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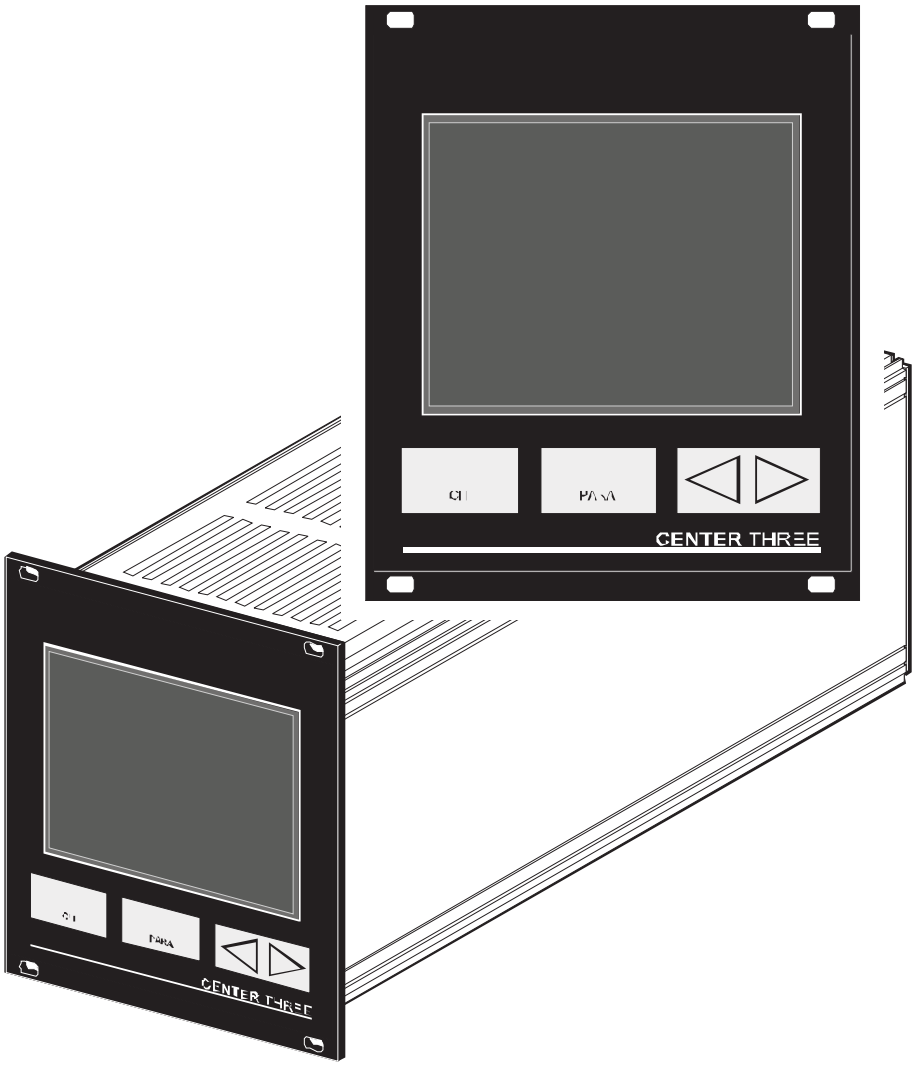
CENTER TWO
CENTER THREE

Multi-Channel Controller

Operating Manual GA 09.035/6.02

Cat. No.

230 003
230 004
235 003
235 004



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1 Introduction

1.1 Validity

1.1.1 Catalog number

This document applies to the following products:

Catalog number	Product
230 003	CENTER THREE with mains cable, EUR version
230 004	CENTER TWO with mains cable, EUR version
235 003	CENTER THREE with mains cable, US version
235 004	CENTER TWO with mains cable, US version

The catalog number can be found on the type label which is attached to one side of the unit.

1.1.2 Firmware version

This Operating Manual is based on the firmware version 302-533-F.

If the unit does not work as described, please check if it is equipped with this firmware version. See Chapter 5.4.2 Firmware version (Pnr), 52.

1.1.3 Type label

There is a type label attached to one side of the unit. In all communication with Oerlikon Leybold Vacuum, please state the information on the type label. For this purpose you may want to copy the information into the space provided below:

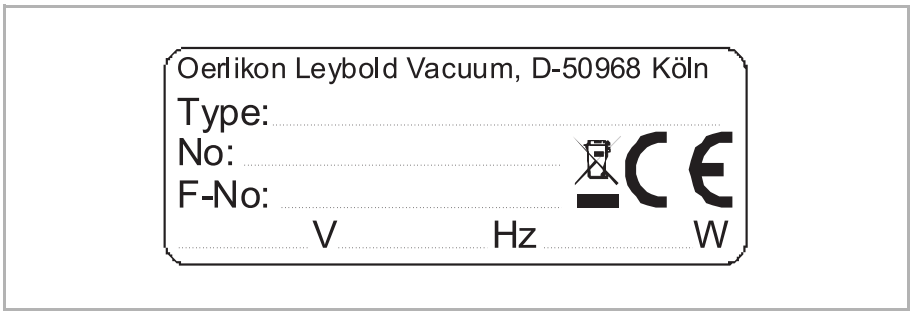


Fig. 1-1 Type label (example)

1.2 Intended use

The CENTER TWO and CENTER THREE Multi-Channel Controller is a display and control unit for transmitters made by Oerlikon Leybold Vacuum.

It is used together with transmitters of the THERMOVAC, PENNINGVAC, CERAVAC and IONIVAC series and is used for total pressure measurements. The transmitters must be operated in accordance with their respective operating manuals.

In the following, the CENTER TWO or CENTER THREE Multi-Channel Controller will be referred to as «Multi-Channel Controller».

1.2.1 Liability and warranty

Oerlikon Leybold Vacuum assumes no liability and the warranty becomes null and void if the end user or third parties

- Disregard the information in this document
- Use the product in a non-conforming manner
- Make any kind of alterations (modifications, repair work, etc.) to the product
- Use the product with accessories not listed in the corresponding product documentation

We reserve the right to make technical changes without prior notice. The figures are non-committal.

1.3 Product versions

The Multi-Channel Controller is available in two different versions: CENTER TWO and CENTER THREE. The two products differ from each other with regard to:

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

See Chapter 2 Technical data, 🗎 9.

This Operating Manual describes both the CENTER TWO and the CENTER THREE.

1.4 Safety

1.4.1 Personnel qualifications

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end user of the product.

1.4.2 Illustration of residual dangers

This Operating Manual illustrates safety notes concerning residual dangers as follows:

Danger



«Danger» indicates an imminently hazardous situation which, if not avoided, will result in death or severe injury.

Warning



«Warning» indicates a potentially hazardous situation which, if not avoided, could result in death or severe injury.

Caution



«Caution» indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or in property damage.

Note:
A note such as this one indicates particularly important, but not safety-relevant information.

1.4.3 General safety instructions

For all work you are going to do, adhere to the applicable safety regulations.

Also observe all safety notes given in this document and forward the information to all other users of the product.

In particular, pay attention to the following safety notes:

Danger



Mains power.

The Multi-Channel Controller contains parts which are connected to the mains supply.

Make sure that no objects enter through the louvers of the unit. Keep the unit dry. Do not open the unit.

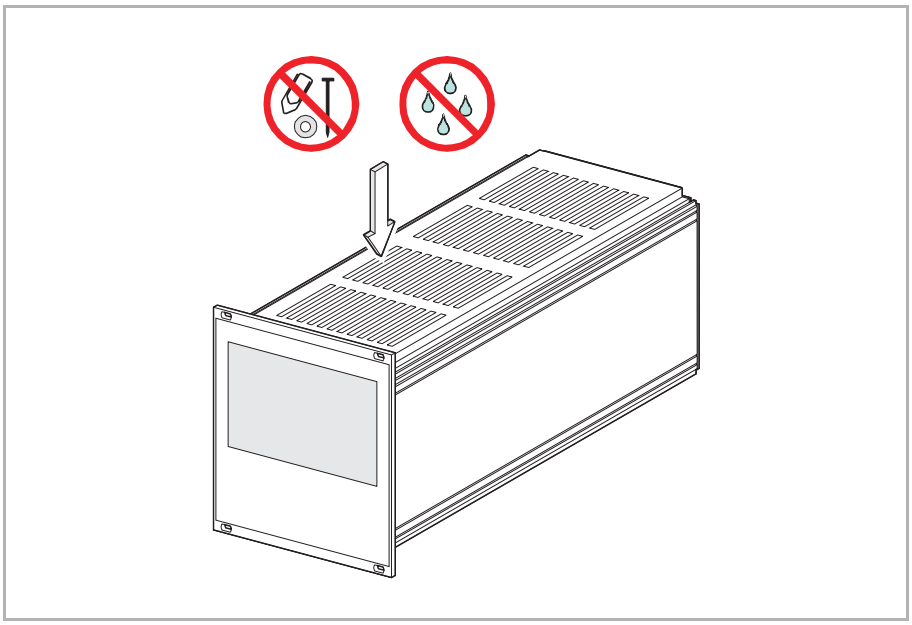


Fig. 1-2 Do not insert objects through louvers and keep unit dry

Caution



Improper use.

Improper use can damage the Multi-Channel Controller.

Use the Multi-Channel Controller only as intended by the manufacturer. See Chapter 1.2 Intended use, 🗎 5.

Caution



Improper installation and operation data.

Improper installation and operation data may damage the Multi-Channel Controller.

Strictly adhere to the stipulated installation and operation data.

1.4.4 Disconnecting device

The Multi-Channel Controller is equipped with a disconnecting device according to EN 61010-1.

The disconnecting device is located at the back of the Multi-Channel Controller. See Fig. 1-3, 8.

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

In order to disconnect the Multi-Channel Controller from mains, you must unplug the mains cable.

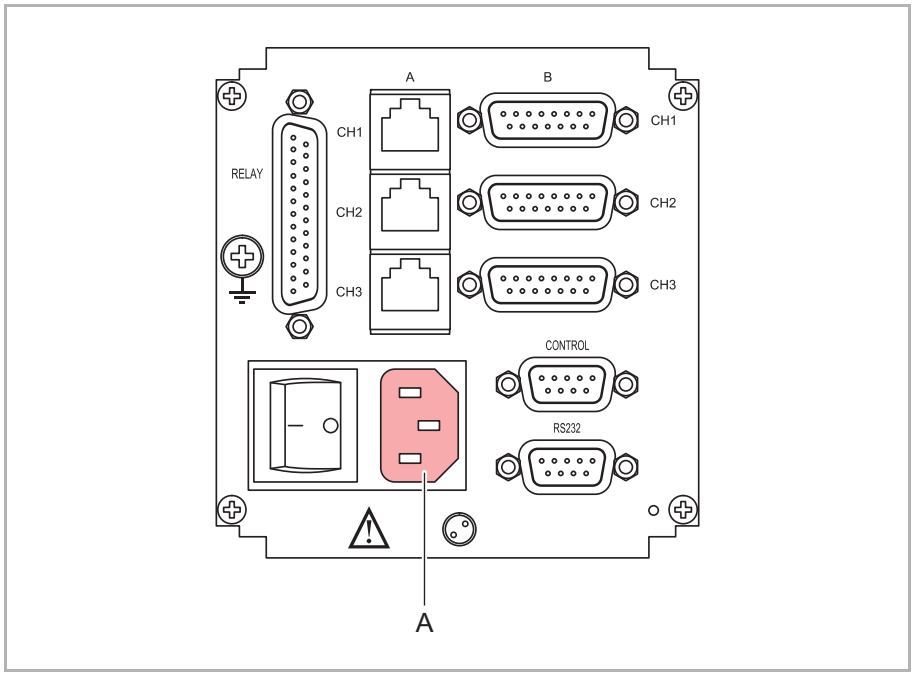


Fig. 1-3 Back side of the CENTER THREE

A Disconnecting device

2 Technical data

2.1 General data

2.1.1 Mechanical data

Dimensions	Width: 106.3 mm Height: 128.5 mm (3 HE) Depth: 207 mm See Fig. 2-1, 🗎 9
Weight	CENTER TWO: 1.04 kg CENTER THREE: 1.16 kg
Use	Desktop unit Control panel mounted Mounting the unit in a rack

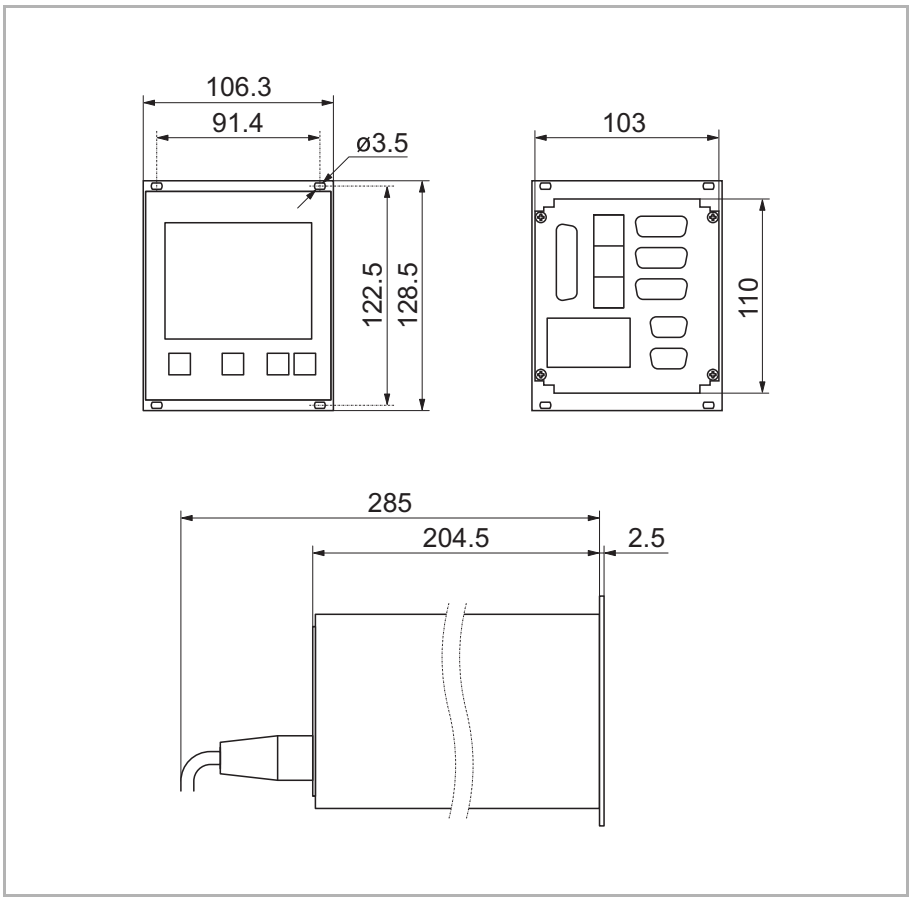


Fig. 2-1 Dimensions (in mm)

2.1.2 Ambience

Temperature	Storage: -20…+60 °C Operation: +5…+50 °C
Relative humidity	Max. 80 % (bis 31 °C), decreasing to max. 50 % (above 40 °C)
Use	Indoors only Altitude max. 2000 m NN
Pollution degree	II
Protection type	IP20

2.1.3 Operation

Manually	Via 4 control buttons on the front panel
Remote control	Via RS232C interface

2.2 Mains connection

Voltage	90…250 VAC
Frequency	50…60 Hz
Power consumption	CENTER TWO: Max. 45 W CENTER THREE: Max. 65 W
Overvoltage category	II
Protection class	1
Connection	European appliance connector IEC 320 C14

2.3 Channels

2.3.1 Sensor connections

Number of channels	CENTER TWO: 2 CENTER THREE: 3
Sensor connections per channel	RJ45 (FCC 68) D-Sub, 15 pins, female (connected in parallel)
Compatible transmitters	THERMOVAC: TTR 90, TTR 91, TTR 96, TTR 100, TTR 101, TTR 211 S, TTR 216 S PENNINGVAC: PTR 225, PTR 90 CERAVAC: CTR 90, CTR 91, CTR 100, CTR 101, DI 200, DI 201, DI 2000, DI 2001, DI 2001 rel IONIVAC: ITR 90, ITR 200

2.3.2 Transmitter supply

Voltage	+24 VDC ±5 %
Current	500 mA (750 mA short-time)
Fuse	900 mA via PTC element Self-resetting after switching the unit off or unplugging the sensor. The supply meets the requirements of a ground protective extra low voltage (SELV).

2.3.3 Measuring technique

Measuring ranges	Transmitter dependent
Error of measurement	Gain error: ≤ 0.005 % FS Offset error: ≤ 0.01 % FS
Measuring rate	50 s^{-1}
Display rate	10 s^{-1}
Filter time constant	Slow: Approx. 1.0 s (f_g = 0.16 Hz) Normal (nor): Approx. 0.3 s (f_g = 0.53 Hz) Fast: Approx. 0.06 s (f_g = 2.65 Hz)

Unit of measurement	mbar, Pa, Torr, Micron
Possible adjustments	Linear transmitters (CTR): Zero-adjust
	Logarithmic transmitters (TTR, PTR, ITR): Fixed correction factors for N_2, Ar, H_2, or a variable correction factor in the range 0.10…9.99
A/D converter	Resolution > 16 bit

Note:
The measurements of the ITR/CTR 100/CTR 101 are transferred digitally.

2.4 Switching functions

Number of switching functions	CENTER TWO: 4 CENTER THREE: 6
Assignment	Can be configured any way
Delay time	Filter time constant dependent
Adjustment range	Transmitter dependent
Hysteresis	Linear transmitters (CTR): ≥ 1 % FS
	Logarithmic transmitters (TTR, PTR, ITR): ≥ 10 % of measurement

2.4.1 Switching function relay

Contact type	Change-over contact, floating
Load (ohmic)	Max. 60 VDC, 0.5 A Max. 30 VAC, 1 A
Lifetime	Mechanical: 10^7 cycles
	Electrical: 10^5 cycles at maximum load
Connection	D-Sub, 25 pins, female. See Fig. 3-8, 🗎 21.

2.4.2 Error signal relay

Number	1
Delay time	≤ 20 ms
Contact type	Change-over contact, floating
Load (ohmic)	Max. 60 VDC, 0.5 A Max. 30 VAC, 1 A
Lifetime	Mechanical: 10^7 cycles Electrical: 10^5 cycles at maximum load
Connection	D-Sub, 25 pins, female. See Fig. 3-8, 🗎 21.

2.5 Outputs

2.5.1 Analog output

Number	1 per channel
Voltage range	0…10 VDC
Deviation from displayed value	± 50 mV
Internal resistance	47 Ω
Relation between voltage and pressure	Transmitter dependent
Connection	D-Sub, 9 pins, male. See Fig. 3-9, 🗎 22.

2.5.2 Recorder output

Number	1
Voltage range	0…10 VDC
Resolution	1 mV
Accuracy	± 20 mV
Internal resistance	3300 Ω
Relation between voltage and pressure	Programmable
Connection	D-Sub, 9 pins, male. See Fig. 3-9, 🗎 22.

2.5.3 Computer interface

Default	RS232C
Protocol	ACK/NAK ASCII with 3-character mnemonics. Bidirectional data flow.
Signals	Only TXD and RXD used
Baud rate	9600, 19200, 38400
Connection	D-Sub, 9 pins, female. See Fig. 3-10, 🗎 23.

2.6 Scope of delivery

Designation	Number
Multi-Channel Controller	1
Mains cable	1
Rubber strip Rubber feet	1 2
Collar screws Plastic sleeves	4 4

2.7 Accessories

Designation	Product number
D-Sub plug for the CONTROL connection, screwon type	230 006

3 Installation

3.1 Unpacking

1 Visually inspect the transport packaging for signs of external damage

2 Unpack the Multi-Channel Controller and put the packaging material aside

Note:
Keep the packaging material for later use. The Multi-Channel Controller must be stored and transported in the original packaging material only.

3 Examine the Multi-Channel Controller for completeness

4 Visually inspect the Multi-Channel Controller for signs of damage

Warning



Damaged product.

Putting a damaged product into operation can be extremely dangerous.

Never attempt to put a damaged product into operation. Secure the damaged product from unintended operation. Send a damage report to the haulage company or the insurer.

3.2 Mechanical installation

The Multi-Channel Controller can be used as follows: As a desk-top unit, mounted in a control panel, or mounted in a 19" rack. In each of these cases you must pay attention to the following safety note:

Caution



Too high ambient temperature.

Exceeding the maximum permitted ambient temperature may damage the unit.

Make sure that the maximum permitted ambient temperature is not exceeded and that the air can flow freely through the louvers. Do not expose the unit to direct sunlight.

3.2.1 Desktop unit

In order to use the Multi-Channel Controller as a desk-top unit, proceed as follows:

1 Turn the Multi-Channel Controller upside down as shown in Fig. 3-1, 16

2 Push the supplied rubber strip onto the lower edge of the front panel

3 Stick the supplied rubber feet to the bottom of the casing

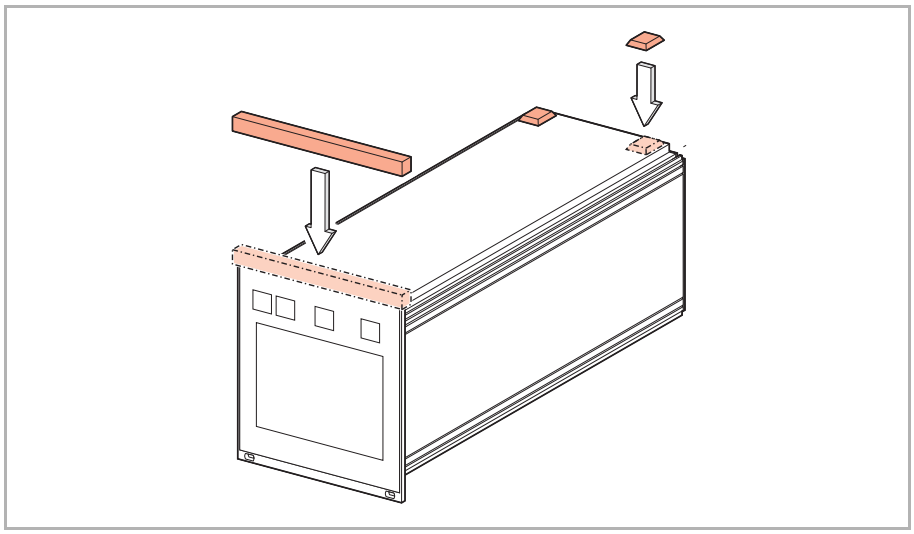


Fig. 3-1 Using the product as a desk-top unit

4 Turn the Multi-Channel Controller back to normal orientation and place it on the required location

3.2.2 Control panel mounted

In order to mount the unit in a control panel, the following cutout is required:

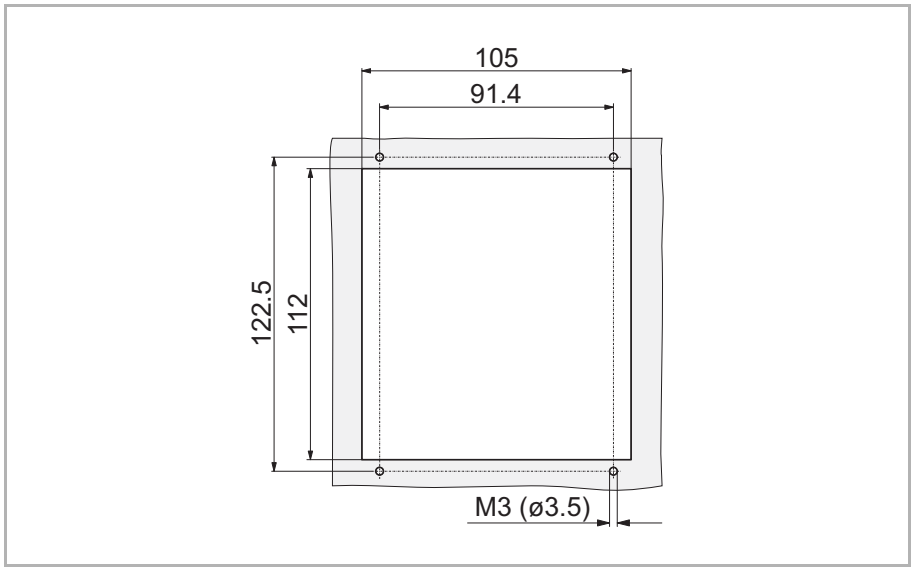


Fig. 3-2 Control panel cutout (in mm)

1 Insert the Multi-Channel Controller into the cutout

2 Fasten the unit with four M3 screws

Note:
In order to reduce the strain on the front panel it is recommended to support the bottom of the unit.

3.2.3 Mounting the unit in a rack

The Multi-Channel Controller is designed for installation into a rack chassis adapter according to DIN 41 494 (19", 3 HE). For this purpose, 4 collar screws and 4 plastic sleeves are supplied with the unit.

Warning



Lower protection class of the rack.

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

Take appropriate measures to restore the required protection class of the rack.

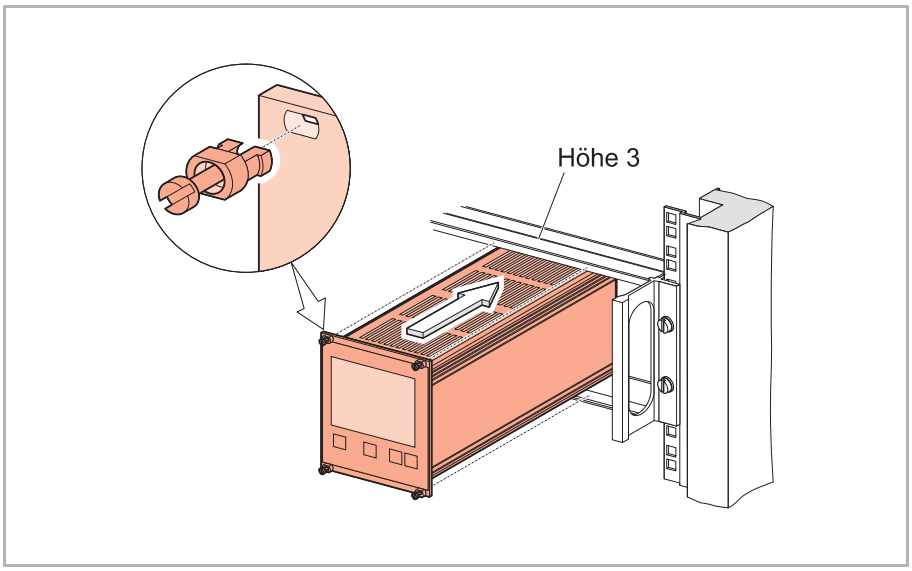


Fig. 3-3 Mounting the unit in a rack

Note:
In order to reduce the strain on the front panel it is recommended to equip the rack chassis adapter with a guide rail.

Note:
For safe and easy installation of heavy rack chassis adapters, it is recommended to equip the rack frame with slide rails.

1 Fasten the rack chassis adapter in the rack

2 Insert the Multi-Channel Controller into the rack chassis adapter

3 Fasten the Multi-Channel Controller with the supplied collar screws and plastic sleeves to the rack chassis adapter

3.3 Connecting

3.3.1 Back side of the device

Fig. 3-4, 🗎 18 shows the back side of the CENTER THREE. The connection for channel 3 (item C) is not available in the CENTER TWO.

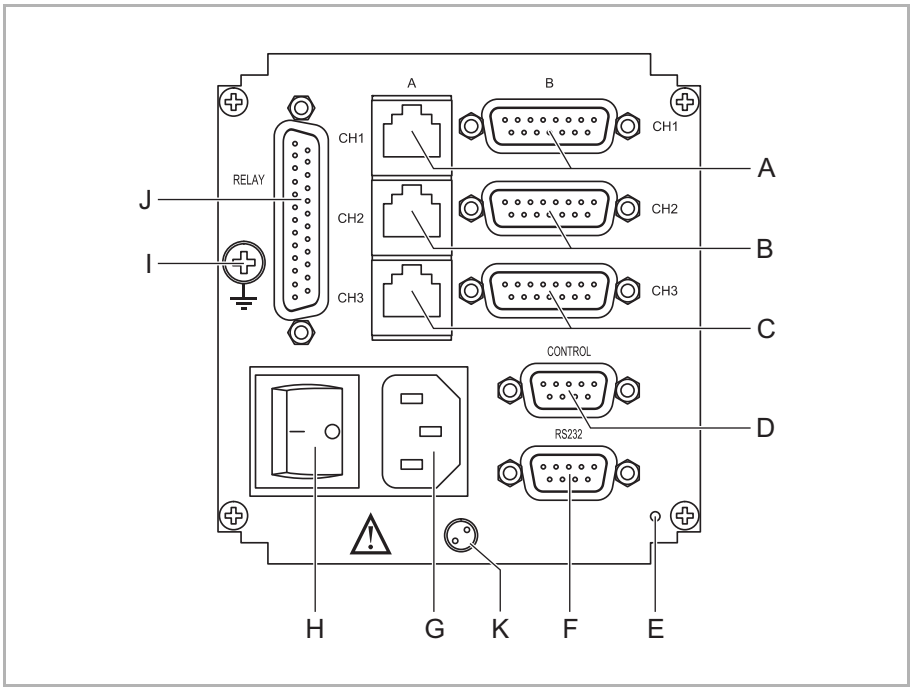


Fig. 3-4 Back side of the CENTER THREE

A Transmitter connection, channel 1
B Transmitter connection, channel 2
C Transmitter connection, channel 3
D CONTROL connection
E Switch for program transfer mode
F RS232C connection
G Mains connection / disconnecting device
H Mains switch
I Ground screw
J RELAY connection
K Screw for internal protective conductor. Do not loosen this screw!

Warning



Internal protective conductor.

The internal protective conductor is connected to the casing with a screw (item K). If the internal protective conductor is not fastened the unit can be extremely dangerous in case of a failure.

Do not turn or loosen the screw that fastens the internal protective conductor.

The configuration of the available connections is described in the following sections.

3.3.2 Mains connection

The mains connection (Fig. 3-4, 🗎 18, item G) is designed for a mains cable which contains a European appliance connector on the device side.

A mains cable is supplied with the unit. If the plug is not compatible with your wall socket, you have to get a suitable mains cable:

- Three-conductor cable with protective ground
- Conductor cross-section 3 × 1.5 mm^2 or larger

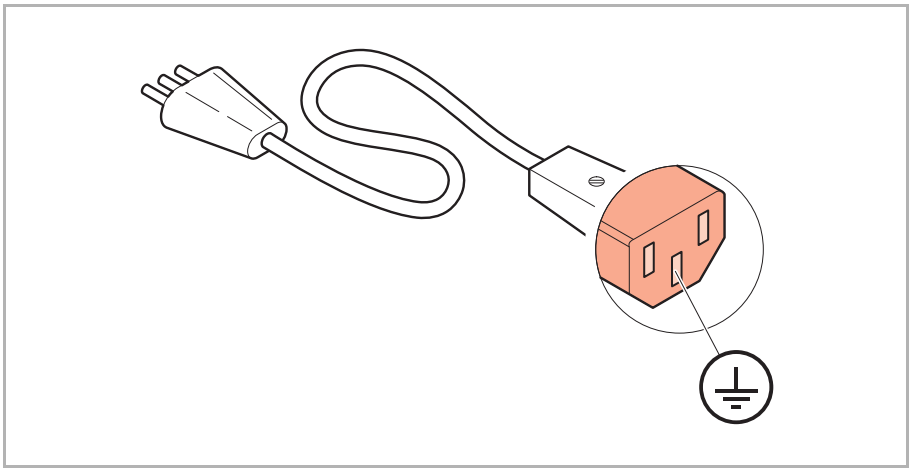


Fig. 3-5 Three-conductor cable with protective ground (example)

Mains power.

Warning



Improperly grounded devices can be extremely dangerous in the event of a fault.

Use three-wire mains or extension cables with protective ground only. Plug the mains cable into wall sockets with protective ground only.

No mains fuse.

Warning



The Multi-Channel Controller is not equipped with a mains fuse.

The wall socket must be protected with a fuse (max. 10 A).

1 Connect the European appliance connector of the mains cord with the mains connection of the unit

2 Connect the plug of the mains cable with the wall socket

Note:
If the unit is installed in a switching cabinet, the mains power can be supplied via a switchable central power distributor.

3.3.3 Ground

The ground screw (Fig. 3-4, 🗎 18, item I) can be used to connect the Multi-Channel Controller with the protective ground of the pumping station.

1 If required: Connect the protective ground of the pumping station with the ground screw. Use a protective conductor.

3.3.4 SENSOR

The SENSOR connection is used to connect the Transmitters.

For each channel, there are two connections available which are connected in parallel: An 8-pin RJ45 appliance socket and a 15-pin D-Sub appliance socket. See Fig. 3-4, 🗎 18, items A…C.

Pin assignment

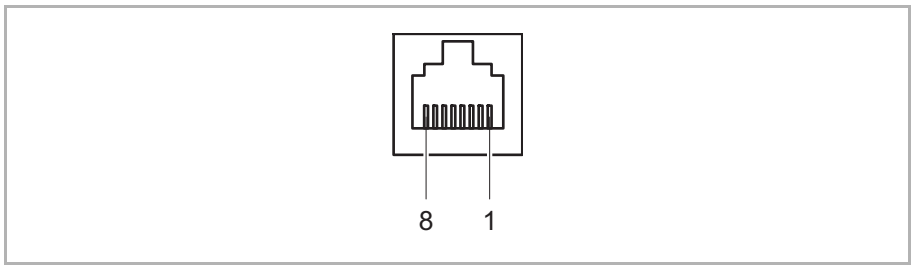


Fig. 3-6 SENSOR appliance socket (RJ45)

1 +24 VDC
2 PGND
3 Signal
4 Ident
5 Signal-GND
6 Status
7 HV_L
8 HV_EMI

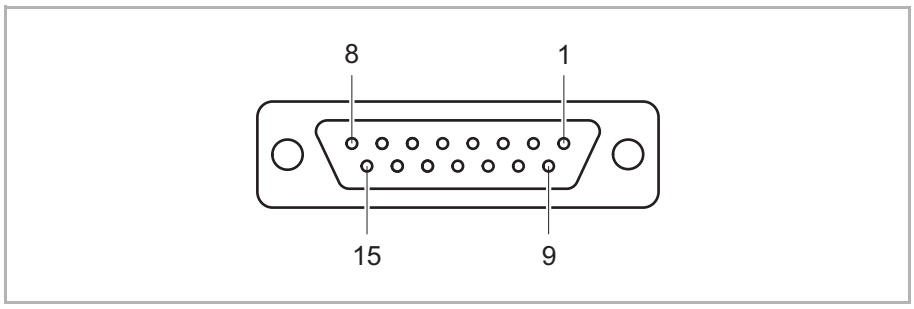


Fig. 3-7 SENSOR appliance socket (D-Sub, 15-pin)

1 EMI-Status
2 Signal
3 Status
4 HV_EMI
5 PGND
6 n.c.
7 Degas
8 Supply
9 n.c.
10 Ident
11 Supply_CDG
12 Signal-GND
13 RXD
14 TXD
15 Chassis

Caution



Improper transmitters.

Transmitters which are not designed for use with the Multi-Channel Controller may damage the unit.

Operate the Multi-Channel Controller with proper transmitters only. See Chapter 2.3.1 Sensor connections, 🗎 11.

Caution



Multiple connection.

Only one Transmitter may be connected to each of the channels. Otherwise the connected transmitters will be damaged.

Never connect more than one transmitter per channel.

Connecting

1 Channel 1: Connect the sensor with to the CH1-A or CH1-B connection. Use a shielded 1:1 cable.

2 Channel 2: Connect the sensor with to the CH2-A or CH2-B connection. Use a shielded 1:1 cable.

3 Channel 3: Connect the sensor with to the CH3-A or CH3-B connection. Use a shielded 1:1 cable.

3.3.5 RELAY

The switching functions and the error monitoring system influence the state of several relays inside of the Multi-Channel Controller. The RELAY connection (Fig. 3-4, 🗎 18, item J) allows to utilize the relay contacts for switching purposes. The relay contacts are potential-free (floating).

Pin assignment

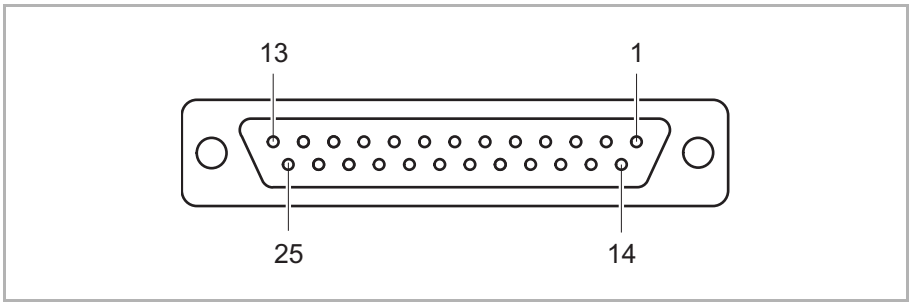


Fig. 3-8 RELAY appliance socket (D-Sub, 25-pin)

1 GND
2 n.c.
3 Error break contact (NC)
4 SP 1 break contact (NC)
5 SP 1 common contact (COM)
6 SP 1 make contact (NO)
7 GND
8 SP 2 break contact (NC)
9 SP 2 common contact (COM)
10 SP 2 make contact (NO)
11 SP 3 break contact (NC)
12 SP 3 common contact (COM)
13 SP 3 make contact (NO)
14 Error make contact (NO)
15 Error common contact (COM)
16 SP 4 break contact (NC)
17 SP 4 common contact (COM)
18 SP 4 make contact (NO)
19 SP 5 break contact (NC)
20 SP 5 common contact (COM)
21 SP 5 make contact (NO)
22 SP 6 break contact (NC)
23 SP 6 common contact (COM)
24 SP 6 make contact (NO)
25 +24 VDC, 200 mA. Meets the requirements of a ground protective extra low voltage (SELV).

n.c. not connected
COM common contact
NC break contact (normally closed)
NO make contact (normally open)

Note:
Pin 25 is used for supplying relays with a higher breaking capacity. The supply contact is protected at 200 mA with a PTC element. The element is self-resetting when switching the unit off or unplugging the RELAY connector.

Warning



Hazardous voltage.

Voltages above 60 VDC or 30 VAC and can cause severe injuries.

The RELAY connection may be used for switching voltages of max. 60 VDC or 30 VAC only. These voltages must meet the requirements of a ground protective extra low voltage (SELV).

1 Connect the peripheral components with the RELAY connection. Use a shielded connection cable.

3.3.6 CONTROL

The CONTROL connection (Fig. 3-4, 🗎 18, item D) contains the following signal pins:

- Analog outputs for the signals of the individual channels
- Recorder output. This is a programmable analog output which can be assigned to one of the three channels.
- HV-EMI. Used to switch the high-vacuum circuit of the PTR 225 transmitter on and off. The signal levels are: On = +24 V. Off = 0 V. See Reference [3].

Pin assignment

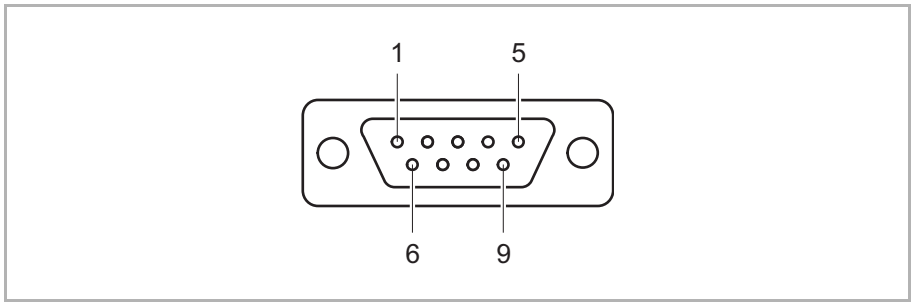


Fig. 3-9 CONTROL appliance plug (D-Sub, 9-pin)

1 Analog output 1
2 Analog output 3
3 GND
4 HV-EMI 3
5 HV-EMI 1
6 Analog output 2
7 Recorder output
8 GND
9 HV-EMI 2

1 Connect the peripheral components with the CONTROL connection. Use a shielded connection cable.

Note:
The analog outputs (pins 1, 2, 6) differ from the displayed values by no more than ±50 mV.

3.3.7 RS232C

The RS232C serial interface (Fig. 3-4, 🗎 18, item F) allows remote control of the unit via a computer or a terminal. See Chapter 6 Computer interface, 🗎 57.

In addition, the interface may be used for firmware updates. See Chapter 7.2 Program transfer mode, 🗎 85.

Pin assignment

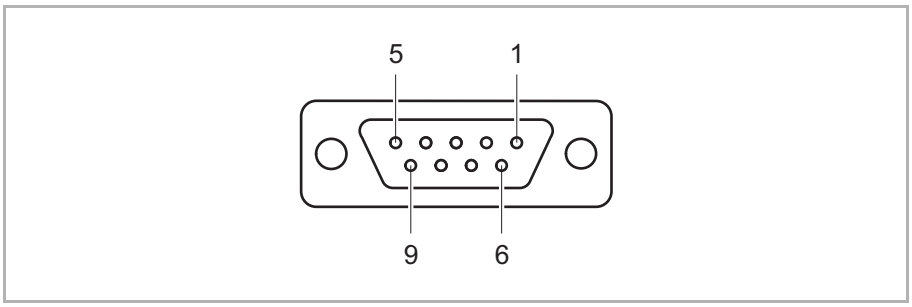


Fig. 3-10 RS232C appliance socket (D-Sub, 9-pin)

1 n.c. / SUP
2 TXD
3 RXD
4 n.c.
5 GND
6 DSR
7 n.c.
8 CTS
9 GND

1 Connect the serial interface of the computer with the RS232C connection. Use a shielded cable.

Note:
Use a serial extension cable with a 9-pin plug and a 9-pin socket. The cable must not contain any crossed wires.

4 Operation

4.1 Front panel

Fig. 4-1, 🖹 24 shows the front panel of the CENTER THREE. The CENTER TWO is not equipped with the switching points SP5 and SP6 (item A) and the display for the channel 3 (item F).

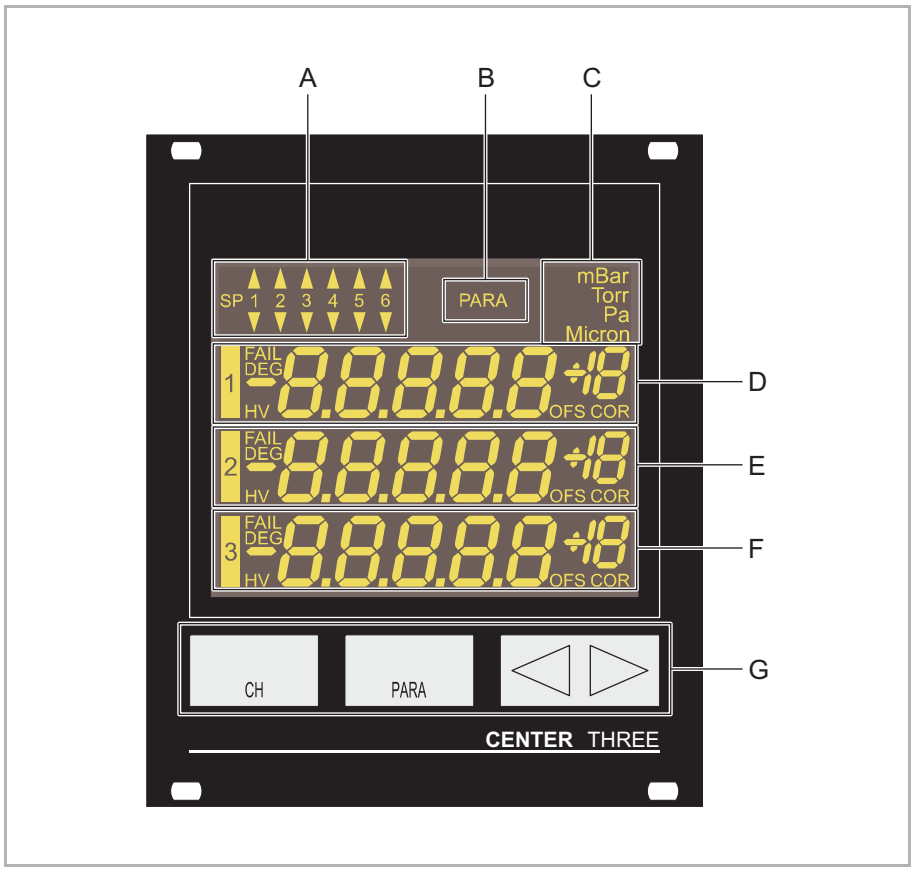


Fig. 4-1 Front panel of the CENTER THREE

A Switching function indicator
B Parameter mode
C Pressure unit
D Display area for channel 1
E Display area for channel 2
F Display area for channel 3
G Control buttons

4.1.1 Display

Switching functions
The top left corner (item A) of the display indicates the switching function states. An illuminated triangle above a number indicates that the pressure is above the lower threshold value. An illuminated triangle below a number indicates that the pressure is below the upper threshold value. See Fig. 5-1, 🗎 37.

Parameter mode
The PARA indicator (item B) is illuminated when the unit is set to the parameter mode.

Pressure unit
The top right corner (item C) of the display indicates the pressure unit: mbar, Torr, Pa, or Micron.

Channels
There is a separate display area for each of the available channels (item D, E, F). From the left to the right, this area displays the following information:

Display	Significance
1, 2, 3	Channel number
FAIL (flashing)	Error
DEG (illuminated)	Degas function is activated
HV (illuminated)	High-vacuum circuit is activated
-8.8.8.8.8^{+18}	Measurement or status message
OFS (illuminated)	Offset correction is activated
COR (illuminated)	Gas type correction is activated

4.1.2 Control buttons

CH
The CH button is used to select a channel. This may be necessary e.g. if you want to switch a particular transmitter on or off, or if you want to modify the sensor parameters. The number of the currently selected channel is flashing for a few seconds.

PARA
The PARA button is used to select the parameter mode. The PARA indicator (item B) is illuminated and you can modify various parameters. See Chapter 4.5 Parameter mode, 🗎 33.

Arrow buttons (DOWN/UP)
The arrow buttons are required for entering data in the parameter mode. Pressing one of these buttons will decrease or increase the currently displayed value. In the following, these buttons will be referred to as DOWN and UP, respectively.

4.2 Switching on and off

4.2.1 Switching on

1 Switch the mains switch on. See Fig. 3-4, 🗎 18, item H.

After switching on, the Multi-Channel Controller will perform the following actions:

- Self test
- Identify all transmitters
- Restore the previously set parameters
- Activate measurement mode
- Adapt parameters (if a transmitter type has changed meanwhile)

4.2.2 Switching off

1 Switch the mains switch off. See Fig. 3-4, 🗎 18, item H.

4.2.3 Waiting time

Caution



Delay time.

After switching off, the Multi-Channel Controller requires approximately 10 seconds to initialize again.

Wait for at least 10 seconds before you switch the Multi-Channel Controller on again.

Note:
If the Multi-Channel Controller has been installed in a control panel or a rack, it can also be switched on and off via the central power distributor.

4.3 Operating modes

The Multi-Channel Controller can be set to one of the following operating modes:

Measurement mode
The measurement mode is the standard operating mode. It displays the pressure readings of the transmitters. In case of an error, a status message is displayed instead. See Chapter 4.4 Measurement mode, 🗎 27.

Parameter mode
The parameter mode gives you access to various parameters. You can check the parameter settings or modify them using the arrow buttons. This allows you to configure the Multi-Channel Controller. See Chapter 4.5 Parameter mode, 🗎 33.

Program transfer mode
The program transfer mode is used to transfer the latest version of the firmware to the Multi-Channel Controller. See Chapter 7.2 Program transfer mode, 🗎 85.

4.4 Measurement mode

4.4.1 Selection

The Multi-Channel Controller automatically selects the measurement mode after it has been switched on.

When the unit is set to the parameter mode, it will automatically return to the measurement mode if no button is pressed for 10 seconds.

4.4.2 Description

The measurement mode is the standard operating mode. It displays the pressure readings of the transmitters. A status message is displayed if the pressure exceeds the permissible range. See Tab. 4-1, 🗎 28.

Display	Pressure
Er Hi	Significantly above the permissible range The FAIL indicator flashes The error signal relay switches
Upper limit	Above the permissible range. The upper limit of the measuring range is displayed.
Reading	In the permissible range
Lower limit	Below the permissible range. The lower limit of the measuring range is displayed.
Er Lo	Significantly below the permissible range The FAIL indicator flashes The error signal relay switches
noSEn	See Tab. 4-2, 🗎 32
noid	See Tab. 4-2, 🗎 32
oFF	See Tab. 5-15, 🗎 53
Hot	See Chapter 5.2.6, 🗎 44
SELF	See Chapter 5.2.8, 🗎 44
CH 1	See Chapter 5.2.8, 🗎 44
CH 2	See Chapter 5.2.8, 🗎 44
CH 3	See Chapter 5.2.8, 🗎 44
LoC	See Chapter 5.4.5, 🗎 53

Tab. 4-1 Display when in measurement mode

Channels which are not connected to a transmitter display noSEn. This status message disappears after approximately two minutes.

4.4.3 Control button functions

4.4.3.1 Selecting a channel

1 Press the CH button

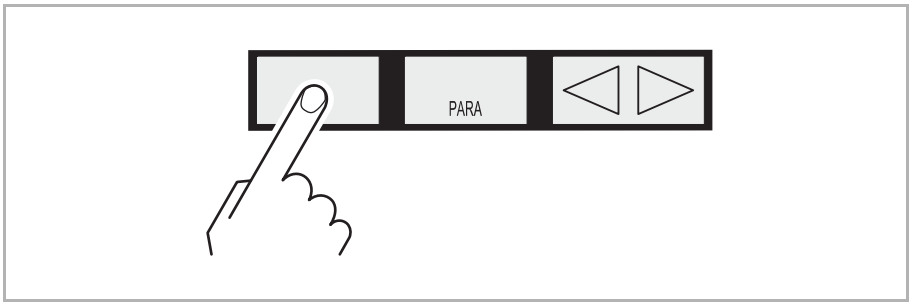


Fig. 4-2 Pressing the CH button

The unit selects the next channel. The number of the selected channel is flashing for a few seconds.

4.4.3.2 Selecting parameter mode

1 Press the PARA button

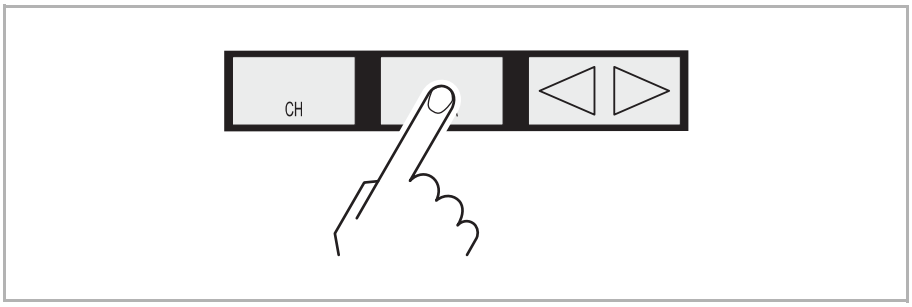


Fig. 4-3 Pressing the PARA button

The unit changes to the parameter mode. See Chapter 4.5 Parameter mode, 33. It will automatically return to the measurement mode if no button is pressed for 10 seconds.

4.4.3.3 Switching high-vacuum circuit on

The high-vacuum circuit of the following transmitters can be switched on manually: PTR 225.

For this purpose the transmitter control must be set to HAnd. See Chapter 5.2.6 Transmitter activation (S-on), 🗎 44.

1 Press the CH button to select the required channel

2 Keep the UP button pressed for approximately 1 second

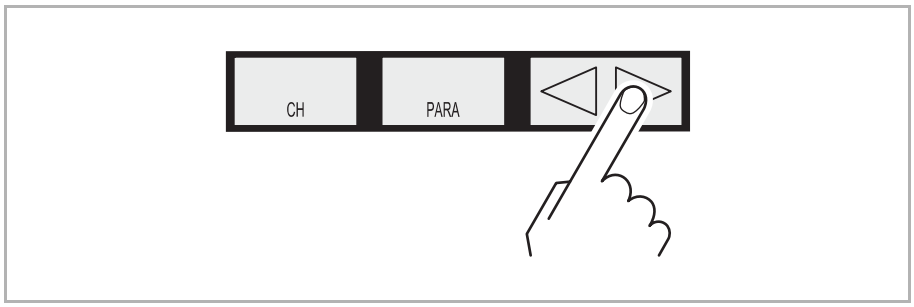


Fig. 4-4 Press the UP button for 1 second

The transmitter on the selected channel is switched on. The HV indicator is illuminated. The display shows the pressure reading or a status message. See Tab. 4-1, 🗎 28.

4.4.3.4 Switching degas function on

The degas function of the following transmitters can be switched on manually: ITR.

1 Press the CH button to select the required channel

2 Keep the UP button pressed for approximately 1 second. See Fig. 4-4, 🗎 30.

The degas function of the transmitter on the selected channel is switched on. The DEG indicator is illuminated.

4.4.3.5 Switching high-vacuum circuit off

The high-vacuum circuit of the following transmitters can be switched off manually: PTR 225.

For this purpose the transmitter control must be set to HAnd. See Chapter 5.2.8 Transmitter deactivation (S-oFF), 🗎 44.

1 Press the CH button to select the required channel

2 Keep the DOWN button pressed for approximately 1 second

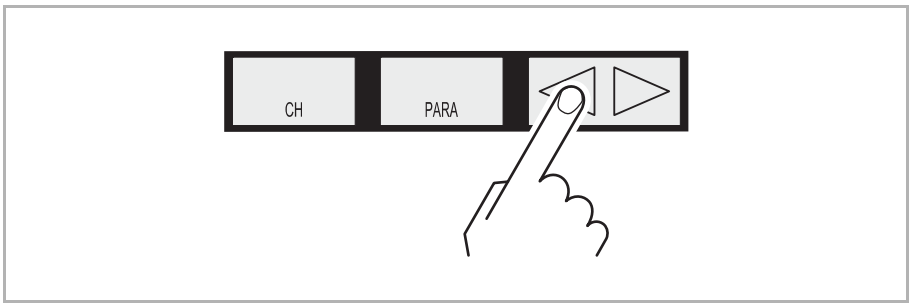


Fig. 4-5 Press the DOWN button for 1 second

The transmitter on the selected channel is switched off. The HV indicator is dark. The display shows the status oFF.

4.4.3.6 Switching degas function off

The degas function of the following transmitters can be switched off manually: ITR.

1 Press the CH button to select the required channel

2 Keep the DOWN button pressed for approximately 1 second. See Fig. 4-5, 🗎 31.

The degas function of the transmitter on the selected channel is switched off. The DEG indicator is dark.

4.4.3.7 Identifying a transmitter

1 Keep the UP and DOWN buttons pressed for approximately 1 second

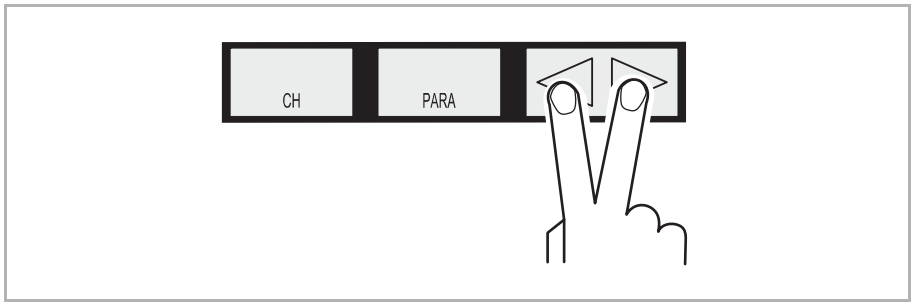


Fig. 4-6 Press the UP and DOWN buttons for 1 second

The display area of the individual channels shows the connected transmitters. See Tab. 4-2, 32.

Display	Significance
ttr	THERMOVAC (TTR)
ttr1	THERMOVAC (TTR 100, TTR 101)
Ptr	PENNINGVAC (PTR 225)
Ptr90	PENNINGVAC (PTR 90)
Ctr	CERAVAC (CTR 90, CTR 91, DI 200, DI 201, DI 2000, DI 2001, DI 2001 rel)
Ctr1	CERAVAC (CTR 100, CTR 101)
itr	IONIVAC (ITR 90)
itr2	IONIVAC (ITR 200)
noSEn	No transmitter found
noid	No transmitter identification found

Tab. 4-2 Transmitter identification

Note:
In the case of ITR transmitters, the software version number of the sensor is also shown (e.g. 1.20).

4.5 Parameter mode

4.5.1 Selection

Pressing the PARA button switches from the measurement mode to the parameter mode. The PARA indicator is illuminated.

When the unit is set to the parameter mode, it will automatically return to the measurement mode if no button is pressed for 10 seconds. The PARA indicator is dark.

4.5.2 Parameter groups

The parameter mode gives you access to various parameters. You can check the parameter settings or modify them using the arrow buttons. This allows you to configure the Multi-Channel Controller.

Tab. 4-3, 🗎 34 shows all available parameters.

Parameter group	Parameters
PArA SP	SP1-L SP1-H SP2-L SP2-H SP3-L SP3-H SP4-L SP4-H SP5-L SP5-H SP6-L SP6-H
PArA SEn	FiLt GAS FS oFS dEGAS S-on S-oFF EMi FiL PrE
PArA GEn	unit bAud diGit dEF Ao Err-r

Parameter group	Parameters
PArA	Pnr
tESt	dt-C tr-L LoC rA-t EP-t EE-t di-t Ad-S Ad-i CALib io-t rS-t

Tab. 4-3 Parameter groups and their parameters

The available parameters are subdivided into the following parameter groups:

Switching function parameters (PArA SP**)**
These parameters are used to assign pressure dependent switching functions to the channels. The switching points 5 and 6 are only available in the CENTER THREE. See Chapter 5.1 Switching function parameters (PArA SP), 🗎 36.

Sensor parameters (PArA SEn**)**
These parameters concern the transmitter on the currently selected channel only. There is an individual set of parameters for each channel. See Chapter 5.2 Sensor parameters (PArA SEn), 🗎 39.

General parameters (PArA GEn**)**
These parameters are used for general configuration of the unit. The parameters affect all channels. See Chapter 5.3 General parameters (PArA GEn), 🗎 47.

Test parameters (PArA tESt**)**
This parameter group is used to check individual system functions. The parameter group is not required during normal operation. For this reason it must be accessed in a special way. See Chapter 5.4 Test parameters (PArA tESt), 🗎 52.

4.5.3 Basic operation

Starting at the measurement menu, you can select and modify a specific parameter as follows:

1 Press the CH button to select the required channel. (This is only necessary if you want to modify a sensor parameter.)

2 Press the PARA button
- The parameter menu is selected
- The PARA indicator is illuminated

3 Use the arrow buttons to select the required parameter group
- The name of the parameter group is displayed

4 Press the PARA button to select the required parameter
- The name and the value of the parameter are displayed

5 Use the arrow keys (and the CH button, if necessary) to modify the parameter value
- The value of the parameter is changed

6 Repeat the steps 4 and 5 to change further parameters of the same parameter group

The unit returns to the measurement mode after the last parameter of a parameter group has been accessed. Parameter modifications are effective immediately, and they are saved in the EEPROM automatically.

5 Parameters

5.1 Switching function parameters (PArA SP)

This parameter group allows you to configure the switching functions. The following switching function parameters are available in the CENTER TWO:

- SP1-L
- SP1-H
- SP2-L
- SP2-H
- SP3-L
- SP3-H
- SP4-L
- SP4-H

In addition, the CENTER THREE is equipped with the following switching function parameters:

- SP5-L
- SP5-H
- SP6-L
- SP6-H

5.1.1 Fundamental terms

Switching functions
The CENTER TWO is equipped with four relays which switch in dependance of the measured pressure. The relay contacts are potential-free and can be used for switching via the RELAY connection. See Chapter 3.3.5 RELAY, 21. In this context we speak of the switching functions 1…4.

The CENTER THREE contains a total of six switching function relays, i.e. the switching functions 1…6 are available in this unit.

Threshold values
The switching behavior of the individual relays is determined by two parameters each: The lower threshold value and the upper threshold value of the switching function.

- Lower threshold value SP-L:
  The lower threshold value is responsible for activating the assigned switching function. The relay switches on as soon as the pressure falls below the lower threshold value. This means that the common contact of the relay is connected to the make contact.
- Upper threshold value SP-H:
  The upper threshold value is responsible for deactivating the assigned switching function. The relay switches off as soon as the pressure rises above the upper threshold value. This means that the common contact of the relay is connected to the make contact.

Hysteresis
In the pressure range between the two threshold values, the previous relay state is maintained. The relay does not switch in this range, and the relay state depends on the pressure curve history. See Fig. 5-1, 🗎 37.

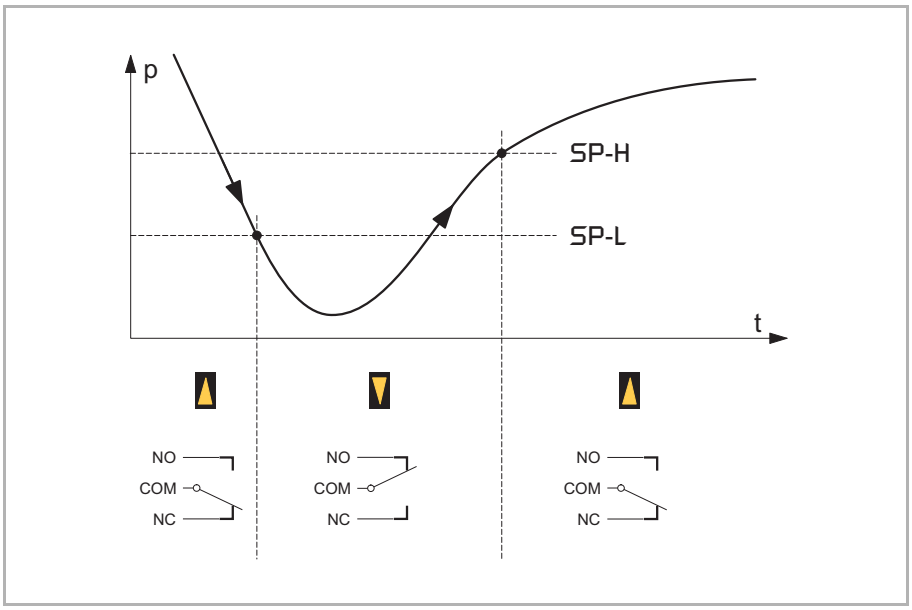


Fig. 5-1 Behaviour of a switching function when the pressure changes

p Pressure
t Time
NO make contact (normally open)
COM common contact
NC break contact (normally closed)

The region between the threshold values generates a hysteresis (lag) between activating and deactivating of the relay. The hysteresis prevents the switching function from rapidly switching on and off when the pressure is close to one of the threshold values.

5.1.2 Configuring switching functions

Prerequisite: The parameter group SP-P is selected

1 Press the PARA button to select the required parameter
- The name and the value of the parameter are displayed

2 Use the CH button to assign the switching function to a channel
- The switching functions can be assigned to the channels any way
- The two threshold values of the switching function are always assigned to the same channel

3 Use the arrow buttons to modify the threshold value
- The value of the parameter is changed

4 Repeat the steps 1 to 3 to change further parameters of the same parameter group

5.1.3 Adjustment range

Adjustment range of the lower threshold value
The lower threshold value of a switching function can be set in the following pressure range:

Transmitter	SP-L min. [mbar]	SP-L max. [mbar]
TTR	2×10^{-3} *)	5×10^{2}
TTR 100	2×10^{-3} *)	1.5×10^{3}
PTR	1×10^{-9}	1×10^{-2}
PTR 90	5×10^{-9}	5×10^{2}
CTR	FS/1000	FS
ITR	1×10^{-8}	5×10^{2}

Tab. 5-1 Adjustment range of the lower threshold values

**) 2×10^{-4} mbar if PrE is activated (see Chapter 5.2.12, 46)*

Adjustment range of the upper threshold value
The upper threshold value of a switching function can be set in the following pressure ranges:

Transmitter	SP-H min. [mbar]	SP-H max. [mbar]
TTR	1.1 SP-L	5×10^{2}
TTR 100	1.1 SP-L	1.5×10^{3}
PTR	1.1 SP-L	1×10^{-2}
PTR 90	1.1 SP-L	5×10^{2}
CTR	SP-L + 0.01 FS	FS
ITR	1.1 SP-L	5×10^{2}

Tab. 5-2 Adjustment range of the upper threshold values

This means that the hysteresis amounts to 10 % of the lower threshold value (logarithmic transmitters) or to 1 % of the full-scale range (linear transmitters) at least. If another transmitter type is connected to a channel, the respective threshold values will be adjusted automatically if necessary.

5.2 Sensor parameters (PArA SEn)

There is an individual set of sensor parameters for each channel. Select the required channel before you change to the parameter menu and modify the sensor parameters.

The number of available parameters depends on the transmitter type which is connected to the selected channel. See Tab. 5-3, 🗎 39.

Transmitter	FiLt	GAS	FS	oFS	dEGAS	S-on	S-oFF	EMi	FiL	PrE
TTR	✓	✓								✓
TTR 100	✓	✓								✓
PTR	✓	✓				✓	✓			
PTR 90	✓	✓								
CTR	✓		✓	✓						
CTR 100	✓		✓	✓						
ITR		✓			✓					
ITR 200		✓			✓			✓	✓	

Tab. 5-3 Available sensor parameters

5.2.1 Measurement filter (FiLt)

The measurement filter improves measurements when the signal is noisy or disturbed. The filter affects the readings on the display, the RS232C output, the recorder output, and the switching functions. The analog outputs, however, are not affected.

The filter can be set to one of the following values:

FASt
Fast. The Multi-Channel Controller responds quickly to signal changes. This makes it rather sensitive to signal noise.

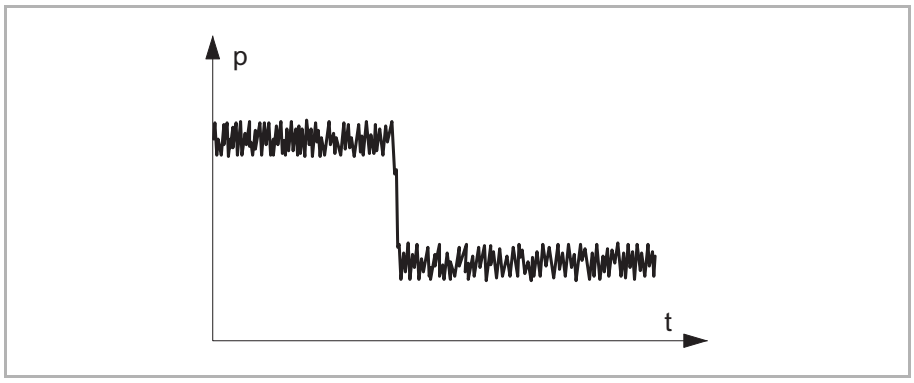


Fig. 5-2 Measurement with filter set to FASt *(example)*

nor
Normal. This is the default setting. It offers a good compromise between the response time and the sensitivity to noise.

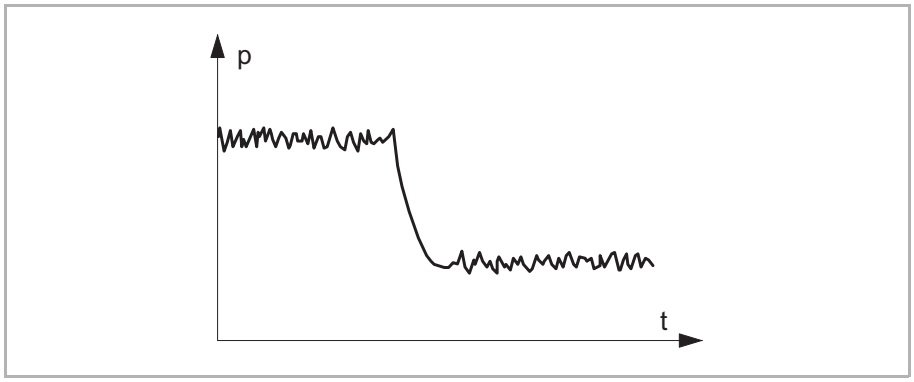


Fig. 5-3 Measurement with filter set to nor *(example)*

SLo
Slow. The Multi-Channel Controller responds slowly to signal changes. This makes it less sensitive to signal noise. This setting is recommended for precise comparison measurements.

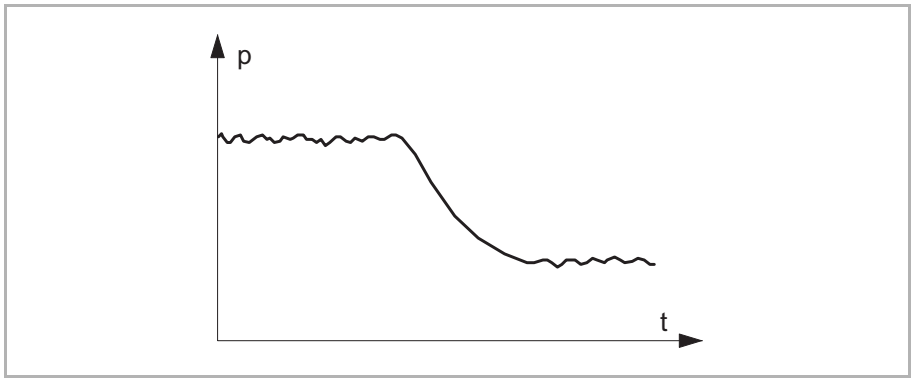


Fig. 5-4 Measurement with filter set to SLo *(example)*

Ctr
For CTR transmitters. The response of the Multi-Channel Controller to signal changes depends on the measuring range. The display is especially stable in the low measuring range.

Measuring range	Filter
0.1 … 1 FS	nor (normal)
0.04 … 0.1 FS	SLo (slow)
0.01 … 0.04 FS	Approx. 2 × SLo
0 … 0.01 FS	Approx. 4 × SLo

Tab. 5-4 Measurement with filter set to Ctr

5.2.2 Gas type (GAS)

Transmitters are normally calibrated for a measurement in nitrogen or in air. The GAS parameter is used to configure the channel to other gas types.

Display	Significance
n2	Nitrogen or air. No correction of any kind is required.
Ar	Argon. The pressure reading is determined utilizing a correction factor for argon. COR is illuminated.
H2	Hydrogen. The pressure reading is determined utilizing a correction factor for hydrogen. COR is illuminated.
Cor	Other gases. The pressure reading is determined utilizing a variable correction factor. COR is illuminated.

Tab. 5-5 GAS parameter settings

Cor
If you want to perform pressure measurements in a gas type without a fixed correction factor, you may multiply the pressure reading with a variable correction factor. To this end proceed as follows:

1 Set the GAS parameter to Cor

2 Press the PARA button
- The correction factor is displayed

3 Use the arrow buttons the modify the correction factor
- The value of the parameter is changed
- The COR indicator is illuminated

You can adjust the correction factor of a transmitter in the range 0.10…9.99. The setting 1.00 returns the uncorrected pressure reading.

Note:
For transmitters of type ITR und PTR 90, the gas type correction is effective only for p < 10^{-2} mbar; in case of TTR100 and TTR 101 only for p < 10 mbar.

5.2.3 Measuring range (FS)

Linear transmitters (CTR) require specification of the full-scale range. You can set this value using the cursor buttons. The following values are available:

- 0.01 mbar
- 0.01 Torr, 0.02 Torr, 0.05 Torr
- 0.10 mbar, 0.25 mbar, 0.50 mbar
- 0.10 Torr, 0.25 Torr, 0.50 Torr
- 1 mbar, 2 mbar, 5 mbar
- 1 Torr, 2 Torr, 5 Torr
- 10 mbar, 20 mbar, 50 mbar
- 10 Torr, 20 Torr, 50 Torr
- 100 mbar, 200 mbar, 500 mbar
- 100 Torr, 200 Torr, 500 Torr
- 1000 mbar, 1100 mbar
- 1000 Torr
- 2 bar, 5 bar, 10 bar, 50 bar

DI gauge heads

- 200 mbar (di200)
- 2 bar (di2)
- 2 bar relative (dir2)

5.2.4 Offset (oFS)

When the offset correction is activated, a previously specified offset value will be subtracted from each pressure reading. This allows to conveniently measure the relative pressure with respect to a reference pressure.

The offset correction affects the readings on the display, the RS232C output, the recorder output, and the switching functions. The analog outputs, however, are not affected.

Establishing an offset value and activating the offset correction

1 Select the oFS parameter

2 Keep the UP button pressed for approximately 2 seconds
- The current pressure reading becomes the new offset value
- The offset correction is activated
- The OFS indicator is illuminated

Deactivating the offset correction

1 Select the oFS parameter

2 Press the DOWN button
- The offset correction is deactivated
- The display shows oFF
- The OFS indicator is dark

Activating the offset correction

1 Select the oFS parameter

2 Press the UP button

- The offset correction is activated
- The OFS indicator is illuminated

Note:
Always deactivate the offset correction before adjusting the offset of a transmitter.

Adjusting the zero point of a digital CTR

1 Select the oFS parameter

2 Keep the DOWN button pressed for approximately 2 seconds
- The zero point of the transmitter is adjusted
- The OFS indicator is illuminated after >2 s and as long as the button is being pressed

Note:
First adjust the transmitter, then the Multi-Channel Controller.

Note:
After adjusting the zero point, a zero value is displayed. Due to the measuring resolution of the CTR 100 and CTR 101 (noise, drift), a zero with plus/minus several digits are displayed.

5.2.5 Degas function (dEGAS)

Ionization transmitters with a hot cathode are sensitive with regard to depositions on the electrodes. These depositions can cause signal fluctuations.

The dEGAS function is to bakeout and thereby clean the electrode system of the transmitter. See Reference [6].

ITR 200 transmitter:
The dEGAS function only affects the currently active filament. See Reference [15].

Activating the degas function

1 Select the dEGAS parameter

2 Press the UP button
- The degas function is activated
- The display shows on
- The DEG indicator is illuminated

The cleaning process takes approximately 3 minutes. Then the degas function switches off automatically. You may also deactivate this function manually.

Deactivating the degas function

1 Select the dEGAS parameter

2 Press the DOWN button
- The degas function is deactivated
- The display shows oFF
- The DEG indicator is dark

5.2.6 Transmitter activation (S-on)

This parameter determines how the transmitter is switched on. The transmitter activation can be set to one of the following values:

HAnd
Manually. The transmitter can be switched on by pressing the UP button. See Chapter 4.4.3.3 Switching high-vacuum circuit on, 🗎 30.

Hot
Hot start. The transmitter automatically switches on when the unit is switched on. After a power failure the measurement will be resumed automatically.

CH 1
By channel 1. The subsequent parameter t-on is used to specify the switch-on threshold. The transmitter is switched on when the pressure on channel 1 falls below the switch-on threshold.

CH 2
By channel 2. The subsequent parameter t-on is used to specify the switch-on threshold. The transmitter is switched on when the pressure on channel 2 falls below the switch-on threshold.

CH 3
By channel 3. This setting is only available if the unit is equipped with three channels. The subsequent parameter t-on is used to specify the switch-on threshold. The transmitter is switched on when the pressure on channel 3 falls below the switch-on threshold.

5.2.7 Switch-on threshold (t-on)

This parameter is only available if the transmitter activation parameter is set to CH 1, CH 2 or CH 3. See Chapter 5.2.6 Transmitter activation (S-on), 🗎 44.

The t-on parameter is used to specify a switch-on threshold. The transmitter is switched on when the pressure on the respective channel falls below the switch-on threshold.

5.2.8 Transmitter deactivation (S-oFF)

This parameter determines how the transmitter is switched off. The transmitter deactivation can be set to one of the following values:

HAnd
Manually. The transmitter can be switched off by pressing the DOWN button. See Chapter 4.4.3.5 Switching high-vacuum circuit off, 🗎 31.

SELF
Self control. The subsequent parameter t-off is used to specify the switch-off threshold. The transmitter is switched off when the pressure at the sensor exceeds the switch-off threshold.

CH 1
By channel 1. The subsequent parameter t-off is used to specify the switch-off threshold. The transmitter is switched off when the pressure on channel 1 exceeds the switch-off threshold.

CH 2
By channel 2. The subsequent parameter t-oFF is used to specify the switch-off threshold. The transmitter is switched off when the pressure on channel 2 exceeds the switch-off threshold.

CH 3
By channel 3. This setting is only available if the unit is equipped with three channels. The subsequent parameter t-oFF is used to specify the switch-off threshold. The transmitter is switched off when the pressure on channel 3 exceeds the switch-off threshold.

5.2.9 Switch-off threshold (t-oFF)

This parameter is only available if the transmitter deactivation parameter is set to CH 1, CH 2 or CH 3. See Chapter 5.2.8 Transmitter deactivation (S-oFF), 44.

The t-oFF parameter is used to specify a switch-off threshold. The transmitter is switched off when the pressure on the respective channel exceeds the switch-off threshold.

5.2.10 Emission (EMi)

This parameter defines the rules for switching the emission on.

Display	Significance
Auto	Emission is switched on and off by the transmitter electronics
MAn	Emission is switched on and off manually

Tab. 5-6 EMi parameter values

5.2.11 Filament selection (FiL)

This parameter defines the rules for selecting the active filament.

Display	Significance
Auto	The transmitter alternately selects one of the two filaments
Fil 1	Filament 1 ist active
Fil 2	Filament 2 ist active

Tab. 5-7 FiL parameter values

5.2.12 Pirani range extension (PrE)

Extend the display and the setpoint adjustment range.

Display	Significance
oFF	Normal operation
on	Range extension: ■ Display down to 5×10^{-5} mbar ■ Setpoint adjustment range down to 2×10^{-4} mbar

Tab. 5-8 PrE parameter values

5.3 General parameters (PArA GEn)

These parameters are used for general configuration of the unit. The parameters affect all channels.

5.3.1 Unit of measurement (unit)

Unit of measurement for pressure values. The unit affects displayed pressure readings, threshold values, etc.

Display	Significance
bAr	Pressure unit mbar or bar
torr	Pressure unit Torr
PASC	Pressure unit Pascal
uC	Pressure unit Micron

Tab. 5-9 unit *parameter values*

The unit of measurement is indicated on the display. See Fig. 4-1, 🗎 24, item C.

Note:
The pressure unit «Torr» can be locked. In this case torr **is not available for selection. See Chapter 5.4.4 Torr lock (tr-L), 🗎 53.**

5.3.2 Baud rate (bAud)

Transfer rate of the RS232C interface.

Display	Significance
9600	9600 Baud
19200	19200 Baud
38400	38400 Baud

Tab. 5-10 bAud *parameter values*

5.3.3 Display format (diGit)

Number of digits shown in the display.

Display	Significance
2	Two digits e.g. 2.5^{-1} or 370
3	Three digits e.g. 2.47^{-1} or 373

Tab. 5-11 diGit *parameter values*

Note:
The diGit **parameter has no effect on CTR transmitter.**

Note:
When PrE **is enabled, the display of TTR transmitters in the pressure range p < 10^{-4} mbar is reduced by one digit.**

5.3.4 Default parameters (dEF)

Reset all parameters to the default values (factory settings). Please note that this action cannot be undone.

Proceed as follows to reset the parameters:

1 Select the dEF parameter

2 Press both the UP and the DOWN button at the same time
- The display shows SEt
- All parameters are reset to the default values

5.3.5 Recorder output (Ao)

The recorder output is a programmable analog output. The recorder output voltage is a function of the pressure on the transmitter. The relation between the pressure and the voltage is called the characteristic curve of the output. It can be selected.

Modifying parameter

1 Select the Ao parameter

2 Use the CH button to assign the recorder output to a channel

3 Use the arrow buttons to select the characteristic curve of the output
- The value of the parameter is changed

Characteristic curves
Fundamentally we have to distinguish between logarithmic and linear characteristic curves. A logarithmic characteristic curve is useful if the pressure range covers several orders of magnitude in the measurement. In this case it is appropriate to take the logarithm of the pressure and then scale the result in a suitable manner.

A linear characteristic curve is useful if the pressure range covers only a few orders of magnitude in the measurement. In this case the recorder output voltage is proportional to the pressure value. You can specify which pressure value will result in the maximum output voltage.

The available characteristic curves will be described in the following. In each case it is shown how to calculate the pressure p (in mbar) from the recorder output voltage U (in volts).

LoG
Logarithmic representation of the entire measuring range.

Transmitter	Pressure (in mbar)
TTR	p = 10^[U/(10/7) - 4]
TTR 100	p = 10^[U/(10/7) - 4]
PTR	p = 10^[U/(10/7) - 9]
PTR 90	p = 10^[U/(10/12) - 9]
CTR	p = 10^[U/(10/4) - 4] * FS
ITR	p = 10^[U/(10/12) - 9]

LoG A
Logarithmic representation of the entire measuring range (compatible with the A series).

Transmitter	Pressure (in mbar)
TTR	p = 10^[U/(10/6) - 3]
TTR 100	p = 10^[U/(10/7) - 4]
PTR	p = 10^[U/(9/7) - 9 - 7/9]
PTR 90	p = 10^[U/(10/11) - 8]
CTR	p = 10^[U/(10/4) - 4] * FS
ITR 90	p = 10^[(U - 7.75)/0.75]
ITR 200	p = 10^[U - 8]

LoG -b
Logarithmic representation of a partial measurement range (2.5 V/decade).

Transmitter	Pressure (in mbar)
All types	p = 10^[U/(10/4) - 10]

LoG -3
Logarithmic representation of a partial measurement range (2.5 V/decade).

Transmitter	Pressure (in mbar)
All types	p = 10^[U/(10/4) - 7]

LoG +0
Logarithmic representation of a partial measurement range (2.5 V/decade).

Transmitter	Pressure (in mbar)
All types	p = 10^[U/(10/4) - 4]

LoG +3
Logarithmic representation of a partial measurement range (2.5 V/decade).

Transmitter	Pressure (in mbar)
All types	p = 10^[U/(10/4) - 1]

LoGC1
Logarithmic representation matched to the following sensor combination:

- TTR on channel 1
- PTR 225 on channel 2

Transmitter	Pressure (in mbar)
TTR + PTR 225	p = 10^[U/(10/12) - 9]

LoGC2
Logarithmic representation matched to the following sensor combination:

- CTR on channel 1
- CTR on channel 2

This characteristic curve is only useful if the transmitters have different measuring ranges. The total measuring range of the sensor combination is represented logarithmically in the range 0…10 V.

LoGC3
Logarithmic representation matched to the following sensor combination:

- CTR on channel 1
- CTR on channel 2
- CTR on channel 3

This characteristic curve is only useful if the transmitters have different measuring ranges. The total measuring range of the sensor combination is represented logarithmically in the range 0…10 V.

Note:
The three transmitters must be sorted with regard to their measuring range (FS). The sort order may be increasing or decreasing.

Lin n
Linear representation. U = 10 V is equivalent of p = 10^n mbar. The exponent n may be any integer value in the range -10…+3.

Transmitter	Pressure (in mbar)
All types	p = U/10 * 10^n

iM221
Logarithmic representation of the IM 221 controller (1 V/decade). U = 8 V is equivalent of p = 10^{-2} mbar.

Controller	Pressure (in mbar)
IM 221	p = 10^[U - 10]

LoGCH
Logarithmic representation of 12 decades (0.83 V / decade) matched to the following sensor combination:

- TTR 100 or TTR 101 on channel 1
- ITR 200 on channel 2

Transmitter	Pressure (in mbar)
TTR 100 + ITR 200 TTR 101 + ITR 200	p = 10^[U/(10/12) - 9]

U = 10 V is equivalent of p = 1000 mbar. The switching point between the transmitters is 10^{-2} mbar.

PM411
Nonlinear characteristic curve of the output as with the PM 411 board.

5.3.6 Error signal relay (Err-r)

The Err-r parameter is used to specify what kind of error will trigger the error signal relay.

Display	Significance
ALL	All errors
no SE	Device errors
CH 1	Sensor 1 and device errors
CH 2	Sensor 2 and device errors
CH 3	Sensor 3 and device errors

Tab. 5-12 Err-r *parameter values*

5.4 Test parameters (PArA tESt)

This parameter group is intended for test and service purposes. It is used to examine additional system data, to set basic system parameters, and to check individual system functions.

The parameter group tESt is not required for normal operation. For this reason it is not accessible normally.

5.4.1 Selection

When switching on
The parameter group tESt becomes available if you switch on the Multi-Channel Controller as follows:

1 Press the PARA button and keep it pressed

2 Switch the mains switch on. See Fig. 3-4, 🗎 18, item H.
- The Multi-Channel Controller is switched on
- The parameter group tESt is selected
- The PARA indicator is illuminated

During normal operation
During normal operation it is also possible to activate the parameter group tESt from the measurement mode:

1 Press the PARA button
- The parameter menu is selected
- The PARA indicator is illuminated

2 Keep the UP and DOWN buttons pressed for approximately 5 seconds
- The firmware version is displayed
- The parameter group tESt is selected

Note:
When the parameter group tESt **is selected, the Multi-Channel Controller will not automatically return to the measurement mode. In order to return to the measurement mode, press the PARA button repeatedly until all test parameters have been run through.**

5.4.2 Firmware version (Pnr)

Displays the firmware version number. The last character represents the modification index.

Example: 302-533-F

5.4.3 Watchdog control (dt-C)

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

Display	Significance
Auto	An error message from the watchdog control is acknowledged automatically after 2 seconds
oFF	An error message from the watchdog control must be acknowledged by the user

Tab. 5-13 dt-C *parameter values*

5.4.4 Torr lock (tr-L)

This parameter affects the general parameter unit. When the lock is activated, the unit of measurement «Torr» cannot be selected. See Chapter 5.3.1 Unit of measurement (unit), 47.

Display	Significance
oFF	Unit of measurement «Torr» can be selected
on	Unit of measurement «Torr» cannot be selected

Tab. 5-14 tr-L *parameter values*

5.4.5 Parameter setup lock (LoC)

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

Display	Significance
oFF	Parameters can be inspected and modified
on	Parameters can be inspected only

Tab. 5-15 LoC *parameter values*

5.4.6 RAM test (rA-t)

Test the main memory. Press the UP button to start the test.

Display	Significance
run	Test is running
PASS	Test completed without errors
Err	Test completed and errors detected

Tab. 5-16 RAM test

Please contact your local Oerlikon Leybold Vacuum service center if the test fails repeatedly.

5.4.7 EPROM test (EP-t)

Test the program memory.
Press the UP button to start the test.

Display	Significance
run	Test is running
PASS	Test completed without errors
Err	Test completed and errors detected. A four-digit checksum is displayed.

Tab. 5-17 EPROM test

Please contact your local Oerlikon Leybold Vacuum service center if the test fails repeatedly.

5.4.8 EEPROM test (EE-t)

Test the parameter memory.
Press the UP button to start the test.

Display	Significance
run	Test is running
PASS	Test completed without errors
Err	Test completed and errors detected

Tab. 5-18 EEPROM test

Please contact your local Oerlikon Leybold Vacuum service center if the test fails repeatedly.

5.4.9 Display test (di-t)

Test the display. In this test all segments of the display are illuminated simultaneously at first. Then the individual segments of the display are activated one after the other.

Press the UP button to start the test.

5.4.10 A/D converter signal (Ad-S)

Display the A/D converter output signal (in volts) for each of the channels. When applying a reference voltage to the input signal pin of the SENSOR connection, this allows you to check the A/D converters of the respective channel. See Chapter 3.3.4 SENSOR, 🗎 20.

Note:
When the signal input is not connected, a quickly fluctuating value is displayed because of the high measurement sensitivity of the unit.

Press the UP button to start the test.

5.4.11 A/D converter ID (Ad-i)

For each channel, display a signal (in volts) which is caused by a resistor inside the connected transmitter. This signal is used for identification of the connected transmitter.

Press the UP button to start the test.

5.4.12 I/O test (io-t)

Test all relays. In this test the relays are switched on and off one after the other, and the relay states are shown on the display. A circuit indicator or an ohmmeter may be used to verify the relay states on the RELAY connection. See Chapter 3.3.5 RELAY, 🗎 21.

Press the UP button to start the test.

Relay test.

Caution



In this test the relays switch irrespective of the actual pressure. This may cause unintended switching of devices.

Unplug the RELAY connection before performing a relay test.

Display	Significance
off	All relays switched off
r1-H r1-L	Switching function 1 relay on Switching function 1 relay off
r2-H r2-L	Switching function 2 relay on Switching function 2 relay off
r3-H r3-L	Switching function 3 relay on Switching function 3 relay off

Display	Significance
r4-H r4-L	Switching function 4 relay on Switching function 4 relay off
r5-H r5-L	Switching function 5 relay on Switching function 5 relay off
r6-H r6-L	Switching function 6 relay on Switching function 6 relay off
r7-H r7-L	Error signal relay on Error signal relay off

Tab. 5-19 Relay test

5.4.13 RS232C test (rS-t)

Test the RS232C interface. In this test, the Multi-Channel Controller echoes each character received from from the serial interface back to the interface.

The test starts as soon as the rS-t parameter has been selected. You may e.g. use a terminal program and input characters via the keyboard. Each of the input characters is returned to the terminal from the Multi-Channel Controller. The data transfer between the two units is visible on the terminal screen only.

Press the PARA button to quit the test and to return to the measurement mode.

6 Computer interface

6.1 Basics

6.1.1 Connection

The Multi-Channel Controller is able to communicate with a computer via a serial interface (RS232C). The connection socket and the required connection cable are described in Chapter 3.3.7 RS232C, 🗎 23.

6.1.2 Nomenclature

The following terms and symbolic styles will be used in the description of the computer interface:

Term	Significance
Host	Computer or terminal
Sending (S)	Data transfer from the Host to the Multi-Channel Controller
Receiving (R)	Data transfer from the Multi-Channel Controller to the Host
ASCII	American Standard Code for Information Interchange

Tab. 6-1 Terms

Square brackets [...]
Square brackets identify optional parameters. The items enclosed by the brackets may appear, but they are not essential. The brackets are not actually used in the command.

Angle brackets <...>
Abbreviations enclosed by angle brackes identify control characters. The entire expession including the brackets is replaced by a numerical value. See Tab. 6-2, 🗎 57.

Term	Value	Significance
<EXT>	03h	End of text (Ctrl-C). Reset the interface. Delete the input buffer.
<ENQ>	05h	Enquiry (Ctrl-E). Request data transmission.
<ACK>	06h	Acknowledge. Positive acknowledge.
<LF>	0Ah	Line feed. Line feed.
<CR>	0Dh	Carriage return. Carriage return.
<NAK>	15h	Negative acknowledge. Negative acknowledge.

Tab. 6-2 Control characters

6.2 Communication

6.2.1 Protocol

The following protocol is used in the communication:

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

The baud rate can be selected. See Chapter 5.3.2 Baud rate (bAud), 47. Hardware handshake is not used.

Messages are transferred as ASCII strings. Blanks (spaces) in the string are ignored. The information is exchanged bidirectionally, i.e. data and control commands can be exchanged in both directions.

The input buffer of the Host must have a capacity of at least 75 bytes.

6.2.2 Sending (Host --> Unit)

Messages of the Host are composed of mnemonics and parameters. Mnemonics are command abbreviations and always consist of three ASCII characters. See Chapter 6.3 Mnemonics, 61. The control characters <CR> or <CR><LF> signal the end of the message.

The Multi-Channel Controller checks every message it receives. Afterwards it sends a positive or a negative acknowledgement to the Host.

In a symbolic representation this process can be illustrated as follows:

S: Mnemonic [parameters]<CR>[<LF>]

R: <ACK><CR><LF> or <NAK><CR><LF>

6.2.3 Receiving (Unit --> Host)

The Host may request data from the unit. To this end the Host first sends a message which describes what kind of data is requested. The Multi-Channel Controller then stores the requested data in the output buffer of the interface.

Afterwards the Host sends the control character <ENQ> to the unit. This prompts the unit to send to contents of the output buffer to the Host.

In a symbolic representation this process can be illustrated as follows:

S: Mnemonic [parameters]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: Data<CR><LF>

If the Multi-Channel Controller receives a message which cannot be interpreted (syntax error) it stores the respective error status in the output buffer. See Chapter 6.3.9 ERR, 67.

6.2.4 Examples

Inquiring the transmitter identification

S: TID<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: TTR,CTR,noSen<CR><LF>

Inquiring the transmitter status

S: HVC<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: 0,0,0<CR><LF>

Inquiring parameters of the switching function 1

S: SP1<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: 0,2.0000E-01,5.0000E+00<CR><LF>

Inquiring parameters of the switching function 2

S: SP2,0,9E-1,2.2E0<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: 0,9.0000E-01,2.2000E+00<CR><LF>

Setting the filter

S: FIL,1,2,1<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: 1,2,1<CR><LF>

Behavior in case of a syntax error

S: FOL,1,2,1<CR>[<LF>]

R: <NAK><CR><LF>

S: <ENQ>

R: 0001<CR><LF>

6.2.5 Number formats

The following data is always stored in the exponential format in the Multi-Channel Controller:

- Pressure values
- Offset values
- Threshold values

Output
The above data is always output in the exponential format. A five-digit mantissa and a two-digit exponent are used. Both parts of the number may contain a sign.

Symbolic representation: ±a.aaaaE±aa
Example: 1.2500E-01

In the case of logarithmic transmitters (TTR, PTR, ITR) the last two digits of the mantissa are always zero. Linear transmitters (CTR) use all digits of the mantissa.

Input
The above data may be input either in the exponential format or in the fixed point format. The input data is automatically converted to the exponential format by the unit.

Example: 1.25E-1 and 0.125 are both valid input data.

6.2.6 Continuous transmission of measurements

After the unit has been switched on, it starts to continuously send measurements to the serial interface. By default one set of measurements is sent every second.

The continuous measurement transmission stops when the Host sends a character to the serial interface. The transmission can be resumed with the COM command. See Chapter 6.3.4 COM, 64.

6.3 Mnemonics

6.3.1 Overview

Mnemonic	Significance
AOM	Analog output mode. Characteristic curve of the recorder output.
BAU	Baud rate. Transfer rate of the RS232C interface.
COM	Continuous mode. Continuous transmission of measurements to the serial interface.
COR	Correction factor.
DCD	Display control digits. Number of digits shown in the display.
DGS	Degas.
ERA	Error relay allocation.
ERR	Error status.
EUM	Switch the emission.
FIL	Filter. Measurement filter.
FUM	Select the filament.
FSR	Full scale range. Full scale range of linear transmitters (CTR, DI).
GAS	Gas type correction.
HVC	High vacuum circuit on/off. Switch the high vacuum circuit of transmitters on/off.
ITR	Read a data string from the ITR/CTR 100/CTR 101 transmitter.
LOC	Parameter setup lock.
OFC	Offset correction. Offset correction function for linear transmitters (CTR).
OFD	Offset display. Offset correction values for linear transmitters (CTR).
PNR	Program number. Firmware version number.
PR1	Pressure sensor 1. Pressure reading of transmitter 1.
PR2	Pressure sensor 2. Pressure reading of transmitter 2.
PR3	Pressure sensor 3. Pressure reading of transmitter 3.
PRE	Pirani range extension.
PRX	Pressure sensors. Pressure readings of all transmitters.
RES	Reset. Reset the serial interface.

Mnemonic	Significance
SAV	Save parameters to EEPROM.
SC1	Sensor 1 control. Transmitter 1 control.
SC2	Sensor 2 control. Transmitter 2 control.
SC3	Sensor 3 control. Transmitter 3 control.
SP1	Setpoint 1. Switching function 1.
SP2	Setpoint 2. Switching function 2.
SP3	Setpoint 3. Switching function 3.
SP4	Setpoint 4. Switching function 4.
SP5	Setpoint 5. Switching function 5.
SP6	Setpoint 6. Switching function 6.
SPS	Setpoint status. Switching function status.
TAD	Test A/D converter. Test the A/D converter.
TDI	Test display. Test the display.
TEE	Test EEPROM. Test the EEPROM.
TEP	Test EPROM. Test the EPROM.
TID	Transmitter identification.
TIO	Test I/O. Test the relays.
TKB	Test keyboard. Test the keyboard.
TLC	Torr lock.
TRA	Test RAM. Test the RAM.
TRS	Test RS232C interface. Test the RS232C interface.
UNI	Unit of measurement.
WDT	Watchdog control.

Tab. 6-3 Mnemonics

6.3.2 AOM

Analog output mode. Characteristic curve of the recorder output. See Chapter 5.3.5 Recorder output (Ao), 🗎 48.

S: AOM[,a,b]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b<CR><LF>

Parameters	Significance
a	Channel number 0 = Channel 1 1 = Channel 2 2 = Channel 3
b	Characteristic curve 0 = Logarithmic LoG 1 = Logarithmic LoG A 2 = Logarithmic LoG -6 3 = Logarithmic LoG -3 4 = Logarithmic LoG +0 5 = Logarithmic LoG +3 6 = Logarithmic LoGC1 7 = Logarithmic LoGC2 8 = Logarithmic LoGC3 9 = Linear Lin -10 10 = Linear Lin -9 11 = Linear Lin -8 12 = Linear Lin -7 13 = Linear Lin -6 14 = Linear Lin -5 15 = Linear Lin -4 16 = Linear Lin -3 17 = Linear Lin -2 18 = Linear Lin -1 19 = Linear Lin +0 20 = Linear Lin +1 21 = Linear Lin +2 22 = Linear Lin +3 23 = iM221 24 = Logarithmic LoGC4 25 = PM411

6.3.3 BAU

Baud rate. Transfer rate of the RS232C interface. See Chapter 5.3.2 Baud rate (bAud), 🗎 47.

S: BAU[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Transfer rate 0 = 9600 baud (default) 1 = 19200 Baud 2 = 38400 Baud

Note:
The acknowledgement of the BAU command will already be sent with the changed transfer rate.

6.3.4 COM

Continuous mode. Continuous transmission of measurements to the serial interface.

S: COM,a<CR>[<LF>]

R: <ACK><CR><LF>

The acknowledgement is immediately followed by the continuous measurement transmission. The measurements are always output in the exponential format.

R: b,±c.ccccE±cc,d,±e.eeeeE±ee,f,±g.ggggE±gg <CR><LF>

Parameters	Significance
a	Period 0 = 100 milliseconds 1 = 1 second (default) 2 = 1 minute
b	Status of channel 1 0 = Measurement data ok 1 = Underrange 2 = Overrange 3 = Transmitter error 4 = Transmitter switched off 5 = No Transmitter 6 = Identification error 7 = ITR error
±c.ccccE±cc	Reading of transmitter 1 in current unit of measurement

Parameters	Significance
d	Status of channel 2 (see above)
±e.eeeeE±ee	Reading of transmitter 2 in current unit of measurement
f	Status of channel 3 (see above)
±g.ggggE±gg	Reading of transmitter 3 in current unit of measurement

6.3.5 COR

Correction factor. See Chapter 5.2.2 Gas type (GAS), 41.

S: COR[,a.aa,b.bb,c.cc]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a.aa,b.bb,c.cc<CR><LF>

Parameters	Significance
a.aa	Correction factor of channel 1 0.10…9.99 (default: 1.00)
b.bb	Correction factor of channel 2 (see above)
c.cc	Correction factor of channel 3 (see above)

Note:
The correction factor is only used when the gas type is set to «Other gas». See Chapter 6.3.14 GAS, 70.

6.3.6 DCD

Display control digits. Number of digits shown in the display. See Chapter 5.3.3 Display format (diGit), 🗎 48.

S: DCD[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Number of digits 2 = 2 digits (default) 3 = 3 digits

Note:
When PrE **is enabled, the display of TTR transmitters in the pressure range p < 10^{-4} mbar is reduced by one digit.**

6.3.7 DGS

Degas. See Chapter 5.2.5 Degas function (dEGAS), 🗎 43.

S: DGS[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Transmitter 1 0 = Degassing off (default) 1 = Degassing on
b	Transmitter 2 (see above)

Note:
The degas function is switched off automatically after 3 minutes. It may be also be stopped prematurely.

6.3.8 ERA

Error relay allocation. See Chapter 5.3.6 Error signal relay (Err-r), 51.

S: ERA[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Error relay allocation 0 = All errors 1 = Device errors 2 = Sensor 1 and device errors 3 = Sensor 2 and device errors 4 = Sensor 3 and device errors

6.3.9 ERR

Error status.

S: ERR<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aaaa<CR><LF>

Parameters	Significance
aaaa	Error status 0000 = No error 1000 = Device error (FAIL illum.) 0100 = Hardware not installed 0010 = Parameter invalid 0001 = Syntax error

Note:
The error status is a binary number. It may be combined by the logical operator OR. Example: 1001 = Device error and syntax error.

6.3.10 EUM

Switch the emission. See Chapter 5.2.10 Emission (EMi), 🗎 45.

S: EUM[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Emission for channel 1 0 = Manually 1 = Automatic (default)
b	Emission for channel 2 (see above)
c	Emission for channel 3 (see above)

6.3.11 FIL

Filter. Measurement filter. See Chapter 5.2.1 Measurement filter (FiLt), 🗎 39.

S: FIL[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Filter for channel 1 0 = Fast 1 = Medium (default) 2 = Slow 3 = CTR
b	Filter for channel 2 (see above)
c	Filter for channel 3 (see above)

6.3.12 FSR

Full scale range. Full scale range of linear transmitters (CTR, DI). See Chapter 5.2.3 Measuring range (FS), 🗎 42.

S: FSR[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Full scale range of transmitter 1 0 = 0.01 mbar 1 = 0.01 Torr 2 = 0.02 Torr 3 = 0.05 Torr 4 = 0.10 mbar 5 = 0.10 Torr 6 = 0.25 mbar 7 = 0.25 Torr 8 = 0.50 mbar 9 = 0.50 Torr 10 = 1 mbar 11 = 1 Torr 12 = 2 mbar 13 = 2 Torr 14 = 5 mbar 15 = 5 Torr 16 = 10 mbar 17 = 10 Torr 18 = 20 mbar 19 = 20 Torr 20 = 50 mbar 21 = 50 Torr 22 = 100 mbar 23 = 100 Torr 24 = 200 mbar 25 = 200 Torr 26 = 500 mbar 27 = 500 Torr 28 = 1000 mbar 29 = 1100 mbar 30 = 1000 Torr 31 = 2 bar 32 = 5 bar 33 = 10 bar 34 = 50 bar 35 = DI200 mbar 36 = DI2 bar 37 = DI2 bar relative
b	Full scale range of transmitter 2 (see above)
c	Full scale range of transmitter 3 (see above)

6.3.13 FUM

Select the filament. See Chapter 5.2.11 Filament selection (FiL), 🗎 45.

S: FUM[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Filament for channel 1 0 = Automatic (default) 1 = Filament 1 2 = Filament 2
b	Filament for channel 2 (see above)
c	Filament for channel 3 (see above)

6.3.14 GAS

Gas type correction. See Chapter 5.2.2 Gas type (GAS), 🗎 41.

S: GAS[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Gas type for channel 1 0 = Nitrogen/air (default) 1 = Argon 2 = Hydrogen 3 = Other gas
b	Gas type for channel 2 (see above)
c	Gas type for channel 3 (see above)

Note:
When «Other gas» is selected, the gas type dependence of the measurements will be corrected by a variable correction factor. See Chapter 6.3.5 COR, 🗎 65.

6.3.15 HVC

High vacuum circuit on/off. Switch the high vacuum circuit of transmitters on/off. See Chapter 4.4.3 Control button functions, 🗎 29.

S: HVC[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Transmitter 1 0 = Off 1 = On
b	Transmitter 2 (see above)
b	Transmitter 3 (see above)

Note:
In order to switch a transmitter on/off, the transmitter control must be set to «Hand». See Chapter 6.3.26 SC1, 🗎 77.

6.3.16 ITR

Read a data string from the ITR/CTR 100/CTR 101 transmitter.

The measurements of the ITR/CTR 100/CTR 101 are transferred digitally. A data string consists of 8 bytes (hexadecimal numbers) which are separated from each other by a comma. See Reference [6]. The data strings of the transmitters are separated from each other by double space characters.

S: ITR<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aa,aa,aa,aa,aa,aa,aa,aa bb,bb,bb,bb,bb,bb,bb,bb cc,cc,cc,cc,cc, cc,cc<CR><LF>

Parameters	Significance
aa,aa,aa,aa,aa,aa,aa,aa	Data string of transmitter 1
bb,bb,bb,bb,bb,bb,bb,bb	Data string of transmitter 2
cc,cc,cc,cc,cc,cc,cc,cc	Data string of transmitter 3

6.3.17 LOC

Parameter setup lock. See Chapter 5.4.5 Parameter setup lock (LoC), 🗎 53.

S: LOC[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Parameter setup lock 0 = Off (default) 1 = On

6.3.18 OFC

Offset correction. Offset correction function for linear transmitters (CTR). See Chapter 5.2.4 Offset (oFS), 🗎 42.

S: OFC[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Offset correction of channel 1 0 = Off (default) 1 = On 2 = Determine the offset value and activate offset correction function 3 = Adjust the zero point of a CTR 100/CTR101
b	Offset correction of channel 2 (see above)
c	Offset correction of channel 3 (see above)

6.3.19 OFD

Offset display. Offset correction values for linear transmitters (CTR). See Chapter 5.2.4 Offset (oFS), 🗎 42.

S: OFD[,±a.aaaaE±aa,±b.bbbbE±bb,±c.ccccE±cc] <CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: ±a.aaaaE±aa,±b.bbbbE±bb,±c.ccccE±cc<CR><LF>

Parameters	Significance
±a.aaaaE±aa	Offset value of transmitter 1 in current unit of measurement Default: 0.0000E+00
±b.bbbbE±bb	Offset value of transmitter 2 in current unit of measurement (see above)
±c.ccccE±cc	Offset value of transmitter 3 in current unit of measurement (see above)

6.3.20 PNR

Program number. Firmware version number. See Chapter 5.4.2 Firmware version (Pnr), 🗎 52.

S: PNR<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Firmware version Example: 302-533-F

6.3.21 PR1

Pressure sensor 1. Pressure reading of transmitter 1.

S: PR1<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,±b.bbbbE±bb<CR><LF>

Parameters	Significance
a	Status of channel 1 0 = Measurement data ok 1 = Underrange 2 = Overrange 3 = Transmitter error 4 = Transmitter switched off 5 = No Transmitter 6 = Identification error 7 = ITR error
±b.bbbbE±bb	Pressure reading of transmitter 1 in the current unit of measurement

Note:
The commands PR2 and PR3 concern the transmitters 2 and 3, respectively. The commands are analogous to the PR1 command.

6.3.22 PRE

Pirani range extension. See Pirani range extension (PrE).

S: PRE[,a,b,c]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Range extension for transmitter 1 0 = Off (default) 1 = On
b	Range extension for transmitter 2 (see above)
c	Range extension for transmitter 3 (see above)

6.3.23 PRX

Pressure sensors. Pressure readings of all transmitters.

S: PRX<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,±b.bbbbE±bb,c,±d.ddddE±dd,e,±f.ffffEff<CR><LF>

Parameters	Significance
a	Status of channel 1 0 = Measurement data ok 1 = Underrange 2 = Overrange 3 = Transmitter error 4 = Transmitter switched off 5 = No Transmitter 6 = Identification error 7 = ITR error
±b.bbbbE±bb	Pressure reading of transmitter 1 in the current unit of measurement
c	Status of channel 2 (see above)
±d.ddddE±dd	Pressure reading of transmitter 2 in the current unit of measurement
e	Status of channel 3 (see above)
±f.ffffE±ff	Pressure reading of transmitter 3 in the current unit of measurement

6.3.24 RES

Reset. Reset the serial interface.

Deletes the input buffer. All queued error messages are sent to the Host. The unit returns to the measurement mode.

S: RES[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: b,c,d,...<CR><LF>

Parameters	Significance
a	1 = Perform reset

Parameters	Significance
b,c,d...	Queued error messages 0 = No error 1 = Watchdog has triggered 2 = Task(s) not executed 3 = EPROM error 4 = RAM error 5 = EEPROM error 6 = Display error 7 = A/D converter error 8 = UART error 9 = Transmitter 1 general error Error 10 = Transmitter 1 ID error 11 = Transmitter 2 general error Error 12 = Transmitter 2 ID error 13 = Transmitter 3 general error Error 14 = Transmitter 3 ID error

6.3.25 SAV

Save parameters to EEPROM.

The command SAV,0 resets all parameters to their default values (factory settings). See Chapter 5.3.4 Default parameters (dEF), 🗎 48.

The command SAV,1 saves parameter values which have been changed via the serial interface in the EEPROM. These values will be preserved even when the unit is switched off.

S: SAV,a<CR>[<LF>]

R: <ACK><CR><LF>

Parameters	Significance
a	Save parameters 0 = Save default parameters 1 = Save user parameters

Note:
Parameters which have been changed manually (control buttons) are saved in the EEPROM automatically. The SAV command is not required in this case.

6.3.26 SC1

Sensor 1 control. Transmitter 1 control. See Chapter 5.2.6 Transmitter activation (S-on), 44 and Chapter 5.2.8 Transmitter deactivation (S-oFF), 44.

S: SC1[,a,b,c.ccE±cc,d.ddE±dd]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c.ccE±cc,d.ddE±dd<CR><LF>

Parameters	Significance
a	Transmitter activation 0 = Manual (default) 1 = Hot start 2 = By channel 1 3 = By channel 2 4 = By channel 3
b	Transmitter deactivation 0 = Manual (default) 1 = Self control 2 = By channel 1 3 = By channel 2 4 = By channel 3
c.ccE±cc	Activation value in current unit of measurement
d.ddE±dd	Deactivation value in current unit of measurement

Note:
The commands SC2 and SC3 concern the transmitters 2 and 3, respectively. The commands are analogous to the SC1 command.

6.3.27 SP1

Setpoint 1. Switching function 1. See Chapter 5.1 Switching function parameters (PArA SP), 36.

S: SP1[,a,b.bbbbE±bb,c.ccccE±cc]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b.bbbbE±bb,c.ccccE±cc<CR><LF>

Parameters	Significance
a	Switching function assignment 0 = Channel 1 1 = Channel 2 2 = Channel 3

Parameters	Significance
b.bbbbE±bb	Lower threshold value in the current unit of measurement
c.ccccE±cc	Upper threshold value in the current unit of measurement

Note:
The commands SP2…SP6 concern the switching functions 2…6, respectively. The commands are analogous to the SP1 command.

6.3.28 SPS

Setpoint status. Switching function status. See Chapter 5.1 Switching function parameters (PArA SP), 36.

S: SPS<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c,d,e,f<CR><LF>

Parameters	Significance
a	Status of switching function 1 0 = Off 1 = On
b	Status of switching function 2 (see above)
c	Status of switching function 3 (see above)
d	Status of switching function 4 (see above)
e	Status of switching function 5 (see above)
f	Status of switching function 6 (see above)

6.3.29 TAD

Test A/D converter. Test the A/D converter. See Chapter 5.4.10 A/D converter signal (Ad-S), 🗎 55 and Chapter 5.4.11 A/D converter ID (Ad-i), 🗎 55.

S: TAD<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: ±a.aaaa,±b.bbbb,±c.cccc,±d.dddd,±e.eeee,±f.ffff <CR><LF>

Parameters	Significance
±a.aaaa	ADC channel 1 Reading of transmitter 1 in volts. 0.0000…+11.0000
±b.bbbb	ADC channel 2. Reading of transmitter 2 in volts. 0.0000…+11.0000
±c.cccc	ADC channel 3. Reading of transmitter 3 in volts. 0.0000…+11.0000
±d.dddd	ADC channel 4. Identification of transmitter 1 in volts. 0.0000…+5.0000
±e.eeee	ADC channel 5. Identification of transmitter 2 in volts. 0.0000…+5.0000
±f.ffff	ADC channel 6. Identification of transmitter 3 in volts. 0.0000…+5.0000

6.3.30 TDI

Test display. Test the display. See Chapter 5.4.9 Display test (di-t), 🗎 55.

S: TDI[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Test status 0 = Off 1 = On

6.3.31 TEE

Test EEPROM. Test the EEPROM. See Chapter 5.4.8 EEPROM test (EE-t), 54.

Caution



EEPROM life.

A large number of write operations will reduce the EEPROM life.

Do not repeat the EEPROM test more often than necessary (e.g. in program loops).

S: TEE<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aaaa<CR><LF>

The control character <ENQ> starts the test. It takes approximately one second to complete the test.

Parameters	Significance
aaaa	Error status. See Chapter 6.3.9 ERR, 67.

6.3.32 TEP

Test EPROM. Test the EPROM. See Chapter 5.4.7 EPROM test (EP-t), 54.

S: TEP<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aaaa,bbbb<CR><LF>

The control character <ENQ> starts the test. It takes approximately 5 seconds to complete the test.

Parameters	Significance
aaaa	Error status. See Chapter 6.3.9 ERR, 67.
bbbb	Check sum (hexadecimal)

6.3.33 TID

Transmitter identification. See Chapter 4.4.3.7 Identifying a transmitter, 🗎 32.

S: TID<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,b,c<CR><LF>

Parameters	Significance
a	Identification of transmitter 1 TTR TTR100 PTR PTR 90 CTR ITR ITR200 noSen noid
b	Identification of transmitter 2 (see above)
c	Identification of transmitter 3 (see above)

6.3.34 TIO

Test I/O. Test the relays. This command allows to switch a single relay or several relays at a time.

Relay test.

In this test the relays switch irrespective of the actual pressure. This may cause unintended switching of devices.

Unplug the RELAY connection before performing a relay test.

Caution



S: TIO[,a,bb]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a,bb<CR><LF>

Parameters	Significance
a	Test status 0 = Off 1 = On
bb	Relay status 00 = All relays off 01 = Switching function 1 relay on 02 = Switching function 2 relay on 04 = Switching function 3 relay on 08 = Switching function 4 relay on 10 = Switching function 5 relay on 20 = Switching function 6 relay on 40 = Error signal relay on 7F = All relays on

Note:
The relay status is a hexadecimal number. It may be combined by the logical operator OR. Example: 24 = Switching functions relays 3 and 6 on.

6.3.35 TKB

Test keyboard. Test the keyboard.

S: TKB<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aaaa<CR><LF>

The control character <ENQ> starts the test. The Multi-Channel Controller polls the keyboard and sends a message to the computer.

Parameters	Significance
aaaa	Keyboard status 0000 = No button pressed 1000 = CH pressed 0100 = PARA pressed 0010 = DOWN pressed 0001 = UP pressed

Note:
The keyboard status is a binary number. It may be combined by the logical operator OR. Example: 0011 = DOWN and UP pressed at the same time.

6.3.36 TLC

Torr lock. See Chapter 5.4.4 Torr lock (tr-L), 🗎 53.

S: TLC[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Torr lock 0 = Off (default) 1 = On

6.3.37 TRA

Test RAM. Test the RAM. See Chapter 5.4.6 RAM test (rA-t), 🗎 54.

S: TRA<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: aaaa<CR><LF>

The control character <ENQ> starts the test. It takes approximately one second to complete the test.

Parameters	Significance
aaaa	Error status. See Chapter 6.3.9 ERR, 🗎 67.

6.3.38 TRS

Test RS232C interface. Test the RS232C interface. See Chapter 5.4.13 RS232C test (rS-t), 🗎 56.

S: TRS<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

The control character <ENQ> starts the test. The test can be stopped by pressing Ctrl-C.

6.3.39 UNI

Unit of measurement. See Chapter 5.3.1 Unit of measurement (unit), 47.

S: UNI[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Unit of measurement 0 = mbar/bar (default) 1 = Torr 2 = Pascal 3 = Micron

6.3.40 WDT

Watchdog control. See Chapter 5.4.3 Watchdog control (dt-C), 53.

S: WDT[,a]<CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a<CR><LF>

Parameters	Significance
a	Error acknowledgement 0 = Manually 1 = Automatic (default)

7 Maintenance and service

7.1 Maintenance

The Multi-Channel Controller does not require any special maintenance work.

7.1.1 Cleaning

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

Danger



Mains power.

The Multi-Channel Controller contains parts which are connected to the mains supply.

Make sure that no objects enter through the louvers of the unit. Keep the unit dry. Do not open the unit.

7.2 Program transfer mode

If your Multi-Channel Controller requires an updated firmware version, e.g. for using a new transmitter type, please contact your local Oerlikon Leybold Vacuum service center.

The user parameters set by you are generally still available after the firmware update. It is however recommended that you make a note of the settings before updating. See Section «Default parameters», 🗎 92.

7.2.1 Preparations and selection

1 Switch the Multi-Channel Controller off

2 Connect the RS232C socket (Fig. 3-4, 🗎 18, item F) with a serial interface of the PC (e.g. COM1). See Chapter 3.3.7 RS232C, 🗎 23.

3 Press the button behind the opening (Fig. 3-4, 🗎 18, item E) with a pencil and switch the Multi-Channel Controller on

Note:
The display remains dark. The Multi-Channel Controller is set to the program transfer mode.

7.2.2 Program transfer

The firmware for the Multi-Channel Controller is delivered as a self-extracting *.exe file or as a packed *.zip file.

1 Copy the *.exe or the *.zip file into an empty directory

2 Unpack the file. One of the extracted files is a batch file *.bat.

3 By default, the program transfer is assumed to run via the COM1 serial interface. Proceed as follows if you want to use another serial interface:

3.1 Click the batch file with the right mouse button
- A menu appears

3.2 From the menu, select the option «Edit»

- The batch file is loaded into a text editor

3.3 Change the COM1 entry to the interface you want to use (e.g. COM2)

3.4 Save and close the modified batch file

4 Execute the batch file by double-clicking it with the mouse

The new firmware is being transferred to the Multi-Channel Controller. You can monitor the individual steps on the PC screen. After approximately 1 minute the transfer is completed.

7.2.3 Restarting

Proceed as follows after the firmware has been transferred completely:

1 Switch the Multi-Channel Controller off

2 Wait at least 10 seconds to make sure that the Multi-Channel Controller can initialize

3 Switch the Multi-Channel Controller on again

4 Check if the current parameter settings still agree with the previous ones. See Section «Default parameters», 92.

The Multi-Channel Controller is ready for operation again.

7.3 Calibration

7.3.1 Basics

The Multi-Channel Controller can only measure with high accuracy when it is calibrated precisely. The Multi-Channel Controller is calibrated by Oerlikon Leybold Vacuum before it is shipped. Normally there is no need to change the calibration data.

Caution



Calibration.

If you input incorrect calibration data, the Multi-Channel Controller cannot perform accurate measurements anymore.

The interface commands for calibrating the unit are intended for service technicians of Oerlikon Leybold Vacuum only.

The calibration affects the A/D converters of the individual channels. The measuring curve of an ideal A/D converter is a straight line which has a slope of one and runs through the origin, i.e.:

- Factor = 1 (slope of the line)
- Offset = 0 (intersection with the y axis)

The curves of real A/D converters differ slightly from these ideal values. Calibrating the unit means to determine the gain factors and the offset voltages of the individual A/D converters and to store these calibration values.

The interface commands CAF and CAO are used to access the calibration data of the unit.

7.3.2 CAO

Calibration offset. Calibration offset of the A/D converter. The command is intended for service technicians of Oerlikon Leybold Vacuum only.

S: CAO[,±a.aaaaE±aa,±b.bbbbE±bb,±c.ccccE±cc] <CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: ±a.aaaaE±aa,±b.bbbbE±bb,±c.ccccE±cc<CR><LF>

Parameters	Significance
±a.aaaaE±aa	Calibration offset of channel 1
±b.bbbbE±bb	Calibration offset of channel 2
±c.ccccE±cc	Calibration offset of channel 3

Note:
The CAO command can also be used with other parameters. See Chapter 7.3.4 Calibrating the unit, 🗎 88.

7.3.3 CAF

Calibration factor. Calibration factor of the A/D converter. The command is intended for service technicians of Oerlikon Leybold Vacuum only.

S: CAF[,a.aaaaE±aa,b.bbbbE±bb,c.ccccE±cc] <CR>[<LF>]

R: <ACK><CR><LF>

S: <ENQ>

R: a.aaaaE±aa,b.bbbbE±bb,c.ccccE±cc<CR><LF>

Parameters	Significance
a.aaaaE±aa	Calibration factor of channel 1
b.bbbbE±bb	Calibration factor of channel 2
c.ccccE±cc	Calibration factor of channel 3

Note:
The CAF command can also be used with other parameters. See Chapter 7.3.4 Calibrating the unit, 🗎 88.

7.3.4 Calibrating the unit

The Multi-Channel Controller can be calibrated automatically with the interface commands CAF and CAO. The following auxiliary tools are required:

- D-Sub plug, 15-pin
- Soldering equipment
- High-precision voltage source for 10 volts (10.000 V)

Calibration offset

1 Unplug the transmitter of the respective channel

2 Connect pin 2 (Signal) and Pin 12 (Signal-GND) of a 15-pin D-Sub plug with a wire strap. See Chapter 3.3.4 SENSOR, 🗎 20.

3 Put the D-Sub plug with the wire strap onto the sensor connection of the respective channel
- The input of the A/D converter is short-circuited

4 Use the serial interface to send the command CAO,a to the unit. For the parameter a, use:
- 0 = Channel 1
- 1 = Channel 2
- 2 = Channel 3

The calibration offset of the respective channel is determined and stored in the EEPROM.

Calibration factor

5 Remove the D-Sub plug with the wire strap from the sensor connection of the respective channel

6 Connect pin 2 (Signal) and pin 12 (Signal-GND) of a 15-pin D-Sub plug with a high-precision voltage source. See Chapter 3.3.4 SENSOR, 20.
- Pin 2 = +10.000 V
- Pin 12 = GND

7 Put the D-Sub plug with the voltage source connections onto the sensor connection of the respective channel

8 Use the serial interface to send the command CAF,a to the unit. For the parameter a, use:
- 0 = Channel 1
- 1 = Channel 2
- 2 = Channel 3

The calibration factor of the respective channel is determined and stored in the EEPROM. Now the channel is calibrated.

8 Troubleshooting

8.1 Fault indication

A fault in the Multi-Channel Controller is indicated as follows:

- FAIL flashes and the display shows an error message. See Chapter 8.2 Error messages, 🗎 90.
- The error signal relay opens

8.2 Error messages

Display	Possible cause and corrective action
SE	Sensor error. Error in the connection of the respective transmitter. Press PARA to acknowledge. If the cause has not been removed, then noSEn or noid will be displayed.
dt	The watchdog control has been triggered. Severe electrical fault or an operating system error. Or: The Multi-Channel Controller has been switched off and on without sufficient delay. Press PARA to acknowledge. The Multi-Channel Controller will acknowledge automatically after 2 s if the watchdog control is set to auto.
rA	Error in the main memory (RAM). Press PARA to acknowledge.
EP	Error in the program memory (EPROM). Press PARA to acknowledge.
EE	Error in parameter memory (EEPROM). Press PARA to acknowledge.
di	Error in the display driver. Press PARA to acknowledge.
Ad	Error in the A/D converter. Press PARA to acknowledge.
tF	Task fail. Error in the operating system. Press PARA to acknowledge.
UA	Error in UART. Press PARA to acknowledge.
Er x	Error message ITR 90. 0 = No communication with the transmitter. x = Error code (High-Byte). See Reference [6].
Er xx	Error message ITR 200. xxH = Error code. See Reference [15].

8.3 Technical support

If the fault persists even after the message has been acknowledged several times and/or the transmitter has been exchanged, please contact your local Oerlikon Leybold Vacuum service center.

9 Storage and disposal

9.1 Packaging

Please keep the original packaging. The packaging is required for storing the Multi-Channel Controller and for shipping it to an Oerlikon Leybold Vacuum service center.

9.2 Storage

The Multi-Channel Controller may only be stored in a dry room. The following requirements must be met:

Ambient temperature	-20…+60 °C
Humidity	As low as possible. Preferably in an air-tight plastic bag with a desiccant.

9.3 Disposal

The product must be disposed of in accordance with the relevant local regulations for the environmentally safe disposal of systems and electronic components.

Appendix

Default parameters

Display	Default	User
SP -L	1×10^{-11} mbar	
SP -H	9×10^{-11} mbar	
FiLt	nor	
GAS	n2	
Cor	1.00	
FS	1000 mbar	
oFS	oFF 0.0000E+00 mbar	
S-on	HAnd 1.00E-03 mbar	
S-oFF	HAnd 1.00E-03 mbar	
unit	bAr	
bAud	9600	
PrE	oFF	
diGit	2	
Ao	LoG	
Err-r	ALL	
dt-C	Auto	
tr-L	oFF	
LoC	oFF	
EMi	Auto	
FiL	Auto	

Literature

[1] Operating Manual
THERMOVAC Transmitter TTR 90
GA 09.220
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[2] Operating Manual
THERMOVAC Transmitter TTR 211 S
GA 09.216
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[3] Operating Manual
PENNING Transmitter PTR 225
GA 09.308
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[4] Operating Manual
CERAVAC Transmitter CTR 90
GA 09.040
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[5] Operating Manual
CERAVAC Transmitter CTR 91
GA 09.040
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[6] Operating Manual
IONIVAC Transmitter ITR 90
GA 09.420
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[7] Operating Manual
THERMOVAC Transmitter TTR 100, TTR 100 S2
GA 09.221
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[8] Operating Manual
THERMOVAC Transmitter TTR 101, TTR 101 S2
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[9] Operating Manual
THERMOVAC Transmitter TTR 91, TTR 91 S
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[10] Operating Manual
THERMOVAC Transmitter TTR 96 S
GA 09.223
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[11] Operating Manual
PENNINGVAC Transmitter PTR 90
GA 09.313
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

Appendix

[12] Operating Manual
Gauge Heads DI 200, DI 201, DI 2000, DI 2001, DI 2001 rel
GA09611_002_A1
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[13] Operating Manual
CERAVAC Transmitter CTR 100
17200257_002_00
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[14] Operating Manual
CERAVAC Transmitter CTR 101
130002066_002_A0
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

[15] Operating Manual
IONIVAC ITR 200 S, ITR 200 SP, ITR 200 SD
17200137_002_00
Oerlikon Leybold Vacuum GmbH, D-50968 Köln

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EG- Konformitätserklärung

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erklärt hiermit, dass die nachfolgend bezeichneten Produkte in der von uns in Verkehr gebrachten Ausführung den einschlägigen EG-Richtlinien entsprechen. Bei einer nicht mit uns abgestimmten Änderung eines Produktes verliert diese Erklärung ihre Gültigkeit. Die Einhaltung der EMV-Richtlinien setzt einen EMV-angepassten Einbau der Komponenten in der Anlage oder Maschine voraus.

Produktbezeichnung:	Mehrkanal-Messgerät
Typenbezeichnung:	CENTER TWO, CENTER THREE
Katalognummer:	230003 230004 235003 235004

Die Produkte entsprechen folgenden Richtlinien:

- Niederspannungsrichtlinie (2006/95/EG)
- Richtlinie Elektromagnetische Verträglichkeit (2004/108/EG)

Folgende harmonisierte Normen wurden angewandt:

• EN 61010-1	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte Teil 1: Allgemeine Anforderungen
• EN 61000-3-2	EMV: Grenzwerte für Oberschwingungsströme
• EN 61000-3-3 + A1 + A2	EMV: Grenzwerte - Begrenzung von Spannungsänderungen, Spannungsschwankungen und Flicker
• EN 61000-6-2	EMV: Fachgrundnormen - Störfestigkeit für Industriebereiche
• EN 61000-6-3	EMV: Fachgrundnormen - Störaussendung für Wohnbereich, Geschäfts- und Gewerbebereiche sowie Kleinbetriebe

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