vacuubrand

Technology for Vacuum Systems

Instructions for use

CVC 3000

Vacuum controller

LAB Online Exhibition

Operation Manual

knowledge

Action movie

www.1788lab.com E-mail:info@1788lab.com

Dear customer,

Your VACUUBRAND controller should support you for a long time without trouble and with maximal power. Thanks to our long practical experience we have much information how you could ensure powerful application and personal safety. Please read these instructions for use before the initial operation of your controller.
VACUUBRAND controllers are the result of many years of experience in construction and practical operation of these controllers combined with the latest developments in material and manufacturing technology.

Our quality maxim is the ”zero fault principle”:
Every controller leaving our company is tested intensively including an endurance run. Therefore also faults which occur rarely, are identified and can be eliminated immediately.
The achievement of the specifications after the endurance run is tested for every controller.
Every VACUUBRAND controller achieves the specifications. We feel obliged to this high quality standard.
We know that the controller should not take a part of your real work and hope that our products contribute to an effective and trouble-free realisation of your work.

Yours
VACUUBRAND GMBH + CO KG

After sales service: Contact your local dealer or call (++49) 9342/808-193.

DANGER ➨ Danger! Immediate danger. Death or severe injuries as well as damage to equipment and environment can occur.

WARNING ☞ Warning! Possible danger. Severe injuries as well as damage to equipment and environment can occur.

CAUTION • Caution! Possible danger. Slight injuries as well as damage to equipment and environment can occur.

NOTICE Note. Disregarding of notes may cause damage to the product.

Isolate equipment from mains before removing the cover.

Contents

Safety information

General information

NOTICE

Read and comply with this manual before installing or operating the equipment.
To operate the vacuum controller, valves and/or vacuum pumps are necessary. Otherwise the controller acts as measuring device.
Remove all packing material, remove the product from its packing-box, remove the protective covers and keep, inspect the equipment.
If the equipment is damaged, notify the supplier and the carrier in writing within three days; state the item number of the product together with the order number and the supplier's invoice number. Retain all packing material for inspection.
Do not use the equipment if it is damaged.
If the equipment is not used immediately, replace the protective covers. Store the equipment in suitable conditions.

Intended use

⚠WARNING

☞ Operate the controller only in combination with VACUUBRAND genuine accessories (e. g. isolation valve, vacuum management module VMS A). Make sure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.
☞ Comply with notes on correct vacuum and electrical connections, see section "Use and operation".

⚠CAUTION

- The controller is designated for an ambient and gas temperature at the pressure transducer connection of +10°C to +40°C at continuous operation. If installing the device into a cabinet or a housing check maximum temperature. Ensure that the maximum permitted gas temperature at the pressure transducer (see "Technical data") is not exceeded.

NOTICE

Use the equipment for the intended use only, i.e. for measurement and control of vacuum.

Connecting the controller

⚠WARNING

☞ **Avoid uncontrolled overpressure** (e. g. when connecting to a locked or blocked tube system). **Risk of bursting.**

⚠CAUTION

- **Comply with max. permitted pressure** at the pressure transducer, see section "Technical data".
- Connect hoses at the pressure transducer gas tight.

- Using a wall power supply, assemble and lock the suitable mains plug (included in delivery) to the power supply prior to use.

- The controller is equipped with a **short circuit proof wide range power supply** with an integrated overload protection. Check that mains voltage and current conform with the equipment (see rating plate).

☞ Comply with **max. permitted gas and ambient temperatures** and make sure ventilation is adequate, if the equipment is installed in a housing or if the ambient temperature is elevated.
☞ Avoid high heat supply (e. g. due to hot process gases).
☞ In case of residues, aggressive or condensable media install a gas washing bottle if necessary.

NOTICE

Position device and vacuum connection lines so that no condensate can flow towards the pressure transducer.
Use inert gas for venting if necessary.
Ensure stability of the hose connection. Comply with all relevant **safety requirements.**

When the controller is brought from cold environment into a warm room for operation **bedewing** may occur. Allow the device to acclimatise.

Comply with **national safety regulations and safety requirements** concerning the use of vacuum and electrical equipment. Comply with all **applicable and relevant safety requirements** (regulations and guidelines), **implement the required actions and adopt suitable safety measures**.

Ambient conditions

NOTICE

To the best of our knowledge the equipment is in compliance with the requirements of the applicable **EC-directives** and harmonized standards with regard to design, type and model, especially directive IEC 1010 (DIN EN 61010.1). This directive gives in detail conditions under which the equipment can be operated safely (see also IP degree of protection).
Adopt suitable measures in case of differences, like using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or dewiness.

Operating conditions

⚠ DANGER

➨ The devices are **not suitable** for applications which involve **dangerous or explosive gases or explosive or flammable mixtures**.

NOTICE

Ensure that the materials of the wetted parts are compatible with the substances in the vacuum system, see section “Technical data”.

Safety during operation

⚠ DANGER

➨ Adopt suitable measures to prevent the release of dangerous, explosive, corrosive or polluting fluids, gases or vapours.

➨ Prevent any part of the human body from coming in contact with the vacuum.

⚠ WARNING

☞ **Attention:** If the pressure is higher than approximately 1080 mbar the pressure reading becomes incorrect (saturation of the pressure transducer). The display flashes. **Immediate pressure relief necessary! Risk of bursting!**
☞ Starting of a NT VARIO / VARIO-B pump, switching of an isolation valve, a coolant valve or a vacuum pump (in combination with a VMS Module A) or opening of the venting valve of the controller must not lead to a critical dangerous situation under any circumstances.

⚠ CAUTION

- Use only **genuine spare parts and accessories.** Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.
  Possibly the CE mark or the C/US conformity (see rating plate) becomes void if not using genuine spare parts.

NOTICE

- **Attention:** If **Auto-Start** is preselected, the process starts immediately after a power failure without any further action. It is the user’s responsibility to ensure that no dangerous status of the system due to the automatic start-up can occur and to provide appropriate safety measures. If necessary, the user has to check **prior to starting the process** whether the option ”Auto-Start” is enabled.

Electronic equipment is never 100% fail-safe. This may lead to an ill-defined status of the equipment or of other connected devices. Provide protective measures against misfunction and failure. Ensure that in case of failure the controller and the vacuum system always will turn into a safe status.

Maintenance and repair

Before starting maintenance, isolate the vacuum controller from the vacuum system and the electrical supply.
Wait two minutes after isolating the equipment from mains to allow the capacitors to discharge.

⚠CAUTION

- **Attention:** Due to the operation the device might be contaminated by harmful or dangerous substances. Clean or decontaminate prior to maintenance.

Before starting **maintenance** vent the vacuum connection to atmospheric pressure and isolate the vacuum controller from the vacuum system.

Ensure that maintenance is done only by suitably trained and supervised technicians.

Interior components of the controller can only be repaired at the factory.

In order to comply with law (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments returned to the manufacturer can be repaired only when certain procedures (see section **"Notes on return to the factory"**) are followed.

Technical data

Technical data of controller

Controller	CVC 3000
Pressure transducer	internal, capacative, absolute pressure transducer made of aluminium oxide ceramics
Display	LCD graphic display
Pressure units / scale (selectable)	mbar, Torr or hPa
Measuring range (absolute)	1080 mbar - 0,1 mbar (810 Torr - 0,1 Torr)
Max. control range with internal pressure transducer (absolute)*	1060 mbar - 1 mbar (795 Torr - 1Torr), HI < 1 mbar (Torr)
Resolution	0.1 mbar (Torr)
Measurement uncertainty after careful adjustment and at constant temperature	<+/-1 mbar (0,75 Torr)
Temperature coefficient	<+/- 0.07 mbar/K (0,05 Torr/K)
Ambient temperature range (operation)	10°C to +40°C
Ambient temperature range (storage)	-10°C to +70°C
Permitted relative ambient moisture during operation (condensation)	30% to 85%
Max. permitted range of voltage supply	24 V= (+/- 6V)
Max. power draw	3.4 W (140 mA at 24 V=)
Max. permitted current of connected valves (connected components)	4 A
Degree of protection according to IEC 529 (front side)	IP 42
Measurement connection (housing version)	connection for PTFE tube10/8 mm or hose nozzle 6/10 mm
Measurement connection (built-in version)	connection for PTFE tube10/8 mm
Venting connection	hose nozzle for hose 4-5 mm
Max. inert gas pressure (absolute)	1.2 bar
Max. permitted pressure at the pressure transducer (absolute)	1.5 bar (1125 Torr)
Max. media temperature at the pressure transducer (gas!)	continuous: 40°C, short time: up to 80°C
Interface	RS 232 C
Length of cable (power supply)	approx. 2 m
Weight (without power supply)	0.44 kg
Dimensions L x W X H, housing version (with foot, without power supply)	138 mm x 124 mm x 115 mm
Dimensions L x W X H, built-in version	123 mm x 124 mm x 83 mm
Cut-out for front assembly	111.5 mm x 111.5 mm at wall thickness 1 mm 112.0 mm x 112.0 mm at wall thickness 2 mm 112.6 mm x 112.6 mm at wall thickness 3 mm

* The actual vacuum control range in your special application might be reduced due to ultimate vacuum of the pump, quantity of gas occurring etc.

We reserve the right for technical modification without prior notice!

Technical data power supply

Power supply (wall plug)*	
Input voltage	90-264 V~, 47-63 Hz
Max. current draw	0.8 A
Ambient temperature range (operation)	0°C to +40°C
Ambient temperature range (storage)	-20°C to +85°C
Output voltage	24 V=, short-circuit proof
Max. output current	1.25 A
Mains connection	exchangeable plug Europe / UK / US / AUS
Dimensions	108 mm x 58 mm x 34 mm
Weight	0.3 kg

* if provided

Wetted parts

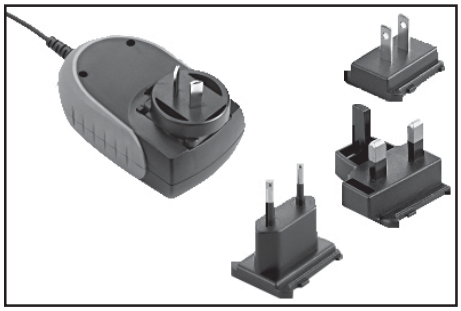
Components	**Wetted parts**
Vacuum connection / hose nozzle	PP
Sensor	aluminium oxide ceramics
Sensor housing	PPS / glas fibre
Sensor seal	chemically resistant fluoroelastomer
Venting valve seal	FPM

We reserve the right for technical modification without prior notice!

➨ The VACUUBRAND controller CVC 3000 can only be operated with components compatible to the VACUUBRAND **VACUU•BUS system**, see accessories.
➨ Speed control is only possible with **VACUUBRAND NT VARIO / VARIO-B** pumps and pumping units.

Use and operation

Assembling the country specific mains plug



- ☞ The wall power supply is delivered with a mains plug for Europe, UK, US and Australia.
- ☞ To replace the mains plug press locking key and remove mains plug.
- ☞ Assemble the suitable mains plug to the power supply and lock.

The vacuum controller with internal pressure transducer and venting valve controls pumps, valves, NT VARIO / VARIO-B pumps and pumping units and VARIO-SP pumps.

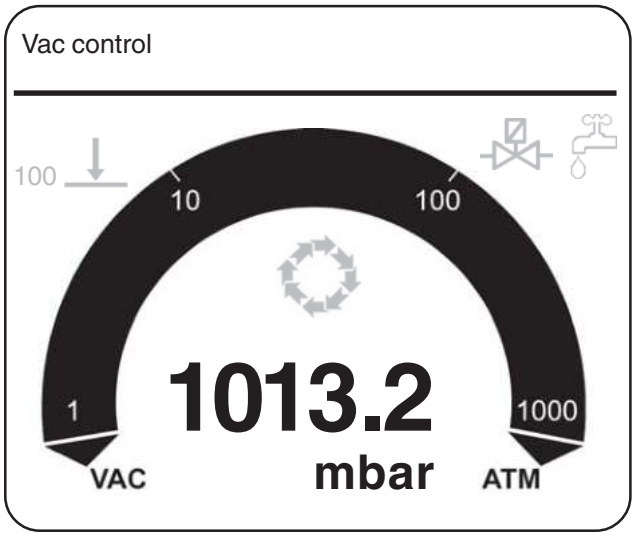
When switching on the controller CVC 3000 for the very first time, a menu to select the language of the controller menu is displayed. Select the desired language ("*Deutsch*", "*English*", "*Français*") by turning the selection knob and press to confirm. Then select the pressure unit ("*mbar*", "*Torr*" or" *hPa*") in the same way.
It is possible to access the language selection menu at any time by switching on the controller while keeping the selection knob pressed.

After switching on, the **version number of the software** is displayed, then the preselected function with pressure reading.

The connected components (pumps, valves, external sensor) are automatically identified and configurated.

Don't use more than one controller within a VACUU•BUS system. More than one controller within the same VACUU•BUS system will interfere with each other and cause error messages of the connected components (pumps, valves).

Display and symbols



Function of the device

Pump down
Vac control
Auto mode
Program
VACUULAN
Configuration

00:00:00	Process runtime (only if process control is running)
100	Vacuum control to a preset vacuum value (here 100 mbar/Torr/hPa)
	Pump down (continuous pumping)
50%	Pump symbol is displayed when pump is running. If a NT VARIO / VARIO-B pump is connected, the pump's rotational speed in % is displayed.
5	Time meter is running (in function "VACUULAN"), remaining time in minutes is displayed.
	In-line valve switched on
	Venting valve switched on
	Coolant valve switched on
	PC symbol: controller is in remote operation
	Control is running
	Warning notice (if necessary in combination with other symbols), flashing
1013.2	actual absolute pressure at the pressure transducer
mbar Torr hPa	preselected pressure unit

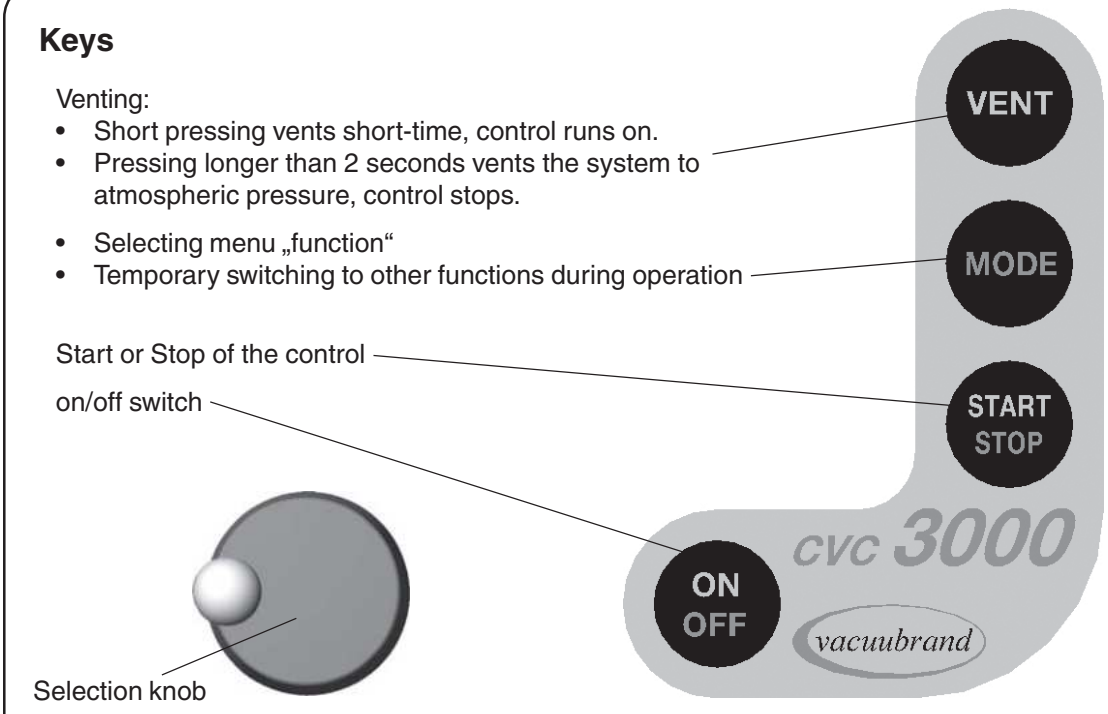
Keys

Venting:
- Short pressing vents short-time, control runs on.
- Pressing longer than 2 seconds vents the system to atmospheric pressure, control stops.

- Selecting menu „function“
- Temporary switching to other functions during operation

Start or Stop of the control

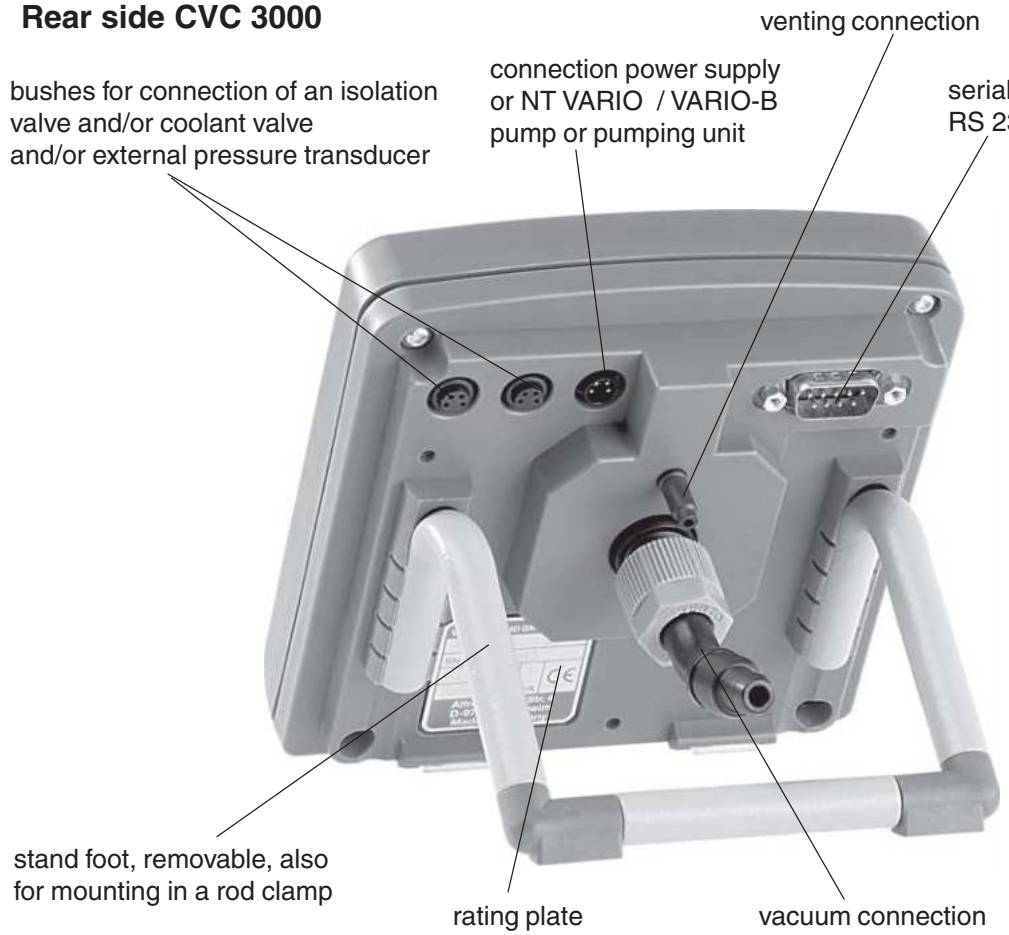
on/off switch



Selection knob

- Press to reach the set-up menu of the function
- Turn to reach the parameter set-up
- Press to reach the set value
- Turn to change the set value
- Press to confirm and to reach further parameters or to leave the set-up menu

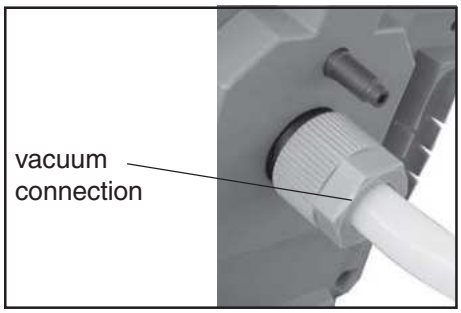
Rear side CVC 3000



Attention: Do not cant when assembling or removing plug connections! Comply with correct positioning of the plug. To connect further components use Y-adapters and extension cables VACUU•BUS. When connecting an external pressure transducer, it is used automatically. Further information on how to use several sensors simultaneously is available on request.

Notes on operation

To operate the controller valves and/or vacuum pumps are necessary.
Without those components the controller can be used as vacuum measurement device.
The controller used as measurement device switches a connected coolant valve.



Max. permitted pressure at the pressure transducer: 1.5 bar (absolute).

- ☞ The display flashes at a pressure higher than approximately 1080 mbar. **Immediate pressure release. Risk of bursting!**
- ☞ Inside a vacuum system where evaporation occurs, e. g. rotary evaporator, the vacuum is not uniform, e. g. a condenser acts as pump or the vacuum in the pipeline is lower than in the system. Therefore choose the position where to connect the pressure transducer carefully.
- ☞ Condensate and deposits at the pressure transducer falsify the measurement result.
- ☞ If residues occur or when working with aggressive or condensable substances, install a gas washing bottle in front of the pressure transducer.
- ☞ **Position controller in such a way, that condensate can not flow into the pressure transducer.**
- ☞ If necessary, clean pressure transducer.

Notes on selecting the function

The controller CVC 3000 can be adapted to the specific application by choosing the appropriate function depending on the connected components.

Automatic detection of the components:

When switching on the controller, the actual configuration of the connected components is checked automatically.

Connected components (valves, sensors, pumps) are **detected automatically** and used and supervised until the controller is switched off.

The last mode of operation and the preselected values (e. g. for pressure, speed or time for switching off) are stored.

In case of similar operation conditions it is possible to start immediately, if the preselections are chosen appropriately.

The controller has five functions and one menu for configuration, see section ”Menu guide”. Each function includes specific preselection possibilities and is adapted automatically with regard to the connected components.

Depending on the connected components (valves, pump,...) some menu might not be active!

Changing the function:

➨ Switch controller on.
➨ Press START/STOP if control is running.
➨ Press key MODE.
➨ Select function with knob and press to confirm.
☞ Depending on the selected function, the controller controls different components.

”Pump down”

- Pump or in-line valve depending on pressure and time preselections
- NT VARIO / VARIO-B pumps depending on pressure and time preselections with continuous speed control
- Coolant valve

”Vac control”

- Pump and / or in-line valve depending on pressure preselection in two-point control
- NT VARIO / VARIO-B pumps depending on pressure preselection with pinpoint precision
- Coolant valve

”Auto mode” (only available if a NT VARIO / VARIO-B pump is connected)

- NT VARIO / VARIO-B pump with pinpoint precision with fully automatic boiling point determination and adaptation
- Coolant valve

”Program”

- Pump or in-line valve depending on pressure and time preselections or ”Auto mode” (”Auto mode” only available if a NT VARIO / VARIO-B pump is connected)
- Coolant valve
- Venting valve

”VACUULAN”

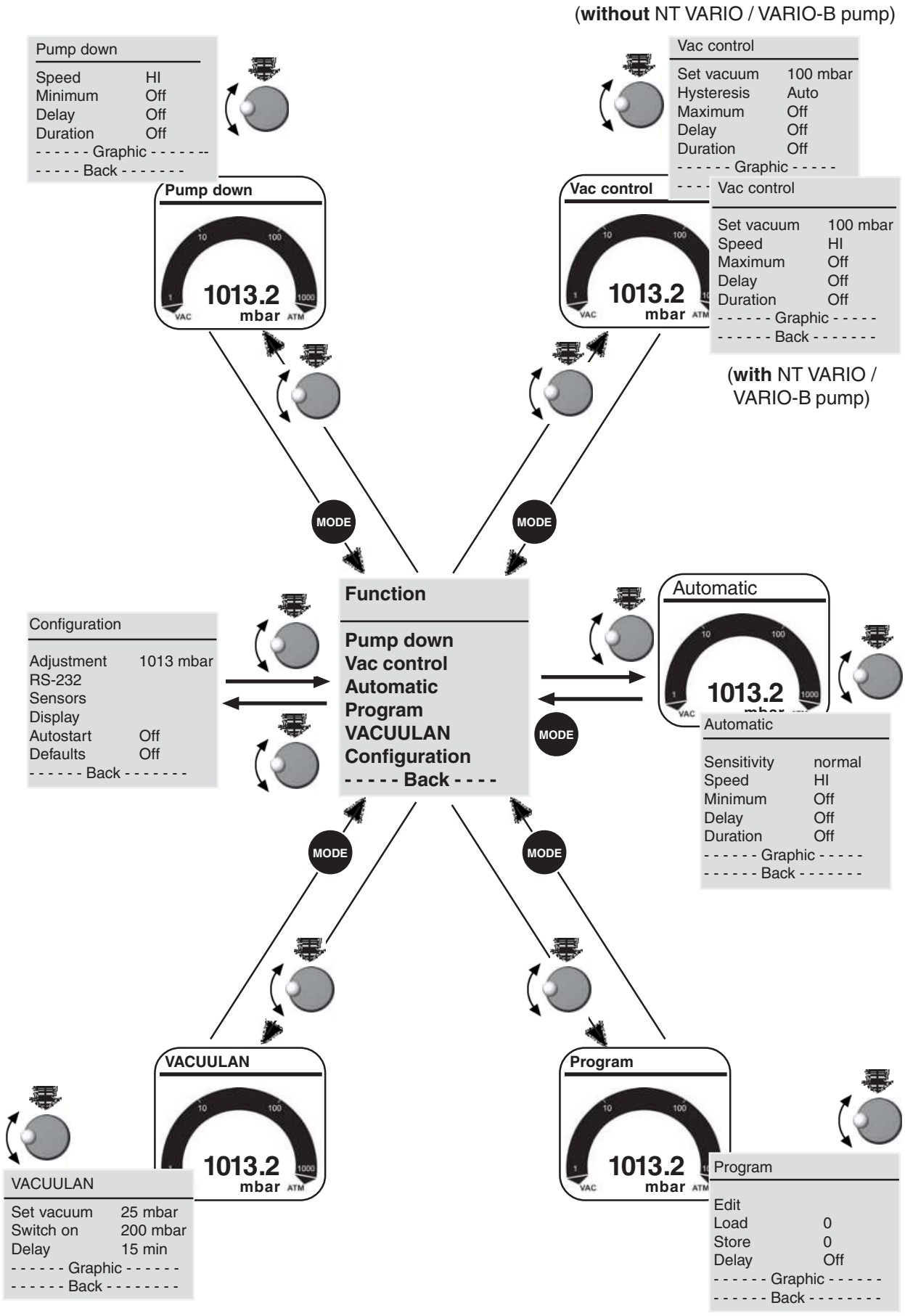
- Pump or in-line valve depending on pressure and time preselections
- NT VARIO / VARIO-B pump depending on pressure and time preselections with continuous speed control
- Coolant valve

”Configuration” (Menu also accessible by pressing the selection knob while the start display is shown)

Preselections for

- Adjustment of the pressure transducer
- Interface RS-232
- Sensors (configuration and switching between several sensors)
- Display (brightness and contrast of the display, language, sound)
- Autostart (automatic restart after power failure)
- Defaults (Resetting the controller is to factory set values)

Menu guide



Function Pump down

➨ **Continuous pumping with pressure and time settings**

- **Operation of a vacuum pump via in-line valve**
- **Operation of a vacuum pump without in-line valve with VMS (Vacuum Management System, see "Accessories")**
- **Operation on demand of a speed controlled pump (NT VARIO / VARIO-B)**

Preselections

☞ Use the selection knob to select the parameters. All parameters can also be altered even while the operation control is running.

☞ ***Speed:*** Only for NT VARIO / VARIO-B pumps: Preselection of the motor speed for pump down. The selection "HI" causes the maximum speed and best ultimate vacuum of the pump (with automatic speed reduction at high vacuum).
The "*Speed*" is adjustable in a range of 1-100% and to "HI".

☞ ***Minimum:*** The controller switches off the pump or closes the in-line valve when the preset value for "*Minimum*" is reached.
"*Minimum*" is adjustable in a range of 1-1060 mbar or can be set to "Off".
A preset "*Duration*" (process time) is without effect, if the process is stopped due to a preset "*Minimum*" before "*Duration*" is reached.

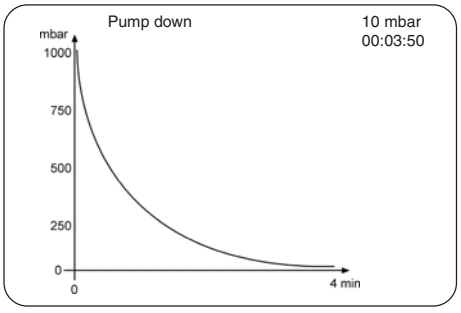
☞ ***Delay:*** "*Delay*" determines the time the pump (with VMS and in-line valve) and the coolant valve are running on after the process has been stopped.
The "*Delay*" is adjustable in a range of 1-300 minutes or can be set to "Off".

☞ ***Duration:*** "*Duration*" determines the total process time since control start.
The process time is adjustable between 1-1440 minutes (24 h) or can be set to "Off". "Off" indicates that no endpoint for pump down is determined.
If a "*Duration*" is preset, the controller switches off the pump if the preset process time is reached, also if a preset "*Minimum*" is still not reached.

☞ If neither "*Minimum*" nor "D*uration*" are preset, process control has to be stopped by pressing key "STOP".

The screen-shot shows the factory-set values.

Pump down	00:00:00
Speed	HI
Minimum	Off
Delay	Off
Duration	Off
- - - - - - Graphic - - - - - -	
- - - - - - Back- - - - - - - -	



When selecting "*Graphic*" the display shows a pressure vs. time curve.

The timeline in the diagram adapts automatically to the process time.

☞ Press the selection knob twice to return to the standard display.

Temporary switching from "Pump down" to "Vac control" or "Auto mode" (only if control is running):

☞ Press key "MODE". The controller switches to function **"Vac control"**, the current vacuum is used as set value.

☞ Only for VARIO NT pumps: Pressing key "MODE" again switches to function **"Auto mode"**. The controller adapts the boiling pressure starting with the current vacuum.

☞ The preset function of the controller does not change due to this temporary switching. When pressing key "STOP" the controller is in function **"Pump down"** again.

Adapting the speed (only for NT VARIO / VARIO-B pumps) during pump down:

☞ Press the selection knob and turn.

☞ Turning the knob to the left reduces the speed.

☞ Turning the knob to the right increases the speed.

Function Vac control

➨ **Vacuum control to a preset vacuum value**

- **Operation of a vacuum pump via in-line valve**
- **Operation of a vacuum pump without in-line valve with VMS (Vacuum Management System, see ”Accessories”)**
- **Operation on demand of a speed controlled pump (NT VARIO / VARIO-B)**

Preselections

☞ Use the selection knob to select the parameters. All parameters can also be altered even while the operation control is running.

☞ ***Set vacuum**:* The ”*Set vacuum*” is the lower vacuum value for two-point control or the set point for vacuum control with pinpoint precision for NT VARIO / VARIO-B pumps. The selection ”Turbo” (only NT VARIO / VARIO-B pumps) leads to the optimum backing pressure for a turbomolecular pump.
The ”*Set vacuum*” is adjustable in a range of 1 - 1060 mbar or can be set to ”Turbo”.

☞ ***Hysteresis**:* Control bandwidth of a two-point control. A too small hysteresis leads to frequent switching of the valve or the pump. A too large hysteresis leads to imprecise control. NT VARIO / VARIO-B pumps are controlled without hysteresis. Suggested values (see table) for the ”*Hysteresis*” are stored in the controller (setup ”Auto”) and are adapted automatically to the preset pressure. Adapting the ”*Hysteresis*” by the user is possible at any time.
The ”*Hysteresis*” is adjustable in a range of 1 - 300 mbar or can be set to ”Auto”.

p in mbar	5	10	50	80	100	200	500	700	900	1000
Hysteresis in mbar (suggested values)	2	2	5	8	9	17	40	55	71	78

☞ ***Speed:* Only for speed controlled pumps** (NT VARIO / VARIO-B): The maximum motor speed can be preselected (to control the pumping speed).
The selection ”HI” (recommended) provides the optimum pumping speed of the pump and therefore an optimum ultimate vacuum.
The ”*Speed*” is adjustable in a range of 1-100% or can be set to ”HI”.

☞ ***Maximum**:* An upper pressure limit can be preselected. The pump switches off if the pressure limit is exceeded, e. g. at the end of suctions, filtrations. The pressure limit is only active once the pressure has gone below the ”*Maximum*”.
The ”*Maximum*” is adjustable in a range of 1059 - 1 mbar (at the least 1 mbar higher than the ”*Set vacuum*”) and to ”Off”. ”Off” indicates that no maximum value is preset.

☞ ***Delay:*** ”*Delay*” determines the time the pump (with VMS and in-line valve) and the coolant valve are running on after the process has been stopped.
The ”*Delay*” is adjustable in a range of 1-300 minutes or can be set to ”Off”.

☞ ***Duration:*** ”*Duration*” determines the total process time since control start.
The process time is adjustable between 1-1440 minutes (24 h) or can be set to ”Off”. ”Off” indicates that no endpoint for pump down is determined.
If a ”*Duration*” is preset, the controller switches off the pump if the preset process time is reached, also if a preset ”*Minimum*” is still not reached.

The screen-shots show the factory-set values.

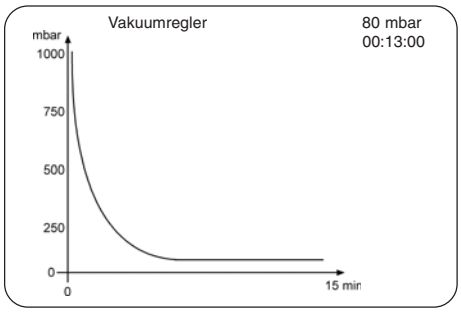
Vac control	00:00:00
Set vacuum	100 mbar
Hysteresis	Auto
Maximum	Off
Delay	Off
Duration	Off
- - - - - - Graphic - - - - - -	
- - - - - - Back - - - - - - -	

Vacuum control **without** NT VARIO / VARIO-B pump

Vac control	00:00:00
Set vacuum	100 mbar
Speed	HI
Maximum	Off
Delay	Off
Duration	Off
- - - - - - Graphic - - - - - -	
- - - - - - Back - - - - - - -	

Vacuum control **with** NT VARIO / VARIO-B pump

When selecting "*Graphic*" the display shows a pressure vs. time curve.



The timeline in the diagram adapts automatically to the process time.
☞ Press the selection knob twice to return to the standard display.

Temporary switching from "Vac control" to "Auto mode" (only NT VARIO / VARIO-B pumps) while process control is running:

☞ Press key MODE. The controller switches to **"Auto mode"** and adapts the boiling pressure starting with the actual set value. The preset function of the controller does not change due to this switching. When pressing key "STOP" the controller is in function **"Vac control"** again.

Adjustment of the "*Set vacuum*" during vacuum control:

Dynamic, interactive adaption:
☞ Press the selection knob and keep pressed.
☞ Turning the knob for a 1/4 turn to the left causes pump down.
☞ Turning the knob for a 1/4 turn to the right causes venting.
☞ When the knob is released the actual value is taken over as new set value.

Alternatively:
Fine tuning:
The "*Set vacuum*" can be adapted only by turning the selection knob **while process is running.**
☞ Turn the selection knob.
☞ A full turn causes a change of the "*Set vacuum*" of 12 mbar.
☞ Turning the knob for one detent causes a change of the "*Set vacuum*" of 1 mbar.

Function Auto mode (pumps NT VARIO / VARIO-B)

➨ **Control of a NT VARIO / VARIO-B pump in operation mode auto mode: Automatic determination of the boiling vacuum and automatic adapting of the boiling vacuum also in case of changing process parameters.**

Preselections

☞ The selection of the parameters is carried out via the selection knob.

☞ ***Sensitivity*:** The "*Sensitivity*" of the control effects the control speed. High sensitivity leads to a reduced pumping down speed, e. g. for small amounts of solvents or foaming processes. Use a low sensitivity for "uncritical" processes to reduce process time. Usually setting the "*Sensitivity*" to "normal" is appropriate.
The "*Sensitivity*" is adjustable to "high", "normal" or "low".

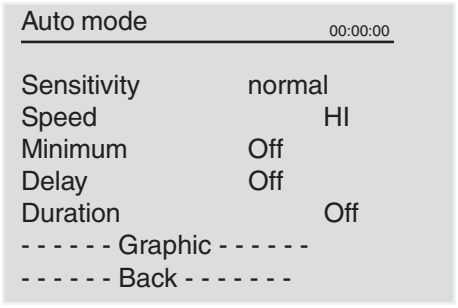
☞ ***Speed:*** The maximum motor speed can be preselected (to control the pumping speed). The selection "HI" (recommended) causes an automatic limitation of the adaptation depending on parameters determined during the process. Only in case of very sensitive processes it is recommended to reduce the maximum speed.
The "*Speed*" is adjustable in a range of 1-100% or can be set to "HI".

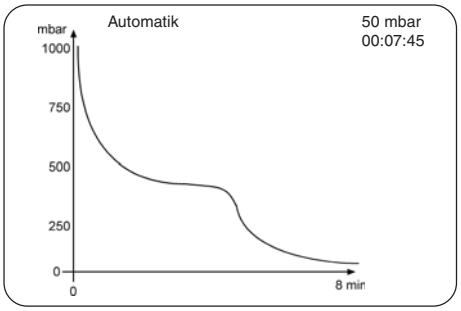
☞ ***Minimum*:** If the vacuum value reaches "*Minimum*" the process is stopped. Use "*Minimum*" for automatic process termination. When selecting "Auto" the controller switches off automatically at the end of the process (boiling plateau), recommended only for large solvent amounts.
The "*Minimum*" is adjustable in a range of 2 - 1060 mbar or can be set to "Auto" or "Off".

☞ ***Delay:*** "*Delay*" determines the time the coolant valve continues to run after process stop.
The "*Delay*" is adjustable in a range of 1-300 minutes or can be set to "Off".

☞ ***Duration:*** "*Duration*" determines the total process time since control start.
The process time is adjustable between 1-1440 minutes (24 h) or can be set to "Off". "Off" indicates that no endpoint for pump down is determined.
If a "*Duration*" is preset, the controller switches off the pump if the preset process time is reached, also if a preset "*Minimum*" is still not reached.

The screen-shot shows the factory-set values.





When "*Graphic*" is selected the display shows a pressure vs. time curve (right screen-shot).

The timeline in the diagram adapts automatically to the process time.

☞ Press the selection knob twice to return to the standard display.

Temporary switching from "Auto mode" into function "Vac control"

☞ Press key "MODE". The controller switches to "Vac control" . The current pressure is used and held as new set point.

☞ The preset function of the controller does not change due to this temporary switching. When pressing key "STOP" the controller is in function "Auto mode" again.

Function Program

➨ **Ten programs with up to ten program steps with preset values for vacuum and time can be set and stored.**

☞ ***Edit*:** Preset values for the process run can be edited:
Time: Process runtime to reach a preset vacuum level or if setting ”Step” runtime after having achieved the vacuum level. A preset runtime of 18:00:00 hours in the final program step will cause the process to run endlessly. Terminationof the process by pressing key ”STOP”.
Vacuum: Vacuum level to be attained.
Venting valve: Operation of a venting valve to reach a preset vacuum level.
”Step”: ”Step” causes pump down as fast as possible to the preset vacuum level. As soon as the vacuum level is reached, the time meter starts to run.
Auto (”Auto” only for NT VARIO / VARIO-B pumps): Auto = 1 means automatic determination of a boiling point and adaptation to changes of the boiling point within the preselected time interval. Auto = 2 means automatic adaptation to changes of the boiling point. If selecting ”Auto” without ”Step” the program step is finished when the selected time or vacuum value has been reached.
”Step” in combination with Auto = 1: Pump down as fast as possible to the preset vacuum level. Then the automatic determination and later adaptation of a boiling point is started.
”Step” in combination with Auto = 2: Pump down as fast as possible to the preset vacuum level. The reached vacuum level is then set as boiling point and automatically adapted to changes of the boiling point.

☞ ***Load*:** Load programs (Program 0 - 9).

☞ ***Store*:** This command stores an edited program or the program of the just expired process to one of the storage spaces 0 - 9.

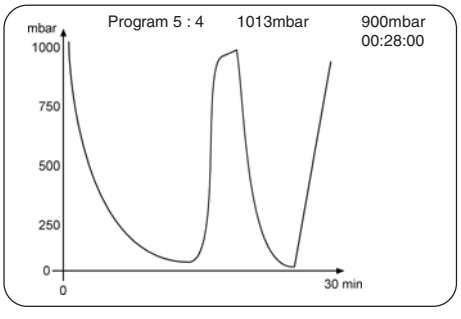
☞ ***Hysteresis**:* Control bandwidth of a two-point control. A too small hysteresis leads to frequent switching of the valve or the pump, a too large hysteresis leads to imprecise control. NT VARIO / VARIO-B pumps are controlled without hysteresis. Suggested values for the ”*Hysteresis*” are stored in the controller (setup ”Auto”) and are adapted automatically to the preset pressure. Adapting the ”*Hysteresis*” by the user is possible at any time.
The ”*Hysteresis*” is adjustable in a range of 1 - 300 mbar or can be set to ”Auto”.

☞ ***Delay*:** ”*Delay*” specifies the time which the pump (with VMS and in-line valve) and the coolant valve continue to run after process stop.
The ”*Delay*” is adjustable in a range of 1-300 minutes and to ”Off”.

Editing:
☞ To select row: turn and press selection knob.
☞ Turning the selection knob: adjust parameter.
☞ Pressing the selection knob: confirm parameter, jump to next parameter.
☞ After 2 seconds without change the parameter is accepted automatically.

The screen-shot shows the factory-set values.

Program -	1013mbar
Edit	
Load	0
Store	0
Hysteresis	Auto
Delay	Off
- - - - - - Graphic - - - - - -	
- - - - - - Back - - - - - - -	



When *”Graphic”* is selected the display shows a pressure vs. time curve (right screen-shot).

The number of the program with program step, the set vacuum, the actual vacuum and the runtime are displayed.
The timeline in the diagram adapts automatically to the process time.
☞ Press the selection knob twice to return to the standard display.

The last process (not in function VACUULAN) is stored in the temporary data memory as long as the controller stays switched on. This program can be transferred to a storage space and edited.

Attention: If the controller is set to ”Defaults on”, all stored programs will be deleted.

Once the program is finished, the clock symbol starts to flash. Confirm the end of the program by pressing START/STOP (clock symbol will disappear).

Attention: If ***”Autostart”*** is set to ***”On”***, the program will start again (time will be reset to 00:00:00) after a power failure or after switching the controller off/on. Only if the end of the program (clock symbol flashing) has been confirmed by pressing START/STOP, the program will not start again.

Example for use

Example 1
NT VARIO / VARIO-B vacuum pump with speed control (e.g. at a rotary evaporator): Degassing and automatic distillation with timing

Program

No	hh:mm:ss	Vac	Vent.	Step	Auto
01	00:00:00	ATM	✔	✔	
02	00:10:00	300		✔	
03	00:60:00	2			1*
04	01:01:00	ATM	✔	✔	
05	01:01:00	0			
06	01:01:00	0			
07	01:01:00	0			
08	01:01:00	0			
09	01:01:00	0			
10	01:01:00	0			

* If the pressure difference between the vacuum for degassing and the expected vacuum for distillation is very small (distillation vacuum >75% of the degassing vacuum), choose the function ”Auto 2” instead of ”Auto 1” (adapting the vacuum).

Program step 1 should be always a definite initial state, here atmospheric pressure (ATM). To reach this state definitely set a tickmark at ”Vent.” and ”Step” (press selection knob).
In step 2 pumping down starts as fast as possible (”Step”) to 300 mbar and the vacuum is kept for 10 minutes (degassing of the solvent).
In step 3 ”Auto 1” causes an automatic search of the boiling vacuum in the pressure interval between 300 mbar and 2 mbar and automatic adaptation to a changing boiling pressure. The following step starts if the preset time is over (60 minutes in total) even if the preset pressure (2 mbar) is still not reached or if a vacuum of 2 mbar is reached even if the preset time has not yet passed.
Step 4 vents to atmospheric pressure as fast as possible and switches off the control after one minute.

Example 2
Vacuum pump with in-line valve and/or Vacuum-Management-System Module A: Pumping down with intermediate venting

Program

N0	hh:mm:ss	Vac	Vent.	Step
01	00:00:00	ATM	✔	✔
02	00:05:00	10		
03	00:20:00	10		
04	00:21:00	500	✔	
05	00:30:00	500	✔	
06	00:40:00	5		
07	01:00:00	5		
08	01:01:00	ATM	✔	✔
09	01:01:00			
10	01:01:00			

Program step 1 should be always a definite initial state, here atmospheric pressure. To reach this state definitely set a tickmark at venting and ”Step” (press selection knob).
Step 2 causes pumping down to 10 mbar within 5 minutes (linear ramp) as ”Step” is not set.
Step 3 keeps the vacuum (10 mbar) constant for 15 minutes.
Step 4 vents within 1 minute to 500 mbar.
Step 5 keeps 500 mbar for 9 minutes.
Step 6 pumps down to 5 mbar within 10 minutes.
Step 7 keeps the vacuum (5 mbar) constant for 20 minutes.
Step 8 vents as fast as possible to atmospheric pressure and switches off the control after one minute.

Function VACUULAN

➨ **Optimised vacuum control for vacuum networks (e. g. VACUUBRAND VACUU•LAN)**

- **Operation of a vacuum pump via in-line valve**
- **Operation of a vacuum pump without in-line valve with Vacuum-Management-System VMS**
- **Operation on demand of a speed controlled pump (NT VARIO / VARIO B)**

Preselections

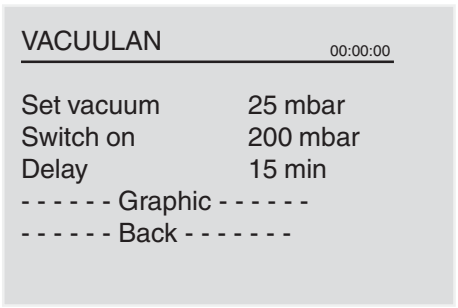
☞ Use the selection knob to select the parameters.

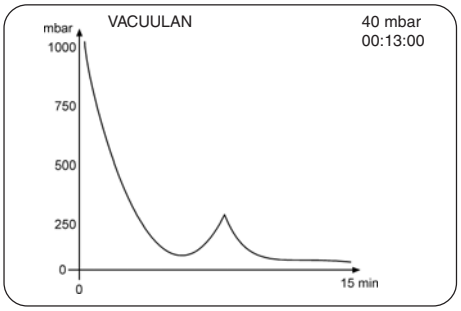
☞ ***Set vacuum*** (lower switch-off value): If the pressure drops below the "*Set vacuum*" a time-meter starts to run; if using a NT VARIO / VARIO-B pump, the motor speed is reduced additionally. The time-meter is reset, if the pressure exceeds the pressure value for switching on again ("*Switch on*"). If the "*Set vacuum*" is not reached within 100 hours the controller signals an error.
The "*Set vacuum*" is adjustable in range of 1 - 1060 mbar.

☞ ***Switch on*****:** If the pressure exceeds the pressure for switching on, pumping down starts again.
The "*Switch on*" pressure is adjustable in a range of 1 - 1060 mbar.
In case of sudden high pressure increase pumping starts even if the "*Switch on*" pressure has not been reached (pressure increase control).

☞ ***Delay:*** If the vacuum is below the "*Set vacuum*" level for longer than the "*Delay*" time, the pump is stopped. The pump is started again in case of rapid pressure increase or if the "*Switch on*" level is exceeded.
The "*Delay*" is adjustable in a range of 1-300 minutes or can be set to "Off".

The screen-shot shows the factory-set values.





When "*Graphic*" is selected the display shows a pressure vs. time curve (right screen-shot).

The timeline in the diagram adapts automatically to the process time.

☞ Press the selection knob twice to return to the standard display.

Examples for use

Assembly of a vacuum system

- ☞ Assemble vacuum connection lines between controller, vacuum pump (NT VARIO / VARIO-B pump or diaphragm pump with in-line valve or Vacuum-Management-System) and apparatus.
- ☞ Assemble electrical connections.
- ☞ Connect coolant if necessary.

Vacuum for filtration and suction

- ☞ Select function "**Pump down**".
- ☞ If necessary set value for *"Speed"* (only for NT VARIO / VARIO-B pumps) (high or low pumping speed). Reduce the "*Speed*" in case of fast sedimentation (formation of a filter cake).
- ☞ Set "*Minimum*" to a value which still does not lead to evaporation of the solvent.
- ☞ Start process by pressing key "START/STOP".

alternatively:

- ☞ Select function "**Vac control"**.
- ☞ *Set "Set vacuum"* (and *"Hysteresis"*, if necessary) so that still no evaporation of the solvent occurs.
- ☞ If necessary set value for *"Speed"* (only for NT VARIO / VARIO-B pumps) (high or low pumping speed). Reduce the "*Speed*" in case of fast sedimentation (formation of a filter cake).
- ☞ Set *"Maximum"* to switch off the pump at the end of the process or in case of a filter cake crack (pressure **increase**).
- ☞ Start process by pressing key "START/STOP".

- ☞ **Tip for filtration:** Adjust preset pressure to a value well above the boiling pressure of the solvent (e.g. water >>20 mbar). Set the maximum pressure to e.g. 500 mbar. Once the filtration has finished, the pressure increases and the pump is switched off automatically.

Vacuum for gel dryer, drying chambers and vacuum concentrators

- ☞ Select function "**Pump down**". For NT VARIO / VARIO-B pumps speed "HI" is recommended. For gel dryers set a lower "*Speed*" if the gels tend to break.
- ☞ Set *"Minimum"* to prevent volatile components to evaporate. The process is stopped automatically as soon as "*Minimum*" is reached.
- ☞ Start process by pressing key "START/STOP".

alternatively:

- ☞ Select function **"Vac control"** to dry at a predetermined vacuum level.
- ☞ Set *"Set vacuum"* to the evaporation vacuum of the solvent. Adapt "*Hysteresis*" if necessary.
- ☞ Set a process time ("*Duration*") if necessary.
- ☞ Start process by pressing key "START/STOP".

Vacuum for distillation and evaporation (e. g. rotary evaporator)

Semi-automatic distillation and evaporation

- ☞ Select function "**Pump down**".
- ☞ Start process by pressing key "START/STOP".
- ☞ Observe process. As soon as evaporation starts, press key "MODE" (switching to "Vac control"). The vacuum level is kept constant (at the boiling pressure). Fine tuning of the vacuum value is possible by turning the selection knob.
  If a NT VARIO / VARIO-B pump is connected, pressing key "MODE" a second time switches to "Auto mode" causing the vacuum level to be automatically adapted to changes of the boiling pressure.

alternatively:

Diaphragm pump with in-line valve and/or Vacuum-Management-System

- ☞ Select function "**Vac control"**.
- ☞ *Set "Set vacuum"* (and *"Hysteresis"*, if necessary) depending on the solvent and the temperature.
- ☞ Set the "*Set vacuum*" to a value which ensures that the solvent will boil definitely with respect to hysteresis and the set bath temperature.
- ☞ It is usually not necessary to set *a "Maximum"* because the pressure does not increase at the end of the evaporation.
- ☞ Set a value for *"Duration"* if the process should be terminated automatically at the end of a definite time.
- ☞ Use *"Delay"* to pump condensate out of the pump at the end of the process. During "*Delay*" the coolant is still running. The in-line valve is closed and so the pump is separated from the apparatus.
- ☞ Start process by pressing key "START/STOP".

alternatively:

for NT VARIO / VARIO-B diaphragm pump (vacuum control with pin-point precision)

- ☞ Select function "**Vac control"**.
- ☞ Setting a maximum *"Speed"* leads to a faster or slower process.
- ☞ To set *a "Maximum"* is usually not necessary because the pressure does not increase at the end of the evaporation.
- ☞ Set a value for *"Duration",* if the process should be terminated automatically after a definite time.
- ☞ Set *"Set vacuum"* depending on the solvent and the temperature.
- ☞ Start process by pressing key "START".
- ☞ **Temporary switching to" Auto mode"**: Press key "MODE". The controller switches to "Auto mode". The setting of the controller does not change due to this switching. After pressing key "START/STOP" the controller is in "Vac control" again.

alternatively:

Fully automatic determination and adaptation of the boiling point (recommended)

- ☞ Select function "**Auto mode"**.
- ☞ Start process by pressing key "START/STOP".
- ☞ The function "Auto mode" (only in combination with a NT VARIO / VARIO-B pump) allows a fully automatic distillation even if the boiling vacuum is unknown. In case of solvent mixtures the vacuum is reduced until all solvents or volatile components are evaporated (with respect to the ultimate vacuum of the pump and the bath temperature).
- ☞ If *"Minimum"* is set, the controller switches off the pump when the preset vacuum value is reached. The *"Minimum"* should be clearly below the boiling vacuum of the solvent to be evaporated and above the ultimate vacuum attainable in the apparatus. If the *"Minimum"* is set to *"Auto"*, the controller automatically switches off the pump at the end of the evaporation (recommended for large solvent quantities only). The setting of *"Duration"* (process runtime) has no effect, if the pump is switched off due to *"Minimum"* before *"Duration"* is over.

- ☞ When setting a value for *"Duration"* , the controller switches off the pump when *"Duration"* has passed even if a preset *"Minimum"* has still not been reached.
- ☞ If neither *"Minimum"* nor *"Duration"* are preset, pumping down has to be finished by pressing key "STOP".

Vacuum for VACUU•LAN networks

- ☞ Select function **VACUULAN**.
- ☞ Set *"Set vacuum"* to a pressure value, which can be reached reliably in the vacuum network, considering the ultimate vacuum of the pump and the leak rate of the system in case of no vacuum demand.
- ☞ Choose the vacuum for switching on the pump again (*"Switch on"*) in order to ensure sufficient vacuum for all processes.
- ☞ Preset *"Delay"* if necessary.
- ☞ Start process by pressing key "START/STOP".

Function Configuration

In the menu ”Configuration” the device parameters are preselected.

Preselections

☞ Use the selection knob to select the parameters.

☞ ***Adjustment*:** Adjustment of the pressure transducer under vacuum and/or at atmospheric pressure, see also section ”Readjustment”.
Adjustment at atmospheric pressure is carried out at an absolute vacuum value between 1060 - 700 mbar and under vacuum at an absolute vacuum value between 0 - 20 mbar.

☞ ***RS-232*:** Configuration of the interface, setting of parameters and commands, see section ”Interface parameters”.
Baud rate is selectable on 19200, 9600, 4800 or 2400, parity on ”8-N-1”, ”7-O-1” or ”7-E-1”, Handshake on ”no”, ”Xon-Xoff” or ”RTS-CTS” and remote on ”On” or ”Off”.

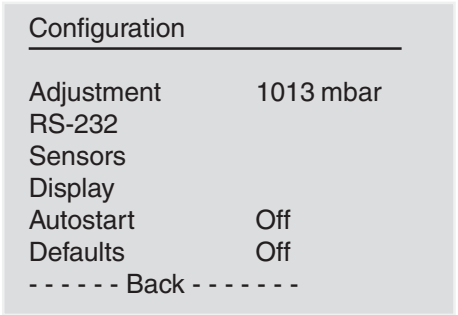
☞ ***Sensors*:** Selection of the pressure transducer to be controlled (maximum 4 sensors).

☞ ***Display*:** Selection of the device parameters ”Brightness” between 0 - 100%, ”Contrast” between 0 - 100%, ”Sound” ”On” or ”Off”, ”Units” ”mbar”, ”hPa” or ”Torr”, ”Language” ”Deutsch”, ”English” or ”Français”.

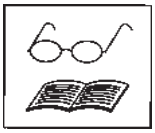
☞ ***Autostart*:** If ”*Autostart*” is set to ”On” the controller restarts a running process automatically after a mains failure. If this is unwanted, set ”*Autostart*” to ”Off”.
Attention: If ”*Autostart*” is preselected, the process starts immediately after power failure without pressing any further key. It is the user’s responsibility to ensure that no dangerous status of the system due to the automatic start-up can occur and to provide appropriate safety measures. If necessary, the user has to check **prior to starting the process** if the option ”*Autostart*” is enabled.

☞ ***Defaults*:** If ”*Defaults*” is set to ”On”, the controller is reset to factory set values. All stored programs and parameters are deleted.

The screen-shot shows the factory-set values.

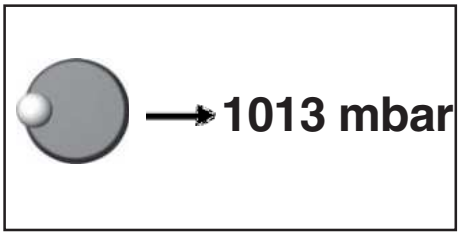


Readjustment



The vacuum gauge was adjusted using factory standards, which are traceable through regular calibration in an accredited laboratory (German Calibration service) to the German national pressure standard. Depending on the process and/or accuracy requirements, check the adjustment and readjust if necessary. For readjustment, the device has to be adjusted both at atmospheric pressure as well as under vacuum but only if the reference pressures are certainly known.
The adjustment mode can be activated only if the process control is inactive. Press key ”START/STOP” if necessary.

Adjustment at atmospheric pressure

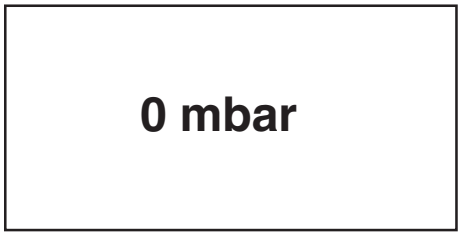


An adjustment at atmospheric pressure is only possible if the pressure is higher than 700 mbar.
Ventilate the controller and/or the vacuum system. Make sure that the vacuum connection at the controller is at atmospheric pressure.

- ➨ In function ”Configuration” select program ”*Adjustment*” at the controller.
- ➨ Use the selection knob to adjust the reading to current atmospheric pressure.
- ➨ Press the selection knob to confirm.

Note: *To determine the actual atmospheric pressure, use an accurate barometer or get accurate reading from the weather service, the next airport.....(take into account the difference in altitude between e. g. airport and laboratory).*

Adjustment under vacuum

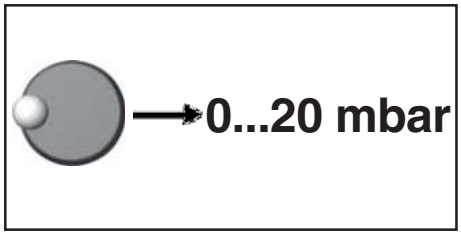


An adjustment under vacuum is only possible if the pressure is lower than 20 mbar absolute.
Evacuate the controller to a pressure < 0.1 mbar (e. g. by applying a good two-stage rotary vane pump).

- ➨ In function ”Configuration” select program ”*Adjustment*” at the controller.
- ☞ The reading is automatically adjusted to ”zero”.
- ➨ Press the selection knob to confirm.

Note: *Adjustment under vacuum with an actual pressure higher than 0.1 mbar reduces the accuracy of the measurement. If the pressure is significantly higher than 0.1 mbar, adjustment to a reference pressure is recommended.*

Adjustment at a reference pressure



Instead of adjustment under vacuum to a pressure < 0.1 mbar, adjustment to a precisely known reference pressure within the range of 0 ..... 20 mbar is possible. Evacuate the controller to a pressure within 0 ..... 20 mbar

- ➨ In function ”Configuration” select program ”*Adjustment*” at the controller.
- ☞ The reading is automatically adjusted to ”zero”.
- ➨ Use the selection knob to adjust the display to the reference pressure at the vacuum line within the range of 0 ..... 20 mbar.
- ➨ Press the selection knob to confirm.

Note: *The accuracy of the value of the reference pressure will directly affect the accuracy of the adjustment. If the nominal ultimate vacuum of a diaphragm pump is used as reference vacuum, the accuracy of the controller might be doubtful. The diaphragm pump may not achieve the specified value (due to condensate, poor condition, failure of valves or diaphragm).*

Calibration in the factory

Control of measuring equipment

The **VACUUBRAND DKD calibration laboratory** is accredited by the Physikalisch-Technische Bundesanstalt (PTB; German national institute for science and technology and the highest technical authority of the Federal Republic of Germany for the field of meteorology and certain sectors of safety engineering) for the measurable variable **pressure in the pressure range from 10^{-3} mbar to 1000 mbar** in accordance with the general criteria for the operation of testing laboratories defined in the DIN EN ISO/IEC 17025:2000 series of standards.
Calibration in the VACUUBRAND calibration laboratory:

- To meet the requirements of the DIN ISO 9000ff and 10012 series of standards regarding the calibration of inspection, measuring and test equipment at specified intervals.
- To document that the vacuum gauges calibrated are traceable to national standards of the PTB.

DKD calibration controller CVC 3000 ..... 90 02 15

Interface parameters

The controller CVC 3000 is equipped with a serial interface (RS 232C, nine-pole Sub-D-plug).

☞ Plug-in or remove the cable (cable RS 232C) from the interface only if the equipment is switched off.
☞ The interface is **not** electrically isolated from the measuring circuit.
☞ For optimal electromagnetic compatibility assemble an interface filter (cat. no.: 63 82 35).

The controller is fully operable via the serial interface. Measuring results, preselections and the status of the controller can be read at any time.

Factory-set the read and write commands are completely compatible to the VACUUBRAND controller CVC 2000 (see section ”Read and write commands CVC 2000”). An extended instruction set is available using the command ”CVC 3” (see section ”Read and write commands CVC 3000”).

Setting of the interface

Set the interface parameters directly at the controller CVC 3000. The factory set values are underlined. Edit and confirm the interface parameters in the function ”Configuration” in the menu ”RS-232” using the selection knob.

➨ Baud: 2400, 4800, 9600 or 19200
➨ Parity: 8-N-1, 7-O-1 or 7-E-1
➨ Handshake: Off, Xon-Xoff or RTS-CTS
➨ Remote: On or Off
➨ Timeout: Sending 1s, receiving 10s.

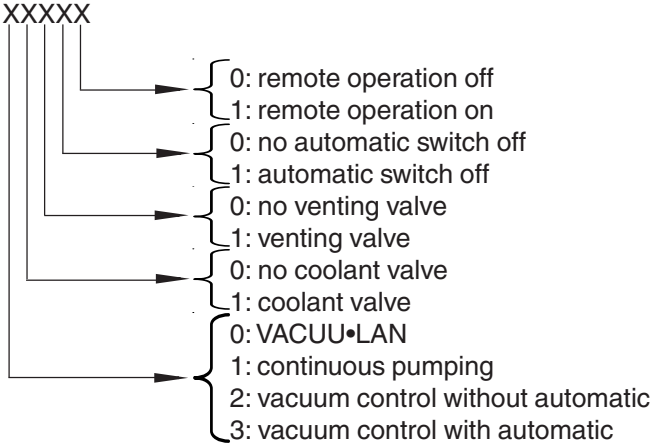
In remote mode (Remote On, ”PC symbol” in the display) all keys at the controller are inoperable.

To return to manual operation of the controller, set the controller to ”Remote off” in the configuration menu: At first switch off the controller. Then switch it on again and press the selection knob within 2s.

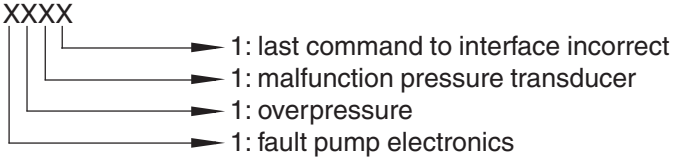
➨ Maximum ten commands per second are possible.
➨ Read commands and commands ”REMOTE”, ”CVC” and ”STORE” can be sent always. The sending of other write commands is only possible, if ”Remote on” is selected.
➨ The commands have to be written in capital letters.
➨ Command and parameter have to be separated by a blank.
➨ The string is terminated with <CR> or <CR><LF>.
➨ The response of the controller is always terminated with <CR><LF>.
➨ Numerical values and parameters can be written without leading zeros.
➨ The response of the controller is always with leading zeros.

Read commands CVC 2000

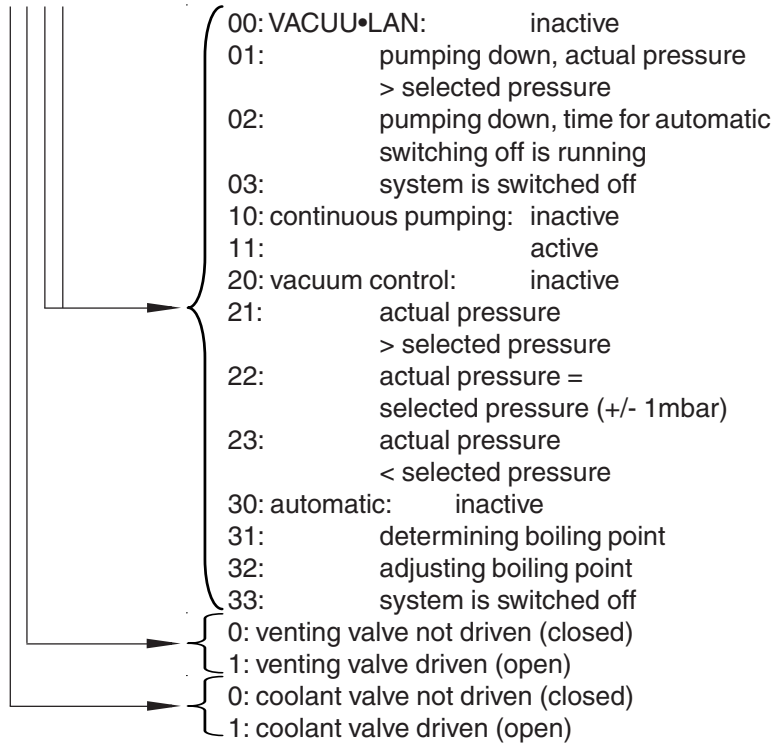
Function	Command	Response	Description
actual pressure	IN_PV_1	XXXX mbar or XXXX Torr or XXXX hPa	unit according to preselections
actual frequency	IN_PV_2	XX.X Hz	
device set preselections	IN_CFG	XXXXX	



malfunction — IN_ERR — XXXX



status of process control — IN_STAT — XXXX



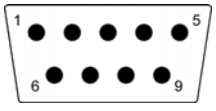
Write commands CVC 2000

Function	Command	Parameter	Description
selected pressure	OUT_SP_1	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
selected pressure with venting*	OUT_SP_V	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
selected frequency	OUT_SP_2	XX.X	Hz (01.0 to 60.0 in steps of 0.5 Hz or 99.9 for “HI”)
pressure for restart (VACUU•LAN)	OUT_SP_3	XXXX	unit according to preselection (see OUT_SP_1)
time for automatic switching off (VACUU•LAN)	OUT_SP_4	XX:XX	hours:minutes
automatic switching off (vacuum control)	OUT_SP_5	XXXX	unit according to preselection (see OUT_SP_1) or ”0000” for automatic switching off (“AE”)
operation mode	OUT_MODE	X	1: continuous pumping 2: vacuum control without automatic 3: vacuum control with automatic
driving venting valve	OUT_VENT	X	0: close venting valve 1: open venting valve (does not close again automatically; process control stopped)
starting process control	START		
stopping process control	STOP	X	1: termination of process control 2: termination of process control and storage of the actual pressure as new set point
Remote operation**	REMOTE	X	0: set controller to local operation 1: set controller to remote operation

* Pressure setting with venting is only possible in operation mode ”Vacuum control” if an venting valve is connected and configurated and vacuum control is started. The venting valve opens automatically if the actual pressure is at least 10 mbar below the preset pressure. Automatic venting becomes inactive if vacuum control is stopped (STOP or VENT), if setting a pressure value using the command OUT_SP_1 or if the operation mode is changed. Activate the command OUT_SP_V again if necessary.

** If remote operation is selected or deselected, the user has to ensure that no dangerous status of the system due to the change of the mode of operation can occur and to provide appropriate safety measures, especially if selecting remote operation interferes with a locally operated active process.

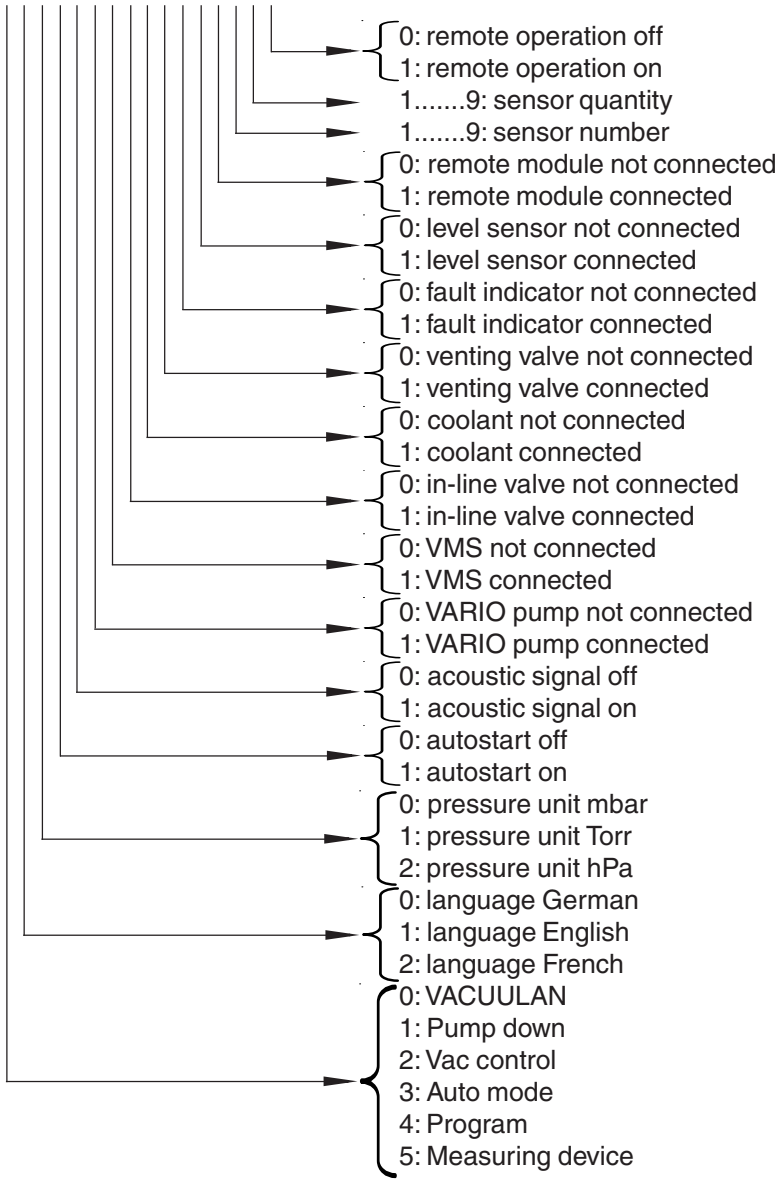
Connection plug arrangement



2: RxD
3: TxD
4: DTR
5: Mass
7: RTS
8: CTS
9: +5V (Bluetooth)

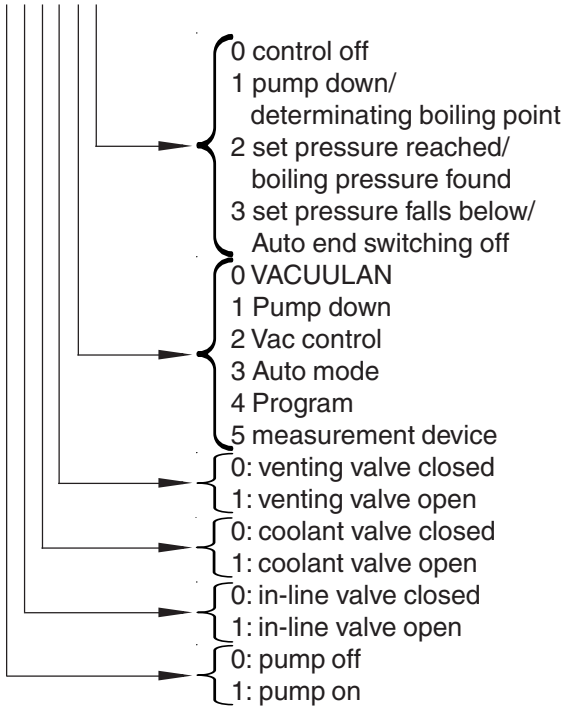
Read commands CVC 3000

Function	Command	Response	Description
actual pressure	IN_PV_1	XXXX.X mbar/Torr/hPa	unit according to preselections
actual speed	IN_PV_2	XXX%	1-100% or HI
time	IN_PV_3	XX:XX h:m	process runtime
pressure	IN_PV_X	XXXX.X XXXX.X ...mbar	pressure of all connected sensors
operation time of the controller	IN_PV_T	XXXXdXXh	operation time in days and hours
device set preselections	IN_CFG	XXXXXXXXXXXXXXXX	

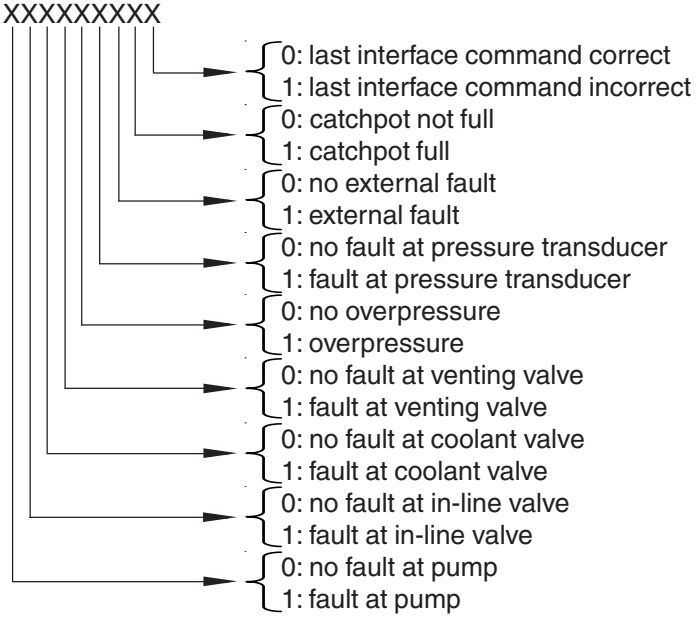


Read commands CVC 3000

Function	Command	Response	Description
Status process control	IN_STAT	XXXXXX	



Fault status	IN_ERR	XXXXXXXXX	



Read commands CVC 3000

Function	Command	Response	Description
	IN_SP_1	XXXX mbar or XXXX Torr or XXXX hPa	set vacuum
	IN_SP_2	XXX%	maximum speed (100% = ”HI”)
	IN_SP_3	XXXX mbar or XXXX Torr or XXXX hPa	switching on pressure for VACUULAN or two point control
	IN_SP_4	XX:XX h:m	delay (00:00 = Off)
	IN_SP_5	XXXX mbar or XXXX Torr or XXXX hPa	switch off pressure (”Maximum” for ”Vac control”, ”Minimum” for ”Pump down”)
	IN_SP_6	XX:XX h:m	process runtime
time	IN_SP_P1y	XX:XX:XX h:m:s	time in program step y (0.....9)
pressure	IN_SP_P2y	XXXX mbar	pressure in program step y (0.....9)
valve	IN_SP_P3y	X	0: no venting valve in program step y (0.....9) 1: venting valve in program step y (0.....9)
Step	IN_SP_P4y	X	0: no ”Step” in program step y (0.....9) 1: ”Step” in program step y (0.....9)
Auto	IN_SP_P5y	X	0: no ”Auto” in program step y (0.....9) 1: ”Auto” in program step y (0.....9)
	IN_VER	CVC 3000 VX.XX	software version

Write commands CVC 3000

Function	Command	Parameter	Description
operation mode	OUT_MODE	X	0: VACUULAN 1: Pump down 2: Vac control 3: Auto mode 4: Program **Attention:** If control is running only switching from 1 to 2, 2 to 3 and 3 to 2 is possible with adoption of the set pressure.
configuration (bus monitoring)	OUT_CFG	XXXX	0: acoustic signal off 1: acoustic signal on 0: Autostart off 1: Autostart on 0: pressure unit mbar 1: pressure unit Torr 2: pressure unit hPa 0: language German 1: language English 2: language french
set vacuum	OUT_SP_1	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
set vacuum with venting	OUT_SP_V	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
speed	OUT_SP_2	XXX	speed in %, (100% = ”HI”)
start-up pressure	OUT_SP_3	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
delay	OUT_SP_4	XX:XX	hh:mm (hours:minutes)
switch off pressure	OUT_SP_5	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
switch-off time	OUT_SP_6	XX:XX	hh:mm (hours:minutes)
load program	OUT_SP_PL	X	program 0.....9
store program	OUT_SP_PS	X	program 0.....9
time	OUT_SP_P1y	XX:XX:XX	time at program step y (0.....9)
pressure	OUT_SP_P2y	XXXX	pressure at program step y (0.....9)
valve	OUT_SP_P3y	X	0: no venting valve in program step y (0.....9) 1: venting valve in program step y (0.....9)
Step	OUT_SP_P4y	X	0: no ”Step” in program step y (0.....9) 1: ”Step” in program step y (0.....9)
Auto	OUT_SP_P5y	X	0: no ”Auto” in program step y (0.....9) 1: ”Auto 1” in program step y (0.....9) 2: ”Auto 2” in program step y (0.....9)

Write commands CVC 3000

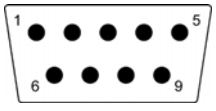
Function	Command	Parameter	Description
	START	X	1 started
	STOP	X	0 Stop and delete fault 1 Stop 2 Stop with adoption of the set vacuum
	REMOTE*	X	1 Remote off 2 Remote on
	ECHO**	X	0 Echo off 1 Echo on, write command with return value
	CVC	X	2 CVC 2000 commands 3 CVC 3000 commands***
	OUT_VENT	X	0 venting valve closed 1 venting valve open 2 venting until atmospheric pressure
	STORE		store settings permanently; in case of Echo ”1” storing after execution
	OUT_SENSOR	X	1 internal sensor 2-9 external sensors (if connected)

* If remote operation is selected or deselected, the user has to ensure that no dangerous status of the system due to the change of the mode of operation can occur. He has to provide appropriate safety measures, especially if selecting remote operation interferes with a locally operated active process.

** With command „ECHO 1“ a return value at write commands can be activated. A return value is only given if the command has been executed correctly.

*** After switching on, the controller is in ”CVC 2” mode by default. Send ”CVC 3” and ”STORE” to permanently set the controller’s RS 232C commands to the extended set ”CVC 3000”.

Connection plug arrangement



2: RxD
3: TxD
4: DTR

5: Mass
7: RTS
8: CTS
9: +5V (Bluetooth)

Accessories

Pressure transducer VSK 3000, capacitive Al_2O_3 sensor 1080-0,1 mbar 63 66 57
In-line valve VV-B 6, 24 V= 67 42 90
In-line valve VV-B 6C, 24 V= 67 42 91
In-line valve VV-B 15C, KF 16, 24 V= 67 42 10
In-line valve VV-B 15C, KF 25, 24 V= 67 42 15
Coolant valve VKW-B, 24 V= 67 42 20
Venting valve VBM-B / KF 16, 24 V= 67 42 17
Y-type adapter VACUU•BUS 63 66 56
Extension cable VACUU•BUS, 2m 61 25 52
Cable RS 232C, 9-pole, Sub-D 63 78 37
VMS adapter cable (to connect Vacuum-Management-System VMS Module A) 63 66 55
VMS-Module A, 100-230 V, 3,5 A, CEE 67 60 01
VMS-Module A, 100-230 V, 3,5 A, UK 67 60 02
VMS-Module A, 100-230 V, 3,5 A, CH 67 60 03
VMS-Module A, 100-230 V, 3,5 A, US 67 60 04
VMS-Module A, 100-230 V, 8 A, CEE 67 60 06
VMS-Module A, 100-230 V, 8 A, UK 67 60 07
VMS-Module A, 100-230 V, 8 A, CH 67 60 08
VMS-Module A, 100-230 V, 8 A, US 67 60 09
Installation set CVC 3000 (clips and screws) 63 65 93

To connect further components use Y-adapters and extension cables VACUU•BUS. When connecting an external pressure transducer, it is used automatically. Further information on how to use several sensors simultaneously is available on request.

Conversion of VACUUBRAND valves with diode plug to VACUUBRAND valves with VACUU•BUS plug

VACUUBRAND valve with diode plug	Conversion kit valve cable with VACUU-BUS plug
In-line valve VV 6, 24 V= (67 40 90) In-line valve VV 6C, 24 V= (67 40 91) In-line valve VV 15, 24 V= (67 41 10) In-line valve VV 15C, 24 V= (67 41 15)	61 25 56 (conversion to in-line valve) 61 25 66 (conversion to venting valve)
Coolant valve VKW, 24 V= (67 60 13)	61 25 67
Venting valve VBM, 24 V= (66 68 17)	61 25 54
In-line valve water jet pump (61 06 23)	61 25 56

➨ To control a **VACUUBRAND water jet pump** (69 50 00) with solenoid operated valve with diode plug with a controller CVC 3000 instead of a controller CVC 2 / CVC 2^{II}, the valve cable has to be replaced (see table). After this the water valve is switched like an in-line valve.

Troubleshooting

Fault	Possible cause	Remedy
❑ No display.	➔ Mains adapter not plugged in?	☞ Plug in mains adapter in controller and/or socket.
	➔ Device switched off?	☞ Switch on device.
	➔ Plug to mains adapter not plugged in?	☞ Plug in mains adapter to controller.
	➔ Other causes (device defective)?	☞ Contact local distributor.
❑ Display disappears.	➔ Too much load (e. g. valves) connected?	☞ Check current draw of the connected devices (pumps, valves).
	➔ Short circuit at connected valves?	☞ Check valves.
	➔ Short circuit at the RS232 plug?	☞ Check plug and cable.
	➔ Other causes (device defective)?	☞ Contact local distributor.
❑ Pressure reading incorrect.	➔ Device not adjusted?	☞ Readjust the controller.
	➔ Humidity in the pressure transducer?	☞ Let the pressure transducer dry, e. g. by pumping. Readjsut if necessary. Determine and eliminate cause of humidity.
	➔ Pressure transducer contaminated?	☞ See "Cleaning the pressure transducer".
❑ No digital pressure reading.	➔ Pressure transducer defective?	☞ Contact local distributor.
❑ Digital pressure reading is flashing, ''0.0'' is displayed.	➔ Pressure transducer not correctly adjusted under vacuum?	☞ Adjust pressure transducer correctly.
❑ Digital pressure reading is flashing, one blip*.	➔ Overpressure at the pressure transducer, pressure >1060 mbar?	☞ Release pressure immediately (**risk of bursting**).
❑ Warning triangle and black valve symbol are flashing, two blips*.	➔ External venting valve removed or defective?	☞ Connect valve or replace by a new one or reconfigure without valve.
❑ Warning triangle and valve symbol are flashing, three blips*.	➔ NT VARIO / VARIO-B pump and in-line valve connected? ➔ In-line valve removed or defective?	☞ Disconnect in-line valve, switch off/on the controller. ☞ Check connection cable of the valve or use new valve or reconfigure without valve.
❑ Warning triangle and coolant valve symbol are flashing, four blips*.	➔ Coolant valve removed or defective?	☞ Check connection cable of the valve or use new valve or reconfigure without valve.
❑ No digital pressure reading, warning triangle is flashing, five or seven blips*.	➔ Five blips: External sensor defective or removed? ➔ Seven blips: Internal sensor defective?	☞ Plug in sensor or use new one or reconfigure without sensor. ☞ Contact local distributor.

Fault	Possible cause	Remedy
❑ Warning triangle and pump symbol are flashing, six blips*.	➔ NT VARIO / VARIO-B pump and VMS connected? ➔ Fault at the NT VARIO / VARIO-B pump or the VMS? ➔ Connecting cable from pump or VMS removed?	☞ Disconnect VMS, start controller. ☞ Check pump and/or VMS or reconfigure. ☞ Check cable connections.
❑ Clock symbol is flashing, control is stopped.	➔ Preselected process time has passed?	☞ Confirm by pressing START/STOP.
❑ Internal venting valve does not react, valve symbol is not displayed.	➔ External pressure transducer connected and active?	☞ Select internal pressure transducer or connect external venting valve.
❑ Venting valve does not react, valve symbol is displayed.	➔ Valve contaminated?	☞ Clean valve.
❑ Function "Vac control": Control stops, arrow up is flashing.	➔ Preselected maximum pressure exceeded?	☞ Confirm by pressing START/STOP, adapt pressure value if necessary.
❑ Function "Pump down": Control stops, arrow down is flashing.	➔ Pressure below preselected minimum pressure.	☞ Confirm by pressing START/STOP, adapt pressure value if necessary.
❑ Function is not displayed, no menu.	➔ No controllable device connected (valve, VMS, NT VARIO / VARIO-B pump)?	☞ Connect devices or use controller as measuring device.
❑ Controller does not react when pressing keys (except ON/OFF), PC symbol is displayed.	➔ Controller in remote operation?	☞ Control controller via interface or switch off remote operation.
❑ Controller does not react when operating keys. No change after switch ON/OFF.		☞ Contact local distributor.

* Blips only if in the ”Configuration” menu ”Sound” is set to ”On”.

Attention: All error messages have to be confirmed (deleted) by pressing key START/STOP.

Cleaning the pressure transducer

The Controller itself is maintenance free.

If the vacuum system is contaminated (oil, particles, etc.), contamination of the pressure transducer will influence the accuracy of measurement.

Attention: Never use a spiky or sharp-edged tool to clean the pressure transducer.

Clean a contaminated pressure transducer as follows:

- ➨ Fill the measurement chamber with a solvent (e. g. benzene) and allow sufficient cleaning time. Observe all regulations concerning usage and disposal of solvents!
- ➨ Drain the solvent and dispose of in accordance with regulations, repeat cleaning if necessary.
- ➨ Rinse the gauge head chamber several times with alcohol in order to remove all solvent residues.
- ➨ Allow the pressure transducer to dry.
- ➨ Readjust the pressure transducer if necessary.

Notes on return to the factory

Repair - return - DKD calibration

NOTICE

Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations and regulations regarding safe disposal of waste require, that for all pumps and other products the **"Health and safety clearance form"** must be sent to our office duly completed and signed before any equipment is dispatched to our premises.
Fax or post a completed copy of the health and safety clearance form to us in advance. The declaration must arrive before the equipment. Enclose a second completed copy with the product. If the equipment is contaminated you must notify the carrier.
No repair / DKD calibration is possible unless the correctly completed form is returned. Inevitably, there will be a delay in processing the equipment if information is missing or if this procedure is not complied with.

⚠CAUTION

If the product has come in contact with chemicals, radioactive substances or other substances dangerous to health or environment, the product must be decontaminated **prior to sending it back to the factory.**

- Return the product to us **disassembled and cleaned** and accompanied by a certificate verifying decontamination or
- Contact an industrial cleaning and **decontamination service** directly or
- Authorize us to send the product to an industrial cleaning facility **at your expense.**

To expedite repair and to reduce costs, please enclose a detailed description of the problem and the product´s operating conditions with every product returned for repair. We submit **quotations** only on request and always at the customer´s expense. If an order is given, the costs incurred are offset from the costs for repair or from the purchase price, if the customer prefers to buy a new product instead of repairing the defective one.

- **If you do not wish a repair on the basis of our quotation, the equipment might be returned to you disassembled and at your charge!**

In many cases, the **components must be cleaned in the factory** prior to repair.
For cleaning we use an environmentally responsible water based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurised water) may result in damage to the paint. Please mark in the health and safety clearance form if you wish a **repaint at your expense** just in case such a damage should occur.
We also replace parts due to optical aspects upon your request.

NOTICE

Before returning the equipment ensure that (if applicable):

- Equipment has been cleaned and/or decontaminated.
- All inlet and outlet ports have been sealed.
- Equipment has been properly packed, if necessary, please order an original packaging (costs will be charged), marked as appropriate and the carrier has been notified.
- Ensure that the completed health and safety declaration is enclosed.

We hope for your understanding for these measures, which are beyond our control.

Scrapping and waste disposal:
Dispose of the equipment and any components removed from it safely in accordance with all local and national safety and environmental requirements. Particular care must be taken with components and waste oil which have been contaminated with dangerous substances from the process. Do not incinerate fluoroelastomer seals and "O" rings.

- You may authorize us to dispose of the equipment **at your expense.**

Health and safety clearance form

Declaration concerning safety, potential hazards and safe disposal of waste, e. g. used oil.
Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations, safety at work laws and regulations regarding safe disposal of waste, e. g. waste oil, require that for all pumps and other products this form must be sent to our office duly completed and signed before any equipment is dispatched to our premises. **Products will not be accepted for any procedure and handling and repair / DKD calibration will not start before we have received this declaration.**

a) Fax or post a **completed copy of this form** to us in advance. The declaration must arrive before the equipment. **Enclose a second, completed copy with the product.** If the product is contaminated you must notify the carrier (**GGVE, GGVS, RID, ADR**).
b) Inevitably, the repair process will be delayed considerably, if this information is missing or this procedure is not complied with. We hope for your understanding for these measures which are beyond our control and that you will assist us in expediting the repair procedure.
c) **Make sure that you know all about the substances which have been in contact with the equipment and that all questions have been answered correctly and in detail.**

1. Product (Model): .....

2. Serial No.: .....

3. List of substances in contact with the equipment or reaction products:

3.1 Chemical/substance name, chemical symbol:

a) .....

b) .....

c) .....

d) .....

3.2 Important informations and precautions, e. g. danger classification:

a) .....

b) .....

c) .....

d) .....

4. Declaration (please mark as applicable):

❑ **4.1 for non dangerous goods:**

We assure for the returned product that
- neither toxic, corrosive, biologically active, explosive, radioactive nor contamination dangerous in any way has occurred.
- the product is free of dangerous substances.
- the oil or residues of pumped media have been drained.

❑ **4.2 for dangerous goods:**

We assure for the returned product that
- all substances, toxic, corrosive, biologically active, explosive, radioactive or dangerous in any way which have been pumped or been in contact with the product are listed in 3.1, that the information is complete and that we have not withheld any information.
- the product, in accordance with regulations, has been
  ❑ cleaned ❑ decontaminated ❑ sterilized.

5. Way of transport / carrier:

.....

Day of dispatch to VACUUBRAND:

.....

If the paint is damaged, we wish a repaint or a replacement of parts due to optical aspects at our expense (see "Notes on return to the factory"):

❑ yes ❑ no

We declare that the following measures - where applicable - have been taken:
- The oil has been drained from the product.
  Important: Dispose of according to national regulations.
- The interior of the product has been cleaned.
- All inlet and outlet ports of the product have been sealed.
- The product has been properly packed, if necessary, please order an original packaging (costs will be charged) and marked as appropriate.
- The carrier has been informed about the hazardous nature of the goods (if applicable).

We assure VACUUBRAND that we accept liability for any damage caused by providing incomplete or incorrect information and that we shall indemnify VACUUBRAND from any claims as regards damages from third parties.

We are aware that as expressed in § 823 BGB (Public Law Code of Germany) we are directly liable for injuries or damages suffered by third parties, particularly VACUUBRAND employees occupied with handling/repairing the product.

Signature: .....

Name (print): .....

Job title (print): .....

Company´s seal: .....

Date: .....

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CE

Konformitätserklärung
Declaration of conformity
Déclaration de conformité

Vakuum-Controller / Vacuum controller / Régulateur de vide

CVC 3000 (68 31 60) 100-230V

Hiermit erklären wir, dass das oben bezeichnete Gerät in Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den grundlegenden Anforderungen der zutreffenden, aufgeführten EU-Richtlinien entspricht. Bei einer mit uns nicht abgestimmten Änderung an dem Gerät verliert diese Erklärung ihre Gültigkeit.
We herewith declare that the product designated above is in compliance with the basic requirements of the applicable EC-directives stated below with regard to design, type and model sold by us. This certificate ceases to be valid if the product is modified without the agreement of the manufacturer.
Par la présente, nous déclarons que le dispositif désigné ci-dessus est conforme aux prescriptions de base des directives EU applicables et indiqués en ci que concerne conception, dessin et modèle vendu par nous-mêmes. Cette déclaration cesse d´être valable si des modifications sont apportées au dispositif sans notre autorisation préalable.

Niederspannungsrichtlinie / Low-Voltage Directive / Directive Basse Tension
2006/95/EG
Richtlinie Elektromagnetische Verträglichkeit / Electromagnetic Compatibility Directive / Directive Compatibilité Electromagnétique
2004/108/EG
Angewandte Harmonisierte Normen / Harmonized Standards applied / Normes Harmonisées utilisées
DIN EN 61010-1, DIN EN 61326
Managementsysteme / Management systems / Systèmes de Management
EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 05.12.2007
. . . . . .
Ort, Datum / place, date / lieu, date

. . . . . .
(Dr. F. Gitmans)
Geschäftsführer / Managing director / Gérant

ppa. . . . . .
(Dr. J. Dirscherl)
Technischer Leiter / Technical Director / Directeur technique

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