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vacuubrand

Technology for Vacuum Systems

Instructions for use



ME 4C NT VARIO
MZ 2C NT VARIO
MD 4C NT VARIO
MV 10C VARIO-B
MD 12C VARIO-B

PC 3002 VARIO
PC 3003 VARIO
PC 3004 VARIO
PC 3010 VARIO
PC 3012 VARIO

Speed controlled chemistry diaphragm pumps and chemistry pumping units

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Dear customer,

Your VACUUBRAND diaphragm pumps 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 pump.
VACUUBRAND diaphragm pumps are the result of many years of experience in construction and practical operation of these pumps combined with the latest developments in material and manufacturing technology.

Our quality maxim is the ”zero fault principle”:
Every diaphragm pump, leaving our company, is tested intensively including an endurance run of 18 hours. 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 pump.
Every VACUUBRAND pump achieves the specifications. We feel obliged to this high quality standard.
We know that the vacuum pump can 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.



Caution! Hot surface!



Isolate equipment from mains before removing the cover.



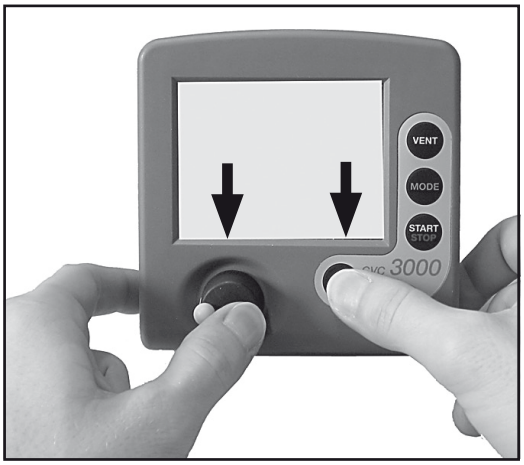
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Reset / Language selection

1 switch off



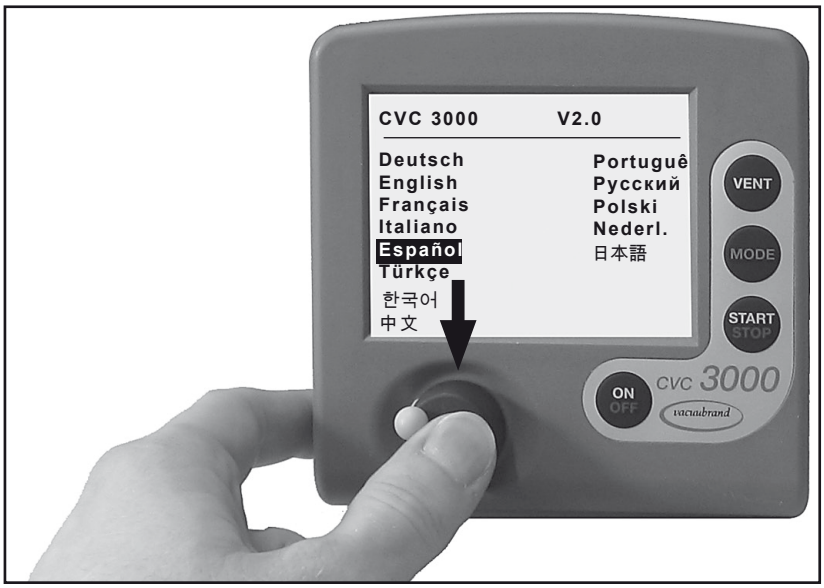
2 press both



3 turn



4 press



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Safety information!

General information

NOTICE

☞ **Read and comply with this manual before installing or operating the equipment.**
☞ Transport the pump at the provided handles or recessed grips.
Remove all packing material, remove the product from its packing-box, remove the protective covers from the inlet and outlet ports 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

☞ The pump and all system parts are not to be used on humans or animals.
☞ Prevent any part of the human body from coming into contact with vacuum.
☞ 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 pumps are designed for **ambient temperatures** during operation between +10°C and +40°C. Check the maximum temperatures if installing the pump in a cabinet or a housing and make sure ventilation is adequate. Install an external automatic ventilation system if necessary. If pumping hot process gases make sure that the maximum permitted gas inlet temperature, which depends on several parameters like inlet pressure or ambient temperature (see "Technical data"), is not exceeded.
- Particles and dust must not be aspirated.

NOTICE

Use the equipment **for the intended use only**, i.e. for generation, measurement and control of vacuum in vessels designed for that purpose.

Setting up and installing the equipment

⚠ DANGER

➨ Equipment must be connected only to a **suitable electrical supply** and a suitable earth point. Failure to connect the motor to ground may result in deadly electrical shock.
The supply cable may be fitted with a moulded European IEC plug or a plug suitable for your local electrical supply. If the plug has been removed or has to be removed, the cable will contain wires colour coded as follows: green or green and yellow: earth; blue or white: neutral; brown or black: live.

⚠WARNING

☞ Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the maximum permissible pressure compatible with the mechanical stability of the system.
☞ Do not permit any **uncontrolled pressurizing** (e. g. make sure that the exhaust pipeline cannot become blocked). If you have an exhaust isolation valve, make sure that you cannot operate the equipment with the valve closed. **Risk of bursting!**

☞ Provide always a free and pressureless exhaust pipeline.
☞ Ensure that the system design does not allow the coolant outlet pipeline to become blocked. Install an optional coolant valve always in the supply line of the exhaust waste vapour condenser only.
☞ Check the overpressure safety relief device at the exhaust waste vapour condenser in appropriate intervals.

⚠CAUTION

- Comply with **maximum permissible pressures** at inlet and outlet and pressure differences between inlet and outlet, see section ”Technical data”. Do not operate the pump with overpressure at the inlet.
- **Obey maximum permitted pressure** at the pressure transducer, see section ”Technical data”.

- Check that mains voltage and current conform with the equipment (see rating plate).

- Avoid overpressure of more than 0.2 bar in case inert gas is connected.
- Connect pipes gas tight at inlet and outlet of the pump and at the pressure transducer.
- Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.
- **Attention:** Flexible elements tend to shrink when evacuated.

NOTICE

Provide a firm level platform for the equipment and check that the system to be evacuated is mechanically stable and that all fittings are secure. Ensure a stable position of the pump without any mechanical contact except of the pump feet. Comply with all applicable safety regulations.

Position the CVC 3000 and its vacuum connection lines so that no condensate can flow towards the pressure transducer.

Keep a distance of minimum 20 cm between fan and ambient parts (e.g. housing, walls, ...). Check fan regularly for dust/dirt, clean if necessary to avoid a cutback of ventilation.

If the equipment is brought from cold environment into a room for operation, allow the equipment to warm up (pay attention to water condensation on cold surfaces).

The diameter of the inlet and outlet pipeline should be at the least as large as the diameter of the pump connection pipelines.

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 (see ”Declaration of conformity”) with regard to design, type and model. Directive IEC 1010 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, e. g. using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or bedewing.
Pay attention to the **permissible maximum ambient and gas inlet temperatures** (see ”Technical data”).

Operating conditions

DANGER

➨ **The pumps have no approval for operation in or for pumping of potentially explosive atmospheres.**

➨ The pumps are **not suitable** to pump
- **unstable substances,**
- substances which react explosively under **impact** (mechanical stress) and/or when being exposed to **elevated temperatures** without air.
- **self inflammable** substances,
- substances which are inflammable without air and
- **explosive substances**.

CAUTION

• The pumps are **not suitable** for pumping substances which may form **deposits** inside the pump. Deposits and condensate in the pump may lead to increased temperatures even to the point of excessing the maximum permitted temperatures!

• If there is a danger of **deposits** in the pump chamber (check inlet and outlet of the pump), inspect the pump chambers regularly and clean if necessary.

• The pumps are **not suitable** for pumping dust and have **no approval** for operation below ground.

NOTICE

If pumping **different substances**, it is recommended to purge the pump with air or inert gas prior to changing the pumped media in order to pump out residues and to avoid reactions of the pumped substances with each other and with the pump materials.
Take into consideration interactions and chemical reactions of the pumped media. Ensure that the materials of the **wetted parts** are compatible with the pumped substances, see section ”Technical data”.

Safety during operation

DANGER

➨ Adopt suitable measures to prevent the release of dangerous, toxic, explosive, corrosive, noxious or polluting fluids, vapours and gases. In case install an appropriate collecting and disposal system and take protective action for pump and environment.

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

➨ The user must take suitable precautions to prevent any formation of explosive mixtures in the expansion chamber or at the outlet. In case of e.g. a diaphragm crack, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures. Use inert gas for gas ballast or venting if necessary.
➨ Potentially explosive mixtures at the outlet of the pump have to be drained appropriately, sucked off or diluted with inert gas to non-explosive mixtures.



☞ Pay attention to the symbol ”hot surfaces” on the equipment. Adopt suitable measures to prevent any danger arising from the formation of hot surfaces or electric sparks. Provide a suitable protection against contact if necessary.

WARNING

☞ Ensure that the exhaust pipeline is always free and pressureless.
☞ Ensure that the coolant outlet pipeline at the exhaust waste vapour condenser is always free and that the coolant can flow off unobstructedly.

☞ Pumping at high inlet pressure may lead to overpressure at the gas ballast valve. Pumped gases or condensate might be pushed out in case the valve is open. If an inert gas supply is connected, ensure that the inlet pipeline is not contaminated.

☞ **Attention:** In case of pressures above approximately 1080 mbar the pressure reading gets incorrect (saturation of the pressure transducer). The display flashes. **Immediate pressure relief necessary! Risk of bursting!**

⚠CAUTION

- Comply with applicable regulations when disposing of chemicals. Take into consideration that chemicals may be polluted.
  Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.

- Check the overpressure safety relief device at the exhaust waste vapour condenser in appropriate intervals.

- 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 becomes void if not using genuine spare parts.

- Starting of the NT VARIO or VARIO-B pump, switching of a coolant valve or opening of a venting valve by the controller must not lead to a dangerous situation under any circumstances.
- **Attention:** If **Autostart** is preselected, the process starts immediately after a 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** whether the option "*Autostart*" (menu: configuration) is enabled.

NOTICE

Do not start the pump if the pressure difference between inlet and outlet port exceeds 1.1 bar at maximum.
Prevent the backpressure of gases and the backflow of condensates. Never suck liquids or dust into the pump.

Check liquid level in both catchpots regularly and drain condensate in time. In case, install level sensor (see "Accessories").

Provide appropriate protective measures (i.e. precautions which allow for the requirements of the respective application) even for the case of failure and **maloperation mode**.

Failure of the pump (e.g. due to power failure) or of connected components, parts of the supply or change of parameters must not lead to a critical dangerous situation under any circumstances. In case of diaphragm cracks or leaks in the manifold pumped substances might be released into the environment or into the pump housing or motor. Comply especially with notes on operation and use and maintenance.

Due to the residual **leak rate of the equipment**, there might be an exchange of gas, albeit extremely slight, between the environment and the vacuum system.
Adopt suitable measures to prevent contamination of the pumped substances or the environment.

In case of overload the motor is shut down by a **thermal cutout** in the winding.
Attention: Reset possible only manually. Confirm error message at controller by pressing key START/STOP or switch off the pump or isolate the equipment from mains. Identify and eliminate the cause of failure. Wait approx. five minutes before restarting the pump.

The A-weighed emission sound pressure level of the pump does not exceed 70 dB(A). Measurement according to EN ISO 2151:2004 and EN ISO 3744:1995 with standard silencer or exhaust tube at outlet.

Maintenance and repair

NOTICE



WARNING

Wear parts have to be replaced regularly. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours. Bearings have a typical durability of 40000 h.

➨ **Isolate equipment from mains** and **wait two minutes** before starting maintenance to allow the capacitors to discharge.

☞ **Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

☞ **Attention**: The pump might be contaminated with process chemicals which have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

CAUTION

- Before starting maintenance vent the pump, isolate the pump and other components from the vacuum system. Allow sufficient cooling of the pump. Drain condensate, if applicable.

Ensure that **maintenance** is done only by suitably trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.
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

The pump achieves its ultimate pumping speed and ultimate vacuum only at operating temperature (after approx. 15 min.).

Type		ME 4C NT VARIO	MZ 2C NT VARIO	MD 4C NT VARIO
Maximum pumping speed (ISO 21360)	m^3/h	4.9	2.8	4.6
Ultimate vacuum (absolute) without gas ballast*	mbar	70	7	1.5
Ultimate vacuum (absolute) with gas ballast*	mbar	-	12	3
Maximum permissible inlet pressure (absolute)	bar	1.1		
Maximum permissible outlet pressure (absolute)	bar	1.1		
Maximum permissible pressure (absolute) at gas ballast valve	bar	-	1.2	
Permissible ambient temperature storage / operation	°C	-10 to +60 / +10 to +40		
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85		
Power (electric)	W	575		
No-load speed	min^{-1}	30 - 2400		
Maximum permissible range of supply voltage (±10%) **Attention: Observe specifications of rating plate!**		100-120 V~ 50-60 Hz 200-230 V~ 50-60 Hz		
Maximum nominal current draw at: 100-120 V~ 50/60 Hz 200-230 V~ 50/60 Hz	 A A	 3.2 1.4		 6.3 2.5
Device fuse		slow blow fuse 4A (200-230V) / 8A (100-120V)		
Motor protection		thermal cutout		
Degree of protection IEC 529		IP 20		
Inlet		hose nozzle NW 10 mm		
Outlet		silencer / hose nozzle NW 10 mm	hose nozzle NW 10 mm	
Dimensions L x W x H approx.	mm	254 x 243 x 245	243 x 243 x 245	325 x 243 x 245
Weight approx.	kg	13.8	13.8	16.3

* Ultimate vacuum at setting ”Pump down” at speed ”HI”

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Type		PC 3002 VARIO	PC 3003 VARIO	PC 3004 VARIO
Maximum pumping speed (ISO 21360)*	m^3/h	2.8	2.8	4.6
Ultimate vacuum (absolute) without gas ballast**	mbar	7	0.6	1.5
Ultimate vacuum (absolute) with gas ballast**	mbar	12	2	3
Maximum permissible inlet pressure (absolute)	bar	1.1		
Maximum permissible outlet pressure (absolute)	bar	1.1		
Maximum permissible pressure (absolute) at gas ballast valve	bar	1.2		
Permissible ambient temperature storage / operation	°C	-10 to +60 / +10 to +40		
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85		
Power (electric)	W	575		
No-load speed	min^{-1}	30 - 2400		
Maximum permissible range of supply voltage (±10%) **Attention: Observe specifications of rating plate!**		100-120 V~ 50-60 Hz 200-230 V~ 50-60 Hz		
Maximum nominal current draw at: 100-120 V~ 50/60 Hz 200-230 V~ 50/60 Hz	 A A	 3.2 1.4	 6.3 2.5	
Device fuse		slow blow fuse 4A (200-230V) / 8A (100-120V)		
Motor protection		thermal cutout		
Degree of protection IEC 529		IP 20		
Inlet		hose nozzle NW 10 mm		
Outlet		hose nozzle NW 10 mm		
Coolant connections (waste vapour condenser)		hose nozzle NW 6-8 mm		
Maximum permissible pressure of coolant at waste vapour condenser	bar	6 (absolute)		
Permissible range of coolant temperature	°C	-15 to +20		
Dimensions L x W x H approx.	mm	422 x 258 x 516		
Weight approx.	kg	18.4	21.0	

* Pumping speed of diaphragm pump
** Ultimate vacuum at setting ”Pump down” at speed ”HI”

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Type		MV 10C VARIO-B PC 3010 VARIO	MD 12C VARIO-B PC 3012 VARIO
Maximum pumping speed (ISO 21360)*	m^3/h	8.6	10.0
Ultimate vacuum (absolute) without gas ballast**	mbar	0.6	2
Ultimate vacuum (absolute) with gas ballast**	mbar	9	9
Maximum permissible inlet pressure (absolute)	bar	1.1	
Maximum permissible outlet pressure (absolute)	bar	1.1	
Maximum permissible pressure (absolute) at gas ballast valve	bar	1.2	
Permissible ambient temperature storage / operation	°C	-10 to +60 / +10 to +40	
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85	
Power (electric)	W	575	
No-load speed	min^{-1}	30 - 2400	
Maximum permissible range of supply voltage (±10%) **Attention: Observe specifications of rating plate!**		100-120 V~ 50-60 Hz 200-230 V~ 50-60 Hz	
Maximum nominal current draw at: 100-120 V~ 50/60 Hz 200-230 V~ 50/60 Hz	 A A	 8 3.5	
Device fuse		slow blow fuse 4A (200-230V) / 8A (100-120V)	
Motor protection		thermal cutout	
Degree of protection IEC 529		IP 20	
Inlet Pump Pumping unit		small flange NW 25 small flange NW 25 or hose nozzle NW 15	
Outlet		hose nozzle NW 10 mm	
Coolant connections (waste vapour condenser)		hose nozzle NW 6-8 mm	
Maximum permissible pressure of coolant at waste vapour condenser	bar	6 (absolute)	
Permissible range of coolant temperature	°C	-15 to +20	
Dimensions L x W x H approx. Pump Pumping unit	mm	 505 x 237 x 303 645 x 365 x 600	
Weight approx. Pump Pumping unit	kg	 27.0 35.8	

* Pumping speed of diaphragm pump
** Ultimate vacuum at setting ”Pump down” at speed ”HI”

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Controller	CVC 3000
Pressure transducer	ceramic diaphragm (alumina), capacitive, absolute pressure, gas type independent
Display	LCD graphic display, illuminated
Pressure units / scale (selectable)	mbar, Torr or hPa
Measuring range (absolute)	1080 mbar - 0.1 mbar (810 Torr - 0.1 Torr)
Maximum control range with internal pressure transducer (absolute)*	1060 mbar - 1 mbar (795 Torr - 1 Torr) Turbo mode < 1 mbar (Torr)
Resolution	0.1 mbar
Maximum permissible pressure at pressure transducer (absolute)	1.5 bar (1125 Torr)
Maximum permissible temperature of gaseous media	continuous operation: 40°C, for short periods up to 80°C
Measurement uncertainty (absolute) 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 atmospheric moisture during operation (no condensation)	30% to 85%
Maximum permitted current of connected valves (connected components)	4A
Degree of protection according to IEC 529 (front side)	IP 42
Measurement connection of pressure transducer	connection for PTFE tube 10/8 mm or hose nozzle 6/10 mm
Venting connection	hose nozzle for hose 4-5 mm
Maximum admissible pressure at venting connection	1.2 bar absolute
Interface	RS 232 C

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

We reserve the right for technical modifications without prior notice!

Gas inlet temperatures

Operating condition	Inlet pressure	Permitted range of gas temperatures at inlet
Continuous operation	> 100 mbar (high gas load)	+10°C to +40°C
Continuous operation	< 100 mbar (low gas load)	0°C to +60°C
Short-time (< 5 minutes)	< 100 mbar (low gas load)	-10°C to +80°C

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Wetted parts

Components	Wetted materials
Pump	
Head cover	ETFE carbon fibre reinforced
Diaphragm clamping disc	ETFE carbon fibre reinforced
Diaphragm	PTFE
Valves	FFKM (ME 4C NT VARIO: PTFE)
O-rings	FPM
Valve head (pumps NT VARIO)	ECTFE carbon fibre reinforced
Housing cover insert (pumps VARIO-B / PC 301x)	PTFE carbon reinforced
Gas ballast tube, inlet, outlet (pumps NT VARIO)	PTFE carbon reinforced
Inlet (pumps VARIO-B)	Stainless steel
Outlet (pumps VARIO-B)	ETFE
Silencer // hose to silencer	PBT/PVF // PVC
Fittings (pumps VARIO-B / PC 301x VARIO)	ETFE/ECTFE
Tubing	PTFE
Pumping unit	
Inlet pumping unit (PC 300x / PC 301x VARIO)	PP / Stainless steel
Outlet pumping unit	PET
Distribution head (inlet PC 300x)	PPS glass fibre reinforced
Tubing	PTFE
Screw-in fittings	ETFE / ECTFE
O-ring at the catchpot	FPM
Overpressure safety relief device	Silicone rubber / PTFE foil
Blind plug (inlet PC 300x VARIO)	PP
Exhaust waste vapour condenser / catchpot / collecting flask	Borsilicate glass
Catchpot (inlet PC 301x VARIO)	PMP
Drain screw (catchpot PC 301x VARIO)	Steel
O-rings (catchpot PC 301x VARIO)	NBR
CVC 3000	
Sensor	Aluminium oxide ceramic
Vacuum connection (pump NT VARIO)	PP
Vacuum connection (PC 300x VARIO)	PP / PVDF
Sensor housing	PPS / glass fibre
Sensor seal	Chemically resistant fluoroelastomer
Venting valve seal	FPM

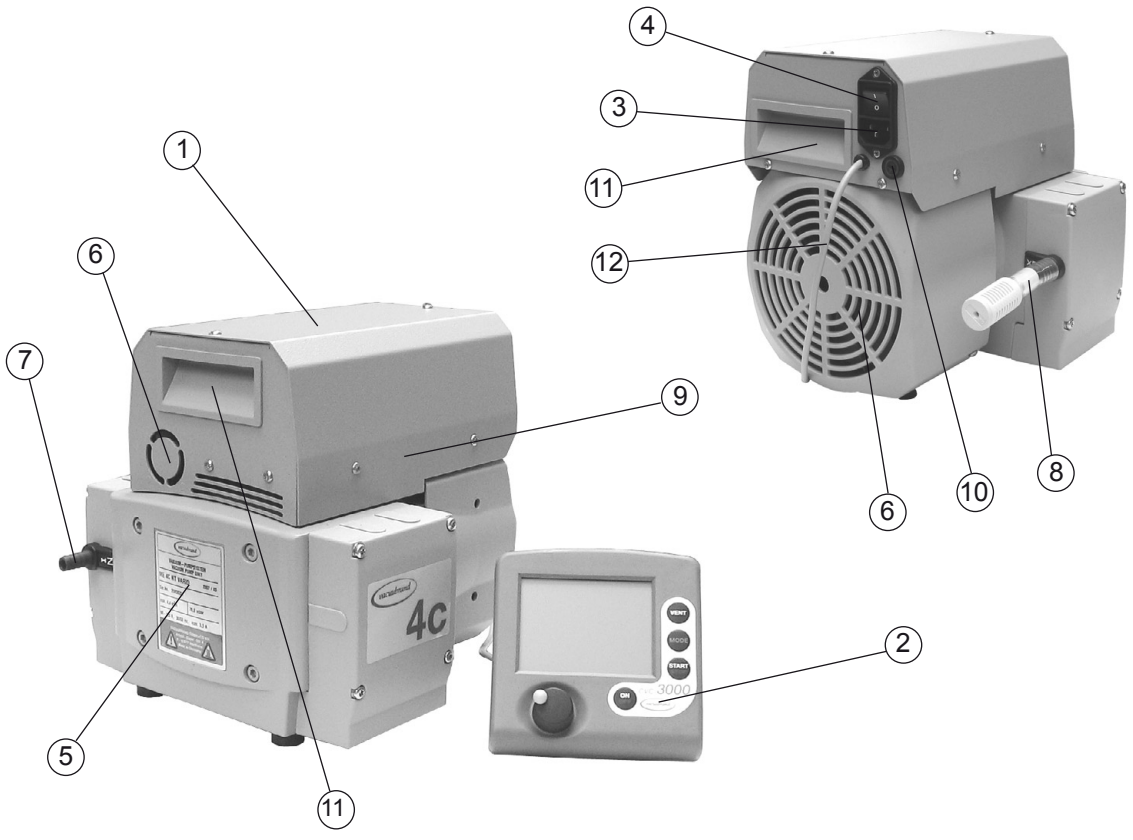
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Pump parts

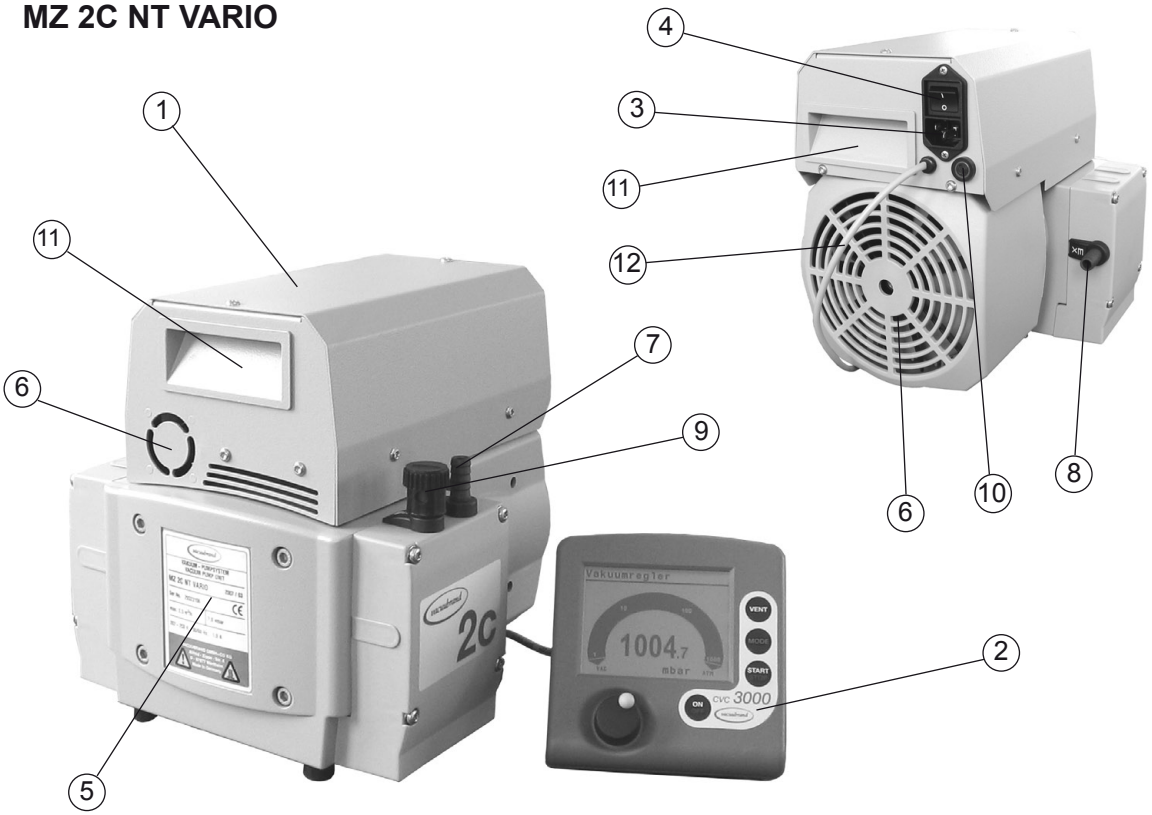
Position	Component	Position	Component
1	Diaphragm pump NT VARIO	11	Recessed grip / handle
2	Controller CVC 3000	12	VACUU•BUS cable to controller
3	Mains connection	13	Exhaust waste vapour condenser
4	ON/OFF switch	14	Catchpot
5	Pump rating plate	15	Coolant inlet
6	Fan	16	Coolant outlet
7	Inlet	17	Overpressure safety relief device
8	Outlet	18	Catchpot (inlet)
9	Gas ballast valve	19	Drain screw
10	Fuse holder	20	Collecting flask (outlet)

ME 4C NT VARIO

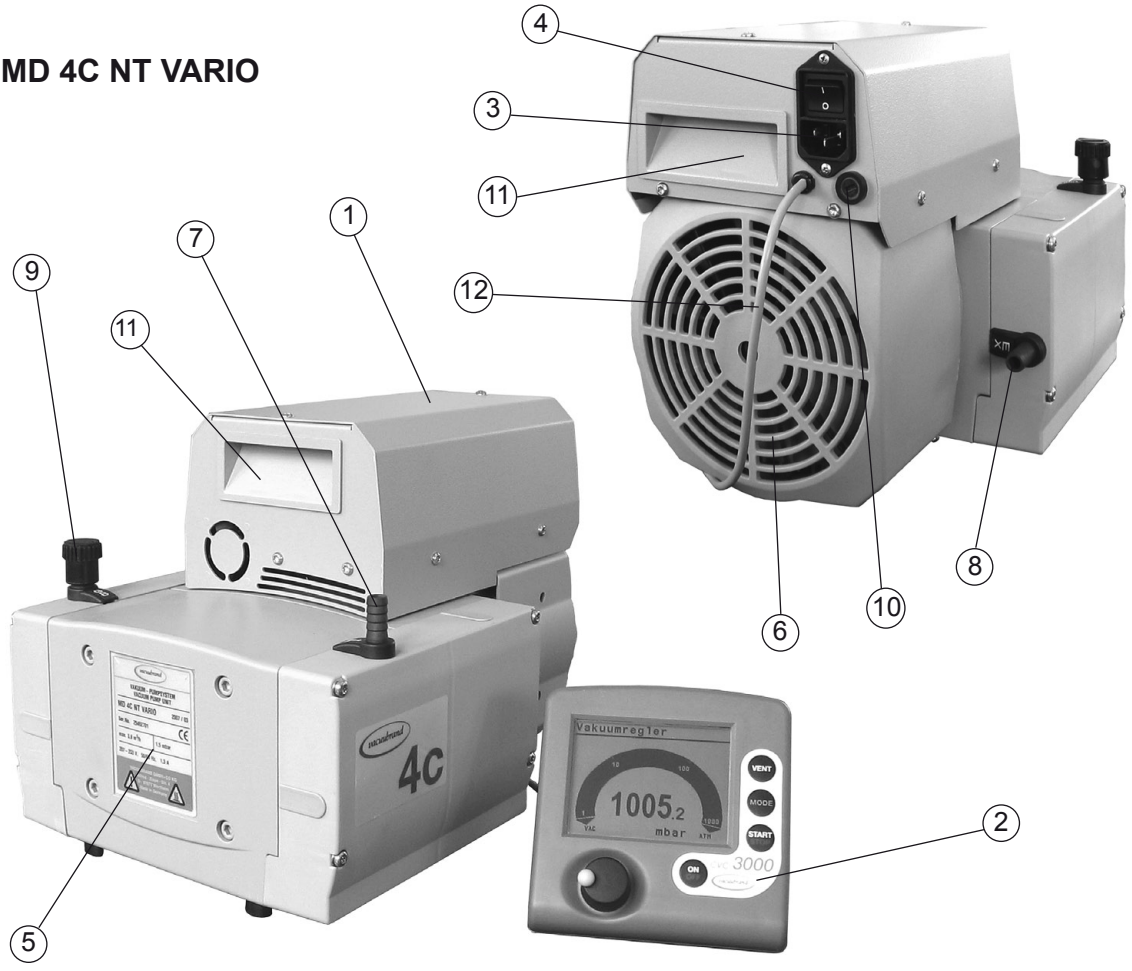


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MZ 2C NT VARIO

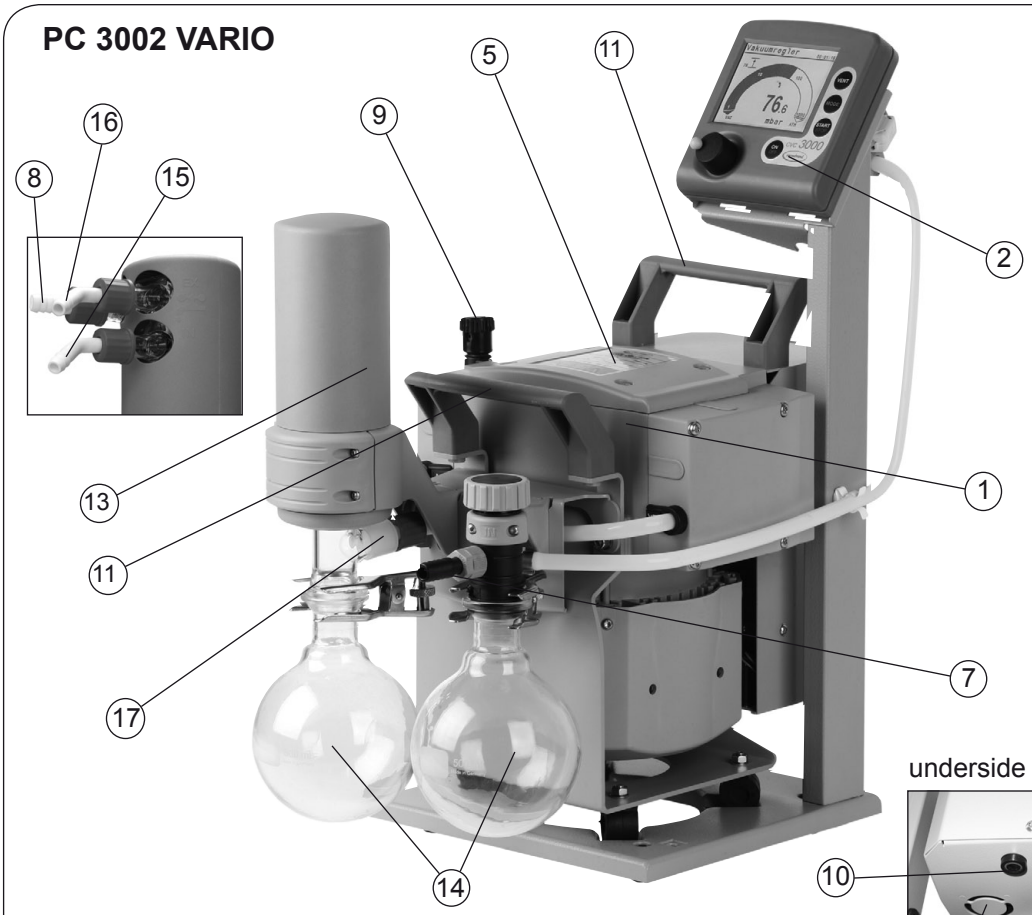


MD 4C NT VARIO

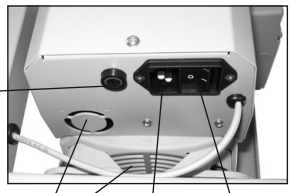


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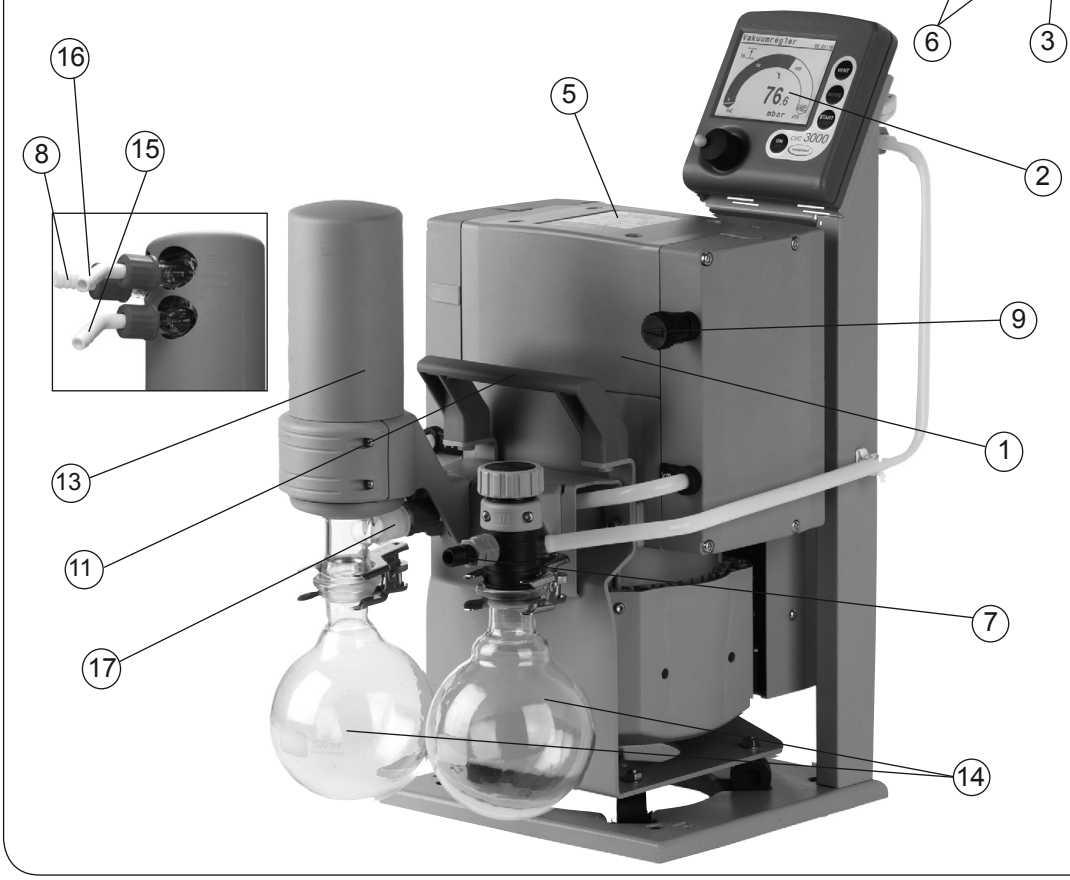
PC 3002 VARIO



underside terminal box:

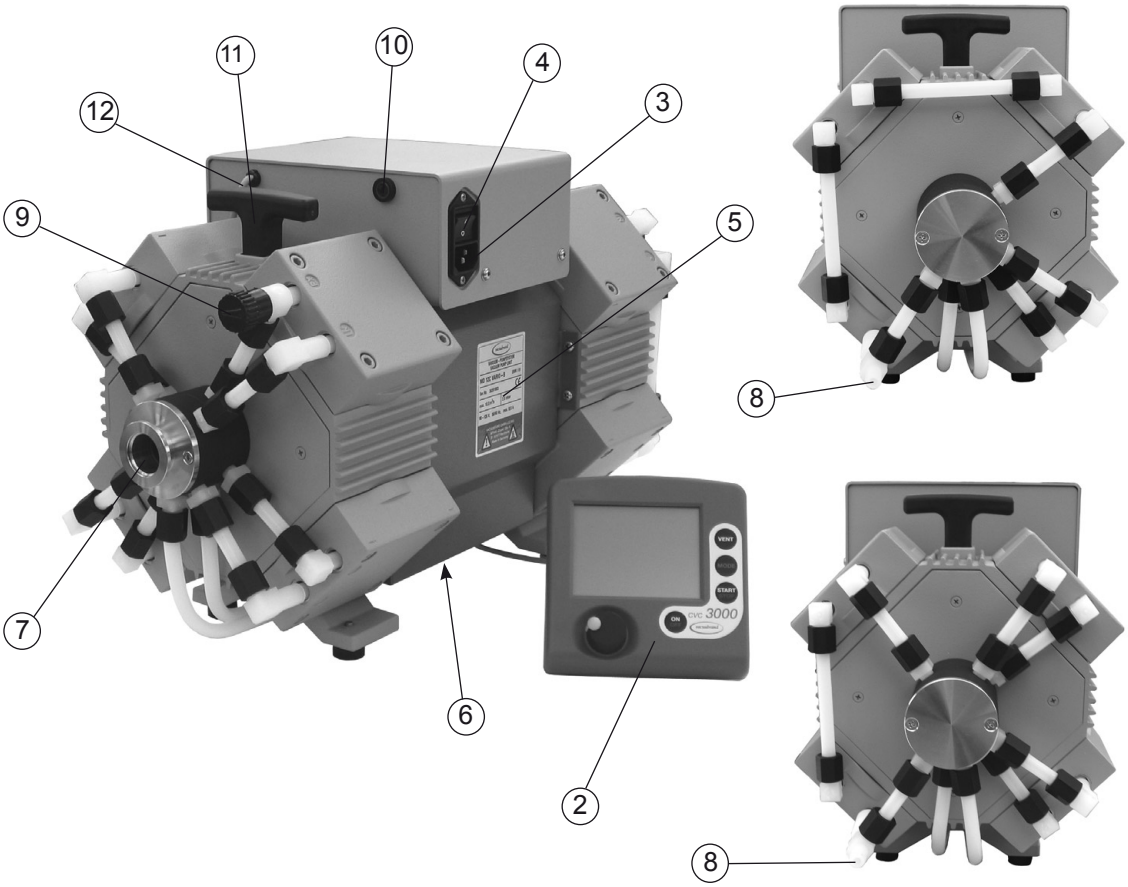


PC 3003 VARIO / PC 3004 VARIO



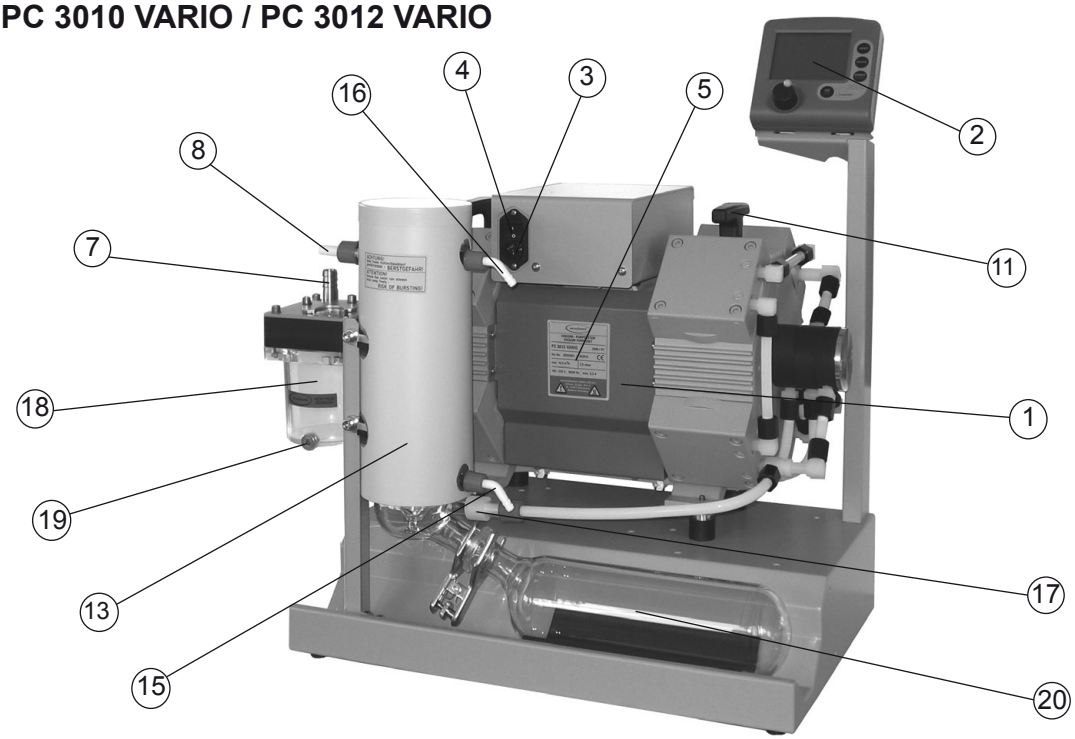
MV 10C VARIO-B / MD 12C VARIO-B

outlet side MV 10C VARIO-B

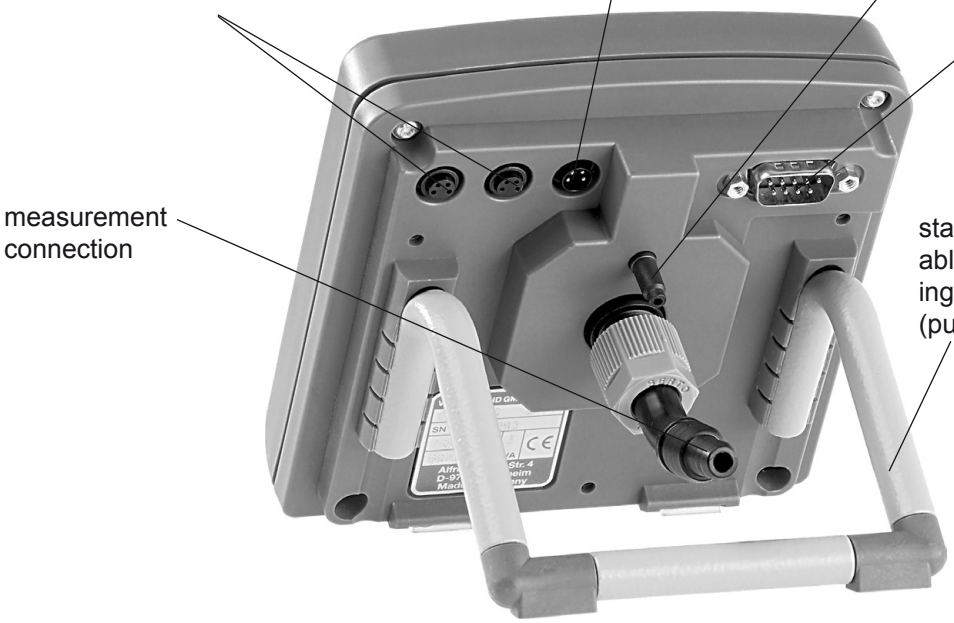


outlet side MD 12C VARIO-B

PC 3010 VARIO / PC 3012 VARIO



Rear side CVC 3000



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Use and operation

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 (e.g. ”*English*”) 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.

Installing in a vacuum system

⚠CAUTION

- Connection lines at the pump inlet have to be gas tight. Particles and dust must not be aspirated, the user has to provide appropriate filters if necessary. The user must ensure their suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.
- Connect an exhaust line gas tight at the pump outlet if necessary. Always dispose of exhaust gases appropriately (e.g. into a fume hood). If there is risk of release of dangerous or polluting fluids, install an appropriate system to catch and dispose of those fluids.

- Reduce the transmission of vibration and prevent mechanical load due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Attention:** Flexible elements tend to shrink when evacuated.
- The gas outlet must never be blocked. The exhaust line has always to be free (pressureless) to ensure an unimpeded discharge of gas.

- In case of mains failure accidental venting of the system, especially with an open gas ballast, may occur. If this may cause possible dangers provide suitable safety measures.

- Make sure ventilation is adequate especially if the pump is installed in a housing or if the ambient temperature is elevated. Provide external ventilation if necessary.

NOTICE

Avoid throttling losses by using connecting pipes with large diameter and by keeping them as short as possible.
In case of perturbing exhaust noise connect an exhaust hose or use a silencer (see ”Accessories”).
Install outlet pipelines always falling to avoid backflow of condensate towards the pump.
Use of a suitable valve to isolate the pump from the vacuum system is recommended to allow the pump to warm up before pumping condensable vapours or to clean the pump before it is switched off.
When assembling, ensure **vacuum-tightness**. After assembly, check the whole system for leaks.
Secure hose connections at the pump appropriately against accidental detaching.

The VACUUBRAND controller CVC 3000 can only be operated with components compatible to the VACUUBRAND **VACUU•BUS system**, see accessories.
The vacuum controller CVC 3000 controls VACUUBRAND diaphragm pumps NT VARIO and VARIO-B, pumping units PC 30xx VARIO and optional coolant and venting valves. Connected components (e.g. venting valve, level sensor, external pressure transducer 3000 series) are automatically identified and configurated.
Do not use more than one controller within the same VACUU•BUS system. Several controllers in the same VACUU•BUS system will interfere with each other and result in error messages of the connected components (pumps, valves).

CVC 3000
The CVC 3000 is equipped with an internal capacitive pressure transducer with ceramic diaphragm to measure the actual pressure independently of the gas type and with reference to the vacuum, i. e. absolute.

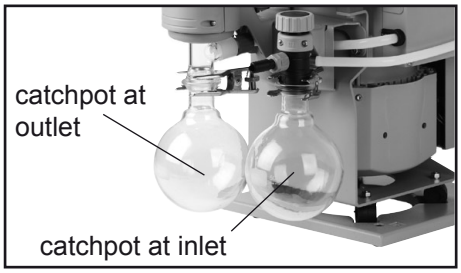
Pumps NT VARIO and VARIO-B:
☞ Connect the controller CVC 3000 via the VACUU•BUS cable of the NT VARIO or VARIO-B pump to the diaphragm pump. **Attention**: Do not cant when assembling or removing plug connections! Obey correct positioning of the plug. To connect further components use Y-adapters and extension cables VACUU•BUS.

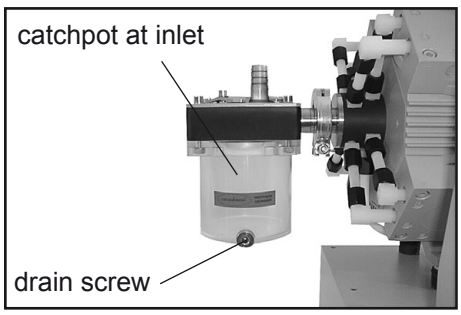
☞ Connect the vacuum connection of the controller via hose or PTFE tubing to the vacuum application. The diameter of the pipelines should be as large as possible.

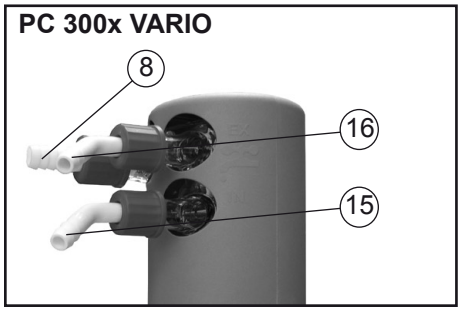
⚠WARNING

☞ Maximally permitted pressure: 1.5 bar (absolute).
☞ **Attention**: At pressures above 1080 mbar the pressure transducer gets saturated, the pressure measurement grows erroneous. Release pressure immediately. 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. This effects the measurement results as well as the controlling. Therefore carefully choose position where to connect the vacuum controller. Install the CVC 3000 so that no condensate can flow towards the pressure transducer. Clean pressure transducer if necessary, see section ”Cleaning the pressure transducer”.

Pumping units PC 30xx VARIO
with separator at the inlet and exhaust waste vapour condenser at the outlet:







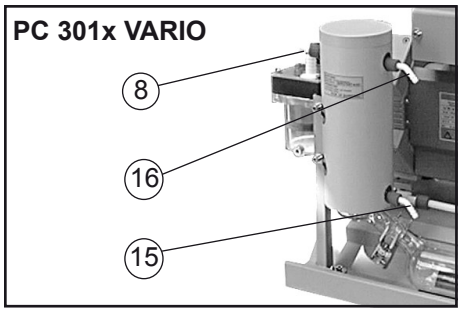
Assembling the hose nozzle with union nut at the inlet:
➨ Take the hose nozzle with attached compression ferrule and union nut out of the round bottom flask and put onto inlet connection.
➨ Tighten the union nut by hand until you can feel the stop. Then tighten an additional 1/4 rotation with an open-ended wrench size 17 for final installation.

The catchpot at the inlet prevents droplets and particles from entering the pump.
☞ Lifetimes of diaphragms and valves are enhanced.
☞ Improves vacuum in case of condensation.

Round bottom flasks (PC 300x VARIO):
Both round bottom flasks are coated with a protective layer to prevent disintegration in case of breakage or implosion.
➨ Assemble the catchpots at the inlet and at the outlet using joint clips.

PC 301x VARIO:
➨ Assemble the inlet catchpot with centring ring and clamping ring at the inlet of the pump.
➨ Assemble the collecting flask at the exhaust waste vapour condenser using joint clips.
➨ Install a vacuum connection (hose) between the pressure transducer (measurement connection at the rear of the CVC 3000) and the vacuum system.

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Exhaust waste vapour condenser:

➨ Assemble hose nozzles for coolant inlet and coolant outlet pipelines at the exhaust waste vapour condenser.

The exhaust waste vapour condenser enables an efficient condensation of the pumped vapours at the outlet.

☞ No backflow of condensates.
☞ Controlled recovery of condensates.
☞ Next to 100% solvent recovery.
☞ The isolation cover protects against glass splinters in case of breaking, acts as thermal isolation to avoid condensation of humidity and is intended to absorb shocks.

NOTICE

Attach the pipelines of the coolant circuit to the respective hose nozzles (see image, hose nozzles 6-8 mm) at the waste vapour condenser. Check hose connections prior to starting operation of the cooling system.
Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.

⚠CAUTION

- The gas outlet (hose nozzle 10 mm) must not be blocked. The exhaust pipeline has always to be free and pressureless to enable an unhindered discharge of gases.
- Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.

- **Attention**: Install hoses of the cooling system in a way to avoid flow / dropping of condensed water onto the pumping unit (especially cables and electronic parts).
- Ensure that the coolant outlet pipeline is always free and that it cannot get blocked.
- Install coolant valves always in the supply line of the waste vapour condenser only.

During operation

⚠CAUTION

- **Maximum ambient temperature**: 40 °C
- Make sure ventilation is adequate especially if the pump is installed in a housing or if the ambient temperature is elevated.
- **Potentially dangerous gases or vapours** at the outlet of the pump have to be drained and disposed of appropriately.
- Due to the high compression ratio of the pumps, the pressure at the outlet port might get higher than the maximally permitted pressure compatible with the **mechanical stability** of the system. Ensure that the pump outlet is neither blocked nor restricted.

NOTICE

If the pump is installed in altitudes of more than 1000 m above mean sea level check compatibility with applicable safety requirements, especially IEC 60034 (motor might overheat due to insufficient cooling).
Do not start the pump if the **pressure at outlet port** exceeds **maximum 1.1 bar (absolute)**. Attempts to start the pump at higher pressures may cause blockade and damage of the motor.
Check compatibility with **maximally permitted pressure** at inlet and outlet.

Prevent internal condensation, transfer of liquids or dust. The diaphragms and valves will be damaged, if liquids are pumped in significant amounts.
Check the pump regularly for external soiling and deposits, clean if necessary to avoid an increase of the pump‘s operating temperature.

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If pumping condensable vapours (water vapour, solvents, ...), let the pump run with gas ballast to reduce condensation in the pump.

Operation with silencer at the outlet: Operating the pump at high inlet pressure or pumping dusty gases for a long time may cause clogging of the silencer. Check the silencer regularly and replace if necessary.

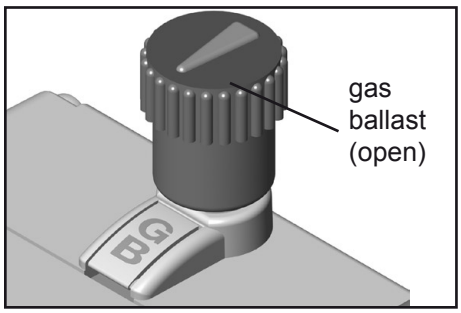
In case of excess temperature, the motor is shut down by a **thermal cutout** in the winding. Attention: Reset possible only manually. Confirm error message at controller by pressing key START/STOP or switch off the pump or isolate the equipment from mains. Determine and eliminate the cause of failure. Wait approx. five minutes before restarting the pump.
Check fan (underside the pump) regularly for dust/dirt. Clean if necessary.

A warm up period (approx. 15 min.) is required to ensure that the rated ultimate vacuum and pumping speed are attained.

Attention: Important notes regarding the use of gas ballast

⚠ DANGER

- When using air rather than inert gas, risk of significant damage to equipment and/or facilities, risk of personal injury or even loss of life exists due to the formation of hazardous and/or explosive mixtures if air and pumped media react inside or at the outlet of the pump.
- Make sure that air/gas inlet through the gas ballast valve never leads to hazardous, explosive or otherwise dangerous mixtures. If in doubt, use inert gas.



In case of condensable vapours (water vapour, solvents, ...):
- ☞ Do not pump vapour until the pump has reached its operating temperature.
- ☞ Open gas ballast valve. The gas ballast valve is open if the arrow on the gas ballast cap shows towards the marking ”GB”.
- ☞ With gas ballast valve open ultimate vacuum will be reduced, pumping speed is decreased.
- ☞ Use inert gas at the air inlet to avoid the formation of explosive mixtures.
- ☞ Close gas ballast valve by turning it 180°.

In case of low boiling solvents when the formation of condensate is unlikely, the use of gas ballast might be unnecessary.
Operating the pump without gas ballast increases the solvent recovery rate at the exhaust waste vapour condenser.

Attention: Notes concerning the operation of the exhaust waste vapour condenser

⚠WARNING

☞ The gas outlet (hose nozzle 10 mm) must not be blocked. The exhaust pipeline has always to be free and pressureless to enable an unhindered discharge of gases.
☞ Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.
☞ Ensure that the coolant outlet pipeline is always free and that it cannot get blocked.

⚠CAUTION

- Check the overpressure safety relief device at the exhaust waste vapour condenser regularly, replace if necessary. Check especially for conglutination and cracks.

- Maximum permissible coolant pressure at the exhaust waste vapour condenser: 6 bar (absolute)
- Comply with the maximum permissible coolant pressures of additional components in the coolant circuit (e.g coolant valve).
- Install coolant valves always in the supply line of the waste vapour condenser only.
- Avoid overpressure in the coolant circuit (e.g. caused by blocked or squeezed coolant hoses).

- In case of **condensation**: Check liquid level in both catchpots during operation. Avoid overflowing of the catchpots.

NOTICE

Do not allow the catchpots to get overfilled. Maximum liquid level approx. 80%, to avoid problems when removing the catchpots.
Check liquid level in both catchpots regularly and drain catchpots in time. In case, install level sensor (see “Accessories“).

Permissible range of coolant temperature at the exhaust waste vapour condenser: -15°C to +20°C

Check hose connections prior to starting operation of the cooling system.
Check coolant hoses regularly during operation.

Removing the catchpots:

Catchpot at outlet:
Remove joint clip, remove catchpot and drain condensate.

Round bottom flask at inlet:
Admit air or inert gas (via inlet of pumping unit) to atmospheric pressure. Remove joint clip, remove catchpot and drain condensate.

Catchpot at inlet (PC 301x VARIO):
Admit air or inert gas (via inlet of pumping unit) to atmospheric pressure. Open drain screw and drain condensate.

NOTICE

➨ Reassemble drained catchpots.

Important: Comply with regulations when disposing of solvents/condensates. Reuse if possible, purify if contaminated.

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Shutdown

NOTICE

Short-term:
Has the pump been exposed to condensate?
- Allow the pump to continue to run at atmospheric pressure for a few minutes (continuous pumping).

Has the pump been exposed to media which may damage the pump materials or forms deposits?
- Check and clean pump heads if necessary.

Long-term:
- Take measures as described in section short-term shutdown.
- Separate pump from the application. Close gas ballast valve.
- Drain catchpots.
- Close inlet and outlet port (e. g. with transport caps).
- Store the pump in dry conditions.

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Vacuum Controller CVC 3000

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 e.g., "*English*" 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 device the **version number of the software** is displayed, then the preselected function with the pressure reading.

Attention: Do not cant when assembling or removing plug connections! Comply with correct orientation 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.

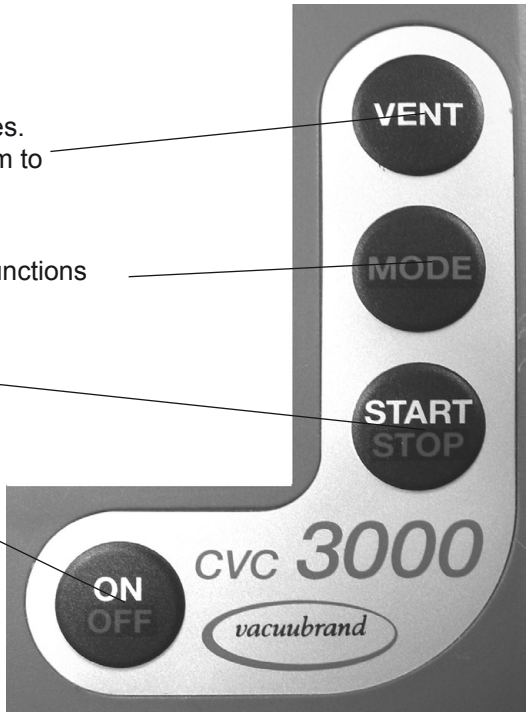
Keys

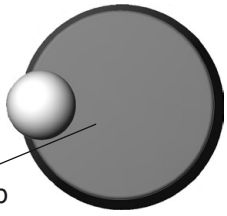
Venting:
- Short pressing vents short-time, control continues.
- Pressing longer than 2 seconds vents the system to atmospheric pressure, control stops.

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

Start or Stop of the control

on/off switch



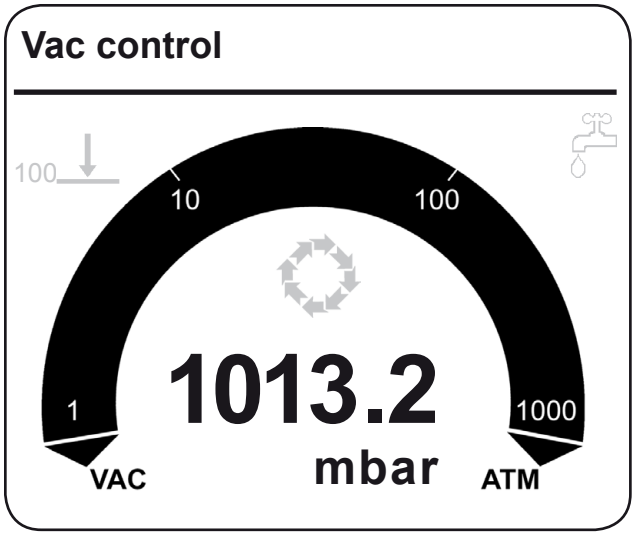


Selection knob

- 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

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Display and symbols



Function of the device:
(displayed in the upper left corner)

Pump down
Vac control
Auto mode (only with NT VARIO pump)
Program
VACUULAN
Configuration

1013.2	Actual absolute pressure at the pressure transducer
mbar Torr hPa	Preselected pressure unit

100 100 Vacuum control to a preset vacuum value (here 100 mbar/Torr/hPa) (without NT VARIO pump / with NT VARIO pump)

Actual pressure in interval “Set vacuum + hysteresis“ / Actual pressure = set vacuum (without NT VARIO pump / with NT VARIO pump)

flashing: actual pressure > preset maximum value (“*Maximum*“)

Minimum value (“*Minimum*“) reached

00:00:00 Process runtime (only if process control is running)

Pump down (continuous pumping)

50% Pump symbol is displayed when pump is running.
The pump’s motor speed in % is displayed additionally (only with NT VARIO pump).

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

Level sensor activated

Emission condenser Peltronic connected

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 and the requirements of the application.

Automatic detection of the components
When switching on the controller the actual configuration of the connected components is checked automatically.
Connected components (pump NT VARIO / VARIO-B, VSK 3000, valves) are **detected automatically** and used and supervised until the controller is switched off. Switch off/on the controller to renew the configuration.
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 features **five functions and one configuration menu**, see section ”Menu guide”. Each of these functions includes specific preselection possibilities and is adapted automatically with regard to the connected components.
Depending on the connected components (e.g. valves) some menu items might not be active!

Changing the function:
➨ Switch controller on.
➨ Press START/STOP to terminate control in case 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”
- NT VARIO/VARIO-B pump depending on pressure and time preselections with continuous speed control
- Coolant valve

”Vac control”
- NT VARIO / VARIO-B pump with pinpoint precision according to pressure preselection
- Coolant valve

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

”Program”
- Pump depending on pressure and time preselections or ”Auto mode”
- Coolant valve
- Venting valve

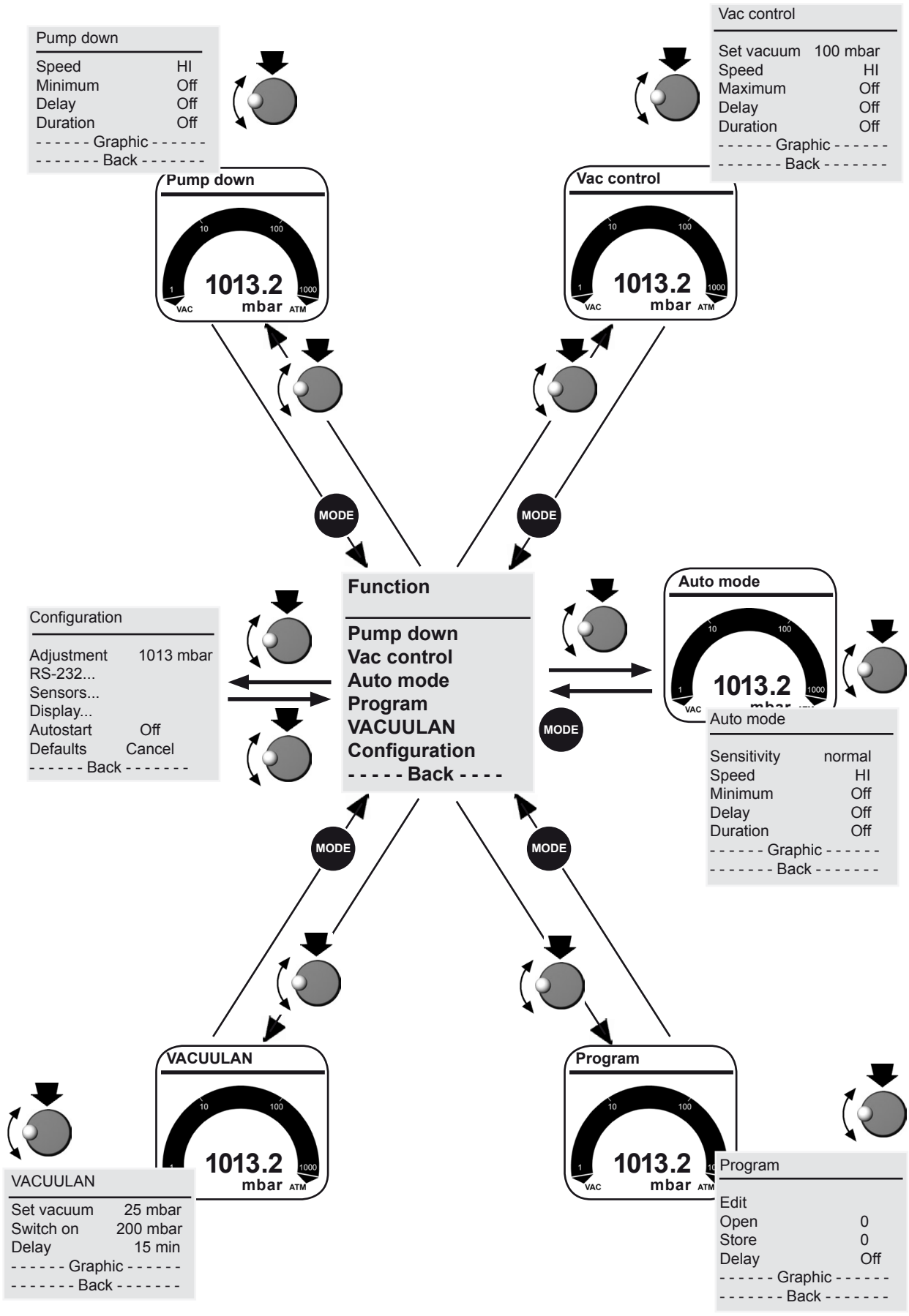
”VACUULAN”
- NT VARIO/VARIO-B pump depending on pressure and time preselections with continuous speed control
- Coolant valve

”Configuration”
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)

☞ The menu ”Configuration” is also accessible by pressing the selection knob while the start display is shown.

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Menu guide



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Function Pump down

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

• **Operation on demand of a speed controlled NT VARIO / VARIO-B pump**

Preselections

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

☞ ***Speed:*** Preselection of the motor speed for pump down. The selection ”HI” effects the maximum speed and best ultimate vacuum of the pump (with automatic speed reduction at ultimate vacuum). The ”*Speed*” is adjustable in a range of 1-100% and to ”HI”.

☞ ***Minimum:*** The controller switches the pump off once the preset value for ”*Minimum*” has been 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.

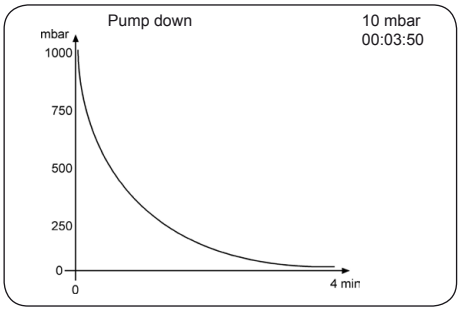
☞ ***Delay:*** ”*Delay*” determines the time the coolant valve is running on after the process has been stopped.
The ”*Delay*” is adjustable in a range of 1-300 minutes or can be set to ”Off”.

☞ ***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 when the preset process time is reached, also if a preset ”*Minimum*” is still not reached.

☞ If neither ”*Minimum*” nor ”*Duration*” 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.

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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.
☞ Pressing key ”MODE” again switches to function ”Auto mode”. The controller adapts the boiling pressure starting from the current vacuum.
☞ The preset function of the controller does not change due to this temporary switching. When pressing key ”STOP” the controller is set again to the function ”Pump down”.

Adapting the pumping speed 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.

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Function Vac control

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

• **Operation on demand of a speed controlled pump (NT VARIO / VARIO-B)**

Preselections

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

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

☞ ***Speed:*** 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”.

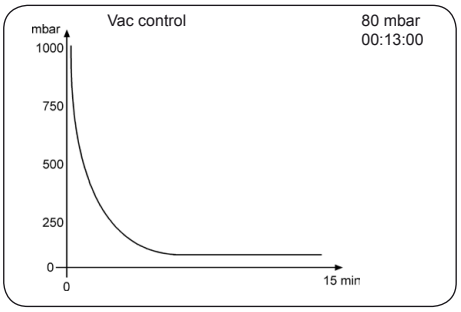
☞ ***Maximum**:* An upper pressure limit can be preselected. The pump switches off if the pressure limit is exceeded, e. g. at the end of suctions or filtrations. The pressure limit is only active once the pressure has gone below ”*Maximum*”.
The ”*Maximum*” is adjustable in a range of 1059 - 1 mbar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

☞ ***Delay:*** ”*Delay*” determines the time the coolant valve is 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.
A preset ”*Duration*” (process time) is without effect, if the process is stopped due to a preset ”*Maximum*” before ”*Duration*” is reached.
The ”*Duration*” is adjustable between 1-1440 minutes (24 h) or can be set to ”Off”. ”Off” means that no endpoint of the process is defined.

The screen-shots show the factory-set values.

Vac control	00:00:00
Set vacuum	100 mbar
Speed	HI
Maximum	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 ”*Vac control*” to ”Auto mode” 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 adaptation:
☞ 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 current pressure value is used as new set value.

Alternatively:
Fine tuning:
The set vacuum can be adapted simply 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.

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Function Auto mode

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

Preselections

☞ Use the selection knob to set the parameters.

☞ ***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 limit 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 advisable to reduce the maximum speed.
The "*Speed*" is adjustable in a range of 1-100% or can be set to "HI".

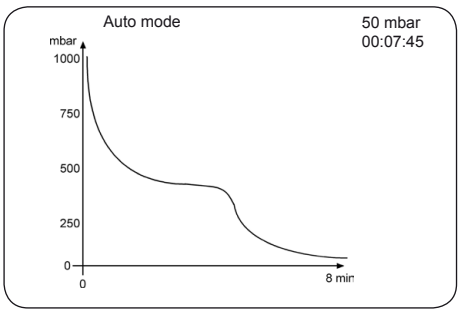
☞ ***Minimum*:** If the vacuum value reaches "*Minimum*" the process is stopped. Use "*Minimum*" for automatic process termination. When selecting "Auto" the controller switches off automatically at the end of the process (boiling plateau), recommended only for large amounts of solvents.
The "*Minimum*"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

☞ ***Delay:*** "*Delay*" specifies 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 "*Duration*" is adjustable between 1-1440 minutes (24 h) or can be set to "Off". A preset "*Duration*" (process time) is without effect, if the process is stopped earlier by reaching the preset "*Minimum*".

The screen-shot shows the factory-set values.

Auto mode	00:00:00
Sensitivity	normal
Speed	HI
Minimum	Off
Delay	Off
Duration	Off
- - - - - - Graphic - - - - - -	
- - - - - - - Back - - - - - - -	



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" to function "Vac control"

☞ Press key "MODE". The controller switches to "Vac control" . The current pressure value 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 set again to the function "Auto mode".

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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 for each program step to reach a preset vacuum level or if setting ”Step” runtime after having achieved the vacuum level. The summed up total process runtime is shown in the base line. Attention: A preset runtime of 99:59:59 hours in the final program step will cause the process to run endlessly. Termination of the process by pressing key STOP.
Vacuum: Vacuum level to be attained.
Venting valve: Operating 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 running.
”Auto”: Auto = ⇓: automatic determination of a boiling point and adaptation to changes of the boiling point within the preselected time interval. Auto = ⇢: only automatic adaptation to changes of the boiling point. The program step is finished when the selected time or pressure value has been reached.
Selecting ”Auto” in combination with ”Step” in one program step is not possible.

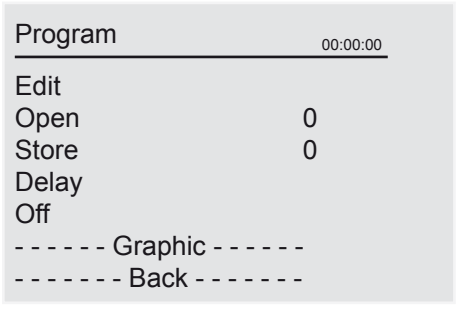
☞ **Open:** Open programs (Program 0 - 9).

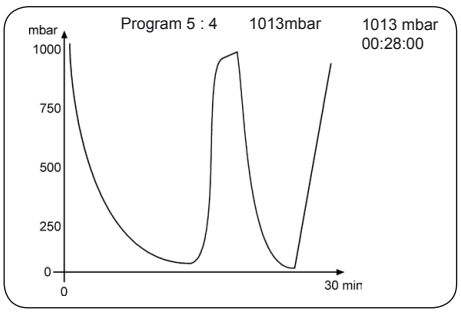
☞ **Store:** This command stores an edited program or the program of the last process to one of the storage spaces 0 - 9.

☞ **Delay:** ”*Delay*” specifies 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”.

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 5 seconds without change the parameter is quit automatically.

The screen-shot shows the factory-set values.





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.

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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.

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.

Attention: If the controller is set to "*Defaults*": "On", all stored programs will be deleted.

Example for use

Example
NT VARIO 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	01:00:00	2			⬇ *
04	00:01:00	ATM	✓	✓	
05	00:00:00	0			
06	00:00:00	0			
07	00:00:00	0			
08	00:00:00	0			
09	00:00:00	0			
10	00:00:00	0			

- - - - - - - - - - - - - Back - - - - - - - - - - - - -

01:11:00

* 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), select the function "Auto⇹" instead of "Auto⬇" (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⬇" 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 time is over (after 60 minutes) 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 passed.
Step 4 vents to atmospheric pressure as fast as possible and switches off the control after one minute.

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Function VACUULAN

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

• **Operation on demand of a speed controlled pump (NT VARIO / VARIO-B)**

Preselections

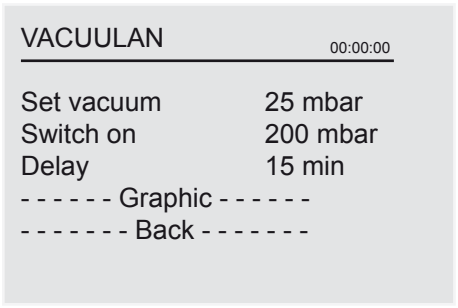
☞ Use the selection knob to select the parameters.

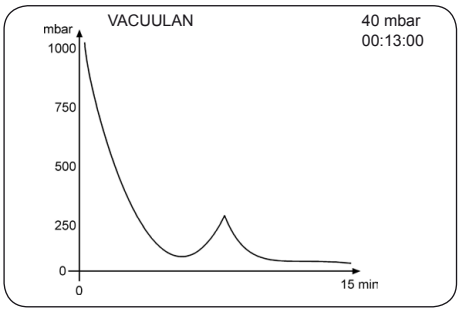
☞ ***Set vacuum*** (lower switch-off value): If the pressure drops below the ”*Set vacuum*” a time-meter starts to run; additionally the motor speed is reduced. The time-meter is reset, if the pressure exceeds the pressure value for switching on again (”***Switch on***”). If the ”*Set vacuum*” is not reached within 100 hours the controller signals an error.
The ”*Set vacuum*” is adjustable in the 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 the range of 1 - 1060 mbar.
In case of sudden high pressure increase pumping starts again even if the ”*Switch on*” pressure has not been not reached (pressure increase control).

☞ ***Delay:*** If the vacuum is below ”*Set vacuum*” for longer than the ”*Delay*” time, the pump is stopped. The pumping down 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.

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Examples for use

Assembly of a vacuum system

- ☞ Assemble vacuum connection lines between vacuum pump, CVC 3000 and vacuum application.
- ☞ Assemble the vacuum connection line between the controller and the vacuum application, if the controller is not part of a pumping unit.
- ☞ Assemble electrical connections.
- ☞ Connect coolant if necessary.

Vacuum for filtration and suction

- ☞ Select function ”**Pump down**”.
- ☞ If necessary set value for *”Speed”* (high or low pumping speed). Reduce the speed in case of fast sedimentation (formation of a filter cake).
- ☞ Set ”*Set vacuum*” 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*” to a value which still does not lead to evaporation of the solvent.
- ☞ If necessary set value for *”Speed”* (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**”. ”*Speed*” ”HI” is recommended. For gel dryers set a lower speed if necessary (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.
- ☞ Set a process time (”*Duration*”) if necessary.
- ☞ 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.
- ☞ Set a process time (”*Duration*”) if necessary.
- ☞ Start process by pressing key ”START/STOP”.

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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.
  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:

- ☞ Select function ”**Vac control”**.
- ☞ Setting a maximum *”Speed”* leads to a faster or slower process.
- ☞ To set *”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” 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”* is still not reached.
- ☞ If neither *”Minimum”* nor *”Duration”* is preset, pumping down has to be finished by pressing key STOP.

Fore-vacuum for high vacuum pumps

Using the pump NT VARIO as fore-vacuum pump for a high vacuum pump (e.g. turbo-molecular with high fore-vacuum tolerance):

- ☞ Function ”Pump down” with ”*Speed*” set to ”HI” or
- ☞ Function ”Vac control” with ”*Set vacuum*” set to ”Turbo”

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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 of CVC 3000”.
Adjustment at atmospheric pressure is carried out at an absolute pressure value between 1060 - 700 mbar and under vacuum at an absolute vacuum value between 0 - 20 mbar. In the range between 20 and 700 mbar no adjustment is possible; ---- mbar is displayed.

☞ ***RS-232*:** Configuration of the interface, setting of parameters and commands, see section ”Interface”.
Baud rate can be set to 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”.

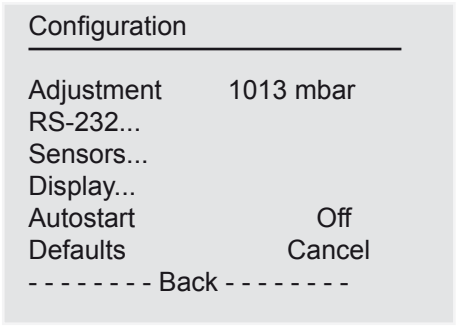
☞ ***Sensors*:** Selection of the pressure transducer to be controlled (maximum 4 external sensors).

☞ ***Display*:** Selection of the device parameters ”*Brightness*” between 0 - 100%, ”*Contrast*” between 0 - 100%, ”*Sound*” ”On” or ”Off”, ”*Units*” ”mbar”, ”hPa” or ”Torr”, ”*Language*” ”German”, ”English”, ”French”, ”Italian”, ”Spanish”, ”Turkish”, ”Korean”, ”Chinese”, ”Portuguese”, ”Russian”, ”Polish”, ”Dutch”, ”Japanese”

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

The screen-shot shows the factory-set values.



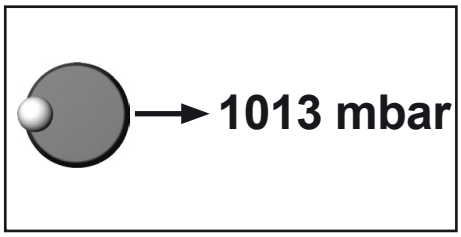
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Readjustment of CVC 3000

NOTICE

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. In the range between 20 and 700 mbar no adjustment is possible; ---- mbar is displayed.

Adjustment at atmospheric pressure

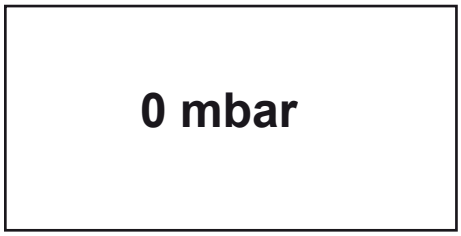


An adjustment at atmospheric pressure is only possible if the pressure is higher than 700 mbar.
Ventilate the measurement connection of the CVC 3000 and/or the vacuum system. Make sure that the pressure transducer is at atmospheric pressure.

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

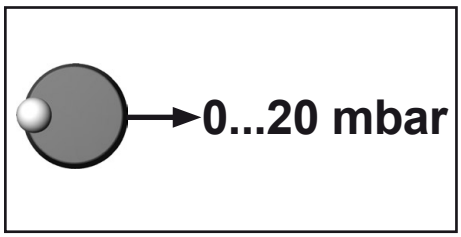


An adjustment under vacuum is only possible if the pressure is lower than 20 mbar absolute.
Evacuate the measurement connection of the CVC 3000 to a pressure < 0.1 mbar (e. g. by applying a good two-stage rotary vane pump).

- ➨ 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 measurement connection of the CVC 3000 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, leaks).*

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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 pressure transducer CVC 3000 ..... **900217**

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.: 638235).

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 the manual operation of the controller set the controller to ”Remote off” in menu configuration. Therefore switch off the controller. Switch on the controller and press selection knob within 2s.

➨ A maximum of ten commands per second is 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 answer of the controller is always terminated with <CR><LF>.
➨ Numerical values and parameters can be written without leading zeros.
➨ The answer of the controller is always with leading zeros.

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Read commands "CVC 2000"

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

XXXXX
- 0: remote operation off
  1: remote operation on
- 0: no automatic switch off
  1: automatic switch off
- 0: no venting valve
  1: venting valve
- 0: no coolant valve
  1: coolant valve
- 0: VACUU•LAN
  1: continuous pumping
  2: vacuum control without automatic
  3: vacuum control with automatic

maloperation mode — IN_ERR — XXXX

XXXX
- 1: last command to interface incorrect
- 1: maloperation mode pressure transducer
- 1: overpressure
- 1: fault pump electronics

status of process control — IN_STAT — XXXX

XXXX
- 00: VACUU•LAN: inactive
  01: pumping down, current pressure > selected pressure
  02: pumping down, time for automatic switching off is running
  03: system is switched off
  10: continuous pumping: inactive
  11: active
  20: vacuum control: inactive
  21: current pressure > selected pressure
  22: current pressure = selected pressure (+/- 1mbar)
  23: current pressure < selected pressure
  30: automatic: inactive
  31: determining boiling point
  32: adjusting boiling point
  33: system is switched off
- 0: venting valve not driven (closed)
  1: venting valve driven (open)
- 0: coolant valve not driven (closed)
  1: coolant valve driven (open)

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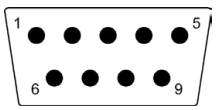
Write commands "CVC 2000"

Operation	Command	Parameter	Description
function	OUT_MODE	X	1: continuous pumping 2: vacuum control without automatic 3: vacuum control with automatic (optional) → 30: sensitivity: low 31: sensitivity: normal 32: sensitivity: high
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)
selected frequency	OUT_SP_2	XX.X	motor frequency in 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)
delay	OUT_SP_4	XX:XX	hh:mm (hours:minutes)
vacuum for automatic switching off	OUT_SP_5	XXXX	unit according to preselection (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
time for automatic switching off (VACUU•LAN)	OUT_SP_6	XX:XX	hh:mm (hours:minutes)
starting process control	START		
stopping process control	STOP	X	1: termination of process control 2: termination of process control and storage of the current pressure as new set point
Remote operation**	REMOTE	X	0: set controller to local operation 1: set controller to remote operation
driving venting valve	OUT_VENT	X	0: close venting valve (not automatically) 1: open venting valve (process control stopped)

* Pressure setting with venting is only possible in function "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), setting a pressure value using the command OUT_SP_1 or if the function 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.

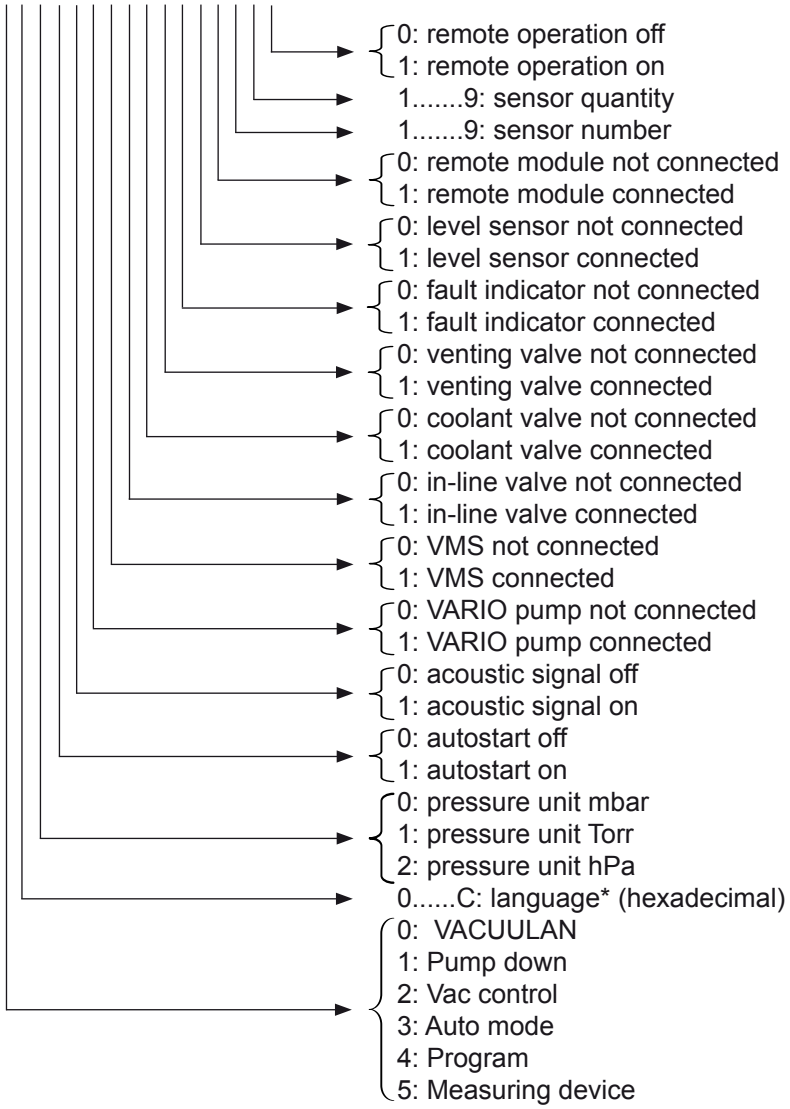
Connection plug arrangement



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

Read commands "CVC 3000"

Operation	Command	Response	Description
current pressure	IN_PV_1	XXXX.X mbar/Torr/hPa	unit according to preselections
current 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	

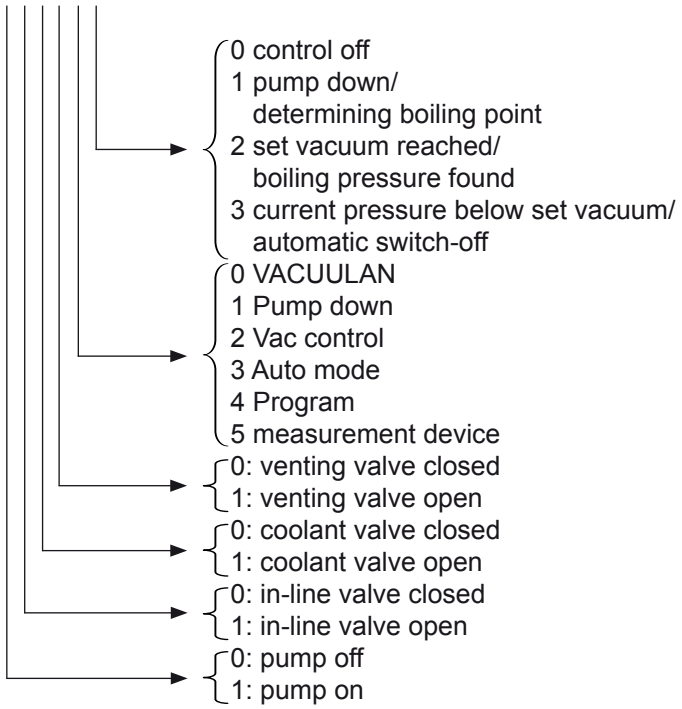


* Language:
0: German
1: English
2: French
3: Italian
4: Spanish
5: Turkish
6: Korean
7: Chinese
8: Portuguese
9: Russian
A: Polish
B: Dutch
C: Japanese

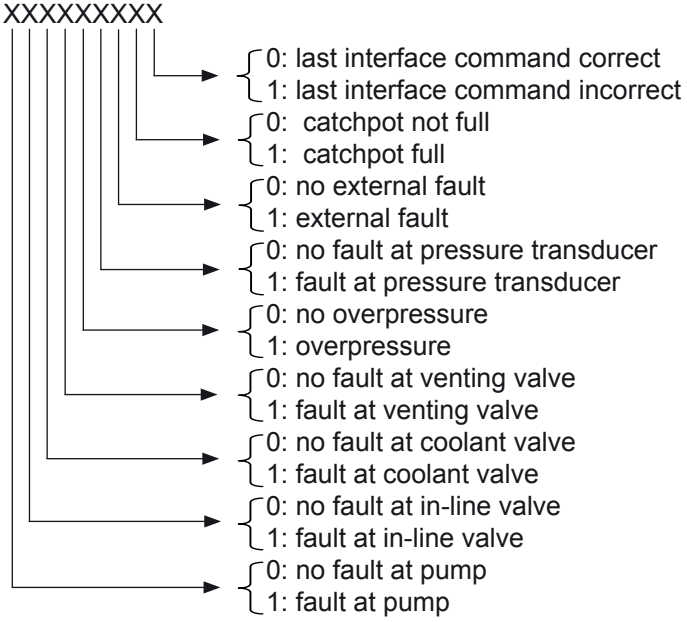
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Read commands ”CVC 3000”

Operation	Command	Response	Description
Status process control	IN_STAT	XXXXXX	



Fault status	IN_ERR	XXXXXXXXX	



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Read commands ”CVC 3000”

Operation	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

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Write commands "CVC 3000"

Operation	Command	Parameter	Description
function	OUT_MODE	X	0: VACUULAN 1: Pump down 2: Vac control 3: Auto mode → 30: sensitivity: low / 31: sensitivity: normal / 32: sensitivity: high (optional) 4: Program
Attention: If control is running only switching from 1 to 2, 2 to 3 and 3 to 2 is possible with takeover of the set vacuum.			
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.....C: language* * Language: 0: German, 1: English, 2: French, 3: Italian, 4: Spanish, 5: Turkish, 6: Korean, 7: Chinese, 8: Portuguese, 9: Russian, A: Polish, B: Dutch, C: Japanese
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)
open program	OUT_SP_PL	X	programm 0.....9
store program	OUT_SP_PS	X	programm 0.....9
time	OUT_SP_P1y	XX:XX:XX +XX:XX:XX	total runtime until program step y (0.....9) or time for program step y (0.....9) (additive)
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 ↓" in program step y (0.....9) 2: "Auto ⇥" in program step y (0.....9)

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Write commands ”CVC 3000”

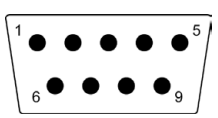
Operation mode	Command	Parameter	Description
	START	X	1 started
	STOP	X	0 Stop and delete fault 1 Stop 2 Stop with adopting the set vacuum
	REMOTE*	X	0 Remote off 1 Remote on
	ECHO**	X	0 Echo off 1 Echo on, write command with return value
	CVC	X	2 CVC 2000 commands 3 CVC 3000 commands***
	OUT_VENT	X	0 venting valve closed 1 venting valve open 2 venting until atmospheric pressure
	STORE		store settings permanently, if Echo ”1” after realisation
	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 and to provide appropriate safety measures, especially if selecting remote operation interferes with a locally operated active process.

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

*** After switching on the controller is in ”CVC 2” mode by default. Send ”CVC 3” and ”STORE” to permanently set the controller 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)

Cleaning the pressure transducer

NOTICE

- **Attention: Never use a spiky or sharp-edged tool to clean the pressure transducer.**
- **Never touch the ceramic diaphragm of the pressure transducer with hard objects.**
- 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 measurement chamber several times with alcohol in order to remove all solvent residues.
- Allow the pressure transducer to dry.
- Readjust the pressure transducer if necessary.

Readjustment of the controller CVC 3000

See section ”Readjustment of CVC 3000”

Accessories

External pressure transducer VSK 3000,
capacitive, ceramic diaphragm sensor 1080-0.1 mbar **636657**
Coolant valve VKW-B, 24 V= **674220**
Venting valve VBM-B / KF 16, 24 V= **674217**
Y-type adapter VACUU•BUS **636656**
Extension cable VACUU•BUS, 2m **612552**
Wall bushing VACUU•BUS **636153**
Cable RS 232C, 9-pole, Sub-D **637837**
Installation set CVC 3000 (clips and screws) **636593**
Level sensor (control of liquid level in catchpots, only for PC 3002/3003/3004 VARIO) **699908**
Exhaust waste vapour condenser Peltronic **699905**
Silencer (with connection hose) **636588**

Attention: Dust-laden gases, deposits and condensed solvent vapour can restrict air flow out the silencer. The resultant back pressure can lead to damage of pump bearings, diaphragms, and valves. Under those conditions, a silencer must not be used.

Ways to connect NT VARIO chemistry diaphragm pumps:

Small flange KF DN 16, with hose - for installation at hose nozzle **677058**
Small flange KF DN 16, for assembly directly at the valve head **699918**
(at inlet of ME 4C NT VARIO / MD 4C NT VARIO;
at outlet of ME 4C NT VARIO / MZ 2C NT VARIO)
Small flange KF DN 16, for assembly directly at the valve head **699919**
(at outlet of MD 4C NT VARIO)
Adapter to PTFE tubing DN 10/8 mm, for assembly directly at the valve head **636274**
(at inlet of ME 4C NT VARIO / MD 4C NT;
at outlet of ME 4C NT VARIO / MZ 2C NT VARIO)
Adapter to PTFE tubing DN 10/8 mm, for assembly directly at the valve head **636275**
(at inlet of MZ 2C NT VARIO; at outlet of MD 4C NT VARIO)
Elbow connecting piece (90°) for PTFE tubing DN 10/8 mm **638434**
T-piece for PTFE tubing DN 10/8 mm **638435**
PTFE tubing DN 10/8 mm (sold by meter) **638644**

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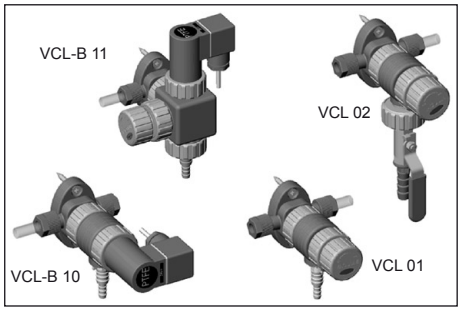
Ways to connect pumping units PC 300x VARIO:

Modification kit for small flange KF DN 16 at inlet **699939**
Hose nozzle DN 6/10 mm, for inlet **636635**
Elbow piece (90°) for PTFE tubing DN 10/8 mm for assembly at inlet **637873**
PTFE tubing DN 10/8 mm (sold by meter) **638644**

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
Coolant valve VKW, 24 V= (676013)	612567
Venting valve VBM, 24 V= (666817)	612554

Vacuum distribution:



The VACUU•LAN® modules allow process orientated, flexible and cost effective connections according to the requirements: One vacuum pump for multiple work stations.

VACUU•LAN® manual flow control module VCL 01 ..... **677106**

VACUU•LAN® shut off / manual flow control module VCL 02 ..... **677107**

VACUU•LAN® automatic control module VCL-B 10 ..... **677208**

VACUU•LAN® manual flow control/ automatic control module VCL-B 11 ..... **677209**

On this page we offer only a small selection of VACUU•LAN® options. Please refer for further information.

For additional accessories such as vacuum valves, small-flange components, vacuum gauges or vacuum controllers refer to www.vacuubrand.com

Spare parts (PC 301x VARIO):

Exhaust waste vapour condenser **699975**
Catchpot (at inlet) **699980**

Troubleshooting

Fault	Possible cause	Remedy
❑ No display.	➡ Mains not plugged in?	✓ Plug in mains plug of NT VARIO / VARIO-B pump.
	➡ Controller CVC 3000 or pump NT VARIO / VARIO-B switched off?	✓ Switch on devices.
	➡ VACUU • BUS cable between pump and controller not plugged in at controller?	✓ Plug in VACUU • BUS cable at controller CVC 3000.
	➡ Other causes (device defective)?	✓ Contact local distributor.
❑ Display disappears.	➡ Too much load (e.g. valves) connected?	✓ Check current draw of the connected devices.
	➡ Short circuit at connected valves?	✓ Replace valves.
	➡ Short circuit at the RS 232 plug?	✓ Check plug and cable.
	➡ Other causes (device defective)?	✓ Contact local distributor.
❑ Pressure reading incorrect.	➡ Pressure transducer not adjusted?	✓ Readjust CVC 3000.
	➡ Humidity in the measurement chamber?	✓ Let the pressure transducer dry, e.g. by pumping. Readjust if necessary. Determine and eliminate the cause for humidity.
	➡ Pressure transducer contaminated?	✓ See „Cleaning the pressure transducer“.
❑ Digital pressure reading is flashing, display shows ”0.0”.	➡ Pressure transducer not correctly adjusted under vacuum?	✓ Adjust CVC 3000 correctly.
❑ No digital pressure reading.	➡ Pressure transducer defective?	✓ Contact local distributor.
❑ 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?	✓ Disconnect in-line valve, switch controller off/on.
❑ 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.

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Fault	Possible cause	Remedy
❑ Warning triangle and pump symbol are flashing, six blips*.	➡ NT VARIO / VARIO-B pump and VMS** (Vacuum Management System) connected?	✓ Remove VMS. Restart controller.
	➡ Fault at the NT VARIO / VARIO-B pump?	✓ Check pump, restart controller.
❑ Clock symbol is flashing.	➡ Preselected process time is over?	✓ Confirm by pressing key START/STOP.
❑ Venting valve does not respond, valve symbol is displayed.	➡ Venting valve contaminated?	✓ Clean valve.
❑ Operation mode ”Vac control”: Control stops, ”arrow up” is flashing.	➡ Preset maximum pressure exceeded?	✓ Confirm by pressing key START/STOP. Adapt maximum pressure value if necessary.
❑ Operation mode ”Pump down”: Control stops, ”arrow down” is flashing.	➡ Pressure below preset minimum pressure?	✓ Confirm by pressing key START/STOP. Adapt minimum pressure value if necessary.
❑ Controller does not respond when pressing keys (except ON/OFF). PC symbol is displayed.	➡ Controller in remote mode?	✓ Control CVC 3000 via interface or switch off remote mode.
❑ Controller does not respond when operating any keys. No change after switching off/on.		✓ Contact local distributor.
❑ Pump does not start or stops immediately. Warning triangle and pump symbol are flashing.	➡ Pump has been exposed to condensate?	✓ Allow pump to run for some minutes at maximum speed with atmospheric pressure at the inlet.
	➡ Overpressure in the exhaust line?	✓ Open exhaust line, ensure a free (pressureless) outlet line.
❑ Pump does not achieve ultimate vacuum or normal pumping speed.	➡ Wrong setting at controller?	✓ Select operation mode ”Pump down” with speed set to ”HI” and check again.
	➡ Centring ring not correctly positioned or leak in the pipeline or vacuum system?	✓ Check pump directly - connect CVC 3000 directly at pump inlet - then check connection, pipeline and vacuum system if necessary.
	➡ Long, narrow line?	✓ Use lines with larger diameter, length as short as possible.
	➡ Pump has been exposed to condensate?	✓ Allow pump to run for some minutes at maximum speed with atmospheric pressure at the inlet.
	➡ Deposits have been formed inside the pump?	✓ Clean and inspect the pump heads.

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Fault	Possible cause	Remedy
❑ Pump does not achieve its ultimate vacuum or usual pumping speed.	➡ Outgassing substances or vapour generated in the process?	✓ Check process parameters.
	➡ Diaphragms or valves defective?	✓ Replace diaphragms and/or valves.
	➡ Pump too hot?	✓ Allow pump to cool down. Determine and eliminate the cause of overheating.
	➡ Pressure below ”Minimum” in Auto mode?	✓ Adapt switch off pressure (”Minimum”) if necessary.
❑ Pump too noisy.	➡ Loud exhaust noise?	✓ Connect hose or silencer to pump outlet.
	➡ Diaphragm crack or diaphragm clamping disc loose?	✓ Perform maintenance.
	➡ Other than above mentioned causes?	✓ Contact local distributor.
❑ Pump seized.		✓ Contact local distributor.

* only if ”*Sound*” ”On” is selected
** VMS: Vacuum management system to switch non-VARIO pumps

NOTICE

A service manual with exploded view drawings, spare parts list and directions for repair is available on request.
☞ The service manual is intended for trained service people only.

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Replacing diaphragms and valves

NOTICE

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the pump is maintenance free. The valves and diaphragms are wear parts. If the rated ultimate vacuum is no longer achieved or in case of increased noise level, the pump interior, the diaphragms and the valves must be cleaned and the diaphragms and valves must be checked for cracks or other damage. Depending on individual cases it may be efficient to check and clean the pump heads on a regular basis. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours.

- Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amount.

If the pump is exposed to corrosive gases or vapour or in case of deposits, maintenance should be carried out frequently.

- Regular maintenance will improve the lifetime of the pump and also protect both man and environment.

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

⚠WARNING

☞ Ensure that the pump cannot be operated accidentally. **Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**



☞ **Before starting maintenance** isolate the pump from the electrical supply and wait **two minutes** after isolating the equipment from mains to allow the capacitors to discharge. Avoid the release of pollutants. Allow sufficient cooling of the pump.

⚠CAUTION

- Attention: The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred. Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.
- Wear appropriate safety-clothing when you come into contact with contaminated components. Avoid the release of pollutants.

NOTICE

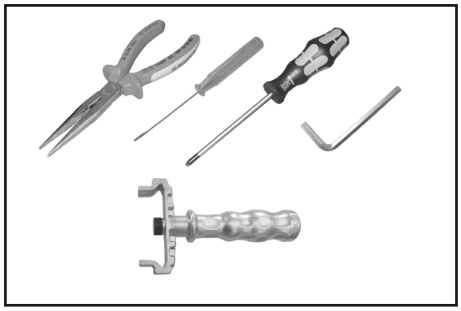
Before starting maintenance vent the pump and isolate it from the vacuum system.

Set of seals for **ME 4C NT VARIO** **696864**
Set of seals for **MZ 2C NT VARIO / PC 3002 VARIO** **696869**
Set of seals for **MD 4C NT VARIO / PC 3003/3004 VARIO** **696870**
Set of seals for **MV 10C VARIO-B / MD 12C VARIO-B / PC 301x VARIO** **696821**
Diaphragm key (w/f 66) **636554**

☞ **Please read section ”Replacing diaphragms and valves” completely before starting maintenance.**
Partially the pictures show pumps in other versions. This doesn’t influence replacing diaphragms and valves of the pump.

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Cleaning and inspecting the pump heads (pumps NT VARIO / PC 300x VARIO)



Tools required (metric):

- Torx screw driver TX20
- Hex key size 5
- Flat-bladed screw driver 2.5 mm
- Flat pliers
- Diaphragm key w/f 66

The replacement of the diaphragm and the replacement of the valves can be carried out separately.

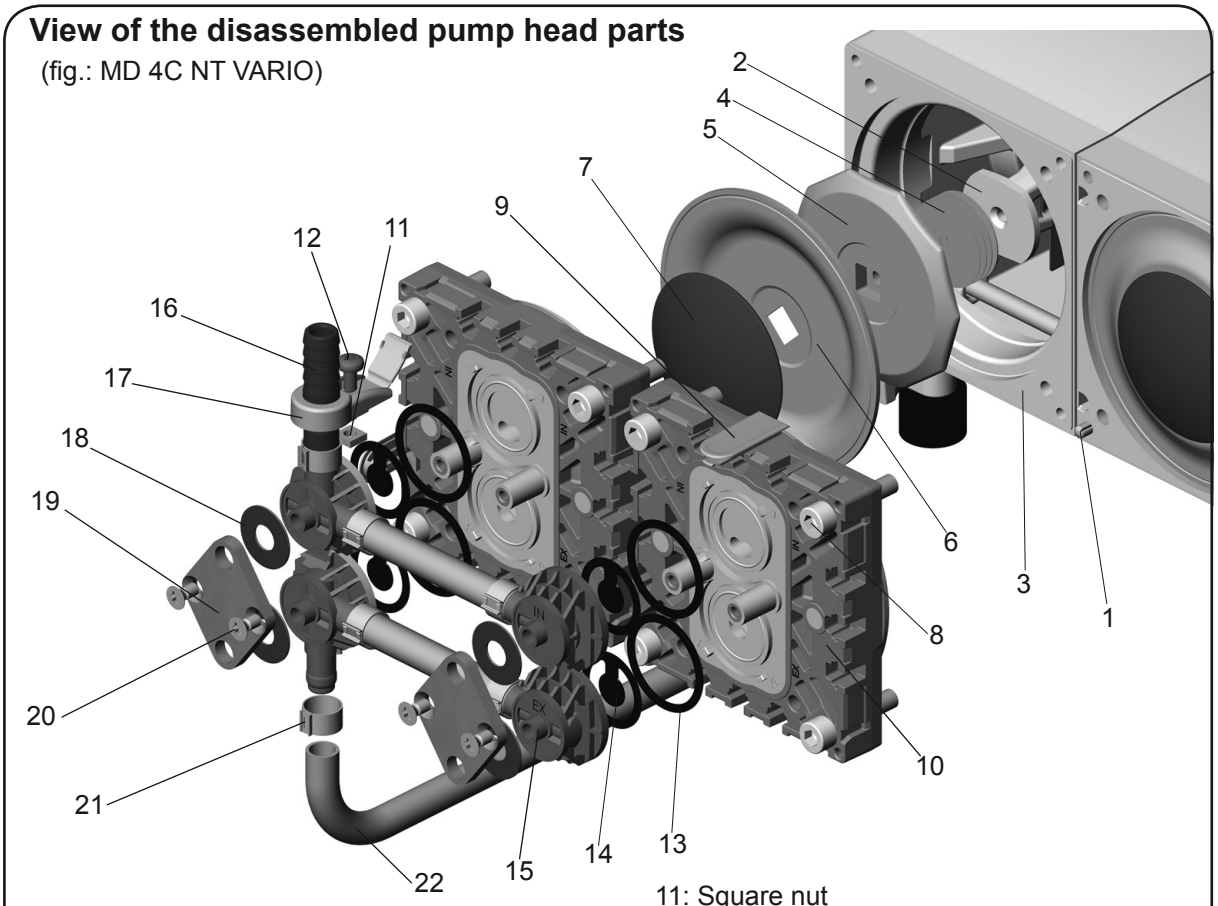
☞ To replace the valves, remove the head covers of one side of the pump conjointly with the assembled valve heads and fittings.

☞ To maintain the diaphragms, the valve heads and the fittings don't have to be disassembled. The head covers can be removed conjointly with the assembled valve heads and fittings.

☞ Maintain only one side of the pump at a time.

View of the disassembled pump head parts

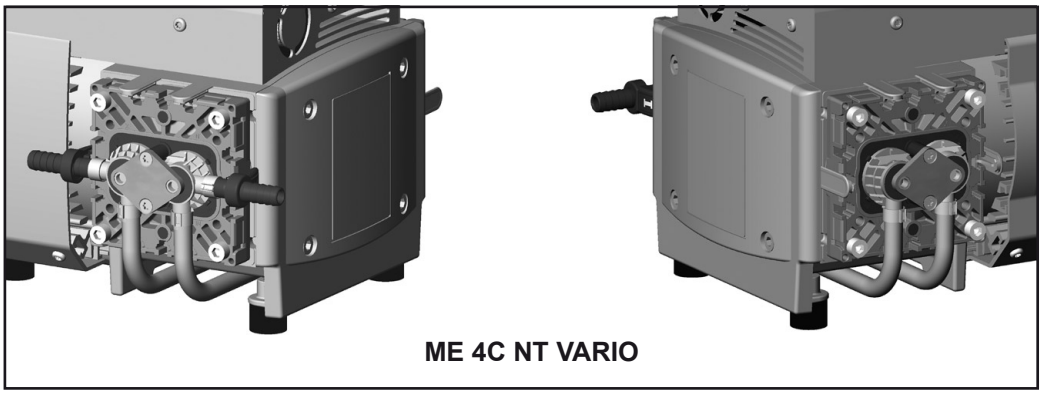
(fig.: MD 4C NT VARIO)



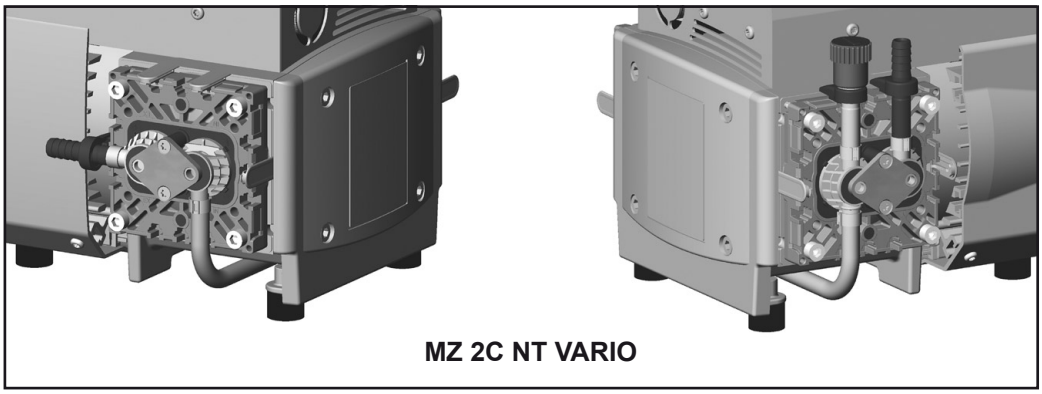
1: Cylinder pin / mark
2: Connecting rod
3: Housing
4: Washer
5: Diaphragm support disc
6: Diaphragm
7: Diaphragm clamping disc with square head screw
8: Socket head screw
9: Blind
10: Head cover
11: Square nut
12: Fillister head screw
13: O-ring
14: Valve
15: Valve head
16: Hose nozzle
17: Connection fastener with hinged cover
18: Disc spring
19: Clamping bracket
20: Countersunk screw
21: Hose clip
22: Connection tube

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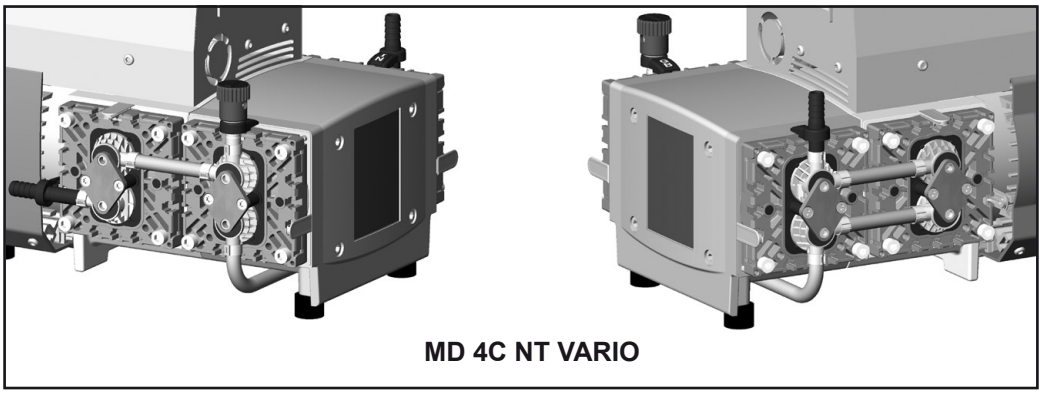
Fittings and tubing of the different pump models:



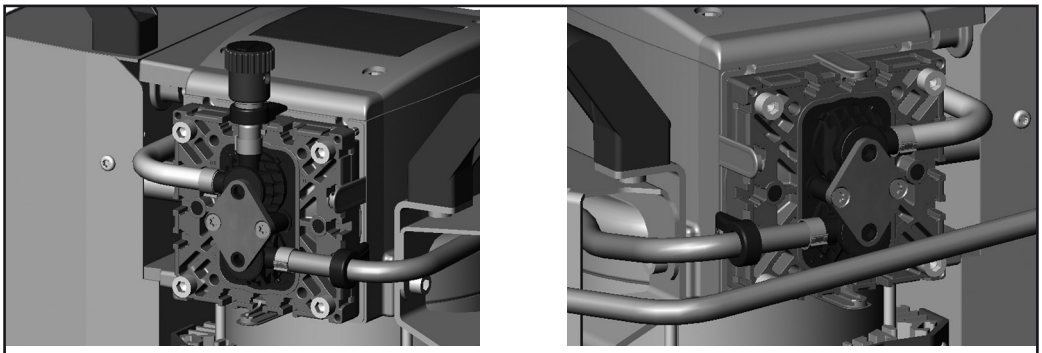
ME 4C NT VARIO



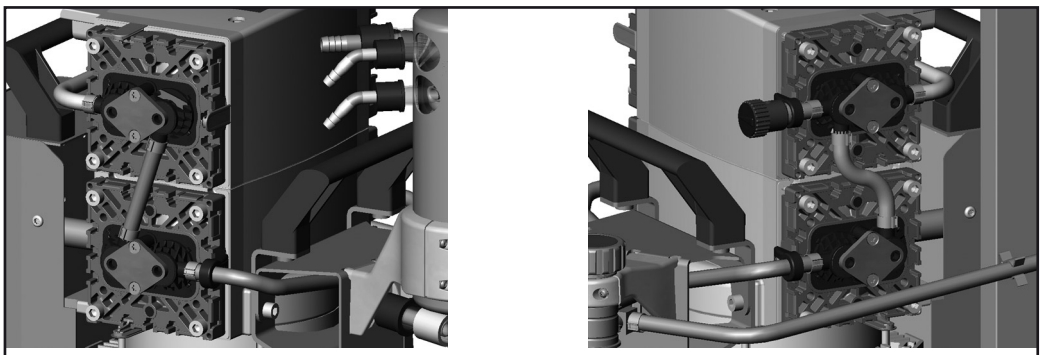
MZ 2C NT VARIO



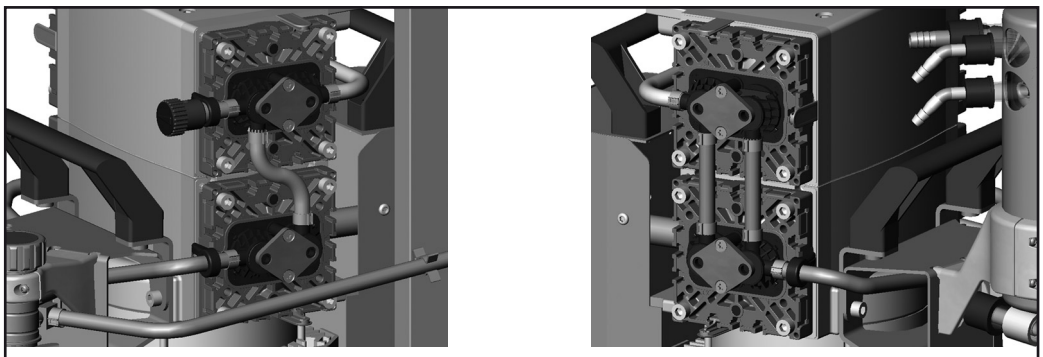
MD 4C NT VARIO



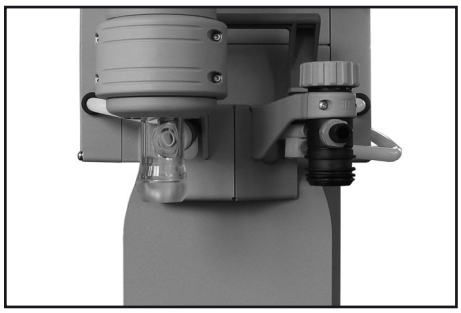
PC 3002 VARIO



PC 3003 VARIO

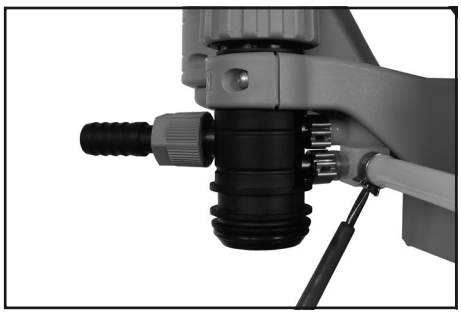


PC 3004 VARIO



PC 3002/3003/3004 VARIO:

➨ Remove catchpots at inlet and outlet (see ”Use and operation”).

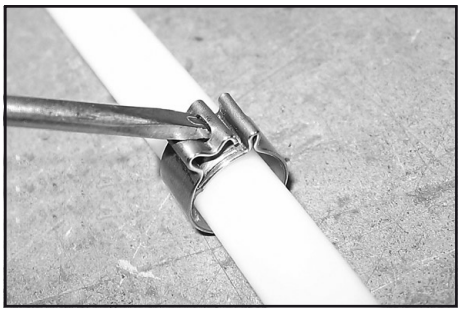


PC 3002/3003/3004 VARIO at inlet side:

➨ Open the hose clip at the inlet of the pumping unit (hose connection to controller CVC 3000) with a flat-bladed screw driver (see below).

➨ Pull the tubing off the hose connector.

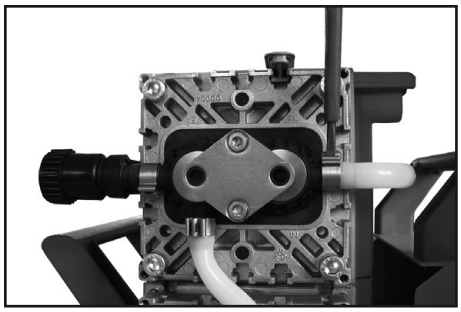
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Opening the hose clip:
➨ Apply screw driver as shown and turn.



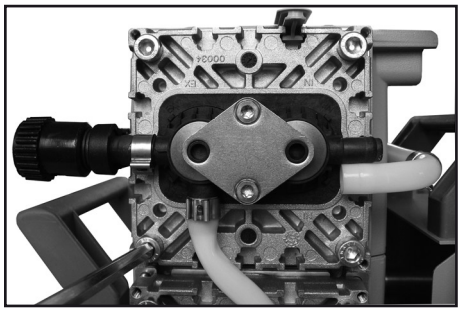
➨ Detach hose from hose clip at controller support.
➨ Use a Torx screw driver TX20 to unscrew the 4 screws fixating the head cover cowling. Pay attention to the washers under the screws and remove.
➨ Pull off head cover cowling carefully. Do not cant.



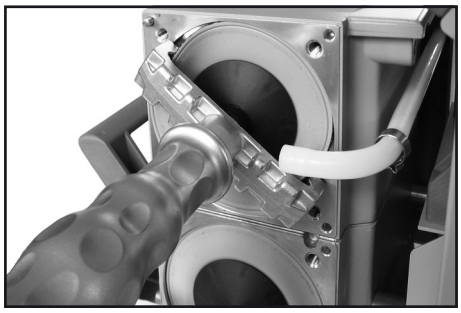
Detach the fixing of the connection tube to the other side of the pump at the valve head.
PC 3002/3003/3004 VARIO at inlet side:
Detach the fixing of the connection tube to the other side of the pump as well as the hose connection to the inlet/outlet of the pumping unit at the valve head.

➨ Open the hose clip with a flat-bladed screw driver.
➨ Pull the tubing off the hose connector.

Replacing the diaphragm



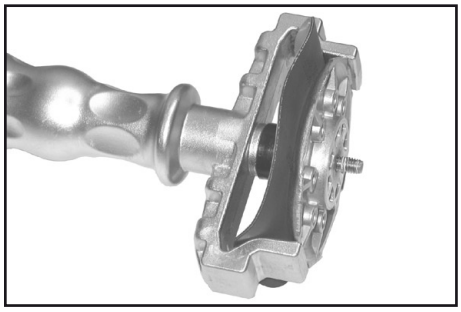
➨ Disassemble head covers to check the diaphragm.
➨ Unscrew four (pump with two cylinders) or eight (pump with four cylinders) socket head screws with a hex key size 5 and remove both head covers (pumps with two cylinders: only one head cover) together with valve heads and connections.
☞ It is not necessary to disassemble the valve heads, the connection fasteners, or the hose connection between the adjacent head covers (pumps with four cylinders).



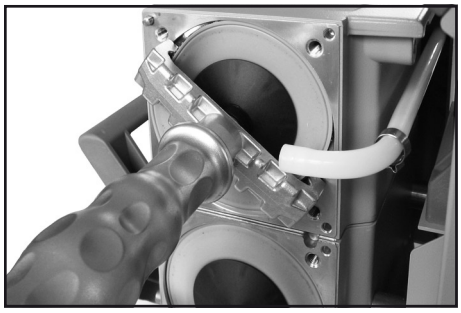
☞ Check diaphragm for damage and replace if necessary.
➨ Lift diaphragm carefully sidewise.
☞ Never use a spiky or sharp-edged tool to lift the diaphragm.
➨ Use the diaphragm key to grip the diaphragm support disc below the diaphragm.
➨ Unscrew diaphragm support disc with diaphragm and diaphragm clamping disc.

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- ➨ Check for washers between the diaphragm support disc and the connecting rod. Do not mix the washers from the different pump heads. Make sure that the original number is reassembled at the individual pump head.
- ☞ If the old diaphragm is difficult to separate from the support disc, immerse assembly in naphtha or petroleum ether. Do not inhale!
- ☞ Too small number of washers: The pump will not attain ultimate vacuum. Too many washers: Clamping disc will hit head cover; noise or even blockade of the pump.

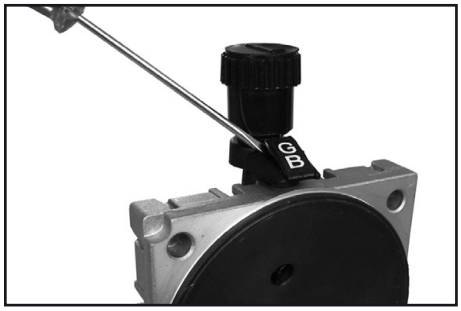


- ➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
- ☞ Attention: Position diaphragm with pale side towards diaphragm clamping disc (to pump chamber).
- ☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
- ➨ Lift diaphragm at the side and position carefully together with diaphragm clamping disc and diaphragm support disc in the diaphragm key.
- ☞ Avoid damage of the diaphragm: Do not bend diaphragm too much.



- ☞ Assemble the original number of washers between support disc and connecting rod.
- ➨ Screw diaphragm clamping disc, diaphragm, diaphragm support disc and washers to connecting rod.
- ➨ Optimum torque for the diaphragm support disc: 6 Nm, it is recommended to use a torque key. Attach hex key to diaphragm key (hexagonal bolt 6 mm wide).
  Attention: Never use the diaphragm key with any additional tools like tongs or hex keys without torque limitation.

Replacing the valves



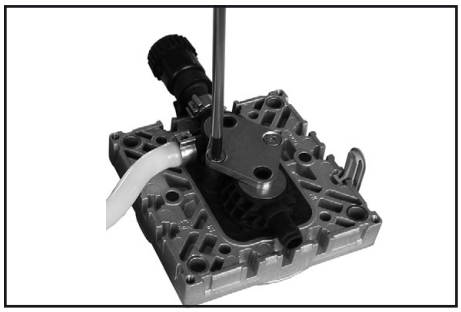
- ➨ Open the hinged cover of the connection fastener with a flat-bladed screw driver.



Loosen connection fastener slightly.

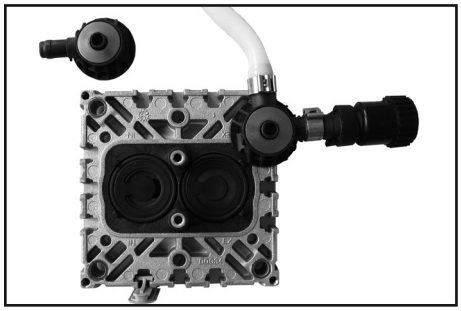
- ➨ Turn the fillister head screw with a Torx screw driver TX20 one turn at most.
- ☞ Do not detach the fillister head screw from the square nut.

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Loosen the clamping brackets on the valve heads.

➨ Unscrew at each clamping bracket the two countersunk screws with a Torx screw driver TX20. Remove the clamping brackets.



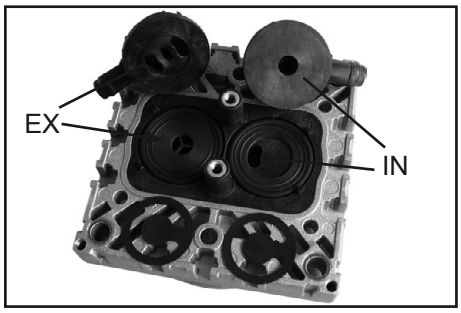
➨ Remove valve heads conjointly with disc springs, connection tube if applicable, hose nozzles and connection fasteners or move the valve heads carefully aside. Note position and orientation of the valve heads.

☞ Note position of valves.

➨ Check valves and O-rings for damages and soiling.

➨ Replace valves or O-rings if necessary.

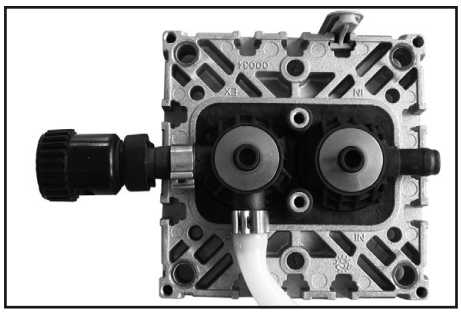
➨ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.



➨ Insert O-rings and valves. See figure for the correct position of the valves:

☞ **Inlet side** (IN):
Marked ”IN” next to the valve seat. The valve tongue points at the reniform orifice in the valve seat.

☞ **Outlet side** (EX):
Marked with ”EX” next to the valve seat. The valve is oriented the same way as the valve at the inlet side.



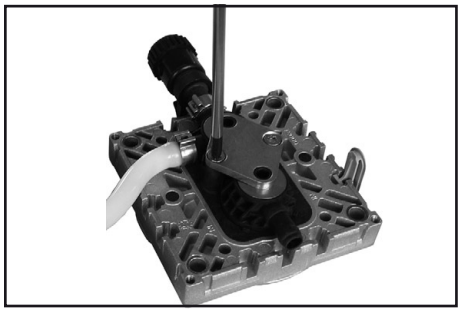
➨ Position valve heads, if applicable with hose nozzle, connection tube or connection fastener, and disc springs on the valve seats. Position disc springs with camber upwards. Pay attention to the correct orientation of the valve heads.

☞ Centre the valve head with respect to the valve seat. The valve head must lie plane within the noses of the valve seat.

Valve head with gas ballast or hose nozzle connection:

➨ Insert square nut in the groove of the head cover or position square nut in the groove and screw on connection fastener afterwards.

☞ Fix fillister head screw only slightly.



➨ Position clamping bracket with countersunk bores upwards.

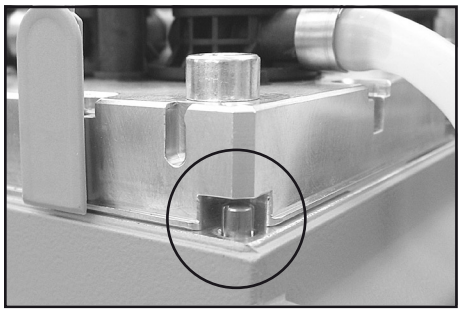
➨ Align the countersunk bores with the threaded pegs.

➨ Fasten the countersunk screws slightly and correct the alignment of the valve heads if necessary.

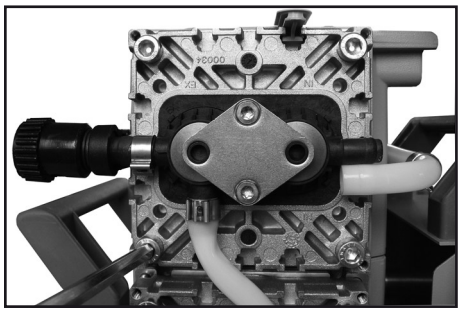
➨ Tighten countersunk screws with Torx screw driver TX20.

☞ Torque: 3 Nm.

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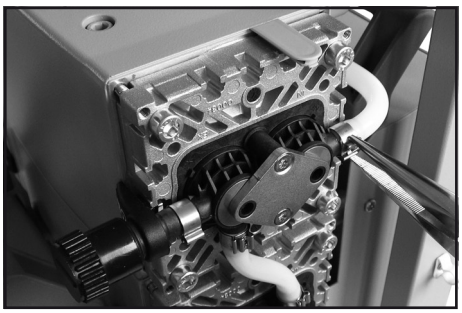


- ➨ Bring the diaphragms into a position in which they are in contact with the housing and centred with respect to the bore.
- ➨ Put on head cover with valve heads and connections.
- ☞ Pay attention to the correct orientation of the head covers: Housing with cylinder pin: The cylinder pin at the pump housing has to fit into the recess at the head cover. Housing with mark: Align the recess at the head cover with the mark at the pump housing.



- ➨ Screw in the socket head screws at the head covers diagonally first slightly with a hex key size 5, then tighten.
- ☞ Recommended torque: 12 Nm.

- ➨ Slot the blinds into the head cover.



Fix the connection tube to the other side of the pump at the valve head.

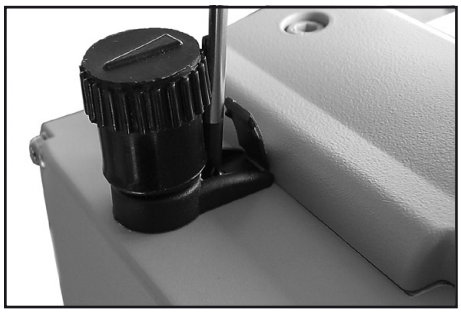
PC 3002/3003/3004 VARIO at inlet side:

Fix the connection tube to the other side of the pump as well as the hose connection to the inlet/outlet of the pumping unit at the valve head.

- ➨ Slip connecting tube onto hose connection of valve head.
- ➨ Slide on the tube and the hose clip until touching the nose at the valve head.
- ➨ Close hose clip with flat pliers.

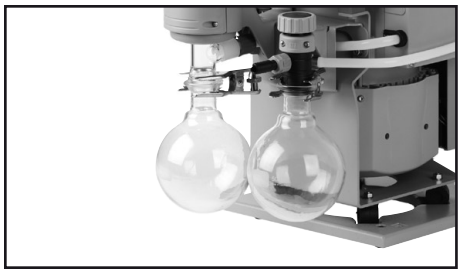


- ➨ Put head cover cowling on.
- ➨ Slide the head cover cowling in the grooves of the blinds and under the connection fasteners.
- ➨ Install the washers. Use a Torx screw driver TX20 to screw in the 4 screws fixating the head cover cowling.



- ➨ Tighten the fillister head screws of the connection fasteners with a Torx screw driver TX20.
- ➨ Close the hinged covers.

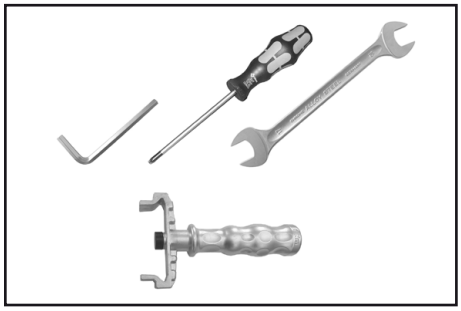
Replace diaphragms and valves of the opposite side of the pump in the same way!



PC 3002/3003/3004 VARIO:

➨ Assemble catchpots with joint clips.

Cleaning and inspecting the pump heads (pumps VARIO-B / PC 301x VARIO)

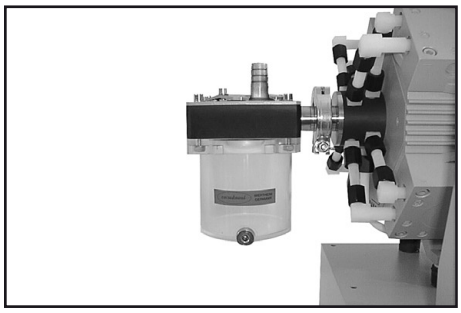


Tools:

- Phillips screw driver size 2
- Open-ended wrench w/f 10/14/16/17
- Hex key size 5
- Diaphragm key w/f 66

Disassembling the pump from the pumping unit (PC 3010/3012 VARIO)

➨ Disconnect controller from pump (VACUU•BUS cable).



➨ Detach separator from pump inlet (open clamping ring).

☞ Avoid the release of pollutants.

➨ Observe applicable regulations when disposing of condensate which may be contaminated by pumped chemicals.

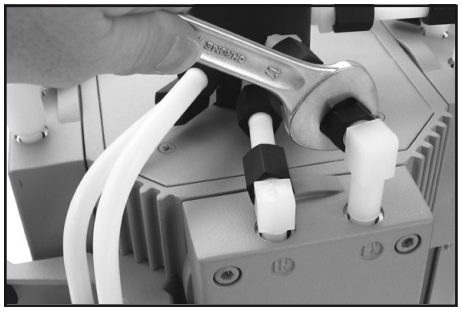
➨ Disconnect hose connection between pump and exhaust waste vapour condenser. Loosen union nut at exhaust waste vapour condenser and pull hose out of the inlet of the condenser.

➨ Collecting flask at the outlet: Remove joint clip, remove flask and drain condensate. Observe applicable regulations when disposing of condensate which may be contaminated by pumped chemicals.

Disassembling pump from base plate:

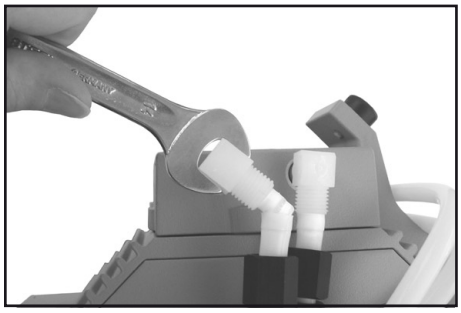
➨ Lay the pump on its side: the rating plate of the pump and the exhaust waste vapour condenser have to be on top, support pump suitably.

➨ Use open ended wrench (w/f 10) to remove hex nuts underneath the base plate from the feet of the pump (pay attention to serrated washers) and take off pump from base plate.



➨ Use an open-ended wrench (w/f) 17 to remove the union nuts of the hose connections at the pump heads.

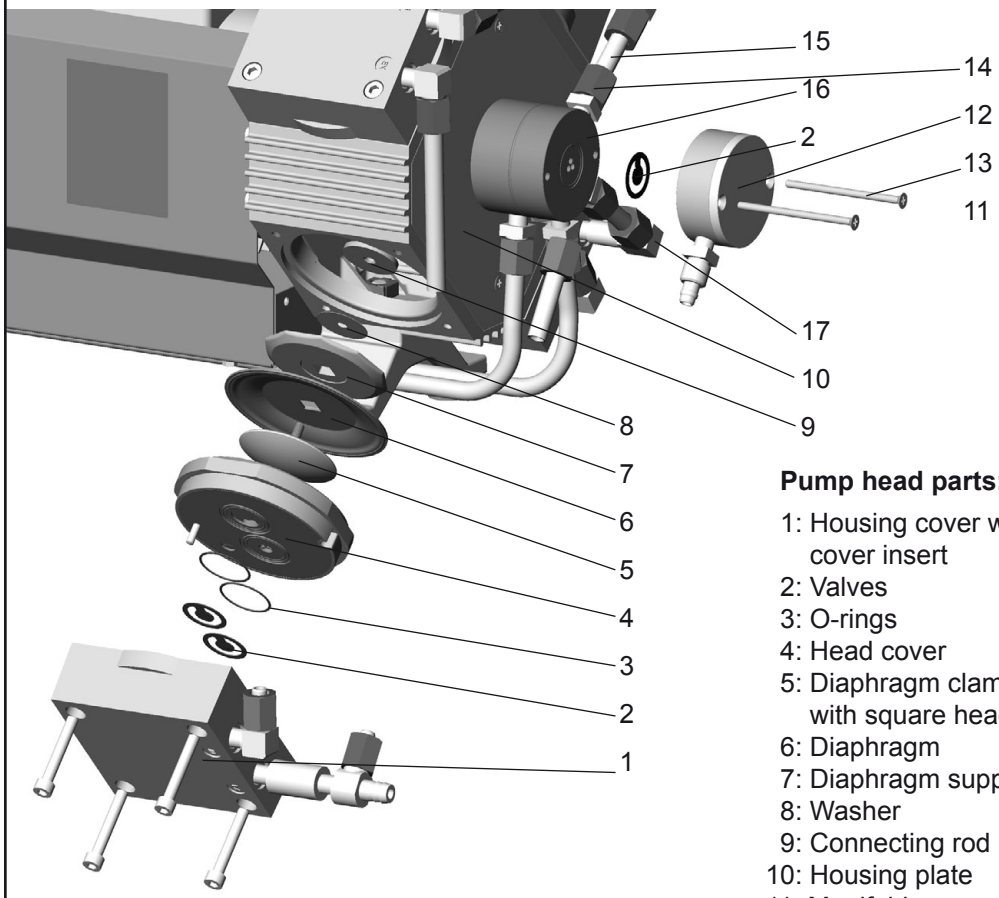
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➨ Turn the fittings with an open-ended wrench (w/f 14, at outlet w/f 16) to detach the hoses from the pump heads.

☞ Do not remove the elbow fittings from the pump heads. Through reassembly a leak may result.

View of the disassembled pump head parts

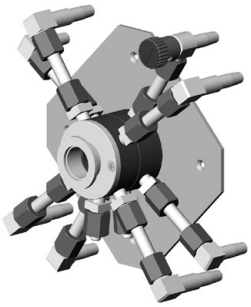


Pump head parts:

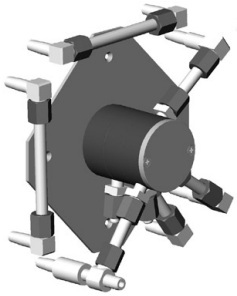
1: Housing cover with housing cover insert
2: Valves
3: O-rings
4: Head cover
5: Diaphragm clamping disc with square head screw
6: Diaphragm
7: Diaphragm support disc
8: Washer
9: Connecting rod
10: Housing plate
11: Manifold cover
12: Cover plate (only at outlet)
13: Countersunk screw
14: Union nut
15: Connecting hose
16: Distributor
17: Fitting

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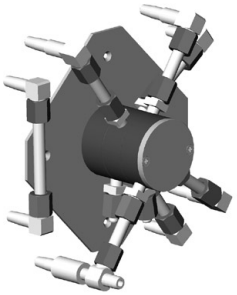
Inlet side



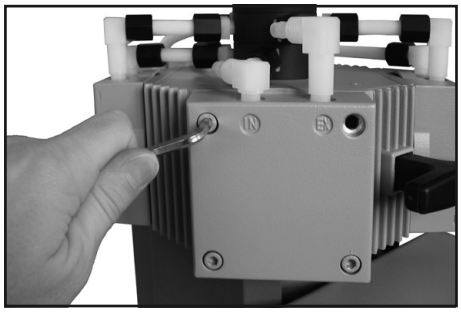
Pumps VARIO-B / Pumping units PC 301x VARIO



Outlet side



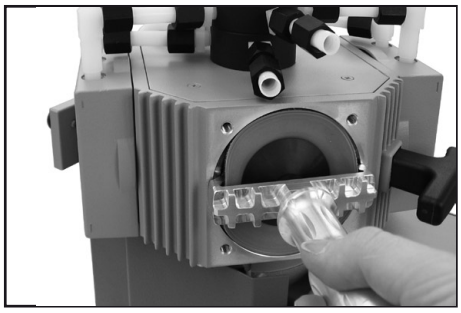
MV 10C VARIO-B / PC 3010 VARIO **MD 12C VARIO-B / PC 3012 VARIO**



- ➨ To check the valves and the diaphragms use a hex key to remove four socket-head screws from the pump head and remove the upper part of the housing (housing cover with housing cover insert) together with the head cover, the valves and the O-rings.
- ☞ Never remove parts by using a spiky or sharp-edged tool (e.g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
- ➨ Remove the head cover carefully from the upper part of the housing. Note the position of the valves and remove them.
- ☞ Replace valves and/or O-rings if damaged.
- ☞ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.

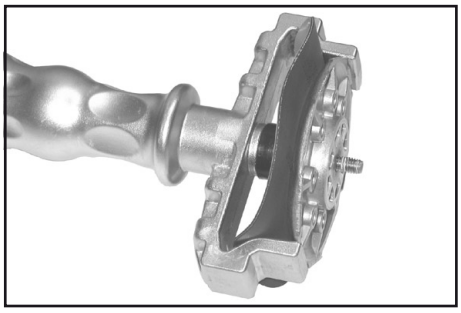
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Replacing the diaphragm

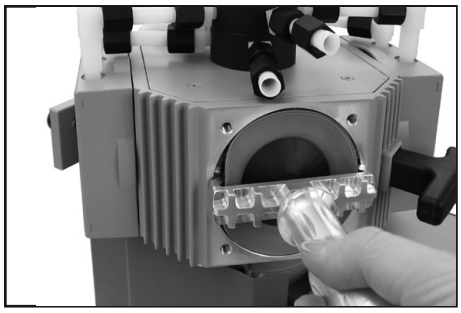


☞ Check diaphragm for damage and replace if necessary.
➨ Lift diaphragm carefully sidewise.
☞ Never use a spiky or sharp-edged tool to lift the diaphragm.
➨ Use the diaphragm key to grip the diaphragm support disc below the diaphragm.
➨ Unscrew diaphragm support disc with diaphragm and diaphragm clamping disc.

➨ Check for washers between the diaphragm support disc and the connecting rod. Do not mix the washers from the different pump heads. Make sure that the original number is reassembled at the individual pump head.
☞ If the old diaphragm is difficult to separate from the support disc, immerse assembly in naphtha or petroleum ether. Do not inhale!
☞ Too small number of washers: The pump will not attain ultimate vacuum. Too many washers: Clamping disc will hit head cover; noise or even blockade of the pump.



➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
☞ **Attention**: Position diaphragm with pale side towards diaphragm clamping disc (to pump chamber).
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
➨ Lift diaphragm at the side and position carefully together with diaphragm clamping disc and diaphragm support disc in the diaphragm key.
☞ Avoid damage of the diaphragm: Do not bend diaphragm too much.

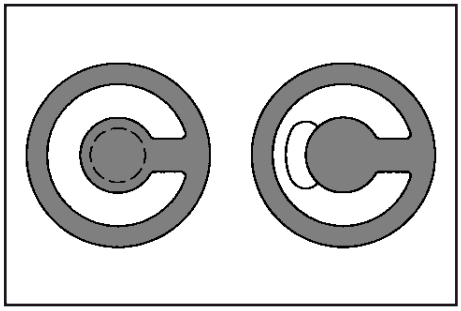


➨ Assemble the original number of washers between support disc and connecting rod.
➨ Screw diaphragm clamping disc, diaphragm, diaphragm support disc and washers to connecting rod.
☞ Optimum torque for the diaphragm support disc: 6 Nm, it is recommended to use a torque key. Attach hex key to diaphragm key (hexagonal bolt 6 mm wide).
Attention: Never use the diaphragm key with any additional tools like tongs or hex keys without torque limitation.

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Assembling the pump heads

➨ Bring connecting rod into a position in which the diaphragm is in contact with the housing and centred with respect to the bore.

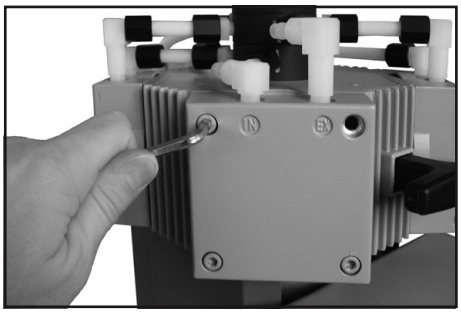


Reassemble in reverse order.

➨ Install head cover with O-rings, valves and housing cover with housing cover insert.

☞ Make sure that the valves are correctly seated: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.

☞ Pay attention that the diaphragm stays positioned centrally so that it will become clamped uniformly between housing and head cover.



➨ Screw in four socket head screws fixing the housing cover crosswise first slightly, then tighten.

☞ Do not tighten until head cover is in contact with housing, torque 12 Nm.

Individual performance check of a pump head:

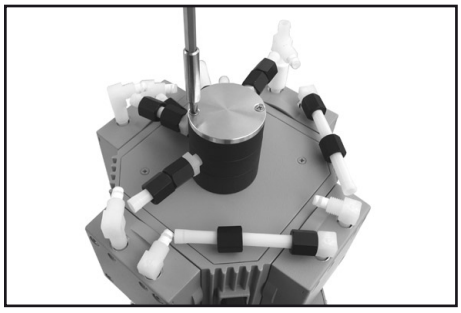
By measuring the pressure at the inlet port of the individual head:
Use a suitable vacuum gauge (e. g. DVR 2, cat. no.: 682902), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.

☞ If the reading is higher, recheck the pump chamber and make sure that the valves and the diaphragms are correctly seated (diaphragms concentric with bore).

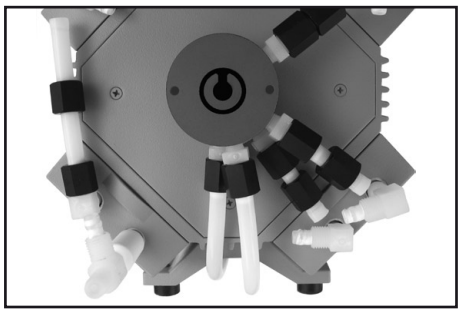
Replace diaphragms and valves of the opposite side of the pump in the same way!

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Replacing the valve at the distributor (outlet side)

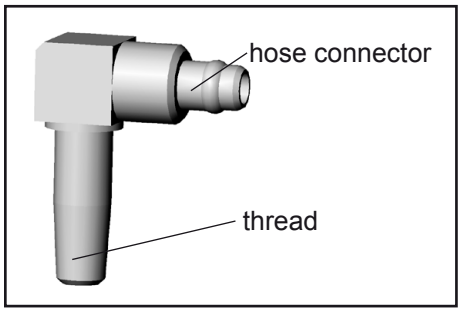


- ➨ Use open-ended wrench (w/f 17) to loosen the union nut of the hose, which runs directly to the cover plate of the distributor, at the pump head.
- ➨ Use open-ended wrench (w/f 15) to turn elbow fitting 1/4 of a turn, remove hose. Do not remove the elbow fitting from the pump head.
- ➨ Unscrew the two countersunk head screws at the manifold cover with an Phillips screw driver and remove cover plate and manifold cover.



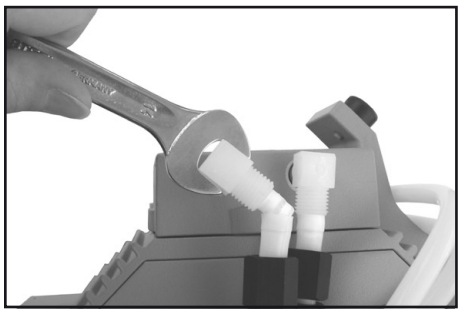
- ➨ Note position of valve and remove.
- ☞ Check valve for damage and replace if necessary. Make sure that the valve is correctly seated.
- ➨ Reassemble manifold cover and cover plate and fixate with countersunk screws.

Notes on assembling fittings and hose connections (only MV 10C VARIO-B, PC 3010 VARIO)

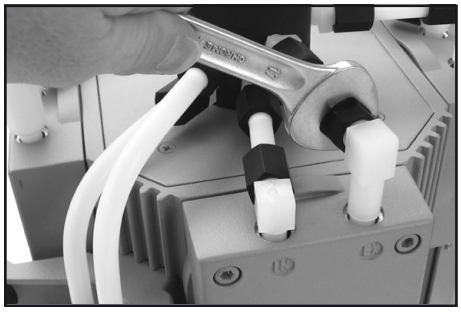


The thread of the fittings at the pump heads, at the inlet and outlet distributors as well as the hose connectors are sealed with PTFE bond.
If the fittings or the hoses have been removed, use new PTFE bond (included in set of seals) when reassembling.
Wind the thread of the fitting two times counterclockwise with PTFE bond, the hose connectors three times. Ensure that the PTFE bond ends flush with the fittings.

Assembling the connecting hoses



- ➨ Use an open-ended wrench w/f 14 (w/f 16 at outlet) to slip the hoses onto the hose connectors by turning the fittings.



- ➨ Tighten the union nuts of the hose connections at the pump heads with an open-ended wrench w/f 17.
- ☞ Tighten union nuts first by hand and then tighten one full turn using the open ended wrench.

Reassembling the pump at the pumping units PC 3010/3012 VARIO:

- ➨ Lay the pump on its side: the rating plate of the pump has to be on top (support pump suitably).
- ☞ Note that to install the console, the exhaust waste vapour condenser and the condensate flask must be on top.
- ➨ Push the console over the threads at the pump feet.
- ➨ Install the serrated washers. Install the hex nuts and tighten using open-ended wrench (w/f 10). Place pumping unit in normal operating position.
- ➨ Attach the connecting hose between the pump and the exhaust waste vapour condenser at the inlet of the condenser. Connect exhaust waste vapour condenser to the coolant circuit. Plug in VACUU•BUS cable at controller.

If the pump does not achieve the ultimate vacuum:

- ☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.
- ☞ In case of unusual noise switch off pump immediately and check clamping disc positions.

If the specified ultimate vacuum is not achieved and if this does not change after the run-in period:
Check hose connectors at pump head for leaks. If necessary recheck valve seats and pump chambers.

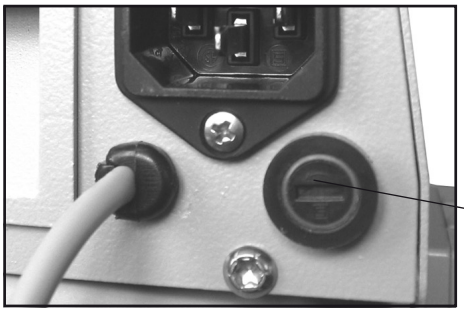
Replacing the overpressure safety relief device at the exhaust waste vapour condenser:

- ➨ Remove the red union nut at the condenser. Remove hose from the inlet of the condenser.
- ➨ Pull off old overpressure safety relief device and install new one.
- ➨ Connect hose to the inlet of the exhaust waste vapour condenser and tighten union nut.

Overpressure safety relief device at exhaust waste vapour condenser **638821**

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Replacing the device fuse

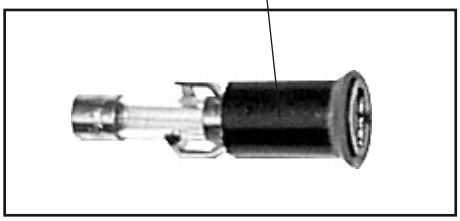


Pumps NT VARIO / PC 300x VARIO



Pumps VARIO-B / PC 301x VARIO

fuse holder



- Unscrew the fuse holder using a screw driver.
- Replace the defective fuse by a fuse of the same type (see ”Technical data”) and reassemble holder with fuse to the pump.

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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 send 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 obeyed.

⚠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 obeyed. 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 information 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

Pumpstand / Pumping unit / Groupe de pompage

ME 4C NT VARIO (120V; 2613818), (230V; 2613819)
MZ 2C NT VARIO (230V; 732400, 732401, 732402)
MD 4C NT VARIO (230V; 736500, 736501, 736502)
PC 3002 VARIO (230V; 733500, 733501, 733502)
PC 3003 VARIO (230V; 738400, 738401, 738402)
PC 3004 VARIO (230V; 737500, 737501, 737502)

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.

Maschinenrichtlinie (mit Änderungen) / Machine directive (with supplements) / Directive Machines (avec des suppléments)
2006/42/EG
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 12100-2, DIN EN 61010-1, DIN EN 1012-2
DIN EN 61326-1: 230V: Klasse / class / classe A + B // 120V: Klasse / class / classe A
Managementsysteme / Management systems / Systèmes de Management
EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 21.05.2008
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Ort, Datum / place, date / lieu, date

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

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

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CE

Konformitätserklärung
Declaration of conformity
Déclaration de conformité

Pumpstand / Pumping unit / Groupe de pompage

MV 10C VARIO-B (230V; 710600, 710601)
MD 12C VARIO-B (230V; 710800)
PC 3010 VARIO (230V; 710700, 710701, 710702)
PC 3012 VARIO (230V; 710900, 710901, 710902)

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