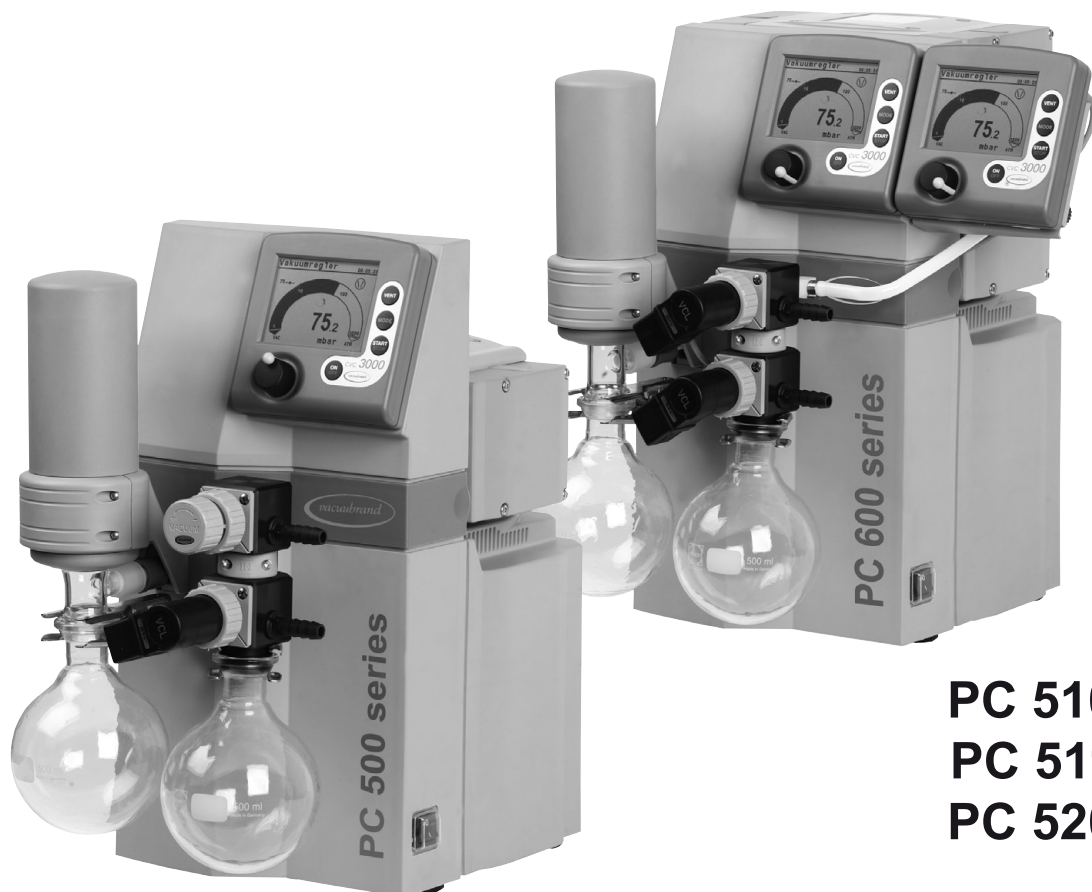




Technology for Vacuum Systems

Instructions for use

Part I of II



Part I:
Safety information - Technical data -
Use and operation

PC 510 NT
PC 511 NT
PC 520 NT

PC 610 NT
PC 611 NT
PC 620 NT

Chemistry pumping units

Dear customer,

Your VACUUBRAND diaphragm pumps are designed to provide you with many years of trouble-free service with optimal performance. Our many years of practical experience allow us to provide a wealth of application and safety information. Please read these instructions for use before the initial operation of your pump.

VACUUBRAND diaphragm pumps combine our many years of experience in design, construction and practical operation, with the latest developments in material and manufacturing technology.

Our quality maxim is the "zero fault principle":

Every diaphragm pump, before leaving our factory, is tested intensively, including an endurance run of 18 hours. Any faults, even those which occur rarely, are identified and can be eliminated immediately.

After completion of the endurance run, every pump is tested, and must achieve specifications before shipment.

We are committed to providing our customers only pumps that meet this high quality standard.

While our pumps cannot eliminate all of your work, we design, manufacture and test them to ensure that they will be an effective and trouble-free tool to assist you in that work.

Yours,

VACUUBRAND GMBH + CO KG

After sales service:

Contact your local dealer or call +49 9342 808-193.

Trademark index:

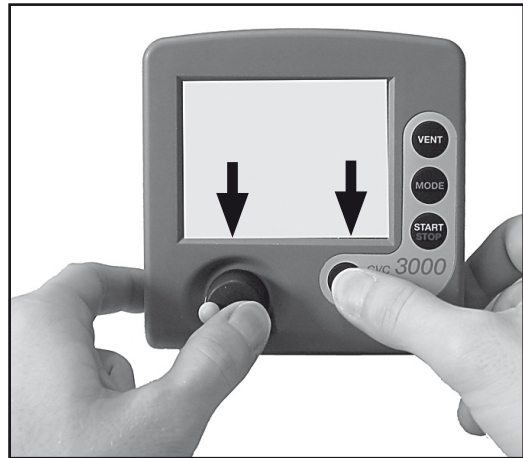
VACUU•LAN[®], VACUU•BUS[™], VACUU•CONTROL[™], chemistry-HYBRID[™], Peltronic[™], TURBO•MODE[™], VARIO[™], VARIO-SP[™], VACUUBRAND[®] and also the shown company logos are trademarks of VACUUBRAND GMBH + CO KG, Germany

Reset / Language selection

1 switch off



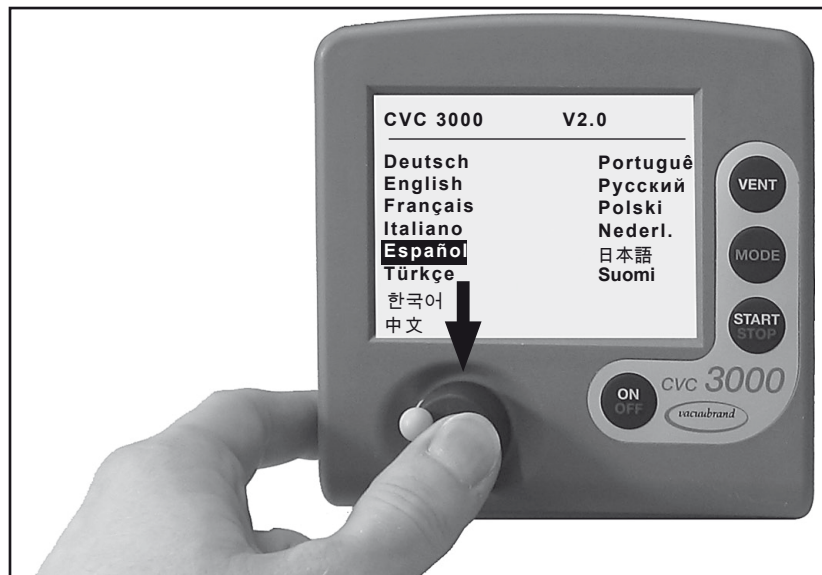
2 press both ↓ ↓



3 turn ↺ ↻



4 press ↓



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Safety information!

Important information!

NOTICE

This manual is an integral part of the equipment described herein. It describes the safe and proper use of the vacuum pump. The manual consists of two parts. Keep this manual complete and accessible to personnel at all times!

Make operating personnel aware of dangers arising from the pump and the pumped substances.

Read this manual carefully before installing or operating the equipment. Observe the instructions contained in this manual.

VACUUBRAND disclaims any liability for inappropriate use of these pumps and for damage resulting from disregarding the instructions contained in this manual.

Do not modify the equipment without authorization.

This manual is only to be used and distributed completely and unchanged. It is strictly the users' responsibility to check carefully the validity of this manual with respect to his product.

Manual-no.: 999220 / 05/20/2010

The following signal word panels and safety symbols are used throughout this manual:



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury and death.



➔ DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



☞ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



• CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to personal injury.



Caution! Hot surface!



Disconnect equipment from AC power.



Dispose off electronic equipment according to regulations.



Formatting used in this manual:

Note: The signal word panels in all sections of this manual always refer to all paragraphs of the same format (➔ / ☞ / • / plain text) following each signal word panel.

General information

NOTICE

Remove all packing material from the packing box. Remove the product from its packing-box and retain all packaging until the equipment is inspected and tested. Remove the protective caps from the inlet and outlet ports and retain for future use. Inspect the equipment promptly and carefully.

If the equipment is damaged, notify the supplier and the carrier in writing within three days. Retain all packing material for inspection. State the item number of the product together with the order number and the supplier's invoice number. Failure to check and give notice of damage will void any and all warranty claims for those deficiencies.

Replace the protective caps, if the equipment is not used immediately. Store the equipment in dry and non-corrosive conditions (see also "Technical data", pg. 19).

Use the mounted handle or the recessed grips when moving the pump.

WARNING

☞ **Do not use any damaged equipment.**

Intended use

WARNING

☞ Do not use the pump or any system parts on humans or animals.

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

☞ Ensure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.

☞ Comply with all notes on correct vacuum and electrical connections; see section "Use and operation", pg. 28.

☞ Use the equipment **only as intended**, that is, for generation, measurement, and control of vacuum in vessels designed for that purpose. Any other use will automatically invalidate all warranty and liability claims.

Remain aware of safety and risks.

☞ Do not use the pump to generate pressure.

NOTICE

The pumps are designed for operation at **ambient temperatures** between +50°F and +104°F (+10°C and +40°C). Check the maximum temperatures if installing the pump in a cabinet or a housing. Make sure ventilation is adequate to maintain recommended operating temperature. Install an external automatic ventilation system if necessary. If pumping hot process gases, make sure that the maximum permitted gas inlet temperature is not exceeded. The maximum permitted gas inlet temperature depends on several parameters like inlet pressure and ambient temperature (see "Technical data", pg. 19).

Do not aspirate particles and dust.

Do not pump liquids.

Ensure that the pump is chemically resistant to the pumped substances prior to operation.

Setting up and installing the equipment

DANGER

➔ Equipment must be connected only to a **suitable electrical supply** and a suitable ground point. As such, the plug must be plugged into an outlet that is properly grounded. Failure to connect the motor to ground may result in deadly electrical shock.

The supply cable may be fitted with a molded European IEC plug or a plug suitable for your local electrical supply. The cable contains wires color coded as follows: green or green and yellow: ground; blue or white: neutral; brown or black: hot.

WARNING

☞ Due to the high compression ratio, the pump may generate overpressure at the outlet. Check pressure compatibility with system components (e.g., exhaust pipeline or exhaust valve) at the outlet.

☞ Do not permit any **uncontrolled pressurizing**. Make sure that the exhaust pipeline cannot become

blocked. If there is an exhaust isolation valve, make sure that you cannot operate the equipment with the valve closed to avoid a **risk of bursting!**

- ☞ Always provide a free and pressureless exhaust outlet to avoid damage to pump valves and risk of bursting of condenser glassware.
- ☞ Check the overpressure safety relief device at the exhaust waste vapor condenser at appropriate intervals.

CAUTION

- Provide a firm, level platform for the equipment. Check that the system which you are going to evacuate is mechanically stable. Check that all fittings are secure. Ensure a stable position of the pump without any mechanical contact other than the pump feet. Comply with all applicable safety regulations.
- Comply with **maximum permissible pressures** at inlet and outlet and with **maximum permissible pressure differences** between inlet and outlet. See section "Technical data", pg. 19. Do not operate the pump with overpressure at the inlet.
- Comply with **maximum permissible pressures** at the pressure transducer. See section "Technical data", pg. 19.
- Avoid overpressure of more than 2.9 psi (0.2 bar) in the event that inert gas is connected to the pump, to the gas ballast or to a venting valve.
- Ensure that the **coolant outlet pipe** is always free and that it cannot get blocked. If installing an optional coolant valve, it must always be in the supply line of the exhaust waste vapor condenser.
- Keep the electrical power cord away from heated surfaces.
- **Note:** Flexible elements will shrink when evacuated.

NOTICE

Check the power source and the pump's rating plate to be sure that the power source and the equipment match in voltage, phase, and frequency.

Check fan regularly for dust/dirt. Clean fan guard grill if

necessary to avoid a reduction of ventilation.

Do not place the pumping unit on soft surfaces (e.g., rubber foam) during operation. This may reduce or block the fans' air supply. Keep a minimum distance of 8 in (20 cm) between the cooling fan and surrounding items (e.g., housing, walls, etc.). Do not cover the pumping unit.

Use only hoses at the inlet and outlet of the pump with an inner diameter at least as large as the diameter of the pump's tubing (to avoid overpressure at the outlet, and reduction of pumping speed at the inlet).

Connect hoses gas tight at inlet and outlet of the pump. Secure coolant hoses at the hose nozzles (e.g., with hose clamp) to prevent their accidental slipping.

Allow the equipment to equilibrate to ambient temperature if you bring it from cold environment into a room prior to operation. Notice if there is water condensation on cold surfaces.

Check liquid level in catchpots regularly and drain condensate in time to avoid overflowing. A level sensor can be purchased to trigger an alarm when the catchpot is full (see "Accessories", pg. 79).

Ensure that no foreign objects can be drawn into the pump.

Comply with all **applicable and relevant safety requirements** (regulations and guidelines). **Implement the required actions and adopt suitable safety measures.**

Ambient conditions



☞ Do not use this product in an area where it can fall or be pulled into water or other liquids.



➔ Do not reach for this product if it has fallen into liquid. There is a risk of deadly electrical shock. Unplug the system immediately.

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 (EN 61010-1) gives in detail the conditions under which the equipment can be operated safely (see also IP degree of protection, "Technical data", pg. 19).

Adopt suitable measures in case of differences from recommended conditions, e.g., using the equipment outdoors, installation in altitudes of more than 3300 ft (1000 m) above mean sea level, conductive pollution or external condensation on the pump.

Pay attention to the **permissible maximum ambient and gas inlet temperatures** (see "Technical data", pg. 19).

Do not operate this product near flames.

Operating conditions

! DANGER

- ➔ These pumps are not approved for operation in potentially explosive atmospheres. Do not operate the pumps in potentially explosive atmospheres.
- ➔ These pumps are not approved for the pumping of potentially explosive atmospheres. Do not pump potentially explosive atmospheres.

- ➔ The pumps are **not suitable** to pump any of the substances listed below.
Do not pump:
 - **unstable substances**
 - substances which react explosively under **impact** (mechanical stress) without air
 - substances which react explosively when being exposed to **elevated temperatures** without air,
 - **self inflammable** substances,
 - substances which are **inflammable without air**
 - **explosive substances**.

NOTICE

Do not pump substances which may form **deposits** inside the pump. 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 exceeding the maximum permitted temperatures.

Check the inlet and outlet of the pump, if there is a danger of forming **deposits** inside the pump, e.g., in the pump chambers (the pump chamber is the part between diaphragm and head cover. See section "Replacing diaphragms and valves", pg. 86). Inspect the pump chambers regularly and clean if necessary.

The pumps are **not suitable** for pumping dust and they are **not approved** for operation below ground.

Do not pump dust and do not operate the pump **below ground**.

When changing the substances pumped, we recommend to purge the pump with air or inert gas prior to changing the pumped media. Purging the pump will pump out residues and it will reduce the possibility of reactions of the pumped substances with each other and with the pump's materials.

Consider interactions and chemical reactions of the pumped media. Ensure that the materials of the pump's wetted parts are compatible with the pumped substances, see section "Technical data", pg. 19.

Safety during operation

⚠ DANGER

➔ Adopt suitable measures to prevent the release of dangerous, toxic, explosive, corrosive, noxious or polluting fluids, vapors and gases. To prevent any emission of such substances from the pump outlet, install an appropriate collecting and disposal system and take protective action for pump and environment.

 **WARNING**

- ☞ Never operate this pump if it has a damaged cord or plug. If the pump is not working properly, has been dropped or has fallen into water, contact your pump service provider.
- ☞ Prevent any part of the human body from coming into contact with vacuum.

- ☞ Make sure that the exhaust pipeline cannot become blocked.
- ☞ Check the overpressure safety relief device at the exhaust waste vapor condenser at appropriate intervals.
- ☞ **Attention:** At pressures above approximately 795 Torr (1060 mbar) the pressure reading becomes incorrect due to saturation of the pressure transducer. The display flashes. Release pressure immediately! Risk of bursting!

- ☞ You must take suitable precautions to prevent any formation of explosive mixtures in the pump chamber or at the outlet of the pump. In case, e.g., of a diaphragm failure, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures. Use inert gas for gas ballast or venting, if necessary.
- ☞ Drain appropriately or otherwise remove any potentially explosive mixtures at the outlet of the pump, or dilute them with inert gas to non-explosive concentrations.

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

- ☞ Use only **original manufacturer's spare parts and accessories**. Otherwise the safety and performance of the equipment, as well as the electromagnetic compatibility of the equipment might be reduced.
The CE mark or the cTÜVus mark may be voided if not

using original manufacturer's spare parts.

A yellow rectangular label with a black border. On the left side, there is a black triangle containing a white exclamation mark. To the right of the triangle, the word "CAUTION" is written in bold, black, uppercase letters.

- Ensure that no parts of your clothing, hair or fingers can be caught or drawn in at the inlet of the pump. Never insert fingers or drop any other object into the inlet or outlet.
- Pay attention to the safety symbol "hot surfaces" on the equipment. Hot parts may cause burns if touched. Adopt suitable measures to prevent any danger arising from hot surfaces or electric sparks. Ensure that hot surfaces of the pump do not cause burns. Provide a suitable contact guard if necessary.
- Pumping at high inlet pressure may lead to overpressure at the gas ballast valve. Pumped gases or condensate might be expelled if the valve is open. If an inert gas supply is connected to the gas ballast, ensure that its inlet pipeline is not contaminated.
- Ensure that the **coolant outlet pipe** at the waste vapor condenser is always free and that it cannot get blocked.
- Failure of the pump (e.g., due to power interruption), failure of connected components or of parts of the supply, or a change of parameters must not be allowed to lead to a dangerous situation under any circumstances. In case of a diaphragm failure or in case of a leak in the manifold, pumped substances might be released into the environment or into the pump housing or motor. Especially comply with notes on use and operation and maintenance.
- The residual **leak rate of the equipment** might render possible 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.
- You must take suitable precautions to prevent any dan-

gerous situation from arising if the controller starts a vacuum pump (in combination with a VMS Module A), switches an in-line valve or a coolant valve, or opens a venting valve.

- **Attention:** If the controller is set to **Autostart**, the process will start immediately after a power failure without pressing any further key. It is your responsibility to ensure that automatic start-up of the system will not lead to any dangerous condition. Provide appropriate safety measures. 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 exceeds 16 psi (1.1 bar) at maximum. Prevent the backpressure of gases and the backflow of condensates at the outlet.

Never aspirate liquids or dust into the pump.

Check the liquid level in the catchpots regularly and drain condensate in time to prevent overflowing. A level sensor can be purchased to trigger an alarm when the catchpot is full (see "Accessories", pg. 79).

Provide appropriate protective measures to allow for the possibility of failure and **malfunction**. The protective measures must also allow for the requirements of the respective application.

The CVC 3000 controller is powered by a short circuit proof wide-range power supply with integrated overload protection.

In case of overload, the motor is shut down by a **self-hold thermal cutout** in the winding.

Note: Only manual reset is possible. Press the START/STOP key at the controller to confirm the error message. Switch off the pump and disconnect from the power source. Identify and eliminate the cause of failure. Wait approx.

five minutes before restarting the pump.

CAUTION

- **Note:** In case of **supply voltage below 100V**, the lock of the cutout might be impaired and the pump may restart on its own after sufficient cooling down. Take appropriate precautions, if an automatic restart of the pump may lead to a dangerous situation.

The A-weighted 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

In order to comply with laws (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments can only be returned when certain procedures (see section "**Notes on return to the factory**", pg. 100) are followed.

Take advantage of our service seminars, which put special focus on the maintenance and repair of vacuum pumps. For details see www.vacuubrand.com.

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. Motor capacitors have a typical durability in the range of 10000 to 40000 h depending strongly on operation conditions including ambient temperature, humidity or load.

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.**



☞ **Switch off the pump. Disconnect the electrical power cord and wait two minutes** before starting maintenance to allow the capacitors to discharge.

☞ **Note:** The pump may be contaminated with process chemicals, which have been pumped during operation. Ensure that the pump is completely decontaminated before maintenance commences. Take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred. Use appropriate protective clothing, safety goggles and protective gloves.



- Check every motor capacitor regularly by measuring its capacity and estimating its time in operation. Replace old capacitors early enough to prevent a failure in operation. If an old motor capacitor fails, the capacitor may get hot. It may even melt or emit a flame, which could be **dangerous for persons and equipment in the vicinity**. The capacitors have to be replaced by an electrician.
- Vent the pump before starting maintenance. Isolate the pump and other components from the vacuum system. Allow sufficient cooling of the pump. Separate the pump from the coolant circuit and 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.
Only dismantle the pump as far as necessary.

Technical data

Type		PC 510 NT PC 511 NT PC 520 NT		PC 610 NT PC 611 NT PC 620 NT	
		Maximum pumping speed 50/60 Hz (ISO 21360)*	cfm (m ³ /h)	1.2 / 1.4 (2.0 / 2.3)	
Ultimate vacuum (absolute) without gas ballast	Torr (mbar)	5.3 (7)		1.1 (1.5)	
Ultimate vacuum (absolute) with gas ballast	Torr (mbar)	9.0 (12)		2.3 (3)	
Maximum permissible inlet pressure (absolute)	psi (bar)	16 (1.1)			
Maximum permissible outlet pressure (absolute)	psi (bar)	16 (1.1)			
Maximum pressure difference between inlet and outlet	psi (bar)	16 (1.1)			
Maximum permissible pressure (absolute) at gas ballast valve	psi (bar)	17.5 (1.2)			
Permissible ambient temperature storage / operation	°F (°C)	14 to 140 / 50 to 104 (-10 to +60 / +10 to +40)			
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85			
Rated motor power	hp (kW)	0.24 (0.18)		0.34 (0.25)	
No-load speed 50/60 Hz	rpm	1500 / 1800			
Maximum permissible range of supply voltage (±10%) Attention: Observe specifications of rating plate!		100-115 V~ 50/60 Hz, 120 V~ 60 Hz 230 V~ 50/60 Hz			
Maximum rated current at: 100-115 V~ 50/60 Hz, 120 V~ 60 Hz 230 V~ 50/60 Hz	A A	3.4 1.8		5.7 3.0	
Device fuse		2 slow blow fuses 6.3A			
Motor protection		thermal cutout, manual reset			
Degree of protection IEC 529		IP 40			

* Pumping speed of diaphragm pump

Type	PC 510 NT PC 511 NT PC 520 NT		PC 610 NT PC 611 NT PC 620 NT	
	Inlet	hose nozzle for tubing I.D. 3/8" (hose nozzle DN 10 mm)		
Outlet	hose nozzle for tubing I.D. 3/8" (hose nozzle DN 10 mm)			
Coolant connection (waste vapor condenser)	hose nozzle for tubing I.D. 1/4" - 5/16" (hose nozzle DN 6-8 mm)			
Maximum permissible pressure of coolant at waste vapor condenser	psi (bar)	87 (absolute) (6 (absolute))		
Permissible range of cool- ant temperature (waste vapor condenser)	°F (°C)	5 to 68 (-15 to +20)		
Volume of catchpot (only pumping unit)	qt (ml)	0.52 (500)		
Dimensions L x W x H approx. PC 510 NT / PC 610 NT PC 511 NT / PC 611 NT PC 520 NT / PC 620 NT	in (mm) in (mm)	16.5 x 9.6 x 17.5 (419 x 243 x 444) 17.1 x 9.6 x 17.5 (435 x 243 x 444) 17.1 x 14.2 x 17.5 (435 x 361 x 444)		
Weight approx. PC 510 NT / PC 610 NT PC 511 NT / PC 611 NT PC 520 NT / PC 620 NT	lbs. (kg) lbs. (kg) lbs. (kg)	36.8 (16.7) 37.3 (16.9) 39.0 (17.7)	43.9 (19.9) 44.3 (20.1) 46.1 (20.9)	

Gas inlet temperatures

Operating condition	Inlet pressure	Permitted range of gas temperatures at inlet
Continuous operation	> 75 Torr (100 mbar) (high gas load)	➔ 50 °F to 104 °F (+10°C to +40°C)
Continuous operation	< 75 Torr (100 mbar) (low gas load)	➔ 32 °F to 140 °F (0°C to +60°C)
Short-time (< 5 minutes)	< 75 Torr (100 mbar) (low gas load)	➔ 14 °F to 176 °F (-10°C to +80°C)

Controller	CVC 3000
Pressure transducer	ceramic diaphragm (alumina), capacitive, absolute pressure, gas type independent
Display	LCD graphic display, illuminated
Pressure units / scale (selectable)	Torr, mbar or hPa
Measuring range (absolute)	810 - 0.1 Torr (1080 - 0.1 mbar)
Maximum control range (absolute)*	795 - 1 Torr (1060 - 1 mbar)
Resolution	0.07 Torr (0.1 mbar)
Maximum permissible pressure at pressure transducer (absolute)	1125 Torr (1.5 bar)
Maximum permissible temperature of gaseous media	continuous operation: 104°F (40°C), for short periods up to 176°F (80°C)
Measurement uncertainty (absolute) after careful adjustment and at constant temperature	<± 0.75 Torr (1 mbar)
Temperature coefficient	<± 0.05 Torr/K (0.07 mbar/K)
Ambient temperature range (operation)	50°F to 104°F (10°C to +40°C)
Ambient temperature range (storage)	14°F to 158°F (-10°C to +70°C)
Permissible relative atmospheric moisture during operation (no condensation)	30% to 85%
Maximum permitted current of connected valves (connected components)	4A
Degree of protection IEC 529 (front side)	IP 42
Venting connection	hose nozzle for hose I.D. 3/16" (4-5 mm)
Maximum admissible pressure at venting connection	17.4 psi (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, volume of gas present, etc.

We reserve the right for technical modification without prior notice!

Wetted parts

Components	Wetted materials
Pump	
Head cover; diaphragm clamping disc	ETFE carbon fiber reinforced
Diaphragm	PTFE
Valves	FFKM
O-rings	FPM
Valve head	ECTFE carbon fiber reinforced
Tubing	PTFE
Gas ballast tube	PTFE carbon reinforced
Elbow fitting (at valve head)	ETFE/ECTFE
Pumping unit	
Inlet pumping unit	PBT or PP
Outlet pumping unit	PET
Distribution head	PPS glass fiber reinforced
Tubing	PTFE
Screw-in fittings	ETFE / ECTFE
O-ring at the catchpot	FPM
Overpressure safety relief device at exhaust waste vapor condenser	Silicone rubber / PTFE foil
Exhaust waste vapor condenser / catchpot	Borosilicate glass
Valve block	PP
Flow control diaphragm (PC 511/611 NT)	PTFE
In-line valve	Fluoroelastomer
Housing (in-line valve)	PVDF / PE / PPS
CVC 3000	
Sensor	Aluminum oxide ceramic
Sensor housing	PPS / glass fiber
Sensor seal	Chemically resistant fluoroelastomer
Venting valve seal	FPM

We reserve the right for technical modification without prior notice!

Abbreviations

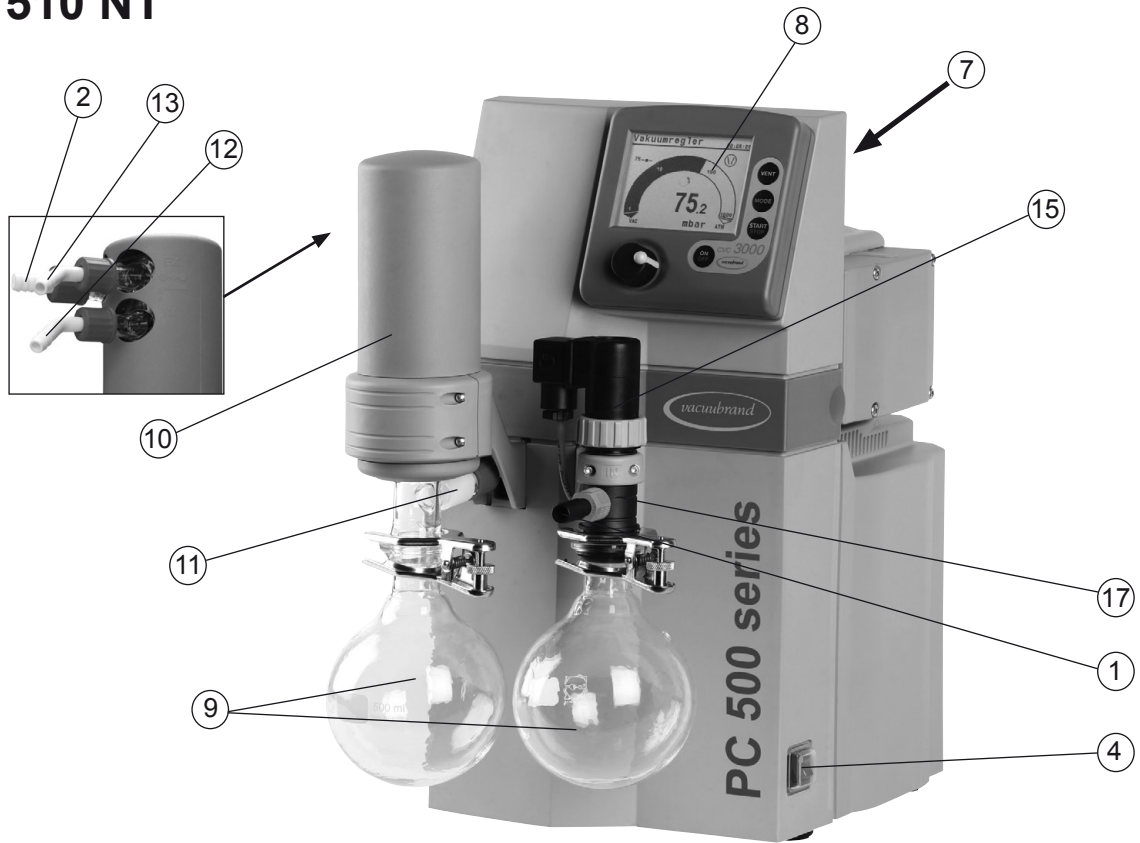
ETFE:	Ethylene/Tetrafluoroethylene
ECTFE:	Ethylene/Chlorotrifluoroethylene
FFKM:	Perfluoro elastomer
FPM:	Fluoroelastomer
PBT:	Polybutylene terephthalate
PET:	Polyethylene terephthalate
PP:	Polypropylene
PPS:	Polyphenylene sulfide
PTFE:	Polytetrafluoroethylene
PVDF:	Polyvinylidene fluoride

Pump parts

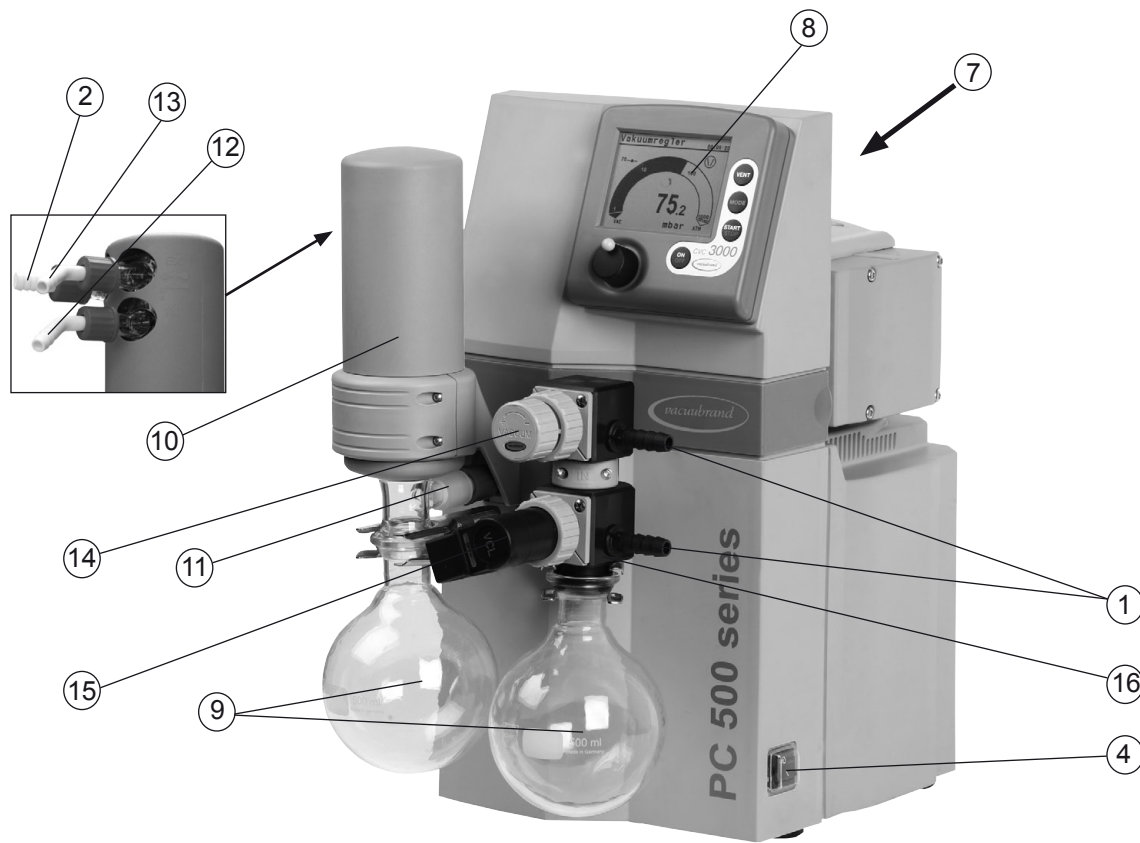
Position	Component
1	Inlet
2	Outlet
3	Gas ballast valve
4	ON/OFF switch
5	Mains connection
6	Recessed grip / handle
7	Pump rating plate
8	Controller CVC 3000
9	Catchpot
10	Exhaust waste vapor condenser

Position	Component
11	Overpressure safety relief device
12	Coolant inlet
13	Coolant outlet
14	Flow control diaphragm
15	In-line valve
16	Valve block
17	Distribution head
18	Fuse holder
19	Connection jack VACUU•BUS
20	Interface RS-232 C

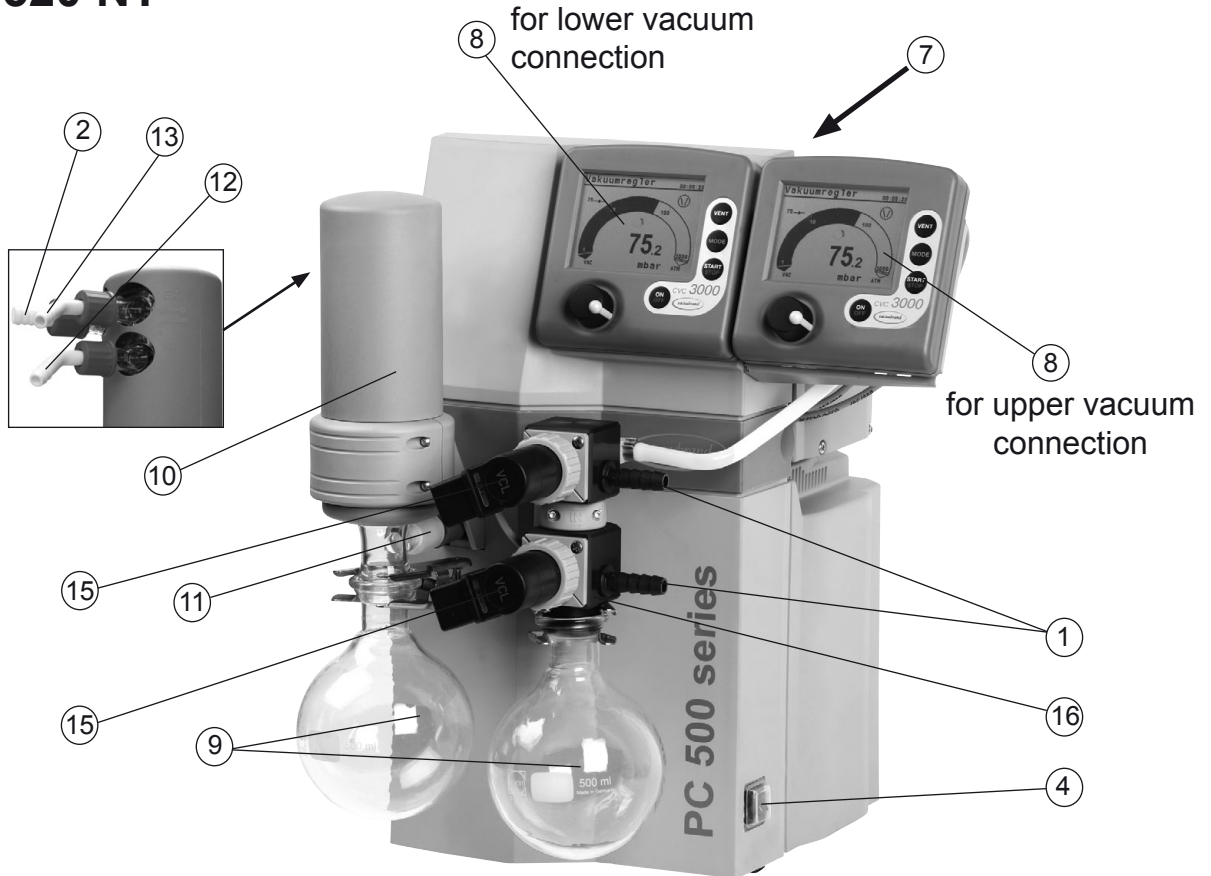
PC 510 NT



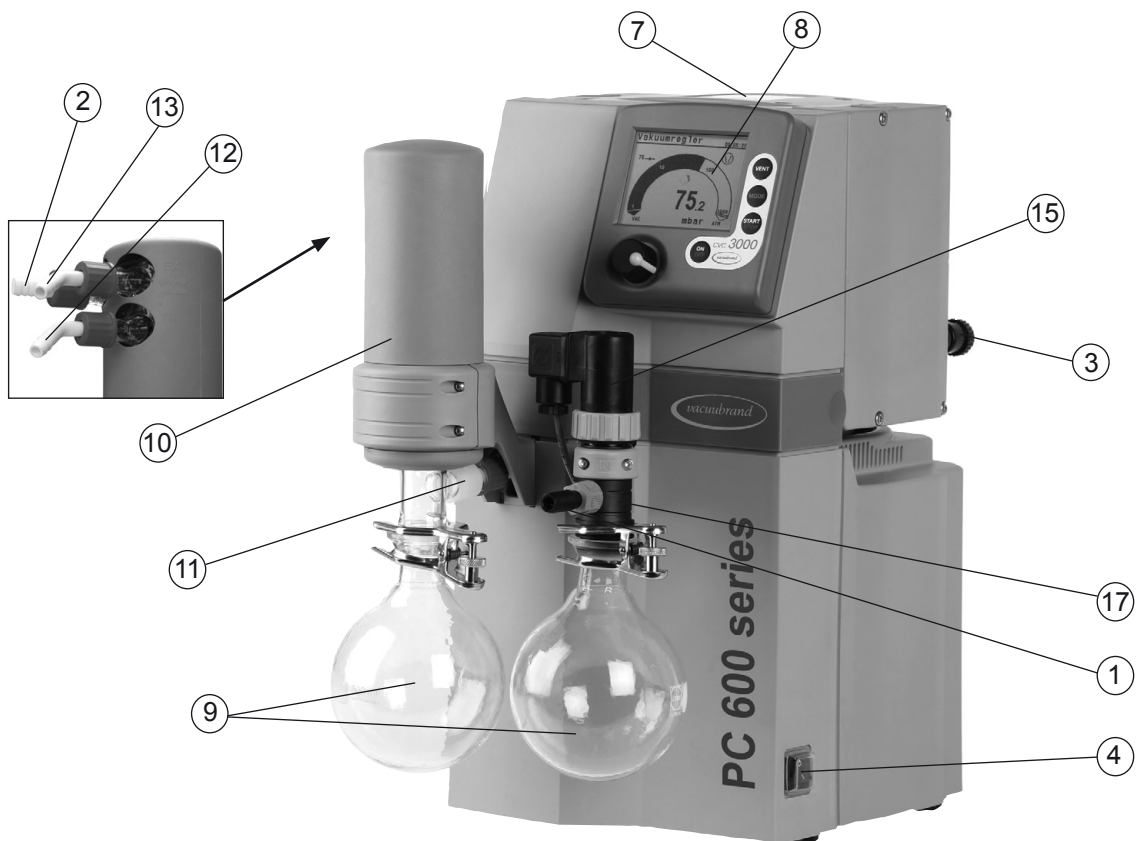
PC 511 NT



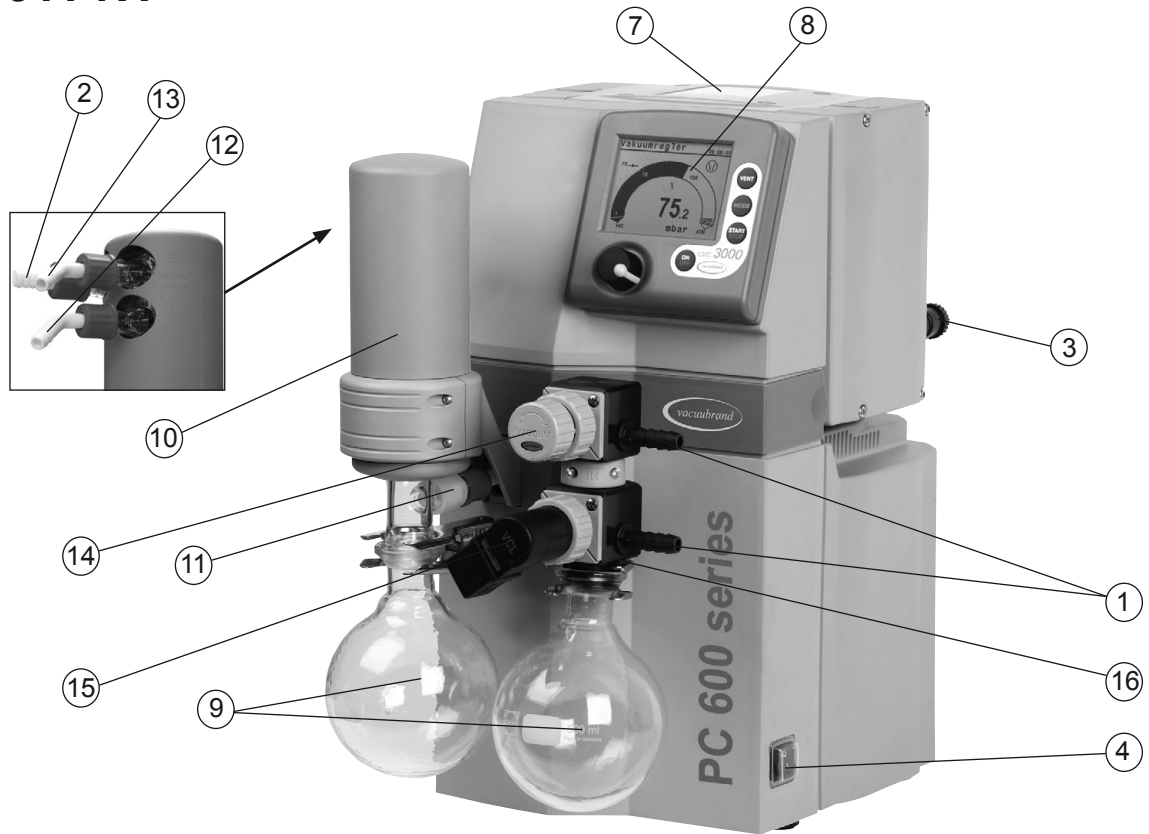
PC 520 NT



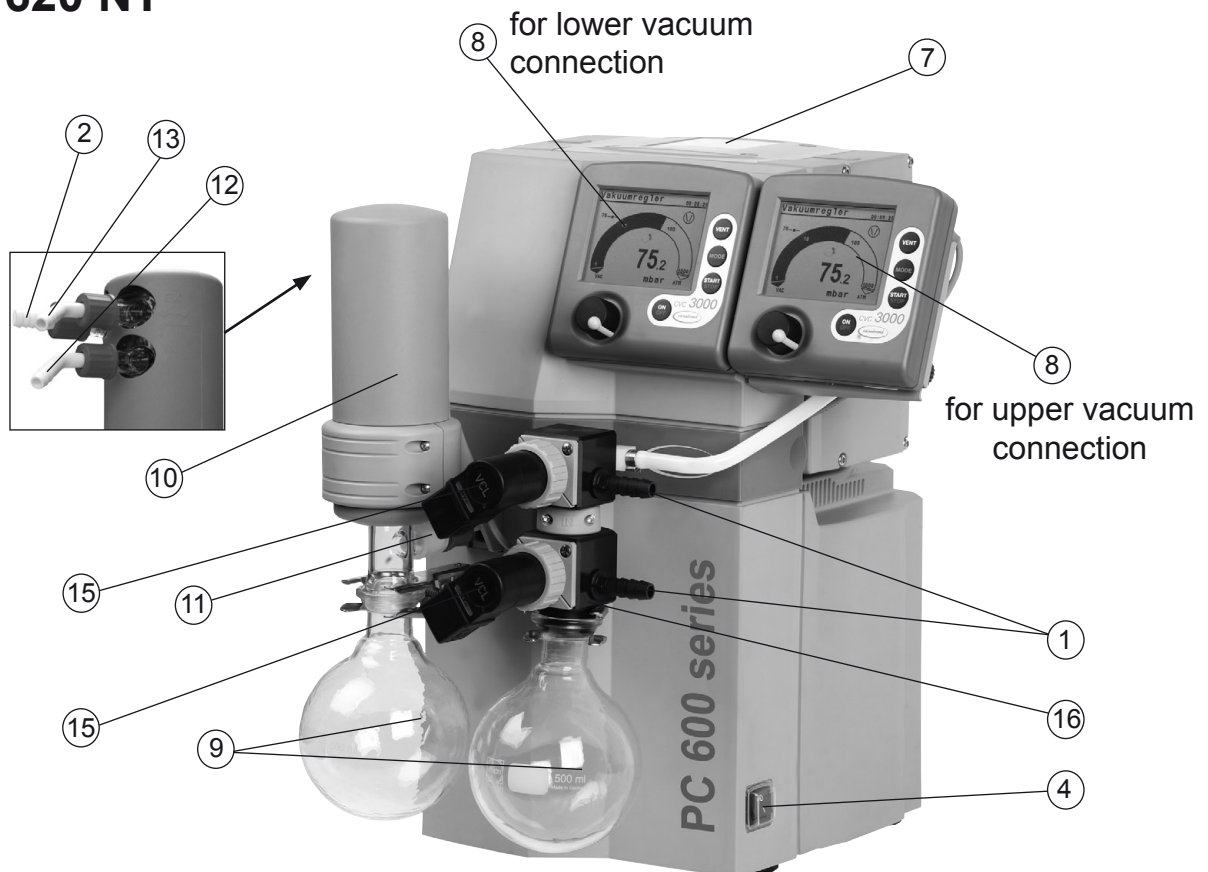
PC 610 NT



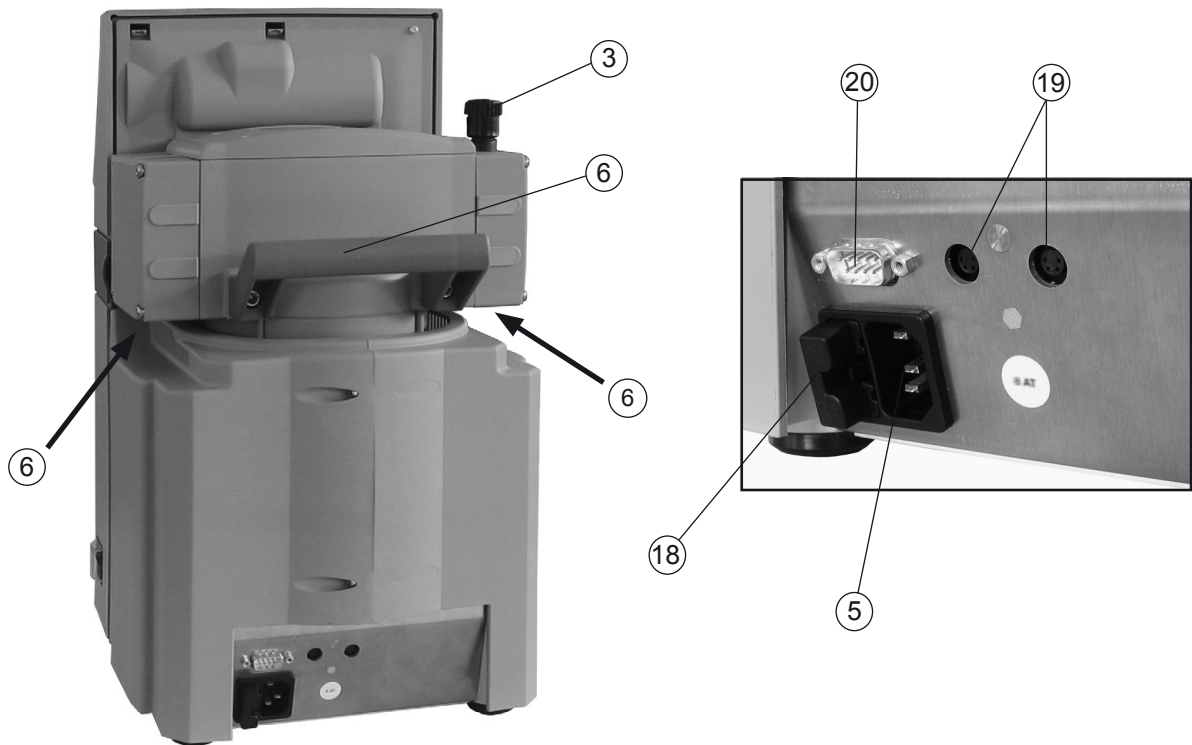
PC 611 NT



PC 620 NT



Rear side of pumping units (shown: PC 510 NT)



Rear side CVC 3000

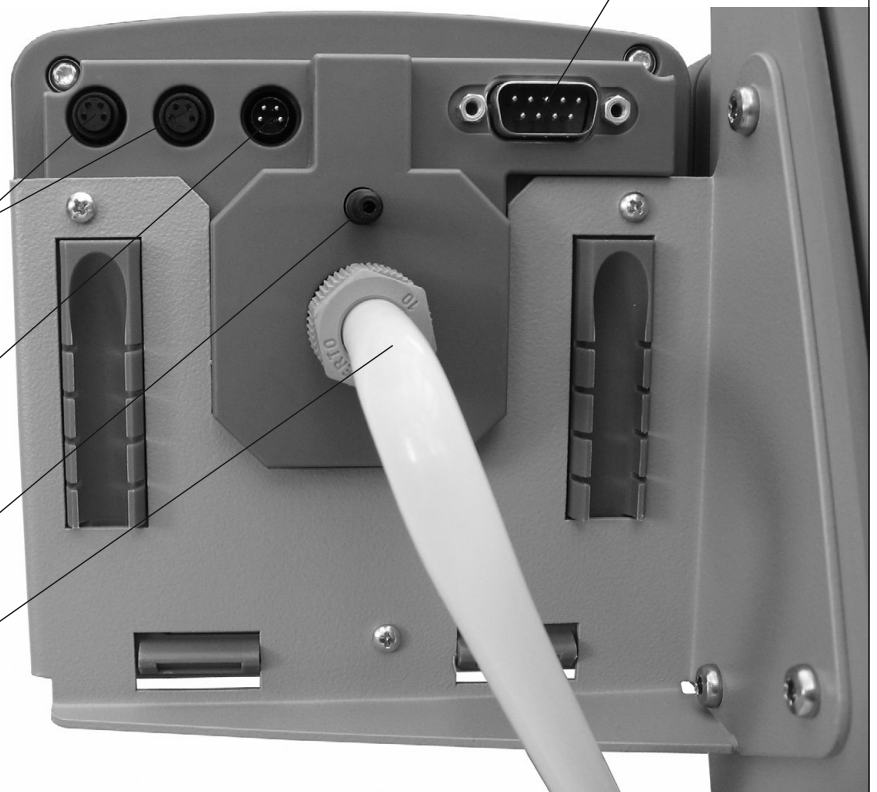
serial interface
RS-232 C

jacks for connection of
VACUU•BUS components
(e.g., coolant valve)

Connection plug of
the power supply

venting connection

vacuum connection



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 a pump in a vacuum system

WARNING

- ☞ Connect a gas-tight exhaust line at the pump outlet if necessary. Always vent exhaust gases appropriately (e.g., into a fume hood). If dangerous or polluting fluids could be released at the outlet, install an appropriate system to catch and dispose of those fluids.
- ☞ Never block the gas outlet. The exhaust line must always be free of obstructions (no back pressure) to ensure an unimpeded discharge of gas. The cross-section of the outlet tubing must be at least the size of the pump's exhaust connection.

CAUTION

- Reduce the transmission of vibration. Prevent mechanical load due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Note:** Flexible elements will compress or flatten when evacuated if not designed for use under vacuum.

NOTICE

Hose connections at the pump inlet must always be gas tight. Particles and dust must not be aspirated. If necessary, you must install appropriate filters. You must ensure their suitability concerning gas flow, chemical resistance and resistance to clogging prior to use.

Make sure ventilation is adequate, especially if the pump is installed in an enclosure, or if the ambient temperature is elevated. Provide external ventilation, if necessary. Keep a distance of minimum 8 in (20 cm) between fan and adjacent equipment or casework.

A power failure may cause accidental ventilation of the pump and of the vacuum system, especially if the gas ballast valve is open. If this constitutes a potential source of danger, take appropriate safety measures.

Use connecting hoses with large diameter and keep them as short as possible to avoid flow losses. Locate the pump as closely as possible to the application.

Always install outlet tubing descending from the pump to avoid backflow of condensate towards the pump.

If exhaust noise is annoying, connect an exhaust hose or use a silencer (see "Accessories", pg. 79).

When assembling, ensure **vacuum-tightness**. After assembly, check the whole system for leaks.

Secure hose connections at the pump appropriately, e.g., with hose clamps, to protect against accidental detachment.

The VACUUBRAND controller CVC 3000 can only be operated with components compatible with the VACUUBRAND VACUU•BUS system, (see "Accessories", pg. 79).

The vacuum controller CVC 3000 controls VACUUBRAND diaphragm pumps NT and optional in-line, coolant, and venting valves. Connected components (e.g., venting valve, level sensor, external pressure transducer 3000 series) are automatically identified and configured.

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. It measures the actual pressure independently of the gas type, and with reference to the vacuum, i.e., absolute.



- ☞ Maximum permissible pressure: 21.8 psi (1.5 bar) absolute.
- ☞ **Attention:** At pressures above approximately 795 Torr (1060 mbar) the pressure reading becomes incorrect due to saturation of the pressure transducer. The display will flash. Release pressure immediately! Risk of bursting!

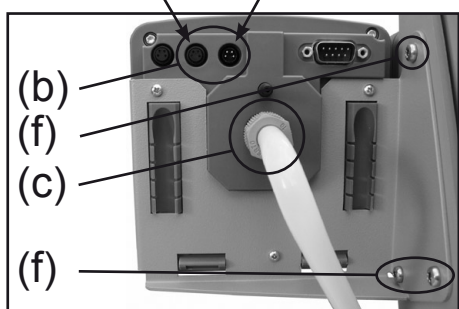
- ☞ Inside a vacuum system where evaporation occurs, e.g., a rotary evaporator, the vacuum is not uniform. For example, a condenser can act as a pump, or the vacuum in the connecting tubing can be higher or lower than in the application itself. This affects the measurement results as well as the control levels. Therefore, carefully choose the position where to connect an external (optional) gauge head. Position an optional external gauge head and its vacuum line in such a way that condensate cannot flow towards the pressure transducer. Condensate and deposits will affect the measurement results. Clean the pressure transducer, if necessary. See section "Cleaning the pressure transducer", pg. 65.

Assembling the second CVC 3000 controller (only PC 520 NT / PC 620 NT):

The pumping unit's second CVC 3000 controller controls the in-line valve at the second inlet (upper vacuum connection). Mount the controller prior to operating the pumping unit.



(a)



- ➔ Affix the controller with its holding plate to the pumping unit (three Allen screws (f), 2.5 mm wide Allen key). Install the washers and screw the holding plate into position.
- ➔ Slip the enclosed molded PTFE hose onto the hose connection of the valve block at the inlet (a). Fasten with hose clip. Close hose clip with flat pliers.
- ➔ Slip the other end of the PTFE hose onto the vacuum connection (c) of the CVC 3000 and fasten with union nut.
- ➔ Plug in the VACUU•BUS lines at the rear of the controller (b): Power supply line of the controller (d) and control line of the in-line valve (e).

Attention: Do not apply off-axis forces when assembling or removing plug connections! Observe correct orientation of the plug.

Carrying the pumping units:

Hold the pumping unit with one hand at its handle and tilt it slightly backwards.

Reach with the other hand underneath the pumping unit and lift the pumping unit.

Or: Use the recessed grips on the side of the pump (below pump heads). Do not grab if the pump is hot.

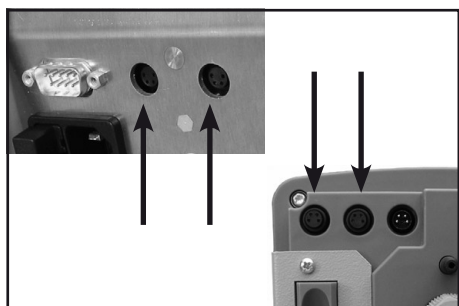


Attention: Do not grab the pumping unit at the holders of the waste vapor condenser or of the catchpot!

Assembling the hose nozzle with union nut (PC 510/610 NT):

- ➔ Take the hose nozzle with attached compression ferrule and union nut out of the catchpot 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 17mm) for final installation.

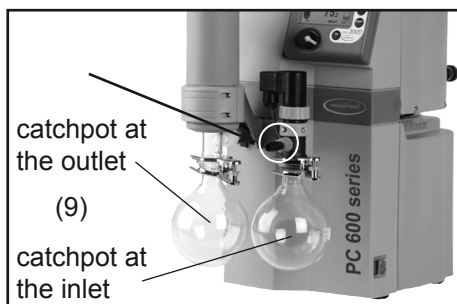
Connection of components at the controller



At the rear side of the pumping unit and at the rear side of the second controller (only PC 520/620 NT) are VACUU•BUS jacks for connection of accessory components: in-line valve / coolant valve / external pressure transducer / external venting valve / level sensor / emission condenser Peltronic etc.

- ☞ Plug the VACUU•BUS lines of accessory components into the VACUU•BUS jacks. Do not apply off-axis forces when assembling or removing plug connections! Observe correct orientation of the plugs.

Catchpots:

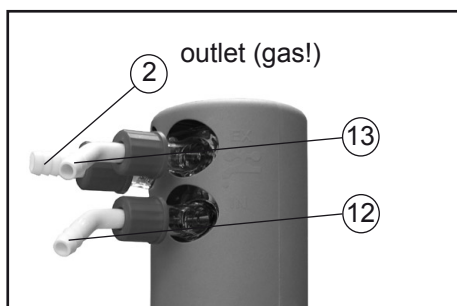


The catchpot at the inlet protects against droplets and particles from entering the pump.

- ☞ Enhances lifetimes of diaphragms and valves.
- ☞ Improves vacuum performance in applications with condensable vapors.

Both catchpots are coated with a protective layer to protect against shattering in case of breakage or implosion.

- ➡ Assemble the catchpots at the inlet and at the outlet using joint clips.



Exhaust waste vapor condenser:

- ➡ Assemble the hose nozzles for coolant inlet (12) and coolant outlet (13) tubing at the exhaust waste vapor condenser.

The **exhaust waste vapor condenser** enables an efficient condensation of the pumped vapors at the outlet.

- ☞ No backflow of condensates.
- ☞ Controlled recovery of condensates.
- ☞ Close to 100% solvent recovery.

- ☞ The isolation cover protects against glass splinters in case of breakage, acts as thermal isolation to avoid condensation of humidity and is intended to absorb shocks.

WARNING

- ☞ Never block the gas outlet ((2) hose nozzle for tubing I.D. 3/8" (10 mm)). The exhaust hose has always to be unobstructed and without back pressure to enable an unhindered discharge of gases and protect the pump valves from damage.
- ☞ Prevent the discharge of dangerous gases and vapors to the surrounding atmosphere. If appropriate, connect the exhaust line to a suitable treatment system.

CAUTION

- **Note:** Install the hoses of the cooling system in a way to avoid the flow / dripping of condensed water onto the pumping unit (especially cables and electronic parts).
- Ensure that the **coolant outlet tubing** is always unobstructed and that it cannot get blocked.
- Maximum permissible coolant pressure at the exhaust waste vapor condenser: 87 psi (6 bar) absolute. Outlet flow must always be unhindered.
- Comply with the maximum permissible coolant pressures of additional components in the coolant circuit (e.g., coolant valve).
- Avoid overpressure in the coolant circuit (e.g., caused by blocked or squeezed coolant hoses).
- Only install the optional coolant valve in the supply line of the exhaust waste vapor condenser.

NOTICE

Attach the tubing of the coolant circuit to the respective hose nozzles (hose nozzles for tubing I.D. 1/4"-5/16" (6-8 mm), see image) at the waste vapor condenser. Check all hose connections prior to starting operation of the cooling system.

Secure coolant hoses at the hose nozzles (e.g., with hose clamps) to prevent their accidentally slipping off.

During operation

WARNING

☞ Vent and dispose of **potentially dangerous gases or vapors** at the outlet of the pump appropriately.

CAUTION

- Due to the high compression ratio, the pump might generate overpressure at the outlet. Check pressure compatibility with system components (e.g., exhaust tubing or exhaust valve) at the outlet. Ensure that the pump outlet is neither blocked nor restricted.

NOTICE

Maximum ambient temperature: 104 °F (40 °C)

Check the maximum temperatures, if installing the pump in a cabinet or a housing. Make sure ventilation is adequate, especially if the ambient temperature is elevated.

If pumping condensable vapors (water vapor, solvents, etc.), let the pump run with **gas ballast** to help purge any condensation in the pump.

If the pump is installed at an altitude of more than 3300 ft (1000 m) above mean sea level, check compatibility with applicable safety requirements, especially IEC 60034. There is a risk of the motor overheating due to insufficient cooling.

Do not start the pump, if the **pressure difference between inlet and outlet ports exceeds max. 16.0 psi (1.1 bar)**. Attempts to start the pump at higher pressure difference may cause stalling and damage of the motor.

Check compatibility with the **maximally permitted pressure** at inlet and outlet ports.

Operation with silencer at the outlet: Operating the pump at a 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.

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 the pump if necessary to avoid an increase of the pump's operating temperature.

In case of overload, the motor is shut down by a **self-hold thermal circuit breaker** in the winding.

Note: Only a manual reset is possible. Press the START/STOP key at the controller to confirm the error message. Switch off the pump and disconnect the electrical power cord. Identify and eliminate the cause of failure. Wait approx. five minutes before restarting the pump.

Attention: In case of **supply voltage below 100V**, the lock of the cutout might be restricted and the pump might restart on its own after sufficient cooling down. Take suitable precautions, if an automatic restart of the pump may lead to a critical dangerous situation.

Check fan regularly for dust/dirt. Clean if necessary.

A warm up period (approximately 15 min.) is required to ensure that the rated ultimate vacuum and pumping speed are attained. Avoid overheating (e.g., due to hot process gases).

Important notes regarding the use of gas ballast

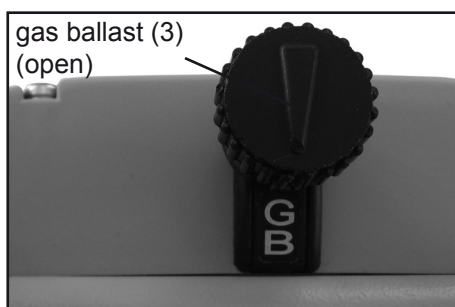
Gas ballast is a continuous purge to keep the pump's interior as clean as possible and to reduce the possibility of condensation inside the pump.

WARNING

- ☞ Air and pumped media might react inside the pump or at the outlet of the pump and form hazardous or explosive mixtures, when you use air rather than inert gas for the gas ballast. This constitutes a risk of significant damage to equipment and/or facilities, a risk of personal injury or even loss of life.
- ☞ Make sure that air/gas intake through the gas ballast valve can never lead to hazardous, explosive or otherwise dangerous mixtures. If in doubt, use inert gas.

NOTICE

To reduce condensation in the pump, do not pump vapor before the pump has reached its operating temperature. Open the gas ballast valve when pumping condensable vapors. Turn gas ballast cap to open valve.



For **condensable vapors** (water vapor, solvents, etc.):

- The gas ballast valve is open if the arrow on the gas ballast cap is pointing towards the labelling "GB".
- With gas ballast valve open, the ultimate vacuum will be reduced.
- Use inert gas for gas ballast to avoid the formation of explosive mixtures.
- Close the gas ballast valve by turning the cap 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 vapor condenser.

Important notes concerning the operation of the exhaust waste vapor condenser

WARNING

- ☞ Do never block the gas outlet ((2) hose nozzle for tubing I.D. 3/8" (10 mm)). The exhaust hose must always be unobstructed and pressureless to enable an unhindered discharge of gases.
- ☞ Connect the exhaust to a suitable treatment system to prevent the discharge of dangerous gases and vapors to the surrounding atmosphere.

CAUTION

- Ensure that the **coolant outlet hose** is always free and that it cannot get blocked.
- Check the overpressure safety relief device (11) at the exhaust waste vapor condenser (10) regularly; replace if necessary. Check especially for deterioration, coalescence and cracks.
- Maximum permissible coolant pressure at the exhaust waste vapor condenser: 87 psi (6 bar) absolute
- Comply with the maximum permissible coolant pressures of additional components in the coolant circuit (e.g., coolant valve).
- We strongly recommend installing an optional coolant valve **in the supply line** of the exhaust vapor condenser to save water and reduce the risk of water spill.
- Avoid overpressure in the coolant circuit (e.g., caused by blocked or kinked coolant hoses).

NOTICE

In case of **condensation**: Check the liquid level in both catchpots (9) during operation. Avoid overflowing of the catchpots. Install a level sensor to automate monitoring, if necessary, (see "Accessories", pg. 79).

Do not allow the catchpots to get overfilled. The maximum liquid level is at approximately 80% of the total filling level to avoid problems when removing the catchpots.

Check the liquid level in both catchpots regularly. Drain catchpots in time to avoid overflow.

Permissible range of coolant temperature at the exhaust waste vapor condenser: 5 °F to 68 °F (-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.

Catchpot at inlet:

Admit air or inert gas (via the pump inlet) to restore atmospheric pressure in the catchpot before attempting removal. Remove joint clip. Remove catchpot and drain condensate.

NOTICE

- Reattach drained catchpots.

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

Shutdown & storage

The pump can be switched off under vacuum.

NOTICE

Short-term:

Has the pump been exposed to condensate?

Allow the pump to continue to run at atmospheric pressure for a few minutes.

Has the pump been exposed to media which may damage the pump materials or form **deposits**?

Check and clean pump heads if necessary.

Long-term:

Take measures as described above regarding short-term shutdown.

Separate the pump from the application.

Close inlet and outlet ports (e.g., with transport caps).

Close the gas ballast valve.

Drain catchpots.

Store the pump under dry conditions.

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 pressing 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, followed by the preselected function and the pressure reading.

Attention: Do not assemble or remove plug connections off-axis! Orient the plug correctly before inserting. To connect additional components use VACUU•BUS Y-adapters and extension cables. If an external pressure transducer is connected, it is recognized automatically. Further information on how to use several sensors simultaneously is available upon request.

Keys

VENT:

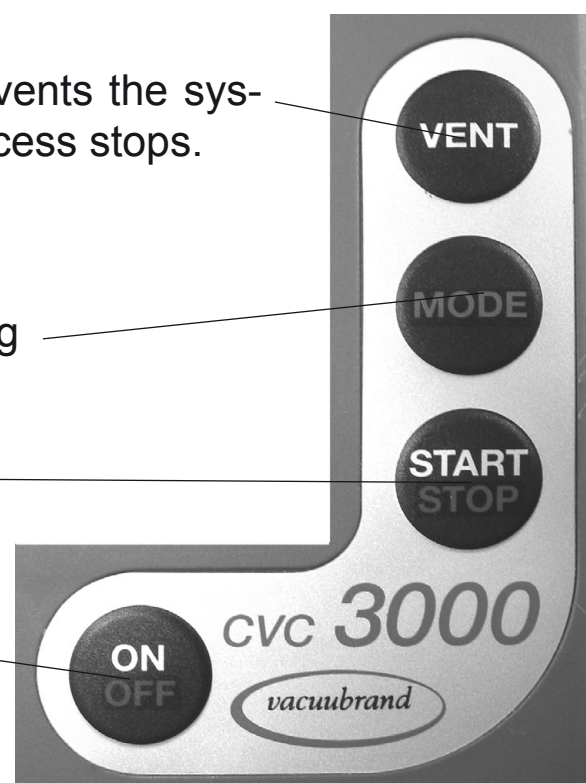
- A short tap vents momentarily; process continues.
- Pressing longer than 2 seconds vents the system to atmospheric pressure; process stops.

MODE:

- Selects menu "function"
- Use for temporary switching during operation to other functions

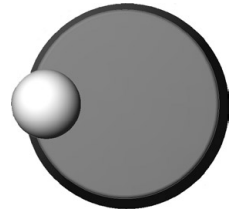
Start or Stop the process

ON/OFF switch

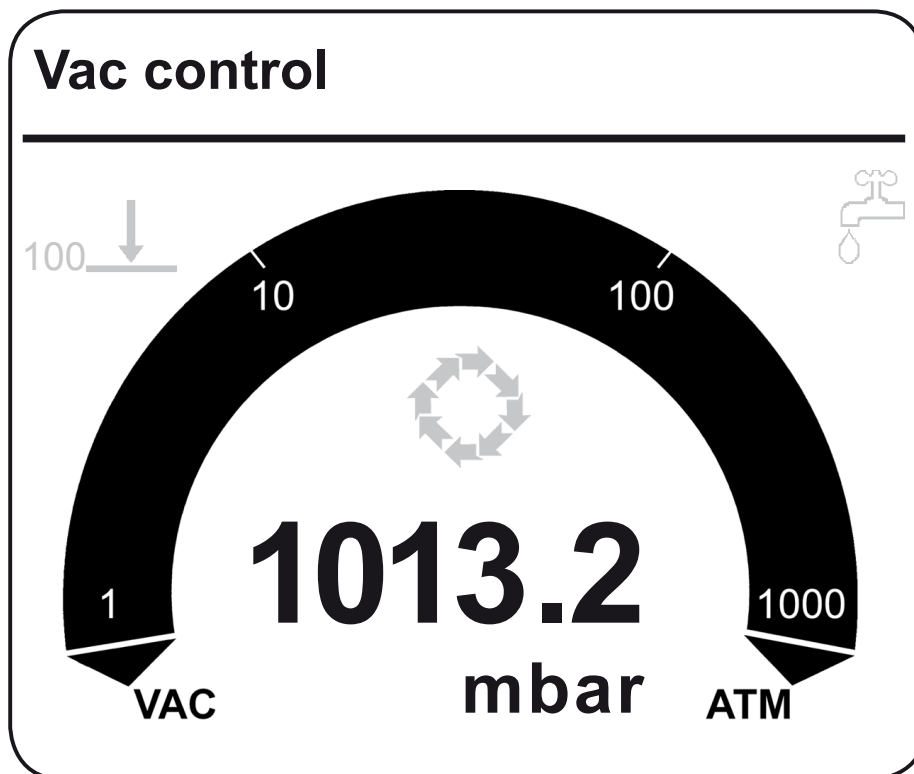


Selection knob

- Press to reach the set-up menu of the function
- Turn to choose the parameter you want to modify
- Press to select the parameter you want to modify
- Turn to change the set value of the parameter
- Press to confirm change of value and to reach further parameters, or to leave the set-up menu



Display and symbols







Selected function (displayed in the upper left corner):
(A "function" is an operation mode of the CVC 3000 controller.)


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

Other display symbols:

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) (with NT pump / with NT VARIO pump)


 /  Actual pressure is in the range "Set vacuum + hysteresis" (with NT pump) / Actual pressure = "Set vacuum" (with NT VARIO pump)


 Flashing: The actual pressure is greater than the 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. With an NT VARIO pump, the pump's motor speed is also displayed in % of full speed.

5  Time meter is running (in function "VACUULAN"); remaining time in minutes is displayed


 In-line valve switched on

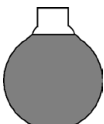
 Venting valve switched on


 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; catchpots need to be emptied.

 Peltronic emission condenser connected

Notes on selecting the function

The CVC 3000 controller 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 configuration of the connected components is checked automatically.

Connected components (valves, pumps, sensors) 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 or time for switching off) are stored.

If the preselections are chosen appropriately, it is possible to start immediately if similar operating conditions are desired.

The controller features **five functions and one configuration menu**, see section "Menu guide". Each of these functions involves different menu options, which are presented automatically and reflect the connected components. **The types of components connected (e.g., valves) determine the active menu items.**

Changing the function:

- Switch controller on.
- Press "START/STOP" key to terminate control in case control is running (e.g., if "Autostart" is activated).
- Press "MODE" key.
- Select function with knob and press to confirm.

☞ Depending on the selected function and system components, the controller provides different operating control, as follows:

"Pump down"

- Controls a NT pump and/or in-line valve depending on preselected pressure and time settings.
- Coolant valve

”Vac control”

- With pressure preselection, controls a NT pump or an in-line valve to maintain two-point control of that pressure.
- Coolant valve

”Program”

- Controls a pump or in-line valve based on time and pressure preselections.
- Coolant valve
- Venting valve


”VACUULAN”

- Controls a pump or in-line valve based on time and pressure preselections.
- Coolant valve

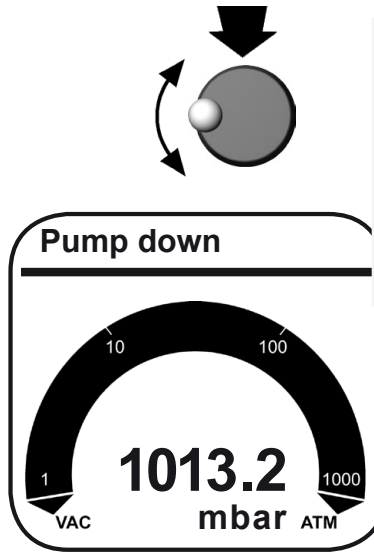
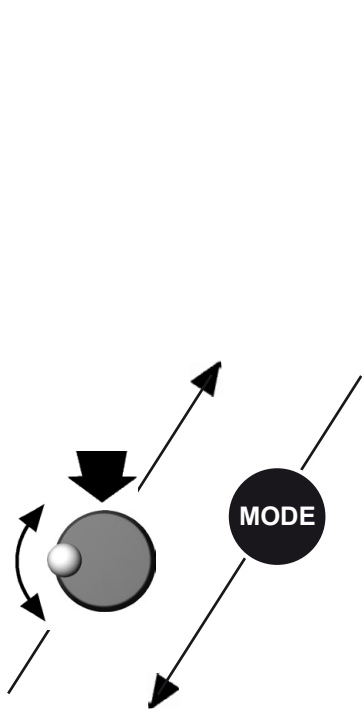
”Configuration”

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 (reset the controller to factory set values)

 You may also access the ”Configuration” menu by pressing the selection knob while the start display is shown (after switching on).

Menu guide

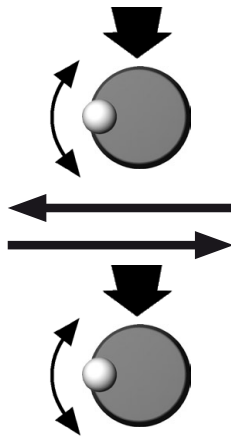


Pump down	
Minimum	Off
Delay	Off
Duration	Off
----- Graphic -----	
----- Back -----	

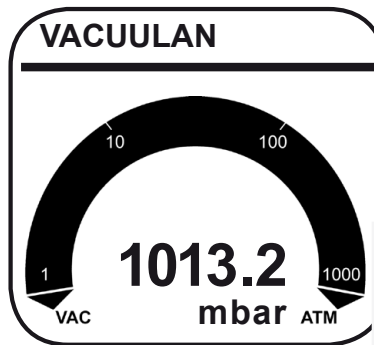
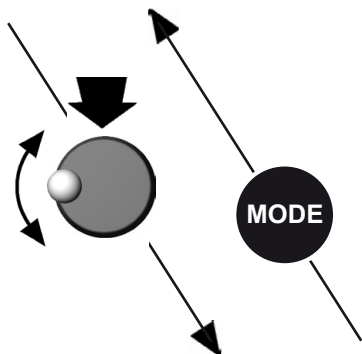
Function

- Pump down
- Vac control
- Program
- VACUULAN
- Configuration

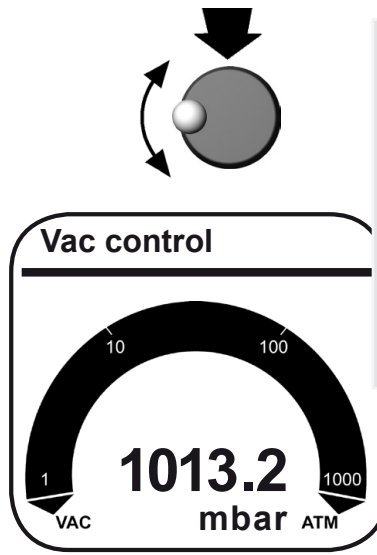
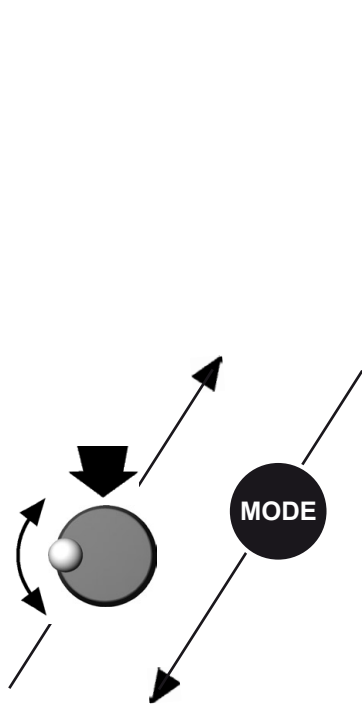
----- Back -----



Configuration	
Adjustment	743 Torr
RS-232...	
Sensors...	
Display...	
Autostart	Off
Defaults	Cancel
----- Back -----	

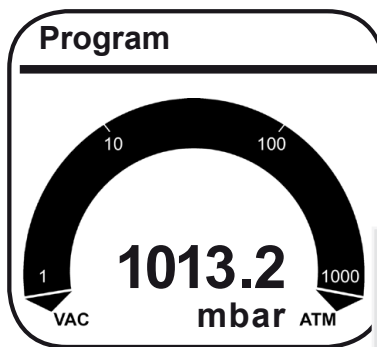
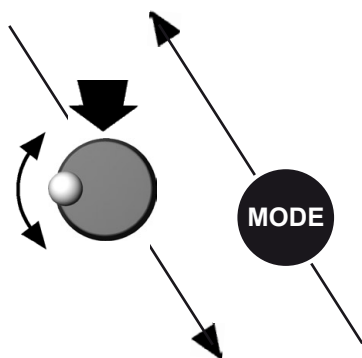


VACUULAN	
Set vacuum	19 Torr
Switch on	150 Torr
Delay	15 min
----- Graphic -----	
----- Back -----	



Vac control	
Set vacuum	75 Torr
Hysteresis	Auto
Minimum	Off
Delay	Off
Duration	Off
----- Graphic -----	
----- Back -----	

Function
Pump down
Vac control
Program
VACUULAN
Configuration
----- Back -----



Program	
Edit	
Open	0
Store	0
Hysteresis	Auto
Delay	Off
----- Graphic -----	
----- Back -----	

Pump down function

➔ Continuous pumping with pressure and time settings

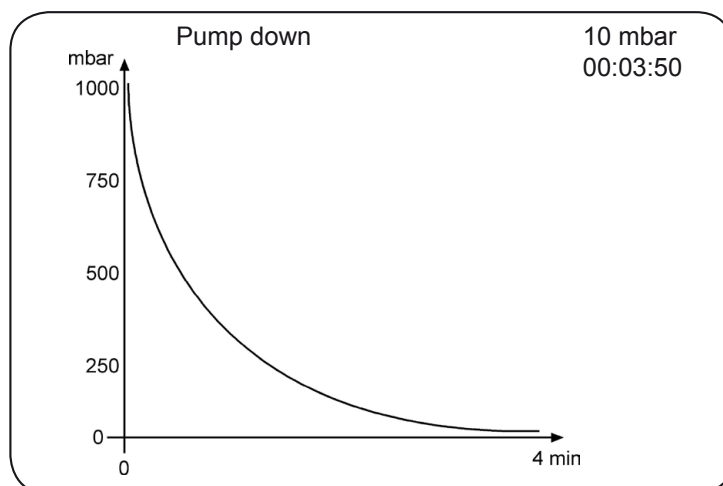
- Operation of a vacuum pump via in-line valve
- Operation of a vacuum pump without in-line valve via VMS (Vacuum Management System), see "Accessories", pg. 79.

Preselections

- ☞ Use the selection knob to select the parameters. All parameters can be altered even while operation control is running.
- ☞ **Minimum:** The controller switches the pump off or closes the in-line valve once the preset value for "Minimum" has been reached. "Minimum" is adjustable in a range of 1-795 Torr (1-1060 mbar) or can be set to "Off".
A preset "Duration" (process time) has no effect if the process is stopped due to a preset "Minimum" before "Duration" is reached.
- ☞ **Delay:** "Delay" determines the time the pump (with VMS module and in-line valve) remains running and the coolant valve remains open after the process has been stopped.
The "Delay" is adjustable in a range of 1-300 minutes or can be set to "Off" ("Off" means that when the process stops, the pump is switched off and the coolant valve closes immediately.).
- ☞ **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, even if a preset "Minimum" is still not reached.
- ☞ If neither "Minimum" nor "Duration" is preset, process control has to be stopped by pressing the "START/STOP" key.

The screen-shot shows the factory-set values.

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



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

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

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

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

- ☞ Press "MODE" key. The controller switches to "Vac control" function, the current vacuum is used as set value.
- ☞ The preset function of the controller does not change due to this temporary switching. When pressing "START/STOP" key, the controller is set again to the "Pump down" function.

Vac Control function

➔ Vacuum control to a preset vacuum value

- Operation of a vacuum pump via in-line valve
- Operation of a vacuum pump without in-line valve via VMS (Vacuum Management System), see "Accessories", pg. 79.

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 lower set point for two-point vacuum control.
The "Set vacuum" is adjustable in a range of 0-795 Torr (0-1060 mbar).
- ☞ **Hysteresis:** The "Hysteresis" is the control bandwidth of the two-point control. A too small hysteresis will lead to frequent switching of the valve or the pump. A too large hysteresis will lead to imprecise control. Suggested "Hysteresis" values (see table) are stored in the controller (setup "Auto") and are adapted automatically to the preset pressure. The hysteresis can be adapted at any time.
The "Hysteresis" is adjustable in a range of 1-225 Torr (1-300 mbar) or can be set to "Auto".

Set vacuum in Torr	5	10	50	80	100	200	500	700
Hysteresis in Torr (suggested values)	2	2	5	8	9	17	40	55

- ☞ **Maximum:** An upper pressure limit can be preselected. The pump switches off if the pressure limit is exceeded, e.g., at the end of suction or filtrations. The pressure limit is only active once the pressure has gone below "Maximum".
The "Maximum" is adjustable in a range of 794-1Torr (1059 - 1 mbar) (at the least 1 Torr (mbar) higher than the "Set vacuum") and to "Off". "Off" means that no "Maximum" value is preset.

☞ **Delay:** "Delay" determines the time the pump (with VMS module and in-line valve) remains running and the coolant valve remains open after the process has been stopped.

The "Delay" is adjustable in a range of 1-300 minutes or can be set to "Off" ("Off" means that when the process stops, the pump is switched off and the coolant valve closes immediately.).

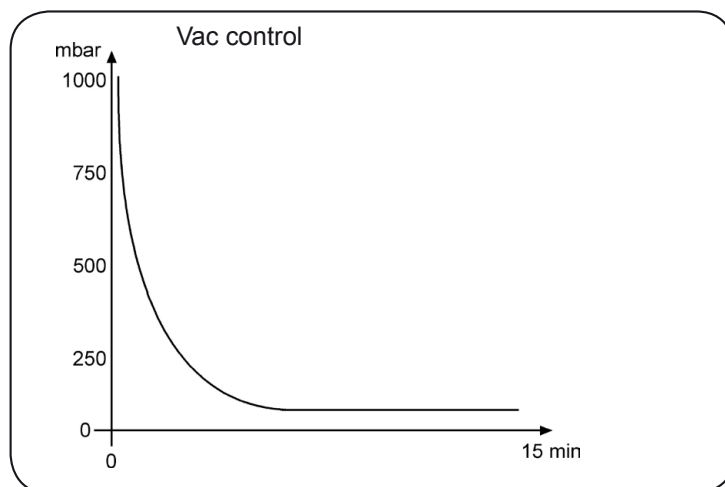
☞ **Duration:** "Duration" determines the total process time since control start.

A preset "Duration" (process time) has no 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-shot shows the factory-set values.

Vac control	00:00:00
Set vacuum	75 Torr
Hysteresis	Auto
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.

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 fine-adjusted by turning the selection knob while process is running.

- ☞ Turn the selection knob.
- ☞ A full turn causes a change of the "*Set vacuum*" of 9 Torr (12 mbar).
- ☞ Turning the knob one detent causes a change of the "*Set vacuum*" of 1 Torr (mbar).

Program function

- **Permits ten programs to be defined and stored, each with up to ten program steps with preset values for vacuum and time.**

- 👉 **Edit:**

Use to define the preset values for the process run:

Time: Defines either the process runtime for each program step to reach a preset vacuum level or, if programming a "Step", the runtime after having achieved the vacuum level. The 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. Terminate the process by pressing the "START/STOP" key .

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.

- 👉 **Open:** Choose program (Programs 0 - 9).

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

- 👉 **Hysteresis:** The "*Hysteresis*" is the control bandwidth of the two-point control. A too small hysteresis will lead to frequent switching of the valve or the pump. A too large hysteresis will lead to imprecise control. Suggested "*Hysteresis*" values are stored in the controller (setup "Auto") and are adapted automatically to the preset pressure. The hysteresis can be adapted at any time.

The "*Hysteresis*" is adjustable in a range of 1-225 Torr (1-300 mbar) or can be set to "Auto".

- 👉 **Delay:** "*Delay*" determines the time the pump (with VMS module and in-line valve) remains running and the coolant valve remains open after the process has been stopped.

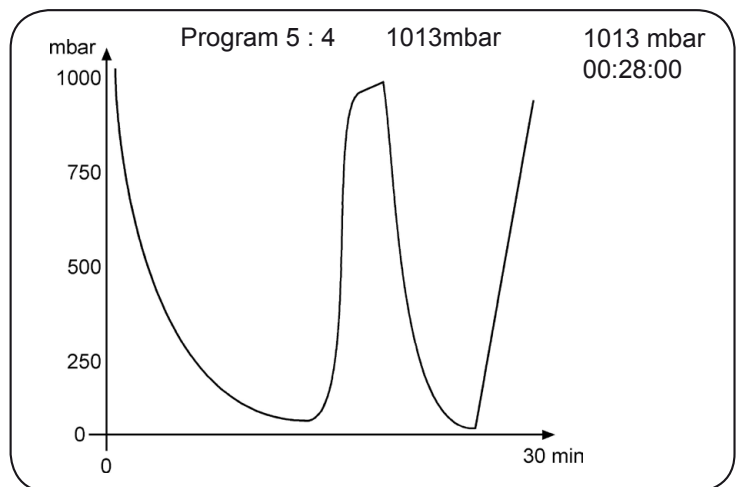
The "*Delay*" is adjustable in a range of 1-300 minutes or can be set to "Off" ("Off" means that when the process stops, the pump is switched off and the coolant valve closes immediately.).

Editing:

- ☞ To select row: turn and press selection knob.
- ☞ To adjust parameter: turn the selection knob.
- ☞ To confirm parameter: Press selection knob. Controller will accept change and jump to the next parameter in the same row.
- ☞ After 5 seconds without a change, the parameter is assumed to be the current setting. Select the next row to edit or return to the Program menu.

The screen-shot shows the factory-set values.

Program	00:00:00
Edit	
Open	0
Store	0
Hysteresis	Auto
Delay	Off
----- Graphic -----	
----- Back -----	



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

Program number, and the step number in that program, along with the vacuum setting, the actual current pressure and the actual runtime are displayed across the top.

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

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

The most recent process (except in "VACUULAN" function) 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.

Application example

Example

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

Program				
No	hh:mm:ss	Vac	Vent.	Step
01	00:00:00	ATM	✓	✓
02	00:05:00	10		
03	00:15:00	10		
04	00:01:00	500	✓	
05	00:09:00	500	✓	
06	00:10:00	5		
07	00:20:00	5		
08	00:01:00	ATM	✓	✓
09	00:00:00			
10	00:00:00			
----- Back -----				
01:11:00				

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" by pressing the selection knob.

In step 2, pumping down begins, reaching 10 Torr/mbar within 5 minutes (linear ramp), as "Step" is not set.

Step 3: Vacuum holds there for 15 minutes.

Step 4: Vents to 500 Torr/mbar within 1 minute.

Step 5: Holds 500 Torr/mbar for 9 minutes.

Step 6: Pumping down, reaching 5 Torr/mbar within 10 minutes (linear ramp), as "Step" is not set.

Step 7: Vacuum holds there for 20 minutes.

Step 8 vents to atmospheric pressure as fast as possible and switches off the control after one minute.

VACUULAN function

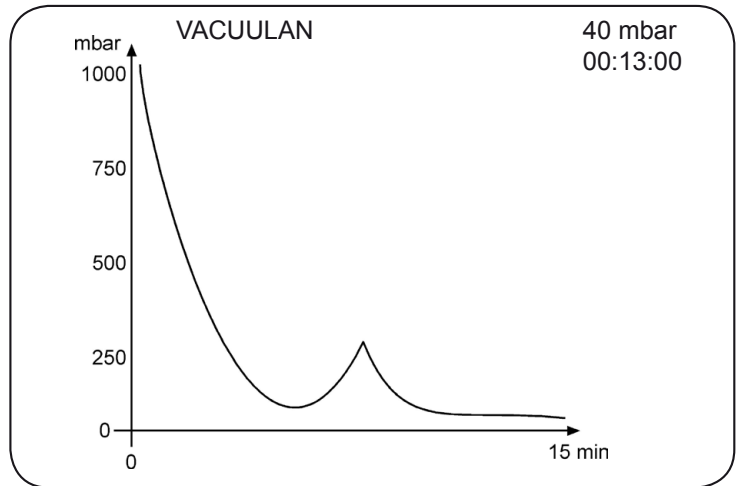
- **Optimizes vacuum control for vacuum networks (e.g., VACUUBRAND VACUU•LAN)**
- **Operation of a vacuum pump via in-line valve**
- **Operation of a vacuum pump without in-line valve via VMS (Vacuum Management System), see "Accessories", pg. 79.**

Preselections

- ☞ Use the selection knob to select the parameters.
- ☞ **Set vacuum** (the lower switch-off value): If the pressure drops below the "Set vacuum", a time-meter starts to run. When the pressure exceeds the "Switch on" pressure, the time meter is reset. If the "Set vacuum" is not reached within 100 hours, the controller signals an error.
The "Set vacuum" is adjustable in the range of 1-795 Torr (1-1060 mbar).
- ☞ **Switch on** (the higher switching value): If the pressure exceeds this pressure, pumping down starts again.
The "Switch on" pressure is adjustable in the range of 2-795 Torr (2-1060 mbar).
In the event of a sudden high-pressure spike, pumping starts again even if the "Switch on" pressure has not been reached (pressure increase control).
- ☞ **Delay**: If the vacuum is below "Set vacuum" for longer than the "Delay" time, the pump is stopped. Pumping starts again in the event of a 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" ("Off" means that the pump stops immediately when the pressure drops below "Set vacuum".).

This screen-shot shows the factory-set values.

VACUULAN	00:00:00
Set vacuum	19 Torr
Switch on	150 Torr
Delay	15 min
----- 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.

Application examples

Assembly of a vacuum system

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

Vacuum for filtration and suction

- ☞ Select "**Pump down**" function.
- ☞ Set "*Minimum*" to a value which provides adequate suction but does not lead to evaporation of the solvent.
- ☞ Start process by pressing "START/STOP" key.

alternatively:

- ☞ Select "**Vac control**" function.
 - ☞ Set "Set vacuum" (and "*Hysteresis*", if necessary) to a value which does not lead to evaporation of the solvent.
 - ☞ Set "*Maximum*" pressure setting so that pump will switch off at the end of the filtration process, or in the event that a filter cake cracks, leading to a sudden pressure increase.
 - ☞ Start process by pressing "START/STOP" key.
- ☞ **Tip for filtration:** Adjust preset pressure to a value well above the boiling pressure of the solvent (e.g., for water >>15 Torr (20 mbar)). Set the maximum pressure to e.g., 375 Torr (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**" function.
- ☞ Set "*Minimum*" to prevent volatile components from evaporating. The process is stopped automatically as soon as "*Minimum*" is reached.
- ☞ Set a process time ("*Duration*") if necessary.
- ☞ Start process by pressing "START/STOP" key.

alternatively:

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

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

Semi-automatic distillation and evaporation

- ☞ Select function "**Pump down**".
- ☞ Start process by pressing "START/STOP" key.
- ☞ Observe process. As soon as evaporation starts, press "MODE" key (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.

alternatively:

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

- ☞ Select "**Vac control**" function.
- ☞ Set "*Set vacuum*" (and "*Hysteresis*", if necessary) depending on the solvent and the bath temperature.
- ☞ To set "*Maximum*" is usually not necessary, unlike filtrations, 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.
- ☞ Use "*Delay*" to pump out condensate and clean the pump at the end of the process. The in-line valve is closed and so the pump is separated from the application. During "*Delay*" the coolant valve is still open.
- ☞ Start process by pressing "START/STOP" key.

Vacuum for VACUU•LAN networks

- ☞ Select function "**VACUULAN**".
- ☞ Set "*Set vacuum*" to a pressure which can be reached reliably in the vacuum network. Take account of the ultimate vacuum of the pump and of the system's leak rate in case of no vacuum demand.
- ☞ Set "*Switch on*" pressure appropriately to ensure sufficient vacuum for all connected applications.
- ☞ Set "*Delay*" if necessary.
- ☞ Start process by pressing "START/STOP" key.

Configuration

In the "Configuration" menu 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", pg. 62.
Adjustment to atmospheric pressure is carried out at an absolute pressure value between 795 - 525 Torr (1060 - 700 mbar). This is especially helpful in high elevation laboratories. Adjustment under vacuum may be done at an absolute vacuum value between 0 - 15 Torr (0 - 20 mbar). In the range between 15 to 525 Torr (20 to 700 mbar) no adjustment is possible; ---- Torr 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", "Finnish".

- ☞ **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".

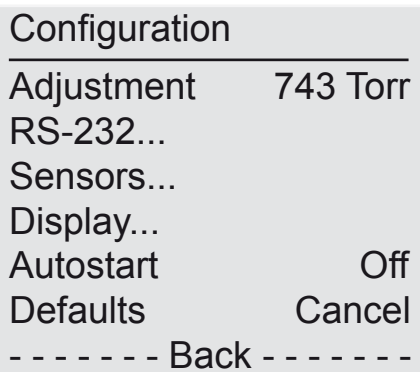


Attention: If "*Autostart*" is preselected, the process starts immediately after power failure without pressing any further key. It is the user's responsibility to ensure that no dangerous status of the system due to the automatic start-

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.

This screen-shot shows the factory-set values.



Configuration

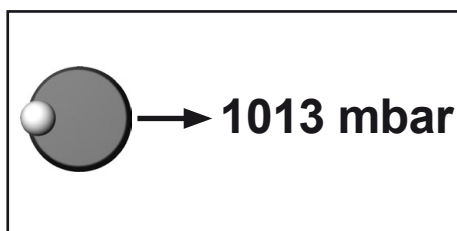
Adjustment	743 Torr
RS-232...	
Sensors...	
Display...	
Autostart	Off
Defaults	Cancel
----- Back -----	

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 known with certainty. The adjustment mode can be activated only if the process control is inactive. Press "START/STOP" key, if necessary. In the range between 15 to 525 Torr (20 to 700 mbar) no adjustment is possible; ---- Torr is displayed.

Adjustment at atmospheric pressure



An adjustment at atmospheric pressure is only possible if the pressure is higher than 525 Torr (700 mbar).

Vent the measurement connection of the CVC 3000 and/or the vacuum system. Make sure that the pressure transducer is at atmospheric pressure.

- In "Configuration" menu, 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, or a nearby airport or other reliable source (taking into account the difference in altitude between the source and the laboratory).

Adjustment under vacuum

0 mbar

An adjustment under vacuum is only possible if the pressure is lower than 15 Torr (20 mbar) absolute.

Evacuate the measurement connection of the CVC 3000 to a pressure < 0.1 Torr (mbar) (e.g. by applying a good two-stage rotary vane pump).

- ➔ In "Configuration" menu, 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 Torr (mbar) reduces the accuracy of the measurement. If the pressure is significantly higher than 0.1 Torr (mbar), adjustment to a reference pressure is recommended.

Adjustment at a reference pressure



Instead of adjustment under vacuum to a pressure < 0.1 Torr (mbar), adjustment to a precisely known reference pressure within the range of 0..... 15 Torr (20 mbar) is possible. Evacuate the measurement connection of the CVC 3000 to a pressure within 0 15 Torr (0.....20 mbar).

- ➔ In "Configuration" menu, 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 15 Torr (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).

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 $7.5 \cdot 10^{-3}$ Torr to 750 Torr (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.

Rely on 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.

To order **DKD calibration** of the CVC 3000 pressure transducer,
order number: **900217**

Cleaning the pressure transducer

- ➔ **Attention: Never use a pointed 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", pg. 62.

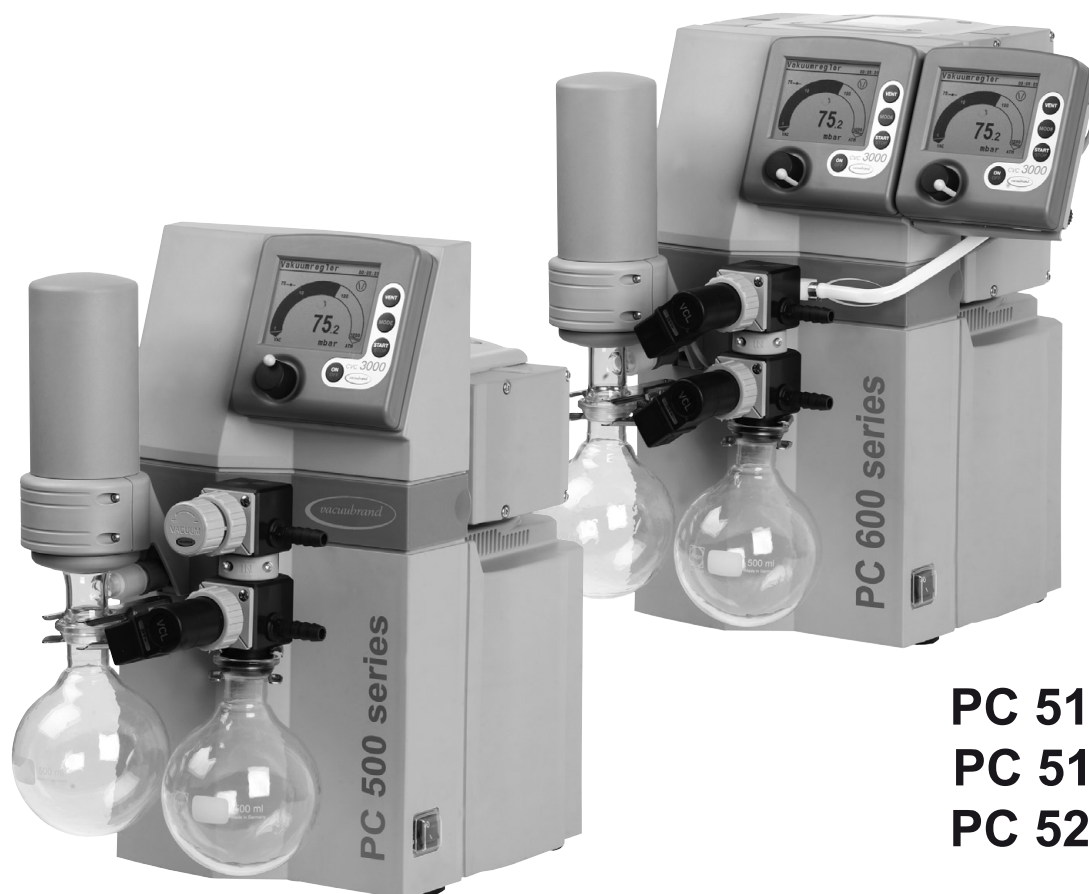
Please continue with part 2 of this manual!



Technology for Vacuum Systems

Instructions for use

Part II of II



Part II:
Interface parameters - Accessories -
Maintenance

PC 510 NT
PC 511 NT
PC 520 NT

PC 610 NT
PC 611 NT
PC 620 NT

Chemistry pumping units

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Interface parameters

The CVC 3000 controller is equipped with a serial interface (RS 232C, nine-pin 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.

The factory-set read and write commands are completely compatible with the VACUUBRAND CVC 2000 controller (see sections "Read / Write commands CVC 2000"). An extended instruction set is available using the command "CVC 3" (see sections "Read / 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 "Configuration" menu in "RS-232" submenu using the selection knob.

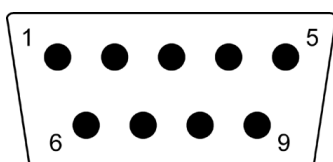
- ➔ Baud: 2400, 4800, 9600 or 19200
- ➔ Parity: 8-N-1, 7-O-1 or 7-E-1
- ➔ Handshake: Off, Xon-Xoff or RTS-CTS
- ➔ Remote: On or Off
- ➔ Timeout: Sending 1s, receiving 10s.

In remote mode (Remote On, with the "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: Switch off the controller. Then switch the controller back on, and press the selection knob within 2s.

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

Pin assignment RS-232 C



2: RxD
3: TxD
4: DTR

5: Mass
7: RTS
8: CTS

9: +5V (Bluetooth)

Read commands "CVC 2000"

Command	Operation	Response	Description
IN_PV_1	current pressure	XXXX mbar/ Torr/hPa	unit according to preselections
IN_PV_2	current frequency	XX.X Hz	pump speed
IN_CFG	device set preselections	0XXXX 1XXXX 2XXXX 3XXXX X0XXX X1XXX XX0XX XX1XX XXX0X XXX1X XXXX0 XXXX1	VACUU•LAN continuous pumping vacuum control without automatic vacuum control with automatic no coolant valve coolant valve no venting valve venting valve no automatic switch off automatic switch off remote operation off remote operation on
IN_ERR	error code	1XXX X1XX XX1X XXX1	fault at pump electronics overpressure maloperation mode pressure transducer last command to interface incorrect
IN_STAT	status of process control	0XXX 1XXX X0XX X1XX XX00 XX01 XX02 XX03 XX10 XX11 XX20 XX21 XX22 XX23 XX30 XX31 XX32 XX33	coolant valve closed coolant valve open venting valve closed venting valve open VACUU•LAN: inactive VACUU•LAN: pumping down, current pressure > selected pressure VACUU•LAN: pumping down, time for automatic switching off is running VACUU•LAN: system is switched off continuous pumping: not active continuous pumping; active vacuum control: not active vacuum control: current pressure above set vacuum vacuum control: current pressure equals set vacuum (± 1 Torr/mbar) vacuum control: current pressure below set vacuum automatic: not active automatic: determining boiling point automatic: adjusting boiling point automatic: system is switched off

Write commands "CVC 2000"

Command	Operation	Response	Description
OUT_MODE	function	1 2 3 30 31 32	continuous pumping vacuum control without automatic vacuum control with automatic <i>optional: sensitivity: low</i> <i>optional: sensitivity: normal</i> <i>optional: sensitivity: high</i>
OUT_SP_1	set vacuum	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_V	set vacuum with venting*	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar, unit according to preselection
OUT_SP_2	set frequency	XX.X	motor speed in Hz (01.0 to 60.0 in steps of 0.5 Hz or 99.9 for "HI")
OUT-SP_3	vacuum for switch on (VACUU•LAN)	XXXX	0002 to 0795 Torr or 0002 to 1060 mbar (hPa), unit according to preselection
OUT_SP_4	delay	XX:XX	hh:mm (hours:minutes)
OUT_SP_5	vacuum for automatic switching off	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_6	time for automatic switching off (VACUU•LAN)	XX:XX	hh:mm (hours:minutes)
START	starting process control		
STOP	stopping process control	1 2	termination of process control termination of process control and storage of the current pressure as new set point
REMOTE	remote operation**	0 1	set controller to local operation set controller to remote operation
OUT_VENT	driving venting valve	0 1	close venting valve (not automatically) open venting valve (process control stopped)

* Pressure setting with venting is only possible in "Vac control" function if a venting valve is connected and configured, and vacuum control is started. The venting valve opens automatically if the actual pressure is at least 7.5 Torr (10 mbar) below the preset pressure. Automatic venting becomes inactive if vacuum control is stopped (by pressing "START/STOP" or "VENT"), a pressure value is set 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 can occur due to the change of the mode of operation, and must take appropriate safety precautions, especially if selecting remote operation interferes with a locally operated active process.

Command	Operation	Response	Description
IN_STAT	status process control	0XXXXX 1XXXXX X0XXXX X1XXXX XX0XXX XX1XXX XXX0XX XXX1XX XXXX0X XXXX1X XXXX2X XXXX3X XXXX4X XXXX5X XXXXX0 XXXXX1 XXXXX2 XXXXX3	pump off pump on in-line valve closed in-line valve open coolant valve closed coolant valve open venting valve closed venting valve open VACUU•LAN Pump down Vac control Auto mode Program measuring device control off pump down - determining boiling point set vacuum reached - boiling pressure found current pressure below set vacuum - automatic switch-off
IN_ERR	fault status	0XXXXXXXXX 1XXXXXXXXX X0XXXXXXXX X1XXXXXXXX XX0XXXXXXXX XX1XXXXXXXX XXX0XXXXXX XXX1XXXXXX XXXX0XXXXX XXXX1XXXXX XXXXX0XXX XXXXX1XXX XXXXXX0XX XXXXXX1XX XXXXXXXX0X XXXXXXXX1X XXXXXXXXX0 XXXXXXXXX1	no fault at pump fault at pump no fault at in-line valve fault at in-line valve no fault at coolant valve fault at coolant valve no fault at venting valve fault at venting valve no overpressure overpressure no fault at pressure transducer fault at pressure transducer no external fault external fault catchpot not full catchpot full last interface command correct last interface command incorrect
IN_SP_1		XXXX mbar/Torr/hPa	set vacuum unit according to preselections
IN_SP_2		XXX%	maximum speed (100% = "HI")
IN_SP_3		XXXX mbar/Torr/hPa	switching pressure for VACUU•LAN or two point control

Command	Operation	Response	Description
IN_SP_4		XX:XX h:m	delay (hours:minutes) (00:00 = Off)
IN_SP_5		XXXX mbar/Torr/hPa	switch off pressure ("Maximum" for "Vac control", "Minimum" for "Pump down")
IN_SP_6		XX:XX h:m	process runtime (hours:minutes)
IN_SP_P1y	time	XX:XX:XX h:m:s	time in program step y (0.....9)
IN_SP_P2y	pressure	XXXX mbar	pressure in program step y (0.....9)
IN_SP_P3y	venting valve	0	no venting valve in program step y (0.....9)
		1	venting valve in program step y (0.....9)
IN_SP_P4y	Step	0	no "Step" in program step y (0.....9)
		1	"Step" in program step y (0.....9)
IN_SP_P5y	Auto	0	no "Auto" in program step y (0.....9)
		1	"Auto" in program step y (0.....9)
IN_VER		CVC 3000 VX.XX	software version

Write commands "CVC 3000"

Command	Operation	Response	Description
OUT_MODE	function	0	VACUU•LAN
		1	Pump down
		2	Vac control
		3	Auto mode
		30	<i>optional: sensitivity: low</i>
		31	<i>optional: sensitivity: normal</i>
		32	<i>optional: sensitivity: high</i>
OUT_CFG	configuration (bus monitoring)	4	Program
		yXXX	y: 0.....D: language* (hexadecimal), see "Read commands CVC 3000"
		X0XX	pressure unit mbar
		X1XX	pressure unit Torr
		X2XX	pressure unit hPa
		XX0X	Autostart off
		XX1X	Autostart on
XXX0	acoustic signal off		
XXX1	acoustic signal on		

Attention (OUT_MODE): If control is running, it is only possible to switch either from 1 to 2, or from 2 to 3, or from 3 to 2. The set vacuum is adopted in each case.

Command	Operation	Response	Description
OUT-SP_1	set vacuum	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_V	set vacuum with venting	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_2	speed	XXX	speed in % or "HI"
OUT_SP_3	start-up pressure	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_4	delay	XX:XX	hh:mm (hours:minutes)
OUT_SP_5	switch-off pressure	XXXX	0001 to 0795 Torr or 0001 to 1060 mbar (hPa), unit according to preselection
OUT_SP_6	switch-off time	XX:XX	hh:mm (hours:minutes)
OUT_SP_PL	open program	X	program 0.....9
OUT_SP_PS	store program	X	program 0.....9
OUT_SP_P1y	time	XX:XX:XX +XX:XX:XX	total runtime until program step y (0.....9) or time for program step y (0.....9) (additive)
OUT_SP_P2y	pressure	XXXX	pressure at program step y (0.....9)
OUT_SP_P3y	venting valve	0 1	no venting valve in program step y (0...9) venting valve in program step y (0.....9)
OUT_SP_P4y	Step	0 1	no "Step" in program step y (0.....9) "Step" in program step y (0.....9)
OUT_SP_P5y	Auto	0 1 2	no "Auto" in program step y (0.....9) "Auto ←" in program step y (0.....9) "Auto ↓" in program step y (0.....9)
START		1	started
STOP		0 1 2	Stop and delete fault Stop Stop and adopt the set vacuum
REMOTE*		0 1	Remote off Remote on
ECHO**		0 1	Echo off Echo on, write command with return value
CVC		2 3	CVC 2000 commands CVC 3000 commands***
OUT_VENT		0 1 2	venting valve closed venting valve open venting until atmospheric pressure
STORE			store settings permanently, if "ECHO = 1" after realization
OUT_SENSOR		1 2...9	internal sensor external sensors (if connected)

- * If remote operation is selected or deselected, the user has to ensure that no dangerous status of the system can occur due to the change of the mode of operation, and must also take appropriate safety precautions, 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 being switched 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".

Accessories

External pressure transducer VSK 3000 ,	636657
capacitive, ceramic diaphragm sensor 1080-0.1 mbar	
Coolant valve VKW-B , 24 V=	674220
Venting valve VBM-B / KF 16 , 24 V=	674217
VACUU•BUS Y-type adapter	636656
VACUU•BUS extension cable , 6.6ft (2m).....	612552
VACUU•BUS wall jack	636153
Serial cable RS 232C , 9-pin, Sub-D.....	637837
Level sensor	699908
(control of liquid level in catchpots)	
Peltronic exhaust waste vapor condenser	699905
VACUU•BUS Digital-I/O-Module	636228
(e.g., fault indicator / remote module)	
VACUU•BUS Analog-I/O-Module	636229
(for analog input and output of vacuum and motor speed)	
Silencer (with connection hose).....	636588

Attention: Dust-laden gases, deposits and condensed solvent vapor 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.

Upgrade kit SYNCHRO , for two inlets at PC 510/610 NT	699920
Adapter G 1/4 to PTFE tubing*	677060
for inlet of PC 511/520/611/620 NT	
Small flange KF DN 16	662593
for assembly at inlet of PC 511/520/611/620 NT	
Seal ring for small flange KF DN 16 (662593).....	3120565
Hose nozzle for tubing I.D. 1/4" / 3/8" (6/10 mm)	642470
for inlet at PC 511/520/611/620 NT	
Modification kit for small flange KF DN 16	699939
at inlet of PC 510/610 NT	
Hose nozzle for tubing I.D. 1/4" / 3/8" (6/10 mm)	636635
for inlet at PC 510/610 NT	
Elbow piece (90°) for PTFE tubing*	637873
at inlet of PC 510/610 NT	
Blind flange (C1)	677136
for assembly at valve block or distribution head	
Flow control diaphragm (C2)	677137
for assembly at valve block or distribution head	

Solenoid operated valve (C3-B)636668
 for assembly at valve block or distribution head
Manometer module (C5)677100
 for assembly at valve block or distribution head
PTFE tubing* (sold by meter).....638644

* PTFE tubing O.D. / I.D. 3/8" / 5/16" (DN 10/8 mm)

VMS module A, 100-230 V, 3.5 A, CEE.....676001
VMS module A, 100-230 V, 3.5 A, UK.....676002
VMS module A, 100-230 V, 3.5 A, CH.....676003
VMS module A, 100-230 V, 3.5 A, US.....676004

The 2x5 pole connection cable and the country specific adapter cable (included in the VMS Module A set) are not necessary for pumping units NT, but use instead:

VMS adapter cable.....636655
 (to connect Vacuum Management System VMS Module A to CVC 3000)
Connection cable IEC plug-IEC socket.....636466
 (to connect Vacuum Management System VMS Module A to NT pumping unit)

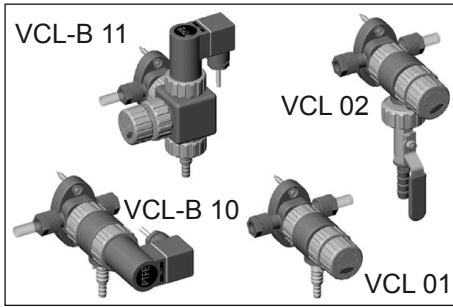


☞ To connect a VMS Module A to a NT pumping unit remove the power cord at the rear side of the pumping unit and connect the pump using the connection cable IEC plug-IEC socket to VMS.

Conversion of VACUUBRAND valves with DIN plug to VACUUBRAND valves with VACUU•BUS plug:

VACUUBRAND-valve with DIN 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 oriented, flexible and cost effective connections according to your requirements. One vacuum pump can support several workstations. Contact VACUUBRAND for details


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 contact VACUUBRAND for further information.

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

Troubleshooting

Fault	Possible cause	Remedy
<input type="checkbox"/> No display.	<ul style="list-style-type: none"> ➔ Electrical power cord not plugged in, electrical supply failure? ➔ Device fuse blown? ➔ Device switched off? ➔ VACUU • BUS cable to internal power supply not plugged in at controller? ➔ Other than above mentioned causes? 	<ul style="list-style-type: none"> ✓ Plug in power cord. Check fuse. ✓ Identify cause of failure. Replace device fuse. ✓ Switch on controller and/or pump. ✓ Plug in VACUU • BUS cable at CVC 3000 controller. ✓ Contact local distributor.
<input type="checkbox"/> Display disappears.	<ul style="list-style-type: none"> ➔ Too much load (e.g., valves) connected? ➔ Short circuit at connected valves? ➔ Short circuit at the RS 232 plug? ➔ Other than above mentioned causes? 	<ul style="list-style-type: none"> ✓ Check current draw of the connected devices. ✓ Replace valves. ✓ Check plug and cable. ✓ Contact local distributor.
<input type="checkbox"/> Pressure reading incorrect.	<ul style="list-style-type: none"> ➔ Pressure transducer decalibrated? ➔ Humidity in the measurement chamber? ➔ Pressure transducer contaminated? ➔ Other than above mentioned causes? 	<ul style="list-style-type: none"> ✓ Readjust CVC 3000. ✓ Let the pressure transducer dry, e.g., by pumping. Readjust if necessary. Determine and eliminate the cause for humidity. ✓ See "Cleaning the pressure transducer". ✓ Contact local distributor.
<input type="checkbox"/> Digital pressure reading is flashing, display shows "0.0".	<ul style="list-style-type: none"> ➔ Pressure transducer not correctly adjusted under vacuum? 	<ul style="list-style-type: none"> ✓ Adjust CVC 3000 correctly.
<input type="checkbox"/> No digital pressure reading.	<ul style="list-style-type: none"> ➔ Pressure transducer defective? 	<ul style="list-style-type: none"> ✓ Contact local distributor.

Fault	Possible cause	Remedy
<input type="checkbox"/> Digital pressure reading is flashing, one blip*.	➔ Overpressure at the pressure transducer pressure > 795 Torr (1060 mbar)? 	✓ Release pressure immediately (risk of bursting).
<input type="checkbox"/> Warning triangle and black valve symbol are flashing, two blips*.	➔ External venting valve removed or defective?	✓ Connect valve or replace with a new one or reconfigure without valve.
<input type="checkbox"/> 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 to reconfigure.
<input type="checkbox"/> 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.
<input type="checkbox"/> No digital pressure reading. Warning triangle is flashing, five or seven blips*.	➔ Five blips: External sensor defective or removed?	✓ Plug in external sensor or use new one or reconfigure without sensor.
	➔ Seven blips: Internal sensor defective?	✓ Contact local distributor.
<input type="checkbox"/> Warning triangle and pump symbol are flashing, six blips*.	➔ NT VARIO / VARIO-B pump and VMS** (Vacuum Management System) connected?	✓ Remove one component. Restart controller.
	➔ Fault at the NT VARIO pump or at the VMS?	✓ Check pump and/or VMS or reconfigure.
	➔ Fault at the NT VARIO / VARIO-B pump?	✓ Check pump, restart controller.
<input type="checkbox"/> Clock symbol is flashing.	➔ Preselected process time is over?	✓ Confirm by pressing START/STOP key.
<input type="checkbox"/> Venting valve does not respond, valve symbol is displayed.	➔ External pressure transducer connected and active?	✓ Select internal sensor or connect an external venting valve.
<input type="checkbox"/> Venting valve does not respond, valve symbol is displayed.	➔ Venting valve contaminated?	✓ Clean valve.
<input type="checkbox"/> "Vac control" function: Control stops, "arrow up" is flashing.	➔ Preset maximum pressure exceeded?	✓ Confirm by pressing START/STOP key. Change maximum pressure value if necessary.

Fault	Possible cause	Remedy
<input type="checkbox"/> "Pump down" function: Control stops, "arrow down" is flashing.	➔ Pressure below preset minimum pressure?	✓ Confirm by pressing START/STOP key. Change minimum pressure value if necessary.
<input type="checkbox"/> No function is displayed, no menu is available.	➔ No controllable device (valve, VMS, VARIO pump) connected?	✓ Connect device at CVC 3000. Switch CVC 3000 off/on to reconfigure.
<input type="checkbox"/> 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.
<input type="checkbox"/> Controller does not respond when operating any keys. No change after switching off/on.		✓ Contact local distributor.
<input type="checkbox"/> Pump does not start or stops immediately. Warning triangle and pump symbol are flashing.	➔ Motor overloaded? ➔ Overpressure in outlet line? ➔ Pump has been exposed to condensate?	✓ Allow motor to cool down, identify and eliminate cause of failure. Manual reset is necessary. Switch off pump or unplug. ✓ Remove blockage in line, open valve. ✓ Allow pump to run for some minutes with atmospheric pressure at the inlet.
<input type="checkbox"/> Pump does not achieve its ultimate vacuum or usual pumping speed.	➔ Leak in the pipeline or in the vacuum system? ➔ Wrong setting at controller? ➔ Long, narrow vacuum line? ➔ Pump has been exposed to condensate?	✓ Check connections, pipeline and vacuum system. ✓ Select function "Pump down" and check again. ✓ Use lines with larger diameter, length as short as possible. ✓ Allow pump to run for some minutes with atmospheric pressure at the inlet to purge.

Fault	Possible cause	Remedy
<input type="checkbox"/> Pump does not achieve its ultimate vacuum or usual pumping speed.	<ul style="list-style-type: none"> ➔ Pump too hot? ➔ Deposits have been formed inside the pump? ➔ Diaphragms or valves damaged? ➔ Outgassing substances or vapor generated in the process? 	<ul style="list-style-type: none"> ✓ Allow pump to cool down. Determine and eliminate the cause of overheating. ✓ Clean and inspect the pump heads. ✓ Replace diaphragms and/or valves. ✓ Check process parameters.
<input type="checkbox"/> Pump too noisy.	<ul style="list-style-type: none"> ➔ Atmospheric or high pressure at the pump inlet? ➔ Diaphragm crack or diaphragm clamping disc loose? ➔ Other than above mentioned causes? 	<ul style="list-style-type: none"> ✓ Connect hose or silencer to pump outlet. Be careful not to cause outlet overpressure, especially with condensable vapors. ✓ Perform maintenance. ✓ Contact local distributor.
<input type="checkbox"/> Pump seized.		<ul style="list-style-type: none"> ✓ Contact local distributor.

* only if "Sound" "On" is selected

** VMS: Vacuum management system to switch non-VARIO pumps

➔ 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.

Replacing diaphragms and valves

☞ Please read section "Replacing diaphragms and valves" completely before starting maintenance.

The pictures may show other versions of pumps. This does not change the method of replacing diaphragms and valves.

⚠ WARNING

☞ **Never operate the pump if covers or other parts of the pump are disassembled.**

Never operate a defective or damaged pump.



☞ Before starting maintenance, **disconnect the electrical power cord. Wait two minutes** after isolating the equipment from AC power to allow the capacitors to discharge.

☞ Ensure that the pump cannot be operated accidentally.

☞ **Note:** The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance. 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. Use appropriate protective clothing, safety goggles and protective gloves.

☞ Avoid the release of pollutants.

⚠ CAUTION

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

• Check every motor capacitor regularly by measuring its capacity and estimating its service life. Replace old capacitors early enough to prevent a failure. The capacitors must be replaced by a trained electrician.

• Allow sufficient cooling of the pump before starting maintenance.

- **Vent the pump and isolate it from the vacuum system before you start maintenance.**

NOTICE

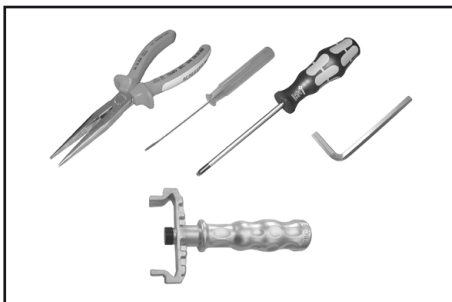
The valves and diaphragms as well as the motor capacitors are wear parts. If the rated ultimate vacuum is no longer achieved or in case of increased noise level, the pump interior, the diaphragms and the valves must be cleaned and the diaphragms and valves must be checked for cracks or other damage.

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the drive system is maintenance free.

In demanding circumstances, it may be efficient to check and clean the pump heads on a regular basis. In normal use, the lifetime of the diaphragms and valves is more than 10,000 operating hours.

- Prevent internal condensation, transfer of liquids or dust. The diaphragms and valves will be damaged if liquid is pumped in significant amount.
- Carry out maintenance frequently if the pump is exposed to corrosive media or in case of deposits.
- Regular maintenance will improve the lifetime of the pump and also protect both users and the environment.

Service kit for PC 5xx NT	696869
Service kit for PC 6xx NT	696870
Diaphragm key (width 66 mm)	636554



Tools required (metric):

- Torx driver T10 / T20
- 5 mm wide Allen key
- 2.5 mm wide Allen key
(only PC 520/620 NT)
- 2.5 mm wide slotted screwdriver
- Flat pliers
- Diaphragm key width 66 mm

Cleaning and inspecting the pump heads

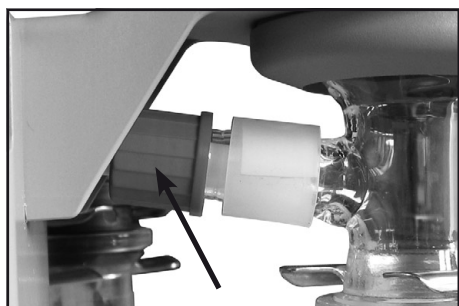
The replacement of the diaphragm and the replacement of the valves can be carried out separately.

- ☞ To replace the valves, remove the head covers of one side of the pump along with the assembled valve heads and fittings.
- ☞ To maintain the diaphragms, the valve heads and the fittings need not be disassembled. The head covers can be removed along with the assembled valve heads and fittings.

- ☞ Service only one side of the pump at a time to avoid the mixing of parts.



- ➡ Remove catchpots (9) at inlet and outlet (see "Use and operation", page 28).



Disassemble the exhaust vapor condenser EK:

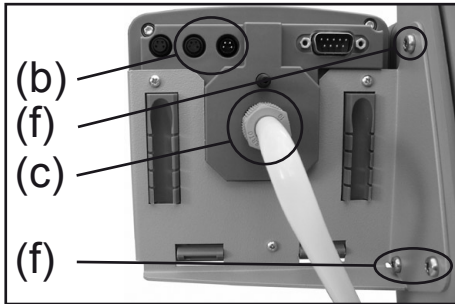
- ➡ Loosen the union nut at the inlet of the exhaust vapor condenser.



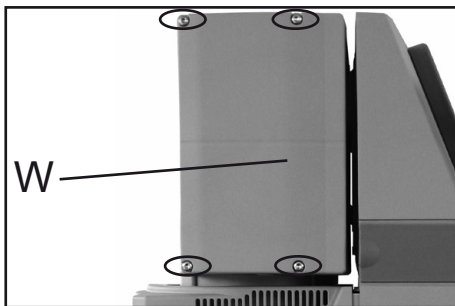
- ➡ Remove the 4 screws affixing the counter holder of the exhaust vapor condenser with a Torx driver T10. Remove the exhaust vapor condenser. In doing so pull the PTFE hose out of the inlet of the exhaust vapor condenser.

PC 520 NT / PC 620 NT:

- ➔ Remove the second controller and its holding plate.



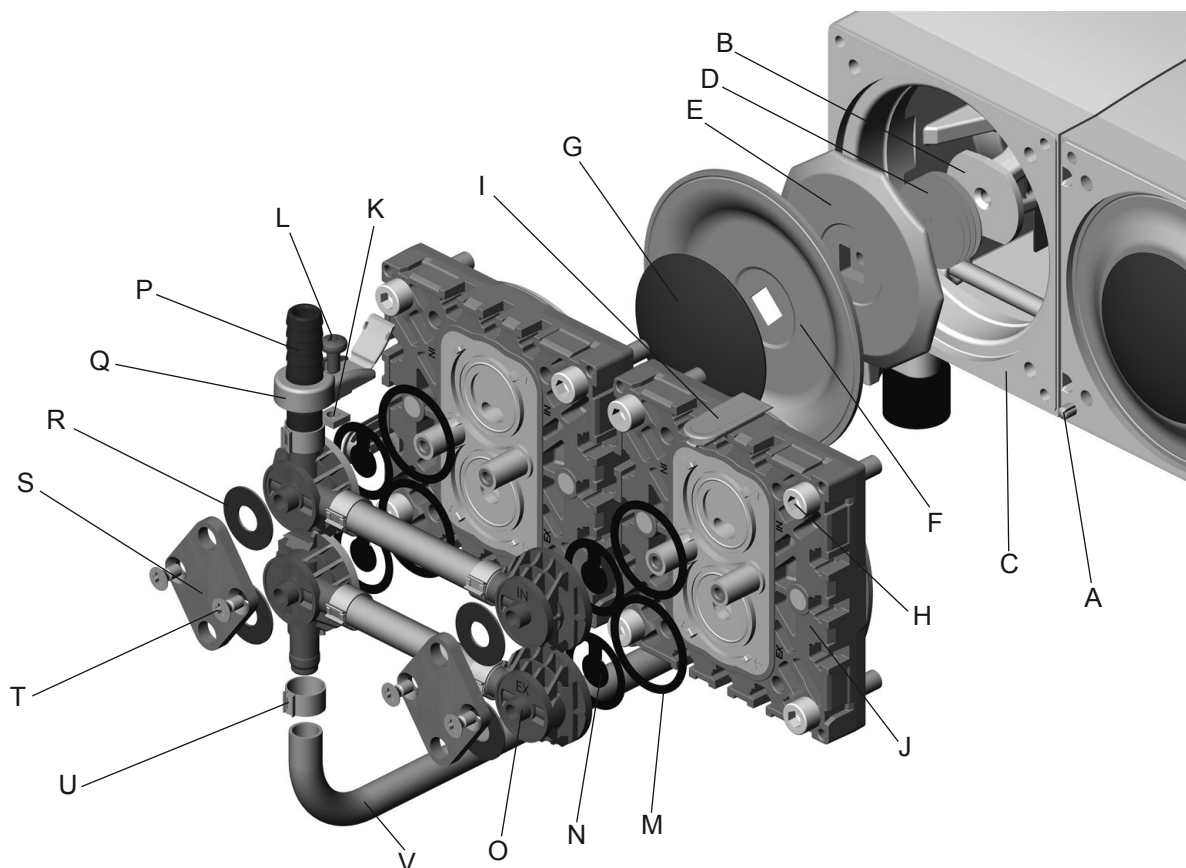
- ➔ Unplug in the VACUU•BUS lines at the rear of the controller (b): Power supply line of the controller and control line of the in-line valve. **Attention:** Do not apply off-axis forces when removing plug connections!
- ➔ Loosen the union nut at the vacuum connection (c) of the controller. Remove the PTFE hose from the vacuum connection.
- ➔ Remove the three Allen screws (f) affixing the holding plate with a 2.5 mm wide Allen key. Remove the controller together with its holding plate. Pay attention to the washers under the screws.
- ➔ For maintenance, lay the pumping unit on its side with the pump heads to be maintained at the top. Support the pumping unit appropriately.



- ➔ Remove the 4 screws affixing the head cover cowling (W) with a Torx driver T20. Pay attention to the washers under the screws and remove.
- ➔ Pull off head cover cowling (W) carefully. Do not tilt.

View of the disassembled pump head parts

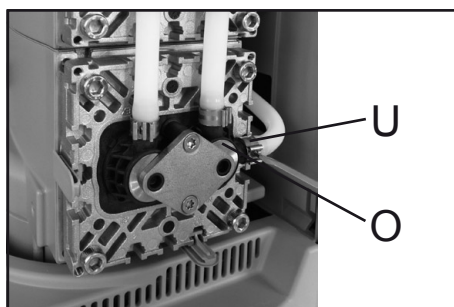
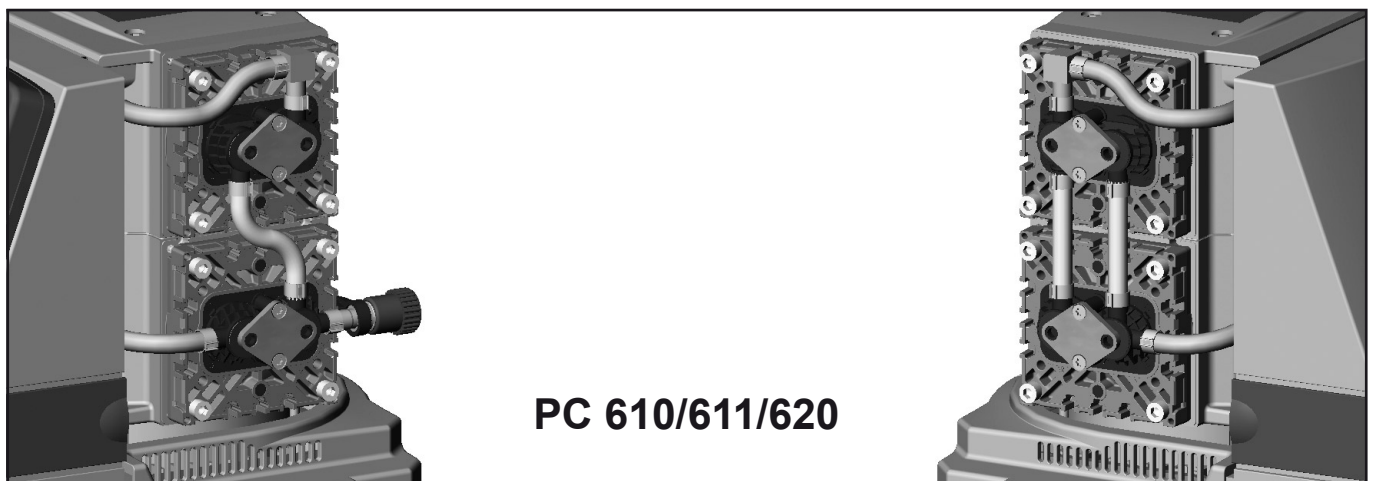
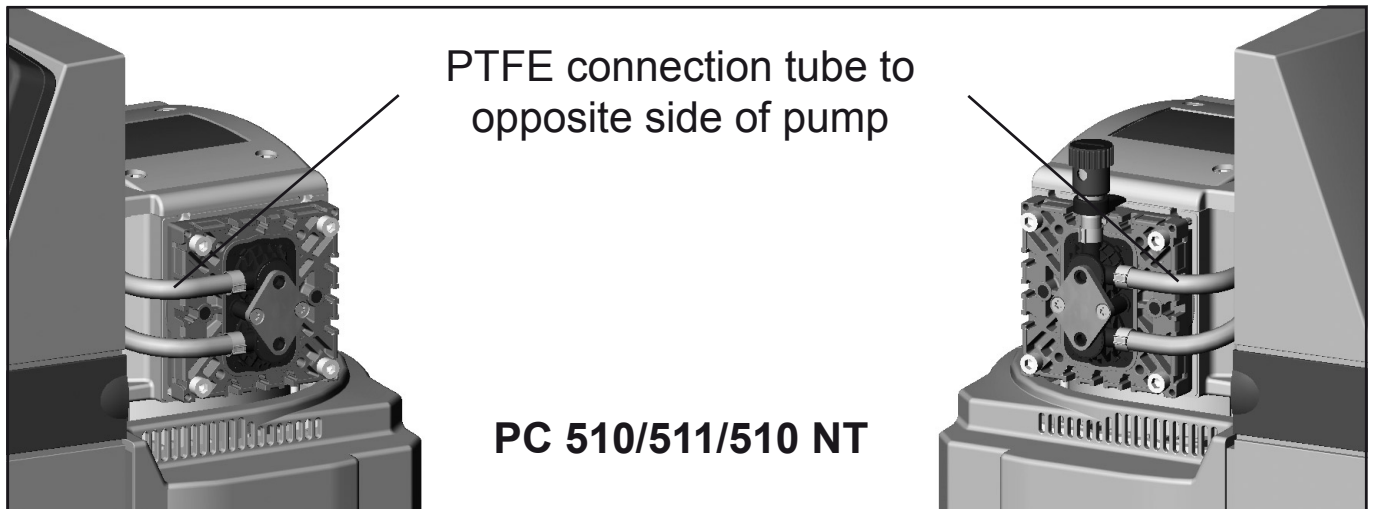
(fig.: MD 4C NT VARIO)



- | | |
|--|---|
| A: Head alignment pin / mark | L: Fillister head screw |
| B: Connecting rod | M: O-ring |
| C: Housing | N: Valve |
| D: Washer | O: Valve head |
| E: Diaphragm support disc | P: Hose nozzle |
| F: Diaphragm | Q: Connection fastener
with hinged cover |
| G: Diaphragm clamping disc
with square head screw | R: Disc spring |
| H: Allen screw | S: Clamping bracket |
| I: Cap | T: Countersunk screw |
| J: Head cover | U: Hose clip |
| K: Square nut | V: Connection tube |

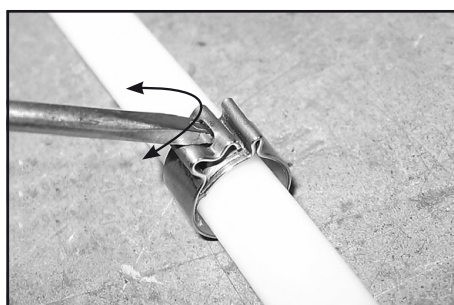
This labeling is used throughout the following pages.

Fittings and tubing of the different pump models:



Detach the coupling of the connection tube (V) to the other side of the pump as well as the hose connection to the inlet/outlet of the vacuum system at the valve head (O).

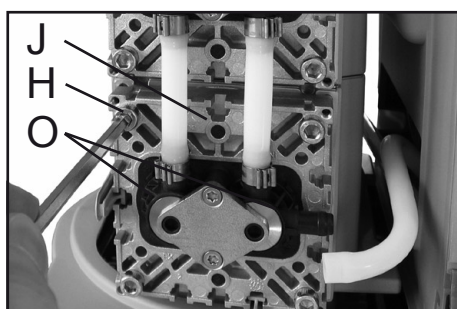
- Open the hose clip (U) with a slotted screwdriver.
- Pull the tubing off the hose connector.



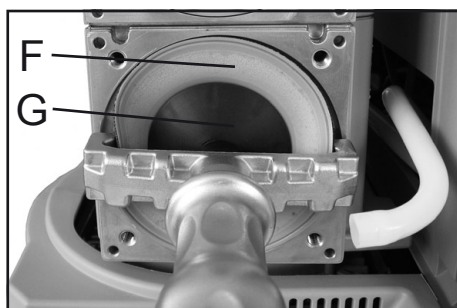
Opening the hose clip:

- Apply slotted screwdriver as shown and turn.

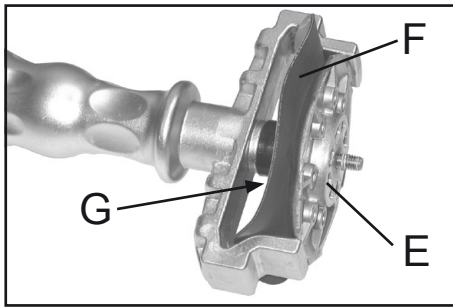
Replacing the diaphragm



- ➔ Disassemble head covers (J) to check the diaphragm (F).
- ➔ Unscrew four (pump with two heads) or eight (pump with four heads) Allen screws (H) with a 5mm wide Allen key. Remove both head covers (J) (pumps with two heads: only one head cover) together with valve heads (O) and connections.
- ☞ It is not necessary to disassemble the valve heads (O), the connection fasteners (Q), or the hose connection between the adjacent head covers (pumps with four heads).

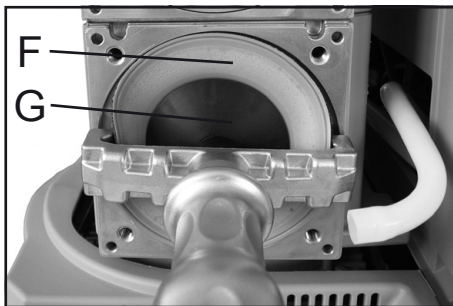


- ☞ Check diaphragm (F) for damage and replace if necessary.
- ➔ Lift diaphragm carefully sidewise.
- ☞ Never use a pointed or sharp-edged tool to lift the diaphragm.
- ➔ Use the diaphragm key to grip the diaphragm support disc (E) below the diaphragm.
- ➔ Unscrew diaphragm support disc (E) with diaphragm (F) and diaphragm clamping disc (G).
- ➔ Check for washers (D) between the diaphragm support disc (E) and the connecting rod (B). Do not mix the washers from the different pump heads, since these are set at the factory to ensure proper pump performance. Make sure that the original number is reassembled at the individual pump head.
- ☞ Too few washers: The pump will not attain vacuum specification. Too many washers: Diaphragm clamping disc will hit head cover, causing noisy operation and possibly causing the pump to seize up.
- ☞ If the old diaphragm is difficult to separate from the diaphragm support disc, immerse assembly in naphtha or petroleum ether. Do not inhale vapors!



- ➡ Position new diaphragm (F) between diaphragm clamping disc with square head screw (G) and diaphragm support disc (E).
- ☞ Note: Position diaphragm with pale side towards diaphragm clamping disc (facing pump chamber).

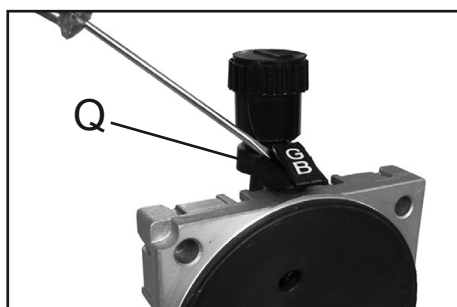
- ☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
- ➡ Lift the diaphragm at the side. Place the diaphragm carefully together with diaphragm clamping disc and diaphragm support disc in the diaphragm key.
- ☞ Avoid damage of the diaphragm: Do not excessively bend or crease the diaphragm.



- ☞ Assemble the original number of washers (D) between diaphragm support disc (E) and connecting rod (B).
- ➡ Screw diaphragm clamping disc (G), diaphragm (F), diaphragm support disc (E), and washers (D) to connecting rod (B).

- ➡ Optimum torque for the diaphragm support disc: 4.4 ft·lb_f (6 Nm), it is recommended to use a torque wrench. Attach Allen key to diaphragm key (hexagonal bolt 6 mm wide).
Note: Never use the diaphragm key with any additional tools like tongs or Allen keys without appropriate torque limitation.

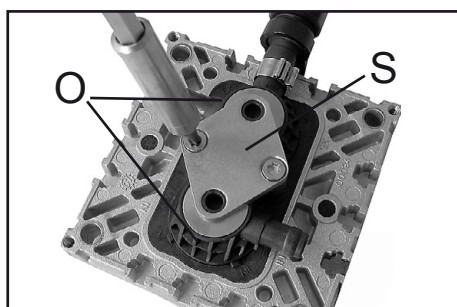
Replacing the valves



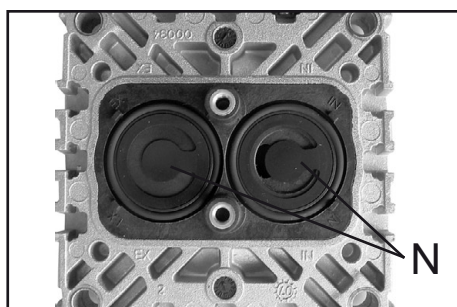
- ➔ Open the hinged cover of the connection fastener (Q) with a slotted screwdriver.



- Loosen connection fastener slightly.
- ➔ Turn the fillister head screw (L) with a Torx driver T20 at most one turn.
- ☞ Do not detach the fillister head screw from the square nut (K).

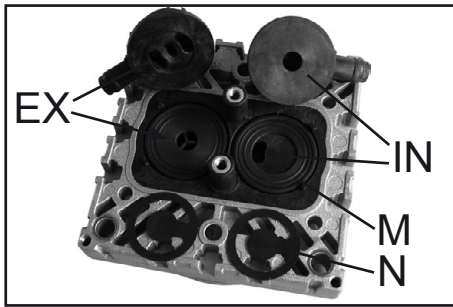


- Loosen the clamping brackets (S) on the valve heads (O).
- ➔ Unscrew at each clamping bracket the two countersunk screws with a Torx driver T20. Remove the clamping brackets.

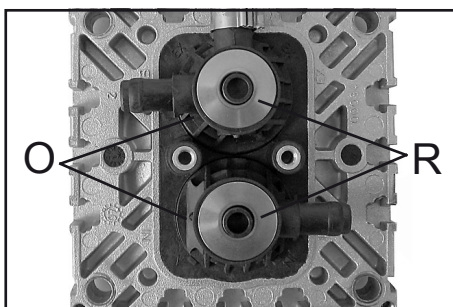


- ➔ Remove valve heads (O) along with the disc springs (R), connection tube if applicable, and connection fasteners (Q) or move the valve heads carefully aside. Note position and orientation of the valve heads.
- ☞ Note position and alignment of valves (N).

- ➔ Check valves (N) and O-rings (M) for damage and soiling.
- ➔ Replace valves or O-rings if necessary.
- ➔ Use petroleum ether or other industrial solvent to remove deposits. Do not inhale vapors.



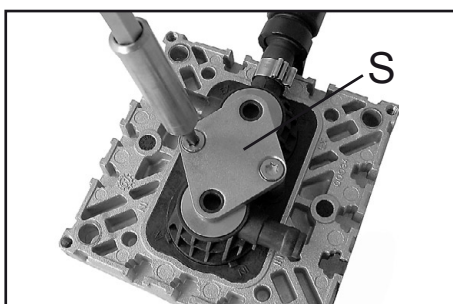
- Insert O-rings (M) and valves (N). See figure for the correct position of the valves:
- ☞ Inlet side (IN):
Marked "IN" next to the valve seat. The valve tongue points at the kidney-shaped orifice in the valve seat.
- ☞ Outlet side (EX):
Marked with "EX" next to the valve seat. The valve is oriented the same direction as the valve at the inlet side.



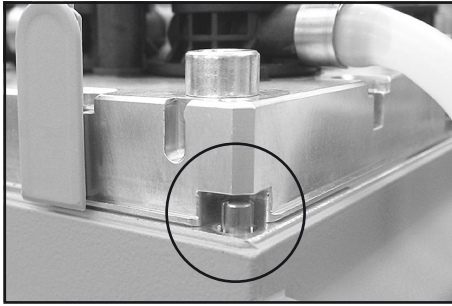
- Position valve heads (O), with connection tube or connection fastener (Q), and disc springs (R) on the valve seats. Position disc springs with large opening downwards. Pay attention to the correct orientation of the valve heads.
- ☞ Center the valve head with respect to the valve seat. The valve head must lie flat on the valve seat.

Valve head with gas ballast connection:

- Insert square nut (K) in the groove of the head cover (J) or position square nut in the groove and then screw on connection fastener.
- ☞ Loosely fasten fillister head screw (L).



- Position clamping bracket (S) with countersunk bores facing upwards.
- Align the countersunk bores with the threaded pegs.
- Loosely fasten the countersunk screws and correct the alignment of the valve heads if necessary.
- Tighten countersunk screws with Torx screwdriver T20.
- ☞ Torque: 2.2 ft·lb_f (3 Nm).

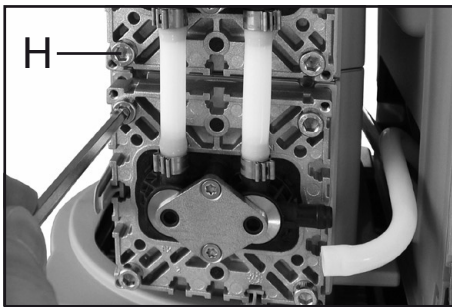


- ➔ Bring the diaphragms (F) into a position, in which they are in contact with the housing (C) and centered with respect to the bore.
- ➔ Put on head cover (J) with valve heads (O) and connections attached.

☞ Pay attention to the correct orientation of the head covers:

Housing with head alignment pin: The head alignment pin (A) at the pump housing (C) has to fit into the recess at the head cover (J).

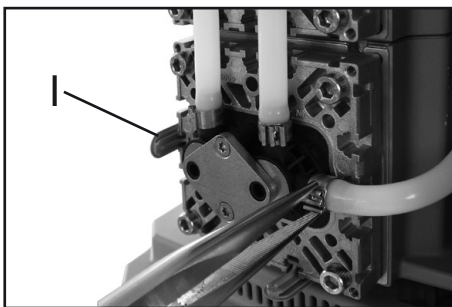
Housing with mark (A): Align the recess at the head cover with the mark at the pump housing.



- ➔ Loosely screw in the Allen head screws (H) at the head covers diagonally at first slightly with a 5 mm wide Allen key, then tighten.

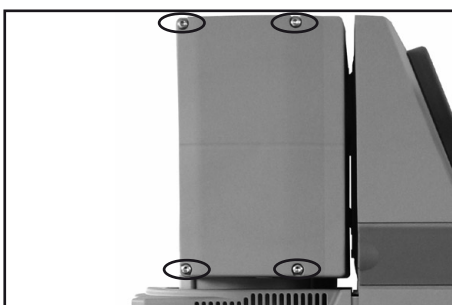
☞ Recommended torque: 8.9 ft·lb_f (12 Nm).

- ➔ Slide the caps (I) into the head cover.



Affix the connection tube (V) to the other side of the pump, as well as the hose connection to the inlet or outlet of the vacuum system at the valve head (O).

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

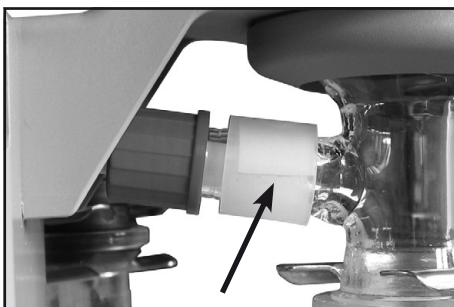


- ➔ Put head cover cowling on.
- ➔ Slide the head cover cowling in the grooves of the caps (I) and under the connection fasteners (Q).
- ➔ Install the washers. Use a Torx driver T20 to attach the 4 screws holding the head cover cowling.



- Tighten the fillister head screws (L) of the connection fasteners (Q) with a Torx driver T20.
- Close the hinged covers.

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



- Check the overpressure safety relief device at the exhaust waste vapor condenser.
- In case pull off the old pressure relief valve and install the new one. Check for correct position of the PTFE-foil under the pressure relief valve.



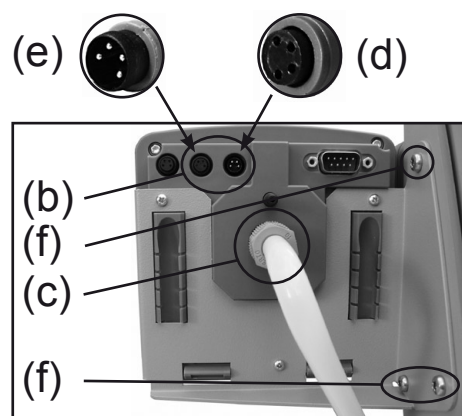
- Feed the PTFE hose into the inlet of the exhaust vapor condenser. Mount the condenser with the counter holder (Torx screws T10) to the pump. Fasten union nut.



- Assemble catchpots (9) with joint clips.

Assembling the second CVC 3000 controller

(only PC 520 NT / PC 620 NT):



- Affix the controller with its holding plate to the pumping unit (three Allen screws (f), 2.5 mm wide Allen key). Install the washers and screw the holding plate into position.
- Slip the loose end of the PTFE hose onto the vacuum connection (c) of the CVC 3000 and fasten with union nut.
- Plug in the VACUU•BUS lines at the rear of the controller (b): Power supply line of the controller (d) and control line of the in-line valve (e).

Attention: Do not apply off-axis forces when assembling or removing plug connections! Observe correct orientation of the plug.

If the pump does not achieve the ultimate vacuum:

- Whenever the diaphragms and valves have been replaced, a break-in period of several hours is required before the pump achieves its ultimate vacuum.
- In case of an 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 break-in period:

Check hose connectors at pump head for leaks. If necessary recheck valve seats and diaphragms.

Replacing the device fuse



- ➔ Before replacing the fuse, switch off the pump. Disconnect the electrical power cord. Wait two minutes after isolating the equipment from AC power to allow capacitors to discharge. Identify and eliminate the cause of failure before switching on the pump again.



fuse holder



- ➔ Keep the snap-fit squeezed and pull the fuse holder out.
- ➔ The fuse holder contains two fuses of the same type. Replace the defective fuse by a fuse of the same type (see "Technical data", pg. 19)
- ➔ Insert the fuse holder into the housing of the pumping unit until it snaps.

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**“, see pg. 104, must be sent to our office fully completed and signed before any equipment is shipped to the authorized service center.

Fax or mail 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 followed.

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 service center.**

- 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 **repair quotations** only on request and always at the customer's expense. If an order is placed, the costs incurred for problem diagnosis 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 may be returned to you disassembled and at your expense.**

In many cases, the **components must be cleaned in the factory** prior to repair.

For cleaning we use an environmentally friendly water-based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurized 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 will also replace parts for cosmetic reasons at your request and at your expense.

NOTICE

Before returning the equipment, ensure that (if applicable):

- Equipment has been cleaned and/or decontaminated.
- All inlet and outlet ports have been capped.
- Equipment has been properly packed, (if necessary, please order original packaging materials at your cost), marked appropriately and the carrier has been notified of any possible contamination.
- The completed health and safety clearance form is enclosed.

We thank you in advance for your understanding of the necessity for these measures that protect our employees, and ensure that your pump is protected in shipment.

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 your processes. Do not incinerate fluoroelastomer seals and O-rings.

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

Warranty

VACUUBRAND shall be liable for insuring that this product, including any agreed installation, has been free of defects at the time of the transfer of risk.

VACUUBRAND shall not be liable for the consequences of improper handling, use, servicing or operation of this product or the consequences of normal wear and tear of wearing parts such as diaphragms, seals, valves, vanes, condensers, oil and the breakage of glass or ceramic parts, for the consequences of chemical, electrochemical or electrical influences or the failure to follow the instructions in this manual.

Claims for defects against VACUUBRAND shall be limited to one year from delivery. The same shall apply to claims for damages irrespective of legal grounds.

For further information on general terms and conditions refer to www.vacuubrand.com.

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 fully 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. Comply with national and international transport regulations.
- b) Inevitably, the repair process will be delayed considerably if this information is missing or this procedure is not obeyed. We appreciate your understanding for these measures which are intended to protect our employees, and ask you that you 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.**

<p>1. Product (Model):</p> <p>2. Serial No.:</p> <p>3. List of substances in contact with the equipment or reaction products:</p> <p>3.1 Chemical/substance name, chemical symbol:</p> <p>a)</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>3.2 Important information and precautions, e.g., danger classification:</p> <p>a)</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>4. Declaration (please mark as applicable):</p> <p><input type="checkbox"/> 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.</p> <p><input type="checkbox"/> 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 <input type="checkbox"/> cleaned <input type="checkbox"/> decontaminated <input type="checkbox"/> sterilized.</p>	<p>5. Method of transport / carrier:</p> <p>..... Date of dispatch to VACUUBRAND:</p> <p>..... If the paint is damaged, we wish a repaint or a replacement of parts for reason of appearance at our expense (see "Notes on return to the factory", pg. 100): <input type="checkbox"/> yes <input type="checkbox"/> no</p> <p>We declare that the following measures - where applicable - have been taken:</p> <p><input type="checkbox"/> The oil has been drained from the product. Important: Dispose of according to national regulations.</p> <p><input type="checkbox"/> The interior of the product has been cleaned.</p> <p><input type="checkbox"/> All inlet and outlet ports of the product have been sealed.</p> <p><input type="checkbox"/> The product has been properly packed and marked as appropriate. If necessary, please order original packaging (costs will be charged).</p> <p><input type="checkbox"/> The carrier has been informed about the hazardous nature of the goods (if applicable).</p> <p>By our signature below we acknowledge that we accept liability for any damage caused by providing incomplete or incorrect information and improper packaging and that we shall indemnify VACUUBRAND from any claims as regards damages from third parties.</p> <p>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.</p> <p>Signature:</p> <p>Name (print):</p> <p>Job title (print):</p> <p>Company's seal:</p> <p>Date:</p>
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Declaration of conformity

Diaphragm pump / Pumping unit

PC 510 NT (230V; 733100, 733101, 733102)
PC 511 NT (230V; 733200, 733201, 733202)
PC 520 NT (230V; 733300, 733301, 733302)
PC 610 NT (230V; 737100, 733101, 733102)
PC 611 NT (230V; 737200, 737201, 737202)
PC 620 NT (230V; 737300, 733301, 733302)

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.

Machine directive (with supplements)

2006/42/EG

Low-Voltage Directive

2006/95/EG

Electromagnetic Compatibility Directive

2004/108/EG

Harmonized Standards applied

DIN EN 12100-2, DIN EN 61010-1, DIN EN 1012-2

DIN EN 61326-1

Management systems

EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 18.05.2010

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place, date

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(Dr. F. Gitmans)

Managing Director

ppa.

.....

(Dr. J. Dirscherl)

Technical Director

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-Technology for Vacuum Systems-

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