vacuubrand

Technology for Vacuum Systems

Instructions for use

PC 500 LAN
PC 600 LAN

Chemistry pumping units

Dear customer,

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

Our quality maxim is the ”zero fault principle”:
Every diaphragm pump, leaving our company, is tested intensively including an endurance run of 18 hours. Therefore also faults, which occur rarely, are identified and can be eliminated immediately.
The achievement of the specifications after the endurance run is tested for every pump.
Every VACUUBRAND pump achieves the specifications. We feel obliged to this high quality standard.
We know that the vacuum pump can not take a part of your real work and hope that our products contribute to an effective and trouble-free realisation of your work.

Yours
VACUUBRAND GMBH + CO KG

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

Contents

Attention! Important notes!

Not permitted! Misuse may cause damage.

Caution! Hot surface!

Isolate equipment from mains.

Note.

Safety information!

Remove all packing material, remove the product from its packing-box, remove the protective covers from the inlet and outlet ports and keep, inspect the equipment and check oil level.
If the equipment is damaged, notify the supplier and the carrier in writing within three days; state the item number of the product together with the order number and the supplier's invoice number. Retain all packing material for inspection.
Do not use the equipment if it is damaged.
If the equipment is not used immediately, replace the protective covers. Store the equipment in suitable conditions.

- ☞ **Read and comply with this manual before installing or operating the equipment.**
- ☞ Transport the pump at the provided handles.

Use the equipment **for the intended use only** (for generation and measurement of vacuum).

- ☞ Prevent any part of the human body from coming in contact with the vacuum.
- ☞ Comply with notes on correct vacuum and electrical connections.
- ☞ Make sure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.

Comply with **national safety regulations and safety requirements** concerning the use of vacuum and electrical equipment.

- ☞ Equipment must be connected only to a **suitable fused and protected electrical supply** and a suitable earth point. Failure to connect the motor to ground may result in deadly electrical shock.
- ☞ The supply cable may be fitted with a moulded European IEC plug or a plug suitable for your local electrical supply. If the plug has been removed or has to be removed, the cable will contain wires colour coded as follows: green or green and yellow: earth; blue or white: neutral; brown or black: live.
- ☞ Check that mains voltage and current conform with the equipment (see rating plate).
- ☞ Ensure that the pump motor rotates in the correct direction. If it does not, the pump and the vacuum system become pressurised, the system may burst.
- ☞ If the equipment is brought from cold environment into a room for operation, allow the equipment to warm up (pay attention to **water condensation on cold surfaces**).
- ☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated.
- ☞ **Do not operate the equipment if it is damaged.**

Comply with all **relevant safety requirements** (regulations and guidelines) and adopt suitable safety measures.

- ☞ Provide a firm level platform for the equipment and check that the system to be evacuated is mechanically stable and that all fittings are secure.
  Attention: Flexible elements tend to shrink when evacuated.

Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the mechanical stability of the system.

- ☞ Comply with **permissible maximum pressures** and pressure differences, see section "Technical data". Do not operate the pump with overpressure at the inlet.

Do not permit any **uncontrolled pressurizing** (e. g. make sure that the exhaust pipeline cannot become blocked). If you have an exhaust-isolation valve, make sure that you cannot operate the equipment with the valve closed. **Risk of bursting!**

- ☞ Ensure that the system design does not allow the exhaust pipeline to become blocked.

Permissible maximum pressure at the pressure transducer: 1.5 bar (absolute).

☞ At pressures higher than 1060 mbar the **display flashes. Error** message "`p Error`" appears, four beeps.

➨ Immediate pressure relief necessary! **Risk of bursting!**

Attention: At pressures above 1100 mbar the device does no longer display the correct pressure values (pressure transducer saturated).

☞ Ensure that the system design **does not allow the coolant outlet pipeline to become blocked.**

☞ Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.

☞ Check liquid level in both catchpots regularly and drain condensate in time.

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

☞ Avoid overpressure of more than 0.2 bar in case inert gas is connected.

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

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, especially directive IEC 1010. This directive gives in detail conditions, under which the equipment can be operated safely (see also IP degree of protection).

☞ Adopt suitable measures in case of differences, e. g. using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or dewiness.

Pay attention to symbol "hot surfaces" on the equipment.

☞ Adopt suitable measures to prevent any danger arising from the formation of hot surfaces or electric sparks.

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

If pumping **different substances**, purge the pump with inert gas prior to changing the pumped media in order to pump out residues and to avoid reactions of the pumped substances with each other with and the pump material.

Take into consideration interactions and chemical reactions of the pumped media.

The pumps are **not suitable** for pumping substances which may form **deposits** inside the pump.

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

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

The pumps are **not suitable** to pump **self inflammable** substances, substances which are inflammable without air and **explosive substances**.

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

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

☞ Use inert gas for gas ballast or venting if necessary.

☞ The user must take suitable precautions to prevent any formation of explosive mixtures in the expansion chamber. In case of a diaphragm crack, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures.

☞ Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.

☞ Comply with applicable regulations when disposing of chemicals. Take into consideration that chemicals may be polluted.

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

- ☞ Attention: Manual reset is necessary. Switch off the pump or isolate the equipment from mains. 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.
- ☞ Avoid high heat supply (e. g. due to hot process gases).
- ☞ Ensure sufficient air admittance if pump is installed in a housing.

Due to the residual **leak rate of the equipment**, there may be an exchange of gas, albeit extremely slight, between the environment and the vacuum system.

- ☞ Adopt suitable measures to prevent contamination of the pumped substances or the environment.

Pumping at **high inlet pressure** may lead to overpressure at the gas ballast valve.

- ☞ Pumped gases or condensate might be pushed out in case the valve is open.
- ☞ If an inert gas supply is connected, ensure that the inlet pipeline is not contaminated.

The controller is equipped with a **short circuit proof wide-range power supply** with integrated overload protection and with a fuse 8A(T).

Check the level of condensate in the round bottom collecting flask regularly. Do not overfill the collecting flask.

Ensure that in case of failure the pump and the vacuum system always will turn into a safe status.

- ☞ In case of diaphragm cracks or leaks in the manifold, pumped substances might be released into the environment or into the pump housing. To reduce the risk of leaks, ask for a diaphragm pump with additional safety diaphragm.
- ☞ Comply especially with notes on operation and use and maintenance.
- ☞ Failure of the pump (e. g. due to power failure) must not lead to a critical dangerous situation under any circumstances.

Electronic equipment is never 100% fail-safe. This may lead to an indefinite status of the equipment. Provide protective measures against malfunction and failure.

- ☞ Operating the pump, stand still of the pump or operating the venting valve must not lead to a critical dangerous situation under any circumstances.

Attention: If **Auto-Start** (`Auto-St.`) is preselected, the process starts immediately after switching on the controller without pressing any further key. It is the user's responsibility to ensure that no dangerous status of the system due to the automatic startup of the pump, e.g. after a power failure, can occur and to provide appropriate safety measures. If necessary, the user has to check **prior to using the equipment** if the option "Auto-Start" is enabled.

Use only **genuine spare parts and accessories.**

- ☞ Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.
  Possibly the CE mark or the C/US conformity becomes void if not using genuine spare parts.

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

Ensure that maintenance is done only by suitable trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures which relate to the product processed by the vacuum system and that the equipment, if necessary, is appropriately decontaminated before starting maintenance.
Comply with local and national safety regulations.

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 the operation conditions like ambient temperature, humidity or load.

☞ Check every capacitor regularly by measuring its capacity and estimating its operation time. Exchange old capacitors early enough to prevent a failure. If an overaged motor capacitor fails it might get hot and even melt and may cause a flame to form which could be **dangerous for persons and equipment in the vicinity**. The capacitors have to be replaced by an electrician.

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

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

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

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

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

Technical data

Type		PC 500 LAN	PC 600 LAN
Pumping speed* 50/60 Hz (DIN 28432)	m^3/h	1.9 / 2.1	3.0 / 3.5 (max.)
Ultimate vacuum (absolute)	mbar	9	2
Ultimate vacuum (absolute) with gas ballast	mbar	15	9
Max. permissible outlet pressure (absolute)	bar	1.1	
Max. permissible pressure at gas ballast (absolute)	bar	1.2	
Permissible ambient temperature storage operation	 °C °C	 -10 to +60 +10 to +30 or +40 (see breaking capacity of IEC socket of VNC 1)	
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85	
Power	W	180	200
No-load speed 50/60 Hz	min^{-1}	1500 / 1800	
Rated current at 100 V~ 50/60 Hz 120 V~ 60 Hz 230 V~ 50/60 Hz	 A A A	 3.6 / 3.8 3.0 1.6 / 1.6	 3.8 / 4.8 4.2 1.7 / 1.9
Maximum permissible range of supply voltage **Attention: Observe specifications of rating plate!**		100 V~ +/-10% 50/60 Hz 120 V~ +5%/-10% 60 Hz 230 V~ +/-10% 50/60 Hz	
Motor protection		thermal cutout	
Degree of protection IEC 529		IP 20	
Inlet		elbow fitting for PTFE tubing NW 10/8	
Outlet		hose nozzle NW 10	
Connection of cooling water		hose nozzle NW 6	
Dimensions L x W x H	mm	350 x 260 x 495	350 x 275 x 495
Weight approx.	kg	15.1	20.9

* Pumping speed of diaphragm pump

We reserve the right for technical modification without prior note!

Gas inlet temperatures:

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

Controller	VNC 1
Pressure transducer	capacitive absolute pressure transducer made of aluminium oxide ceramic
Display	alphanumerical LCD display, 2 x 8 characters
Electronic scale conversion (to be switched between)	mbar, Torr or hPa
Measurement range (absolute)	1100 mbar - 1 mbar (825 Torr - 1 Torr)
Maximum range of vacuum control (absolute)*	1060 mbar - 1 mbar (795 Torr - 1Torr)
Uncertainty (with transducer carefully calibrated and at constant temperature)	<+/-1 mbar (0,75 Torr) +/-1 digit
Temperature coefficient	<+/- 0,07 mbar/K (0,05 Torr/K)
Permissible ambient temperature at operation	10°C to +40°C
Permissible ambient temperature at storage	-10°C to +70°C
Permissible relative atmospheric moisture during operation (no condensation)	30% to 85%
Maximum permissible range of voltage supply	100 V~ (-10%) to 230 V~ (+10%) 50/60 Hz
Fuse	5x20 mm, T 8 A / 250 V
Power draw (no-load operation)	3 VA
Power draw with VACUUBRAND VV 6C - isolation valve and cooling water valve	maximum 10 VA (without switch output)
Breaking capacity of diode socket: voltage supply 110-230 V 50/60 Hz voltage supply 100-110 V 50/60 Hz designed for the simultaneous operation (parallel connection) with the following original accessories	 24 V, max. 400 mA 24 V, max. 340 mA - isolation valve VV 6C - cooling water valve 24 V=
Breaking capacity of IEC socket** ambient temperature 30°C ambient temperature 40°C	 7,2(4) A 250 V~, 7,2(7,2) A 125 V~ 6(4) A 250 V~, 6(6) A 125 V~
Degree of protection according to IEC 529	IP 20
Vacuum connection	screwed hose connection NW 10/8 for PTFE tubing
Maximum permissible pressure at pressure transducer (absolute)	1.5 bar (1125 Torr)
Maximum permissible temperature of gaseous media at pressure transducer	for short periods up to 80°C
External error input (via diode socket)	5-24 V
Serial interface	RS 232 C

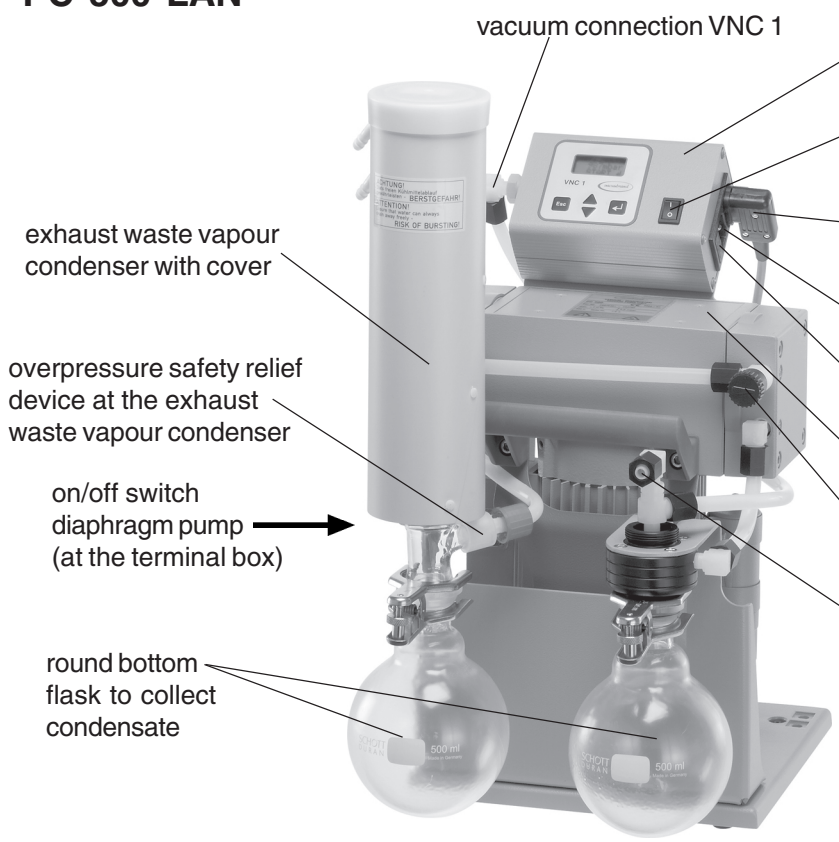
* The actual available range of the vacuum control can be limited due to the ultimate vacuum of the pump, the developed amount of gas, etc.
** ohm resistive (inductive) load

We reserve the right for technical modification without prior note!

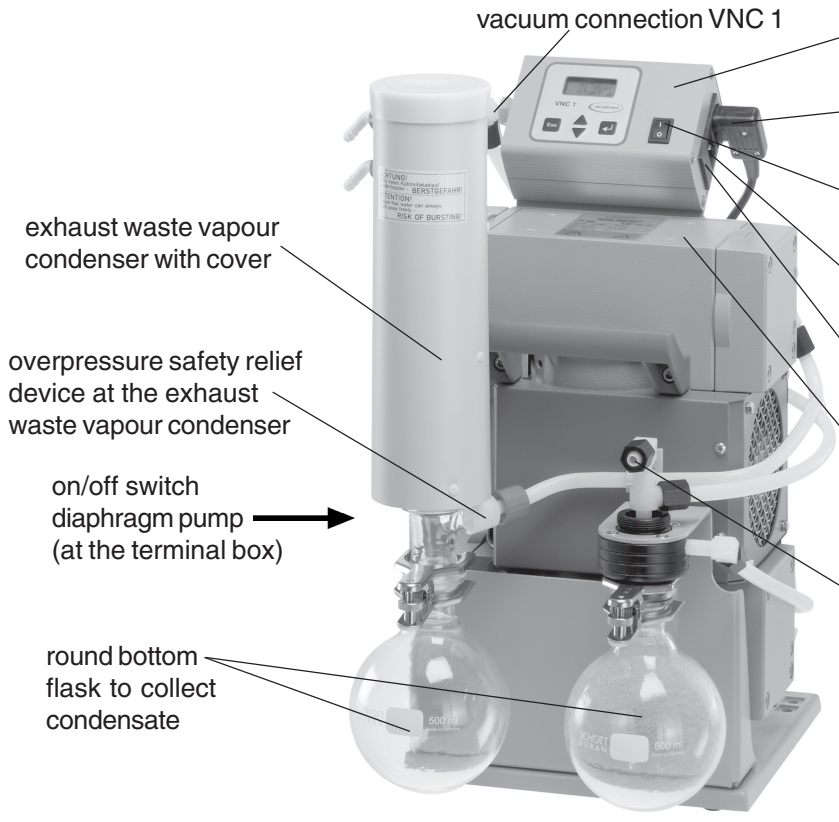
Components	Wetted parts
Pumping unit	
Outlet	PBT
Inlet	ETFE / ECTFE
Hose	PTFE
Fitting	ETFE / ECTFE
O-rings at the catchpot	FPM
Overpressure safety relief device	PTFE foil / silicon rubber
Catchpot cover plate	PP
Exhaust waste vapour condenser, collecting flask	Borosilicate glass; borosilicate glass coated
Pump	
Housing cover insert	PTFE carbon reinforced
Head cover	ETFE carbon fibre reinforced
Diaphragm clamping disc	ETFE carbon fibre reinforced
Valve	FFKM
Diaphragm	PTFE
Vacuum controller	
Vacuum connection / hose connection	Stainless steel / ETFE, PP
Seal	chemically resistant fluoroelastomer
Sensor housing	Stainless steel
Sensor	aluminium oxide ceramic

We reserve the right for technical modification without prior note!

PC 500 LAN

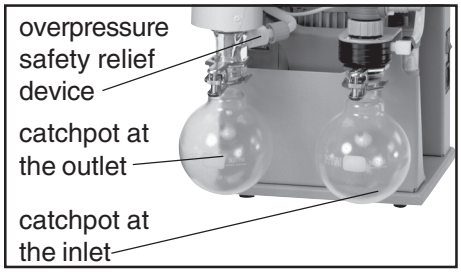


PC 600 LAN



Use and operation

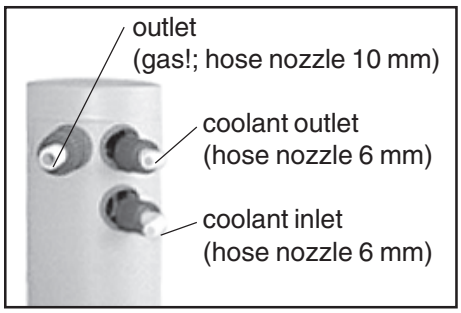
Assembly of enclosed components



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

Both round bottom flasks are coated with a protective layer to prevent disintegration in case of breakage or implosion.

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



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

The **exhaust waste vapour condenser** enables an efficient condensation of the pumped vapours at the outlet.
- ☞ No backflow of condensates.
- ☞ Controlled recovery of condensates.
- ☞ Next to 100% solvent recovery.
- ☞ The isolation cover protects against glass splinters in case of breaking, acts as thermal isolation to avoid condensation of humidity and is intended to absorb shocks.

- ➨ Attach the pipelines of the coolant circuit to the respective hose nozzles (see image) at the waste vapour condenser. Check hose connections prior to starting operation of the cooling system.
- ➨ Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.
- ☞ Ensure that the **coolant outlet pipeline** is always free and that it cannot get blocked.
- ☞ Install an optional **coolant valve** always **only in the inlet line** of the exhaust waste vapour condenser.

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

Installing in a vacuum system:
- ☞ Avoid throttling losses by using connecting pipes with large diameter and keep them as short as possible.
- ☞ Reduce the transmission of vibration and prevent loading due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Attention:** Flexible elements tend to shrink when evacuated.
- ☞ Use a suitable valve to isolate the pump from the vacuum system to allow the pump to warm up before condensable vapours are pumped or to clean the pump before it is switched off.
- ☞ Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere. Use a catchpot to prevent the drainage of contaminated condensate back into the pump.

Prior to use:

- ☞ **Maximum ambient temperature**: 30 °C or 40 °C (See "Technical Data - VNC 1").
- ☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated. Keep a distance of minimum 20 cm between fans and ambient parts.
- ☞ If pump is installed in altitudes of more than 1000 m above mean sea level check compatibility with applicable safety requirements, e. g. IEC 60034 (motor may overheat due to insufficient cooling).
- ☞ If the gas ballast valve is open, a power failure may cause unintentional ventilation of the pump. In case this constitutes a potential source of danger, take appropriate safety measures.
- ☞ When assembling, ensure **vacuum-tightness**. After assembly, check the complete system for leaks.

During operation:

Do not start pump if **pressure difference** between inlet and outlet port exceeds **maximum 1 bar**. Attempts to start pump at higher difference may cause blockade and damage of the motor.

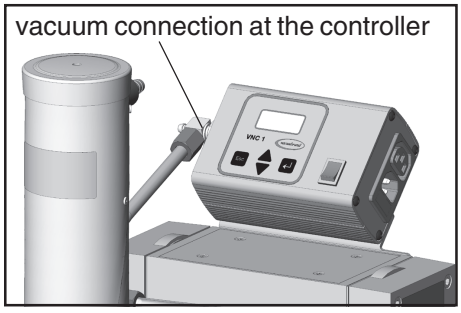
- ☞ Check compatibility with **permissible maximum pressure** at outlet and **maximum pressure difference** between inlet and outlet ports. Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the **mechanical stability** of the system.

The pump achieves its **pumping speed, ultimate total vacuum** and vapour pumping rate only at operating temperature (after approx. 15 minutes).

- ☞ Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amounts.
- ☞ Let the pump run with **gas ballast** to reduce condensation of pumped substances (water vapour, solvents, ...) in the pump.

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

- ☞ Manual reset is necessary. Switch off the pump or isolate the equipment from mains. Wait approx. five minutes before restarting the pump. Identify cause of failure and eliminate.
- ☞ **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



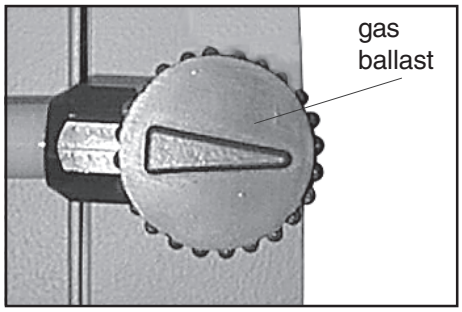
Permissible maximum pressure at the pressure transducer (vacuum connection at controller): 1.5 bar (absolute).

- ☞ At pressures higher than 1060 mbar the **display flashes. Error** message "`p Error`" appears, four beeps.
- ➨ Immediate pressure relief necessary! **Risk of bursting! Attention:** At pressures above 1100 mbar the device does no longer display the correct pressure values (pressure transducer saturated).

- ☞ Comply with permissible maximum pressure and pressure differences at the pump.
- ☞ Inside a vacuum system where evaporation occurs, e. g. rotary evaporator, the vacuum is not uniform. This effects the measured pressure and thus the process control. E.g. a condenser acts as pump or the vacuum in the pipeline is lower than in the system. Therefore carefully choose position where to instal the vacuum connection to the controller.
- ☞ In order to avoid malfunction it is important to position the controller so as to avoid flow of condensate towards the pressure transducer.

Attention: Important notes regarding the use of gas ballast

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



For **condensable vapours** (water vapour, solvents, ...):

- ☞ Do not pump vapour before pump has reached its operating temperature and with gas ballast valve closed.
- ☞ Open gas ballast valve. (Closing of gas ballast valve by turning 180°.)
- ☞ The gas ballast valve is open if the arrow on the gas ballast cap shows away from the pump.
- ☞ With gas ballast valve open ultimate vacuum will be reduced, pumping speed is decreased.
- ☞ Use inert gas at the air inlet to avoid the formation of explosive mixtures.

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 rates at the exhaust waste vapour condenser.

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

- ➨ Check hose connections prior to starting operation of the cooling system.
- ➨ Check coolant hoses regularly during operation.
- ☞ Ensure that the **coolant outlet pipeline** is always free and that it cannot get blocked.

- ☞ Maximum permissible coolant pressure at the exhaust waste vapour condenser: 6 bar (absolute)
- ☞ Comply with the maximum permissible coolant pressures of additional components in the coolant circuit (e.g coolant valve).
- ☞ Avoid overpressure in the coolant circuit (e.g. caused by blocked or squeezed coolant hoses).
- ☞ Permissible range of coolant temperature at the exhaust waste vapour condenser: -15°C to +20°C

- ☞ The gas outlet (hose nozzle 10 mm) must not be blocked. The exhaust pipeline has always to be free and pressureless to enable an unhindered discharge of gases.
- ➨ Check the overpressure safety relief device at the exhaust waste vapour condenser regularly, replace if necessary. Check especially for sticking and cracks.
- ☞ Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.

In case of **condensation:**

- ➨ Check liquid level in both catchpots during operation. Avoid overflowing of the catchpots.
- ☞ Do not overfill the catchpots. Maximum liquid level approx. 80%, to avoid problems when removing the catchpots.
- ➨ Check liquid level in both catchpots regularely and drain catchpots in time.

Removing the catchpots:
Catchpot at outlet:

- ➨ Remove joint clip, remove catchpot and drain condensate.

Catchpot at inlet:

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

➨ Reassemble drained catchpots.

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

Shutdown:

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 forms **deposits**?

☞ Check and clean pump heads if necessary.

Long-term:

➨ Take measures as described in section short-term shutdown.

➨ Separate pump from the apparatus.

➨ Drain catchpots.

➨ Close inlet and outlet port (e. g. with transport caps).

➨ Store the pump in dry conditions.

Description

After the connection of components the controller can be operated in different basic modes, see **"Basic modes and menu structure".**

When switching on the controller, the current basic mode and the **number of version** are displayed for 2s.

Display and keys

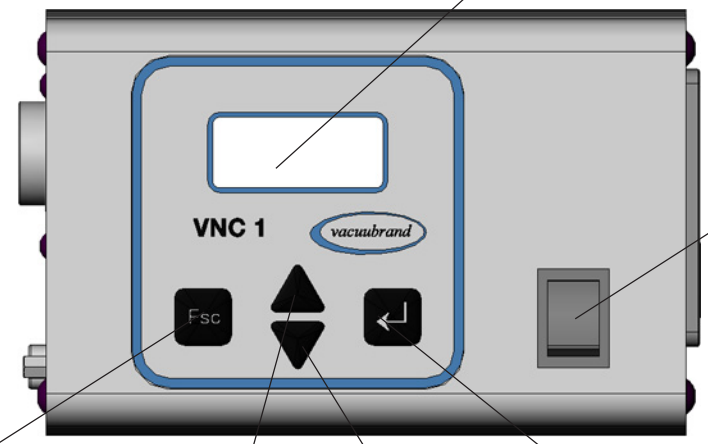
Display

In menus
line1: caption
line 2: menu item

In submenus (only setting of RS 232C)
line 1: menu item (RS232)
line 2: submenu

After selection of menu item
line 1: menu item (or submenu)
line 2: value to be set

In program
line 1: pressure
line 2: status message



mains switch

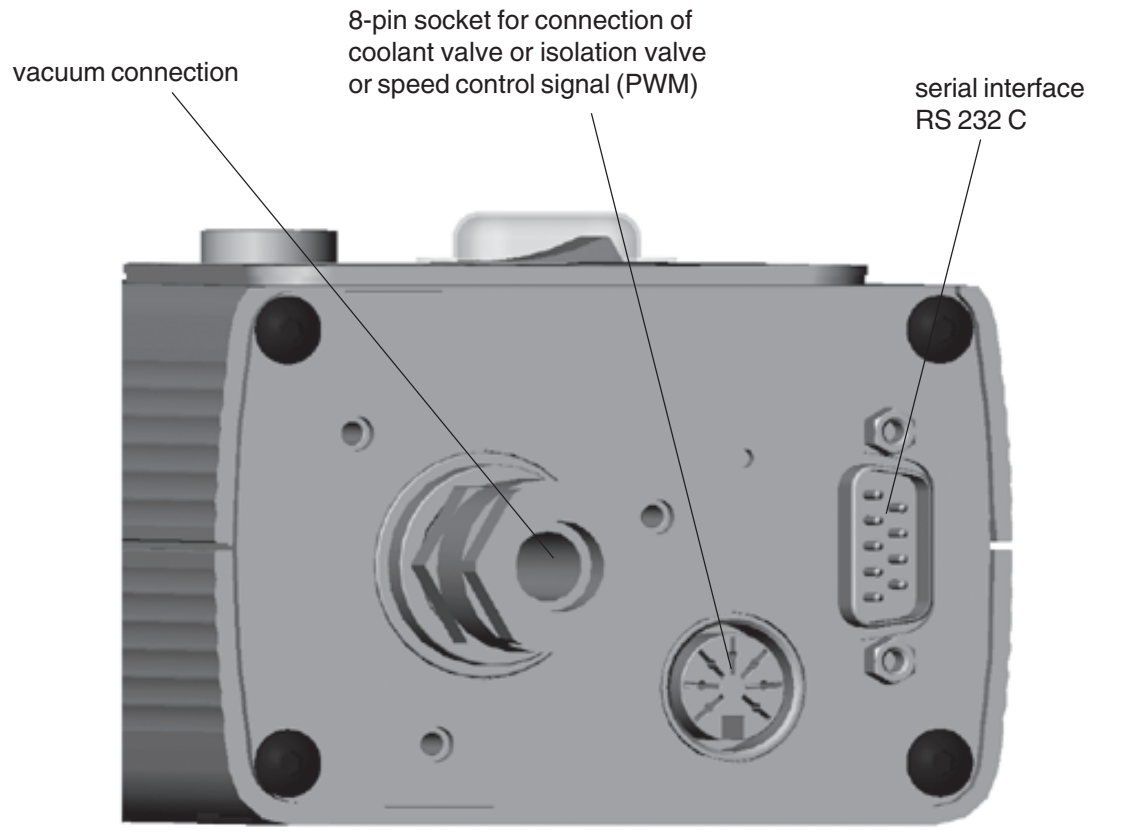
key "Esc":
- go to previous level of program (operation menu)
- interruption of operation (reset to previous settings)
- stop of control

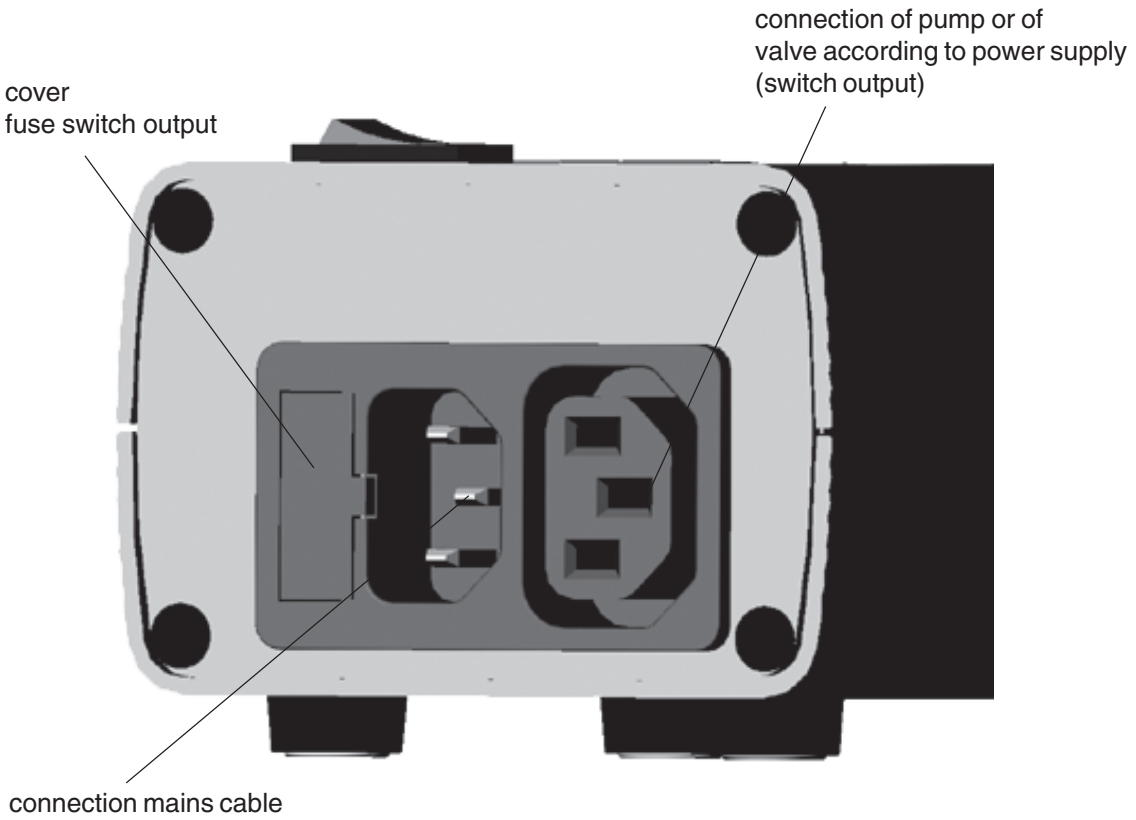
key "Enter"
- start of control
- next step in menu setting
- adopt set value and quit menu

key "up"
- select menu
- next menu item
- increase value

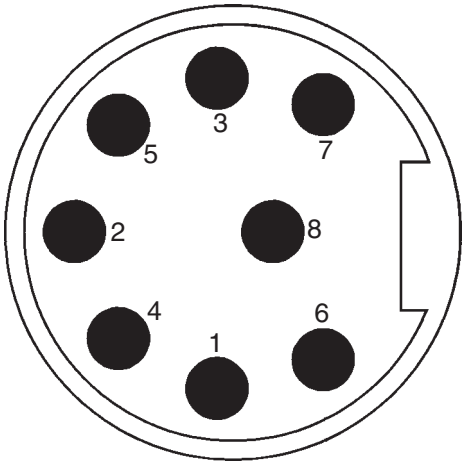
key "down"
- select menu
- previous menu item
- decrease value

Connections





Assignment of pins

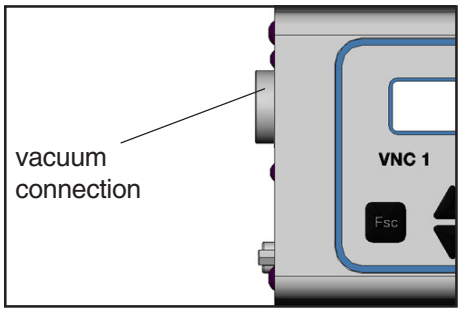


1	coolant valve
2	+ 24V
3	isolation valve
4	external error -
5	external error +
6	mass (PWM -)
7	PWM + (speed control signal for VARIO pumps)
8	+12 V

Notes on operation

For operation it is necessary to install valves and/or vacuum pumps.

Note: `Texts written in Courier font` mirror the display of the LCD of the controller.

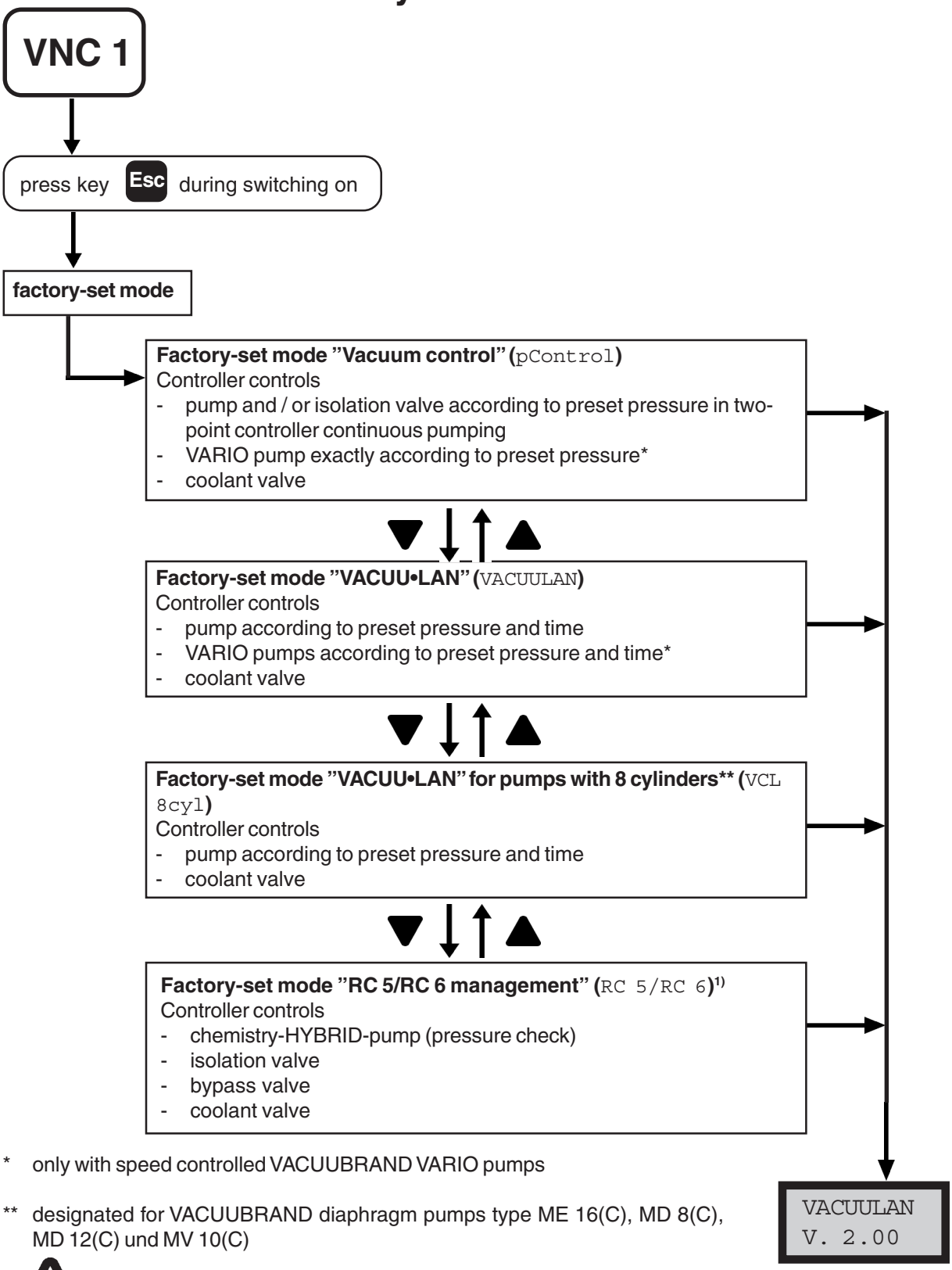


Max. permitted pressure at pressure transducer: 2 bar (absolute).

- ☞ The display flashes at a pressure higher than 1060 mbar.
- ☞ Comply with max. permitted pressure of 2 bar absolute.
- ☞ Inside a vacuum system where evaporation occurs, the vacuum is not uniform. This effects the value of the measured pressure and such the controlling. Therefore carefully choose the position where to connect the pressure transducer.
- ☞ Condensate and deposits at the pressure transducer falsify the measurement result.
- ☞ If residues occur or when working with aggressive or condensable substances, install a gas washing bottle in front of the pressure transducer.
- ☞ **Position controller in such a way, that condensate can not flow into the pressure transducer.**
- ☞ If necessary, clean pressure transducer, see section ”Cleaning the pressure transducer”.

- ☞ Setting of interface parameters, see **”Interface parameters”.**
- ☞ Presettings at controller, see **”’Factory-set modes and menu structure”.**
- ☞ Operating the controller, see **”Working with the controller”.**

General view of factory-set modes



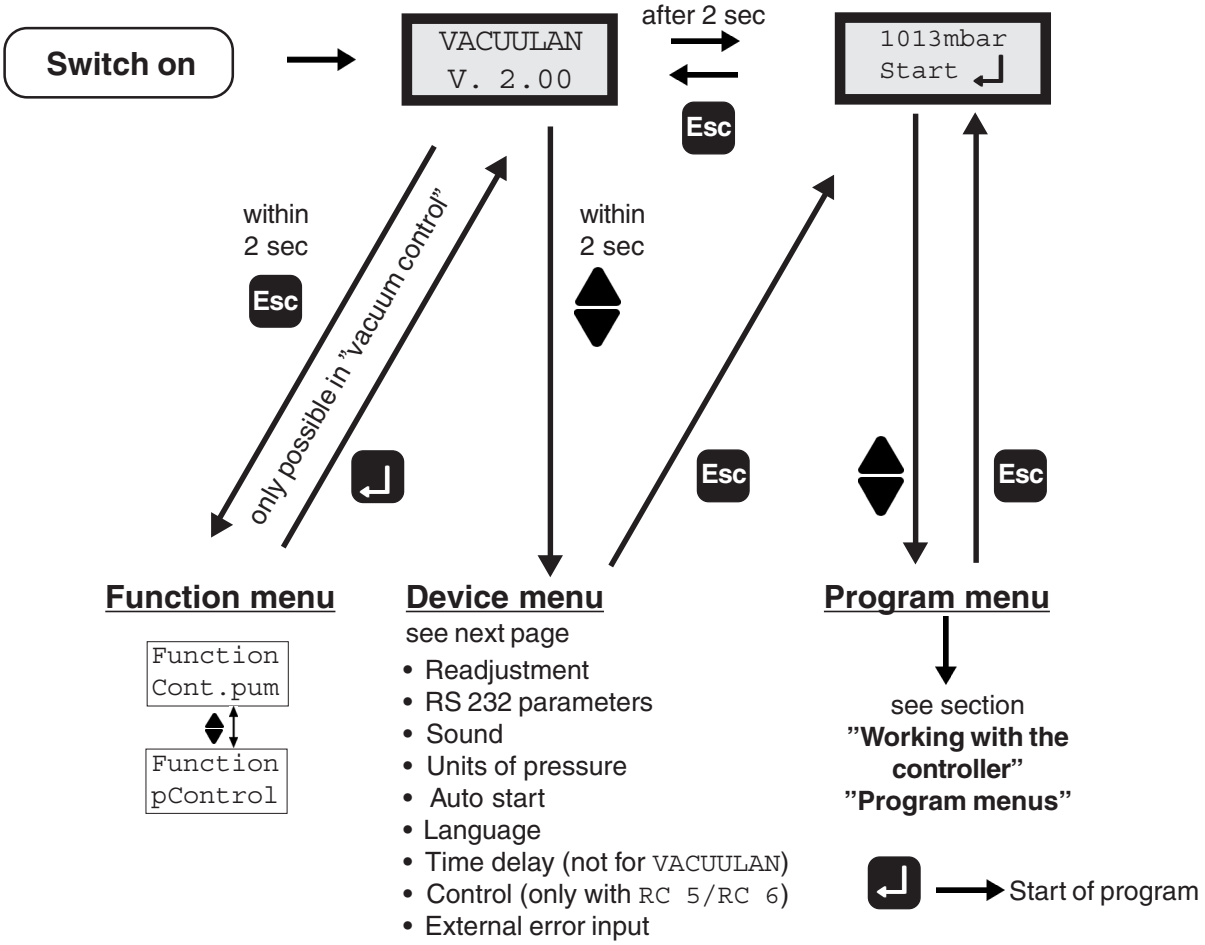
* only with speed controlled VACUUBRAND VARIO pumps

** designated for VACUUBRAND diaphragm pumps type ME 16(C), MD 8(C), MD 12(C) und MV 10(C)

Attention: When connecting pumps pay attention to the breaking capacity of the IEC socket (see "Technical Data")!

1) **Attention: For factory-set mode "RC 5/RC 6 management" please order separate instructions for use!**

Menu structure of controller



Notes on menu structure of the controller

Function menu:

- Setting of the basic function of the controller (only in "vacuum control" (pControl)).

Device menu:

- Setting of the device specific features and the periphery of the controller.

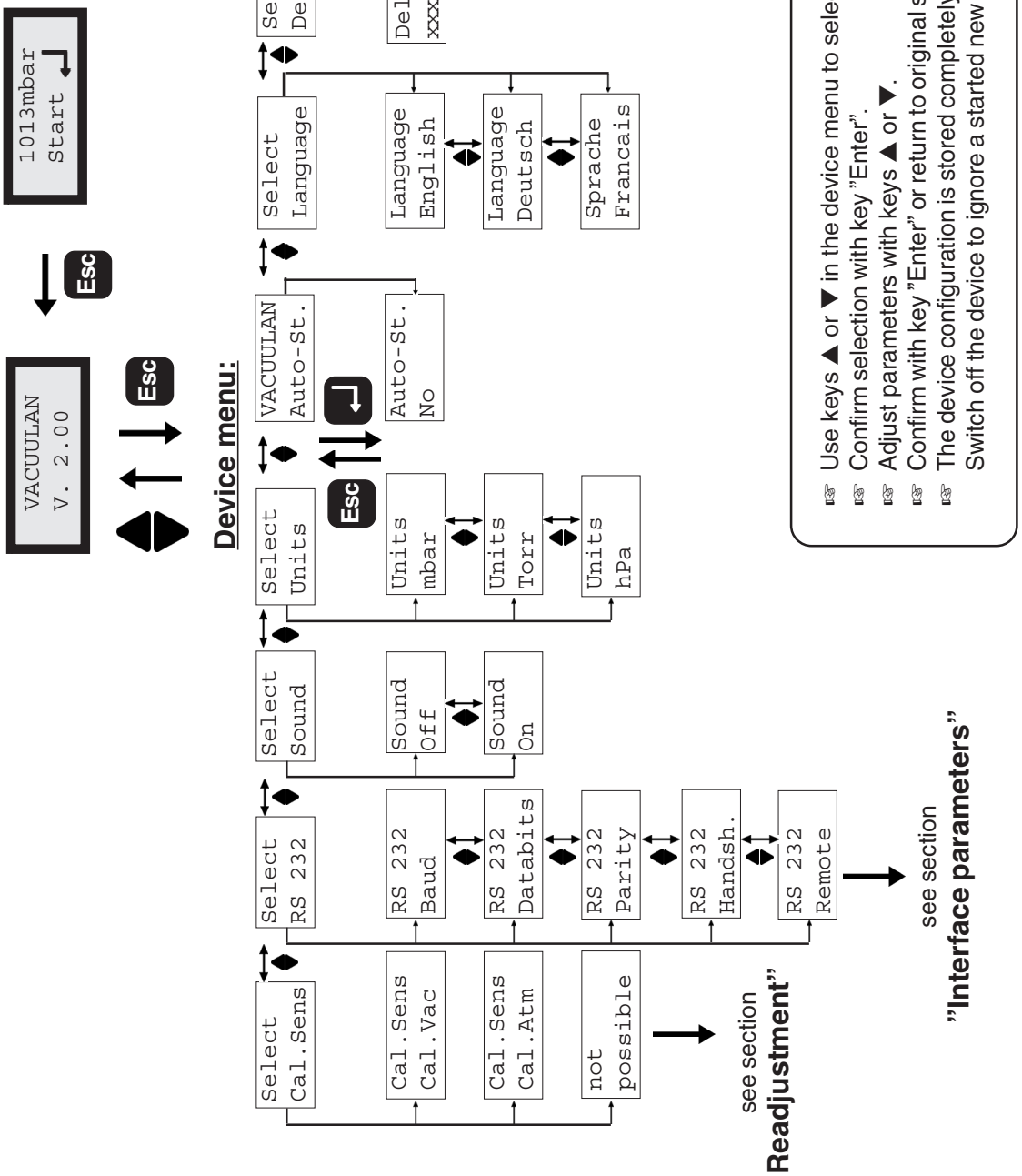
- Readjustment: Adjusting the pressure transducer at atmospheric pressure and under vacuum, see section "Readjustment".
- RS 232 parameters: Setting of the interface parameters, see section "Interface parameters".
- Sound: Switching on/off the function "acoustic warning signal".
- Pressure unit: Selection of the pressure unit mbar, Torr or hPa.
- Auto start: Process starts immediately after switching on the controller.
- Language: Selection of the language in the menus (English, German, French).
- Time delay: Delayed switching off of the cooling water and the pump (not for VACUULAN)
- Control: Control of a valve or a pump via the IEC control line (only for RC 5/RC 6).
- External error input: In case of failure of the signal the control sends an error message and switches off the pump, if preset.

Attention: When operating a VARIO pump the external error input is used to indicate a failure of the frequency converter and can not be wired externally.

Program menu:

- Setting of the function specific parameters (e. g. preset pressure).

Attention: Depending on factory-set configurations some menu options are not active!



Working with the controller

Notes on selecting the basic mode

The controller VNC 1 can be adapted to the specific application by choosing the appropriate mode, **VACUU•LAN, continuous pumping, vacuum control, pressure check or RC 5/RC 6 management**. The components of the chemistry vacuum system (e.g. ”Valve”, ”VARIO”) have to be preset once only.
The basic mode as from last operation and the preselected values (e. g. for pressure, pumping speed or switch-off time) are stored. In case of similar operation conditions it is possible to start immediately, if the preselections are chosen appropriately.

The controller is configured at the factory as follows:
- Basic mode ”VACUU•LAN” (**VACUULAN**)
- ”Control pump” is configured (pump is switched)

Attention: If **Auto-Start** (Auto-St.) is preselected, the process starts immediately after switching on the controller without pressing any further key if the process control has not been terminated by pressing key ”Esc”.
It is the user’s responsibility to ensure that no dangerous status of the system due to the automatic startup of the pump, e.g. after a power failure, can occur and to provide appropriate safety measures. If necessary, the user has to check **prior to using the equipment** if the option ”Auto-Start” is enabled.

Basic mode ”VACUU•LAN” (VACUULAN)

- **operation of a vacuum pump with or without an isolation valve**
- **control of a speed controlled pump (VARIO) according to requirements**

Parameters

☞ **Switch-off time** (t Off, factory-set: 15 min): If the actual pressure is below the lower set point, the time meter for automatic shut down is started; additionally the pumping speed is reduced (VARIO pumps only). If the actual pressure is higher than the lower set point the time meter for automatic shut down is reset. The process control stops when the switch-off time has passed. The vacuum pump is switched off. The pump starts again in case of great pressure increase.

☞ **Upper pressure value** (p On, factory-set: 200 mbar): Condition for restart of the pump when the pressure is increasing. If the actual pressure is higher than the upper set point, the pump starts again.

☞ **Lower pressure value** (p Set, factory-set: 50 mbar): Condition for switching off the pump.

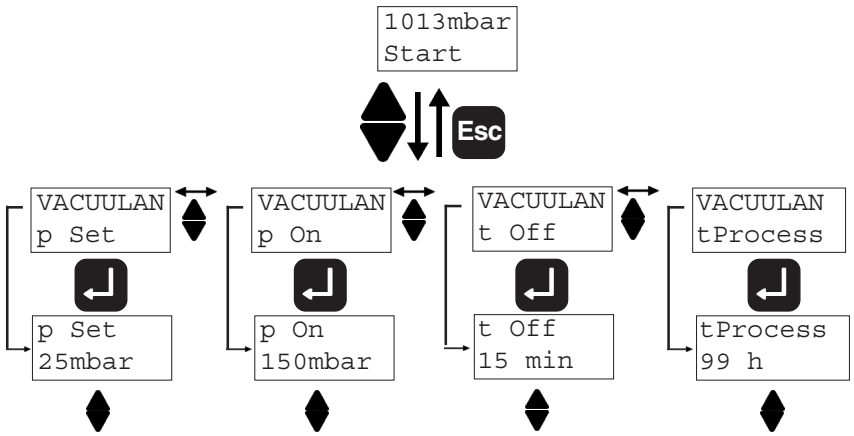
☞ **Time of process** (tProcess, factory-set: 99 h): Check if the switch-off time is reached within the preset time of process. If the switch-off time is not reached, an error message ”CheckSys” appears. In that case, check the process parameters and/or the vacuum system, see section ”Troubleshooting”.

☞ Preselection of **Auto-Start** (Auto-St.,factory-set ”No”): Process starts immediately after switching on the controller.

Suggested values for process parameters

Pumping unit	Switch-off time (min)	Lower pressure value (mbar)	Upper pressure value (mbar)
PC 500 LAN	5-10	15-20	400-600
PC 600 LAN	5-10	5-10	400-600

Program menu in mode `VACUULAN` and `VCL 8cyl`



- ☞ Use keys ▲ or ▼ in the program menu to select an item.
- ☞ Confirm selection with key ”Enter”.
- ☞ Adjust parameters with keys ▲ or ▼.
- ☞ Confirm with key ”Enter” or return to original setting pressing ”Esc”.

Status messages displayed during operation of a program

The messages are always displayed in the second line, the first line always displays the pressure value.

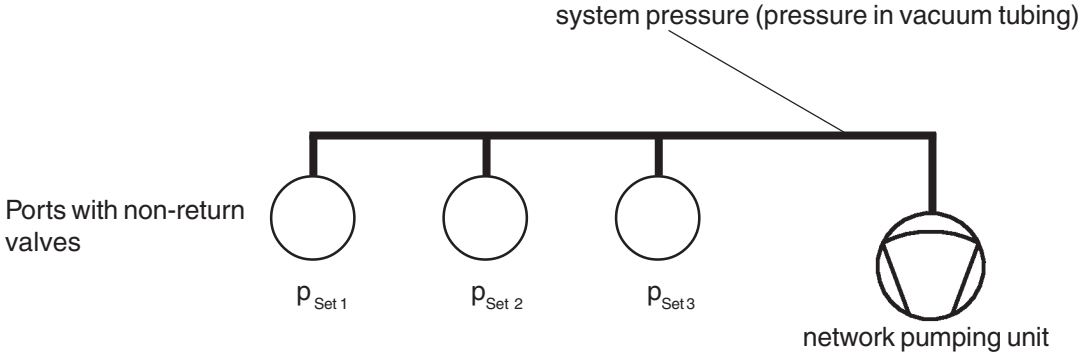
Displays in basic mode ”VACUU•LAN”

Process running, pressure above lower pressure value	`Process`
Time delay, pressure below lower pressure value:	`xxx min`
Key ”ENTER” pressed:	`xx.x Hz` (only with VARIO pumps during process)
After process, check of pressure:	`Monitor`
Key ”ENTER” pressed after process:	`xxx/min` (increase of pressure)

In remote mode: P is displayed in the second line.

Notes on operating a local vacuum network VACUU•LAN®

Assembling the components of a VACUU•LAN® - network:
A VACUU•LAN®-vacuum network consists of three main components: **vacuum pump or vacuum pumping unit, vacuum tubing and ports**.
The ports, i.e. the VACUU•LAN®-modules, are composed of connecting parts, basic parts and operating parts. They can be combined or adapted in accordance to the requirements in the laboratory.
A non-return valve is integrated in each VACUU•LAN®-module.



Manually controlled vacuum applications:

In general: Avoid parallel processes which differ strongly in their demands concerning pumping speed or ultimate vacuum as well as their simultaneous operation.
If several manually controlled ports are operated simultaneously, it is recommended to install a flow control, such that the required process pressures of the applications are just attained. The permanent gas flow through the hand-controlled ports has the same effect as a leak and leads to an increase of pressure in the system.
If the pressure in the network exceeds the preset pressure of a parallelly operated application, the non-return valve of that port closes. Such the application is protected against contamination or backflow, but it is no longer possible to evacuate or control the application!
Remedial action: Further reduction of gas flow at the manual port is necessary until the system pressure in the network is decreased below the lowest process pressure of a parallel application.

Automatically controlled vacuum applications:

An increase of system pressure due to formation of gas (e.g. pumping down) and/or programmed preset pressures can occur if several automatically controlled ports of a vacuum network are operated simultaneously. Such an increase of pressure usually occurs in form of a pressure peak. Therefore the vacuum supply of parallelly operated applications is cut off only temporarily; the non-return valves counteract the mutual interference.
In general: It is recommended to reduce the pumping speed at automatically controlled ports as well using an additional flow control. By that means pressure bursts on the application side or in the vacuum network are minimised. The hysteresis (Δp) at the vacuum controller at the port should not be set too low (Δp= approx. $\pm 10\% p_{Set}$), if possible use the automatic hysteresis preset at the controller.
Notes: If the system pressure is increasing, the port with the lowest preset pressure is closed at first. At decreasing system pressure the port with highest preset pressure is opened at first.

Effect of the integrated non-return valves:

At each port a non-return valve is integrated to avoid an increase of pressure or contamination. The preset pressures of the different applications are related to the system pressure in the vacuum network as shown below:

status of non-return valve		system pressure in local vacuum netwok (mbar)														
	preset pressure (mbar)	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
application 1	250													■	■	■
application 2	100						■	■	■	■	■	■	■	■	■	■
application 3	35		■	■	■	■	■	■	■	■	■	■	■	■	■	■

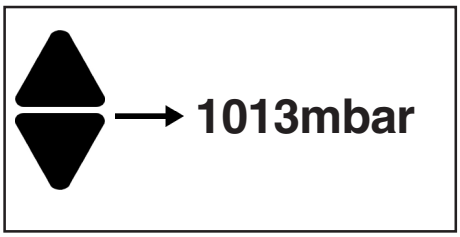
■ non-return valve closed □ non-return valve open

Notes: If the system pressure is increasing, the port with the lowest preset pressure is closed at first. At decreasing system pressure the port with highest preset pressure is opened at first.

Readjustment

The vacuum gauge was adjusted using factory standards, which are traceable through regular calibration in an accredited laboratory (German Calibration service) to the national standard. Depending on the process and/or accuracy requirements, check the adjustment from time to time and readjust if necessary. For readjustment, the device has to be adjusted both at atmospheric pressure as well as under vacuum.

Adjustment at atmospheric pressure

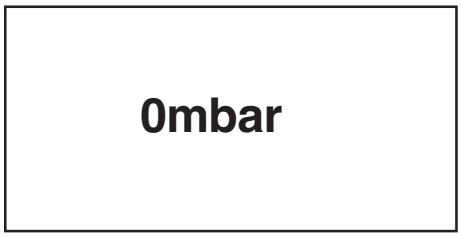


Ventilate the controller and/or the vacuum system. Make sure that the vacuum connection at the controller is at atmospheric pressure.

- ➨ Select program "Cal . Sens" at controller.
- ➨ Use keys ▲ and ▼ to adjust the display to the actual local atmospheric pressure.
- ➨ Confirm value with key "Enter".

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

Adjustment under vacuum

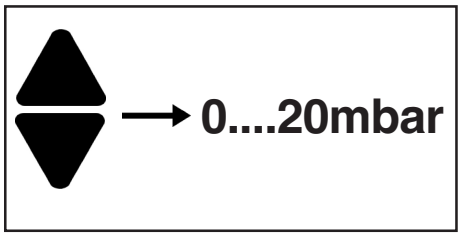


Evacuate the controller via the vacuum connection to a pressure < 0.5 mbar (e. g. by applying a good rotary vane pump).

- ➨ Select program "Cal . Sens" at controller.
- ☞ The display is set to zero automatically.
- ➨ Confirm value with key "Enter".

Note: *Adjustment under vacuum with an actual pressure higher than 0.5 mbar reduces the accuracy of the measurement. If the pressure is significantly higher than 0.5 mbar, adjustment to a reference pressure is recommended.*

Adjustment at a reference pressure



Instead of adjustment under vacuum to a pressure < 0.5 mbar, adjustment to a reference pressure within the range of 0 ..... 20 mbar is possible.
Evacuate the controller via the vacuum connection to a reference pressure within the range 0 .... 20 mbar.

- ➨ Select program "Cal . Sens" at controller.
- ☞ The display is set to zero automatically.
- ➨ Use keys ▲ and ▼ to adjust the display to the actual reference pressure at the vacuum connection within the range of 0 .... 20 mbar.
- ➨ Confirm value with key "Enter".

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 state, failure of valves or the diaphragm).*

Interface parameters

The controller VNC 1 is equipped with a serial interface (RS 232C, nine-pole Sub-D-plug).

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

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

Setting of the interface

Setting of the interface parameters directly at the controller is described below. Enter the device menu "`Select RS 232`". The factory set values are underlined.

➨ `Baud 9600`, `2400`, `4800` or `19200`
➨ 7 data bits odd (`Databits 7, Parity Odd`); 7 data bits even (`Databits 7, Parity Even`); 7 data bits none (`Databits 8, Parity None`); 8 data bits none (`Databits 8, Parity None`)
➨ no Handshake (`Handsh. None`), XON/XOFF Handshake (`Handsh. Xon-Xoff`)
➨ `Remote on`, `Remote off`
➨ Startbit = 1, Stopbit = 1 (Stopbit = 2 at 7 data bits none)

In remote mode (`Remote on`, "P" is displayed) all keys at the controller are without function. To return to the manual operation of the controller set the controller to the mode "`Remote off`" via the interface or switch off controller and enter the device menu within the first 2s after having switched on the controller again.

Read commands can be sent always. The sending of write commands is only possible, if the remote mode (`Remote on`) is selected.

Read commands

Function	Command	Response	Description
Actual pressure	IN_PV_1	XXXX mbar or XXXX Torr or XXXX hPa	Unit according to preselection
Actual pumping speed	IN_PV_2	XX.X Hz	
Time	IN_PV_3	XX:XX h:m	Time for shut down or time of warmup (only RC 5/RC 6)
Increase of pressure	IN_PV_4	xxx/min	Only VACUU•LAN
Time of process	IN_PV_5	XX:XX h:m	Only VACUU•LAN
Preselected at controller	IN_CFG	XXXXX	

XXXXX
- 0: Remote mode off
- 1: Remote mode on
- 0: not used
- 0: not used
- 0: No coolant valve
- 1: Coolant valve
- 0: VACUU•LAN
- 1: Continuous pumping
- 2: Vacuum control
- 4: RC 5/RC 6 management

Preselected at controller — IN_CFG_1 — XXXXXXXX

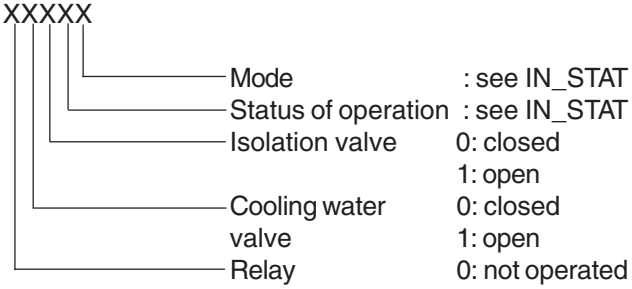
- 0: Remote mode off
- 1: Remote mode on
- 0: mbar
- 1: Torr
- 2: hPa
- 0: External error off
- 1: External error on (evaluation)
- 2: Stop (control is stopped)
- 0: Acoustic signal off
- 1: Acoustic signal on
- 0: Isolation valve off
- 1: Isolation valve on
- 0: Coolant valve off
- 1: Coolant valve on
- Control with 0: Valve
- 1: Pump
- 2: VARIO
- 0: VACUU•LAN
- 1: Continuous pumping
- 2: Vacuum control
- 4: RC 5/RC 6 management

Read commands

Function	Command	Response	Description
Error status	IN_ERR	XXXX	1: Last command to interface incorrect 1: Failure at pressure transducer 1: Overpressure 1: See ERR_1
Error status	IN_ERR_1	XXXX	1: Temperature error 1: Error isolation valve 1: Error coolant valve 1: External errorr (e.g. at VARIO)
Preset pressure	IN_SP_1	XXXX mbar or XXXX Torr or XXXX hPa	Unit according to preselection
Status of process control	IN_STAT	XXXX	VACUU•LAN: 0: Off; 1: Process; 2: Pressure<preset pressure; 3: Pressure check Continuous pumping: 0: Off; 1: On Vacuum control: 0: Off; 1: Pressure>upper pressure value; 2: Preset pressure<pressure< upper pressure value; 3: Pressure<Preset pressure; 4: End RC 5: 0: Off; 1: Warmup; 2: Pressrue>preset pressure; 3: Pressure<preset pressure Mode: 0: VACUU•LAN; 1: Continuous pumping; 2: Vacuum control; 4: RC 5/RC 6 management 0: not used Coolant valve: 0: Closed; 1: Open

Read command

Function	Command	Response	Description
Status of process control	IN_STAT_1	XXXXX	

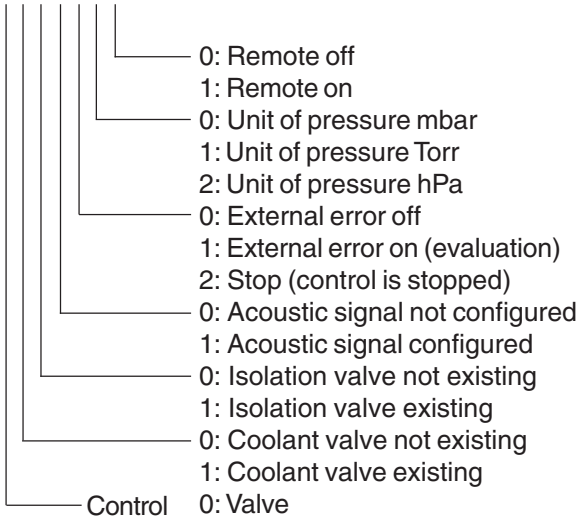


Write commands

Function	Command	Parameter	Description
Preset pressure	OUT_SP_1	XXXX	In unit according to selection at controller (0001 to 1060 mbar (hPa) or 0001 to 0795 Torr)
Pumping speed	OUT_SP_2	XX.X	In Hz (01.0 to 60.0, 99.9 corresponds HI)
Start-up pressure/ upper pressure value	OUT_SP_3	XXXX	In unit according to selection at controller (see OUT_SP_1) VACUU•LAN: start-up pressure "p On" Vacuum control: "p set" + "Δp"
Switch-off time	OUT_SP_4	hh:mm	Hours:minutes
Lower pressure value	OUT_SP_5	XXXX	In unit according to selection at controller (see OUT_SP_1) Vacuum control: upper pressure Continuous pumping: lower pressure
Time delay (only VACUU•LAN; otherwise process time)	OUT_SP_6	hh:mm	Hours:minutes
Mode of operation	OUT_MODE	X	0: VACUU•LAN 0S: VACUU•LAN blocked 1: Continuous pumping 2: Vacuum control 4: RC /RC 6 management

Write commands

Function	Command	Parameter	Description
Configuration	OUT_CFG	XXXXXXX	

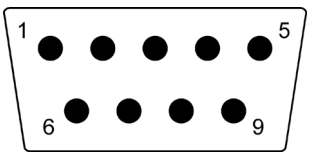


Start process control	START		
End process control	STOP	X	1: End process control 2: End process control and store actual pressure value as preset pressure
Remote operation*	REMOTE	X	0: Set controller to local operation 1: Set controller to remote operation
Store all parameters to EEPROM	STORE		

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

The single abbreviations of a command are separated by underscores (ASCII 5FH).
Command and parameter are separated by ignore characters (ASCII 20H).
The string is terminated with <CR><LF> (ASCII 0DH, ASCII 0AH).

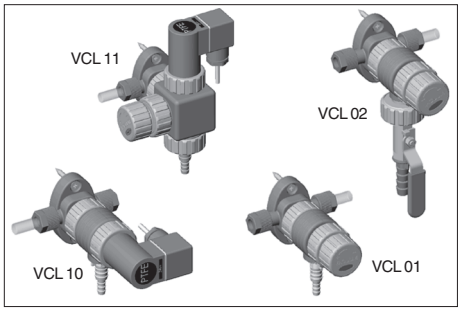
Connector assignment



2: RxD
3: TxD
4: DTR (12 V)
5: Mass

Installation and accessories

Vacuum distribution



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

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

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

VACUU•LAN® automatic control module VCL 10 ..... **677108**

VACUU•LAN® manual flow control/automatic control module VCL 11 ..... **677109**

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

Cooling water minimization

Coolant valve 24 V= **676013**

- compact design, designed for a high number of operations at short intervals
- solenoid systems with splash protection
- conductance optimised for applications with rotary evaporator and exhaust waste vapour condenser
- with integrated Y-connector to connect an isolation valve

Accessories of controller

In-line valve VV 6C 24 V= **674091**
(PVDF/PTFE, small flange NW 16, hose nozzle NW 6/10)
In-line valve VV 6 24 V= **674090**
(PP/FPM, small flange NW 16, hose nozzle NW 6/10)
In-line valve VV 15C 24 V= **674110**
(PVDF/PTFE, small flange NW 16)
In-line valve VV 15 24 V= **674115**
(PVDF/PTFE, small flange NW 25)

Troubleshooting

Fault	Possible cause	Remedy
❑ No display.	➔ Mains cable not plugged in?	☞ Plug in mains cable. Switch on device. Check fuse in building.
	➔ Fuse defective?	☞ Check fuse in building and fuse at switch output of VNC 1, replace if necessary.
	➔ Other cause (device defective)?	☞ Return controller to the factory for repair.
❑ Display disappears, internal overload protection activated.	➔ Thermal overload at controller, ambient temperature too high?	☞ Ensure adequate ventilation.
	➔ Thermal overload at controller, overload?	☞ Check current draw of connected devices (pumps, valves).
	➔ Short circuit at connected valves?	☞ Replace valves.
	➔ Other cause (device defective)?	☞ Return controller to the factory for repair.
❑ Pressure reading incorrect.	➔ Device not adjusted correctly?	☞ Readjust controller.
	➔ Humidity in pressure transducer?	☞ Let dry pressure transducer, e.g. by pumping down, readjust if necessary, detect end eliminate cause.
	➔ Pressure transducer contaminated?	☞ See "Cleaning the pressure transducer".
❑ Error message "CheckSys", five beeps.	➔ Time of process in basic mode VACUU•LAN exceeded?	☞ Check system for leaks, select suitable pressure value. Check time of process.
❑ Error message "p Error", four beeps.	➔ Overpressure at pressure transducer, pressure >1060 mbar?	☞ Immediate pressure relief necessary (Risk of bursting)! ⚠
❑ Error message "ErrSens.", three beeps.	➔ Pressure transducer or connecting cable to board defective?	☞ Return controller to the factory for repair.
❑ Error message "ErrValve", two beeps.	➔ Error at isolation valve or at cooling water valve?	☞ Check valve, connect correctly.
❑ Error message "ext. Err", one beep.	➔ No signal at external error pin of 8-pin socket?	☞ Eliminate external error or deactivate external error input (controller menu).
❑ Error message "ErrTemp.", six beeps.	➔ Excess temperature at relay due to frequent switching?	☞ Check configuration and process parameters.
	➔ Relay circuit defective?	☞ Return controller to the factory for repair.
❑ All keys without function.	➔ Controller set to remote mode, "P" is displayed?	☞ Control controller via interface or switch off remote mode (see 'Interface parameters').
❑ Controller does not react when operating keys. No change after switch off/on.		☞ Return controller to the factory for repair.

Fault	Possible cause	Remedy
❑ Pump does not work.	➔ Thermal overload of the pump?	☞ Allow the pump to cool down, check system.
❑ Pump fails to start or stops immediately.	➔ Mains not plugged in, electrical supply failure?	☞ Plug in. Check fuse.
	➔ Pressure in outlet pipeline too high?	☞ Remove blockade in line, open valve.
	➔ Motor overloaded?	☞ Allow motor to cool, identify cause of failure.
❑ Pump does not achieve ultimate total pressure or normal pumping speed.	➔ Centring ring not correctly positioned or leak in the pipeline or vacuum system?	☞ Check pump with a vacuum gauge directly at pump inlet port, check connections and line.
	➔ Long narrow line?	☞ Use line with larger diameter, length as short as possible.
	➔ Pump has been exposed to condensate?	☞ Run pump at atmospheric pressure for a few minutes.
	➔ Deposits have been formed inside the pump?	☞ Clean and inspect pump heads.
	➔ Valves or diaphragm damaged?	☞ Replace valves and/or diaphragms.
	➔ Outgasing substances or vapour generated in the process?	☞ Check process parameters.
❑ Pump too noisy.	➔ Atmospheric or high pressure at inlet port?	☞ Connect hose to pump outlet.
	➔ Diaphragm or diaphragm clamping disc loose?	☞ Perform maintenance.
	➔ None of above mentioned causes?	☞ Return the device to the factory for repair.
❑ Pump seized.		☞ Return the device to the factory for repair.

Instructions for repair with directions for repair and spare parts list are available on request.

☞ The instructions are for trained service people.

How to determine the best distillation conditions

Determine the temperature of the available coolant.

☞ In most cases the coolant temperature is given (e. g. tap water, in house cooling water circuit). For maximum solvent recovery, carefully choose the boiling point of the product (by choosing the vacuum level) and the bath temperature accordingly.
☞ Determine the lowest boiling point of the product (solvent).
☞ The temperature difference between boiling point of the product and the coolant should be more than 20°C, otherwise low vacuum level will lead to significant loss of solvent.
☞ Select a water bath temperature of 20-30°C above the boiling point of the product to provide sufficient heat transfer.

Determine the bath temperature

☞ If there is no limitation from the product side, a water bath temperature of 60-70°C is usually recommended (efficient heating with minimum generation of water vapour from the bath).

Example:

☞ The cooling temperature assumed to be 15-20°C.
☞ Water bath temperature between 60-70°C. Wait until temperature is reached.
☞ Determine the vacuum level for a boiling point (use published data of solvents). Reduce pressure until a sufficient level of evaporation is attained.
☞ If hysteresis is set manually, avoid frequent operation of the isolation valve (approx. not more than two operations per minute).

List of solvents

Solvent	Boiling point (°C) at 1013 mbar	Vacuum for boiling point (mbar) (abs.) at T_s=40°C	Solvent	Boiling point (°C) at 1013 mbar	Vacuum for boiling point (mbar) (abs.) at T_s=40°C
Acetone	56	556	Ethyl acetate	77	240
Acetonitrile	82	230	Ethylene-dichloride	83	210
Benzene	80	236	Hexane	69	335
t-Butanol	82	130	Methanol	64	337
1-Butanol	118	25	Pentane	36	> 1000
Chloroform	62	474	Isopropanol	82	137
Cyclohexane	81	235	Pyridine	115	60
Dichloromethane	40	1000	Tetrachloro-methane	77	271
Diethyl ether	35	> 1000	Tetrahydrofurane	66	357
Diisopropyl ether	68	375	Toluene	111	77
Dimethylformamide	153	11	Trichloroethylene	87	183
1,4-Dioxane	101	107	Xylene	138	25
Ethanol	78	175	Water	100	72

Replacing diaphragms and valves

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the pump is maintenance free. The valves and the 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.
Depending on individual cases it may be efficient to check and clean the pump heads on a regular basis. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours.

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

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

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

Before starting maintenance vent the system, isolate the pump and other components from the vacuum system and the electrical supply. Drain condensate if applicable, avoid the release of pollutants. Separate pump from cooling water circuit. Allow sufficient cooling of the pump. **Wait two minutes** after isolating the equipment from mains to allow the capacitors to discharge. **Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.

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

☞ Wear appropriate safety-clothing when you come in contact with contaminated components.

Set of seals (2 diaphragms and 4 valves) for MZ 2C **(PC 500)**..... ..... **696814**
Set of seals (4 diaphragms and 8 valves) for MD 4C **(PC 600)** **696815**
Face wrench with torque indicator **637580**

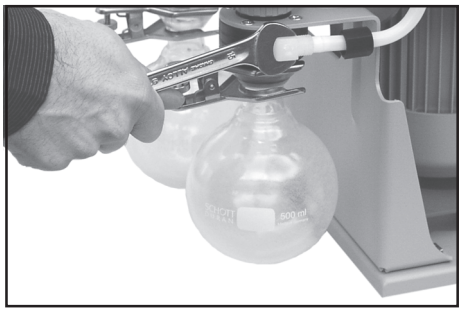
Tools required (metric):

- Phillips screw driver size 2
- Open-ended wrench w/f 10/14/17
- Hex key size 5/7
- Face wrench with torque indicator

☞ **Please read section "Replacing diaphragms and valves" completely before starting maintenance.**
Partially the pictures show pumps in other versions. This doesn´t influence replacing diaphragms and valves of the pump.

Disassembling the pump from the pump support

➨ Use open-ended wrench (w/f 17) to remove union nut on the fitting of the cover plate.



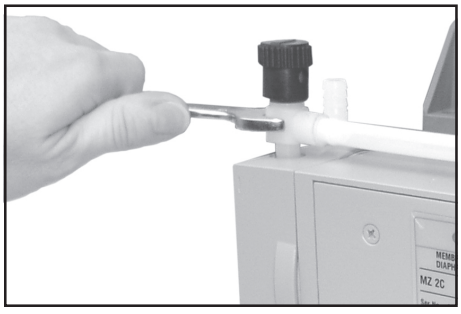
➨ Use open-ended wrench (w/f 14) to turn elbow fitting 1/4 of a turn, remove hose.
☞ Do not remove the elbow fitting from the cover plate. Through reassembly a leak may result.

➨ Remove union nut at the exhaust waste vapour condenser and remove hose from the inlet of the condenser.

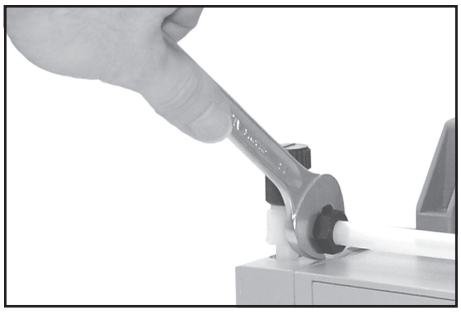
➨ Disconnect cables from the controller and unscrew controller from holding plate.
☞ Unscrew socket head screw at rear of controller with hex key size 7.
☞ It is not necessary to remove the vacuum connection at the controller.

PC 510 / 511 / 520:
➨ Do not disassemble pump from pump support.
PC 610 / 611 / 620:
➨ Use open-ended wrench (w/f 10) to remove four hexagon nuts from the feet of the pump support and lift off pump together with pump support from the base plate.
➨ Disassemble pump from pump support. Support pump appropriately.
➨ Loosen at each case two socket head screws at the rear and the front of the pump with hex key size 5. Pay attention to washers.
☞ Remove pump from pump support.

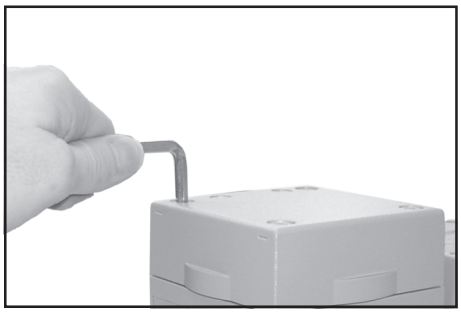
Cleaning and inspecting the pump heads



➨ Use open-ended wrench (w/f 17) to remove union nuts.

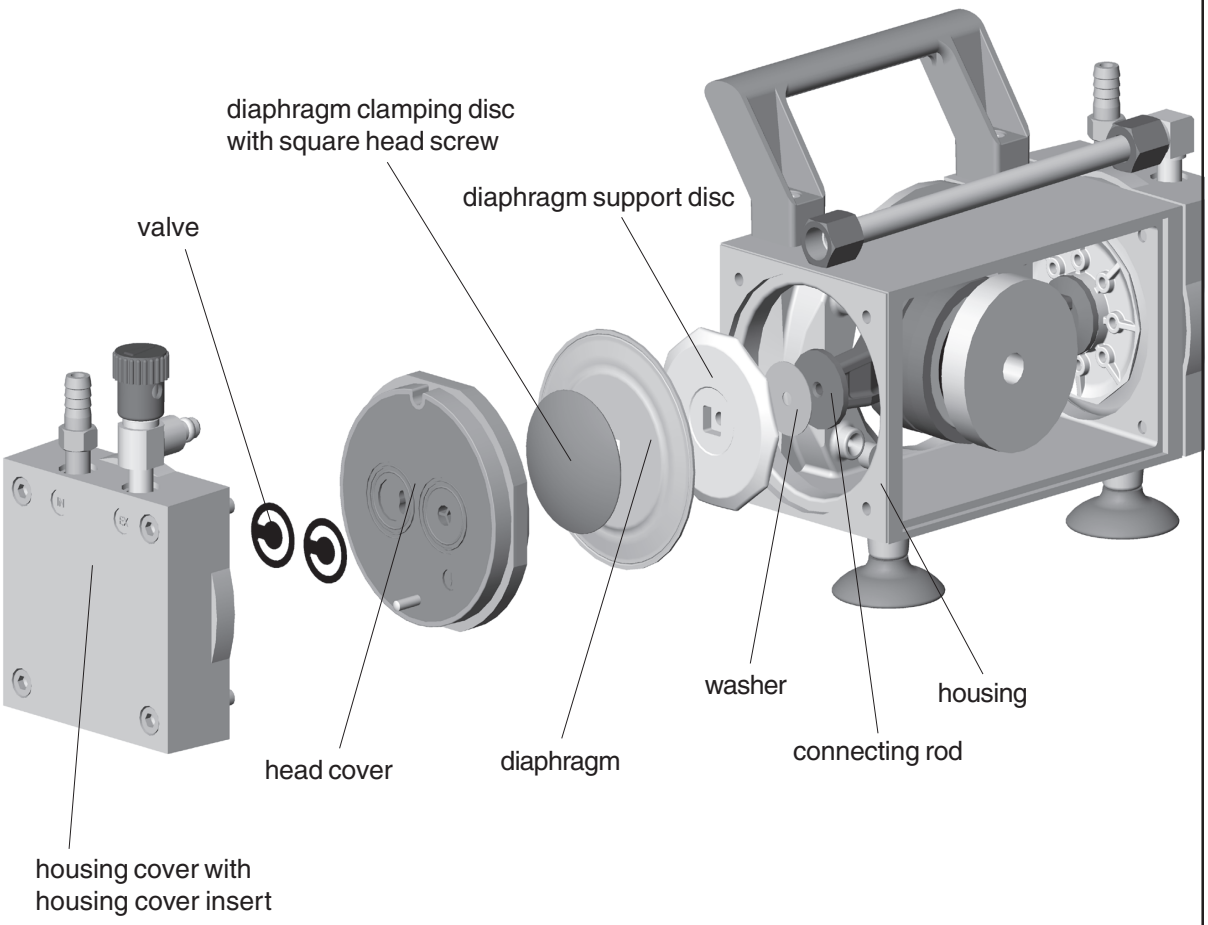


➨ Use open-ended wrench (w/f 14) to turn elbow fitting 1/4 of a turn, remove hose.
☞ Do not remove the elbow fitting from the pump head. Through reassembly a leak may result.



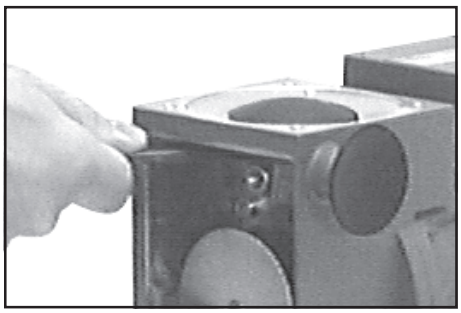
➨ To check valves use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert), head cover and valves.
☞ Never remove parts by using a spiky or sharp-edged tool (e.g. screw driver), we recommend to use a rubber mallet or compressed air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

View of the disassembled pump head parts

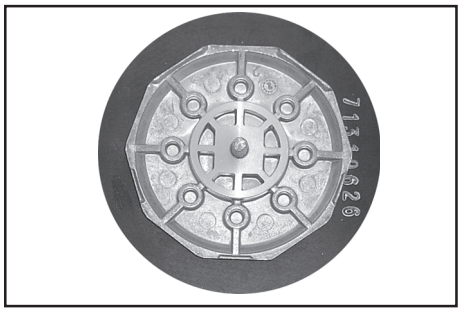


☞ Check diaphragm for damage and replace if necessary.
➨ To do so use Phillips screw driver to remove four countersunk head screws and lift off housing plate.
☞ Use petroleum ether or industrial solvent to remove deposits if necessary. Do not inhale.

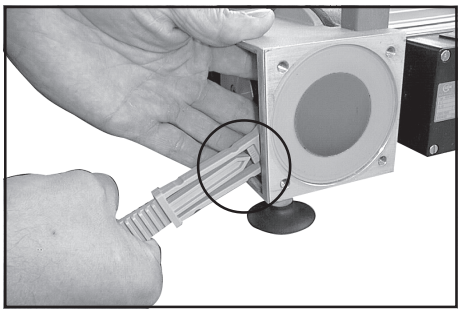
Replacing the diaphragm



➨ Use face wrench to remove diaphragm support disc.
➨ Check for washers. Do not mix the washers from the different heads. Make sure that the original number is reassembled at the individual pump head.
☞ Smaller number of washers: The pump will not attain ultimate vacuum. More washers: Clamping disc will hit head cover; noise or even blockade of the pump.



➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
☞ **Note:** Position diaphragm with light-coloured PTFE side to diaphragm clamping disc (to pump chamber).

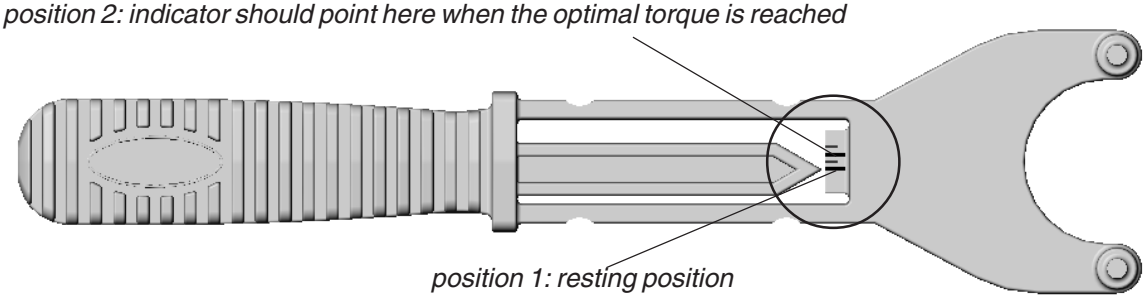


➨ Use **face wrench with torque indicator** (recommended: **face wrench with torque indicator from VACUUBRAND, Cat.-No.: 637580**) to assemble diaphragm clamping disc, diaphragm and diaphragm support disc (and eventually washers) to the connecting rod.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

Optimum torque for the diaphragm support disc: **6 Nm.**

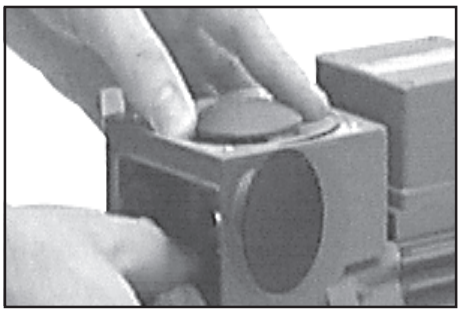
☞ The optimum torque is achieved if the pointer in the handle of the VACUUBRAND face wrench shows to the longer marking line.

position 2: indicator should point here when the optimal torque is reached

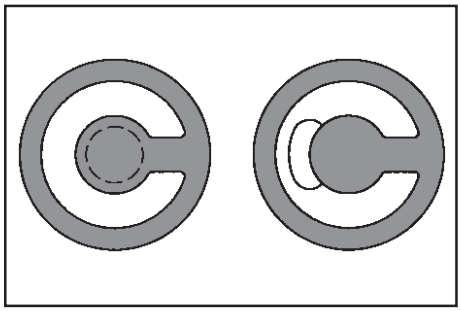


position 1: resting position

Assembling pump heads



➨ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.



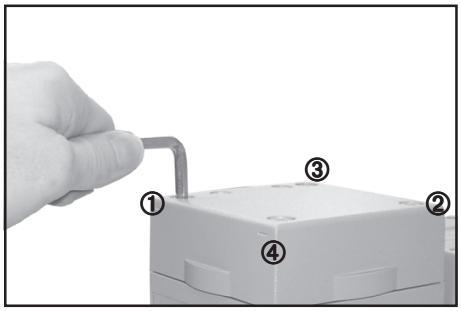
Reassemble in reverse order.

➨ Install head cover, valves and housing cover with housing cover insert.

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

➨ By turning eccentric bushing, bring connecting rod into upper turning point position (Max. stroke of the rod).

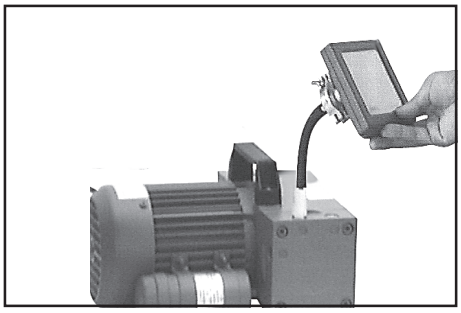
☞ Pay attention that the diaphragm stays positioned centrally so that it will become clamped uniformly between housing and head cover.



➨ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence ①, ②, ③, ④) first slightly, then tighten.

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

Individual performance check of a pump head:

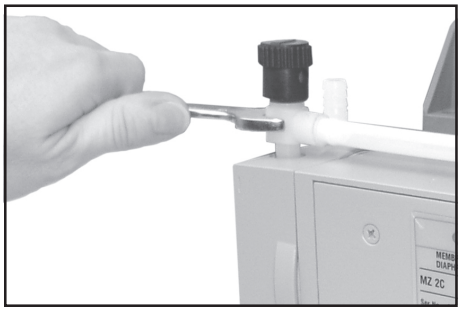


By measuring the pressure at the inlet port of the individual head:

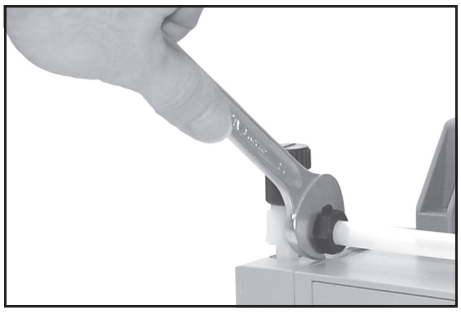
Use a suitable vacuum gauge (e. g. DVR 2, cat. no.: 68 29 02), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.

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

Montage of the connecting hose:



➨ Use open ended wrench (w/f 14) to reconnect hose to elbow fitting.



➨ Tighten union nuts first by hand and then tighten one full turn using open ended wrench (w/f 17).

If the pump does not achieve the ultimate pressure:

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

If all pump heads achieve a vacuum below 120 mbar but pump does not achieve the ultimate total pressure:
Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber.

Assembling the pump at the pump support and on the base plate:

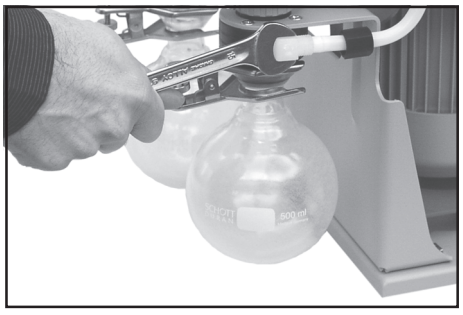
PC 600 LAN

➨ Assemble pump at pump support. Support pump appropriately.
➨ Screw in at each case two socket head screws at the rear and the front of the pump with hex key size 5. Pay attention to washers.
➨ Position pump with pump support on the base plate and tighten the four hexagon nuts on the feet of the pump support with an open-ended wrench w/f 10.

PC 500/600 LAN

➨ Screw controller to holding plate.
☞ Using hex key size 7 fix socket head screw at rear of controller.
➨ Reassemble connections at controller.

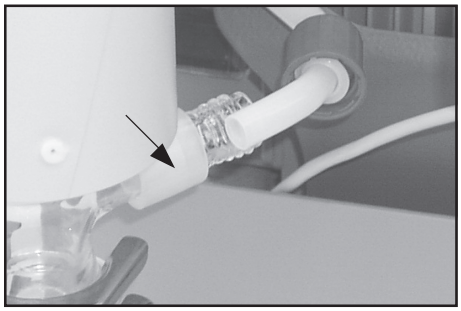
➨ Reconnect hose to the inlet of the condenser and tighten union nut.



➨ Use open-ended wrench to reconnect hose to elbow fitting.

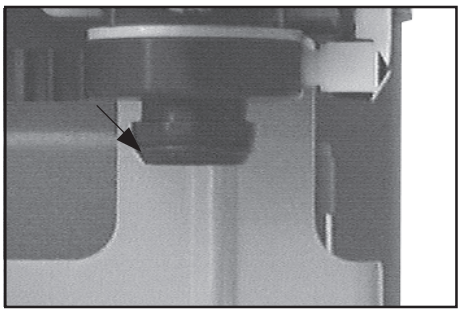
➨ Tighten union nut first by hand and then tighten by one full turn using open-ended wrench.

Cleaning and assembling components



Overpressure safety relief device **638821**
(at the exhaust waste vapour condenser)

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



Round bottom flask 500 ml, coated **638497**

O-ring 28 x 2,5 ..... **3120553**
(FPM) at the spherical ground joint of the round bottom flask at the inlet

alternative:
O-ring 28 x 2,5 ..... **638304**
(FPM covered with FEP)

Cleaning the pressure transducer

The controller itself is maintenance-free.
If the vacuum system is contaminated (oil, particles, etc.), contamination of the pressure transducer will influence the accuracy of measurement.

Attention: Never use hard objects to clean the pressure transducer!

➨ Fill the chamber of the pressure transducer 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 chamber of the pressure transducer several times with alcohol in order to remove all solvent residues.
☞ Never use a spiky or sharp-edged tool to clean the pressure transducer.
➨ Allow the pressure transducer to dry.
➨ Readjust the pressure transducer if necessary.

Calibration in the factory

Control of measuring equipment

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

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

DKD-Calibration Controller VNC 1 ..... **900217**

Notes on return to the factory

Repair - return - DKD calibration

Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations and regulations regarding safe disposal of waste require that for all pumps and other products the **"Health and safety clearance form"**
must be send to our office duly completed and signed before any equipment is dispatched to our premises.
Fax or post a completed copy of the health and safety clearance form to us in advance. The declaration must arrive before the equipment. Enclose a second completed copy with the product. If the equipment is contaminated you must notify the carrier.

No repair / DKD calibration is possible unless the correctly completed form is returned. Inevitably, there will be a delay in processing the equipment if information is missing or if this procedure is not obeyed.
If the product has come in contact with chemicals, radioactive substances or other substances dangerous to health or environment, the product must be decontaminated prior to **sending it back to the factory.**

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

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

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

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

Before returning the equipment ensure that (if applicable):

- ☞ Oil has been drained and an adequate quantity of fresh oil has been filled in to protect against corrosion.
- ☞ Equipment has been cleaned and/or decontaminated.
- ☞ All inlet and outlet ports have been sealed.
- ☞ Equipment has been properly packed, if necessary, please order an original packaging (costs will be charged), marked as appropriate and the carrier has been notified.
- ☞ Ensure that the completed health and safety declaration is enclosed.

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

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

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

Health and safety clearance form

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

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

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

2. Serial No.: .....

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

3.1 Chemical/substance name, chemical symbol:

a) .....

b) .....

c) .....

d) .....

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

a) .....

b) .....

c) .....

d) .....

4. Declaration (please mark as applicable):

❑ **4.1 for non dangerous goods:**

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

❑ **4.2 for dangerous goods:**

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

5. Way of transport / carrier:

.....

Day of dispatch to VACUUBRAND:

.....

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

❑ yes ❑ no

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

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

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

Signature: .....

Name (print): .....

Job title (print): .....

Company´s seal: .....

Date: .....

VACUUBRAND GMBH + CO KG
-Technology for Vacuum Systems-

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E-Mail: info@vacuubrand.de
Web: www.vacuubrand.com

vacuubrand

CE

Konformitätserklärung
Declaration of conformity
Déclaration de conformité

Chemie-Pumpstand / Chemistry pumping unit / Groupe de pompage chimique

PC 500 LAN (230 V; 688140, 688141, 688142)
PC 600 LAN (230 V; 688160, 688161, 688162)

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

Maschinenrichtlinie (mit Änderungen) / Machine directive (with supplements) / Directive Machines (avec des suppléments)
2006/42/EG
Niederspannungsrichtlinie / Low-Voltage Directive / Directive Basse Tension
2006/95/EG
Richtlinie Elektromagnetische Verträglichkeit / Electromagnetic Compatibility Directive / Directive Compatibilité Electromagnétique
2004/108/EG
Angewandte Harmonisierte Normen / Harmonized Standards applied / Normes Harmonisées utilisées
DIN EN 12100-2, DIN EN 61010-1, DIN EN 1012-2, DIN EN 61326-1
Managementsysteme / Management systems / Systèmes de Management
EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 05.10.2009
. . . . . .
Ort, Datum / place, date / lieu, date

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

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

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