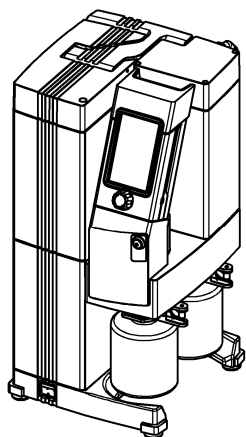


## Operating Instructions

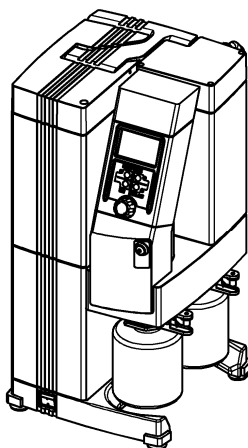
Read and observe these Operating Instructions!

# Vacuum pump systems

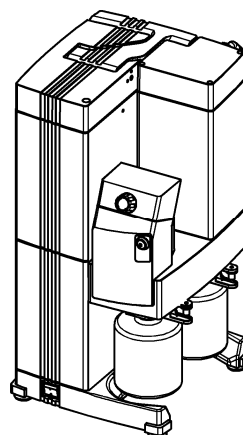
SC 950



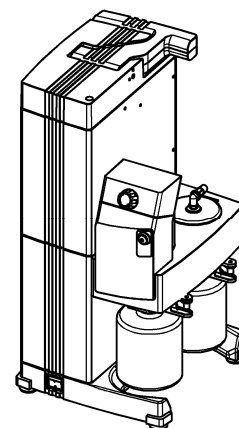
SEM 950



SH 950



SR 950



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**Items including delivery SC 950:**

- Vacuum pump system including hand terminal (batteries included)
- Coated collection flasks (2 x)
- Flask clamps (2 x)
- Mains cable
- USB cable for connecting vacuum pump system to PC
- Power supply for hand terminal
- Operating Instructions
- CD with digital Operating Instructions and software for operating the vacuum pump system with a PC

**Items including delivery SEM/SH/SR 950:**

- Vacuum pump system
- Coated collection flasks (2 x)
- Flask clamps (2 x)
- Mains cable
- Operating Instructions
- CD with digital Operating Instructions

**Transport fastener (only SC 950)**

**i** The hand terminal is fastened in place at the factory, to prevent damage during transport.

To remove the hand terminal, it is first necessary to release the transport fastener. For further details, see chapter *6. Installation and connection.*

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# 1. About this document

## 1.1. Use of the Operating Instructions

The Operating Instructions are part of the vacuum pump system.

- ➔ Carefully study the Operating Instructions before using a vacuum pump system.
- ➔ Always keep the Operating Instructions handy in the work area.
- ➔ Forward the Operating Instructions to any subsequent owners of the vacuum pump system.

Project systems

Customer-specific project systems (systems which begin with “PJ” or “PM”) may differ from the Operating Instructions.

- ➔ In case of project systems, take note of any additionally agreed specifications.
- i** Compliance with the Operating Instructions is essential for the safe and reliable operation of the vacuum pump system. Failure to do so may result in damage or injury.

## 1.2. Symbols and markings

### Warning



A danger warning is located here.

It also indicates the possible consequences of failure to observe the warning. The signal word (i.e. “Warning”) indicates the level of danger.

**WARNING**

- ➔ Here you will see actions for avoiding the danger and potential consequences.

### Danger levels

Signal word	Meaning	Consequences if not observed
<b>DANGER</b>	warns of immediate danger	Consequences include death or serious injuries and/or serious property damage.
<b>WARNING</b>	warns of potential danger	Death or serious injuries and/or serious property damage are possible.
<b>CAUTION</b>	warns of a potentially dangerous situation	Minor injuries or damage to property are possible.

Tab. 1

### Other information and symbols

- ➔ This indicates an activity (step) that must be carried out.
- 1. This indicates the first step of an activity to be carried out. Any additional steps are consecutively numbered.
- i** This symbol indicates important information.

## 2. Use

### 2.1. Intended use

The vacuum pump systems SC/SEM/SH/SR 950 are designed for use in chemical, pharmaceutical, and biological laboratories. They are exclusively intended for transferring gases and vapors.

Make sure that the installation location is dry and the pump/system is protected against water in the form of rain, spray, splashes and drips.

Vacuum pump system is solely for use in indoor areas.

#### Owner's responsibility

Operating parameters and conditions	Only install and operate the vacuum pump system under the operating parameters and conditions described in chapter 4, Technical data.
Requirements for transferred medium	<p>Protect vacuum pump system against humidity.</p> <p>Before using a medium, check the compatibility of the materials of the pump head, diaphragm, valves, sealings and tubing with the medium.</p> <p>Before using a medium, check whether the medium can be transferred danger-free in the specific application case.</p> <p>Only transfer gases which remain stable under the pressures and temperatures occurring in the pump.</p>
High performance condenser	<p>Only SC/SEM/SH 950:</p> <p>The high performance condenser must be installed on the outlet side of the pump; if it is installed on the inlet side there is a danger of implosion.</p> <p>Observe the correct usage of the gas- and cooling liquid-connections on the high performance condenser. Inlet and outlet connections for the gas are not interchangeable.</p>
Accessories	Laboratory equipment or additional components connected to a vacuum pump system have to be suitable for use with the pneumatic capabilities of the vacuum pump system (see chapter 4, page 8).

## **2.2. Improper use**

The vacuum pump system must not be operated in an explosive atmosphere.

The vacuum pump system is not suitable for transferring dusts.

The vacuum pump system is not suitable for transferring liquids.

The vacuum pump system must not be used if the entry of air or gas into the vacuum pump system during venting (vent valve) or an open gas ballast valve could result in the creation of reactive, explosive or otherwise hazardous mixtures (e.g. with the medium).

The vacuum pump system must not be used to create vacuum and pressure simultaneously.

Never apply positive pressure to the suction side of the vacuum pump system.

### 3. Safety

The vacuum pump systems are built according to the generally recognized rules of technology and in accordance with the pertinent occupational safety and accident prevention regulations. Nevertheless, potential dangers during use can result in injuries to the user or others or in damage to the pump systems or other property.

Only use the vacuum pump systems when they are in a good technical and proper working order, in accordance with their intended use, observing the safety advice within the Operating Instructions, at all times.

Personnel

Make sure that only trained and instructed personnel or specially trained personnel work on the vacuum pump systems. This especially applies to assembly, connection and servicing work.

Make sure that all personnel have read and understood the Operating Instructions, especially the "Safety" chapter.

Working in a safety-conscious manner

Observe the accident prevention and safety regulations when performing any work on the vacuum pump systems and during operation.

Do not expose any part of your body to the vacuum.

Open housing parts with notice sticker (see fig. 1) only after separating mains plug from power source.

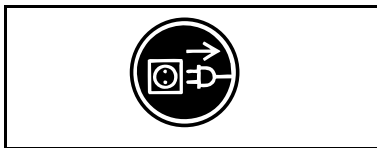


Fig. 1: Notice sticker

Correct match between hand terminal and vacuum pump system

Only SC 950:

Ensure that personnel check that the hand terminal is the right one for this particular system before using a SC 950 vacuum pump system. Vacuum pump systems are equipped with a paging system for this purpose (see Actuating the vacuum pump system, page 38).

Handling dangerous media

When transferring dangerous media, observe the safety regulations for handling such media.

Handling flammable media

Be aware that the vacuum pump systems are not designed to be explosion-proof.

Make sure the temperature of the medium is always sufficiently below its ignition temperature, to avoid ignition or explosion. This also applies to unusual operational situations.

Note that the temperature of the medium increases when the pump compresses the medium.

Hence, make sure the temperature of the medium is sufficiently below the ignition temperature of the medium, even when it is compressed to maximum permissible operating pressure of the vacuum pump system. The maximum permissible operating pressure of the vacuum pump system is stated in the technical specifications (see chapter 4, page 9).

If necessary, consider any external sources of energy, such as sources of radiation, that could additionally heat the medium.

---

	In case of doubt, consult the KNF customer service.
Ventilating the vacuum pump system	When ventilating the vacuum pump system with air or inert gas, be sure to prevent formation of reactive or explosive media. The maximum permissible operating pressure at the ventilation connection (Fig. 2/18, p. 13 (SC 950) or Fig. 4/15, p. 17 (SEM 950)) is 0.1 bar g.
Environmental protection	All replacement parts should be properly stored and disposed of in accordance with the applicable environmental protection regulations. Ensure adherence to the pertinent national and international regulations. This applies especially to parts contaminated with toxic substances.
Standards	<p>The vacuum pump systems SC/SEM/SH/SR 950 conform to the Directive 2011/65/EU (RoHS2).</p> <p>The vacuum pump systems SC/SEM/SH/SR 950 conform to the safety regulations of the EC Directive 2004/108/EC concerning Electromagnetic Compatibility and the EC Directive 2006/42/EC concerning Machinery. The requirements of the following harmonised standards have been used:</p> <ul style="list-style-type: none"><li>▪ DIN EN 61010-1</li><li>▪ DIN EN 61326-1 – Class A</li><li>▪ DIN EN 50581</li></ul> <p>The systems correspond to IEC 664:</p> <ul style="list-style-type: none"><li>▪ the overvoltage category II</li><li>▪ the pollution degree 2</li></ul>
Customer service and repairs	<p>All repairs to the vacuum pump system must be carried out by the relevant KNF Customer Service team.</p> <p>Housings with voltage-caring parts may be opened by technical personnel only.</p> <p>Use only genuine parts from KNF for servicing work.</p>



## 4. Technical data

### 4.1. Vacuum pump system

<i>Materials for parts contacting the medium</i>	
Pump head	PPS
Connection parts	PPS
Diaphragms	PTFE-coated
Valve plates	FFPM
Flat seals	FFPM
O-rings, green	FPM
O-rings, black	FFPM
Hose connector gas inlet	PTFE / PVDF
Jose connector gas outlet	PP / PVDF
Hose connector inert gas connection	POM / PA
Tubing	Norprene®
Only SC/SEM 950: Tubing inert gas connection	PVC
Adaptor separator	PP
Only SC/SEM 950: Pressure sensor	Ceramics / 1.4404
Venting valve / Gas ballast valve:	
Piston seal	FFPM
O-ring	FPM
Tube	1.4301
<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0
Ultimate vacuum [mbar abs.]	≤ 2 mbar ≤ 4 mbar with opened gas ballast
Flow rate at atm. pressure [l/min]*	50 (controllable)
Max. permissible pressure at the inert gas connection [bar g]	0.1
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 10 °C to + 40 °C
Permissible media temperature	+ 10 °C to + 40 °C

\*Liters in standard state (1,013 mbar at 0 °C)

Tab. 2 (part 1)


<i>Other parameters</i>	
Vacuum connection and gas outlet	For tube ID 10 mm
Ventilation connection	For tube ID 4 mm
Weight [kg]: - SC 950 (including hand terminal) - SEM 950 - SH 950 - SR 950	14 13.5 13 12.5
Dimensions W x H x D [mm]: SC/SEM/SH 950: SR 950:	246 x 487 x 313 246 x 487 x 264
Maximum permissible ambient relative humidity	80 % for temperatures up to 31°C, decreasing linearly to 50 % at 40°C
Maximum altitude of installation [m above sea level]	2000
<i>Only SC/SEM/SH 950: Operating parameters of coolant (high-performance condenser)</i>	
Max. permissible pressure [bar g]	3
Permissible temperature	- 15 °C to + 20 °C
Coolant connections on high-performance condenser	For tube ID 8 mm
Coolant-wetted surface [cm <sup>2</sup> ]	Min. 470
<i>Electrical data vacuum pump system</i>	
Voltage** [V]	100-240 V +/- 10 %
Frequency [Hz]	50-60 Hz
Max. current consumption [A]	1.7
Max. watt consumption [W]	150
Protection class	IP20
Fuse vacuum pump system [A]	2 x T2.5
Drive motor fusing	Electronic overcurrent protection

Tab. 2 (part 2)

\*\* Automatic voltage selection

- i** The pumps of the vacuum pump systems are supplied by a universal power supply with integrated overload protection. They are protected against overheating by a temperature sensor on the motor board and equipped with overcurrent protection.
- If one of these safety functions is triggered, the pump will be shut down and must be manually reset, as follows:
- ➔ Separate pump from the mains.
  - ➔ Remove the cause(s) of the fault before restarting.

#### 4.2. Vacuum pump system's hand terminal (only SC 950)

Dimensions: W x H x D [mm]	91 x 190 x 65
Weight [kg]	0.5
Operating voltage [V DC]	12
Current consumption [A]	1.25
Wireless connection's frequency band [GHz]	2.4
Wireless range	About 50 m without obstacles, about 10 m through walls
Power supply	Through integrated batteries or power supply (in delivery included)
DC charging socket	 External diameter: 6.3 mm Inside diameter: 2 mm
Chargeable batteries	4 x round AA 1.2 V 2300 mAh, fast-charging; see spare parts list in chapter 11
Battery service life*	Up to 12 hours, depending on number of entries and data transmission
Charging time*	approx. 7 h

Tab. 3

\* Applies to standard included batteries

- i** When charging the SC 950 vacuum pump system's hand terminal, use only the original power supply from KNF.
- i** Several different vacuum pump systems SC 950 may be operated simultaneously with their respective hand terminals within the wireless connection range.
- i** The wireless connection between hand terminal and vacuum pump system SC 950 is robustly resistant to operation of mobile telephones and Bluetooth devices in the immediate area.

### **4.3. Software (only SC 950)**

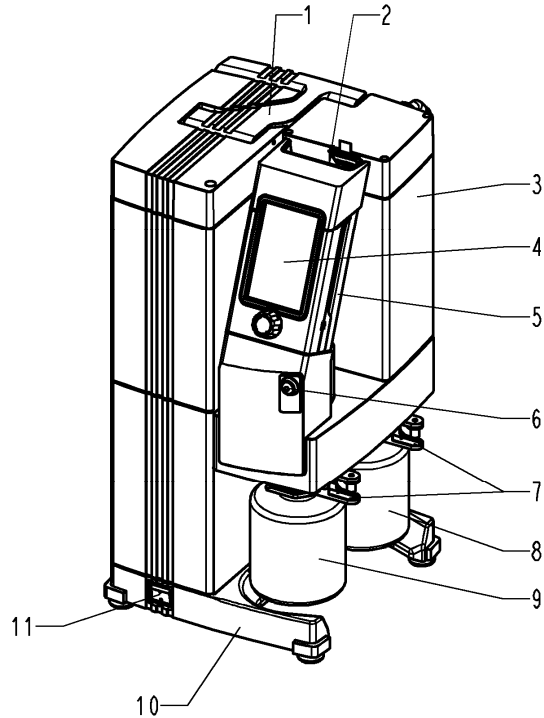
The USB connection between the PC and the vacuum pump system is operated as an RS232 interface. Accordingly, in the operating system it is managed as an additional COM connection and can be addressed with conventional terminal software. Please see the delivered CD for information on operating the vacuum pump system via software.

## 5. Assembly and function

### 5.1. SC 950

#### 5.1.1. Assembly of the vacuum pump system

- 1 Carrying handle
- 2 Transport fastener for hand terminal
- 3 High-performance condenser
- 4 Hand terminal (removable; signals transmitted wirelessly)
- 5 Hand terminal dock
- 6 Gas ballast switch
- 7 Flask clamp for 8 and 9
- 8 Pressure-side condensation collection flask (coated)
- 9 Suction-side condensation collection flask (coated)
- 10 Base
- 11 Mains switch



- 12 Top fan
- 13 Bottom fan
- 14 Coolant valve connection
- 15 USB port for connecting vacuum pump system to PC
- 16 Mains plug connection
- 17 Fuse drawer
- 18 Ventilation connection
- 19 Vacuum chamber connection (gas inlet)
- 20 Coolant connection on high-performance condenser (feed)
- 21 Coolant connection on high-performance condenser (return)
- 22 Gas outlet

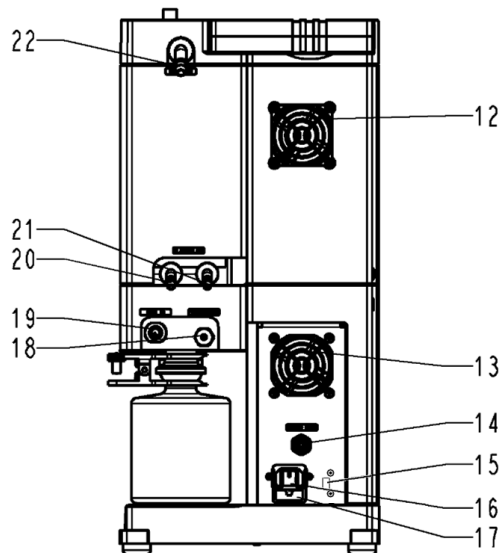


Fig. 2: Vacuum pump system SC 950

The vacuum pump system generates a vacuum that can be controlled either through the hand terminal (see Fig. 2/4, p. 13) or a PC.

Collection flask (Fig. 2/9) collects on the suction side of the pump particles and drops that were, contrary to the requirements of the pump, suctioned from the vacuum chamber. The collection flask is coated (implosion protection) and fastened to the vacuum pump system via a flask clip (7).

The high-performance condenser (3) at the pump outlet once again recollects solvents from the pumped gas instead of allowing it exit into the environment or fume hood. The high-performance condenser is surrounded by a shell for temperature insulation and explosion protection.

Solvents deposited in the high-performance condenser are collected in the coated (for explosion protection) collection flask (8). A flask clip (7) secures the glass flask to the condenser flange. A recirculating cooler or continuously flowing cold water (or another cooling media) cools the high-performance condenser to the condensation temperature.

### 5.1.2. Vacuum pump system functions

The vacuum pump system can be operated in four different modes:

- **Evacuate**  
The vacuum pump system evacuates a vacuum chamber with adjustable pump capacity.
- **Pressure control**  
The vacuum pump system controls system pressure to the set-point pressure value (constant pressure).
- **Automatic**  
The vacuum pump system independently finds the sample's vapor pressure and adjusts process pressure accordingly.
- **Function**  
The vacuum pump system controls pressure according to the entered pressure curve. Up to 10 different pressure curves can be stored. The following process parameters can be entered:
  - Setpoint pressure at various time points after starting the process
  - Coolant valve (accessory) ON and OFF with time point after start of process
  - Option "Jump" with time after the start of the process:  
The system evacuates/ventilates to the required pressure as quickly as possible.
  - Option "Automatic" with time after the start of the process:  
Automatic detection of the boiling pressure  
If the set limit pressure is reached without a vapor pressure, the program goes to the next function step.

- Option "Automatic Plus" with time after the start of the process:  
Automatic detection of the vapor pressure with subsequent pressure reduction.

At any time during an active process, you can switch to **manual process control**. Functions for Evacuate and Pressure control will be available simultaneously. When activating manual process control, the current actual pressure will be adopted as the first setpoint pressure. In other words, process pressure will be initially "frozen" at the current value.

The operating modes can be **combined in any way** for the purposes of intelligent process control. For example, after successful boiling point detection in the automatic mode, the following operating modes are available for specific distilling off of the solvent recovered:

- Evacuation  
(constant vaporization rate for optimum condenser capacity utilization)
- Function  
(Following a preset pressure ramp provided in order to attain a separation from components with higher boiling points)
- Manual process control  
(active control of the distillation using the setpoint pressure)

In order to change to another operating mode, the process is first stopped and then restarted in the new operating mode.

Gas ballast The gas ballast switch (Fig. 2/6) can be used to open and close the gas ballast valve on the vacuum pump system's pump (see Chapter 5.6).

### 5.1.3. Hand terminal

#### Basic elements

- 1 Upper grip
- 2 Touchscreen
- 3 I/O switch
- 4 DC input 12 V
- 5 Rotary knob for
  - adjusting pump speed and setpoint pressure
  - switching to manual operation

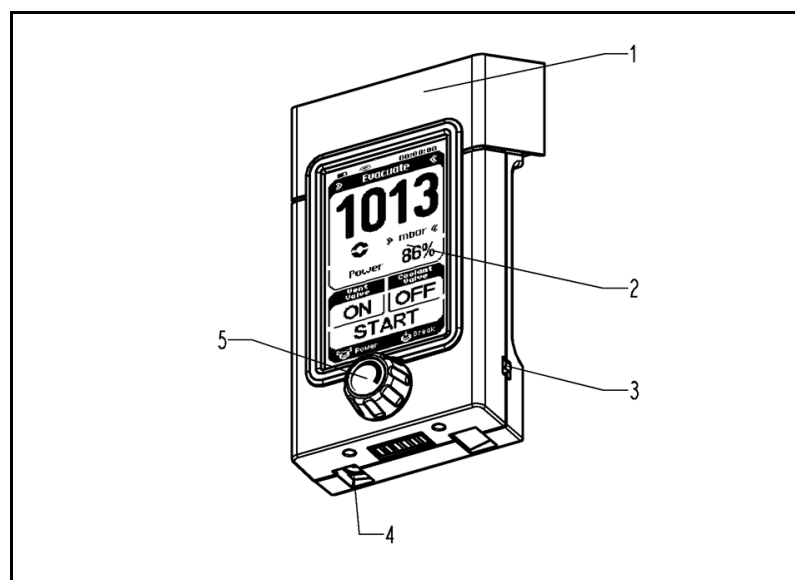


Fig. 3: Hand terminal SC 950

**Function**

The hand terminal is used to set process parameters with which the vacuum pump system SC 950 will control pressure.

Settings can be made on the hand terminal's touchscreen (2) and with the rotary knob (5).

To operate the vacuum pump system remotely, remove the hand terminal from the holder (see chapter 5.1.1, page 13) on the vacuum pump system. This provides a convenient way to operate the vacuum pump system when it is in a cabinet or under a closed fume hood.

Whenever the hand terminal is located in the holder while the vacuum pump system is turned on, the batteries in the hand terminal will charge automatically. This happens even when hand terminal is switched off. Alternatively, the batteries can be charged through the hand terminal's power supply (see DC input (4)). As a result, it is not necessary to place the vacuum pump system where it is easily accessible for the user.

The power supply also makes it possible to supply the hand terminal with electrical power directly from a mains connection.

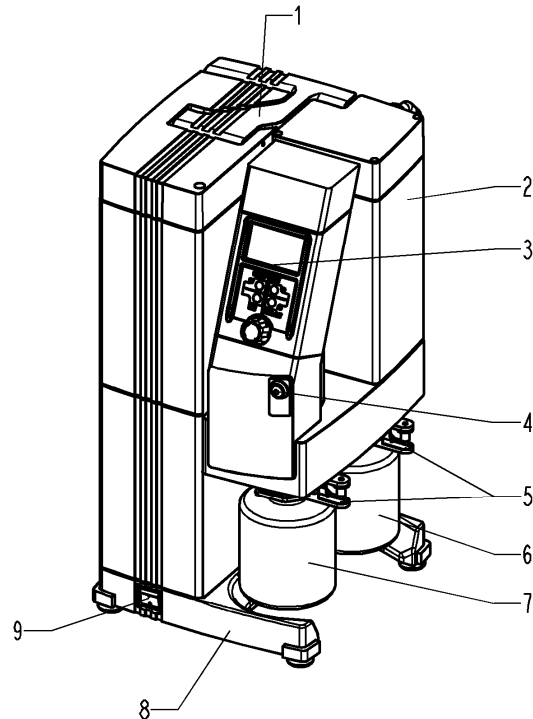
An acoustic alarm sounds on the hand terminal when the battery charge levels are low.



## 5.2. SEM 950

### 5.2.1. Assembly of the vacuum pump system

- 1 Carrying handle
- 2 High-performance condenser
- 3 Control terminal
- 4 Gas ballast switch
- 5 Flask clamp for 6 and 7
- 6 Pressure-side condensation collection flask (coated)
- 7 Suction-side condensation collection flask (coated)
- 8 Base
- 9 Mains switch



- 10 Top fan
- 11 Bottom fan
- 12 Coolant valve connection
- 13 Mains plug connection
- 14 Fuse drawer
- 15 Ventilation connection
- 16 Vacuum chamber connection (gas inlet)
- 17 Coolant connection on high-performance condenser (feed)
- 18 Coolant connection on high-performance condenser (return)
- 19 Gas outlet

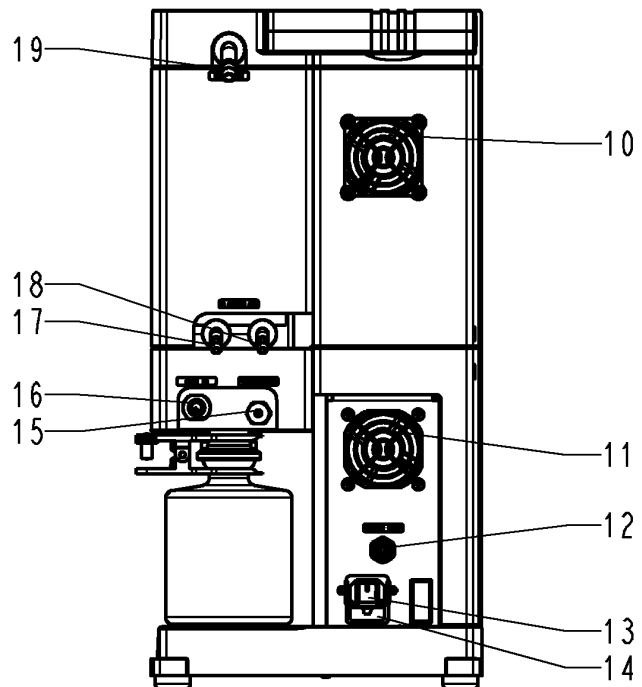


Fig. 4: Vacuum pump system SEM 950

Collection flask (Fig. 4/7) collects on the suction side of the pump particles and drops that were, contrary to the requirements of the pump, suctioned from the vacuum chamber. The collection flask is coated (implosion protection) and fastened to the vacuum pump system via a flask clip (5).

The high-performance condenser (2) at the pump outlet once again recollects solvents from the pumped gas instead of allowing it exit into the environment or fume hood. The high-performance condenser is surrounded by a shell for temperature insulation and explosion protection.

Solvents deposited in the high-performance condenser are collected in the coated (for explosion protection) collection flask (6). A flask clip (5) secures the glass flask to the condenser flange. A recirculating cooler or continuously flowing cold water (or another cooling media) cools the high-performance condenser to the condensation temperature.

### 5.2.2. Vacuum pump system functions

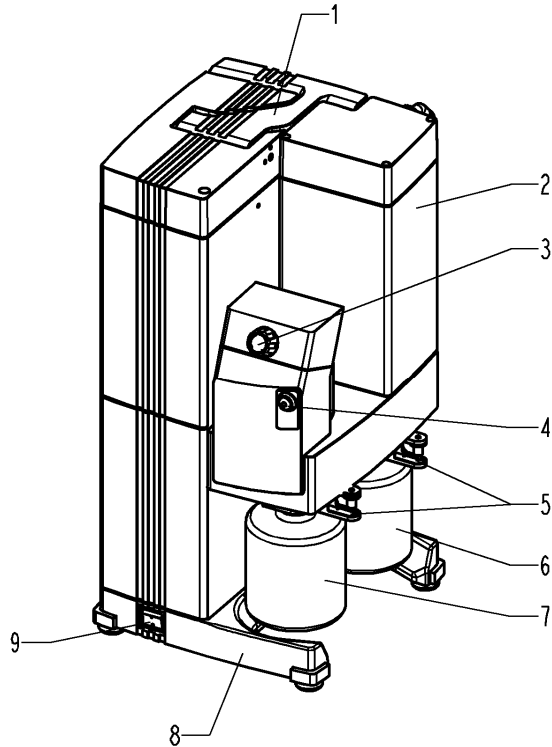
The flow of the pump (15% - 100%) can be set via the rotary knob on the control terminal (3).

Gas ballast      The gas ballast switch (4) can be used to open and close the gas ballast valve on the vacuum pump system's pump (see Chapter 5.6).

### 5.3. SH 950

#### 5.3.1. Assembly of the vacuum pump system

- 1 Carrying handle
- 2 High-performance condenser
- 3 Rotary knob
- 4 Gas ballast switch
- 5 Flask clamp for 6 and 7
- 6 Pressure-side condensation collection flask (coated)
- 7 Suction-side condensation collection flask (coated)
- 8 Base
- 9 Mains switch



- 10 Top fan
- 11 Bottom fan
- 12 Mains plug connection
- 13 Fuse drawer
- 14 Vacuum chamber connection (gas inlet)
- 15 Coolant connection on high-performance condenser (feed)
- 16 Coolant connection on high-performance condenser (return)
- 17 Gas outlet

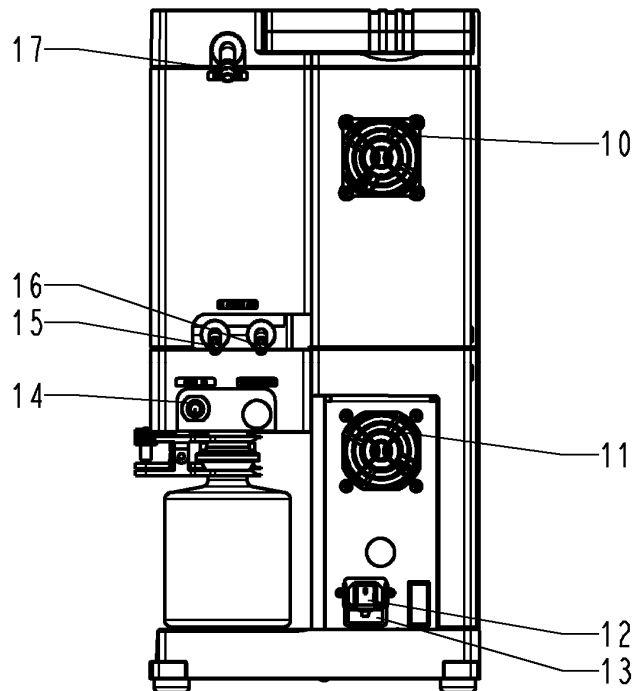


Fig. 5: Vacuum pump system SH 950

Collection flask (Fig. 5/7) collects on the suction side of the pump particles and drops that were, contrary to the requirements of the pump, suctioned from the vacuum chamber. The collection flask is coated (implosion protection) and fastened to the vacuum pump system via a flask clip (5).

The high-performance condenser (2) at the pump outlet once again recollects solvents from the pumped gas instead of allowing it exit into the environment or fume hood. The high-performance condenser is surrounded by a shell for temperature insulation and explosion protection.

Solvents deposited in the high-performance condenser are collected in the coated (for explosion protection) collection flask (6). A flask clip (5) secures the glass flask to the condenser flange. A recirculating cooler or continuously flowing cold water (or another cooling media) cools the high-performance condenser to the condensation temperature.

### 5.3.2. Vacuum pump system functions

The flow of the pump can be set via the rotary knob on the control terminal (3).

**i** If the rotary knob is rotated to the left until it engages the mechanical indent, the pump will rotate with a minimum flow rate of 15%.

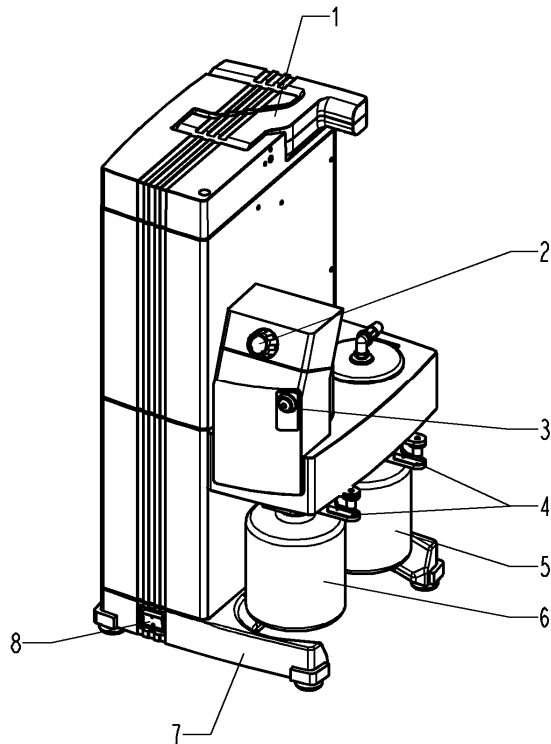
If the rotary knob is then rotated farther to the left (past the mechanical indent), the vacuum pump system's pump will be switched off.

Gas ballast      The gas ballast switch (4) can be used to open and close the gas ballast valve on the vacuum pump system's pump (see Chapter 5.6).

### 5.4. SR 950

#### 5.4.1. Assembly of the vacuum pump system

- 1 Carrying handle
- 2 Rotary knob
- 3 Gas ballast switch
- 4 Flask clamp for 6 and 7
- 5 Pressure-side condensation collection flask (coated)
- 6 Suction-side condensation collection flask (coated)
- 7 Base
- 8 Mains switch



- 9 Top fan
- 10 Bottom fan
- 11 Mains plug connection
- 12 Fuse drawer
- 13 Vacuum chamber connection (gas inlet)
- 14 Gas outlet

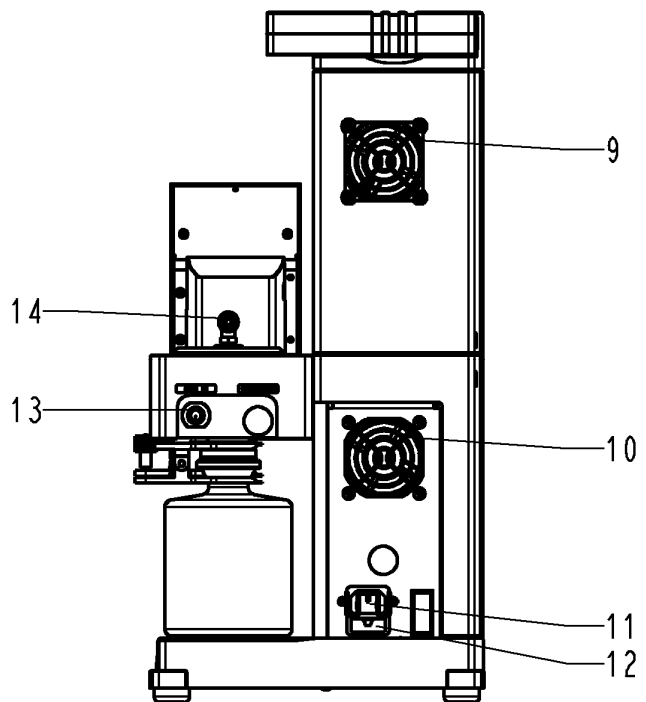


Fig. 6: Vacuum pump system SR 950

Collection flask (Fig. 6/6) collects on the suction side of the pump particles and drops that were, contrary to the requirements of the pump, suctioned from the vacuum chamber. The collection flask is coated (implosion protection) and fastened to the vacuum pump system via a flask clip (4).

Solvents deposited on the pressure side of the pump are collected in the collection flask (coated for explosion protection) (5). A flask clip (4) fastens the glass flask to the separator adapter.

#### 5.4.2. Vacuum pump system functions

The flow of the pump can be set via the rotary knob on the control terminal (2).

**i** If the rotary knob is rotated to the left until it engages the mechanical indent, the pump will rotate with a minimum flow rate of 15%.

If the rotary knob is then rotated farther to the left (past the mechanical indent), the vacuum pump system's pump will be switched off.

Gas ballast      The gas ballast switch (3) can be used to open and close the gas ballast valve on the vacuum pump system's pump (see Chapter 5.6).

## 5.5. Pump

### Assembly

- 1 Outlet valve
- 2 Inlet valve
- 3 Working chamber
- 4 Diaphragm
- 5 Eccentric
- 6 Connecting rod
- 7 Pump drive

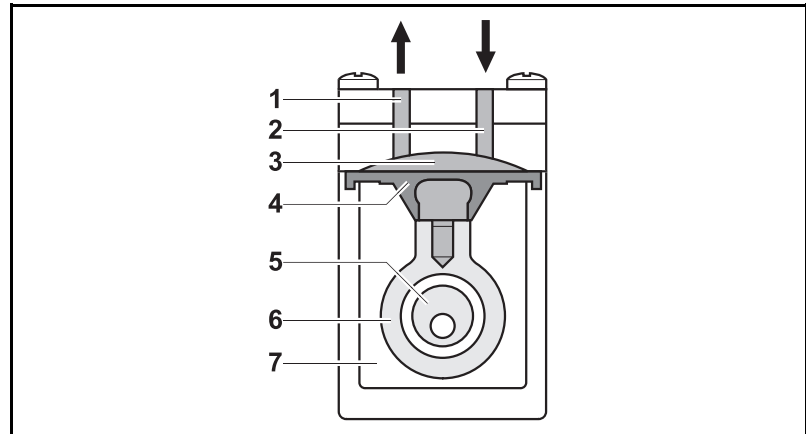


Fig. 7: Pump design

### How diaphragm pumps work

Diaphragm pumps transfer, compress (depending on pump version) and evacuate gases and vapors.

The elastic diaphragm (4) is moved up and down by the eccentric (5) and the connecting rod (6). In the downward stroke it aspirates the gas to be transferred via the inlet valve (2). In the upward stroke, the diaphragm presses the medium out of the pump head via the outlet valve (1). The diaphragm hermetically seals the working chamber (3) from the pump drive (7).

## 5.6. Gas ballast

### Assembly

#### 1 Gas ballast valve

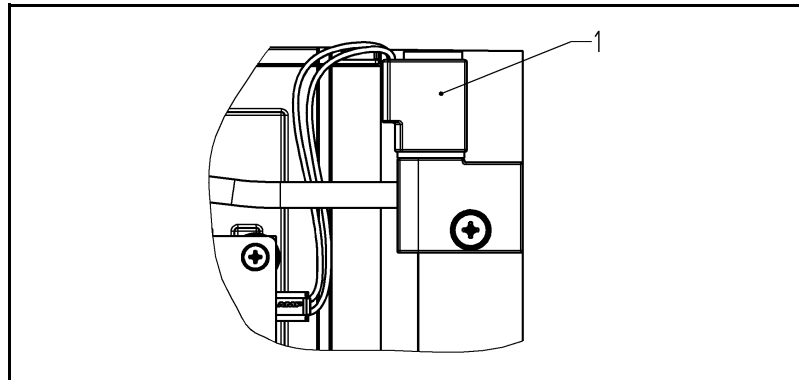


Fig. 8: Gas ballast of the pump

### Function gas ballast



**WARNING**

Personal injury caused by poisoning or explosion and damage to the pump.

→ Make sure that no reactive or explosive mixtures will be produced when gas ballast valve is open.

**i** When pumping vaporous media, opening the gas ballast valve can minimise the formation of condensation in the pump heads.

**i** Opening the gas ballast valve deteriorates ultimate vacuum performance.

The gas ballast valve can be opened and closed via the gas ballast switch (Fig. 2/6, p. 13 or Fig. 4/4, p. 17, Fig. 5/4, p. 19 and Fig. 6/3, p. 21):

- push once
  - open gas ballast valve, blue LED on
- push again
  - close gas ballast valve again, blue LED off

Please contact KNF Service if you require an inert connection for the gas ballast.



## 6. Installation and connection

- Always install the vacuum pump system under the operating parameters and conditions described in chapter 4, Technical data, page 9).
- Observe the safety precautions (see chapter 3, page 7).

### 6.1. Installation

- Before installation, store the vacuum pump system at the installation location to bring it up to room temperature.
- Cooling air supply → Install the vacuum pump system so that the two motor fans of the vacuum pump system are not blocked.
- Installation location → Make sure that the installation location is dry and the vacuum pump system is protected against water in the form of rain, spray, splashes and drips.
  - Choose a safe location (flat surface) for the vacuum pump system.
  - Protect the vacuum pump system against dust.
  - Protect the vacuum pump system against vibrations and jolts.
- Connected components → Only connect components to the vacuum pump system which are designed for the pneumatic data of the vacuum pump system (see chapter 4, page 9).
- Coolant for high-performance condenser Only SC/SEM/SH 950:  
A recirculating cooler or flowing cold water (or another cooling media) is needed to cool the high-performance condenser to the condensation temperature.
- Removing the transport fastener Only SC 950:  
The hand terminal of the vacuum pump system SC 950 is fastened in place at the factory, to prevent damage during transport. To remove the hand terminal, it is first necessary to release the transport fastener. To do this, rotate the knurled knob (Fig. 2/2, p. 13) out until the hand terminal can be removed.
  - i** The transport fastener can be screwed in again for any future transport operations.
- Installing the collection flask Install the collection flasks (Fig. 2/8 and 9, p. 13 or Fig. 4/6 and 7, p. 17, Fig. 5/6 and 7, p. 19 and Fig. 6/5 and 6, p. 21) with the flask clips (Fig. 2/7, p. 13 or Fig. 4/5, p. 17, Fig. 5/5, p. 19 and Fig. 6/4, p. 21). The flasks and clips are included as loose parts.

## 6.2. Connection

1. Connect the vacuum chamber to the gas inlet's hose connector (Fig. 2/19, p. 13 or Fig. 4/16, p. 17, Fig. 5/14, p. 19 and Fig. 6/13, p. 21, for hose inside diameter of 10 mm). For this, vacuum tubing must be used.
2. Connect hose to high-performance condenser in order to discharge gas exhaust (Fig. 2/22, p. 13 or Fig. 4/19, p. 17, Fig. 5/17, p. 19 and Fig. 6/14, p. 21, for hose inside diameter of 10 mm).

Only SC/SEM/SH 950:



Danger of high performance condenser bursting. The high-performance condenser is not pressure-proof.

**CAUTION**

→ Do not reduce or regulate the quantity of gas at the gas outlet, and do not install any components that hinder the gas flow.

- i** Safely discharge gas exhaust so that no gas can escape into the ambient air.
- i** Only SC/SEM/SH 950:  
Make sure that the high-performance condenser's gas outlet is not blocked (high-performance condenser is not pressure-proof).
- 3. Only SC/SEM/SH 950:  
Attach coolant feed and return to high-performance condenser (Fig. 2/20 and 21, p. 13 or Fig. 4/17 and 18, p. 17 and Fig. 5/15 and 16, p. 19, for hose inside diameter of 8 mm).
- i** SC/SEM 950 only:  
Connect only the KNF coolant valve (see Chapter 11.2, Accessories) to the coolant valve connection (Fig. 2/14, p. 13 or Fig. 4/12, p. 17). Consult with KNF before using any other valves.
- 4. Only SC/SEM 950:  
If necessary: Connect inert gas supply to ventilation connection (Fig. 2/18, p. 13 or Fig. 4/15, p. 17). Observe the safety instructions in chapter 3. Please contact KNF Service if you require an inert connection for the gas ballast.
- 5. Insert the power cable plug into a properly installed shockproof socket.

## 7. Operation

### 7.1. Start up

Before switching on the vacuum pump system, observe the following points:

Operational requirements
<ul style="list-style-type: none"> <li>▪ All hoses attached properly</li> <li>▪ Fan openings not blocked</li> <li>▪ Specifications of the power supply correspond with the data on the vacuum pump system's type plate.</li> <li>▪ Only SC/SEM/SH 950: Recirculating cooler or cold water connection ready on high-performance condenser.</li> <li>▪ Only SC/SEM/SH 950: The high-performance condenser's gas outlet is not blocked (high-performance condenser is not pressure-proof).</li> <li>▪ Vacuum pump system is at room temperature.</li> <li>▪ Only SC 950: Ensure that hand terminals are properly matched up with appropriate vacuum pump system.</li> <li>▪ Only SC/SEM 950: No reactive, explosive or otherwise hazardous mixtures may be produced when ventilating the vacuum system through the air inlet (Fig. 2/18, p. 13 or Fig. 4/15, p. 17) (if necessary, use an inert gas)</li> <li>▪ When the gas ballast valve is open (blue LED illuminates) do not allow reactive, explosive, or otherwise hazardous mixtures to form (contact KNF Service when in doubt).</li> </ul>

Tab. 4

- ➔ Only operate the vacuum pump system under the operating parameters and conditions described in chapter 4, Technical data (page 9).
- ➔ Make sure the vacuum pump system is used properly (see chapter 2.1, page 5).
- ➔ Make sure the vacuum pump system is not used improperly (see chapter 2.2, page 6).
- ➔ Observe the safety precautions (see chapter 3, page 7).

Only SC 950:

---



**DANGER**

Uncontrolled operation may result in personal injury and damage to the vacuum pump system.

When using several vacuum pump systems SC 950, there is the danger of confusing them, which can result in undesired interference into other processes: The transmission of commands from the wrong hand terminal for the vacuum pump system may trigger an uncontrolled response in the vacuum pump system that the terminal controls.

- Every time a vacuum pump system SC 950 is used with a hand terminal, it is essential to ensure a correct match between the two components. Use the paging function for this purpose (see Actuating the vacuum pump system, page 38).
  - Additionally it is possible to use color stickers to indicate which hand terminal belongs to which vacuum pump system SC 950 (see chapter 11. *Spare parts and accessories*).
- 

Only SC 950:

---



**WARNING**

Uncontrolled operation may result in personal injury and damage to the vacuum pump system SC 950.

If the wireless connection between the hand terminal and vacuum pump system SC 950 is broken, the vacuum pump system will continue to operate with the current settings.

- Immediately determine and remove the cause of the interruption between the hand terminal and vacuum pump system (chapter 10, page 54).
  - If you are not able to reestablish wireless contact, replace the hand terminal back to the vacuum pump system (chapter 8.1.1, page 31). The vacuum pump system can also be operated directly and the ventilation valve and coolant valve can be opened and closed directly (chapter 8.2, page 40).
-

Only SC/SEM 950:



**WARNING**

Personal injury caused by poisoning or explosion and damage to the vacuum pump system.

- Make sure that no reactive or explosive mixtures will be produced when ventilating the vacuum pump system through the air inlet or when gas ballast valve is opened.



**WARNING**

Hazard of the vacuum pump system bursting due to excessive pressure increase

- Do not exceed max. permissible operating pressure (0 bar).
- Monitor pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure, immediately shut down vacuum pump system and eliminate fault (see chapter 10, page 54).

Only SC/SEM/SH 950:



**CAUTION**

Danger of high performance condenser bursting. The high-performance condenser is not pressure-proof.

- Make sure that the high performance condenser's gas outlet is not blocked.

**i** In order for the high-performance condenser to recover solvent from the delivered gas, it must be cooled by means of a cold water supply or recirculating cooler.

Only SC/SEM 950:

When using a coolant valve:



**WARNING**

Danger of the high performance condenser bursting

- Make sure that the coolant valve is mounted between the coolant supply and the coolant inlet port of high performance condenser.

Pump standstill

With the pump at a standstill, open pressure and suction lines to normal atmospheric pressure

Inspect and empty collection flasks

At appropriate intervals, inspect the fill level in the condensation collection flasks located on the suction and pressure sides of the vacuum pump system (Fig. 2/8 and 9, p. 13 or Fig. 4/6 and 7, p. 17). When needed, empty the collection flasks; properly dispose contents.

**Switching vacuum pump system on**

**i** The vacuum pump system may not start up against overpressure during switch-on. During operation as well, there may be no overpressure in the pneumatic lines. If a pump starts against pressure, it may block. This activates the overload protection, and the pump switches off.

→ Switch on vacuum pump system at mains switch (Fig. 2/11, p. 13 or Fig. 4/9, p. 17, Fig. 5/9, p. 19 and Fig. 6/8, p. 21).

→ Only SC 950:  
Switch on hand terminal at its I/O switch (see Fig. 3/3, page 15).

**i** Refer to chapter 8, page 31, for information on operating the vacuum pump system.

**7.2. Taking system out of operation**

→ Stop the ongoing process.

→ When transferring aggressive media, flush the vacuum pump system prior to switch-off to increase the service life of the diaphragms (see chapter 9.2.1, page 44).

→ Switch off vacuum pump system with mains switch (see Fig. 2/11, p. 13 or Fig. 4/9, p. 17, Fig. 5/9, p. 19 and Fig. 6/8, p. 21).

→ Only SC 950:  
Switch off hand terminal at its I/O switch (see Fig. 3/3, page 15).

Only SC 950:

**WARNING**

Uncontrolled operation may result in personal injury and damage to the vacuum pump system SC 950.

If the hand terminal is switched off while the vacuum pump system SC 950 remains switched on, the vacuum pump system will continue to operate with the current settings.

→ Always switch the vacuum pump system off when done working.

---

## 8. Operating vacuum pump system

### 8.1. Hand terminal (only SC 950)

#### 8.1.1. General functions and displays

- 1 Upper grip
- 2 Touchscreen
- 3 I/O switch
- 4 DC input 12 V
- 5 Rotary knob for
  - adjusting pump speed and setpoint pressure
  - switching to manual operation

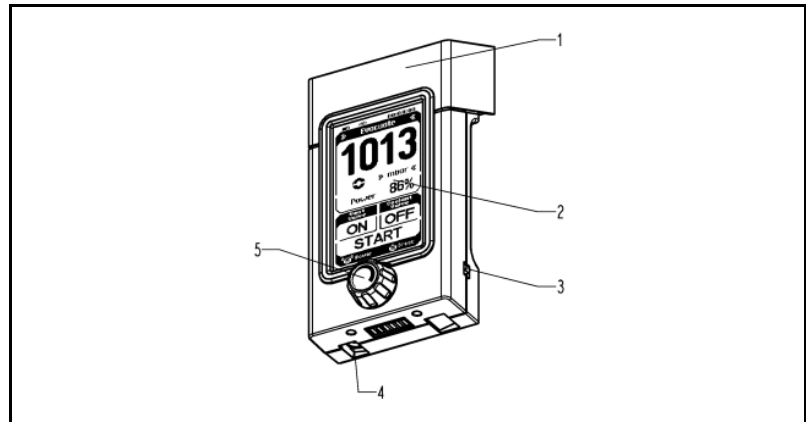


Fig. 9: Hand terminal

The vacuum pump system is operated via the hand terminal with the aid of:

- a rotary knob (Fig. 9/5) and
- a touchscreen (Fig. 9/2).

The **rotary knob** has the following functions:

- Rotate: Changes pump capacity or the selected pressure setting (depending on selected operating mode).
- Press: Interrupts the active process and switches into manual process control (pressing effects an evacuation in this case).

**Touchscreen** contents:

- Display of the most important process variables (Fig. 10, page 32).
- Menu for selecting operating mode and units for pressure display (Fig. 11, page 33).
- Operating buttons (Fig. 11, page 33) with the following functions:
  - Start and stop the process;
  - open and close the ventilation valve;
  - open and close the high-performance condenser's coolant valve (accessory).

#### Removing and replacing the hand terminal

To remove the hand terminal from the vacuum pump system: grasp the upper grip of the hand terminal (Fig. 9/1) and pull until it releases, and then remove it.

Replacing the hand terminal:

Insert the bottom of the terminal into the holder provided in the vacuum pump system (Fig. 2/5, page 13); then push firmly on the upper grip of the terminal (Fig. 9/1) until it clicks into place.

- i** Whenever the hand terminal is located in the holder while the vacuum pump system is turned on, the batteries in the hand terminal will charge automatically. This happens irrespective of whether the hand terminal is switched on or off.
- i** Every time you use a hand terminal, check to ensure a correct match between the terminal and the vacuum pump system. Use the paging system for this purpose (see Actuating the vacuum pump system, page 38).

**Displays**

- 1** Battery:
  - Charging
  - Charging status
- 2** Connection to vacuum pump system
  - Direct connection
  - Wireless connection
- 3** Process time
- 4** Actual pressure in selected pressure unit (or „No connection“, if no wireless connection to vacuum pump system)
- 5** Process active
- 6** Capacity in percent or setpoint pressure in selected pressure unit (depending on operating mode)
- 7** Explanation of rotary knob functions  
(Rotate: change capacity; Press: interrupt operating mode and switch to manual process control)
- 8** Only in *Automatic* operating mode  
Automatic with pressure reduction
- 9** Only in *Automatic* operating mode  
Automatic pressure reduction active

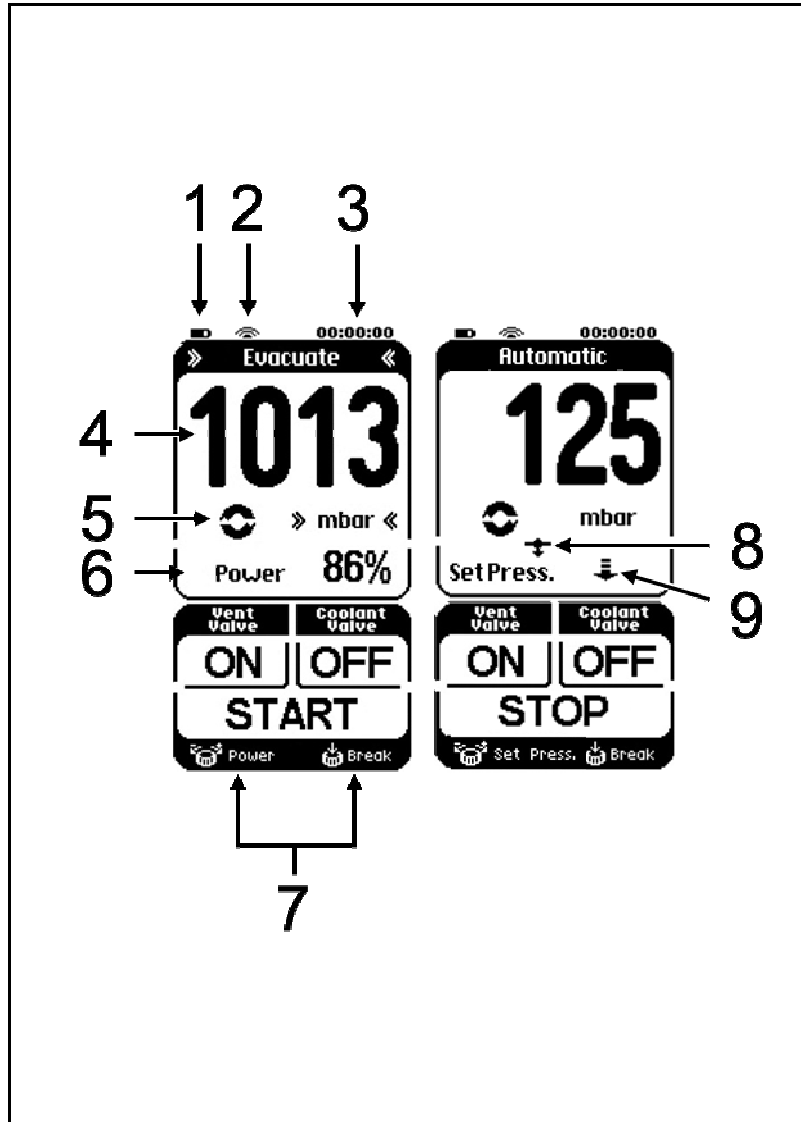
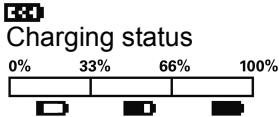


Fig. 10: Display on the touchscreen



**Menus and buttons**

- 1 Operating mode menu
- 2 Pressure units menu
- 3 Button Actuating the vacuum pump system (Paging)
- 4 Button for ventilation valve:  
ON = To open  
OFF = To close
- 5 Button for coolant valve (accessory) at high-performance condenser:  
ON = To open  
OFF = To close
- 6 Button for the process:  
START = To start  
STOP = To stop
- 7 Button for automatic pressure reduction:  
Press = Finish (the current pressure is applied as the setpoint pressure)

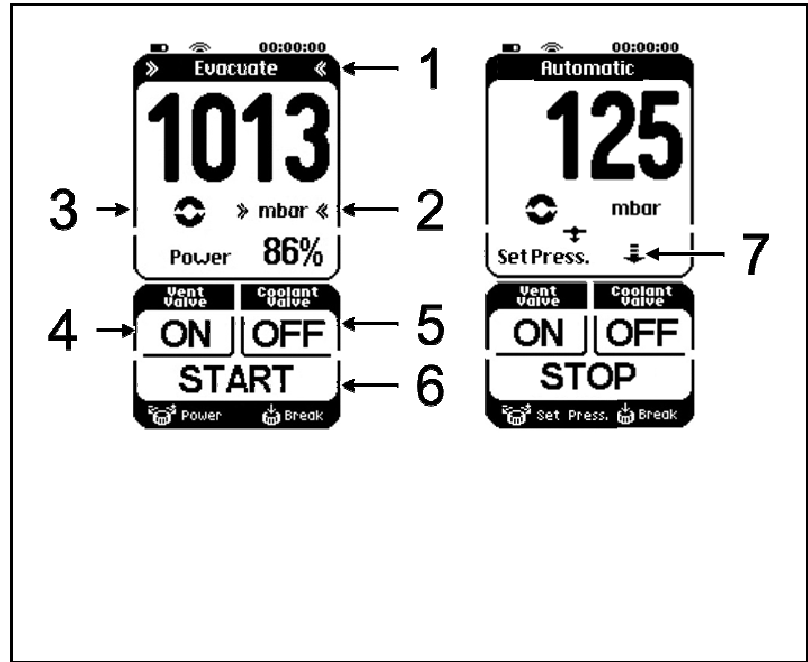


Fig. 11: Menus and buttons on the touchscreen

## 8.1.2. Operation

### Menu language

When the start page appears after switching the hand terminal on, choose between the following languages: German, English, French, Italian, Spanish, Dutch, Japanese, and Chinese. The selection can be made only immediately after switching on.

### Pressure unit

Process pressure can be displayed on the hand terminal in mbar, bar, hPa, or Torr.

Use the Pressure units menu to select the pressure units (button on touchscreen; see Fig. 12).

- i** Pressure units can be changed only when no process is active.
- i** In order to change the unit of pressure, it is necessary to temporarily switch to another operating mode.

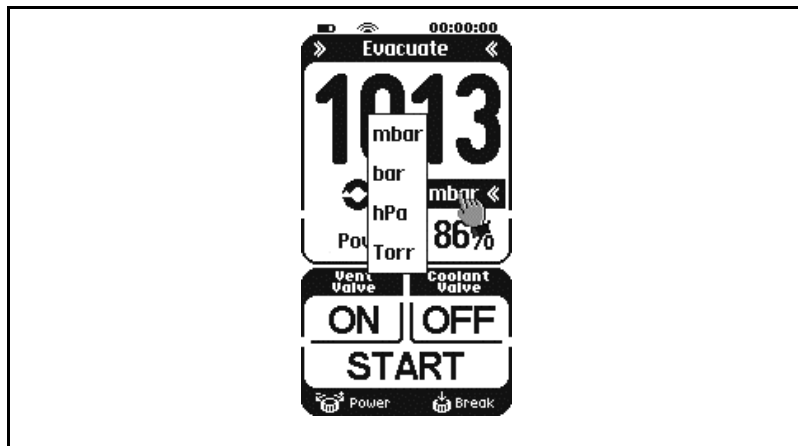


Fig. 12: Pressure units menu

### Operating modes

The current operating mode is displayed at the top of the hand terminal's touchscreen. Press on this line of the touchscreen to open the menu for changing operating mode (see Fig. 13, at the top).

- i** Operating mode can be changed only when no process is active.

### Switching to manual process control (Break)

- Press briefly on the rotary knob:  
Manual process control; actual pressure will be adopted as the setpoint pressure and actively controlled.

### Within the manual process control

- Press on the rotary knob:  
Vacuum pump system will evacuate.
- Let go:  
Actual pressure will be adopted as setpoint pressure.

- Rotate:  
Changes setpoint pressure.

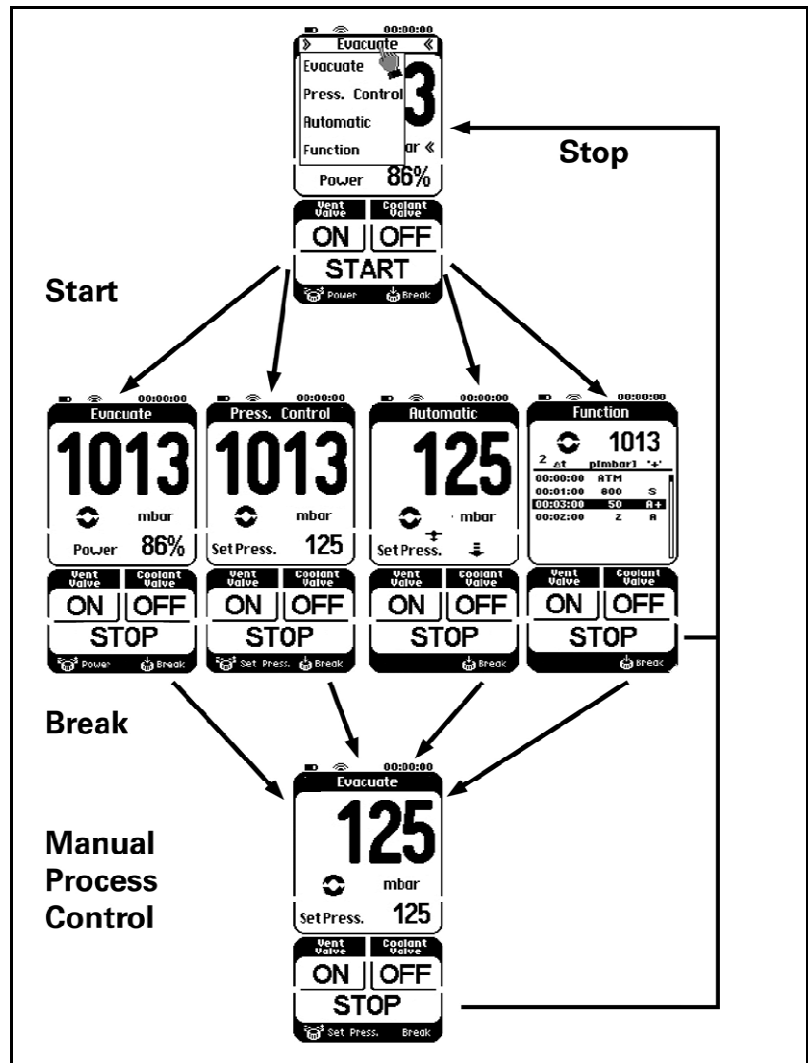


Fig. 13: Operating mode menu

### Starting and stopping the process

Pressing the START button starts a process.

Pressing the STOP button stops a process.

### Open and close the ventilation valve



**WARNING**

Personal injury caused by poisoning or explosion and damage to the vacuum pump system

→ Ensure that the creation of reactive, explosive or otherwise hazardous mixtures during the supply of air is prevented.

Pressing the ON button for ventilation valve (left button below) opens the ventilation valve.

**i** If the ON button is pressed for more than 3 seconds, the ventilation valve remains open.

If the ventilation valve is permanently open (OFF button shown in display), it can be closed again with the *OFF* button.

**Opening and closing coolant valve (accessory)**

Pressing the ON button for coolant valve (right button below) opens the coolant valve on the high-performance condenser.

Pressing the OFF button for the coolant valve closes the coolant valve on the high-performance condenser.

**Entering value in Evacuate operating mode**

Use the rotary knob to set pump capacity.

**Entering value in Pressure control operating mode**

Use rotary knob to set desired pressure.

**Entering value in Automatic operating mode**

Not necessary to enter value.

If a boiling point is detected in *Automatic* mode, after the system regulates to this pressure, the pressure is reduced automatically to speed up evaporation of the solvent (see Fig. 14).

- 1.) Start Automatic operating mode
- 2.) Boiling point detected; system regulates to this pressure
- 3.) Automatic pressure reduction

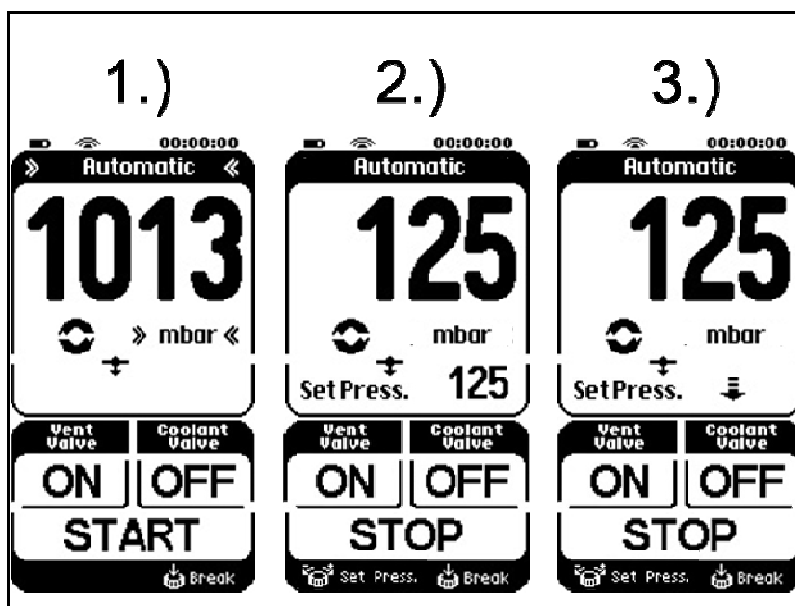


Fig. 14: Automatic function sequence

**i** If you press the arrow key (see Fig. 11/7) during automatic pressure reduction, the current pressure is applied as the new setpoint pressure and the vacuum pump system regulates to this pressure. The current setpoint pressure is shown in the display in place of the arrow.

If you press again on the setpoint pressure value, automatic pressure reduction is reactivated and the arrow appears in the display after about 25 seconds.

### Entering value in Function operating mode

The desired pressure curve is entered via data points that connect the vacuum pump system to pressure ramps.

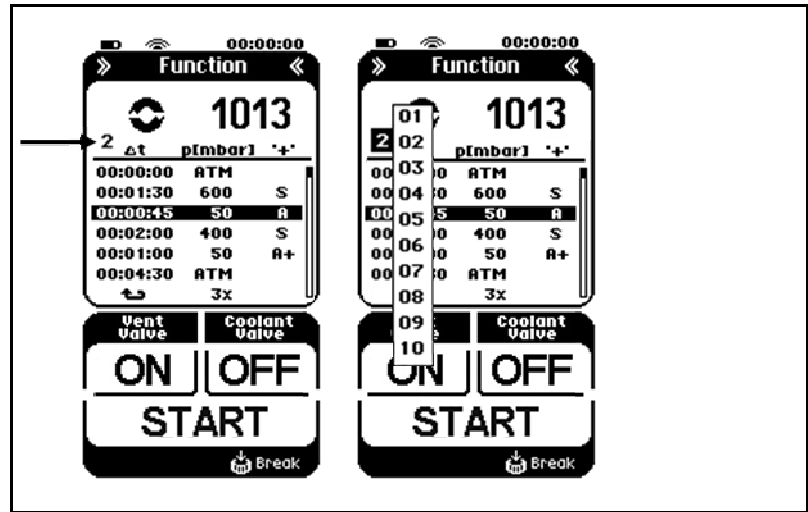


Fig. 15: Menu for Function operating mode

Entering data points (up to 12):

1. Time interval since the last data point:  $\Delta t$
  2. Setpoint pressure: p (mbar) / p (bar) / p (hPa) / p (Torr)
  3. Additional options ("+" column) to influence the course of the function:
    - CV1: Open coolant valve (accessory):
    - CV0: Close coolant valve (accessory):
    - S: Jump – the system evacuates/ventilates to the required pressure as quickly as possible.
    - A: Automatic – Automatic detection of the boiling pressure
- i** If the set limit pressure is reached without a vapor pressure, the program goes to the next function step.
- A+: Automatic Plus – Automatic detection of the vapor pressure with subsequent pressure reduction.

Line selection (see Fig. 15):

- To change the line:  
Turn the rotary knob.
- To select a line for editing:  
Press the rotary knob.


To edit a selected line:

- To change columns:  
(e.g. from  $\Delta t$  to p (mbar):  
Press the rotary knob.

- To change an entry:  
Turn the rotary knob.
- i** After the last column (+), the display automatically returns to line selection and jumps to the next line.
- i** If you are in input mode and have not entered any data within 3 seconds, the display automatically returns to line selection.
- i** The function values of the data point table are stored in the internal memory of the vacuum pump system when the process starts, and are available again when there is a restart.
- i** Changes to the function values (sampling point table) are carried over directly from the PC software, which may be used simultaneously.

Repeating/deleting sampling points:

The following symbols may be set in the column for the time intervals under the value 00:00:00:

-  = Repetition. The desired number of repetitions can now be specified in the field for the setpoint pressure.
- ... = Deletion of the data point.

In both cases, all subsequent sampling points are automatically deleted.

Calling the stored data point tables:

- Press the button to select data point tables (arrow in Fig. 15) and select the required data point table.  
You can now see the data point table that is stored under the number.
- i** Up to 10 different data point tables can be stored and called as required. The number in the display (arrow in Fig. 15) indicates the data point table that is currently selected.

### **Actuating the vacuum pump system (Paging)**

When you press the circle symbol for the active process (Fig. 10/5, page 32) in the hand terminal display, the LED next to the page button (Fig. 17, page 40) on the vacuum pump system will blink.

The other way around, the hand terminal will answer with a signal tone if you press the paging button of the vacuum pump system (see chapter 8.2, page 40).

### **No wireless connection**

If there is no wireless connection between the hand terminal and the related vacuum pump system (for example if the vacuum pump system is not switched on or the wireless connection is being established or is interrupted):

- The message "No connection" will blink in the hand terminal's display (see Fig. 16);
- An audible warning will be emitted if a button on the touch-screen is pressed.

Refer to chapter 10, table 9 for tips on resolving this problem.

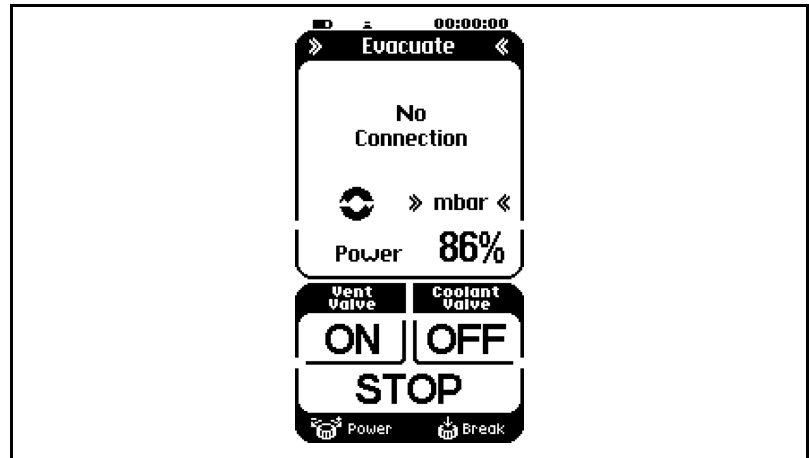


Fig. 16: Display „No connection“

### 8.1.3. Changing batteries on the hand terminal

Necessary tool

Qty.	Material
1	Phillips-head screwdriver No. 2

Tab. 5

1. Loosen the six screws on the underside of the hand terminal.
2. Remove the rear cover plate.
3. Replace the batteries.
- i** Refer to chapter 4.2, page 11, for required battery specifications.
- i** Never use new and used batteries together. Batteries must always be replaced all at the same time.
4. Re-install cover plate.
5. Dispose of batteries according to regulations.

## 8.2. Operation without hand terminal

### 8.2.1. SC 950

The following actions can be taken directly on the vacuum pump system when the hand terminal is removed (Fig. 17):

- Stop the process;
- Open and close the ventilation valve;
- Open and close the high-performance condenser's coolant valve (accessory).
- Call the hand terminal (paging); the hand terminal will answer with a signal tone.
- Open/Close gas ballast valve via gas ballast switch (6)  
(also possible with put on hand terminal):
  - push once → open gas ballast valve, blue LED on
  - push again → close gas ballast valve again, blue LED off

- 1 Stop process button
- 2 To open/to close ventilation valve button
- 3 Call the hand terminal button (paging)
- 4 Button to open/to close coolant valve (accessory) on the high-performance condenser
- 6 Gas ballast switch

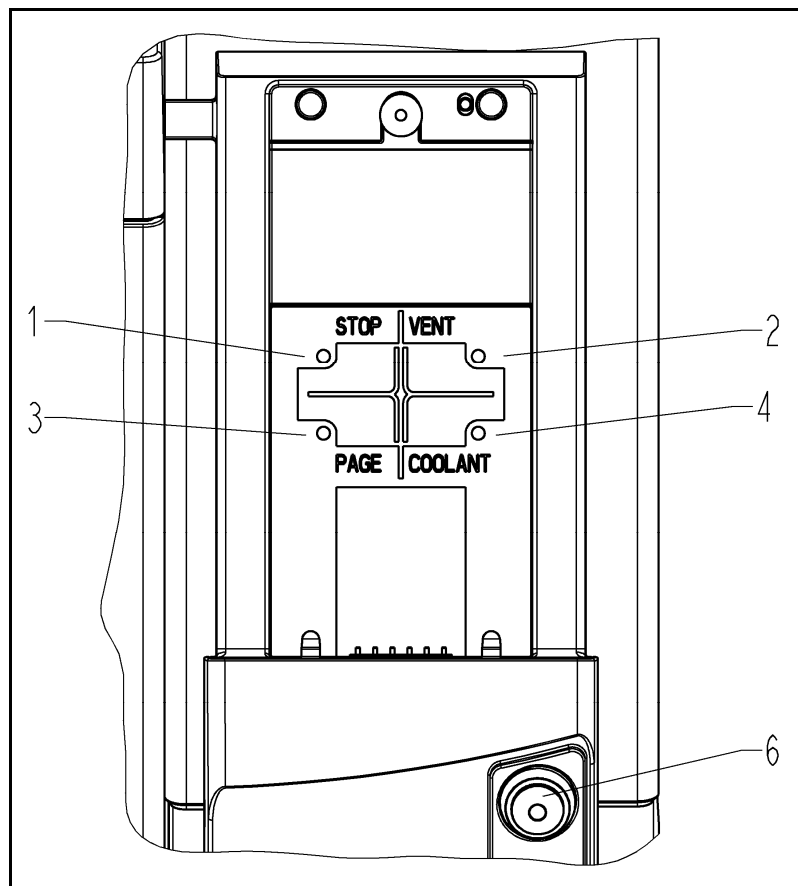


Fig. 17: Buttons on vacuum pump system SC 950



**8.2.2. SEM 950**

The following actions can be taken directly on the vacuum pump system (Fig. 18):

- Switch on/off pump (1)
- Open and close the ventilation valve (2)
- Switch units on display (3)  
mbar → hPa → Torr → mbar
- Open and close coolant valve (accessory) for the high-performance condenser (4)
- Set flow of the pump via rotary knob (5) (15% - 100%)
- Open/Close gas ballast valve via gas ballast switch (6):  
- push once → open gas ballast valve, blue LED on  
- push again → close gas ballast valve again, blue LED off

- 1 Button on/off pump
- 2 To open/to close ventilation valve button
- 3 Button to switch units on display
- 4 Button to open/to close coolant valve (accessory) on the high-performance condenser
- 5 Rotary knob (setting the flow)
- 6 Gas ballast switch

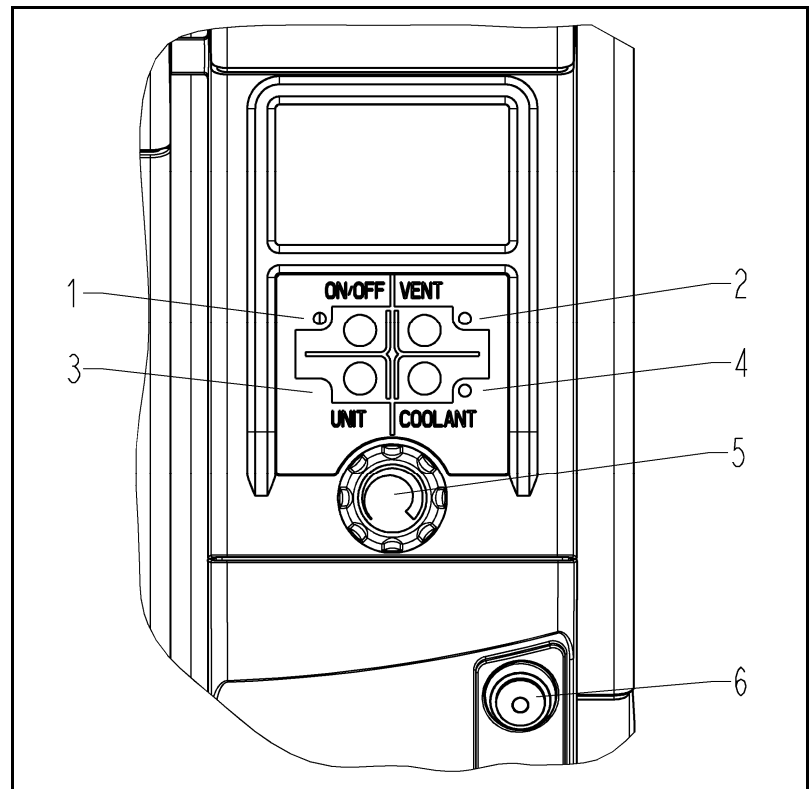


Fig. 18: Buttons on vacuum pump system SEM 950

### 8.2.3. SH/SR 950

The following actions can be taken directly on the vacuum pump systems SH 950 and SR 950 (Fig. 19):

- Set flow of the pump via rotary knob (5):
  - i** If the rotary knob is rotated to the left until it engages the mechanical indent, the pump will rotate with a minimum flow rate of 15%.  
If the rotary knob is then rotated farther to the left (past the mechanical indent), the vacuum pump system's pump will be switched off.
- Open/Close gas ballast valve via gas ballast switch (6):
  - push once → open gas ballast valve, blue LED on
  - push again → close gas ballast valve again, blue LED off
- Switch off pump (i.e. also complete system) via the green rocker switch at the bottom left of the base (see Fig. 5/9, p. 19 and Fig. 6/8, p. 21).

- 5 Rotary knob (setting the flow)
- 6 Gas ballast switch

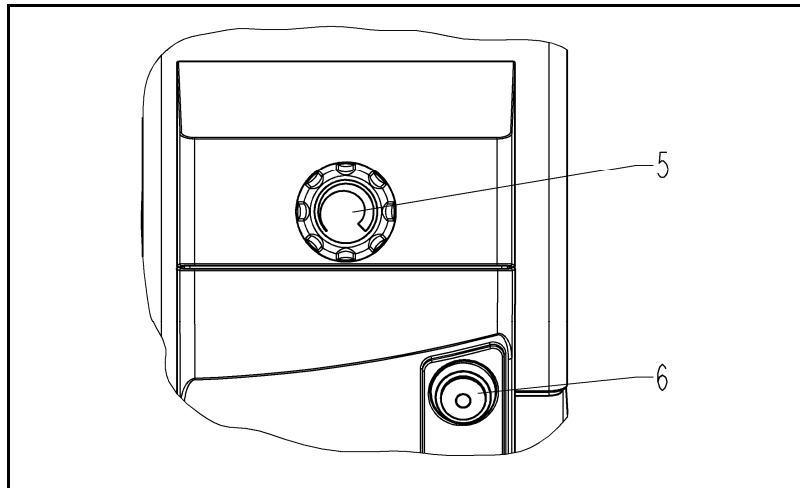


Fig. 19: Buttons on vacuum pump systems SH 950 and SR 950

### 8.3. Software (only SC950)

- i** Please see the delivered CD for information on operating the vacuum pump system via software.

## 9. Servicing

### 9.1. Servicing schedule

Component	Servicing interval
Vacuum pump system	Regular inspection for external damage or leaks
Diaphragms and valve plates	Replace when pumping capacity decreases, or sooner

Tab. 6

### 9.2. Cleaning

**i** When cleaning, make sure that no liquids enter the inside of the housing.

#### 9.2.1. Flushing vacuum pump system



**WARNING**

Avoid damage to the vacuum system and personal injury caused by poisoning or explosion

→ When flushing the vacuum pump system with inert gas, make sure that the gas ballast valve is closed so no reactive or explosive mixtures can form.

→ Before switching off the vacuum pump system, separate it from the vacuum chamber and flush it with air (if necessary for safety reasons: with an inert gas) under atmospheric conditions (ambient pressure) for about five minutes.

Only SC/SEM 950:

If inert gas is used: connect the inert gas feed to the gas inlet (Fig. 2/18, p. 13 or Fig. 4/15, p. 17) of the vacuum pump system and close the gas ballast valve. Observe the safety instructions in chapter 3.

#### 9.2.2. Cleaning vacuum pump system

→ Only clean vacuum pump system with a damp cloth and non-flammable cleaning agents.

#### 9.2.3. Emptying collection flask on the suction and pressure sides

##### Suction side

1. Grasp the collection flask (Fig. 2/9, p. 13 or Fig. 4/7, p. 17, Fig. 5/7, p. 19 and Fig. 6/6, p. 21) and simultaneously remove attachment clamp **7** (or **5, 5** and **4**); pull out collection flask.
2. Dispose of contents in collection flask according to local regulations. Then rinse out collection flask.
3. Reattach collection flask.

**Pressure side**

1. Grasp the collection flask (Fig. 2/8, p. 13 or Fig. 4/6, p. 17, Fig. 5/6, p. 19 and Fig. 6/5, p. 21) and simultaneously remove attachment clamp **7** (or **5, 5** and **4**); pull out collection flask.
2. Dispose of contents in collection flask according to local regulations. Then rinse out collection flask.
3. Reattach collection flask.

### 9.3. Replacing diaphragms and valve plates

- Conditions
- Pump disconnected from mains and de-energized.
  - Vacuum pump system is clean and free of hazardous materials
  - Hoses removed from pump's pneumatic inlet and outlet.

Tools and material

Qty	Material
1	Phillips-head screwdriver No. 2
1	3-mm hexagon screwdriver
1	2.5-mm hexagon screwdriver
1	Open end wrench 7 mm
1	Service Set (see chapter 11, page 59)
1	Pencil

Tab. 7

- Information on procedure
- ➔ Always replace diaphragms and valve plates together to maintain the pump performance.



**WARNING**

Health hazard due to dangerous substances in the vacuum pump system and pump!  
 Depending on the substance transferred, caustic burns or poisoning are possible.

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Flush vacuum pump system before replacing the diaphragms and valve plates (see chapter 9.2.1, page 44).



**CAUTION**

Danger of burns from hot pump parts  
 The pump head or motor may be hot even after the pump has been shut off.

- ➔ Allow the pump to cool off after operation.

9.3.1. Removing the pump

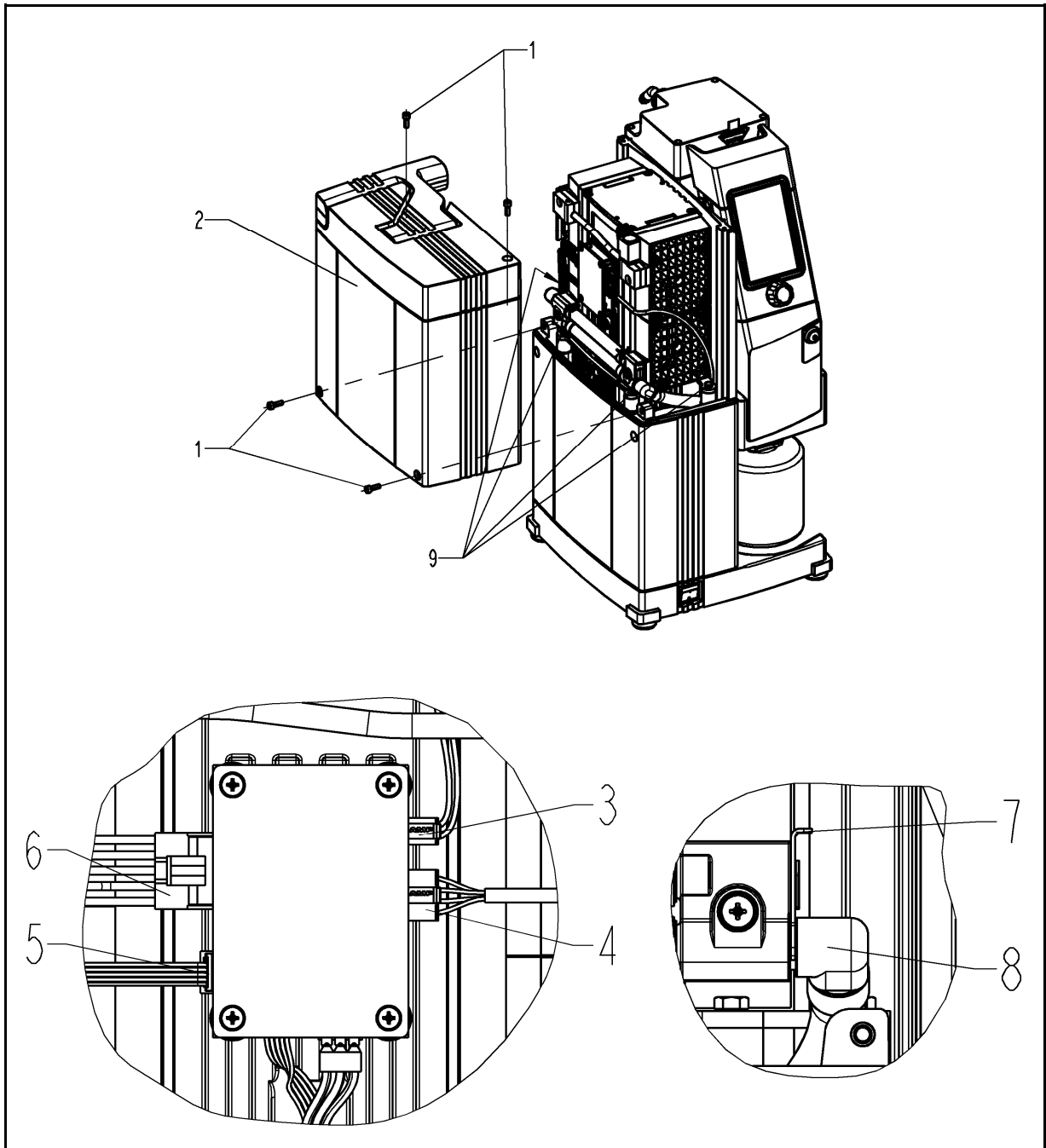


Fig. 20: Accessing the pump in the SC 950 vacuum pump system

- |   |                                      |   |                             |
|---|--------------------------------------|---|-----------------------------|
| 1 | 4x attachment screws (grip assembly) | 6 | 1x plug for voltage supply  |
| 2 | 1x grip assembly                     | 7 | 2x spring steel clips       |
| 3 | 1x plug for gas ballast valve        | 8 | 2x head connection fittings |
| 4 | 1x plug for pressure switch          | 9 | 4x attachment screws (pump) |
| 5 | 1x plug for resonance sensors        |   |                             |

1. Loosen the four attachments screws (Fig. 21/1) and remove the grip assembly (2).

- i** In order to remove the grip assembly, you must first lift it approximately 5 mm and then pull it away laterally over the pump.
- 2. Loosen plugs **3**, **4**, **5** and **6** at the pump's electrical connection.
- 3. Loosen the suction-side and pressure-side head connections from the pump:  
To do this, first pull the two spring steel clips (**7**) from the head connection fittings (**8**), then pull the two head connection fittings out of the connection blocks.
- 4. Replace the O-rings (ø10 x 1.8) in the two connection fittings (**8**) and properly dispose of the old O-rings.
- 5. Loosen the four attachment screws (**9**) and remove the pump.

**9.3.2. Overview of pump parts**

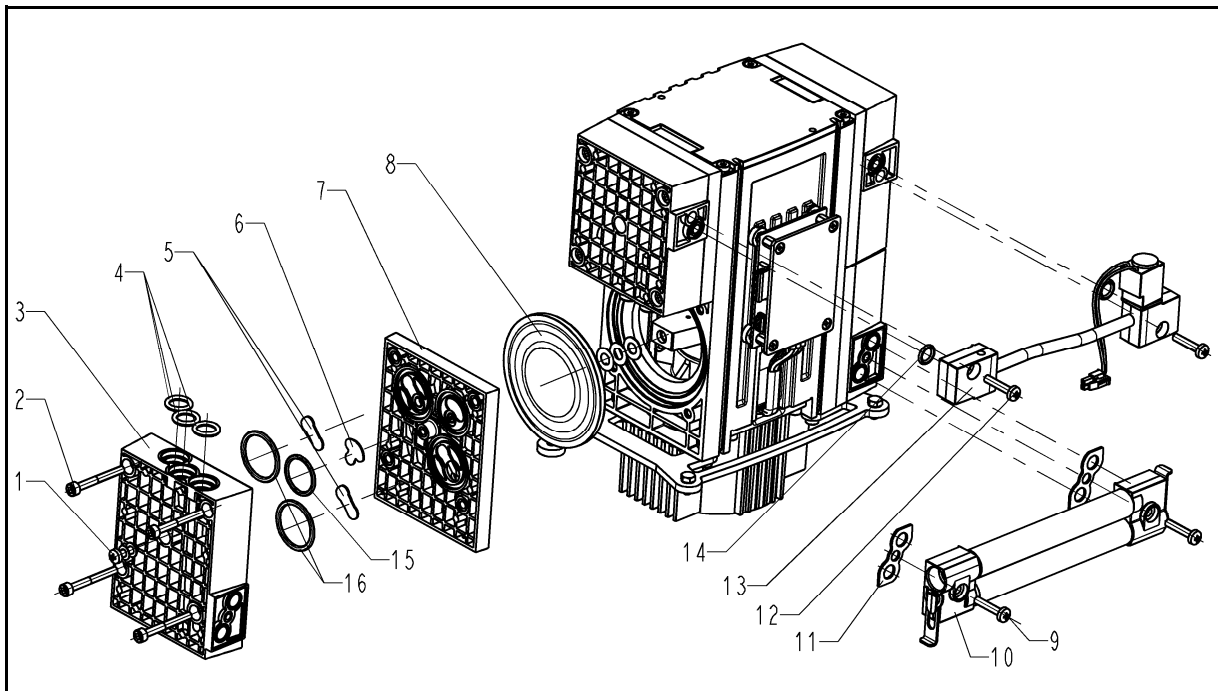
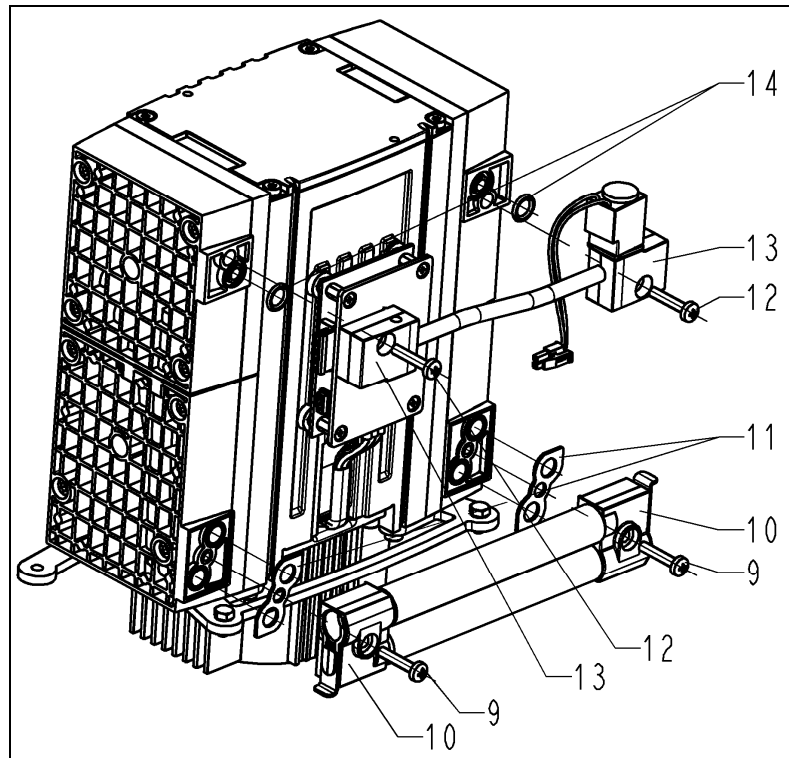


Fig. 21: Exploded drawing of pump SC 950

- |                                       |   |
|---------------------------------------|---|
| <b>1</b> 4x head screws               | <b>9</b> 2x attachment screws (connection .1.2) |
| <b>2</b> 16x attachment screws (head) | <b>10</b> 2x connection blocks .1.2             |
| <b>3</b> 4x head plates               | <b>11</b> 2x flat seals                         |
| <b>4</b> 6x O-ring (ø10 x 2.5)        | <b>12</b> 2x attachment screws (connection .50) |
| <b>5</b> 8x valve plates              | <b>13</b> 2x connection blocks .50              |
| <b>6</b> 6x valve plates              | <b>14</b> 2x O-rings (ø7.65 x 1.78)             |
| <b>7</b> 4x intermediate plates       | <b>15</b> 6x O-rings (ø18.77 x 1.78)            |
| <b>8</b> 4x diaphragms                | <b>16</b> 8x O-rings (ø24 x 2)                  |



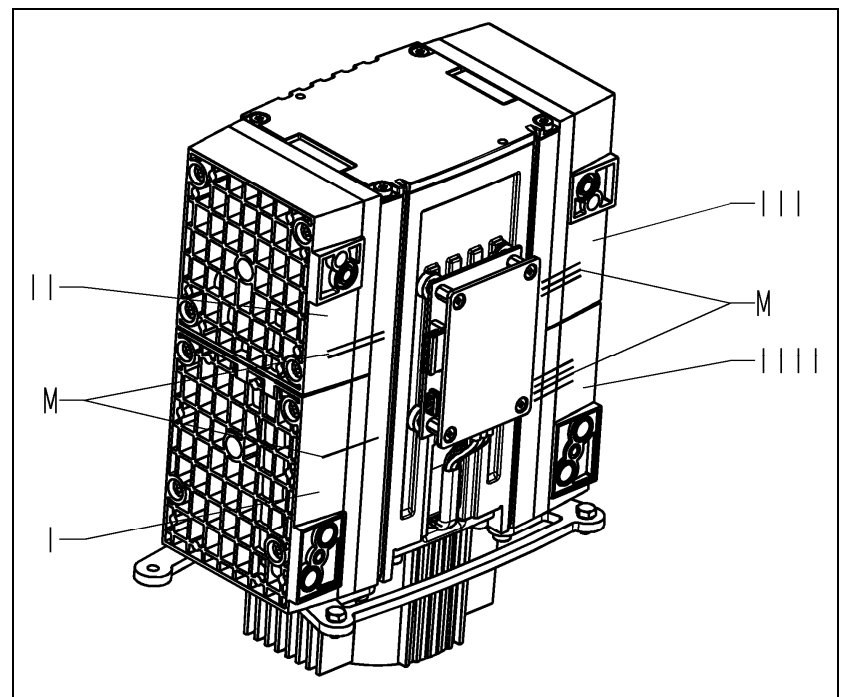
**9.3.3. Disassembling head connection**



*Fig. 22: Disassembling the head connections*

1. Remove the head connections' (10) and (13) attachment screws (Fig. 23/9) and (12) and remove the head connections.
2. Remove O-rings (14) and flat seals (11).

**9.3.4. Disassembling pump heads**



*Fig. 23: Marking the pump*

1. Head 1 (Fig. 24/I):  
Use a lead pencil (**M**) to apply a single mark across the head plate, intermediate plate, and compressor housing.
  2. Head 2 (Fig. 24/II):  
Use a lead pencil (**M**) to apply two marks across the head plate, intermediate plate, and compressor housing.
  3. Head 3 (Fig. 24/III):  
Use a lead pencil (**M**) to apply three marks across the head plate, intermediate plate, and compressor housing.
  4. Head 4 (Fig. 24/IIII):  
Use a lead pencil (**M**) to apply four marks across the head plate, intermediate plate, and compressor housing.
- i** During re-assembly, refer to the marks on the individual heads to ensure that the parts are properly re-assembled.
5. Loosen the 16 attachment screws (Fig. 22/2) on the heads (**1** to **4**) and remove the heads (**1** and **2** as well as **3** and **4**).
  6. Pull apart heads 1 (Fig. 25/I) and 2 (II) and heads 3 (III) and 4 (IIII) and remove O-rings (**4**).

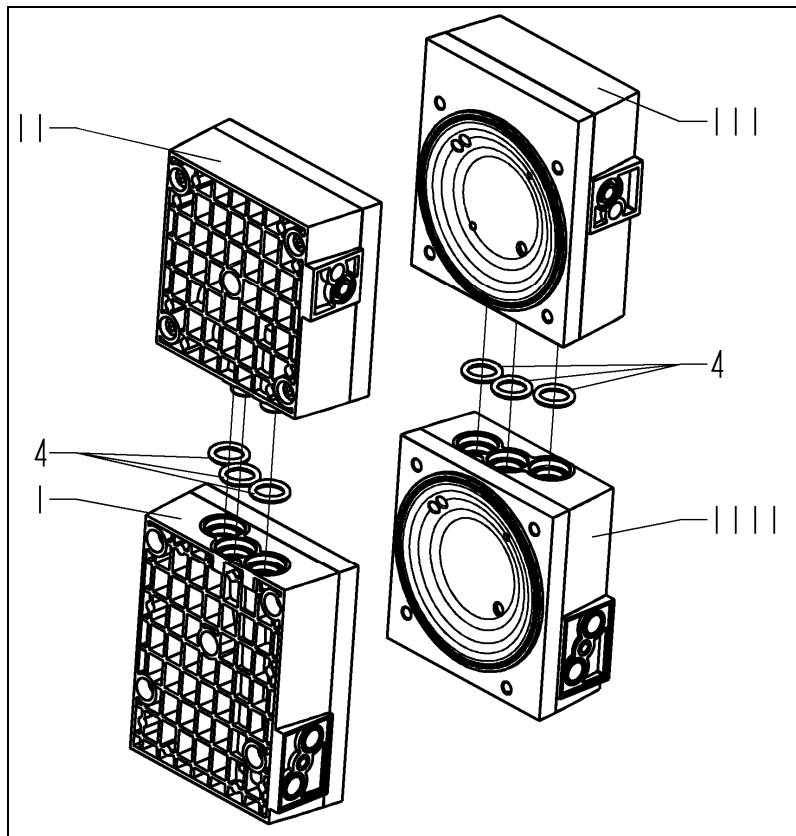


Fig. 24: Removing the O-rings

7. On all four heads, loosen the head screw (Fig. 26/1) in the head plate (**3**) and remove the head plate from the intermediate plate (**7**).

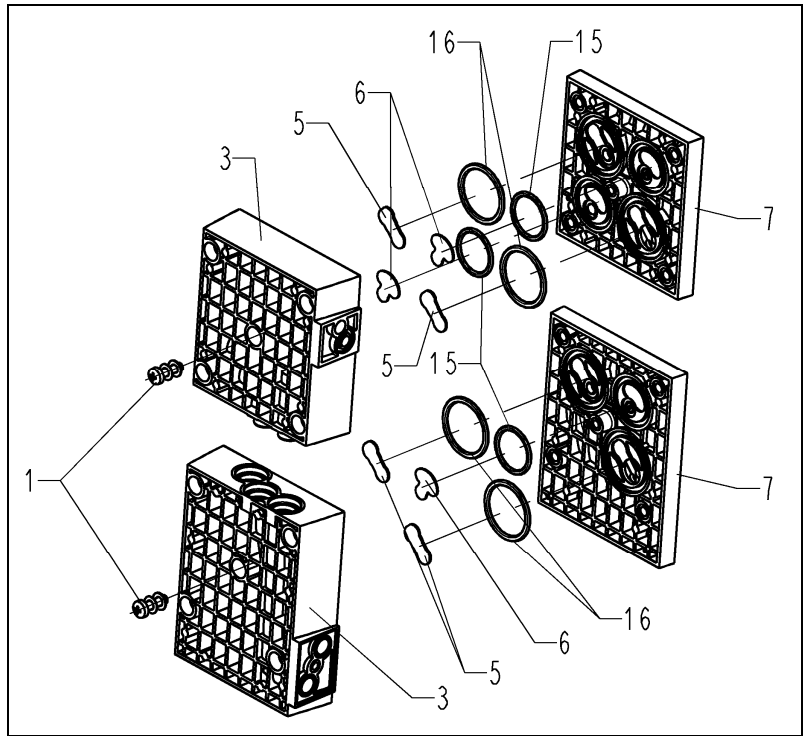


Fig. 25: Exploded drawing of pump heads 1 and 2

### 9.3.5. Replacing the diaphragms and valve plates

1. Manually remove the four diaphragms (Fig. 27/8) by turning them in the counterclockwise direction.

**i** Use caution to prevent the shim rings (17) located between the diaphragm and the connecting rod from falling into the pump housing. The shim rings (17) must be installed in the same quantity as before to ensure the pump's pneumatic performance.

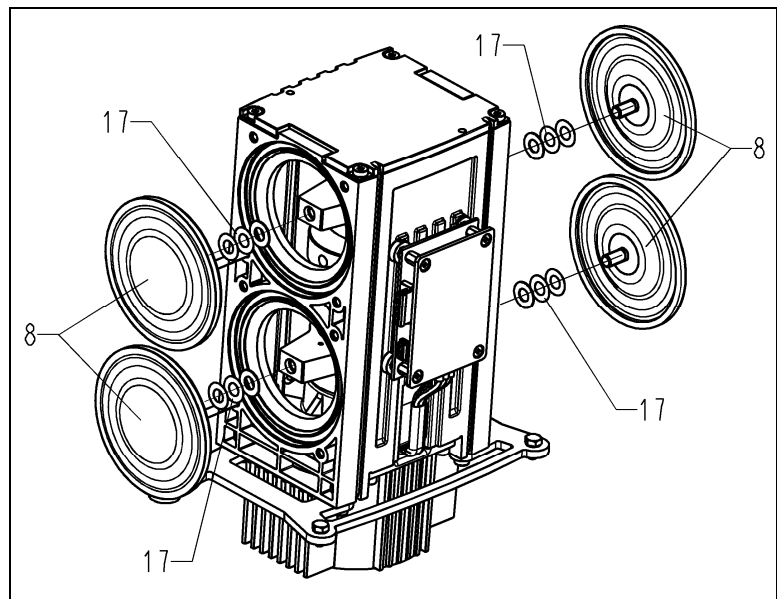


Fig. 26: Replacing the diaphragm

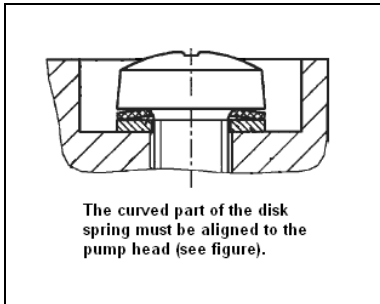


Fig. 27: Aligning the disk spring

2. Remove from the intermediate plates (Fig. 26/7) the valve plates (5) and (6) as well as the O-rings (15) and (16).
3. Manually screw the new diaphragms (Fig. 27/8) into the connecting rods' threads and tighten to hand tightness.
  - i** Before you fully tighten the diaphragms, you are recommended to move the diaphragm to the peak position (before it reverses).
4. Insert the new valve plates (Fig. 26/5) and (6) and the new O-rings (15) and (16) into the intermediate plates (7).
  - i** The upper and lower sides of the valve plates are identical.
  - i** The black O-rings (15) and (16) must be placed into the intermediate plate of head 4 (see Fig. 25)!
5. Place head plate (Fig. 26/3) onto the intermediate plates (7), observing the pencil marks (Fig. 24/M).
6. Carefully tighten the head screw of each head plate (Fig. 26/1). Use light force and tighten only to hand-tightness (tightening torque: 60 Ncm).
  - i** Refer to Fig. 28 for arrangement and alignment of disk springs and the screw's washer.

### 9.3.6. Assembling heads and head connection

1. Place three O-rings (Fig. 25/4) into each of the head connection holes.
  - i** The three black O-rings (4) must be placed into the connection holes between head 3 and head 4!
2. Press together heads 1 and 2 (Fig. 24/I and II) and heads 3 and 4 (III and IIII).
3. Place heads 1 and 2 and heads 3 and 4 onto the compressor housing; alternately tighten attachment screws (Fig. 22/2) to hand-tightness (tightening torque: 3.5 Nm).
4. Insert O-rings (Fig. 24/14) and flat seals (11) into the grooves or depressions in the head plates.
5. Reinstall the head connections:
 

To do this, manually tighten the head connections' attachment screws to hand-tightness. (Fig. 23/9 and 12).

  - i** Before assembling the head connections, make sure that the two front attachment screws (Fig. 21/9) are inserted into the foot plate. This is required in order to later re-fasten the pump in the vacuum pump system.
6. Properly dispose of the old diaphragms, valve plates, and O-rings.

**9.3.7. Final steps**

1. Place the pump back into the vacuum pump system and tighten the four attachment screws (Fig. 21/9) to hand-tightness.
2. Install the suction-side and pressure-side head connections back onto the pump:  
To do this, first insert the two head connection fittings (8) into the connection blocks and then fasten them with the two spring steel clips (7).
3. Put plugs 3, 4, 5 and 6 back onto the pump's electrical connection.
4. Put the grip assembly (2) back onto the vacuum pump system and tighten the four attachment screws (1) to hand-tightness.
5. Reconnect suction and pressure lines to the vacuum pump system.
7. Reconnect the vacuum pump system to the mains power.

If you have any questions about servicing, call your KNF technical adviser (see last page for contact telephone number).

## 10. Troubleshooting



Extreme danger from electrical shock!

→ Disconnect the pump power supply before working on the pump.

**DANGER**

→ Make sure the pump is de-energized and secure.

- Vacuum pump system as a whole: see table 9.
- Only SC 950:  
Hand terminal: see table 10.
- Only SC 950:  
Software operation: see table 11.

Vacuum pump system as a whole		
Problem	Cause	Solution
Vacuum pump system is switched on, but the mains switch does not light up.	Mains cable not plugged in.	→ Plug the mains cable for the vacuum pump system into a properly grounded power socket.
	No current in electricity network.	→ Check the electricity supply.
	Vacuum pump system fuses blown.	<ol style="list-style-type: none"> <li>1. Find and eliminate the cause of the overload.</li> <li>2. Replace the mains fuse(s) of the vacuum pump system:                             <ul style="list-style-type: none"> <li>▪ Push the locking clip on the fuse drawer down (Fig. 2/17, p. 13 or Fig. 4/14, p. 17, Fig. 5/13, p. 19 and Fig. 6/12, p. 21) and pull the drawer out.</li> <li>▪ Replace the defective fuse(s) (for fuse specifications see chapter 4.1, page 9f; for fuse order numbers see chapter 11, p. 59).</li> <li>▪ Push the fuse drawer back in until it clicks into position.</li> </ul> </li> </ol>
Required vacuum not generated even though pump is running.	Leaks in vacuum chamber.	<ol style="list-style-type: none"> <li>1. Run a test by closing the gas inlet (Fig. 2/19, p. 13 or Fig. 4/16, p. 17, Fig. 5/14, p. 19 and Fig. 6/13, p. 21). If the pump reaches the required vacuum, this confirms the presence of leaks in the vacuum chamber.</li> <li>2. Eliminate leaks in the vacuum chamber.</li> </ol>
	O-ring is not sitting correctly in the slot on the suction side of the collection flask.	<ul style="list-style-type: none"> <li>→ Adjust O-ring.</li> <li>→ Replace if defective (for order number for O-ring, see chapter 11, p. 59).</li> </ul>

Vacuum pump system as a whole		
Problem	Cause	Solution
	Leaks in hose connection.	<ul style="list-style-type: none"> <li>➔ Check hoses are sitting correctly on hose nipples.</li> <li>➔ Replace any leaky hoses.</li> <li>➔ Replace any damaged hose nipples.</li> <li>➔ For ordering numbers see chapter 11, page 59.</li> </ul>
	Only SC/SEM 950: Leaks in venting valve.	<ul style="list-style-type: none"> <li>➔ Temporarily close the ventilation connection (Fig. 2/18, p. 13 or Fig. 4/15, p. 17). If this stops the leak, leaks are present in the venting valve. In this case:</li> <li>➔ Flush the venting valve:               <ol style="list-style-type: none"> <li>1. Close the gas inlet (Fig. 2/19 or Fig. 4/16).</li> <li>2. If necessary for safety reasons: Connect inert gas to ventilation connection. Observe the safety instructions in chapter 3.</li> <li>3. Run the vacuum pump system (SC 950 in <i>evacuation</i> mode) at 100% pump capacity.</li> <li>4. Re-open the gas inlet.</li> </ol> </li> <li>➔ If problem persists, contact KNF Service.</li> </ul>
	Condensation in pump head.	<ul style="list-style-type: none"> <li>➔ Open gas ballast and flush pump heads</li> <li>➔ Dry system with fresh air or, if necessary for safety reasons, with an inert gas:               <ol style="list-style-type: none"> <li>1. Using inert gas: Connect inert gas source with gas inlet (Fig. 2/19, p. 13 or Fig. 4/16, p. 17, Fig. 5/14, p. 19 and Fig. 6/13, p. 21) and start system up in <i>evacuation</i> mode (100% capacity). Observe the safety instructions in chapter 3.</li> <li>2. Using air: Open gas line (Fig. 2/19, p. 13 or Fig. 4/16, p. 17, Fig. 5/14, p. 19 and Fig. 6/13, p. 21) to the surrounding environment and start system up in <i>evacuation</i> mode (100% capacity).</li> <li>3. Close the gas inlet after 30 seconds, and leave the vacuum pump system running for 30 seconds under vacuum.</li> <li>4. Repeat this process 3–5 times.</li> </ol> </li> <li>➔ If this problem occurs frequently, place the vacuum pump system at a higher level than the vacuum chamber.</li> </ul>

Vacuum pump system as a whole		
Problem	Cause	Solution
	Only SC/SEM/SH 950: Gas outlet blocked on high-performance condenser.	Risk of bursting of high-performance condenser! → Eliminate blocking of gas outlet.
	Worn diaphragms or valve plates.	→ Replace diaphragms and valve plates (chapter 9.3).
	Replaced diaphragms and valve plates.	→ Check that the correct diaphragm spacers are placed under the diaphragms. → If necessary, carefully tighten the pump head fixing screws (Fig. 21/2, p. 48) in diagonally opposite sequence.
	Gas ballast still open	→ Close gas ballast
Pump not activated on process start-up, in spite of pressure decrease command.	Only SC 950: Hand terminal or software not connected to vacuum pump system.	→ Make connection.
	Overcurrent protection of vacuum pump system has been activated.	→ Reset by switching the vacuum pump system off and back on. → Check that there is no object blocking the vacuum pump system fans (Fig. 2/12 and 13, p. 13 or Fig. 4/10 and 11, p. 17, Fig. 5/10 and 11, p. 19 and Fig. 6/9 and 10, p. 21) and make sure that adequate supply and removal of cool air is provided. → Find and eliminate any other cause of pump overload.

Tab. 8

**Only SC 950:**

Hand terminal		
Problem	Cause	Solution
Hand terminal cannot be removed from vacuum pump system.	Transport fastener has not been removed.	→ Remove transport fastener (see chapter 6.1).
Hand terminal display fails to light up.	Hand terminal not switched on.	→ Switch hand terminal on.
	Batteries of hand terminal have run down.	→ Charge batteries by placing the terminal in the holder provided on the vacuum pump system, with the system switched on. → Alternatively, operate the terminal via the power supply.
The hand terminal display keeps showing "No connection"; if a button of the touchscreen is actuated a signal tone sounds.	Vacuum pump system is switched off.	→ Switch the vacuum pump system on at the mains switch. The mains switch should light up.
	The hand terminal is designed for use with a different SC 950 vacuum pump system.	→ Use the page function (see Actuating the vacuum pump system, p. 38) to check whether the right hand terminal is being used.



Hand terminal		
Problem	Cause	Solution
	Problem with wireless connection.	<ul style="list-style-type: none"> <li>➔ Check whether the hand terminal is being operated outside the wireless connection range.</li> <li>➔ Check that the wireless connection is not obstructed by any electrical devices or metal objects.</li> <li>➔ Otherwise, to confirm that the problem lies in the wireless connection, place the hand terminal in the holder provided on the vacuum pump system.</li> </ul>
	Defective wireless module.	➔ Contact KNF Service.
Vacuum pump system does not respond to commands input at the hand terminal after removal from the system, even though the "No connection " is no longer lit up and a pressure is displayed.	The hand terminal is designed for use with a different SC 950 system, which is currently in operation.	➔ Use the page function (see Actuating the vacuum pump system, p. 38) to check whether the right hand terminal is being used.
Acoustic alarm sounds on hand terminal.	Batteries low.	<ul style="list-style-type: none"> <li>➔ Charge batteries by placing the terminal in the holder provided on the vacuum pump system, with the system switched on.</li> <li>➔ Alternatively, operate the terminal via the power supply.</li> </ul>
Marked decrease in operating time for the hand terminal in wireless mode.	Batteries have reached limit of their useful life.	➔ Change batteries (see chapter 8.1.3, p. 39).
Vacuum pump system cannot be activated, even with the hand terminal placed in the holder provided.	Soiled contacts on the bottom of the hand terminal or in the holder for the terminal on the vacuum pump system.	➔ Clean contacts.
Pressure display shows implausible values.	Unit of pressure for display has been changed.	➔ Set desired unit of pressure.
	Leaks in system.	➔ See Tab. 9, "Required vacuum not generated even though pump is running".
	Recalibration of pressure sensor required.	➔ Contact KNF Service.

Tab. 9

**Only SC 950:**

<b>Software operation</b>		
<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
PC software unable to connect to vacuum pump system.	Vacuum pump system not switched on.	➔ Switch vacuum pump system on.
	USB connection between system and PC is not operating correctly.	➔ Check correct connection of USB cable. If necessary, pull out the USB cable and reinsert (USB interface reset).
Pressure display shows implausible values.	Unit of pressure for display has been changed.	➔ Set desired unit of pressure.
	Leaks in system.	➔ See Tab. 9, "Required vacuum not generated even though pump is running".
	Recalibration of pressure sensor required.	➔ Contact KNF Service.

*Tab. 10*

**Fault cannot be rectified**

If you are unable to identify the cause of the problem, please send the vacuum pump system to KNF Customer Service (see last page for the address).

1. Flush the vacuum pump system to free the pump head, tubing and glass vessels of dangerous or aggressive gases (see chapter 9.2.1, page 44).
2. Clean the vacuum pump system (see chapter 9.2.2, page 44).
3. Send the vacuum pump system, together with completed Health and Safety Clearance and Decontamination Form (Chapter 13), to KNF stating the nature of the transferred medium.

## 11. Spare parts and accessories

### 11.1. Spare parts

#### Spare parts Pump

A spare parts kit contains all parts needed for complete overhaul of the pump head:

- 4x diaphragms
- 8x valve plates
- 6x valve plates
- 2x flat seals
- 8x O-rings (ø 24 x 2)
  - 6 x green
  - 2 x black
- 6x O-rings (ø 18.77 x 1.78)
  - 5 x green
  - 1 x black
- 6x O-rings (ø 10 x 2.5)
  - 3 x green
  - 3 x black
- 2x O-rings (ø 7.65 x 1.78), green
- 2x O-rings (ø 10 x 1.8), black

Spare parts kit for system type	Order-No.
SC/SEM/SH/SR 950	126111

Tab. 11

**Other spare parts**

Spare part	Order-No.
Battery set for hand terminal (see chapter 8.1.3, page 39)	117427
Power supply for hand terminal	302033
USB cable	136174
Mains cable D	026363
Mains cable CH	027523
Mains cable GB	029866
Mains cable USA/JP	027524
Spare parts kit tubes SC 950	126331
Spare parts kit tubes SEM 950	126332
Spare parts kit tubes SH 950	126333
Spare parts kit tubes SR 950	126334
Hose nipple gas inlet (ID 10)	124548
Only SC/SEM 950: Hose nipple ventilating (ID 4)	057594
Only SC/SEM/SH 950: Hose nipple gas outlet for high performance condenser: gas connection (ID 10)	026237
Only SC/SEM/SH 950: Hose nipple for high performance condenser: coolant connection (ID 8)	025981
O-ring adapter on collection flask	047744
Collection flask 500 ml (coated)	121415
Flask clamp	025968
Fuse T 2.5	027575

Tab. 12

**11.2. Accessories**

Accessory	Order-No.
Coolant valve	117121
Color sticker for indicating correct match between hand terminal and vacuum pump system*	117433
Chemical-resistant protective film for hand terminal display	117407
Contact cover set (SC 950 only)**	126335

\* For situations in which several SC 950 vacuum pump systems are operated within the wireless connection range.

\*\* The contact cover is used to protect the hand terminal contacts from contamination when the hand terminal is taken off.

Tab. 13

## 12. Returns

Pumps and systems used in laboratories and process-based industries are exposed to a wide variety of conditions. This means that the components contacting pumped media could become contaminated by toxic, radioactive, or otherwise hazardous substances.

For this reason, customers who send any pumps or systems back to KNF must submit a Health and safety clearance and decontamination form in order to avoid a hazardous situation for KNF employees. This Health and safety clearance and decontamination form provides the following information, among other things:

- physiological safety
- whether medium-contacting parts have been cleaned
- whether the equipment has been decontaminated
- media that have been pumped or used

To ensure worker safety, work may not be started on pumps or systems without a signed Health and safety clearance and decontamination form.

For optimal processing of a return, a copy of this declaration should be sent in advance via e-mail, regular mail, or fax to KNF Customer Service (refer to final page for address). In order to avoid endangering employees who open the shipment's packaging, despite any residual hazards, the original version of the Health and safety clearance and decontamination form must accompany the delivery receipt on the outside of the packing.

The template for the Health and safety clearance and decontamination form is included with these Operating Instructions and may also be downloaded from the KNF website.

The customer must specify the device type(s) and serial number(s) in the Health and safety clearance and decontamination form in order to provide for the unambiguous assignment of the Declaration to the device that is sent to KNF.

In addition to the customer's declaration of physiological safety, information about operating conditions and the customer's application are also of importance to ensure that the return shipment is handled appropriately. Therefore, the Health and safety clearance and decontamination form requests this information as well.

### 13. Health and safety clearance and decontamination form



#### Health and safety clearance and decontamination form

This declaration must be present and complete (the original must accompany the shipment's delivery receipt) before the returned device can be examined.

Device type: .....

Serial number(s): .....

.....

.....

Reason for returning the device (please describe in detail):

(The device(s) was(were) in operation  yes  no)

.....

.....

.....

.....

.....

We confirm that the above device(s)

has(have) pumped exclusively **physiologically unobjectionable** media and that it(they) are free of hazardous materials and any materials that are harmful to health.

Pumped media: .....

The device(s) was(were) cleaned  yes  no

has(have) pumped media of the following category(categories) which are not physiologically unobjectionable and that cleaning of the device(s) (potentially only media-contacting parts) is required.

Name, chemical formula, Material Safety Data Sheet

aggressive .....

biological .....

radioactive .....

toxic .....

other .....

The device(s) was(were) decontaminated and work can proceed without special measures  yes

Method / proof: .....

.....

The device(s) was(were) not decontaminated and special measures are required before starting work  yes

Measures: .....

.....

Legally binding declaration

We herewith affirm that the information provided in this form is correct and complete. Shipment of the devices and components is in compliance with statutory regulations.

.....  
Company (stamp)      Date      Name      Authorized signature      Position



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