



# OPERATING INSTRUCTIONS

Scroll pump standard version | ATEX  
certification

COBALT 6 | 12 | 18

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## **Disclaimer of liability**

These operating instructions describe all models and variants of your product. Note that your product may not be equipped with all features described in this document. The Kurt J. Lesker Company constantly adapts its products to the latest state of the art without prior notice. Please take into account that online operating instructions can deviate from the printed operating instructions supplied with your product.

Furthermore, Kurt J. Lesker Company assumes no responsibility or liability for damage resulting from the use of the product that contradicts its proper use or is explicitly defined as foreseeable misuse.

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# 1 About this manual



## IMPORTANT

Read carefully before use.  
Keep the manual for future consultation.

## 1.1 Validity

The operating instructions describe the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in these operating instructions refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

### 1.1.1 Applicable documents

Document	Reference
Declaration of conformity	included with these operating instructions

### 1.1.2 Variants

- Cobalt 6 Standard / ATEX
- Cobalt 12 Standard / ATEX
- Cobalt 18 Standard / ATEX

## 1.2 Target group

These operating instructions are aimed at all persons performing the following activities on the product:

- Transportation
- Setup (Installation)
- Usage and operation
- Decommissioning
- Maintenance and cleaning
- Storage or disposal

The work described in this document is only permitted to be performed by persons with the appropriate technical qualifications (expert personnel) or who have received the relevant training from the Kurt J. Lesker Company.

## 1.3 Conventions

### 1.3.1 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

### 1.3.2 Instructions in the text

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by an individual step or multi-part action steps.

#### Individual action step

A horizontal, solid triangle indicates the only step in an action.

- ▶ This is an individual action step.




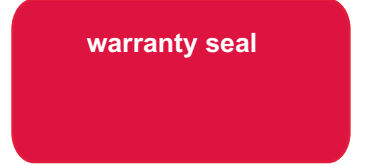
### Sequence of multi-part action steps

The numerical list indicates an action with multiple necessary steps.

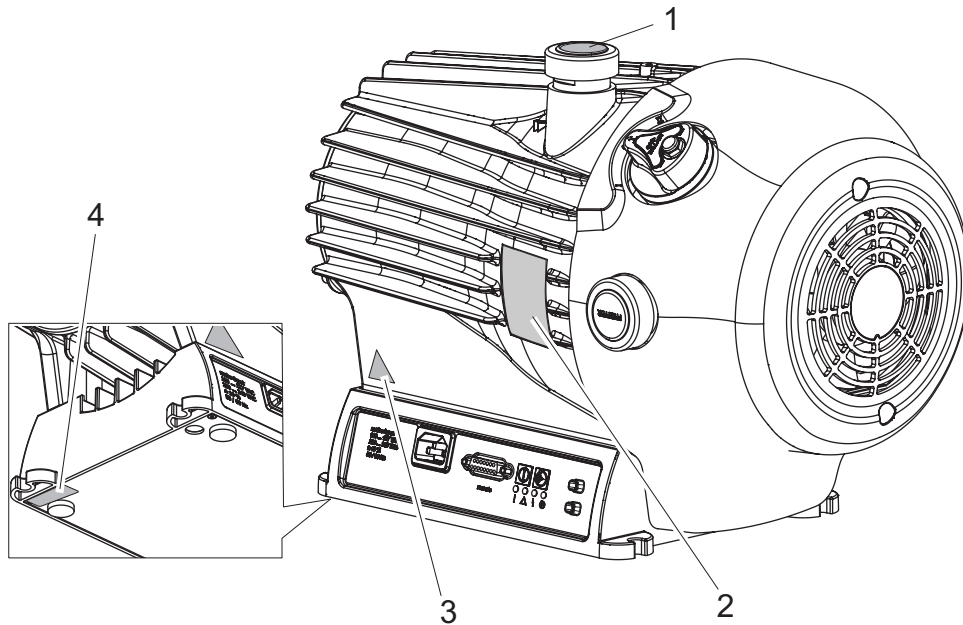
1. Step 1
2. Step 2
3. ...

### 1.3.3 Stickers on the product

This section describes all the stickers on the product along with their meanings.

 <p><b>Kurt J. Lesker</b> Company</p> <p>Mod. Cobalt 12 P/N KJLC300 S/N -----</p> <p>S(N<sub>2</sub>) max. 12.1 m<sup>3</sup>/h Mass 24 kg n max. 1870 rpm</p> <p>SCCR: 500 A @ 250 VAC, 10 kA @ 125 VAC 100-127 VAC ±10% 50/60 Hz 8.0 A 200-240 VAC ±10% 50/60 Hz 4.0 A</p> <p>II 3-G Ex h IIC T4 Gc X +5 °C ≤ Ta ≤ +40 °C</p> <p>Made in Germany 2023/04</p> <p>QR code, TÜV Rheinland logo, UL/CSA 61010-1 IP40/Type 1 logo, CE mark</p>	<p><b>Rating plate, Cobalt 12</b> (for example)</p> <p>The rating plate is located clearly visible on a longitudinal side of the vacuum pump.</p>
	<p><b>Warning hot surface</b></p> <p>This sticker warns of injuries caused by high temperatures as a result of contact without protection during operation.</p>
	<p><b>Operating instructions note</b></p> <p>This sticker indicates that this operating instructions must be read before performing any tasks.</p>
	<p><b>Warranty seal</b></p> <p>The product is sealed ex factory. Damaging or removing a warranty seal results in loss of the warranty.</p>

Tbl. 1: Stickers on the product



**Fig. 1: Position of the stickers on the product**

- 1 Note: Read the operating instructions
- 2 Rating plate
- 3 Hot surface warning sign
- 4 Warranty seal

### 1.3.4 Abbreviations

Abbreviation	Explanation
<b>ATEX</b>	ATmosphères EXplosibles
<b>ATM</b>	Atmospheric pressure
<b>OI</b>	Operating instructions
<b>f</b>	Rotation speed value of a vacuum pump (frequency, in rpm or Hz)
<b>FKM</b>	Fluorinated rubber
<b>GB</b>	Gas ballast
<b>HV</b>	High vacuum
<b>[P:xxx]</b>	Parameters are printed in bold as three-digit numbers in square brackets. Example: [P:xxx] Software version
<b>PC</b>	Personal computer
<b>PTFE</b>	Polytetrafluoroethylene
<b>RCD</b>	Residual Current Device
<b>RS-485</b>	Standard for a physical interface for asynchronous serial data transmission (Recommended Standard)
<b>SI</b>	Service instructions
<b>SCCR</b>	Short Circuit Current Rating
<b>USB</b>	Universal Serial Bus

**Tbl. 2: Abbreviations used**

## 2 Safety

### 2.1 General safety information

The following 4 risk levels and 1 information level are taken into account in this document.

#### **DANGER**

##### **Immediately pending danger**

Indicates an immediately pending danger that will result in death or serious injury if not observed.

- ▶ Instructions to avoid the danger situation

#### **WARNING**

##### **Potential pending danger**

Indicates a pending danger that could result in death or serious injury if not observed.

- ▶ Instructions to avoid the danger situation

#### **CAUTION**

##### **Potential pending danger**

Indicates a pending danger that could result in minor injuries if not observed.

- ▶ Instructions to avoid the danger situation

#### **NOTICE**

##### **Danger of damage to property**

Is used to highlight actions that are not associated with personal injury.

- ▶ Instructions to avoid damage to property



Notes, tips or examples indicate important information about the product or about this document.

### 2.2 Safety instructions

All safety instructions in this document are based on the results of the risk assessment carried out in accordance with Machinery Directive 2006/42/EC Annex I and EN ISO 12100 Section 5. Where applicable, all life cycle phases of the product were taken into account.

#### **Risks during transport**

#### **WARNING**

##### **Risk of serious injury from swinging, toppling or falling objects**

During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.

- ▶ Secure the danger zone if necessary.
- ▶ Pay attention to the center of gravity of the load during transport.
- ▶ Ensure even movements and moderate speeds.
- ▶ Observe safe handling of the transport devices.
- ▶ Avoid sloping attachment aids.
- ▶ Never stack products.
- ▶ Wear protective equipment, e.g. safety shoes.

Risks during installation

**⚠ DANGER**

**Danger to life from electric shock**

Inadequate or incorrect grounding of the unit leads to contact-sensitive voltage on the housing. When making contact, increased leakage currents will cause a life-threatening electric shock.

- ▶ Before the installation, check that the connection leads are voltage-free.
- ▶ Conduct the electrical connection in accordance with locally applicable regulations.
- ▶ Make sure that the local mains voltage and frequency match rating plate specifications.
- ▶ Make sure that the mains cable and extension cable meet the requirements for double isolation between input voltage and output voltage, in accordance with IEC 61010 and IEC 60950.
- ▶ Use only a 3-pin mains cable and extension cable with properly connected protective earthing (earthed conductor).
- ▶ Plug the mains plug into a socket with earthing contact only.
- ▶ Always connect the mains cable prior to all other cables, to ensure continuous protective earthing.

**⚠ DANGER**

**Danger to life from electric shock**

When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.

- ▶ Connect only suitable devices to the bus system.

**⚠ WARNING**

**Explosion hazard when using accessories outside the limits of use**

When using accessories, there is a risk of an ignition source forming that could potentially result in an explosion when pumping explosive gases.

- ▶ When pumping explosive media, use only accessories that comply with the requirements of Directive 2014/34/EU.

**⚠ WARNING**

**Explosion hazard if particles enter the vacuum connection**

During commissioning, there is a risk of foreign particles entering the vacuum chamber, forming a source of ignition, and potentially resulting in an explosion in combination with explosive gases.

- ▶ Use a suitable protective strainer at the vacuum connection.
- ▶ Do not remove the strainer until you are sure that no solid particles can enter the vacuum pump.

**⚠ WARNING**

**Explosion hazard if particles enter at the gas ballast valve**

When connecting the gas ballast line, there is a risk of foreign particles entering, which may cause an exothermic reaction if the material pairing in the suction chamber is unfavorable.

- ▶ When connecting the external gas ballast supply, ensure that the gas ballast valve is closed.
- ▶ Clean the inlet area of the gas ballast valve by activating the gas supply with slight overpressure when the valve is closed.

**⚠ WARNING**

**Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures**

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.



**⚠ WARNING****Risk of fatal injury due to electric shock on account of incorrect installation**

The device's power supply uses life-threatening voltages. Unsafe or improper installation can lead to life-threatening situations from electric shocks obtained from working with or on the unit.

- ▶ Ensure safe integration into an emergency off safety circuit.
- ▶ Do not carry out your own conversions or modifications on the unit.

**⚠ WARNING****Mortal danger from electric shock caused by water damage**

The device complies with protection degree IP40 according to DIN EN 60529: 2014 and is not protected against water ingress. Vacuum pumps operated on the floor lead to leakage current in penetrating and surrounding water. There is a danger to life from electric shock when making contact with live water.

- ▶ In case of water damage, disconnect the complete power supply from the area affected.
- ▶ Provide an on-site electrical fuse protection (e.g. RCD) in hazardous areas.
- ▶ When selecting the installation location, observe potential damage from water.

**⚠ WARNING****Danger to life from poisoning where toxic process gases leak with no exhaust line**

During normal operation, the vacuum pump expels exhaust gases and vapors freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Observe the relevant regulations for handling toxic substances.
- ▶ Safely purge toxic process gases via an exhaust line.

**⚠ CAUTION****Danger of injury from bursting as a result of high pressure in the exhaust line**

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g., increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- ▶ Route the exhaust line without shut-off units.
- ▶ Observe the maximum permissible pressure of 1,500 hPa (absolute).
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.

**Risks during operation****⚠ WARNING****Risk of explosion in the medium to be pumped as a result of increased pressure**

With installation on the exhaust side, there is a risk of the exhaust pressure of the vacuum pump exceeding the atmospheric conditions. The ignition temperature of the medium to be pumped is lowered in the suction chamber. If the ignition temperature of the medium to be pumped falls below a temperature of  $T_4 = +135^\circ\text{C}$ , there is a risk of explosion, and consequently serious injury.

- ▶ Ensure that the ignition temperature of the medium to be pumped is maintained above a temperature of  $+135^\circ\text{C}$  at 3500 hPa abs.

**⚠ WARNING****Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures**

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.

**⚠ WARNING**

**Danger of poisoning due to toxic process media escaping from the exhaust pipe**

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. There is a risk of injury and fatality due to poisoning in processes with toxic process media.

- ▶ Observe the pertinent regulations for handling toxic process media.
- ▶ Safely purge toxic process media via an exhaust line.
- ▶ Use appropriate filter equipment to separate toxic process media.

**⚠ WARNING**

**Risk of poisoning from incorrect use of the gas ballast system**

The gas ballast system of the scroll pump is vacuum sealed only when used in valid, snapped positions "0", "1" and "2". When operating the valves in intermediate stages, there is a risk that process media can escape to the environment uncontrolled. When using toxic process media, there is a risk of poisoning.

- ▶ Change the positions of the valve only for setting the gas ballast stages.
- ▶ Operate the gas ballast valve only in the snap positions.

**⚠ WARNING**

**Mortal danger from electric shock during operation caused by transport damage**

Damage to the transport packaging may favor the ingress of moisture or electrically conductive media into the vacuum pump. Devices connected to the mains may still be live. There is a danger to life from electric shock when making contact with live components.

- ▶ Before commissioning, convince yourself of the trouble-free state of your vacuum pump.
- ▶ Pay attention to residues of fluids or condensate.
- ▶ Do not put the vacuum pump into operation if there is obvious external damage.

**⚠ WARNING**

**Mortal danger from electric shock caused by water damage**

The device complies with protection degree IP40 according to DIN EN 60529: 2014 and is not protected against water ingress. Vacuum pumps operated on the floor lead to leakage current in penetrating and surrounding water. There is a danger to life from electric shock when making contact with live water.

- ▶ In case of water damage, disconnect the complete power supply from the area affected.
- ▶ Provide an on-site electrical fuse protection (e.g. RCD) in hazardous areas.
- ▶ When selecting the installation location, observe potential damage from water.

**⚠ CAUTION**

**Danger of injury from bursting as a result of high pressure in the exhaust line**

Faulty or inadequate exhaust pipes lead to dangerous situations, e.g., increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- ▶ Route the exhaust line without shut-off units.
- ▶ Observe the maximum permissible pressure of 1,500 hPa (absolute).
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.

**⚠ CAUTION**

**Risk of injury from burns where hot process gases leak with no exhaust line**

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. For processes with high temperatures, there is a risk of burns on hot exhaust gases.

- ▶ If necessary, safely purge hot process gases via an exhaust line.
- ▶ Wear personal protective equipment if necessary.

**Risks during maintenance****⚠ WARNING****Risk of injury from reactive, potentially explosive, or otherwise hazardous gas/air mixtures during maintenance**

Uncontrolled leakage of process gases may result in the formation of explosive gas-air mixtures after opening the vacuum pump. Ignition can cause very serious injuries.

- ▶ Ensure that the suction chamber is sufficiently inert before starting maintenance work.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas escaping.

**⚠ WARNING****Danger to life from electric shock during maintenance and service work**

There is a danger to life from electric shock when making contact with live components that still exist after the vacuum pump has been switched off.

- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Wait until the vacuum pump comes to a standstill (rotation speed = 0).
- ▶ After switching off the vacuum pump, wait another 5 minutes until the capacitors have discharged.

**⚠ WARNING****Health hazard through poisoning from toxic contaminated components or devices**

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

**⚠ WARNING****Crushing and cutting danger on unprotected parts from unforeseeable automatic run-up during maintenance.**

During activities on exposed mechanical components, there is a risk of crushing or cut injuries from sudden run-up.

- ▶ Switch off the vacuum pump before any maintenance work and work.
- ▶ Vent the vacuum pump to atmospheric pressure.
- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Secure the vacuum pump against re-start.
- ▶ Disconnect the mains cable from the vacuum pump.

**Risks in the event of malfunctions****⚠ WARNING****Danger to life from electric shock in the event of a fault**

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

- ▶ Always keep the mains connection freely accessible so you can disconnect it at any time.

**⚠ CAUTION**

**Danger of burns on hot surfaces in case of malfunctions**

Failure of the ventilation due to transport damage or disregarded previous damage lead to impermissibly high temperatures. There is a danger of burns by accidental contact. There is a risk of property damage to, and even destruction of the vacuum pump.

- ▶ Disconnect the vacuum pump from the mains.
- ▶ Allow the vacuum pump to cool down before carrying out any maintenance work.
- ▶ Wear personal protective equipment if necessary.

## 2.3 Safety precautions



**Duty to provide information on potential dangers**

The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.

Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety-related parts of this document.



**Infringement of conformity due to modifications to the product**

The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

**General safety precautions when handling the product**

- ▶ Observe all applicable safety and accident prevention regulations.
- ▶ Check that all safety measures are observed at regular intervals.
- ▶ Do not expose body parts to the vacuum.
- ▶ Always ensure a secure connection to the earthed conductor (PE).
- ▶ Never disconnect plug connections during operation.
- ▶ Observe the above shutdown procedures.
- ▶ Before working on the vacuum pump, wait until complete standstill (rotation speed  $f = 0$ ).
- ▶ Never put the device into operation with the vacuum connection open.
- ▶ Keep lines and cables away from hot surfaces ( $> 70^{\circ}\text{C}$ ).
- ▶ Never fill or operate the unit with cleaning agents or cleaning agent residues.
- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Observe the unit's protection degree prior to installation or operation in other environments.

## 2.4 ATEX classification and safety measures

**⚠ WARNING**

**Explosion hazard when using accessories outside the limits of use**

When using accessories, there is a risk of an ignition source forming that could potentially result in an explosion when pumping explosive gases.

- ▶ When pumping explosive media, use only accessories that comply with the requirements of Directive 2014/34/EU.

The Cobalt pumps comply with the requirements of Directive 2014/34/EU for equipment and protective systems intended for use in potentially explosive atmospheres with the following marking:

- $\text{Ex}$  II 3/-G Ex h IIC T4 Gc X  $+5^{\circ}\text{C} \leq \text{Ta} \leq +40^{\circ}\text{C}$ 
  - Cat. 3G = can be used in Zone 2 inside
  - Cat. /- G = installation only in environments without Ex zone; operation in outdoor hazardous areas is not permitted.

Classification	Description
Device group	<p>Devices which can be used for applications in potentially explosive atmospheres are divided into two groups:</p> <p><b>Device group I:</b> Devices for mines susceptible to firedamp (will not be discussed in any more detail here)</p> <p><b>Device group II:</b> Devices for all other potentially explosive areas with the exception of underground operations in mines and their surface installations which are susceptible to hazardous firedamp and / or combustible dust.</p>
Device category	<p>Device group II is divided into three categories which vary in their respective degree of safety.</p> <p>Devices of <b>Device category 1</b> are designed to guarantee an extremely high degree of safety. They must guarantee the necessary degree of safety even if malfunctions occur only rarely on the device.</p> <p>Devices of <b>Device category 2</b> are designed to guarantee a high degree of safety. They must guarantee the necessary degree of safety even with regular occurrences of malfunctions or fault conditions which are generally to be expected.</p> <p>Devices of <b>Device category 3</b> are designed to guarantee a normal degree of safety. They guarantee the necessary degree of safety for normal operation.</p>
Combustible materials	<p><b>G:</b> Gases or vapors</p> <p><b>D:</b> Dust (will not be discussed in any more detail here)</p>
Type of protection	<p>Identification code "Ex h" designated in the standard DIN EN ISO 80079-36 for non-electrical equipment. A protection type established for electrical equipment is not used.</p>
Explosion groups	<p>Gases and vapors are divided into three Explosion groups based on their particular ignition capability (IIA, IIB and IIC). The ignition power in this regard decreases from Explosion group IIA to IIC. (The higher Explosion group, e.g. IIC incorporates the respectively lower IIB and IIA).</p>
Temperature class	<p>Classification of equipment depending on their maximum surface temperature, in accordance with assignment as follows:</p> <p>Temperature class --&gt; Maximum surface temperature/gas temperature:</p> <ul style="list-style-type: none"> <li>• T1 --&gt; +450 °C</li> <li>• T2 --&gt; +300 °C</li> <li>• T3 --&gt; +200 °C</li> <li>• T4 --&gt; +135 °C</li> <li>• T5 --&gt; +100 °C</li> <li>• T6 --&gt; +85 °C</li> </ul> <p>The temperature class and the actual maximum surface temperature of the equipment includes a safety margin to the minimum ignition temperature of the potentially explosive atmospheres as stipulated in DIN EN ISO 80079-36.</p>
EPL according to DIN EN 60079	<p>Equipment protection level</p> <p><b>EPL Ga:</b> Equipment with "extremely high" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation, with foreseeable or infrequent faults/malfunctions.</p> <p><b>EPL Gb:</b> Equipment with "high" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation, with foreseeable faults/malfunctions.</p> <p><b>EPL Gc:</b> Equipment with "extended" protection level for use in potentially explosive gas atmospheres in which no risk of ignition exists during normal operation.</p>
X	<p>Special operating conditions apply that must be observed when pumping in an explosive atmosphere. These include:</p> <ul style="list-style-type: none"> <li>• The limits of use of the product shown in chapter 2.5.</li> <li>• The prohibition of using accessories (e.g., pressure sensor) without ATEX approval.</li> </ul>
Ta	<p>Permissible ambient temperature for operation of the vacuum pump prescribed on the rating plate.</p>

**Tbl. 3: General ATEX designations**

## 2.5 Limits of use of product

Installation location	Interiors, protected against the accumulation of dust and weather influences, in a non-explosive, dry environment
Air pressure	750 hPa to 1060 hPa
Installation altitude	Max. 2500 m
Recommended constant intake pressure	200 hPa <sup>1)</sup>
Installation surface flatness	±10 %
Rel. air humidity	max. 90 %, non-condensing
Ambient temperature	5 °C to 40 °C
Transport temperature	-25 °C to 55 °C
Storage temperature	-10 °C to 50 °C
Protection class	I
Overvoltage category	II
Permissible protection degree	IP40 Type 1 according to UL 50E
Degree of pollution	2

**Tbl. 4: Permissible ambient conditions**

## 2.6 Proper use

- ▶ Use the scroll pump only for generating vacuum.
- ▶ Use the vacuum pump to convey potentially explosive atmospheres in accordance with the labeling.
- ▶ Use the scroll pump only in closed indoor areas.
- ▶ Use the scroll pump for the evacuation of dry and inert gases.
- ▶ Use the scroll pump with gas ballast to evacuate moist gases.
- ▶ Use only inert gases as gas ballast when evacuating explosive gases.

## 2.7 Foreseeable improper use

Improper use of the product invalidates all warranty and liability claims. Any use that is counter to the purpose of the product, whether intentional or unintentional, is regarded as misuse.

- Transporting, installing, or operating the vacuum pump in an impermissible spatial position
- Establishing the voltage supply without correct installation
- Connecting the vacuum pump to unsuitable operating voltages
- Pumping of explosive media when using accessories that do not comply with the pump classification.
- Pumping of corrosive media
- Pumping of dust and media containing particles
- Pumping of fluids
- Operating with impermissible high gas throughput
- Operating with impermissible gas ballast quantities
- Operating with impermissibly set stages of the gas ballast valve
- Operating with excessive irradiated heat output
- Operating with impermissibly high exhaust pressure
- Operating in impermissible high magnetic fields
- Using the vacuum pump outside the specified range of application
- Using for pressure generation
- Using in areas with ionizing radiation
- Using in potentially explosive areas
- Using in systems in which sporadic loads and vibrations or periodic forces act on the device
- Using the vacuum pump as a climbing aid
- Using of accessories or spare parts that are not listed in these instructions
- Separating, replacing, or reusing the electronic drive unit.

1) Higher permanent intake pressures can lead to increased wear

## 2.8 Personnel qualification

The work described in this document may only be carried out by persons who have appropriate professional qualifications and the necessary experience or who have completed the necessary training.

### Training people

1. Train the technical personnel on the product.
2. Only let personnel to be trained work with and on the product when under the supervision of trained personnel.
3. Only allow trained technical personnel to work with the product.
4. Before starting work, make sure that the commissioned personnel have read and understood these operating instructions and all applicable documents, in particular the safety, maintenance and repair information.

### 2.8.1 Ensuring personnel qualification

#### Specialist for mechanical work

Only a trained specialist may carry out mechanical work. Within the meaning of this document, specialists are people responsible for construction, mechanical installation, troubleshooting and maintenance of the product, and who have the following qualifications:

- Qualification in the mechanical field in accordance with nationally applicable regulations
- Knowledge of this documentation

#### Specialist for electrotechnical work

Only a trained electrician may carry out electrical engineering work. Within the meaning of this document, electricians are people responsible for electrical installation, commissioning, troubleshooting, and maintenance of the product, and who have the following qualifications:

- Qualification in the electrical engineering field in accordance with nationally applicable regulations
- Knowledge of this documentation

In addition, these individuals must be familiar with applicable safety regulations and laws, as well as the other standards, guidelines, and laws referred to in this documentation. The above individuals must have an explicitly granted operational authorization to commission, program, configure, mark, and earth devices, systems, and circuits in accordance with safety technology standards.

#### Trained individuals

Only adequately trained individuals may carry out all works in other transport, storage, operation and disposal fields. Such training must ensure that individuals are capable of carrying out the required activities and work steps safely and properly.

### 2.8.2 Personnel qualification for maintenance and repair

Adequately trained individuals are:

- **Maintenance level 1**
  - Customer (trained specialist)
- **Maintenance level 2**
  - Customer with technical education
  - Service technician
- **Maintenance level 3**
  - Customer service training
  - Service technician

### 2.8.3 Advanced training

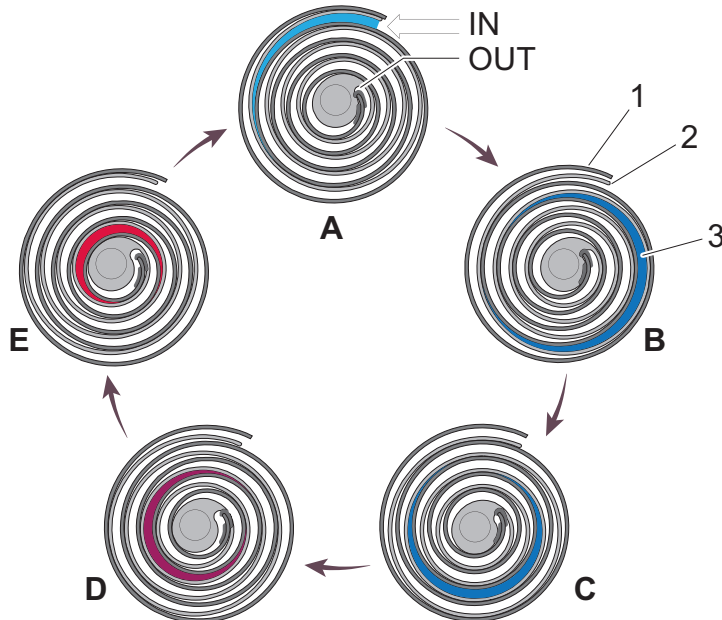
For optimal and trouble-free use of this product, Kurt J. Lesker offers a comprehensive range of courses and technical trainings.

For more information, please contact [Kurt J. Lesker Company](#).

### 3 Product description

#### 3.1 Function

The scroll pump is a vacuum pump operating dry in a suction chamber for generating a coarse or medium vacuum according to the physical pumping principle of a spiral vacuum pump. The pump is equipped with an integrated drive and control unit. A three-stage gas ballast system supports the prevention of condensation accumulating in the vacuum pump.

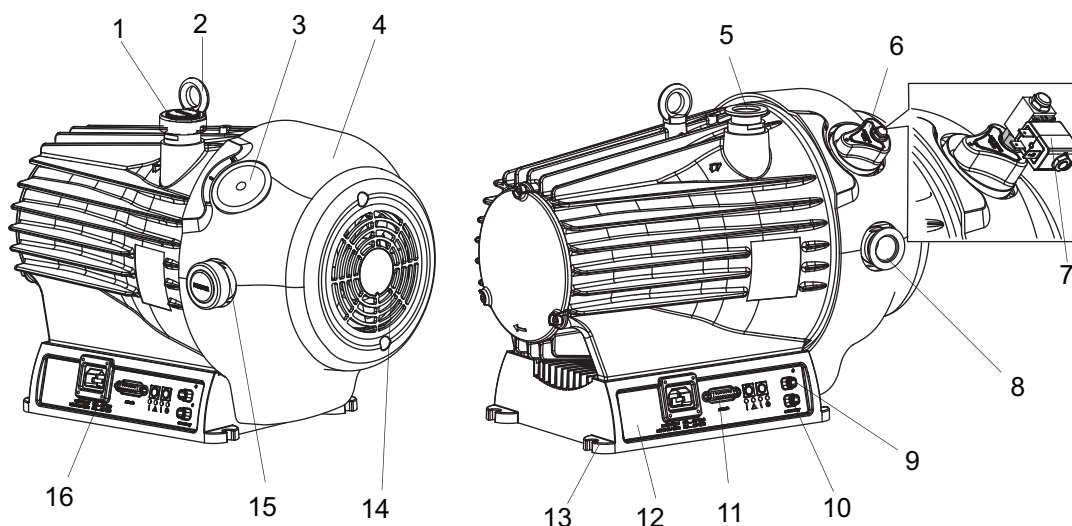


**Fig. 2: Schematic compression cycle of scroll pumps**

IN	Gas inlet	2	Orbiting spiral
OUT	Gas outlet	3	Gas compression
1	Stationary spiral	A bis E	Sections of increasing compression in the pumping cycle

Spiral vacuum pumps comprise a stationary and orbiting spiral. Varying cavities are generated at the pump inlet by the movements of the orbiting spiral, which suck in the gas. The movement of the rotor compresses the gas continuously until being expelled into the atmosphere at the pump outlet. The suction chamber is completely free from lubricants.





**Fig. 3: Cobalt design**

- |  |                                       |
|--|---------------------------------------|
| 1 Protective cover for DN 25 vacuum connection | 9 Accessory connection "C"            |
| 2 Eye bolt                                     | 10 Accessory connection "D"           |
| 3 Blank cover for version without GB           | 11 "Remote" connecting socket         |
| 4 Fan cover                                    | 12 Electronic drive unit              |
| 5 Vacuum connection                            | 13 Base with fixing hole              |
| 6 Gas ballast valve for version with GB        | 14 Fan                                |
| 7 Version with automated GB (option)           | 15 Protective cover for DN 25 exhaust |
| 8 Exhaust connection                           | 16 Mains supply plug                  |

### 3.1.1 Drive

The vacuum pump is equipped with a highly efficient synchronous motor with sensor-free control, in accordance with the patented INFORM procedure according to Prof. Schrödl.

The integrated electronic drive unit permits the control and monitoring of pumping functions via the "remote" interface using a display and control panel.

### 3.1.2 Cooling

- Air cooling

The electronic drive unit regulates the cooling capacity of the integrated fan depending on the cooling requirement.

### 3.1.3 Shaft bearing

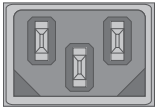




Ball bearing-mounted eccentric shaft. The dry running working chamber of the vacuum pump is separated hermetically from the shaft bearing.

- 2 x deep groove ball bearings, maintenance-free

### 3.1.4 Gas ballast

Depending on the pump version, the vacuum pump has a gas ballast system for manual or automated supply of inert gas to the suction chamber. Gas ballast supports the reduction of condensate accumulating in the pumping system. Pumping explosive atmospheres when using the automated gas ballast valve is not permitted as the electromagnetic valve does not have ATEX approval.

### 3.2 Connections

Connection	Description
	<b>mains input</b> Housing connector for the voltage supply
	<b>remote</b> D-sub socket with 15 pins for configuration and connection of a remote control.
	<b>Stand-by button</b> Pressing this button activates or deactivates the stand-by mode of the vacuum pump. Corresponds with parameter <b>[P:002]</b> .
	<b>On/Off button</b> Switches the vacuum pump and all components connected on or off, depending on their configuration. Corresponds with parameter <b>[P:010]</b> .
	<b>Accessory connection</b> 2 connecting sockets for the operation of suitable accessory devices

Tbl. 5: Interfaces of the electronic drive unit

### 3.3 Identifying the product

- ▶ To ensure clear identification of the product when communicating with Kurt J. Lesker, always keep all of the information on the rating plate to hand.

### 3.4 Product features

Version	Nominal pumping speed
Cobalt 6, scroll pump	6.1 m <sup>3</sup> /h
Cobalt 12, scroll pump	12.1 m <sup>3</sup> /h
Cobalt 18, scroll pump	18.1 m <sup>3</sup> /h

Tbl. 6: Features of scroll pumps

### 3.5 Scope of delivery

- Scroll pump with electronic drive unit
- Protective cap for vacuum connection
- Protective cover for the exhaust connection
- Operating instructions

## 4 Transportation and Storage

### 4.1 Transporting vacuum pump

#### **⚠ WARNING**

##### **Risk of serious injury from swinging, toppling or falling objects**

During transport, there is a risk of crushing and impact on swinging, toppling or falling objects. There is a risk of injuries to limbs, up to and including bone fractures and head injuries.

- ▶ Secure the danger zone if necessary.
- ▶ Pay attention to the center of gravity of the load during transport.
- ▶ Ensure even movements and moderate speeds.
- ▶ Observe safe handling of the transport devices.
- ▶ Avoid sloping attachment aids.
- ▶ Never stack products.
- ▶ Wear protective equipment, e.g. safety shoes.



#### **Packing**

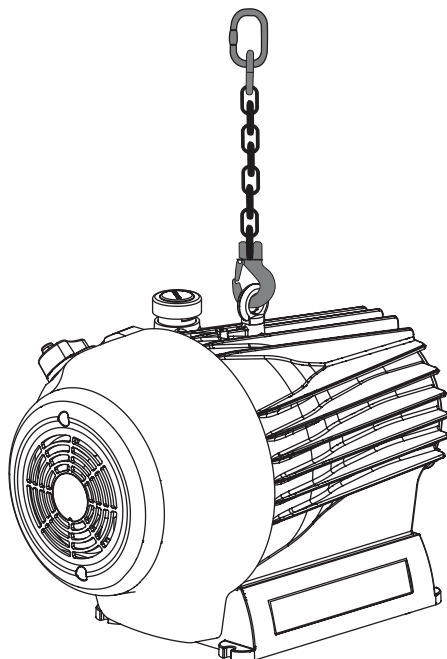
We recommend keeping the transport packaging and original protective cover.

#### **Safe transport of the product**

1. Observe weight specified on the rating plate.
2. Wherever possible, always transport or ship the vacuum pump in its original packaging.
3. Remove the protective cap only immediately prior to installation.

#### **Transporting the vacuum pump in its packaging**

1. Use a pallet truck to transport the vacuum pump in its packaging.
2. Note the center of gravity of the load.
3. Observe safe handling of manually operated transport devices.
4. Ensure harmonious movements and moderate speeds.
5. Ensure a flat substrate.
6. Wear protective equipment, e.g. safety shoes.



**Fig. 4: Slinging points for transport of the scroll pump**

### Transporting vacuum pump without packaging

1 eye bolt is included in the scope of delivery. It is securely bolted to the vacuum pump at the factory.

1. Attach suitable lifting tools to the eye bolt.
2. Pay attention to the correct use and fastening of the lifting equipment.
3. Lift the vacuum pump vertically (e.g. out of the packaging).
4. Remove the eye bolt following transport and installation as required.
  - Keep the eye bolt for future use.

## 4.2 Storing the vacuum pump



### Packing

We recommend storing the product in its original packaging.

### Storing the scroll pump

1. Close all flange openings with the original protective caps.
2. Close the gas ballast valve (position "0").
3. Store the vacuum pump only indoors within the permissible temperature limits.
4. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.

## 5 Installation

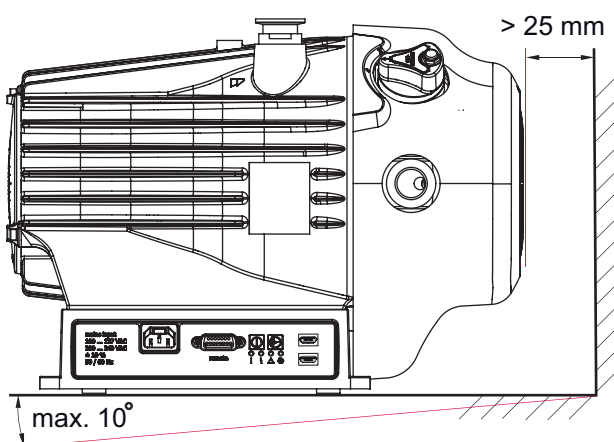
### 5.1 Set up the vacuum pump

#### **⚠ WARNING**

##### **Mortal danger from electric shock caused by water damage**

The device complies with protection degree IP40 according to DIN EN 60529: 2014 and is not protected against water ingress. Vacuum pumps operated on the floor lead to leakage current in penetrating and surrounding water. There is a danger to life from electric shock when making contact with live water.

- ▶ In case of water damage, disconnect the complete power supply from the area affected.
- ▶ Provide an on-site electrical fuse protection (e.g. RCD) in hazardous areas.
- ▶ When selecting the installation location, observe potential damage from water.



**Fig. 5: Minimum clearances and permissible inclination**

#### **Procedure**

- ▶ Place the vacuum pump on a flat, horizontal surface.
- ▶ Always keep the connections and manual control elements freely accessible.
- ▶ Keep the specifications on the motor rating plate visible and freely accessible.
- ▶ With stationary installation, if necessary, secure the vacuum pump on the standing area with all 4 fixing holes (M8).
- ▶ When installing the pump in a closed housing, ensure adequate air circulation.

### 5.2 Connecting vacuum side

#### **⚠ WARNING**

##### **Explosion hazard if particles enter the vacuum connection**

During commissioning, there is a risk of foreign particles entering the vacuum chamber, forming a source of ignition, and potentially resulting in an explosion in combination with explosive gases.

- ▶ Use a suitable protective strainer at the vacuum connection.
- ▶ Do not remove the strainer until you are sure that no solid particles can enter the vacuum pump.



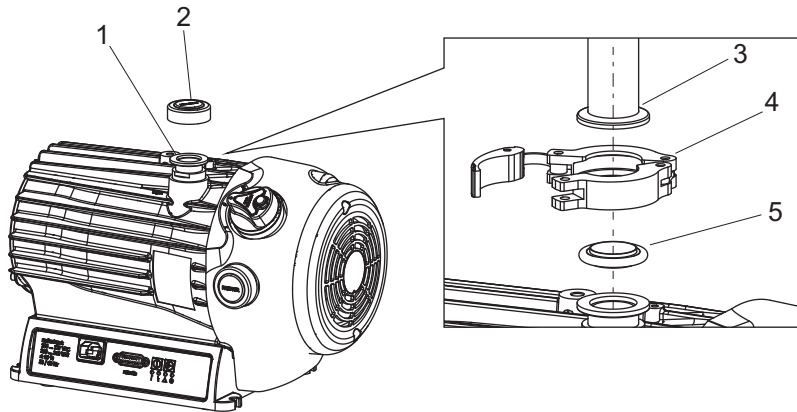
#### **Preventing throttling losses**

Using short vacuum lines with a large nominal diameter prevents throttling losses.



#### **Preventing condensate**

If moisture occurs in the process, the use of a condensate separator during evacuation prevents the formation of vapors.



**Fig. 6: Example of vacuum connection**

- |  |                  |
|--|------------------|
| 1 Vacuum connection of the scroll pump | 4 Circlip        |
| 2 Protective cap                       | 5 Centering ring |
| 3 Vacuum components DN 25 ISO-KF       |                  |

**Procedure**

1. Take the protective cap off the scroll pump vacuum connection.
2. Install the connection between vacuum pump and vacuum system so that it is as short as possible.
3. Install a vacuum connection with small flange components, e.g. fasteners and pipe components DN 25 ISO-KF from the Kurt J. Lesker Company.
4. Connect the vacuum pump to the vacuum system using the vacuum connection.

### 5.3 Connecting the exhaust side

**⚠ WARNING**

**Danger to life from poisoning where toxic process gases leak with no exhaust line**

During normal operation, the vacuum pump expels exhaust gases and vapors freely into the air. In processes involving toxic media, there is a risk of injury and danger to life due to poisoning.

- ▶ Observe the relevant regulations for handling toxic substances.
- ▶ Safely purge toxic process gases via an exhaust line.

**⚠ CAUTION**

**Danger of injury from bursting as a result of high pressure in the exhaust line**

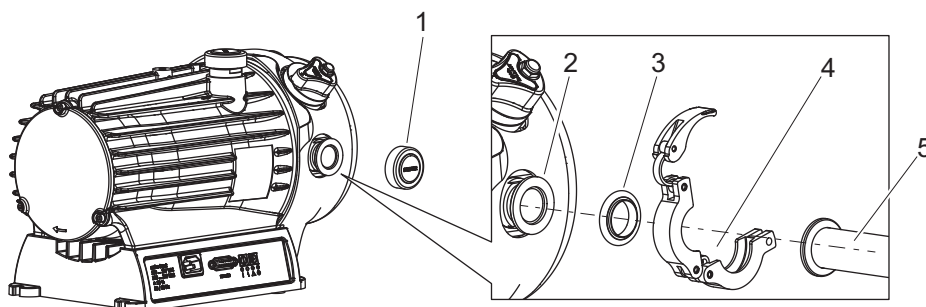
Faulty or inadequate exhaust pipes lead to dangerous situations, e.g., increased exhaust pressure. There is a danger of bursting. Injuries caused by flying fragments, the escaping of high pressure, and damage to the unit cannot be excluded.

- ▶ Route the exhaust line without shut-off units.
- ▶ Observe the maximum permissible pressure of 1,500 hPa (absolute).
- ▶ Observe the permissible pressures and pressure differentials for the product.
- ▶ Check the function of the exhaust line on a regular basis.



**Condensate separator**

Recommendation for exhaust line: A condensate separator, with condensate drain at the lowest point of the exhaust line.



**Fig. 7: Example of exhaust connection**

- |   |                                  |
|---|----------------------------------|
| 1 Protective cover                      | 4 Clamp                          |
| 2 Exhaust connection of the scroll pump | 5 Vacuum components DN 25 ISO-KF |
| 3 Centering ring                        |                                  |

#### Procedure

1. Remove the protective cover from the exhaust connection.
2. Choose a minimum exhaust line cross section equal to the connection nominal diameter.
3. Install a vacuum connection with small flange components, e.g. fasteners and pipe components DN 25 ISO-KF from the [Kurt J. Lesker Company](#).
4. Route the piping downwards from the vacuum pump, to prevent condensate return.
5. Support or suspend the piping to the vacuum pump so that no piping system forces act on the vacuum pump.

## 5.4 Connecting gas ballast external supply

### **⚠ WARNING**

#### **Explosion hazard if particles enter at the gas ballast valve**

When connecting the gas ballast line, there is a risk of foreign particles entering, which may cause an exothermic reaction if the material pairing in the suction chamber is unfavorable.

- ▶ When connecting the external gas ballast supply, ensure that the gas ballast valve is closed.
- ▶ Clean the inlet area of the gas ballast valve by activating the gas supply with slight overpressure when the valve is closed.

### **⚠ WARNING**

#### **Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures**

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.

### **NOTICE**

#### **Risk of damage from condensation in vacuum pump**

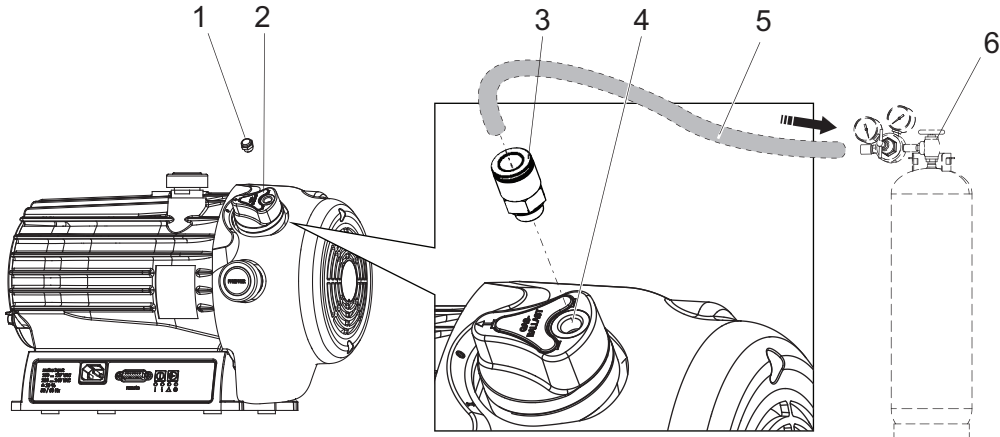
Exceeding the saturation vapor pressure of process media during the compression phase leads to condensation in the suction chamber. This results in an increase of the achievable ultimate pressure and to a general deterioration of the performance data of the vacuum pump as a whole. Corrosion and contamination impair service life.

- ▶ Use the gas ballast.
- ▶ Supply dry room air or inert gas in order to increase the vapor capacity of the process medium.
- ▶ Pump condensable vapors only when the vacuum pump is warm and the gas ballast valve open.
- ▶ Operate the vacuum pump with gas ballast a further approx. 30 minutes after finishing the process in order to dissipate any residual moisture.

The gas ballast system of the scroll pump is suitable for being connected to a gas external supply. Couplings for the G 1/8" connection from the accessories range are available for this purpose.

**Required tools**

- Wrench, **WAF 13**
- Calibrated torque wrench (tightening factor  $\leq 1.6$ )



**Fig. 8: Connecting gas ballast external supply**

- |                                  |                                  |
|----------------------------------|----------------------------------|
| 1 Sinter filter                  | 4 Gas ballast connection opening |
| 2 Gas ballast valve              | 5 External gas supply line       |
| 3 Example of connecting coupling | 6 External gas supply            |

**Connecting gas supply**

1. Turn the gas ballast valve to position "0".
2. Unscrew the sinter filter the from valve housing.
3. Screw a connecting coupling with sealing ring into the G 1/8" filter bore.
  - Tightening torque: **2.5 Nm**.
4. Connect an external supply with nitrogen (N<sub>2</sub>) or another dry, inert gas to the coupling.
5. With the gas supply, observe the maximum permissible inlet pressure.
6. Briefly open the gas ballast valve by turning the selector switch to position "1".
  - Letting in inert gas removes any particles from the inlet area of the gas ballast valve.

**5.5 Connecting to mains power supply**

**⚠ DANGER**

**Danger to life from electric shock**

Inadequate or incorrect grounding of the unit leads to contact-sensitive voltage on the housing. When making contact, increased leakage currents will cause a life-threatening electric shock.

- ▶ Before the installation, check that the connection leads are voltage-free.
- ▶ Conduct the electrical connection in accordance with locally applicable regulations.
- ▶ Make sure that the local mains voltage and frequency match rating plate specifications.
- ▶ Make sure that the mains cable and extension cable meet the requirements for double isolation between input voltage and output voltage, in accordance with IEC 61010 and IEC 60950.
- ▶ Use only a 3-pin mains cable and extension cable with properly connected protective earthing (earthed conductor).
- ▶ Plug the mains plug into a socket with earthing contact only.
- ▶ Always connect the mains cable prior to all other cables, to ensure continuous protective earthing.



**⚠ WARNING****Risk of danger to life through missing mains disconnection device**

The vacuum pump and electronic drive unit are **not** equipped with a mains disconnection device (mains switch).

- ▶ Install a mains disconnection device according to SEMI-S2.
- ▶ Install a circuit breaker with an interruption rating of at least 10,000 A.

**⚠ WARNING****Risk of fatal injury due to electric shock on account of incorrect installation**

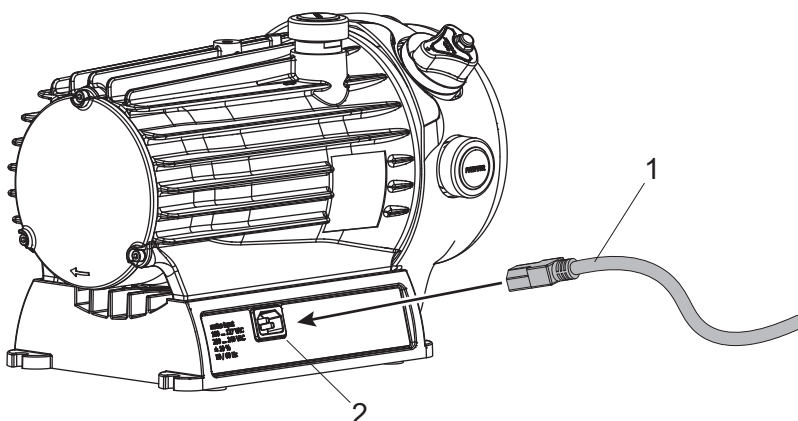
The device's power supply uses life-threatening voltages. Unsafe or improper installation can lead to life-threatening situations from electric shocks obtained from working with or on the unit.

- ▶ Ensure safe integration into an emergency off safety circuit.
- ▶ Do not carry out your own conversions or modifications on the unit.

**⚠ WARNING****Mortal danger from electric shock caused by water damage**

The device complies with protection degree IP40 according to DIN EN 60529: 2014 and is not protected against water ingress. Vacuum pumps operated on the floor lead to leakage current in penetrating and surrounding water. There is a danger to life from electric shock when making contact with live water.

- ▶ In case of water damage, disconnect the complete power supply from the area affected.
- ▶ Provide an on-site electrical fuse protection (e.g. RCD) in hazardous areas.
- ▶ When selecting the installation location, observe potential damage from water.



**Fig. 9: Connecting to mains power supply**

- 1 Mains cable      2 Power supply plug ACin

**Mains supply**

The electronic drive unit starts when the mains supply is established.

**Establishing mains supply**

1. Order a country-specific power cable from the accessories.
2. Always ensure a secure connection to the earthed conductor.
3. Plug the mains cable into the connecting plug of the electronic drive unit.

## 6 Interfaces

### 6.1 Interface overview

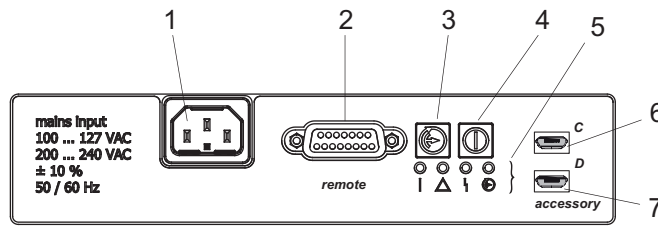


Fig. 10: Interfaces of the electronic drive unit

- |                              |                              |
|------------------------------|------------------------------|
| 1 Mains connection ACin, C14 | 5 LED operating mode display |
| 2 Remote connection          | 6 Accessory connection "C"   |
| 3 Stand-by button            | 7 Accessory connection "D"   |
| 4 On/Off button              |                              |

### 6.2 "Remote" interface

The 15-pin sub-D connection with the "remote" designation offers the possibility to operate the electronic drive unit via remote control. The following specifications are the factory settings for the electronic drive unit. They can be configured with the corresponding parameter set.

► Utilize the screened plug and cable.

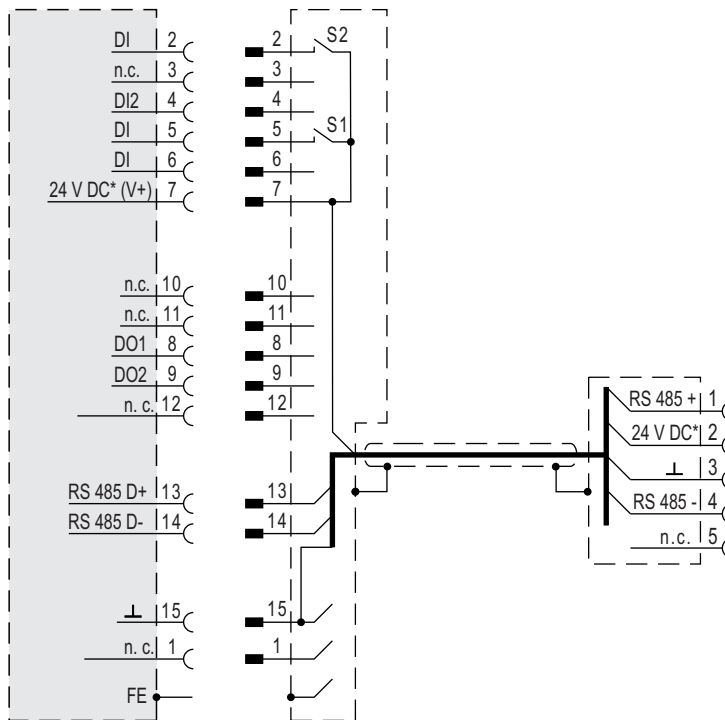
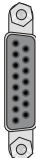


Fig. 11: Connection diagram of 15-pin "remote" connection



Pin	Assignment	Description, factory setting
1	unassigned	
2	DI remote priority	Operation via "remote" interface
3	unassigned	
4	DI2	open: off; V+: on
5	DI Pumping station	open: off; V+: on and malfunction acknowledgment
6	DI stand-by	open: Standby off, V+: Standby on
7	+24 V DC* output (V+)	Reference voltage for all digital inputs (5 W max.)
8	DO1	GND: no, V+: yes ( $I_{\max} = 50 \text{ mA}/24 \text{ V}$ ), function can be selected via parameters
9	DO2	GND: no, V+: yes ( $I_{\max} = 50 \text{ mA}/24 \text{ V}$ ), function can be selected via parameters
10	unassigned	
11	unassigned	
12	unassigned	
13	RS-485	D+
14	RS-485	D-
15	Ground (GND)	Reference earth for all digital inputs and outputs

**Tbl. 7: Connection assignment of 15-pin "remote" connection**

## 6.2.1 Inputs

The digital inputs at the "remote" connection are used to switch various electronic drive unit functions. Inputs are assigned with functions ex-factory. You can configure them via the RS-485 interface and the corresponding parameter set.

### DI remote priority/pin 2

**V+:** The "remote" connection has control priority over all other control sources.

**open:** Remote priority inactive

### DI/Pin 4

**V+:** On

**open:** Off

### DI pumping station/pin 5

**V+:** Pumping station on and malfunction acknowledgment.  
Reset pending error messages after eliminating the cause.

**open:** Pumping station off

### DI standby/pin 6

**V+:** Standby on

**open:** Operation at nominal rotation speed or selected rotation speed in rotation speed setting mode

## 6.2.2 Outputs

The digital outputs at the "remote" connection have a maximum load limit of 24 V/50 mA per output. You can configure all listed outputs with the parameter set via the RS-485 interface (description relates to factory settings).

### DO1/Pin 8

Active high yes

GND no

**DO2/Pin 9**

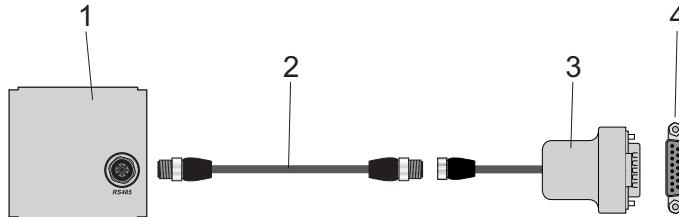
Active high    yes  
 GND            no

**6.2.3 RS-485**

**Connecting RS-485 via D-Sub**

- ▶ Connect a control unit or an external PC via pin 13 and pin 14 at the D-Sub connection of the electronic drive unit.

**6.3 Connecting control unit**



**Fig. 12: Connecting a control unit via the "remote" connection**

- 1 Control unit
- 2 M12 to M12 interface cable
- 3 RS-485 to M12 adapter
- 4 "remote" connection

**Procedure**

- ▶ Use cables from the scope of delivery of the control unit, or from the accessories program.
- ▶ Install the interface cables between the "remote" connection and the "RS-485" connection of the control unit.
  - Tightening torque: **0.4 Nm**
- ▶ Always connect the RS-485 interface to one external control unit only.

**6.4 Using RS-485 interface**

**⚠ DANGER**

**Danger to life from electric shock**

When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.

- ▶ Connect only suitable devices to the bus system.

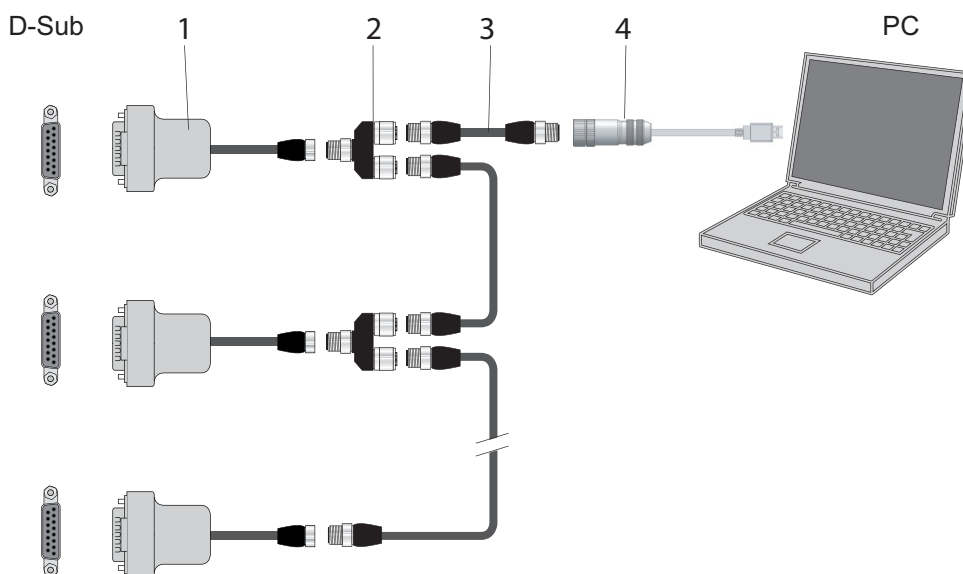
The interface designated "RS-485" is intended for connecting a corresponding control unit or a external PC. The connections are galvanically safe and are isolated from the maximum supply voltage for the electronic drive unit.

Designation	Value
Serial interface	RS-485
Baud rate	9600 Baud
Data word length	8 bit
Parity	none (no parity)
Start bits	1
Stop bits	1

**Tbl. 8: Features of the RS-485 interface**

**Connecting corresponding control units or a PC**

- ▶ Use the connection cable from the scope of delivery of the control unit or from the accessories.
- ▶ Connect a control unit to the RS-485 interface.
- ▶ Connect a PC via the USB/RS-485 converter.



**Fig. 13: Cross-link via connection RS-485 using connection cables and accessories**

- 1 RS-485 to M12 adapter
- 2 Y-connector for RS-485
- 3 M12 to M12 interface cable
- 4 USB RS-485 converter

**Networking as RS-485 bus**

The group address for the electronic drive unit is **902**.

1. Install the devices according to the specification for RS-485 interfaces.
2. Make sure that all devices connected to the bus have different RS-485 device addresses [P:797].
3. Connect all devices with RS-485 D+ and RS-485 D- to the bus.

## 6.5 Protocol for RS-485 interface



### 6.5.1 Telegram frame


The telegram frame of the protocol contains only ASCII code characters [32; 127], the exception being the end character of the telegram  $C_R$ . Basically, a host (e.g. a PC) sends a telegram, which a device (e.g. electronic drive unit or gauge) responds to.

a2	a1	a0	*	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	$C_R$
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	-------

a2 – a0	Device address
	<ul style="list-style-type: none"> <li>• Individual address of the unit ["001";"255"]</li> <li>• Group address "9xx" for all identical units (no response)</li> <li>• Global address "000" for all units on the bus (no response)</li> </ul>
*	Action according to telegram description
n2 – n0	Parameter numbers
l1 – l0	Data length dn to d0
dn – d0	Data in the respective data type (see chapter "Data types", page 35).
c2 – c0	Checksum (sum of ASCII values of cells a2 to d0) modulo 256
$C_R$	carriage return (ASCII 13)

### 6.5.2 Telegram frame

The telegram frame of the RS-485 protocol contains only ASCII code characters [32; 127], the exception being the end character of the telegram  $C_R$ . Basically, a host  (e.g. a PC) sends a telegram, which a device  (e.g. electronic drive unit or gauge) responds to.

a2	a1	a0	*	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	$C_R$
a2 – a0				Device address 												
				<ul style="list-style-type: none"> <li>• Individual address of the unit ["001";"255"]</li> <li>• Group address "9xx" for all identical units (no response)</li> <li>• Global address "000" for all units on the bus (no response)</li> </ul>												
*				Action according to telegram description												
n2 – n0				Parameter numbers												
l1 – l0				Data length dn to d0												
dn – d0				Data in the respective data type (see chapter "Data types", page 35).												
c2 – c0				Checksum (sum of ASCII values of cells a2 to d0) modulo 256												
$C_R$				carriage return (ASCII 13)												

### 6.5.3 Telegram description

**Data query**  -->  ?

a2	a1	a0	0	0	n2	n1	n0	0	2	=	?	c2	c1	c0	$C_R$
----	----	----	---	---	----	----	----	---	---	---	---	----	----	----	-------

**Control command**  -->  !

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	$C_R$
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	-------

**Data response / Control command understood**  --> 

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	$C_R$
----	----	----	---	---	----	----	----	----	----	----	-----	----	----	----	----	-------

**Error message**  --> 



a2	a1	a0	1	0	n2	n1	n0	0	6	N	O	_	D	E	F	c2	c1	c0	$C_R$	
											_	R	A	N	G	E				
											_	L	O	G	I	C				

- NO\_DEF            Parameter number n2–n0 no longer exists
- \_RANGE          Data dn–d0 outside the permissible range
- \_LOGIC          Logical access error

### 6.5.4 Telegram example 1



**Data query**

Current rotation speed (parameter **[P:309]**, device address: "123")

 -->  ?	1	2	3	0	0	3	0	9	0	2	=	?	1	1	2	$C_R$
ASCII	49	50	51	48	48	51	48	57	48	50	61	63	49	49	50	13

**Data response: 633 Hz**



Current rotation speed (parameter **[P:309]**, device address: "123")

 --> 	1	2	3	1	0	3	0	9	0	6	0	0	0	6	3	3	0	3	7	$C_R$
ASCII	49	50	51	49	48	51	48	57	48	54	48	48	48	54	51	51	48	51	55	13



### 6.5.5 Telegram example 2

**Control command**

Switch on the pumping station (parameter **[P:010]**, device address: "042")

 -->  !	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	C <sub>R</sub>
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

**Control command understood**Switch on the pumping station (parameter **[P:010]**, device address: "042")

 --> 	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	C <sub>R</sub>
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

**6.5.6 Data types**

No.	Data type	Description	Length l1 – l0	Example
0	boolean_old	Logical value (false/true)	06	000000 is equivalent to false 111111 is equivalent to true
1	u_integer	Positive whole number	06	000000 to 999999
2	u_real	Fixed point number (unsigned)	06	001571 corresponds with 15.71
4	string	Any character string with 6 characters. ASCII codes between 32 and 127	06	TC_110, TM_700
6	boolean_new	Logical value (false/true)	01	0 is equivalent to false 1 is equivalent to true
7	u_short_int	Positive whole number	03	000 to 999
10	u_expo_new	Positive exponential number. The last of both digits are the exponent with a deduction of 20.	06	100023 is equivalent to $1,0 \cdot 10^3$ 100000 is equivalent to $1,0 \cdot 10^{-20}$
11	string16	Any character string with 16 characters. ASCII codes between 32 and 127	16	BrezelBier&Wurst
12	string8	Any character string with 8 characters. ASCII codes between 32 and 127	08	Example

## 7 Parameter set

### 7.1 General

Important settings and function-related characteristics are factory-programmed into the electronic drive unit as parameters. Each parameter has a three-digit number and a description. The parameter can be accessed via control units or externally via RS-485 using the corresponding protocol.

The vacuum pump starts in standard mode with factory default pre-set parameters.



#### Non-volatile data storage

When switching off or in the event of unintentional voltage drop, the **parameters** and the operating hours stay saved in the electronics.








#	Three digit number of the parameter
Indicator	Display of parameter description
Description	Brief description of the parameters
Functions	Function description of the parameters
Data type	Protocol for formatting the parameters
Access type	R (read): Read access; W (write): Write access
Unit	Physical unit of the described variable
min. / max.	Permissible limit values for the entry of a value
default	Factory default pre-setting (partially pump-specific)
	The parameter can be saved persistently in the electronic drive unit

Tbl. 9: Explanation and meaning of the parameters

### 7.2 Control commands

#	Display	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
002	Stand-by	Stand-by	0 = off 1 = on	0	RW		0	1	0	✓
006	Auto stdby	automatic standby	0 = off 1 = on	0	RW		0	1	0	✓
009	ErrorAckn	Malfunction acknowledgment	1 = Malfunction acknowledgment	0	W		1	1		
010	Pumpg-Statn	Pumping station	0 = off 1 = on and malfunction acknowledgment	0	RW		0	1	0	✓
011	Auto boost	automatic boost operation	0 = off 1 = on	0	RW		0	1	0	✓
019	Cfg DO2	Output DO2 configuration	0 = Switch-point reached 1 = No error 2 = Error 5 = Set rotation speed reached 6 = Pump on 9 = Always "0" 10 = Always "1" 11 = Remote priority active 21 = Gas ballast	7	RW		0	21	5	✓




#	Display	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
020	PressMode	Pressure regulation	0 = off 1 = on	0	RW		0	1	0	
024	Cfg DO1	Output DO1 configuration	0 = Switch-point reached 1 = No error 2 = Error 5 = Set rotation speed reached 6 = Pump on 9 = Always "0" 10 = Always "1" 11 = Remote priority active 21 = Gas ballast	7	RW		0	21	21	
026	SpdSet-Mode	Rotation speed setting mode	0 = off 1 = on	7	RW		0	1	0	
030	VentMode	Valve mode	0 = auto (factory setting) 1 = closed 2 = open	7	RW		0	2	0	
034	Auto start	automatic start after power failure	0 = off 1 = on	0	RW		0	1	0	
052	BalGasValv	Gas ballast valve control	0 = off 1 = on	0	RW		0	1	0	
060	CtrlVialnt	Operate via interface	1 = remote 2 = RS-485 255 = Unlock interface selection	7	RW		1	255	1	
061	IntSelLckd	Interface selection locked	0 = off 1 = on	0	RW		0	1	0	
063	Cfg DI2	Configuration input DI2	0 - 4 = Deactivated 5 = Rotation speed setting mode On	7	RW		0	5	0	
068	Cfg Acc C1	Configuration accessory connection C1 <sup>2)</sup>	15 = gas ballast valve 16 = vacuum safety valve , type IV 16 M 17 = pressure sensor <sup>3)</sup> 18 = vacuum safety valve, type ISV 25	7	RW		0	7	0	
069	Cfg Acc D1	Configuration accessory connection D1 <sup>4)</sup>	15 = gas ballast valve 16 = vacuum safety valve , type IV 16 M 17 = pressure sensor 18 = vacuum safety valve, type ISV 25	7	RW		0	7	0	
095	FactorySet	Factory settings	1 = Reset to factory configuration	0	RW		0	1	0	

Tbl. 10: Control commands


- 2) Detection through interface  
3) Preferred plug-in position  
4) Detection through interface




## 7.3 Status requests

#	Display	Designations	Func-tions	Data type	Access type	Unit	min.	max.	de-fault	
300	RemotePrio	Remote priority	0 = no 1 = yes	0	R		0	1		
303	Error code	Error code		4	R					
304	OvTempElec	Excess temperature drive electronics	0 = no 1 = yes	0	R		0	1		
305	OvTempPump	Excess temperature pump	0 = no 1 = yes	0	R		0	1		
308	SetRotSpd	Set rotation speed (Hz)		1	R	Hz	0	999999		
309	ActualSpd	Actual rotation speed (Hz)		1	R	Hz	0	999999		
310	DrvCurrent	Drive current		2	R	A	0	9999.99		
311	OpHrsPump	Pump operating hours		1	R	h	0	999999		✓
312	Fw version	Drive electronics software version		4	R					
313	DrvVoltage	Drive voltage		2	R	V	0	9999.99		
314	OpHrsElec	Drive electronics operating hours		1	R	h	0	999999		✓
315	Nominal Spd	Nominal rotation speed (Hz)		1	R	Hz	0	999999		
316	DrvPower	Drive power		1	R	W	0	999999		
324	TempPwrStg	Final stage temperature		1	R	°C	0	999999		
326	TempElec	Electronics temperature		1	R	°C	0	999999		
346	TempMotor	Motor temperature		1	R	°C	0	999999		
349	ElecName	Electronic drive unit designation		4	R					
360	ErrHist1	Error code history, item 1		4	R					✓
361	ErrHist2	Error code history, item 2		4	R					✓
362	ErrHist3	Error code history, item 3		4	R					✓
397	SetRotSpd	Set rotation speed (rpm)		1	R	rpm	0	999999		
398	ActualSpd	Actual rotation speed (rpm)		1	R	rpm	0	999999		
399	NominalSpd	Nominal rotation speed (rpm)		1	R	rpm	0	999999		

Tbl. 11: Status requests

## 7.4 Reference value inputs

#	Display	Designations	Func-tions	Data type	Access type	Unit	min.	max.	de-fault	
707	SpdSVal	Set value in rotation speed setting mode		2	RW	%	40	100	83	✓
717	StdbySVal	Rotation speed set value in stand-by operation		2	RW	%	40	100	50	✓
721	SlgVlvTime	Opening interval of gas ballast valve		2	RW	min	0	60	5	✓
730	Press. Set	Switch-on threshold with auto standby / target pressure with pressure regulation		10	RW	hPa	0.01	30.0	10.0	✓
732	Press. Rel	Switch-off threshold with auto standby		10	RW	hPa	1.0	100.0	20.0	✓
739	PrsSn1Name	Name sensor 1		4	R					
740	Pressure 1	Pressure value 1		10	RW	hPa	$1 \cdot 10^{-5}$	1200.0		✓

#	Display	Designations	Functions	Data type	Access type	Unit	min.	max.	de-fault	
742	PrsCorrPi 1	Correction factor 1		2	RW		0.1	8.0	-	
797	RS485Adr	RS-485 Interface address		1	RW		1	255	2	

**Tbl. 12: Reference value inputs**

## 8 Operation

### 8.1 Commissioning vacuum pump

#### **WARNING**

##### **Risk of explosion in the medium to be pumped as a result of increased pressure**

With installation on the exhaust side, there is a risk of the exhaust pressure of the vacuum pump exceeding the atmospheric conditions. The ignition temperature of the medium to be pumped is lowered in the suction chamber. If the ignition temperature of the medium to be pumped falls below a temperature of  $T_4 = +135^{\circ}\text{C}$ , there is a risk of explosion, and consequently serious injury.

- ▶ Ensure that the ignition temperature of the medium to be pumped is maintained above a temperature of  $+135^{\circ}\text{C}$  at 3500 hPa abs.

#### **WARNING**

##### **Danger of poisoning due to toxic process media escaping from the exhaust pipe**

During operation with no exhaust line, the vacuum pump allows exhaust gases and vapors to escape freely into the air. There is a risk of injury and fatality due to poisoning in processes with toxic process media.

- ▶ Observe the pertinent regulations for handling toxic process media.
- ▶ Safely purge toxic process media via an exhaust line.
- ▶ Use appropriate filter equipment to separate toxic process media.

#### **CAUTION**

##### **Danger of burns on hot surfaces**

Depending on the operating and ambient conditions, the surface temperature of the vacuum pump can increase to above  $70^{\circ}\text{C}$ .

- ▶ Provide suitable touch protection.


Important settings and function-related variables are programmed ex factory as parameters in the vacuum pump electronic drive unit. Each parameter has a three-digit number and a description. Parameter-driven operation and control is supported via displays and control units, or externally via RS-485 protocol.

### 8.2 Switch vacuum pump on

The "Pumping station" parameter **[P:010]** comprises operation of the vacuum pump with control of all connected interfaces and configurations.

#### **Switch on via electronic drive unit**

After successfully completing the self-test, the electronic drive unit resets pending and corrected error messages.

1. Switch voltage supply on.
2. Switch the vacuum pump on by pressing the  button once.

#### **Alternative: Switch on via parameter setting**

- ▶ Set parameter **[P:010]** to value of "1".

#### **Alternative: Switch on via "remote" interface**

- ▶ Bridge pins 7, 2 and 5.

### 8.3 Configuring the connections with the parameter set

The electronic drive unit is pre-configured with the factory default basic functions and is ready for operation. For individual requirements, you can configure most connections for the electronic drive unit with the parameter set.

### 8.3.1 Configuring the digital outputs

Option	Description
0 = Rotation speed switchpoint reached	active, once the switch-point is reached
1 = No error	active, with trouble-free operation
2 = Error	active, if the error message is active
5 = Set rotation speed reached	active, once the set rotation speed switch-point is reached
6 = Pump on	active, if pumping station on, motor on and no error
9 = Always "0"	GND for the control of an external device
10 = Always "1"	+24 V DC for the control of an external device
11 = Remote priority active	active, if the remote priority is active
21 = Gas ballast valve, delayed	+24 V DC with a time delay after pumping station on, only in version with gas ballast valve

Tbl. 13: Configure parameters [P:019] and [P:024]

### 8.3.2 Configuring the digital input

Option	Description
0 - 4 = Deactivated	Connection not operational
5 = Rotation speed setting mode	Control corresponds to parameter [P:026]

Tbl. 14: Configure parameter [P:063]

### 8.3.3 Selecting the interfaces

The parameter [P:060] indicates the current selected interface with operating priority. The electronic drive unit only accepts control commands via the interface with operating priority. If the actual setting is not locked by the parameter [P061] = 1, if another interface issues a control command, operating priority is automatically transferred to the other interface.

Option	Description
1 = remote	Operation via connection "remote"
2 = RS-485	Operation via connection "RS-485"
255 = Unlock interface selection	-

Tbl. 15: Parameter [P:060]

### 8.3.4 Configuring accessories

#### NOTICE

##### Property damage to third-party electronic devices

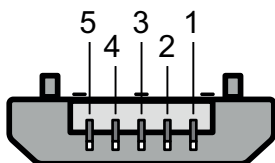
The accessory connections on the vacuum pump do not meet any USB standard. The connection assignment does not comply with any standard. Depending on their configuration, the 24 V DC supply voltage may damage or destroy third-party electronic devices, e.g. tablet computer.

- ▶ Do not connect any third-party electronic devices to the accessory connections.
- ▶ Only use the connecting sockets for pump-specific accessories.

Accessory connectors "C" and "D" are each used to connect an accessory. The software of the electronic drive unit automatically detects accessories connected to interfaces.

##### Approved accessories

- Pressure sensor
- Solenoid valve for gas ballast
- Vacuum safety valve



**Fig. 14: Accessory connector assignment**

- |                                   |  |
|-----------------------------------|--|
| 1 + 5 V (blue)                    | 4 + 24 V (depending on software configuration) |
| 2 Sensor Rx/D / host Tx/D (white) | 5 GND (black)                                  |
| 3 Sensor Tx/D / host Rx/D (green) |  |

**Configuring accessories**

- ▶ Configure connected accessories with parameters **[P:068]** and **[P:069]**, if necessary.
  - The manual configuration overwrites the automatically detected value.

## 8.4 Selecting operating mode

After applying the operating voltage, the electronic drive unit carries out a self-test to check the supply voltage.

**Operating vacuum pump without controller**

1. Establish the current supply.
2. Operate the vacuum pump with the on/off and standby buttons.

**Operating vacuum pump with external controller**

1. Connect a remote control via the "remote" 15-pin D-Sub socket.
2. Control the vacuum pump by means of the "PLC level".

**Operating vacuum pump with peripheral device**

1. Observe the operating instructions of the peripheral device.
2. Connect the respective peripheral device to the "remote" 15-pin D-Sub socket.
3. Make the desired settings via the RS-485 using the peripheral device.

## 8.5 Speed modes

The vacuum pump has 6 different speed modes.

- General speed modes
  - Normal operation
  - Standby mode
  - Rotation speed setting mode
- Automatic speed modes
  - Auto boost
  - Auto standby
  - Pressure regulation



**Pressure regulation has priority**

When pressure regulation is activated, all other speed modes are inactive.

Standby mode has priority over rotation speed setting mode, auto boost and normal operation.

The automatic speed modes are only possible in combination with the connected pressure sensor. Auto boost and auto standby can be combined.

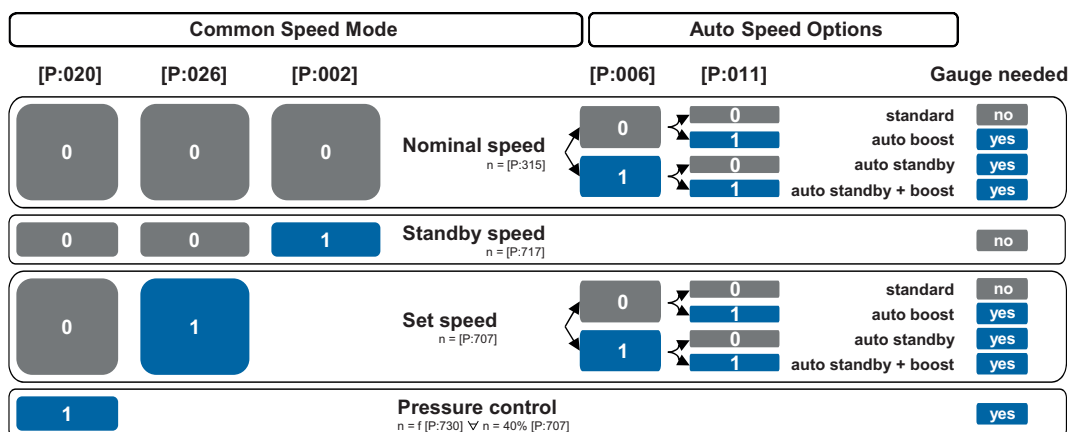


Fig. 15: Speed modes

### 8.5.1 Normal operation

The vacuum pump starts and operates at nominal rotation speed.

#### Setting the related parameters

1. Set the parameter **[P:002]** to "0".
2. Set the parameter **[P:026]** to "0".
3. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

### 8.5.2 Standby mode

Standby mode is recommended during process or operating breaks. When standby mode is active, the electronic drive unit reduces the rotation speed of the vacuum pump. The factory setting is 50 % of the nominal rotation speed. Stand-by mode has priority over rotation speed setting mode.

#### Switching on standby mode

- ▶ Press the button.

#### Alternative: Operating stand-by using parameters

- ▶ Set parameter **[P:002]** to value of "1".

#### Alternative: Operating stand-by via "remote" interface

- ▶ Bridge pins 7 and 6 for DI standby.

#### Setting the stand-by rotation speed

The vacuum pump has a variable working range from 40 to 100% of the nominal rotation speed.

1. Set the parameter **[P:717]** to the required value in %.
2. Set the parameter **[P:002]** to "1".
3. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

### 8.5.3 Speed actuator operation

Rotation speed setting mode reduces the speed and hence the throughput of the vacuum pump. The pumping speed changes proportionally to the rotation speed. Standby has priority over rotation speed setting mode. The specification in rotation speed setting mode **[P:707]** sets the set rotation speed. The rotation speed switch point varies with the set rotation speed.



#### Permissible rotation speed range

Settings in the rotation speed mode or stand-by mode are subject to the permissible rotation speed range of the respective vacuum pump (technical data). The electronic drive unit adjusts the set rotation speed automatically to the next valid value.

#### Set the rotation speed setting mode

1. Set the parameter **[P:707]** to the required value in %.
2. Set the parameter **[P:026]** to "1".
3. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

## 8.5.4 Auto boost



**Option: Pressure sensor**

- This function is only available in the version with pressure sensor.
- Pumping explosive atmospheres when using the pressure sensor is not permitted, as the sensor does not have ATEX approval.

If a threshold value set at the factory is exceeded, the vacuum pump runs for max. 30 s with 120 % of the current selected set rotation speed and the green LED flickers. The boost mode is then deactivated by the software for 5 mins (recovery time).

**Setting related parameters**

1. Set the parameter **[P:011]** to "1".
2. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).
3. Check the set rotation speed (parameter **[P:309]** or **[P:398]**).

## 8.5.5 Auto standby



**Option: Pressure sensor**

- This function is only available in the version with pressure sensor.
- Pumping explosive atmospheres when using the pressure sensor is not permitted, as the sensor does not have ATEX approval.

If a specific intake pressure is not reached **[P:730]**, the electronic drive unit automatically reduces the rotation speed. If the intake pressure is exceeded **[P:732]**, the electronic drive unit increases the rotation speed again to the original value. If operating priority is 1 = "remote", auto standby cannot be executed and warning Wrn037 is displayed.




**Setting related parameters**

1. Set the parameter **[P:002]** to "0".
2. Set the parameter **[P:006]** to "1".
3. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

**Setting the auto standby rotation speed**

1. Set the parameter **[P:717]** to the required value in %.
2. Set the switch-on threshold with parameter **[P:730]**.
3. Set the switch-off threshold with parameter **[P:732]**.
4. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

**Operation with auto standby function**


- ▶ Hold the  button pressed for longer than 5 s.
  - This will change parameter **[P:006]**.
  - To confirm the command, the yellow LED flashes for 1 second after releasing the button.
- Parameter **[P:002] = 1**: You press the  button for 5 s and switch off the auto standby. **[P:006] = 0**. The standby pre-selection remains activated.
- Parameter **[P:002] = 0**: You press the  button for 5 s and switch off the auto standby. **[P:006] = 1**. The standby pre-selection remains deactivated.

## 8.5.6 Auto start

The auto start function can only be activated while the vacuum pump is stationary (**[P:010] = 0**).

The auto start function can only be deactivated while the vacuum pump is stationary (**[P:010] = 1**).


**Switching on auto start**

1. Switch off the vacuum pump and wait for it to come to a standstill.
2. Press the  button for longer than 5 s to switch on auto start.
  - **[P:034] = 1**
  - The yellow LED flashes for about 1 s after releasing the button.

In the event of power recovery after a power failure, the vacuum pump restores the operating status that existed at the time of the power failure.



**Switching off auto start**

- ▶ Press the  button for longer than 5 s to switch off auto start.
  - **[P:034] = 0**
  - The yellow LED flashes for about 1 s after releasing the button.

In the event of power recovery after a power failure, the vacuum pump remains deactivated.

**8.6 Pressure regulation operation****Option: Pressure sensor**

- This function is only available in the version with pressure sensor.
- Pumping explosive atmospheres when using the pressure sensor is not permitted, as the sensor does not have ATEX approval.

Pressure regulation operation is only possible with the pressure sensor connected. The pressure sensor measures the intake pressure. The electronic drive unit varies the rotation speed of the vacuum pump so that the target pressure is adjusted. If the target pressure cannot be reached under the specified conditions (e.g. through higher gas throughput), warning Wrn038 is displayed. The pressure regulation operation is effective in the range between final pressure and 30 hPa.

**Setting related parameters**

1. Set the parameter **[P:020]** to "1".
2. Adjust the target pressure using parameter **[P:730]**.

**8.7 Determining effective pressure with correction factors****Gas and vapor mixtures**

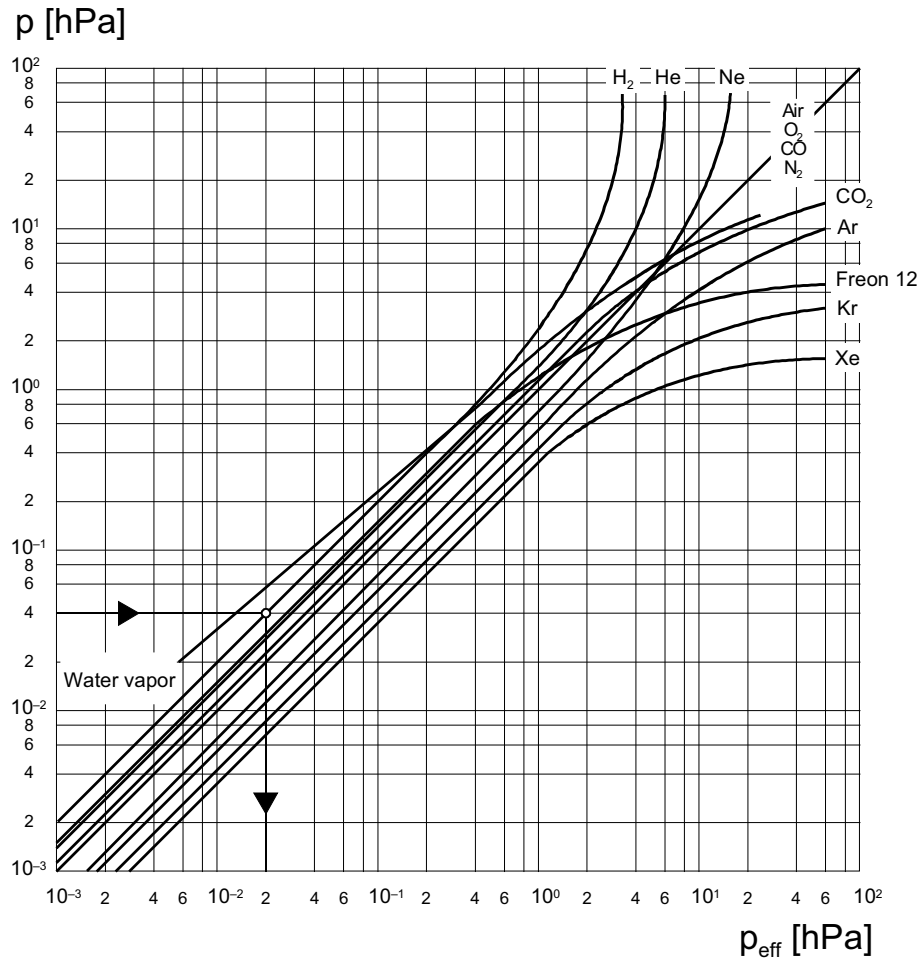
Process gases are mostly mixtures of gas and vapor. Precise measuring of gas and vapor mixtures is only possible using partial pressure measurement instruments, for example a quadrupole mass spectrometer.

The measurement signal of the pressure sensor depends on the type of gas in the Pirani range. The pre-set correction factor = 1 applies for nitrogen (N<sub>2</sub>), oxygen (O<sub>2</sub>), dry air, and carbon monoxide (CO).

Gas type	Correction factor (C)
Air, oxygen (O <sub>2</sub> ), carbon monoxide (CO), nitrogen (N <sub>2</sub> )	1.0
Hydrogen (H <sub>2</sub> )	0.5
Carbon dioxide (CO <sub>2</sub> )	0.9
Water vapor	0.5
Helium (He)	0.8
Neon (Ne)	1.4
Argon (Ar)	1.7
Krypton (Kr)	2.4
Xenon (Xe)	3.0
Dichlorodifluoromethane (CCl <sub>2</sub> F <sub>2</sub> , R12)	0.7

The correction factors provided are mean values.

**Tbl. 16: Correction factor for pressure range < 1 hPa**



**Fig. 16: Displayed pressure**

Within the pressure range < 1 hPa, the display is linear.

**Set correction factor at electronic drive unit**

- ▶ Use [P:742] to enter correction factor and correct displayed measured value.

**Alternatively: Calculating pressure for gases other than air**

1. Set the correction factor in the electronic drive unit to 1
2. Calculate the effective pressure using the following formula:

$$P_{\text{eff}} = C \times p$$

- $P_{\text{eff}}$  = Effective pressure
- $C$  = Correction factor of the gas to be measured
- $p$  = Displayed pressure (gauge calibrated for air)

## 8.8 Operating with gas ballast

**⚠ WARNING**

**Risk of injury from reactive, potentially explosive or otherwise hazardous gas/air mixtures**

Uncontrolled gas inlet of air or gases containing oxygen may lead to the formation of potentially explosive gas/air mixtures in the vacuum system. Ignition can cause very serious injuries.

- ▶ Use inert gases only for the supply of ballast gas in order to prevent the formation of a potentially explosive atmosphere.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas entering into the inert gas line.

**⚠ WARNING**

**Risk of poisoning from incorrect use of the gas ballast system**

The gas ballast system of the scroll pump is vacuum sealed only when used in valid, snapped positions "0", "1" and "2". When operating the valves in intermediate stages, there is a risk that process media can escape to the environment uncontrolled. When using toxic process media, there is a risk of poisoning.

- ▶ Change the positions of the valve only for setting the gas ballast stages.
- ▶ Operate the gas ballast valve only in the snap positions.

**NOTICE**

**Risk of damage from condensation in vacuum pump**

Exceeding the saturation vapor pressure of process media during the compression phase leads to condensation in the suction chamber. This results in an increase of the achievable ultimate pressure and to a general deterioration of the performance data of the vacuum pump as a whole. Corrosion and contamination impair service life.

- ▶ Use the gas ballast.
- ▶ Supply dry room air or inert gas in order to increase the vapor capacity of the process medium.
- ▶ Pump condensable vapors only when the vacuum pump is warm and the gas ballast valve open.
- ▶ Operate the vacuum pump with gas ballast a further approx. 30 minutes after finishing the process in order to dissipate any residual moisture.



**Gas flow**

The flow rate (gas flow) increases according to inlet pressure.




Depending on the pump version, the vacuum pump has a mechanically operated two-stage gas ballast valve for controlled supply of inert gas to the suction chamber.

**Prerequisites**

- Vacuum pump is warm
- An external gas supply is connected
- The inlet area of the gas ballast valve is flushed with inert gas in the ATEX version

**Operating with gas ballast**

1. If necessary, connect an existing shut-off unit to the vacuum side.
2. Turn the selector switch of the gas ballast valve to the desired position.
  - Allow the selector switch to completely engage in position.
3. In case an external gas supply is used, open the supply.
  - Observe the permissible inlet pressure.

	<p><b>Position "0":</b></p> <ul style="list-style-type: none"> <li>• Switch setting for media without condensation</li> <li>• The gas ballast valve is closed</li> <li>• No gas flow into the suction chamber</li> </ul>
	<p><b>Position "1":</b></p> <ul style="list-style-type: none"> <li>• Switch setting for slight to medium condensation</li> <li>• The gas ballast valve is open</li> <li>• The gas flow depends on the type</li> </ul>
	<p><b>Position "2":</b></p> <ul style="list-style-type: none"> <li>• Switch setting for medium to severe condensation</li> <li>• The gas ballast valve is open</li> <li>• The gas flow depends on the type</li> </ul>

**Tbl. 17: Gas ballast valve switch settings**

### 8.8.1 Controlling gas ballast valve with a pressure sensor

**i** **Automatic valve control**  
 The solenoid valve opens automatically depending on the parametrization and the respective operating status.

- Observe the preset parameters before commissioning.

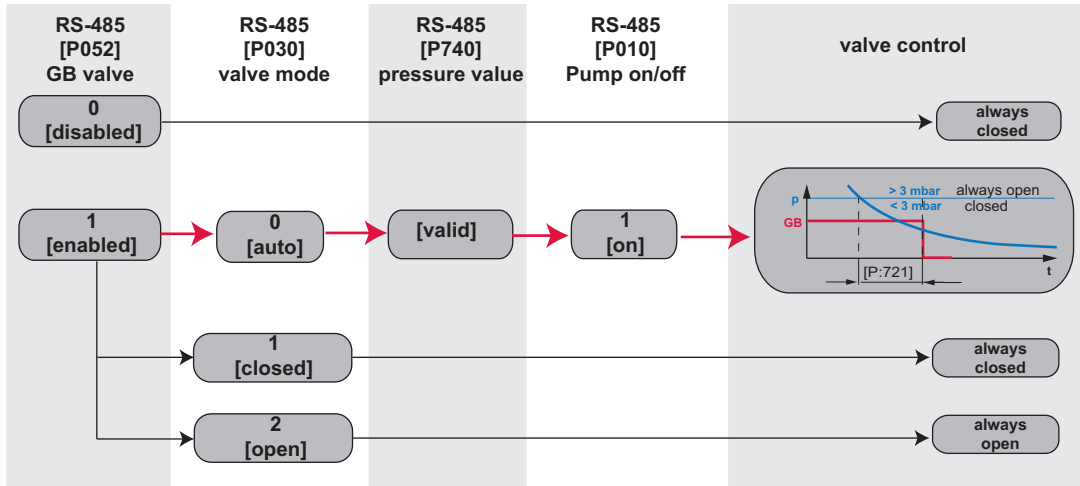


Fig. 17: Pressure-dependent gas ballast valve control in automatic mode

**Procedure**

- Set the desired opening interval for the gas ballast valve with [P:721].

**Sequence in automatic mode for version with pressure sensor**

- The gas ballast valve opens each time the pump is started. If the pressure value falls to  $\leq 3$  mbar, the solenoid valve closes after the time set in [P:721].
- The gas ballast valve is permanently open if the pressure value remains  $> 3$  mbar.

### 8.8.2 Controlling gas ballast valve without a pressure sensor

**i** **Automatic valve control**  
 The solenoid valve opens automatically depending on the parametrization and the respective operating status.

- Observe the preset parameters before commissioning.

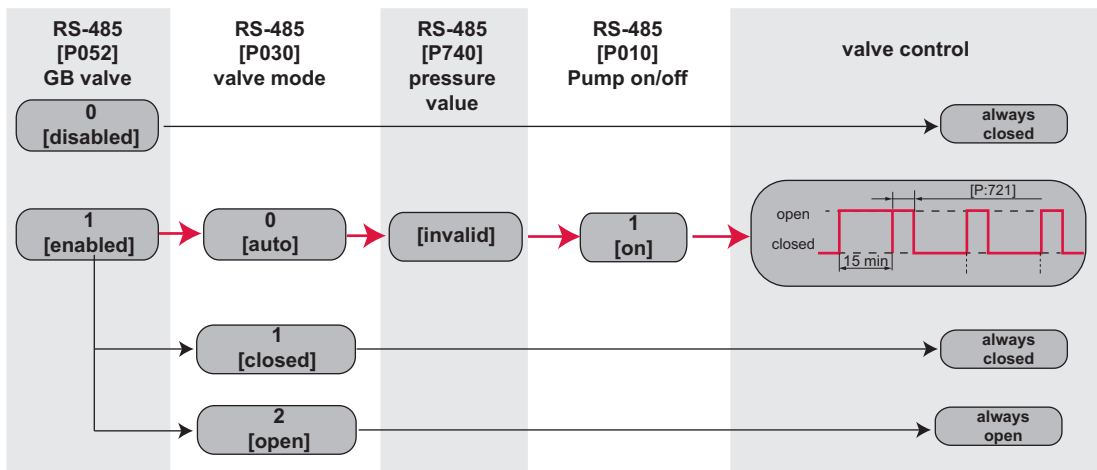


Fig. 18: Gas ballast valve control in automatic mode

**Procedure**













- ▶ Set the desired opening interval for the gas ballast valve with [P:721].

**Sequence in automatic mode for version without pressure sensor**





- The gas ballast valve opens automatically for a time of **15 min.** plus the time set in [P:721] each time the pump starts.
- The gas ballast valve then opens every **15 min.** for the time set in [P:721].

## 8.9 Operating mode display via LED

LEDs on the electronic drive unit show the basic operating states of the vacuum pump. A differentiated error and warning display is only possible for operation with the display and control unit or a PC.

LED	Symbol	LED status	Display	Meaning
Green 		Off	_____	without current
		On, flashing		"Pumping station OFF", rotation speed ≤ 60 rpm
		On, blinking		"Pumping station OFF", rotation speed > 60 rpm
		On, inverse flashing		"Pumping station ON", set rotation speed not reached
		On, constant		"Pumping station ON", set rotation speed reached Standby on
		On, inverse flashes twice		Selected speed temporarily overwritten by an autospeed mode
Yellow 	△	Off	_____	no warning
		On, short-time blinking		Note <sup>5)</sup>
		On, constant		Warning
		On, flickering 1 sec		Confirmation, command acceptance
Red 	⚡	Off	_____	No error
		On, constant		Error

**Tbl. 18: Behavior and meaning of the LEDs of the electronic drive unit**


LED	Symbol	LED status	Display	Meaning
Green 		Off	_____	Standby OFF
		On, constant		Standby ON
		On, inverse flashes twice		Auto standby active

**Tbl. 19: Behavior and meaning of the LED standby**

## 8.10 Switching off vacuum pump

The "Pumping station" parameter [P:010] comprises operation of the vacuum pump with control of all connected interfaces and configurations.

**Procedure**

1. Switch the running vacuum pump off by pressing the  button once.
2. Switch the voltage supply off.

**Alternative: Switch off via parameters**

- ▶ Set parameter [P:010] to value of "0".

**Alternative: Switch off via "remote" interface**

- ▶ Remove the bridge between pins 7 ad 5.

5) Regularly check the performance data of the vacuum pump.

## 9 Maintenance

### 9.1 Maintenance information

#### **WARNING**

##### **Risk of injury from reactive, potentially explosive, or otherwise hazardous gas/air mixtures during maintenance**

Uncontrolled leakage of process gases may result in the formation of explosive gas-air mixtures after opening the vacuum pump. Ignition can cause very serious injuries.

- ▶ Ensure that the suction chamber is sufficiently inert before starting maintenance work.
- ▶ Ensure a closed inert gas system in order to avoid zone entrainment as a result of process gas escaping.

#### **WARNING**

##### **Danger to life from electric shock during maintenance and service work**

There is a danger to life from electric shock when making contact with live components that still exist after the vacuum pump has been switched off.

- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Wait until the vacuum pump comes to a standstill (rotation speed = 0).
- ▶ After switching off the vacuum pump, wait another 5 minutes until the capacitors have discharged.

#### **WARNING**

##### **Health hazard through poisoning from toxic contaminated components or devices**

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

#### **WARNING**

##### **Crushing and cutting danger on unprotected parts from unforeseeable automatic run-up during maintenance.**

During activities on exposed mechanical components, there is a risk of crushing or cut injuries from sudden run-up.

- ▶ Switch off the vacuum pump before any maintenance work and work.
- ▶ Vent the vacuum pump to atmospheric pressure.
- ▶ Disconnect the vacuum pump safely from the mains.
- ▶ Secure the vacuum pump against re-start.
- ▶ Disconnect the mains cable from the vacuum pump.

#### **NOTICE**

##### **Danger of property damage from improper maintenance**

Unprofessional work on the vacuum pump will lead to damage for which the manufacturer accepts no liability.

- ▶ We recommend taking advantage of our service training offering.
- ▶ When ordering spare parts, specify the information on the nameplate.

##### **General cleaning and maintenance work**

- Clean the ventilation grille
- Clean the outside of the vacuum pump

## 9.2 Checklist for inspection and maintenance



### Maintenance frequency and service lives

Maintenance frequency and service lives are process-dependent. Chemical and thermic loads or contamination reduce the recommended reference values.

- Determine the specific service lives during the first operating interval.
- Consult with the manufacturer's service department if you wish to reduce the maintenance frequency.



### Yellow LED flashing: Checking performance data

The flashing yellow LED indicates that maintenance may be required. The wear and service life of the tip seals basically depend on the application. The scroll pump remains fully functional, even if there is a high level of wear to the tip seals. If the pumping capacity is no longer adequate, we recommend carrying out maintenance level 1.

- Regularly observe the performance data of the scroll pump.
- To reset the message, press and for 5 s at the same time

After replacing the tip seals, they need to be run in for a certain period of time. Operate the scroll pump for a while without a load in order to restore the performance data.



### Maintenance work

We recommend using the manufacturer's service for level 3 maintenance work. Any warranty and liability claims against the manufacturer are void if maintenance work is not carried out properly. This also applies wherever parts other than original spare parts are used.

You can carry out maintenance work at **Level 1** yourself.

Action	Inspection	Maintenance level 1	Maintenance level 3	Required material
described in	OI	OI	SI	
Interval	daily	as required	5 years or 40,000 operating hours	
<b>Inspection</b> <ul style="list-style-type: none"> <li>• Visual and acoustic test</li> <li>• Vacuum pump performance test</li> <li>• Equipment check for abrasion, discoloration and other anomalies</li> <li>• Creation of an action plan</li> </ul>	■			
<b>Maintenance level 1</b> <ul style="list-style-type: none"> <li>• Replacement of tip seal</li> <li>• Replacement of valves</li> </ul>		■		Tip seal maintenance set Valve set
<b>Maintenance level 3</b> <ul style="list-style-type: none"> <li>• Replacement of all wear parts</li> <li>• Complete cleaning</li> </ul>			■ manufacturer	Maintenance set level 3

Tbl. 20: Maintenance intervals

## 9.3 Replacing the non-return valve on the exhaust side

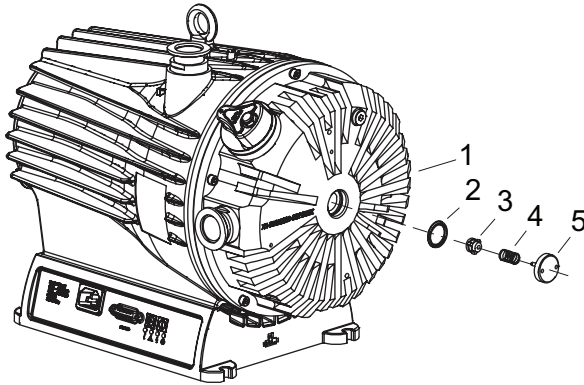
### Prerequisites

- Vacuum pump switched off
- Vacuum pump is vented to atmospheric pressure on the suction side
- Vacuum pump cooled

**Required tools**

- Face spanner, **pin diameter 3 mm**, article number: PV D40 012
- Open-end wrench, **WAF 13**
- Calibrated torque wrench (tightening factor  $\leq 2.5$ )

**9.3.1 Removing the non-return valve**



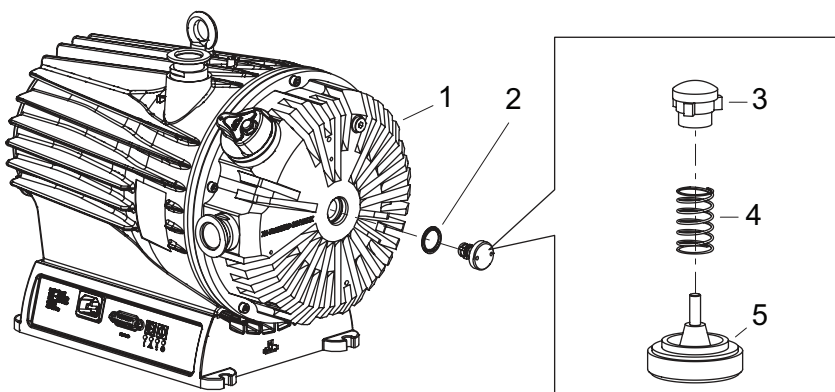
**Fig. 19: Removing valve**

- |                  |                      |
|------------------|----------------------|
| 1 Spiral housing | 4 Compression spring |
| 2 O-ring         | 5 Valve guide        |
| 3 Valve plate    |                      |

**Removing valve**

1. Use the face spanner to unscrew the valve guide with compression spring and valve plate from the spiral housing.
2. Remove the O-ring from the hole in the spiral housing.
3. Unscrew the valve plate from the compression spring.
4. Clean the valve seat and the valve guide.
5. Replace all wear parts according to the spare part package.

**9.3.2 Installing the non-return valve**



**Fig. 20: Installing valve**

- |                  |                      |
|------------------|----------------------|
| 1 Spiral housing | 4 Compression spring |
| 2 O-ring         | 5 Valve guide        |
| 3 Valve plate    |                      |

**Installing valve**

1. Insert the O-ring into the designated groove in the spiral housing.
2. Turn the compression spring on the valve plate to open it.
  - The valve guide centers and fixes the compression spring.
3. Place the valve plate on the valve guide.
4. Insert the valve into the spiral housing.



5. Make sure that the O-ring and valve are seated correctly.
6. Screw the valve into the spiral housing using the face spanner.
  - Tightening torque: **5 Nm**

## 9.4 Replacing the gas ballast valve

### Prerequisites

- Vacuum pump switched off
- Vacuum system vented to atmospheric pressure
- Electrical supply disconnected
- Mains cable disconnected
- Vacuum inlet sealed with the original protective cover

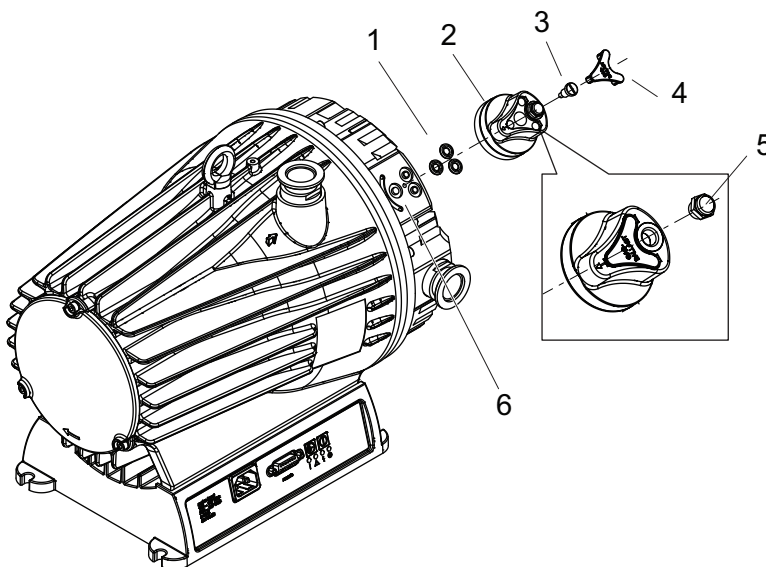
### Required tools

- Slot screwdriver
- Allen key, **WAF 2.5**
- Hexagon socket torque wrench, **WAF 2.5**

### 9.4.1 Removing gas ballast valve

#### Required tools

- Slot screwdriver
- Allen key, **WAF 2.5**
- O-ring picker

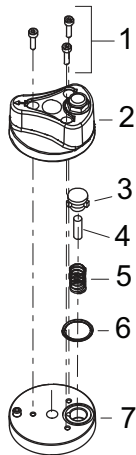


**Fig. 21: Removing gas ballast valve**

- |                     |                  |
|---------------------|------------------|
| 1 O-ring, 3x        | 4 Cover          |
| 2 Gas ballast valve | 5 Sinter filter  |
| 3 Special screw     | 6 Spiral housing |

#### Removing the gas ballast valve

1. Pry off the cover from the gas ballast valve using a screwdriver.
2. Unscrew the special screw from the base plate.
3. Remove the gas ballast valve part from the spiral housing.
4. Replace the O-rings between the gas ballast valve and the spiral housing.



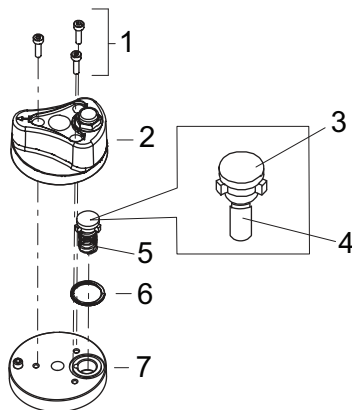
**Fig. 22: Removing gas ballast valve**

- |                      |                      |
|----------------------|----------------------|
| 1 Cylinder screw, 3x | 5 Compression spring |
| 2 Gas ballast handle | 6 O-ring             |
| 3 Valve plate        | 7 Base plate         |
| 4 Weight             |                      |

**Removing gas ballast valve**

1. Unscrew the cylinder screws from the gas ballast handle.
2. Remove the gas ballast handle from the base plate.
3. Remove the compression spring with valve plate from the gas ballast handle.
4. Unscrew the valve plate from the compression spring.
5. Pull the weight out of the valve plate.
  - Retain the weight for loading the valve plate for the installation.
6. Replace the O-ring between the gas ballast handle and the base plate.

**9.4.2 Installing gas ballast valve**

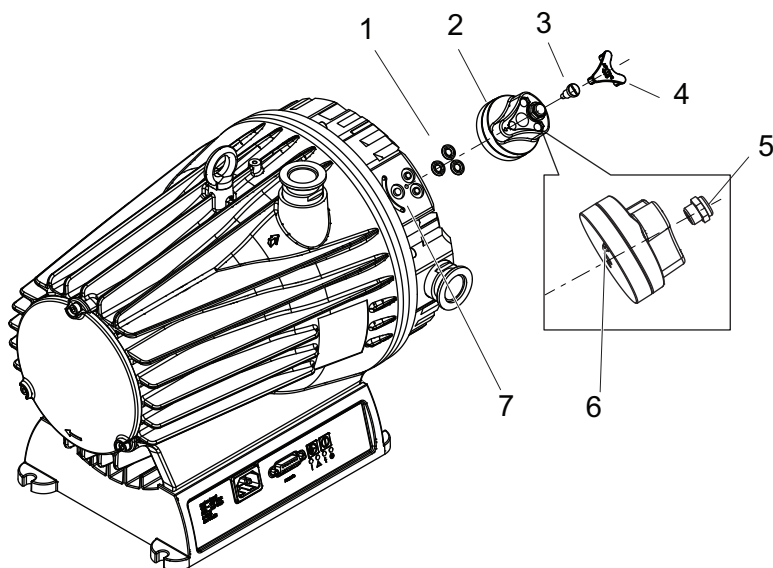


**Fig. 23: Assemble gas ballast valve**

- |                      |                      |
|----------------------|----------------------|
| 1 Cylinder screw, 3x | 5 Compression spring |
| 2 Gas ballast handle | 6 O-ring             |
| 3 Valve plate        | 7 Base plate         |
| 4 Weight             |                      |

**Assemble gas ballast valve**

1. Turn the compression spring on the valve plate to open it.
2. Insert the O-ring into the designated groove in the base plate.
3. Insert the valve plate with compression spring and weight into the base plate.
4. Place the gas ballast handle on the valve plate.
5. Screw the cylinder screws into the gas ballast handle.
  - Tightening torque: **1 Nm**



**Fig. 24: Installing gas ballast valve**

- |                     |                  |
|---------------------|------------------|
| 1 O-ring, 3x        | 5 Sinter filter  |
| 2 Gas ballast valve | 6 Ball           |
| 3 Special screw     | 7 Spiral housing |
| 4 Cover             |                  |

#### Installing gas ballast valve

1. Insert the O-rings into the designated grooves in the spiral housing.
2. Place the gas ballast valve on the spiral housing while making sure that the ball is seated in the groove in the spiral housing.
3. Screw the special screw into the gas ballast valve.
  - Tightening torque: **2.5 Nm**
4. Check the function of the gas ballast valve by turning it to all positions.
5. Press the cover into the gas ballast valve.

## 9.5 Changing the tip seal

#### Prerequisites

- Vacuum pump switched off
- Vacuum system vented to atmospheric pressure
- Electrical supply disconnected
- Mains cable disconnected
- Vacuum inlet sealed with the original protective cover

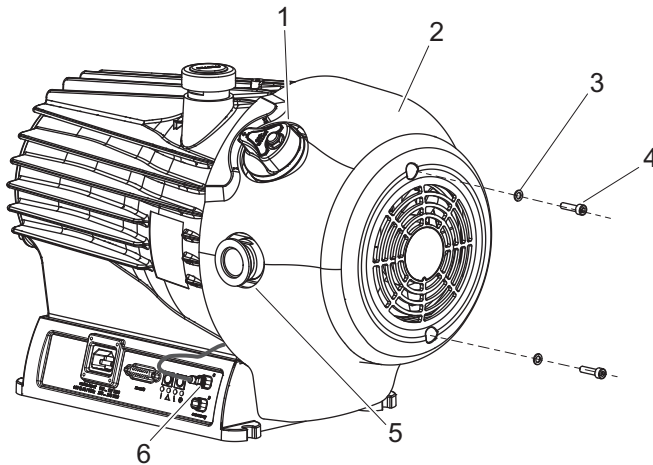
### 9.5.1 Disassembling the spiral housing

#### Required tools

- Allen key, **WAF 5**

#### Required consumables

- Laboratory gloves

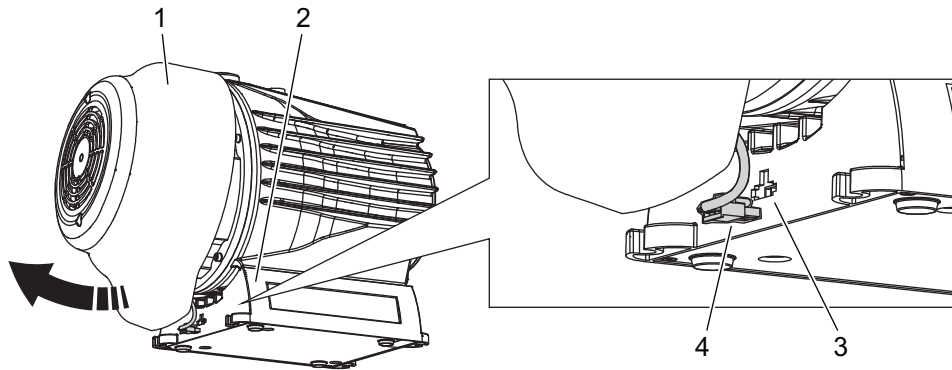


**Fig. 25: Loosening the fan cover on the scroll pump**

- |                     |   |
|---------------------|---|
| 1 Gas ballast valve | 4 Hexagon socket screw                      |
| 2 Fan cover         | 5 Exhaust connection without protective cap |
| 3 Washer            | 6 Accessory connection                      |

**Loosening the fan cover**

1. Remove any power supply plugs from the accessory connections (e.g., pressure sensor).
2. Unscrew the 2 hexagon socket screws with washers from the fan cover.
3. Remove the protective cap from the exhaust connection.

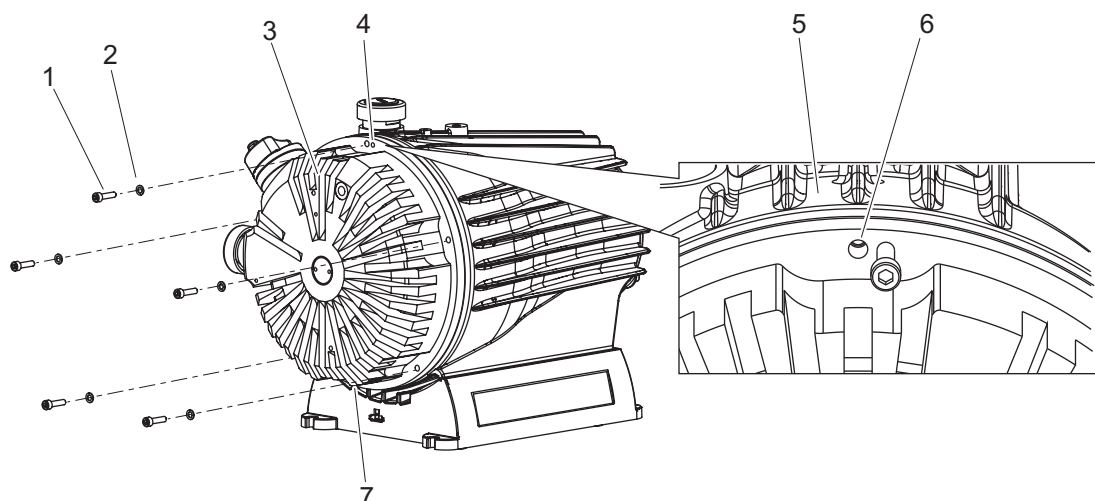


**Fig. 26: Removing the fan cover from the scroll pump**

- |                         |                                     |
|-------------------------|-------------------------------------|
| 1 Fan cover             | 3 Connecting socket for air cooling |
| 2 Electronic drive unit | 4 Fan cable                         |

**Removing the fan cover**

1. Pull the fan cover at the bottom slightly to the front.
2. Undo the plug of the fan cable on the electronic drive unit.
  - Be careful with the circlip.
3. Lift the fan cover over the gas ballast valve and the exhaust connection.
4. Seal off the exhaust connection with the original protective cover.



**Fig. 27: Removing the scroll pump spiral housing**

- |                             |   |
|-----------------------------|---|
| 1 Hexagon socket screw (5×) | 5 Pump housing                              |
| 2 Washer (5×)               | 6 Hexagon socket screw as an auxiliary hole |
| 3 Spiral housing            | 7 Bottom auxiliary hole                     |
| 4 Top auxiliary hole        |   |

#### Removing the spiral housing

1. Unscrew all 5 hexagon socket screws from the spiral housing.
  - Pay attention to the washers.
2. Screw the 2 hexagon socket screws evenly and alternately into the top and bottom auxiliary holes.
3. Push the spiral housing off the pump housing, ensuring that it does not tilt.
4. Unscrew the auxiliary screws from the spiral housing.

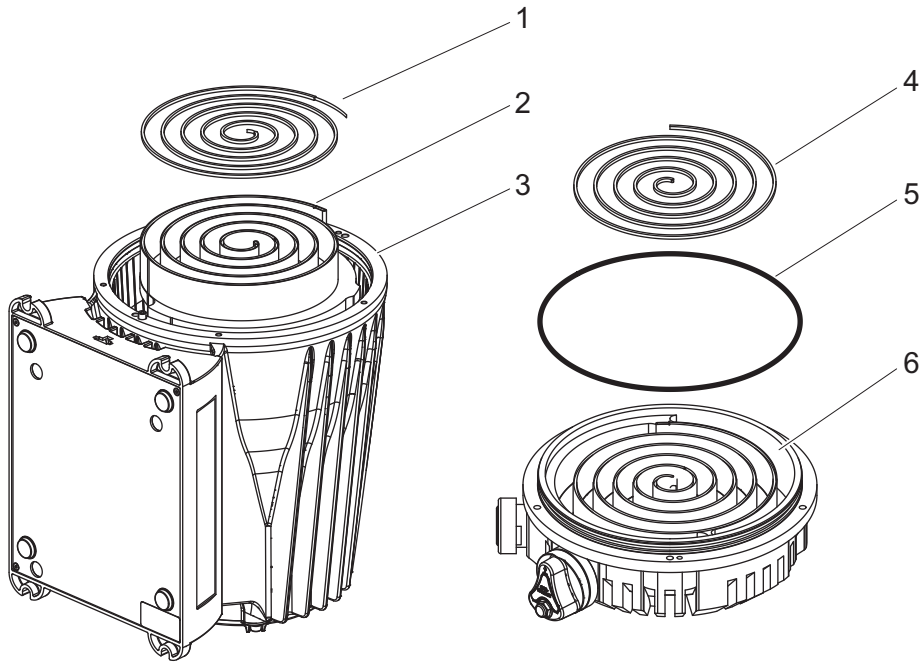
## 9.5.2 Replacing the tip seal

#### Required tools

- O-ring picker
- Side cutter

#### Required consumables

- Laboratory gloves
- Clean, lint-free cloth
- Isopropanol
- Spare part package 1

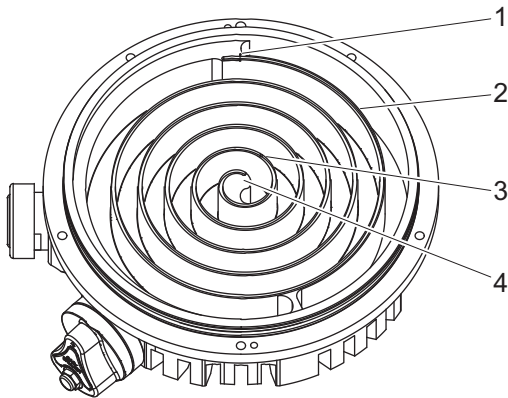


**Fig. 28: Replacing the tip seal on the scroll pump**

- |                |                  |
|----------------|------------------|
| 1 Tip seal     | 4 Tip seal       |
| 2 Orbiter      | 5 O-ring         |
| 3 Pump housing | 6 Spiral housing |

**Removing the tip seal**

1. Place the pump housing in an upright position.
2. Use the o-ring picker and remove the o-ring from the spiral housing.
3. Use the o-ring picker and remove the tip seal from the orbiter.
4. Use the o-ring picker and remove the tip seal from the spiral housing.
5. Clean the working area of the orbiter and spiral housing as well as the spiral groove on both sides using a clean, lint-free cloth and a little isopropanol.
6. Clean the cooling fin on the spiral housing to remove any soiling that might impact the cooling performance.



**Fig. 29: Tip seal nut in the spiral housing**

- |                 |                   |
|-----------------|-------------------|
| 1 Cut mark      | 3 Clamping point  |
| 2 Spiral groove | 4 Start of spiral |

**Inserting the tip seal**

The described steps apply equally to the spiral housing and the orbiter in the pump housing.

1. Press a new tip seal, starting from the inside, into the spiral groove.
  - The clamping points in the groove help you to fix the tip seal in place.
2. Carefully cut the tip seal at the outer cut mark using a side cutter.

3. Moisten the groove of the spiral housing with a little isopropanol as an assembly aid for the o-ring.
4. Carefully insert the o-ring into the spiral housing.

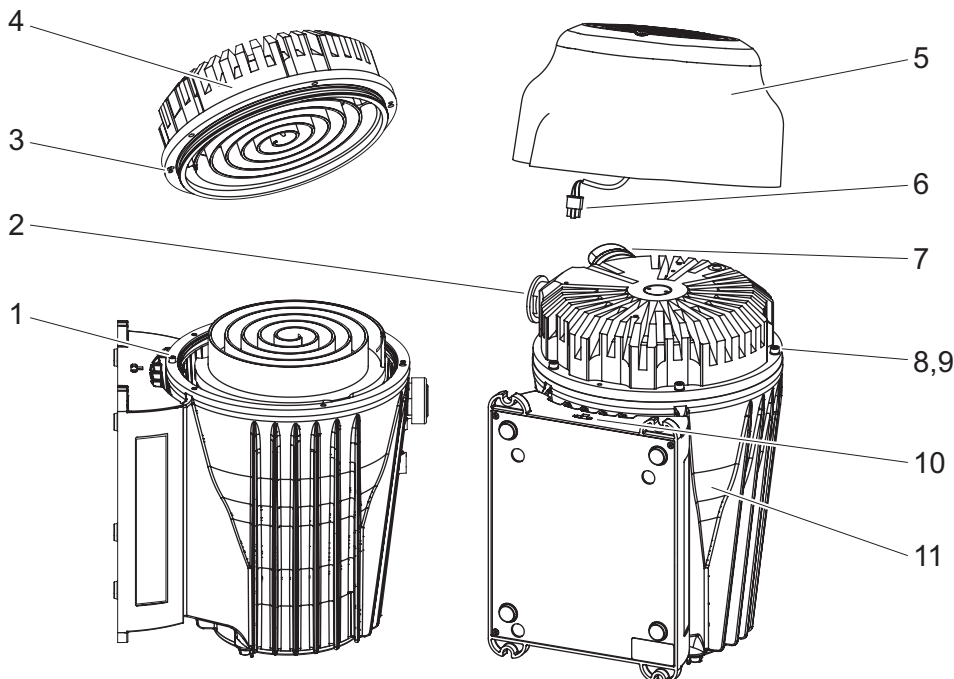
### 9.5.3 Assembling the pump housing

#### Required tools

- Allen key, **WAF 5**
- Calibrated torque wrench

#### Required consumables

- Laboratory gloves
- Isopropanol



**Fig. 30: Assembling the housing parts**

- |   |                                      |
|---|--------------------------------------|
| 1 Guide pin                                 | 7 Gas ballast valve                  |
| 2 Exhaust connection without protective cap | 8 Hexagon socket screw               |
| 3 Guide hole                                | 9 Washer                             |
| 4 Spiral housing                            | 10 Connecting socket for air cooling |
| 5 Fan cover                                 | 11 Pump housing                      |
| 6 Fan cable                                 |                                      |

#### Assembling the spiral housing

1. Remove the protective cap from the exhaust connection.
2. Moisten the O-ring in the spiral housing with a little isopropanol as an assembly aid for the O-ring.
3. Fit the spiral housing with the guide hole exactly on the guide pin of the pump housing.
  - Make sure that the tip seals remain in the grooves.
4. Screw the spiral housing with hexagon socket screws (5×) and washers firmly onto the pump housing.
5. Tighten the screws evenly and crosswise in steps.
  - Tightening torque: **5 Nm**

#### Assembling the fan cover

1. Fix the fan cable in place in the groove provided on the fan cover.
2. Place the fan cover over the gas ballast valve and exhaust connection on the spiral housing, ensuring that it is not tilted.
  - Pay attention to the existing cabling and the distance pin within the fan cover.
3. Plug the fan cable into the connecting socket of the electronic drive unit.

4. Secure the fan housing with both hexagon socket screws and washers.
  - Tightening torque: **3.5 Nm**
5. **Optional:** Fasten an existing mating plug on the “remote” connection of the electronic drive unit.
  - Tightening torque: **0.4 Nm**

## 9.6 Final inspection

### Prerequisite

- Maintenance work carried out on opening the housing

### Carrying out a final inspection

- ▶ Perform a functional test.
- ▶ Check to make sure the fan is working.

### Recommended final check

- ▶ Carry out a leak test.



## 10 Decommissioning

### 10.1 Shutting down for longer periods

#### **WARNING**

##### **Health hazard through poisoning from toxic contaminated components or devices**

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.

#### **Procedure for longer vacuum pump shutdowns**

1. Switch off the vacuum pump.
2. Vent the vacuum pump.
3. Allow the vacuum pump to cool down.
4. Close the vacuum connection.
5. Evacuate the vacuum pump via the exhaust connection.
6. Evacuate the pump interior to  $p < 1$  hPa.
7. Vent the vacuum pump with dry, oil-free air or inert gas.
8. Seal all connections with the original protective caps.
9. Store the vacuum pump in dry, dust-free rooms, within the specified ambient conditions.
10. In rooms with humid or aggressive atmospheres: Hermetically seal the vacuum pump together with a drying agent in a plastic bag.
11. Do not store the vacuum pump in the vicinity of machines, traffic routes, etc., as strong vibrations may damage the bearing.

### 10.2 Recommissioning

#### **Checking the state**

- ▶ Check the vacuum pump for visible damage.
- ▶ Check the vacuum pump for contamination and moisture.
- ▶ Put the vacuum pump into operation only if it is in a correct state.
- ▶ If necessary, consult the manufacturer's service department.

#### **Procedure for recommissioning the vacuum pump**

1. Clean the vacuum pump exterior with a lint-free cloth and a little isopropanol.
2. If necessary, have the vacuum pump completely cleaned by the manufacturer's service department.
3. Observe the total service life of the vacuum pump and make use of the manufacturer's service support if necessary.
4. Install the vacuum pump as described in the Installation chapter.
5. Put the vacuum pump back into operation according to the operation chapter.

# 11 Recycling and disposal

## **WARNING**

### **Health hazard through poisoning from toxic contaminated components or devices**

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ▶ Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ▶ Decontaminate affected parts before carrying out maintenance work.
- ▶ Wear protective equipment.



### **Environmental protection**

You **must** dispose of the product and its components in accordance with all applicable regulations for protecting people, the environment and nature.

- Help to reduce the wastage of natural resources.
- Prevent contamination.

## 11.1 General disposal information

The components of the vacuum pump contain materials that you must recycle.

- ▶ Dispose of our products according to the following:
  - Iron
  - Aluminium
  - Copper
  - Synthetic
  - Electronic components
  - Oil and fat, solvent-free
- ▶ Observe the special precautionary measures when disposing of:
  - Fluoroelastomers (FKM)
  - Potentially contaminated components that come into contact with media

## 11.2 Disposing of the scroll pump

1. Disconnect the electronic drive unit.
2. Dismantle the motor.
3. Decontaminate the components that come into contact with process gases.
4. Separate the components into recyclable materials.
5. Recycle the non-contaminated components.
6. Dispose of the product or components in a safe manner according to locally applicable regulations.

## 12 Malfunctions

### 12.1 General

#### **WARNING**


##### **Danger to life from electric shock in the event of a fault**

In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.

- ▶ Always keep the mains connection freely accessible so you can disconnect it at any time.

Vacuum pump and electronic drive unit malfunctions always result in a warning or error message. In both cases, you will receive an error code that you can read out via the interfaces of the electronic drive unit. Generally, the LED on the electronic drive unit displays the operating messages. If an error occurs, the vacuum pump and connected devices will be switched off.

Problem	Possible causes	Remedy
The vacuum pump will not start up; none of the built-in LEDs on the electronic drive unit light up	<ul style="list-style-type: none"> <li>● Current supply interrupted</li> </ul>	<ul style="list-style-type: none"> <li>● Check the current supply lines.</li> </ul>
	<ul style="list-style-type: none"> <li>● Incorrect operating voltage</li> </ul>	<ul style="list-style-type: none"> <li>● Supply the correct operating voltage.</li> </ul>
	<ul style="list-style-type: none"> <li>● Electronic drive unit defective</li> </ul>	<ul style="list-style-type: none"> <li>● Contact the <a href="#">Kurt J. Lesker Company</a>.</li> </ul>
The vacuum pump fails to reach the nominal rotation speed within the run-up time	<ul style="list-style-type: none"> <li>● Leakage on the vacuum pump</li> </ul>	<ol style="list-style-type: none"> <li>1. Carry out leak detection.</li> <li>2. Check seals and flange connections.</li> <li>3. Eliminate leaks.</li> </ol>
	<ul style="list-style-type: none"> <li>● Gas throughput too high</li> </ul>	<ul style="list-style-type: none"> <li>● Reduce the process gas load.</li> </ul>
	<ul style="list-style-type: none"> <li>● Rotor not running smoothly, defective bearing</li> </ul>	<ol style="list-style-type: none"> <li>1. Check the vacuum pump for noise development.</li> <li>2. Contact the manufacturer's service.</li> </ol>
	<p><b>Thermal load due to:</b></p> <ul style="list-style-type: none"> <li>● lack of ventilation</li> <li>● ambient temperature too high</li> </ul>	<ol style="list-style-type: none"> <li>1. Check to make sure the fan is working. <ul style="list-style-type: none"> <li>– Check the fan connecting cable for a correct fit and damage.</li> </ul> </li> <li>2. Reduce the thermal load. <ul style="list-style-type: none"> <li>– Ensure adequate air supply.</li> <li>– Adapt the ambient conditions.</li> </ul> </li> </ol>
Vacuum pump does not reach ultimate pressure	<ul style="list-style-type: none"> <li>● The vacuum pump is contaminated</li> </ul>	<ol style="list-style-type: none"> <li>1. Contact the <a href="#">Kurt J. Lesker Company</a>.</li> <li>2. Have it cleaned.</li> </ol>
	<ul style="list-style-type: none"> <li>● Vacuum chamber, pipes or vacuum pump are leaking</li> </ul>	<ol style="list-style-type: none"> <li>1. Carry out leak detection starting from the vacuum chamber.</li> <li>2. Check seals and flange connections.</li> <li>3. Eliminate leaks in the vacuum system.</li> </ol>
	<ul style="list-style-type: none"> <li>● Pressure measurement incorrect or not calibrated</li> </ul>	<ul style="list-style-type: none"> <li>● Check the pressure measurement settings.</li> <li>● Calibrate the integrated pressure sensor. <ul style="list-style-type: none"> <li>– Use a vacuum gauge for the reference measurement.</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>● Condensate in the suction chamber</li> </ul>	<ol style="list-style-type: none"> <li>1. Check the process medium.</li> <li>2. Operate the scroll pump with gas ballast.</li> </ol>
	<ul style="list-style-type: none"> <li>● Seal the tip seal</li> </ul>	<ul style="list-style-type: none"> <li>● Contact the <a href="#">Kurt J. Lesker Company</a>.</li> <li>● Replace the tip seal.</li> </ul>
	<ul style="list-style-type: none"> <li>● Tip seal insufficiently run in (e.g., after tip seal replacement)</li> </ul>	<ul style="list-style-type: none"> <li>● Operate the vacuum pump with no load for a while</li> </ul>

Unusual noises during operation	<ul style="list-style-type: none"> <li>● Bearing is damaged</li> </ul>	<ul style="list-style-type: none"> <li>● Contact the <a href="#">Kurt J. Lesker Company</a>.</li> </ul>
	<ul style="list-style-type: none"> <li>● Rotor damaged</li> </ul>	<ul style="list-style-type: none"> <li>● Contact the <a href="#">Kurt J. Lesker Company</a>.</li> </ul>
	<ul style="list-style-type: none"> <li>● Spiral element contaminated or damaged</li> </ul>	<ul style="list-style-type: none"> <li>● Contact the <a href="#">Kurt J. Lesker Company</a>.</li> </ul>
Red LED on the electronic drive unit illuminates	<ul style="list-style-type: none"> <li>● Group error</li> </ul>	<ol style="list-style-type: none"> <li>1. Reset the error by pressing the OFF/ON  button.</li> <li>2. Set the parameter <b>[P: 010]</b> via the interface RS-485 to 0 = off and then 1 = On and Malfunction acknowledgment.</li> <li>3. Reset the malfunction with V+ on pin 13 on the “remote” connection.</li> <li>4. Set the parameter <b>[P: 009]</b> via the interface RS-485 to 1 = Malfunction acknowledgment.</li> <li>5. Reset the malfunction by switching the current supply off and on.</li> <li>6. Carry out a differentiated malfunction analysis with a display and control unit.</li> <li>7. Contact the manufacturer's service.</li> </ol>

Tbl. 21: Troubleshooting with scroll pumps

## 12.2 Error codes

Errors (\*\* Error E—— \*\*) always cause the connected peripheral devices to be switched off.

Warnings (\* Warning F —— \*) are only displayed and do not cause components to be switched off.



### Handling malfunction messages

1. Read out error codes via control units or a PC.
2. Remove the cause of the malfunction.
3. Reset the malfunction message with parameter **[P:009]**.
  - Use preconfigured interfaces or screen tiles on the respective control units.

Error code	Problem	Possible causes	Remedy
Err001	Excess rotation speed	–	<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> <li>● Only acknowledge for rotational speed f = 0</li> </ul>
Err002	Excess voltage	<ul style="list-style-type: none"> <li>● Incorrect mains input voltage</li> </ul>	<ul style="list-style-type: none"> <li>● Check the mains input voltage</li> <li>● Only acknowledge for rotational speed f = 0</li> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err006	Overload	<ul style="list-style-type: none"> <li>● Load too high</li> <li>● Rotation speed cannot be maintained</li> </ul>	<ul style="list-style-type: none"> <li>● Reduce the load (poss. limited power due to excess temperature)</li> </ul>
Err021	Pump not recognized		<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err037	Overflow motor end stage		<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err041	Overflow motor end stage		<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err044	Excess temperature, electronics	<ul style="list-style-type: none"> <li>● Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>● Check to make sure the fan is working.</li> <li>● Check the fan connecting cable for a correct fit and damage.</li> <li>● Improve the cooling</li> <li>● Check the operating conditions</li> </ul>
Err045	Excess temperature, motor	<ul style="list-style-type: none"> <li>● Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>● Check to make sure the fan is working.</li> <li>● Check the fan connecting cable for a correct fit and damage.</li> <li>● Improve the cooling</li> <li>● Check the operating conditions</li> </ul>
Err093	Motor temperature evaluation faulty	–	<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err094	Electronics temperature evaluation faulty		<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err098	Internal communication error	–	<ul style="list-style-type: none"> <li>● Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>

Error code	Problem	Possible causes	Remedy
Err114	Final stage temperature evaluation faulty	–	<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err118	Excess temperature, final stage	<ul style="list-style-type: none"> <li>• Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>• Check to make sure the fan is working.</li> <li>• Check the fan connecting cable for a correct fit and damage.</li> <li>• Improve the cooling</li> <li>• Check the operating conditions</li> </ul>
Err175	PFC excess current		<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err176	Flash Program Error		<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err825	Internal communication error		<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Err913	Direction of rotation	Incorrect direction of rotation	<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>

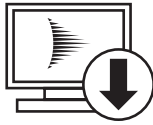
Tbl. 22: Error messages of the electronic drive unit

Error code	Problem	Possible causes	Remedy
Wrn007	Undervoltage or power failure	<ul style="list-style-type: none"> <li>• Mains failure</li> </ul>	<ul style="list-style-type: none"> <li>• Check the mains input voltage</li> </ul>
Wrn037	Auto standby inactive	<ul style="list-style-type: none"> <li>• Control set to remote</li> </ul>	<ul style="list-style-type: none"> <li>• Deactivate the remote priority</li> </ul>
Wrn038	Pressure regulation error	<ul style="list-style-type: none"> <li>• Target pressure cannot be reached</li> </ul>	<ul style="list-style-type: none"> <li>• Increase or decrease the gas load</li> </ul>
Wrn040	Note	Maintenance level 1 recommended	<ul style="list-style-type: none"> <li>• Regularly check the performance data of the vacuum pump</li> <li>• If necessary, perform maintenance</li> <li>• To reset the message, press  and  for 5 s at the same time</li> </ul>
Wrn042	Maintenance required	Have maintenance performed	<ul style="list-style-type: none"> <li>• Contact <a href="#">Kurt J. Lesker Company</a></li> </ul>
Wrn044	Electronics high temperature	<ul style="list-style-type: none"> <li>• Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>• Check to make sure the fan is working.</li> <li>• Check the fan connecting cable for a correct fit and damage.</li> <li>• Improve the cooling</li> <li>• Check the operating conditions</li> </ul>
Wrn045	Motor high temperature	<ul style="list-style-type: none"> <li>• Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>• Check to make sure the fan is working.</li> <li>• Check the fan connecting cable for a correct fit and damage.</li> <li>• Improve the cooling</li> <li>• Check the operating conditions</li> </ul>
Wrn118	High power electronics temperature	<ul style="list-style-type: none"> <li>• Insufficient cooling</li> </ul>	<ul style="list-style-type: none"> <li>• Check to make sure the fan is working.</li> <li>• Check the fan connecting cable for a correct fit and damage.</li> <li>• Improve the cooling</li> <li>• Check the operating conditions</li> </ul>

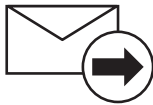
Tbl. 23: Warning messages of the electronic drive unit

# 13 Service solutions

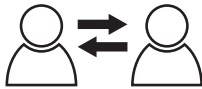
You can obtain advice on the optimal solution for you, from your Kurt J. Lesker Sales Team. For fast and smooth service process handling, we recommend the following:



1. Visit the Kurt J Lesker Vacuum Pump Repair & Services webpage:
  - [Pump repair quote form](#)
  - [Pump repair / Return request form](#)
- a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
- b) If necessary, drain operating fluid/lubricant.
- c) If necessary, drain coolant.
2. Complete the service request and contamination declaration.



3. Send the forms by email, fax, or post to your local Kurt J. Lesker Sales Manager.

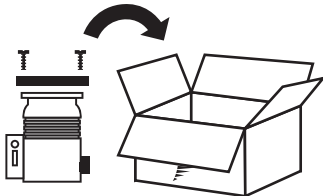


4. You will receive an acknowledgment from the Kurt J. Lesker Company.

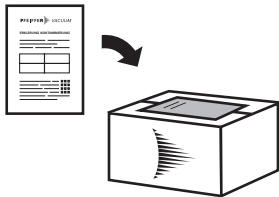
PFEIFFER VACUUM

## Submission of contaminated products

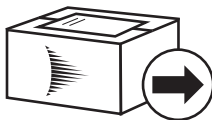
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Kurt J. Lesker Company will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination costs** may be incurred.



5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
  - a) Neutralize the product with nitrogen or dry air.
  - b) Seal all openings with blind flanges, so that they are airtight.
  - c) Shrink-wrap the product in suitable protective foil.
  - d) Package the product in suitable, stable transport containers only.
  - e) Maintain applicable transport conditions.



6. Attach the contamination declaration to the **outside** of the packaging.



7. Now send your product to your local Kurt J. Lesker Service Center.



8. You will receive an acknowledgment/quotation, from Kurt J. Lesker Company.

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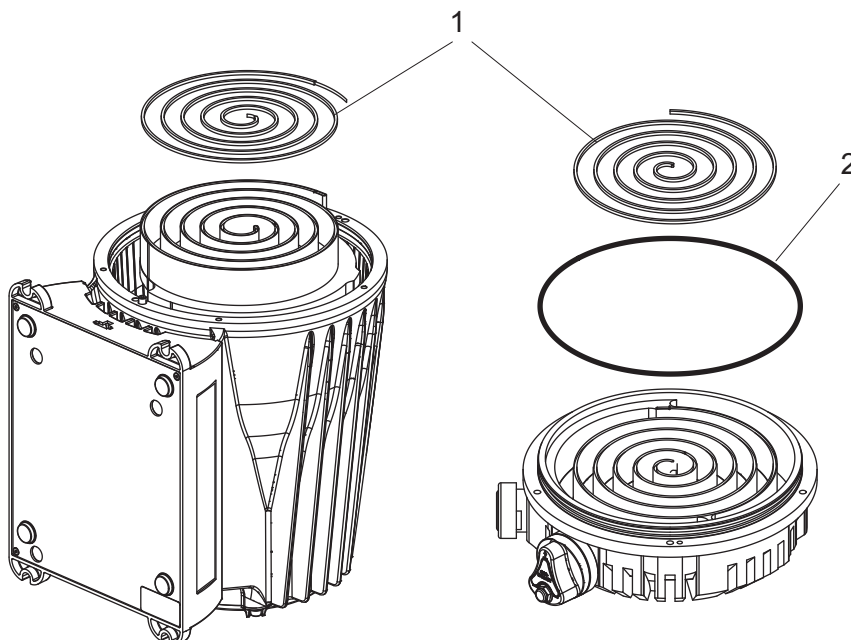
Our sales and delivery conditions and repair and maintenance conditions for vacuum devices and components apply to all service orders.

## 14 Spare parts

Observe the following instructions when ordering spare parts:

### Ordering spare parts

- ▶ Read the data on the product rating plate.
- ▶ Always have the vacuum pump article number at hand, along with other details from the rating plate.
- ▶ Install original spare parts only.

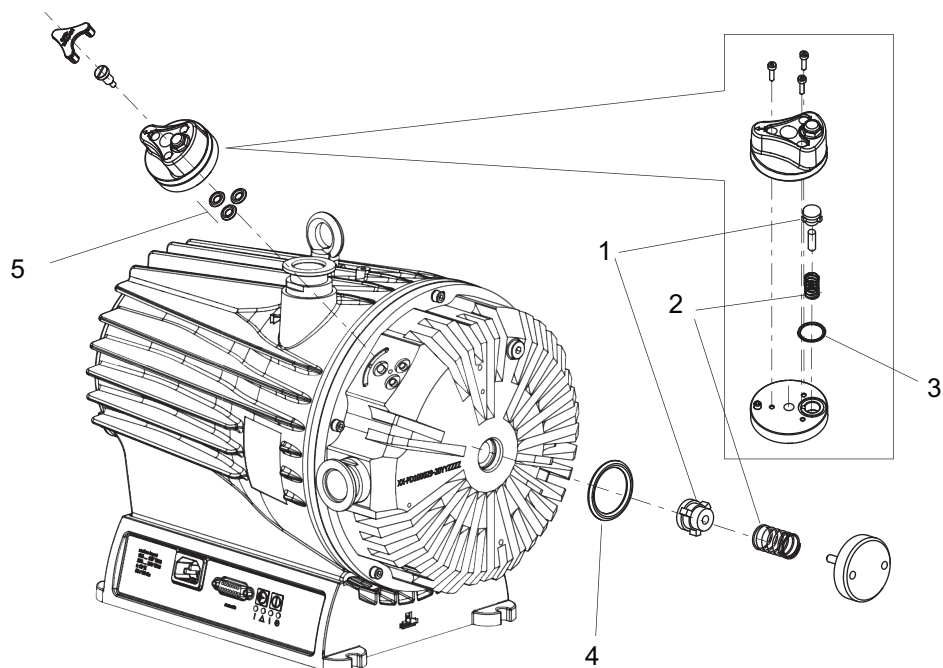


**Fig. 31: Maintenance kit 1**

1 Tip seal                      2 O-ring

Spare part package	Order number	
	Cobalt 6	Cobalt 12   Cobalt 18
Maintenance kit 1 – maintenance level 1	KJL10000-T	KJL20000-T

**Tbl. 24: Spare part package**



**Fig. 32: Valve set**

- |                          |                    |
|--------------------------|--------------------|
| 1 Valve plate, 2×        | 4 O-ring, 19 × 2.5 |
| 2 Compression spring, 2× | 5 O-ring, 6 × 3    |
| 3 O-ring, 16 × 1.5       |                    |

Spare part package	Order number
Valve set	KJL13000-T

**Tbl. 25: Spare part package**



## 15 Accessories

### 15.1 Accessory information

#### Cable and adapter

Mains, interface, connection, and extension cables provide a secure and suitable connection. Different lengths on request

#### Condensate separator

Protect the vacuum pump against fluids from the intake line and from the condensate return from the exhaust line

#### Dust separator

Protect the vacuum pump from particles from the process

#### Conversion kit for automated gas ballast valve

The retrofittable electromagnetic gas ballast valve is used to automate the gas inlet of scroll pumps.

### 15.2 Ordering accessories

Article	Order number
Mains cable 230 V AC, CEE 7/7 to C13, 3 m	KJLC-RVMCEU-1
Mains cable 115 V AC, NEMA 5-15 to C13, 3 m	KJLC-RVMCUS
Mains Cable, 230 V AC, BS 1363/A to C13, 3 m	KJLC-RVMCUK-1
External silencer KJLC EFS 25 M, DN 25	EFS07KF25
External silencer KJLC EFS 25 L, DN 25	EFS07KF25I
Dust separator KJLC PFI, DN 25 ISO-KF	PF1843KF25B
Automated gas ballast valve, 24 V DC, G 1/8"	ABG-COBALT-24VDC
Push-in fitting G 1/8" including seal for hose connection (8/6 mm)	GB-COBALT-G1/8
Screw cap for gas ballast valve	GB-COBALT-CAP
Adapter RS-485 M12	A-RS485-M12
Interface cable, M12 m straight / M12 m straight, 3 m	M12-M12-3
Y-connector M12 for RS-485	Y-RS485-M12
USB RS-485 converter	USB-RS485-M12

**Tbl. 26: Accessories for Cobalt**

## 16 Technical data and dimensions

### 16.1 General

Basis for the technical data of the Scroll vacuum pumps:

- Specifications according to PNEUROP committee PN5
- ISO 21360-1 2016: "Vacuum technology - Standard methods for measuring vacuum-pump performance - Part 1: General description"
- Integral leakage rate with 100 % helium concentration, 10 s measurement duration

	mbar	bar	Pa	hPa	kPa	Torr   mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^5$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr   mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1

1 Pa = 1 N/m<sup>2</sup>

**Tbl. 27: Conversion table: Pressure units**

	mbar l/s	Pa m <sup>3</sup> /s	sccm	Torr l/s	atm cm <sup>3</sup> /s
mbar l/s	1	0.1	59.2	0.75	0.987
Pa m <sup>3</sup> /s	10	1	592	7.5	9.87
sccm	$1.69 \cdot 10^{-2}$	$1.69 \cdot 10^{-3}$	1	$1.27 \cdot 10^{-2}$	$1.67 \cdot 10^{-2}$
Torr l/s	1.33	0.133	78.9	1	1.32
atm cm <sup>3</sup> /s	1.01	0.101	59.8	0.76	1

**Tbl. 28: Conversion table: Units for gas throughput**

### 16.2 Technical data



#### Performance data

- The **tested base pressure** is measured during quality control prior to delivery using a gas-type-independent measuring device (according to ISO 21360).

Selection field	Cobalt 6 Standard / ATEX	Cobalt 12 Standard / ATEX	Cobalt 18 Standard / ATEX
ATEX-certification	Ex II 3/-G Ex h IIC T4 Gc X +5 °C ≤ T <sub>a</sub> ≤ +40 °C	Ex II 3/-G Ex h IIC T4 Gc X +5 °C ≤ T <sub>a</sub> ≤ +40 °C	Ex II 3/-G Ex h IIC T4 Gc X +5 °C ≤ T <sub>a</sub> ≤ +40 °C
Part number	KJLC100	KJLC200	KJLC300
Connection flange (in)	DN 25 ISO-KF	DN 25 ISO-KF	DN 25 ISO-KF
Connection flange (out)	DN 25 ISO-KF	DN 25 ISO-KF	DN 25 ISO-KF
Cooling method	Air (Forced convection)	Air (Forced convection)	Air (Forced convection)
Tested base pressure	$1.5 \cdot 10^{-2}$ hPa	$6 \cdot 10^{-3}$ hPa	$6 \cdot 10^{-3}$ hPa
Intake pressure max.	1100 hPa	1100 hPa	1100 hPa
Recommended continuous inlet pressure, max.	200 hPa	200 hPa	200 hPa
Exhaust pressure, max.	1500 hPa	1500 hPa	1500 hPa
Pumping speed	6.1 m <sup>3</sup> /h	12.1 m <sup>3</sup> /h	18.1 m <sup>3</sup> /h
Gas ballast	Yes	Yes	Yes

Selection field	Cobalt 6 Standard / ATEX	Cobalt 12 Standard / ATEX	Cobalt 18 Standard / ATEX
Gas ballast pressure	1500 hPa	1500 hPa	1500 hPa
Gas ballast flow stage 1	11 l/min	18 l/min	23 l/min
Gas ballast flow stage 2	16 l/min	30 l/min	30 l/min
Rotation speed	1 000 – 3 000 rpm	624 – 1 870 rpm	624 – 1 870 rpm
Nominal rotation speed	2500 rpm	1560 rpm	1560 rpm
Input voltage(s)	100 – 127 / 200 – 240 V AC ( $\pm 10\%$ ), 50/60 Hz	100 – 127 / 200 – 240 V AC ( $\pm 10\%$ ), 50/60 Hz	100 – 127 / 200 – 240 V AC ( $\pm 10\%$ ), 50/60 Hz
Rated current consumption	100 V – 127 V: 4 A   200 V – 240 V: 2 A	100 V – 127 V: 8 A   200 V – 240 V: 4 A	100 V – 127 V: 10 A   200 V – 240 V: 6 A
Motor protection	Internal	Internal	Internal
Mains cable included	No	No	No
I/O interfaces	RS-485	RS-485	RS-485
Emission sound pressure level (EN ISO 2151)	48 dB(A)	47 dB(A)	47 dB(A)
Operating altitude, max.	2500 m	2500 m	2500 m
Protection degree	IP40, Type 1	IP40, Type 1	IP40, Type 1
Ambient temperature	5 – 40 °C	5 – 40 °C	5 – 40 °C
Temperature: Storage	-10 – 50 °C	-10 – 50 °C	-10 – 50 °C
Temperature: Shipping	-25 – 55 °C	-25 – 55 °C	-25 – 55 °C
Integral leak rate	$5 \cdot 10^{-7}$ Pa m <sup>3</sup> /s	$5 \cdot 10^{-7}$ Pa m <sup>3</sup> /s	$5 \cdot 10^{-7}$ Pa m <sup>3</sup> /s
Weight	19 kg	24 kg	23 kg

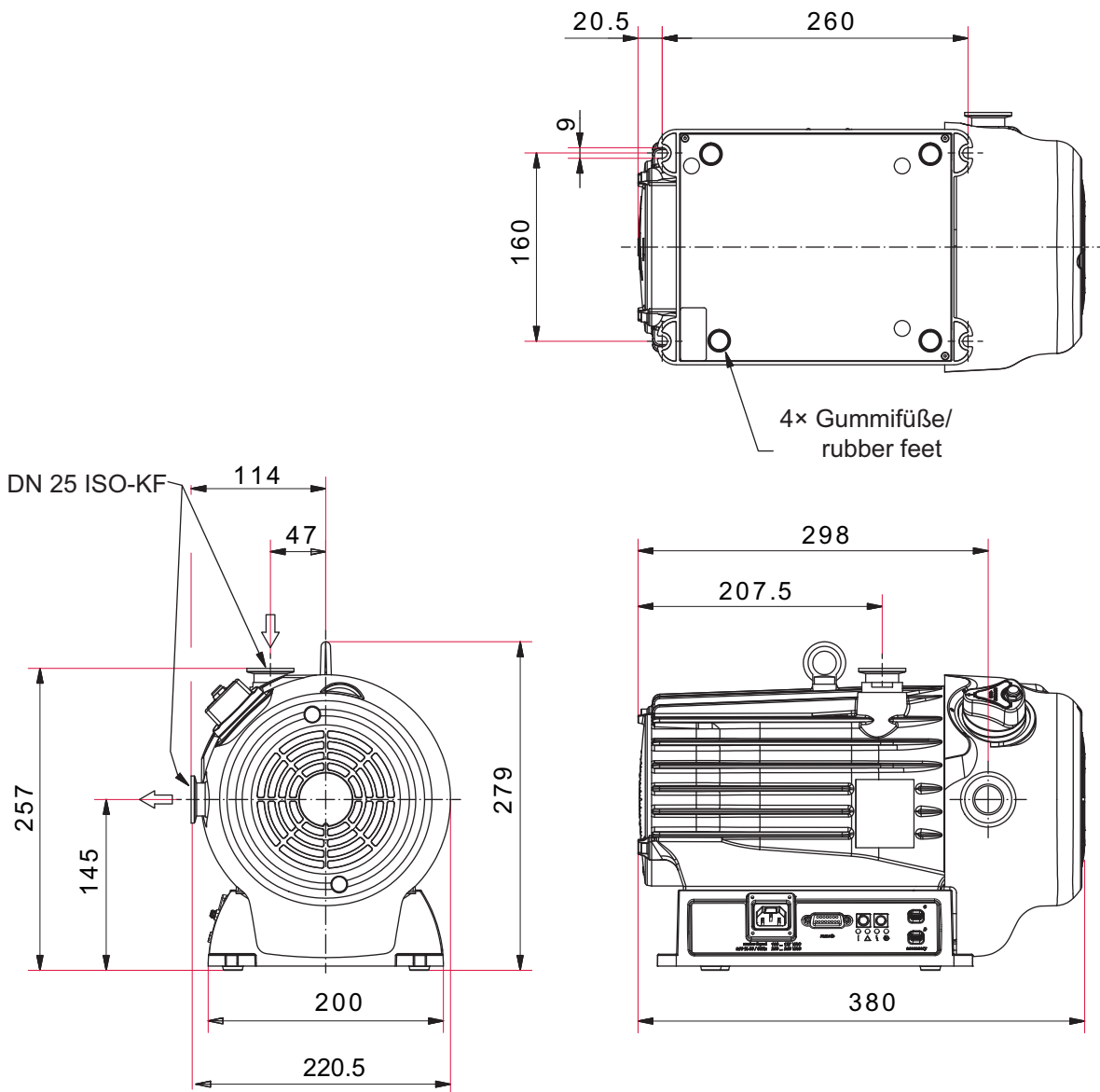
Tbl. 29: Technical data for Cobalt 6 | 12 | 18

### 16.3 Substances in contact with the media

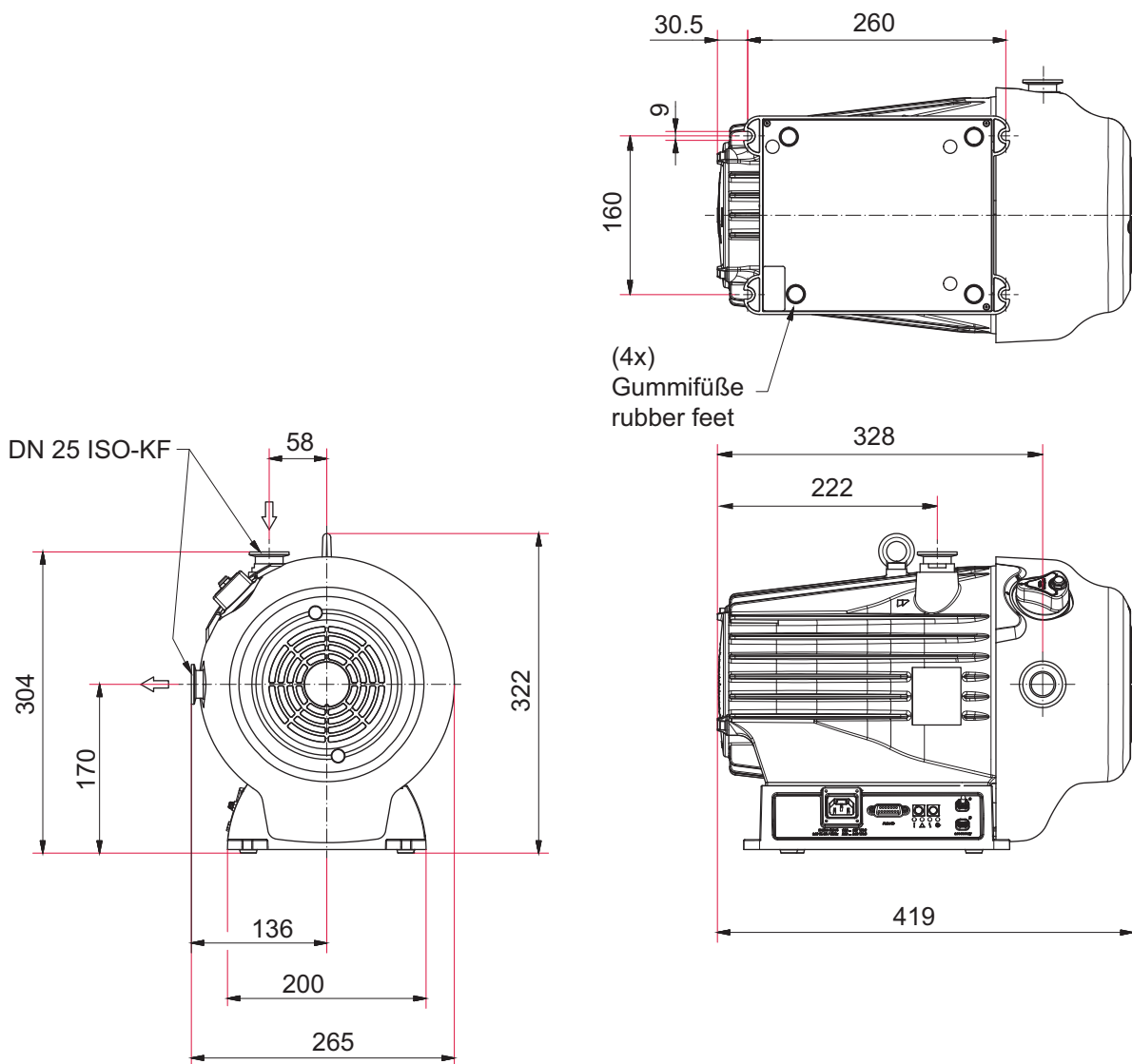
Pump parts	Substances in contact with the media	Standard
Housing	Aluminum	X
Inlet flange	Stainless steel	X
Outlet flange	Stainless steel	X
Corrugated bellows	Stainless steel	X
Pumping system	Anodized aluminum, PTFE compound	X
Non-return valve	Stainless steel, FKM	X
Gas ballast valve	Nickel-plated aluminum, stainless steel, FKM, PTFE	X
Screw-in filter gas ballast valve	Bronze/brass	X
Pressure sensor RPT	Ceramic, nickel, stainless steel, tungsten, silicon dioxide, araldite, solder	Option
Screws	Stainless steel	X
Seals	FKM	X

Tbl. 30: Materials that make contact with the process media

## 16.4 Dimensions



**Fig. 33: Cobalt 6**  
Dimensions in mm



**Fig. 34: Cobalt 12 | Cobalt 18**  
Dimensions in mm

# EC Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

## Scroll pump

Cobalt 6, Standard

Cobalt 12, Standard

Cobalt 18, Standard

⊕ II 3/-G Ex h IIC T4 Gc X +5° C ≤ Ta ≤ +40 °C

We hereby declare that the listed product satisfies all relevant provisions of the following **European Directives**.

- **Machinery 2006/42/EC (Annex II, no. 1 A)**
- **Electromagnetic compatibility 2014/30/EU**
- **Explosion protection 2014/34/EU according to article 13 (1) c)**
- **Restriction of the use of certain hazardous substances 2011/65/EU**
- **Restriction of the use of certain hazardous substances, delegated directive 2015/863/EU**

## Harmonized standards and applied national standards and specifications

DIN EN ISO 12100: 2011

DIN EN 61010-1: 2020

DIN EN 1012-2: 2011

DIN EN IEC 61326-1: 2012

DIN EN ISO 13857: 2020

DIN EN IEC 63000: 2019

DIN EN 1127-1: 2019

DIN EN ISO 80079-36: 2016-12

DIN ISO 21360-1 : 2020

DIN EN ISO 80079-37: 2016-12

ISO 21360-2 : 2020

Semi S2 0818 EA

DIN EN 61000-3-2: 2019

Semi S8 0218

DIN EN 61000-3-3: 2020

The authorized representative for the compilation of technical documents is  
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Signature:



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Simon Mansbridge Managing Director, EMEIA

Jefferson Hills,  
2024-01-08



# UK Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

## Scroll pump

Cobalt 6, Standard

Cobalt 12, Standard

Cobalt 18, Standard

⊕ II 3/-G Ex h IIC T4 Gc X +5° C ≤ Ta ≤ +40 °C

We hereby declare that the listed product satisfies all relevant provisions of the following **British Directives**.

**Supply of Machinery (Safety) Regulations 2008**

**Electrical Equipment (Safety) Regulations 2016**

**Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016**

**Electromagnetic Compatibility Regulations 2016**

**The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012**

## Applied standards and specifications:

ISO 12100: 2010

IEC 61000-3-3: 2013 + A1: 2017

EN 1012-2: 1996 + A1: 2009

IEC 61326-1: 2012

ISO 13857: 2019

EN ISO 80079-36: 2016

EN 1127-1: 2019

EN ISO 80079-37: 2016

ISO 21360-1 : 2020

IEC 63000: 2016

ISO 21360-2 : 2020

Semi S2 0818 EA

IEC 61010-1: 2010 + A1: 2016

Semi S8 0218

IEC 61000-3-2: 2018

The manufacturer's authorized representative in the United Kingdom and the authorized agent for compiling the technical documentation is Kurt J. Lesker Company Ltd., 15-16 Burgess Road, Hastings, East Sussex, TN35 4NR, England.

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