

# ECODRY plus

Multi-stage Roots vacuum pump



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**PTB SALES** T :: 626.334.0500  
sales@ptbsales.com  
service@ptbsales.com  
www.ptbsales.com

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Operating Instructions 300503441\_002\_C1

Part Nos.

161065V01

161040V01



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These Operating Instructions are a translation of the German Operating Instructions 300503441\_001\_C1.

# Safety Information

## Obligation to Provide Information

Before installing and commissioning the pump, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Leybold **ECODRY plus** has been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. Moreover, observe the information in all additionally supplied Operating Instructions for switches or valves, for example. The pump must only be operated in the proper condition and under the conditions described in the Operating Instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

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

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

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

NOTICE is used to notify users of installation, operation, programming or maintenance information that is important, but not hazard related.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

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## NOTICE



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## DANGER



---

## WARNING



---

## CAUTION



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## NOTICE



# Safety Information

## 0 Important Safety Information

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### WARNING



#### 0.1 Mechanical Hazards

- 1 Avoid exposing any part of the human body to the vacuum.
- 2 Select a secure place for the appliance (level surface).
- 3 The discharge port of the pump must not be blocked or constricted. Never operate the pump with a seal-off stopper in place blanking off the exhaust port. Operate the pump only with a connected vacuum system to the intake flange.
- 4 With a closed exhaust pipe, the pump can generate up to 5 bar pressure (absolute) on the exhaust. The exhaust pipes should be laid out according.
- 5 Condensates from the pump can collect inside or at the exhaust, escape and spill onto the floor, when operating the pump without an exhaust line or during transport with an exhaust being not blanked off. In this case there exists the risk of slipping.
- 6 Due to its weight the pump must only be lifted by duly trained and qualified persons.

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### DANGER



#### 0.2 Electrical hazards

- 1 Housing parts must not be opened.
- 2 Connect the appliance only to a properly and professionally installed mains outlet socket with protective earth connection.
- 3 Note the information on the IP type of protection.

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### CAUTION



#### 0.3 Thermal Hazards

- 1 At the crane eye, the intake flange and the exhaust flange, the pump may attain temperatures over 80 °C. There is the risk of suffering burns. Note the danger symbols on the pump itself.

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### DANGER



#### 0.4 Hazards Caused by Materials and Substances

- 1 Fluoropolymers are used as sealants (FKM) and as lubricants (PFPE) in the pumps. In case the pump suffers a severe mechanical failure, it cannot be ruled out that toxic and/or corrosive substances may be released due to thermal decomposition. Do not open the pump module, and close off the inlet and exhaust flanges using blank flanges.
- 2 Before commissioning the pump, make sure that the media which are to be pumped are compatible with each other so as to avoid hazardous situations. Observe the instructions for proper and improper use of the pump in Section 3.2.
- 3 When pumping hazardous gases we recommend a leak search on a regular basis. Leaks in the pump cannot be ruled out under all circumstances. When pumping hazardous gases, the operator must ensure that that leaks at the pump will not be a hazard. When pumping toxic gases replace the gas ballast switch with a plug screw or connect a gas supply to the gas ballast.

# Safety Information

- 4 If required additional monitoring of the gas ballast quantities is necessary from the side of the operator when a well-defined and ensured dilution is necessary from the side of the process. The type of protection depends on the specific process and needs to be assessed by of the customer.
- 5 When the pump has been used to pump hazardous gases, introduce appropriate safety precautions before opening the intake or the discharge connections. Before opening the pump, purge it for a longer period of time with an inert gas. If necessary, wear suitable personal protection equipment like gloves, breathing protection and protection clothing, for example (see Material Safety Data Sheets for the substances in use, the chemical reactions and the by-products). Close off the pump's inlet and exhaust flanges using blank flanges.
- 6 When disposing of the pump, observe the applicable environment regulations.

## 0.5 Noise Hazard

- 1 The noise level of the pump during ultimate pressure operation corresponds to the values stated in the technical data. In other operating modes and depending on the connected vacuum system, higher values can be expected. Make sure that suitable protection measures are taken to protect your hearing.

---

### CAUTION



# Description

## 1 Description

The ECODRY plus is an eight-stage Roots pump. It is of the dry compressing type and capable of evacuating chambers down to the medium vacuum range.

The pump is connected to a single-phase supply using a mains power cable and is powered via a built-in electronic drive unit. It is air-cooled. Bearings and gears are lubricated using PFPE. The pump is therefore maintenance-free from the customer's perspective.

### 1.1 Supplied Equipment

The pump is delivered ready for use, except from a power cable. Inlet and exhaust flanges are closed. The scope of delivery includes:

- 2 centering rings, 2 clamping rings, 2 blank flanges for the inlet and exhaust flanges
- D-sub 9-pin jumper for manual operation of the pump.

### 1.2 Technical Data

<b>ECODRY plus</b>	<b>40</b>	<b>65</b>
Maximum pumping speed without gas ballast	40 m <sup>3</sup> /h	55 m <sup>3</sup> /h
Ultimate partial pressure without gas ballast	< 0.03 mbar	
Ultimate partial pressure with gas ballast	< 0.1 mbar	
Maximum permissible inlet pressure	1050 mbar	
Max. perm. discharge pressure (relative to ambient)	200 mbar	
Leak rate	< 10 <sup>-5</sup> mbar·l/s	
Water vapour tolerance with gas ballast	20 mbar	20 mbar
Water vapour capacity with gas ballast	300 g/h	500 g/h
Permissible ambient temperature	+5 to +40 °C	
Storage temperature	-20 to +60 °C	
Noise level without silencer, at ultimate pressure (acc. to DIN EN ISO 2151)	< 52 dB(A)	
Relative ambient atmospheric humidity	95%, non-condensing	
Max. installation height	up to 2000 m (NHN)*	
Cooling	Air	
Leakage current in accordance with IEC 61010-1	< 3.5 mA	
Max. contamination grade acc. to IEC 61010-1	2	

# Description

<b>ECODRY plus</b>	<b>40</b>	<b>65</b>
Mains voltage	200 – 240 V ± 10 %	
Frequency	50 / 60 Hz ± 5 %	
Phases	1-ph	
Max. current	10 A	
Max. power consumption	1200 W	
Mains fusing / characteristic	16 A / T	
Plug connector for power supply	C 20 acc. to IEC 60320	
Speed	12 600 RPM	
Protection class	IP 42	
Intake flange	DN 25 ISO-KF	DN 40 ISO-KF
Discharge flange	DN 16 ISO-KF	
Weight, approx.	43 kg	

\* Please inquire for installation heights above 2000 m.

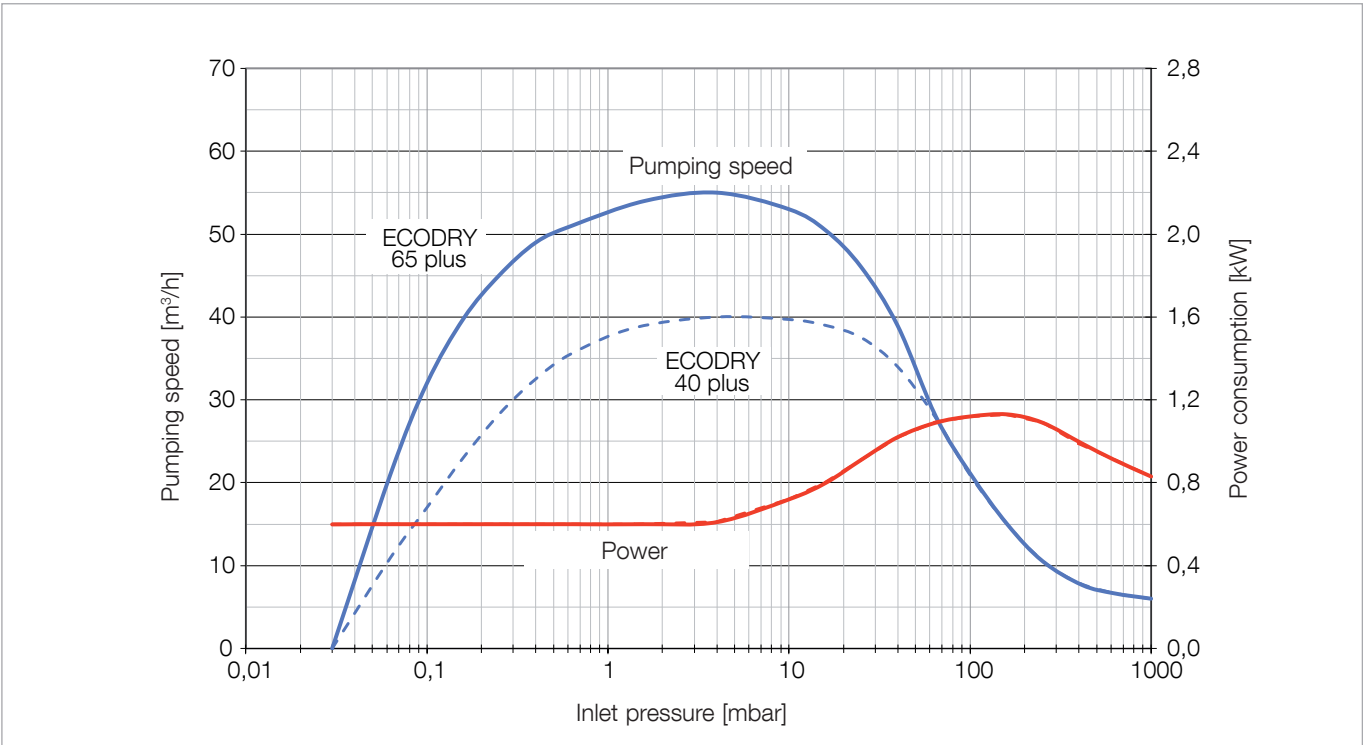


Fig. 1.1 Pumping speed curves

# Description

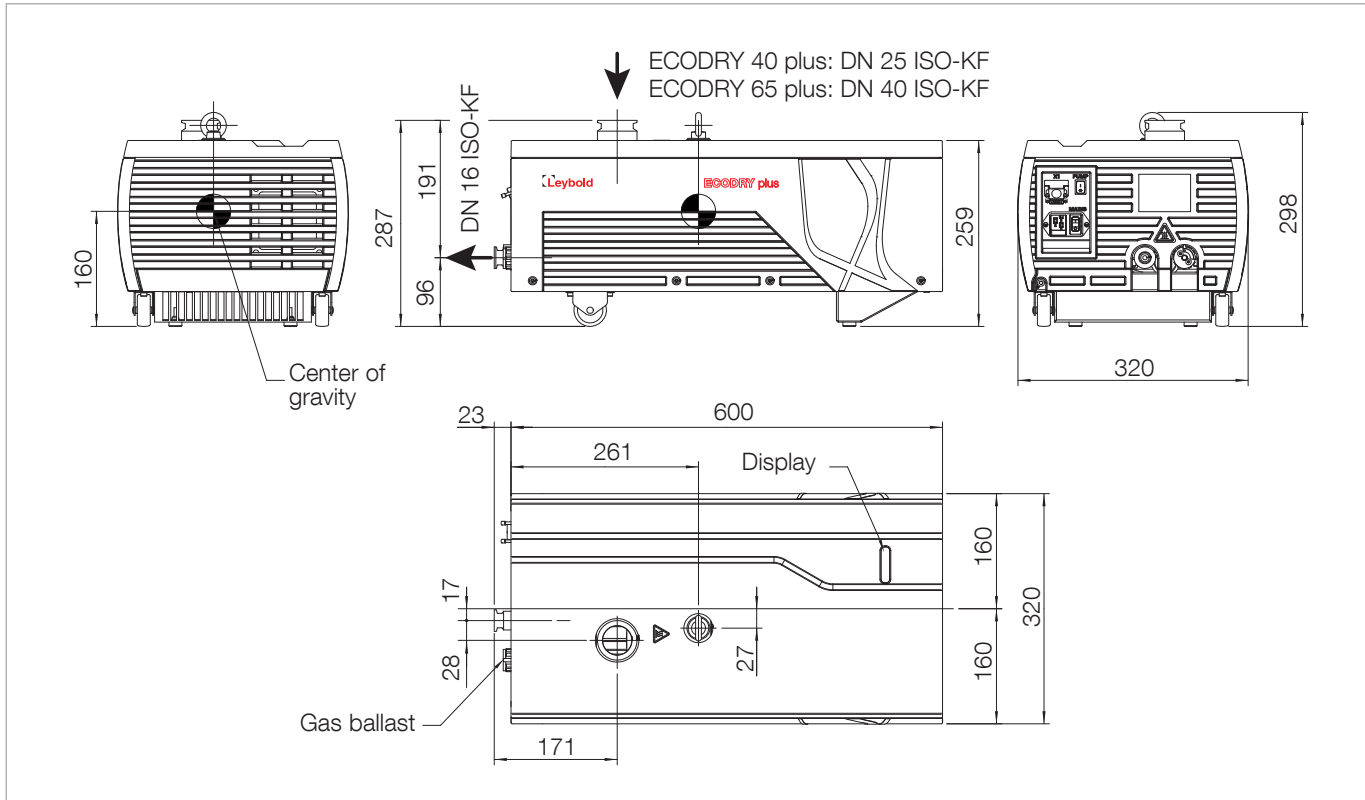


Fig. 1.2 Dimensional drawing, dimensions in mm

## 1.3 Ordering Data

	Part No.
ECODRY 40 plus	161 040 V01
ECODRY 65 plus	161 065 V01



## 1.4 Accessories

Inlet screen	
DN 40 ISO-KF	E41 170 121
DN 25 ISO-KF	E41 170 206
<hr/>	
Mains cable	
EU (CEE 7/7 - C19, 2.0 m)	161 810 EU
UK (BS 1363 - C19, 2.0 m)	161 810 UK
US (NEMA 6-15P - C19, 2.5 m)	161 810 US
<hr/>	
Blank flange, aluminium	
DN 16 ISO-KF	184 46
DN 25 ISO-KF	184 47
DN 40 ISO-KF	184 48
<hr/>	
Centering ring, aluminium, FPM	
DN 16 ISO-KF	182 06
DN 25 ISO-KF	182 07
DN 40 ISO-KF	182 08
<hr/>	
Clamping ring, aluminium	
DN 16 ISO-KF	183 41
DN 25 ISO-KF	183 42
DN 40 ISO-KF	183 43
<hr/>	
Casing assembly mounting kit	161 831 A
<hr/>	
DN 16 ISO-KF/12 mm hose adapter for exhaust flange	182 90
<hr/>	
RS485/USB connecting cable for X104 interface, 1.8 m	161 820 USB
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LEYASSIST software	230 439 V01
<hr/>	
Replacement control interface jumper X1	161 823 A
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# Transport and Storage

## **2 Transport and Storage**

For transportation lift the pump at the crane eye or safely secured on a suitable pallet.

The pump must not be tilted more than 30 degrees during transport.

For transports over short distances slightly lift the pump at the front side and move it to the desired location.

### **Storage**

Store the pumps only horizontally standing on their feet and castors.

The pump has been blanked off with blank flanges. Open the pump only immediately before installing it.

Until putting the pump into service, store the pump in a dry place preferably at room temperature blanked off with the supplied blank flanges.

The pump must be stored at the most for one year only. Longer storing without turning the rotors will damage the bearings. Therefore, if you are storing the pump for longer periods, it should be run once a year for at least 45 minutes and then returned to storage, as described in the following sections. (The intake flange can stay sealed during this brief operation, the exhaust flange must be opened.)

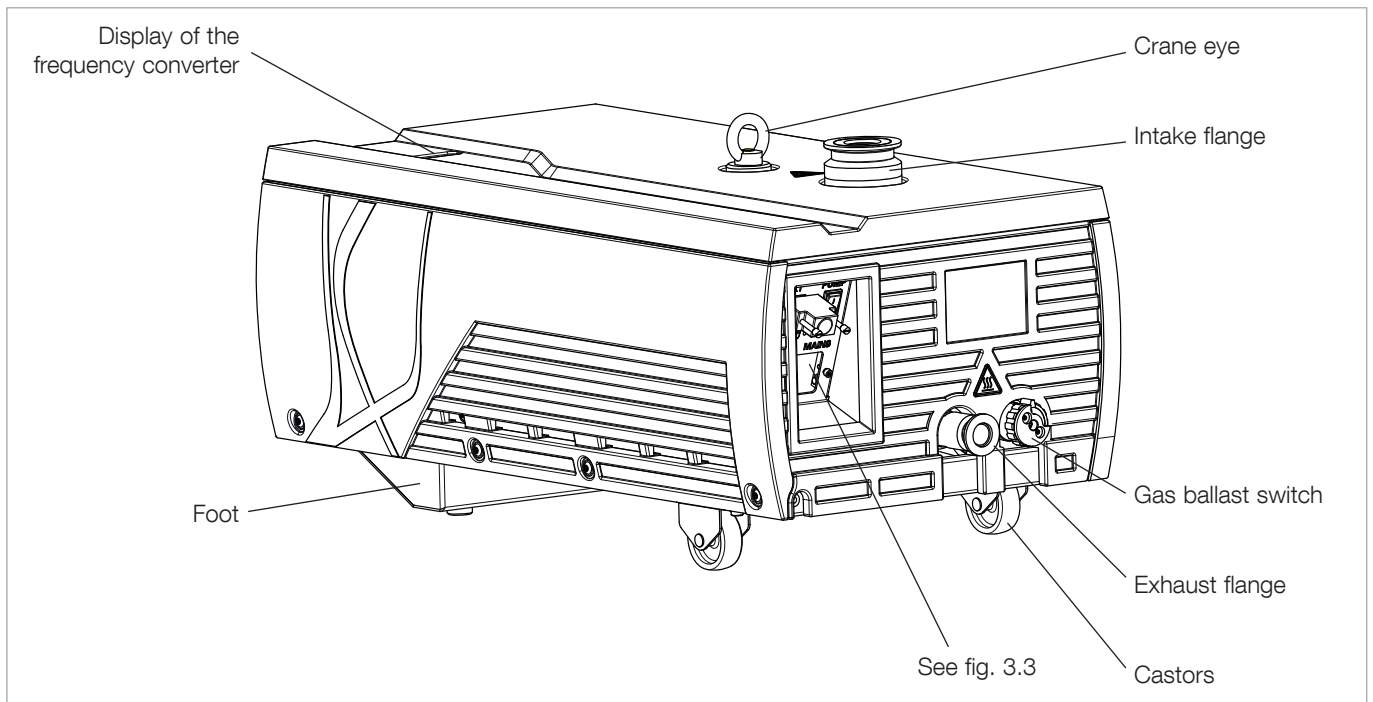


Fig. 3.1 Connections and controls

## 3 Installation

### 3.1 Placement

Place the pump on a straight and level surface (max. tilt of 2°).

To ensure sufficient cooling of the pump, the fan openings of the pump must not be obstructed, see fig. 3.2.

### 3.2 Conforming Use

The ECODRY plus has been designed to produce a vacuum. It is capable of pumping clean, dry gases, which are free of particles, like air, nitrogen, oxygen  $\leq 21\%$ , argon with inlet pressure  $< 100$  mbar and helium. Moreover, it is capable of evacuating vessels of vacuum systems down to the medium vacuum range.

The pump is suited for deployment as a backing pump for turbomolecular pumps.

Organic solvents may only be pumped in traces/at low concentrations (consult Leybold first) outside the flammability range. The pump is suited for pumping water vapour within the limits given in the technical data.

# Installation

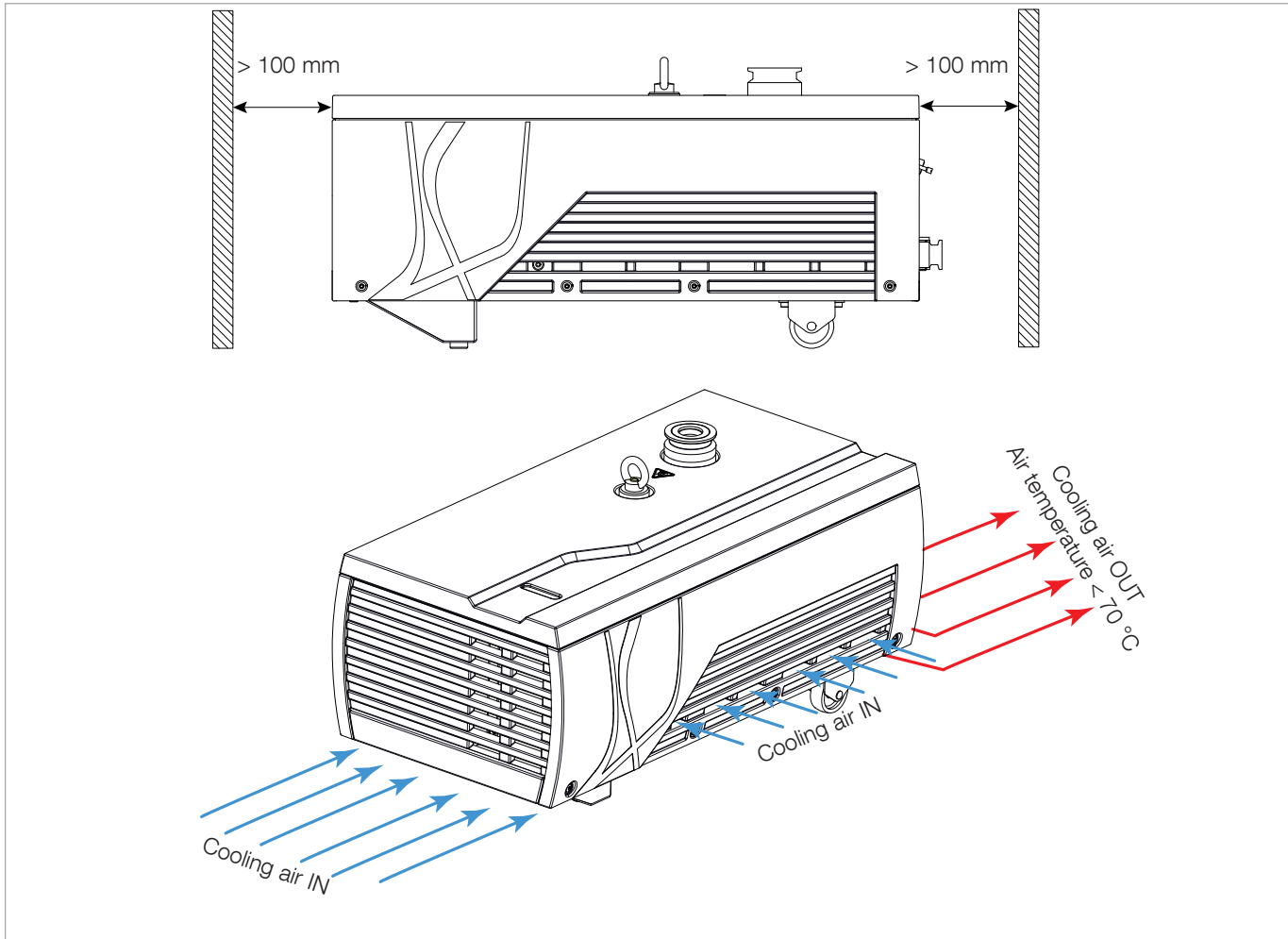


Fig. 3.2 Cooling air flow

## 3.2.1 Non-conforming Use

**DANGER**



The ECODRY plus is not suited for pumping of:

- Radioactive substances
- Explosive substances
- Ignitable gas mixtures
- Pyrophorous gases
- Liquids
- Media condensing in the pump
- Solids/dusts
- Oxidative substances with the exception of  $\leq 21\%$  oxygen in the air
- Toxic gases belonging to GHS category I and II

Pumping of the following gases is only permissible after having consulted Leybold first:

- corrosive gases
- toxic gases belonging to GHS category II and IV

When pumping toxic gases replace the gas ballast switch with a plug screw or connect a gas supply to the gas ballast.

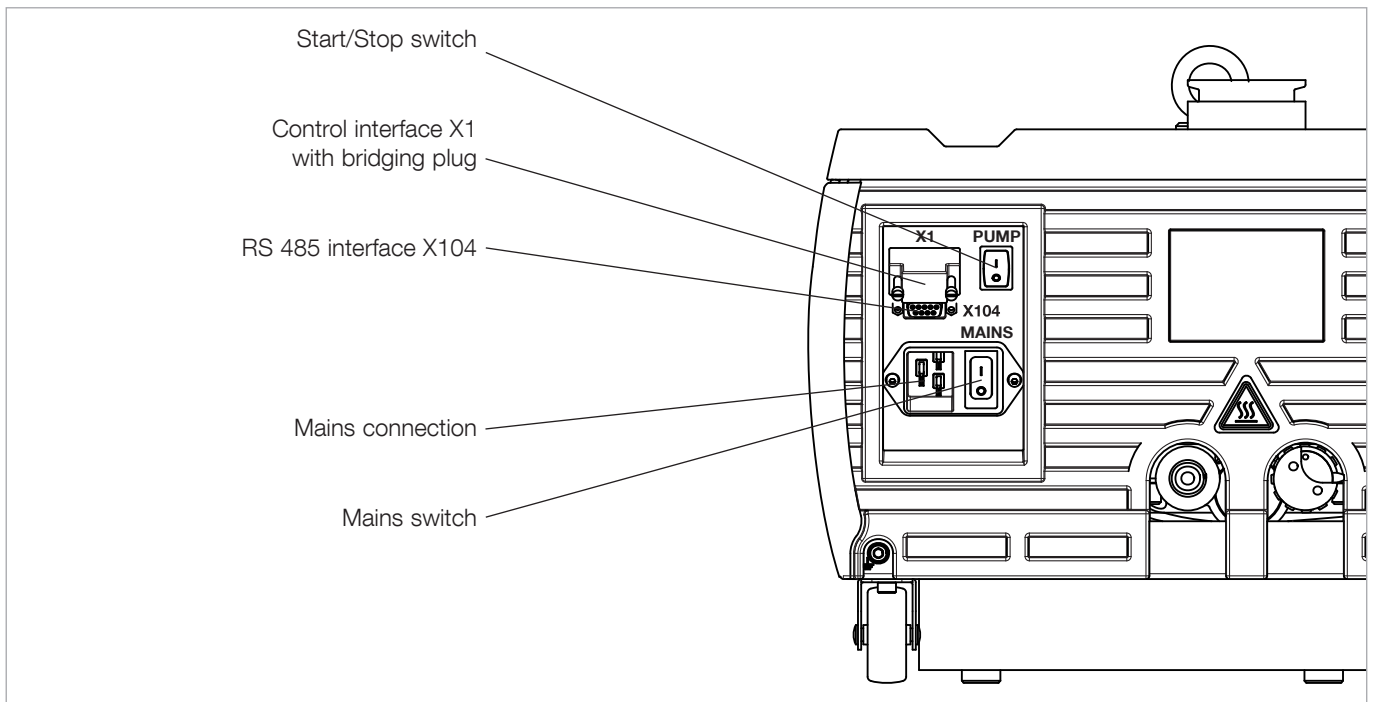


Fig. 3.3 Connections and controls

### 3.3 Connecting the Pump

Remove the blank flanges. We recommend that you retain the blank flanges for decommissioning of the pump.

During installation work on the intake and discharge lines do not subject flanges to any stresses.

#### Intake side

At the intake side, connect a hose to the vacuum chamber.

Do not allow the ingestion of any objects (screws, welding beads, nuts, washers, pieces of wire, etc.) through the intake port of the pump.

The intake line must be clean. Deposits in the intake line can degas and impair the vacuum. The connecting flanges must be clean and undamaged.

#### Exhaust line

Connect the exhaust line with a hose to the pump, or when operating the pump without a connected exhaust line, operate the pump only in a well ventilated room. The operator must check, whether the pumped gases will lead to safety risks on the environment if the pump is operated without an exhaust line (i.e. risk of suffocation, risk of slipping due to condensing vapours, etc.).

The cross-section of the exhaust line must at least match the inside diameter of the connections.

#### NOTICE



#### DANGER



# Installation

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**CAUTION**

Smaller cross sections may cause an undesirable overpressure within the system. Do not start up the pump with a constricted or blocked exhaust. Ensure that any valves or blocking devices in the exhaust line are open. Clogged exhaust lines will reduce the available pumping speed, increase temperature and cause overloading of the pump motor or a dangerous overpressure within the system. There is the risk of bursting. The pump can generate pressures up to 5 bar (abs.) at the exhaust, when the discharge line is shut.

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When pumping vapours we recommend connecting a condensate separator at the exhaust.

The exhaust lines should be laid so that they drop down and away thereby preventing condensate from flowing back into the pump.

Connect the exhaust line to an abatement system with sufficient throughput, if required by the process.

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**DANGER**

If within the system toxic substances or gases are being used, then the operator will be responsible for ensuring that the corresponding safety precautions are introduced!

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### 3.4 Electrical Connection

Read the data on the device nameplate carefully before connecting to mains voltage. Plug in the power connector.

The plug is equipped with a cable pull-out protection. When plugging in the mains plug, the pull-out protection mechanism engages. To pull out, press finger on the yellow release lever, which will release the locking mechanism again.

If required, connect the X1 control interface or the X104 RS 485 interface (see Section 4.2).



## 4 Operation

The ECODRY plus can be operated either manually or via an interface.

Switch the pump only on provided an exhaust line has been connected. The exhaust of the pump must not be blocked or constricted. Never operate the pump with the seal-off stoppers in place blanking off the exhaust port.

### 4.1 Manual Operation

For manual operation, connect the jumper supplied with the unit to the X1 interface.

Switch the pump on at the MAINS switch and wait for approximately two seconds while the frequency converter initialises. Now the pump can be started using the start/stop switch (PUMP).

Following start-up, the pump requires a few seconds in order to reach its rated frequency.

In this mode, the X104 interface can only be used for reading off operating parameters.

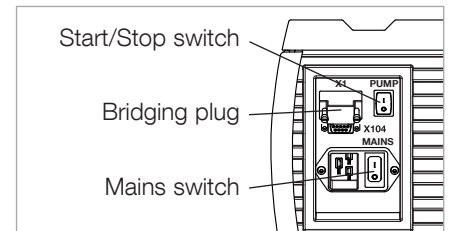
### 4.2 Interfaces

#### 4.2.1 X1 Control Interface

The pump can be incorporated within a plant control system by means of the X1 control interface. To do this, set the start/stop (PUMP) switch to "1". The ECODRY plus can be started remotely by closing the pin 8 contact to pin 9 on the X1 interface. Opening the contact stops the unit.

In this mode, the X104 interface can only be used for reading off operational parameters.

#### WARNING



# Operation

**Table: Pin assignment X1**

Customer plug (provided with pump) SUB-D 9 (female)		ECODRY plus X1 SUB-D 9 (male)				
Description	Pin	Pin	Internal Name	Description	Limits	Function
	1	1	AM	Analog Frequency Monitor output	0 ... +10 Vdc (2 mA)	Analog signal proportional to current rotation frequency (10 V = 210 Hz)
	2	2	S5	Digital Input / Low speed	connected to optocoupler with +24 Vdc/8 mA (max.)	Bridge to pin 4 for lower speed (170 Hz), open for full speed (210 Hz)
	3	3	V+	Voltage supply for analog input	+10.5 V (max. 16 mA)	Voltage supply for analog input A1
	4	4	SC/PC	Digital Common		
	5	5	P1	Digital Output (Pump Status)	Open collector, supply max. 24 Vdc (< 50 mA)	On: Pump is running Off: Pump is stopped
Jumper Pin 6 / Pin 7: speed control deactivated	6	6	A1	Analog Input (Speed Control)	0 ... +10 V (20 kOhm)	Optional input, deactivated by default. Contact Leybold for further information.
	7	7	AC	Analog Common		
Jumper Pin 9 / Pin 8: Run Switch active	8	8	SC	Digital Common		
	9	9	S1	Digital Input / RUN	connected to optocoupler with +24 Vdc/8 mA (max.)	Bridge to pin 8 for RUN, open for STOP
Housing		Housing	Shield	Pump housing, PE		



**NOTICE:** Do not apply external voltage to the digital input terminals because the internal optocouplers can be damaged.

Do not exceed the stated voltage and current limits.



## 4.2.2 X104 Serial RS-485 Interface

Alternatively, the X104 RS 485 interface can be used to operate the pump, giving access to additional operational parameters for the frequency converter.

The user can access the operational parameters using MEMOBUS (a protocol closely related to MODBUS) or using the LEYASSIST software (see Section 1.4 on accessories).

For the MEMOBUS protocol, the following connection parameters are used:

Baudrate:	9600 bps
Data length:	8 bit
Parity:	No parity
Stop bit:	1 bit
Address:	31

A cable for the connection of the pump to a PC via USB is available at Leybold. The necessary drivers are available at <http://www.leybold.com/drivers>.

By default, the pump is set such that it can be started/stopped manually or via the X1 interface, while only the operational parameters can be read off via the X104 interface.

If the pump is to be operated via the X104 interface, the parameter b1-02 "Run Command Selection 1" (Hex Addr. 0181H) must be switched from "1" (Digital Input Terminals) to "2" (MEMOBUS communications).

By writing the value 0 in the register 0900h the change is written into the EEPROM (permanently), or when using the register 0910h it is confirmed in the RAM.

Once this has been done, the pump's operating state can be controlled using bit 0 of register 0001H (0=stop, 1=run).

In this mode ("MEMOBUS"), the pump can no longer be controlled manually or using the X1 interface. In order to be able to do so, b1-02 must first be reset to "1".

Find more parameters relevant to remote control in the tables "ModBus Register (pump operation)" and "ModBus Register (monitor values)"

# Operation

**Table: Pin assignment serial interface X104**

Customer plug SUB-D 9 (male)		ECODRY plus Serial Interface X104 SUB-D 9 (female)			
Description	Pin	Pin	Internal Name	Description	Comment
	1	1	n.c.	Not connected	
Bridge to Pin 3 for termination	2	2	T+	Termination	
Bridge to Pin 2 for termination	3	3	T-	Termination	
	4	4	n.c.	Not connected	
GND	5	5	IG	Ground (GND)	
	6	6	R-	Receive -	
Tx/Rx+	7	7	R+	Receive + (Tx/Rx+)	Bridged internally to Pin 9
Tx/Rx-	8	8	S-	Send - (Tx/Rx-)	Bridged internally to Pin 6
	9	9	S+	Send +	
Shield	Housing	Housing	Shield	Grounded	

**Table: ModBus register (pump operation)**

Hex address	Register	Designation	Description
0001h		Operation Signals and Multifunction inputs	bit 0: 0 = Stop, 1 = Run bit 1 Reserved bit 2 External Fault (EF0) bit 3 Fault Reset bit 4 - F Reserved
0002h		Frequency Reference	Configure drive frequency reference (used when b1-01 is set to 2). Frequency is set in steps of 0.01 Hz.
0180h	b1-01	Frequency Reference Selection 1	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-17. 1: Terminals - Analog input terminal A1 or A2. 2: MEMOBUS communications
0181h	b1-02	Run Command Selection 1	Selects the run command input source. 1: Digital input terminals 2: MEMOBUS communications
0280h	d1-01	Frequency reference	Configure drive frequency reference (used when b1-01 is set to 0). Frequency is set in steps of 0.01 Hz.
0900H		Enter Command Type (EEPROM)	Write zero for writing data into the EEPROM (non-volatile memory) of the drive and enabling the data in RAM at the same time. Parameter changes remain even if the power supply is cycled.
0910H		Enter Command Type (RAM only)	Write zero for writing data in the RAM only.

# Operation

**Table: ModBus register (monitor values)**

Reg No.	Const No.	Display	Base	Dig-its	Decimal	Unit	Size	Sign	DIV	Warning Lower limit	Warning Upper limit	Note
40H	U1-01	Frequency Reference	DEC	5	01-03	Hz	UWORD		01-03	80	215	Nominal speed = 210 Hz
41H	U1-02	Output Frequency	DEC	5	01-03	Hz	WORD	y	01-03	0	215	Nominal speed = 210 Hz
42H	U1-03	Output Current	DEC	5	1	A	UWORD		10	0	12	Motor current
45H	U1-06	Output Voltage Reference	DEC	5	1	VAC	UWORD		10	0	254	
46H	U1-07	DC Bus Voltage	DEC	5	0	VDC	UWORD		1	0	360	
47H	U1-08	Output Power	DEC	5	1	kW	WORD	y	10	0	2	Drive power
49H	U1-10	Input Terminal Status	BIN	5	0		UWORD		1			
4AH	U1-11	Output Terminal Status	BIN	5	0		UWORD		1			
4BH	U1-12	Drive Status	BIN	5	0		UBYTE		1			
66H	U1-19	MEMOBUS Error Code	BIN	5	0		UWORD		1			
4DH	U1-25	Software No. (Flash)	DEC	5	0		UWORD		1			
5BH	U1-26	Software No. (ROM)	DEC	5	0		UWORD		1			
80H	U2-01	Current Fault	HEX	5			UWORD					
81H	U2-02	Previous Fault	HEX	5			UWORD					
83H	U2-04	Output Frequency at Previous Fault	DEC	5	2	Hz	WORD	y	100	0	215	
84H	U2-05	Output Current at Previous Fault	DEC	5	1	A	UWORD		10	0	12	
8CH	U2-13	Drive Operation Status at Previous Fault	BIN	5	0		UBYTE		1			
8DH	U2-14	Cumulative Operation Time at Previous Fault	DEC	5	0	h	UWORD		1	0	100.000	Upper limit is "none" or here set to 100.000
90H	U3-01	Most Recent Fault	DEC	5	0		UWORD		1			
94H	U3-11	Cumulative Operation Time at Most Recent Fault	DEC	5	0	h	UWORD		1	0	100.000	Upper limit is "none" or here set to 100.000
4CH	U4-01	Accumulated Operation Time	DEC	5	0	h	UWORD		1	0	100.000	counts time when power on Upper limit is "none" or here set to 100 000
75H	U4-02	Number of Run Commands	DEC	5	0		UWORD		1	0	none	

Reg No.	Const No.	Display	Base	Dig-its	Decimal	Unit	Size	Sign	DIV	Warning Lower limit	Warning Upper limit	Note
67H	U4-03	Cooling Fan Operation Time	DEC	5	0	h	UWORD		1	0	100.000	Counts the time during which the frequency converter delivers output and thus also during which the fan of the frequency converter is running.  Upper limit is "none" or here set to 100 000
68H	U4-08	Heatsink Temperature	DEC	5	0	°C	UWORD		1	5	120	
667h	U7-08	ServiceHoursCnt Service Hours Counter	DEC	5	0	h	UWORD		1	0	24.000	Counter for operation hours (running motor). Reset after service.
669h	U7-10	ServiceCycleCnt Service Cycle Counter	DEC	5	0		UWORD		1	0	3.000	Counter that is increased by one for every pump-down cycle. Reset after service.
66Ch	U7-12	TimeUntilService Time until next service	DEC	5	0	d	UWORD		1	0	1.095	Time to next recommended service, count-down.  for < 3 years
66Ch	U7-12	TimeUntilService Time until next service	DEC	5	1	yr	UWORD		1	3	3	for ≥ 3 years

UBYTE = 8bit unsigned

BYTE = 8bit signed

UWORD = 16bit unsigned

WORD = 16bit signed



## 4.2.3 Frequency converter display

ALM LED	Flashes: drive is in the warning state. On: drive is in an error state and the pump is stopped.
REV LED	On: the motor is turning in reverse. Off: the motor is turning in a forwards direction.
DRV LED	On: the pump is ready or is running. Off: the drive is in the initialisation phase.
FOUT LED	On: the output frequency is shown on the display. Off: everything except the output frequency is shown on the display.

After switching on, the output frequency in Hz and the time until the next service appear on the display, alternating every three seconds.

The unit of output frequency is not displayed.

The unit of time until the next service is indicated with “d” for days.

If the output frequency is displayed, the FOUT LED lights up at the same time, and the display shows the frequency to two decimal places. For example:

<i>210.00</i>	210.00 Hz: pump rotational speed
FOUT LED is on	
<i>657d</i>	657 days: time remaining until next service
FOUT LED is off	

If faults are present, an error message is displayed.

## 4.3 Gas Ballast

If the process contains mainly permanent gases, the ECODRY plus may be operated without gas ballast.

If the composition of the gases to be pumped is not known and if condensation in the pump cannot be ruled out, run the pump with the gas ballast valve open.

### Pumping of Condensable Gases and Vapours

If the gas ballast valve is open when the temperature is at operating level, the ECODRY plus can pump water vapour within the limits specified in the technical data. If the vapour pressure rises above the permitted water vapour tolerance, the gasses condense to vapour in the pump. This can lead to corrosion and thus damage to the pump.

Before pumping out vapours, open the gas ballast valve and warm up the pump for around 30 minutes with the inlet line closed.

Running under gas ballast has a detrimental effect on the final vacuum which can be achieved.

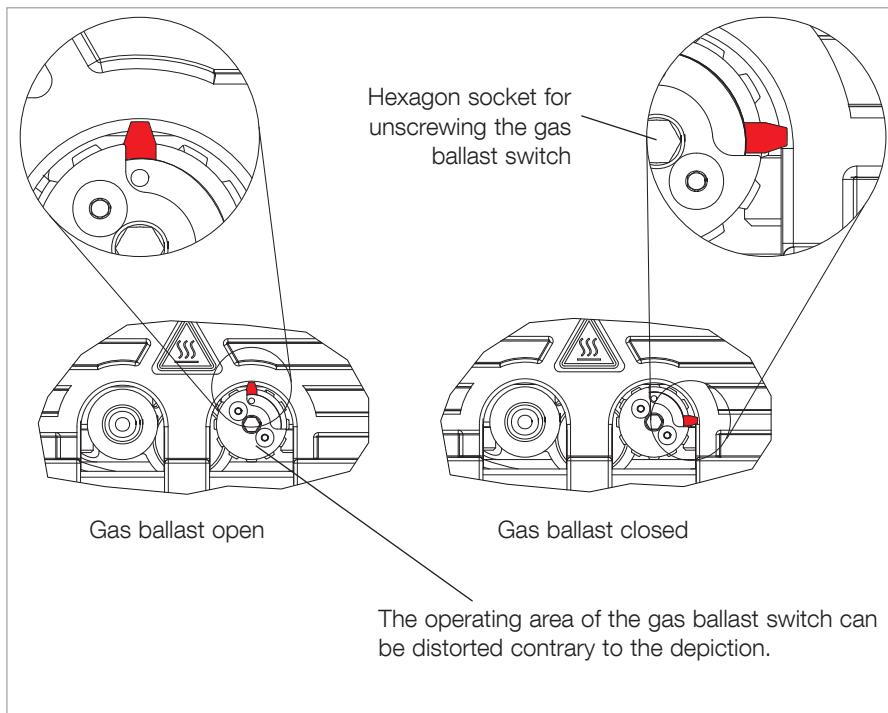


Fig. 3.4 Gas ballast switch

After a pumpdown cycle leave the pump to operate for at least 30 minutes approx. with the gas ballast open and the intake line closed until it is dry again.

With the gas ballast valve opened the vacuum vessel will be vented in the event of a power failure.

### Swapping out the gas ballast switch

The gas ballast switch can be swapped for a solenoid valve or a purge gas connector.

To do this, unscrew the gas ballast switch from the pump using a 6 mm Allen key.

Then, screw in a suitable solenoid valve or purge gas connector with a quarter-inch thread. Max torque = 8 Nm.

Following assembly, check for leaks in the pump in order to ensure optimum vacuum performance.

When connecting a gas supply to the gas ballast, reduce the pressure to 0.5 bar(g).

---

### NOTICE



## 4.4 Switching off / Decommissioning

### Switching off

Stop the pump using the start/stop switch or via an interface. If the pump is to be disconnected from the supply voltage, switch off the mains switch.

If the gas ballast valve is closed, rapid ventilation of the attached vacuum vessel and damage to any turbomolecular pump which may be attached are prevented by means of a check valve.

### Decommissioning

If the pump is to be decommissioned for an extended period of time, the pump should first be run dry and then evacuated.

The pump should then be switched off and removed from the system.

---

**DANGER**



When the pump has been used to pump hazardous gases, introduce appropriate safety precautions before opening the intake or the discharge connections.

Close off the inlet aperture using the blank flange supplied with the unit.

Leave the outlet flange open or, if necessary, connect it to a suitable exhaust system.

Start the pump and, with the gas ballast switch open, let it run for at least 30 minutes.

Thereafter, close the gas ballast switch and run the pump for a further 5 minutes.

Then, stop the pump and leave it connected to the power supply for another few minutes to cool down (the ventilator continues to run).

Next, close off the pump's outlet aperture using the blank flange supplied with the unit, switch of the MAINS switch and remove the mains plug.



## 5 Servicing

The pump is maintenance-free. We recommend that a precautionary service (an overhaul at the Leybold Service Centre) be carried out after five years of service life at the latest, or after 22,000 hours of operation, whichever occurs sooner. The pump is fitted with a counter for this purpose, which shows the remaining number of days of operation until the next recommended service on the pump's display.

If the recommended service interval is exceeded, the message **SEr** appears on the display, and the ALM and REV LED indicators flash.

Within the pumps, fluoropolymers are used as a sealant (FKM) and as a lubricant (PFPE). In case the pump suffers severe mechanical damage, it cannot be ruled out that toxic and/or corrosive substances may be released due to thermal decomposition. Do not open the pump module, and close off the inlet and exhaust flanges using blank flanges.

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### DANGER



### 5.1 Leybold Service

Whenever you send us in equipment, indicate whether the equipment is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

A copy of the form has been reproduced at the end of these Operating Instructions: "Declaration of Contamination for Compressors, Vacuum Pumps and Components". Another suitable form is available from [www.leybold.com](http://www.leybold.com) -> Downloads -> Download Documents.

Attach the form to each pump.

This statement detailing the type of contamination is required to satisfy legal requirements and for the protection of our employees.

We must return to the sender any equipment which is not accompanied by a contamination statement.

# Troubleshooting

## **6 Troubleshooting**

Faults and alarms indicate problems in the frequency converter or in the pump.

An alarm (warning) is indicated by a code on the display and the flashing ALM LED. The frequency converter output is not necessarily switched off, the pump is not necessarily stopped.

A fault is indicated by a code on the display and the ALM LED is on. The frequency converter output is always switched off immediately and the pump coast to stop.

To reset an alarm or an error, first find the cause for it. Remedy it and then switch the Start/Stop switch to Stop. Then switch the mains switch off, wait for a few seconds until the display goes out and then switch the mains switch on again, and thereafter switch the Start/Stop switch to Start.

This lists up the most important alarms and faults only.

# Troubleshooting

Malfunction	Error message	Brief Description	Likely cause	Remedy
End pressure will not be reached.	-	-	Gas ballast valve open	Close gas ballast valve, if possible.
			Leakage in the system	Check for leak.
			Gas ballast valve defective	Check for leak. Replace gas ballast valve – please send us your enquiry.
			Outlet blocked	Ensure the pump outlet is clear.
			Unacceptably high back pressure in outlet	Ensure that outlet pressure does not exceed 1200 mbar.
			Pump does not run at the rated rotational speed of 210 Hz	Set target speed of 210 Hz (using X104 RS-485 interface). Contact Leybold Service.
Error message in the display	SEr	Service Alarm	Pump service countdown has expired	Pump service required.
	aC	Overcurrent	Short circuit or earthing fault on the output side of the frequency converter	Contact Leybold Service.
Pump is extremely loud.	-	-	Bearing defective	Contact Leybold Service.
Pump switches off	aH oder HI	Heatsink Overheat	Ambient temperature too high	Set the pump up at a suitable location with a lower ambient temperature.
			Cooling air supply or discharge impeded	Ensure sufficient cooling air supply or discharge.
			Ventilator defective	Contact Leybold Service.
			Pump cooling fins blocked by dirt	Contact Leybold Service.
			Gas temperature too high	Check the system.
Pump switches off	aL1 or aL2	Motor Overload	Bearing defective	Contact Leybold Service.
			Foreign bodies, particles or process deposits are blocking the rotor	Contact Leybold Service.
Pump switches off	Uv1	DC Under-voltage	The voltage on the DC bus fell for longer than two seconds. (The power supply dropped or is too weak)	Check the power supply. Ensure that the power supply is sufficiently strong. Remove the pump from the mains supply for at least 10 seconds and restart.
Pump does not start.	-	-	No mains voltage present	Check mains power supply. Set the mains switch on the pump to 1.
Pump does not start.	Uv1 or Uv2	DC Under-voltage or Controller Under-voltage"	Input voltage too low	Compare the voltage range on the pump's nameplate with the available mains voltage, and connect the pump to a power supply at the correct voltage.

# Troubleshooting

Malfunction	Error message	Brief Description	Likely cause	Remedy
Pump does not start.	-	-	Mains cable defective or not correctly inserted	Check the pump's power supply
			If operating using the start-stop switch: the plug supplied is not connected to the X1 control interface, or pins 8 and 9 are not bridged	Connect the plug supplied, with a bridge between pins 8 and 9, to the X1 control interface.
			If operating using the X1 control interface: start-stop button is not set to "start"	Set start-stop switch to "start".
			Drive defective	Contact Leybold Service.
Pump does not start or switches off.	Uv2	Controller Under-voltage	Voltage too low for controlling the frequency converter	Disconnect the pump from the mains for at least 10 seconds and restart.
Pump does not start or switches off.	Uv3	DC Charge Circuit Fault	Charging circuit for DC bus is defective	Disconnect the pump from the mains for at least 10 seconds and restart.
Pump does not start or switches off.	ov	DC Over-voltage	DC bus voltage was too high The rundown time is too short Unstable motor controller Input voltage is too high	Compare the voltage range on the pump's nameplate with the available mains voltage, and connect the pump to a power supply at the correct voltage.
Pump does not reach nominal speed 210 Hz	-	-	Inlet pressure > 50 mbar	Close the pump inlet and check the rotational speed on the display.
			Outlet blocked	Ensure the pump outlet is clear.
			Unacceptably high back pressure in outlet	Ensure that outlet pressure does not exceed 1200 mbar.
Others				Contact Leybold Service.

## 7 Waste Disposal

The pump may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices. Further details are available on request.

Contaminated parts can be detrimental to health and environment. Before beginning with any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean pumps according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending us a pump, observe the regulations given in the Section “Leybold Service”.

---

### WARNING



## 8 Certificates

The ECODRY have been tested by the TÜV Rheinland of North America according to the requirements of

- IEC 61010-1:2010 (Third Edition)

CB Report no. 21260099 001  
CB Certificate no. DE 2-021229

- UL 61010-1:2012

CAN/CSA-C22.2 NO. 61010-1-12

cTUVus File no. 3168306.001  
cTUVus Certificate no. CU 72162606 01

The TÜV Rheinland of North America is a “Nationally Recognized Testing Laboratory” (NRTL) for the USA and Canada.



# EU Declaration of Conformity

(Translation of original Declaration of Conformity)

**The manufacturer:** Leybold GmbH  
Bonner Strasse 498  
D-50968 Köln  
Germany

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EU Directives. This declaration becomes invalid if modifications are made to the product without agreement of Leybold GmbH.

**Product designation:** Multi-stage Roots vacuum pump  
**Type designation:** ECODRY 40 plus      ECODRY 65 plus  
**Part numbers:** 161040V01      161065V01

## The products comply with the following Directives:

Machinery Directive (2006/42/EC)

The safety objectives of the Low Voltage Directive 2014/35/EU are complied with in accordance with Appendix 1 No. 1.5.1 of Machinery Directive 2006/42/EC.

Electromagnetic Compatibility (2014/30/EU)

Directive RoHS (2011/65/EU)

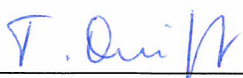
## The following harmonized standards have been applied:

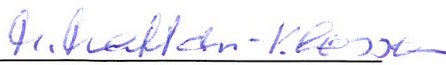
EN 1012-2:1996+A1:2009	Compressors and vacuum pumps — Safety requirements — Part 2: Vacuum pumps
EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: General requirements Emissions: Group 1, Class B Immunity: Industrial electromagnetic environment
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

**Documentation officer:** Herbert Etges  
T: +49(0)221 347 0  
F: +49(0)221 347 1250  
documentation@leybold.com

Cologne, January 24, 2017

Cologne, January 24, 2017

  
i.V. Dr. Thomas Dreifert  
Head of Product Group Rough Vacuum  
& Technology Management

  
ppa. Dr. Monika Mattern-Klosson  
Head of Quality & Business Process Management

Document No.: 300579067-002-A4

## Declaration of Contamination of Compressors, Vacuum Pumps and Components

The repair and / or servicing of compressors, vacuum pumps and components will be carried out only if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer can refuse to accept any equipment without a declaration.


**A separate declaration has to be completed for each single component.**

This declaration may be completed and signed only by authorized and qualified staff.

Customer/Dep./Institute : _____ Address : _____ _____ Person to contact: _____ Phone : _____ Fax: _____ End user: _____	Reason for return: <input checked="" type="checkbox"/> applicable please mark <b>Repair:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty <b>Exchange:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty <input type="checkbox"/> Exchange already arranged / received <b>Return only:</b> <input type="checkbox"/> rent <input type="checkbox"/> loan <input type="checkbox"/> for credit <b>Calibration:</b> <input type="checkbox"/> DKD <input type="checkbox"/> Factory-calibr. <input type="checkbox"/> Quality test certificate DIN 55350-18-4.2.1																																																															
<b>A. Description of the Leybold product:</b> _____ <b>Failure description:</b> _____ Material description : _____ Catalog number: _____ <b>Additional parts:</b> _____ Serial number: _____ <b>Application-Tool:</b> _____ Type of oil (ForeVacuum-Pumps) : _____ <b>Application- Process:</b> _____																																																																
<b>B. Condition of the equipment</b> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:40%;"></th> <th style="width:10%; text-align: center;">No<sup>1)</sup></th> <th style="width:10%; text-align: center;">Yes</th> <th style="width:10%; text-align: center;">No</th> <th style="width:20%;"></th> <th style="width:10%; text-align: center;">No<sup>1)</sup></th> <th style="width:10%; text-align: center;">Yes</th> </tr> </thead> <tbody> <tr> <td>1. Has the equipment been used</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">→</td> <td>toxic</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>2. Drained (Product/service fluid)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> <td>corrosive</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>3. All openings sealed airtight</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> <td>flammable</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>4. Purged</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> <td>explosive <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td colspan="4">If yes, which cleaning agent</td> <td></td> <td>radioactive <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td colspan="4">and which method of cleaning</td> <td></td> <td>microbiological <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td colspan="4"><sup>1)</sup> If answered with "No", go to D. ←</td> <td></td> <td>other harmful substances</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table>			No <sup>1)</sup>	Yes	No		No <sup>1)</sup>	Yes	1. Has the equipment been used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	→	toxic	<input type="checkbox"/>	<input type="checkbox"/>	2. Drained (Product/service fluid)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		corrosive	<input type="checkbox"/>	<input type="checkbox"/>	3. All openings sealed airtight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		flammable	<input type="checkbox"/>	<input type="checkbox"/>	4. Purged	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		explosive <sup>2)</sup>	<input type="checkbox"/>	<input type="checkbox"/>	If yes, which cleaning agent					radioactive <sup>2)</sup>	<input type="checkbox"/>	<input type="checkbox"/>	and which method of cleaning					microbiological <sup>2)</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<sup>1)</sup> If answered with "No", go to D. ←					other harmful substances	<input type="checkbox"/>	<input type="checkbox"/>
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<b>C. Description of processed substances (Please fill in absolutely)</b> 1. What substances have come into contact with the equipment ? Trade name and / or chemical term of service fluids and substances processed, properties of the substances According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)																																																																
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:5%;">X</th> <th style="width:30%;">Tradename:</th> <th style="width:65%;">Chemical name:</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td>a)</td><td> </td><td> </td></tr> <tr><td>b)</td><td> </td><td> </td></tr> <tr><td>c)</td><td> </td><td> </td></tr> <tr><td>d)</td><td> </td><td> </td></tr> </tbody> </table>		X	Tradename:	Chemical name:				a)			b)			c)			d)																																															
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<sup>2)</sup> Components contaminated by microbiological, explosive or radioactive products/substances will not be accepted without written evidence of decontamination.																																																																

### D. Legally binding declaration

I / we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.


 Name of authorized person (block letters) : \_\_\_\_\_  
 \_\_\_\_\_  
 Date \_\_\_\_\_ signature of authorized person \_\_\_\_\_

firm stamp



# Sales and Service

## Germany

### Leybold GmbH

Sales, Service, Support Center (3SC)  
Bonner Strasse 498  
D-50968 Cologne  
T: +49-(0)221-347 1234  
F: +49-(0)221-347 31234  
sales@leybold.com  
www.leybold.com

### Leybold GmbH

#### Sales Area North

Branch Office Berlin  
Industriestrasse 10b  
D-12099 Berlin  
T: +49-(0)30-435 609 0  
F: +49-(0)30-435 609 10  
sales.bn@leybold.com

### Leybold GmbH

#### Sales Office South

Branch Office Munich  
Karl-Hammerschmidt-Strasse 34  
D-85609 Aschheim-Dornach  
T: +49-(0)89-357 33 9-10  
F: +49-(0)89-357 33 9-33  
sales.mn@leybold.com  
service.mn@leybold.com

### Leybold Dresden GmbH

#### Service Competence Center

Zur Wetterwarte 50, Haus 304  
D-01109 Dresden  
Service:  
T: +49-(0)351-88 55 00  
F: +49-(0)351-88 55 041  
info.dr@leybold.com

## Europe

### Belgium

### Leybold Nederland B.V.

#### Belgisch bijkantoor

Leuvensesteenweg 542-9A  
B-1930 Zaventem  
Sales:  
T: +32-2-711 00 83  
F: +32-2-720 83 38  
sales.zv@leybold.com  
Service:  
T: +32-2-711 00 82  
F: +32-2-720 83 38  
service.zv@leybold.com

### France

### Leybold France S.A.S.

Parc du Technopolis, Bâtiment Beta  
3, Avenue du Canada  
F-91940 Les Ulis cedex  
Sales and Service:  
T: +33-1-69 82 48 00  
F: +33-1-69 07 57 38  
info.ctb@leybold.com  
sales.ctb@leybold.com

### Leybold France S.A.S.

Valence Factory  
640, Rue A. Bergès  
B.P. 107  
F-26501 Bourg-lès-Valence Cedex  
T: +33-4-75 82 33 00  
F: +33-4-75 82 92 69  
marketing.vc@leybold.com

## Great Britain

### Leybold UK LTD.

Unit 9  
Silverglade Business Park  
Leatherhead Road  
Chessington  
Surrey (London)  
KT9 2QL  
Sales:  
T: +44-13-7273 7300  
F: +44-13-7273 7301  
sales.ln@leybold.com  
Service:  
T: +44-13-7273 7320  
F: +44-13-7273 7303  
service.ln@leybold.com

## Italy

### Leybold Italia S.r.l.

Via Trasimeno 8  
I-20128 Mailand  
Sales:  
T: +39-02-27 22 31  
F: +39-02-27 20 96 41  
sales.mi@leybold.com  
Service:  
T: +39-02-27 22 31  
F: +39-02-27 22 32 17  
service.mi@leybold.com

## Netherlands

### Leybold Nederland B.V.

Floridadreef 102  
NL-3565 AM Utrecht  
Sales and Service:  
T: +31-(30) 242 63 30  
F: +31-(30) 242 63 31  
sales.ut@leybold.com  
service.ut@leybold.com

## Switzerland

### Leybold Schweiz AG, Pfäffikon

Churerstrasse 120  
CH-8808 Pfäffikon  
Warehouse and shipping address:  
Riedthofstrasse 214  
CH-8105 Regensdorf  
Sales:  
T: +41-44-308 40 50  
F: +41-44-302 43 73  
sales.zh@leybold.com  
Service:  
T: +41-44-308 40 62  
F: +41-44-308 40 60  
service.zh@leybold.com

## Spain

### Leybold Hispánica, S.A.

C/. Huelva, 7  
E-08940 Cornellà de Llobregat  
(Barcelona)  
Sales:  
T: +34-93-666 43 11  
F: +34-93-666 43 70  
sales.ba@leybold.com  
Service:  
T: +34-93-666 46 11  
F: +34-93-685 43 70  
service.ba@leybold.com

## America

## USA

### Leybold USA Inc.

5700 Mellon Road  
USA-Export, PA 15632  
T: +1-724-327-5700  
F: +1-724-325-3577  
info.ex@leybold.com  
Sales:  
T: +1-724-327-5700  
F: +1-724-333-1217  
Service:  
T: +1-724-327-5700  
F: +1-724-325-3577

## Brazil

### Leybold do Brasil

Rod. Vice-Prefeito Hermenegildo Tonolli,  
nº. 4413 - 6B  
Distrito Industrial  
Jundiá - SP  
CEP 13.213-086  
Sales and Service:  
T: +55 11 3395 3180  
F: +55 11 99467 5934  
sales.ju@leybold.com  
service.ju@leybold.com

## Asia

## P. R. China

### Leybold (Tianjin)

#### International Trade Co. Ltd.

Beichen Economic  
Development Area (BEDA),  
No. 8 Western Shuangchen Road  
Tianjin 300400  
China  
Sales and Service:  
T: +86-22-2697 0808  
F: +86-22-2697 4061  
F: +86-22-2697 2017  
sales.tj@leybold.com  
service.tj@leybold.com

## India

### Leybold India Pvt Ltd.

No. 82(P), 4th Phase  
K.I.A.D.B. Plot  
Bommasandra Industrial Area  
Bangalore - 560 099  
Indien  
Sales and Service:  
T: +91-80-2783 9925  
F: +91-80-2783 9926  
sales.bgl@leybold.com  
service.bgl@leybold.com

## Japan

### Leybold Japan Co., Ltd.

Headquarters  
Shin-Yokohama A.K.Bldg., 4th floor  
3-23-3, Shin-Yokohama  
Kohoku-ku, Yokohama-shi  
Kanagawa-ken 222-0033  
Japan  
Sales:  
T: +81-45-471-3330  
F: +81-45-471-3323  
sales.yh@leybold.com

### Leybold Japan Co., Ltd.

Tsukuba Technical Service Center  
1959, Kami-yokoba  
Tsukuba-shi, Ibaraki-shi 305-0854  
Japan  
Service:  
T: +81-29 839 5480  
F: +81-29 839 5485  
service.iik@leybold.com

## Malaysia

### Leybold Malaysia

#### Leybold Singapore Pte Ltd.

No. 1 Jalan Hi-Tech 2/6  
Kulim Hi-Tech Park  
Kulim, Kedah Darul  
Aman 09000  
Malaysia  
Sales and Service:  
T: +604 4020 222  
F: +604 4020 221  
sales.ku@leybold.com  
service.ku@leybold.com

## South Korea

### Leybold Korea Ltd.

3F. Jellzone 2 Tower  
Jeongja-dong 159-4  
Bundang-gu Sungnam-si  
Gyeonggi-do  
Bundang 463-384, Korea  
Sales:  
T: +82-31 785 1367  
F: +82-31 785 1359  
sales.bd@leybold.com  
Service:  
623-7, Upsung-Dong  
Cheonan-Si  
Chungcheongnam-Do  
Korea 330-290  
T: +82-41 589 3035  
F: +82-41 588 0166  
service.cn@leybold.com

## Singapore

### Leybold Singapore Pte Ltd.

8 Commonwealth Lane #01-01  
Singapore 149555  
Singapore  
Sales and Service:  
T: +65-6303 7030  
F: +65-6773 0039  
sales.sg@leybold.com  
service.sg@leybold.com

## Taiwan

### Leybold Taiwan Ltd.

No 416-1, Sec. 3  
Chunghsin Rd., Chutung  
Hsinchu County 310  
Taiwan, R.O.C.  
Sales and Service:  
T: +886-3-500 1688  
F: +886-3-583 3999  
sales.hc@leybold.com  
service.hc@leybold.com

## Headquarter

### Leybold GmbH

Bonner Strasse 498  
D-50968 Cologne  
T: +49-(0)221-347-0  
F: +49-(0)221-347-1250  
info@leybold.com



www.leybold.com