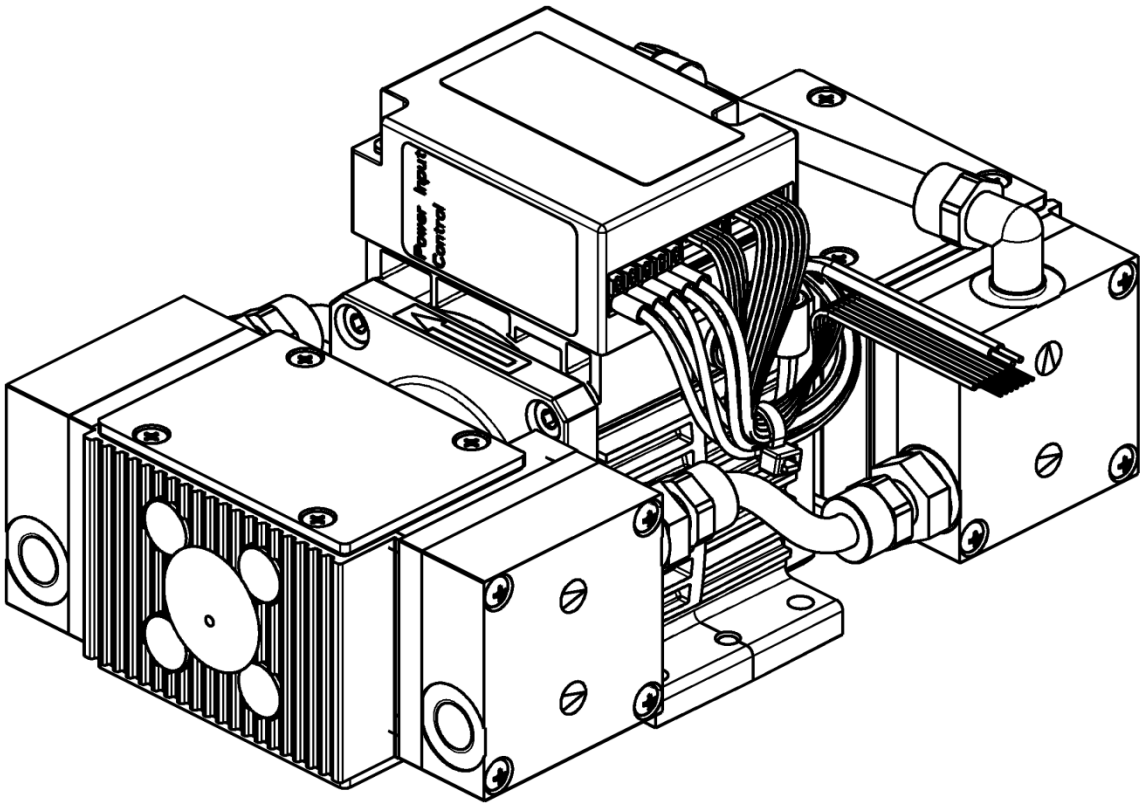
OEM

N 84
TRANSLATION OF ORIGINAL OPERATING AND INSTALLATION INSTRUCTIONS
ENGLISH

MINI DIAPHRAGM VACUUM PUMPS



Note!
Before operating the pump and the accessories, please read the operating instructions on the web site (www.knf.com/downloads) and pay attention to the safety precautions!

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1. About this document

1.1. Using the Operating and Installation Instructions

The Operating and Installation Instructions are part of the pump.

➔ Pass on the Operating and Installation Instructions to the next owner.

Project pump

Customer-specific project pumps (pump models which begin with “PJ” or “PM”) may differ from the Operating and Installation Instructions.

➔ For project pumps, also observe the agreed upon specifications.

1.2. Symbols and markings

Warning



WARNING

A danger is located here.

Possible consequences of a failure to observe the warning are specified here. The signal word, e.g. Warning, indicates the danger level.

➔ Measures for avoiding the danger and its consequences are specified here.

Danger levels

Signal word	Meaning	Consequences if not observed
DANGER	warns of immediate danger	Death or serious injuries and/or serious damage are the consequence.
WARNING	warns of possible danger	Death or serious injuries and/or serious damage are possible.
CAUTION	warns of a possibly dangerous situation	Minor injuries or damage are possible.

Tab. 1

Other information and symbols

➔ An activity to be carried out (a step) is specified here.

1. The first step of an activity to be carried out is specified here. Additional, consecutively numbered steps follow.

This symbol refers to important information.

2. Use

2.1. Proper use

The pumps are exclusively intended for transferring gases and vapors.

Owner's responsibility

Operating parameter and conditions

Only install and operate the pumps under the operating parameters and conditions described in Chapter 4. Technical Data.

Only complete pumps may be taken into service.

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

Requirements for transferred medium

Before using a medium, check whether the medium can be transferred danger-free in the specific application case.

Before using a medium, check the compatibility of the materials of the pump head, diaphragm, and valves with the medium.

Only transfer gases which remain stable under the pressures and temperatures occurring in the pump.

2.2. Improper use

The pumps must not be operated in an explosive atmosphere.

The pumps are not suitable for transferring dust.

The pumps are not suitable for transferring liquids.

The pumps are not suitable for use with aggressive media. Other pumps in the KNF product line are designed for use with aggressive media. Please contact us for more information.

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

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

3. Safety

Observe the safety precautions in Chapters 6. Installation and connection and 7. Operation.

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

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

Personnel

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

Make sure that all personnel have read and understood the Operating and Installation Instructions, especially the “Safety” Chapter.

Working in a safety-conscious manner

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

Ensure that the pump is separated from the mains and is de-energized.

Handling dangerous media

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

Handling flammable media

Be aware that the pumps are not designed to be explosion-proof.

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

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

Hence, make sure that the temperature of the medium is sufficiently below its ignition temperature, even when it is compressed to maximum permissible operating pressure of the pump. The pump’s maximum permissible operating pressure is stated in the Technical data (see Chapter 4).

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

In case of doubt, consult the KNF customer service.

Environmental protection

All replacement parts should be properly stored and disposed of in accordance with the applicable environmental protection regulations. Ensure adherence to the pertinent national and international regulations. This applies especially to parts contaminated with toxic substances.

EC directives / standards

For the purposes of Machinery Directive 2006/42/EC, pumps are “partly completed machinery,” and are therefore to be regarded as not ready for use. Partly completed machinery may not be commissioned until such time as it has been determined that the ma-

chine in which the partly completed machinery is to be assembled conforms to the provisions of the Machinery Directive 2006/42/EC. The following essential requirements of Annex I of Directive 2006/42/EC (general principles) are applied and observed:

- General Principles No. 1
- No. 1.1.2. / 1.1.3. / 1.3.1. / 1.3.3. / 1.3.4. / 1.4.1. / 1.5.1.* / 1.5.2.* / 1.5.8. / 1.5.9. / 1.7.4. / 1.7.4.1. / 1.7.4.3.
  (* only for N 84.3 ANE)

As these partly completed machinery are OEM-models the power supplies and the equipment for disconnecting and switching-off the partly completed machinery respectively have to be considered when mounting as well as over-current and overload protective gear.

In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.

CE The pumps conform to the Directive 2011/65/EU.

The following harmonized standards are met:

N 84.3 ANE	N 84.3 ANDC N 84.4 ANDC	N 84.4 ANDC-B N 84.4 AN.29DC-B
DIN EN 55014-1/2	DIN EN 55014-1/2	DIN EN 61000-6-2/3
DIN EN 61000-3-2/3	DIN EN 60034-1	DIN EN 50581
DIN EN 50581	DIN EN 61000-6-1/2	
DIN EN 60335-1	DIN EN 50581	

Tab. 2

Customer services and repairs

All repairs to the pump(s) must be carried out by the relevant KNF Customer Service team.

Housings with voltage-caring parts may be opened by technical personnel only.

Use only genuine parts from KNF for servicing work.

4. Technical Data

N 84.3 ANE

Pneumatic performance	
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum [mbar abs.]	7
Flow rate at atm. pressure [l/min]*	4.2
Pneumatic connections	
Thread size	G 1/8
Ambient and media temperature	
Permissible ambient temperature	+ 5°C to + 40°C
Permissible media temperature	+ 5°C to + 40°C
Other parameters	
Weight [kg]	1.4
Dimensions: L x H x W [mm]	136 x 74 x 109
Maximum permissible ambient relative humidity	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C.
Maximum altitude of installation [m above sea level]	2000
Electrical data	
Voltage / Frequencies	see type label
Max. operating current	
Pump power consumption	
Maximum permissible mains voltage fluctuations	+/- 10%
Motor protection class	IP 00
Pump materials	
Pump head	Aluminum
Diaphragm	PTFE-coated
Valve	EPDM

Tab. 3 **liters in standard state (1013 mbar)*

Thermo switch

For pumps with thermo switch:
The pumps are fitted with a thermo switch to protect against overloading.

WARNING

Automatic starting can cause personal injury and pump damage

When the operation of the pump is interrupted by the thermal switch, the pump will restart automatically after cooling down.

➔ Take all necessary care to prevent this leading to a dangerous situation.

Project-specific pumps that are **not** fitted with a thermal switch must be protected by the user against the risk of overheating.

N 84.3 ANDC

Pneumatic performance	
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum [mbar abs.]	7
Flow rate at atm. pressure [l/min]*	5
Pneumatic connections	
Thread size	G 1/8
Ambient and media temperature	
Permissible ambient temperature	+ 5°C to + 40°C
Permissible media temperature	+ 5°C to + 40°C
Other parameters	
Weight [kg]	0.9
Dimensions: L x H x W [mm]	133 x 50 x 105
Maximum permissible ambient relative humidity	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C.
Maximum altitude of installation [m above sea level]	2000
Electrical data	
Motor type	DC motor
Voltage	See type label
Max. operating current	
Maximum permissible mains voltage fluctuations	+/- 10%
Motor protection class	IP 00
Pump materials	
Pump head	Aluminum
Diaphragm	PTFE-coated
Valve	EPDM

Tab. 4 **liters in standard state (1013 mbar)*

N 84.4 ANDC

Pneumatic performance	
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum [mbar abs.]	2
Flow rate at atm. pressure [l/min]*	4.8
Pneumatic connections	
Thread size	G 1/8
Ambient and media temperature	
Permissible ambient temperature	+ 5°C to + 40°C
Permissible media temperature	+ 5°C to + 40°C
Other parameters	
Weight [kg]	1.6
Dimensions: L x H x W [mm]	194 x 77 x 115
Maximum permissible ambient relative humidity	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C.
Maximum altitude of installation [m above sea level]	2000
Electrical data	
Motor type	DC motor
Voltage	See type label
Max. operating current	
Maximum permissible mains voltage fluctuations	+/- 10%
Motor protection class	IP 00
Pump materials	
Pump head	Aluminum
Diaphragm	PTFE-coated
Valve	EPDM

Tab. 5 **liters in standard state (1013 mbar)*

N 84.4 ANDC-B and N 84.4 AN.29DC-B

Pneumatic performance	
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum at nominal speed [mbar abs.]	2
Flow rate at atm. pressure and nominal speed [l/min]*	4.8
Flow rate at atm. pressure and 0.1 V control voltage (only .29 version) [l/min]*	1
Pneumatic connections	
Thread size	G 1/8
Ambient and media temperature	
Permissible ambient temperature	+ 5°C to + 40°C
Permissible media temperature	+ 5°C to + 40°C
Other parameters	
Weight [kg]	1.8
Dimensions L x H x W [mm]	180 x 89 x 106
Maximum permissible ambient relative humidity	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C
Maximum altitude of installation [m above sea level]	2000
Electrical data	
Motor type	Brushless DC motor
Voltage [V]	24
Control voltage (only .29 version) [V]	0.1…5**
Max. operating current [A] - for $p > p_{atm.}$ - for $p < p_{atm.}$	 1.2 1.2
Starting current	The starting current can be up to 50% above the maximum operating current.
Starting ramp [ms]	800
Max. power consumption of the pump [W]: - for $p > p_{atm.}$ - for $p < p_{atm.}$	 28.8 28.8
Maximum permissible mains voltage fluctuations	+/- 10%
Motor protection class	IP 20
Overcurrent limitation of the motor electronics [A]	7.5
Pump materials	
Pump head	Aluminum
Diaphragm	PTFE-coated
Valve	EPDM

Tab. 6

**liters in standard state (1013 mbar)*
***further control voltage versions on demand*

The pump is protected against overheating by a temperature sensor on the motor board and equipped with overcurrent protection.
If one of these safety functions is triggered or if the maximum blocking time of the rotor is exceeded due to a fault, the pump will be shut down and must be manually reset, as follows:

➔ Separate pump from the mains.

➔ Remove the cause(s) of the fault before restarting.

5. Design and function

1 Inlet (suction side)
2 Pneumatic connection
3 Outlet (pressure side)
4 Motor

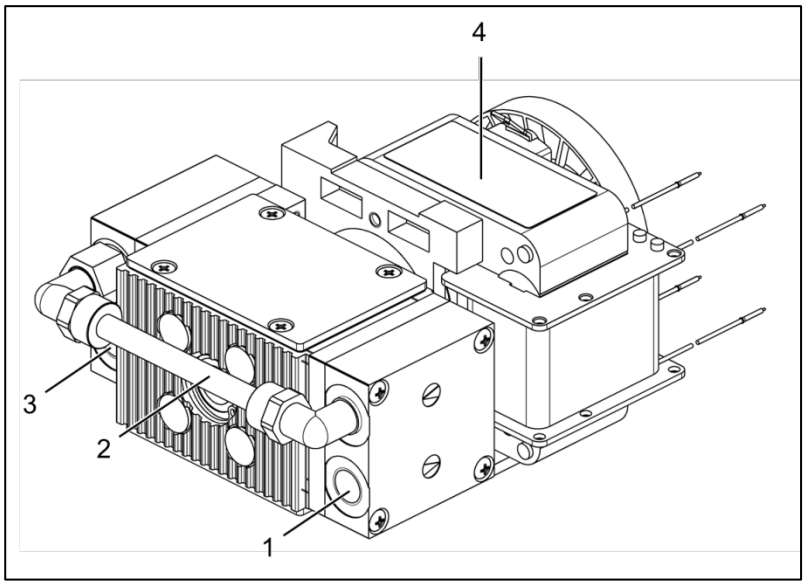


Fig. 1: Assembly of N 84.3 ANE

Assembly of N 84.3 ANDC

1 Inlet (suction side)
2 Pneumatic connection
3 Outlet (pressure side)
4 Motor

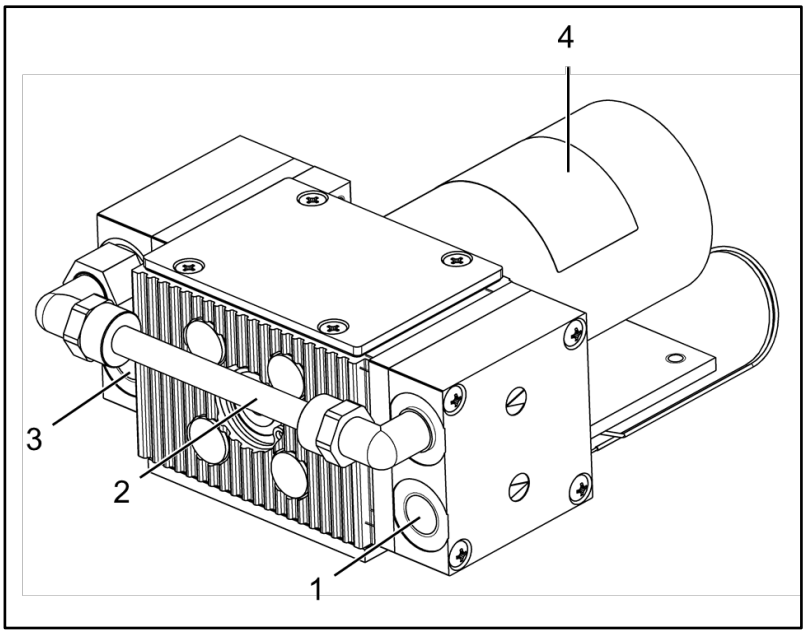


Fig. 2: Assembly of N 84.3 ANDC

Assembly of N 84.4 ANDC

1 Inlet (suction side)
2 Outlet (pressure side)
3 Motor
4 Pneumatic connection

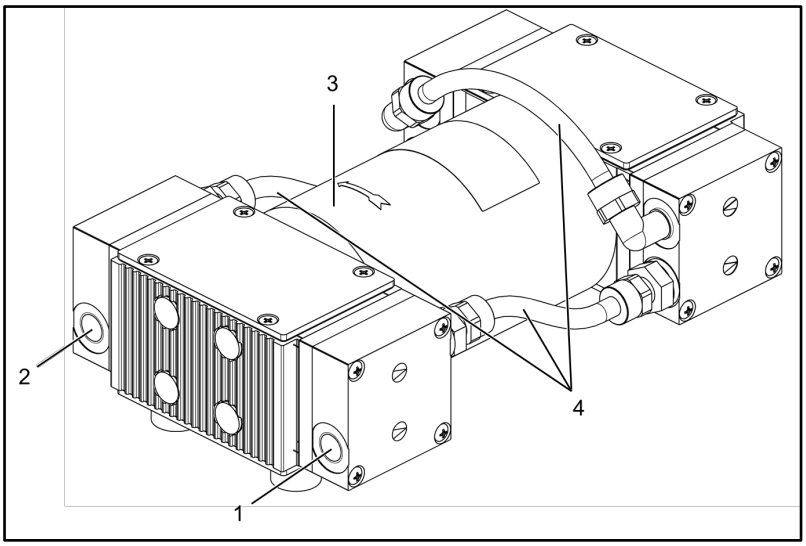


Fig. 3: Assembly of N 84.4 ANDC

Assembly of N 84.4 ANDC and N 84.4 AN.29DC-B

1 Inlet (suction side)
2 Outlet (pressure side)
3 Pneumatic connection
4 Motor

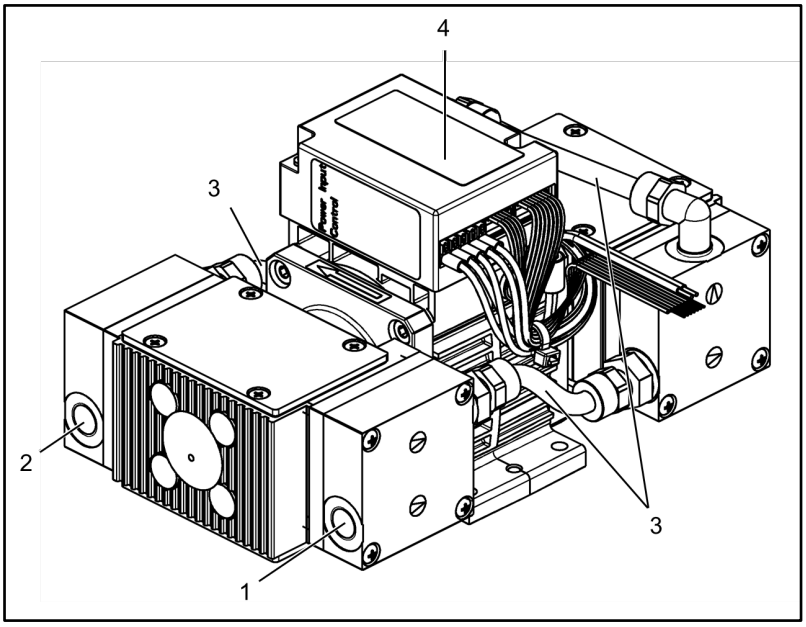


Fig. 4: Assembly of N 84.4 ANDC-B and N 84.4 AN.29DC-B

How diaphragm pumps work

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

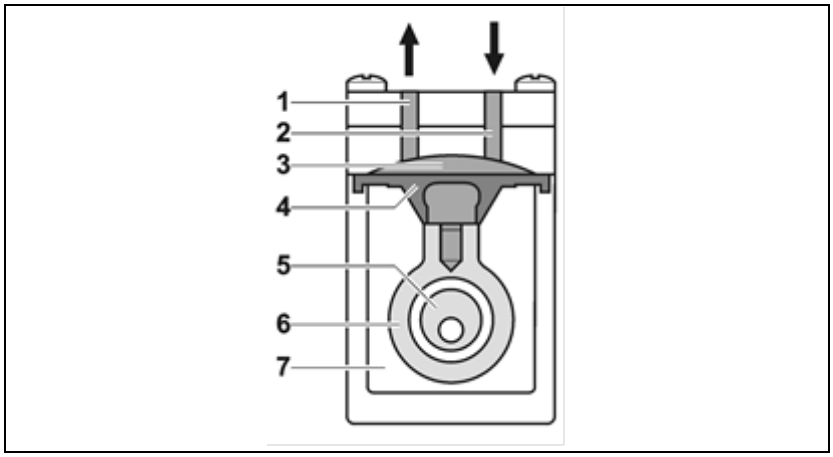


Fig. 5: Pump head

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

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

6. Installation and connection

Always install the pumps under the operating parameters and conditions described in Chapter 4. Technical Data.

Observe all safety precautions (see Chapter 3).

6.1. Setting up or installing the pump

➔ Choose a safe location (flat surface) for the pump.

➔ Before installation, store the pump at the installation location to bring it up to ambient temperature.

Dimensions

➔ Refer to Fig. 6 (N 84.3 ANE), Fig. 7 (N 84.3 ANDC), Fig. 8 (N 84.4 ANDC) or Fig. 9 (N 84.4 ANDC-B and N 84.4 AN.29DC-B) for the pump dimensions.

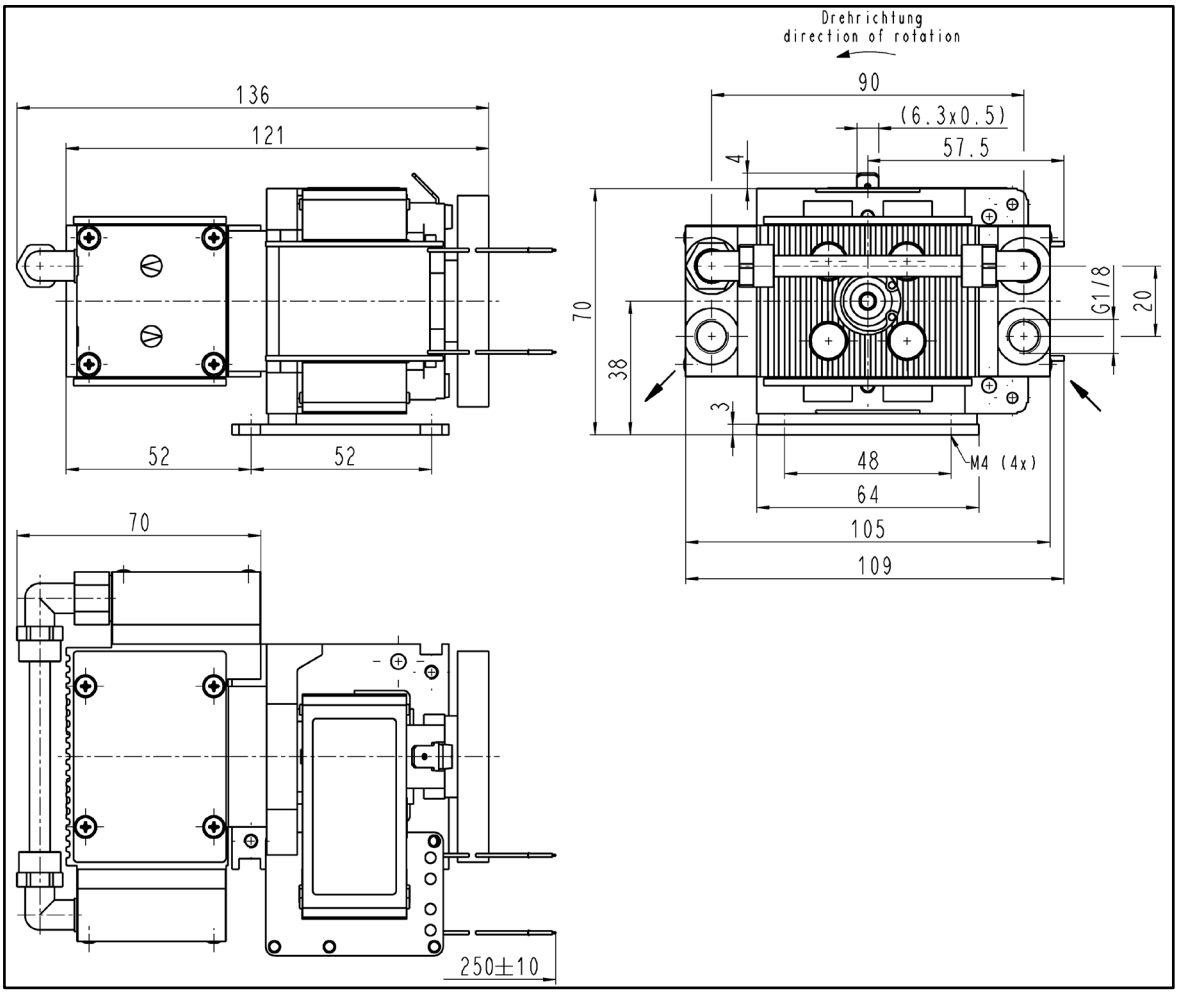


Fig. 6: Attachment dimensions of N 84.3 ANE
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

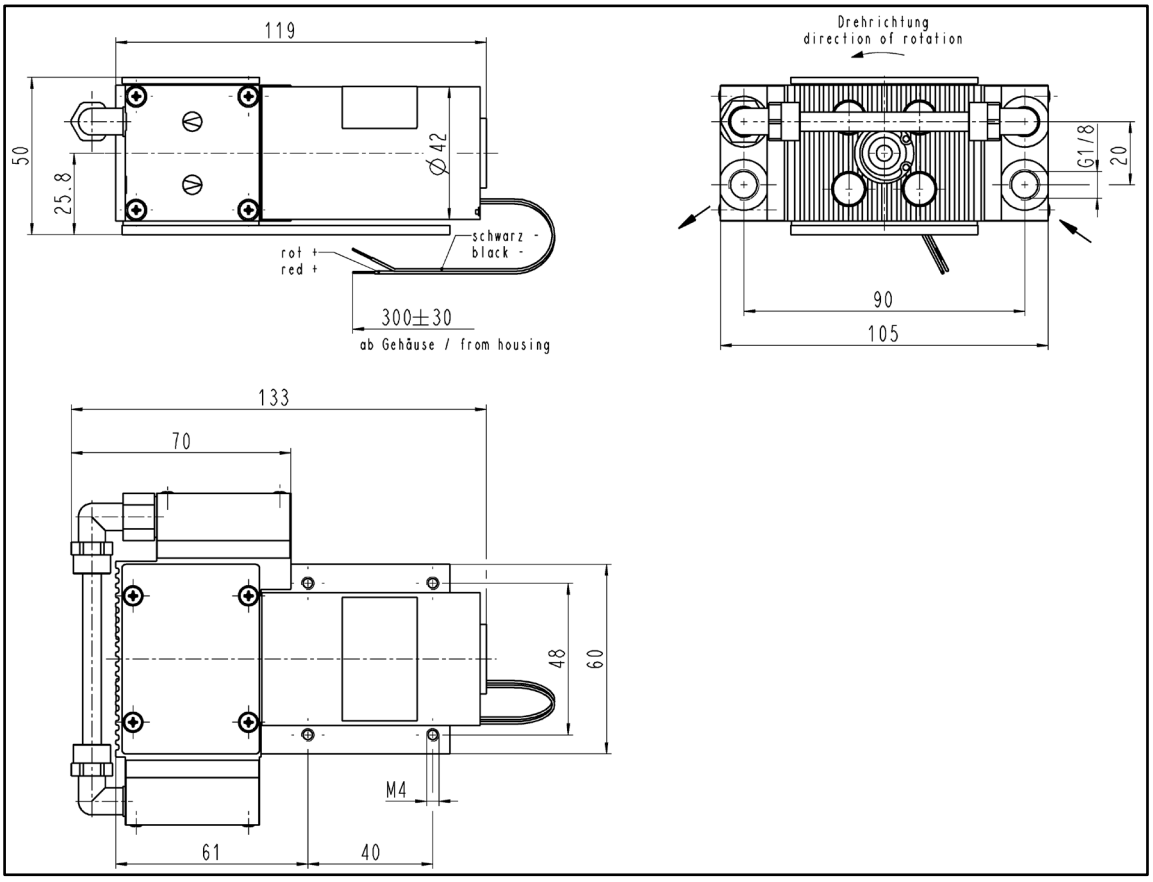


Fig. 7: Attachment dimensions of N 84.3 ANDC
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

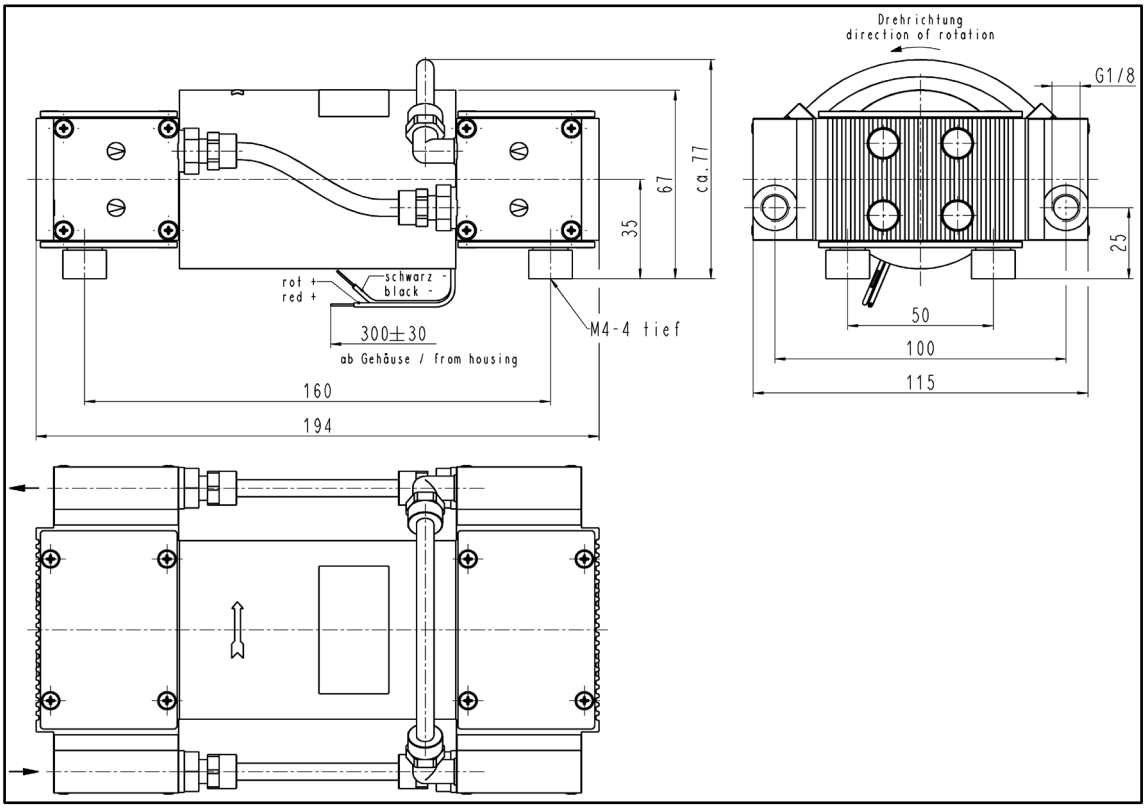


Fig. 8: Attachment dimensions of N 84.4 ANDC
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

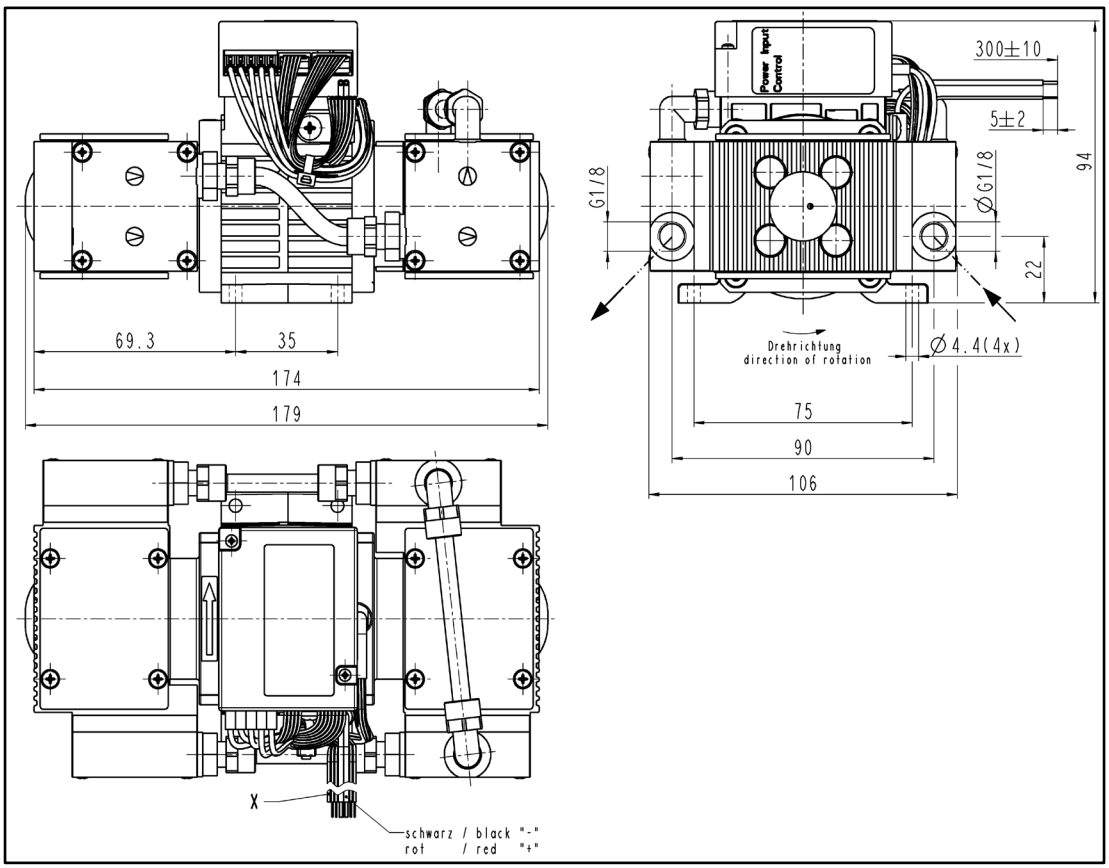


*Fig. 9: Attachment dimensions of N 84.4 ANDC-B and N 84.4 AN.29DC-B (dimensional tolerances according to DIN ISO 2768-1, tolerance class V) *Connection (X) only for N 84.4AN.29DC-B*

Cooling air supply

Only for N 84.3 ANE:

➔ When setting up or installing the pump, make sure that the fan can draw in an adequate amount of cooling air.

For pumps with fan: Install the pump so as accidental finger contact is with the fan is impossible.

Installation location

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

i The pump motor's IP protection class is provided on the type plate.

➔ Set up or install the pump at the highest point in the system to prevent condensate from collecting in the pump head.

➔ Protect the pump against dust.

➔ Protect the pump against grease and oils.

➔ Protect the pump against vibration and impact.

Accessories

Only for pump N 84.3 ANE:
Rubber feet (accessories) may be used to reduce noise, and vibration. They are not suitable for mounting the pump on its side, or suspended.

6.2. Electrical connection



DANGER

Extreme danger from electrical shock

➔ Only have the pump connected by an authorized specialist.

➔ Only have the pump connected when the power supply is disconnected.

➔ When connecting the device to a power source, the relevant standards, directives, regulations, and technical standards must be observed.

➔ In the electrical installation, arrangements (complying with EN 60335-1 must be made for disconnecting the pump motor from the electrical supply.

➔ For pumps with AC motor:
The motors of the pump must be protected according to EN 60204-1 (protection against excess current, or overloading).

i For operating current see type plate.

➔ For pumps with DC motor:
The pumps may only be operated in a SELV power circuit.

➔ It is recommended that an additional “Emergency Stop” switch is installed.

➔ The pump must be installed so that contact with live parts (electrical connection) is impossible.

Pumps with AC motor

1. Make sure that the power supply data match the data on the pump type plate.

i The voltage must not vary by more than + 10% and – 10% from that shown on the type-plate.

2. Connect earth (ground) wire to the motor.
3. Connect motor wires.

Pumps with DC motor

1. Make sure that the power supply data match the data on the pump type plate.

i The voltage must not vary by more than + 10% and – 10% from that shown on the type-plate.

2. Connect the positive and negative terminals.

i Note the proper polarity:
red connection cable: +
black connection cable: -

EMC-compatible Installation

The Tests:

- Magnetic field with energy-technical frequency
- Electromagnetic HF field, amplitude-modulated
- Electromagnetic HF field, pulse-modulated
- Discharging of static electricity
- High frequency, asymmetric
- Fast transients

were not carried out, cause the products do not contain electronic modules, which can be affected by these tests.

The Surge-test can only be passed with additional means, or is not mandatory, if: Form EN 61000-6-1 technical norm for EMC protection, part 1, 10 test demands for EMC protection, table 3, EMC protection, D.C.-power in- and outputs. Remark 3: (quotation) Not to be used with input connections which are foreseen for a connection with a battery or a rechargeable battery which has to be removed or disconnected from the device for the recharge.

Devices with a D.C. power input which are foreseen to be operated with an A.C. / D.C. converter have to be tested at an A.C. power input of an A.C. / D.C. converter fixed by the manufacturer. In case the converter was not fixed they have to be tested at an A.C. power input of a typical (usual) A.C. / D.C. converter.

The test is applicable for D.C. power inputs which are foreseen for a permanent connection to cables which are longer than 10 m.

Pumps with brushless DC motor

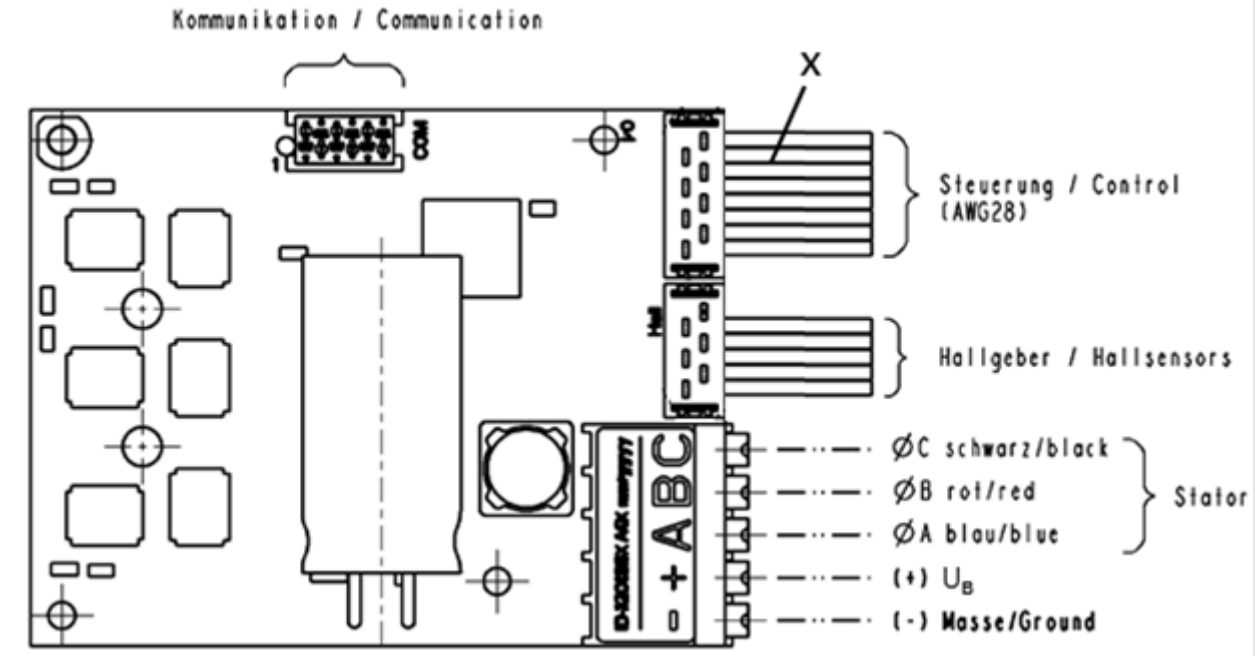
1. Make sure that the power supply data match the data on the type plate.

The voltage must not vary by more than + 10% and – 10% from that shown on the type-plate.

2. Electrical connect of the pump according to Fig. 10, page 20.

Note the proper polarity (see marking on the motor). Incorrect lead connection will damage electronics of brushless dc motors (type designation ending with B). The supply wires have inverse-polarity protection on the motor board for this purpose, while the control-voltage wires do not have this protection function.

Control voltage may only be applied if the motor controller is supplied with operating voltage. Otherwise damages can occur on the motor controller.



Pin Nr. Pin No.	Farbcodierung Color coding	Benennung Description	Elektrische Eigenschaft Electrical characteristic	
1	schwarz black	DC Spannungsquelle DC power supply	$U_{0\text{-}DC}$: 5 ± 0.2V I_0: max. 170 mA	
2	weiß white	Eingang Steuerspannung Control voltage input	$U_{IN\text{-}DC}$: 0…5V ($P_{IN\text{-}MAX}$: ≤5mW) $f_{PWM\text{-}IN}$: 100 Hz ± 50Hz duty cycle: 0…100% R_{IN}: ≥12.2Ω @1kHz	
3*	grau grey	Masse Ground		
4	lila purple	Ausgang Fehlermeldung Error signal output	$U_{ERROR\text{-}0\text{-}DC}$: ≤0.6V / $U_{ERROR\text{-}1\text{-}DC}$: ≥4.5V…$U_{0\text{-}DC}$	
5*	blau blue	Masse Ground	$U_{ON\text{-}DC}$: ≤0.9V $U_{OFF\text{-}DC}$: ≥4.2V…$U_{0\text{-}DC}$	
6	grün green	Eingang Remote EIN/AUS Input Remote ON/OFF		
7	gelb yellow	Ausgang Drehzahlsignal Speed signal output	**PWM-OUT** $f_{PWM\text{-}OUT}$: 50Hz $U_{PWMF\text{-}OUT}$: $U_{0\text{-}DC}$ duty cycle: 0…100%	**FREQ-OUT** $f_{FREQ\text{-}OUT}$: n 1 pulse / revolution $U_{FREQ\text{-}OUT}$: $U_{0\text{-}DC}$
8*	orange orange	Masse Ground		
Zulässige Spannung an den Steuereingängen allowable voltage at control inputs			U_{cc}: max. 5.5V	
Zulässige Strombelastbarkeit an den Steuerausgängen allowable ampacity at control outputs			I: max. 10mA	

Fig. 10: Connection plan motor electronics (connection (X) only for N 84.4AN.29DC-B)
**Ground Pin 3, 5 and 8 are connected with each other*

If Pin 1 is simultaneously used as control voltage specification for Pin 2, please contact the KNF customer services (contact data: see www.knf.com).

6.3. Pneumatic connection

Connected components

➔ Connect to the pump only components that are designed to handle the pump's pneumatic specifications (see Chapter 4. Technical Data).

Pump discharge

➔ When using the pump as a vacuum pump, safely divert the pump's discharge from its pneumatic outlet.

Connecting the pump

ℹ See markings on the pump head for the direction of flow.

1. Remove protective plugs from the hose connection threads.
2. If the accessories silencer or hose connector are present, screw them onto the corresponding hose connection threads.

ℹ Install the silencer in the pump's outlet.

3. Connect suction and pressure lines.
4. Lay the suction and pressure lines at a downward angle to prevent condensate from running into the pump.

7. Operation

7.1. General

➔ Operate the pump only under the operating parameters and conditions described in Chapter 4. Technical Data.

➔ Make sure the pump is used properly (see Chapter 2.1).

➔ Avoid improper use of the pump (see Chapter 2.2).

➔ Observe the safety precautions (see Chapter 3).

➔ The pumps are components that are intended to be incorporated into another machine. Before putting them into service it must be established that machinery or equipment in which they are installed meet the relevant regulations.



WARNING

Excessive pressure may cause the pump head to burst.

➔ Do not exceed the maximum permissible operating pressure (see Chapter 4).
➔ Monitor pressure during operation.
➔ If pressure exceeds the maximum permissible operating pressure, immediately switch off the pump and eliminate the fault (see Chapter 9. Troubleshooting).
➔ Only throttle or regulate the air or gas in the suction line to prevent the maximum permissible operating pressure from being exceeded.
➔ If the air or gas quantity is throttled or regulated in the pressure line, make sure that the maximum permissible operating pressure is not exceeded.
➔ Make sure that the pump outlet is not closed or constricted.

i Excessive pressure can be prevented by placing a bypass line with a pressure relief valve between the pressure and suction side of the pump. For further information, contact your KNF technical adviser.

Pump standstill

➔ When the pump stops, restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

Switching on the pump

i For pumps with AC motor:
Do not allow the pumps to start against pressure or vacuum. If you experience a brief power interruption, check for the presence of pressure or vacuum before restarting. If a pump starts against pressure or vacuum, it may block. This activates the overload switch and the pump switches off.

ℹ For pumps with DC motor:
Do not allow the pumps to start against pressure or vacuum. If you experience a brief power interruption, check for the presence of pressure or vacuum before restarting. If a pump starts against pressure or vacuum, it may block.
➔ Install overload switch (see Chapter 6.2).

➔ Make sure that there is no pressure in the hoses before switching on the pump.

ℹ For pumps with brushless DC motor:
The pumps may start against pressure or vacuum. This is also allowed if you experience a brief power interruption.

Switching off the pump/removing from operation

➔ Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

7.2. Control functions (for pumps with brushless DC motor)

7.2.1. Speed control

DC-B (constant speed)

The motor drives the pump at a constant, unchangeable speed across the entire permissible pressure range.

.29DC-B (regulated speed)

The motor drives the pump at a changeable speed between n_{min} and n_{max}. Speed is specified via the control voltage.

7.2.1.1. Speed input (m29 versions)

Speed range

The speed range of n_{min} … n_{max} is shown scaled to the control votage U_c:

- Uc_{min}: 0.1V
- Uc_{max}: 5.0V

If the control voltage is less than Uc_{min}, the motor is OFF.

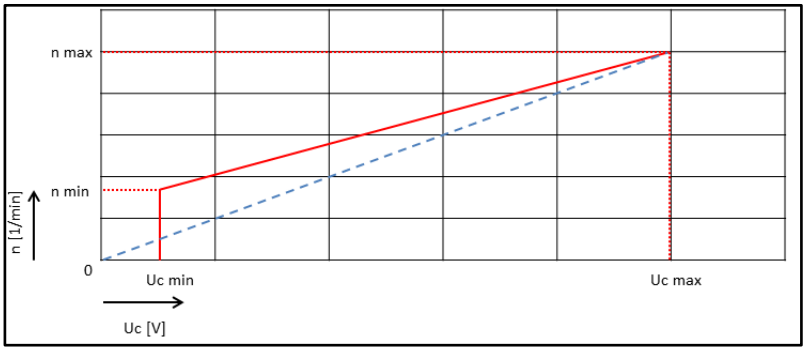


Fig. 11: Control-voltage/speed curve (standard)

Speed specification

Speed is specified through the 8-pin controller connection, Pin 2 (see Table in Fig. 10).

Optional analog settings for control voltage input

The following additional settings can be made at the factory upon request:

- Modify control voltage values Uc_{min} and Uc_{max}.
- If the control voltage is less than Uc_{min}, the motor will be ON.

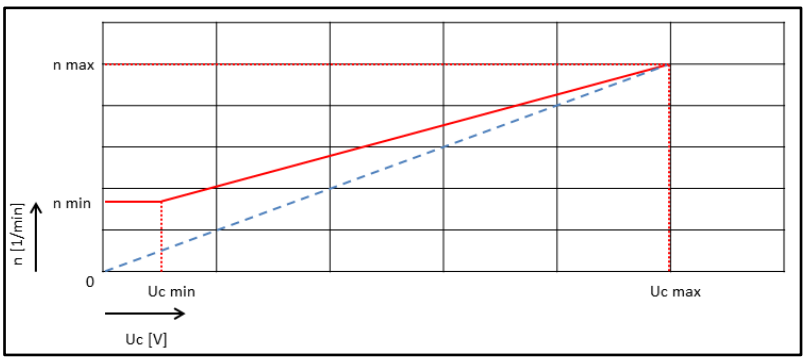


Fig. 12: Scaled control-voltage/speed curve (optional)

7.2.1.2. Speed output (.29 versions)

Speed output

Speed is outputted through the 8-pin controller connection (Pin 7, see Table in Fig. 10).

The motor controller generates speed-synchronized pulse-width modulation (see Fig. 13).

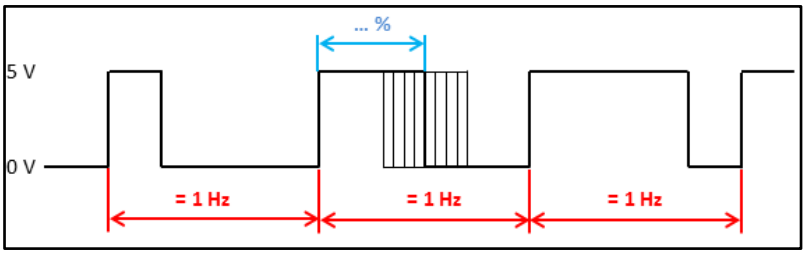


Fig. 13: Analog speed output (standard)

Optional speed output

The motor controller generates a speed-synchronized right-angle frequency with 5V TTL level (see Fig. 14).

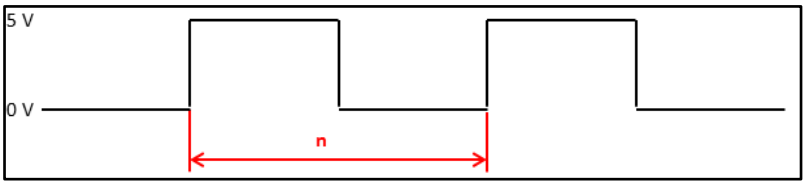


Fig. 14: Digital speed output (optional)

7.2.2. Remote ON/OFF (.29 versions)

Remote ON/OFF

Remote ON/OFF is through an 8-pin controller connection (pin 6, see Fig. 10).

To start the motor, Pin 6 must be bridged to the ground of the controller connection.

7.2.3. External digital activation (.29 versions, optional)

External activation

If desired, the pump motor can be activated externally. This requires a special setting at the factory (contact data: see www.knf.com).

External activation is through the 6-pin communication connection (see Fig. 10 above).

Connector type: Micro-Match-Female Top Entry
Part no.: 7-215079-6

When the motor is activated externally, the control inputs are inactive.

Connection communication plug (see Fig. 10 top)

PIN 1 – do not connect
PIN 2 – do not connect
PIN 3 – GND
PIN 4 – 5V (max. 50 mA
PIN 5 – TX MBLC
PIN 6 – RX MBLC

Motor connection options – external control unit

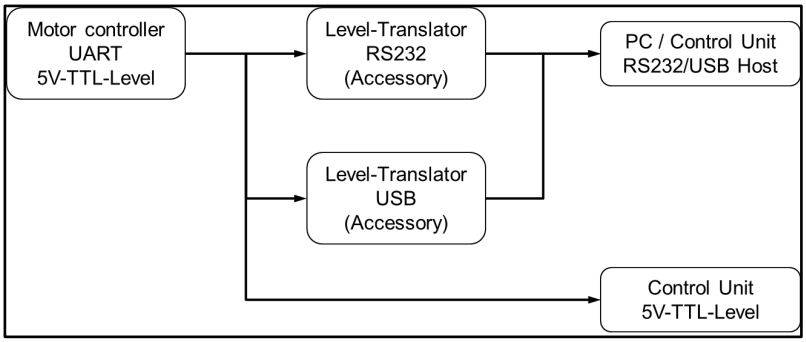


Fig. 15: External activation options (optional)

The following motor functions can be controlled:

- Motor remote ON/OFF
  In the factory condition, the motor is OFF when operating voltage is applied. However, as an option the motor can be ON when operating voltage is applied.
- Motor speed
  Setting motor speed within speed limits n_{min} and n_{max}.
- Reed out of the following process parameters:
  - Actual/Nominal motor speed
  - Control limit of motor speed
  - Operating current of the motor
  - Temperature of the motor controller
  - Fault status
  - Software version number

Interface protocol

The connection between the PC and motor controller can be operated as an RS-232 interface. Accordingly, in the operating system it is managed as an additional COM connection and can be addressed with conventional terminal software.

Interface configuration

- Baud rate: 57600 bits/s
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

Tables Tab. 7 to Tab. 9 contain the necessary command sets, shown as ASCII characters. When transmitting, the commands must be followed by ASCII character <CR> (carriage return, decimal value 013). The underlined expressions are not characters, but symbols as explained in Tab. 9.

Parameter	Command*	Function	Reply
Motor	dB	Start	S ; E
	dE	Stop	S ; E
Speed	dD*nnnn* [*nnnn*=speed value]	Set nominal speed	ns ; E

Tab. 7: Control commands
**A pause of at least 25 ms is required after the "dB" instruction set.*

Parameter	Command	Reply
Actual motor speed; operating current of the motor; temperature of the motor controller; Fault status	pP	ni ; ii ; ti ; ei ; E
Fault status (single value)	gP	ei ; E
Nominal motor speed	gS	ns ; E
Minimum possible motor speed	gSl	nl ; E
Maximum possible motor speed	gSh	nh ; E
Software version number	iV	V ; E

Tab. 8: Reed commands

Symbol	Interpretation	Meaning
E	Announcement of completion	0 command cannot be completed
		1 command completed
		? command unclear
S	Status message	For service only
V	Version number	e.g. 01.018
ni	Actual motor speed	Value [min^{-1}]
ns	Nominal motor speed	Value [min^{-1}]
nl	Minimum nominal motor speed	Value [min^{-1}]
nh	Maximum nominal motor speed	Value [min^{-1}]
ii	operating current of the motor	Value [mA]
ti	temperature of the motor controller	Value [°C]
ei	Fault status	16 bit value

Tab. 9: Symbols

The symbols represent the ASCII codes of sequences of digits any length. The controller processes input values only as whole numbers (integers).

Interface level

See p. 20 for pin assignment of the motor controller's communication plug.

Parameter	Value
Rx KNF MBLC	Low: 0V…0.9V High: 4.2V…5.2V
Tx KNF MBLC	Low: 0V…0.6V High: 4.5V…5.2V

Tab. 10

8. Servicing

8.1. Servicing schedule

Component	Servicing interval
Pump	Regular inspection for external damage or leaks
Hose connections	Regular inspection for external damage or leaks
Diaphragm and valve plates	Replace when pumping capacity decreases, or sooner
Silencer (accessory)	Change if it is dirty

Tab. 11

8.2. Cleaning

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

8.2.1. Flushing pump

➔ Before switching off the pump, flush it with air (or with inert gas if required for safety reasons) under atmospheric conditions (ambient pressure) for about five minutes.

8.2.2. Cleaning the pump

Requirements

- Pump disconnected from mains and de-energized.



WARNING

Dangerous substances in the pump can cause a health hazard

Depending on the substance transferred, caustic burns or poisoning are possible.

➔ Wear protective clothing if necessary, e.g. protective gloves.

➔ Take the proper steps to clean the pump.



CAUTION

Danger of burns from hot pump parts

The pump head or motor may be hot even after the pump has been shut off.

➔ Allow the pump to cool off after operation.

➔ Solvent should be used for cleaning only if the head materials are not corroded (ensure compatibility of the material).

➔ If compressed air is available, blow out the parts.

8.3. Replacing diaphragm and reed valves

Requirements

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

Spare parts/tools

Spare part/tool	Quantity
Valve plates	2 (per pump head)
Diaphragm	1 (per pump head)
Sealing rings	2 (per pump head)
Phillips screwdriver No. 1	1
Felt-tip pen	1

Tab. 12

Information on procedure

Diaphragm, valve plates and sealing rings are the only parts of the pump subject to wear. They are simple to change.

Always change diaphragm, valve plates and sealing rings at the same time. Service all heads.



WARNING

Dangerous substances in the pump can cause a health hazard

Depending on the substance transferred, caustic burns or poisoning are possible.

➔ Wear protective clothing if necessary, e.g. protective gloves.

➔ Flush the pump before replacing the diaphragm and valve plates (see Chapter 8.2.1).



CAUTION

Danger of burns from hot pump parts

The pump head or motor may be hot even after the pump has been shut off.

➔ Allow the pump to cool off after operation.

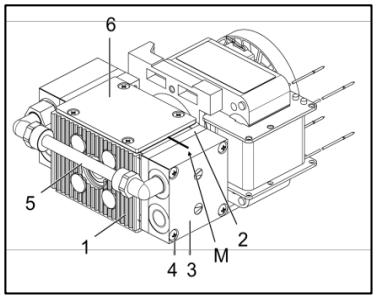


Fig. 16: (for the whole type range)

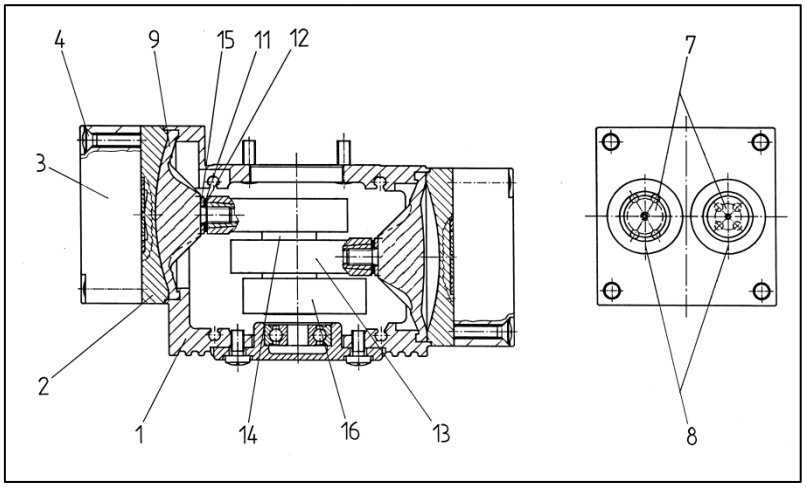


Fig. 17: Sectional view (symbolic)

Specification

Pos. Description

1	Housing	8	Sealing ring
2	Intermediate plate	9	Diaphragm
3	Head plate	11	Diaphragm Spacer(s)
4	Screw	12	Disc Spring
5	Connection	13	Connection rod
6	Cover	14	Spacer ring
7	Valve plate	15	Washer
		16	Counter Weight

Change the diaphragms, valve plates and sealing rings in the following sequence.

a) Removing the pump head

b) Changing diaphragm

c) Changing valve plates and sealing rings

d) Refitting pump head

With the exception of removal and refitting of the cover plate (**6**) (twin headed pumps) or of two cover plates (four headed pumps) all operations are to be carried out separately for each head. This prevents the parts getting mixed up (the head plates are not identical).

The position numbers in the following text refer to Fig. 16 and Fig. 17.

Proceed as follows:

a) Removing the pump head

1. Only for models with dc motors (no cooling fan): undo the 4 screws securing the cover (**6**) to the pump housing (**1**), and remove the cover (**6**).

   - On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight (**16**).

2. For one head: Mark the position of the head plate (**3**), intermediate plate (**2**), and housing (**1**) relative to each other by a drawing line (**M**) with a felt-tip pen. This helps avoid incorrect assembly later.
3. Undo the 4 screws (**4**) in the head plate and lift the head plate (**3**) with the intermediate plate (**2**) off the pump housing.

b) Changing the diaphragm

1. Turn the fan to bring the diaphragm (**9**) to top dead centre.
2. Lift the edge of the diaphragm, and gripping it on opposite sides, unscrew by turning anti-clockwise. Please take care that the disc spring (**12**), diaphragm spacers (**11**) and washer (**15**) on the threaded portion of the diaphragm do not fall into the housing.
3. Take the disc spring (**12**), diaphragm spacer(s) (**11**), and the washer (**15**) off the threaded portion of the diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see Chapter 8.2. Cleaning).
5. Put the washer, diaphragm spacer(s), and disc spring, in that order, on the thread of the new diaphragm.
   - The concave side of the disc spring must be towards the diaphragm. Please note that the same diaphragm spacer(s) must be used for resp. diaphragm.
6. Turn the fan until the connecting rod (**13**) is at top dead centre.
7. Screw the diaphragm, complete with washer, diaphragm spacer(s), and disc spring, into the connecting rod (clockwise) and tighten it by hand.

c) Changing the valve plates and sealing rings

1. Separate the head plate (**3**) from intermediate plate (**2**).
2. Remove the valve plates (**7**) and sealing rings (**8**) from the intermediate plate.
3. Check that the valve seats in the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts they should be replaced.
4. Lay the new valve plates in the recesses in the intermediate plate. The valve plates for suction and pressure sides are identical, as are upper and lower sides of the plates.
5. Check that the valve plates are not deformed by moving them gently sideways in their recesses.
6. Lay the sealing rings on the intermediate plate.

d) Refitting the pump head

1. Turn the fan to bring the diaphragm (9) to top dead centre.
2. Place the intermediate plate (2) (with valve plates (7) and sealing rings (8)), and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centred by moving it gently sideways.
4. Gently tighten the screws (4), evenly and diagonally.
5. Turn the fan to check that the pump rotates freely.
6. Turn the fan again to bring the diaphragm to top dead centre.
7. Now tighten screws (4) firmly.

e) Second pump head

1. Repeat operations a) (2, 3) and b) to d) for the second pump head.
2. Refix the cover (6) to the housing (1).

Only for type range N 84.4:

Repeat operations a) to e) for the both remaining pump heads.

If you have any questions about servicing, call your KNF technical adviser (contact data: see www.knf.com).

9. Troubleshooting



DANGER

Risk of electric shock, danger of death!

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

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

➔ Check the pump (see Tab. 13 and Tab. 14).

Pump does not work	
Cause	Fault remedy
Pump not connected to the mains.	➔ Connect pump to the mains.
No voltage in the mains.	➔ Check room fuse and switch on if necessary.
For pumps with brushless DC motor: ▪ The motor board's overcurrent protection circuit has activated. ▪ Maximum temperature of motor board is exceeded ▪ Maximum blocking time of the rotor is exceeded	➔ Separate pump from the mains. ➔ Determine and remove the cause of the overcurrent (for example: improper pressure, liquid in the pump heads). **i** The pump must be separated from the mains for several seconds before the electronics will permit restarting.
For pumps with brushless DC motor: Wrong polarity of the connection wires	➔ Separate pump from the mains. ➔ Be aware of right polarity of the connection wires and connect pump.
For pumps with AC motor: The pump's thermal switch has triggered.	➔ Disconnect pump from the mains. ➔ Allow pump to cool. ➔ Identify and eliminate cause of overheating.
Connections or hoses are blocked.	➔ Check hoses and connections. ➔ Remove blockage.
External valve is closed or filter is clogged.	➔ Check external valves and filters.
Condensate has collected in the pump head.	➔ Detach the condensate source from the pump. ➔ Flush the pump (see Chapter 8.2.1). ➔ Install the pump at the highest point in the system.
Diaphragm or valve plates are worn.	➔ Replace diaphragm and valve plates (see Chapter 8.3).

Tab. 13

Flow rate, pressure, or vacuum are too low The pump does not achieve the performance stated in the technical data or on the data sheet.	
Cause	Fault remedy
Condensate has collected in the pump head.	➔ Detach the condensate source from the pump. ➔ Flush the pump (see Chapter 8.2.1).
Presence of positive pressure on the pressure side with simultaneous vacuum or positive pressure on the suction side.	➔ Change the pressure conditions.
Cross-section of pneumatic hoses or connectors too narrow or restricted.	➔ Disconnect the pump from the system and determine output values. ➔ Remove restriction (e.g. valve) if necessary. ➔ If applicable, use larger-diameter hoses or connectors.
Leaks in connections, hoses or pump head.	➔ Make sure the hoses are properly seated on the hose connectors. ➔ Replace leaking hoses. ➔ Eliminate leaks.
Connections or hoses completely or partially clogged.	➔ Check hoses and connections. ➔ Remove any parts or particles causing blockages.
Pump head components are soiled.	➔ Clean head components.
Diaphragm valve plates are worn.	➔ Replace diaphragm and valve plates (see Chapter 8.3).
Diaphragm and valve plates have been replaced.	➔ Make sure that the shim rings have been replaced onto the diaphragm screw thread. ➔ Check head connection and hose connections for leaks.

Tab. 14

Fault visualization on motor controller (for pumps with brushless DC motor)

The excess of the overcurrent limit, the excess of the maximum temperature of the motor board or the blocking of the rotor is shown as a fault. A red LED on the BLDC motor controller signals the cause of the fault.

Optional setting:
If desired, the motor controller can be programmed so that the error output voltage exhibits the same characteristics as the LED. With factory settings, only 1 or 0 are logically outputted as voltage at the fault output.

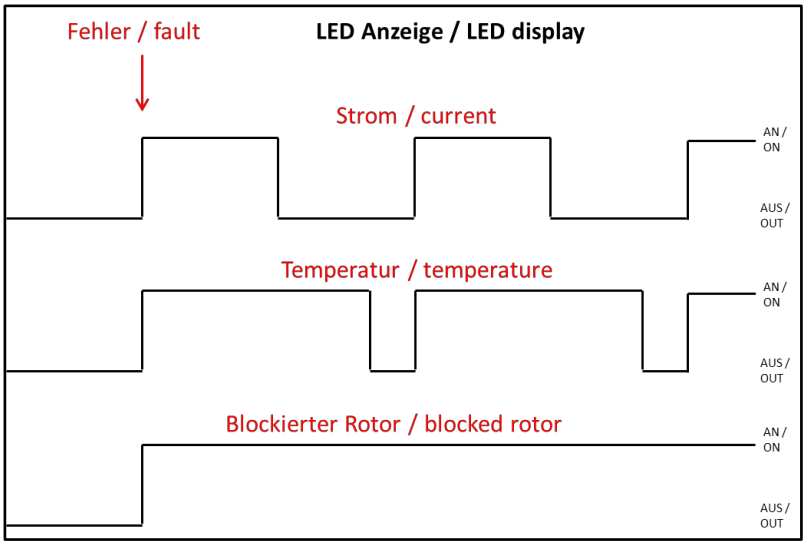


Fig. 18: LED blinking duration according to different faults

To delete the error condition the motor has to be disconnected from the mains.

Fault cannot be rectified

If you are unable to identify the cause of the problem, please send the pump to KNF customer services (contact data: see www.knf.com).

1. Flush the pump (see Chapter 8.2.1).
2. Clean the pump (see Chapter 8.2.2).
3. Send the pump, together with completed Health and Safety Clearance and Decontamination Form, to KNF stating the nature of the transferred medium.

10. Spare parts and accessories

10.1. Spare parts

Pos. No.*		Order No.
(**7**)	Valve plate	055353
(**8**)	Sealing ring	055354
(**9**)	Diaphragm	027578
(**11**)	Diaphragm spacer	024986
(**12**)	Disk spring	024987
(**15**)	Washer	005193

Tab. 15 **according Fig. 16 and Fig. 17*

10.2. Accessories

General accessories

Description	Order No.
Silencer G 1/8	000345
Hose connector (right) PA, G 1/8	001936
Rubber feet (for N 84.3 ANE) (2 pieces are necessary)	024435

Tab. 16

Accessories for pumps with brushless DC motor

Description	Order No.
PWM analog voltage converter Function: Smoothing of the speed output signal into an analog voltage output and simultaneous transformation of 5V to ≤ 5V.	on request
External potentiometer for setting of the speed	on request
RS232 Level-Translator with SUB-D9 plug	on request
RS232 Level-Translator with Micro-USB plug	on request
Completely connectorized control cable (analog or digital controlling)	on request

Tab. 17

11. Returns

Prerequisite for repairing a pump by KNF is a completed Decontamination Form.

This is made available on the KNF website as a download. To find the form, select your country on the overview page (www.knf.com). You can find the Decontamination Form in the download area.

If you have questions, please contact your sales partner (contact data: see www.knf.com).

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KNF worldwide
Find your local KNF partner on www.knf.com