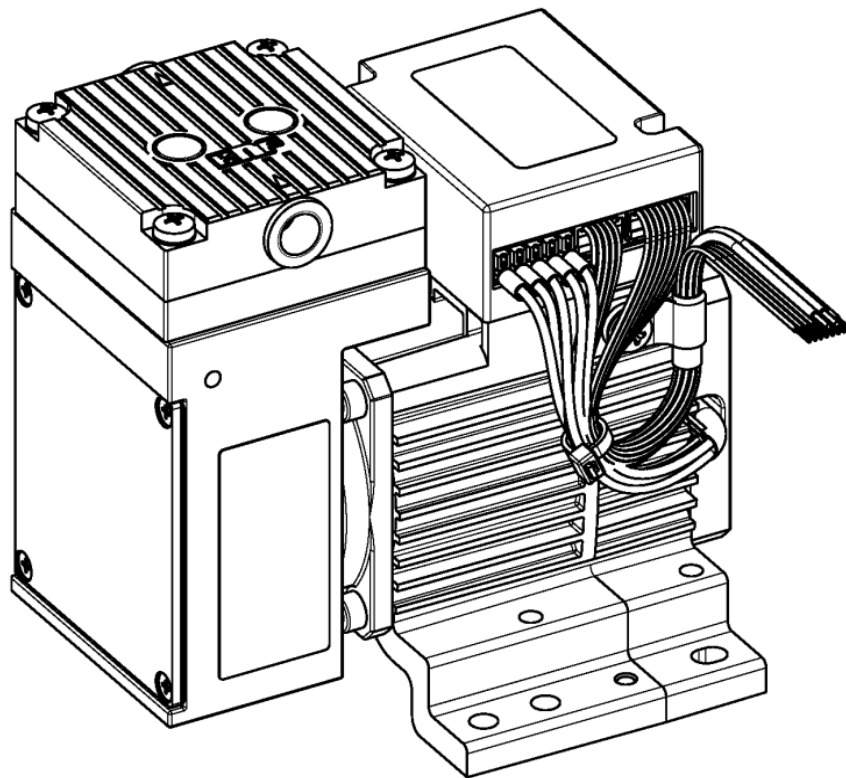


OEM

**N 816
TRANSLATION OF ORIGINAL OPERATING AND
INSTALLATION INSTRUCTIONS
ENGLISH**

DIAPHRAGM PUMP



Note!

Before operating the pump and the accessories, please read the operating instructions 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



A danger is located here.

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

WARNING 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.

i 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 rain, splash, hose and drip water as well as other pollutions.

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 may not be operated in an explosive atmosphere.

The pumps are not suitable for transferring dusts.

The pumps are not suitable for transferring liquids.

The pumps are not suitable for transferring aerosol.

The pumps are not suitable for transferring biological and microbiological substances.

The pumps are not suitable for transferring fuel.

The pumps are not suitable for transferring explosive and combustible materials.

The pumps are not suitable for transferring fibers.

The pumps are not suitable for transferring oxidizing agent.

The pumps are not suitable for transferring foodstuffs.

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 overpressure simultaneously.

An overpressure must not be applied to the suction side of the pump.

3. Safety

i Note the safety precautions in Chapter 7. Installation and connection and 8. Operation.

The pumps are built according to the generally recognized rules of the technology and in accordance with the occupational safety and accident prevention regulations. Nevertheless, dangers can result during their use which lead to injuries to the user or others, or to 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.

Components connected to the pump must be designed to withstand the pneumatic performance of the pump.

Take care that safety regulations are observed when connecting the pump to the electricity supply.

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

Make sure that the personnel has read and understood the Operating and Installation Instructions, and in particular 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.

The pump heads heat up during operation – avoid contact with them.

Make sure that there are no hazards due to flow with open gas connections, noises or hot gases.

Ensure that an EMC-compatible installation of the pump is ensured at all times and that this cannot lead to a hazardous situation.

Handling dangerous media When transferring dangerous media, observe the safety regulations when handling these media.

If the diaphragm ruptures, the transferred medium will mix with the air in the environment.

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

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

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

Note that the temperature of the medium increases when the pump compresses the medium (compressor operation).

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

If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.

When the operation of the pump is interrupted by the thermal switch, the pump will re-start automatically after cooling down. Take all care necessary to prevent this leading to a dangerous situation.

In case of doubt, consult the KNF customer service.

Environmental protection Store all replacement parts in a protected manner and dispose of them properly in accordance with the applicable environmental protection regulations. Observe the respective national and international regulations. This especially applies to parts contaminated with toxic substances.

EU/EC Directives / Standards For the purposes of the 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 machine in which the partly completed machinery is to be assembled is in conformity with 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 pumps with AC motor)

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.

The safety objectives of the following Directive(s) have been met:

- Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (Annex II amended by Commission Delegated Directive (EU) 2015/863).
- Only pumps with AC motor:
Directive 2014/35/EU on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits in accordance with Annex I, No. 1.5.1. of the Directive 2006/42/EC.

The following harmonized standards were taken as a basis:

N 816 K_DC-B-M	N 816 K_DC-B	N 816 K_E
EN IEC 63000	EN IEC 63000	EN IEC 63000
EN IEC 61000-6-2/3	EN IEC 61000-6-2/3	EN IEC 55014-1/2
		EN IEC 61000-3-2
		EN 61000-3-3
		EN 60335-1

Tab. 2

Customer service and repairs

The pump is maintenance-free. But KNF recommends, checking the pump regularly with regard to conspicuous changes in noise and vibrations.

Only have repairs to the pumps carried out by the KNF Customer Service responsible.

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

Use only genuine parts from KNF for servicing work.

4. Technical Data

N 816 KNE and N 816 KTE

Pneumatic performance				
Max. permissible operating pressure [bar g]	0.5			
Ultimate vacuum [mbar abs.]	N 816 KN_	N 816 KT_		
	100	140		
Flow rate at atm. pressure [l/min]*	N 816 KN_	N 816 KT_		
	14	13		
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]	approx. 1.8			
Dimensions L x H x W [mm]	See Fig. 5, Chapter 7.1			
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	AC-Motor			
Voltage / Frequency**	100V / 50/60Hz ; 115V / 60Hz 230V / 50Hz ; 220V / 60Hz			
Max. operating current [A]:	100V 50/60Hz	115V 60Hz	220V 60Hz	230V 50Hz
	N 816 KN_			
- for p > p _{atm.}	0.9/0.7	0.6	0.35	0.45
- for p < p _{atm.}	0.9/0.7	0.6	0.35	0.45
N 816 KT_				
- for p > p _{atm.}	0.9/0.7	0.6	0.35	0.45
- for p < p _{atm.}	1.0/0.7	0.6	0.35	0.5
Max. power consumption of the pump [W]:	100V 50/60Hz	115V 60Hz	220V 60Hz	230V 50Hz
	N 816 KN_			
- for p > p _{atm.}	75/64	64	64	79
- for p < p _{atm.}	75/63	62	61	76
N 816 KT_				
- for p > p _{atm.}	78/63	61	65	76
- for p < p _{atm.}	78/62	58	62	75
Maximum permissible mains voltage fluctuations	+/- 10 %			
Motor protection class	IP 00			

Tab. 3 (part 1)

* liters in standard state (1013 mbar)

**further voltage and frequency versions on demand

Pump materials		
Pump head	PPS	
Diaphragm	N816 KN_	N816 KT_
	EPDM	PTFE
Valve plate/sealing	N816 KN_	N816 KT_
	EPDM	FFPM

Tab. 3 (part 2)

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.

N 816 KNDC-B and N 816 KN.29DC-B

N 816 KTDC-B and N 816 KT.29DC-B

Pneumatic performance		
Max. permissible operating pressure [bar g]	0.5	
Ultimate vacuum [mbar abs.]	N 816 KN_	N 816 KT_
	100	140
Flow rate at atm. pressure [l/min]*	N 816 KN_	N 816 KT_
	16	14
Flow rate at atm. pressure and 0.1 V control voltage (only .29 version) [l/min]*	3.5	
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]	approx. 1.55	
Dimensions L x H x W [mm]	See Fig. 6, Chapter 7.1	
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 $p < p_{atm.}$	N 816 KN_	N 816 KT_
	1.4 1.2	1.3 1.1
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 $p < p_{atm.}$	N 816 KN_	N 816 KT_
	33 28	31 26
Maximum permissible mains voltage fluctuations	+/- 10 %	
Motor protection class	IP 20	
Overcurrent limitation of the motor electronics [A]	7.5	

Tab. 4 (part 1)

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

Pump materials		
Pump head	PPS	
Diaphragm	N816 KN_	N816 KT_
	EPDM	PTFE
Valve plate/sealing	N816 KN_	N816 KT_
	EPDM	FFPM

Tab. 4 (part 2)

i 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.

N 816 KN.29DC-B-M and N 816 KT.29DC-B-M

Pneumatic performance		
Max. permissible operating pressure [bar g]	0.5	
Ultimate vacuum [mbar abs.]	N 816 KN_	N 816 KT_
	100	140
Flow rate at atm. pressure [l/min]*	N 816 KN_	N 816 KT_
	16	14
Flow rate at atm. pressure and 0.1 V control voltage (only .29 version) [l/min]*	3.5	
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]	approx. 1.05	
Dimensions L x H x W [mm]	See Fig. 7, Chapter 7.1	
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	
PWM signal [%]	20...100	
Max. operating current [A]: - for $p > p_{atm.}$ - for $p < p_{atm.}$	N 816 KN_	N 816 KT_
	1.3	1.1
	1.1	1.0
Starting current	The starting current can be up to 50 % above the maximum operating current.	
Max. power consumption of the pump [W]: - for $p > p_{atm.}$ - for $p < p_{atm.}$	N 816 KN_	N 816 KT_
	31	26
	24	24
Maximum permissible mains voltage fluctuations	+/- 10 %	
Motor protection class	IP 30	
Overcurrent limitation of the motor electronics [A]	8	

Tab. 5 (part 1)

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

Pump materials		
Pump head	PPS	
Diaphragm	N816 KN_	N816 KT_
	EPDM	PTFE
Valve plate/sealing	N816 KN_	N816 KT_
	EPDM	FFPM

Tab. 5 (part 2)

- i** The pump is equipped with overcurrent protection. If this safety function is triggered, the pump will be shut down and must be manually reset, as follows:
- ➔ Separate pump from the mains.
 - ➔ Remove the cause(s) of the fault before restarting.
- i** 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 or separate pump from PWM signal.
 - ➔ Remove the cause(s) of the fault before restarting.

5. Design and function

Design

- 1 Pneumatic pump outlet
- 2 Capacitor
- 3 Pneumatic pump inlet
- 4 Fan
- 5 Motor

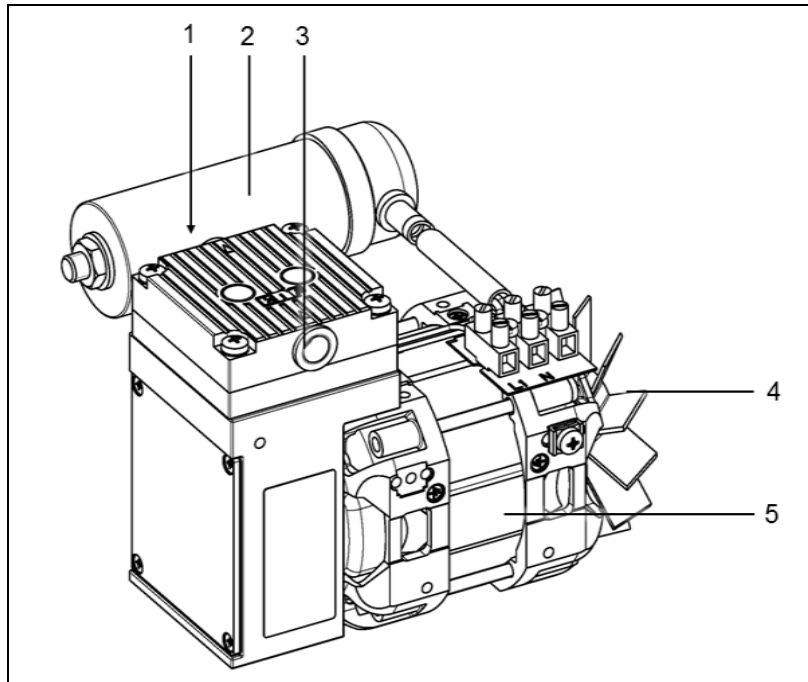


Fig. 1: Design N 816 K_E

- 1 Pneumatic pump outlet
- 2 Pneumatic pump inlet
- 3 Motor

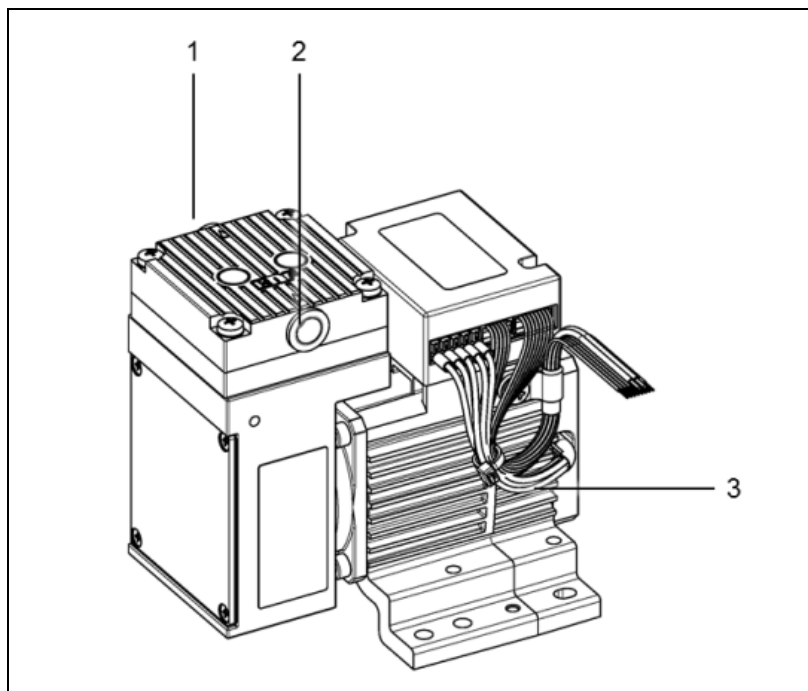


Fig. 2: Design N 816 K_DC-B

- 1 Pneumatic pump outlet
- 2 Pneumatic pump inlet
- 3 Motor

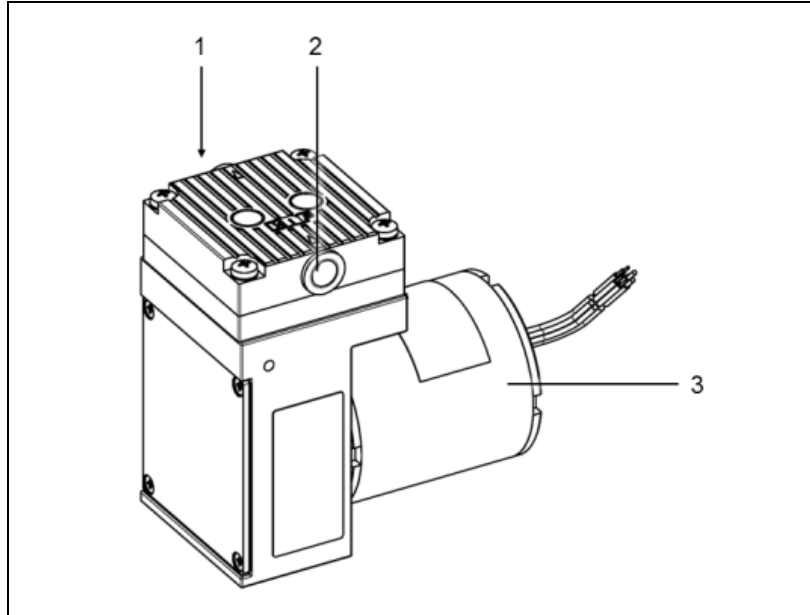


Fig. 3: Design N 816 K_DC-B-M

Function Diaphragm Pump

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

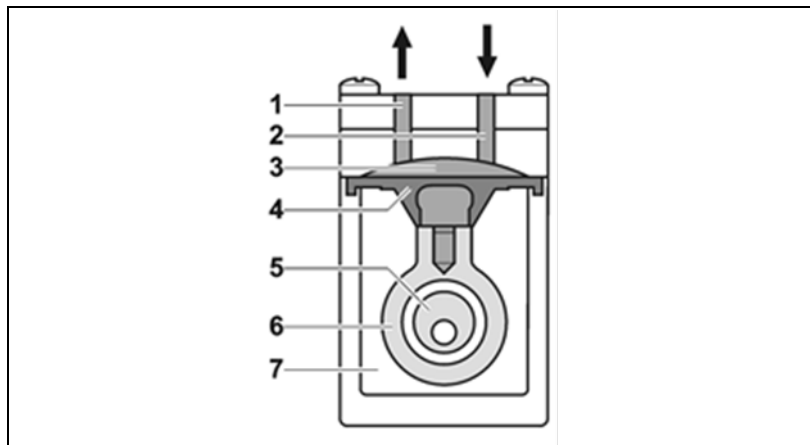


Fig. 4: Pump head

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 transfer chamber (3) is hermetically separated from the pump drive (7) by the diaphragm.

6. Transportation



Danger of injury due to sharp edges on the package.

When handling or opening the package there is the possibility of injury by cutting at sharp edges.

CAUTION

→ If necessary, wear proper personal protective equipment (e.g. safety gloves).



Personal injury and/or damage to property because of false or improper transportation of the pump

Due to false or improper transportation the pump can fall down, become damaged and injure people.

CAUTION

→ If necessary, use suitable aids (eyebolt, harness, lifting device, etc.).

→ If necessary, wear proper personal protective equipment (e.g. safety gloves, safety shoes).

- Check the pump for transport damages after receipt.
- Document occurred transport damages in writing and with pictures.
- Carry the pump in the original packaging up to its place of installation.
- Retain the original packaging of the pump (e.g. for later storage).

7. Installation and connection

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

Observe the safety precautions (see Chapter 3).

7.1. Installation of the pump

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

Mounting dimensions See Fig. 5 (N 816 K_E), Fig. 6 (N 816 K_DC-B) and Fig. 7 (N 816 K_DC-B-M) for mounting dimensions.

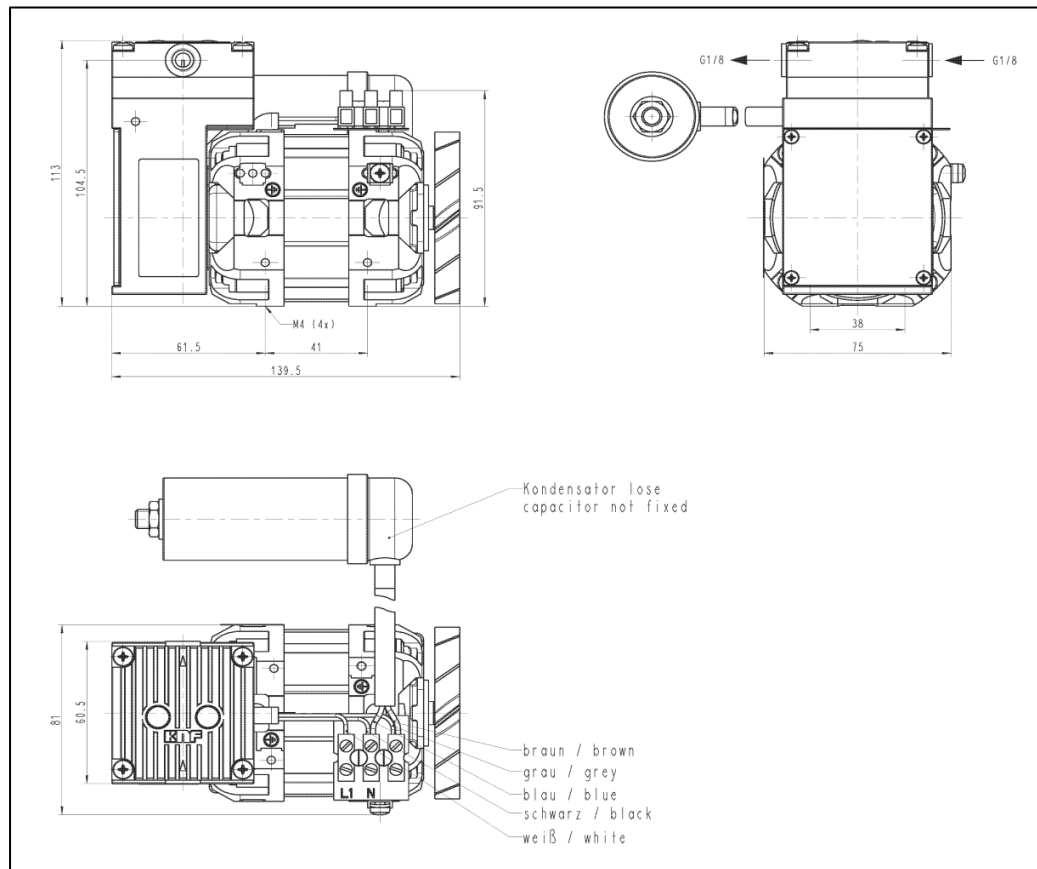


Fig. 5: Mounting dimensions pump series N 816 K_E (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

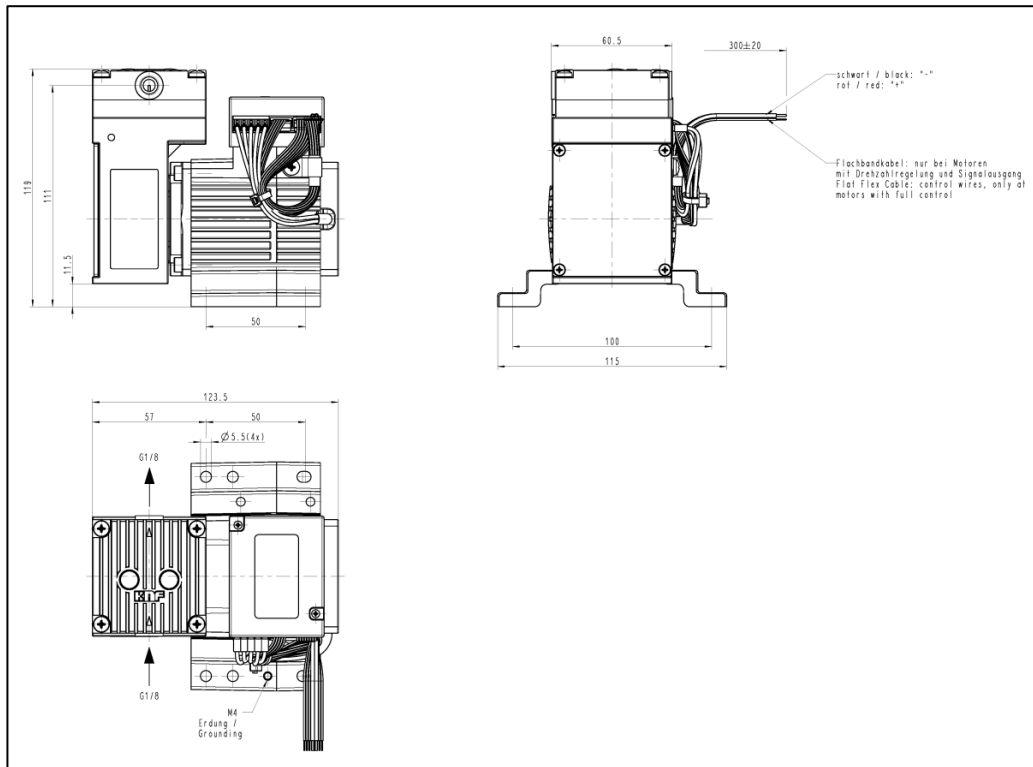


Fig. 6: Mounting dimensions pump series N 816 K_DC-B (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

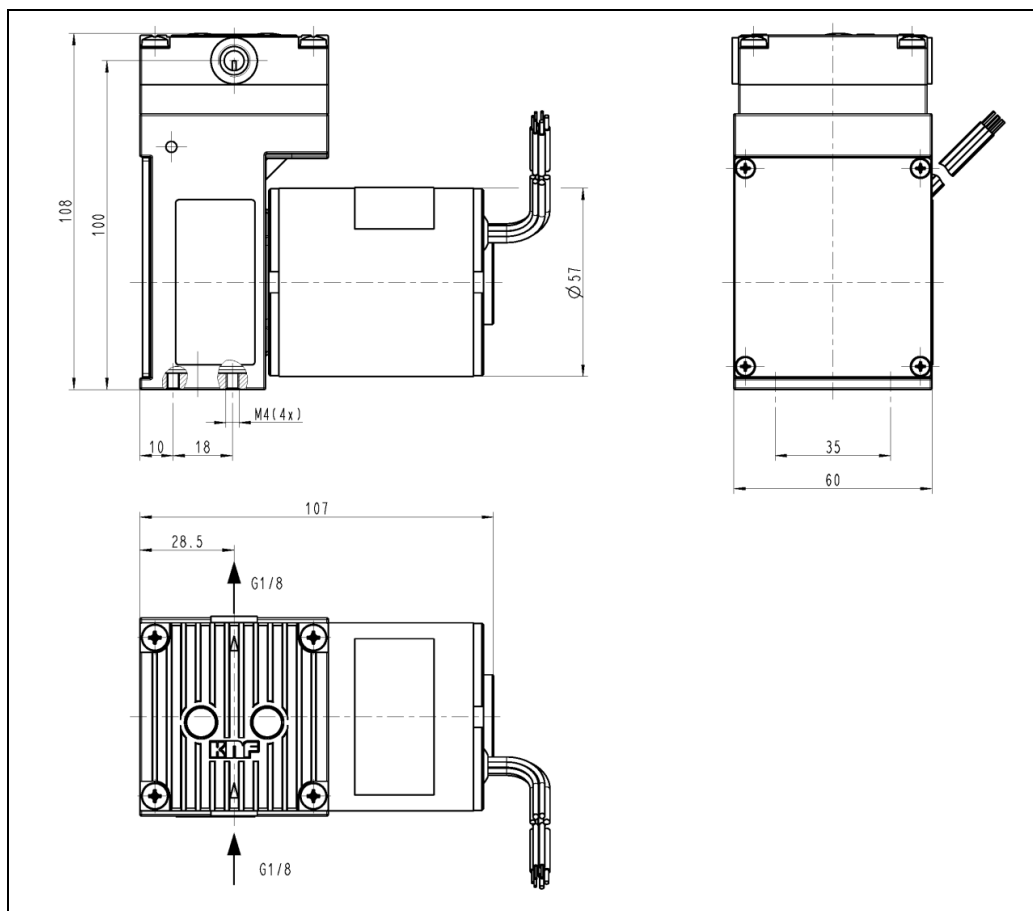


Fig. 7: Mounting dimensions pump series N 816 K_DC-B-M (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

Cooling air supply



Danger of burns from hot surfaces

Hot surfaces may be caused by overheating of the pump.

WARNING → Install the pump so that the motor fan can intake sufficient cooling air.

Immediate ambient of the hot pump parts

→ When installing, make sure that there are no combustible or thermally malleable objects placed in the immediate ambient of the hot pump parts (head, motor).

Installation position

→ The pump may be installed in any position. Use metal screws to fasten the pump at the indicated attachment points.



In order to drain off possible condensate successfully, KNF recommends that pumps are installed in oblique position (with the suction line in higher position than the pressure line; for flow direction see the markings on the pump heads).

Installation location

→ Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water as well as other pollutions.

→ Make sure, that the installation location is accessible for maintenance and service.



The IP protection class of the pump motor is indicated on the type plate.

→ Install the pump at the highest point in the system to prevent condensate from collecting in the pump head.

→ Protect the pump from dust.

→ Protect the pump from exposure to fats and oils.

→ Protect the pump from vibrations and jolts.



Personal injury and/or damage to property because of vibration

In conjunction with adjacent components, vibration of the pump may result in crushing and/or damage to these components.

WARNING

→ Make sure that vibrations of the pump do not result in hazards associated with adjacent components.

Protection against touching and foreign objects



WARNING

Hazard of injuries during operation

- Take protective measures against touching parts connected to electrical power (electrical connection, possibly motor coils).
- Take protective measures against touching moving parts (e.g. fans).
- The pump will restart automatically after the automatic resetting temperature limiter has been triggered.

Hazard of damage to the pump during operation

- Take protective measures against foreign objects which could enter the pump.

7.2. Electrical connection



Extreme danger from electrical shock

DANGER

→ 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 is impossible.

Attach connection cables

→ Fasten the connection cables so that:

- the cables do not contact moving or hot parts.
- the cables will not chafe or be damaged on sharp edges or corners.
- no pulling or pushing forces are exerted on the cable's connection points (strain relief).

i The pumps are fitted as standard with a thermal switch to protect against overloading.

Pumps with AC motor

1. Compare the supply data with the data on the motor plate.
For maximum operating current of the pump see pump's type plate.

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

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

3. Connect motor wires.

Pumps with brushless DC motor

1. Compare the supply data with the data on the motor plate.
For maximum operating current of the pump see pump's type plate.

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

2. Electrical connection of the pump (N 816 K_DC-B Tab. 6, p. 23; N 816 K_.29DC-B Tab. 7, p. 24 or N 816-K_DC-B-M Tab. 8, p. 27).

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

N 816 K_DC-B:

i 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.

N 816 K_DC-B-M:

i Note the proper polarity (see marking on the motor). Incorrect lead connection will damage electronics of brushless DC motors (type designation ending with B).

N 816 K_DC-B

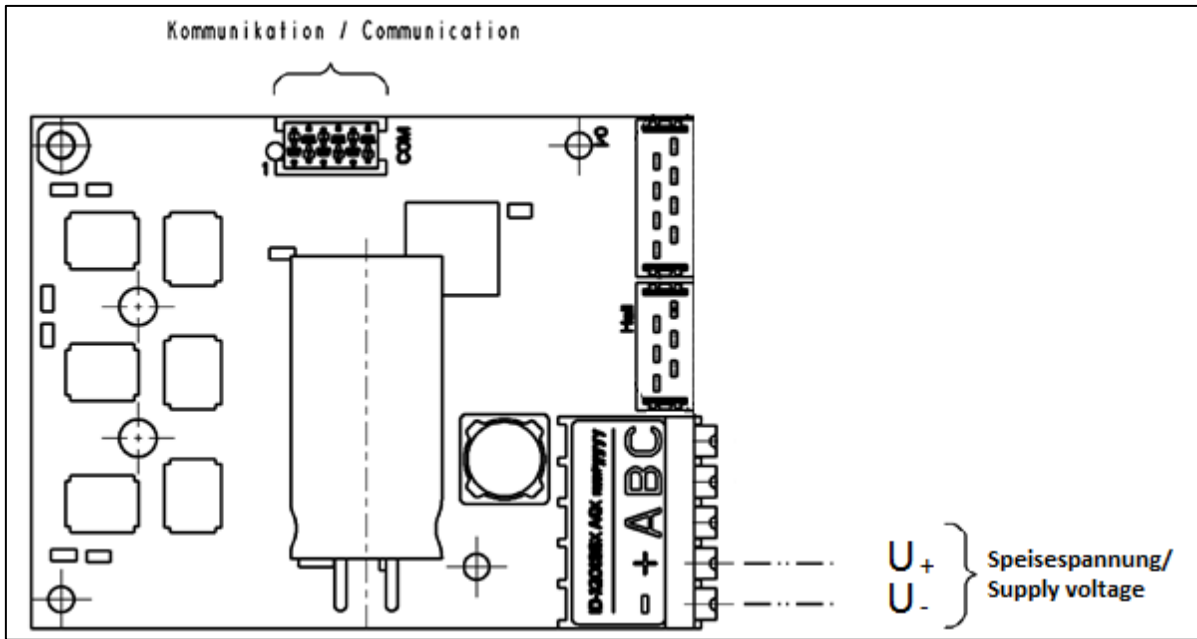


Fig. 8: Connection plan motor electronics N 816 K_DC-B

Motor			
Nennspannung / Nominal voltage	[V]	24	
Spannungsbereich / Voltage range	[V]	7 ... 30	
Elektrische Anschlüsse / Electrical connection			
Litzenbelegung / lead assignment			
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / size
+ Speisespannung + Supply voltage	rot / red	U+	AWG 18
- Speisespannung - Ground (0V)	schwarz / black	U- / GND	AWG 18

Tab. 6 : Connection plan motor electronics N 816 K_DC-B

N 816 K_29DC-B

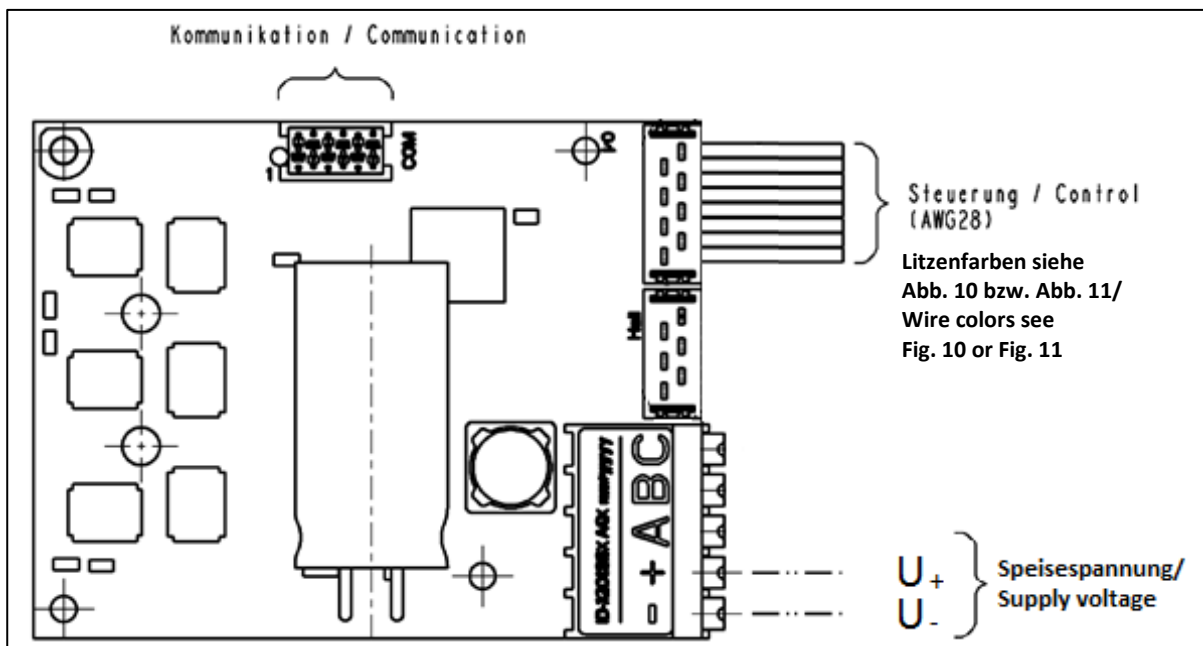


Fig. 9: Connection plan motor electronics N 816 K_29DC-B

Motor			
Nennspannung / Nominal voltage	[V]	24	
Spannungsbereich / Voltage range	[V]	7 ... 30	
Elektrische Anschlüsse / Electrical connection			
Litzenbelegung / lead assignment			
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / size
+ Speisespannung + Supply voltage	rot / red	U ₊	AWG 18
- Speisespannung (0V) - Ground (0V)	schwarz / black	U ₋ / GND	AWG 18
5V Ausgangsspannung 5V power supply	schwarz / black	U _{5V}	AWG 28 UL 20932
Eingangssignal Drehzahlregelung Input signal speed control	weiß / white	U _{Ctrl}	AWG 28 UL 20932
Ausgangssignal Drehzahl Output signal speed	gelb / yellow	U _{Spd}	AWG 28 UL 20932
Eingangssignal Remote EIN/AUS Input signal Remote ON/OFF	grün / green	U _{Rmt}	AWG 28 UL 20932
Ausgangssignal Fehler Output signal fault	lila / purple	U _{Flt}	AWG 28 UL20932
Masse Ground	grau & blau & orange grey & blue & orange	GND	AWG 28 UL 20932
5V Ausgangsspannung U _{5V} / 5V Power supply U _{5V}			
Ausgangsspannung DC Control voltage range DC	[V]	5 ± 0.2	
Max. Ausgangsstrom Max. current output	[mA]	170	

Tab. 7 (part 1): Connection plan motor electronics N 816 K_29DC-B

Eingangssignal Drehzahlregelung U_{Ctrl} / Input signal speed control U_{Ctrl}			
Analog	Steuerspannungsbereich DC Control voltage range DC	[V]	0 ... 5
	Steuerspannungsbeschreibung: min. → Pumpe min. Förderleistung max. → Pumpe max. Förderleistung Control voltage description min. → pump min. flow max. → pump max. flow	[V]	min. 0.1 max. 5
	Max. Eingangsspannung Max. input voltage	[V]	5.5
	Schwellenspannung Treshold voltage	[mV]	25 ± 0.5
PWM-Signal	PWM Frequenzbereich PWM frequency range	[Hz]	100 [50 ... 150]
	Eingangsspiegel „high“ Input level „high“	[V]	5 [4.2 ... 5.5]
	Eingangsspiegel „low“ Input level „low“	[V]	0 [0 ... 0.9]
	Tastgradbereich Duty cycle range	[%]	0 ... 100
	Tastgradbeschreibung: min. → Pumpe min. Förderleistung max. → Pumpe max. Förderleistung Duty cycle description min. → pump min. flow max. → pump max. flow	[%]	min. 2 max. 100
Eingangsimpedanz @ 1kHz Input impedance @ 1kHz		[kΩ]	≥ 12
Ausgangssignal Drehzahl U_{Spd} / Output signal speed U_{Spd}			
Analog	Pulse pro Umdrehung Pulses per revolution	[-]	1
	Pulstastverhältnis Pulse duty cycle	[%]	50 ± 1
PWM-Signal	PWM Frequenz PWM frequency	[Hz]	50 ± 0.5
Ausgangsspiegel „high“ Output level „high“		[V]	5 [4.1 ... V_{5V}]
Ausgangsspiegel „low“ Output level „low“		[V]	0 [0 ... 0.6]
Max. Strombelastbarkeit Max. current carrying capacity		[mA]	10
Ausgangsimpedanz @ 1 kHz Output impedance @ 1 kHz		[kΩ]	≥ 9
Eingangssignal Remote EIN/AUS U_{Rmt} / Input signal Remote ON/OFF U_{Rmt}			
Eingangsspiegel „high“ → Motor AUS Input level „high“ → motor OFF		[V]	5 [3.9 ... 5.5]
Eingangsspiegel „low“ → Motor EIN Input level „low“ → motor ON		[V]	0 [0 ... 0.9]
Eingangsimpedanz @ 1 kHz Input impedance @ 1 kHz		[kΩ]	≥ 1.8

Tab. 7 (part 2): Connection plan motor electronics N 816 K_ .29DC-B

Ausgangssignal Fehler U_{Fit} / Output signal fault U_{Fit}		
Eingangsspiegel „high“ → Fehler vorhanden Input level „high“ → error detected	[V]	5 [3.9 ... 5.5]
Eingangsspiegel „low“ → kein Fehler Input level „low“ → no error	[V]	0 [0 ... 0.9]
Max. Strombelastbarkeit Max. current carrying capacity	[mA]	10
Ausgangsimpedanz @ 1kHz Output impedance @ 1kHz	[kΩ]	≥ 9

Tab. 7 (part 3): Connection plan motor electronics N 816 K_.29DC-B

i If the black wire is used as voltage source and at the same time as the default control voltage for the white wire, the output voltage decreases when the voltage source is under load. At the same time the default voltage for the white wire decreases. Because of this the nominal final speed can no longer be reached.

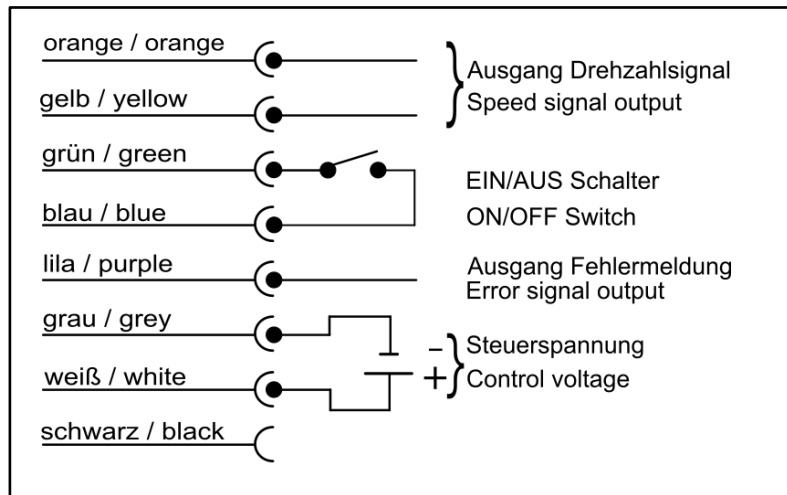


Fig. 10: Exposition Control without Potentiometer

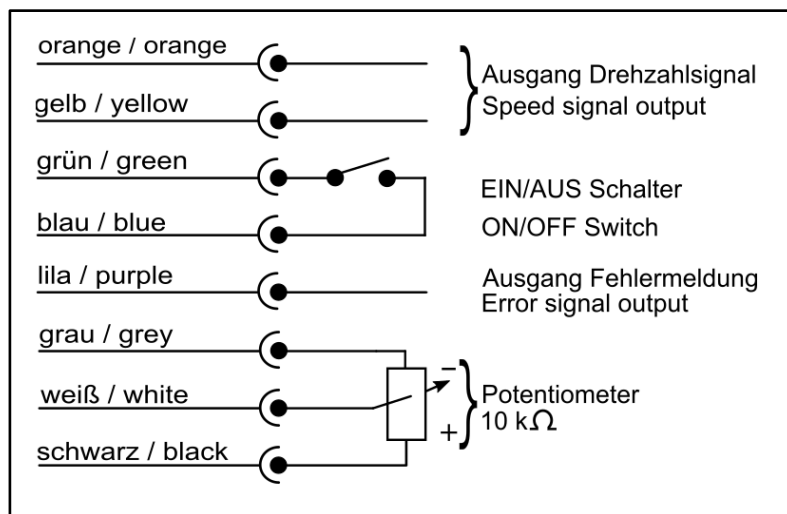


Fig. 11: Exposition Control with Potentiometer

N 816 K_DC-B-M

Motor			
Nennspannung / Nominal voltage	[V]	24	
Spannungsbereich / Voltage range	[V]	8 ... 26.4	
Elektrische Anschlüsse / Electrical connection			
Litzenbelegung / lead assignment			
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / size
+ Speisespannung + Supply voltage	rot / red	U ₊	AWG 18 UL 3266
- Speisespannung (0V) - Ground (0V)	schwarz / black	U ₋ / GND	AWG 18 UL 3266
Eingangssignal Drehzahlregelung Input signal speed control	blau / blue	U _{Ctrl}	AWG 24 UL 1385
Ausgangssignal Drehzahl Output signal speed	grün / green	U _{Spd}	AWG 24 UL 1385
Eingangssignal Remote EIN/AUS Input signal Remote ON/OFF	weiß / white	U _{Rmt}	AWG 24 UL 1385
Eingangssignal Motordrehrichtung Input signal motor rotation direction	gelb / yellow	U _{Rot}	AWG 24 UL 1385
Eingangssignal Drehzahlregelung U _{Ctrl} / Input signal speed control U _{Ctrl}			
PWM Frequenzbereich PWM frequency range	[kHz]	20 [10 ... 30]	
Eingangspegel „high“ Input level „high“	[V]	5 [2 ... 5.5]	
Eingangspegel „low“ Input level „low“	[V]	0 [0 ... 0.5]	
Tastgradbereich Duty cycle range	[%]	80 ... 0	
Tastgradbeschreibung: min. → Pumpe min. Förderleistung max. → Pumpe max. Förderleistung Duty cycle description min. → pump min. flow max. → pump max. flow	[%]	min.	max.
		80	0
Eingangsimpedanz @ 1kHz Input impedance @ 1kHz	[kΩ]	≥ 5	
Ausgangssignal Drehzahl U _{Spd} / Output signal speed U _{Spd}			
Pulse pro Umdrehung Pulses per revolution	[-]	3	
Pulstastverhältnis Pulse duty cycle	[%]	50	
Ausgangspegel „high“ Output level „high“	[V]	4.6 [4.2 ... 6]	
Ausgangspegel „low“ Output level „low“	[V]	0 [0 ... 0.5]	
Max. Strombelastbarkeit Max. current carrying capacity	[mA]	2	
Eingangsimpedanz @ 1kHz Input impedance @ 1kHz	[kΩ]	≥ 20	

Tab. 8 (part 1): Connection plan motor electronics N 816 K_DC-B-M

Eingangssignal Remote EIN/AUS U_{Rmt} / Input signal Remote ON/OFF U_{Rmt}		
Eingangspegel „high“ → Motor EIN Input level „high“ → motor ON	[V]	5 [2 ... 5.5 or open contact]
Eingangspegel „low“ → Motor AUS Input level „low“ → motor OFF	[V]	0 [0 ... 0.5]
Eingangsimpedanz @ 1 kHz Input impedance @ 1 kHz	[kΩ]	≥ 5
Eingangssignal Motordrehrichtung U_{Rot} / Input signal motor rotation U_{Rot}		
<i>Standard für Pumpe / standard for pump</i> Eingangspegel „high“ → Motor CCW Input level „high“ → motor CCW	[V]	5 [2 ... 5.5 or open]
<i>Nicht empfohlen für Pumpe / not recommended for pump</i> Eingangspegel „low“ → Motor CW Input level „low“ → motor CW	[V]	0 [0 ... 0.5]
Eingangsimpedanz @ 1 kHz Input impedance @ 1 kHz	[kΩ]	≥ 5

Tab. 8 (part 2): Connection plan motor electronics N 816 K_DC-B-M

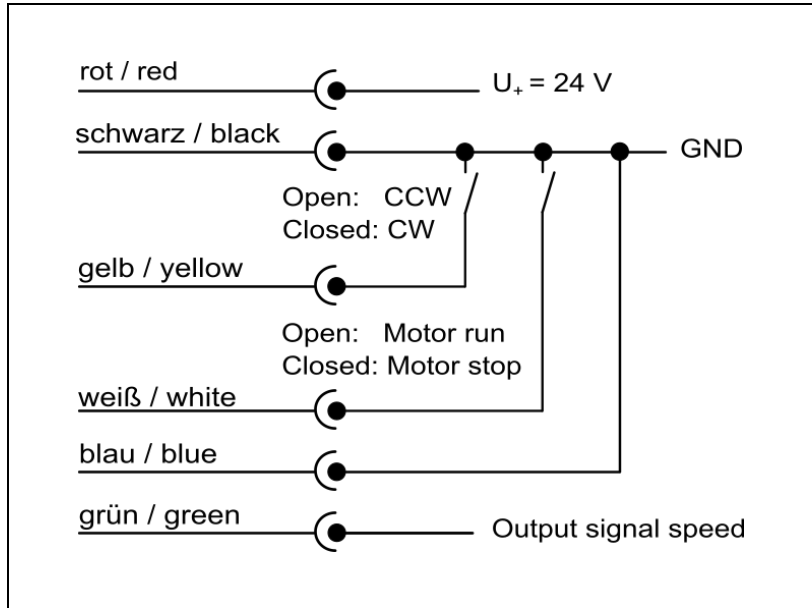


Fig. 12: Connection plan without external setpoint setting

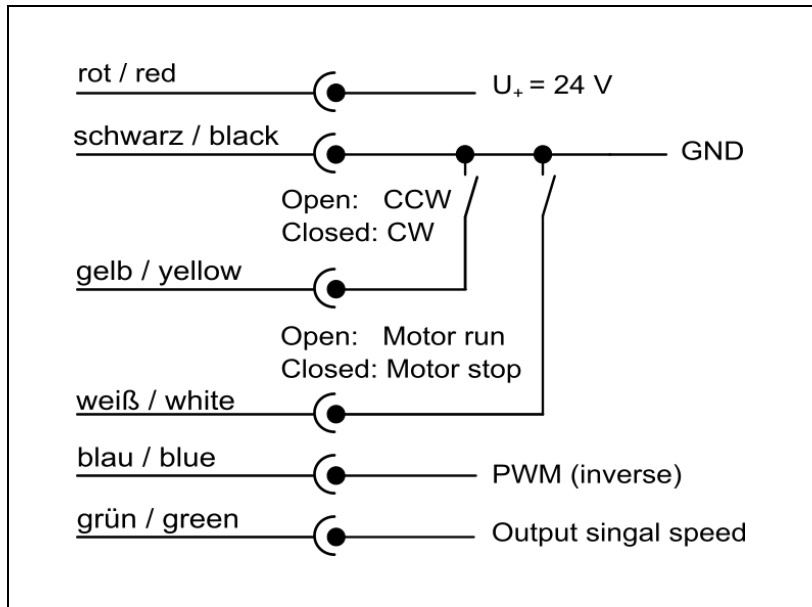


Fig. 13: Connection plan with external setpoint setting

7.3. Pneumatic connection



CAUTION

Personal injury or damages to property by ejected plugs

If the plug at the pressure side of the pump hasn't been removed, it could be ejected because of the overpressure during operation.

→ Remove the plug during the installation.

-
- | | |
|----------------------|--|
| Connected components | → Only connect components to the pump which are designed for the pneumatic data of the pump (see Chapter 4, Technical Data). |
| Pump exhaust | → If the pump is used as a vacuum pump, safely discharge the pump exhaust at the pump's pneumatic outlet. |
| Disengaging | → KNF recommends mechanically disengaging the pump from the piping system. This can be achieved with flexible tubing or pipes, for example. This will avoid transferring to the system any pump oscillations that may arise. |

Connecting pump



A marking on the pump head shows the direction of flow.



Confusion between suction and pressure sides can lead to breakage of connected components on the suction and pressure sides.

1. Remove the protective plugs from the hose connection threads.
2. Connect the suction line and pressure line (see Chapter 4, Technical Data for mounting dimensions).
3. Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.

8. Operation

8.1. General



Danger of burns from hot pump parts or hot medium

During or after operation of the pump, some pump parts may be hot.

- WARNING**
- Allow the pump to cool after operation.
 - Take safety precautions against the contact of hot parts/media.



Injury of the eyes

During excessive approach to the inlet or outlet of the pump, the eyes could be injured by the upcoming vacuum or overpressure.

- WARNING**
- Don't look into the pump's inlet or outlet during the operation.

- Only operate the pumps under the operating parameters and conditions described in Chapter 4. Technical Data.
- Make sure the pumps are used properly (see Chapter 2.1).
- Make sure the pumps are not used improperly (see Chapter 2.2).
- Observe the safety precautions (see Chapter 3).
- The pumps are intended for installation. Before putting them into service it must be established that machinery or equipment in which they are installed meets the relevant regulations.



Hazard of the pump head bursting due to excessive pressure increase

WARNING

- Do not exceed max. permissible operating pressure (see Chapter 4. Technical Data).
- Monitor pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure, immediately switch off pump and eliminate fault (see Chapter 10. Troubleshooting).
- Only throttle or regulate the air or gas quantity in the suction line to prevent the maximum permissible operating pressure from being exceeded.
- If the air or gas quantity in the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure is not exceeded.
- Ensure that the pump outlet is not closed or constricted.

i Excessive pressure (with all of the related hazards) can be prevented by placing a bypass line with a pressure-relief valve between the pressure and suction sides of the pump. For further information, contact our technical adviser (contact data: see www.knf.com).

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



WARNING

Automatic starting can cause personal injury and pump damage

When the operation of the pump is interrupted by the thermal switch or the triggering device for PTC sensors, the pump will restart automatically after cooling down.

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

Switching pump on

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 7.2).

➔ Make sure that normal atmospheric pressure is present in the lines during switch-on.

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.

Vapors as media The life of the diaphragm is prolonged the formation of condensate is avoided. Therefore the following precautions should be taken:

- ➔ Run the pump for a few minutes to warm it up before handling saturated or nearly saturated vapors.
- ➔ KNF recommends: When transferring aggressive media, flush the pump prior to switch off (see Chapter 9.2.1) to increase the service life of the diaphragm.

Switching pump off

- KNF recommends that, at the end of an evacuation operation, the pump should be allowed to run for a few minutes to remove condensate from the pump heads (drying of the pump).
- Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

8.2. Control functions N 816 K_DC-B

8.2.1. 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.

8.2.1.1. Speed input (.29 versions)

Speed range The speed range of $n_{\min} \dots n_{\max}$ is shown scaled to the control voltage U_{Ctrl} :

- $U_{\text{Ctrl min}}: 0.1 \text{ V}$
- $U_{\text{Ctrl max}}: 5.0 \text{ V}$

If the control voltage is less than $U_{\text{Ctrl min}}$, the motor is OFF.

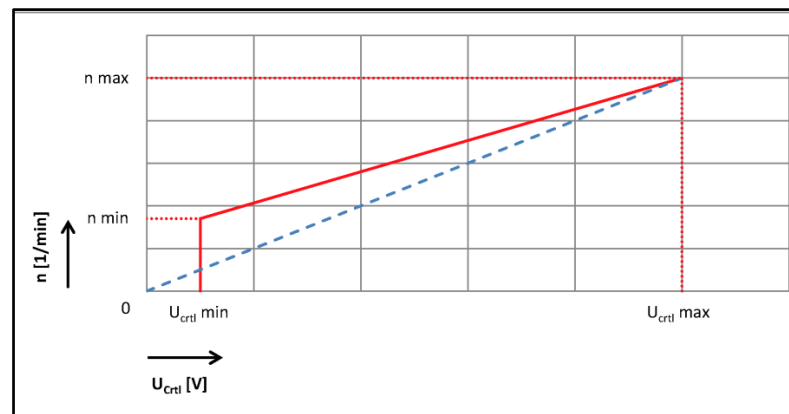


Fig. 14: Control-voltage/speed curve (standard)

Speed specification Speed is specified through the 8-pin controller connection, (white wire, see Tab. 7).

Optional analog settings for control voltage input

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

- Modify control voltage values $U_{\text{Ctrl min}}$ and $U_{\text{Ctrl max}}$
- If the control voltage is less than $U_{\text{Ctrl min}}$, the motor will be ON.

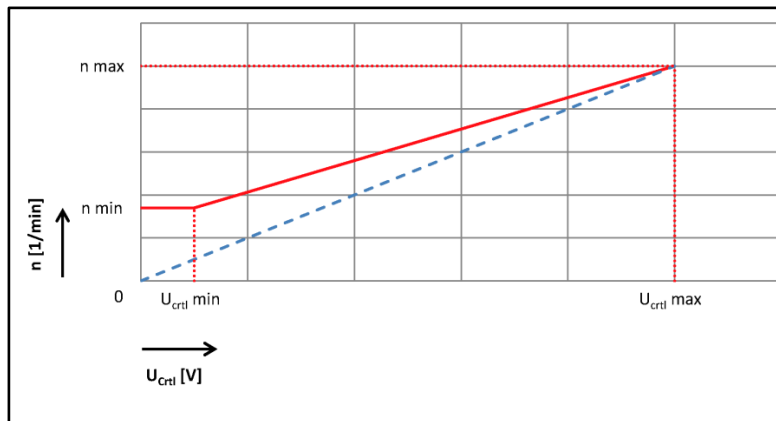


Fig. 15: Scaled control-voltage/speed curve (optional)

8.2.1.2. Speed output (.29 versions)

Speed output Speed is outputted through the 8-pin controller connection (yellow wire, see Tab. 7).

The motor controller generated speed-synchronized pulse-width modulation (see Fig. 16).

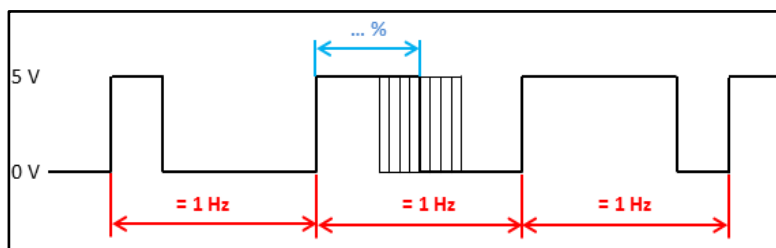


Fig. 16: Analog speed output (standard)

Optional speed output

The motor controller generates a speed-synchronized right-angle frequency with 5V TTL level (see Fig. 17).

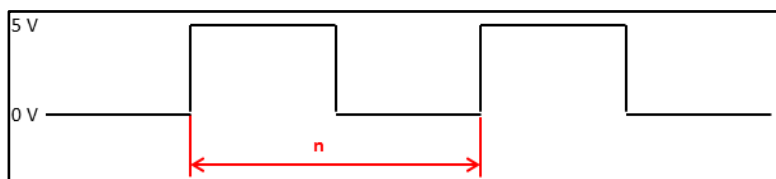


Fig. 17: Digital speed output (optional)

8.2.2. Remote ON/OFF (.29 versions)

Remote ON/OFF Remote ON/OFF is through an 8-pin controller connection (green wire, see Tab. 7).

i To start the motor, the green wire must be bridged to the ground of the controller connection (grey wire, blue wire or orange wire).

8.2.3. 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. 9).

Connector type: Micro-Match Female Top Entry

Part no.: 7-215079-6

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

Connection communication plug (see Fig. 9)

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

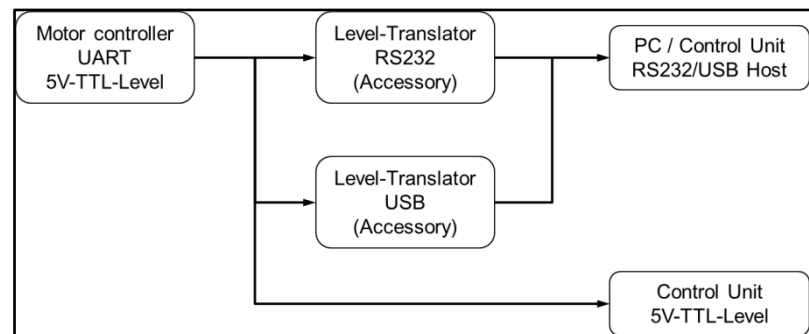


Fig. 18: External activation options (optional)

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} .
- Read-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. 9 to Tab. 11 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 table Tab. 11.

Parameter	Command*	Function	Reply
Motor	dB	Start	<u>S</u> ; <u>E</u>
	dE	Stop	<u>S</u> ; <u>E</u>
Speed	dSnnnn [nnnn = speed value]	Set nominal speed	<u>ns</u> ; <u>E</u>

Tab. 9: 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	<u>ni</u> ; <u>ii</u> , <u>ti</u> , <u>ei</u> , <u>E</u>
Fault status (single value)	gP	<u>ei</u> ; <u>E</u>
Nominal motor speed	gS	<u>ns</u> ; <u>E</u>
Minimum possible motor speed	gSl	<u>nl</u> ; <u>E</u>
Maximum possible motor speed	gSh	<u>nh</u> ; <u>E</u>
Software version number	iV	<u>V</u> ; <u>E</u>

Tab. 10: Read commands

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

Tab. 11: 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

i See p. 24 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. 12

8.3. Control functions N 816 K_DC-B-M

8.3.1. Speed control

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

Speed specification Speed is specified through the blue wire (see Tab. 8).

Speed output Speed is outputted through the green wire (see Tab. 8).
The motor controller generates a speed-synchronized right-angle frequency with 5V (see Fig. 19).

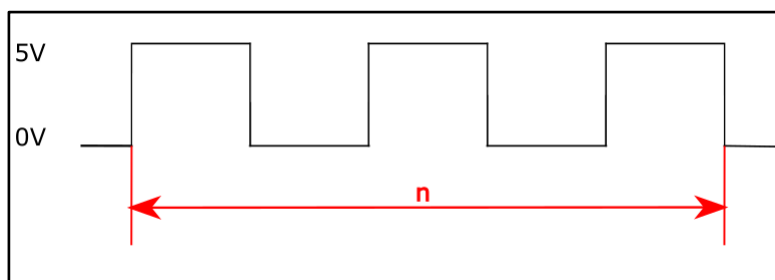


Fig. 19: Speed output N 816 K_DC-B-M

8.3.2. Input signal motor rotation

The input signal motor rotation is specified through the yellow wire (see Tab. 8).

8.3.3. Input signal Remote ON/OFF

The input signal Remote ON/OFF is specified through the white wire (see Tab. 8).

9. Servicing

9.1. Servicing schedule

Component	Servicing interval
Pump	- Regular inspection for external damage or leaks
Tube connection	- Regular inspection for external damage or leaks
Diaphragm and valve plates/sealings	- Replace if pump's pressure or flow rate change without apparent reason - Replace at the latest, when pump output decreases

Tab. 13

9.2. Cleaning

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

9.2.1. Flushing pump

→ Flush the pump under atmospheric conditions some minutes with air (or, if necessary for safety reasons, with an inert gas) prior to switch-off.

9.2.2. Cleaning pump

Conditions

- Motor disconnected from mains and de-energized



WARNING

Health hazard due to dangerous substances in the pump!

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

- Wear protective clothing if necessary, e.g. protective gloves.
- Clean pump with suitable measures.



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.

- As far as possible, clean the parts with a dry cloth. Solvents should not be used as they can attack the plastics, and synthetic rubber parts.
- If compressed air is available, blow out the components.

9.3. Replacing diaphragm and valve plates/sealings

- Conditions
- Motor disconnected from mains and de-energized
 - Pump is clean and free of dangerous substances
 - Tubes/pipes removed from pump's pneumatic inlet and outlet



Danger of burns from hot pump parts

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

CAUTION → Allow the pump to cool off after operation.

→ Always replace diaphragm and the valve plates/sealings together to maintain the performance and safety of the pump.



Health hazard due to dangerous substances in the pump!

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

WARNING

- Wear protective clothing if necessary, e.g. protective gloves.
- Clean pump with suitable measures.

Spare parts

Spare part*	Position**	Quantity
Diaphragm	(9)	1
Valve plate/sealing	(2)	2

Tab. 14

*According to spare parts list, Chapter 11

**According to Fig. 20

Tools and material

Quantity	Tools/material
1	Phillips screwdriver No. 2
1	Felt-tip pen

Tab. 15

*According to accessories list, Chapter 11

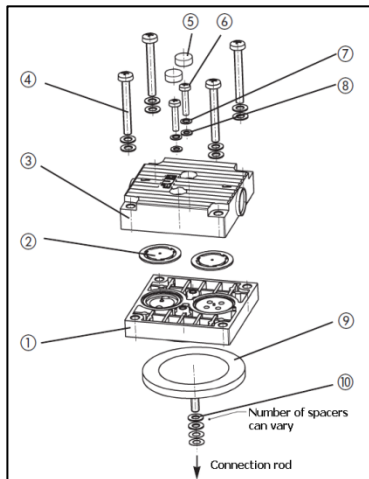


Fig. 20: N 816 K_
Parts of pump head

Remove pump head

1. Mark the position of head plate (3), intermediate plate (1) and pump housing relative to each other by a drawing line with a felt-tip pen. This helps avoid incorrect assembly later.
2. Undo the four screws (4) and remove them from the head plate (3).
3. Remove head plate (3) and intermediate plate (1) together from the pump housing.

i Put the head plate down carefully, so that its sealing edge will not get damaged.

Change diaphragm

1. Lift the edge of the diaphragm (9) and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
2. Take the diaphragm spacer(s) (10) off the threaded portion of the diaphragm and retain them.
3. Check that all parts are free from dirt and clean them if necessary (see Chapter 9.2.2).
4. Put the diaphragm spacer(s) (10) on the thread of the new diaphragm (9).
5. Move the connecting rod (connecting part between motor shaft and diaphragm) to top dead center.
6. Screw the diaphragm (9) clockwise onto the connecting rod and tighten hand-tight.

Change valve plates/sealings

1. Separate the head plate (3) from the intermediate plate (1).
2. Remove the valve plates/sealings (2) from the intermediate plate (1).
3. Check the valve seats, intermediate plate and head plate for soiling and damage. Clean the parts if necessary.
4. Contact KNF in case of roughness, scratches and corrosion. Order and replaced damaged parts.
5. Lay in valve plates/sealings:

i The valve plates/sealings for suction and pressure sides are identical; Upper and lower side of the valve plates/sealings are identical.

Lay the new valve plates (2) in the recesses in the intermediate plate (1).

6. Check that the hole of the valve plates/sealings (2) is centered on the centering pin of intermediate plate (1) by moving them gently sideways.

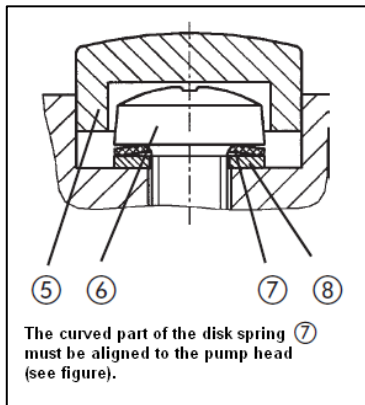


Fig. 21: Orientation of disk spring

7. Place the head plate (3) on the intermediate plate (1), in the position indicated by the marking.
8. Check that the head plate is centred by moving it gently sideways.
9. Join the head plate (3) and the intermediate plate (1) by tightening the two screws (6) (hand-tight).

i For placement of disk spring (7) and washer (8) and for orientation of disk spring see Fig. 21.

10. Install the screw caps (5).
11. Dispose of the old diaphragm and valve plates/sealings properly.

Refit pump heads

1. Place the pump head on the housing according to the marking.
2. Screw in the screws (4) and tighten only slightly diagonally.
3. Turn the fan to check that the pump rotates freely.
4. Tighten the screws (4) diagonally hand-tight.

Final steps

1. Reconnect suction and pressure line to the pump.
2. Reconnect the pump to the electricity supply.

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

10. Troubleshooting



DANGER

Extreme danger from electrical shock!

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

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

→ Check the pump (see Tab. 16 and Tab. 17).

Pump does not transfer	
Cause	Fault remedy
Pump not connected to the mains.	→ Connect pump to the mains.
No voltage in the mains.	→ Check room fuse switch on if necessary.
For N 816 K_DC-B-M: <ul style="list-style-type: none"> ▪ Max. voltage range of motor is exceeded. 	→ Separate pump from the mains. → The impressed voltage may not exceed the value shown in Chapter 7.2. (Electrical connection, Tab. 8).
For N 816 K_DC-B: <ul style="list-style-type: none"> ▪ 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 mains. → Be aware of right polarity of the connection wires and connect pump.
For pumps with AC motor: Thermal switch has operated following to over-heating.	→ Disconnect pump from mains. → Allow pump to cool. → Trace cause of over-heating and eliminate it.
Connections or lines blocked.	→ Check connections and lines. → Remove blockage.
External valve is closed or filter is clogged.	→ Check external valves and filters.
Condensate has collected in pump head.	→ Detach the condensate source from the pump. → Flush pump (see Chapter 9.2.1). → Install the pump at the highest point in the system.
Diaphragm or valve plates/sealings are worn	→ Replace diaphragm and valve plates/sealings (see Chapter 9.3).

Tab. 16

Flow rate, pressure or vacuum too low	
The pump does not achieve the output specified in the Technical data or the data sheet.	
Cause	Fault remedy
Condensate has collected in pump head.	<ul style="list-style-type: none"> ➔ Detach the condensate source from the pump. ➔ Flush pump (see Chapter 9.2.1). ➔ Install the pump at the highest point in the system.
There is gauge pressure on pressure side and at the same time vacuum or a pressure above atmospheric pressure on suction side.	<ul style="list-style-type: none"> ➔ The pump is not designed for this condition.
The cross section of pneumatic lines, or connected components is too small, or they are restricted.	<ul style="list-style-type: none"> ➔ To measure the performance, disconnect the pump from the system (small diameter tubing or valve can significantly affect performance). ➔ Eliminate throttling (e.g. valve) if necessary. ➔ Use lines or connection parts with larger cross section if necessary.
Leaks occur on connections, lines or pump head.	<ul style="list-style-type: none"> ➔ Eliminate leaks.
Connections or lines completely or partially jammed.	<ul style="list-style-type: none"> ➔ Check connections and lines. ➔ Remove the jamming parts and particles.
Head parts are soiled.	<ul style="list-style-type: none"> ➔ Clean head components.
Diaphragm or valve plates/sealings are worn	<ul style="list-style-type: none"> ➔ Replace diaphragm and valve plates/sealings (see Chapter 9.3).

Tab. 17

Fault visualization on motor controller (only N 816 K-DC-B)

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.

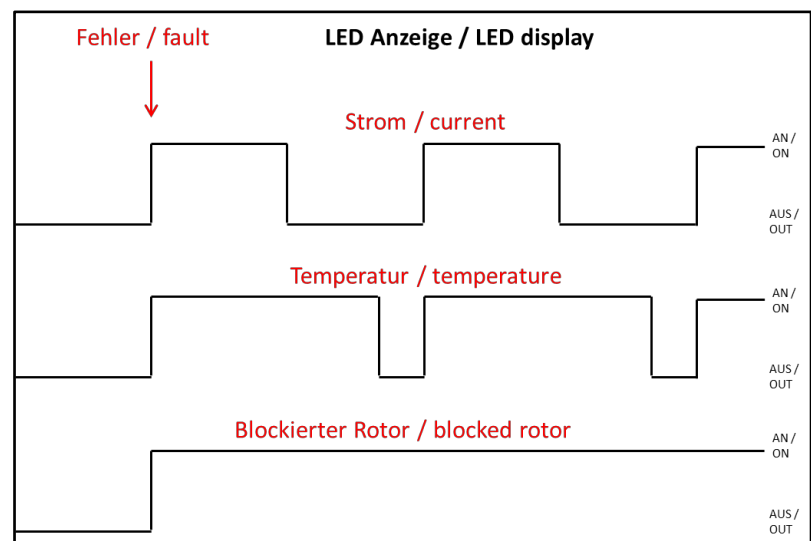


Fig. 22: LED blinking duration according to different faults

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

Fault cannot be rectified

If you are unable to determine any of the specified causes, send the pump to KNF Customer Service (contact data: see www.knf.de).

1. Flush the pump under atmospheric conditions some minutes with air (if necessary for safety reasons: with an inert gas) to free the pump head of dangerous or aggressive gases (see Chapter 9.2.1).
2. Remove the pump.
3. Clean the pump (see Chapter 9.2.2).
4. Send the pump to KNF with a filled out decontamination declaration and specification of the medium transferred.

11. Spare parts and accessories

Spare parts

N 816 KN_

Spare part	Position*	Order No.
Valve plate/sealing	(2)	059267
Diaphragm	(9)	052066

Tab. 18

*According to Fig. 20

N 816 KT_

Spare part	Position*	Order No.
Valve plate/sealing	(2)	057172
Diaphragm	(9)	044973

Tab. 19

*According to Fig. 20

12. Returns

Preparing for return

1. Flush the pump with air for a few minutes (if necessary for safety reasons: with inert gas) at atmospheric pressure to free the pump head of dangerous or aggressive gases (see Chapter 9.2.1).

i Please contact your KNF sales partner if the pump cannot be flushed due to damage.

2. Remove the pump.
3. Clean up the pump (see chapter 9.2.2).
4. Send the pump together with the completed Health and Safety Clearance and Decontamination Form to KNF, stating the nature of the transferred medium.
5. Pack the device securely to prevent further damage to the product. If necessary, request original packaging for a fee.

Returns

KNF shall undertake to repair the pump only under the condition that the customer presents a certificate regarding the medium that is pumped and the cleaning of the pump. In this case too, old devices can be returned. Please follow the instructions at knf.com/repairs here.

Contact your KNF sales partner directly if you require additional support for your return service.

KNF worldwide

Find your local KNF partner on www.knf.com