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## 1. SAFETY REGULATIONS AND NOTES

Please read these operating instructions carefully before starting to work with the device. Observe the following warnings to prevent malfunctions or physical damage to both property and people.

These operating instructions are to be regarded as part of this device.

If the device is sold or transferred, the operating instructions must accompany it.

These operating instructions may be duplicated and forwarded for information about potential dangers and their prevention.

### 1.1 Levels of hazard warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:



#### DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Compliance with the measures is mandatory.

#### WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Exercise extreme caution while working.

#### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage of property.

#### NOTE

A potentially harmful situation can occur and, if not avoided, can lead to property damage.

### 1.2 Staff qualification

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by qualified, trained and authorised technical staff.

Only authorised specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

### 1.3 Basic safety rules

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device.

The local industrial safety regulations must always be observed when working on the device.

Keep the workplace clean and tidy. Untidiness in the working area increases the risk of injury.

Observe the following when working on the unit:

- ⇒ Do not make any modifications, additions or conversions to the device without the approval of ebm-papst.

### 1.4 Electrical voltage

- ⇒ Check the electrical equipment of the device at regular intervals, refer to chapter 6.3 Safety test.

- ⇒ Replace loose connections and defective cables immediately.



#### DANGER

#### Electrical load on the device

Risk of electric shock

- Stand on a rubber mat if you are working on an electrically charged device.

**WARNING**

**Terminals and connections have voltage even with a unit that is shut off**

Electric shock

- Wait five minutes after disconnecting the voltage at all poles before opening the device.

**CAUTION**

**In the event of failure, there is electric voltage at the rotor and impeller**

The rotor and impeller are base insulated.

- Do not touch the rotor and impeller once they are installed.

**CAUTION**

**If control voltage is applied or a speed setpoint is stored, the motor will restart automatically, e.g. after a mains failure.**

Risk of injury

- Keep out of the device hazard zone.
- When working on the device, switch off the mains power and ensure that it cannot be switched back on.
- Wait until the device stops.
- After working on the device, remove any tools used or other objects from the device.

**1.5 Safety and protective functions****DANGER**

**Protective device missing and protective device not functioning**

Without a protective device there is a risk of serious injury, for instance if the hands reach or are sucked into the device during operation.

- Operate the device only with a fixed protective device and guard grille.
- The fixed protective device must be able to withstand the kinetic energy of a fan blade that becomes detached at maximum speed. There must not be any gaps which it is possible to reach into with the fingers, for example.
- The device is a built-in component. As the operator, you are responsible for ensuring that the device is secured adequately.
- Stop the device immediately if a protective device is found to be missing or ineffective.

**1.6 Electromagnetic radiation**

Interference from electromagnetic radiation is possible, e.g. in conjunction with open and closed-loop control devices.

If unacceptable emission intensities occur when the fan is installed, appropriate shielding measures have to be taken by the user.

**NOTE**

**Electrical or electromagnetic interferences after integrating the device in installations on the customer's side.**

- Verify that the entire setup is EMC compliant.

**1.7 Mechanical movement****DANGER**

**Rotating device**

Body parts that come into contact with the rotor and impeller can be injured.

- Secure the device against accidental contact.
- Before working on the system/machine, wait until all parts have come to a standstill.

**DANGER**

**Flying parts**

Missing safety devices may cause balancing weights or broken fan blades to be ejected at high speeds, causing bodily harm.

- Take appropriate safety measures.

**WARNING**

**Rotating device**

Long hair, dangling items of clothing, jewellery and similar items can become entangled and be pulled into the device. Risk of injury.

- Do not wear any loose-fitting or dangling clothing or jewellery while working on rotating parts.
- Protect long hair with a cap.

**1.8 Emission****WARNING**

**Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise.**

Danger of noise-induced hearing loss

- Take appropriate technical safety measures.
- Protect operating personnel with appropriate safety equipment, e.g. hearing protection.
- Also observe the requirements of local agencies.

**1.9 Hot surface****CAUTION**

**High temperature at the electronics housing**

Risk of burns

- Ensure sufficient contact protection.

**1.10 Transport****WARNING**

**Transportation of fan**

Injuries from tipping or slipping

- Always transport the fan carefully and only in its original packaging.
- Impact arising from setting down too hard or at an angle can cause bearing damage or deformation at the frame and impeller.
- The fans must always be transported and handled such that they cannot tip over.
- Secure the fan(s) with a lashing strip for example so that nothing can slip or tip up, particularly when stacking several fans.
- Also make allowance for possible wind forces.

### 1.11 Storage

- ⇒ Store the device, partially or fully assembled, in the original packaging in a clean, dry and weatherproof place free of vibrations.
- ⇒ Protect the device against environmental effects and dirt until final installation.
- ⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and longest possible service life.
- ⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.
- ⇒ Maintain the storage temperature, see chapter 3.6 Transport and storage conditions.
- ⇒ Please make sure that all screwed cable glands are fitted with dummy plugs.

- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or for taking on safety-related functions.
- Operation with completely or partially disassembled or modified protective features.
- In addition, all application options that are not listed under proper use.

## 2. PROPER USE

The device is exclusively designed as a built-in device for conveying air according to its technical data.

Any other usage above and beyond this does not conform with the intended purpose and constitutes misuse of the device.

Customer equipment must be capable of withstanding the mechanical and thermal stresses that can arise from this product. This applies for the entire service life of the equipment in which this product is installed.

### Proper use also includes:

- Use the device in power systems with earthed neutral (TN/TT power systems) only.
- The device is to be used in networks with network quality characteristics as per EN 50160.
- Only using the device in stationary systems.
- Carrying out all maintenance.
- Conveying of air at an ambient air pressure of 800 mbar to 1050 mbar.
- Using the device in accordance with the permitted ambient temperature, see chapter 3.6 Transport and storage conditions and chapter 3.2 Nominal data.
- Operating the device with all protective features in place.
- Minding the operating instructions.

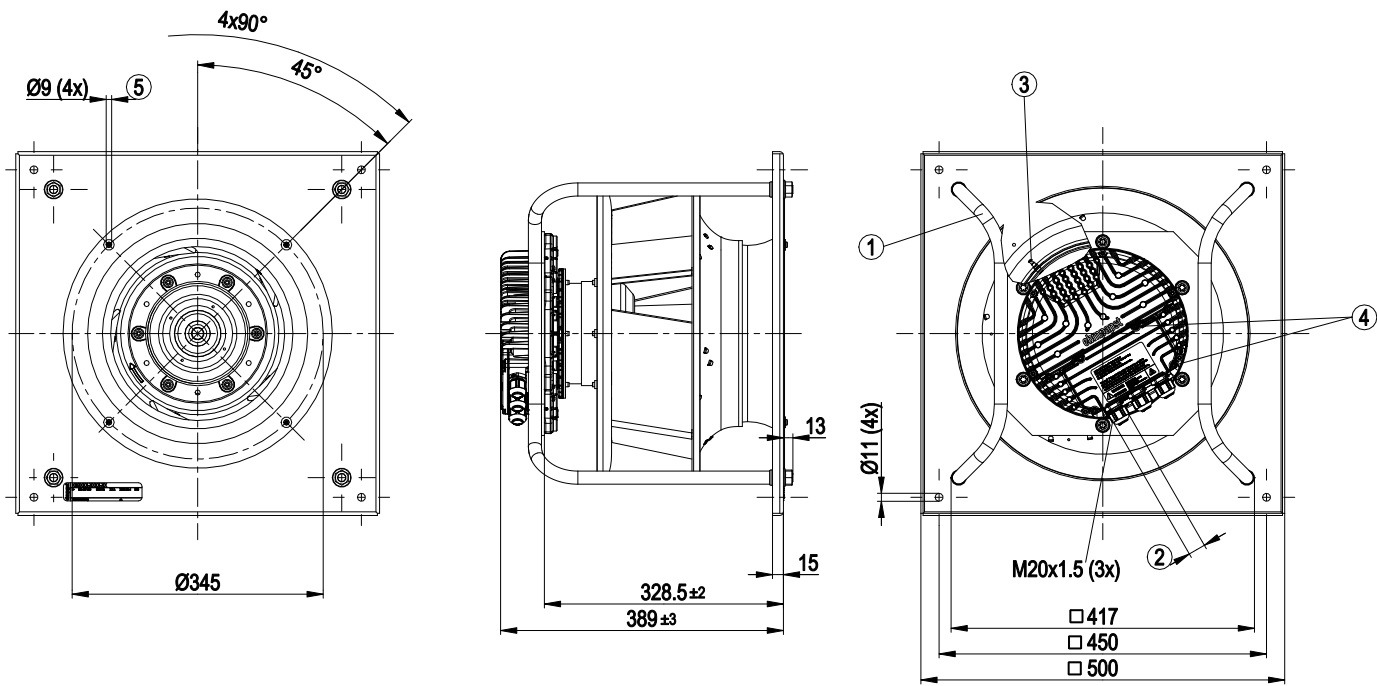
### Improper use

Using the device in the following ways is particularly prohibited and may cause hazards:

- Operating the device with an imbalance, e.g. caused by dirt deposits or icing.
- Resonance mode, operation with heavy vibrations. These also include vibrations that are transmitted from the customer system to the fan.
- Operation in medical equipment with a life-sustaining or lifesaving function.
- Moving solids content in flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Moving air that contains abrasive particles.
- Moving highly corrosive air, e.g. salt spray mist. Exceptions are devices that are intended for salt spray mist and protected accordingly.
- Moving air that contains dust pollution, e.g. suctioning off saw dust.

3. TECHNICAL DATA

3.1 Product drawing



All measures have the unit mm.

1	Installation position: Shaft horizontal (install the support struts only vertically as shown in the illustration!) or rotor on bottom; rotor on top on request
2	Cable diameter min. 4 mm, max. 10 mm, tightening torque 4±0.6 Nm
3	Inlet nozzle with pressure tap (k-factor: 148)
4	Tightening torque 3.5±0.5 Nm
5	Mounting holes for FlowGrid



## 3.2 Nominal data

Motor	M3G112-GA
Phase	3~
Nominal voltage / VAC	400
Nominal voltage range / VAC	380 .. 480
Frequency / Hz	50/60
Type of data definition	ml
Speed (rpm) / min <sup>-1</sup>	2870
Power input / W	1900
Current draw / A	3
Min. ambient temperature / °C	-25
Max. ambient temperature / °C	55

ml = Max. load · me = Max. efficiency · fa = Running at free air  
 cs = Customer specs · cu = Customer unit

Subject to alterations

## 3.3 Data in accordance with ecodesign regulation EU 327/2011

	Actual	Request 2015
01 Overall efficiency $\eta_{es}$ / %	68.8	54.4
02 Measurement category	A	
03 Efficiency category	Static	
04 Efficiency grade N	76.4	62
05 Variable speed drive	Yes	
06 Year of manufacture	The year of manufacture is specified on the rating plate on the product.	
07 Manufacturer	ebm-papst Mulfingen GmbH & Co. KG County court Stuttgart · HRA 590344 D-74673 Mulfingen	
08 Type	K3G355-PH49-05	
09 Power input $P_{ed}$ / kW	1.89	
09 Air flow $q_v$ / m <sup>3</sup> /h	4470	
09 Pressure increase total $p_{sf}$ / Pa	991	
10 Speed (rpm) $n$ / min <sup>-1</sup>	2895	
11 Specific ratio*	1.01	
12 Recycling/disposal	Information on recycling and disposal is provided in the operating instructions.	
13 Maintenance	Information on installation, operation and maintenance is provided in the operating instructions.	
14 Additional components	Components used to calculate the energy efficiency that are not apparent from the measurement category are detailed in the CE declaration.	

\* Specific ratio =  $1 + p_{sf} / 100\,000\text{ Pa}$

Data definition with optimum efficiency. The ErP data is determined using a motor-impeller combination in a standardised measurement configuration.

## 3.4 Technical features

Mass	24.5 kg
Size	355 mm
Motor size	112
Surface of rotor	Coated in black
Material of electronics housing	Die-cast aluminium
Material of impeller	Aluminium sheet
Material of mounting plate	Sheet steel, galvanised
Material of support bracket	Steel, galvanised and coated in black
Material of inlet nozzle	Sheet steel, galvanised
Number of blades	5
Direction of rotation	Clockwise, seen on rotor
Type of protection	IP54
Insulation class	"B"
Humidity (F) / environmental protection class (H)	H1
Mounting position	Refer to product drawing
Condensation drainage holes	Rotor-side
Operation mode	S1
Motor bearing	Ball bearing
Technical features	<ul style="list-style-type: none"> <li>- Output 10 VDC, max. 10 mA</li> <li>- Output 20 VDC, max. 50 mA</li> <li>- Output for slave 0-10 V</li> <li>- Operation and alarm display</li> <li>- Input for sensor 0-10 V or 4-20 mA</li> <li>- External 24 V input (programming)</li> <li>- External release input</li> <li>- Alarm relay</li> <li>- Integrated PID controller</li> <li>- Output limit</li> <li>- Motor current limit</li> <li>- PFC, passive</li> <li>- RS485 MODBUS RTU</li> <li>- Soft start</li> <li>- Control input 0-10 VDC / PWM</li> <li>- Control interface with SELV potential safely disconnected from the mains</li> <li>- Over-temperature protected electronics / motor</li> <li>- Line undervoltage / phase failure detection</li> </ul>
Touch current acc. IEC 60990 (measuring network Fig. 4, TN system)	$\leq 3.5\text{ mA}$
Electrical connection	Terminal box
Motor protection	Thermal overload protector (TOP) wired internally
Protection class	I (if protective earth is connected by customer)
Product conforming to standard	EN 61800-5-1; CE
Approval	CSA C22.2 no. 77 + CAN/CSA-E60730-1; EAC; UL 1004-7 + 60730-1



For cyclic speed loads, note that the rotating parts of the device are designed for maximum one million load cycles. If you have specific questions, contact ebm-papst for support.

⇒ Use the device in accordance with its protection type.

### Notes on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may vary during the production period. Strength, dimensional stability and dimensional accuracy are not affected by this.

The colour pigments of the paints used react perceptibly to UV light over the course of time. This does not however have any influence on the technical properties of the products. To prevent the formation of patches and fading, the product is to be protected against UV radiation. Changes in colour are not a reason for complaint and are not covered by the warranty.

### 3.5 Mounting data

⇒ Secure the mounting screws against accidentally coming loose (e.g. by using self-locking screws).

<b>Strength class for mounting screws</b>	8.8
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Any further mounting data required can be taken from the product drawing or Section chapter 4.1 Connecting the mechanical system.

### 3.6 Transport and storage conditions

<b>Max. permissible ambient motor temp. (transp./ storage)</b>	+80 °C
<b>Min. permissible ambient motor temp. (transp./storage)</b>	-40 °C

### 3.7 Electromagnetic compatibility



If several devices are switched in parallel on the mains side so that the line current of the arrangement is in the range of 16 - 75 A, then this arrangement conforms to IEC 61000-3-12 provided that the short-circuit power  $S_{sc}$  at the connection point of the customer system to the public power system is greater than or equal to 120 times the rated output of the arrangement. It is the responsibility of the installation engineer or operator/owner of the device to ensure, if necessary after consultation with the network operator, that this device is only connected to a connection point with a  $S_{sc}$  value that is greater than or equal to 120 times the rated output of the arrangement.

## 4. CONNECTION AND START-UP

### 4.1 Connecting the mechanical system



#### CAUTION

**Cutting and crushing hazard when removing device from packaging**



→ Carefully remove the device from its packaging, only touching the housing. Strictly avoid shocks.

→ Wear safety shoes and cut-resistant safety gloves.

#### CAUTION

**Heavy load when taking out the device**

Bodily harm, e.g. back injuries, are possible.

→ Two people should remove the device out of its packaging together.

#### NOTE

**Damage to device from vibration**

Bearing damage, reduced service life

→ Forces or impermissibly high vibration levels must not be transmitted to the fan from system components.

→ If the fan is connected to air ducts, it should be isolated from vibrations, for example using compensators or similar elements.

→ Fasten the fan to the substructure without distorting it.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.

There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices must no longer be installed.

⇒ Install the undamaged device according to your application.



#### CAUTION

**Possibility of damage to the device**

Serious damage may result if the device slips during assembly.

→ Keep the device fixed in position at the installation location until all attachment screws have been tightened.

• The fan must not be strained on fastening.

### 4.2 Connecting the electrical system



#### DANGER

**Electric voltage on the device**

Electric shock

→ Always install a protective earth first.

→ Check the protective earth.



#### DANGER

**Incorrect insulation**

Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation requirements for voltage, current, insulation material, load etc.

→ Route cables such that they cannot be touched by any rotating parts.

**DANGER**

**Electrical load (>50 µC) between mains wire and protective earth connection after switching of the supply when switching multiple devices in parallel.**

Electric shock, risk of injury

- Make sure that sufficient protection against accidental contact is provided.
- Before working on the electrical connection, the connections to the mains supply and PE must be shorted.

**CAUTION****Electrical voltage**

The fan is a built-in component and features no electrically isolating switch.

- Only connect the fan to circuits that can be switched off with an all-pole separating switch.
- When working on the fan, you must switch off the installation/machine in which the fan is installed and secure it from being switched on again.

**NOTE****Interferences and failures are possible**

Maintain a distance to the power supply line when routing the control lines of the device.

- Ensure a sufficiently large clearance.
- Recommendation: clearance > 10 cm (separate cable routing)

**NOTE****Water penetration into leads or wires**

Water enters at the cable end on the customers side and can damage the device.

- Make sure that the cable end is connected in a dry environment.



Connect the device only to circuits that can be switched off using an all-pole disconnecting switch.

**4.2.1 Prerequisites**

- ⇒ Check that the data on the type plate match the connection data.
- ⇒ Before connecting the device, ensure that the supply voltage matches the operating voltage of the device.
- ⇒ Only use cables designed for current according to the type plate. For determining the cross-section, follow the basic principles in accordance with EN 61800-5-1. The protective earth must have a cross-section equal to or greater than the outer conductor cross-section. We recommend the use of 105°C cables. Ensure that the minimum cable cross-section is at least AWG26/0.13 mm².

**Protective earth contact resistance as per EN 61800-5-1**

Compliance with the resistance specifications as per EN 61800-5-1 for the protective earth connection circuit must be verified in the application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device. The protective earth terminal is located on the housing and provided with a protective earth symbol and a hole.

**4.2.2 Power supply connection, fuse protection**

Assignment of conductor cross-sections and the fuse protection required for them (overload protection only, no device protection).

Nominal voltage	Safety fuse		Automatic circuit breaker	Wire cross-section	Wire cross-section
	VDE	UL	VDE	mm²	*AWG
3/PE AC 380 - 480 VAC	16 A	15 A	C16A	1.5	16
3/PE AC 380 - 480 VAC	20 A	20 A	C20A	2.5	14
3/PE AC 380 - 480 VAC	25 A	25 A	C25A	4.0	12

\* AWG = American Wire Gauge

**4.2.3 Idle current**

Because of the EMC filter integrated for compliance with EMC limits (interference emission and interference immunity), idle currents in the mains cable can be measured even when the motor is at a standstill and the mains voltage is switched on.

- The values are typically in the range < 250 mA
- At the same time, the effective power in this operating state (operational readiness) is typically < 5 W.

**4.2.4 Residual current operated device**

If the use of a residual current device (RCD) is required in your installation, only universal residual current devices (type B or B+) are permissible. Residual current devices (RCD) cannot provide personal safety while operating the device, as is also the case with frequency converters. When the device power supply is switched on, charging current pulses from the capacitors in the integrated EMC filter can lead to the instant triggering of residual current devices. We recommend residual current circuit breakers (RCCB) with an activation threshold of 300 mA and delayed tripping (super-resistant, characteristic K).

**4.2.5 Leakage current**

For asymmetrical power systems or if a phase fails, the leakage current can increase to a multiple of the nominal value.

**4.2.6 Locked-rotor protection**

Due to the locked-rotor protection, the start-up current (LRA) is equal to or less than the nominal current (FLA).

**4.3 Connection in terminal box**

#### 4.3.1 Preparing connection lines for the connection

Strip the cable just enough so that the screwed cable gland is tight and the terminals are relieved of strain. Tightening torque, see chapter 3.1 Product drawing.



##### NOTE

Tightness and strain relief depend on the cable used.

→ The user must check this.

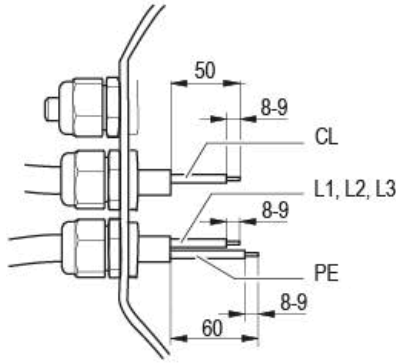


Fig. 1: Recommended stripping lengths in mm (inside the terminal box)  
Legend: CL = control lines

#### 4.3.2 Connecting cables with terminals



##### WARNING

Terminals and connections have voltage even with a unit that is shut off

Electric shock

→ Wait five minutes after disconnecting the voltage at all poles before opening the device.

⇒ Remove the cap from the screwed cable gland.

Remove the cap only in those places where cables are inserted.

⇒ Mount the screwed cable glands with the seal inserts provided in the terminal box.

⇒ Insert the line(s) (not included in the standard scope of delivery) into the terminal box.

⇒ First connect the "PE" (protective earth) connection.

⇒ Connect the lines to the corresponding terminals.

Use a screwdriver to do so.

During the connection work, ensure that no cables splice off.

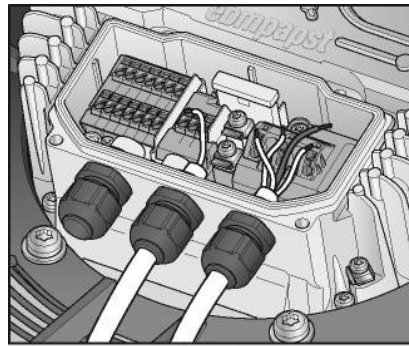


Fig. 2: Connecting the wires to terminals

⇒ Seal the terminal box.

#### 4.3.3 Cable routing

No water may penetrate along the cable in the direction of the cable gland.



##### NOTE

**Damage caused by moisture penetration.**

Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop (siphon) wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

#### 4.4 Factory settings

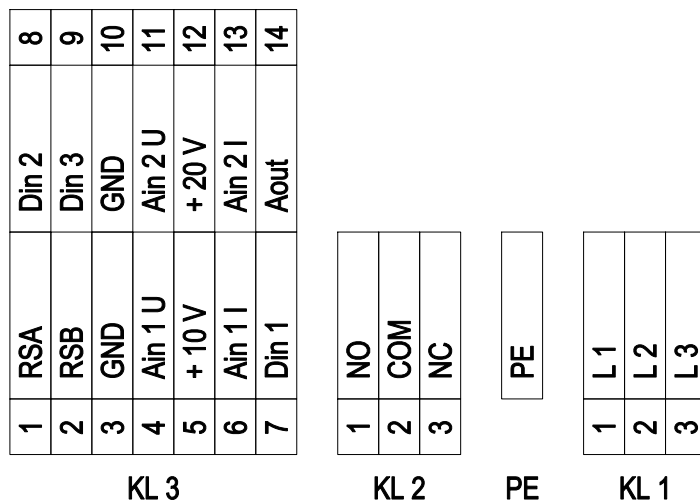
Factory settings with which the device is pre-set by ebm-papst.

Control mode parameter set 1	PWM controlling
Control mode parameter set 2	PWM controlling
Fan / device adress	01
Max. PWM / %	100
Min. PWM / %	5
Save set value to EEPROM	Yes
Set value control	Analogue (linear)
Control function parameter set 1	Positive (heating)

Control function parameter set 2	Positive (heating)
-------------------------------------	--------------------



## 4.5 Connection screen



No.	Conn.	Designation	Function / assignment
KL 1	1	L1	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
KL 1	2	L2	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
KL 1	3	L3	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
PE		PE	Earth connection, PE connection
KL 2	1	NO	Status relay, floating status contact; normally open; close with error
KL2	2	COM	Status relay; floating status contact; changeover contact; common connection; contact rating 250 VAC / max. 2 A (AC1) / min. 10 mA
KL2	3	NC	Status relay, floating status contact; break with error
KL 3	1	RSA	Bus connection RS-485, RSA, MODBUS RTU; SELV
KL 3	2	RSB	Bus connection RS-485, RSB, MODBUS RTU; SELV
KL 3	3 / 10	GND	Signal ground for control interface; SELV
KL 3	4	Ain1 U	Analogue input 1, set value: 0-10 V, Ri = 100 kΩ, parametrisable curve, only usable as alternative to input Ain1; SELV
KL 3	5	+ 10 V	Fixed voltage output 10 VDC, +10 V ±3%, max. 10 mA, short-circuit-proof, power supply for external devices (e.g. potentiometer), SELV
KL 3	6	Ain1 I	Analogue input 1, set value: 4-20 mA; Ri = 100 Ω, parametrisable curve, only usable as alternative to input Ain1 U; SELV
KL 3	7	Din1	Digital input 1: enabling of electronics, enabling: open pin or applied voltage 5-50 VDC disabling: bridge to GND or applied voltage <1 VDC reset function: triggers software reset after a level change to <1 VDC; SELV
KL 3	8	Din2	Digital input 2: parameter set switch 1/2, according to EEPROM setting, the valid/used parameter set can be selected via bus or via digital input DIN2. Parameter set 1: open pin or applied voltage 5-50 VDC Parameter set 2: bridge to GND or applied voltage <1 VDC; SELV
KL 3	9	Din3	Digital input 3: controller function of integrated controller, according to EEPROM setting, the controller function of the integrated controller is normally/inversely selectable per bus or per digital input normal: open pin or applied voltage 5-50 VDC inverse: bridge to GND or applied voltage <1 VDC; SELV
KL 3	11	Ain2 U	Analogue input 2, actual value: 0-10 V, Ri = 100 kΩ, parametrisable curve, only usable as alternative to input Ain2; SELV
KL 3	12	+ 20 V	Fixed voltage output 20 VDC, +20 V ±25/-10%, max. 50 mA, short-circuit-proof, power supply for external devices (e.g. sensors); SELV
KL 3	13	Ain2 I	Analogue input 2, actual value: 4-20 mA, Ri = 100 Ω, parametrisable curve, only usable as alternative to input Ain2 U; SELV
KL 3	14	Aout	Analogue output 0-10 VDC, max. 5 mA, output of the current motor level control coefficient / motor speed parametrisable curve; SELV

#### 4.6 Checking the connections

- ⇒ Make sure that the power is off (all phases).
- ⇒ Secure it from being switched on again.
- ⇒ Check the correct fit of the connection lines.
- ⇒ Screw the terminal box cover closed again. Terminal box tightening torque, see chapter 3.1 Product drawing.
- ⇒ Route the connecting cables in the terminal box so that the terminal box cover closes without resistance.
- ⇒ Use all plug screws (the entire number). In doing so, insert the screws manually to avoid damage to the thread.
- ⇒ Make sure that the terminal box is correctly closed and sealed and that all screws and screwed cable glands are properly tightened.

#### 4.7 Switch on device

The device is not to be switched on until it has been installed properly and in accordance with its intended use, including the required protective devices and professional electrical connection. This also applies to devices which have already been equipped with plugs and terminals or similar connectors by the customer.



#### WARNING

##### Hot motor housing

Fire hazard

→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Inspect the device for visible external damage and the proper function of the protective features before switching it on.
- ⇒ Check the air flow paths of the fan for foreign objects and remove any that are found.
- ⇒ Apply the nominal voltage to the voltage supply.
- ⇒ Start the device by changing the input signal.



#### NOTE

##### Damage to device by vibrations

Bearing damage, reduced service life

- The fan must operate free of vibrations throughout its speed control range.
- Strong vibrations can result from improper handling, imbalance resulting from damage during transport, or component-induced or structural resonances.
- When putting the fan into service, determine the speed ranges with excessive vibration levels and also any resonance frequencies that may be present.
- When regulating the speed, pass through resonance ranges as quickly as possible or find another remedy.
- Operation at excessive vibration levels can lead to premature failure.
- The maximum vibration severity may not exceed 3.5 mm/s and should be checked every 6 months.
- It must be measured along all 3 spatial axes at the place where the motor is attached to the motor support plate; see chapter 6. Maintenance, malfunctions, possible causes and remedies.

#### 4.8 Switching off the device

Switching off the device during operation:

- ⇒ Switch off the device via the control input.
- ⇒ Do not switch the motor (e.g. in cyclic operation) on and off via power supply.

Switching off the device for maintenance work:

- ⇒ Switch off the device via the control input.
- ⇒ Do not switch the motor (e.g. in cyclic operation) on and off via power supply.
- ⇒ Disconnect the device from the supply voltage.
- ⇒ When disconnecting, be sure to disconnect the earth wire connection last.

### 5. INTEGRATED PROTECTIVE FUNCTIONS

The integrated protective functions cause the motor to switch off automatically in case of faults described in the table.

Malfunctions	Description / Function of safety feature
Rotor position detection error	An automatic restart occurs.
Locked rotor	⇒ After the blockage is removed, the motor restarts automatically.
Line under-voltage (mains input voltage outside of permitted nominal voltage)	⇒ If the mains supply voltage returns to permitted values, the motor restarts automatically.
Phase failure	A phase of the supply voltage fails for at least 5 s. ⇒ If all phases are correctly supplied again, the motor automatically restarts after 10 - 40 s.

## 6. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

Do not perform any repairs on your device. Return the device to ebm-papst for repair or replacement.



### WARNING

**Terminals and connections have voltage even with a unit that is shut off**

Electric shock

→ Wait five minutes after disconnecting the voltage at all poles before opening the device.

### CAUTION

**If control voltage is applied or a speed setpoint is stored, the motor will restart automatically, e.g. after a mains failure.**

Risk of injury

→ Keep out of the device hazard zone.

→ When working on the device, switch off the mains power and ensure that it cannot be switched back on.

→ Wait until the device stops.

→ After working on the device, remove any tools used or other objects from the device.



### NOTE

If the device is not operated for a lengthy period in installed condition in a dry environment, it is to be started up and operated at full speed for one hour at least every four months. If the device is not operated for a lengthy period in installed condition in a damp environment (e.g. outdoors), it is to be started up and operated at full speed for at least two hours once a month to move the bearings and allow any condensate that may have ingressed to evaporate.

Malfunction/error	Possible cause	Possible remedy
Impeller running roughly	Imbalance in rotating parts	Clean the device; if imbalance is still evident after cleaning, replace the device. If you have attached any weight clips during cleaning, make sure to remove them afterwards.
Motor does not turn	Mechanical blockage	Switch off, de-energise, and remove mechanical blockage.
	Mains supply voltage faulty	Check mains supply voltage, restore power supply. Important! The error message resets automatically. The device starts up again automatically without advance warning.
	Faulty connection	De-energise, correct connection, see connection diagram.

	Motor winding broken	Replace device
	Thermal overload protector responded	Allow motor to cool off, locate and rectify cause of error, if necessary cancel restart lock-out
	Insufficient cooling	Improve cooling. Let the device cool down. To reset the error message, switch off the mains supply voltage for a min. of 25 s and switch it on again. Alternatively, reset the error message by applying a control signal of <0.5 V to DIN1 or by short circuiting Din1 to GND.
	Ambient temperature too high	Reduce the ambient temperature. Let the device cool down. To reset the error message, switch off the mains supply voltage for a min. of 25 s and switch it on again. Alternatively, reset the error message by applying a control signal of <0.5 V to DIN1 or by short circuiting Din1 to GND.
	Unacceptable operating point (e.g. counterpressure is too high)	Correct the operating point. Let the device cool down. To reset the error message, switch off the mains supply voltage for a min. of 25 s and switch it on again. Alternatively, reset the error message by applying a control signal of <0.5 V to DIN1 or by short circuiting Din1 to GND.



If you have any other problems, contact ebm-papst.



### 6.1 Vibration test

Checking the fan for mechanical vibrations based on ISO 14694. Recommendation: every 6 months. Maximum vibration severity is 3.5 mm/s measured at the motor's fastening diameter on the motor support plate towards and perpendicular to the motor's axis of rotation.

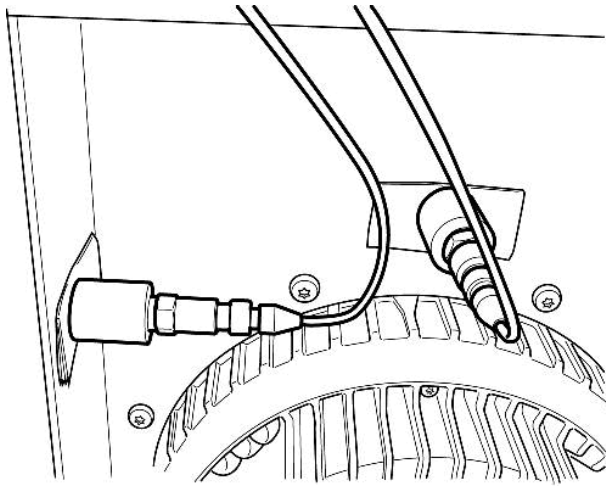


Fig. 3: Example showing vibration measurement. Positioning of the sensors will vary depending on the device and the circumstances of installation.

### 6.2 Cleaning

#### NOTE

#### Damage to the device during cleaning

Malfunction possible

- Do not clean the device using a water jet or high-pressure cleaner.
- Do not use any acid, alkali or solvent-based cleaning agents.
- Do not use any pointed or sharp-edged objects for cleaning

### 6.3 Safety test

#### NOTE

#### High-voltage test

The integrated EMC filter contains Y capacitors. Therefore, the trigger current is exceeded when AC testing voltage is applied.

- Test the device with DC voltage when you carry out the high-voltage test required by law. The voltage to be used corresponds to the peak value of the AC voltage required by the standard.

What has to be tested?	How to test?	Frequency	Which measure?
Check the protective casing against accidental contact for damage and to ensure that it is intact	Visual inspection	At least every 6 months	Repair or replacement of the device

Check the device for damage to blades and housing	Visual inspection	At least every 6 months	Replacement of the device
Mounting the connection lines	Visual inspection	At least every 6 months	Fasten
Check the insulation of the wires for damage	Visual inspection	At least every 6 months	Replace wires
Impeller for wear/deposits/corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of screwed cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Condensate discharge holes for clogging, as necessary	Visual inspection	At least every 6 months	Open bore holes
Abnormal bearing noise	acoustic	At least every 6 months	Replace device
Vibration test	Vibration tester, acceleration or deceleration measurement	Recommended every 6 months	Clean impeller or replace device

### 6.4 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.

ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.

Right from the development stage, ecological design, technical safety and health protection are fixed criteria.

The following section contains recommendations for ecological disposal of the product and its components.

#### 6.4.1 Country-specific legal requirements



#### NOTE

#### Country-specific legal requirements

Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

#### 6.4.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.

The product is to be disassembled into suitable components for disposal employing standard procedures for motors.



#### WARNING

**Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.**

This can result in fatal or serious injury and material damage.

- Secure components before unfastening to stop them falling.

#### 6.4.3 Component disposal

The products are mostly made of steel, copper, aluminium and plastic.

Metallic materials are generally considered to be fully recyclable.

Separate the components for recycling into the following categories:

- Steel and iron
- Aluminium
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires
- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.

The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power lines
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.



→ Please contact ebm-papst for any other questions on disposal.