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## CONTENTS

<b>1. SAFETY REGULATIONS AND INFORMATION</b>	<b>1</b>
1.1 Hazard levels for warnings	1
1.2 Staff qualifications	1
1.3 Basic safety rules	1
1.4 Voltage	1
1.5 Safety and protective features	2
1.6 Electromagnetic radiation	2
1.7 Mechanical movement	2
1.8 Emissions	2
1.9 Hot surface	2
1.10 Transport	2
1.11 Storage	3
<b>2. INTENDED USE</b>	<b>3</b>
<b>3. TECHNICAL DATA</b>	<b>4</b>
3.1 Product drawing	4
3.2 Nominal data	5
3.3 Data according to Commission Regulation (EU) 327/2011	5
3.4 Technical description	5
3.5 Mounting data	6
3.6 Transport and storage conditions	6
3.7 Electromagnetic compatibility	6
<b>4. CONNECTION AND STARTUP</b>	<b>6</b>
4.1 Mechanical connection	6
4.2 Electrical connection	6
4.3 Plug connection	8
4.4 Factory settings	8
4.5 Connection diagram	9
4.6 Configuration options	10
4.7 Equivalent circuit diagrams	11
4.8 Checking connections	12
4.9 Switching on the device	12
4.10 Switching off the device	12
<b>5. INTEGRATED PROTECTIVE FEATURES</b>	<b>12</b>
<b>6. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES</b>	<b>12</b>
6.1 Warning/status codes	13
6.2 Vibration testing	13
6.3 Cleaning	14
6.4 Safety inspection	14
6.5 Disposal	14

## 1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.

These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.

These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

### 1.1 Hazard levels for 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 will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

#### WARNING

Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

#### CAUTION

Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

#### NOTE

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

### 1.2 Staff qualifications

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

Only authorized 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

The safety hazards associated with the device must be assessed again following installation in the final product.

The locally applicable industrial safety regulations are always to be observed when working on the device.

Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.

Note the following when working on the device:

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

### 1.4 Voltage

- ⇒ Check the device's electrical equipment at regular intervals; see Chapter 6.4 Safety inspection.

- ⇒ Replace loose connections and defective cables immediately.



#### DANGER

#### Electrically charged device

Risk of electric shock

- When working on an electrically charged device, stand on a rubber mat.

**WARNING****Live terminals and connections even with device switched off**

Electric shock

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

**CAUTION****In the event of a fault, the rotor and the impeller will be energized**

The rotor and the impeller have basic insulation.

- Do not touch the rotor and impeller once installed.

**CAUTION****If control voltage or a stored speed set value is applied, the motor will restart automatically, e.g. after a power failure.**

Risk of injury

- Keep out of the device's danger zone.
- When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
- Wait until the device comes to a stop.
- After working on the device, remove any tools or other objects from the device.

**1.5 Safety and protective features****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 you notice a missing or ineffective protective device.

**1.6 Electromagnetic radiation**

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

If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

**NOTE****Electrical or electromagnetic interference after installing the device in customer equipment.**

- Verify that the entire setup is EMC-compliant.

**1.7 Mechanical movement****DANGER****Rotating device**

Risk of injury to body parts coming into contact with the rotor or the impeller.

- Secure the device against accidental contact.

- Before working on the system/machine, wait until all parts have come to a standstill.

**DANGER****Ejected parts**

Missing protective devices may cause balancing weights or broken fan blades to be ejected and cause injuries.

- Take appropriate safety measures.

**WARNING****Rotating device**

Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

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

**1.8 Emissions****WARNING****Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).**

Risk of noise-induced hearing loss

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

**1.9 Hot surface****CAUTION****High temperature on electronics housing**

Risk of burns

- Ensure sufficient protection against accidental contact.

**1.10 Transport****WARNING****Transporting the fan**

Injuries from tipping or slipping

- The fan is always to be transported with care and in its original packaging.
- If set down too hard or at an angle for example, the impact can lead to bearing damage or deformation of the frame or impeller.
- It must be ensured that the fans cannot tip over during transportation and handling.
- Secure the fan(s) with appropriate equipment such as a lashing strip so that nothing can slip or tip, especially when stacking multiple fans.
- Also make allowance for possible wind forces.

### 1.11 Storage

- ⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.
- ⇒ 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 the 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.

- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

## 2. INTENDED 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.

### Intended use also includes

- The device is only to be used in power systems with grounded neutral (TN/TT power systems), in power systems with phase conductor grounding, or in IT power systems.
- The device is to be used in networks with network quality characteristics as per EN 50160.
- Using the device only in stationary systems.
- Performing all maintenance work.
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.6 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

### Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.



## 3.2 Nominal data

Motor	M3G150-FF
Phase	3~
Nominal voltage / VAC	400
Nominal voltage range / VAC	380 .. 480
Frequency / Hz	50/60
Method of obtaining data	ml
Status	prelim.
Speed (rpm) / min <sup>-1</sup>	2800
Power consumption / W	3800
Current draw / A	5.8
Min. ambient temperature / °C	-40
Max. ambient temperature / °C	40

ml = Max. load · me = Max. efficiency · fa = Free air  
 cs = Customer specification · ce = Customer equipment

Subject to change

## 3.3 Data according to Commission Regulation (EU) 327/2011

	Actual	Req. 2015
01 Overall efficiency $\eta_{es}$ / %	66.3	57.5
02 Measurement category	A	
03 Efficiency category	Static	
04 Efficiency grade N	70.8	62
05 Variable speed drive	Yes	
06 Year of manufacture	The year of manufacture is specified on the product's rating label.	
07 Manufacturer	ebm-papst Mulfingen GmbH & Co. KG Amtsgericht (court of registration) Stuttgart · HRA 590344 D-74673 Mulfingen	
08 Type	K3G400-PA27-62	
09 Power consumption $P_{ed}$ / kW	3.7	
09 Air flow $q_v$ / m <sup>3</sup> /h	6230	
09 Pressure increase total $p_{sf}$ / Pa	1362	
10 Speed (rpm) $n$ / min <sup>-1</sup>	2810	
11 Specific ratio <sup>*</sup>	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.	

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

Data obtained at optimum efficiency level. The ErP data is determined using a motor-impeller combination in a standardized measurement setup.

## 3.4 Technical description

Weight	31.5 kg
Size	400 mm
Motor size	150
Rotor surface	Painted black
Electronics housing material	Die-cast aluminum
Impeller material	Sheet aluminum
Support plate material	Sheet steel, galvanized
Support bracket material	Steel, painted black
Inlet nozzle material	Sheet steel, galvanized
Number of blades	5
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1
Ambient temperature note	Occasional start-up at temperatures between -40°C and -25°C is permitted. For continuous operation at ambient temperatures below -25°C (such as refrigeration applications), use must be made of a fan design with special low-temperature bearings.
Installation position	See product drawing
Condensation drainage holes	On rotor side
Mode	S1
Motor bearing	Ball bearing
Technical features	<ul style="list-style-type: none"> <li>- Operation and alarm display with LED</li> <li>- External 15-50 VDC input (parameterization)</li> <li>- Alarm relay</li> <li>- Integrated PI controller</li> <li>- Configurable inputs/outputs (I/O)</li> <li>- MODBUS V6.0</li> <li>- Motor current limitation</li> <li>- RFID - ISO 15693 compatible</li> <li>- RS-485 MODBUS-RTU</li> <li>- Soft start</li> <li>- Voltage output 3.3-24 VDC, P<sub>max</sub> = 800 mW</li> <li>- Control interface with SELV potential safely disconnected from the mains</li> <li>- Thermal overload protection for electronics/motor</li> <li>- Line undervoltage / phase failure detection</li> </ul>
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	≤ 3.5 mA
Electrical hookup	Terminal box
Motor protection	Reverse polarity and locked-rotor protection
Protection class	I (with customer connection of protective earth)

Conformity with standards	EN 61800-5-1; CE
Approval	UL 1004-7 + 60730-1; EAC; CSA C22.2 No. 77 + CAN/CSA-E60730-1



With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

### Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.

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

### 3.5 Mounting data

For screw clearance, see Chapter 3.1 Product drawing

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

Strength class of screws	8.8
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Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

### 3.6 Transport and storage conditions

Max. permitted ambient temp. for motor (transport/storage)	+80 °C
Min. permitted ambient temp. for motor (transport/storage)	-40 °C

### 3.7 Electromagnetic compatibility



If several devices are switched in parallel on the supply 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 STARTUP

### 4.1 Mechanical connection



#### CAUTION

**Risk of cutting and crushing when removing device from packaging**

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.



#### CAUTION

**Device weighs over 25 kg! Heavy load when unpacking device.**

Risk of physical injury, such as back injuries.

→ Use suitable hoisting equipment to remove the device from its packaging.

#### NOTE

**Damage to the device from vibration**

Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ 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 are not to be installed.

⇒ Install the undamaged device in accordance with your application.



#### CAUTION

**Possible damage to the device**

If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

• The fan must not be strained on fastening.

### 4.2 Electrical connection



#### DANGER

**Voltage on the device**

Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.



#### DANGER

**Faulty insulation**

Risk of fatal injury from electric shock

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

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

**DANGER**

**Electrical charge (>50 µC) between phase conductor and protective earth connection after switching off supply with multiple devices connected in parallel.**

Electric shock, risk of injury

- Ensure sufficient protection against accidental contact. Before working on the electrical hookup, short the supply and PE connections.

**CAUTION****Voltage**

The fan is a built-in component and has no disconnecting switch.

- Only connect the fan to circuits that can be switched off with an all-pole disconnection switch.
- When working on the fan, secure the system/machine in which the fan is installed so as to prevent it from being switched back on.

**NOTE****Device malfunctions possible**

Route the device's control lines separately from the supply line.

- Maintain the greatest possible clearance. Recommendation: clearance > 10 cm (separate cable routing)

**NOTE****Water ingress into wires or cables**

Water ingress at the customer end of the cable can damage the device.

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



Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

**4.2.1 Requirements**

- ⇒ Check whether the information on the nameplate matches the connection data.
- ⇒ Before connecting the device, make sure the power supply matches the device voltage.
- ⇒ Only use cables designed for the current level indicated on the nameplate. For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor. We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least AWG 26 / 0.13 mm<sup>2</sup>.

**Protective earth contact resistance according to EN 61800-5-1**

Compliance with the resistance specifications according to EN 61800-5-1 for the protective earth connection circuit must be verified in the end 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 Supply connection and fuses**

Assignment of supply cable cross-sections and their required fuses (line protection only, no equipment protection).

Nominal voltage	Fuse		Automatic circuit breaker	Cable cross-section	Cable cross-section
	VDE	UL	VDE	mm <sup>2</sup>	*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 Reactive currents**

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

- The values are typically in the range < 500 mA.
- At the same time, the effective power in this operating state (operational readiness) is typically < 6 W.

**4.2.4 Residual current circuit breaker (RCCB)**

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices (type B or B+) are permissible. As with variable frequency drives, residual current devices cannot provide personal safety while operating the device. When the device power supply is switched on, pulsed charging currents from the capacitors in the integrated EMC filter can lead to the instant tripping of residual current devices. We recommend the use of residual current circuit breakers (RCCB) with a trip 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 starting current (LRA) is equal to or less than the nominal current (FLA).

### 4.3 Plug connection

#### 4.3.1 Making supply connections

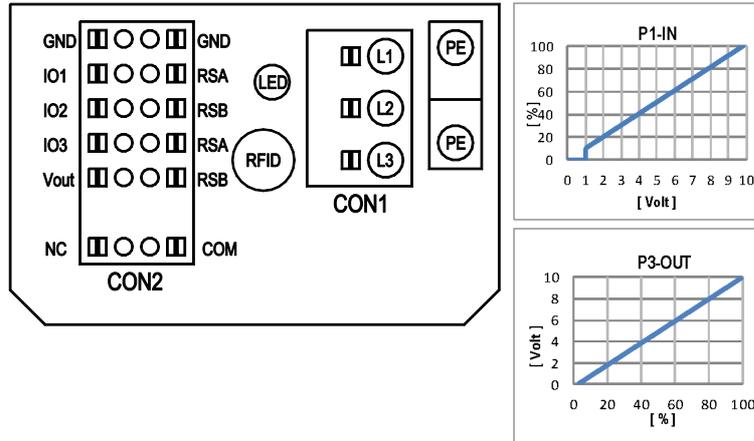
- ⇒ Check your connector's pin assignment.
- ⇒ Connect the built-in connector with the mating connector.
- ⇒ Ensure that the connector is properly engaged.

### 4.4 Factory settings

Factory settings made for the device by ebm-papst.

<b>Mode parameter set 1</b>	PWM control
<b>Mode parameter set 2</b>	PWM control
<b>Fan/device address</b>	01
<b>Max. PWM / %</b>	100
<b>Min. PWM / %</b>	5
<b>Save set value to EEPROM</b>	Yes
<b>Set value requirement</b>	Analog (linear)
<b>Direction of action parameter set 1</b>	Positive (heating)
<b>Direction of action parameter set 2</b>	Positive (heating)

## 4.5 Connection diagram



No.	Conn.	Designation	Function/assignment
	CON1	L1, L2, L3	Power supply, phase, see nameplate for voltage range
	PE	PE	Protective earth
	CON2	RSA	RS485 interface for MODBUS, RSA; SELV
	CON2	RSB	RS485 interface for MODBUS, RSB; SELV
	CON2	GND	Reference ground for control interface, SELV
	CON2	IO1	Function parameterizable (see "Optional interface functions" table) Factory setting: Digital input - high active, function: Disable input, SELV - inactive: Pin open or applied voltage < 1.5 VDC - active: applied voltage 3.5-50 VDC Reset function: Triggering of error reset on change of state from "enabled" to "disabled"
	CON2	IO2	Function parameterizable (see "Optional interface functions" table) Factory setting: Analog input 0-10 V / PWM, Ri=100 kΩ, function: Set value Characteristic curve parameterizable (see input characteristic curve P1-IN), SELV
	CON2	IO3	Function parameterizable (see "Optional interface functions" table) Factory setting: Analog output 0-10 V, max. 5 mA, function: Fan modulation level Characteristic curve parameterizable (see output characteristic curve P3-OUT), SELV
	CON2	Vout	Voltage output 3.3-24 VDC ±5%, Pmax=800 mW, voltage parameterizable Factory setting: 10 VDC short-circuit-proof, supply for external devices, SELV alternatively: 15-50 VDC input for parameterization via MODBUS without line voltage
	CON2	COM	Status relay, floating status contact, common connection, contact rating 250 VAC / 2 A (AC1) / min. 10 mA, reinforced insulation on supply side and on control interface side
	CON2	NC	Status relay, floating status contact, break for failure
		LED	green: status = good, ready for operation orange: status = warning red: status = failure
		P1-IN	Input characteristic curve
		P3-OUT	Output characteristic curve

## 4.6 Configuration options

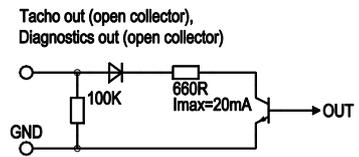
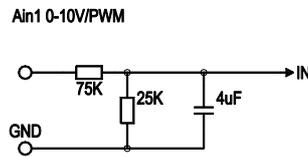
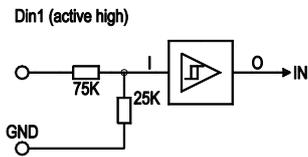
configurable IO functions: normal / inverse	MODBUS Register for IO mode configuration	electrical specification	CON2		INPUT										OUTPUT			
			configurable IO mode	digital input	D101 [..]	D147 [..]	D104 [..]	D12E [..]	D148 [..]	D16C [..]	D16A [..]	(selected directly via IO mode)	D130 [0]	D130 [1]	D130 [2]	D130 [5]	D00C [1]	D130 [4]
○ configurable option For further information and additional functions see EC Control Software, Fan-Set-App. or MODBUS Parameter Specification V6.0	IO1	○ Din1 (active high): digital input	not active: pin open or applied voltage < 1,5VDC active: applied voltage 3,5-50VDC, SELV	D158 [0]	○	○	○	○	○	○	○	○	○	○	○	○	○	
		○ Ain1 0-10V/PWM: analog input	RI=100K, characteristic curve parameterizable, f <sub>PWM</sub> =1k..10KHz, SELV	D158 [2]	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○ Tach out (open collector output)	U <sub>max</sub> =50VDC, I <sub>max</sub> =20mA, SELV	D158 [5]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○ Diagnostics out (open collector output)	U <sub>max</sub> =50VDC, I <sub>max</sub> =20mA, SELV	D158 [6]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○ Din2 (active high): digital input	not active: pin open or applied voltage < 1,5VDC active: applied voltage 3,5-50VDC, SELV	D159 [0]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	○ Ain2 0-10V/PWM: analog input	RI=100K, characteristic curve parameterizable, f <sub>PWM</sub> =1k..10KHz, SELV	D159 [2]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
IO2	○ Ain2 4-20mA: analog input	RI=125R, characteristic curve parameterizable, SELV	D159 [3]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○ Din3 (active high): digital input	not active: pin open or applied voltage < 1,5VDC active: applied voltage 3,5-50VDC, SELV	D15A [0]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○ Din3 (active low): digital input	active: pin open or applied voltage 3,5-50VDC not active: applied voltage < 1,5VDC, SELV	D15A [1]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○ PWM in 3: digital input	40Hz - 10kHz, characteristics parameterizable not active: pin open or applied voltage 3,5-50VDC active: applied voltage < 1,5VDC, SELV	D15A [7]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
IO3	○ Aout3 0-10V: analog output	function parameterizable, max. 5mA, max output frequency 300Hz, SELV	D15A [4]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○ Tacho out (pulses), analog output	0-10V max. 5mA, max output frequency 300Hz, SELV	D15A [5]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○ Diagnostics out (pulses)	0-10V max. 5mA, max output frequency 300Hz, SELV	D15A [6]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
RSA	RS485 bus connection,	MODBUS RTU, specification V6.0, SELV		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
RSB																		
Vout	voltage output	voltage parameterizable 3,3..24VDC +/- 5,5%, P <sub>max</sub> =800mW, short-circuit-proof, supply for external devices, SELV	D16E [..]	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	alternatively: input auxiliary power supply for parameterization via RS485/MODBUS RTU without line voltage	15..50VDC		○	○	○	○	○	○	○	○	○	○	○	○	○	○	



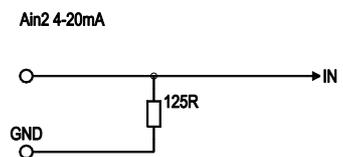
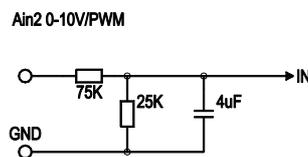
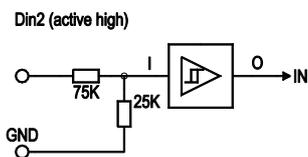
## 4.7 Equivalent circuit diagrams

Hardware

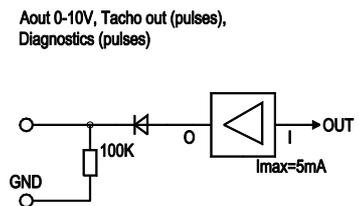
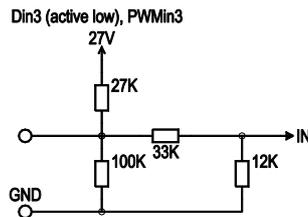
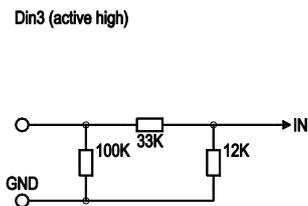
**I01**



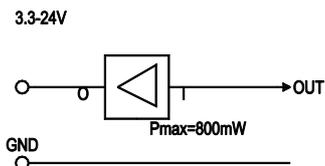
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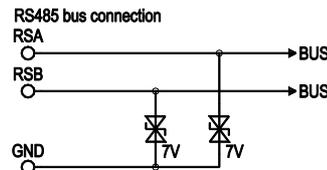
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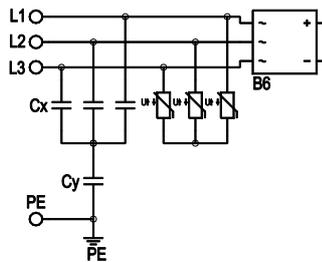
**Vout**



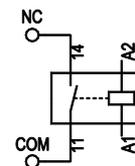
**BUS**



**Power**



**Status**



#### 4.8 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.

#### 4.9 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.



##### WARNING

##### Hot motor housing

Risk of fire

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

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.
- ⇒ Start the device by changing the input signal.



##### NOTE

##### Damage to the device from vibration

Bearing damage, shorter service life

- Low-vibration operation of the fan must be ensured over the entire speed control range.
- Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
- Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
- Either run through the resonant range as quickly as possible with speed control or find another remedy.
- Operation with excessively high vibration levels can lead to premature failure.
- The maximum permissible vibration severity must not exceed 3.5 mm/s and should be checked at intervals of 6 months.
- It is to be measured at the motor mount at the motor support plate in all three 3 dimensions, see Chapter 6. Maintenance, malfunctions, possible causes and remedies.

#### 4.10 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:

- ⇒ 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 power supply.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

## 5. INTEGRATED PROTECTIVE FEATURES

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

Fault	Safety feature description/function
Rotor position detection error	An automatic restart follows.
Blocked rotor	⇒ After the blockage is removed, the motor restarts automatically.
Line undervoltage (line voltage outside of permitted nominal voltage range)	⇒ If the line voltage returns to permitted values, the motor restarts automatically.
Phase failure	A phase of the supply voltage fails for at least 5 s. ⇒ When 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. Send the device to ebmpapst for repair or replacement.



##### WARNING

##### Live terminals and connections even with device switched off

Electric shock

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

##### CAUTION

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

Risk of injury

- Keep out of the device's danger zone.
- When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
- Wait until the device comes to a stop.
- After working on the device, remove any tools 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 three hours once a month to move the bearings and allow any condensate that may have ingressed to evaporate.

Malfunction/fault	Possible cause	Possible remedy
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<b>Impeller not running smoothly</b>	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
<b>Motor not turning</b>	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply. Attention! The error message resets automatically. Device restarts automatically without warning.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Inadequate cooling	Improve cooling. Allow the device to cool down.
	Ambient temperature too high	Reduce the ambient temperature. Allow the device to cool down.
	Impermissible operating point (e.g. back pressure too high)	Correct the operating point. Allow the device to cool down.



In the event of further malfunctions, contact ebm-papst.

### 6.1 Warning/status codes

The LED on the electronics housing shows the motor status with various colors and flash codes. The flash codes have a frequency of 2 Hz. Each flash code is followed by a pause lasting 3 seconds. The following colors are used: Green: no warning or fault. Orange: There is a warning. No user intervention is required for warnings. Red: There is at least one error. See the following table. If there are multiple simultaneous errors, their associated flash codes are displayed in succession. If there are simultaneous warnings and errors, only the errors are displayed.

Number of pulses	Motor status - LED red	Manual reset required	Possible cause	Possible remedy
1	Phase failure or line undervoltage	no	Missing phase Poor grid quality	Check line voltage
3	Output stage overheating.	yes	Dirty electronics housing.	Improve cooling.

4	Communication error between master controller and slave controller	no	External supply applied via Vout for setting parameters. Internal error.	Switch off line voltage - wait - switch back on.
6	Motor overheating	yes	Ambient temperature too high. Impermissible operating point.	Lower the ambient temperature. Correct the operating point.
7	Hall sensor fault	yes	Internal error	Switch off line voltage - wait - switch back on.
8	Motor blocked	no	Mechanical blockage	Switch off - Verify isolation from supply - Check rotor freedom of movement.
9	Speed limit exceeded	no	-	-
11	Rotor position sensor calibration error	no	Follow the replacement instructions	Rotor position sensor needs calibration. Notify ebm-papst.
13	DC-link undervoltage	no	Line voltage faulty	Check applied line voltage on fan.

### 6.2 Vibration testing

Checking of fan for mechanical vibration based on ISO 14694.

Recommendation: Every 6 months. Max. vibration severity is 3.5 mm/s, measured at the motor fastening diameter on the motor support plate in the direction of the motor axis of rotation and perpendicular to this.



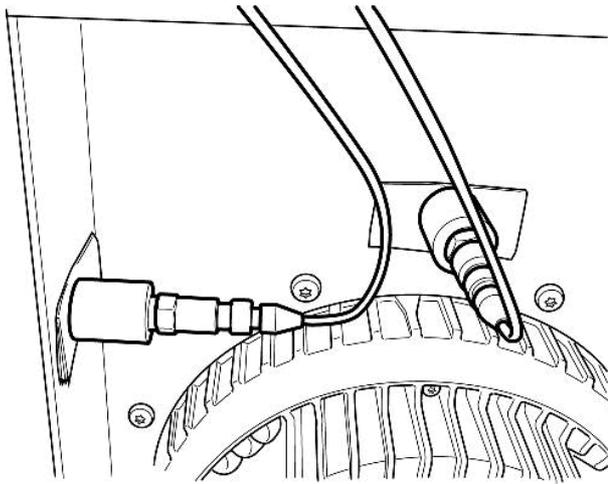


Fig. 1: Example illustrating vibration measurement. The arrangement of the sensors depends on the device concerned and the installation situation.

### 6.3 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.



#### **DANGER**

#### **Risk of injury from rotating fan.**

→ Only clean when not in motion. Do not disconnect the fan from the power supply, just switch it off via the control input. This will prevent start-up of the fan.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ If water is required for cleaning, the preferred method is to perform cleaning with a conventional water hose or to employ foam cleaning.
- ⇒ Do not use aggressive cleaning agents!

#### **NOTE**

#### **Damage to the device during cleaning**

Malfunction possible

→ Do not clean the device using a high-pressure cleaner. # Do not use acid, alkali or solvent-based cleaning agents.

→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ If cleaning agents have been used, rinse these off with clean water.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted.
- ⇒ Operate the fan for 2 hours at maximum speed to permit the evaporation of any water that has ingressed.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.

- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the level of dust exposure.

### 6.4 Safety inspection

#### **NOTE**

#### **High-voltage test**

The integrated EMC filter has Y capacitors. The tripping current is exceeded when AC testing voltage is applied.

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

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage to blades and housing	Visual inspection	At least every 6 months	Replacement of device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Condensation drainage holes for clogging, where necessary	Visual inspection	At least every 6 months	Open holes
Abnormal bearing noise	acoustic	At least every 6 months	Replace device
Vibration test	Vibration tester, start-up or deceleration measurement	Recommended every 6 months	Clean impeller or replace device

### 6.5 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.

### 6.5.1 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.

### 6.5.2 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.

### 6.5.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable. Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- 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 cables
- 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.