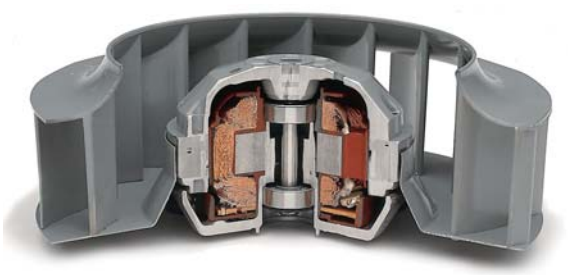


An external rotor motor is essentially constructed like a normal non-synchronous motor, with one difference: the stator and the rotor have swapped places. The stator with its windings is at the centre of the motor, while the rotor is located in the casing itself. The motor shaft (connected to the rotor) turns on sealed ball bearings inside the stator, and the impeller or fan blades are fitted to the rotor casing. With this design, the motor and fan form a compact unit at the centre of the air stream.

Because the external rotor motor's unique construction allows it to be cooled by the transported air, the motor speed can be controlled by voltage regulation.

Casing

Most of the fans have an outer casing made of hot-rolled galvanised sheet steel complying with EN 10 142/10 147. The sheet steel has a layer of 20 µm zinc which provides excellent protection against corrosion. The galvanised sheet-metal parts are either spot-welded, screwed or riveted together.

Fans with powder-coated surfaces are well protected against corrosion. The powder coating is at least 40 µm thick and produces a hard and impact-resistant surface. To avoid environmental pollution, no solvents are used at the Systemair powder-coating plant.

Insulation

The material used in our insulated fans is water-repellent, non-capillary mineral wool whose stability is unaffected by steam and moisture. The insulation is classified as non-combustible material which tolerates 200°C.

Motors and impellers

The direction of rotation for three-phase fans is indicated by an arrow on the motor housing. Fans with forward-curved impellers are manufactured from galvanised sheet steel.

Backward-curved impellers have polyamid or galvanised steel plate blades. These blades are mounted on a galvanised steel plate. The impellers are press-fitted directly onto the rotor of the external rotor motor. The motor (complete with impeller) is balanced dynamically in two planes in accordance with DIN ISO 1940.

Bearings

The motor's ball bearings are completely maintenance-free and can be used in any installation position at the maximum indicated temperature for transported air. At a 40°C ambient temperature for transported air, the life expectancy of the bearings is at least 40.000 hours (L10). NB! Low ambient temperature is not a problem for the motor ball bearings if the fan is operating. The reason is the 60- to 90 K temperature increase inside the motor during operation.

Motor protection

Most fans have an integral thermal protection relay which provides the motors with better protection against overheating than an overcurrent protection relay. This is especially important if the fan is speed-controlled by means of voltage reduction, as it is then impossible to stipulate the precise overcurrent.

The thermal contacts are fitted in the motor winding. It will open and disconnect the power supply to the fan when the critical temperature is reached. This is 130°C for motors with insulation class B and 155°C for motors with insulation class F.

Integral thermal contact

Fans with integral thermal contacts are reset either automatically or manually by switching off the current and then wait for up to an hour before the fan can be started again.

External leads from thermal contact

Fans with external leads from the thermal contact are supplied with two leads connected to the integral thermal contact (marked TK in wiring diagrams). These leads must always be connected to a motor-protection relay. The S-ET 10 is suitable for single-phase fans (or the AWE-SK if the current is below 0.45 A) and the STDT-16 is suitable for three-phase fans. If the thermal contact has opened, the protection relay must be reset manually.

Thermal contacts that can be reset electrically

If a fan is fitted with a thermal contact that can be reset electrically, one must first switch off the current and then wait for up to an hour before the fan can be started again. KVKF and small KD fans are among those models which require electrical resetting.

Rating

Rated voltage/ Frequency

Maximum permitted voltage variation: +6%, -10% in accordance with DIN IEC 38, plus maximum permitted frequency.

Power rating

Maximum power used by the fan from the mains supply.

Rated current

Rated current means the maximum current used by the fan from the mains supply at nominal mains voltage. When the fan speed is controlled by lowering the voltage, the current in the motor may exceed the specified rated current when the voltage is low. (The recommended speed controllers are designed with this in mind.) The increased current in the motor requires a reduction of the maximum permitted temperature for transported air. In the technical tables, the highest permitted temperature for transported air is shown for both the rated current and for speed control.

Airflow

The air flow is shown for free-blowing conditions (at zero back pressure). Air flow is measured in accordance with DIN 24 163 and BSA BS 848. Assumed air density is 1.2 kg/m^3 at 20°C.

Pressure

The static pressure is shown in the fan diagrams as ps (Pa).

R.p.m.

The tables show the fan's nominal r.p.m. at the rated current.

Capacitor

A capacitor is connected to the single-phase motors. The relevant capacitance is shown in the table for each fan.

Sound pressure – and sound power level

The sound pressure level emitted by duct fans to the surroundings is measured while operating at optimal efficiency in a 20 m^2 equivalent room absorption area (Sabine) at a distance of 3 m.

The sound pressure level emitted by roof fans to the surroundings is measured while operating at optimal efficiency in a free field and at a distance of 4/10 m.

	Duct fan	Roof fan
Room volume	80 m^3	Free field
Room's equiv. absorption area	20 m^2	–
Distance from fan (r)	3 m	4/10 m
Direction factor (Q)	1	1
Difference between sound power (L_W) and sound pressure (L_p)	-7 dB	23/-31 dB

The relationship between the sound pressure level and sound power level is described in the Theory Section on page 509.

Adjusted sound values
In this catalogue, all the sound values for fans (both sound power levels and sound pressure levels) have been adjusted to the ear's sensitivity with an A filter.

The sound power levels shown in the diagram are measured at the fan's inlet. Octave band apportioning of the sound pressure level is made at the fan's maximum operating efficiency. The tables show the inlet, outlet and ambient sound.

Speed control

Choosing a speed control method
Both economical and technical aspects should be taken into consideration when selecting speed control. When assessing the most economical option, both the investment cost and the operating cost should be included in the calculations. The most important technical aspects that need to be considered are noise and life-expectancy.

Most of the electrical means for varying a motor's speed cause some degree of noise in the motor, with the exception of transformer-controlled speed. Power dissipation increases when running at lower speeds. This dissipation is transformed into heat in the motor. If the power dissipation is substantial, the operating temperature for the bearings will alter significantly, which will reduce their life-expectancy.

Suitable operating conditions and characteristics of the different speed control methods:

Transformers
No increased motor noise when the speed is regulated. Life-expectancy of the motor bearings can be shortened when operating at low voltages for long periods (voltage steps 1 and 2). Suitable range for speed control: steps 1-5. Several fans can be run via the same transformer without special procedures.

The five curves in the fan diagram show the different voltage outputs from our transformers.

Step (curve)	1	2	3	4	5
Voltage, 1~	80	105	130	160	230
Voltage, 3~	95	145	190	240	400

Single-phase stepless speed control
Can cause noise problems when reducing speed. Should be avoided in noise-sensitive installations. The life-expectancy of the motor bearings will be reduced by operating at lower voltages. Suitable range of adjustment: 60-100% of the rated voltage. Using the same speed control to run several fans increases the levels of noise and electromagnetic interference. Shielded motor cables are recommended for installations with several fans connected to one speed control unit.

Three-phase speed control
There are normally no noise problems associated with speed-controlled operation. The life-expectancy of the motor bearings will be somewhat reduced by operating at lower voltages. Suitable range for speed control: 40-100% of rated voltage. Suitable when using one speed-control unit for several fans. In order to minimise noise and electromagnetic interference, we recommend sound filters and also the use of shielded motor cables when several fans are connected to one speed-control unit.

Explosion-proof fans

The owner of the property and the installation engineer are responsible for ensuring that all equipment that is installed in explosive areas is approved by a recognised testing laboratory and installed correctly. Fans must be installed and protected so that no foreign object can come into contact with the impeller or cause hazardous sparking. Both the motor-protection relay and the transformer must be positioned outside the risk area.

EX series
These fans are fitted with specially-made EX motors. Single-phase fans use a special EX-approved motor capacitor encased in sand which complies with the requirements for Fire Class T5.

The fans casings are cast in silumin alloy, and the impeller is made of aluminium. The certificate of compliance refers to explosion-proof versions in accordance with EN 50014, EN 50017, EN 50019, EN 1127-1 and EN13463-1. Improved safety versions comply with EEx e II T3.

This series must always be connected to an over-current relay which protects the motor against overheating or short-circuiting (for instance with a seized rotor). The motor protection must break the circuit within 15 seconds of a short circuit. The current must be disconnected definitively. This means that the motor-protection relay must require manual resetting. Fans in the EX series are not speed-controllable.

The DKEX and KTEX series
These fans are supplied as 400 V three-phase models. Permissible ambient temperature range: from -20°C to +40°C. The fan casing and impeller are manufactured in galvanised steel plate and the inlet cone is made of copper. The certificate of compliance refers to explosion-proof versions in accordance with EN 50014, EN 50019, EN 1127-1 and EN13463-1. Improved safety versions comply with EEx e II T3.

The fans are fitted with specially-made external rotor motors which allow their speeds to be adjusted from 100% to 15% by lowering the voltage. These motors must be connected to the U-EK230E thermistor motor protection unit.

Step (curve)	1	2	3	4	5
Voltage, 3~	90	140	180	230	400

The fan motors have six series-connected thermistors (two per phase winding) whose resistance is determined by the motor temperature. When the motor temperature exceeds the permitted limit, the resistance rises sharply and the connected motor protector is triggered to break the circuit.

DVEX series
These fans can be speed-controlled from 100% to 15% by lowering the voltage. These motors must be connected to the U-EK230E thermistor motor protection unit.

The fan motors have six series-connected thermistors (two per phase winding) whose resistance is determined by the motor temperature. When the motor temperature exceeds the permitted limit, the resistance rises sharply and the connected motor protector is triggered to break the circuit.

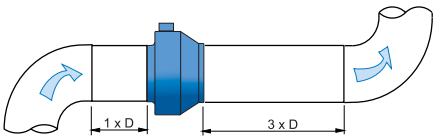
DVEX fans are supplied as 400 V three-phase models. Permissible ambient temperature range: from -20°C to +40°C. The casing is manufactured in galvanised steel plate and the impeller is made of aluminium. The inlet cone is made of copper. The certificate of compliance refers to explosion-proof versions in accordance with EN 50014, EN 50019, EN1127-1 and EN 13463-1. Improved safety versions comply with EEx e II T3.

Installation

All fans can be installed in any position, but roof fans should be installed horizontally. Smaller roof fans can be installed on the roof pitch. To avoid the transfer of vibrations to the duct system, we recommend that fans are installed with mounting clips or flexible sleeve couplings. All fans are designed for continuous operation.

Fitting a straight duct or silencer onto the inlet and outlet of the fan will help to prevent pressure-drop and system efficiency losses caused by turbulent air flow. The straight section must have no filter or similar, and its length must be at least 1 x the duct diamater on the fan's inlet side and at least 3 x the duct diameter on the fan's outlet side. (See figure 1.)

Figure 1. Correctly installed duct fan.



For a rectangular duct, the duct diameter is calculated as:

$$D = \sqrt{\frac{4 \cdot H \cdot B}{\pi}}$$

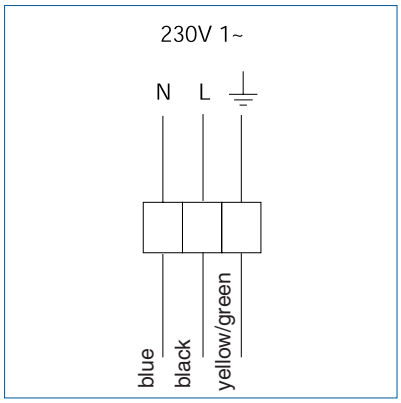
D = duct diameter
H = duct height
B = duct widht

Guarantee
The guarantee period is specified in the relevant terms and conditions for delivery. The guarantee is only valid when the thermal contact motor protector and transformer are correctly installed.

Electrical connection

General technical information: fans

1



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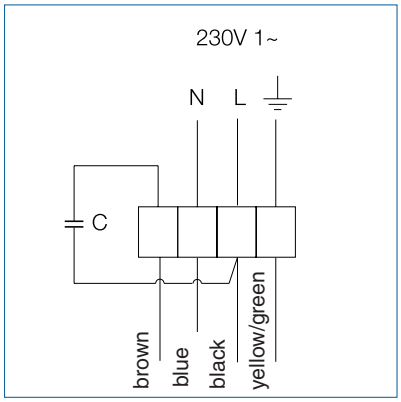

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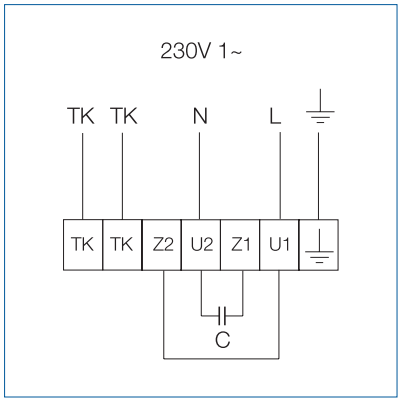

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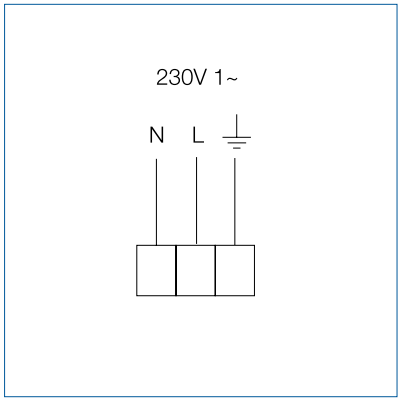

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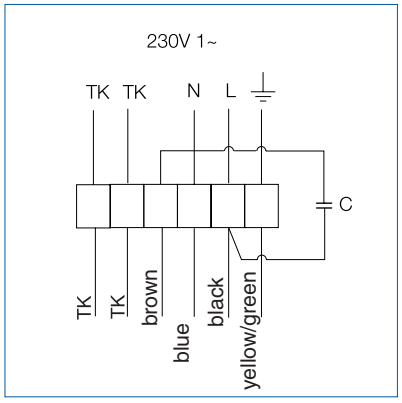

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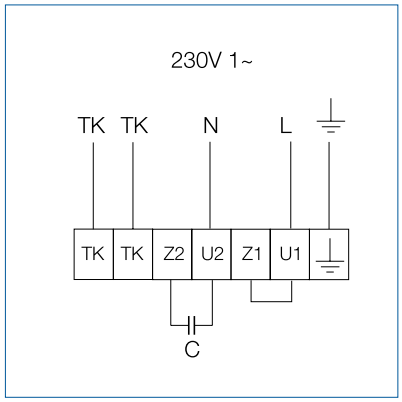

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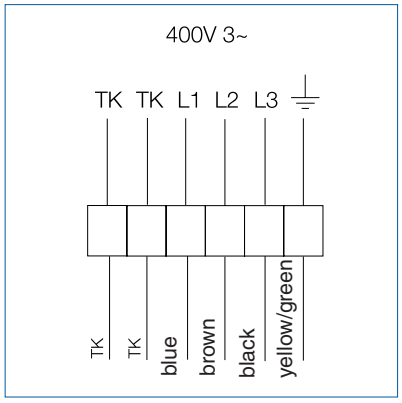

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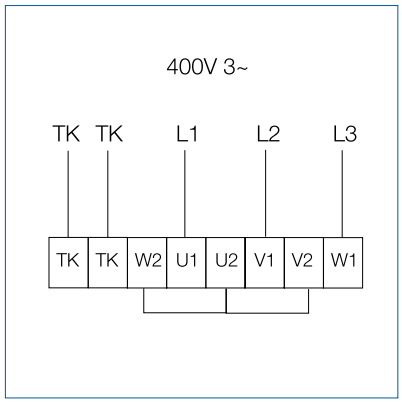

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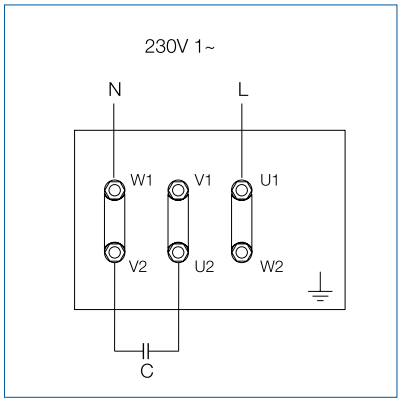

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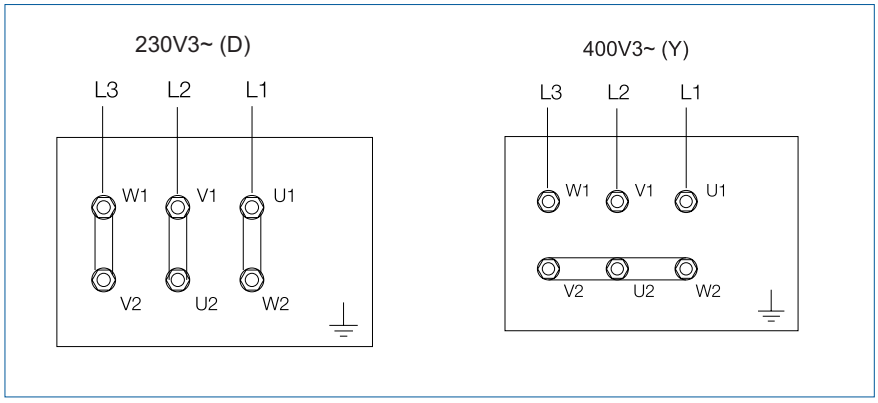

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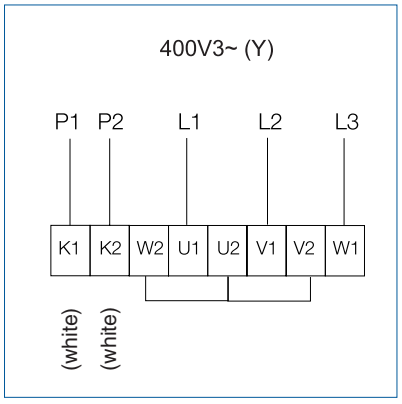

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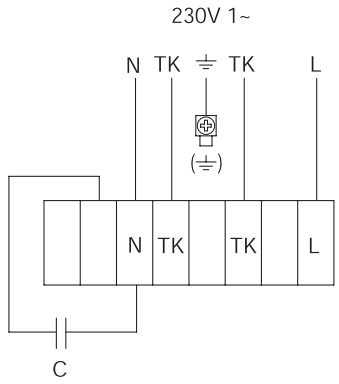

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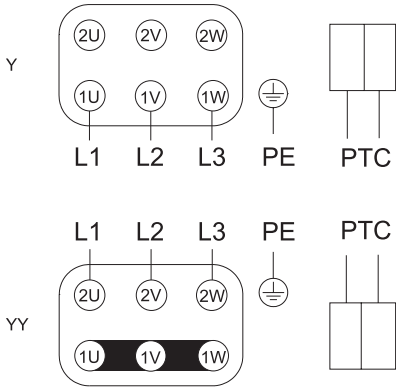

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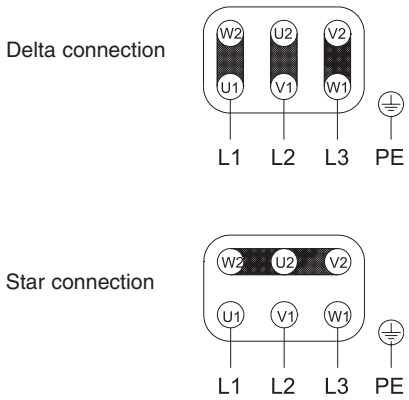

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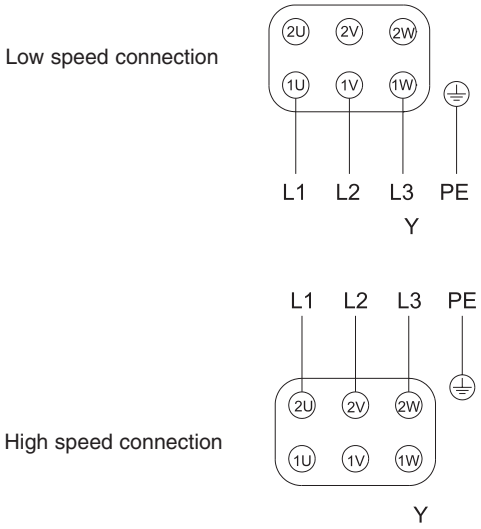

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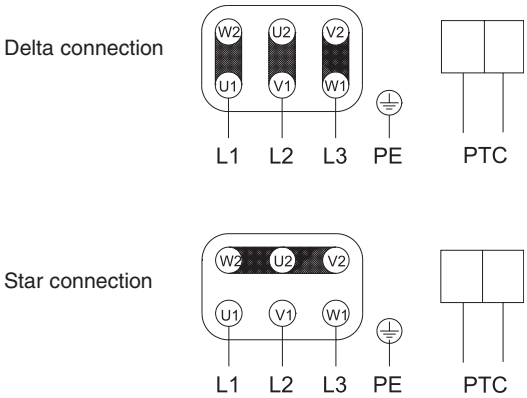

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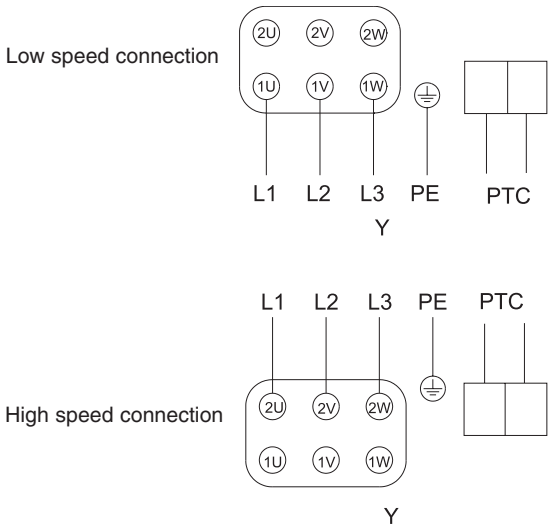
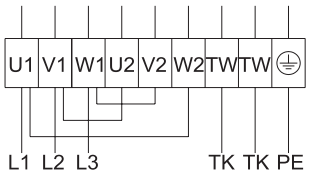


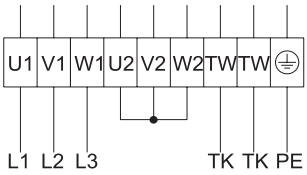
General technical information: fans

16

Delta connection



Star connection



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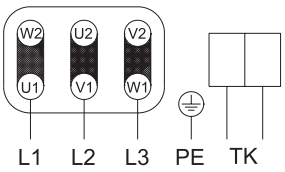
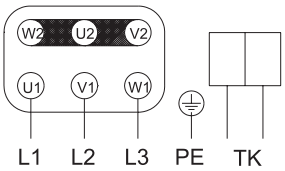
Delta connection
High speed connection



Star connection
Low speed connection



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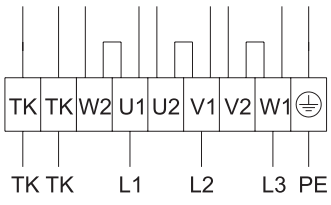

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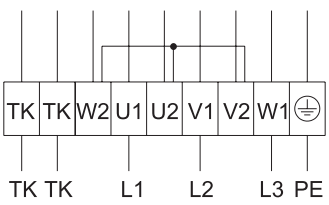

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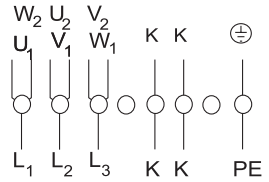

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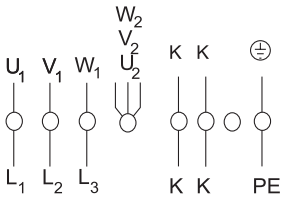

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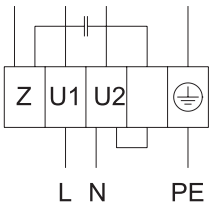
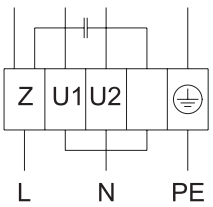
High speed

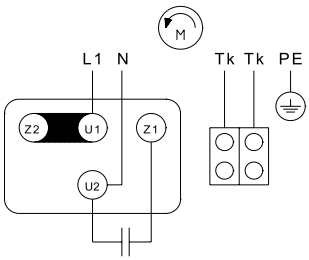


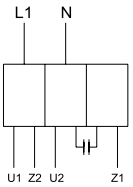
Low speed



U1 = blue
U2 = black
Z = brown

21





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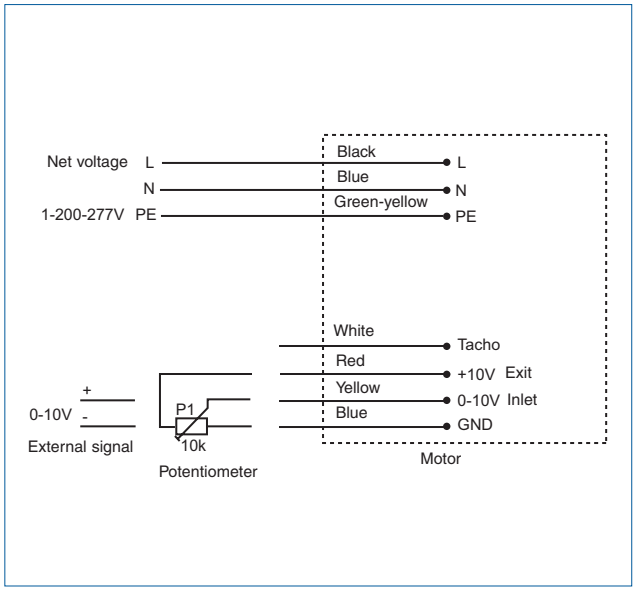
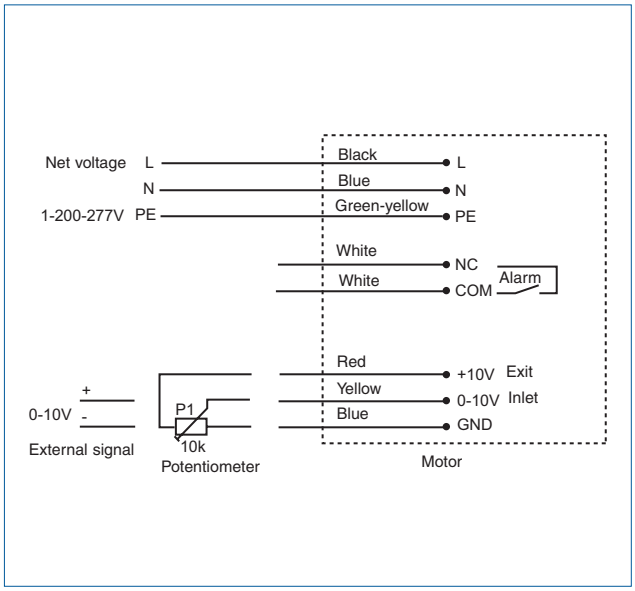
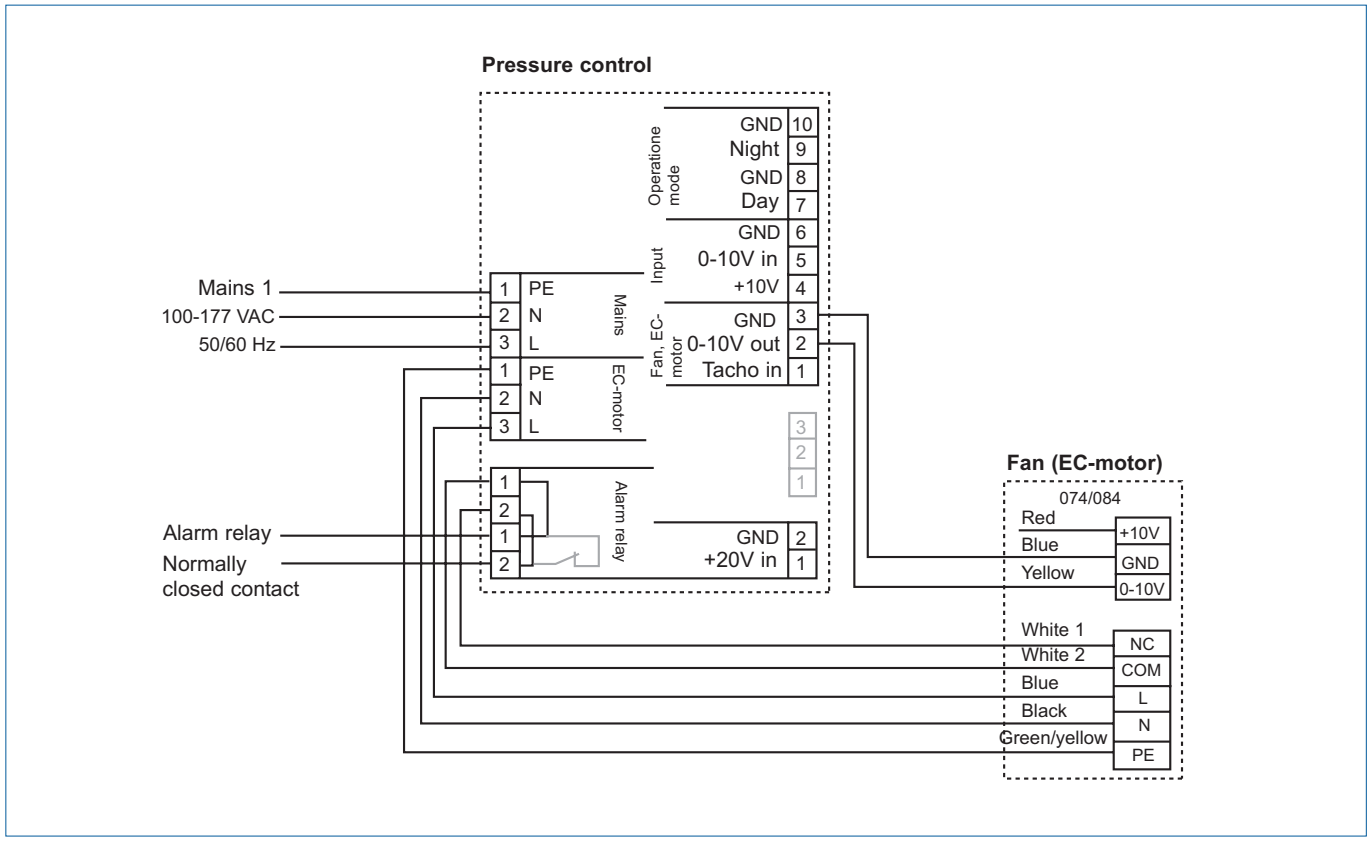

Net voltage
L
N
1-200-277V PE
Black
Blue
Green-yellow
L
N
PE
White
Red
Yellow
Blue
Tacho
+10V Exit
0-10V Inlet
GND
0-10V
+
-
External signal
P1
10k
Potentiometer
Motor

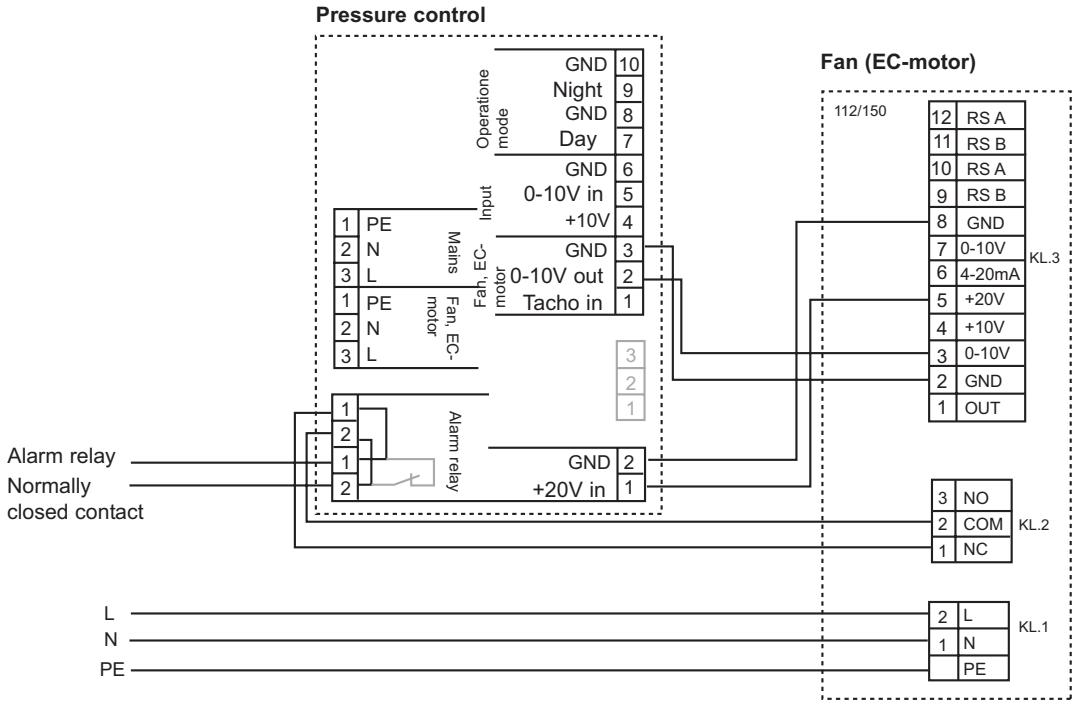
23


Net voltage
L
N
1-200-277V PE
Black
Blue
Green-yellow
L
N
PE
White
White
NC
COM
Alarm
Red
Yellow
Blue
+10V Exit
0-10V Inlet
GND
0-10V
+
-
External signal
P1
10k
Potentiometer
Motor

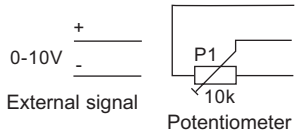
24


Pressure control
Operatione mode
GND 10
Night 9
GND 8
Day 7
Input
GND 6
0-10V in 5
+10V 4
Fan, EC-motor
GND 3
0-10V out 2
Tacho in 1
Mains
1 PE
2 N
3 L
EC-motor
1 PE
2 N
3 L
Alarm relay
1
2
1
2
GND 2
+20V in 1
Mains 1
100-177 VAC
50/60 Hz
Alarm relay
Normally
closed contact
Fan (EC-motor)
074/084
Red
Blue
Yellow
+10V
GND
0-10V
White 1
White 2
Blue
Black
Green/yellow
NC
COM
L
N
PE

25



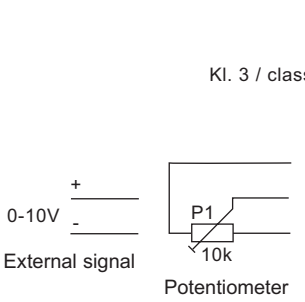
26



Kl. 3 / class 3	12	RS A	Interface RS485 for ebmBUS
	11	RS B	Interface RS485 for ebmBUS
	10	RS A	Interface RS485 for ebmBUS
	9	RS B	Interface RS485 for ebmBUS
	8	GND	GND
	7	0-10V	Control- / Actual value inlet
	6	4-20mA	Control- / Actual value inlet
	5	+20V	Supply ext. sensor 50mA
	4	+10V	Supply ext. potentiometer 10mA
	3	0-10V	Control- / Actual value inlet
	2	GND	GND
	1	OUT	Master exit 0-10V max. 3mA
Kl. 2 / class 2	3	NO	Error signal relay, closer in the case of error
	2	COM	Error signal relay, COMMON
	1	NC	Error signal relay, opener in the case of error
Kl. 1 / class 1	3	L1	Net, L1
	2	L2	Net, L2
	1	L3	Net, L3
		PE	Protective conductor

Art.-Nr.: 305332

27



Kl. 3 / class 3	12	RS A	Interface RS485 for ebmBUS
	11	RS B	Interface RS485 for ebmBUS
	10	RS A	Interface RS485 for ebmBUS
	9	RS B	Interface RS485 for ebmBUS
	8	GND	GND
	7	0-10V	Control- / Actual value inlet
	6	4-20mA	Control- / Actual value inlet
	5	+20V	Supply ext. sensor 50mA
	4	+10V	Supply ext. potentiometer 10mA
	3	0-10V	Control- / Actual value inlet
	2	GND	GND
	1	OUT	Master exit 0-10V max. 3mA
Kl. 2 / class 2	3	NO	Error signal relay, closer in the case of error
	2	COM	Error signal relay, COMMON
	1	NC	Error signal relay, opener in the case of error
Kl. 1 / class 1	2	L	Net, L
	1	N	Net, N
		PE	Protective conductor

Art.-Nr.: 305386

28