

Operating Instructions



English

PAE10E-M Part-No. 303510

PSE-6V Part-No. 303570

PSE-14V Part-No. 303585

Electronic speed controller for variable voltage 1~ motors



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1. General

Before installation and start-up, read this manual carefully to ensure a correct use.

Attention! Hazardous area!



Danger owing to electric current or voltage!!



Important information!



- The copyright for these operating instructions remains to ZIEHL-ABEGG AG, Künzelsau.
- The device is constructed in accordance with the current state of technology and the recognised safety regulations. Nevertheless, use of the device is associated with dangers which may cause death or injury to users or third parties as well as damage to the system and other objects.
- The device is intended exclusively for the tasks listed in the order confirmation. Any other or extraordinary uses of the device (unless previously agreed by contract) are considered contrary to regulations. The manufacturer is not liable for damages resulting from incorrect use. The operating company alone bears the risk.
- To allow for future developments, construction methods and technical data given are subject to alteration. We do not accept any liability for possible errors or omissions in the information contained in data, illustrations or drawings provided.
- The controllers are packed ex factory to suit the transport method previously agreed. Always use the original packaging materials when transporting the controller. When transporting by hand, ensure that personnel possess the strength required to lift and carry the device. Avoid shocks and impacts to the device. Check the packaging and controller for damage.
- Store the controller in its original packaging in a dry and weather-proof room. The device must not be exposed to extreme heat and low temperatures.

2. Safety measures

In the case of a malfunction or a failure of the equipment check all functions with alarms in order to prevent injury to persons or property. Note possibility of back-up operation.

If used in intensive animal environments, any malfunctions in the air supply must be detected as soon as possible to prevent the development of a life-threatening situation for the animals. The design and installation of the system must comply with local regulations and directives. In Germany these include DIN VDE 0100, the animal protection and the keeping of working animals ordinance and the pig-keeping ordinance etc. Also note the instructions of AEL, DLG, VdS.

- Apart from the operating instructions and the obligatory regulations to be followed by users relating to accident prevention, the recognised technical regulations must also be observed (safety and branch-related work as per UVV, VBG, VDE, etc.).
- These devices are potentially dangerous if they are used incorrectly by untrained personnel or are not implemented according to their specified use.
- **Work on electric components/modules may only be carried out by trained electricians in accordance with electro-technical regulations (e.g. EN 60204, DIN VDE 0100/0113/0160).**
- The contractor or owner must also ensure that the electric systems and equipment are operated and maintained in accordance with electro-technical regulations. The owner is obliged to ensure that the device are operated in perfect working order only.
- **It is forbidden to carry out work on electrically live parts. The rating given in the enclosure for the device when open is IP00! It is possible to inadvertently touch components carrying hazardous voltages!**
- During operation, the device must be closed or installed in a control cabinet.
- Fuses may only be replaced by new ones and must not be repaired or bypassed. The data for the maximum line fuse are to be considered absolutely (☞ Technical data). Use only fuses specified in schematic diagrams.
- The safe isolation from the supply must be checked using a two-pole voltage detector.
- Any faults detected in the electric system/modules/operating equipment must be corrected immediately. If these faults are not corrected, the device/system is potentially very dangerous. The device/system must therefore not be operated when it is faulty.

3. General description

3.1 Range of application

The controlling device as described is intended for infinitely variable speed settings in voltage-regulated 1-phase motors for driving fans and pumps.

3.2 Technical data

- Line voltage 1~ 230 V (-15 / +10 %), 50/60 Hz

The name plate data refer to a maximum ambient temperature of 40°C.

Type	PAE10E-M	PSE-6V	PSE-14V
Part-No.	303510	303570	303585
Rated current / A	10	6	14
Max. line fuse* / A	16	10	20
Semiconductor fuse construction site**/A	FF20A	FF20A	FF25A
Heat dissipation / W	17	12	26
Housing protection	IP20	IP54	IP54
Weight / kg	0.63	0.65	1.9

* Max. supply side line fuse according to DIN EN 60204-1 classification VDE0113 chapter 1

** Semiconductor fuse, not in the scope of supply! Installation on site recommended for protection for damages in the case of short-circuits.

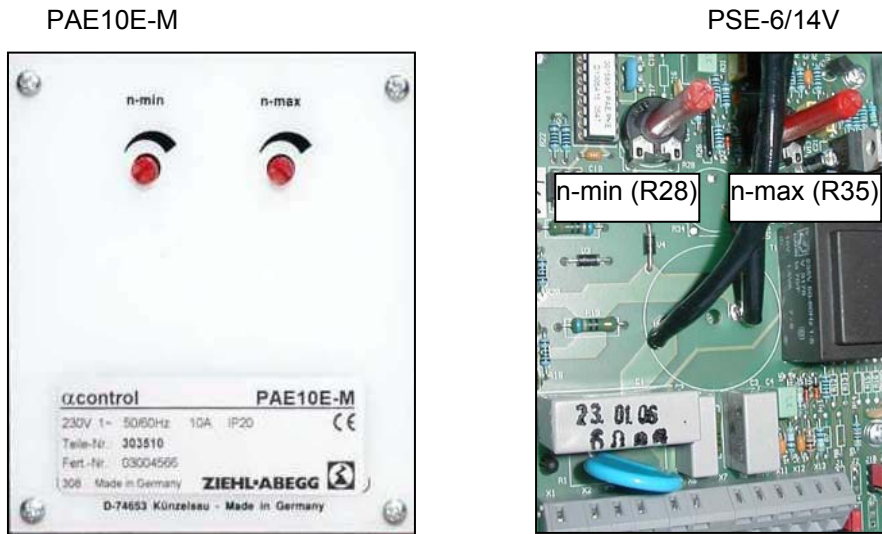
- Minimal motor current 0.2 A
- Controlled output voltage about 0-100 %
- Input resistance (input 0-10V) $R_i > 100 \text{ k}\Omega$ / $R_i = 500 \Omega$ (input 0-20 mA)
- Output 0-10 V PAE10E-M / PSE14-V : $I_{\max} 10 \text{ mA}$ (short circuit-proof)
PSE-6V: $I_{\max} 1 \text{ mA}$ (short circuit-proof)
- Permissible ambient temperature 0-40° C
- Acceptable rel. humidity 85 % no condensation
- Interference emission EN 61000-6-3
- Harmonics current EN 61000-3-2*
- Interference immunity EN 61000-6-2

* The units comply with EN 61000-3-2 for a "professional unit". Up to a maximum current of 4 ampere the limits were complied without any qualification.

3.3 Versions

Type	Part.-No.:	Housing	Protection class
PAE10E-M	303510	Aluminium channel	IP 20
PSE-6V	303570	Plastic	IP 54
PSE-14V	303585	top ABS plastic bottom aluminium die casting	IP54

3.4 Controls



„n-min“ (R28)	Potentiometer min. speed	Speed adjuster (0-100 %) or setting the minimal output (basic speed)
„n-max“ (R35)	Potentiometer max. speed	Setting the max. Output (speed limit)

3.4.1 Manual speed setting or adjust of min. speed (basic speed)

Setting range: approx. 0% up to 100% line voltage

1. Adjustment “0 V” by external signal or potentiometer
2. Adjust desired min. speed by means of potentiometer "n-min".

3.4.2 Setting of max. speed-potentiometer (speed limiter) and cos φ adjustment

Setting range from 100% down to setting “n-min”

This adjustment has to be made with full load condition i.e. when radial fans are used all dampers must be open.


1. Adjustment by external signal: input signal 10 V (20 mA).
2. Adjust the desired max. speed by means of potentiometer "n-max". For cos φ adjustment, turn “n-max” counter-clockwise such that the maximum output voltage will just be measured (with TRUE-RMS multimeter).

Cos φ adjustment

The output voltage from the unit depends on the inductance of the motor (cos φ). By this, the maximum output voltage can already be reached below the maximum input signal (<10 V / 20 mA). A correction is possible by setting “n-max” (cos φ adjustment).

4. Installation

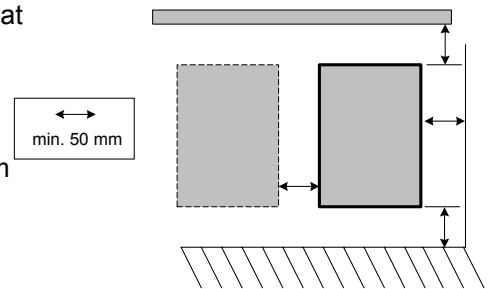
4.1 Mounting

- Assemble the device on a clean and stable base. Do not distort during assembly! Use the appropriate mounting devices for proper installation of the unit!
- Do not mount equipment on vibrating base!
- Use the appropriate fixing equipment. The plastic washers must be installed between the screw heads and the housing for models with mounting holes on the inside of the housing!
- Install the device away from transport routes. However, ensure however that the device is still easily accessible!
- Depending on the housing model cut off necessary cable inlets respectively to the cable diameter. Or alternative use cable inlet for cable glands. Metal sheet housings are supplied with stoppers. Any cable ducts openings not used must be sealed!
- Protect the device from direct exposure to sunlight!
- The device is designed for vertical installation (cable inlet down). A horizontal or reclined installation is only permissible after consultation with the manufacturer.
- **Be sure to observe proper heat dissipation (☞ Technical data, "heat dissipation")** 

4.2 Minimum space requirement

In order to ensure sufficient ventilation of the device, clearance on all sides of at least 50 mm has to be maintained to the housing walls, switch cabinet doors, wiring ducts, etc. The same clearance applies to the installation of several devices next to each other (☞ illustration).

When installing several devices on top of each other, the danger of reciprocal heating exists. This layout is only then permissible when the air suctioned from the upper unit does not become warmer than the permissible ambient temperature (☞ Technical data). I.e., a correspondingly larger clearance or thermal shielding is required.



4.3 Outdoor installation (PSE-6/14V or PAE10E-M in empty case IP 54)

Outdoor installation in IP 54 is possible up to -20° C, if device is not switched off.

4.4 Temperature influences during commissioning

To prevent functional faults, no condensing humidity must be allowed to enter the controller. The controller should therefore be stored at room temperature!

4.5 Systems with current-operated circuit-breaker

Owing to possible leakage currents occurring when the device is switched on, it is advisable to use time-delay current-operated circuit-breakers. This prevents false triggering.

4.6 Potential of control voltage connections

As a result of the ex factory connection between a "GND" terminal and the "PE" connection, the control voltage connections are, for safety reasons, applied to the protective-conductor potential. If, in exceptional cases, disconnection of the potential is necessary, this connection can be removed.



- If this connection is removed, it must be ensured that the maximum external voltage at the control voltage connections does not exceed **20 V** (between the "GND" terminals and the "PE" protective conductor).
- **An insulated power cable must be used for the sensor cable.**

4.7 Interference Emissions / Cable installation

Motor cable

The applicable standard for radiating interference is EN 61000-6-3.

For type PAE10E-M and type PSE-6V:

Interference level „B“ according to EN 55022 up to maximum 2 m motor cable not screend or maximum 5m motor cable screend.

Interference level „A“ according to EN 55022 up to maximum 50 m motor cable length screend.

For type PSE-14V:

Interverence level „B“ according to EN 55022 up to maximal 15 m motor cable not screend.

If a shielded cable is used, the shielding (as short as possible) must be connected to the protective conductor of the device.

Signal cable

Pay attention to sufficient distance from powerlines and motor wires to prevent interferences.

The control cables may not be longer than 30 m. Screened control cables must be used when the cable length is longer than 20 m. When using a screened cable, the screen must be connected to the protective conductor at one end, i.e. only at the control unit (as short and of as low an inductance as possible!).

4.8 Electrical installation



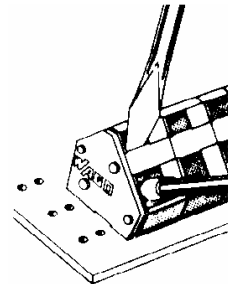
- **Electrical installation may only be carried out by trained specialists in accordance with general and locally applicable directives!**
- **Dangerous electric voltages are exposed when the controller is opened. Behave accordingly when installing the device and ensure that employees without appropriate training cannot enter the hazardous area!**



The relevant connections can be found in the circuit diagram enclosed in the Appendix at the back of these operating instructions (☞ Chap. 7.1 Connection diagram)!

With "WAGO" terminal strips, insert only one conductor with max. 2.5 □.

Before final commissioning is performed, the housing must be correctly screwed into position and the unused cable ducts must be sealed using the supplied stoppers!



5. Basic settings / connections possible

5.1 Adjustment of the speed by an external potentiometer

The external potentiometer (10 k Ω) is connected to the terminals "A" and "GND". Depending on the setting, a voltage of 0-10 V is returned to the input terminal "E" by the potentiometer pick-off (for 10 V max. output voltage). The connector J 10 (in the terminal compartment) must be inserted in the "up" position, i.e. in position "A", to do this, (see terminal connection plan).

J10 "up" position "A" (**factory setting**) = fixed voltage at terminal "A" (+ 10 V for potentiometer)
 J10 "down" position "B" = voltage at terminal "A" = 0-10 V proportional to the motor voltage.

5.2 Adjustment of the speed by an external signal

The external signal for selecting the speed is connected to terminals "E" and "GND" (see terminal connection plan). The speed of the motors connected is controlled as a direct variance of the signal at the input terminals (for max. 10 V output voltage).

Subsequent change from 0-10 V to 0-20 mA for the input signal:

Control by a 0-20 mA signal is possible by an external circuit resistor (499 Ω / 0.25 W) between the terminals "E" and "GND".

5.3 Voltage supply for external equipment

There is an integrated power supply for external equipment. A selection between +15 V and +24 V is possible by mean of jumper J15.

Reference point for voltage = next GND-terminal, max. 20 mA

J15 up position "A" +15 V	output voltage \pm 5 %.
J15 down position "B" +24 V (standard setting)	output voltage \pm 20 %.



The voltage stabilisation function for the motor voltage is limited for a load on this voltage supply. Thus this must be interrupted in the terminal compartment by connector J 3 (☞Section 5.5 Stabilisation of output voltage)

5.4 Running several fans from one controller

Several fans can be connected to the controller. The maximum total current of all motors (maximum rated current for electronic control of the voltage) must not exceed the current rating of the controller.

If the maximum control current for the electronic voltage control is not known, then allowance for an increase up to 20 % in the motor nominal current must be made.

For the control of motors made by other manufacturers (not Ziehl-Abegg), the control characteristics and the maximum current for electronic regulation of the voltage should be enquired from the manufacturer.

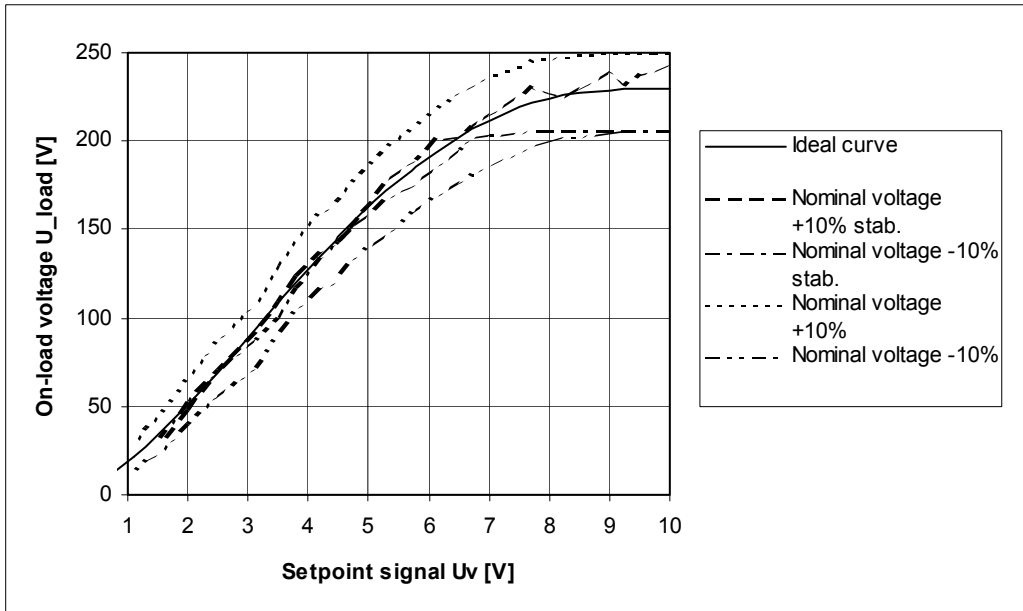
It is recommended that a separate motor surveillance unit (e.g. S-ET10) is foreseen for each fan.

5.5 Stabilisation of the output voltage for fluctuations in the line voltage

By means of the integrated voltage stabilisation function, the output voltage and hence the speed of the connected motor remain essentially constant throughout fluctuations in the line voltage. The unit supplies the maximum output voltage (approximately the line voltage) for line voltages above the signal input which are less than the specified output voltage. The output voltage of the unit cannot rise above the line voltage for system reasons.

Characteristic for ohmic loads

By comparison, units without integrated voltage stabilisation for line voltage + and -10 %.



Stabilisation of the output voltage can be switched on and off again with the jumper J3.

Jumper J3 “up”: without stabilisation (**factory setting**)
 Jumper J3 “down”: with stabilisation



The stabilisation must be switched off when loading the voltage supply for external units (+15 V / +24 V) (section 5.3 Voltage supply) or for running from a mains transformer.

It is not meaningful to operate with stabilisation for control (0-10 V) by a control unit (e.g. when used as a “follower controller”).

The function “stabilisation” serves to specify a voltage as constant as possible, e.g. over a potentiometer.

5.6 Output voltage 0-10 V

The output voltage 0-10 V, (terminal “A” / “GND”) is almost proportional to the regulated motor voltage. This can be used for example, if a speed controller, type PAE / PASTE, or valve positioning motor, is installed. The output is set to a fixed voltage of 10 V at the factory for supply to a potentiometer. A switchover to 0-10 V proportional to the motor voltage is possible by means of the connector J10 in the terminal compartment.

J10 „up“ position „A“ (**standard setting**) = fixed voltage to terminal „A“ (+10 V for potentiometer)
 J10 „down“ position „B“ = voltage to terminal „A“ 0-10 V proportional to the controlled motor

Max. load output voltage 0-10V
 - PAE10E-M and PSE-14: I_{max} 10 mA
 - PSE-6V: I_{max} 1 mA

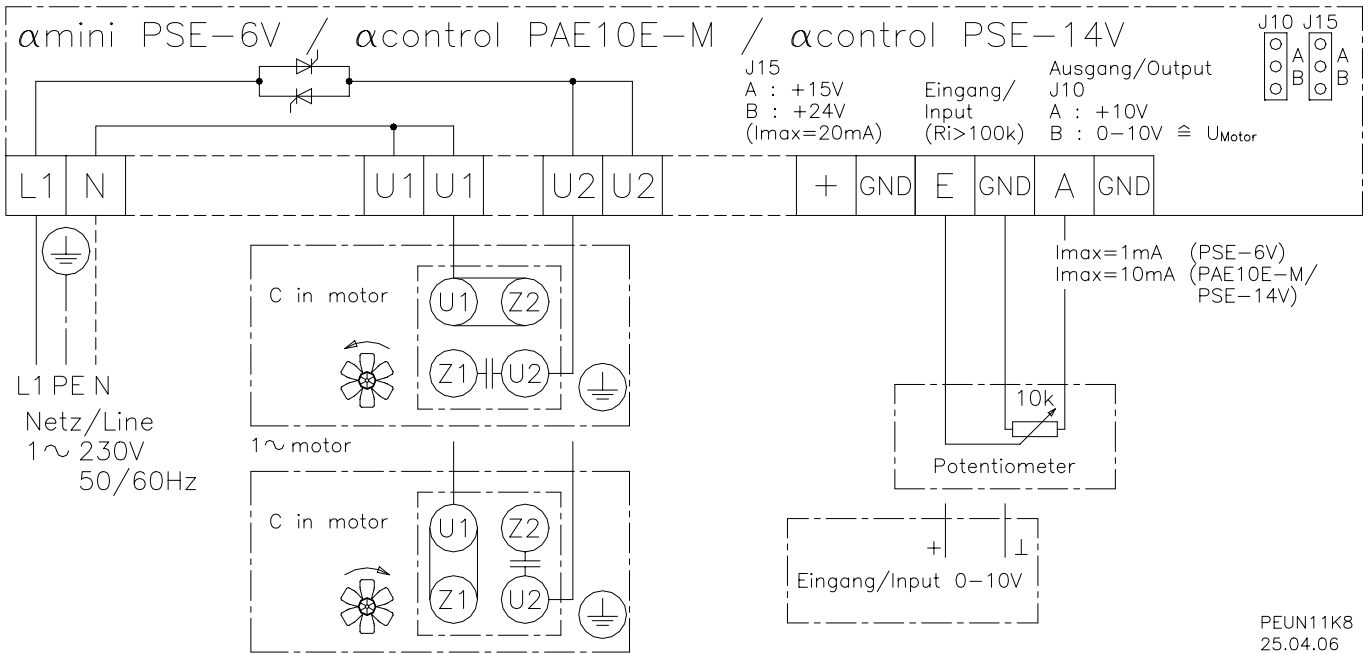
6. Faults and their rectification

6.1 Line faults

The controller switches off in the event of a line fault, e.g. fuse or network failures. The controller switches on again automatically following restoration of the voltage.

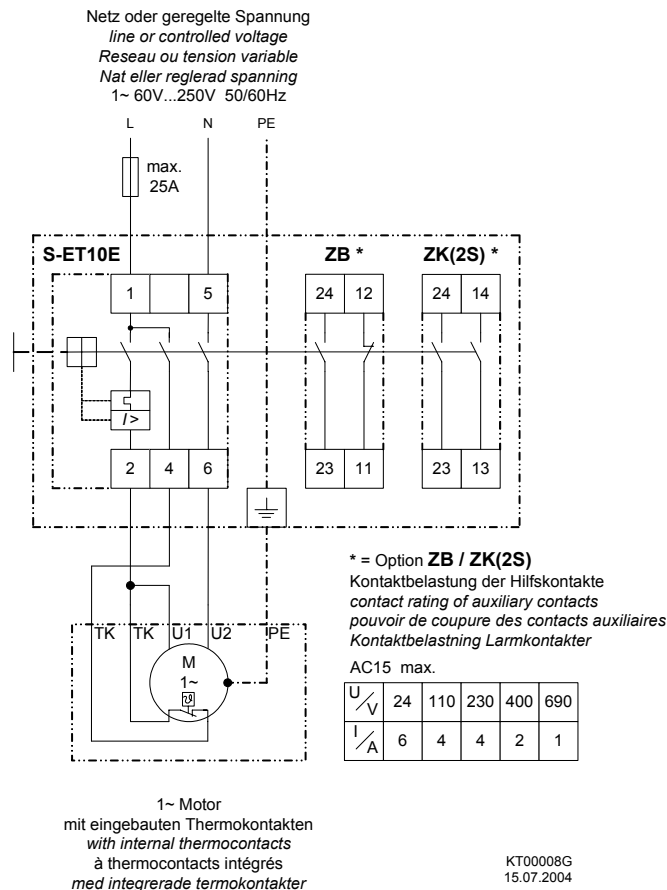
7. Enclosure

7.1 Connection diagram



7.2 Anschlussplan von Motorschutzgerät für Motoren mit Thermokontakten Typ S-ET10

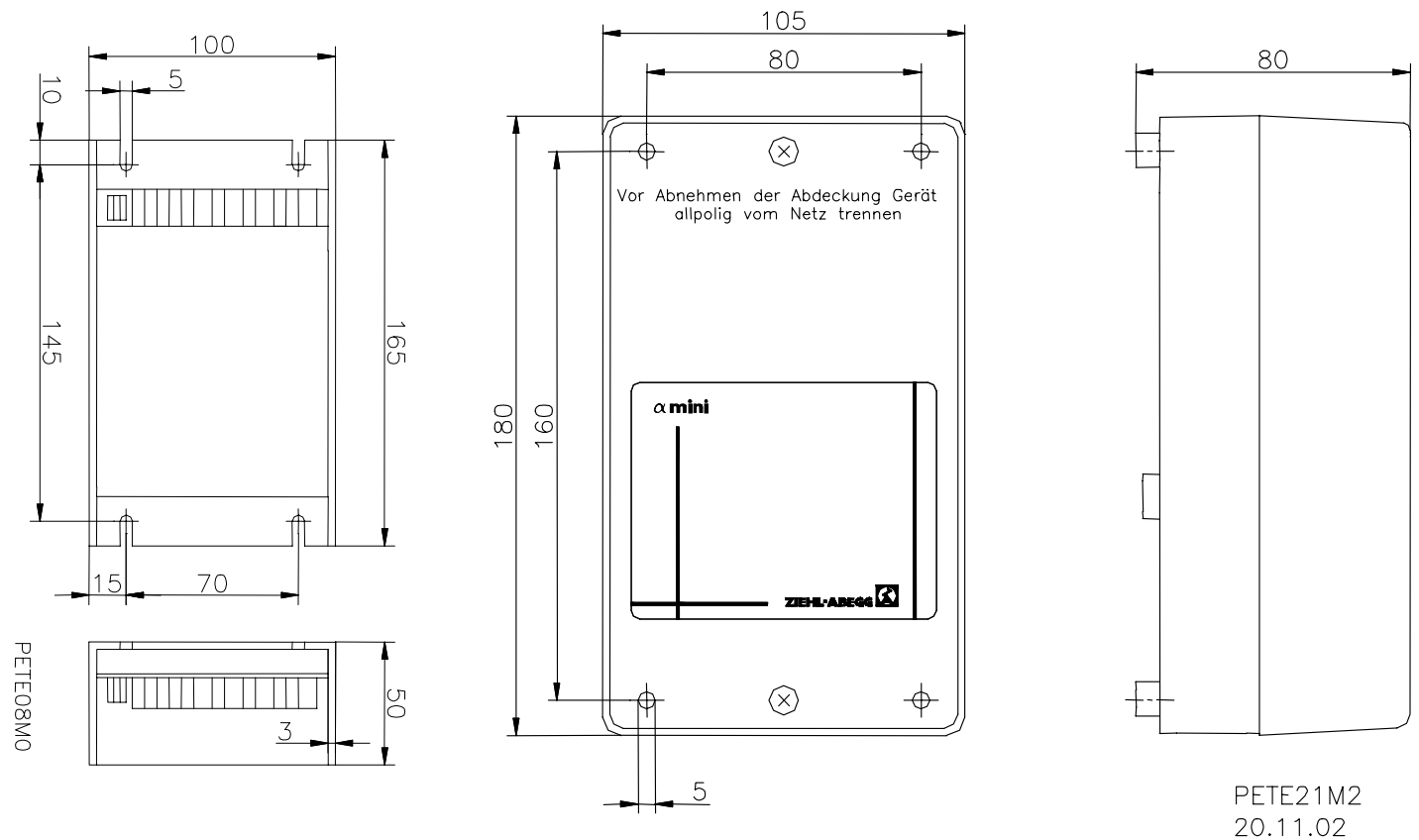
- Total motor protection: Automatic cut-off by thermocontact actuation $\hat{=}$ motor overtemperature. Button for Reset after malfunction.
- No cut-off if the mains supply is interrupted.



7.2 Dimension sheet

PAE10E-M

PSE-6V



PSE-14V

