

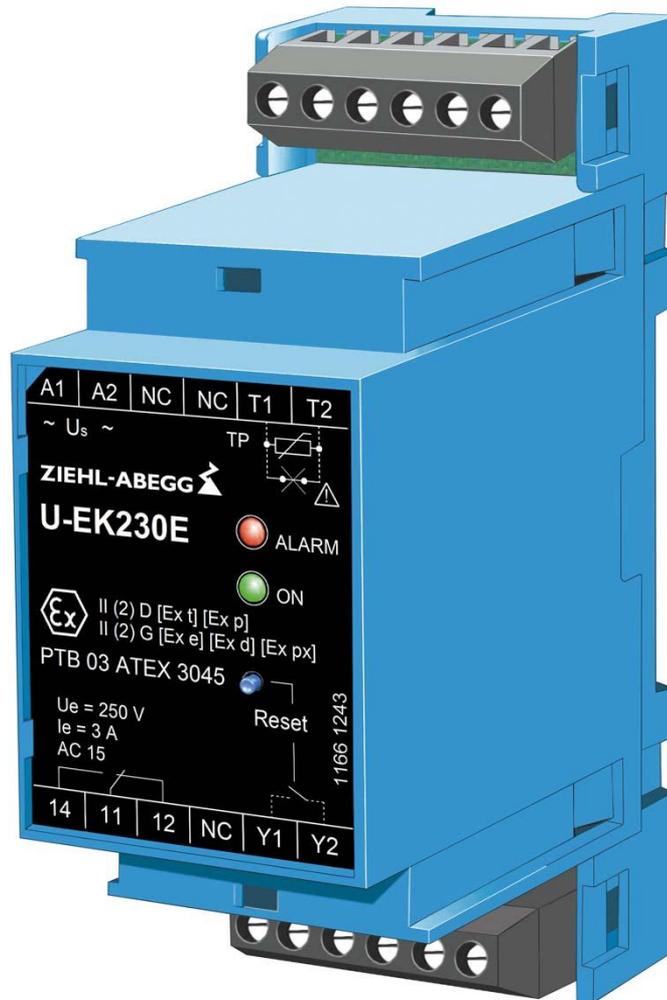
# Operating Instructions

English

## Type U-EK230E

Part.-No. 382008

Motor protection- and releasing unit with thermistors "TP" (PTC thermistor relay)



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# 1. Application

Ziehl-Abegg PTC thermistor relays protect motors, transformers, machines and equipment against thermal overload. These are according to DIN EN 60947-8 and are thus exchangeable. Used in conjunction with respective PTC thermistors they provide a reliable temperature protection in the temperature range 60 °C up to 180 °C.

PTC thermistors according DIN 44081 and DIN 44082 shall be connected. PTC thermistors are suitable for the installation into windings of electrical machines, bearings and transformers as well as to monitor the temperature of liquid media, airflow and gases.

With ATEX approval, explosion-protected equipment in explosive gas atmospheres (marking G: gas) or in areas with combustible dust (marking D: dust) can be protected.

# 2. Approvals

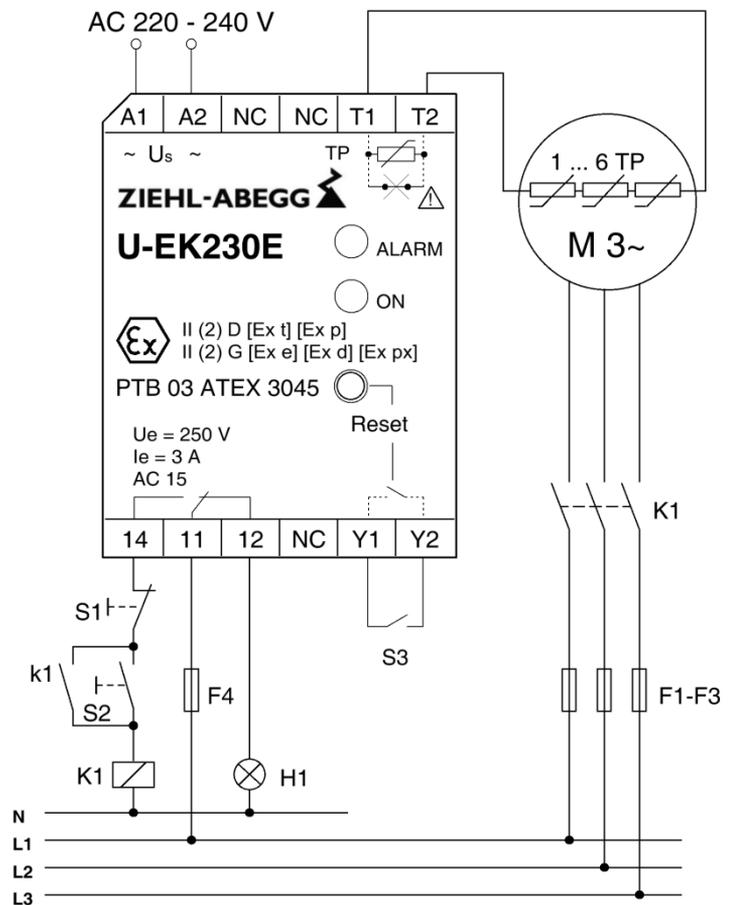
Marking see type plate on the device

# 3. Features

- ATEX directive 94/9/EC
- 1 circuit for 1...6 PTC thermistors
- Short-circuit detection within the thermistor circuit
- Output relay with 1 change-over contact (co)
- Operating status display with LED

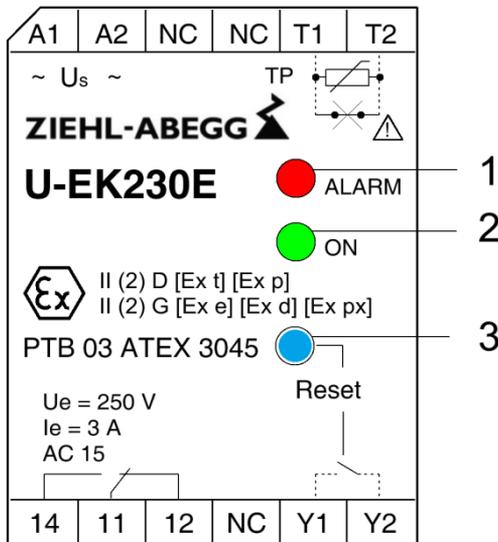
# 4. Connection diagram

- Us = supply voltage
- S1 = off-switch
- S2 = push-button on
- S3 = push-button external reset
- H1 = indicator lamp fault
- F1-F4 = fuses
- K1 = contactor
- TP = PTC thermistor



## 5. Display- and control elements

- 1 = LED red „ALARM“
- 2 = LED green „Power ON“
- 3 = built-in key button “Reset”



## 6. Detailed description

A current monitors continuously the resistance of the PTC thermistors. In cold state, the resistance is <250 Ω per thermistor (thermistor circuit <1.5 kΩ). The relay has picked up and contacts 11/14 are closed. The resistance of the thermistor rises rapidly at detector operating temperature TNF. The relay release at a resistance of 3...4 kΩ and the contacts 11/12 close. The devices also switch off in the case of detector or line short-circuit (<approx. 20 Ω). The device stores the switch-off and must be reset (to be acknowledged) manually with the built-in key button or an external push-button. Power-on is recognized as an automatic reset. With bridged terminals Y1 and Y2, the function reclosing-lock is disabled.

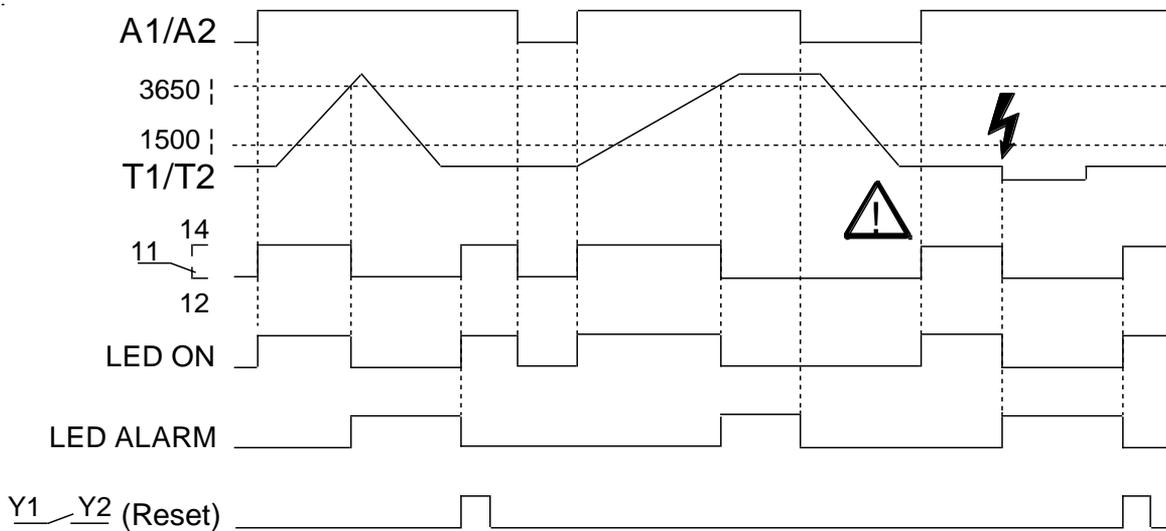


**With a bridge at the RESET inputs (Y1/Y2) the reclosing lock is out of operation. The device switches back automatically, when the temperature of the thermistor circuit has fallen below the switchback value.**

Depending on the number of PTC thermistors the following tripping temperatures and reset temperatures arise related to TNF (detector operating temperature):

	Tripping temperature	Reset temperature
1 PTC thermistor	TNF + 15 K	TNF + 5 K
3 PTC thermistors in series	TNF + 5 K	TNF – 5 K
6 PTC thermistors in series	TNF	TNF – 20 K

## 7. Function diagram



## 8. Installation / commissioning



### Attention!

Observe safety rules and standards. Notice safety remarks!

- The applicant must observe safety rules and standards.



### Danger!

**Hazardous voltage!**

**Will cause death or serious injury. Turn off and lock out all power supplying this device before working on this device.**

- The device can be mounted on 35 mm rail according EN 60715 or with screws M4 (Option)
- The devices must be installed in a closed switchgear cabinet or in an enclosure of international protection class IP 5x according EN 60529 or better.

**When installing the device into the switchgear cabinet, please observe the max. admissible temperature. Care for both, sufficient clearance to other devices or sources of heat or enough forced draught. If cooling is made more difficult, e.g. close devices with increased surface temperature or by handicap of airflow cooling the permissible ambient temperature has to be reduced.**



### Attention!

**Before switching on make sure that the operational voltage  $U_s$  of the type plate and the mains voltage are the same!**

- After installation and before commissioning the correct function of the tripping device must be checked by resistance simulation at terminals T1 and T2. This check is also performed after changes to the installation.

## 9. Trouble-shooting and remedies

Relay does not pick up. Please check:

- The supply voltage  $U_s$  at terminals A1-A2 (green LED lights-up).
- The thermistors at terminals T1-T2. In the case of disturbance the red LED lights-up.
- The resistance of a thermistor circuit must be at  $50 \Omega < R < 1500 \Omega$ . The terminal voltage T1-T2 is to be measured  $< 2.5 \text{ Vdc}$  with connected thermistors.
- Push the key button "Reset". The relay can pick up at resistance  $R < 1650 \Omega$ . LED changes from red to green. Alternatively reset can be done with closing an external contact at terminals Y1-Y2 or with power recovery.

Relay does not release. Please check:

- With no thermistors connected the relay must release. The voltage at terminals T1-T2 must be approx. 8 V. In case of any other malfunctions, replace device. Please add a description of the occurred malfunction when sending back for repair.

## 10. Technical data

Power supply

Rated supply voltage $U_s$	AC 220-240 V
Tolerance voltage $U_s$	0.9 $U_s$ - 1.1 $U_s$
Frequency (AC)	50 / 60 Hz
Tolerance frequency	45 Hz - 65 Hz
Power consumption	$< 2 \text{ VA}$

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Thermistor connection	PTC thermistor according DIN 44081/DIN 44082	
Number	1...6 thermistors in series	
Cut-out-point	3.3 k $\Omega$ ...3.65 k $\Omega$ ...3.85 k $\Omega$	
Reclosing point	1.7 k $\Omega$ ...1.8 k $\Omega$ ...1.95 k $\Omega$	
Response tolerance	$\pm 6 \text{ }^\circ\text{C}$	
Collective resistance cold thermistors	$\leq 1.65 \text{ k}\Omega$	
Terminal voltage (PTC thermistor)	$\leq 2.5 \text{ Vdc}$ at $R \leq 3.65 \text{ k}\Omega$ , $\leq 9 \text{ Vdc}$ at $R = \infty$	
Terminal current (PTC thermistor)	$\leq 1 \text{ mA}$	
Short circuit	$20 \Omega \leq R \leq 40 \Omega$	
Power consumption	$\leq 2 \text{ mW}$	

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Relay output	EN 60947-5-1		
Contacts	1 change-over contact		
Switching voltage	max. AC 415 V		
Switching current	max. 5 A		
Switching power AC $\cos = 1$	max. 1250 VA (ohm resistive load) max. 120 W at DC 24 V		
Rated operational current ( $I_e$ )	AC15	$I_e = 3 \text{ A}$	$U_e = 250 \text{ V}$
	DC13	$I_e = 2 \text{ A}$	$U_e = 24 \text{ V}$
Recommended fuse	4 A (gG)		
Mechanical contact life	$3 \times 10^7$ operations		
Electrical contact life	$1 \times 10^5$ operations at 240 V / 5 A		

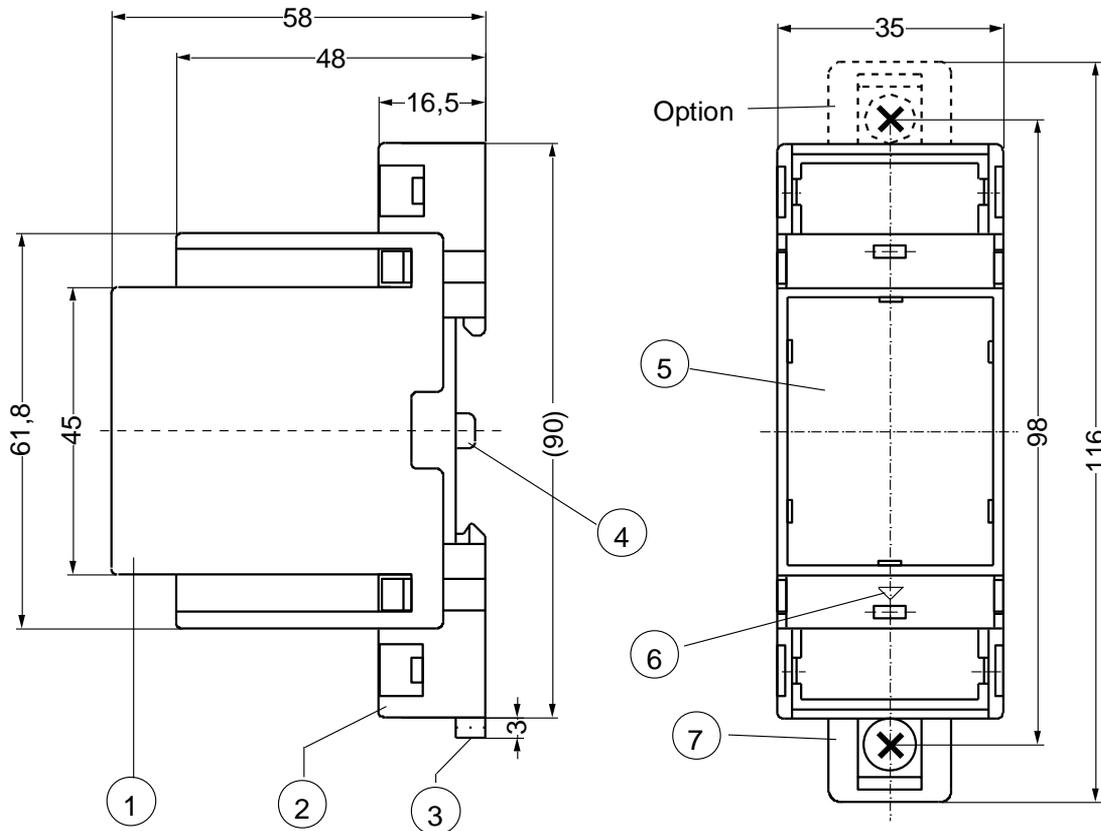
Testing conditions	EN 60947	
Rated impulse voltage	4000 V	
Overvoltage category	III	
Contamination level	3	2
Rated insulation voltage $U_i$	250 V	415 V
Transformer	EN 61558-2-6	
On-period	100 %	
Rated ambient temperature range	-20 °C ... +55 °C	
EMC - Immunity	EN 61000-6-2	
EMC - Emission	EN 61000-6-4	
Vibration resistance EN 60068-2-6	2...13.2 Hz $\pm$ 1 mm	
	13.2 ... 100 Hz 1 g	

Enclosure	Form V2	
Dimensions (H x W x D) mm	90 x 35 x 58	
Line connection solid wire	1 x 0.5 ... 2.5 mm <sup>2</sup> (AWG 22 – 14)	
Stranded wire with insulated ferrules	1 x 0.14 mm <sup>2</sup> up to 1.5 mm <sup>2</sup>	
Insulation strip length min.	8 mm	
Torque	0.5 Nm (3,6 lb.in)	
Protection class enclosure EN 60529	IP 30	
Protection class terminals EN 60529	IP 20	
Fitting position	any	
Mounting EN 60715	standard rail 35 mm	
Optional: Screw mounting	M4, only with additional bolt (not part of delivery)	
Weight	approx. 150 g	

Subject to technical modifications

## 11. Enclosure V2

Dimensions in mm



- 1 Top
- 2 Bottom
- 3 Bolt
- 4 Seal mounting link
- 5 Front plate element
- 6 Characteristic for bottom
- 7 Extensible bolt for wall fastening with screws. Bolt bore  $\varnothing$  4.2 mm.

## 12. Safety instructions and references for putting into operation

- please read carefully!

### Special remarks for hazardous areas (Zone 0, Zone 1 and Zone 2)



- The increased danger within hazardous areas requires the careful attention of the safety instructions and references for putting into operation. Observe the national safety rules and regulations for prevention of accidents as well as the European standard EN 60079-14 „Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)”. All work for the connection, for putting into operation and maintenance is to be implemented by qualified, responsible technical personnel. Inappropriate behaviour can cause heavy personal damage and damages to property.
- The response of the thermal motor protection must directly switch off the motor, also when used together with frequency inverters. This must be realized in the logic section or configuration in the inverter.
- The tripping device may be installed only outside potentially explosive atmospheres for the protection of explosive-protected motors. When used in potentially atmospheres, the device must comply with the required type of protection.

### Special remarks for use in the presence of combustible dust (Zone 20, Zone 21 and Zone 22)

- The increased danger within hazardous areas of combustible dust requires the careful attention of the safety instructions and references for putting into operation. Observe the national safety rules and regulations for prevention of accidents as well as the European Standard EN 61241-14 „Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation” (new in EN 60079-14). Installation, electrical connection and commissioning to be carried out by trained service personnel only. Inappropriate behaviour can cause heavy personal damage and damages to property.
- The relay may be installed only outside potentially explosive atmospheres for the protection of explosive-protected motors. Within potentially explosive atmospheres the equipment is to be provided with a dust proofed enclosure according EN 60529.

## 13. Safety characteristics of the safety device

### Safety Integrity Level (EN 61508) and safety related parameters

Operating mode	Hardware architecture	HFT	Safety Integrity Level
low demand mode	1001	0	SIL 1

Type	MTBF	PFH	SFF	$\lambda_{SD}$	$\lambda_{SU}$	$\lambda_{DD}$	$\lambda_{DU}$
U-EK230E	52 years	4.26E-07	55 %	4.52E-07	6.10E-08	0	4.26E-07

Type	Proof test interval T1	1 year	3 years	5 years	10 years
U-EK230E	PFDavg	1.87E-03	5.60E-03	9.33E-02	1.87E-02

Observe proof test interval according EN 60079-17 for electrical equipment  $\leq$  3 years.

### Category and Performance-Level (EN ISO 13849-1)

The devices fulfil the requirements of category 1 and PL = c.

$MTTF_d = 268$  years.

The data of the functional safety stated above are valid for an ambient temperature of 40 °C. Data for additional ambient temperatures can be obtained on request.

### Application of the safety device used with equipment category (EN 50495/VDE 0171-18)

This standard describes the minimum requirements of safety integrity level and fault tolerance of a safety device in the application together with the category of the Equipment Under Control (EUC).

EUC	Safety device		
	no safety device	SIL 1	SIL 2
Category 2 (2G, 2D) EPL = Gb, Db	Zone 1, Zone 21	Zone 0, Zone 20	Zone 0, Zone 20
Category 3 (3G, 3D) EPL = Gc, Dc	Zone 2, Zone 22	Zone 1, Zone 21	Zone 0, Zone 20

The tripping relay thus is suitable as safety device for Equipment Under Control (EUC) Category 3 (HFT = 0) in Zone 1 and Zone 21 and for Equipment Under Control (EUC) Category 2 (HFT = 1) in Zone 0 and Zone 20.

The combined equipment shall comply with the relevant standards EN 60079-0 respectively EN 61241 according to the categories to match.

## Wiring

- The lines of the thermistor circuit are to be routed as separate control lines as far as to the motor line. The use of lines of the supply cable or other mainstream lines is not permissible. If extreme inductive or capacitive stray effects are to be expected by parallel cables of the power installation, protected control lines should be used.
- Used with electronic speed regulation the thermistor lines must be routed separately from the power lines as far as to the motor line, in order to avoid EMC distortion and thus false signal release.
- The terminals Y1, Y2 may be attached parallel to a common resetting mechanism. Thermistor lines may not be connected together.
- The line resistance within the thermistor circuit may not exceed a value of 20 Ω.
- Maximum of permissible length for thermistor lines:

Wire cross section	Wire length
2.5 mm <sup>2</sup>	2 x 1000 m
1.5 mm <sup>2</sup>	2 x 800 m
1.0 mm <sup>2</sup>	2 x 500 m
0.75 mm <sup>2</sup>	2 x 300 m
0.5 mm <sup>2</sup>	2 x 250 m

- With commissioning and after modification of the plant the thermistor resistance should be measured with a suitable measuring instrument. With a resistance <50 Ω the thermistor circuit is to be examined for short-circuit.



**Attention! Check PTC thermistors only with measuring voltages of <2.5 V.**

### Safe separation

- Line circuits (A1, A2, 11, 12, 14) have a safe separation to low-voltage electric circuits (T1, T2, Y1, Y2).

### Stop Function

- A stop function released by the protection device must transfer the machine after manipulation of this function as fast as possible into a safe condition. The stop function must have priority before an operating stop.
- In case of failure the relay switches off the contactor/circuit breaker and so prevents an overheating of the isolation system and/or the surface temperature. The protective function of the equipment is guaranteed only if wiring is done directly into the control circuit of the motor/machine in accordance with the connection diagram. The contacts must be protected, in order to prevent welding.

## Start and restart



A restart may take place automatically only if no dangerous condition can be present. With a bridge at terminals Y1, Y2 (auto reset) the tripping devices switch-on automatically after cooling down. This function may not be used, where an unexpected restart can lead to damages to property or person.

## Manual resetting

- After introducing a stop instruction by the protection device this must be maintained, until the manual resetting mechanism is operated and safe conditions for a renewed start are given. The manual resetting may be only possible, if all safety functions and protection device are effective.
- Trip devices types U-EK230E have an interlock function. The stop instruction remains, until pressing the push-button „Reset“ a reset is made. A start-up is only possible, if no case of failure occurs and the motor is cooled down to a sufficient value of temperature. Trip devices type U-EK230E switch on automatically with return of mains voltage. The user must guarantee by external interlock (see connection diagram) so the supervised motor/machine does not start again independently or monitor the power supply.



### Attention!

**Safety circuits according to EN 60204/EN 62061.**

**The tripping devices must not be used alone for functions, where an automatic Restart must be prevented.**

## 14. Proof testing of the safety functions

- The safety function must be tested once annually. Depending on the zone risk, tests should be conducted more frequently. A fault is recognized by the safety test. A fault between safety tests could cause loss of protection.
- The safety function must be tested by interrupt the thermistor circuit wire at terminals T1, T2.
- The short circuit monitoring function must be tested by bridging the thermistor circuit wires at terminals T1, T2.
- The safety function must be tested by changing the resistance from 1500 Ohm to 4000 Ohm at terminals T1, T2.
- The function of the electronic interlock must be tested additionally.
- If an error is detected no restart must be induced until the error is cleared.

## 15. Maintenance and repair

The devices are maintenance-free. Only the manufacturer may accomplish repairs. We recommend testing within the regular maintenance intervals of the plant, where the device is used. EN 60079-17 is to be observed.

## 16. Manufacturer reference

Our products are manufactured in accordance with the relevant international regulations. If you have any questions concerning the use of our products or plan special uses, please contact:

**Ziehl-Abegg AG**  
**Heinz-Ziehl-Straße**  
**74653 Künzelsau**  
**Telephone: +49 (0) 7940 16-0**  
**Telefax: +49 (0) 7940 16-504**  
**info@ziehl-abegg.de**  
**http://www.ziehl-abegg.de**

## 17. Service information

If you have any technical questions while commissioning or regarding malfunctions, please contact our V-STE support department for control systems - ventilation technology.

Our worldwide contacts are available in our subsidiaries for deliveries outside of Germany.

☞ [www.ziehl-abegg.com](http://www.ziehl-abegg.com)

If you make returns for inspections or repairs we need certain information in order to facilitate focused trouble shooting and fast repair. Please use our repair tickets for this. It is provided to you after you have consulted our support department.

In addition, you can download it from our homepage. Download - Ventilation Technology - Topic: Control Engineering - Document type: General documents.