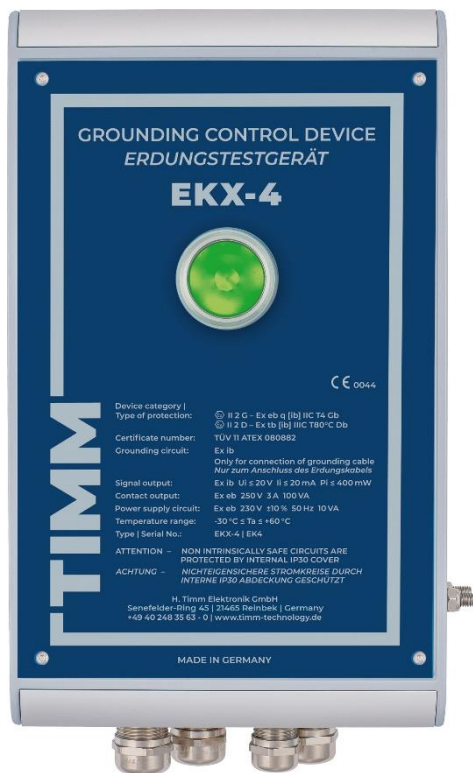


# GROUNDING CONTROL DEVICE EKX-4 AND EKX-4 (2-POLE)

## Technical Description | English



## Table of Content

1.	General Information .....	1
2.	Functional Principle.....	1
3.	Device version.....	2
4.	Special Features.....	3
4.1.	Compliance to latest European Standards.....	3
4.2.	Intelligent Explosion Protection.....	3
4.3.	Proven Factory Settings .....	3
4.4.	Configurability .....	3
4.5.	Object Recognition .....	3
4.6.	Functional Safety (SIL 2) .....	3
4.7.	Ease of Commissioning.....	4
4.8.	Bright Signal Light.....	4
4.9.	Cable Compensation.....	4
4.10.	Supervision of Interfering Voltages .....	4
4.11.	Control Outputs .....	4
4.12.	Made in Germany.....	5
5.	Accessories.....	6
5.1.	Grounding Clamp .....	6
4.1.1	1-pole Grounding Clamp (EZ1-1pol).....	6
4.1.2	Grounding Clamp with Brass Pin (EZ1-DORN).....	6
4.1.3	2-pole Grounding Clamp for cable 2 x 1.5 mm <sup>2</sup> (EZ1-2pol-1.5).....	6
5.2.	Breakaway Coupling .....	6
5.2.1.	Grounding Socket (TW700BU) .....	6
5.2.2.	Grounding Plug (TW700ST) .....	7
5.3.	Grounding Cables.....	7
5.3.1.	Straight Neoprene Grounding Cable.....	7
5.3.2.	Coiled Grounding Cable.....	7
5.3.3.	Special PUR Cable .....	7
5.4.	Cable Reel.....	7
5.5.	Clamp Hanger .....	8
5.6.	Testing Equipment.....	8
6.	Technical Specifications .....	9
7.	Connection Diagram (EKX-4 1-pole).....	10
8.	International Approvals .....	11
9.	Contact us .....	12

## 1. General Information

The Grounding Control Device EKK-4 ensures the controlled discharge of electrostatics occurring during filling processes of tank trucks, silo trucks, railway wagons or tank containers. This makes an important contribution to the prevention of static-caused ignitions in explosive atmospheres and implements the requirements of the most recent national and international regulations e.g. TRGS 727, TRBS 2152, DGUV regulation 113-001 (EX-RL), CLC/TR 50404 and IEC TS 60079-32-1.

railway tank wagons or similar containers. An exceptional hazardous situation will be present, if these electrostatics happen with inflammable products or within an explosive gas or dust atmosphere.

To prevent from static-caused ignitions, the electrostatic charge has to be dissipated safely. The EKK-4 Grounding Control Device provides and monitors the required connection continuously. Therefore it has to be installed firmly connected to the ground reference potential of the filling station (ground connection).

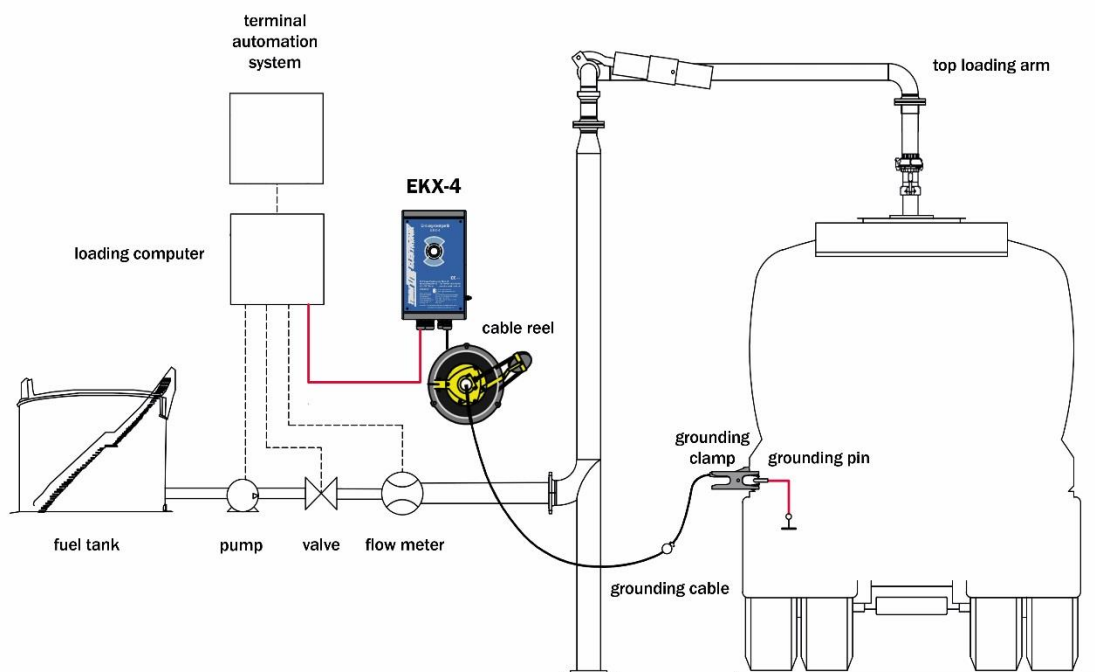


Figure 1: Monitored grounding with EKK-4 Grounding Control Device top loading vehicle

EKK-4 is an electrical apparatus for use in gas and combustible dust hazardous areas of zones 1 and 21 according to European ATEX Directive 2014/34/EU. It is characterized by ease of installation, convenient operation, functional safety (SIL 2) and a user-friendly state-of-the-art explosion protection concept (IEPC) designed by Timm.

## 2. Functional Principle

Electrostatic charges can arise by filling of non-conducting fluids, granulate materials or other products to road tank trucks,

Before starting any filling process, the tanker, railcar or container must be grounded by attaching the grounding cable. As soon as the grounding control device detects a sufficient conductive connection, it will switch the control outputs and the indicator lamp to 'filling release' ('green'). If the proper grounding connection breaks, the device will switch immediately to the safe 'no release' state ('red').

The featured object recognition at the device setting 'tank truck' avoids any faulty operation by short-circuit to

ground. Together with the integrated auto-diagnosis functions, a high level of safety is provided. Depending on the object to be grounded, two different models of the EKX-4 Grounding Control Device are available. It is important for all applications that the object to be grounded has a bare metallic grounding contact.

### 3. Device version

Depending on the electrical characteristics of the object to be grounded there are different versions of the Grounding Control Device EKX:

#### EKX-4

The standard 1-pole version of EKX-4 Grounding Control Device is a safe and versatile solution to discharge the static electricity from tank trucks, silo trucks or railcars during the filling of non-conducting inflammable products like fuels, lacquers or combustible dust. The 1-pole measuring loop of the object recognition and grounding leads via the grounding cable from the grounding control device to the object to be grounded as well as via the earth potential back to the grounding control device.

#### EKX-4 (2-pole)

The EKX-4 (2-pole) Grounding Control Device is designed for applications without a measureable impedance against ground reference potential, like containers or barrels standing on an isolated pallet. In this special case, the measuring loop is established through the 2-pole cable and clamp connection.

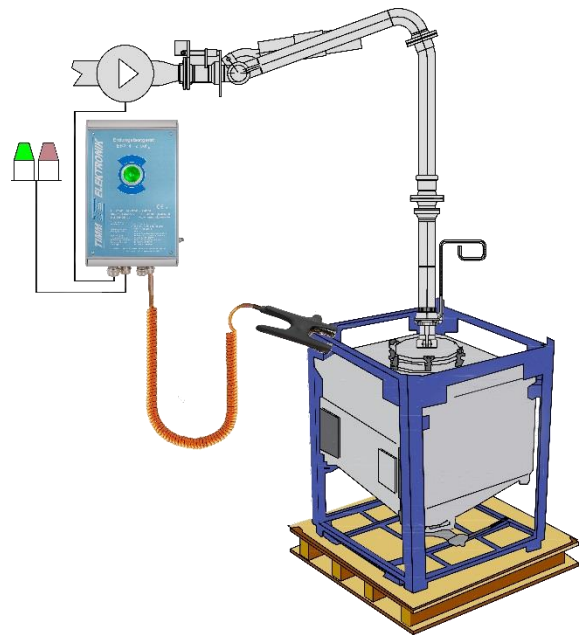


Figure 2: Monitored grounding of bulk containers in dust hazardous areas with EKX-4 (2-pole)

#### New: EKX-FIBC

The new EKX-FIBC was developed for monitoring during the filling process of conductive bag bags with carbon fiber and carbon grounding lug (flexible bulk containers FIBC type C). It is characterized by unique 2-clam measuring principle for identification of FIBC.

#### **For the Russian Market: EKX-4 LT**

Grounding Control Device with a self-regulating heating system for use in the extended temperature range from -55 °C up to +50 °C. This device is available only with the Russian EAC Ex certification and not intended for use within the scope of the ATEX Directive.

Further information about EKX-FIBC and EKX-4 LT you can find in separate technical documentations.

## 4. Special Features

### 4.1. Compliance to latest European Standards

The grounding control device fully complies with the latest editions of the European explosion protection standards EN 60079-0 ff. It is approved as device of category II 2 G for use in hazardous areas of zones 1 and 2, and as device of category II 2 D for use in zones 21 and 22.

### 4.2. Intelligent Explosion Protection

TIMM's intelligent explosion protection concept (IEPC) combines protection by intrinsic safety, increased safety, powder filling and protection by enclosure. With this unique combination of protection types, the grounding control device can be opened in gas hazardous areas for configuration.

### 4.3. Proven Factory Settings

Every unit is delivered pre-configured and therefore ready-for-use right after installation. The factory settings of the object recognition result from long standing experiences and are suitable to all standard grounding applications.

### 4.4. Configurability

Many functions of the grounding control device can be configured in order to cover the wide range of possible electrostatic applications. This includes setting the object to be grounded, e.g. road tank truck or railway tank wagon, adjusting the limit values of object recognition, the type of release signal at the electronic output and the cable compensation function. Thus, the device can get adjusted easily during installation and operation according to the local requirements at site of operation.

### 4.5. Object Recognition

With the setting 'tank truck', the grounding control device can distinguish between correct grounding and faulty operation, e.g. attaching the grounding clamp to the filling frame. 'Filling release' will only be given with proper grounding connection. This protection against false operation increases operational safety and ensures explosion prevention by compulsive grounding.

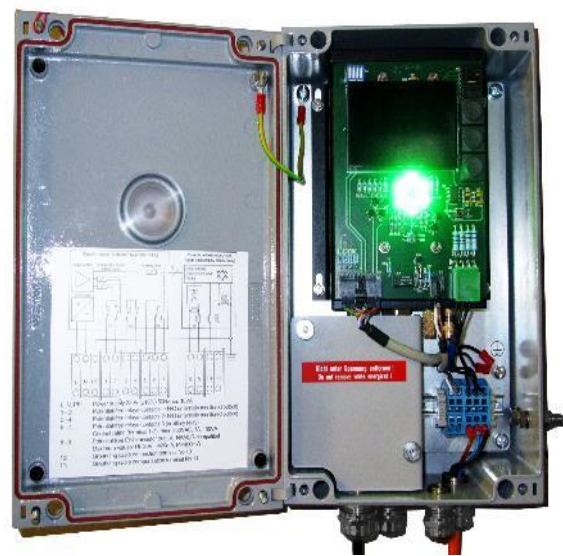


Figure 3: Configuration of EKX-4 in gas hazardous areas with opened enclosure and power switched on

### 4.6. Functional Safety (SIL 2)

The grounding control device performs several internal monitoring functions like a plausibility check of the device configuration, internal self-tests of all safety related functions, an automatic calibration of the measuring circuit electronics and tests of the relay reliability of the release outputs before every switching. The conductivity of the grounding connection is monitored permanently during operation. The unit's design and the selection of its component parts under aspects of explosion prevention and protection assure exceptional equipment reliability and functional safety that has been certified by a SIL2 certificate.



#### 4.7. Ease of Commissioning

With the factory settings and the easy-to-open enclosure, the grounding control device is installed, electrically connected and ready for operation within short time. Except from visual inspections, the device is maintenance-free. The electronic works reliably and requires no readjustment of the switching thresholds. The housing is extra coated for high resistance against chemicals and other environmental influences. With the integrated connection terminals, broken grounding cables can be replaced on site quickly.

#### 4.8. Bright Signal Light

The EKX-4 has a multicolor signal light that is clearly visible even in bright environments. It is mounted considerably raised at the front of the enclosure and can be recognized sidewise.

The signal light indicates the operational state of the device as large display. With opened enclosure, the signal light's six LEDs are used as detail display for indicating measured data, limit values and error diagnostics.

#### 4.9. Cable Compensation

Every grounding cable has a parasitic capacitance against ground potential. Without compensating this cable capacitance, the device may issue a release signal accidentally during connecting the cable to the object to be grounded. The cable compensation function of the EKX-4 Grounding Control Device prevents from these fault releases by enabling a very high accuracy of the object recognition measurements. Besides, increased lengths of grounding cables are possible with active cable compensation.

#### 4.10. Supervision of Interfering Voltages

Separate source voltages result in unregulated stray currents and have to be suspended from hazardous areas. Furthermore, they can interfere the functioning of grounding control devices. The device EKX-4 monitors the level of interfering voltages at the filling station and indicates as soon as the permitted level for its correct functioning is exceeded. Simple grounding control devices may interfere with stray currents and lead to an ungrounded 'release' state



Figure 4: Installed EKX-4 with explosion-proof Cable Reel KA and Grounding Clamp EZ1

#### 4.11. Control Outputs

The EKX-4 comes with four control outputs:

- 2 Contact Release Outputs
- 1 Electronic Release Output
- 1 Auxiliary Output (Changeover switch)

The release outputs can be connected directly to the control system of the filling station, e.g. PLC. Thus, automated filling processes can be released, or interrupted when proper grounding is not ensured. The contact release outputs are doubled, monitored by return signal and tested by the device prior to every release switching. Due to a mechanical link inside the relays, any malfunction of the contacts will be detected reliably.

The electronic output can be configured to a static or a dynamic signal. By using the dynamic oscillating signal together with a suitable evaluation electronic at the PLC, failures at the transmission lines can be recognized.

The auxiliary output is intended for not safety related control functions, e.g. external indicator lights.

#### **4.12. Made in Germany**

TIMM is an independent manufacturer of electronic equipment for control and measuring applications in hazardous areas. All our products are engineered and produced at our site in Reinbek, Germany - near Hamburg. More than fifty years of experience, co-operations with German universities and best qualified employees ensure the high quality of our products and substantiated technical advices by our sales engineers. With our very flexible production system we can provide best service to our customers, even at unanticipated project situations.

## 5. Accessories

TIMM provides a variety of accessories for its grounding control devices.

### 5.1. Grounding Clamp

The grounding clamp EZI is very durable made of stainless steel V2A. The spring action is limited in such way that for a safe contacting of the clamp no strong force is needed. The clamp is covered by an insulated shelf and designed with a special metal sheet. This ensures the release will only be given when the clamp is properly attached. An accidental contact to the object to be grounded will not result in 'filling release'. The insulation cover of nitrile rubber is handy, heat resistant and steady against mineral oil products.



Figure 6: Grounding Clamp

The grounding clamp EZI is approved for use in hazardous areas of zones 1, 2 and 21, 22 (gas group IIC, device category II 2 GD; according to present ATEX Statement of Conformity). The following configurations are available:

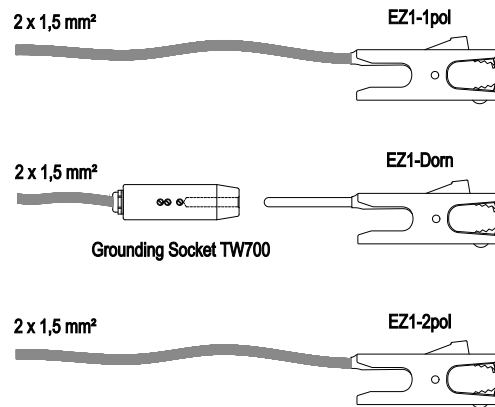


Figure 5: Grounding Clamp Configuration

#### 4.1.1 1-pole Grounding Clamp (EZI-1pol)

Explosion-proof stainless-steel grounding clamp with rubber insulating sheath for EKX-4 Grounding Control Device and predecessor models. For connection to coiled, neoprene or special PUR cable.

#### 4.1.2 Grounding Clamp with Brass Pin (EZI-DORN)

Explosion-proof stainless-steel grounding clamp with rubber insulating sheath and mounted brass pin, fitting into Grounding Socket TW 700. Combinable with coiled, neoprene or PUR cable for use with EKX-4 Grounding Control Device and predecessor models as breakaway coupling.

#### 4.1.3 2-pole Grounding Clamp for cable 2 x 1.5 mm<sup>2</sup> (EZI-2pol-1.5)

Explosion-proof stainless-steel grounding clamp with rubber insulating sheath. Combinable with coiled, neoprene or PUR cable for connection to EKX-4 (2-pole) Grounding Control Device. To ground containers, barrels and similar vessels.

## 5.2. Breakaway Coupling

### 5.2.1. Grounding Socket (TW700BU)

The grounding socket TW700BU is used for road tankers having a 10 mm thick grounding pin. It is impact and oil resistant.

The combination of grounding socket TW 700 and the grounding clamp with brass pin works as a breakaway coupling for EKX-4.



### 5.2.2. Grounding Plug (TW700ST)

Grounding Plug for connection to Grounding Socket TW 700. Combinable with Grounding Cable with 1-pole Grounding Clamp or Grounding Socket TW 700 as breakaway coupling.

The breakaway coupling can be delivered with 1 m cable at the grounding clamp, too, e.g. for pull relief of the plug-in connection.

### 5.3. Grounding Cables

The grounding cable is available as straight neoprene cable with or without cable reel, coiled polyurethane cable or cold-resistant special silicone cable. Grounding clamp or socket are mounted to the cable. All types of cable are oil resistant.

#### 5.3.1. Straight Neoprene Grounding Cable

The Neoprene Grounding Cable is combinable with 1-pole Grounding Clamp, Grounding Plug or Socket TW 700. Suitable for use with EKX-4 Grounding Control Device and predecessor models. You can have a cable length up to 20 m; up to 10 m cable length can be wound at the explosion-proof Cable Reel KA.



Figure 7: Straight Grounding Cable with Clamp EZ-1

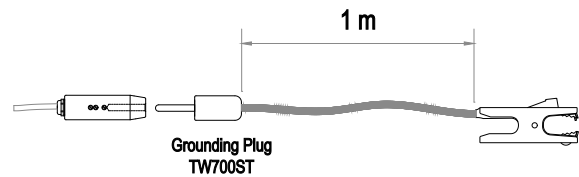


Figure 9: TW 700 Plug-in connection with 1 m grounding cable and clam

#### 5.3.2. Coiled Grounding Cable

The coiled cable is highly mechanical resistant and can be used as alternative to the cable reel. We offer extendable cable lengths up to 2.5 m, 7.5 m, 10 m or 15 m.



Figure 8: Coiled Grounding Cable with Clamp EZ-1

#### 5.3.3. Special PUR Cable

This straight cable is specified for extreme environmental and operating conditions. It is built from special PUR mixture to achieve an extended temperature range from - 60 °C to + 70 °C, a high durability against mechanical stress, flame-resistance and high resistance against aggressive chemicals.

#### 5.4. Cable Reel

The cable reel is driven by tension of a coil spring and works without a slip-ring. Thus, the resistance in the grounding connection is low and prevented from mechanical wear and tear. The winding is done through a rotating winding arm around a fixed reel. A pawl makes it possible to handle the grounding cable without strain.



Figure 10: Cable Reel KA with Neoprene Grounding Cable

As non-electrical device of category II 2 G the cable reel is approved for use in gas hazardous areas of zone 1 and 2.

### 5.5. Clamp Hanger

Recommended accessory for the insulated suspension of the grounding clamp at the filling station.



Figure 11: Clamp hanger

### 5.6. Testing Equipment

The testing equipment is intended to verify the functioning of installed grounding control devices. By using the rotary switch, the preset thresholds (short-circuit to ground, lower and upper limit of road tankers, limit of railcars) can be checked. For this purpose, the grounding clamp can easily get attached to the metal plate at the front. It is suitable for use with EKV-4 Grounding Control Device as well as EKV-4 (2-pole).



Figure 12: Testing Equipment TQ2

## 6. Technical Specifications

### 6.1. Operating Data

- Device category according to ATEX 114 (directive 2014/34/EU)
  - ⊕ II 2 G
  - ⊕ II 2 D
- Degree of enclosure protection
  - Ex eb q [ib] IIC T4 Gb
  - Ex tb [ib] IIIC T80°C Db
- Protection of enclosure
  - IP65
- Power Supply
  - Type of protection 'increased safety' Ex eb
  - 230 V AC  $\pm$  10 %, 50 Hz, about. 10 VA
- Ambient temperature range
  - 30 °C to +60 °C
- Dimensions
  - 306 mm, 190 mm, 110 mm (H, W, D)
- Weight
  - 4,5 kg

### 6.2. Measuring Circuit

For connection of the grounding cable. The measuring circuit is grounded.

- Type of Protection
  - "intrinsic safety" Ex ib / ibD
- Maximum cable length
  - 50 m (ATEX Ex related specification, please observe functional limitations)
- Maximum values
  - $U_o = 6,7 \text{ V}$ ,  $I_o = 68 \text{ mA}$ ,  $P_o = 114 \text{ mW}$

### 6.3. Control Outputs

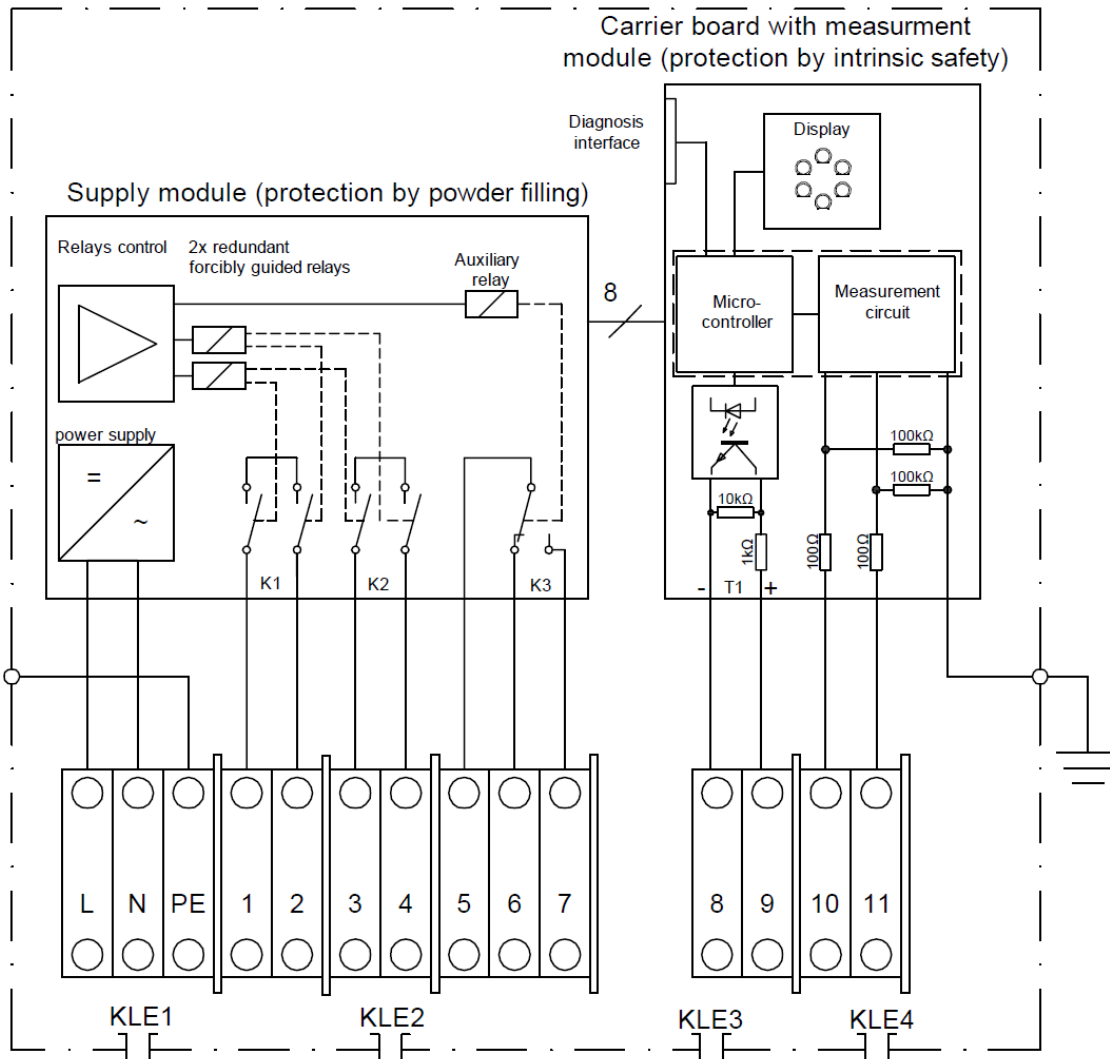
#### Contact Outputs

- Type of protection "Increased safety" Ex eb
- Maximum values: 250 V AC, 3 A, 100 VA
  - ▶ **2 Release Contacts** (K1, K2)
    - 2 potential-free closing contacts, internally monitored
  - ▶ **1 Auxiliary Contact** (K3)
    - Potential-free change-over contact, not monitored

#### Electronic Output (TI)

- Type of protection "Intrinsic safety" Ex ib
- NAMUR-compatible transistor output signaling 'Filling Release'
- Maximum values:
  - $U_i = 20 \text{ V}$ ,  $I_i = 20 \text{ mA}$ ,  $P_i = 400 \text{ mW}$
  - $C_i$  and  $L_i$  negligibly small
- Internal resistances:
  - 1 kOhm and 11 kOhm
- Modulation: 10 Hz, duty cycle 1:1

## 7. Connection Diagram (EKX-4 1-pole)



- L, N, PE: Power supply 230V ( $\pm 10\%$ ) 50Hz, ca. 10VA
- 1 - 2: Potential-free relays-contacts 1: N/O (internally monitored output)
- 3 - 4: Potential-free relays-contacts 2: N/O (internally monitored output)
- 5 - 7: Potential-free relays-contacts 3 (auxiliary relay)  
Contact rating (terminal 1-7): max. 250VAC, 3A, 100VA
- 8 - 9: Potential-free Ex-i transistor output, NAMUR-compatibel  
Maximum values:  $U_i=20V$ ,  $I_i=20mA$ ,  $P_i=400mW$
- 10: Grounding cable connection terminal No.10
- 11: Grounding cable compensation terminal No.11  
Use only cables with a wire diameter of 0.5 - 2.5 mm<sup>2</sup> (AWG 20 to 12)

Cable and cable glands:

- KLE1 (M20) Power supply cable diameter 7-13mm
- KLE2 (M20) Contact outputs cable diameter 7-13mm
- KLE3 (M16) NAMUR transistor output cable diameter 4.5-10mm
- KLE4 (M20) Grounding cable diameter 7-13mm





## 9. Contact us

If you would like to contact us regarding offers and sales or technical support, our employees will be glad to be available for you on the following contact information:



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