



KDZ-3

EARTH FAULT MONITORING SYSTEM

Portable earth fault locator KDZ-3c

KDZ-3c PORTABLE LOCATOR.

1. INTRODUCTION.

Early detection of operating disturbances or breakdowns at electric power facilities the user to avoid major financial losses or other negative technical consequences. One of the causes of breakdowns is deterioration of insulation of auxiliary power supply DC circuits. Regular inspection of those circuits can prevent such breakdowns.

2. Application.

A portable KDZ-3c locator allows for detection of earth fault location in the network. It is fitted with a measurement clamp so circuits do not have to be disconnected. The device can work with a master KDZ-3JN unit or a portable KDZ-3W generator. The measurement algorithm used eliminates capacitive component of earth fault current and makes measurements in high-capacitance networks possible.

3. Construction.

The portable KDZ-3c locator comprises a measurement clamp installed on a measured outgoing feeder and a meter with an LCD display and a keyboard. The elements are permanently connected with a wire. The meter is used for operating the device, setting operating parameters, starting measurements and reading measured current and earth fault resistance. The meter also contains a battery powering the entire device.



Fig. 3.1 View of the KDZ-3c device

KDZ-3 earth fault monitoring system

The buttons below are used to communicate with the user. They perform the following functions:



Select settings.



Change setting parameters.



Go back one level (exit), turn the device on and off (2 sec.), stop measurement.



Go to the next level (confirm).
Start measurement.

There is an LED on the measurement clamp



Continuous light - preparing measurement
Flashing light - measurement

The device is supplied in a suitcase enclosure made of plastic protecting it against mechanical damage, which could occur during frequent transport. The suitcase also provides full protection against adverse weather conditions.

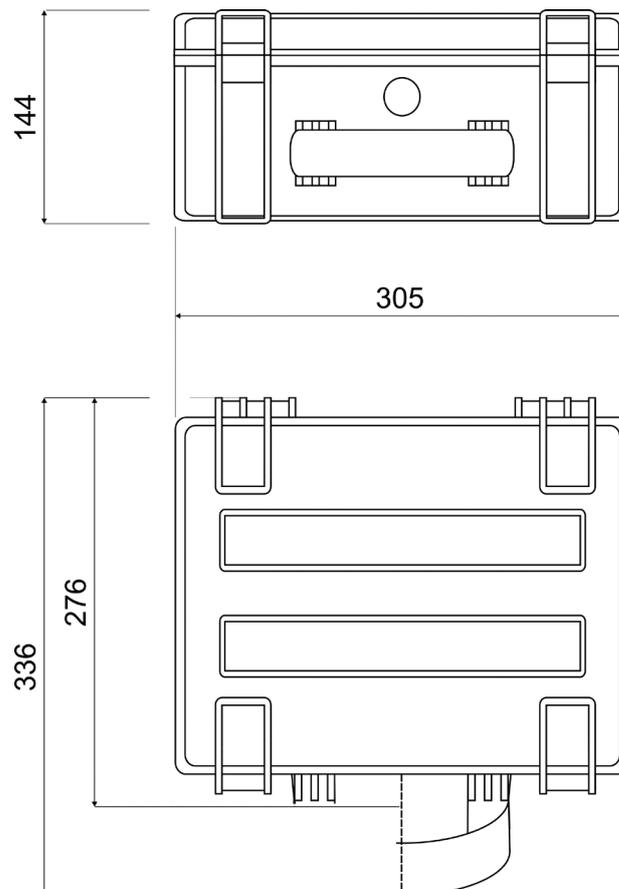


Fig. 3.2 Dimensions of KDZ-3C suitcase enclosure

4. Operating principle.

The portable KDZ-3c locator works with master KDZ-3JN unit or portable KDZ-3W generator. In a measurement cycle the master unit generates proper measurement signals that are sent alternately to the positive and negative poles of monitored network. Signals are sent through resistors, which are inside the master unit. Value of this resistance can be changed through settings. Value of generator resistance set up in the KDZ-3C should be the same as in the KDZ-3JN unit. Then an approximate value of network capacitance must be set up. Table below presents possible settings of network capacitance for selected generator resistance.

Generator resistance [kΩ]	Network capacitance [μF]		
	First range (4s half-period)	Second range (4s half-period)	Third range (16s half-period)
10	< 30	< 80	< 200
20	< 15	< 40	< 100
50	<6	< 16	<40

Table 4. 1 Settings of generator resistance and network capacitance.

To locate the earth fault switch the master KDZ-3JN unit to the „clamp mode”. A measurement signal in half-period of 4 seconds is generated in this mode. In case of network with high capacitance, select a „16s” setting in the master unit and third range of capacitance setting in the KDZ-3C locator. To perform the measurement clasp both power leads (fig. 4.1) within the clamps and press START button.

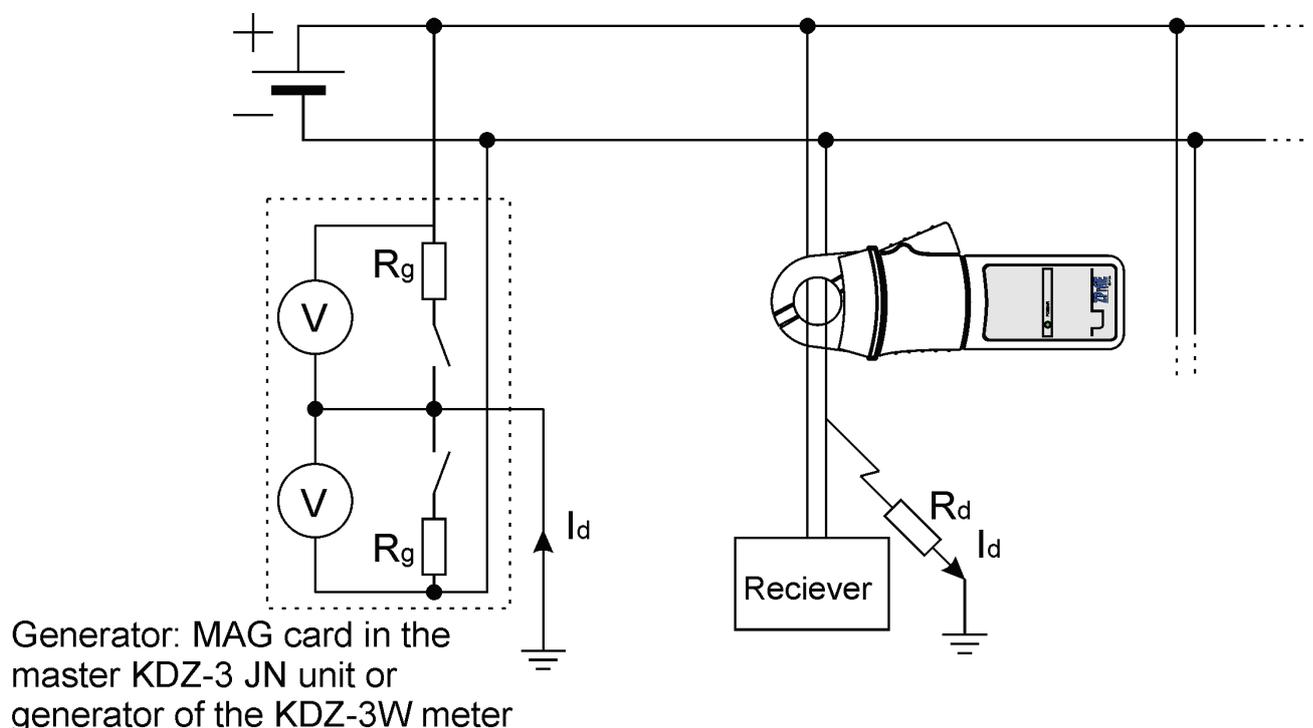


Fig. 4.1 Measurement of earth fault resistance using KDZ-3C.

The locator measures the earth fault current and shows measured earth fault resistance. To enable this, in case of KDZ-3JN set the network voltage in the device parameters or double the amplitude of generator voltage in case of KDZ-3W.

Earth fault resistance is calculated using the formula below:

$$R_d = \frac{U}{I_d} - R_g$$

where: R_d – earth fault resistance,

U – value of voltage forcing the passage of current (set in the KDZ-3c).

- If the KDZ-3JN unit is used (generator - MAG-9 card) network voltage e.g. 220V must be entered.
- If the KDZ-3W generator is used generator amplitude entered must be twice as high as the amplitude set in the KDZ-3W (i.e. $U=220V$ for $U_{g/2}=110V$ or $U=48V$ for $U_{g/2}=24V$),

I_d – measured resistance component of the earth fault current,

R_g – generator resistance (set in the KDZ-3c).

To calculate resistance R_d correctly, it is necessary to enter proper values of: half-period, voltage U and internal apparent resistance R_g .

5. Use of the KDZ-3c locator

When the device is turned on (by pressing  button) it switches to the measurement stand-by mode. To view the settings, press  or . To activate configuration option of a displayed parameter press . Configured parameter will start flashing. Value of a given parameter can be changed to the desired value using  or .  button is used to confirm the edited parameter. It is saved in the non-volatile memory of the device and it is stored even when there is no power supply from the battery. Pressing  button will switch display to the measurement stand-by screen.

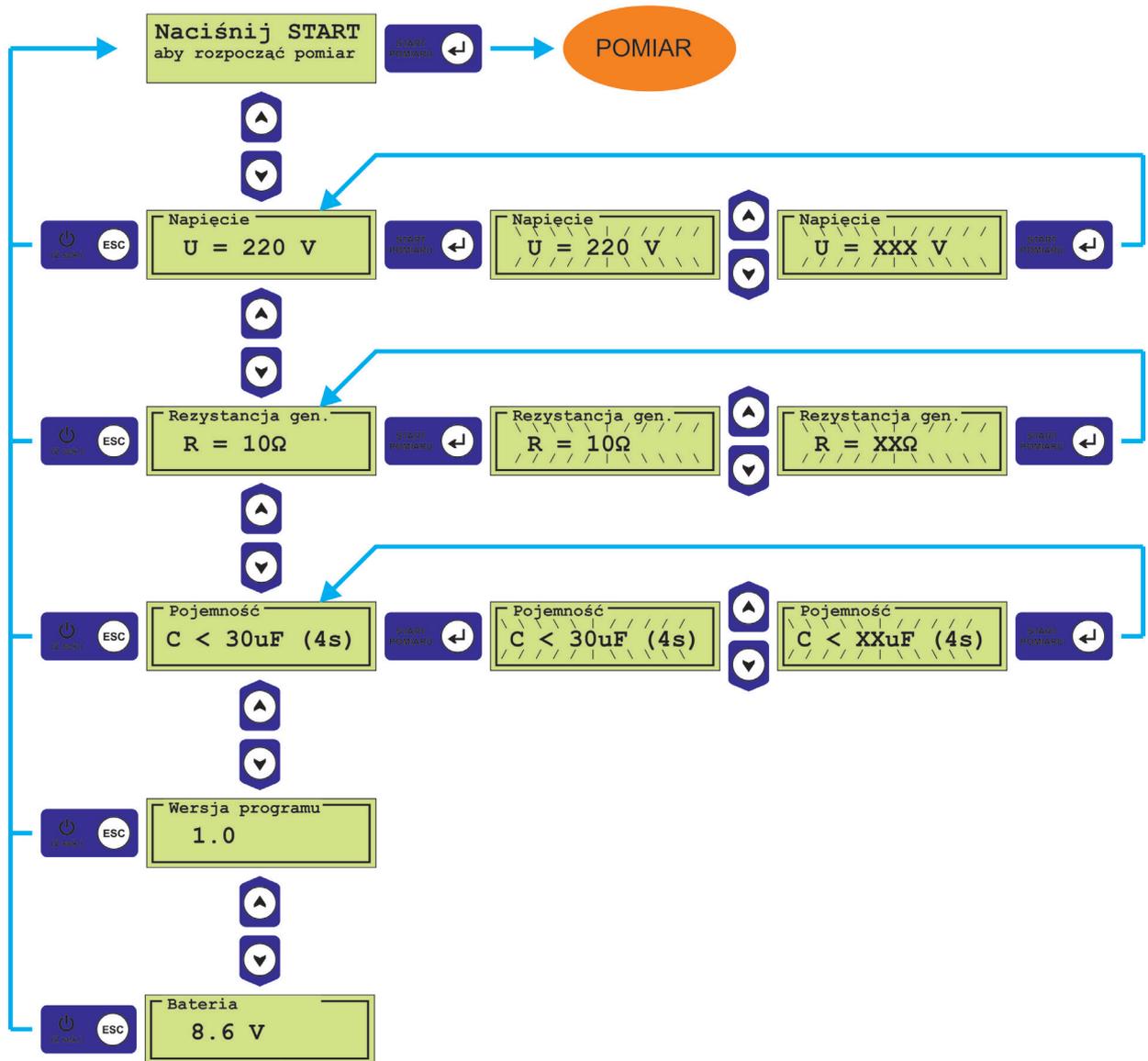


Fig. 5. 1 Flowchart of parameter configuration

MEASUREMENT

Before starting the measurement clasp the outgoing feeder, in which you want to measure the earth fault, within the clamp. Then press  button (start the measurement). The device will take four measurements of current and earth fault resistance. Accuracy of the measured value increases with each measurement. In case of low current its value can be determined only after second or third measurement. The flowcharts below show measurement process.

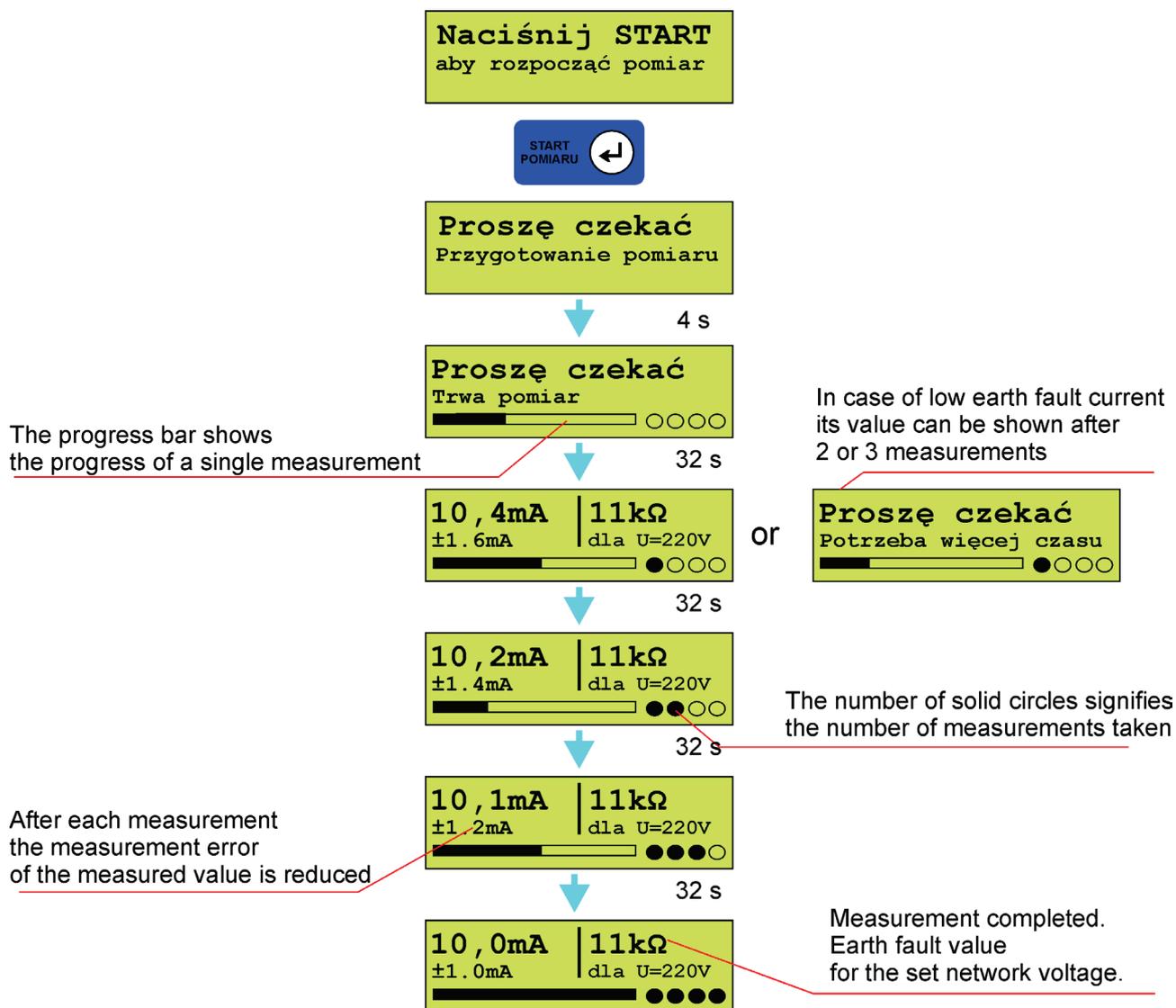


Fig. 5.2 Flowchart of the measurement process in case of earth fault.

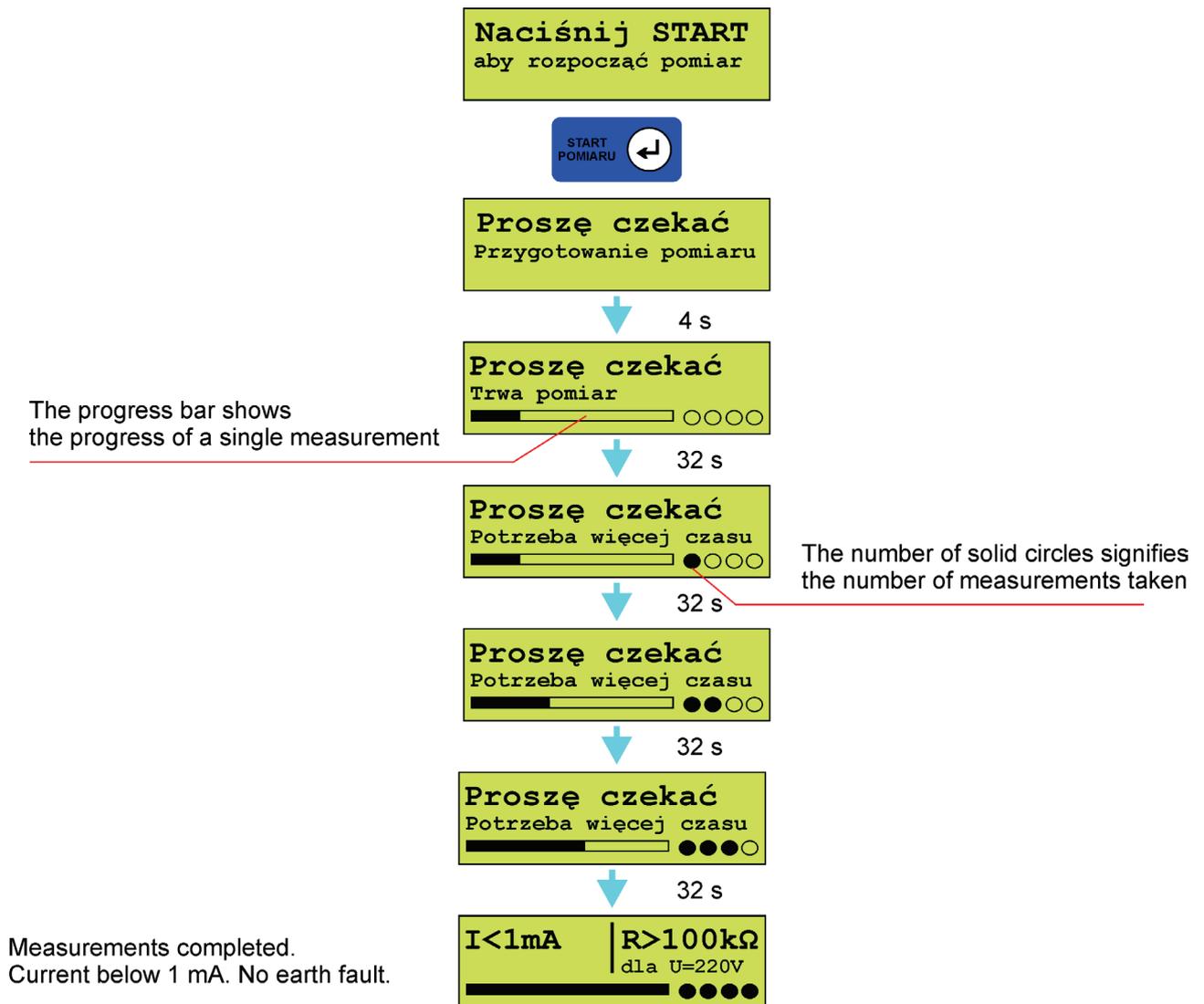


Fig. 5.3 Flowchart of the measurement process in the absence of earth fault.

BATTERY POWER SUPPLY.

The device is powered by a 9V battery located under the cover at the back of the meter. Battery voltage is monitored and can be read on LCD display. When  symbol appears on the screen it is a sign that the battery will need to be replaced soon. If voltage is too low to take the measurement, a message "replace the battery" will be displayed.

6. Technical parameters.

Power supply	Battery	9 V alkaline (6LR61)
	Operating time	18 h of continuous measurement
Electrical parameters	Range of measured current I_m	1 mA ÷ 20mA
	Resolution of current measurement I_m	0.1 mA
	Accuracy of current indication I_m	± (5% I_m + 1.2 mA) in first measurement ± (5% I_m + 0.9 mA) in second measurement ± (5% I_m + 0.7 mA) in third measurement ± (5% I_m + 0.5 mA) in fourth measurement
	Range of network voltage U_i	100 V ÷ 250 V
	Range of network resistance measurement	0 kΩ ÷ 100kΩ
	Resolution of resistance measurement R_m	1 kΩ
	Accuracy of resistance indication R_m (for $C_e=1 \mu\text{F}$)	± (20% R_m + 5 kΩ) for $R_m \geq 50 \text{ k}\Omega$ ± (15% R_m + 5 kΩ) for $R_m < 50 \text{ k}\Omega$ and $R_m \geq 20 \text{ k}\Omega$ ± (10% R_m + 1 kΩ) for $R_m < 20 \text{ k}\Omega$
	Rated insulation voltage	300 V
	Allowable measured current	30 A
	Allowable short-time current	500 A (60s)
General data	Allowable storage temperature range	248 K ÷ 343 K (from -25 °C up to +70 °C)
	Allowable operating temperature range	273 K ÷ 323 K (from 0 °C up to +50 °C)
	Allowable ambient temperature humidity (with no steam or ice condensation)	95 %
	Allowable atmospheric pressure	70 kPa ÷ 106 kPa (0 m – 3000 m a.s.l.)
	Length of wire connecting clamp with the meter	ca. 0.9 m
	Diameter of measurement opening	25 mm
	Weight	ca. 500 g
	Dimensions of suitcase enclosure for KDZ-3C	ca. 276 (336) x 305 x 144 / acc. to fig. 3.2
Weight of the device incl. suitcase enclosure	ca. 2.3 kg	

KDZ-3



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