

KDZ-3

EARTH FAULT MONITORING SYSTEM

Portable earth fault measuring unit KDZ-3w

1. INTRODUCTION.

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

2. APPLICATION.

The portable KDZ-3w earth fault measuring unit is to be used in automation and protection circuits as an element monitoring condition of insulation in both DC and AC circuits. Furthermore, since it works with the KDZ-3c clamp it allows for precise localization of the area with deteriorating insulation. The KDZ-3w earth fault measuring unit is a device designed based on many years of experience in production and installation of switchgears, as well as state of the art trends and technical capabilities. The KDZ-3w is capable of signalling when defined alarm thresholds of earth fault resistance are exceeded.

3. OPERATING PRINCIPLE.

The main function of the KDZ-3 system is continuous measurement and monitoring of insulation's resistance across the entire monitored DC network. In case of reduced resistance the KDZ-3c clamp enables localization of a ground faulted outgoing feeder.

The principle of insulation's resistance measurement is based on generating voltage between the feeding lines of a tested network and an earthing line, and following measurement of the current.

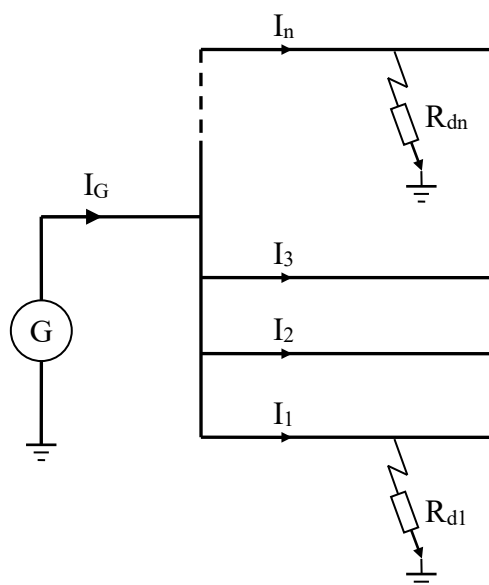


Fig. 3.1. Earth fault measurement concept.

Voltage necessary to perform the measurement is provided by a generator. The value of internal apparent resistance of the generator, voltage amplitude and period of switching polarization of generated voltage are software selected. The higher internal apparent resistance, the lower the locating current. Lower locating current prevents accidental activation of operating devices, e.g. relays.

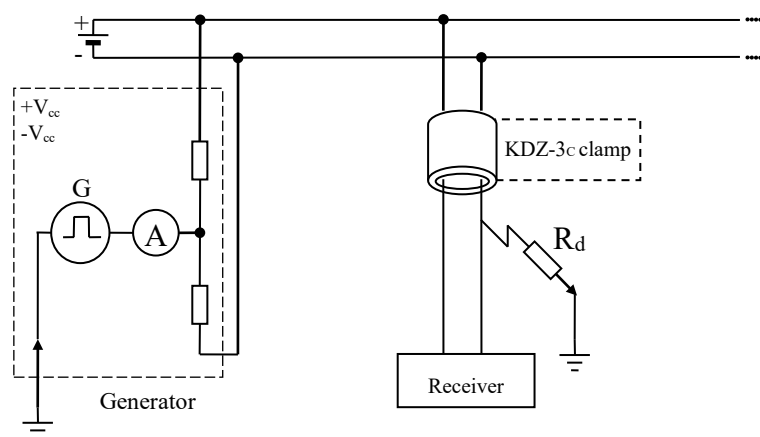


Fig. 3.2. Generator's operation concept.

4. CONSTRUCTION

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.

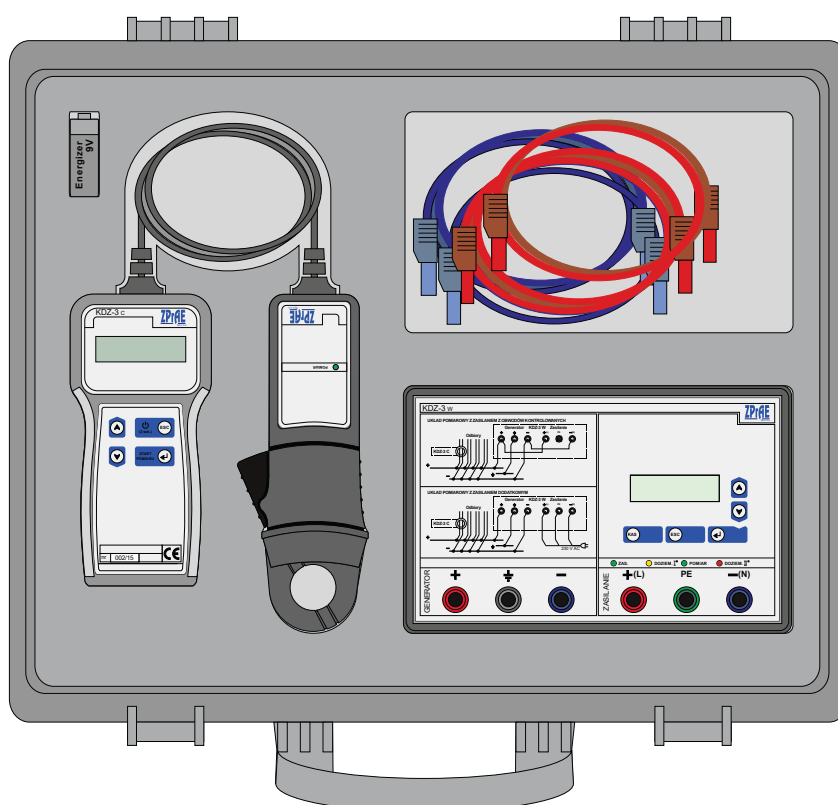


Fig.4.1. Suitcase measuring set.

The suitcase measuring set includes:

- KDZ-3w earth fault measuring unit (generator),
- KDZ-3c measuring clamp (described in a separate document),
- connection cables and a spare 9 V battery.

The KDZ-3w earth fault measuring unit has an integral measuring signal generator allowing it to control condition of circuits' insulation independently of voltage in a monitored circuit. The measuring unit has separate device power supply inputs (right-hand side in fig. 4.2) and separate measuring inputs (left-hand side). Supply voltage inputs are galvanically separated from measuring inputs monitoring resistance, so insulation of one circuit is being monitored, while power is supplied from a different one. Power supply inputs can be shorted to measuring inputs, if necessary.

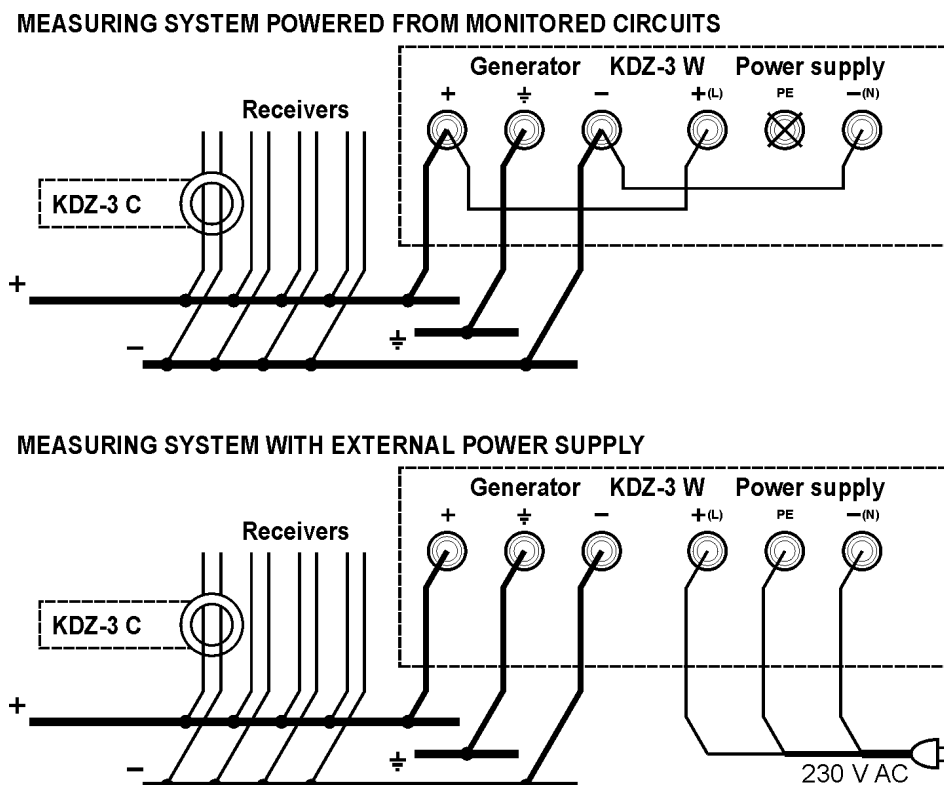


Fig.4.2. Input and clamp connections.

The KDZ-3w can work independently as an earth fault measuring unit in an entire power supply network, but if the clamp is used the outgoing feeder with deteriorating insulation, and therefore earth fault current, can be identified.

The front panel contains an LCD display which allows the user to view operating mode and setting configuration (fig. 4.3).

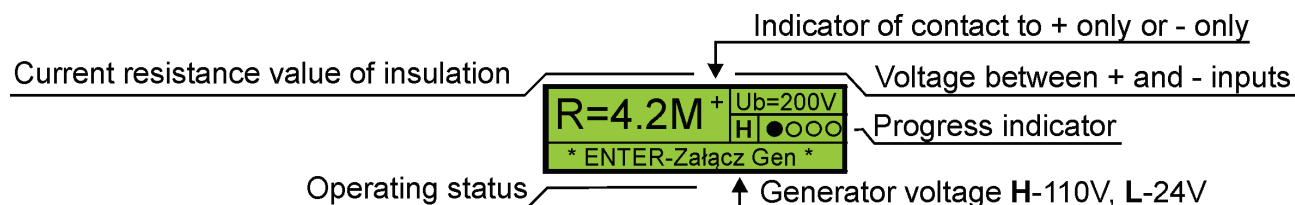











Fig.4.3. Display layout.

Earth fault measuring unit KDZ-3w

Five buttons are used for communication with the user. They enable:

	Settings preview (available in OPERATION mode)
	Setup of desired value (available in PROGRAMMING mode)
	Going one level back (exit)
	Starting the generator Confirming settings (available in PROGRAMMING mode)
	Resetting signalling

The front panel contains four LEDs with the following functions:

LED	Turned off	Continuous light	Blinking light
 ZAS. (green)	KDZ-3w is not powered by auxiliary power supply	KDZ-3w is powered by auxiliary power supply	-----
 DOZIEM. I (yellow)	1 st alarm threshold is not and was not exceeded since the last resetting or loss of auxiliary power supply	Resistance level exceeded the 1 st alarm threshold	Measured resistance is not exceeding the 1 st alarm threshold but it had been exceeded previously. The LED will be blinking until reset or auxiliary power is lost
 POMIAR (red)	Generator off (internal power supply disconnected from the GND input)	Generator on (measurement in progress)	-----
 DOZIEM. II (yellow)	2 nd alarm threshold is not and was not exceeded since the last resetting or loss of auxiliary power supply	Resistance level exceeded the 2 nd alarm threshold	Measured resistance is not exceeding the 2 nd alarm threshold but it had been exceeded previously. The LED will be blinking until reset or auxiliary power is lost

5. MEASUREMENTS.

The KDZ-3w earth fault measuring unit becomes functional as soon as it is connected to auxiliary voltage. Monitored circuit is connected to the earthing terminal through the generator. Input measuring systems monitor generated signal based on which the resistance between the measuring system and the PE earthing terminal is determined.

Prior to the measurements, special attention should be paid to the values of the following settings:

- generator internal apparent resistance ($R_w = 10, 20, 50$ or 140 k Ω),
- generator voltage ($U_{g/2} = 24$ or 110 V),
- generator half-period ($T_{1/2} = 4$ or 16 s).

Settings of the KDZ-3c clamps must be set just like settings of the KDZ-3w measuring unit but for the clamps a double voltage is set ($U = 220$ V for $U_{g/2} = 110$ V or $U = 48$ V for $U_{g/2} = 24$ V).

Generator internal apparent resistance and voltage are selected from the software. The higher the internal apparent resistance and the lower generator voltage, the lower the locating current is. Lower locating current prevents accidental activation of operating devices e.g. relays. Higher internal apparent resistance increases the measurement

accuracy of high resistance, but on the other hand, causes a decrease of the current in the circuit making it more difficult to measure it using the KDZ-3c clamps.



As a standard, generator voltage is set at 110 V unless the network is provided with lower voltage then 24 V is used for safety reasons.

For KDZ-3W operation and correctness of resistance indication it does not matter if the measuring inputs + and – are short-circuited, open-circuited or powered. But to receive correct resistance indication in the clamps **it is necessary** to short-circuit or power the +-measuring inputs.

While using clamps special attention should be paid to clasp two power leads of the measure outgoing feeder (fig. 3.2). Earth current measured is a difference of currents flowing through the + and - power leads.

Typically, the generator half-period is set at 4s. In case of networks with very high capacitance longer time can be set for the PE.

The KDZ-3W measuring unit enables detection of unbalanced and balanced earth faults. If "+" or "-" symbols are displayed next to resistance value earth fault appears in relation to only one power supply pole. If both poles are earth faulted resistance value of parallel connection of both earth fault resistances will be displayed.

If the set alarm value of resistance is exceeded the  DOZIEM. I° (or  DOZIEM. II°) LED will be lit continuously, signalling that the threshold is exceeded. If activation stops the LED switches to blinking light. This will persist until reset.

6. SETUPS PREVIEW AND PROGRAMMING.

Software version.







When the KDZ-3JM measuring unit is powered by auxiliary power supply, it is possible to check the software version. To do this, press   buttons simultaneously. Information about device type, software version, manufacturer and serial number will be shown on the LCD display. To return to the main menu press  or wait 25 seconds (to leave automatically).



Fig. 6.1. Display – relay type, software versions, manufacturer, serial number.

Preview of parameters set.

It is possible to view set parameters during operation. When  or  is pressed the main screen is switched to setting preview screens according to the flowchart presented in fig. 6.2. To return to the main screen press  (ESC) button or wait 25 seconds (to leave automatically).

Configuration of parameters.

As described above, when or is pressed, the main screen is switched to setting preview screens. To activate configuration option of a displayed parameter press (enter) button. Configured parameter that is displayed on the screen will start flashing. Use or to change the value of a given parameter to a desired value. To confirm the value press the (enter) button. The relay will save new values of parameters and confirm it by displaying “Settings saved” information.

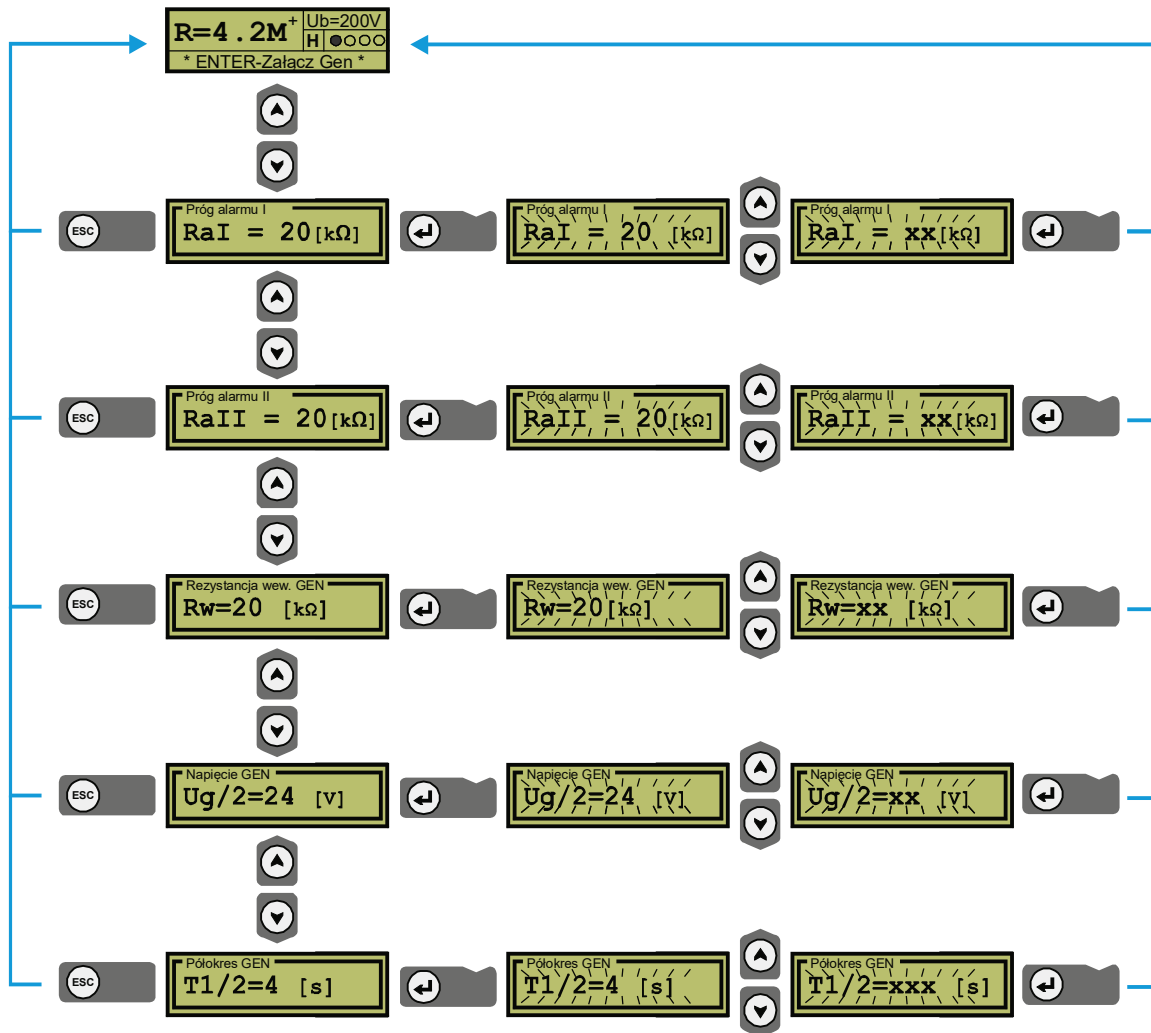


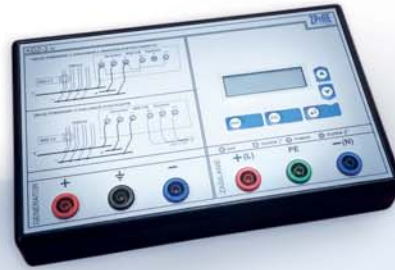
Fig. 6.2. Flowchart of parameter preview and configuration.

7. TECHNICAL PARAMETERS OF THE KDZ-3w EARTH FAULT MEASURING UNIT.

Auxiliary power supply	
Rated auxiliary power supply voltage U_{pn}	DC 110-220 V / AC 110-230 V or other, as agreed
Allowable range of auxiliary voltage	DC 85 V ÷ 370 V / AC 85 V ÷ 265 V
Power consumption P_p / S_p	≤ 7 W / ≤ 16 VA
Measuring input	
Range of network voltage measured U_i	DC 0 V ÷ 320 V
Range of measured input voltage U_{i+} , U_{i-} relative to PE	DC 0 V ÷ 320 V
Resolution of voltage measurement U_i	1 V
Accuracy of voltage measurement U_i	± (2% of indicated value + 1c)
Range of resistance measurement R_m	For $U_{g/2} = 110$ V: 0 kΩ ÷ 20 MΩ for $R_w > 20$ kΩ 0 kΩ ÷ 10 MΩ for $R_w ≤ 20$ kΩ For $U_{g/2} = 24$ V: 0 kΩ ÷ 20 MΩ for $R_w = 140$ kΩ 0 kΩ ÷ 10 MΩ for $R_w = 50$ kΩ 0 kΩ ÷ 1 MΩ for $R_w ≤ 20$ kΩ
Resolution of resistance measurement R_m	0.1 kΩ ... 0.1 MΩ
Accuracy of resistance measurement R_m (for $C_e=1\mu\text{F}$)	For $U_{g/2} = 110$ V: ± (10% $R_m + 1$ kΩ) for $R_w > 20$ kΩ or $R_m < 1$ MΩ ± (20% $R_m + 1$ kΩ) for $R_w ≤ 20$ kΩ and $R_m ≥ 1$ MΩ For $U_{g/2} = 24$ V: ± (10% $R_m + 1$ kΩ) for $R_w > 20$ kΩ and $R_m < 1$ MΩ ± (20% $R_m + 1$ kΩ) for $R_w ≤ 20$ kΩ or $R_m ≥ 1$ MΩ
Maximum network capacitance	600 μF for $R_w = 140$ kΩ, $R_m = 100$ kΩ, $T_{1/2}=16$ s
Internal apparent resistance of terminals U_+ ; U_-	40 kΩ
Internal apparent resistance R_w between terminals U_+ , U_- and PE terminal	10 kΩ, 20 kΩ, 50 kΩ, or 140 kΩ (software-selected)
Generator voltage $U_{g/2}$	±24 V or ±110 V (software-selected)
Maximum generator measuring current corresponding to selected internal apparent resistance $(U_i / 2 + U_{g/2}) / R_w * 1.05$	23 mA, 12 mA, 5 mA, 2 mA for $U_i = 220$ V, $U_{g/2} = 110$ V
Range of resistance alarm setting	1 kΩ ÷ 9.9 MΩ
Resolution of resistance alarm setting	1 kΩ for $R_{alarm} < 100$ kΩ 10 kΩ for 100 kΩ ≤ $R_{alarm} < 1000$ kΩ 100 kΩ for $R_{alarm} > 1000$ kΩ
Hysteresis of resistance alarm	20% of value set
Insulation	
Rated voltage of insulation	250 V
Rated impulse voltage	4 kV (1.2/50 μs)
Overvoltage protection category	III
Electric strength of insulation	2.5 kV; 50 Hz; 1 min

General data	
Allowable storage temperature range	248 K ÷ 343 K (from -25 °C up to +70 °C)
Allowable operating temperature range	263 K ÷ 328 K (from -10 °C up to +55 °C)
Allowable ambient temperature humidity (without steam condensation or ice)	95 %
Mechanical strength acc. to PN-EN 60255-21-(1,2,3); PN-EN 61557-1	class 1
Electromagnetic compatibility acc. to PN-EN 60255-26	Zone A
Enclosure protection rating (internal components)	IP40
Relay operating state signalling	Four LEDs
External dimensions (without socket)	220 mm × 140 mm × 41 mm (H×W×D)

KDZ-3



OFFER

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RSH-3, RSH-3S - tripping

RS-6, RPD-2, RPP-4, RPP-6 - interposing

RMS-2 - signalling

RCW-3, RCDW-1 - circuit continuity monitoring

RKO-3 - power supply circuit
continuity monitoring

RB-1, RBS-1, RBS-2 - bistable

RT-22 - time

RUT-2, RUT-3 - time-voltage

RJT-1, RJT-3 - time-current

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LZ-1, LZ-2 - operation counters

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