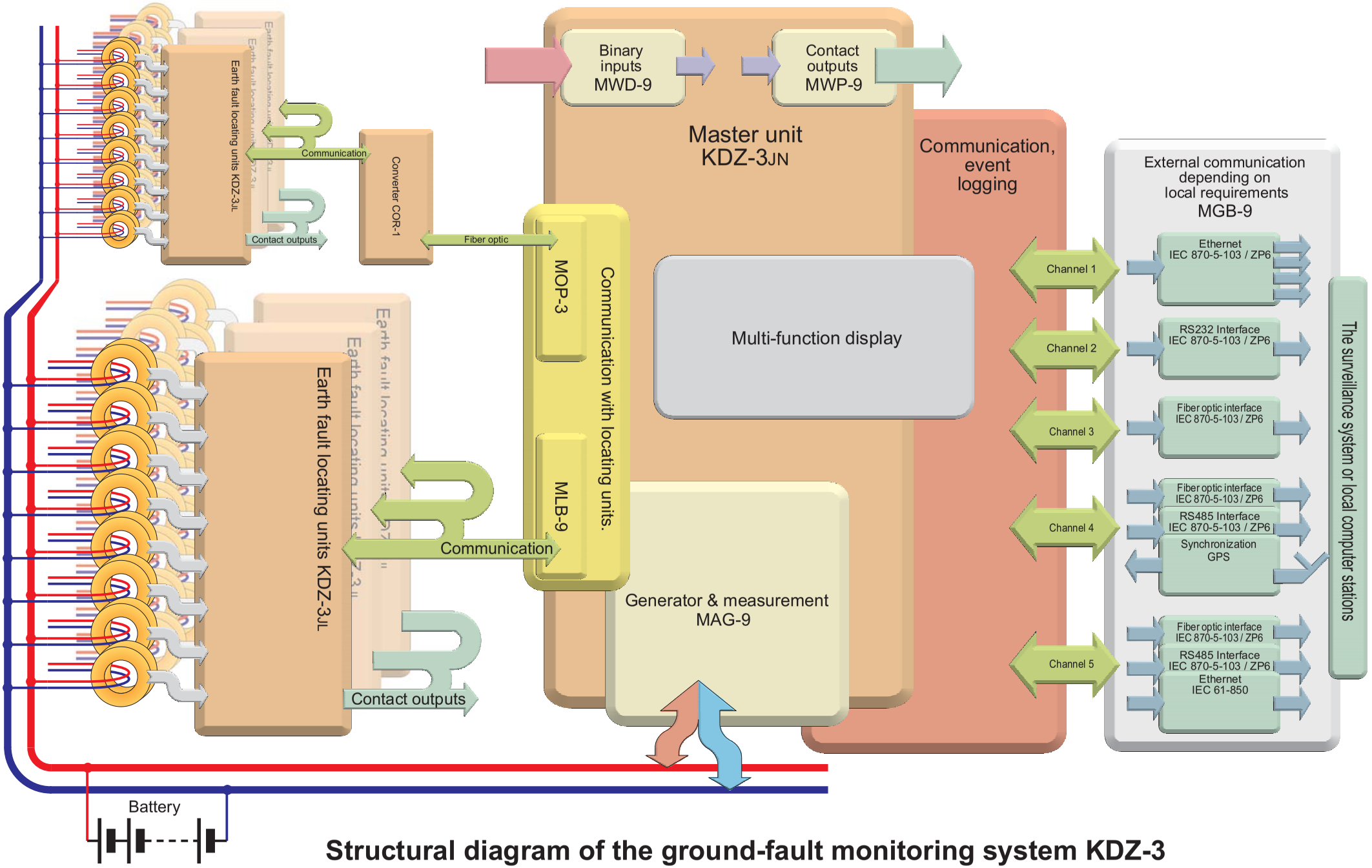
ZPrAE
Sp.z o.o.

KDZ-3

EARTH FAULT MONITORING SYSTEM



Structural diagram of the ground-fault monitoring system KDZ-3

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 KDZ-3 device allows for continuous monitoring of insulation's condition of unearthed DC power supply circuits, and in case of its deterioration, for selective location of earth fault or shorting between circuits of different sections. The digital KDZ-3 monitoring system 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. Apart from having standard signaling functions KDZ-3 is also an event recorder; furthermore, it enables relaying data to a station monitoring system. Software enables remote communication with the device, remote control and monitoring its condition, reading of recorded data, and potential change of settings.

Basic features of the KDZ-3 system:

- continuous monitoring of insulation's condition of DC power supply circuits,
- location of earth faults in up to 2040 outgoing feeders,
- optional use of optical fibres to communicate with remote locating units in distributed systems,
- wide resistance measuring range and high noise immunity,
- colour display with touchscreen functionality enabling previewing operation and basic configuration from the device's front panel,
- internal event recorder,
- set of configurable multicolour LEDs signaling information selected by a user from a list,
- set of relay outputs for contact signaling of operation and potential disturbances in operation,
- option to select locating current value (internal resistance of the generator),
- optional work with portable clamp to exactly locate the earth fault,
- internal WWW server, enabling remote control over an internet browner.

Utility software supplied with the KDZ-3 device can be used to independently configure and service the device, and to view signals from an internal event recorder.

Communication features provide an ability to relay data to a station monitoring system and remotely view the device's condition, control current parameters of insulation's condition, as well as read and optionally modify the device's settings.

3. OPERATING PRINCIPLE.

3.1. Measurement and earth fault location concept.

The main function of the KDZ-3 system is to continuously measure and monitor insulation's resistance across the entire monitored DC network. If resistance is reduced the locating function is initiated and thanks to installed instrument transformers it allows for location of the earth 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.

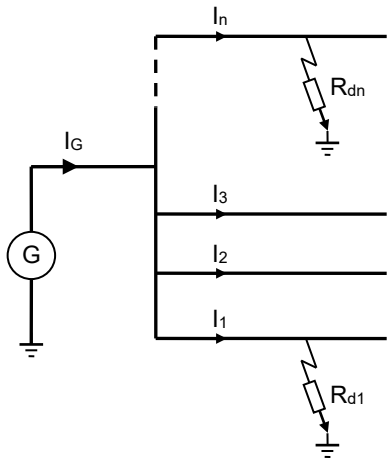


Fig. 3.1.1. Earth fault measurement concept.

Voltage necessary to perform the measurement is provided by a generator by alternately connecting resistance to + and - poles of the power supply of the tested network. The value of internal apparent resistance of the generator is software selected. The higher internal apparent resistance, the lower the locating current. Lower locating current prevents accidental activation of operating devices, e.g. relays.

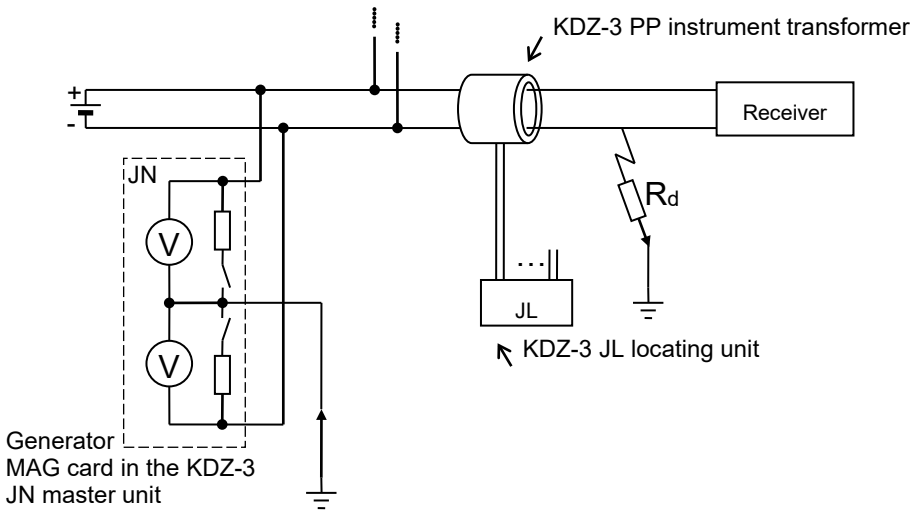


Fig. 3.1.2. Concept of generator's operation.

The applied voltage causes passage of current through earth fault resistance Rd, which is detected by an instrument transformer connected to the locating unit.

Earth fault resistance of the entire network is calculated by the master unit based on known values of resistance inside the generator and voltage measured between an earthing terminal and power supply poles.

3.2. KDZ-3 system components.

Due to development of digital technology it was possible to design a state of the art, universal KDZ-3 earth fault monitoring system, which is characterized by the ability to support extended switchgears with multiple additional functions.

The earth fault monitoring system consists of:

- KDZ-3JN master unit (one or two),
- locating units: as standalone KDZ-3JL locating devices or MDZ locating modules
- KDZ-3PP measurement transformers,
- optionally, KDZ-3C portable clamp for exact earth fault location.

The basic structure of the earth fault monitoring system is shown in fig. 3.2.1.

The master unit communicates with locating units over RS-485 connections. Up to 255 locating units can be connected to a single master unit, while up to 8 transformers can be connected to every locating unit for a maximum of 255*8=**2040** supported outgoing feeders. In systems using up to 32 locating units supporting 32*8=**256** outgoing feeders no additional elements have to be used. In case of more locating units or in distributed systems (main switchgear and remote sub-switchgears) repeaters or optical fibre converters supplied with the device have to be used.

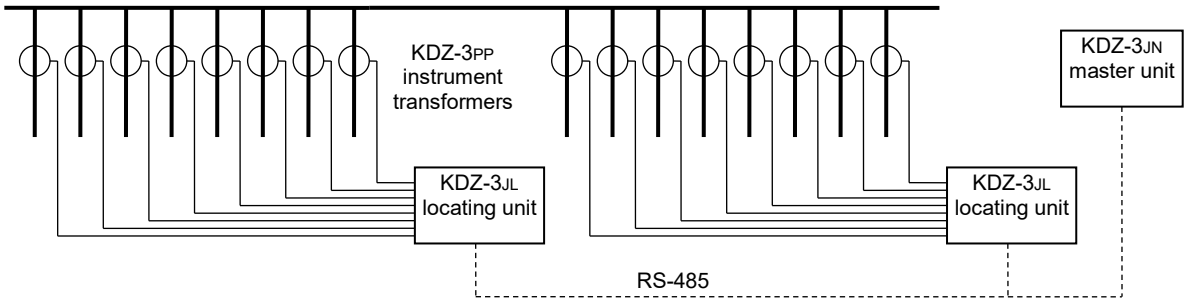


Fig. 3.2.1. Structure of the KDZ-3 distributed earth fault detection system.

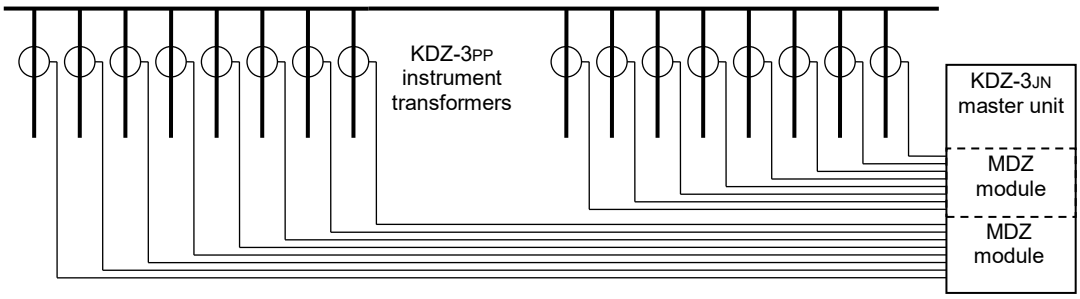


Fig. 3.2.2. Centralized version of the KDZ-3 earth fault detection system.

In case of small substations MDZ modules installed directly in the master unit can perform the function of locating modules. Up to 12 locating modules (8*12 outgoing feeders) can be installed in the master unit. An example of a centralized version of the device is shown in fig. 3.2.2.

The KDZ-3 system can support extended switchgears divided into sections and with two sets of batteries. In that case it is necessary to connect mapping signal of the switch between sections to the master unit. There is one MAG generator installed in the KDZ-3JN master unit per each battery set. If the switch is open the generators work independently. Since the generators operate in opposite phases it is not only possible to detect when one of the battery poles is in contact with a protective conductor, but also when there is shorting between identical poles of batteries of different sections.

If the switch is closed, one of the generators is switched off to prevent parallel operation. Schematics of expanded ground fault monitoring systems are shown in fig. 3.2.3, 3.2.4 and 3.2.5.

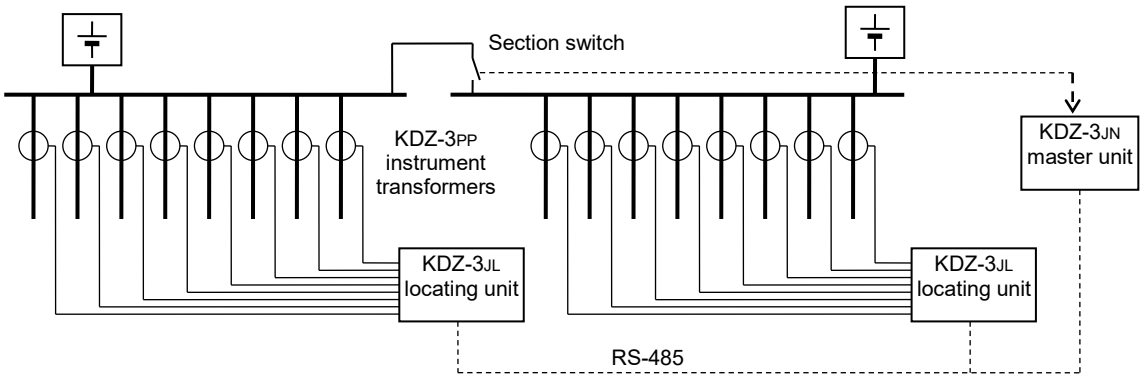


Fig. 3.2.3. Structure of the KDZ-3 earth fault monitoring system in a two-section switchgear with one master unit.

In case of applications, which require two independent devices to be used for each section separately, two KDZ-3JN master units connected over RS-485 or an optical fibre can be used (fig. 3.2.4). In that case it is necessary to connect mapping signal of the switch between sections to the slave KDZ-3JN master unit, i.e. the one, which will have its generator locked, when the switch is closed.

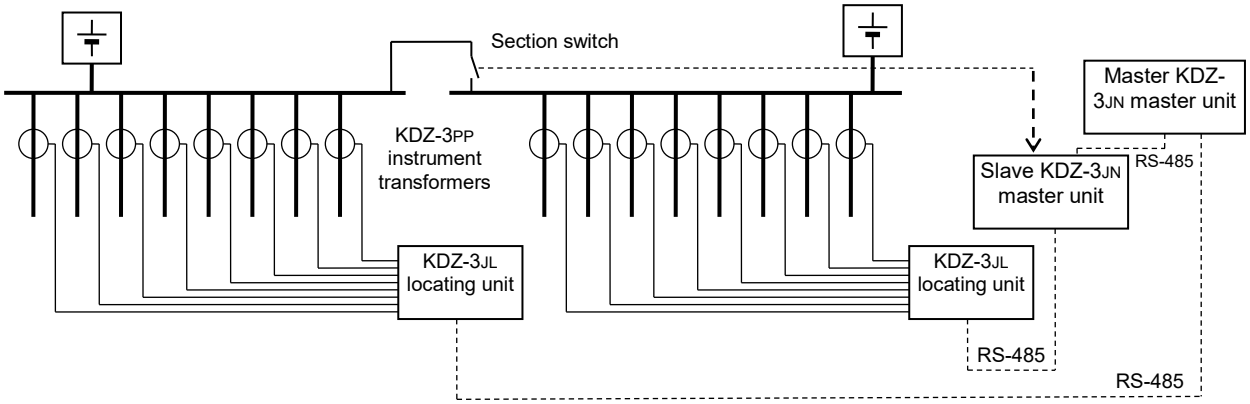


Fig. 3.2.4. Structure of the KDZ-3 earth fault monitoring system in a two-section switchgear with two master units.

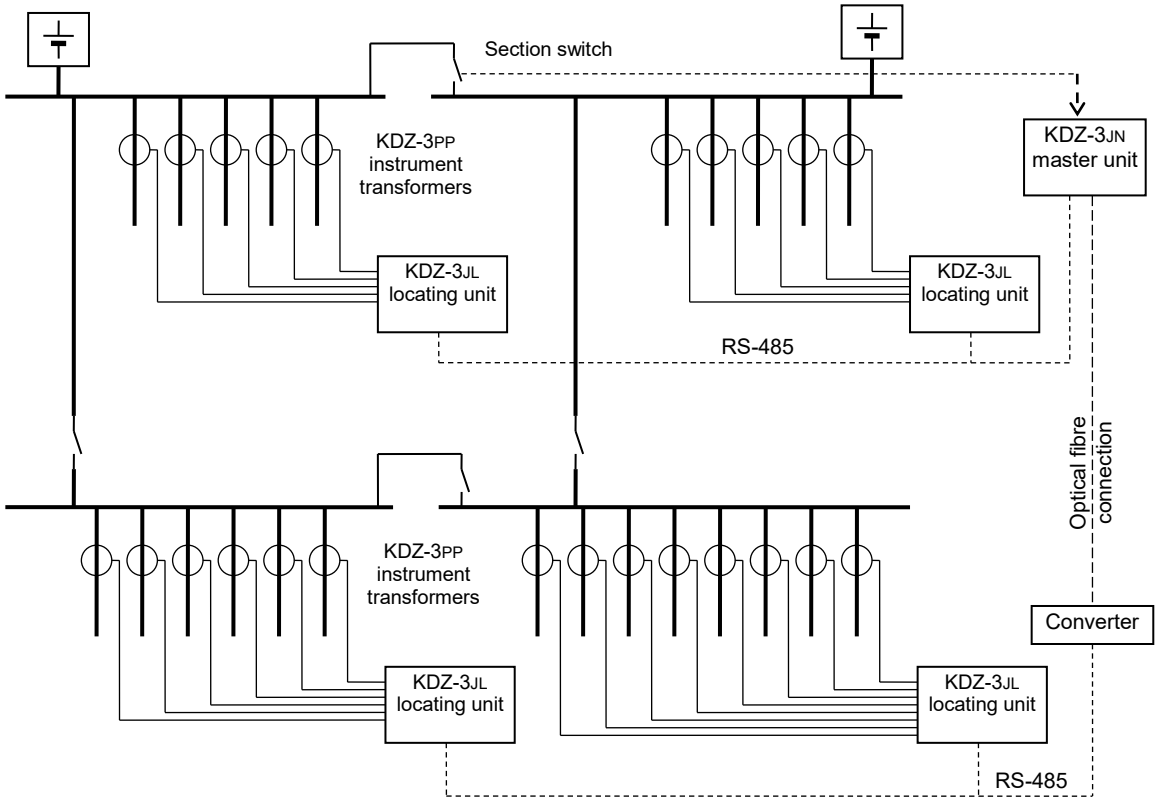


Fig. 3.2.5. Structure of the KDZ-3 earth fault monitoring system with the following setup: two-section main switchgear and a sub-switchgear.

4. KDZ-3JN MASTER UNIT.

4.1. Construction.

The KDZ-3JN device has a power supply unit with two independent converters. It can, therefore, be powered from two independent circuits, ensuring uninterrupted work even if voltage from one of the sources is lost. Configuration with two independent KDZ-3JN units is also possible.

Power supply inputs are galvanically separated from measurement inputs monitoring resistance, so insulation of one circuit is being monitored, while power is supplied from a different one. Binary inputs take AC and DC voltage at 220V (or 110V), output relays provide contact signaling of the devices operating status. An internal MLB logic module supervises operation of the KDZ-3. Furthermore, an MGB hub inside the unit supervises operation of the entire device, archives recorded data and ensures communication with the device. There is also room for an optional GPS clock inside the module.

Multipin connectors on the rear panel of the KDZ-3JN device can be used to connect external circuits. Software supplied with the device enables configuration of KDZ-3 functions and its following operation. It provides the ability to monitor the present status of switchgear on-line on a computer screen, read data from the event recorder and change the device configuration if required. Furthermore, the device can be controlled through a web browser.

4.2. External dimensions.

The KDZ-3JN master unit is built as a EURO-19”/3U unit, made of chromate plated aluminium, which provides higher resistance to EMC interference.

Depending on the selected size of the display and the number of installed modules, one 19”/3U/240 (483×133,5×245 mm) unit can accommodate one (version A) or two (version E) KDZ-3JN devices.

Furthermore, additional space, approximately 55 mm deep, should be available behind the unit for installation cables to be connected with multipin connectors. All the figures show a version of the master unit, which supports two sections (two MAG generator cards).

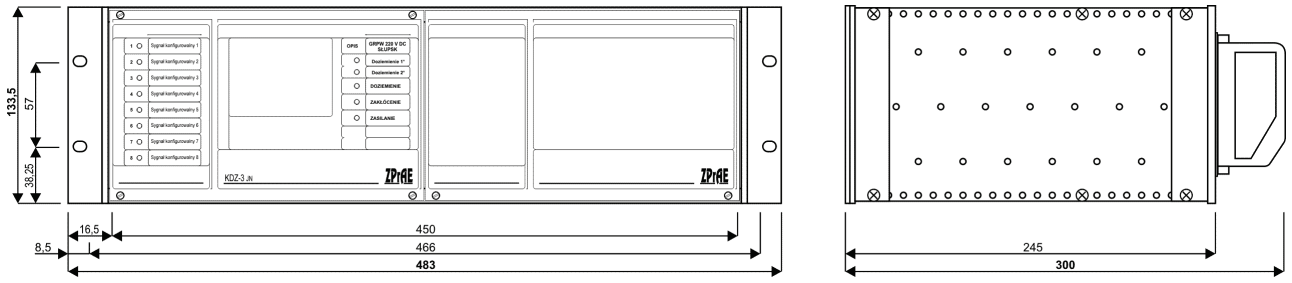


Fig. 4.2.1. External dimensions of the KDZ-3JN master unit.

4.3. Front panel.

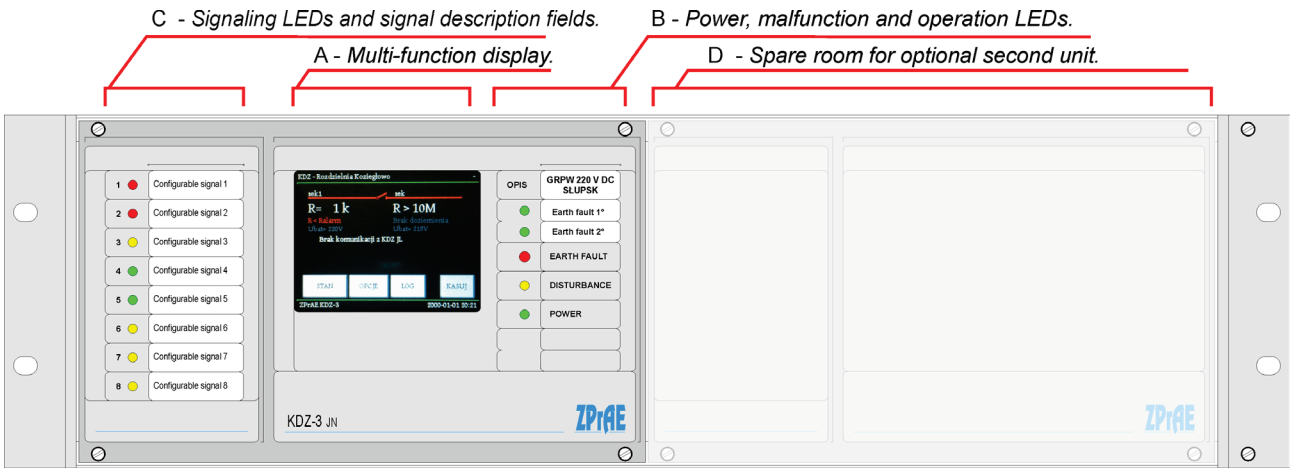


Fig. 4.3.1. Front panel of the KDZ-3JN relay - version E.

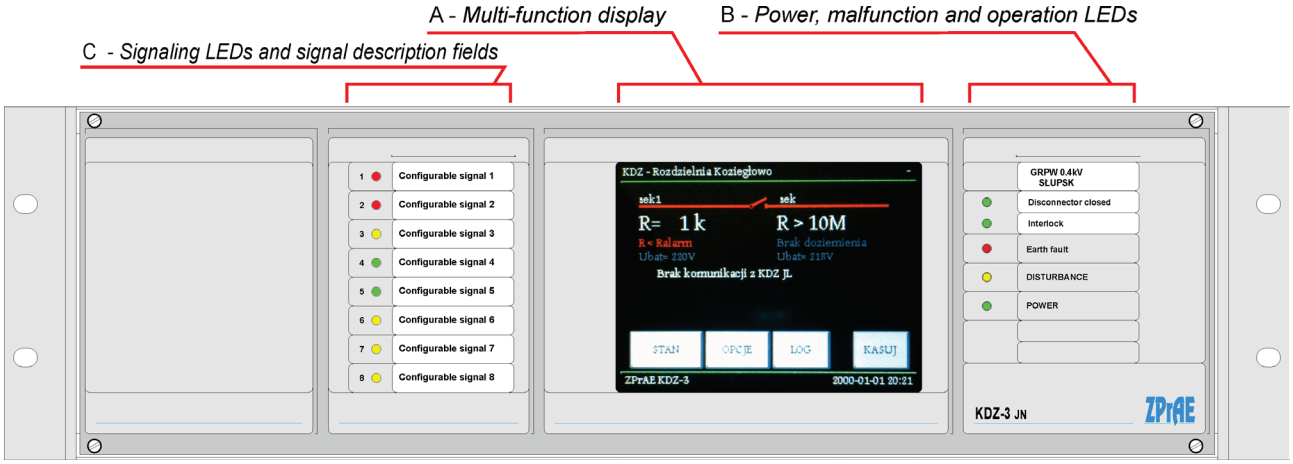


Fig. 4.3.2. Front panel of the KDZ-3JN relay - version A.

Front panel of KDZ-3JN includes:

A – LCD touchscreen.

The centre of the front panel is fitted with a colour touchscreen for previewing the current status and locking the equipment. Version A is fitted with a 5,7” screen, while version E with a 3,5” one. It can also be used to configure basic parameters.

The main screen shows preview of the insulation's condition and the substation's operation mode; in this mode the current state of the section switch, resistance of each section, information about exceeded signaling or alarm threshold, voltage and possible communication errors are displayed. If earth fault is on one power supply pole „**+**” or „**-**” is displayed next to the value of resistance, and „**±**” is displayed if earth fault is on both poles. The screen shows the value resistance of parallel connection of grounding resistance to pole „**+**” and „**-**”. If two units are used, each displays data from its respective section.

In case of two-bit mapping of the switches' state, the switch is highlighted in yellow to signal incorrect mapping.

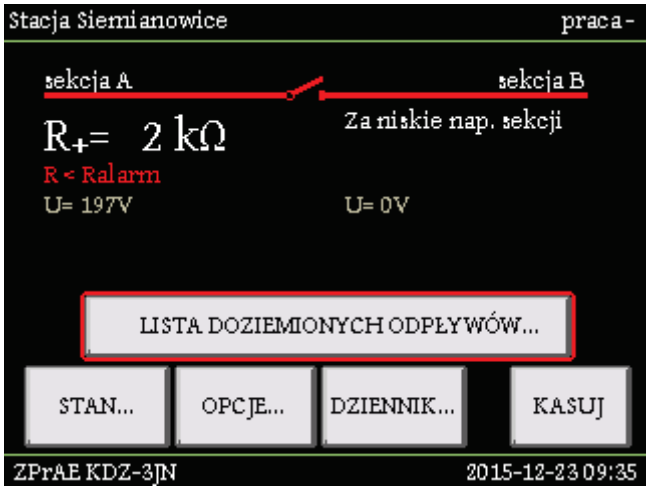


Fig. 4.3.3. Main screen.

The current status of the generator is shown in the top right corner of the screen. A „**+**" means high level is generated, i.e. connection through the internal resistor to the positive power supply pole, while „**-**" means it is connected to the negative one, „**.**" - means there is a break, and no character means the device is inactive. Red colour of the characters means earth fault location is being initiated, white – regular measurement, grey – locked devices (generator disconnected from the protective conductor). Status of the switch and resistance values on the screen is constantly updated.

The bottom part of the screen contains buttons with specific functions:

- **STATUS** – go to the screen showing current status of KDZ-3JL locating units,
- **OPTIONS** – go to the settings screen,
- **LOG** – go to the screen with event log,
- **RESET** – reset sustained signals and LEDs.

If outgoing feeders with earth fault are detected a button displaying their list will be shown in the middle of the screen. Each outgoing feeder can have short (5 characters) and long (64 characters) descriptions defined enabling the operating personnel to locate the malfunction quickly. The long description is shown in the earth fault list, the short one in the event log. If no description was set the locating unit's address and input number are displayed (fig. 4.3.4).

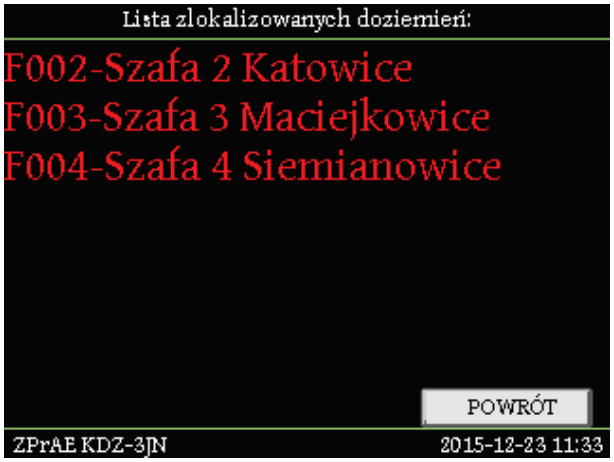


Fig. 4.3.4. List of outgoing feeders with earth faults.

Fig. 4.3.5. Screen with current status of locating units.

The **STATUS** screen shows status of communication with locating units with successive addresses. Red font (2) means that communication was lost, green (1) that communication is correct.

Locations' status is also marked with graphic symbols on the screen, under the address number. A grey empty circle ○ means there is no earth fault, a yellow circle ● - earth fault on at least one input of the LU, a red circle ○ – error status, e.g. lack or shorting of a measurement transformer.

The user can return to the main screen by pressing BACK.

The user can view detailed information about status of particular outgoing feeders by pressing the LU STATUS button (fig. 4.3.6).

Fig. 4.3.6. Preview of the locating unit's status

Fig. 4.3.7. Option screens.

The **OPTIONS** screen (divided into three subpages) can be used to lock and unlock KDZ functions (disconnect the generator from the protective conductor), select signaling and alarm resistance threshold values, and delay time. Press the CONFIRM button after making changes and a pop-up window asking for PIN to be entered will appear. The default code is 1234. It can be changed via ZPrAE EDIT software. Once you have entered the PIN code for a minute, you can make settings changes without having to reenter the code.

If the KDZ-3c clamp is used to locate the shorting precisely, clamp mode can be selected on the screen. In this mode location is continuously active, regardless of earth fault resistance value. In case of high capacitance of the network the half-period of location cycle can be extended to 16 s (4 s by default). Value of internal apparent resistance of the generator (and at the same time the maximum locating current) is also displayed. The following values are available: 10, 20, 50, 150 kΩ (26, 13, 5, 2 mA at 250V).

After selecting the TEST screen the user can check connection voltage polarity of the tested circuit and correct operation of MAG cards' internal circuits. If a card is damaged a message that the test failed will be displayed. Actual voltages and approximate network capacitance can also be viewed.

The LU OPTIONS can be used to set an alarm threshold and time delay for signaling the threshold being exceeded in all the locating units (fig. 4.3.8).

Press BACK to return to the main screen.

Fig. 4.3.8. Location units' options screen.

Fig. 4.3.9. Event log screen.

The event log screen (**LOG**) can be used to view history. For every event the beginning and end (marked by "-K") times are saved. Up to 100 latest events are displayed on the screen, more events can be downloaded via ZPrAE EDIT software. Press BACK to return to the main screen.

B – Power, malfunction and operation LEDs.

On the right hand side there are five LEDs signaling the operating status of the master unit. The two top LEDs are configured and described depending on the version of KDZ-3, for example they could provide information about interlocks, status of the disconnector, activation thresholds set are exceeded. The "EARTH FAULT" LED in the middle shines red, when earth fault resistance is lower than the alarm threshold. The next yellow „DISTURBANCE” LED provides information that there is interference with the device's operation, while the last „POWER” shines green when the unit is connected to power supply.
The name of the substation can be entered in the top description field.

C – Signaling LEDs and signal description fields.

On the left hand side of the front panel there are 8 signaling LEDs with their description fields. The list available in the software provided with the device can be used to select signals suitable to the user and assign them to specific LEDs. The software can also be used to select LED colour from the following available colour palette: yellow, red, green, blue, purple. Description field is located next to the LEDs. Description field of a single LED is 42 mm × 10 mm (W×H) in version A, or 35 mm × 10 mm (W×H) in version E. Signal descriptions can be printed on foil or paper and inserted under the transparent part of the front panel.

4.4. Rear panel and modules.

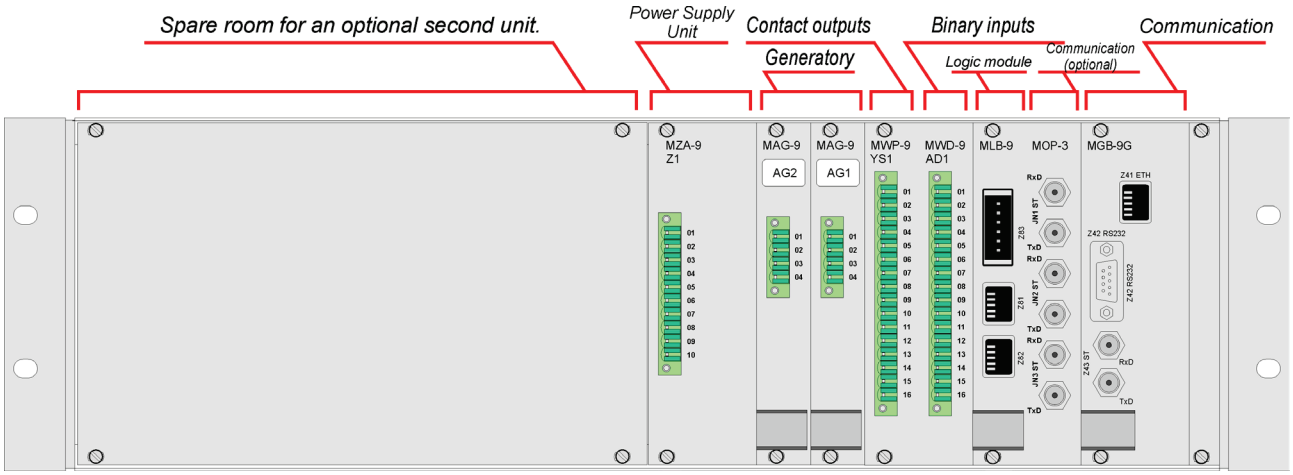


Fig. 4.4.1. Rear panel of version E of the KDZ-3JN master unit.

Fig. 4.4.2. Rear panel of version E of the KDZ-3JN master unit
(with MDZ modules fulfilling the role of locating units).

Card connectors for external connections are located on the rear panel. Plugs with casings are provided with the device. LgY cables are recommended for external connections. The cards have generator and binary input connectors, contact outputs, power supply and external communication connectors.

KDZ-3JN can be fitted with up to two MAG generator modules. MWD cards receive binary signals. The cards are responsible for receiving external control signals (e.g. locking) and information about position of the disconnector. MWP cards send contact information. Communication connectors are grouped separately and their types depend on the MGB module version chosen. If a clock module is used as optional equipment a GPS antenna connector is also located there. Connectors and functions of specific cards are described in the paragraphs below.

A – Generator and measurement circuit.

The MAG generator module forces current flowing to the protective conductor, necessary to detect and locate the earth fault, through a system of switches and resistors. Each MAG module measures voltage between „+” pole and the protective conductor, „–” pole and the protective conductor, and indirectly measures current. Voltage values are converted to digital form and transmitted to the logic module of the device.

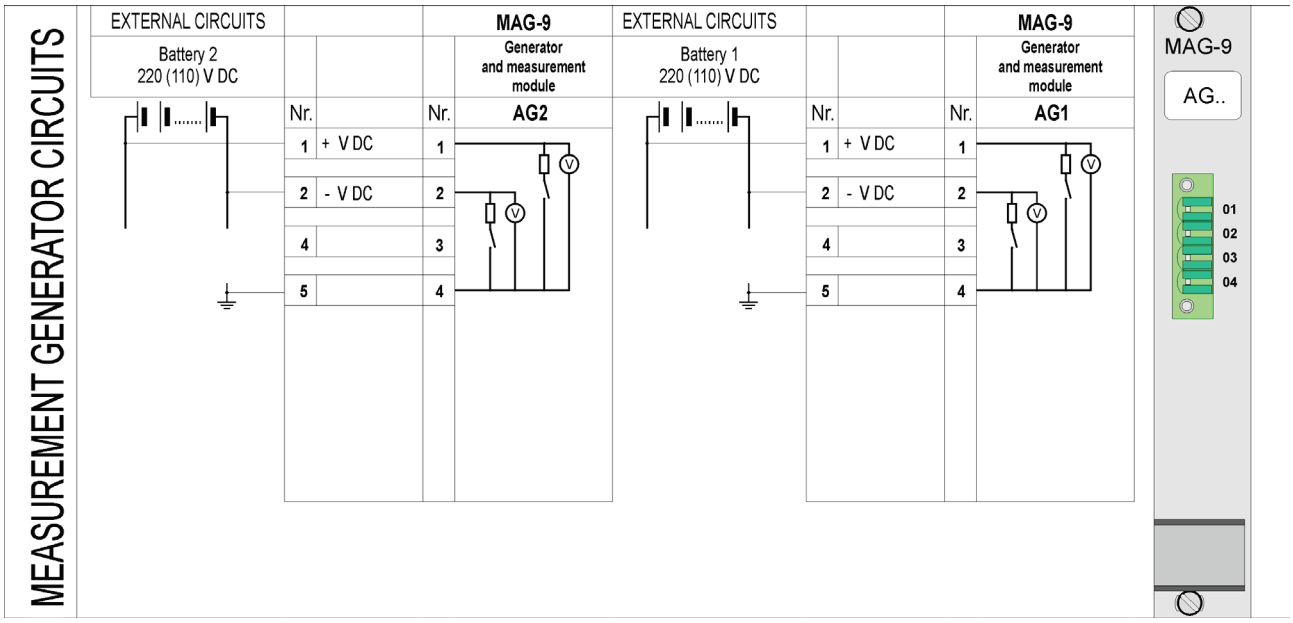


Fig. 4.4.3. Generator and measurement circuits of MAG-9 modules.

The number of MAG-9 generator and measurement modules depends on the number of batteries.

B – Binary inputs.

Signal inputs are processed by MWD modules.

Every MWD input module has 8 individual signal channels. All inputs are 220 V DC / 230 V AC as standard. Special versions are also available, e.g. for 110 V DC / 115 V AC or 24V AC/DC etc. Inputs of all signaling channels are separated from internal electronic circuits of the module with opto-isolators, providing insulation between the circuits. Each of 8 input signaling channels of a MWD module is independent of the others and is isolated form them, therefore every input can work in a different activating circuit.

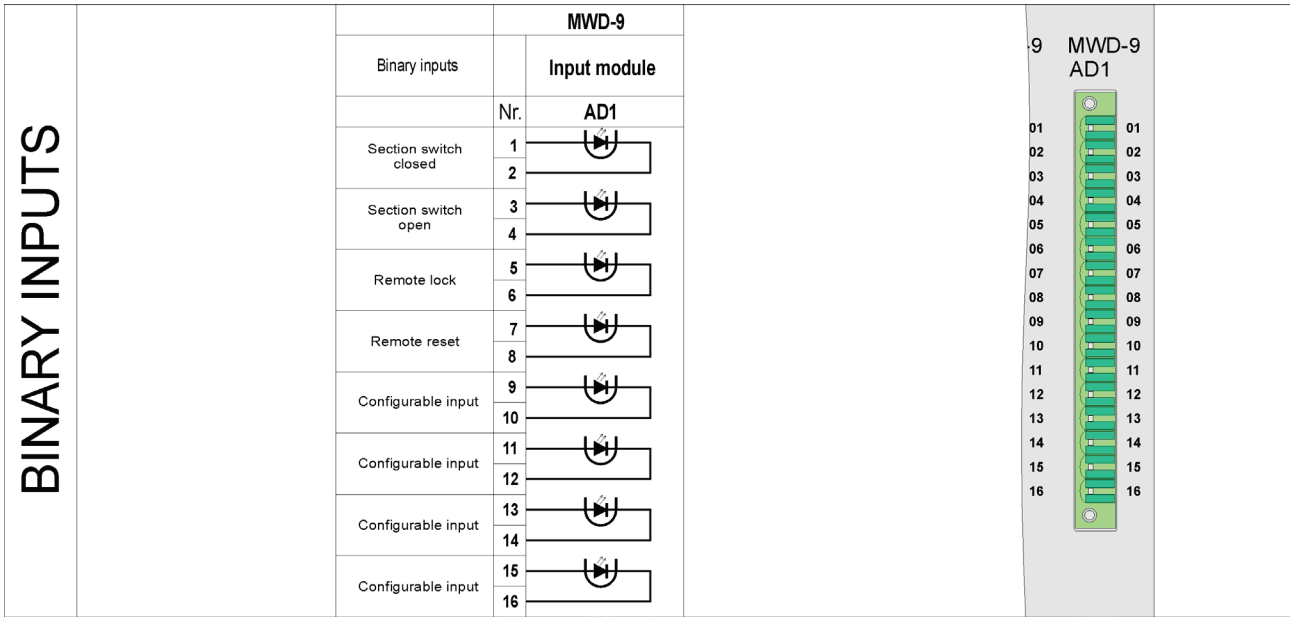


Fig. 4.4.4. Binary inputs of the MWD-9 module.

Functions of specific inputs are shown in the figure above. Unused inputs can be used to provide optional special functions in non-standard versions or specific facilities.

C – Contact outputs.

Contact outputs are processed by MWP modules.

Each MWP contact output module has 8 individual multiplication relays.

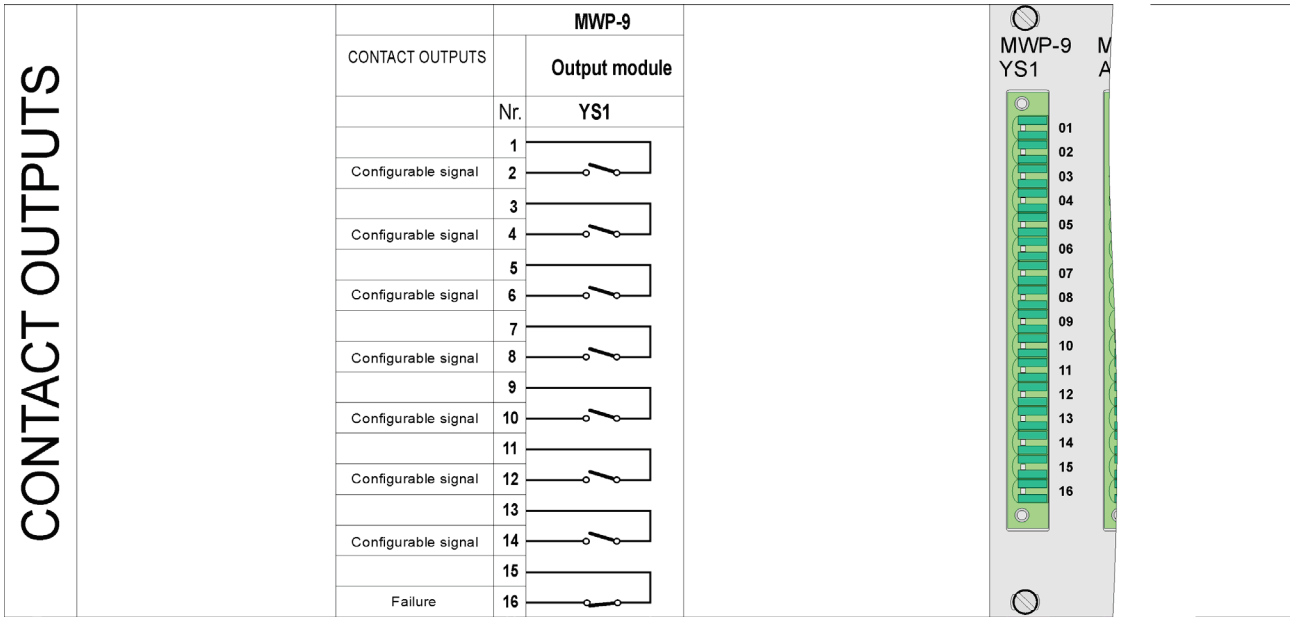


Fig. 4.4.5. Contact outputs of the MWP-9 module.

Functions of specific inputs are shown in the figure above, some of the outputs can be configured in utility software by selecting an item from the available list:

Failure
Section 1 voltage too low
Section 2 voltage too low
Section 1 earth fault signaling operated
Section 2 earth fault signaling operated
Section 1 earth fault alarm operated
Section 2 earth fault alarm operated
Section 1 earth fault signaling activated
Section 2 earth fault signaling activated
Section 1 earth fault alarm activated
Section 1 earth fault alarm activated
Save KDZ-3JN configuration
KDZ-3JN locked
Reset (by protocol)
Section switch closed
Internal communication interrupted (inside the unit)
External communication interrupted (to KDZ-3JL)
KDZ locked (interlock input)
Reset (resetting input)
Work with clamp
Work with clamp - 16 sec. mode
External communication interrupted (to the other KDZ-3JN unit)

Incorrect mapping of the section switch
One of the measurement transformers damaged
Power supply loss in the first circuit of the power supply unit
Power supply loss in the second circuit of the power supply unit

D – Power Supply Unit.

The device is powered from a twin MZA power supply unit.

The MZA power supply module contains two power supply inputs and two independent converters. The power supply units are adapted to 220 V DC +10/-30% or 230 V AC +10/-30% power supply. Power supply units adapted to 110 V DC, 48 V DC, 24 V DC +10/-30% auxiliary power are also available.

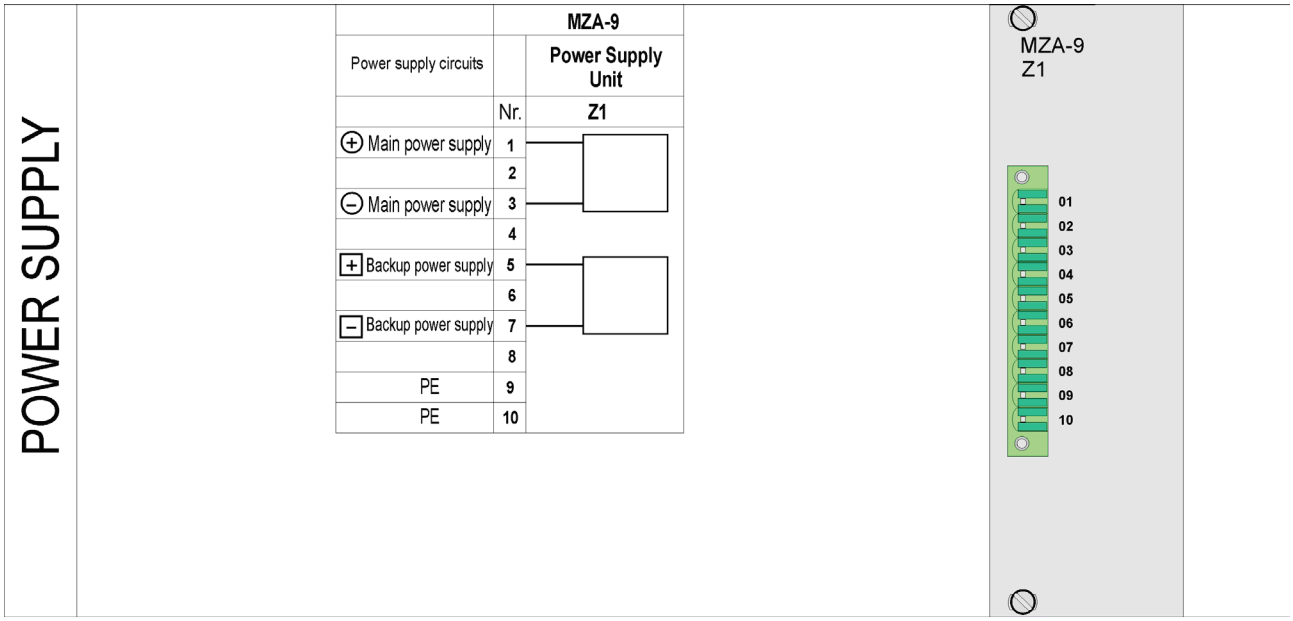


Fig. 4.4.6. MZA-9 power supply unit.

It is recommended to power KDZ-3 JN from two independent circuits, for each power supply channel of MZA-9 separately. One power supply channel from one set of batteries, the other channel from the second one. This will guarantee uninterrupted operation of the device even if one power supply voltage is lost.

E – Logic and communication with locating units – MLB and MOP module.

Internal logic module of the unit is responsible for synchronization of the device operation and communication with locating units. In case of distributed systems in which the monitoring is also carried out in substations that are distant from the master unit, the MLB module is equipped with a MOP communication adapter enabling optical fibre communication.

The rear panel of MLB module contains a screw terminal for communication with locating units. An optional MOP adapter contains another pairs of optical fibre connectors for three remote sub-switchgears.

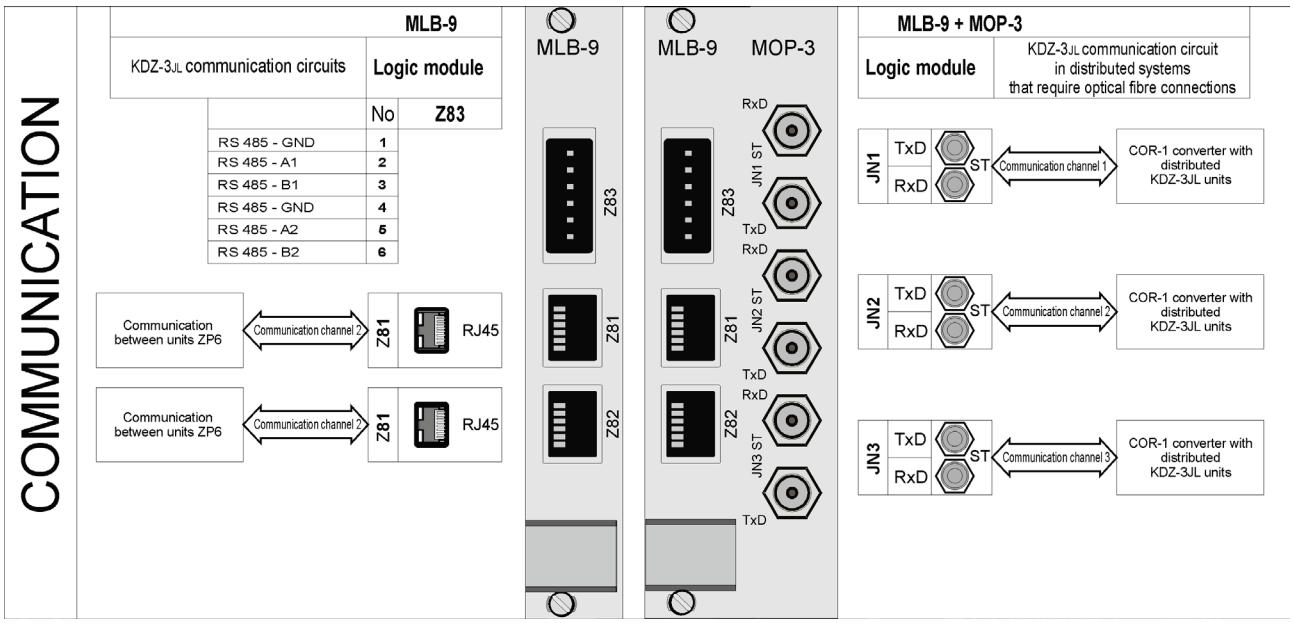


Fig. 4.4.7. Communication with locating units.

F – External communication – MGB module.

An MGB module is responsible for external communication with monitoring systems or station computers. This module also serves as a main memory buffer of the event recorder. It is capable of storing up to 10 thousand events, at 1 ms resolution. The memory used is non-volatile which means that when the power supply is disconnected the event buffer will not be erased. It is equipped with a real time clock used for recording that can be synchronized with primary monitoring system or an optional GPS clock module. Digital recording of data in hub's recorder makes it possible to relay them to the primary control and monitoring system.

The MGB hub can have up to four serial transmission channels (over various physical interfaces i.e. RS232, RS485, optical link) and an Ethernet connection.

The Ethernet enables connection with maximum of four independent users at the same time. Each channel can utilise IEC 870-5-103 or the proprietary ZP-6 protocol. One of the channels can be used for communication with GPS module. The RS485 differential connection is a two-wire version.

Communication via IEC61850 protocol is provided by MGB-9F.1 version of communication module equipped with communication port with Ethernet connector and two optical fibre ports.

Station control and monitoring systems using IEC 870-5-103, IEC61850 communication protocols have capability to receive events, read current disturbance status and control, e.g. remote resetting.

KDZ device offers a possibility to install a WWW server, the so-called web-server. Thanks to this solution the user can preview device's operation through a web browser. MGB-9B-WEB, MGB-9D-WEB, MGB-9E-WEB, MGB-9F.1 and MGB-9F.1/L hubs are provided with a WWW server. For more information on this solution see chapter 8.

Should you have any questions or doubts concerning the communication capabilities, other type of ports or communication protocols, please call us.

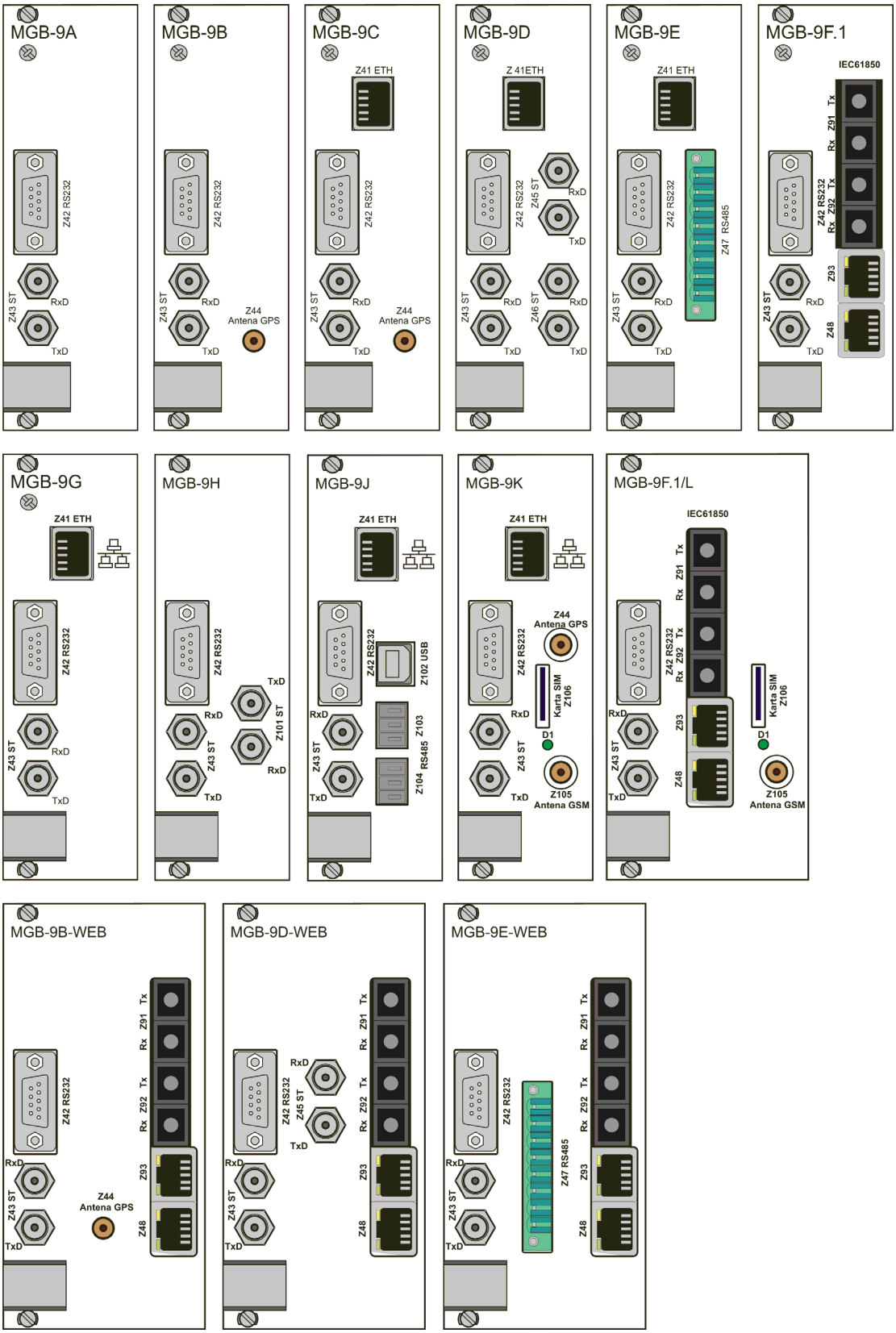


Fig. 4.4.8. Versions of MGB-9 module.

G – Earth fault location – MDZ modules.

The MDZ module acts as a locating unit and its operation is the same as the KDZ-3JL locating units described below. The module enables connection of 8 measurement transformers KDZ-3PP.

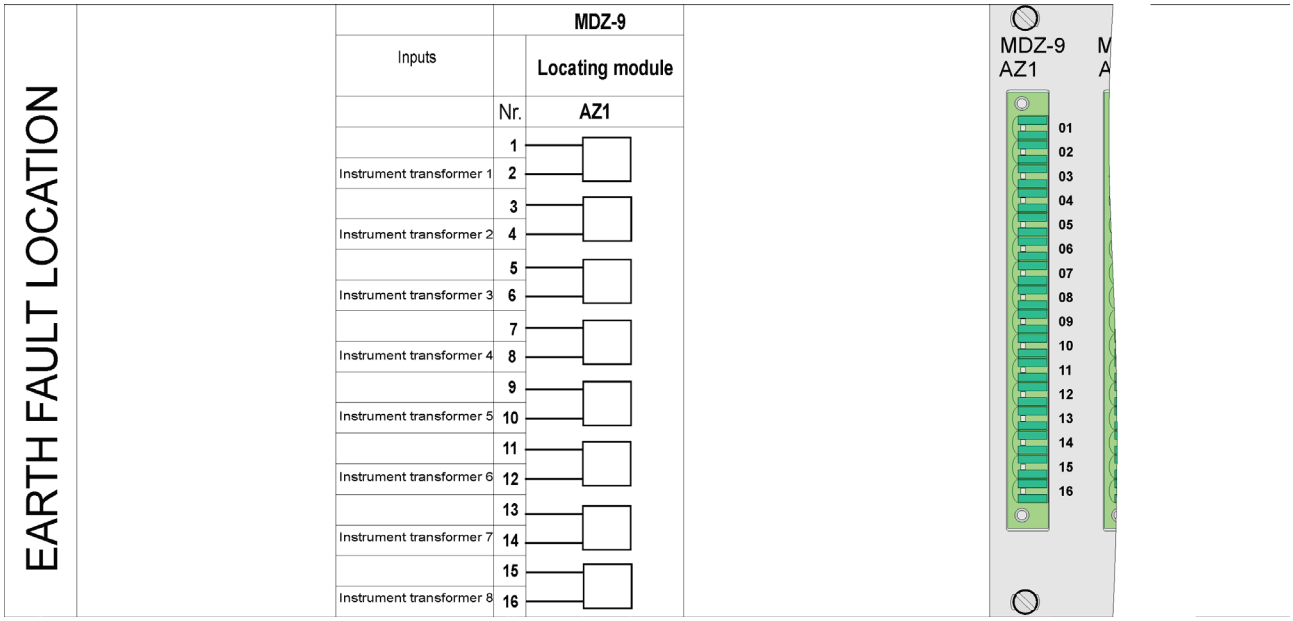


Fig. 4.4.9. MDZ-9 module inputs.

5. KDZ-3JL locating unit.

5.1. Construction.

The KDZ-3JL locating unit contains eight measurement inputs which support dedicated measurement transformers installed on specific outgoing feeders of the substation. Logic unit periodically monitors resistance of every outgoing feeder, the status of specific channels is sent to the master unit. If the resistance drops below the set level, information as a contact on the terminals of locating units is generated, just as information about possible damage of measurement circuit or loss of power supply during monitoring of circuits.

The front panel contains LCD display which allows the user to view operating mode and setting configuration entered. Reading of resistance for specific channels is easy and clear thanks to the bars displayed on the main screen. In addition, above the graph there is an accurate insulation resistance value and below there is a symbol showing that the alarm threshold was exceeded in a given outgoing feeder.

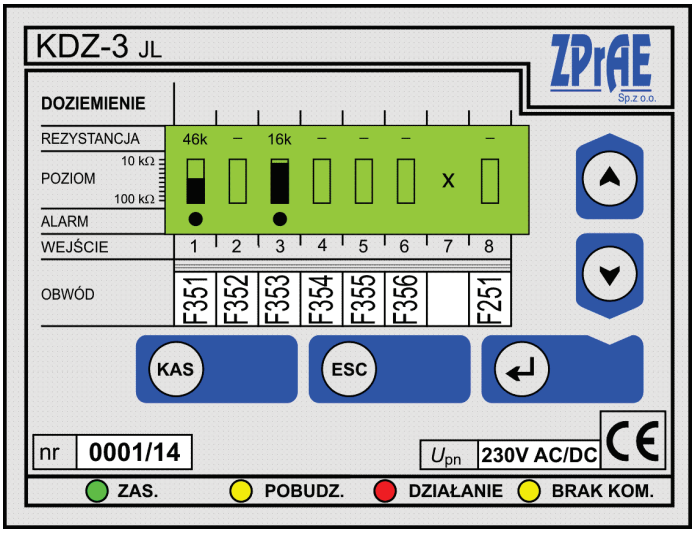


Fig. 5.1.1. View of the front panel of the KDZ-3JL locating unit.

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)
	Going to the next level (confirmation) Confirming settings (available in PROGRAMMING mode)
	Resetting (confirmation of operation)

The front panel also contains four LEDs:

LED	Turned off	Continuous light	Blinking light
ZAS. *(green)*	KDZ-3 is not powered by auxiliary power supply	KDZ-3 is powered by auxiliary power supply	Broken instrument transformer in active measurement circuit.
POBUDZ. *(yellow)*	KDZ-3 is not and was not in activated since the last resetting or loss of auxiliary power supply	KDZ-3 is activated,	KDZ-3 was activated. Activation LED blinks until resetting or loss of auxiliary power supply
DZIAŁANIE *(red)*	KDZ-3 is not and was not operating since the last resetting or loss of auxiliary power supply	KDZ-3 is or was activated and worked, Operating relay is in operating mode	KDZ-3 is not activated but operating relay was in operating mode. OPERATION LED blinks till resetting or loss of auxiliary power supply
BRAK KOM. *(yellow)*	KDZ-3 synchronized with master unit	----------	No communication with master unit

The rear panel contains two multi-plug connectors which enables easy and fast installation of units in the standards GZ-14(U/Z) sockets. Purpose of the specific pins is shown in the figure below.

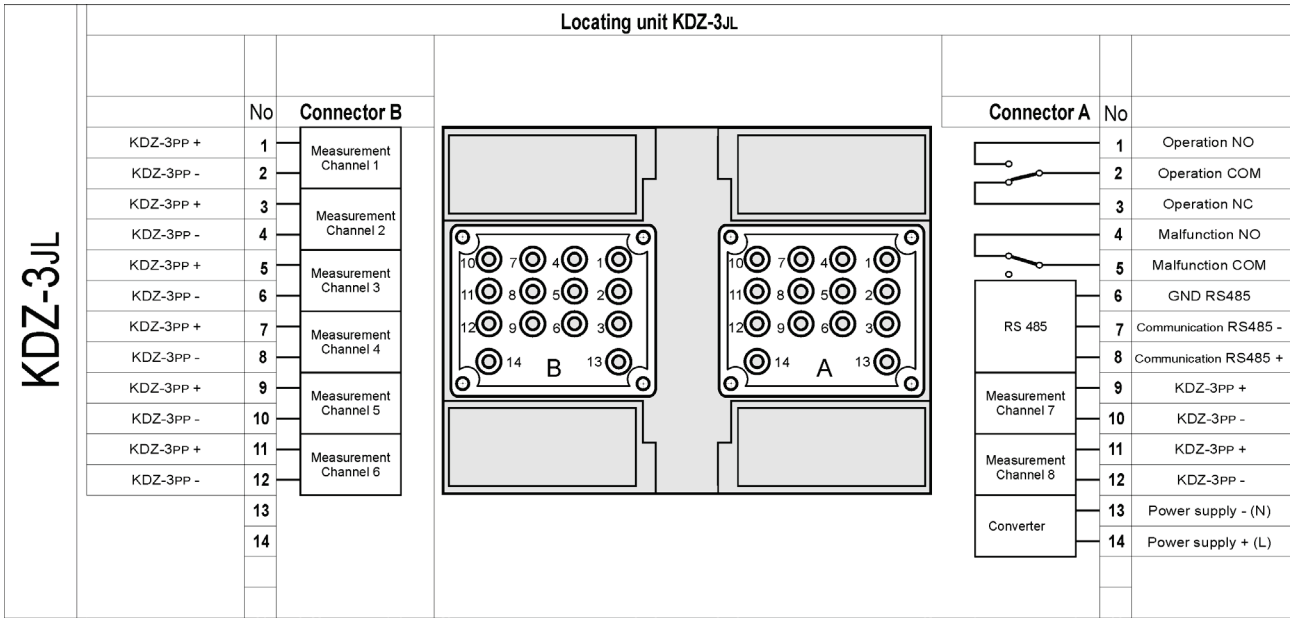


Fig. 5.1.2. Sockets of the KDZ-3JL locating unit.

5.2. Operating principle.

In a measurement cycle the KDZ-3JN master unit generates suitable measurement signals that are sent alternately to the positive and negative poles of the controlled network. When the decrease below the set threshold in the resistance of the entire network is detected by the device, an earth fault locating procedure is initiated. Signal generated by the master unit is measured in the locating unit by measurement transformers at specific outgoing feeders and converted into appropriate resistance value in a given outgoing feeder.

If the resistance of a given outgoing feeder drops below the alarm threshold set, the locating unit is activated and after the time-delay set its operating relay (PW) is activated. Operating relay can work in two operating modes that are selected from the software, sustained or unsustained mode. In a sustained operating mode (PW-ZP) the relay is sustained until it is reset using button (remotely). In unsustained operating mode (PW-BP) the relay is active as long as activation lasts. Each of active inputs of locating unit monitors the measuring channel between the measurement cycles. Thanks to the monitoring function it is possible to detect a shorting or break in the measuring channel or damage of measurement transformer. If damage is detected, an auxiliary relay (PA) is activated.

All information about the resistance of a specific outgoing feeder as well as status of measuring channels is sent to the master unit.

Resistance of specific channels as well as the level of earth fault is displayed on LCD screen in a form of bars. When the resistance alarm threshold is exceeded in a given channel, a flashing alarm symbol ● appears on the LCD screen under the corresponding bar. At the same time, a POBUDZ. LED on the front panel is turned on, and after a time-delay set and activation of operating relay a DZIAŁANIE LED turns on. If the activation stops after operating relay actuation, the POBUDZ. LED as well as DZIAŁANIE LED starts flashing. If a damage of measuring channel is detected, an information in a form of ⚠ symbol, for shorting, and ⚠ for a break in the instrument transformer circuit that indicates the channel in which the damage occurred is displayed on the LCD screen. The KDZ-3JL locating unit

allows for turning off those channels which are currently not used in the system. An "X" symbol, which informs about deactivation of a channel, is then displayed on LCD screen.

If the communication with master unit is lost NO COMMUNICATION LED on the front panel will start flashing.

5.3. Setups preview and programming.

SOFTWARE VERSION.

When the locating 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.

Fig. 5.3.1. Display – type, software version, 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. To return to the main screen press (ESC) button or wait 25 second.

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. A password screen will then be displayed. Use and button to change the values of entered digit in a given item and confirm each time the current digit by pressing (enter) before going to the next one. After entering the correct password KDZ-3JL will save new values of parameters and confirm it by displaying “Settings saved” information. If the password is incorrect, a message “Incorrect password” will be displayed and the user will be returned to password screen. To exit the password screen press (ESC) button or wait 25 seconds (to leave automatically).

To ensure communication with master unit within one system, each locator must have a unique device address set.

WARNING: Default password is **0 0 0 0***. It can be changed in parameters configuration only using relay keyboard. If the new password is lost, please contact the manufacturer.*

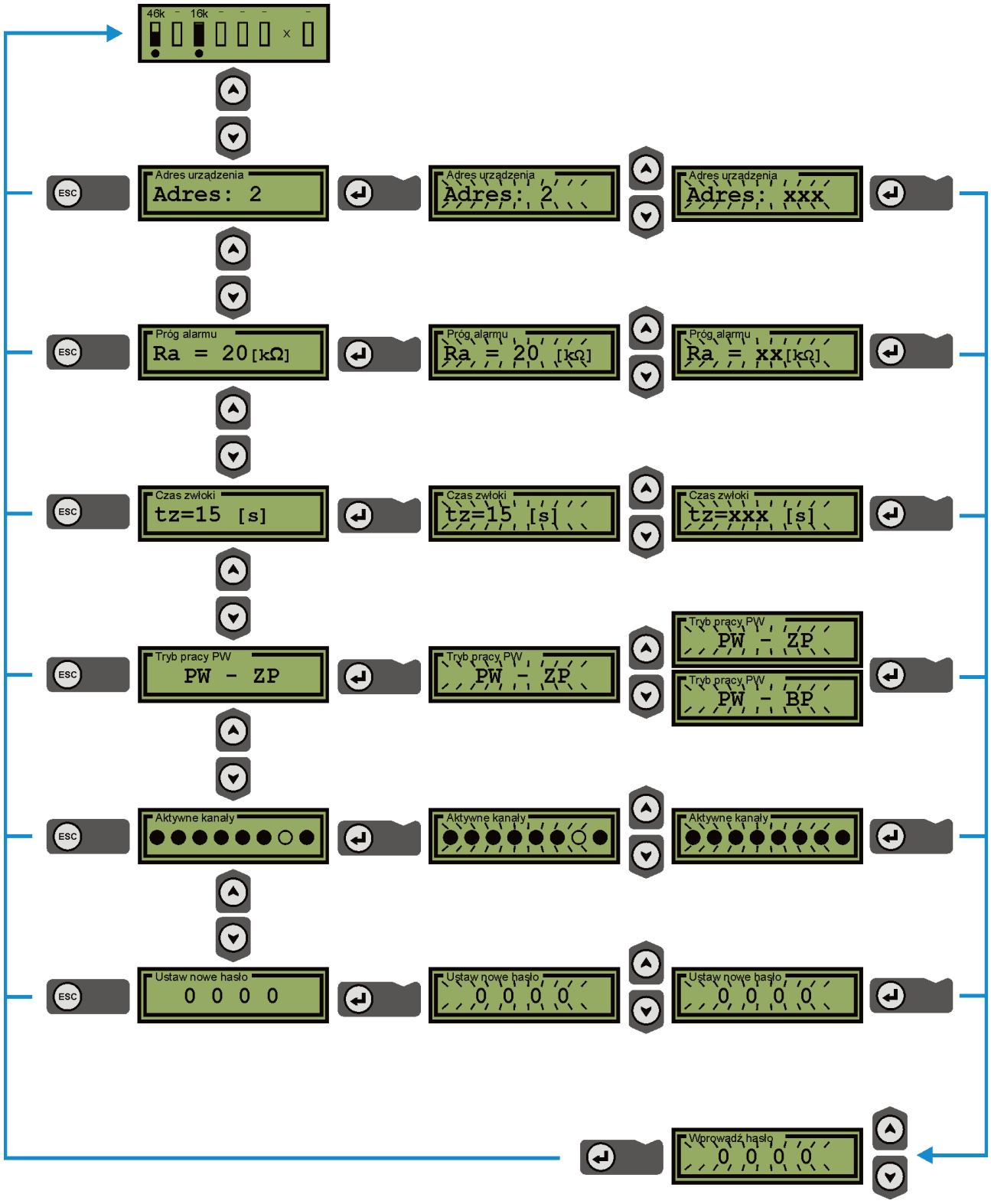


Fig. 5.3.2. Flowchart of parameter preview and configuration.

5.4. External appearance.

Locating unit is assembled in a casing with dimensions 77 × 100 × 110 mm and 28 terminals in a form of 2 plugs suitable for fitting in standard GZ-14 sockets (installed on a panel), GZ14U (installed on a busbar 35mm) and GZ14Z – installed in an R8614Z unit.

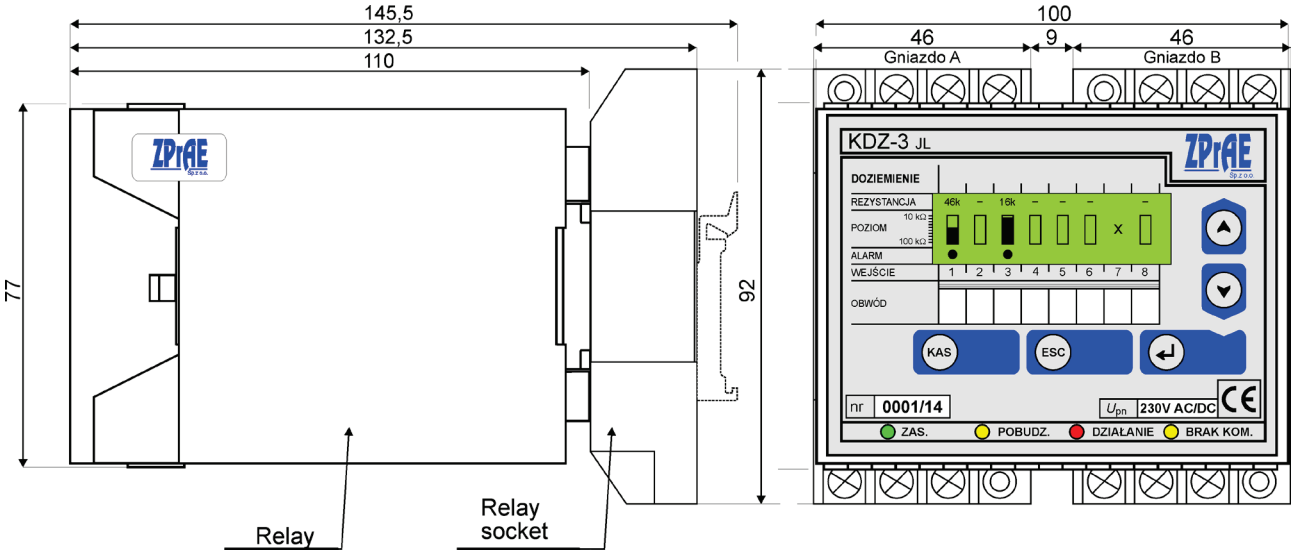


Fig. 5.4.1. Dimension drawing of KDZ-3JL relay.

WARNING:

To install our relays we recommend using auxiliary equipment (units, sockets, plugs) which are designed based on customer's suggestions and many years of experience. For more information see the "Units and sockets of R-8614/R8614Z, GZ-14/GZ-14Z relays" folder available at ***www.zprae.pl****.*

6. MEASUREMENT TRANSFORMERS.

6.1. Installation.

Up to 8 measurement transformers can be connected to each locating unit. KDZ-3PP measurement transformers are suited for mounting on TS-35 busbar. Connection of transformers with locating unit should be done using twisted pair of wires to increase the noise immunity. Length of connection wires between instrument transformers and KDZ-3JL locating unit or MDZ module should not exceed 3m. Measurement transformers are fitted with 2-pin screw terminal allowing for permanent connection of the wires. Wires of the locating unit must be fixed to the relevant socket pins of the KDZ-3JL unit or the MDZ module connector corresponding to a selected measurement channel.

6.2. Dimensions.

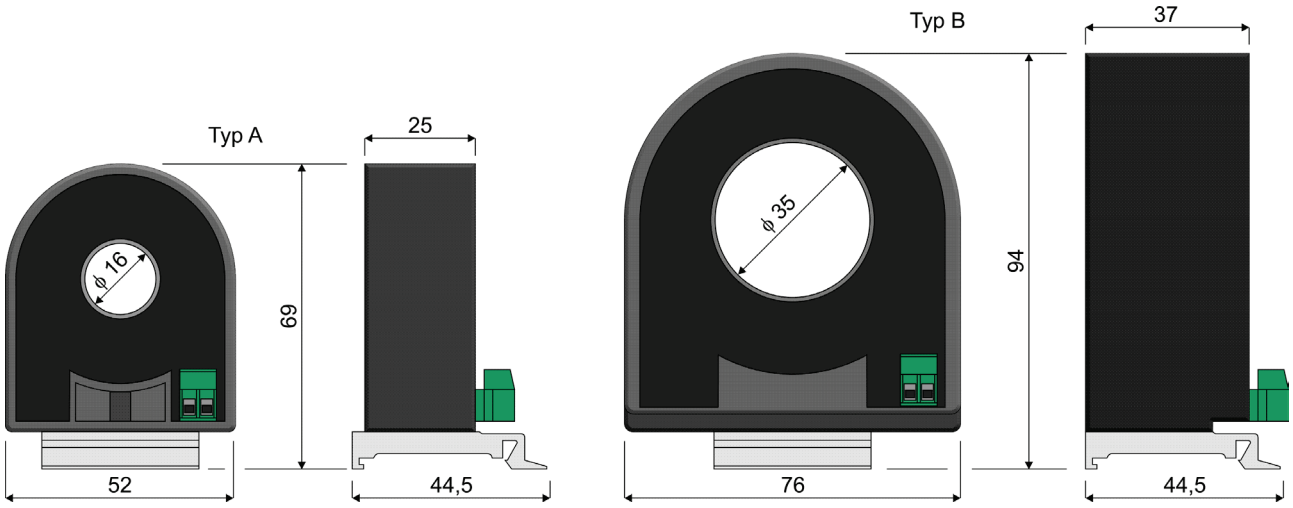


Fig. 6.2.1. Dimension drawing of the KDZ-3PP Type A instrument transformer.

The KDZ-3PP type A instrument transformers have internal opening with diameter of 16m which makes it possible to pass through 2 wires with cross section of 16 mm^2 (maximum diameter of a single wire cannot exceed 8 mm). In case of wires with higher cross section it is necessary to use a special KDZ-3PP type B instrument transformer with internal opening diameter of 35 mm.

7. OPTO-RS485 COR-1 CONVERTER.

7.1. Application.

Locating units use RS-485 differential connection for communication with master unit. In a distributed system in which substations are far away from the master unit it is recommended to use the optical fibre connection. For that purpose the master unit is equipped with a MOP module with optical fibre outputs. Locating units are connected using OPTO-RS485 COR-1 converter. A single converter supports a separated part of the RS-485 bus for maximum of 32 locating units supporting 32*8=**256** outgoing feeders.

COR-1 converter is a universal device and can work with any communication protocol. Its detailed description can be found in a separate document.

8. WWW server.

8.1. Purpose.

The KDZ-3 location system can be equipped with a built-in web-server enabling remote monitoring of the controlled system status through Ethernet. A WWW server was developed so that it can work with any internet browser on any operating system. Thanks to the advanced multi-level authorization system it is possible to access the KDZ-3 device with various levels of rights, which allows for reading presented information, as well as configuring basic device parameters.

8.2. Work with the WWW server.

To establish connection with the WWW server enter an IP address of the KDZ-3 device in the internet browser. After the device page is displayed, enter the access password to KDZ-3 system, in the login box. Current status of the device and parameters of the network monitored such as resistance, battery voltage, and switch status can be found on the main page. On the left hand side there is a navigation window with buttons leading to specific tabs containing information about the device. The user has access to the following tabs:

- Status
- Event log
- Statistics
- Setups
- Configuration
- Maintenance options
- Help

Fig. 8.1 shows view of the log page.

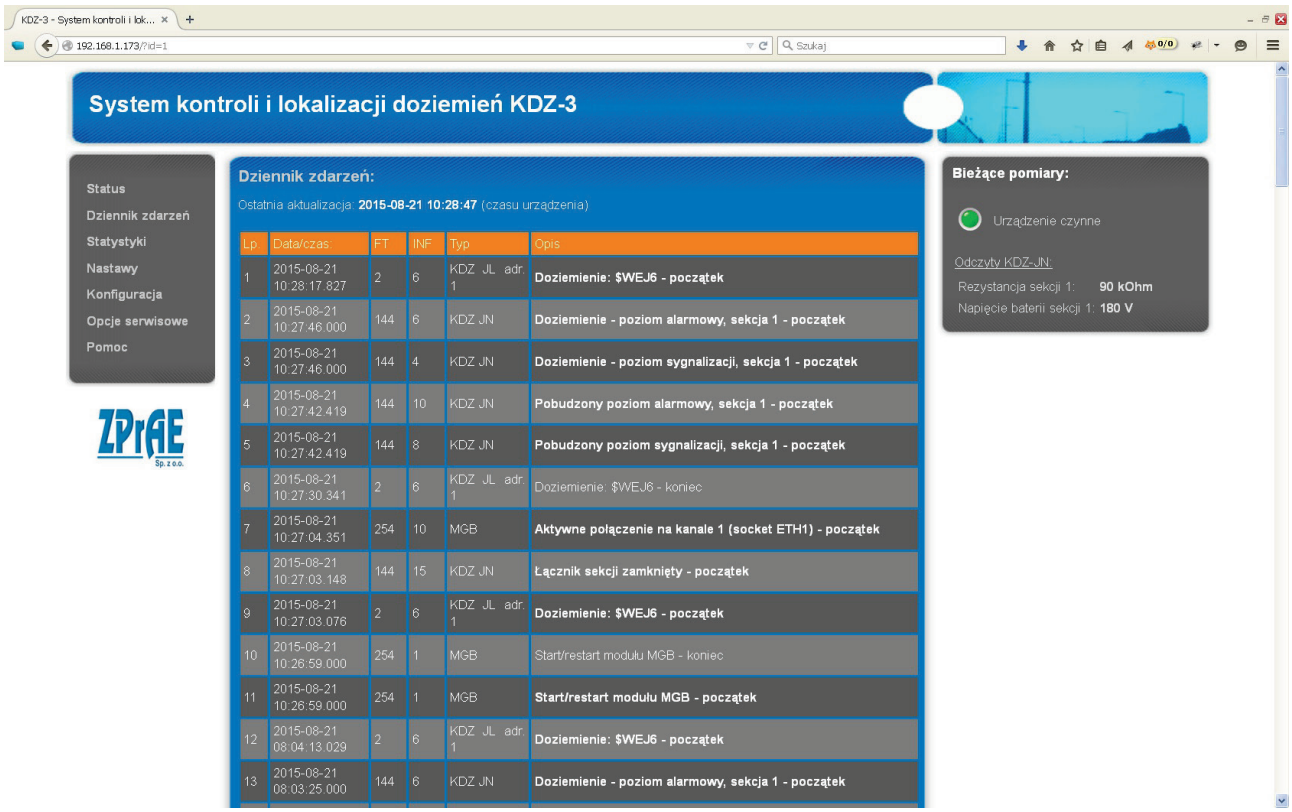


Fig. 8.1. Event log.

9. UTILITY SOFTWARE.

9.1. Installing and launching the software.

Together with a KDZ-3 device the user receives software for its configuration and operation. Installation software is provided on CDs. In order to start installation launch the SETUP.EXE file and then follow the instructions given by the installation program. Files necessary for the program to work will be copied to the computer and a base folder for the events in a given facility will be created (it can be selected during installation), where data files copied from device memory will be saved (with *.ZP6 extension). Depending of the Windows version the base folder will be located as follows:
- for Windows XP a folder in the following location:
C:\Documents and Settings\All Users\Application data\ZPrAE\Dane
- for Windows Vista/7 a folder in the following location:
C:\ProgramData\ZPrAE\
After installation is complete a shortcut to ZPrAE EDIT software will be added in the **Programs** menu in the **ZPrAE Sp. z o.o.** folder.

9.2. Start working with the ZPrAE - EDIT software.

Software can be launched from the **ZPrAE Sp. z o.o.** folder in the START menu by selecting the **ZPrAE EDIT** file or by launching the **ZPrAE EDIT.exe** executable file (in the installation folder). After the software is launched the main window will be displayed; it can be used to view event recorder contents or to access more windows to view operating status or to configure the device.

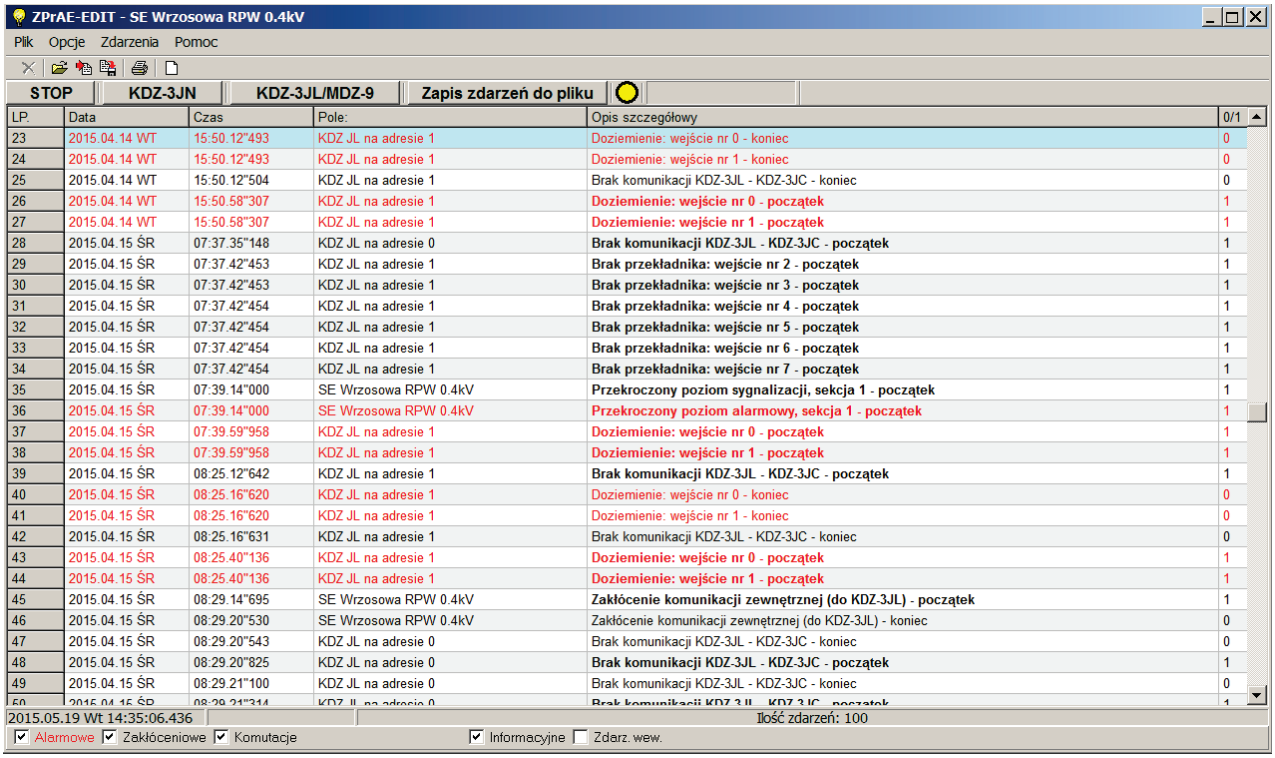


Fig. 9.1. *Main window of the program*.

Before work with the software is started a connection to the device should be properly configured, unless the program had been used before and the configuration was

saved. In order to introduce changes make the following selection in the main menu: OPTIONS and then CONNECTION PARAMETERS, and a port and connection speed selection window will appear.

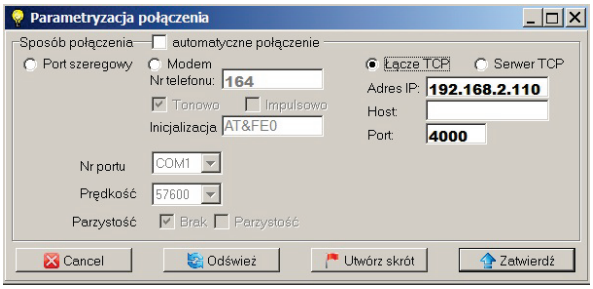


Fig. 9.2. *Connection parameters window*.

Depending on the version of the MGB hub the user can send data over various physical interfaces: RS232, RS485, Ethernet.

If a serial port is to be used select: "serial port", then select an “even” value, then select the correct COM port number and transmission speed, which is by default set to 115200 bps.

In case of an Ethernet connection the configuration requires an IP address of the device and a port number, and the TCP connection option to be selected.

If a traditional external dial-up modem is used select type of dialling (tone or pulse) and enter relevant start-up sequence, telephone number of the modem and select Modem option. Transmission speed is by default set to 115200 bps. Other speed is also available but it needs to be agreed in advance. Change of speed is possible only in software maintenance mode.

After selecting all the transmission parameters press OK to save the device configuration.

To initiate the connection press the START button which can be found in the group of the main buttons of the program. The software will then search for available devices on the transmission channel; select INITIATE SCANNING to begin. Other devices may use the same connection; therefore it is necessary to select the device to connect to. If there is one device on the channel the software displays the name of the device it is assigned to (e.g. KDZ under address no. 1) and if there are more devices it displays a corresponding number of device names. Next, highlight the right device and press CONNECT TO THE SELECTED DEVICE. The software initiates communication with the selected device and closes the selection window.

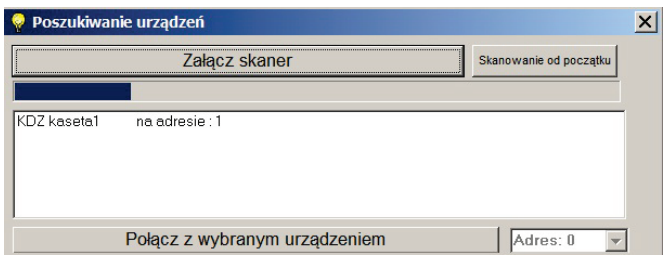


Fig. 9.3. Device scanner window

In case of correct operation, i.e. after connecting to the device and uninterrupted data transfer the round indicator in the top bar of the main window will flash yellow. In case of a transmission error the indicator will turn red.

The top part of the main window contains program icons:
-  - close the program,
-  - open a recorded data file,
-  - save events to a *.ZP6 file,
-  - save events to a *.TXT text file,
-  - print events (preview),
-  - clear event tables.

Below the icons there are five large program buttons:
- **START (STOP)** – connect to (disconnect from) a device,
- **Recorder** – access recorder setups and read saved records
- **Card settings** – preview and change input cards' settings (binary and analogue)
- **Save events to a file** – save a file with current events to the base folder.

9.3. Range of user rights for specific login levels and change of password.

There are four levels of user right: level 0 without any rights, and three other levels which enable access to device functions.

- Level 0 – no password, preview of recorded events and disturbances, saving to the file, preview of device operation, setups preview.
- Level 1 – default password: “password1” gives rights to delete.
- Level 2 – default password: “password2” gives right to set the device time synchronised with the computer system time,
- Level 3 – default password: „password3” gives rights to send the setups to the device, change configuration, etc.

To access a specific level of user rights select OPTIONS>PASSWORD in program menu and enter a correct password for a given level. The program will inform the user about the level they logged into e.g. “Logged into level 1”.

To change the password select OPTIONS> CHANGE YOUR PASSWORD >LEVEL x. After selecting the aforementioned option a pop-up window will appear where it is necessary to enter the old password and a new password for the given level twice. If you are sure that you want to change the password click the CONFIRM button and the program should inform the user that the password has been changed.

9.4. Event recorder readouts.

A main program screen does not only contain the icons and buttons enabling the access to other functions but it is also the main screen of the event recorder and includes a table with the following columns:

- No. – event number,
- Date – date on which the event was recorded by the device,
- Time – time when the event was recorded by the device (with accuracy to 1 ms),
- General description – general name of a signal
- Event – detailed description of a signal, the beginnings of an event are highlighted in bold.
- 1/0 – beginning and end of an event,

Program enables ON-LINE downloading of events (after selecting the DOWNLOAD EVENTS option in the EVENTS menu). After selecting this option, the program will download the archived events that have not been downloaded yet from the device and then will switch to downloading the events in ON-LINE mode. Progress bar in the main

program window shows progress of downloading the events from the device (full bar represents 100 events). It is also possible to download a specific number of events by selecting DOWNLOAD A SPECIFIED NUMBER OF EVENTS in the EVENTS menu. A window as shown in the figure below will be displayed where it is necessary to enter a required number of events to be downloaded and press ENTER.

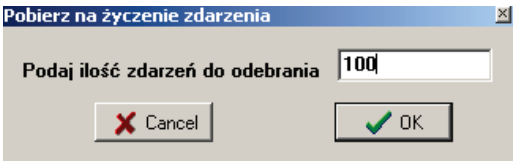


Fig. 9.4. Window for entering a number of events to be downloaded.

An AUTO SAVE AFTER 1000 EVENTS option is also available in the menu. If this option is enabled during ON-LINE download of events, the events will be automatically saved to a file after 1000 events. File name consists of the word EVENTS and a date, and time when the file was saved:

"Events 2008_03_26 13_03_42_749. ZP6"

The file will be saved in a folder relevant for a given device and created during software installation.

The "Save events to file" button on the toolbar in the main program window enables saving of last events received and shown in a table of events to a file with a default name described above, and clearing the table of events. When closing the program all unsaved events are saved to a file with a default name in a relevant folder.

9.5. Change of KDZ-3JN settings.

To change KDZ-3 setting press Configure KDZ button when the connection with the device is established. After selecting this option a window enabling configuration of parameters will be displayed.

Setting window in KDZ-3JN tab enables configuration of:

- R_{sygn} – signaling threshold (signaling at deterioration of insulation resistance) separately for each section,
- R_{alarm} – alarm threshold (deterioration of insulation resistance R_{alarm} simultaneously starts locating earth fault) separately for each section,
- $t_{sygn.}$ – delay-time of earth fault signaling separately for each section,
- $R_{wewn.gen.}$ – internal apparent resistance of the generator and thus maximum locating current.

The top part of the window contains control buttons: Reset signaling, Lock/Unlock. The middle part of the window contains some of the important signals from device operation and current reading of measured resistance or battery voltage. The bottom part of the window contains editable names of sections and substations.

When the new settings are entered press the SEND SETTINGS button and enter level 3 password to send them to the device.

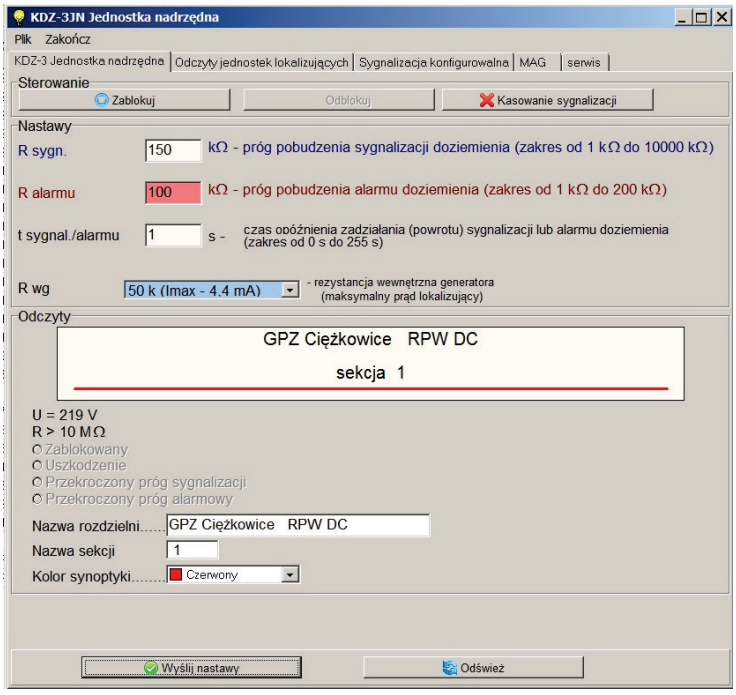
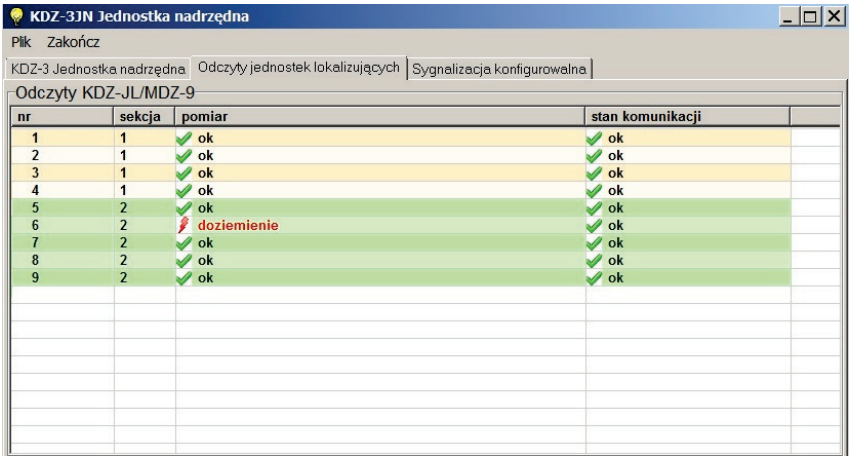


Fig. 9.5. KDZ-3JN setting change window

9.6. Locating units' readouts.

Status of locating units can be checked in the next tab. Example of the screen is shown below. It is a list of all locating units with communication status (ok or error) and earth fault measurement status. The following statuses may be seen in the measurement column:

- *ok* – when there is no earth fault,
- *earth fault* – when earth fault resistance below threshold set is detected
- *error of instrument transformer* – in case of shorting or break in the instrument transformer circuit



nr	sekcja	pomiar	stan komunikacji
1	1	ok	ok
2	1	ok	ok
3	1	ok	ok
4	1	ok	ok
5	2	ok	ok
6	2	doziemienie	ok
7	2	ok	ok
8	2	ok	ok
9	2	ok	ok

Fig .9.6. Locating unit readout window.

If there is a disturbance signal on one of the modules (locating units) the user can get more detailed information by double clicking a given line, they will be redirected to the detailed reading of the locating modules.

9.7. Configuration of LED signaling and relays

Selected operating mode signals can be visualized using multi-colour LEDs on the front panel of the device. There are 8 LEDs available for signals selected from the software. To select a signal go to Configurable signaling tab in the KDZ-3 setting window. When this option is selected, a window enabling their configuration will be displayed.

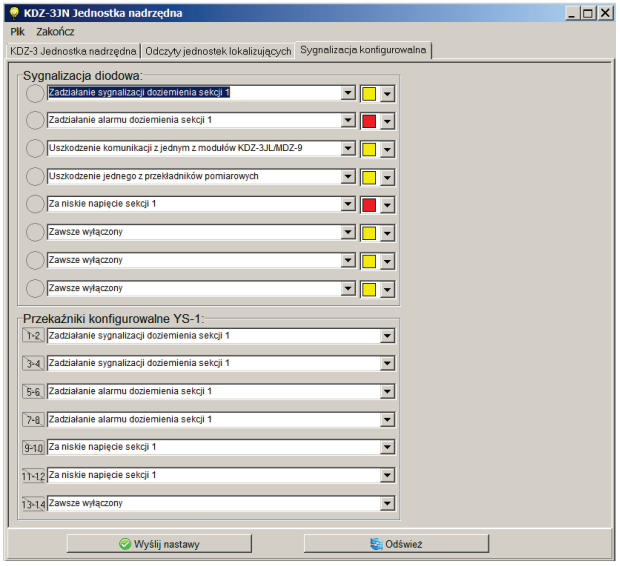


Fig. 9.7. Signaling configuration window.

Single signal from the list and colour can be assigned to each LED. Standard list of signals is available in chapter 4.4.C.

9.8. Change of KDZ-3JL or MDZ-9 settings.

Each location system consists of units KDZ-3$_{JL}$ locating or MDZ-9 locating modules. To change KDZ-3$_{JL}$ / MDZ-9 settings press Configure KDZ-3JL button when the connection with the device is established. When this option is selected a window enabling configuration of parameters will be displayed (as shown in the figure below).

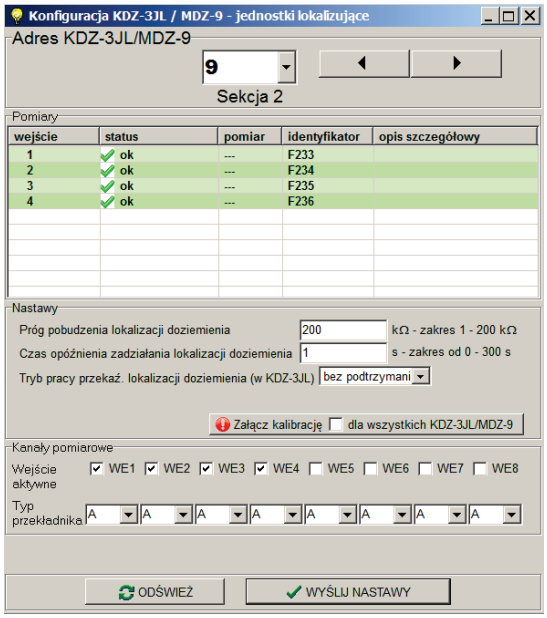


Fig. 9.8. Configuration window of locating modules/units.

Locating units or modules settings window enables configuration of:
- alarm activation limit within a range from 10 up to 200 KOhm,
- alarm delay time within a range from 0 up to 300 s,
- operation mode of sustained or unsustained relay
- number of active measurement channels (instrument transformers)
- type of a measurement transformer

An identifier or detailed description can be assigned to each input. It will appear on the event list next to the description of a specific earth fault, lack of an instrument transformer or shorting of an instrument transformer. The identifier can consist of 5 characters and the detailed description of maximum 63 characters. The identifier is used for correct identification of a measurement input and is displayed on the device's screen.

In case of a new KDZ-3 system or when the measurement transformer is replaced locating units/modules must be calibrated. In the unit/module setting window select the proper type of an instrument transformer corresponding to the instrument transformer installed on a given measurement channel (type A or B). Once the type of instrument transformer is selected press the calibration button. In case of a new system select "Start calibration for all KDZ-3JL/MDZ-9" field too. Calibration is performed when the password with level 3 rights is entered. An information window, which confirms start of the calibration process, will pop up before the calibration begins (fig. 9.9). It is recommended to carry out calibration process when there is no earth fault.

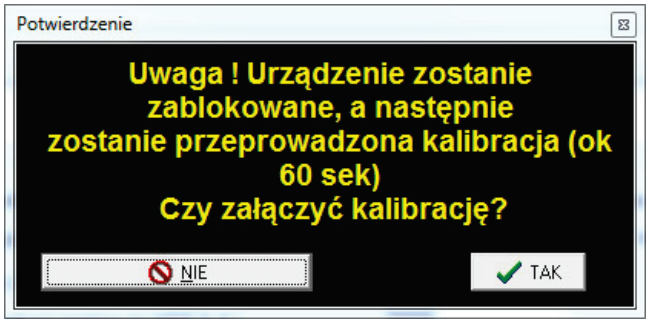


Fig. 9.9. Calibration confirmation window.

10. TECHNICAL PARAMETERS

10.1. KDZ-3JN master unit.

Auxiliary power supply	Rated auxiliary power supply voltage U_{pn}		DC 220 V / AC 230 V or different, as agreed
	Allowable range of auxiliary voltage		0.8 U_{pn} ÷ 1,15 U_{pn}
	Power consumption of power supply circuit P_p		< 20 W or 30 VA
Monitored network	Number of monitored networks		1 or 2
	Range of network DC voltage U_i		19 V ÷ 253 V
	Accuracy of voltage indication		± (1% U_i + 1 V)
	Range of network resistance measurement R_m		0 kΩ ÷ 10 MΩ
	Accuracy of network resistance indication R_m (for C_e=1 µF)		± (5% R_m + 0,5 kΩ) for R_m ≤ 1 MΩ ± (15% R_m + 0,5 MΩ) for R_m > 1 MΩ
	Time of single measuring cycle (depends on network parameters)		8 s ÷ 320 s
	Internal apparent resistance of the generator during measurement		10, 20, 50, 150 kΩ (software-selected)
	Measurement current I_m		< 2 mA
	Locating current I_L corresponding to selected internal apparent resistance		< 26, 13, 5, 2 mA
Binary inputs	Number of binary inputs (for one MWD card)		8
	Rated power supply voltage U_{wn}		DC 220 V / AC 230 V or different as agreed
	Power consumption P_w		< 0.5 W / input
	Activation threshold		0.7 U_{wn} ± 10%
LEDs and signaling panel	Number of signaling LEDs		13
		User-configurable	8
		Functional	2
		Earth fault / Disturbance / Power supply	3
	Dimension of LED light point		3 mm
	Size of LED description field		42 mm x 10 mm (WxH),
	Colour of signaling LED (selected in the programme)		Yellow/Red/Green/Blue/Purple
	Size of mimic and control touch panel		115 mm x 85 mm (WxH),
Contact outputs	Number of contact outputs (for one MWP card)		8
	Current-carrying capacity of contacts		4 A
	Limiting capacity of contacts		AC 3 A / 250 V DC 0.15 A / 250 V; L/R=40 ms
Settings	***Signaling or alarm threshold***		
	Range of start-up resistance settings		1 kΩ ÷ 10 MΩ
	Resolution of start-up resistance settings		1 kΩ
	Guaranteed deviation of start-up resistance setting (for C_e ≤ 1 µF)		± (5% *of setting* + 0.5 kΩ) for R_m ≤ 1 MΩ ± (15% *of setting* + 0.5 MΩ) for R_m > 1 MΩ
	Hysteresis		15% of threshold set
	Time-delay of signaling and alarm operating relays		
	Setting range		0 s ÷ 255 s
	Setting resolution		1 s
	Guaranteed deviation of time setting		(- 1) s

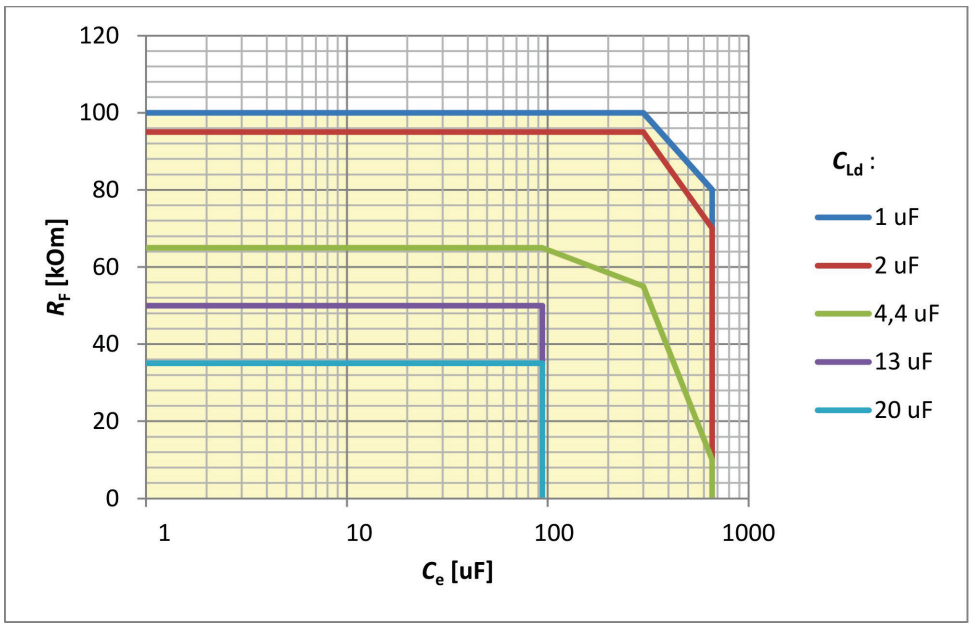
Communication	Maximum number of external communication channels active simultaneously - 5 channels (+ 1 service)		
	Type of connectors and communication protocols depend on the MGB-9 module used		
	Channel 1 / Z41	MGB-9 C / D / E / G / J / K	Ethernet - RJ-45 connector - IEC 60870-5-103 / ZP-6
	Channel 2 / Z42	All versions	RS232 – IEC 870-5-103 / ZP-6
	Channel 3 / Z43	All versions	ST optical fibre connector – IEC 60870-5-103 / ZP-6
	Channel 4 / Z44	MGB-9 B / C / B-WEB	GPS - SMA antenna connector - NMEA
	Channel 5 / Z45	MGB-9 D	ST optical fibre connector – IEC 60870-5-103 / ZP-6
	Channel 6 / Z46	MGB-9 D / D-WEB	ST optical fibre connector – IEC 60870-5-103 / ZP-6
	Channel 7 / Z47-1,2	MGB-9 E / E-WEB	RS485 - 8-pin connector - IEC 60870-5-103 / ZP-6
	Channel 8 / Z47-5,6	MGB-9 E	RS485 - 8-pin connector - IEC 60870-5-103 / ZP-6
	Channel 9 / Z48	MGB-9 F.1 / F1/L / B-WEB / D-WEB / E-WEB	Ethernet - RJ-45 connector – service / server WWW
	Channel 10 / Z91	MGB-9 F.1 / F1/L / B-WEB / D-WEB / E-WEB	Ethernet - SC optical fibre connector - IEC 61850 / WWW server
	Channel 11 / Z92	MGB-9 F.1 / F1/L / B-WEB / D-WEB / E-WEB	Ethernet - SC optical fibre connector - IEC 61850 / WWW server
	Channel 12 / Z93	MGB-9 F.1 / F1/L / B-WEB / D-WEB / E-WEB	Ethernet - Connector RJ-45 - IEC 61850 / WWW server
	Channel 13 / Z101	MGB-9 H	Single mode optical fibre connector – IEC 60870-5-103 / ZP-6
	Channel 14 / Z102	MGB-9 J	USB ST connector – IEC 60870-5-103 / ZP-6
	Channel 15 / Z103	MGB-9 J	3-pin WAGO connector– IEC 60870-5-103 / ZP-6
	Channel 16 / Z104	MGB-9 J	3-pin WAGO connector – IEC 60870-5-103 / ZP-6
	Channel 17 / Z105	MGB-9 K / F1/L	GSM - SMA antenna connector
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; 50Hz; 1 min.
	Electric strength of contact gap insulation		1 kV; 50 Hz; 1 min
General data	Allowable range of storage temperature		248 K ÷ 343 K (from -25 °C up to +70 °C)
	Allowable range of operating temperature		263 K ÷ 328 K (from -10 °C up to +55 °C)
	Allowable ambient air humidity (without steam condensation or ice)		95 %
	Allowable atmospheric pressure		70 kPa ÷ 106 kPa (0 m – 3000 m a.s.l.)
	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		Front panel: IP40, Other panels and terminals: IP20
	Dimensions		19”/3U/240 (483 x 133.5 x 245 mm), WxHxD
	Weight		Ca. 4 kg. (depending on the number of cards)

10.2. KDZ-3 JL locating unit.

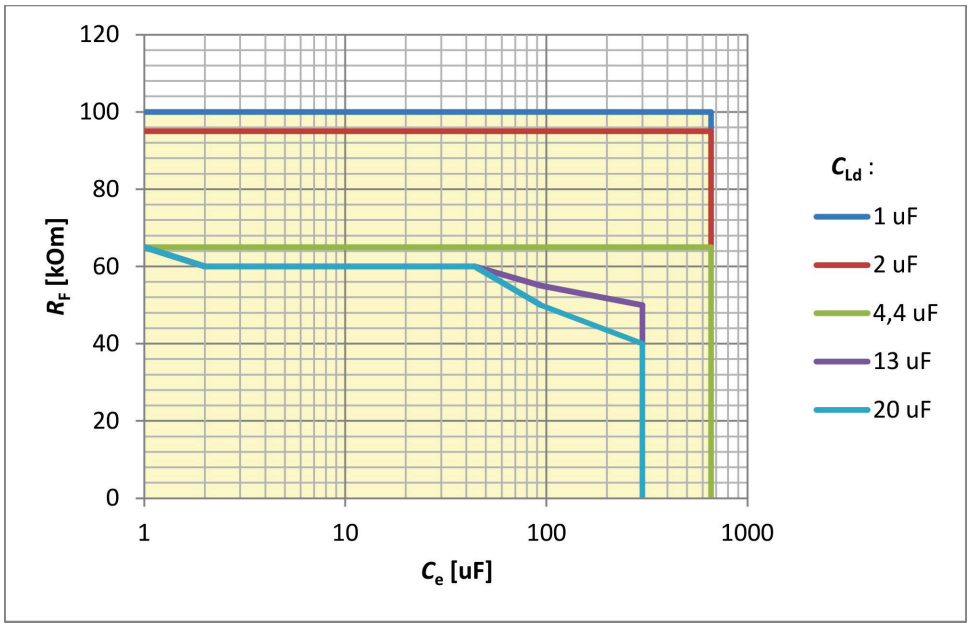
Auxiliary power supply	Rated auxiliary power supply voltage U_{pn}	DC 220 V / AC 230 V or different, as agreed
	Allowable range of auxiliary voltage	0.8 U_{pn} ÷ 1.15 U_{pn}
	Power consumption of the power supply circuit P_p	≤ 2.5 W or 3.0 VA
Resistance measurement of monitored network	Number of measuring inputs	8
	Range of network voltage U_i	DC 19 V ÷ 253 V
	Range of network resistance measurement R_m	0 kΩ ÷ 250 kΩ
	Indication resolution R_m	1 kΩ
	Accuracy of resistance indication R_m (for C_e=1μF)	± (10% R_m + 1 kΩ) for U_i ≥ 176 V ± (15% R_m + 1 kΩ) for U_i ≥ 56 V and U_i< 176 V ± (20% R_m + 1 kΩ) for U_i ≥ 38 V and U_i< 56 V ± (20% R_m + 1 kΩ) for U_i< 38 V and R_m ≤ 50 kΩ
Contact outputs	Current-carrying capacity of contacts	4 A
	Limiting capacity of contacts	AC 3 A / 250 V DC 0.15 A / 250 V; L/R=40 ms
Setting	***Alarm threshold***	
	Range of start-up resistance settings	1 kΩ ÷ 200 kΩ
	Settings resolution	1 kΩ
	Guaranteed deviation of start-up resistance setting	± (10% *of setting* + 1 kΩ) for U_i ≥ 176 V ± (15% *of setting* + 1 kΩ) for U_i ≥ 56 V and U_i< 176 V ± (20% *of setting* + 1 kΩ) for U_i ≥ 38 V and U_i< 56 V ± (20% *of setting* + 1 kΩ) for U_i< 38 V and R_m ≤ 50 kΩ
	Hysteresis	10% of set threshold + 1 kΩ
	Time-delay of operating relay	
	Setting range	0 s ÷ 300 s
	Setting resolution	1 s
	Guaranteed deviation of time setting (excluding measuring cycle)	± 100 ms
Communication	Standard	RS-485 (two-wire)
	Speed	19200 bps
	Protocol	Proprietary
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
	Electric strength of contact gap insulation	1 kV; 50 Hz; 1 min
General data	Allowable range of storage temperature	248 K ÷ 343 K (from -25 °C up to +70 °C)
	Allowable range of operating temperature	263 K ÷ 328 K (from -10 °C up to +55 °C)
	Allowable ambient air humidity (without steam condensation or ice)	95 %
	Allowable atmospheric pressure	70 kPa ÷ 106 kPa (0 m – 3000 m npm)
	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	IP40
	Terminals (socket/plug)	2 × GZ14
	External dimensions (without socket)	77 × 100 × 110 mm (H×W×D)
	Weight	ca. 350 G

11. CHARACTERISTICS

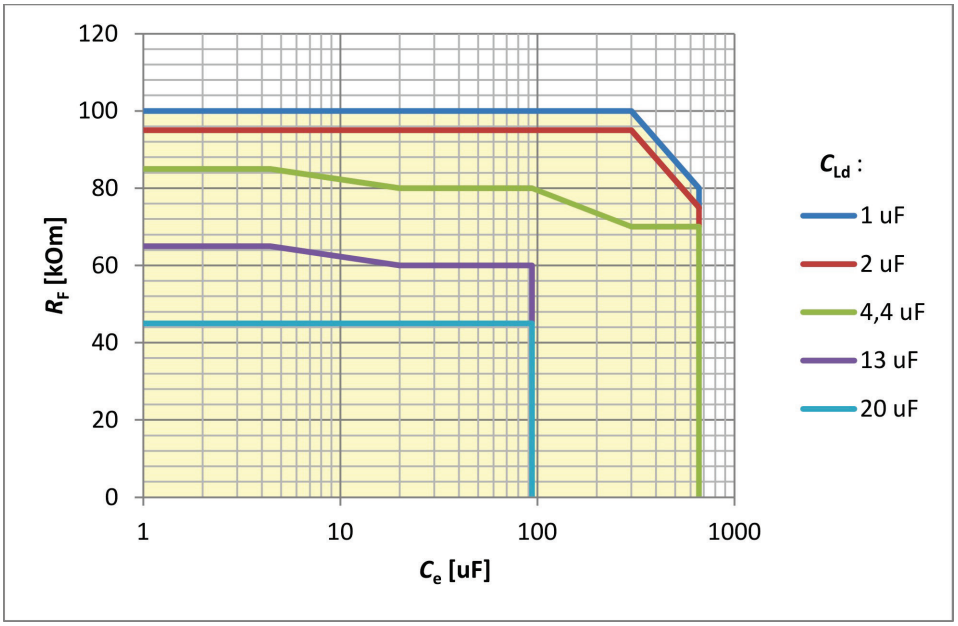
Characteristics for set internal apparent resistance of a generator R_W=10 kΩ.



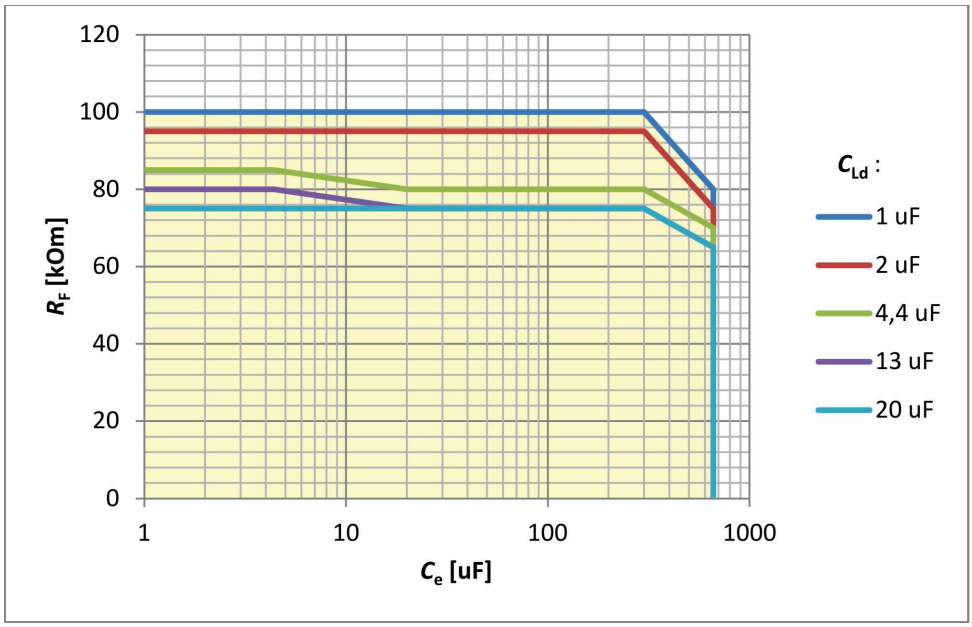
Graph 11.1. Range of allowable earth fault resistances for which the locating unit will locate the earth fault and measure the resistance correctly with a declared error as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 220 V DC.



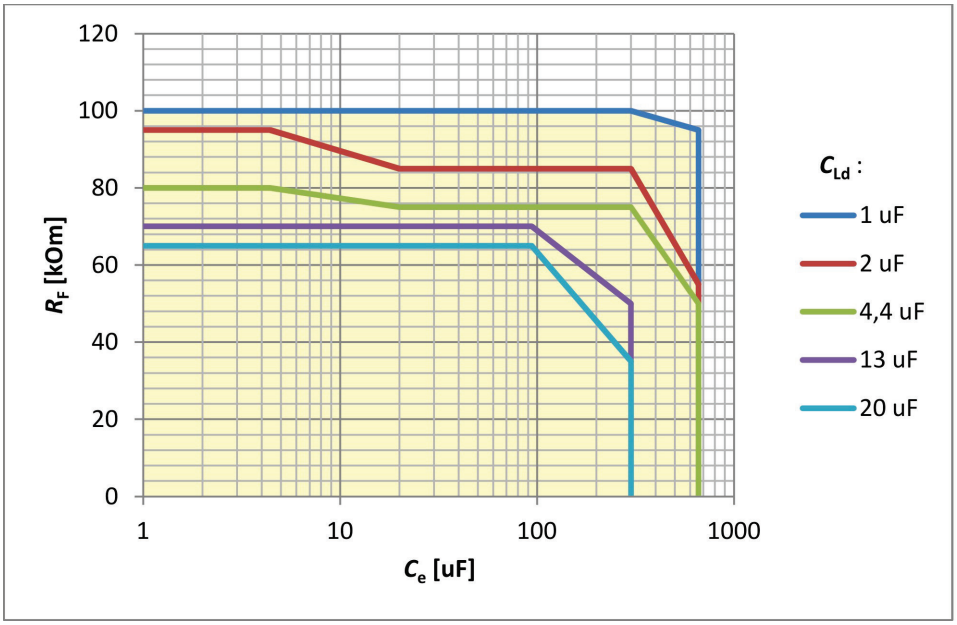
Graph 11.2. Range of allowable earth fault resistance for which the locating unit will locate the earth fault correctly as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 220 V DC. Measured resistance may exceed the declared measurement error.



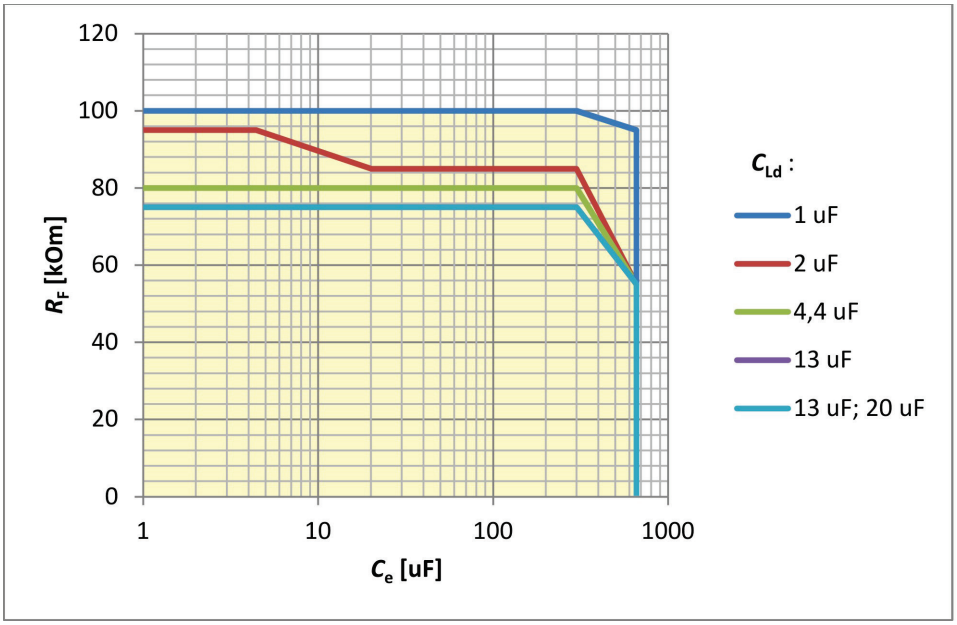
Graph 11.3. Range of allowable earth fault resistances for which the locating unit will locate the earth fault and measure the resistance correctly with a declared error as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 110 V DC.



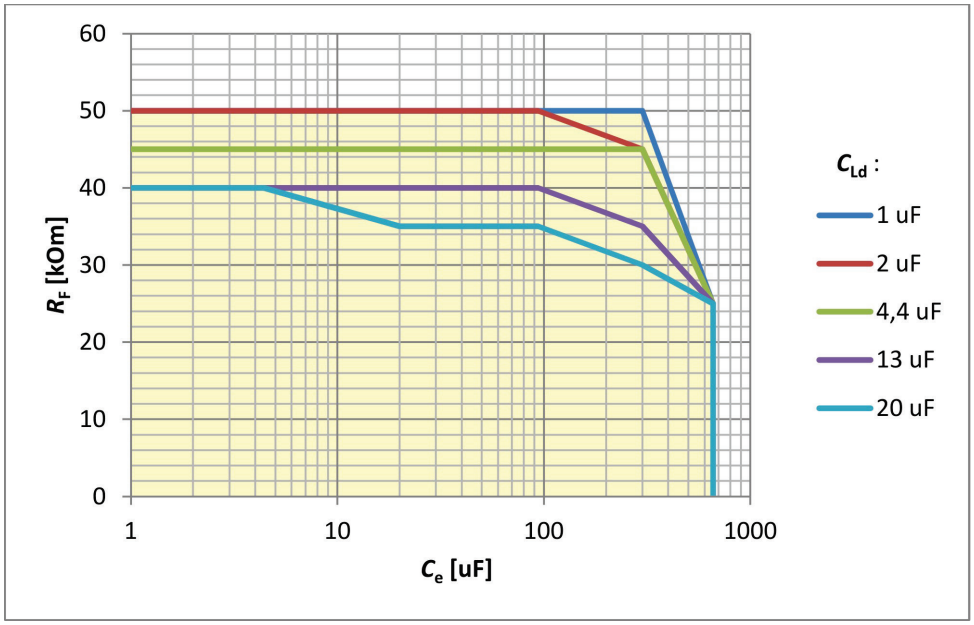
Graph 10.4. Range of allowable earth fault resistance for which the locating unit will locate the earth fault correctly as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 110 V DC. Measured resistance may exceed the declared measurement error.



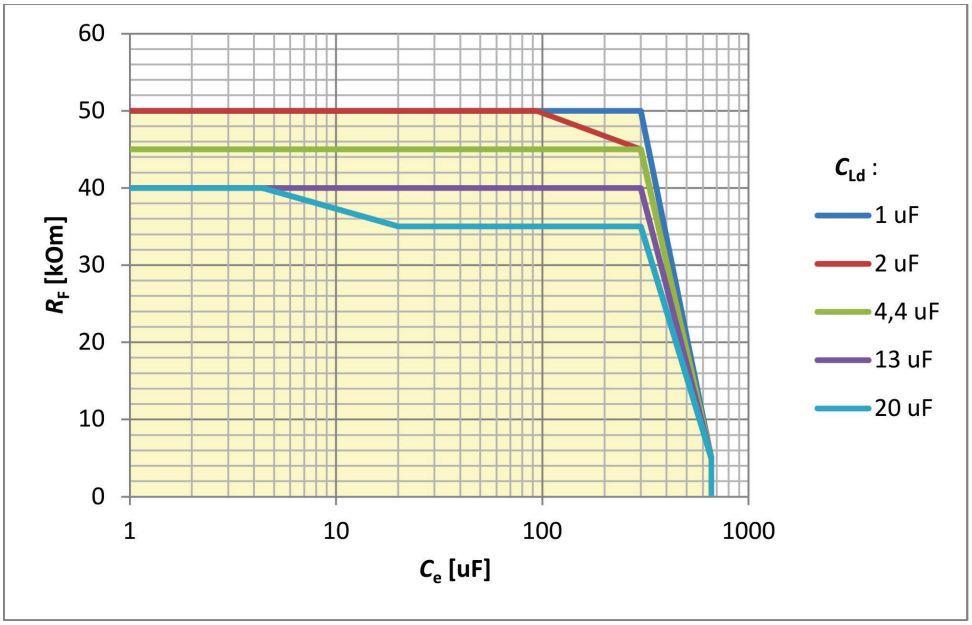
Graph 11.5. Range of allowable earth fault resistances for which the locating unit will locate the earth fault and measure the resistance correctly with a declared error as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 48 V DC.



Graph 11.6. Range of allowable earth fault resistance for which the locating unit will locate the earth fault correctly as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 48 V DC. Measured resistance may exceed the declared measurement error.



Graph 11.7. Range of allowable earth fault resistances for which the locating unit will locate the earth fault and measure the resistance correctly with a declared error as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 24 V DC. .



Graph 11.8. Range of allowable earth fault resistance for which the locating unit will locate the earth fault correctly as a function of system capacitance C_e including capacitance after the measuring transformer C_{Ld} for network voltage of 24 V DC. Measured resistance may exceed the declared measurement error.

12. SCOPE OF SERVICES PROVIDED BY THE MANUFACTURER.

The manufacturer provides support in designing of switchgears using KDZ-3. We have ready-to-use **project outlines**. The manufacturer supplies the KDZ-3 earth fault control and location system configured as agreed, takes care of the equipment during the warranty period and ensures full service after its expiry. The manufacturer also provides services in scope of designing new and revamping existing switchgears, including inventory taking of the circuits and on-site installation of the supplied equipment.

Should you have any questions or doubts, please call us.

13. HOW TO ORDER.

When placing the order please use the device code specified in the "**Order form"**.

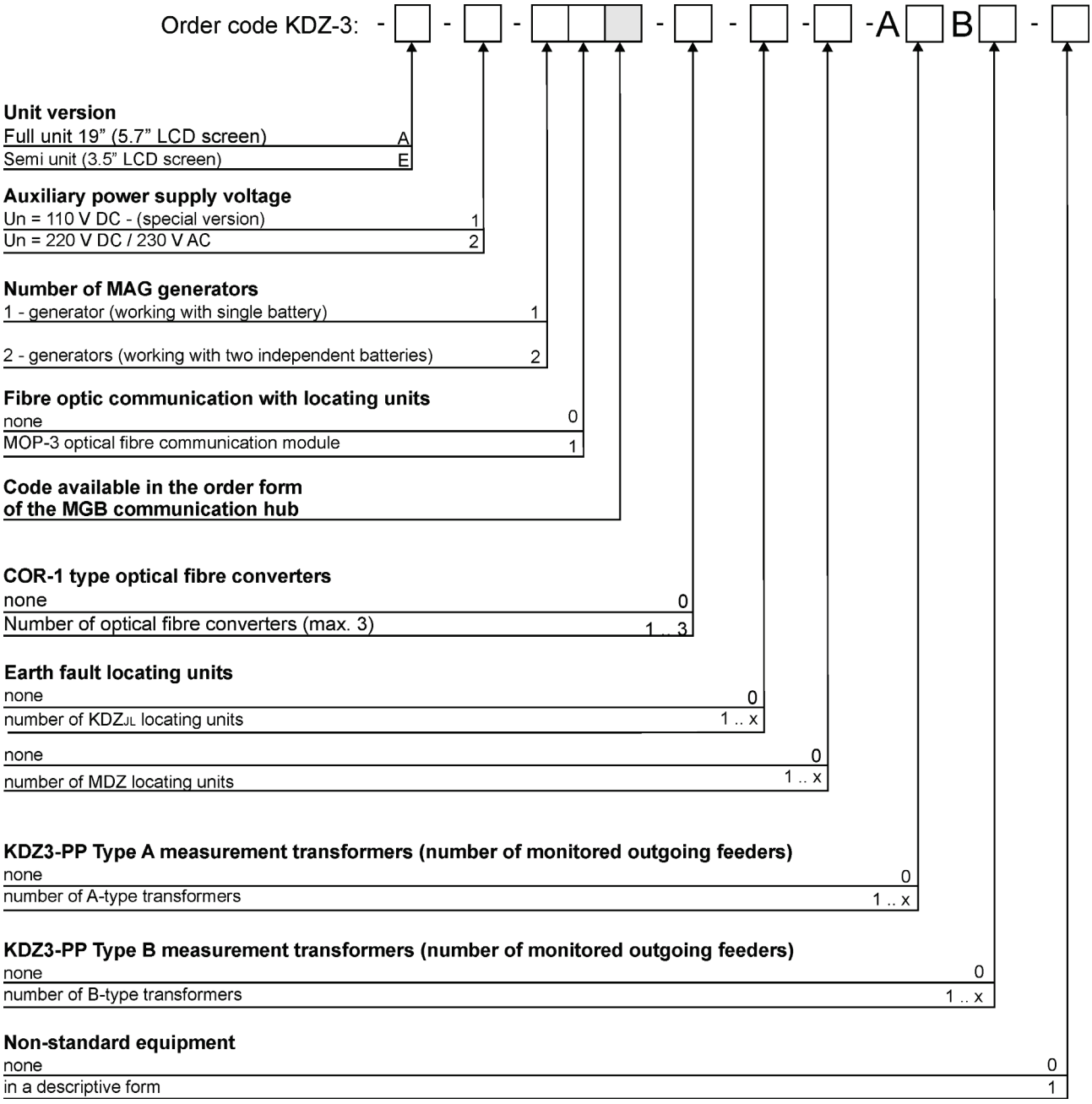
Example of an order code: **KDZ3-X-2-21K-1-30-0-A200B0-0**

A– Full width unit (5.7" display)
-
2 - Auxiliary power supply voltage **220 V DC**
-
2 – Number of MAG cards (number of sections)

1 – Current optical communication module with remote **MOP3** locating units

K – **MGB-9K** version of the communication module
-
1 – Number of opto-RS485 **COR-1** converters
-
30 – Number of **KDZ3JL** locating units
-
0 – Number of **MDZ** locating modules
-
A
200 – Number of **KDZ3PP** type **A** instrument transformers (number outgoing feeders)
B
0 – Number of **KDZ3PP** type **B** instrument transformers (number of outgoing feeders)
-
0 – Without non-standard equipment.

Order form:


Order code KDZ-3: - □ - □ - □□□ - □ - □ - □ -A□B□ - □
Unit version
Full unit 19" (5.7" LCD screen) A
Semi unit (3.5" LCD screen) E
Auxiliary power supply voltage
Un = 110 V DC - (special version) 1
Un = 220 V DC / 230 V AC 2
Number of MAG generators
1 - generator (working with single battery) 1
2 - generators (working with two independent batteries) 2
Fibre optic communication with locating units
none 0
MOP-3 optical fibre communication module 1
Code available in the order form
of the MGB communication hub
COR-1 type optical fibre converters
none 0
Number of optical fibre converters (max. 3) 1 .. 3
Earth fault locating units
none 0
number of KDZJL locating units 1 .. x
none 0
number of MDZ locating units 1 .. x
KDZ3-PP Type A measurement transformers (number of monitored outgoing feeders)
none 0
number of A-type transformers 1 .. x
KDZ3-PP Type B measurement transformers (number of monitored outgoing feeders)
none 0
number of B-type transformers 1 .. x
Non-standard equipment
none 0
in a descriptive form 1

Order form of the MGB communication hub:

Order code KDZ-3: - ☐ - ☐ - ☐☐☐ - ☐ - ☐ - ☐ -A☐B☐ - ☐

Communication

Version A
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol — A

Version B
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
GPS clock, SMA antenna connector — B

Version C
Ethernet connection, RJ45 connector – IEC 870-5-103 / ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
GPS clock, SMA antenna connector — C

Version D
Ethernet connection, RJ45 connector – IEC 870-5-103 / ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
3 sets of optical fibre connections, ST connectors – IEC 870-5-103 / ZP-6 protocol — D

Version E
Ethernet connection, RJ45 connector – IEC 870-5-103 / ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
2 RS485 connections, Phoenix 8x5.08 – IEC 870-5-103 / ZP-6 protocol — E

Version F1
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
Ethernet connection, RJ45 connector – IEC 870-5-103 / ZP-6 protocol/WWW server
2 optical fibre connections, SC connectors – IEC 61850 protocol/WWW server — F1

Version G
Ethernet connection, RJ45 connector – IEC 870-5-103 / ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol — G

Version H
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
Single mode optical fibre connection, ST connectors – IEC 870-5-103/ZP-6 protocol — H

Version J
Ethernet connection, RJ45 connection – IEC 870-5-103 / ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
USB connection, USB-B connector – IEC 870-5-103 / ZP-6 protocol
2 RS485 connections, 3x3.5 Wago connector – IEC 870-5-103/ZP-6 protocol — J

Version K
Ethernet connection, RJ45 connection – IEC 870-5-103/ZP-6 protocol
RS232 connection, DB9 connector – IEC 870-5-103/ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103/ZP-6 protocol
GPS clock, SMA antenna connector
GSM connection, SMA antenna connector, SIM card socket — K

Version F1/L
RS232 connection, DB9 connector – IEC 870-5-103/ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103/ZP-6 protocol
2 Ethernet connections, RJ45 connection – IEC 870-5-103/ZP-6 protocol/WWW server
2 optical fibre connections, SC connectors – IEC 61850 protocol/WWW server
GPS clock, SMA antenna connector
GSM connection, SMA antenna connector, SIM card socket — F1L

Version B-WEB
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
GPS clock, SMA antenna connector
2 Ethernet connections, RJ45 connector – IEC 870-5-103/ZP-6 protocol/WWW server
2 optical fibre connections, SC connectors – IEC 61850 protocol/WWW server — BWEB

Version D-WEB
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103 / ZP-6 protocol
2 Ethernet connections, RJ45 connector – IEC 870-5-103/ZP-6 protocol/WWW server
2 optical fibre connections, SC connectors – IEC 61850 protocol/WWW server — DWEB

Version E-WEB
RS232 connection, DB9 connector – IEC 870-5-103 / ZP-6 protocol
Optical fibre connection, ST connectors – IEC 870-5-103/ZP-6 protocol
1 RS485 connection, Phoenix 8x5.08 – IEC 870-5-103/ZP-6 protocol
2 Ethernet connections, RJ45 connector – IEC 870-5-103/ZP-6 protocol/WWW server
2 optical fibre connections, SC connectors – IEC 61850 protocol/WWW server — EWEB

KDZ-3

OFFER

Busbar protections and breaker failure protections type TSL-9r, TSL-11

Auxiliary and signalization relays

Reserve Central Signalling System type MSA-9, MSA-12, MSA-24

Protection relays type AZT-9, APP-9

Disturbance recorder RZS-9

Energy measurement system and event recorder ZRZ-28

Load Resistors for measuring transformers

DC and AC auxiliary power supply switchgears

Cubicle-contained sets of control and supervision protections

Modular power supplies, measuring suitcases, measuring and registering system RFQ-8

PROFIL-L cubicles

Periodical and post-failure tests, as well as repairs and overhauls of busbar protections TSL

Servicing, strting-up and post assembly tests

RE line® ENERGETIC STANDARDS

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

RKU-1, RKS-1 - final controlling

LZ-1, LZ-2 - operation counters

RPZ-1 - supply source switching

GPS-1 - time synchronisation

MDD-6, MDS-12 - Diode modules

PH-XX, PS-XX - Modules of switches, pushbuttons and control lamps

Relay racks

www.zprae.pl

ZPrAE Sp.z o.o.

ZAKŁAD PRODUKCYJNY APARATURY ELEKTRYCZNEJ
Sp. z o.o. 41-100 Siemianowice Śląskie, ul. Marii Konopnickiej 13
tel: 32 22 00 120; fax: 32 22 00 125; e-mail: biuro@zprae.pl