USER MANUAL

iZAZ600

CONTENTS

1. MANUFACTURER'S NOTES.

1.1. General safety rules.

Warning

During operation of the device, some of its parts may be live with dangerous voltage. Improper or inappropriate use of the device can pose a danger to operators, and risks damaging the device. Installation and operation of the device can only be performed by properly trained personnel.
Proper and fault-free device operation requires proper transportation, storage, assembly, installation and start-up, as well as proper operation, maintenance and service.

The device, which is the subject of this manual, is designed and manufactured for industrial use.

1.2. List of adopted standards.

In the development and production process, compliance with standards was adopted to ensure the implementation of the established safety policies and measures, provided that the user adheres to the guidelines for installation, start-up and operation.

The device complies with the essential requirements set out in the Low Voltage (LVD2006/95/EC) and Electromagnetic Compatibility (EMC2004/108/EC) directives, through compliance with the following standards

Standard number	Standard title
PN-EN 60255-5:2005	Power relays. Measurement relay and protection device insulation coordination.
PN-EN 60255-27:2006	Measurement relays and protection devices. Part 27: Product safety requirements.
PN-EN 60255-26:2010	Measurement relays and protection devices. Part 26: Electromagnetic compatibility requirements.
PN-EN 60529:2003	Protection levels provided by enclosures (IP Code).

Related standards

1. PN-EN 60255-1:2010 – Power relays.

   Measurement relays and protection devices.
2. PN-EN 60255-8:2000 – Power relays -- Electrical thermal relays.
3. PN-EN 60255-21-1:1999 – Power relays. Testing the resistance of measurement relays and protection devices to vibration, single and multiple shocks, and seismic shocks. Testing the resistance to vibration (sinusoidal).
4. PN-EN 60255-21-2:2000 – Power relays. Testing the resistance of measurement relays and protection devices to vibration, single and multiple shocks, and seismic shocks. Testing the resistance to single and multiple impacts.

5. PN-EN 60255-21-3:1999 – Power relays. Testing the resistance of measurement relays and protection devices to vibration, single and multiple shocks, and seismic shocks. a. Testing the resistance to single and multiple impacts.
6. PN-EN 60255-22-1:2009 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to oscillating strokes with a frequency of 1 MHz.
7. PN-EN 60255-22-2:2010 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to disturbances from electrostatic discharges.
8. PN-EN 60255-22-3:2009 – Testing the resistance to electrical disturbances. Testing the resistance to radiated electromagnetic fields.
9. PN-EN 60255-22-4:2010 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to high-speed transient disturbances.
10. PN-EN 60255-22-5:2005 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to shock waveforms.
11. PN-EN 60255-22-6:2004 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to disturbances from radio frequency electromagnetic fields.
12. PN-EN 60255-22-7:2005 – Power relays. Testing the resistance of measurement relays and protection devices to electrical disturbances. Testing the resistance to mains frequency disturbances.
13. PN-EN 60255-25:2002 – Power relays. Testing the electromagnetic disturbances emitted by measurement relays and protection devices.
14. PN-EN 60255-151:2010 – Power relays. Measurement relays with one power supply value, with independent operation time.
15. PN-IEC 255-11:1994 – Power relays. Decays and alternating components of auxiliary DC supply values of measurement relays.
16. PN-IEC 255-12:1994 – Power relays. Angular relays and bipower relays.
17. PN-IEC 255-16:1997 – Power relays. Impedance measurement relays.
18. PN-EN 61810-2:2007 – Electromechanical intermediate relays. Part 2: Reliability.
19. PN-EN 61733-1:1999 – Measurement relays and protection devices. Protection communication interfaces. General provisions.

1.3. Storage and transport.

The devices are packaged in individual shipping boxes to protect them from damage during transport and storage. The devices should be stored in transport packages, in closed rooms, free from vibrations and direct atmospheric impacts, dry, ventilated, free from harmful vapors and gases. The ambient air temperature should not be lower than -25°C or higher than +70°C, and the relative humidity should not exceed 80%.

1.4. Installation site.

The devices should be operated in dry rooms, free of dust and explosive, flammable and chemically active gases and vapors, where mechanical exposures occur to a to a moderate degree. The altitude of the installation site should not exceed 2,000m above sea level at an ambient temperature of -20°C to +55°C and a relative humidity of not more than 80%.
The cassette of the iZAZ600 assembly is grounded by connection to the mounting frame, which must be properly grounded, the contact surfaces should be free of paint and dirt and properly protected against corrosion. In case of doubts about the connection quality, an additional grounding wire in the form of the shortest possible copper braid with a minimum width of 20 mm should be used to ground the assembly's cassette.

1.5. Consumables.

In the iZAZ600 series devices, a CR2032 type lithium battery is used in the MLB-12 module to support data in the memory (events recorder, disturbance recorder, meters). The battery should be replaced after 10 years of use or if the sum of the device shutdowns exceeds 4 years.
Earlier battery replacement should occur if the device loses its memory contents (including time and date) due to a loss of auxiliary power supply voltage.
Battery state is not monitored. The battery was placed in a cradle mounted in the module. The battery can be accessed by removing the module from the housing.
When replacing it, special attention should be paid to the correct polarity of the battery, and activities related to its replacement, with the auxiliary voltage disconnected, should be performed by authorized persons.

1.6. Additional equipment.

- Technical and operational documentation.
- Measurement protocol.
- Warranty card.
- Installation version of iZAZ Tools software on CD.
- USB A/B cable for communication with the device.
- Plug connector set (number depends on the hardware variant) for connecting external circuits.

1.7. Disposal.

The device is made mostly of materials that can be recycled or disposed of without threat to the environment. A decommissioned device may be taken back by the manufacturer, provided that its condition corresponds to normal wear and tear. All components that are not regenerated will be disposed of in an environmentally friendly manner.

1.8. Warranty and service.

The warranty period is 24 months from the date of sale. If the sale was preceded by a contract signed by the Buyer and Seller, the provisions of this contract shall apply.
The warranty covers the free removal of defects, revealed during the device's use, subject to the conditions specified in the warranty card.

ZAZ-En sp. z o. o. provides warranty subject to the following conditions:

- installation and operation of the device should be carried out in accordance with the recommendations provided in the user manual,
- the device housing must not show signs of mechanical damage,
- an original warranty card is provided with the device.

THE WARRANTY DOES NOT COVER:

- damage caused by improper transportation or storage,
- damage resulting from improper installation or operation,
- damage caused by manipulation inside the device, structural changes, alterations and repairs carried out without the manufacturer's consent,
- cables, cells, measurement electrodes, fuses, light bulbs and other life-limited items listed in the manual.

TIPS FOR BUYER:

- proper and fault-free operation of the device requires proper transportation, storage, installation and start-up, as well as proper operation, maintenance and service,
- device operation should be carried out by properly trained and authorized personnel,
- when filing a complaint, specify the reason for the complaint (symptoms related to the malfunction of the device) and the assembly's factory number,
- after receiving confirmation of complaint acceptance, send the complained device together with the warranty card to the manufacturer's address,
- warranty period shall be extended by the time of handling a recognized complaint.

1.9. Software update.

Due to the continuous development and operational experience, the internal device software may be modified by the Manufacturer.
In such cases, the software can be updated during periodic maintenance or service activities, or at the customer's request.

The manufacturer keeps records of software updates.
Information on this subject can be obtained by sending data on the device's factory number. The software version is stored in the device's memory and can be read via the iZAZ Tools operating program or via the operator panel.

Also, it is recommended to update the iZAZ Tools software to operate the device via a PC.

The versions of the internal software (firmware) and the iZAZ Tools program are monitored and deviations from their mutual compatibility are signaled with an appropriate message when attempting to upload the configuration to the device.

2. DEVICE CHARACTERISTICS

The iZAZ600 devices are a series of high-power, multi-functional, communication-enabled digital protection automation assemblies with up to 48 measurement inputs. These devices, characterized by high accuracy and reliability, can work in automation systems as comprehensive protection for generators operating directly on busbars and generator-transformer blocks.
In addition to protection and automation functions, the devices perform measurement, recording, emergency control and signaling. Four serial ports in different physical configurations (RS-485, fiber optic), a wired or fiber optic LAN link, and a USB port on the operator panel can be used to communicate with the assembly.
The modular design provides the opportunity to optimally adapt the hardware configuration to the requirements of the protected object. The 7" color touchscreen display provides a clear presentation of the field's synoptic layout along with the necessary measurements and additional information. Freely programmable operating logic, using a graphical editor, enables a clear and transparent way to implement a variety of applications, both typical and dedicated, including specific requirements for a particular object. The field controller allows control of the breaker and couplers with the required functional interlocks.
Maintaining hardware-software versatility enables reconfiguration and adaptation to a variety of objects in a simple and intuitive way. The application base developed by the manufacturer provides the possibility of using default solutions. Moreover, it is possible to make changes to the configuration, considering the specifics of the protected object and user needs. Configuration modification can include the addition of implemented protection functions or automations, as well as the change of logic-time dependencies (including the control of panel LEDs, display signaling, control of signaling relays and the emergency control).

2.1. Configuration.

The device's mode of operation is uniquely determined by the device's hardware and software configuration. The hardware configuration is selected by the User at the stage of ordering the device, its change after device production is possible only by modifying the layout of the modules after consultation with the Manufacturer.
The software configuration must be associated with the hardware configuration, but its various variants can be replaced in the device after the end of the production process. The software configuration is represented by a series of functions connected with each other by logic-time dependencies.
An important advantage of the device is the graphic configuration presentation, which enables clear visualization of the connection circuit. The logic schemes are grouped into sheets, for easy navigation between them.

The configuration includes the following types of functions:

- source channels (physical signals of currents, voltages and other analog values measured via the A/D converter),
- estimates (digital filters),
- measurements,
- relays (protection functions),
- logic (functions like AND, OR, timers, flip-flops),
- meters (energy meters, PKW and logical binary signals meters, such as tripping protection),
- automations (SPZ, SPZpoSCO, SCK, SZR, SPP, APZ, LRW, ZS),
- two-state inputs (physical and virtual),
- two-state outputs (physical and virtual),
- events (binary signals to the events and disturbance recorder).

A flexible approach to configuration design enables the implementation of a variety of applications tailored to customer needs and requirements.

2.2. Protection and automation set.

Table 1

No.	Protection name	TYPE	ANSI
1.	Overcurrent	I>	50/51
2.	Overcurrent, overload, dependent	Ip>inv	51
3.	Overcurrent, peak (wide frequency range)	Im>	50/51
4.	Overcurrent, dependent	IR>inv	49R
5.	Overcurrent, thermal	Ic>inv	49M
6.	Overcurrent, negative component	IA>	46
7.	Overcurrent, negative component, dependent	IA>inv	46
8.	Overvoltage	U>	59
9.	Overvoltage, peak (wide frequency range)	Um>	59
10.	Undervoltage	U<	27
11.	Overvoltage, zero-sequence component	Uo>	59N
12.	Overvoltage, negative component	UA>	47
13.	Undervoltage, positive component	U1f<	27D
14.	Overcurrent, earth fault	Io>	50N/51N
15.	Overcurrent, earth fault, dependent	Io>inv	51N
16.	Earth fault, directional (MV)	IoKs>	59N/67N
17.	Earth fault, admittance, non-directional	Yo>	21N
18.	Earth fault, admittance, directional (0–90)°, capacitive	YoK>	21N
19.	Frequency	f	81H/81L
20.	Frequency, steepness	df	81S
21.	Frequency, incremental	Δf	81SA
22.	Frequency-voltage from overexcitation	Uf>inv	24
23.	Power, from reverse power	P>	32R
24.	Power, from power shedding	P<	32L
25.	From incorrect order of spinning phases	Usp>	47
26.	From loss of generator excitation	Zuw<	40/27
27.	Underimpedance, circular	Z<	21
28.	From switching on a non-excited generator	Inw>	50/27
29.	Differential of generator, transformer, block	ΔI>	87G/87T/87B
30.	Differential of lines (two-and-a-half-complete)	ΔIL>	87L
31.	Distance (five-zone polygonal or circular)	Zdist<	21
32.	Short circuit locator function	LMZ	
33.	Power swing detection function	PS	68/68T
34.	Earth fault, differential REF (I_{L1}+I_{L2}+I_{L3} - 3Io)	ΔIo>	64REF
35.	Rotor earth fault from the first earth fault	Zw<	64R
36.	Rotor earth fault from the second earth fault	Zw2<	64R2
37.	Stator earth fault 100% (3h difference)	U1f>(3h)	64S
38.	Stator earth fault 100% (injection)	Uinj	64S
39.	From synchronism loss / pole slipping	Zpb<	78
40.	tgφ power factor control function	tg>	55
41.	Automatic frequency relief automation	SCO	
42.	Local breaker reserve automation	LRW	50BF
43.	Synchronism control function	SCK	25

The automation and protection set depends on the analog channel configuration and is limited by the maximum number of iZAZ600 software configuration objects.

2.3. Auxiliary protection circuits.

2.3.1. 64R rotor earth fault protection (from single short circuits)

The iZAZ600 enables the implementation of rotor earth fault protection using a 50 Hz measurement signal injection circuit via the iZAZ-FRC filter circuit.

iZAZ-FRC used as a protection module from a single earth fault made based on the circuit forcing of the 50 Hz alternating component in the circuit: excitation voltage - ground. The excitation voltage negative potential and the brush potential on the generator shaft are used.
If there is no brush on the shaft, it is possible to use the potential of the ground near the generator. Based on the Uw1, Uw2 measurement signals in the iZAZ600, the system impedance vector is measured, which is the criterion value for the 64R protection implemented in the protection assembly.

The iZAZ-FRC requires the connection of 230 V AC 50 Hz supply voltage (terminals 1–2). Through an isolation transformer, a voltage of 100 V AC is generated and injected into the circuit between the negative potential of the excitation voltage and the rotor grounding brush (terminals 4–5). Impedance vector measurement is performed using two analog voltage paths in the iZAZ600 assembly AU2 module (Uw1, Uw2).

The following shows the connection of the override and measurement signals to the iZAZ600:

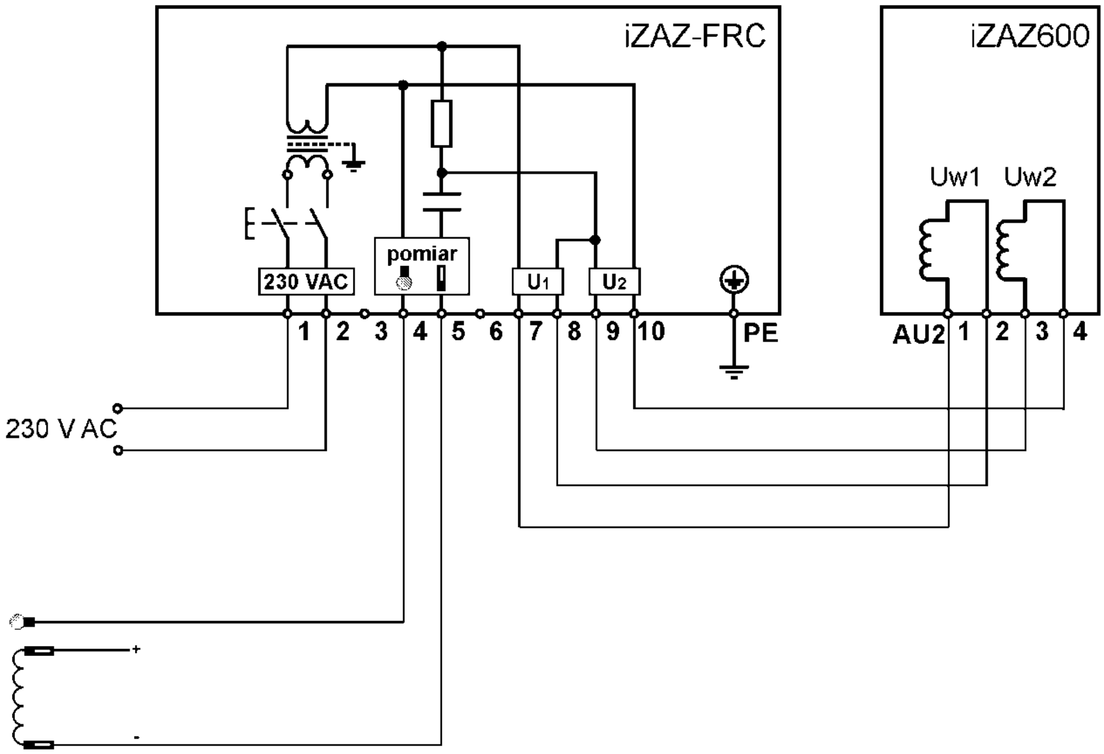


Fig. 1. Connection of iZAZ600 override circuit and measurement signals of 64R rotor earth fault protection

Dimensional sketch - installation on the TS-35 bus.

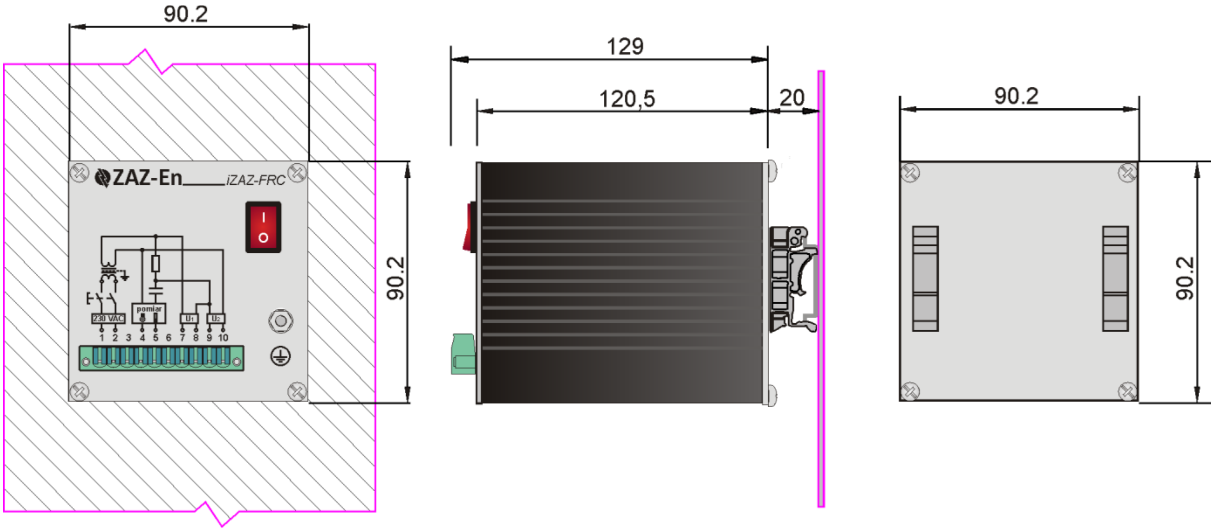


Fig. 2. iZAZ-FRC dimensions and installation

The iZAZ600 assembly implements the Zw< function as a protection that reacts to single earth faults in the excitation circuits and to decrease in the insulation resistance of the generator excitation circuits. Two protection levels are provided for in the algorithm:

- 64R.1 - signaling module,
- 64R.2 - shutdown module.

In addition, the function implements the 64R.3 measurement circuit continuity check using a full-impedance function to detect discontinuity in the measurement circuit.

Operation description

The function is implemented on the impedance plane, where the criterion values are the resistance (R) and reactance (X) components of the impedance vector.

The criterion value is the insulation resistance of the rotor winding and the galvanically connected circuits. Ground insulation resistance is measured in a measurement circuit in which the current flow is forced by 50 Hz AC voltage from an external source using an iZAZ-FRC filter. The iZAZ600 protection assembly uses two voltage paths. The algorithm includes compensation for the excitation circuit capacitance, thus allowing resistance monitoring.

The function can detect the loss of auxiliary measurement voltage and the lack of measurement circuit continuity. Also, the function allows the derivation of resistance and reactance measurements after considering the compensation algorithm.

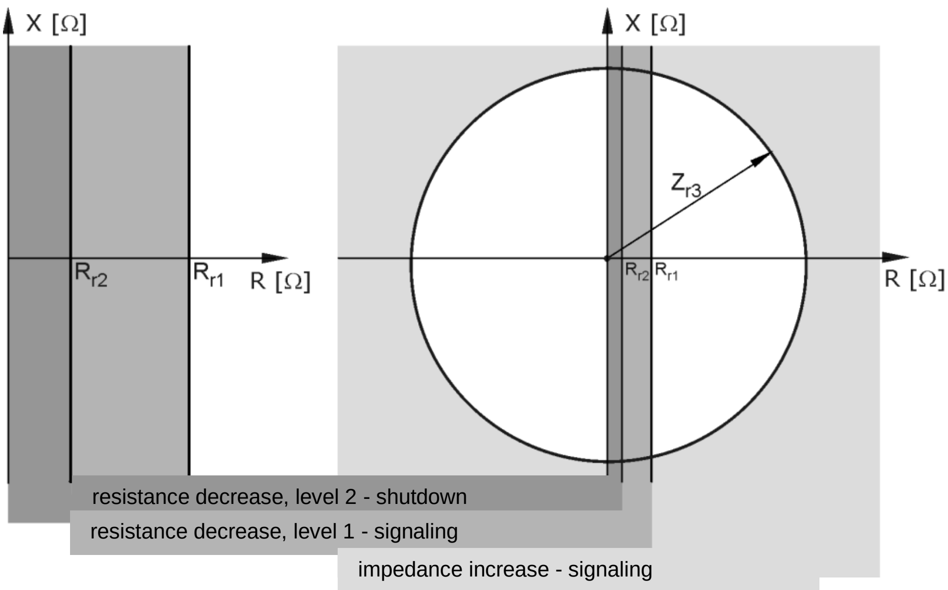


Fig. 3. Start-up characteristics of the function from earthing in the excitation system

Settings table

Setting	Description	Setting range	Default value
R_{r1}	Signaling level start-up resistance	(50÷ 15,000)Ω in 1 Ω increments	5,000 Ω
R_{r2}	Shutdown level start-up resistance	(50÷ 15,000)Ω in 1 Ω increments	1,000 Ω
Z_{r3}	Start-up impedance of signaling discontinuity in the measurement circuit	(15,000 ÷ 50,000)Ω in 1 Ω increments	30,000 Ω
t_1	Signaling module trip time delay	(0.00÷300.00) s in 0.01 s increments	10.00 s
t_2	Shutdown module trip time delay	(0.00÷300.00) s in 0.01 s increments	1.00 s
t_3	Trip time delay of the continuity check module in the measurement circuit	(0.00÷300.00) s in 0.01 s increments	10.00 s
k_p	return factor	(1.01÷1.20) in 0.01 increments	1.10
ON/OFF	Function activity	(ON / OFF)	ON
W	Operation on shutdown	(ON / OFF)	ON

Parameters:
Own time $t_w < 100$ ms
Permissible error $\delta_{\%} = \pm 2.5\%$ (for the 1μF capacity, additional error ± 2.5%)

2.3.2. 64R2 rotor earth fault protection (from double short circuits)

For technological reasons, some generations allow short-term operation of the generator with a single earth fault in the excitation circuit. In such a case, it is necessary to use protection to detect a second earth fault, dangerous for the generator. For generators that have a structurally grounded rotor (in the middle of the winding), such protection is necessary.

In the iZAZ600 assembly, it is possible to implement responsive protection at the occurrence of a second earth fault in the excitation circuit, but it is used occasionally.

In addition to the measurement signals used by the above-described protection that reacts at the first earthquake in the excitation circuit, it is necessary to connect the plus potential of the excitation voltage to the assembly. Based on the supplied signals in the iZAZ600 assembly, two additional voltages are measured - positive and negative excitation voltage in relation to the ground potential (from the brush on the generator shaft).
Until the detection of the first earth fault (tripping of the 64R.2 protection), the protection circuit from the second earth fault is blocked.
After detecting an earth fault by the 64R.2 protection, the procedure of digital calibration of the measurement signals U13, U12 is performed and the protection module from the second earth fault is started automatically. By monitoring both voltages, the iZAZ600 is able to detect the occurrence of a second earth fault and shut down the generator.
The first earth fault protection circuit, which uses an auxiliary 50 Hz measurement signal, is constantly on and keeps pace with the single earth fault state. In case of spontaneous disappearance of the earth fault cause, the protection from the second earth fault will be automatically interlocked.
The algorithm is based on controlling two excitation voltages in relation to the system's earthing point.
The function controls the rms values of both voltages. Under normal conditions, reference potentials will only close through capacitances. The sum of these voltages should produce the excitation voltage.
After the earth fault is detected by the Zw< function (64R1.2 - the signal should be brought to the activation input), the U12 and U13 voltage values will change depending on the first earth fault point. The nature of the phenomenon means that the measured voltages are not constant, but if the first earth fault point is stable the excitation voltage is divided in the appropriate ratio, depending on the earth fault point. For example, with an earth fault in the middle of the winding, the voltages will be equal. The 64R1.2 function operation activates the 64R2 function calibration process. It involves verifying that each voltage is stable within a set time period (calibration time) within a set range (calibration precision).

If, after the set time, the difference in signal fluctuations is below the set value, the function starts operating. Another earth fault causes a change in the measured voltages and a deviation from the calibration point at the first earth fault. The start-up value is the percentage change in voltage division; if it exceeds the set value the function will be activated, and tripping will occur after the set time.
Also, via the undervoltage criterion, the measured voltage sum is controlled. If the voltage value decreases below the set value (U_{gr}), the function operation is blocked.

The circuit connection scheme from single and double earth fault in the excitation circuit is shown below.

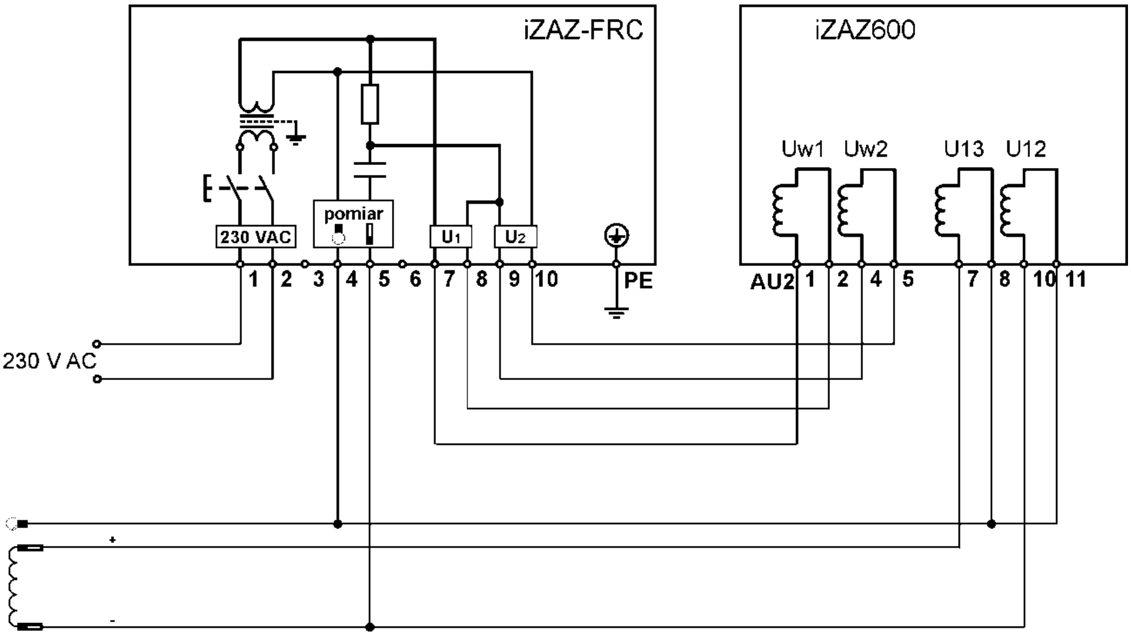


Fig. 4. Connection of the override and measurement signals of iZAZ600 64R2 second rotor earth fault protection

Settings table

Setting	Description	Setting range	Default value
U_{gr}	Minimum excitation voltage value	(0.010÷1.000) Un in 0.001 Un increments	0.060 Un
U_r	Inrush voltage (percentage change in calibration distribution)	(0.1÷30.0)% in 0.1% increments	2.0%
U_{kalib}	Calibration precision	(0.010÷0.200) Un in 0.001 Un increments	0.050 Un
t_z	Trip time delay	(0.00÷100.00) s in 0.01 s increments	1.00 s
t_{kalib}	Calibration time (voltage distribution values determination time)	(0.01÷10.00) s in 0.01 s increments	0.50 s
k_p	return factor	(1.00÷1.20) in 0.01 increments	1.10
ON/OFF	Function activity	(ON / OFF)	ON
W	Operation on shutdown	(ON / OFF)	ON

Parameters:

Own time $t_w < 100$ ms

Permissible error $\delta_{\%} = \pm 2.5\%$

2.3.3. 100% stator earth fault protection with measurement signal injection.

Earth fault short circuits in generator stator circuits are one of the types of disturbances most commonly found in the operation of generating blocks. To decrease the earth fault current value and the associated risk of stator core iron damage, the generator neutral point is usually isolated from the ground. However, such a circuit is very sensitive to ferroresonant overvoltages. Therefore, the circuit is often grounded by a significant impedance (e.g., R=1,000 Ω). It limits the earth fault currents in the generator stator windings to very small values, which also depend on the earth fault capacitance of the block circuits, in particular: the capacitance of the generator stator windings, the lower voltage winding of the block transformer and the additional capacitances installed on the generator breaker poles.

The primary earth fault protection for the generator stator is zero-voltage protection (59N or 59GN), which measures the zero-sequence component using a voltage transformer at the generator's neutral point or terminals. However, it is not able to protect the stator windings in their entirety.
Coverage of 100% of the stator windings is implemented by supplementing the 59N protection with a function that responds to earth faults near the neutral point. This is usually done in two ways: using protection that responds to the third voltage harmonic, or using protection that introduces an additional signal into the system at a frequency lower than the grid frequency. Such protections cover 100% of the stator windings, only when they perform together with 59N protection, as they are too slow on their own or have their own dead zones.
Stator earth fault protection that responds to the third voltage harmonic has a number of disadvantages, related to the variability of the circuit parameters depending on the current load and the generator breaker state. Also, such protection with its operating zone covers only a portion of the stator winding near the generator neutral point - it cannot detect earth faults in the center of the stator winding or at the generator terminals. It also does not work on an unexcited generator. The resistor in the generator's zero is also a major limitation. The above disadvantages are not present in stator earth fault protection, which uses an additional measurement signal with a frequency lower than the grid frequency. Such protection is commonly referred to as earth fault protection with injection.

In the iZAZ600 assembly, it is possible to implement comprehensive generator stator earth fault protection, covering 100% of the windings, using the independent iZAZ-INJ protection, injecting an auxiliary measurement signal of decreased frequency. This device, being both a measurement signal generator and a protection system, individually implements 100% stator earth fault protection. However, there is the possibility of collaboration, via the Z131 fiber-optic link, for the transmission of current criterion values and redundancy of the protection algorithm in the iZAZ600 assembly. The redundant mode of operation involves the implementation of a sub-criteria function, based on resistance measurement, not only in the iZAZ-INJ, but in parallel in the iZAZ600 assembly. Such a solution also has the advantage of allowing the recorders to be used in a common protection system to record activations, trippings and changes in the analog value, which is the estimate of resistance seen from the terminals of the grounding point.

For a detailed description of the iZAZ-INJ device and the iZAZ-INT attachment, see: 5000.51.07.00.Fx.001 iZAZ-INJ data sheet.

The connection of the iZAZ-INJ is shown below:

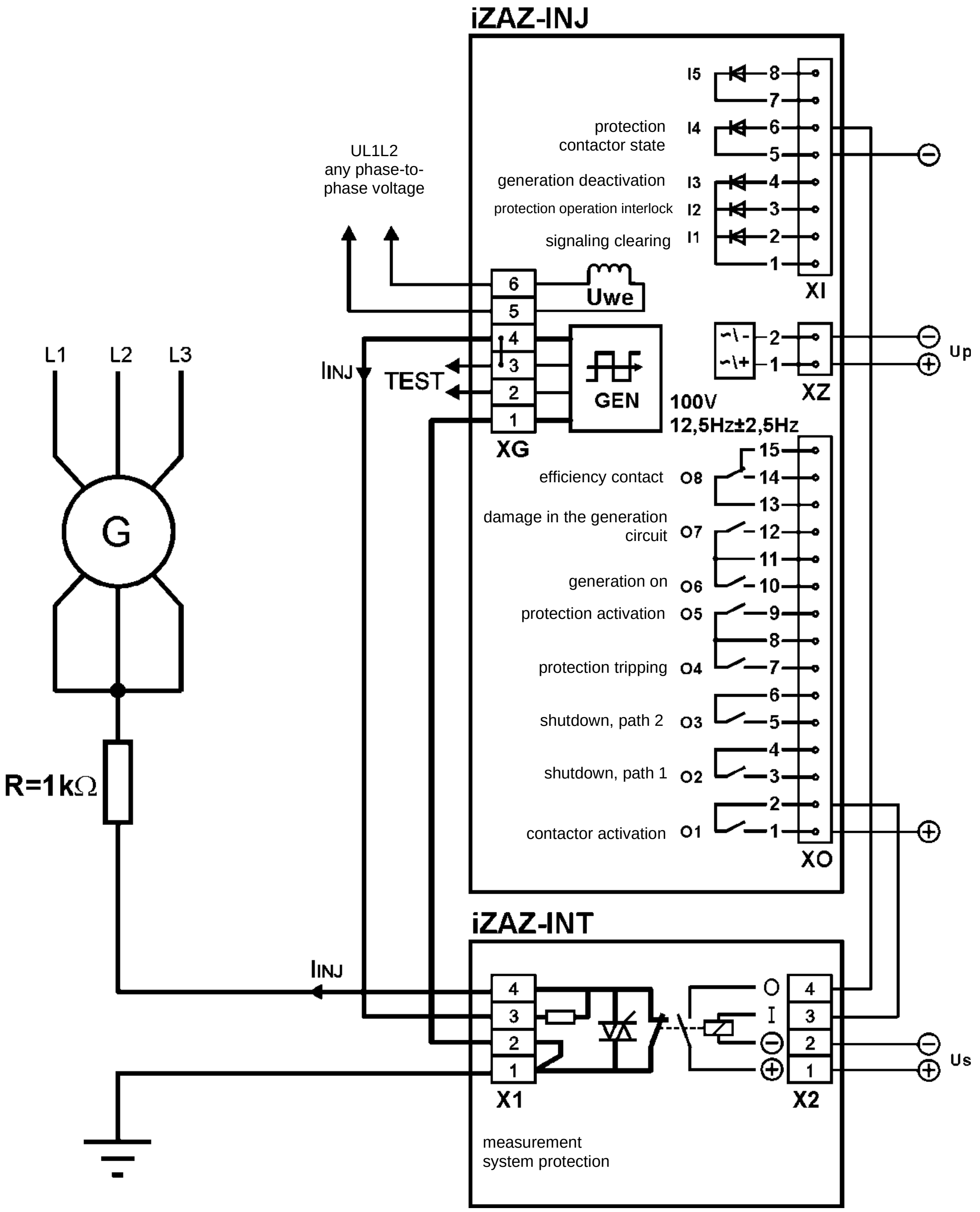


Fig. 5. Connection of stator earth fault protection external circuits with iZAZ-INJ 64S stator earth fault protection circuit.

Protection implemented directly in the iZAZ-INJ device, and via the iZAZ-INJ/COM1 - iZAZ600/Z43 - 820 nm multimode fiber - ST connectors - OM1(62.5/125µm), OM2, OM3, OM4(50/125µm) in accordance with PN-EN 60793-2: 2016-09, measurements of current at generator zero, generator voltage, as well as resistance estimates and activation and tripping states of earth fault protection are transmitted. Protection operation states can also be transmitted via output contact circuits and two-state inputs.

Settings table

Setting	Description	Setting range	Default value
R_{r1}	Signaling level start-up resistance	(0.1÷ 30.0) kΩ in 0.1 kΩ increments	10.0 kΩ
R_{r2}	Shutdown level start-up resistance	(0.1÷ 30.0) kΩ in 0.1 kΩ increments	1.0 kΩ
t_1	Signaling module trip time delay	(0.00÷300.00) s in 0.01 s increments	10.00 s
t_2	Shutdown module trip time delay	(0.00÷300.00) s in 0.01 s increments	1.00 s
k_p	Return factor	(1.10÷2.00) in 0.01 increments	1.20
ON/OFF	Function activity	(ON / OFF)	ON
W	Action on shutdown from the second level	(ON / OFF)	ON

Parameters:

Own time	$t_w < 750$ ms
Permissible error	$\delta_{\%} = \pm 5\% \pm 0{,}1$ kΩ in the range of (0÷ 10) kΩ
	$\delta_{\%} = \pm 10\%$ in the range of (10÷ 30) kΩ
Trip time delay permissible error	$\delta t_{\%} = \pm 1\% \pm 750$ ms

The algorithm for determining the measured resistance includes compensation of the circuit's capacitance, which allows to monitor the measurement circuit's continuity. The function also enables detection of auxiliary measurement voltage loss and various disturbances in the measurement signal generator operation.

2.4. iZAZ600 basic functional features.

- Extensive protection and automation functions set.
- Extensive list of available measurements, including measurement of all currents and voltages and recalculated values (e.g., power and energy, frequency, temperature from the model).
- A programmable controller, represented by an clear graphical interface, which allows the implementation of a variety of logic-time dependencies based on all signals available in the device.
- Counters enabling diagnostics of the field's operating status (including the number of tripping protections, automations, shutdowns, cumulative breaker current meter)
- Freely, graphically programmable operating logic.
- Configurable and system events recorder.
- Tripping recorder.
- Disturbance recorder with criterion recorder function.
- Energy quality values indicator: THD, frequency, number of decays, voltage dips.
- Up to 48 measurement inputs (hardware configurable: currents, voltages, 4–20 mA inputs or from PT100 sensors).
- Up to 233 output relays fully programmable in various configurations, including 8 reed relays for direct control of breaker coils.
- Up to 128 programmable two-state inputs for visualization of coupler states, collaboration with external protections.
- 16 programmable two-color indicator lights on the operator panel.
- An extensive autocontrol system with the ability to signal warnings.
- Real-time clock with synchronization capability.
- Communication with a PC or host system via RS-485 (MODBUS RTU, DNP 3.0, IEC 60870-5-103) or LAN (wired or fiber-optic, MODBUS TCP, DNP 3.0, IEC 60870-5-103, IEC 61850) interfaces and via a standard USB socket on the front panel.
- Operator panel with a clear 7" color touchscreen display, navigation and numeric keypad, with independent installation.
- Standard utility software iZAZ Tools included.
- Digital technology for high stability, accuracy and reliability.
- Protection against unauthorized access (change of settings, configuration).
- The device is typically made with two fully independent power supplies operating in parallel, which significantly increases the reliability of the power supply while maintaining galvanic separation between the supply voltages.

2.5. External connection scheme.

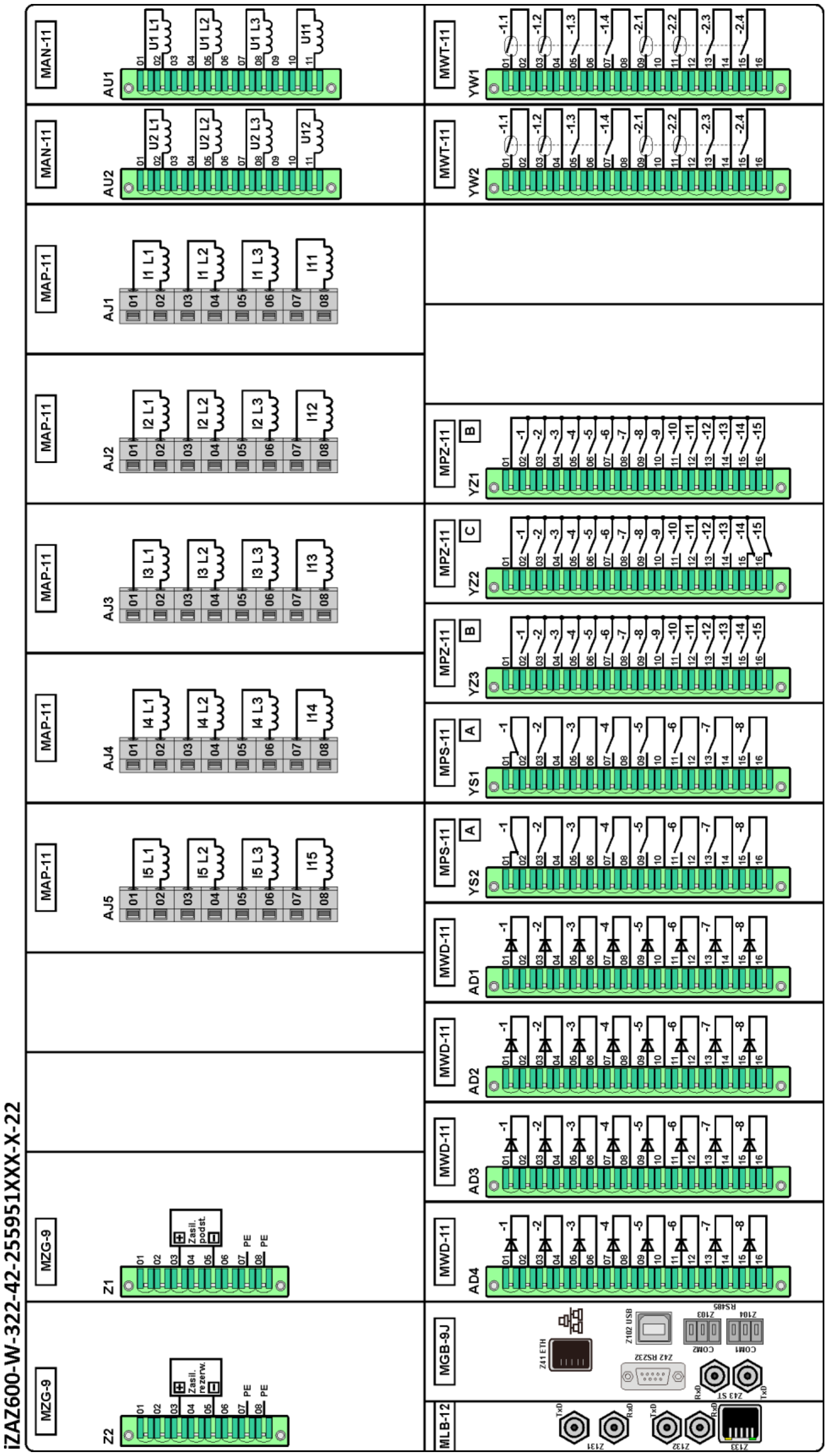


Fig. 6. External connection scheme, example: iZAZ600-W-322-42-255951XXX-X-22

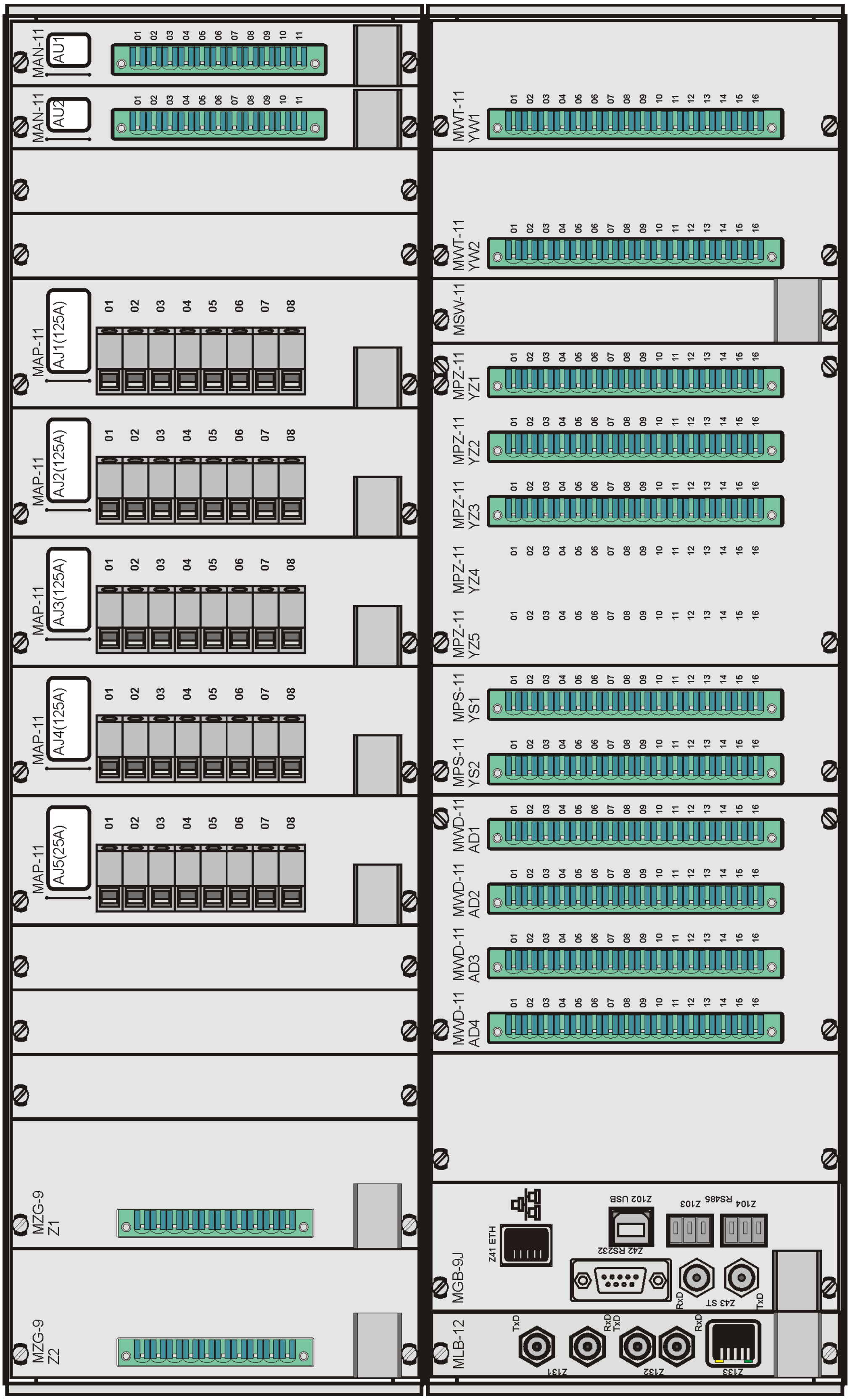


Fig. 7. Module layout, example: iZAZ600-W-322-42-255951XXX-X-22

2.6. Input and output circuits.

An overview of the iZAZ600 protection assembly modules is shown below:

MAP **AJ1÷8** **MAN** **MAR** **MAS** **AU1÷4**	Various variants of analog input module layout (In=1 or In=5 A, Un=100 V): MAP current modules in In=1 or In=5 A design for protection or measurement. MAN voltage modules in one design Un=100 V and PT100 or 4–20 mA input modules.
MLB **MGB**	Processor module (MLB) and communication module (MGB), equipped with a variety of communication ports: USB, RS-232, 2 wired RS-485 serial ports, 2 fiber optic serial ports, 2 wired LAN ports and a fiber optic LAN port.
MPZ **YZ1÷15** **MPS** **YS1÷15** **MWT** **YW1÷4**	Relay output modules in the following variants: MPZ – 15 signaling relays derived from a common potential MPS – 8 signaling relays derived independently MWT – 2 sets of shutdown contacts derived independently with 4 contacts each (two "fast-power", one fast and one signaling)
MWD **AD1÷16** **MZG-9** **MZA-9** **Z1÷2** **MAP** **AJ1÷8** **MAN** **MAR** **MAS** **AU1÷4**	Two-state input modules in the following variants: MWD – 8 two-state inputs derived independently. Total maximum number of modules: 16. A power supply module with one inverter used in a two independent module layout (2 x MZG-9) or a power supply module with two independent inverters in one module (MZA-9). Various variants of analog input module layout (In=1 or In=5 A, Un=100 V): MAP current modules in In=1 or In=5 A design for protection or measurement. MAN voltage modules in one design Un=100 V and PT100 or 4–20 mA input modules.
MLB **MGB**	Processor module (MLB) and communication module (MGB), equipped with a variety of communication ports: USB, RS-232, 2 wired RS-485 serial ports, 2 fiber optic serial ports, 2 wired LAN ports and a fiber optic LAN port.

Analog inputs

Up to 48 analog inputs in module groups: MAP-11 – up to 4 currents in each module, in a typical layout up to 8 modules x 4 currents for a total of 32 current paths, and MAN-11 - up to 4 voltages in each module, up to 4 modules x 4 voltages for a total of 16 voltage paths. It is possible to make an individual set of modules. The current paths can be made in the In=1 A or In=5 A variant in the short circuit option (range up to 25 In) or measurement option (range up to 2 In) for return power protection or earth fault current input from Ferranti transformer).

In addition, it is possible to use PT100 input modules (MAR-11) or 4–20 mA inputs (MAS-11).

Connection terminals – screw terminals for wires up to 5 mm^2 (AWG 10) for MAP current modules, others for 2.5 mm^2 (AWG 13) wires. It is recommended to make external connections with LgY type wires.

Two-state inputs

The number of two-state inputs depends on the module configuration.

Up to sixteen MWD-11 modules are available in positions AD1÷16, giving a total of 128 independent two-state inputs. Each of them can perform any function, including inputs for visualization of the coupler position state, collaboration with external protections, for control circuit continuity control, for internal signaling clearing or other applications. The two-state inputs are activated using a DC voltage with a value compatible with the auxiliary supply voltage.

RS-485 serial port inputs (Z103, Z104, Z131, Z43)

Four serial ports, including two wired RS-485 (Z103, Z104) and two fiber optic (Z131, Z43) for local communication with a PC or remote communication with a host system, with MODBUS RTU, DNP 3.0 or IEC 60870-5-103 protocol, with 2 kV optoisolation.

Connections of ports Z131, Z43 via 820 nm multimode optical fiber - ST connectors - OM1(62.5/125μm), OM2, OM3, OM4(50/125μm) according to PN-EN 60793-2:2016-09.

USB port input (Z102)

USB port - type B socket (USB 1.1), for local communication with a PC. The user software, which comes standard with the device, allows local communication in a range similar to that via the RS-485 port.

LAN port input (Z132, Z133, Z41LAN-FIB)

Fiber optic LAN port (Z132) and 2 wired (Z133, Z41) ports for local communication with a PC or for remote communication with a host system, with MODBUS TCP, DNP 3.0 or IEC 61850 protocol.

Connection of Z132 port via 1,300 nm multimode fiber - ST connectors - OM1(62.5/125μm), OM2, OM3, OM4(50/125μm) according to PN-EN 60793-2:2016-09.

Relay outputs

The number of relay outputs depends on the hardware configuration. As standard, there are two MWT-11 modules (YW1 and YW2) with reed relays with contacts in a "strong-fast" layout.
It is possible to increase the number of MWT-11 modules to 4, or more in a three-cassette version.

In addition, there are MPS-11 (YS) modules with individually routed contacts of eight signaling relays and MPZ-11 (YZ) modules with fifteen signaling relays' contacts routed to a common potential. Both MPS and MPZ modules are available in different active and reactive contact pinouts.

The final number of relay outputs depends on the number and types of control and signaling relay output modules. In the maximum configuration of modules (YW1÷2, YZ1÷15), 233 contact outputs are available.

Signaling outputs

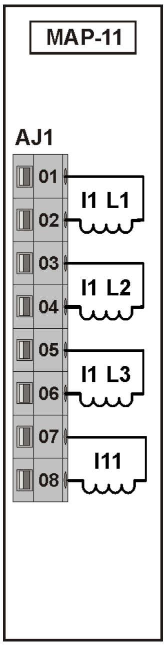
- signaling type — optical – LEDs (L01÷L16, OK, ERROR.)
- programmability — YES (L01÷L16) – two-color diodes
- support — with support or tracking

Text signaling outputs

- text signaling — message at the bottom of the graphic display screen
- message text length — up to 16 characters, comment text (description) length up to 64 characters
- signaling — with support or tracking

2.6.1. Analog inputs description.

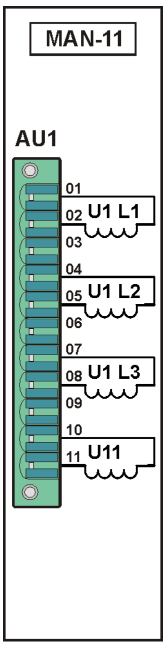
The iZAZ600 has the ability to connect up to 16 analog input modules.
Following module types are available:
MAP – current input module with a rating of 1 A and 5 A in protection or measurement version. Each module has four analog paths.
MAN – voltage input module, used to measure phase, neutral and special voltages - for example, voltages used to implement rotor earth fault protection from single and double earth faults and 100% stator earth fault protection based on 3 h voltages and measurement signal injection.
MAR – special input module from PT-100 sensors
MAS – special input module from 4–20 mA current loops



No.	Input name	Description	Input type	Terminals
Type: MAP11– current input module in In=5 A(z), 1 A(z), 5 A(m), 1 A(m) design				
Measurement inputs – current				
1.	$I1_{L1}$	$I1_{L1}$ input current	current measurement input	AJ1/1 - 2
2.	$I1_{L2}$	$I1_{L2}$ input current	current measurement input	AJ1/3 – 4
3.	$I1_{L3}$	$I1_{L3}$ input current	current measurement input	AJ1/5 – 6
4.	I11	I11 input current	current measurement input	AJ1/7 - 8

The terminal block number (AJx) and current number are derived from the device's hardware configuration. Dedicated measurement paths (m) with a limited measurement range are used to implement reverse power protection and earth fault protection of the MV side (for isolated, compensated and resistor-grounded grids).

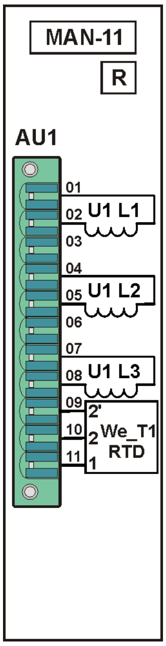
Type: MAN-11 – voltage input module



No.	Name	Description	Input type	Terminals
Type: MAN11– voltage input module in Un=100 V design				
Measurement inputs – voltage				
1.	$U1_{L1}$	$U1_{L1}$ input voltage	voltage measurement input	AU1/1 - 2
2.	$U1_{L2}$	$U1_{L2}$ input voltage	voltage measurement input	AU1/3 – 4
3.	$U1_{L3}$	$U1_{L3}$ input voltage	voltage measurement input	AU1/5 – 6
4.	U11	U11 input voltage	voltage measurement input	AU1/7 - 8

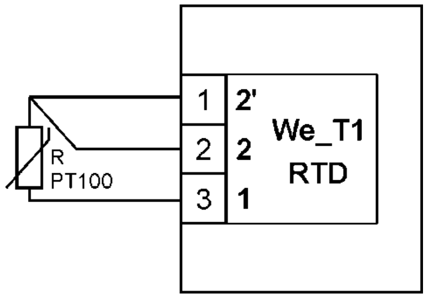
The terminal block number (AUx) and voltage number are derived from the device's hardware configuration. Voltage inputs are used to implement earth fault protection in the excitation circuit and 100% stator winding earth fault protection based on the 3 h zero voltage difference criterion and the measurement signal injection.

Type: MAN-11R – voltage input module and analog input from PT100 sensor

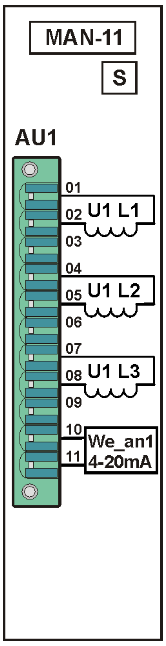


No.	Name	Description	Type	Terminals
1.	$U1_{L1}$	$U1_{L1}$ input voltage	voltage measurement input	AU1/1 - 2
2.	$U1_{L2}$	$U1_{L2}$ input voltage	voltage measurement input	AU1/4 - 5
3.	$U1_{L3}$	$U1_{L3}$ input voltage	voltage measurement input	AU1/7 - 8
4.	We_T1	analog input from PT100 sensor (three-wire circuit)	configurable	AU1/9 - 10 - 11

Three-wire system connection:

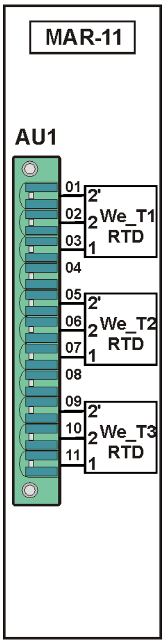


Type: MAN-11S – voltage input module and inputs in 4–20 mA standard



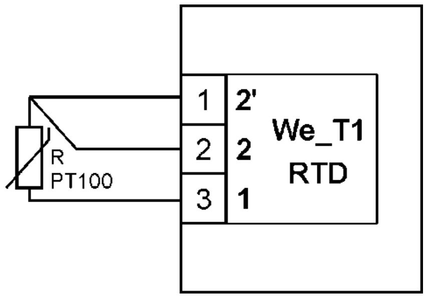
No.	Name	Description	Type	Terminals
1.	$U1_{L1}$	$U1_{L1}$ input voltage	voltage measurement input	AU1/1 - 2
2.	$U1_{L2}$	$U1_{L2}$ input voltage	voltage measurement input	AU1/4 - 5
3.	$U1_{L3}$	$U1_{L3}$ input voltage	voltage measurement input	AU1/7 - 8
4.	We_an1	analog input for 4–20 mA measurement loop circuit	configurable	AU1/10 - 11

Type: MAR-11 – analog input module from PT100 sensors

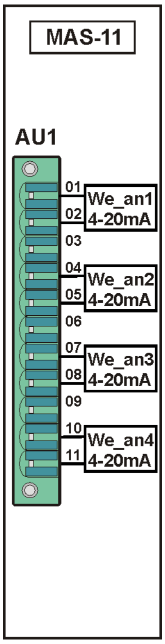


No.	Name	Description	Type	Terminals
1.	We_T1	analog input from PT100 sensor (three-wire circuit)	configurable	AU1/1 - 2 - 3
2.	We_T2	analog input from PT100 sensor (three-wire circuit)	configurable	AU1/5 - 6 - 7
3.	We_T3	analog input from PT100 sensor (three-wire circuit)	configurable	AU1/9 - 10 - 11

Three-wire system connection:



Type: MAS-11 – input module in 4–20 mA standard



No.	Name	Description	Type	Terminals
1.	We_an1	analog output for 4–20 mA measurement loop circuit	configurable	AU1/1 - 2
2.	We_an2	analog output for 4–20 mA measurement loop circuit	configurable	AU1/4 - 5
3.	We_an3	analog output for 4–20 mA measurement loop circuit	configurable	AU1/7 - 8
4.	We_an4	analog output for 4–20 mA measurement loop circuit	configurable	AU1/10 - 11

2.6.2. Two-state inputs description

When configuring the iZAZ600 hardware equipment, the user has various types of two-state input modules and relay outputs available.

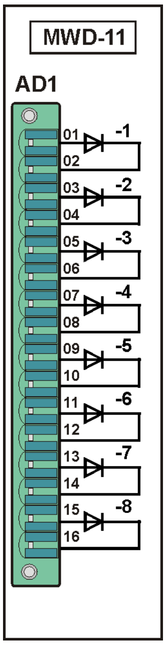
The manufacturer has provided module positions AD1÷16, which gives a total of 128 independent two-state inputs.

In typical module circuits, there are 4 to 6 AD modules.

The use of two-state inputs is fully configurable. Each of them can be used as an input to visualize the coupler position, to collaborate with external protection, to monitor the control circuit continuity, to clear internal signaling, or other various applications.

The two-state inputs are activated using a DC voltage with a value compatible with the auxiliary supply voltage.

Type: MWD-11 – two-state input module



No.	Name	Description	Type	Terminals
1.	AD1-1	-1 two-state input	two-state input	AD1/1 - 2
2.	AD1-2	-2 two-state input	two-state input	AD1/3 - 4
3.	AD1-3	-3 two-state input	two-state input	AD1/5 - 6
4.	AD1-4	-4 two-state input	two-state input	AD1/7 - 8
5.	AD1-5	-5 two-state input	two-state input	AD1/9 - 10
6.	AD1-6	-6 two-state input	two-state input	AD1/11 - 12
7.	AD1-7	-7 two-state input	two-state input	AD1/13 - 14
8.	AD1-8	-8 two-state input	two-state input	AD1/15 - 16

Any two-state inputs from AD modules are intended to implement the breaker circuit continuity monitoring system.

The AD module's two-state input allows continuity monitoring of each control path.

The connection of the continuity monitoring circuit is shown below with the example of input No. 1 for the MWT control path. The two-state input is connected in parallel to the breaker's control contact.

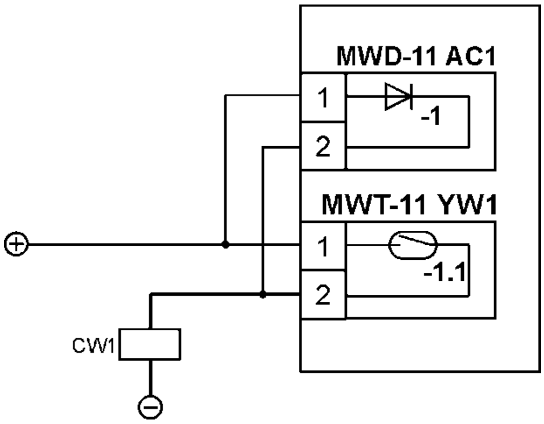


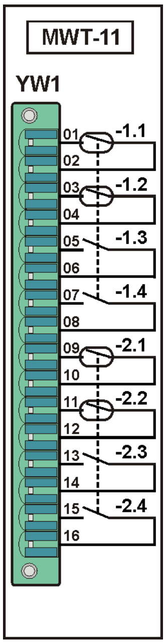
Fig. 8. Control circuit continuity monitoring system scheme

Continuity monitoring of the circuit controlling the breaker's coil is carried out in the breaker's closed circuit, when the breaker's own contact is closed. When the breaker is switched off, the normally closed contact, which opens the control circuit, causes discontinuity in the normal state - in the case of a requirement to monitor the control circuit continuity also in the open state of the breaker - it is necessary to install a resistor on the terminals of the coil circuit normally open contact - which will ensure the flow of current monitoring the control circuit continuity.
During control, with the control relay contact closed - circuit monitoring is impossible. In this state, discontinuity signaling is blocked.
A requirement for the correct control coil continuity monitoring system is that the control voltage of the breaker coil must be the same level as the control voltage of the two-state inputs.

2.6.3. Relay outputs description.

Relay output modules can be grouped into control and signaling outputs, derived in different contact variants:

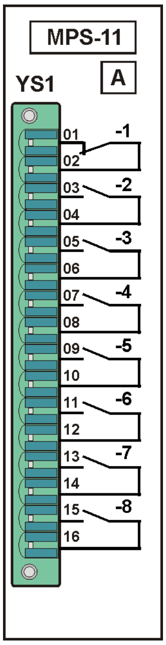
Type: MWT-11 – module of 2 sets of strong and fast reed switch contacts



No.	Name	Description	Type	Terminals
1.	YW1-1.1	reed executive relay, strong and fast	normally open contact	YW1/1 - 2
2.	YW1-1.2	reed executive relay, strong and fast	normally open contact	YW1/3 - 4
3.	YW1-1.3	reed executive relay, fast	normally open contact	YW1/5 - 6
4.	YW1-1.4	signaling relay	normally open contact	YW1/7 - 8
5.	YW1-2.1	reed executive relay, strong and fast	normally open contact	YW1/9 - 10
6.	YW1-2.2	reed executive relay, strong and fast	normally open contact	YW1/11 – 12
7.	YW1-2.3	reed executive relay, fast	normally open contact	YW1/13 – 14
8.	YW1-2.4	signaling relay	normally open contact	YW1/15 – 16

The MWT-11 module contains two independent relay sets. Relays in each set are controlled simultaneously according to the logic configuration. Each set has 4 contacts, the first two of which are used for direct breaker coil control through a paralleled contact arrangement of a vacuum reed switch and a relay, while the remaining two contacts can be used as signaling contacts.
In addition, the MSW-11 module is used to control the MWT-11 modules. One MSW module can control up to four MWT modules.

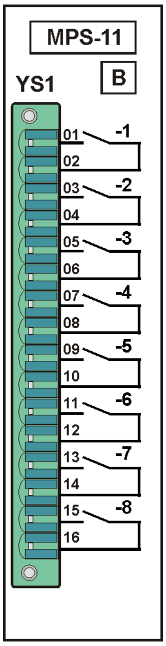
Type: MPS-11A – module of 8 independently derived signaling relays (1B, 7C)



No.	Name	Description	Type	Terminals
1.	YS1-1	signaling or control executive relay	normally closed contact	YS1/1 - 2
2.	YS1-2	signaling or control executive relay	normally open contact	YS1/3 - 4
3.	YS1-3	signaling or control executive relay	normally open contact	YS1/5 - 6
4.	YS1-4	signaling or control executive relay	normally open contact	YS1/7 - 8
5.	YS1-5	signaling or control executive relay	normally open contact	YS1/9 - 10
6.	YS1-6	signaling or control executive relay	normally open contact	YS1/11 – 12
7.	YS1-7	signaling or control executive relay	normally open contact	YS1/13 – 14
8.	YS1-8	signaling or control executive relay	normally open contact	YS1/15 – 16

The MPS-11A module contains eight relays, the first of which has a passive contact, and the remaining seven - active contacts. They can be used as control or signaling. All relays are fully configurable in logic.

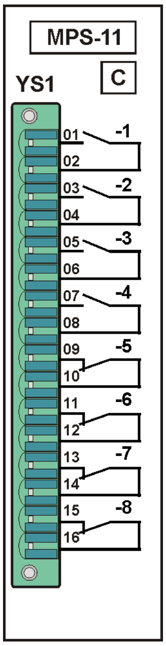
Type: MPS-11B – module of 8 independently derived signaling relays (8C)



No.	Name	Description	Type	Terminals
1.	YS1-1	signaling or control executive relay	normally open contact	YS1/1 - 2
2.	YS1-2	signaling or control executive relay	normally open contact	YS1/3 - 4
3.	YS1-3	signaling or control executive relay	normally open contact	YS1/5 - 6
4.	YS1-4	signaling or control executive relay	normally open contact	YS1/7 - 8
5.	YS1-5	signaling or control executive relay	normally open contact	YS1/9 - 10
6.	YS1-6	signaling or control executive relay	normally open contact	YS1/11 – 12
7.	YS1-7	signaling or control executive relay	normally open contact	YS1/13 – 14
8.	YS1-8	signaling or control executive relay	normally open contact	YS1/15 – 16

The MPS-11B module contains eight relays with derived active contacts that can be used as control or signaling. All relays are fully configurable in logic.

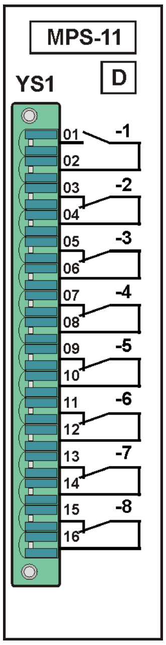
Type: MPS-11C – module of 8 independently derived signaling relays (4C, 4B)



No.	Name	Description	Type	Terminals
1.	YS1-1	signaling or control executive relay	normally open contact	YS1/1 - 2
2.	YS1-2	signaling or control executive relay	normally open contact	YS1/3 - 4
3.	YS1-3	signaling or control executive relay	normally open contact	YS1/5 - 6
4.	YS1-4	signaling or control executive relay	normally open contact	YS1/7 - 8
5.	YS1-5	signaling or control executive relay	normally closed contact	YS1/9 - 10
6.	YS1-6	signaling or control executive relay	normally closed contact	YS1/11 – 12
7.	YS1-7	signaling or control executive relay	normally closed contact	YS1/13 – 14
8.	YS1-8	signaling or control executive relay	normally closed contact	YS1/15 – 16

The MPS-11C module contains eight relays, the first four of which have active contacts and the other four have passive contacts. They can be used as control or signaling. All relays are fully configurable in logic.

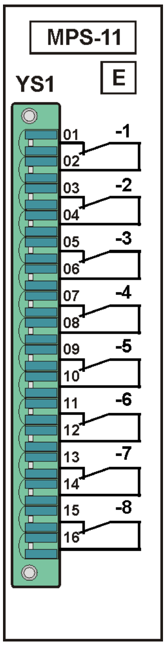
Type: MPS-11D – module of 8 independently derived signaling relays (1C, 7B)



No.	Name	Description	Type	Terminals
1.	YS1-1	signaling or control executive relay	normally open contact	YS1/1 - 2
2.	YS1-2	signaling or control executive relay	normally closed contact	YS1/3 - 4
3.	YS1-3	signaling or control executive relay	normally closed contact	YS1/5 - 6
4.	YS1-4	signaling or control executive relay	normally closed contact	YS1/7 - 8
5.	YS1-5	signaling or control executive relay	normally closed contact	YS1/9 - 10
6.	YS1-6	signaling or control executive relay	normally closed contact	YS1/11 – 12
7.	YS1-7	signaling or control executive relay	normally closed contact	YS1/13 – 14
8.	YS1-8	signaling or control executive relay	normally closed contact	YS1/15 – 16

The MPS-11D module contains eight relays, with the first having an active contact and the other seven having passive contacts. They can be used as control or signaling. All relays are fully configurable in logic.

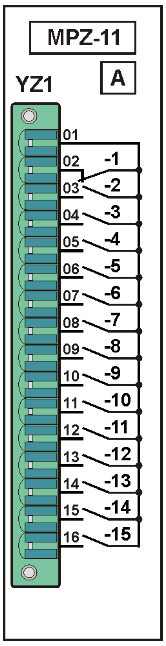
Type: MPS-11E – module of 8 independently derived signaling relays (8B)



No.	Name	Description	Type	Terminals
1.	YS1-1	signaling or control executive relay	normally closed contact	YS1/1 - 2
2.	YS1-2	signaling or control executive relay	normally closed contact	YS1/3 - 4
3.	YS1-3	signaling or control executive relay	normally closed contact	YS1/5 - 6
4.	YS1-4	signaling or control executive relay	normally closed contact	YS1/7 - 8
5.	YS1-5	signaling or control executive relay	normally closed contact	YS1/9 - 10
6.	YS1-6	signaling or control executive relay	normally closed contact	YS1/11 – 12
7.	YS1-7	signaling or control executive relay	normally closed contact	YS1/13 – 14
8.	YS1-8	signaling or control executive relay	normally closed contact	YS1/15 – 16

The MPS-11E module contains eight relays with derived passive contacts that can be used as control or signaling. All relays are fully configurable in logic.

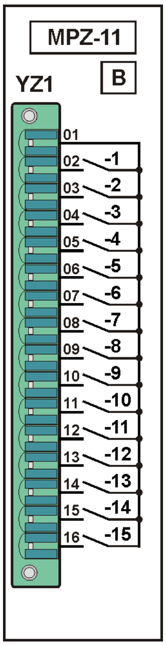
Type: MPZ-11A – module of 15 signaling relays derived from a common potential (1B,14C)



No.	Name	Description	Type	Terminals
1.	YZ1-1	signaling relay	normally closed contact	YZ1/1 - 2
2.	YZ1-2	signaling relay	normally open contact	YZ1/1 - 3
3.	YZ1-3	signaling relay	normally open contact	YZ1/1 - 4
4.	YZ1-4	signaling relay	normally open contact	YZ1/1 - 5
5.	YZ1-5	signaling relay	normally open contact	YZ1/1 - 6
6.	YZ1-6	signaling relay	normally open contact	YZ1/1 - 7
7.	YZ1-7	signaling relay	normally open contact	YZ1/1 - 8
8.	YZ1-8	signaling relay	normally open contact	YZ1/1 - 9
9.	YZ1-9	signaling relay	normally open contact	YZ1/1 - 10
10.	YZ1-10	signaling relay	normally open contact	YZ1/1 - 11
11.	YZ1-11	signaling relay	normally open contact	YZ1/1 - 12
12.	YZ1-12	signaling relay	normally open contact	YZ1/1 - 13
13.	YZ1-13	signaling relay	normally open contact	YZ1/1 - 14
14.	YZ1-14	signaling relay	normally open contact	YZ1/1 - 15
15.	YZ1-15	signaling relay	normally open contact	YZ1/1 - 16

The MPZ-11A module contains fifteen relays with contacts implemented at a common potential. The first relay has a passive contact, the other fourteen have active contacts. They can be used as signaling. All relays are fully configurable in logic.

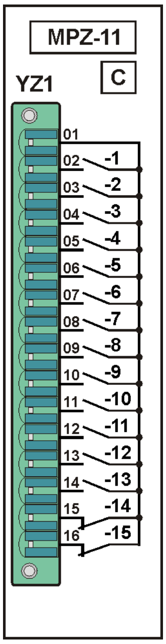
Type: MPZ-11B – module of 15 signaling relays derived from a common potential (15C)



No.	Name	Description	Type	Terminals
1.	YZ1-1	signaling relay	normally open contact	YZ1/1 - 2
2.	YZ1-2	signaling relay	normally open contact	YZ1/1 - 3
3.	YZ1-3	signaling relay	normally open contact	YZ1/1 - 4
4.	YZ1-4	signaling relay	normally open contact	YZ1/1 - 5
5.	YZ1-5	signaling relay	normally open contact	YZ1/1 - 6
6.	YZ1-6	signaling relay	normally open contact	YZ1/1 - 7
7.	YZ1-7	signaling relay	normally open contact	YZ1/1 - 8
8.	YZ1-8	signaling relay	normally open contact	YZ1/1 - 9
9.	YZ1-9	signaling relay	normally open contact	YZ1/1 - 10
10.	YZ1-10	signaling relay	normally open contact	YZ1/1 - 11
11.	YZ1-11	signaling relay	normally open contact	YZ1/1 - 12
12.	YZ1-12	signaling relay	normally open contact	YZ1/1 - 13
13.	YZ1-13	signaling relay	normally open contact	YZ1/1 - 14
14.	YZ1-14	signaling relay	normally open contact	YZ1/1 - 15
15.	YZ1-15	signaling relay	normally open contact	YZ1/1 - 16

The MPZ-11B module contains fifteen relays with live contacts, derived from a common potential. They can be used as signaling. All relays are fully configurable in logic.

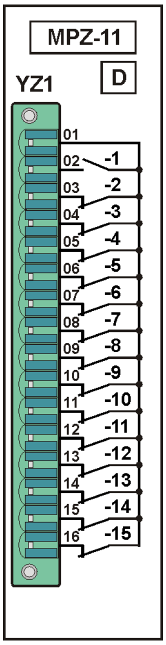
Type: MPZ-11C – module of 15 signaling relays derived from a common potential (2B,14C)



No.	Name	Description	Type	Terminals
1.	YZ1-1	signaling relay	normally open contact	YZ1/1 - 2
2.	YZ1-2	signaling relay	normally open contact	YZ1/1 - 3
3.	YZ1-3	signaling relay	normally open contact	YZ1/1 - 4
4.	YZ1-4	signaling relay	normally open contact	YZ1/1 - 5
5.	YZ1-5	signaling relay	normally open contact	YZ1/1 - 6
6.	YZ1-6	signaling relay	normally open contact	YZ1/1 - 7
7.	YZ1-7	signaling relay	normally open contact	YZ1/1 - 8
8.	YZ1-8	signaling relay	normally open contact	YZ1/1 - 9
9.	YZ1-9	signaling relay	normally open contact	YZ1/1 - 10
10.	YZ1-10	signaling relay	normally open contact	YZ1/1 - 11
11.	YZ1-11	signaling relay	normally open contact	YZ1/1 - 12
12.	YZ1-12	signaling relay	normally open contact	YZ1/1 - 13
13.	YZ1-13	signaling relay	normally open contact	YZ1/1 - 14
14.	YZ1-14	signaling relay	normally closed contact	YZ1/1 - 15
15.	YZ1-15	signaling relay	normally closed contact	YZ1/1 - 16

The MPZ-11C module contains fifteen relays with contacts derived from a common potential. The first thirteen have active contacts, the last two - passive contacts. They can be used as signaling. All relays are fully configurable in logic.

Type: MPZ-11D – module of 15 signaling relays derived from a common potential (1C,14B)

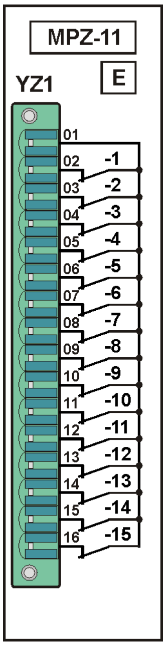


No.	Name	Description	Type	Terminals
1.	YZ1-1	signaling relay	normally open contact	YZ1/1 - 2
2.	YZ1-2	signaling relay	normally closed contact	YZ1/1 - 3
3.	YZ1-3	signaling relay	normally closed contact	YZ1/1 - 4
4.	YZ1-4	signaling relay	normally closed contact	YZ1/1 - 5
5.	YZ1-5	signaling relay	normally closed contact	YZ1/1 - 6
6.	YZ1-6	signaling relay	normally closed contact	YZ1/1 - 7
7.	YZ1-7	signaling relay	normally closed contact	YZ1/1 - 8
8.	YZ1-8	signaling relay	normally closed contact	YZ1/1 - 9
9.	YZ1-9	signaling relay	normally closed contact	YZ1/1 - 10
10.	YZ1-10	signaling relay	normally closed contact	YZ1/1 - 11
11.	YZ1-11	signaling relay	normally closed contact	YZ1/1 - 12
12.	YZ1-12	signaling relay	normally closed contact	YZ1/1 - 13

13.	YZ1-13	signaling relay	normally closed contact	YZ1/1 - 14
14.	YZ1-14	signaling relay	normally closed contact	YZ1/1 - 15
15.	YZ1-15	signaling relay	normally closed contact	YZ1/1 - 16

The MPZ-11D module contains fifteen relays with contacts derived from a common potential. The first relay has an active contact, and the other fourteen have passive contacts. They can be used as signaling. All relays are fully configurable in logic.

Type: MPZ-11E – module of 15 signaling relays derived from a common potential (15B)



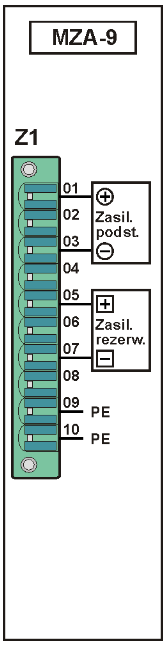
No.	Name	Description	Type	Terminals
1.	YZ1-1	signaling relay	normally closed contact	YZ1/1 - 2
2.	YZ1-2	signaling relay	normally closed contact	YZ1/1 - 3
3.	YZ1-3	signaling relay	normally closed contact	YZ1/1 - 4
4.	YZ1-4	signaling relay	normally closed contact	YZ1/1 - 5
5.	YZ1-5	signaling relay	normally closed contact	YZ1/1 - 6
6.	YZ1-6	signaling relay	normally closed contact	YZ1/1 - 7
7.	YZ1-7	signaling relay	normally closed contact	YZ1/1 - 8
8.	YZ1-8	signaling relay	normally closed contact	YZ1/1 - 9
9.	YZ1-9	signaling relay	normally closed contact	YZ1/1 - 10
10.	YZ1-10	signaling relay	normally closed contact	YZ1/1 - 11
11.	YZ1-11	signaling relay	normally closed contact	YZ1/1 - 12
12.	YZ1-12	signaling relay	normally closed contact	YZ1/1 - 13
13.	YZ1-13	signaling relay	normally closed contact	YZ1/1 - 14
14.	YZ1-14	signaling relay	normally closed contact	YZ1/1 - 15
15.	YZ1-15	signaling relay	normally closed contact	YZ1/1 - 16

The MPZ-11E module contains fifteen relays with passive contacts implemented at a common potential. They can be used as signaling. All relays are fully configurable in logic.

2.6.4. Power supply system description.

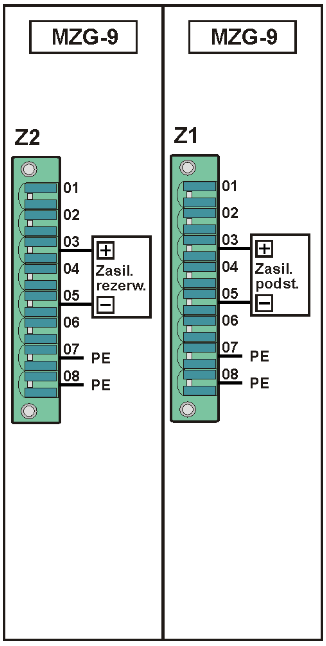
The iZAZ600 is powered by power supply modules coming in several variants.

Type: MZA-9 – 70 W power supply module with two independent inverters



No.	Name	Description	Terminals
1.	Primary power supply	Primary power supply of the protection assembly according to Upn	Z1/1 – 3
2.	Reserve power supply	Reserve power supply of the protection assembly according to Upn	Z1/5 – 7
3.	Earth	Power supply circuit earth	Z1/9 – 10

Type: MZG-9 – 70 W power supply module with one inverter



No.	Name	Description	Terminals
1.	Primary power supply	Primary power supply of the protection assembly according to Upn	Z1/3 – 5
2.	Reserve power supply	Reserve power supply of the protection assembly according to Upn	Z2/3 – 5
3.	Earth	Power supply circuit earth	Z1/7 – 8 Z2/7 – 8

Power supply system based on two independent MZG-9 modules working in parallel. Typically used as two independent, but it is possible to use a single MZG-9 power supply.

2.6.5. Optical signaling outputs (LED) description.

The operator panel allows to output optical signaling using 16 LEDs, with the possibility of configuring the light mode (continuous, flashing) and one of two colors (green/red). Also, there are additionally two dedicated LEDs on the operator panel, indicating the assembly state (OK., ERROR).

Optical signaling outputs			
1.	L01	programmable LED	LEDs - green/red (the color and flashing mode setting results from the control method in programmable logic)
2.	L02	programmable LED	
3.	L03	programmable LED	
4.	L04	programmable LED	
5.	L05	programmable LED	
6.	L06	programmable LED	
7.	L07	programmable LED	
8.	L08	programmable LED	
9.	L09	programmable LED	
10.	L10	programmable LED	
11.	L11	programmable LED	
12.	L12	programmable LED	
13.	L13	programmable LED	
14.	L14	programmable LED	
15.	L15	programmable LED	
16.	L16	programmable LED	
17.	OK.	Device in working order	LED - green
18.	ERROR	Device damage	LED - red

2.7. Specifications.

Auxiliary supply voltage U_{pn}	110 V DC 220 V DC / 230 V AC
Variation range of auxiliary supply voltage U_p	(0.8÷1.15) U_{pn}
Power consumption in the auxiliary supply voltage circuit U_p	≤ 100 W
Current input circuits:	
- rated measurement current I_n	5 A or 1 A
- maximum current for the (z) protection variant	25 I_n
- maximum current for the (m) measurement variant	2 I_n
- rated frequency f_n	50 Hz
- power consumption at $I=I_n$	≤ 0.2 VA / phase
- permanent load capacity	4 I_n
- thermal strength (1 s)	80 I_n
- dynamic strength	250 I_n
Earth fault input circuit:	
- maximum measurement current	10 A
- rated frequency fn	50 Hz
- power consumption at 1 A	≤ 0.1 VA
- permanent load capacity	10 A
- thermal strength (1 s)	80 A
- dynamic strength	250 A
Voltage input circuits:	
- rated measurement voltage U_n	100 V
- maximum measurement voltage	120 V
- rated frequency f_n	50 Hz
- power consumption at $U=U_n$	≤ 0.5 VA
- thermal strength (10 s)	1.50 Un
- long-term voltage strength	1.20 Un
Two-state input circuits:	
- control voltage	110 / 220 V DC
- power consumption	≤ 0.5 W
- voltage limits: active state (energized)	0.75 Un
inactive state (de-energized)	0.55 Un
Guaranteed current measurement error	1% ±0.01 In
Guaranteed earth fault current measurement error	1% ±0.2 mA
Guaranteed voltage measurement error in the range	
for U=(0.76 ÷ 1.20) U_n	0.5%
for U=(0.05 ÷ 0.75) U_n	1% ± 0.001 Un
Guaranteed loop current measurement error 4÷20 mA	1% ±0.2 mA
Guaranteed power and energy measurement error (for current in the protection variant)	2.5%
Guaranteed power and energy measurement error (for current in the measurement variant)	1%
Guaranteed current direction measurement error	±1°
Guaranteed time measurement error	1% ±5 ms
Guaranteed internal clock error (without synchronization)	1 min/month
Vacuum reed switch contacts coupling capacity:	
• permanent current load capacity	6 A
• switched current	3.2 A
Executive relay contacts coupling capacity	
• permanent current load capacity	6 A
• coupling power in AC1 category	1,500 VA / 250 V
• opening the circuit at DC1 load: 28 V / 220 V	6 / 0.16 A
• opening the circuit at inductive load (L/R ≤ 40 ms)	0.1 A / 250 V DC
Operating temperature range	(248÷328) K, (-25÷55) °C
Storage temperature range	(248÷343) K, (-25÷70) °C
Relative humidity	up to 80%
Relative humidity at 56 days and 40 °C with no condensation	up to 95%
Protection rating	IP40 (IP20 terminals)
Housing	EURO19”/6U/300
Assembly weight	10 kg
Dimensions (width, height, depth)	483 / 267 / 345 mm

2.8. Protection against unauthorized access.

The iZAZ600 functions can be accessed:

- locally via the operator panel on the front panel,
- locally or remotely, using communication ports and dedicated iZAZ Tools application software,
- remotely, in host systems, using RS-485 / LAN port and MODBUS protocol.

The primary protection against unauthorized changes to the configuration is the numerical password saved in the device. This type of access verification is used both when operating the device via the operator panel and using the application software and PC.

Number passwords are defined at three levels:

- " Configuration save " level to save configuration files to the device and change settings, controls and tests
- " Settings edit " level to change settings and implement control and test functions,
- " Control " level to enable control functions.

It should be noted that access verification when attempting to change settings and configurations is implemented in the device, which also provides protection in the case of remote communication using the MODBUS protocol.

The second level of protection is implemented in the iZAZ Tools application software by checking the level of permissions assigned to the current application user.
The following authorization levels have been defined:

- " read only " – no changes can be made to the device,
- " edit " – it is possible to change settings and implement control and testing,
- " configuration " – it is possible to make configuration modifications to the extent compatible with the hardware,
- " service ", " application " – full access to the device, reserved for representatives of the Manufacturer.

The standard installation of the iZAZ Tools software gives all users access to all devices at the "edycja" (edit) level (with primary protection through device numeric password verification), with no ability to change these permissions. This level of authorization is sufficient for basic operation, but does not allow configuration changes.

Upon request, it is possible to obtain and register a special license, dedicated to the user (individual or legal entity) and purchased units, upgrading privileges to the "konfiguracja" (configuration) level. It is the highest level of authorization intended for a customer who has been trained to edit and create iZAZ assembly configurations.

After registering a license, obtaining higher privileges will require logging into the application. It is possible to create multiple end-user derivative accounts, as well as to lower the standard no-login access level to "wyłącznie odczyt" (read only), giving users the liberty to manage access to their devices using iZAZ Tools software.

3. SOFTWARE CONFIGURATION

The iZAZ600 operates according to the uploaded software configuration.
The configuration file can be saved on the disk with the .izaz extension; it includes the complete configuration of the device along with the settings of individual protection functions. It consists of functions linked by logic-time dependencies.
The iZAZ Tools program allows to view/edit the configuration saved in graphical mode, making the device's operation interpretation intuitive and user-friendly.
The configuration scheme is presented on sheets that allow functional division of configuration fragments.

At the order stage, the customer specifies the software and hardware configuration that meets their requirements. This includes the number of analog paths, the number of two-state inputs and relay outputs.

The selection of a specific hardware and software variant results in the Manufacturer preparing a device with a specific configuration file. In most cases, there must be an adaptation of the configuration to a specific design or connection circuit in terms of:

- two-state inputs
- relay outputs (control and signaling)
- LEDs
- other logic-time dependencies required in a given circuit

These signals are pre-configured by default, but the user can use the iZAZ Tools maintenance program to modify the configuration according to the system needs.

> **Note:** It is possible to rename each function in the configuration. It increases the readability of the configuration and facilitates navigation between the various functions.

Each function can set the level of access permission to edit the function, its input connections and settings independently.
At the standard access level (EDYCJA (EDIT)), the user can edit the settings and function connections of two-state inputs, relay outputs, LEDs, and create additional logic connections using primary logic functions (AND, OR). Options for analog channel functions, estimates, protection are protected by a higher privilege level - configuration (KONFIGURACJA) as standard.

> **Note:** For a detailed description of the configuration function, see:
> 5000.51.00.00.Fx.001 iZAZ configuration function description

4. AUXILIARY FUNCTIONS

4.1. Measurements.

The iZAZ600 protection device implements the measurement of values such as:

- rms values of input currents ($I1_{L1}$, $I1_{L2}$, $I1_{L3}$, $I2_{L1}$, $I2_{L2}$, $I2_{L3}$, I3, $I3_{L1}$, $I3_{L2}$, $I3_{L3}$, etc.),
- rms values of input phase voltages ($U1_{L1}$, $U1_{L2}$, $U1_{L3}$, U2, etc.),
- rms values of input phase-to-phase voltages ($U1_{L1L2}$, $U1_{L2L3}$, $U1_{L3L1}$, etc),
- rms of zero current (3Io),
- rms of zero voltage (3Uo),
- earth fault conductance value (Go),
- earth fault susceptance value (Bo),
- earth fault admittance value (Yo)
- rms of the negative current component (I1S2 - calculated from the input currents),
- rms of the negative voltage component (U1S2 - calculated from the input voltages),
- rms of the positive current component (I1S1 - calculated from the input currents),
- rms of the positive voltage component (U1S1 - calculated from the input voltages),
- input voltage or current frequency (f),
- phase shift angles of input currents and voltages φ1, φ2, φ3,
- current active power value (P),
- current reactive power value (Q),
- current apparent power value (S),
- average active power value of the last 15 minutes (P15),
- average reactive power value of the last 15 minutes (Q15),
- power factor value tg(φ),

Energy measurements are represented as energy meters (meter group):

- inflowing active energy value (Ec+),
- outflowing active energy value (Ec-),
- inflowing reactive energy value - inductive (Eb+),
- outflowing reactive energy value - capacitive (Eb+),

> **Note:** The list of configured measurements results from the hardware and software configuration. It is possible to modify the list of available measurements according to Annex 12.2.
>
> For a list of available features see:
> 5000.51.00.00.Fx.001 iZAZ configuration function description

The measurement results are available in normalized values: either in the values on the primary side or in the values on the secondary side of the measurement transformers (the value recalculation results from the set transmissions of the input values - currents, voltages). Some measurements, such as frequency, phase shift angle, power factor, are displayed without recalculating.
Moreover, for the 49M time dependent characteristic, the device provides access to the current object temperature value (Θ) calculated from the adopted thermal model. However, for the 49R and 46 dependent characteristics, it is possible to view the percentage of protection state.
The measurement repetition time is 1.0 s. Viewing of measurement results is available via the local operator panel, via iZAZ Tools software in local or remote communication, and via the host system in remote communication.

4.2. Recorders.

The device is equipped with three different recorders that allow analysis of phenomena occurring in the protected object and a system recorder that allows analysis of the device's state.

4.2.1. Events recorder.

Basic state recorder, recorded in a chronological event log with a 1 ms resolution. Circular memory buffer with a capacity of 1,000 events. Each registered state independently generates an event when an increasing slope is detected (NAME ON) and when a decreasing slope is detected (NAME OFF). Protection activations, de-energizations and trippings are recorded, as well as changes in the states of binary inputs, automations and other events generated from internal logic. All events have individually editable names and comments, thus enabling adaptation of the application, in terms of simplifying the user's analysis of events. It is possible to configure additional events not included in the standard configuration.

The events are generated through a function in the configuration labeled Wy_ARZ.

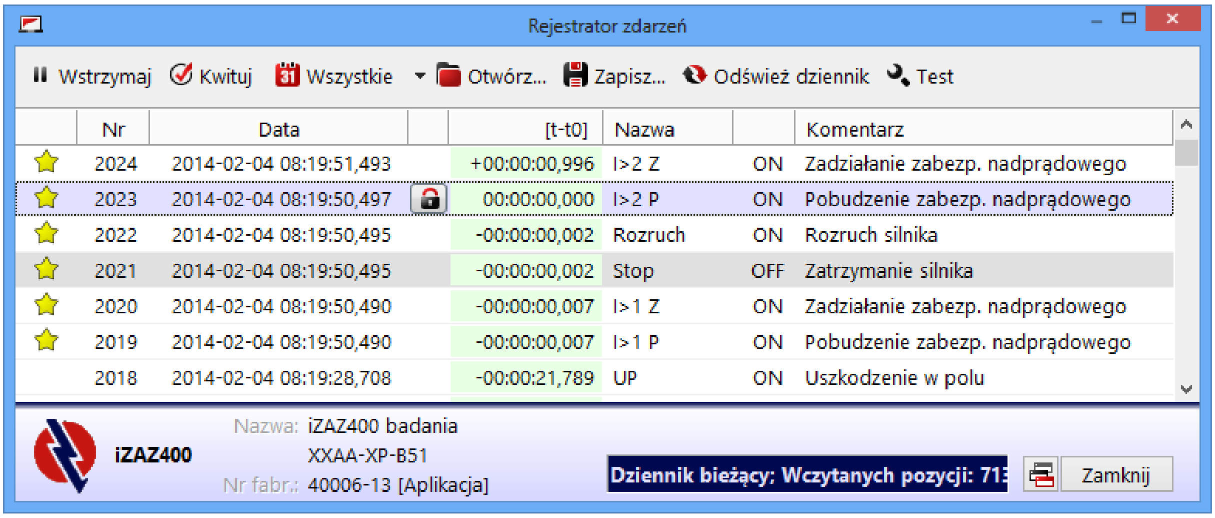


Fig. 9. iZAZ Tools – event recorder example window

The event record has a number, date and time of occurrence, individual name and comment (editable in the device configuration), and ON and OFF slope labeling. Also, the operating program allows analysis of the intervals between events in the [t-t0] column. By marking a reference event, it is possible to analyze the temporal chronology in time relative to the event marked with a padlock within a day.

To protect the recorder from a continuous recording state in the event of a situation in which a signal oscillating with high frequency would cause frequent event recording, a functionality was introduced to filter such events.

Description	Setting range	Default value
Repetition timeout	(1÷60) min in 1 min increments	1 min
Number of repetitions	(10÷100)	10

During the set repetition timeout, consecutive activations of the same recorder signal are counted and if the number of activations exceeds the set number of repetitions, this event will be displayed only once with the OVR state description.

4.2.2. Tripping recorder.

Enables quantitative interference analysis. In addition to the time of the disturbance, this recorder contains information about the signal limits that were measured from the moment of activation, until the function is de-energized, after tripping. The types and amount of data recorded depend on the nature of the function, e.g. for overcurrent protection these include the disturbance duration and the maximum current value at that time. The tripping recorder allows quick assessment of the phenomenon, providing information about the criterion values that accompanied the disturbance. It also provides an opportunity to verify settings. For a typical record of three analog data (e.g., maximum current or voltage), the internal circular buffer allows for storage of up to 200 records.

The records of this recorder are assigned to protection functions and their contents are derived from the function type.

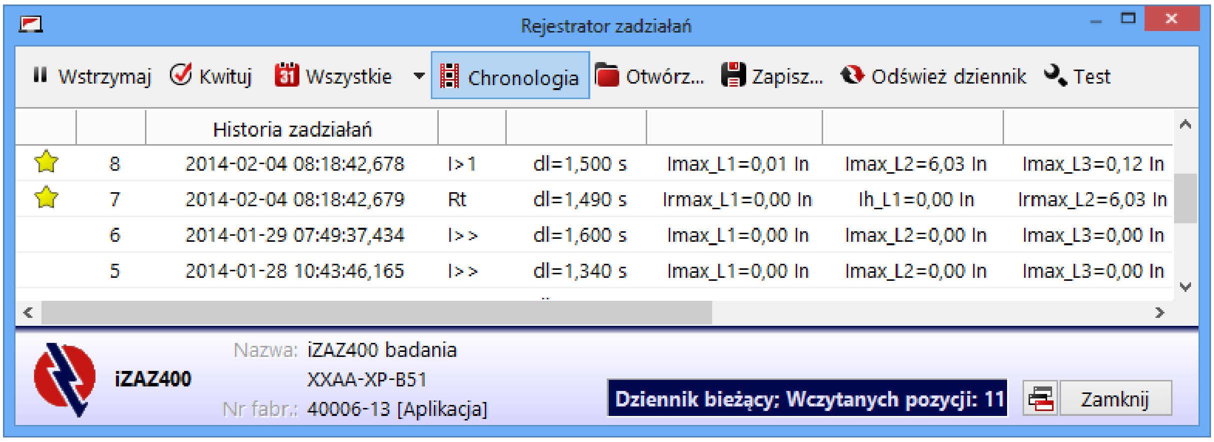


Fig. 10. iZAZ Tools – tripping recorder example window

4.2.3. Disturbance recorder.

A set of analog and two-state waveform recorders, with a criterion recorder function, enabling full analysis of disturbance phenomena. The device provides the ability to program up to two completely independently settable recorders. The criterion recorder function provides the ability to record any of the criterion values (analog and two-state) available on the device.
Standard settings for pre-run time, run-out time and maximum recording time allow the recording window of interest to be shaped accordingly.

To optimize the recording of long-term slow-change phenomena, it is possible to lower the sampling frequency with the option to control the dilution of the recording with a selected two-state signal (e.g., open breaker, start-up state, etc.).

The capacity of the internal buffer depends on the number of activated recorders, programmed analog and binary channels and the maximum duration of a single recording. For one recorder, 8 analog channels, 64 binary channels it is possible to record a file of 1,000 s.

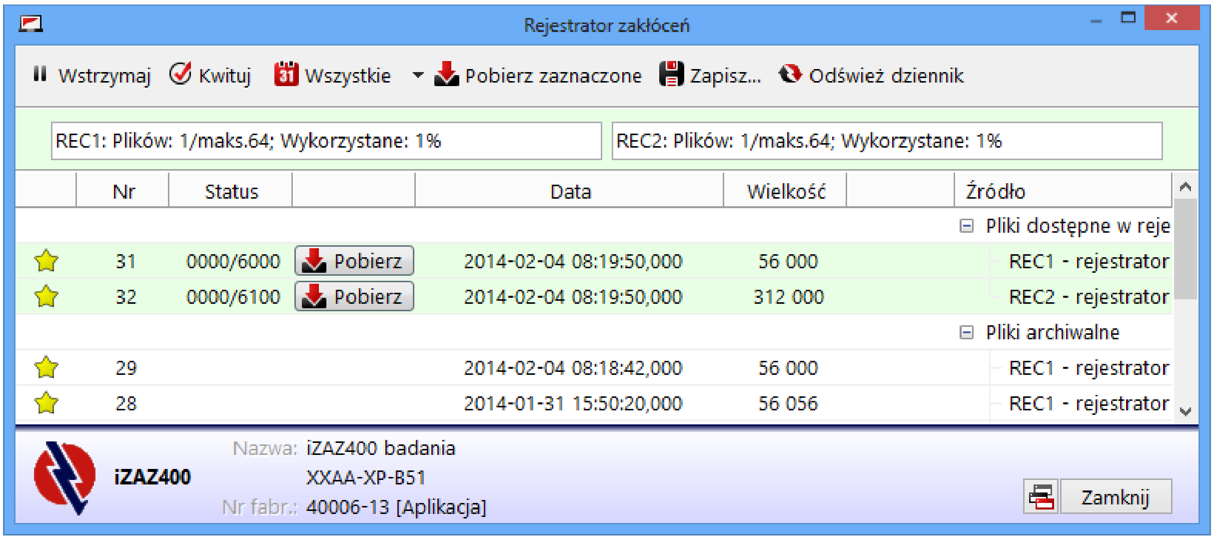


Fig. 11. iZAZ Tools – disturbance recorder example window

REC disturbance recorder settings:

Setting	Description	Setting range	Default value
tp	Pre-run time	(0.00÷100.00) s in 0.01 s increments	1.50 s
tw	Run-out time	(0.00÷100.00) s in 0.01 s increments	0.20 s
tmax	Maximum recording time	(0.00÷100.00) s in 0.01 s increments	2.00 s
kr	Dilution level	(0 ÷ 24) in 1 increments	3
ofs	Signaling overflow threshold	(50÷100)% in 1% increments	80%
ofa	Operation when memory is full	(nadpisywanie/zatrzymanie) (overwriting/stopping)	nadpisywanie (overwriting)
ON/OFF	Function activity	(ON / OFF)	ON

In addition to setting the recorder's functions, the user selects the analog and binary signals to be recorded. The configuration uses functions labeled RCA (for analog channels) and RCB (for binary channels).

Operation

The recorder in the configuration is a two-input function, in which the activation input is configured and possibly the dilution input is used.

Typically, the recorder's activation is combined with the emergency control signal output to shut down the breaker. However, it is possible to add an activation signal, such as from the tripping of signaling protections, from the tripping of selected protections, or any other signal available in the device logic.

It is also possible to activate the recorder with a virtual pulse signal, regardless of the selected activation signal.

When activation occurs (the increasing slope of the activation signal), file recording is started. The pre-run from memory according to the setting is pre-saved in the file. After the activation disappears, the run-out time is counted down and the recording ends. However, the total file time cannot be longer than the maximum recording time setting. Hence, if the activation signal is longer, the recorder file will be saved after the maximum time is exceeded and the next file will be started without the pre-run contents.

For the ofa = nadpisywanie (ofa = overwriting) setting, successive recorder files are saved to memory, and when internal memory resources are full, the oldest files are overwritten. Importantly, when the ofs signaling overflow threshold setting is exceeded, the dedicated state is activated, which can be used additionally to signal that the recorder's memory is full.

However, for the ofa = zatrzymanie (ofa = stopping) setting, the subsequent recordings can be saved until the entire memory is used. This is followed by a stop and activation of the recorder stop state, which can be used additionally to signal the recorder stop.

The iZAZ Tools operating program, after analyzing the selected recording channels and settings, determines the number of possible recording files in memory.

Recording dilution.

In some cases, it is advantageous to dilute the recording, which gives the possibility of extending the recording by saving portions of the recorder file with skipping samples according to the kr setting (e.g., for setting 5 - after recording the value, the next five will be skipped, only the sixth will be recorded and the next skipped).

An example of the use of such functionality is the recorder file during the SPZ automation implementation. When counting down the time of the no-voltage interval after the breaker is opened, the relevance of the analog and two-state signal values recorded is not so important and these times are usually relatively long (the order of seconds). When the position information of the breaker in the OFF state is set to dilute, the recording after the SPZ cycle starts will continue, and for a period of time, when the breaker is off, the recording will be less accurate. When the dilution signal disappears (breaker on), recording will return to continuous recording every sample.

It is possible to deactivate the recorder function at any time, for example, when performing functional tests where it is not desirable to activate the recorder.

4.2.4. System event recorder.

The system event recorder records events related to the operation of the device itself. These are information about the equipment operation, such as: change in the assembly state, switching on or off the Up supply voltage, messages about the possible errors, loading of settings, configuration, etc. System events are recorded regardless of the adopted equipment configuration. The system recorder's capacity is 1,000 events.

The list of recorded system events is shown in section 12.1 (page 63).

4.3. Meters.

The device is equipped with four types of meters: tripping, PKW accumulated currents, energy and time. The meters are available for reading from the operator panel via the iZAZ Tools operating program. The meters' state is saved when the assembly's power is turned off. It is possible to edit the values of all meters by the operating program (setting the "0" value is equivalent to clearing the selected meter).

4.4. Dedicated statuses (device state)

Dedicated status signals are internal logical states of the device mapping the internal state. Control signals are binary outputs that allow internal control.
The dedicated part of the configuration is on a separate sheet.

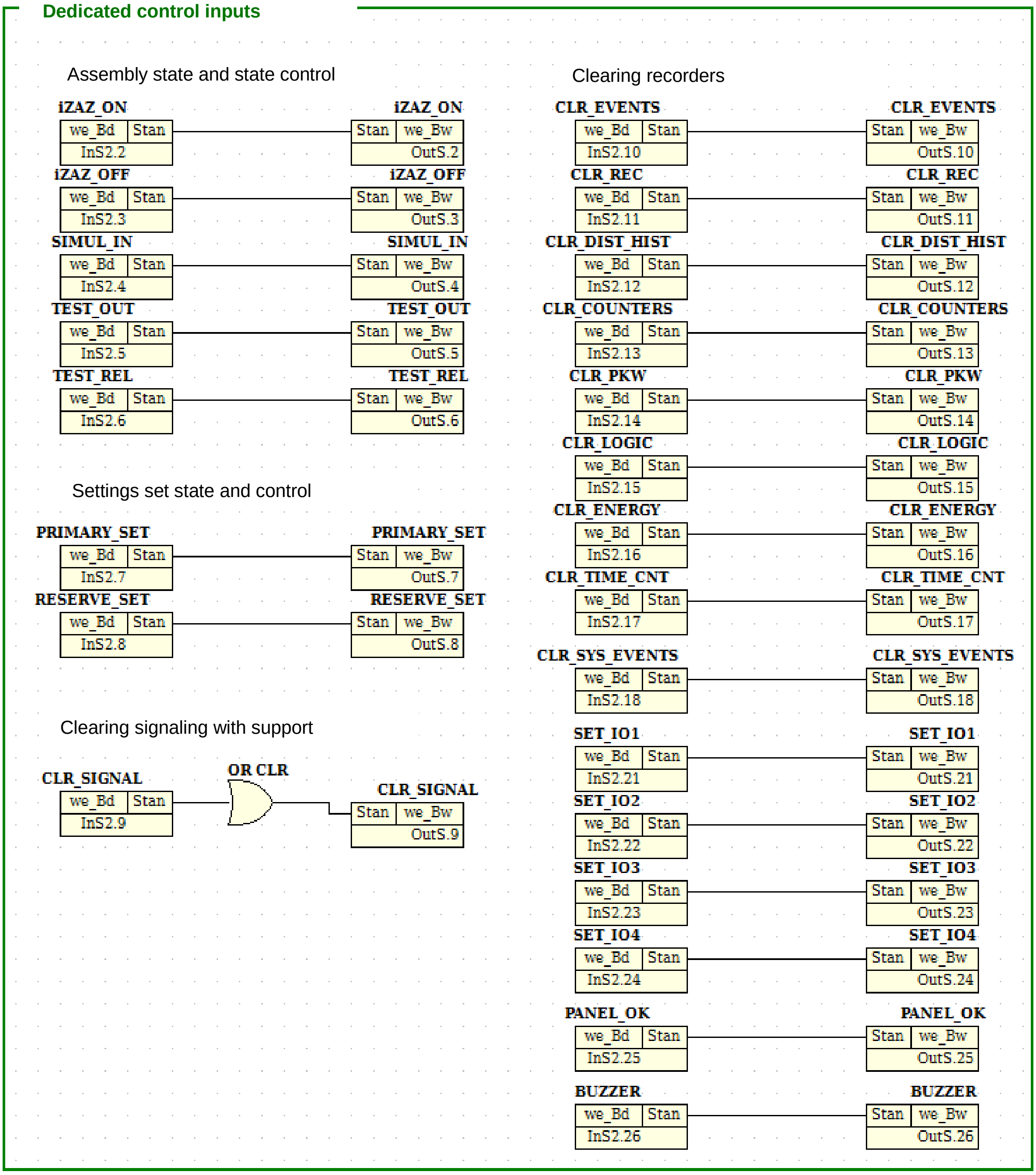


Fig. 12. Connection sheet for pulse inputs of dedicated statuses – iZAZ Tools

The ability to modify control connections allows to change the way of control, according to the circuit needs. For example, the logical sum for the CLR_SIGNAL signal allows to add a signaling clearing signal (e.g., with a two-state input or a command from the host system).

Dedicated status pulse input table (InS2 and OutS)

No.	Name	Description (active state - 1)
1.	-------------------------	not used
2.	iZAZ_ON	Change of state - relay activation
3.	iZAZ_OFF	Change of state - relay deactivation
4.	SIMUL_IN	Change of state - input simulation
5.	TEST_OUT	Change of state - relay outputs test
6.	TEST_REL	Change of state - protection function test.
7.	PRIMARY_SET	Switching the active setting set to primary
8.	RESERVE_SET	Switching the active setting set to reserve
9.	CLR_SIGNAL	Signaling clearing command
10.	CLR_EVENTS	Event recorder memory clearing command
11.	CLR_REC	All disturbance recorder (waveforms) files clearing command
12.	CLR_DIST_HIST	Tripping recorder memory clearing command
13.	CLR_COUNTERS	Meters clearing command
14.	CLR_PKW	PKW meters clearing command
15.	CLR_LOGIC	RS/SR interrupt memory clearing command
16.	CLR_ENERGY	Energy meters clearing command
17.	CLR_TIME_CNT	Timers clearing command
18.	CLR_SYS_EVENTS	System event recorder memory clearing command
19.	-------------------------	not used
20.	-------------------------	not used
21.	-------------------------	not used
22.	-------------------------	not used
23.	-------------------------	not used
24.	-------------------------	not used
25.	PANEL_OK	PAN working order signal

Dedicated outputs carry information about the operating state of the device and additional functions.

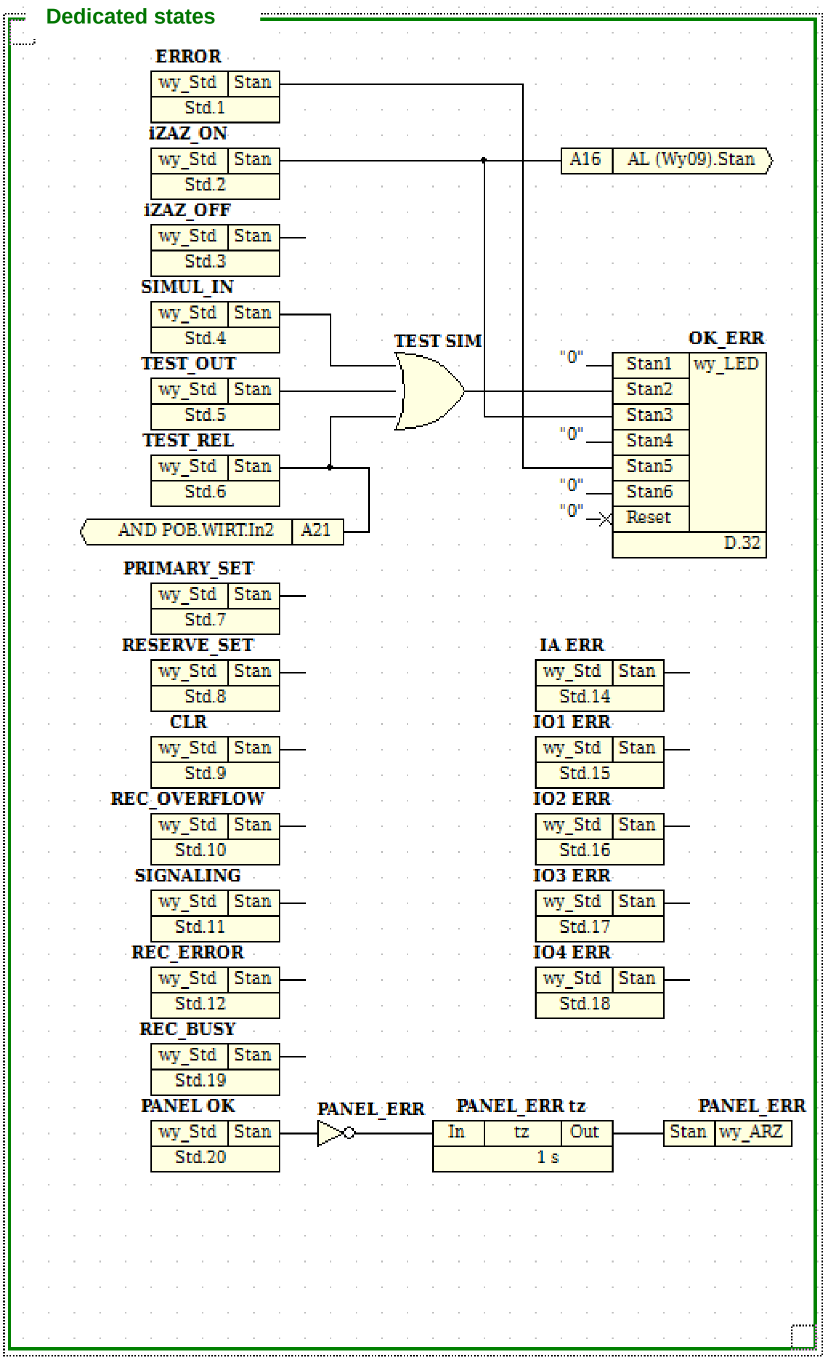


Fig. 13. Connection sheet for dedicated status outputs – iZAZ Tools

Dedicated status output table (Std)

No.	Name	Description (active state - 1)
1.	ERROR	Device error signaling - an error event is generated in the system event recorder.
2.	iZAZ_ON	State signaling - relay active Full protection of the object.
3.	iZAZ_OFF	State signaling - relay deactivated. In this state, the relay does not protect the object.
4.	SIMUL_IN	State signaling - input simulation. The relay works, but the two-state inputs are activated according to the forced setting. In this state, the relay does not fully protect the object.
5.	TEST_OUT	State signaling - relay output test. Allows to control the relays according to the setting. In this state, the relay does not protect the object.
6.	TEST_REL	State signaling - protection function test. The relay is working, but via virtual signals with support it is possible to activate protection functions without forcing analog signals. In this state, the relay does not fully protect the object.
7.	PRIMARY_SET	Primary setting set active.
8.	RESERVE_SET	Reserve setting set active.
9.	CLR	CLR signaling clearing signal active
10.	REC_OVERFLOW	Disturbance recorder overflow, memory full beyond the overflow setting.
11.	SIGNALING	Signaling on the display active (at least one text message)
12.	REC_ERROR	Disturbance recorder setting error Disturbance recorder stopped.
13.	-------------------------	not used
14.	-------------------------	not used
15.	-------------------------	not used
16.	-------------------------	not used
17.	-------------------------	not used
18.	-------------------------	not used
19.	REC_BUSY	Recording
20.	PANEL OK	PAN working order signal

4.5. Real-time clock.

The iZAZ600 is equipped with a real-time clock with an accuracy of more than 1 min/month, which is provided for synchronization by the communication grid. When the power is shut down, the clock's operation is backed up by a battery. In case of incorrect time and date indications or records in the recorders, check the battery state. If the battery needs to be replaced, replace it with a battery of the same type (CR2032).

5. WWZ INTERNAL SIGNALING

5.1. Visual signaling on LEDs.

There are eighteen visual signaling LEDs on the front panel. LEDs L01 ÷ L16 can be assigned standard signaling or modified signaling according to customer needs and requirements. There is an option to set one of two LED colors (green, red), which provides an additional way to indicate the nature of the

signaled event. The description of the LED labeling can be changed at the user's request (replaceable cardboard box in the pocket of the device's front film). Signaling can be either with support (P) or without support (BP).
The LED light is configurable and can be continuous, flashing at 1 Hz and flashing at 4 Hz.

In addition to the 16 two-color programmable LEDs, there are two dedicated LEDs on the operator panel:
OK LED. (green) represents the following operating states:

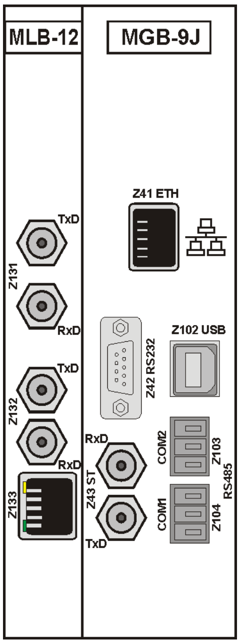
- continuous light - the device is working properly in the ON (active) state
- no light - device deactivated, in test mode or inoperative

ERROR LED (red) indicates that the auto-monitoring system has detected damage to the assembly.

5.2. LCD display signaling.

The iZAZ600 is equipped with an operator panel that features a seven-inch graphic display for visualizing the field's operating state.
The presentation of the synoptic circuit is configured by the user in the iZAZ Tools application. For a detailed description of the front panel, see section 9.1.1, page 50.
The lower signaling window displays, among other things, text signaling messages resulting from the configuration. The meaning and descriptions can be changed at the user's request, and the amount and type of signaling is closely related to the device hardware and software configuration. Signaling can be with or without support.
Message text length up to 16 characters, comment (description) text length up to 64 characters.

6. LOCAL AND HOST COMMUNICATION



Communication with the iZAZ600 is performed via interfaces located on MLB-12 and MGB-9J modules

On the front panel of the MLB-12 module (DSP module) there are LAN interfaces: wired Z133 and fiber optic Z132. In addition, a Z131 fiber optic RS-485 port is also available.
The MGB-9J module's front panel (additional communication module) includes the following interfaces:
LAN wired Z41,
RS-485 fiber optic Z43 and wired Z103 and Z104
USB – additional ability to communicate with a PC - interchangeable with Z104.
RS-232 wired Z42.

6.1. Local device communication via USB link.

The iZAZ600 comes standard with a USB port, located on the operator panel.
It allows the assembly to communicate with a PC using dedicated iZAZ Tools software.
This port operates fully independently of the RS-485 / LAN ports found on the MLB-12 and MGB-9C modules.
There is also an additional USB port (Z102) available directly on the MGB-9J module, but this port works interchangeably with the COM1 serial port (Z104).

6.2. Remote device communication via RS-485 link (Z103, Z104, Z131, Z43).

There are four independent serial ports, including two wired (Z103, Z104) and two fiber optic (Z131, Z43) for local communication with a PC or remote communication with a host system, with MODBUS RTU, DNP 3.0 or IEC 60870-5-103 protocol.
The port is equipped with optical isolation at 2 kV.
Connections of ports Z131, Z43 via 820 nm multimode optical fiber - ST connectors - OM1(62.5/125μm), OM2, OM3, OM4(50/125μm) according to PN-EN 60793-2:2016-09.

The iZAZ Tools software, which comes standard with the device, allows remote operation of the device in the following areas: input and output configuration, entering and reading settings, reading the measured values of input values, reading the input and output state, output test, remote signaling clearing, reading the protection state, reviewing recorders' records, graphical presentation of measurement results and internal clock time synchronization.
Transmission signal connection:
DATA A – COM1/1, COM2/1 terminal
DATA B – COM1/2 , COM2/2 terminal
SIGNAL GROUND – COM1/3 , COM2/3 terminal

Due to the configurable nature of the device, a full table of signal records can be generated from the operating program for a specific configuration.

6.3. Remote device communication via LAN link (Z132, Z133, Z41).

Fiber optic LAN port (Z132) and 2 wired (Z133, Z41) ports for local communication with a PC or for remote communication with a host system, with MODBUS TCP or IEC 61850 protocol.

LAN ports can be used for local communication with a PC or remote communication with a host system, with MODBUS TCP, DNP 3.0 or IEC 61850 protocol (as ordered - only Z132 and Z133 ports on MLB-12 module).
Connection of Z132 port via 1,300 nm multimode fiber - ST connectors - OM1(62.5/125μm), OM2, OM3, OM4(50/125μm) according to PN-EN 60793-2:2016-09.

The iZAZ Tools software, which comes standard with the device, allows the device to be operated in full, just as it is for an RS-485 connection.

Due to the configurable nature of the device, a full table of signal records can be generated from the operating program for a specific configuration.

6.4. Remote device communication via RS-232 link (Z42).

The RS-232 serial port (Z42) is available for local communication with a PC with MODBUS RTU protocol. Connection via a standard DB9 socket.

The iZAZ Tools software, which comes standard with the device, allows the device to be operated in full, just as it is for an RS-485 connection.

Due to the configurable nature of the device, a full table of signal records can be generated from the operating program for a specific configuration.

7. DIMENSION SKETCH

The iZAZ600 consists of a EURO19"/6U/300 cassette housing.

The device's dimensions are shown below.

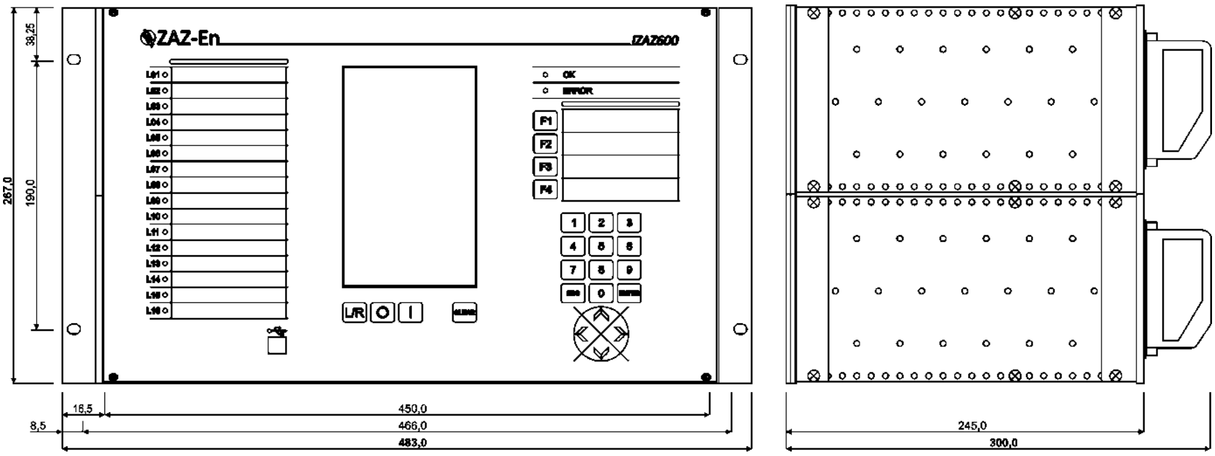


Fig. 14. iZAZ600 dimensions

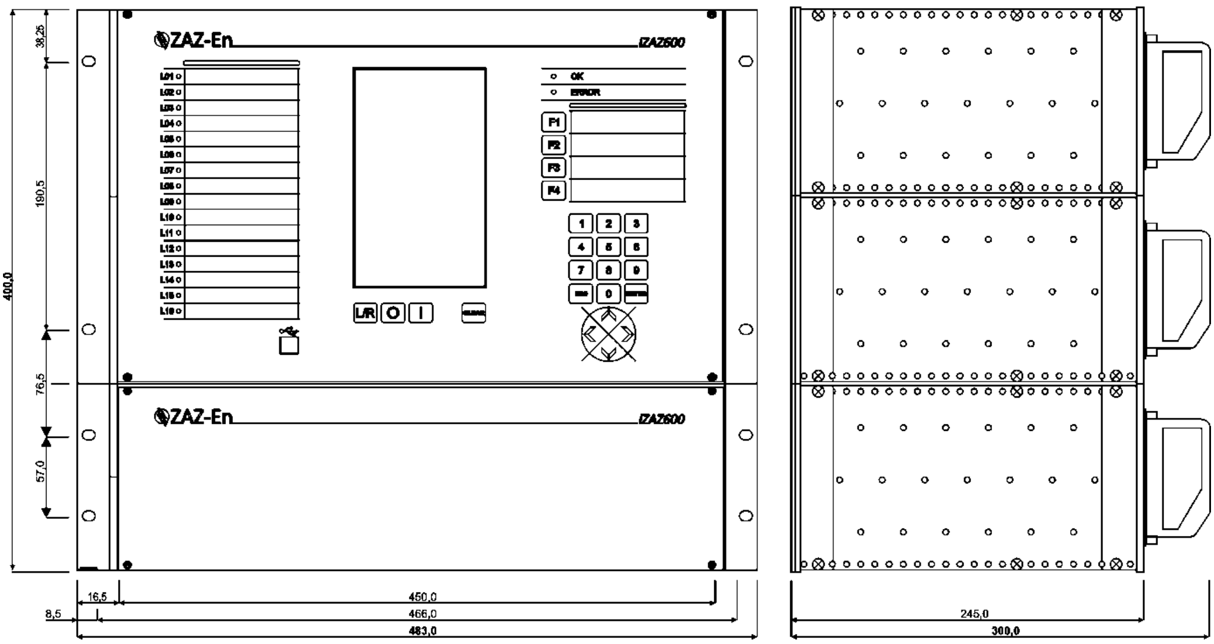


Fig. 15. Dimensions of the iZAZ600 in the 3-cassette version (separated control circuits)

It is also possible to install the device with an operator panel installed separately, connected to the assembly by a communication and power cable (standard Ethernet cable). This solution ensures that the cable harnesses leading to the iZAZ600 assembly's connectors are laid permanently, which greatly simplifies the design solutions used within the protection cabinet. The independent installation of the operator panel is shown below. Since different variants of the operator panel may be available, as an individual, independent assembly component, it is necessary in each case to adapt the installation method to the specific design.

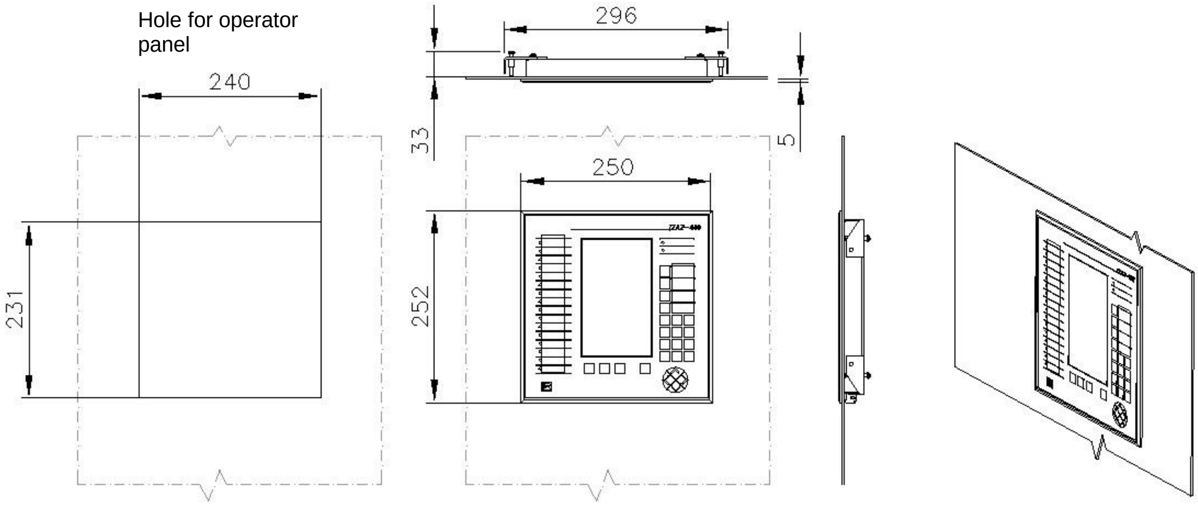


Fig. 16. Dimensions of the PAN operator panel in the independent installation variant

8. INSTALLATION AND START-UP

Devices are allowed to be installed under the conditions specified in the manufacturer's notes (section 1). The device is suitable for countertop installation. The external dimensions of the devices are specified in section 7 (page 52). As a condition for connecting the device to the power grid, it is necessary to verify that the parameters of the installed device are compatible with the operating parameters of the grid.

External connection scheme of the protection to be installed is shown in section 2.5 (page 19)

The device is earthed as standard by installing the cassette in the cabinet design. Therefore, the contact surfaces between the cassette and the mounting frame should be free of paint and any contamination, and should be protected from corrosion. If the design does not provide earthing, make an additional connection from the front mounting bolt with a braided copper cable with a minimum width of 20 mm and a length as short as possible.

Due to the high impedance, the voltage signal measurement inputs are protected by jumpers placed on the terminals. Before connecting input signals, these jumpers must be removed.

For the iZAZ600-P variant, with separate installation of the operator panel (usually on the desktop or cabinet door), the operator panel should be connected to the iZAZ600 with a standard LAN cable, via the PANEL LCD connector, located on the PAN-12 module's front panel. A LAN Ethernet Patch CONNECTING CABLE, CAT 5E, 3M RED is supplied with the device. It is possible to use another cable terminated with RJ-45 plugs crossed in accordance with the standard for non-interlaced Ethernet cables (TIA/EIA-568). It is recommended to use shielded cable (up to 100 m) for connections with lengths greater than 3 m.

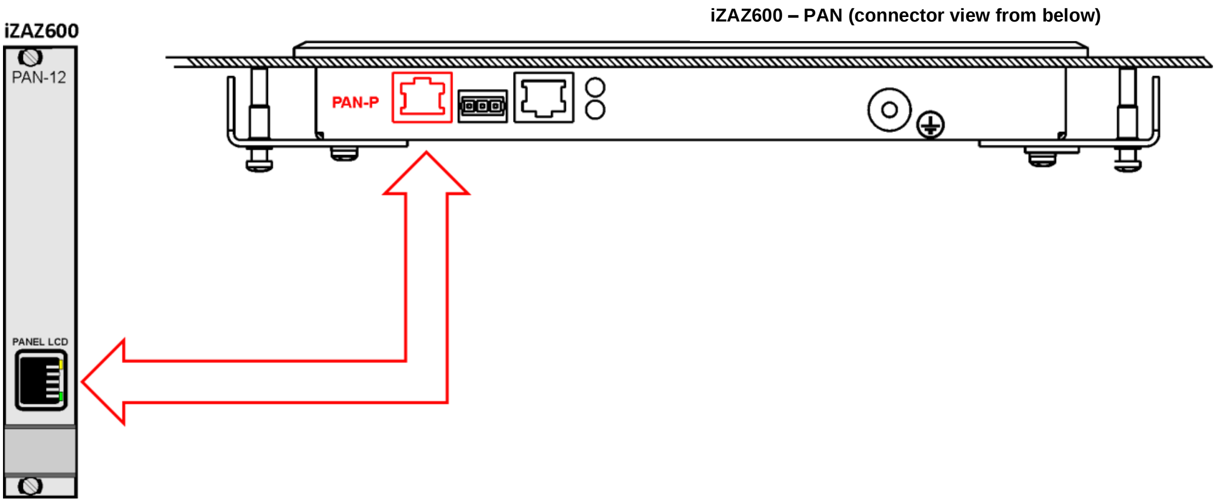


Fig. 17. Connecting the primary unit (JP) and operator panel (PAN)

Start-up of the device, standard, after installation, should be performed as follows:

- switch on the auxiliary voltage (Up = Upn, any polarity),
- check the "**OK**" LED state, indicating the device in working order (description according to section 5.1, page 48),
- upload a configuration file dedicated to the device (or adapt an existing one to the object's needs and requirements),
- perform a relay output test by observing the response of external devices when the assembly's relays are activated (alternatively, check the shorting of the assembly's corresponding terminals),
- functionally check the two-state inputs via high voltage level activation, according to the iZAZ assembly connection circuit,
- force the appropriate signals in the analog input circuits, checking the correctness of the measurements displayed by the assembly, generate a disturbance recorder file and evaluate the recording accuracy,
- functionally check individual protection functions (via the test function with virtual signals without forcing analog signals or by forcing the corresponding analog signals on the terminals of the device using virtual signals to block functions.

After start-up, the device can be put into operation.

NOTE!!!

During operation of the device, some of its parts may be live with dangerous voltage. Improper or inappropriate use of the device can pose a danger to operators, and risks damaging the device. Installation and operation of the device can only be performed by properly trained personnel.
Proper and fault-free device operation requires proper transportation, storage, assembly, installation and start-up, as well as proper operation, maintenance and service.

9. iZAZ600 OPERATION

9.1. Local operation via operator panel.

The device can be operated fully via the operator panel, which is a design element of the iZAZ600 assembly.

Through the operator panel, the following actions can be performed:
- reading the current measurement values and meters,
- preview/edit settings,
- reading the states of two-state inputs and relay outputs
- protection testing via controlled virtual signals (in TEST_REL state),
- relay output testing (in TEST_OUT state),
- LED testing (in TEST_OUT state),
- two-state input simulation (in SIMUL_IN state),
- reading of event, system events and tripping recorders.

9.1.1. Front plate description.

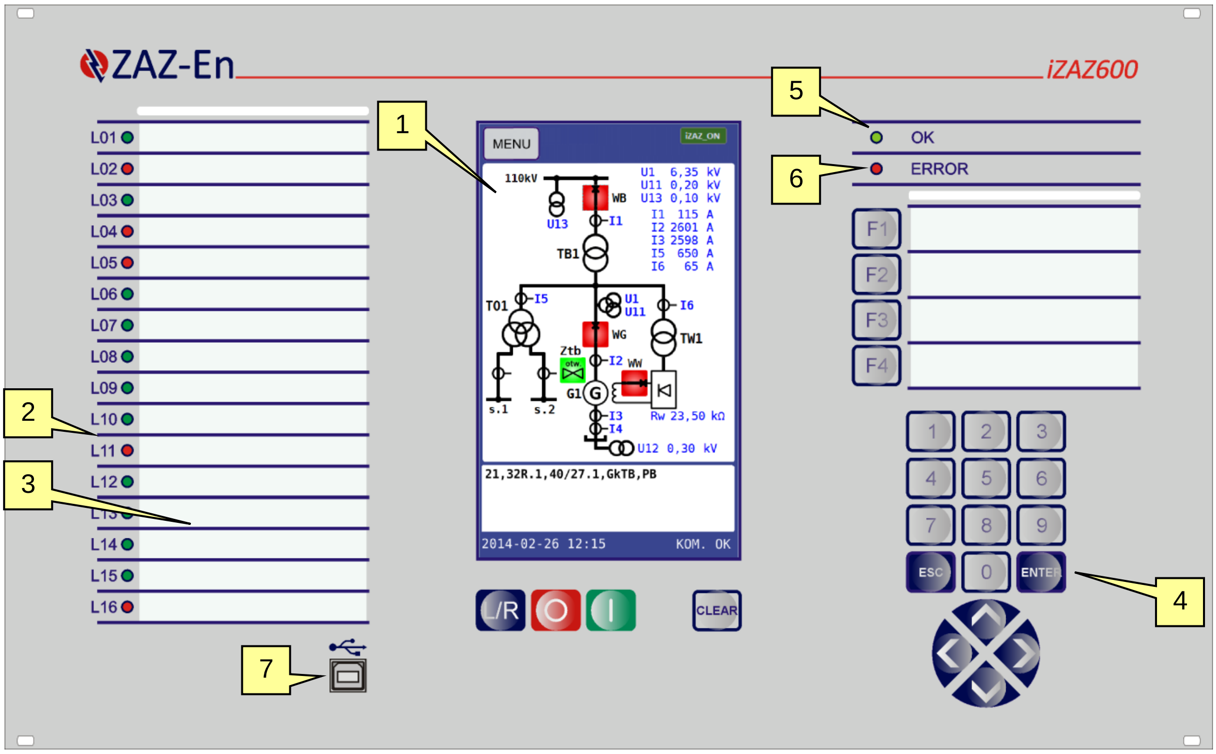


Fig. 18. Front panel - iZAZ600-W operator panel (in the built-in cassette variant)

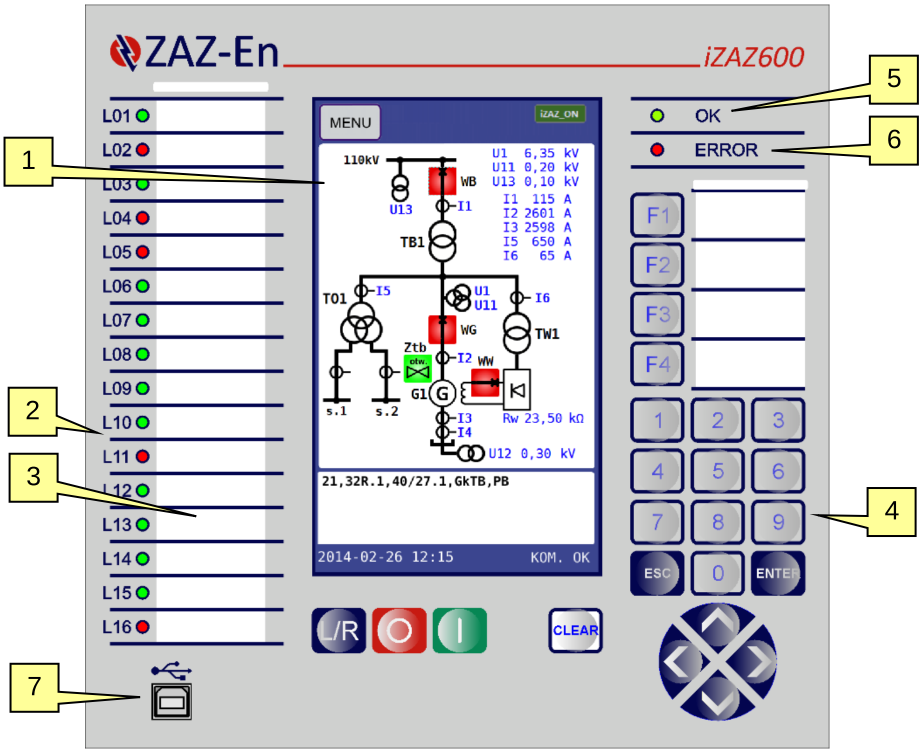


Fig. 19. Front panel - iZAZ600-P operator panel (in independent installation variant)

1	7" touchscreen 800x480 RGB graphic display
2	set of programmable 16 two-color LEDs (green/red)
3	descriptive insert for 16 LEDs
4	24-button keyboard (navigation, control keys, function keys, numeric keypad)
5	OK LED, indicating the assembly's operating state
6	ERROR LED, indicating damage to the assembly
7	USB connector for connection to a PC

The OK LED represents the following operating states:

- continuous light - the device is working properly in the ON (active) state
- no light - device deactivated, in test mode or inoperative

The ERROR LED collectively indicates failure or damage to the assembly.

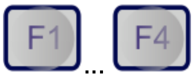
9.1.2. Keyboard

- go to the selected menu item
- confirmation of the set value
- go to the setting editing function
- go to the top level of the program menu
- abort editing of the parameter value with disregarding the changes made

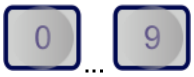
- moving the cursor by one position
- selecting a window in the program menu
- setting the digit (0–9) while editing the setting
- selecting the value of a given parameter from the given options

- coupler on command (I)
- coupler shutdown command (I)
- switching into coupler control mode (L/R)

- signaling clearing



- function buttons, allowing to set a direct jump from any place in the menu to the one in the setting, such as measurements, event recorder, input / output preview, etc.



- full numeric keypad, allowing quick and easy entry of numeric values, such as passwords, set values, etc.

9.1.3. Program main menu layout.

MAIN MENU

- 1. SETTINGS
- 2. MEASUREMENTS
- 3. RECORDERS
- 4. COMMANDS
- 5. STATUSES - TESTS / INPUTS / OUTPUTS
- 6. OPTIONS

1. SETTINGS
- 1.1. Settings editing
- 1.2. No. set Primary/reserve
- 1.3. Date / Time
- 1.4. password changing

2. MEASUREMENTS
- 2.1. Current values
- 2.2. Pick-up counters
- 2.3. Energy couters
- 2.4. AMC couters
- 2.5. Timers
- 2.6. THD Analyzer

3. RECORDERS
- 3.1. Events (Configrable)
- 3.2. Pick-up
- 3.3. Disturbance
- 3.4. System events

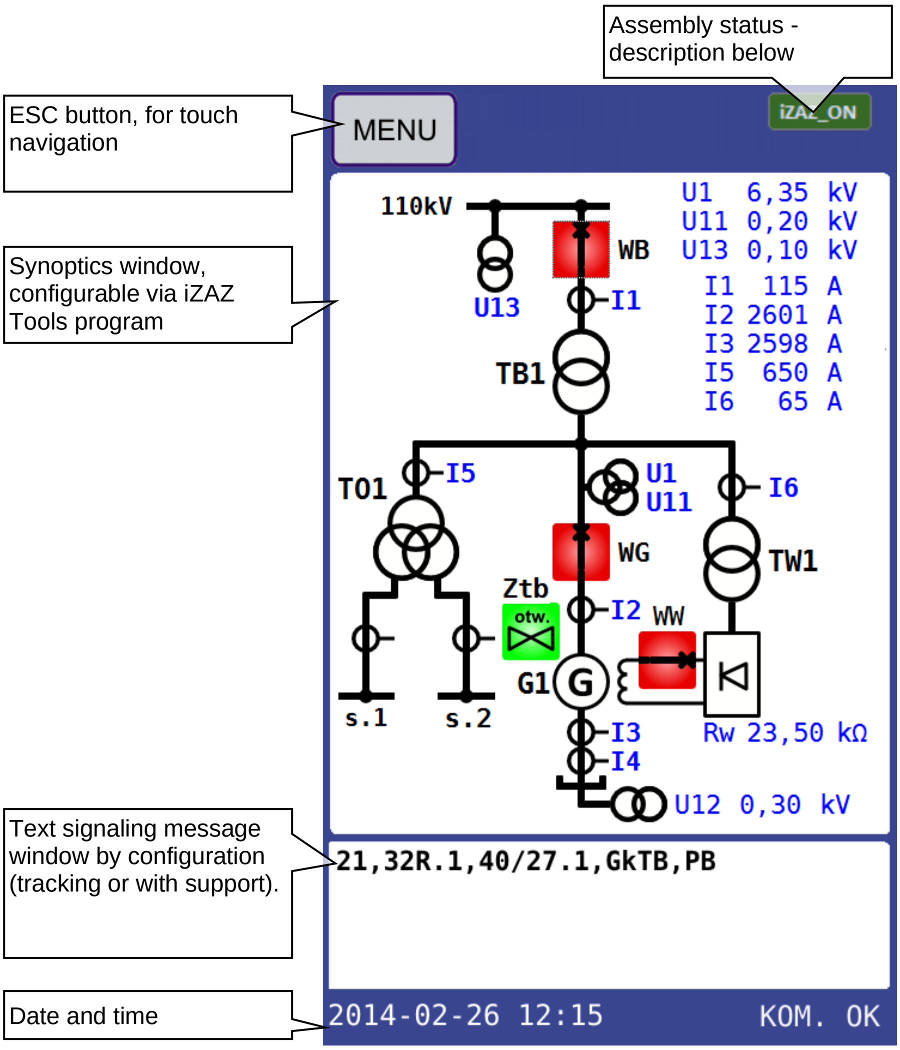
4. COMMANDS
- 4.1. Device state
- 4.2. Control inputs
- 4.3. Reset Counters
- 4.4. Reset AMC
- 4.5. Reset flip-flops (RS/SR)
- 4.6. Reset energy countesr
- 4.7. Reset timers

5. STATES - INPUT / OUTPUT TESTS)
- 5.1. Binary inputs
- 5.2. Virtual inputs
- 5.3. Dedicated inputs
- 5.4. Relay outputs
- 5.5. Dedicated outputs
- 5.6. Signaling outputs
- 5.7. Status outputs
- 5.8. Flip-flop outputs

6. OPCJE (OPTIONS)
- 6.1. Communication
- 6.2. Display
- 6.3. Setting F
- 6.4. Firmware versions
- 6.5. Module profiles
- 6.6. Keyboard test
- 6.7. LED test

9.1.4. Main screen.

The main screen displays the field synoptics by configuration, device description or signaling, if any. The device description can be edited using the operating program. An example screen looks as follows:



Assembly state indication at the top of the screen:

ERROR	Device error signaling.
iZAZ_ON	The device is active, operational, fully protects the object.
iZAZ_OFF	The device is deactivated, in this state, it does not protect the object.
SIMUL_IN	Input simulation state. It's working, but the two-state inputs are activated according to the forced setting. In this state, the relay does not fully protect the object.
TEST_OUT	Relay outputs test. Allows to control the relays according to the setting. In this state, the relay does not protect the object.
TEST_REL	Protection functions test. It's working, but through signals there is the possibility of activating protection functions without forcing analog signals. In this state, the relay does not fully protect the object.

9.2. Operation via PC.

The assembly can be operated using a desktop or laptop PC and iZAZ Tools software.

iZAZ Tools is an application software for operating the entire iZAZ family of devices using a Microsoft Windows XP/VISA/7/8/10/11 PC.

The program allows comprehensive device operation in terms of configuration and settings, with configuration editing in graphical mode, device and protected object state monitoring and control.

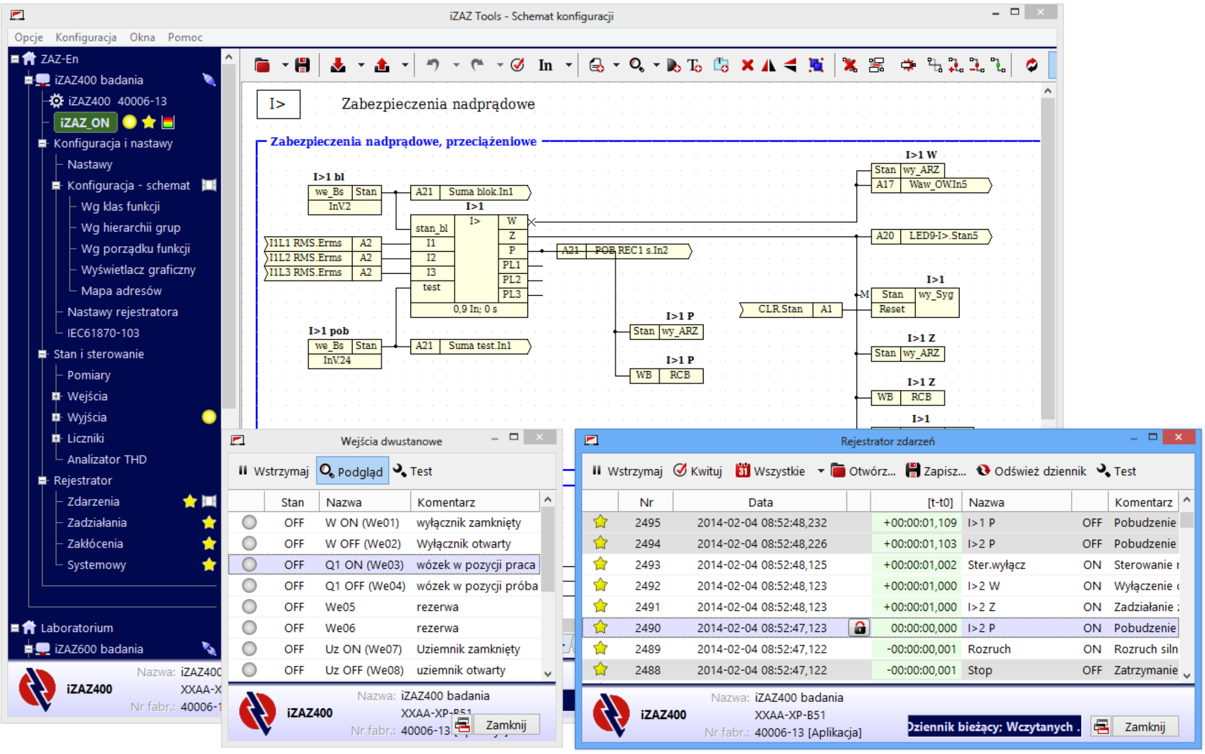


Fig. 20. iZAZ Tools – example program window

Note: For a detailed description of the operation of the iZAZ400 via the communication port using the iZAZ Tools program, see:

5000.51.00.00.Fx.012 User Manual – iZAZ Tools

10. INSPECTIONS AND MAINTENANCE

The iZAZ600 type protection device has built-in auto-monitoring procedures to ensure that its operation is constantly monitored. In addition, using the options of the operating program to view the analog input signal values and the two-state input/output states, it is possible to monitor the correct operation of the device on an ongoing basis.
No special maintenance is required. However, due to the functions performed by the assembly, it is advisable to periodically check the correct operation, especially including the collaboration with external devices (breakers, external protection, signaling and recording circuits). The manufacturer recommends performing such a check once a year or after more than 30 days out of service. Regardless of the length of the interruption in the device's operation, the check should be performed if any works were carried out on the secondary field circuits.

The following procedure is recommended:

- Measurement of values, fed to the device's measurement inputs (currents and voltages) and comparing the results with the values presented on the operator panel or in the operating program.
- External input circuit test, implemented by applying a control voltage to individual two-state inputs and checking whether the input is properly operated by the device (previewing the two-state input states either in the operating program (TESTS) or via the operator panel.
- External output circuit test, performed by activating individual relays using the output test function in the operating program (TEST) or via the operator panel, with simultaneous monitoring of the response of external circuits to the operation of the assembly's control and signaling relays.

The above procedure can be supplemented by checking the operation of the various protections included in the assembly.

Every 5 years it is advisable to test the protection operation with forcing currents and voltages in primary circuits.

The iZAZ series uses a **CR2032** type lithium battery to maintain the current time clock.. The battery should be replaced after 10 years of use or if the sum of the device shutdowns exceeds 4 years.
The battery should be replaced sooner if the protection loses the memory contents (including time and date) due to the auxiliary power supply voltage loss. Battery state is not monitored. Before replacing or disconnecting the battery, secure the registrations by downloading them to the memory of a computer connected to the device.

The battery is placed on the CPU module. The battery can be accessed by removing the housing connector bezel and removing the CPU module. When replacing, special attention should be paid to the correct polarity of the battery. The battery replacement operations, with the auxiliary voltage disconnected, should be performed by authorized personnel. Information about the battery replacement date can be placed on the battery itself or next to it on the module.

11. ORDERING

Ordering iZAZ600

iZAZ600 - ☐ - ☐☐☐ - ☐☐ - ☐☐☐☐☐☐☐☐ - ☐ - ☐☐

AJ1 AJ2 AJ3 AJ4 AJ5 AJ6 AJ7 AJ8

Operator panel configuration:
W – built in cassette
P – separate panel installed independently

YZ outputs configuration*):
MPZ (15 relays) - number of modules
1 – module (15 outputs)
2 – modules (30 outputs)
...
9 – modules (135 outputs)

YS outputs configuration*):
MPS (8 relays) - number of modules
1 – module (8 outputs)
2 – modules (16 outputs)
...
9 – modules (72 outputs)

YW outputs configuration:
MWT (2 sets of relays) - number of modules
2 – modules (4 sets of outputs)
3 – modules (6 sets of outputs)
4 – modules (8 sets of outputs)

AD inputs configuration*):
MWD (8 two-state inputs) - number of modules
2 – modules (16 two-state inputs)
3 – modules (24 two-state inputs)
...
9 – modules (72 two-state inputs)

Control voltage (two-state inputs):
1 – Usn = 110 V DC
2 – Usn = 220 V DC

Number of MAN analog voltage modules:
2 – modules (8 voltage inputs)
3 – modules (12 voltage inputs)
4 – modules (16 voltage inputs)

MAP current channel type; protection (z) range 25In, measurement (m) range 2In:
1 – current inputs – In = 1 A (z)
5 – current inputs – In = 5 A (z)
6 – current inputs – In = 1 A (m)
9 – current inputs – In = 5 A (m)
X – no current channel

IEC61850 configuration:
Y – LAN Z132, Z133 ports with IEC61850 protocol
X – LAN Z132, Z133 ports without IEC61850 protocol

Auxiliary supply voltage:
1 – one MZG-9 power supply with one inverter
2 – two independent redundant MZG-9 power supplies
3 – one MZA-9 power supply with two inverters

Auxiliary supply voltage:
1 – Upn = 110 V DC
2 – Upn = 220 V DC / 230 V AC
3 – for two power supplies option Upn1 = 220 V DC / 230 V AC Upn2 = 110 V DC

*) It is possible to apply additional modules: YZ, YS: up to 15 in total, and AD: up to 16.
The maximum number of each module type depends on the cassette capacity, and the proposed required module configuration should be consulted with the Manufacturer.

Order examples:
iZAZ600-W-212-42-25591XXXX-X-22 - operator panel built in the cassette, two MPZ modules (YZ1,YZ2), 30 signaling outputs, one MPS module (YS1), 8 signaling outputs, two MWT modules (YW1÷2), 4 sets of strong shutdown outputs, four MWD modules (AD1÷4), 32 two-state inputs with a control voltage of 220 V DC, analog channel version: AU1÷2 Un = 100 V; AJ1÷2 In = 5 A, protection range; AJ3 In = 5 A, measurement range; AJ4 In = 1 A protection range, LAN Z132, Z133 ports without IEC61850, two MZG-9 power supplies with auxiliary voltage Upn = 220 V DC / 230 V AC,
iZAZ600-P-324-61-45595551X-Y-31 – operator panel installed independently, three MPZ modules (YZ1÷3), 45 signaling outputs, two MPS modules (YS1÷2), 16 signaling outputs, four MWT modules (YW1÷4), 8 sets of strong shutdown outputs, six MWD modules (AD1÷6), 48 binary inputs with control voltage of 110 V DC, analog channel version: AU1÷4 Un = 100 V; AJ1, 2, 4, 5, 6 In = 5 A protection range; AJ3 In = 5 A measurement range; AJ7 In = 1 A protection range, LAN Z132, Z133 ports with IEC61850 protocol, one MZA-9 power supply with two inverters supplied with auxiliary voltage Upn = 110 V DC.

Note: As a result of continuous development work, the Manufacturer reserves the right to make changes to the manufactured products. This document should be regarded as information about the products and not as a sale offer.

Orders should be addressed to:

ZAZ-En sp. z o.o. , ul. Marii Konopnickiej 13, 41-100 Siemianowice Śląskie, Poland
tel. +48 32 726 69 23, fax +48 32 494 48 85
biuro@zaz-en.pl, http://zaz-en.pl

12. ANNEXES

12.1. List of system events.

No.	Name	Description	ID
1.	RELAY_START	Relay start	5401
2.	TIME_SYNCHRO	Time synchronization	5402
3.	UP_ON	Auxiliary voltage on	5403
4.	UP_OFF	Auxiliary voltage loss	5404
5.	WATCHDOG	Device reset by WATCHDOG	5405
6.	STATE_iZAZ_ON	Device in iZAZ_ON state	5410
7.	STATE_iZAZ_OFF	Device in iZAZ_OFF state	5411
8.	STATE_SIMUL_IN	Device in SIMUL_IN state	5412
9.	STATE_TEST_OUT	Device in TEST_OUT state	5413
10.	STATE_TEST_REL	Device in TEST_REL state	5414
11.	CLR_EVENTS	Configurable recorder clearing	5420
12.	CLR_DIST_HIST	Last trippings recorder clearing	5421
13.	CLR_SIGNAL.	Signaling clearing	5422
14.	CLR_REC_SYS	System events recorder clearing	5423
15.	CLR_REC	Disturbance recorder clearing	5424
16.	CLR_COUNTERS	Meters clearing	5425
17.	CLR_PKW	PKW clearing	5426
18.	CLR_ENERGY	Energy meters clearing	5427
19.	CLR_VIRTUAL	Virtual inputs clearing	5428
20.	CLR_LOGIC	Internal flip-flops states clearing	5429
21.	CLR_TIME_COUNT	Timers clearing	542A
22.	FILE_CONFIG	Uploaded configuration file	5430
23.	FILE_SETTINGS	Uploaded settings file	5431
24.	FILE_DESC	Uploaded descriptions file	5432
25.	FILE_EDIT	Uploaded EDIT file	5433
26.	FILE_TEXTEDIT	Uploaded TEXTEDIT file	5434
27.	FILE_LINKEDIT	Uploaded LINKEDIT file	5435
28.	FILE_POINTEDIT	Uploaded POINTEDIT file	5436
29.	FILE_REC	Uploaded recorder file	5437
30.	FILE_LOADER	Uploaded Flash Loader file	5438
31.	FILE_PROGRAM	Uploaded file with Flash	5439
32.	PRIMARY_SET	The primary set is active	5440
33.	RESERVE_SET	The reserve set is active	5441
34.	PRIMARY_CHANGE	Changing the primary set number	5442
35.	RESERVE_CHANGE	Changing the reserve set number	5443
36.	RECALC_ONLINE	Recalculating settings online	5444
37.	BAD_FILE_CRC	Error in Flash file structure	5450
38.	HIGH_LOOP_TIME	Maximum protection loop time exceeded	5451
39.	RTC_ERROR	Failed to synchronize with internal RTC clock	5452
40.	CACHE_ERROR	Loss of battery-supported data	5453
41.	RAM_CRC	Error in Ram file structure	5454
42.	BAD_CONFIG	Configuration error	5455
43.	EMPTY_CONFIG	Empty configuration	5456
44.	BAD_SET	Settings set error	5457
45.	LOOP_SEQ	Protection loop order error	5458
46.	CRC_VIRTUAL	Error of virtual inputs saved in Ram	5459
47.	FLASH_DATA_INIT	Flash CRC error, data initialized.	545A
48.	REC_SYS_ERROR	System events recorder error	545B
49.	EVENTS_ERROR	Configurable events recorder error	545C
50.	RECORD.ERROR	Disturbance recorder settings error	545D
51.	FS_START	File transfer session start	5460
52.	FS_END	File transfer session end	5461
53.	FS_CANCEL	Open session cancellation.	5462
54.	FS_TIMEOUT	Maximum file transfer session time exceeded	5463
55.	FS_REJECT	Attempting to open an open session	5464
56.	SETTINGS	Sending settings (synchronous)	5465
57.	FIRMWARE_UPDATE	Firmware update	5466
58.	SET_COUNTERS	Meters clearing	5470
59.	SET_PKW	PKW clearing	5471
60.	SET_ENERGY	Energy meters clearing	5472
61.	SET_VIRTUAL	Virtual inputs clearing	5473
62.	SET_LOGIC	Internal flip-flops states clearing	5474
63.	SET_TIME_COUNT	Timers clearing	5475

12.2. List of measurements.

The table lists the measurements by ordinal number, which determines the uniquely specified record value in the MODBUS communication protocol for secondary, primary and rated values.
The configuration usually has a predetermined default number of available measurements, adapted to the configuration type. Measurements not included in the list can be configured on items marked as reserve.

No.	Name	Description
1.	I1L1	Current rms measurement I1 in L1 phase
2.	I1L2	Current rms measurement I1 in L2 phase
3.	I1L3	Current rms measurement I1 in L3 phase
4.	I1S0	Current zero-sequence component rms measurement I1
5.	I1S1	Current positive component rms measurement I1
6.	I1S2	Current negative component rms measurement I1
7.	I2L1	Current rms measurement I2 in L1 phase
8.	I2L2	Current rms measurement I2 in L2 phase
9.	I2L3	Current rms measurement I2 in L3 phase
10.	3Io	Earth fault current rms measurement 3Io
11.	3Uo	Earth fault voltage rms measurement 3Uo
12.	φ(3Uo,3Io)	Phase shift measurement between 3Uo and 3Io
13.	U1L1	Voltage rms measurement U1 in L1 phase
14.	U1L2	Voltage rms measurement U1 in L2 phase
15.	U1L3	Voltage rms measurement U1 in L3 phase
16.	U1L1L2	Phase-to-phase voltage rms measurement U1 L1-L2
17.	U1L2L3	Phase-to-phase voltage rms measurement U1 L2-L3
18.	U1L3L1	Phase-to-phase voltage rms measurement U1 L3-L1
19.	U1S0	Voltage zero-sequence component rms measurement U1
20.	U1S1	Current positive component rms measurement U1
21.	U1S2	Current negative component rms measurement U1
22.	U2	Voltage rms measurement U2
23.	f	U1 voltage frequency measurement
24.	P	Three-phase active power measurement
25.	Q	Three-phase reactive power measurement
26.	S	Three-phase apparent power measurement
27.	P15	Three-phase fifteen-minute active power measurement
28.	Q15	Three-phase fifteen-minute reactive power measurement
29.	tgφ	Power factor value measurement
30.	cosφ	Power factor value measurement
31.	φ(U1L1,I1L1)	Phase shift measurement between U1 andI1 in L1 phase
32.	φ(U1L2,I1L2)	Phase shift measurement between U1 andI1 in L2 phase
33.	φ(U1L3,I1L3)	Phase shift measurement between U1 andI1 in L3 phase
34.	Go	Earth fault conductance value measurement
35.	Bo	Earth fault susceptance value measurement
36.	Yo	Earth fault admittance value measurement
37.	R	Positive component resistance value measurement
38.	X	Positive component reactance value measurement
39.	Z	Positive component impedance value measurement
40.	ϑm	Thermal model temperature value measurement
41.	t46	Asymmetry protection characteristic counting time measurement
42.	t49	Thermal protection characteristic counting time measurement
43.	treg	Engine regeneration time measurement (ItR>0)
44.	ItR1	Measurement of the energy utilization of a single protection start-up ItR1
45.	ItR2	Measurement of energy utilization of multiple protection start-ups ItR2
46.	IrL1	Residual current rms measurement in L1 phase
47.	IrL2	Residual current rms measurement in L2 phase
48.	IrL3	Residual current rms measurement in L3 phase
49.	IhL1	Braking current rms measurement in L1 phase
50.	IhL2	Braking current rms measurement in L2 phase
51.	IhL3	Braking current rms measurement in L3 phase
52.	f2	U2 voltage frequency measurement
53.	reserve	--
54.	reserve	--
55.	reserve	--
56.	reserve	--
57.	Limp	Measurement of the discharge rate in the cable insulation during the current counting period
58.	ΔU-SCK	Measurement of the voltage vector difference at the synchronism monitoring system's open breaker
59.	Δf-SCK	Measurement of the voltage frequency difference at the synchronism monitoring system's open breaker
60.	Δφ-SCK	Measurement of the voltage angle difference at the synchronism monitoring system's open breaker

61.	Uw1	Rotor earth fault protection circuit voltage measurement
62.	Uw2	Rotor earth fault protection circuit voltage measurement
63.	Rw	Excitation circuit resistance value measurement
64.	Xw	Excitation circuit reactance value measurement
65.	I3L1	Current rms measurement I3 in L1 phase
66.	I3L2	Current rms measurement I3 in L2 phase
67.	I3L3	Current rms measurement I3 in L3 phase
68.	I4L1	Current rms measurement I4 in L1 phase
69.	I4L2	Current rms measurement I4 in L2 phase
70.	I4L3	Current rms measurement I4 in L3 phase
71.	I5L1	Current rms measurement I5 in L1 phase
72.	I5L2	Current rms measurement I5 in L2 phase
73.	I5L3	Current rms measurement I5 in L3 phase
74.	I6L1	Current rms measurement I6 in L1 phase
75.	I6L2	Current rms measurement I6 in L2 phase
76.	I6L3	Current rms measurement I6 in L3 phase
77.	I7L1	Current rms measurement I7 in L1 phase
78.	I7L2	Current rms measurement I7 in L2 phase
79.	I7L3	Current rms measurement I7 in L3 phase
80.	I8L1	Current rms measurement I8 in L1 phase
81.	I8L2	Current rms measurement I8 in L2 phase
82.	I8L3	Current rms measurement I8 in L3 phase
83.	U2L1	Voltage rms measurement U2 in L1 phase
84.	U2L2	Voltage rms measurement U2 in L2 phase
85.	U2L3	Voltage rms measurement U2 in L3 phase
86.	U2L1L2	Phase-to-phase voltage rms measurement U2 L1-L2
87.	U2L2L3	Phase-to-phase voltage rms measurement U2 L2-L3
88.	U2L3L1	Phase-to-phase voltage rms measurement U2 L3-L1
89.	U3	Voltage rms measurement U3
90.	U4	Voltage rms measurement U4
91.	U5	Voltage rms measurement U5
92.	U6	Voltage rms measurement U6
93.	reserve	--
94.	reserve	--
95.	I9L1	Current rms measurement I9 in L1 phase
96.	I9L2	Current rms measurement I9 in L2 phase
97.	I9L3	Current rms measurement I9 in L3 phase
98.	reserve	--
99.	reserve	--
100.	IrBL1	Residual current rms measurement in L1 phase
101.	IrBL2	Residual current rms measurement in L2 phase
102.	IrBL3	Residual current rms measurement in L3 phase
103.	IhBL1	Braking current rms measurement in L1 phase
104.	IhBL2	Braking current rms measurement in L2 phase
105.	IhBL3	Braking current rms measurement in L3 phase
106.	ϑ_Ia1	PT100-1 sensor temperature measurement
107.	ϑ_Ia2	PT100-2 sensor temperature measurement
108.	ϑ_Ia3	PT100-3 sensor temperature measurement
109.	ϑ_Ia4	PT100-4 sensor temperature measurement
110.	ϑ_Ia5	PT100-5 sensor temperature measurement
111.	ϑ_Ia6	PT100-6 sensor temperature measurement
112.	LMZ	Short circuit location
113.	reserve	--
114.	reserve	--
115.	reserve	--
116.	reserve	--
117.	reserve	--
118.	reserve	--
119.	reserve	--
120.	reserve	--
121.	reserve	--
122.	reserve	--
123.	reserve	--
124.	reserve	--
125.	reserve	--
126.	reserve	--
127.	reserve	--
128.	reserve	--

12.3. Field synoptics circuit schemes.

Visualization of the field's operating state is implemented based on a 7" 800x480 RGB touchscreen graphic display, which is divided into two areas - description in section 9.1.4.

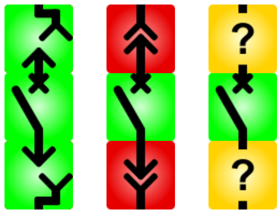
The field synoptic circuit schemes that can be loaded into the configuration are shown below.
The graphic display configuration structure is based on unit images (png files loaded into the device library), on the basis of which the visualization of couplers is implemented.
Available couplers:

Breaker (open, closed, incompatible):

Disconnector (open, closed, incompatible):

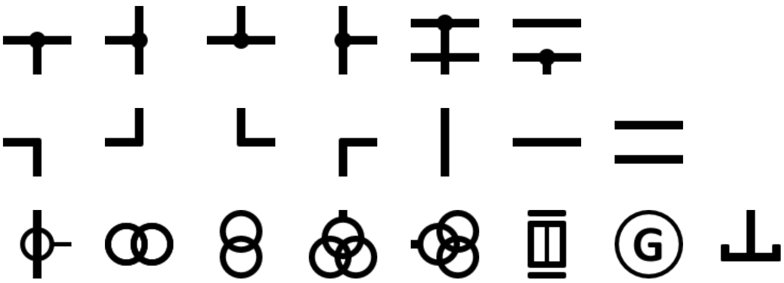
Earthing switch (open, closed, incompatible):

Cart (open, closed, incompatible):

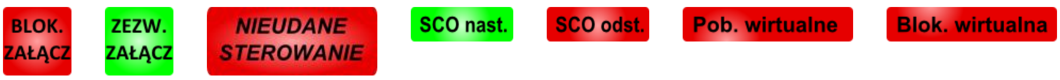


Disconnector-earthing switch (open, closed,

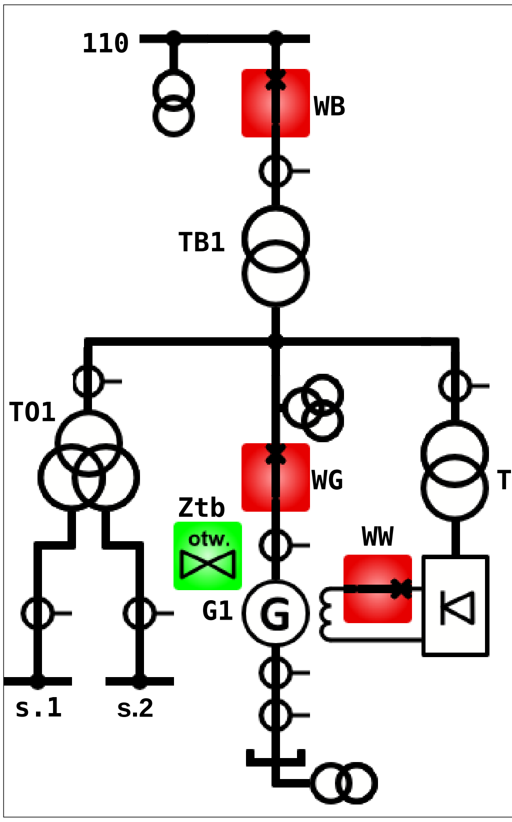
Auxiliary elements:



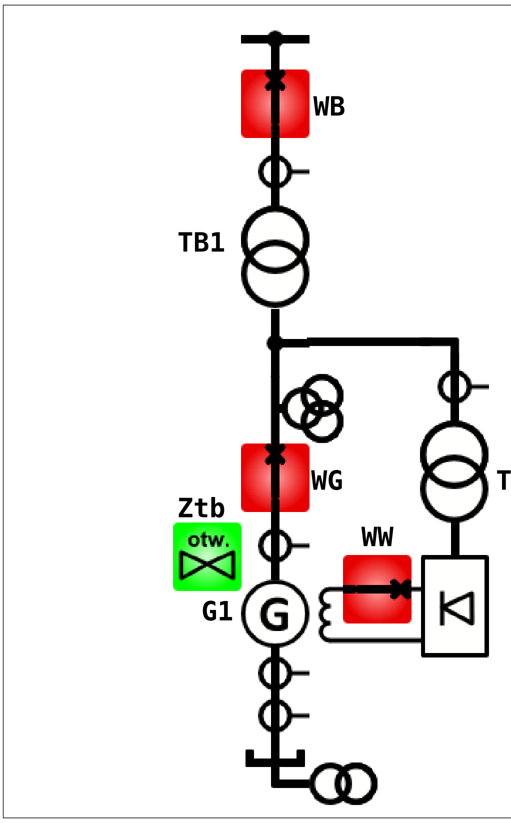
In addition, it is possible to create custom graphics files to visualize various device or field states, such as control interlocks, virtual interlocks, etc.



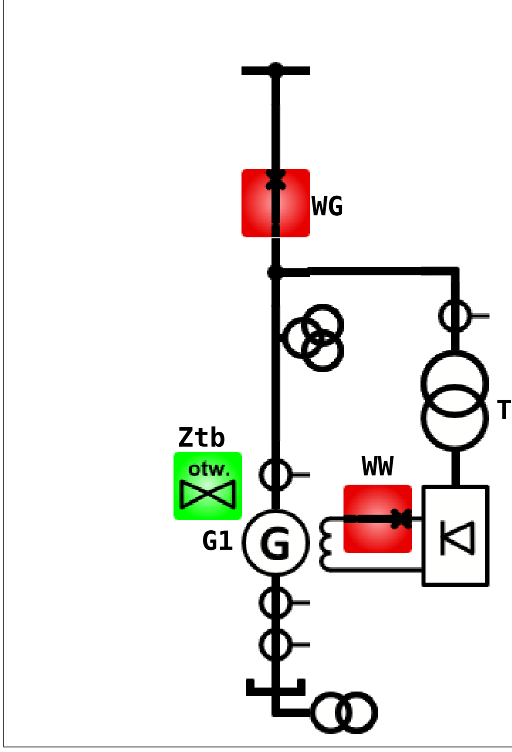
601



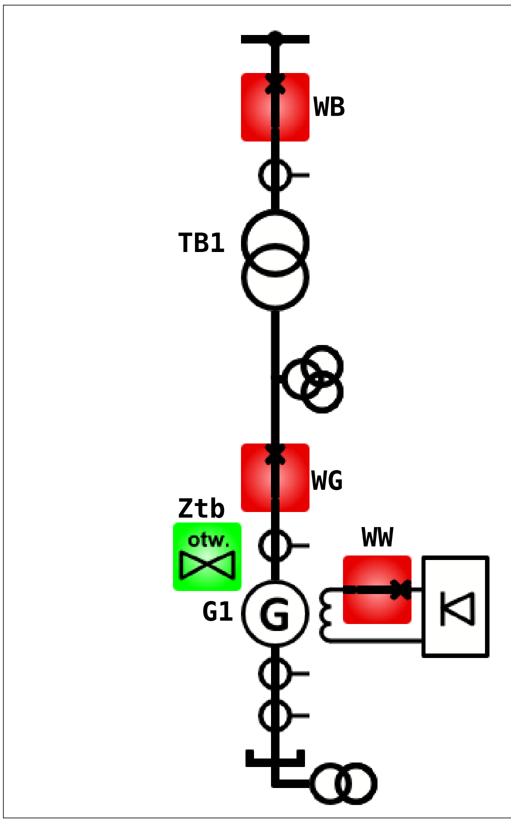
602



603



604



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RELATED DOCUMENTS:

5000.51.06.00.Fx.009 iZAZ600 technical and operating documentation

5000.51.00.00.Fx.012 User Manual – iZAZ Tools

5000.51.00.00.Fx.011 User Manual – iREC

5000.51.00.00.Fx.001 iZAZ configuration function description

Questions regarding the operation of iZAZ family devices and this description should be sent to the manufacturer's address:

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