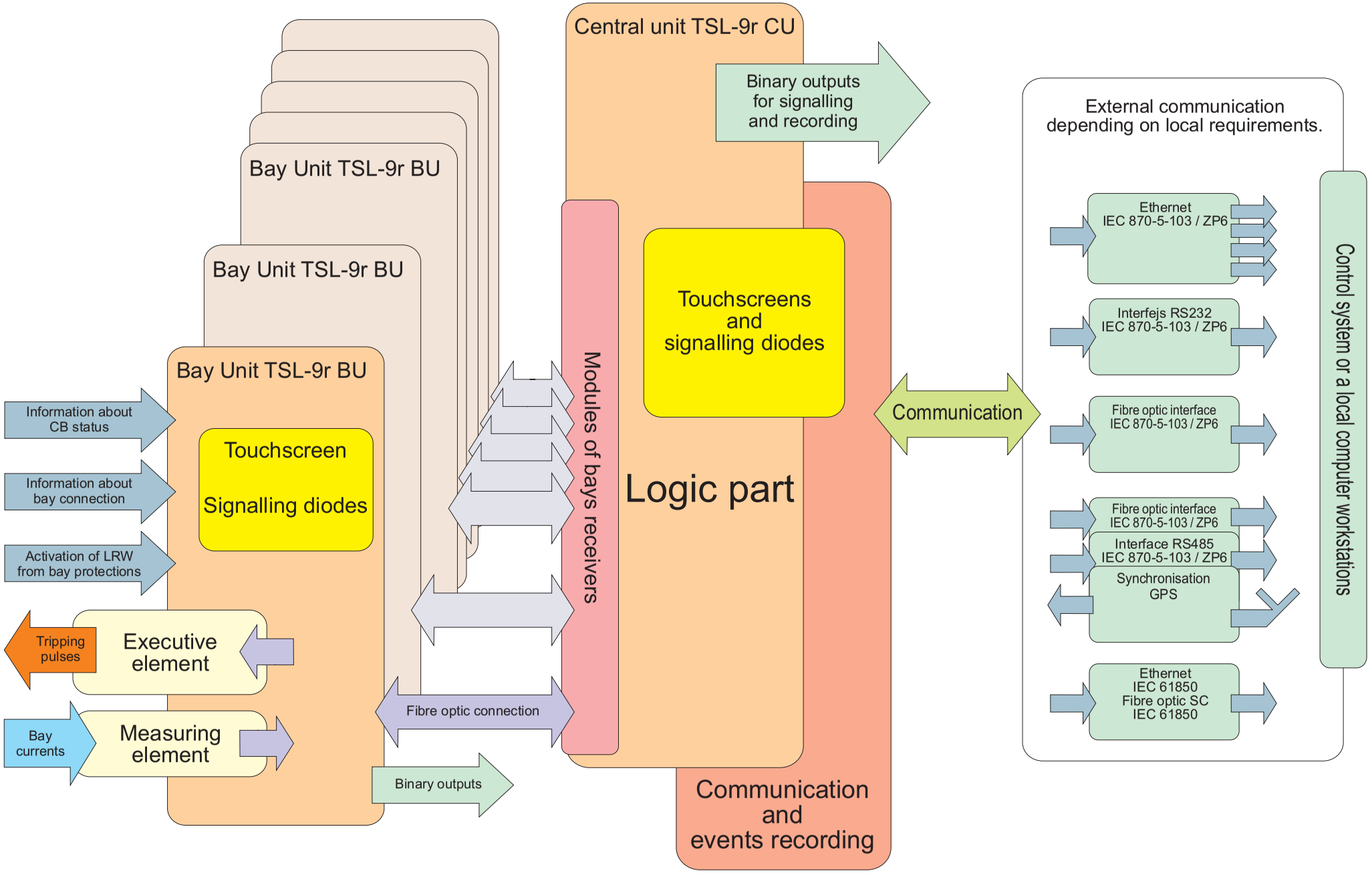
ZPrAE Sp.z o.o.

SZAFY ZABEZPIECZEŃ DLA ENERGETYKI
ISO 9001
ZPrAE Sp.z o.o.
20-letnie doświadczenie
* POLSKA *

TSL-9r

BUSBAR PROTECTION AND BREAKER FAILURE PROTECTION



Structural diagram of the TSL-9r busbar and breaker failure protection

1. INTRODUCTION

40 years of experience in production of busbar (ZSZ) and breaker failure (LRW) protections of our specialists, supported by constant technical cooperation with the power sector enabled us to develop devices, that fill in all the market expectations, including those defined in the standards of Polish Power System Operator (PSE). In order to meet the needs and demands set up by users, we offer a new device – busbar protection **TSL-9** type, functioning as a busbar and breaker failure protection – which was developed basing on rich experience in production of previous models, having a greatest focus on the latest available technologies. The below catalogue represents only brief information, describes basic functions and principles of operation. It does not contain full description enabling designing and further exploitation of electric circuits using TSL-9r. Extended materials can be provided on demand.

2. APPLICATION OF THE DEVICE.

The Busbar Protection is meant for quick and selective tripping of all bays of specified system, or a whole busbar section in case of busbar fault. The range of operation of this protection covers: busbar, busbar isolators and breakers. The range of operation is limited by the place of installation of current measuring transformers.

The Breaker Failure Protection is meant for quick and selective opening circuit breakers on the substation in case of fault (not opening) the circuit breaker in a specified bay despite tripping impulse from its protection. In such instance the device – after specified time T1 – sends a repeated tripping impulse to this circuit breaker. After unsuccessful attempt to open that circuit breaker the device – after time T2 – opens all the circuit breakers of bays connected to the same system or busbar section.

Basic features of the device:

- the device can be used for substation working in any type of arrangement,
- the device consists of one central unit and appropriate (depending on number of bays of the substation) number of bay units,
- the device can operate as:
  - a busbar protection,
  - as a breaker failure protection,
  - execute both functions simultaneously,
- the modular-chassis construction of the device enables its adaptation to a changing arrangement of a substation when it is expanded by new bays,
- universal modules enable easy adaptation of the device to a change of the transformation ratio, by a programmable change of the devices setup,
- two independent tripping circuits for each circuit breaker of the substation, constructed basing on solutions used in RSH-3 relay (“fast tripping” relay), enable breaking – in emergency situations – current of the circuit breakers coil,
- two criteria for defining the circuit breaker position: basing on current flow and auxiliary contacts,
- two independent sets of activation inputs from protections working in different circuits of auxiliary voltage
- possible one- and two-bit representation of the state of isolators and breakers,
- programmable operation algorithm accordingly with arrangement of the substation
- change of the setup can be done with a notebook.

- Built in internal events recorder
- Built in internal disturbance recorder.

ZPrAE-Edit functional application is delivered along with the TSL-9 device. It enables configuration and handling of the device as well as visualisation of current waveforms from the internal disturbance recorder.

The device enables transmitting of data into local control system of a substation, and enable remote, on-line communication with the device: observation of its state, reading of recorded data and change of setup.

3. PRINCIPLE OF OPERATION.

3.1. Principle of operation of the busbar protection.

The TSL-9r busbar protection is fitted with two independent measuring circuits.

The first one – (of a system), operates based on the principle of current phase and amplitude comparison covers bays of a given system or a busbar section. The circuit is activated if phases of currents in all bays are coincident, and the differential current is higher than the setting. Current phase coincidence is detected within the first 2 ms for each half of the sinusoid, which clearly indicates an internal short-circuit. After that time phase coincidence does not activate the measuring module as it may be caused by current transformers being saturated in case of an external short-circuit. This way the current transformers can be oversaturated up to 5 times and the protection still works selectively.

The second measuring circuit – (of a sum), operates in a stabilized differential current circuit covers all substation bays, independent of the system (section), to which they are connected. It works when differential current is higher than the set value. The sum module is always activated during internal short-circuits at substation busbars.

Sensitive currents of both measuring circuits can be set through the values of the primary current of the substation from 100 to 10,000 A.

Busbar protection sends a tripping pulse only if the measuring circuits of both the system and the sum are activated in the same phase (two of two logic). In that case the protection generates pulses to all substation bays connected to a given system, regardless of current values in those bays. Thanks to technical solutions and algorithms used as well as high speed output relays the busbar protection time to operate is below 10 ms.

Busbar protection is fully selective and works correctly even in case of short-circuits during switchovers, and short-circuits between a transformer and a circuit breaker in a busbar switch bay. The protection also detects short-circuits in the dead zone of the feeder bay – between a transformer and a circuit-breaker.

3.2. Principle of operation of breaker failure protection

The primary criterion for activation of the breaker failure protection is coincidence (simultaneous appearance) of:

- tripping impulse from protection of a given bay,
- information that the circuit breaker is closed.

Overrun of the preset permissible duration of this coincidence denotes, that the circuit breaker has not opened, and in order to stop fault current inrush to the point of fault all circuit breakers connected to this point should be opened.

The status of circuit breaker is determined by:

- control over volume of current flow through a given bay (current criterion - KP)

- control over status of auxiliary contacts of a circuit breaker of a bay (circuit breaker criterion KW)

The circuit breaker failure protection operates in two stages. The first stage is a repetition of the tripping impulse for its own circuit breaker. This operation is done immediately or with a very short delay time (T1) – the so called “re-trip”.

After unsuccessful attempt to open its own circuit breaker in the first stage of LRW operation and following the lapse of the second stage time (T2), tripping pulses for all circuit breakers connected to the same busbar system (section) are generated. Those tripping pulses are always generated in both tripping circuits.

There are separate time delay elements, T1 and T2, provided for each phase and for three-phase activations coming from protections “with” and “without current”.

Time delay elements operating in circuits in which current flow is used as the criterion for indicating the CB status have two adjusting elements (T2.J) whereas the circuits in three-phase activations from protections “without current” which as the criterion of CB status use its auxiliary contacts, have a separate adjusting element (T2.W).

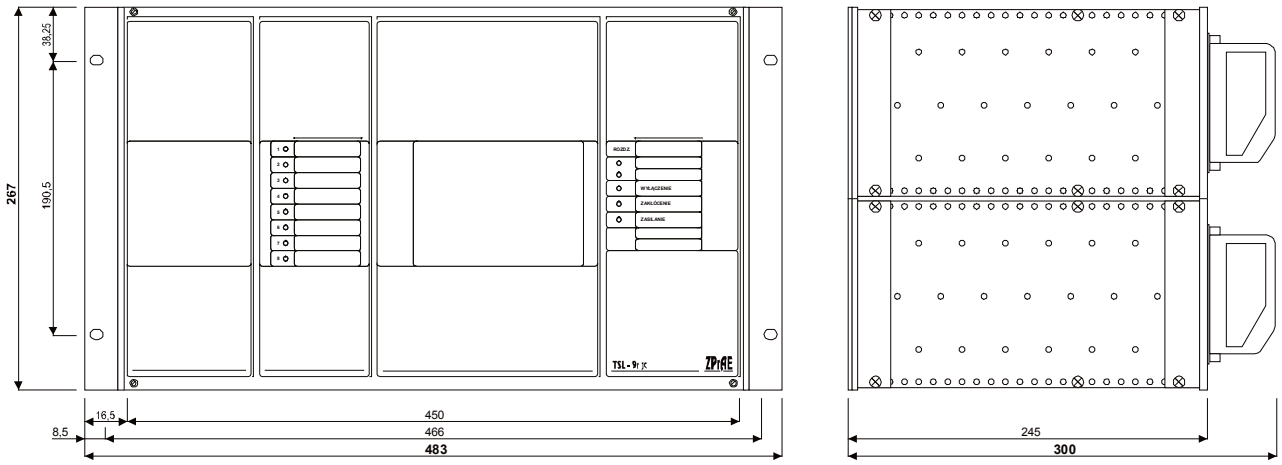
4. CONSTRUCION OF THE DEVICE

The construction and algorithms of operation enabled creating a device, that is technologically advanced, operates fast and reliably being user friendly at the same time. The TSL-9r device consists of terminals, each of which serves one substation bay, hereinafter referred to as bay units (BU), and of one central unit (CU) – controlling cooperation of the bay units. Additionally the central unit acts as an event recorder, ensures communication with the “outer world” and enables full configuration of bay units. Each bay unit is connected to the central unit with a fibre optic cable. The central unit as well as the bay units are produced in chassis to be mounted in a swing frame of a cubicle. Connection of external cables is ensured by terminals mounted on the back wall of the device. An LCD touch panel and signalling diodes are mounted on the front panel of BUs and the CU.

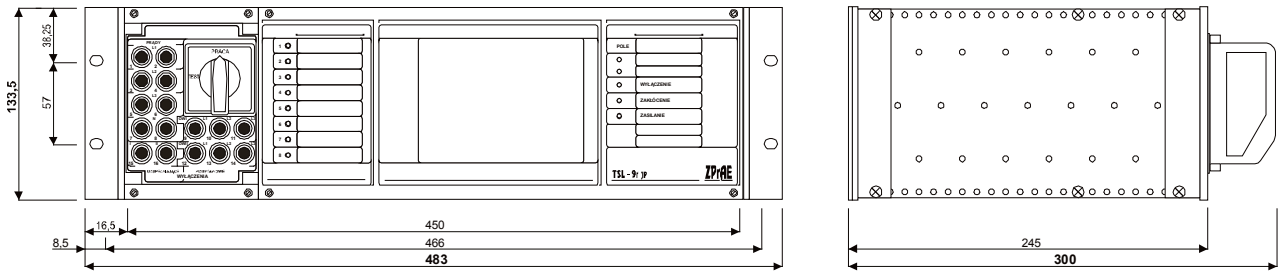
4.1. Dimensions of the device.

The TSL-9r devices are mounted in a 19” EURO chassis made from chromed aluminium, providing sufficient protection for EMC interferences.

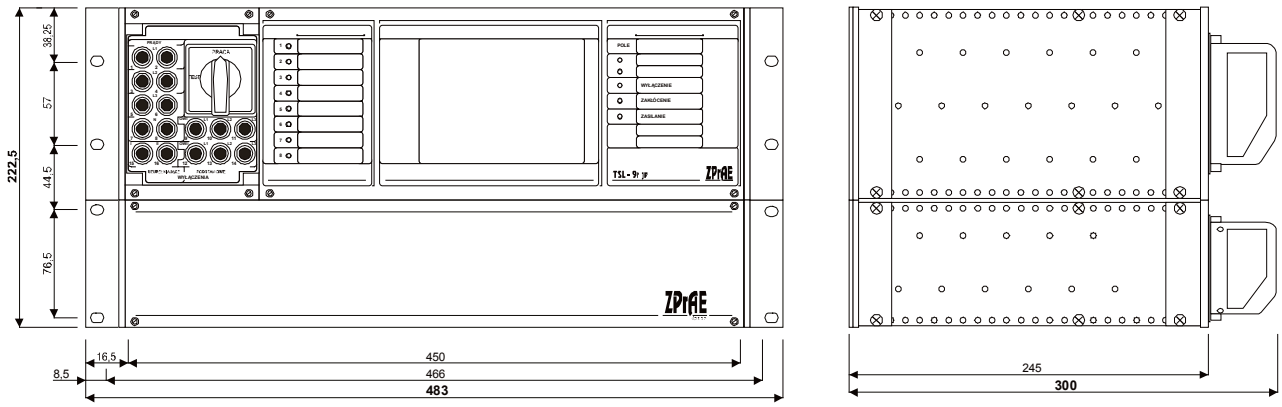
The central unit of TSL-9r is mounted in a 6U chassis. Bay units of the TSL-9r are mounted in chassis 3U high, or in a case of versions with doubled tripping circuits - 5U. Bay units of TSL-9r E are fitted inside a half of the 3U chassis what enables mounting of two such units in one 3U chassis.



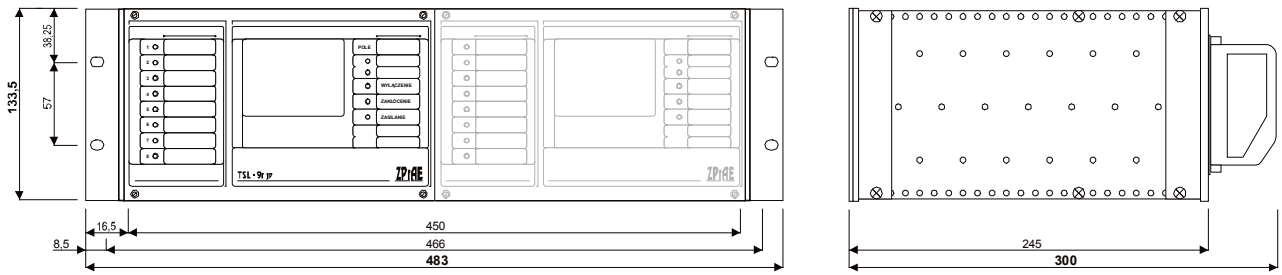
Picture. 4.1. External dimensions of the Central Unit TSL-9r CU.



Picture. 4.2. External dimensions of the Bay Unit TSL-9r BU versions A and C.



Picture*. 4.3.* External dimensions of the Bay Unit in *TSL-9r BU versions B and D.*



Picture. 4.4. External dimensions of the Bay Unit in *TSL-9r BU version E (two in one chassis).*

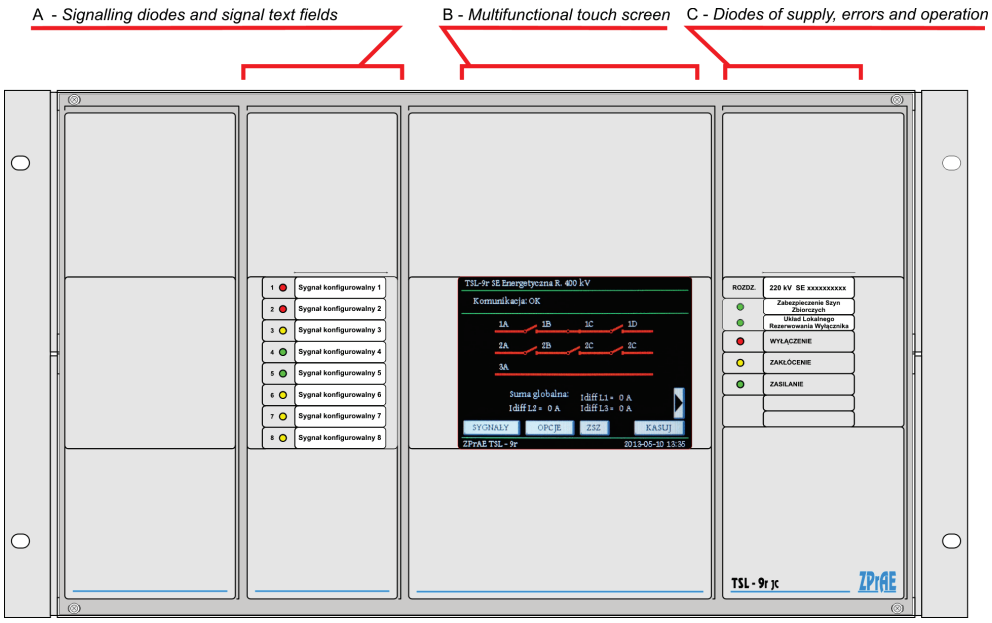
4.2. The central unit.

The chassis of the central unit of TSL-9r contains power supply modules, binary inputs, relay outputs, module for internal logics responsible for synchronisation of operation and internal communication between units, external communication module available in many versions, and modules for communication with bay units.

4.2.1. Front panel.

A – Signalling diodes and text fields for signals.

8 signalling diodes with text fields are located on the left side of the front panel. The most needed signals can be chosen from the list provided in the programme delivered along with the device, and assigned to a specified diode. The colour of the LED (yellow, red, green, blue, violet) can be set with a programme.

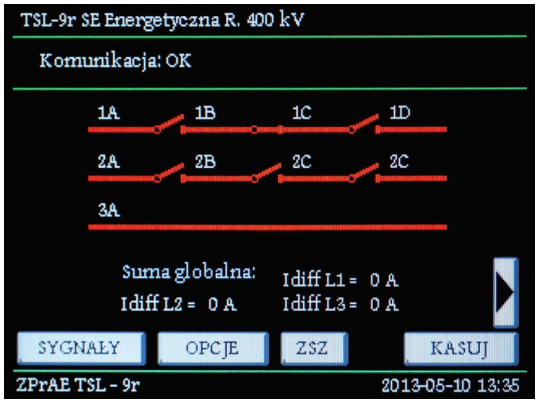


Picture. 4.5. Front panel of the central unit TSL-9r CU

B – An LCD touch screen.

A colour LCD touch screen enabling preview of current status of busbar section disconnectors in the area of operation of the CU, is located in the middle of the front panel,

This basic screen also provides information on status of communication of the CU with each BU and current date and time.



Picture. 4.6 Basic screen

When the function of busbar protection is active the basic screen provides information on error (differential) current in % of primary current of the busbar. Changing the preview of error (differential) current measured for the whole busbar system, and each system separately is done by pushing the arrow situated next to values of measured currents displayed on the screen.

Touch screen buttons, enabling the following operations are located In the bottom of the screen:

- ***RESET*** – confirmation of operation of the protection and resetting signals from the central and all bay units
- ***ZSZ*** – changing preview into setup of busbar protection (possible only for devices with active function of busbar protection)
- ***OPTIONS*** – preview of i.a. mimic diagram of specified bays as well as blocking and unblocking of functions.
- ***SIGNALS*** – preview of chosen interference signals from the device.

C – Diodes of supply, errors and operation.

On the right hand side of the devices five diodes signalling state of operation of the central unit are located. The two upper diodes inform about activation of ZSZ and LRW functions. Green light means that function is active, yellow – disabled. The red diode in the middle - “TRIP” - means that the device sent a tripping pulse. The yellow diode “ERROR” stands for interferences of operation of the device. The last one – green diode “POWER” means that the unit has power supply.

4.2.2. Back panel and terminals.

Terminals for the external connections are located on the back panel of the device. The device is provided with plugs.

A – Power supply.

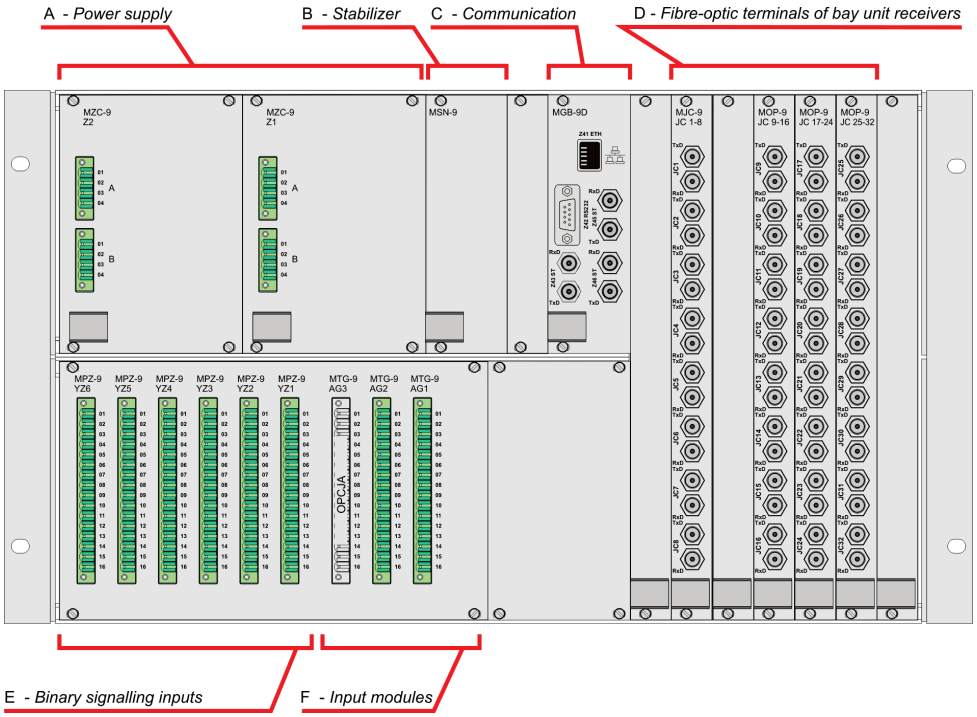
In order to increase reliability of operation the device is equipped with two power supplying modules working in parallel each of which is supplied from two separate circuits of auxiliary supply – primary and backup. Power of one supply module is sufficient to supply the entire central unit.

B – Power system stabilizer.

The Module of the stabilizer ensures appropriate power supply of all modules in the device.

C – Communication.

The MGB concentrator is responsible for external communication with a control system or with a station computer. This module serves also as a main cache memory for the events recorder. It enables archiving up to 10 thousand events with 1ms resolution. The memory used is non-volatile, meaning that lack of power supply does not result with erasing stored events. It is equipped with a real time clock, which can be synchronised with superior control system of a substation or an optional GPS module. Digital recording of data in the hub enables sending them to the superior control system.

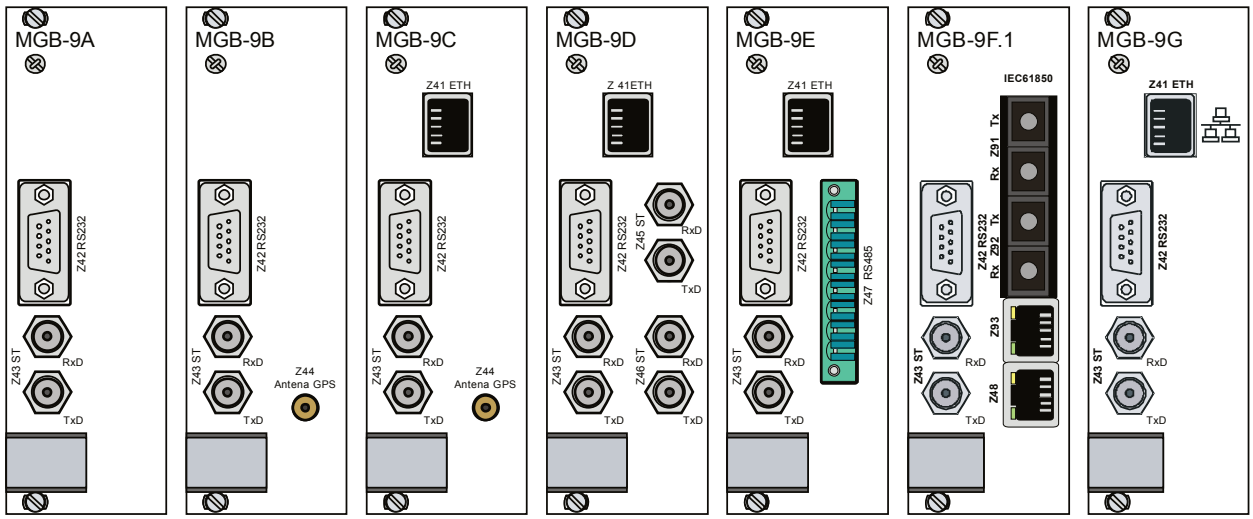


Picture. 4.6. Layout of connection terminals on the back panel of the central unit - TSL-9r CU

The MGB concentrator can be maximally equipped with four transmission channels on different physical layers: RS232, RS485, fibre-optic cable and Ethernet.

The Ethernet enables connection with maximally four independent users at the same time. Each channel may operate in IEC 870-5-103 protocol or factory protocol ZP-6. One of the channels may be used for communication with the GPS module. The RS485 connection is delivered in 2-conductor standard or optionally – 4-conducotor. Communication in accordance with IEC 61850 protocol is provided by communication module version MGB-9F.1, equipped with communication port with Ethernet slot, and with two fibre optic slots.

The control systems of a station using communication protocols IEC 870-5-103, IEC61850 have possibility to receive recorded events, reading current states of faults, and steering, for example remote resetting.



Picture. 4.7. Versionf of MGB-9 module.

D – Fibre-optic connections of bay units.

The fibre-optic connections are used for communication of bay units with the central unit, and the number of connections depends on number of bay units of the device.

E – Binary signalling ports

As a standard the central unit is equipped with three cards each having 15 contacts, meant for outgoing communication to:

- Backup signalling system of the substation
- Control system of a substation
- Disturbance recorder

Optionally the device can be equipped with further three configured cards with binary output terminals:

- a fifteen-contact (with common potential)
- a three times 4-contact (three groups, each with its own potential)
- an eight-contact (eight isolated contacts).

F – Input terminal modules.

As a standard the central unit is equipped with two 8-line isolated input cards meant for receiving information about:

- State of the section disconnectors
- Remote reset and blocking of functions of the device.

Optionally, the device can be equipped in further configured input terminal card.

4.3. Bay Unit.

The bay unit is offered in five basic versions. The versions differ in number of input and output cards as well as number and types of tripping modules. Due to such diversity it is possible to provide protection for any arrangement type of a substation: three-switch substations, system substations, mesh substations or substations with one-and-a-half or two breaker arrangement. Version with double tripping cards can be used in substations where separate circuits for ZSZ and LRW are required when one device executes both functions.

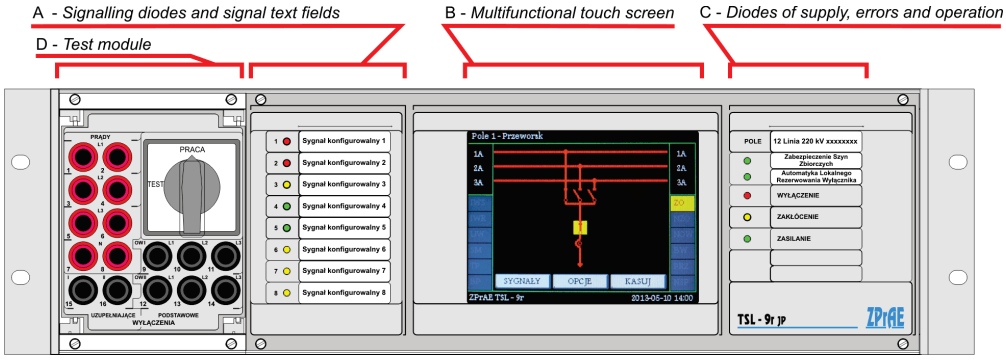
- A – with activation and tripping pulses for each phase separately,
- B – with activation and tripping pulses for each phase and with additional tripping pulses for the LRW function in one-and-a-half breaker arrangements,
- C – with 3-phase activating and tripping pulses separately for each function (ZSZ & LRW),
- D - with activation and tripping pulses for each phase and separately for each function (ZSZ & LRW),
- E - with 3-phase activating and tripping pulses.

The Euro-chassis of the TSL-9r bay unit contains a power supply, binary inputs, current measuring circuit, logic and communication module, relay outputs and tripping relays. Additionally, bay units in version A, B, C and D are equipped in a testing module as a standard.

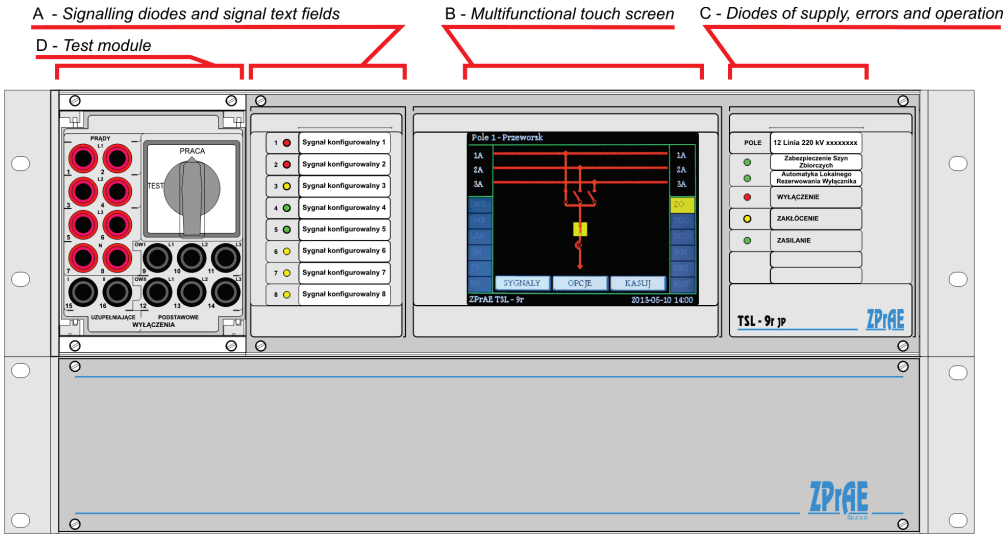
4.3.1. Front panel.

A – Signalling diodes and text fields

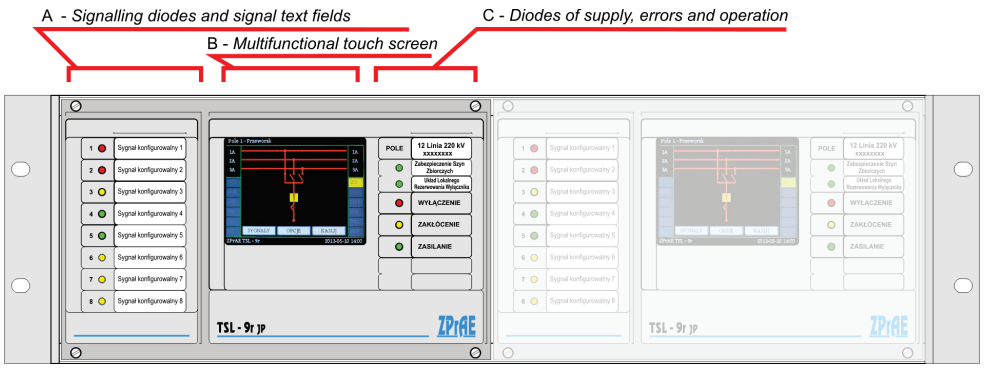
8 signalling diodes with text fields are located on the left hand side of the front panel. The most needed signals can be chosen from a list delivered along with the software of the device and assigned to the diodes. The colour of the diode (yellow, red, green, blue and violet) can be set with a program.



Picture. 4.8. View of the bay unit TSL-9r BU versions A and C.



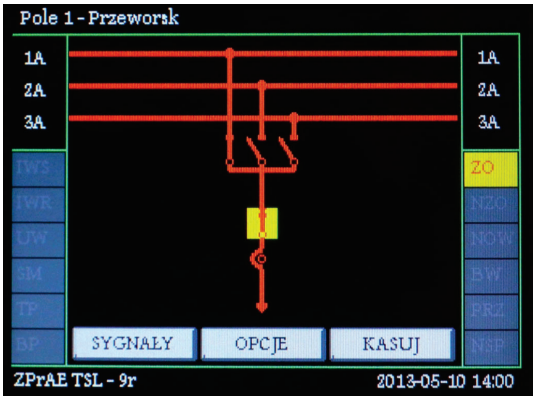
Picture. 4.9. View of the bay unit TSL-9r BU versions B & D.



Picture. 4.10. View of the bay unit TSL-9r BU version E.

B - LCD touch screen.

A colour LCD touch screen is located in the middle of the front panel. This display enables preview of current scheme and work status of the bay.



Picture. 4.11. View of the basic screen

Control fields are located on both sides of the display. In case of activation of a specified signal the fields light up with a colour (depending on importance of the signal with yellow or red light). The number of control fields depends on protection functions the device executes.

The three screen buttons in the bottom of the touch panel „Signals", "Options", "Reset" enable accordingly:

- ***RESET*** – Confirmation of operation of the bay unit and resetting signalisation.
- ***OPTIONS*** – preview of current set up and blocking or unblocking of specified functions of the bay unit.
- ***SIGNALLS*** – preview of full description of signals.

C – Diodes of supply, error and operation.

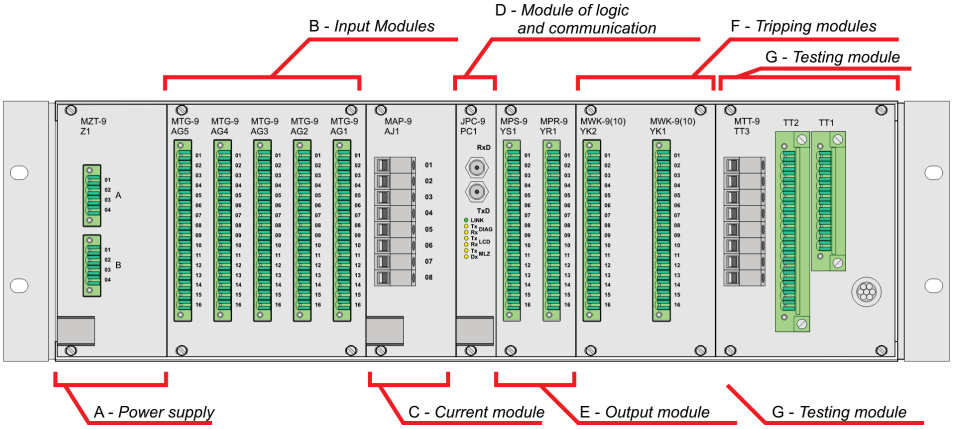
Five signalling diodes are located on the right side of the bay unit. The two upper diodes inform of activation of ZSZ and LRW functions. Green light means that the function is active, yellow – disabled. The red diode in the middle - "TRIP" - signals that the device has send tripping pulse. Another diode – yellow "ERROR", stands for interferences in operation of the device. Green light of the last diode "POWER" means that the unit has power supply.

D – The testing module MTT.

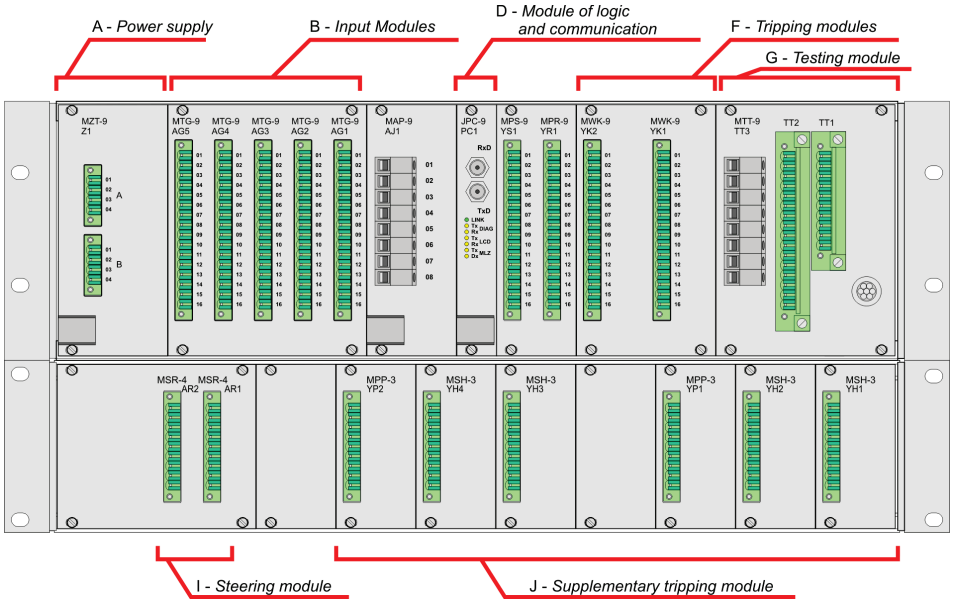
Test terminals are mounted on the front panel of the bay unit. They are available only after removal of a transparent shield, and activation by turning the switch into TEST position. The currents on the side of current transformers are short-cut and current inputs are lead to the test terminal. At the same time the tripping circuits are disconnected and put through to the test terminal. The MTT module is not an obligatory equipment for proper operation of the bay unit; however it is a standard equipment of the A, B, C and D versions.

4.3.2. The back panel and terminals.

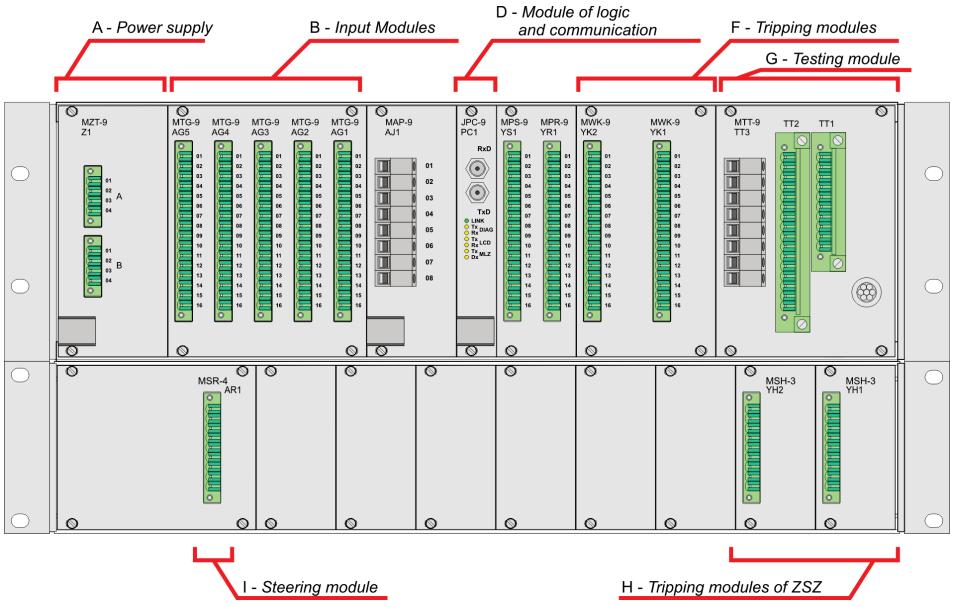
Terminal enabling external connections are mounted on the back panel of the TSL-9r BU bay unit. Plugs are delivered along with the device.



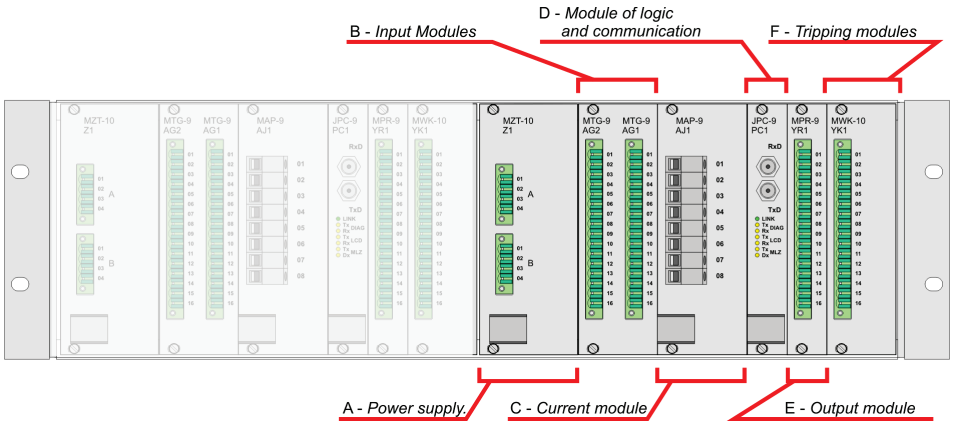
Picture. 4.12. Layout of terminal on the back panel of the bay unit TSL-9r BU in versions A and C.



Picture. 4.13. Layout of terminal on the back panel of the bay unit TSL-9r BU in version B.



Picture. 4.14. Layout of terminal on the back panel of the bay unit TSL-9r BU in version D.



Picture. 4.15. Layout of terminal on the back panel of the bay unit TSL-9r BU in version E (two in a chassis).

A – Power supply –MZT module.

The supply module operates as a recoupling device from among two supplying voltages, supplying voltage for the mapping circuits and for the device.

B – Binary input module MTG.

5 modules of binary inputs, each with 8 lines in versions A, B, C, D or 2 modules each with 8 lines in version E are used for input of mapping and activation signals into the device.

C – Current module MAP

The device is equipped with four circuits for current measurement (three for phase currents, and one for neutral).

D – Logic and communication module JPC.

Microprocessors built inside the JPC modules communicate with microprocessors in MOP modules of the central unit via fibre-optic cables. The communication protocol is in accordance with the IEC 870-5-103. The following information is transferred via the protocol:

- enabling tripping of specified bays,
- configuration data,
- status of inputs and outputs,
- enabling remote blocking, resetting and testing of the device.

E – Output modules MPS, MPR.

The MPR module consists of three groups each of which with 4 programmable signalling outputs, the MPS module built in A, B, C and D versions consists of additional 8 programmable contacts (for example for supplementary tripping signals)

F – Tripping module MWK.

The modules are constructed basing on the RSH-3 relay – tripping relay, enabling breaking of the circuit breaker coil current. The A version of the bay unit has two MWK modules, each of which contains three tripping relays, enabling tripping each phase in both circuits separately. The version C is equipped in two sets of three single-phase modules for each tripping circuit. One set executes operations of ZSZ and the second one - those of LRW. The E version has only one three-phase module for each circuit.

G – Test module MTT.

Module enabling testing of the bay unit.

H – Tripping module MSH.

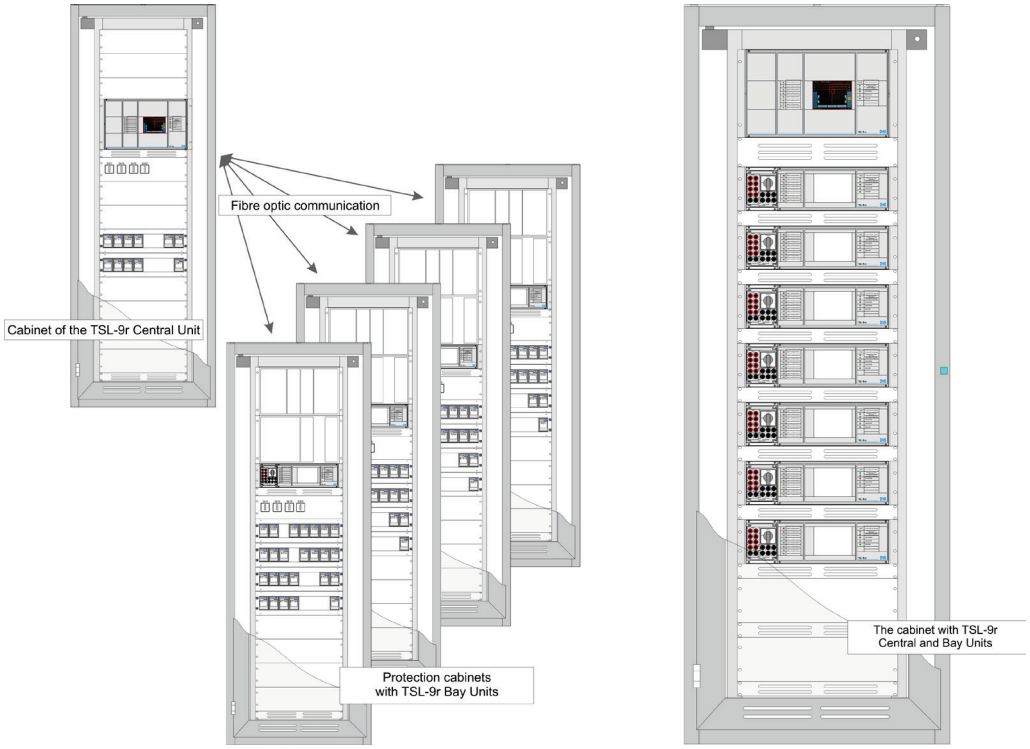
Those modules are used only in the D version and they execute tripping operation of ZSZ. Tripping pulses from LRW are executed by MWK modules.

I – Steering Module MSR.

Module enabling steering the MSH and MPP modules in B and D versions.

J - MSH and MPP modules.

The modules are used in the B version and they execute supplementary tripping pulses for the custom solutions of breakers circuit in switchyards operating in one-and-half breaker arrangement.



Picture. 4.16. Sample placement of TSL-9r units in centralized and decentralized arrangement.

4.3. Construction.

The TLS-9r device has a decentralized construction, adjusted for mounting in protection cabinets for separate bays.

The bay units, however can be located in one cabinet together with the central unit – in such centralised solution, the device can be provided as fully assembled in a cabinet with a terminal strip for the connection of external wiring.

5. FUNCTIONAL SOFTWARE

Along with the TSL-9r user receives a functional software ZPrAE-Edit enabling configuration and use. The installation package is delivered on a CD. It is possible to determine password protected access levels.

The software enables:

- preview of current status of the bay disconnectors and breaker, as well as setup of the bay,

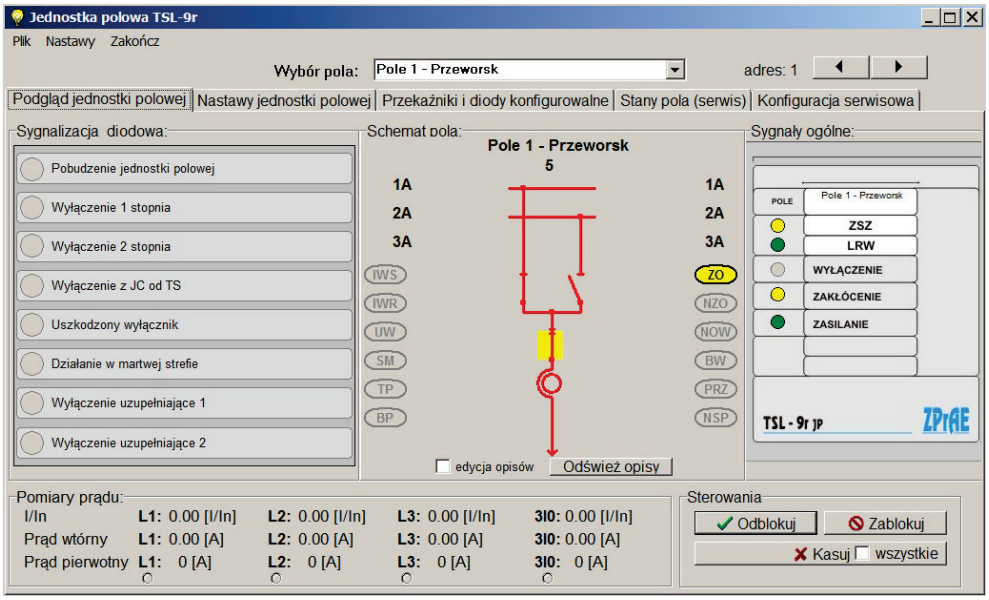
- display of current scheme of the entire switchgear,
- configuration of signalling diodes, touch screen of bay units and the central unit,
- configuration of auxiliary and signalling relays of bay units and the central unit,
- readout from the disturbance recorder and visualisation of recorded waveforms,
- readout from the events recorder.

The software informs user i.a. about status of the bay, i.e. about position of disconnectors and breaker, tripping pulses from ZSZ (IWS), LRW (IWR), defective breaker (UW), operation in the dead zone, interruptions in mapping (ZO), incorrect mapping (NZO), lack of continuity of the tripping circuits (NOW), blockade of the breaker (BW), blockade of the bay and failure of the bay (NSP)

Diode signalisation including status of diodes is presented on the left side of the window. Each of the 8 diodes can be configured to represent chosen signal from the bay unit's signals list.

On the right side of the window following signals are displayed:

- ZSZ – green colour of the diode means that busbar protection is active and operates properly, yellow colour means that ZSZ function is disabled.
- LRW – same as above, green colour of the diode means that breaker failure protection is active and operates properly, yellow colour means that LRW function is disabled. No light of the diode means that the device is not equipped with LRW system.
- ERROR – means that there is a problem with signals connected to the bay unit, i.e. incorrect mapping, long lasting energizing impulse, loss of one of supplying voltages, loss of mapping voltage or loss of communication with the central unit.
- POWER SUPPLY – informs about power supply for the device.



Picture.5.1. Software window „BAY PREVIEW".

Present current flow is presented in the bottom part of the window. User may decide on the way of presentation of current flow volume:

- as a percentage of nominal current of the current transformer I/In,
- in values on the secondary side of the current transformer Iw,
- in values on the primary side of the current transformer Ip.

Additionally user can block/unblock the bay unit (after entering 3-rd level password), or reset signals (after entering 1-st level password).

6. DISTURBANCE RECORDER.

The central unit functions as a disturbance recorder, which is collecting binary and analog data from bay units via fibre optic connections.

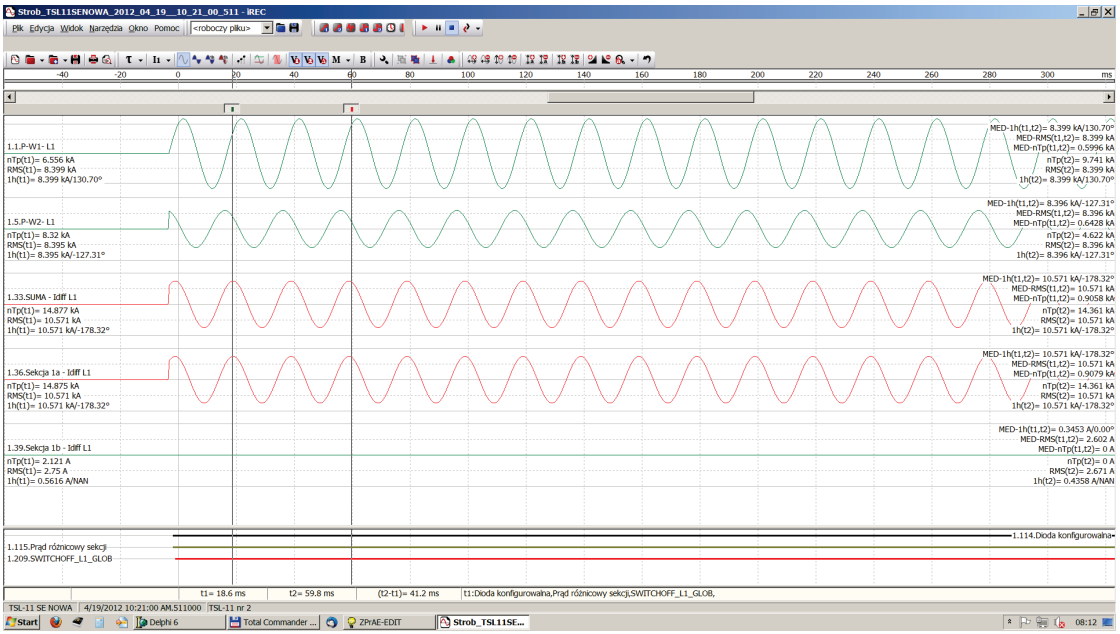
The data are gathered with maintaining mutual synchronism, and written in a cache memory. In the moment of triggering the recorder data recorded in a specified set period before the trigger are stored in a non-volatile flash memory. The data after triggering moment are recorded for as long, as they reach pre-set recording time. The pre-trigger time can be set with the ZPrAE-EDIT software.

The recorder is triggered by one of the below events:

- any external activation,
- exceeding of set current flow value in phase L_1, L_2, L_3,
- exceeding of the set current flow value I_0
- operation of protection

Parameters of recording:

- sampling frequency - 1kHz,
- maximal time of single record - 8 seconds,
- maximal number of stored records in cache memory– 100 (if this number of records is exceeded, new records replace the oldest records stored)



Picture. 6.1. Main window of iREC software.

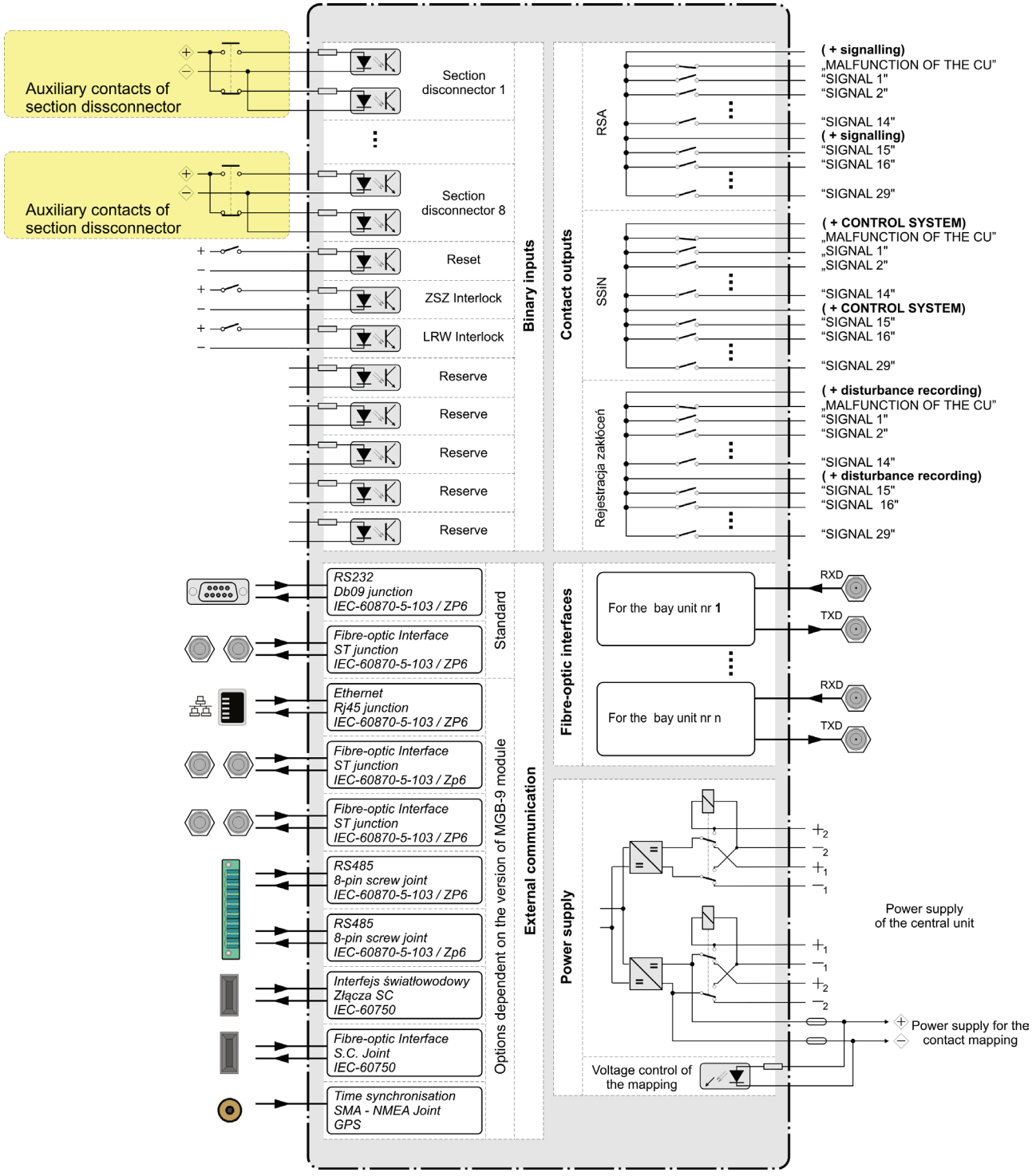
The software provided along with the device enables visualisation of the records saved as a COMTRADE file.

Currents can be viewed in values of primary or secondary current of the current transformers, or in relation to the rated current of the current transformers. An additional practical option enabled by TSL-9r is a possibility to create virtual channels, for which the waveforms are calculated based on real measurements (i.e. it is possible to create differential current waveforms for a system or a section). File with the records presents current waveforms of all bays, and binary signals of all inputs and outputs. It is possible to filter out only chosen waveforms. As an example it is possible to filter out only the phase

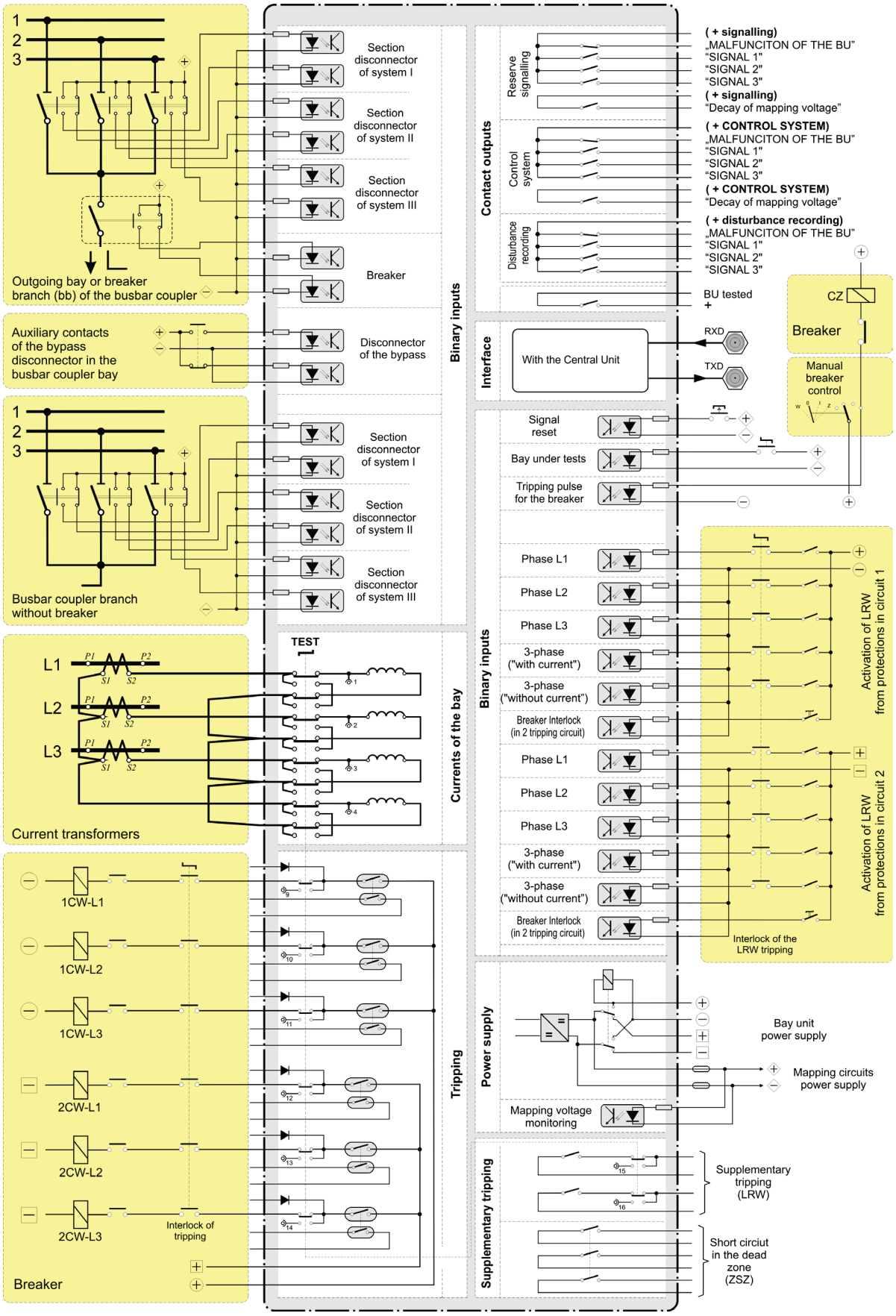
that caused operation of the ZSZ in the analog channels, and in the binary channels to choose only those that changed their status during the recording period.

7. EXTERNAL CONNECTION SCHEMES OF TSL-9r.

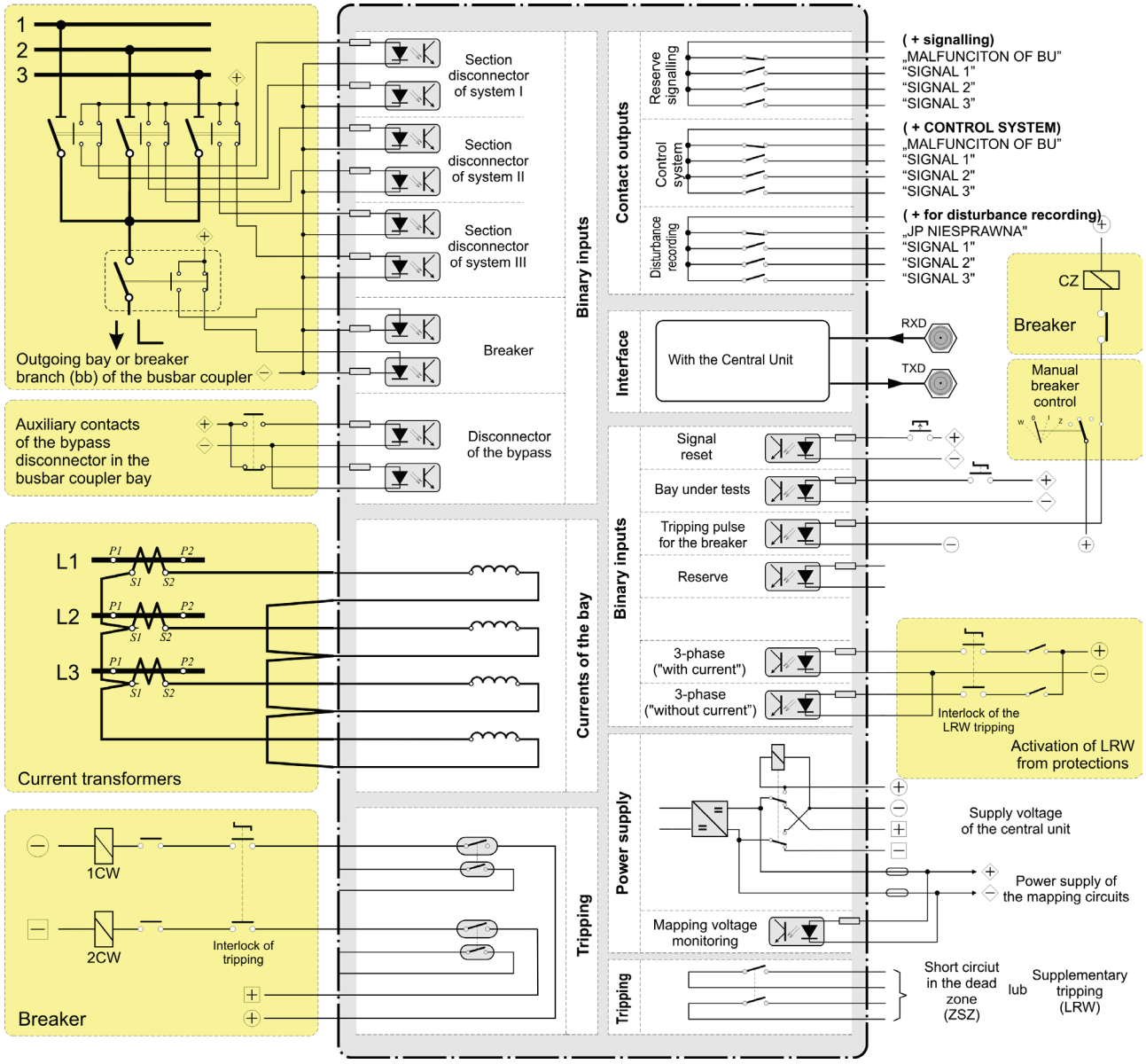
The below schemes represent the central unit and chosen versions of standard bay units. Due to the variety of solutions for custom power system objects, the below schemes should be treated only as an example.



Picture. 7.1. Exemplary connections scheme of the central unit.



Picture. 7.2. Exemplary connections scheme of the bay unit (version A).



Picture. 7.3. Exemplary connections scheme of the bay unit (version E)

8. ADDITIONAL SERVICES RENDERED BY THE PRODUCER.

The producer provides assistance in designing busbar protection (ZSZ) and breaker failure protection (LRW) circuits with use of the TSL-9r (we can provide drawings with terminals and connection schemes facilitating design circuit of a substation). We provide a device accordingly to confirmed design and configuration, take care of this device during the warranty period and after that period, provide full service.

Additionally we provide services relating to ZSZ and URW in respect of:

- stocktake of secondary wiring on power substations,
- preparing the design of secondary circuits,
- connecting the device,
- start-up of the protection,
- training in the operation and maintenance for clients employees,
- help in preparation of operating instructions.

9. TECHNICAL PARAMETERS OF THE TSL-9r PROTECTION.

Auxiliary power supply		Rated auxiliary voltage:		220 V DC or 110 V DC Or other as agreed.
		Permissible range of auxiliary voltage change		0.80 ÷ 1.15 U_{PN}
		Maximal power consumption of the central unit		< 90 W
		Maximal power consumption of the bay unit		< 40 W
Time elements	**ZSZ**	Time to operate of the busbar protection for current level ≥ 2 Inast		< 10 ms
		Dropout time of the busbar protection without tripping relays		< 30 ms
		Dropout time of the busbar protection with tripping relays		< 40 ms
	LRW	I stage time setting range of breaker failure protection		T1 LRW =0…500 ms with 1 ms step
		II stage time setting range of breaker failure protection		T2 LRW =50…500 ms with 1 ms step
		Precision of time setup		1 ms
		Precision of the system: time element + final controlling relay (for time setup above 10 ms)		(1 + 5) ms
Current elements		Rated current		1 A or 5 A
		Rated frequency		50 Hz
		Permissible range of frequency change		47,0 … 52,5 Hz
		Acceptable permanent load		2,5 JN
		Thermal strength 1 s		100 JN
		Power consumption		< 0,2 VA/phase
		Range of current transformers primary current		50 … 3000 [A]
		Range of starting current for busbar protection (values of primary side)		100 … 10 000 [A]
		Range of starting current for breaker failure protection		0,05...2,0JN, with 0,05JN step
		Assigned error of starting current		2,5 %
		Dropout ratio of current relays		0,85 … 0,95
		Dropout time of current relays (breaker failure protection)		< 20 ms
Binary inputs		Rated voltage		220 V DC or 110 V DC or other as agreed
		Energizing voltage		0,7 Un ± 5% (0,7 Un)
		Power consumption of binary inputs		< 0.5 W/input
Relays	**Tripping**	No. of tripping circuits	standard BU	two circuits per bay for each phase, or two circuits per bay for three phases, separately for ZSZ and LRW
			version E of BU	Two three-phase circuits
		Making capacity of contacts: - 1 s - continuous current - breaking 220 V DC L/R=40 ms		10 A 5 A 3,2 A
	Auxiliary	Central Unit (standard version)	Signalling	„CU out of order” + 29 programmable
			Events recorder	„CU out of order” + 29 programmable
			Faults recorder	„ CU out of order” + 29 programmable
		Bay Unit standard	Additional relays	5 programmable
			Signalling	3 groups of 4 relays. In each group „BU out of order” + 3 programmable
		Bay Unit version E	Signalling	3 groups of 4 relays. In each group „BU out of order” + 3 programmable
		Making capacity of contacts: - continuous current - breaking 220 V DC L/R=40 ms		5 A 0,2 A
Recorders		Events recorder		10 000 records
		Disturbance recorder		100 records

Communication	Maximal number of external communication channels active at the same time – 5channels (+ 1 service)		
	Types of terminals and protocols depending on type of MGB-9 module		
	Channel 1 / Z41	MGB-9 C / D / E / G	Ethernet – terminal RJ-45 - IEC 60870-5-103 / ZP-6
	Channel 2 / Z42	MGB-9 A / B / C / D / E / F.1 / G	RS232 – IEC 870-5-103 / ZP-6
	Channel 3 / Z43	MGB-9 A / B / C / D / E / F.1 / G	Fibre optic terminal ST – IEC 60870-5-103 / ZP-6
	Channel 4 / Z44	MGB-9 B / C	GPS – antenna terminal SMA - NMEA
	Channel 5 / Z45	MGB-9 D	Fibre optic terminal ST – IEC 60870-5-103 / ZP-6
	Channel 6 / Z46	MGB-9 D	Fibre optic terminal ST – IEC 60870-5-103 / ZP-6
	Channel 7 / Z47-1,2	MGB-9 E	RS485 - 8-pin terminal - IEC 60870-5-103 / ZP-6
	Channel 8 / Z47-5,6	MGB-9 E	RS485 - 8-pin terminal - IEC 60870-5-103 / ZP-6
	Channel 9 / Z48	MGB-9 F.1	Ethernet – Terminal RJ-45 - service
	Channel 10 / Z91	MGB-9 F.1	Ethernet - Fibre optic terminal SC - IEC 61850
	Channel 11 / Z92	MGB-9 F.1	Ethernet - Fibre optic terminal SC - IEC 61850
	Channel 12 / Z93	MGB-9 F.1	Ethernet - Terminal RJ-45 - IEC 61850

Insulation	Rated voltage of insulation:		250 V
	Proof impulse voltage:		5000 V (1,2/50 μs)
	Overvoltage category:		III
	Insulation electrical strength:		2,5 kV; 50 Hz; 1 min.
	Enclosure protection degree	front	IP-50
		back	IP-20

General Data	Ambient temperature range:		248 ÷ 328 K (od -25° do +55° C)
	Ambient humidity (with no water vapour condensation or ice)		95 %
	Dimensions:	Chassis of CU (EURO 19"/6U)	483 × 268 × 246 mm
		Chassis of BU (EURO 19"/3U)	483 × 134 × 246
	Weight	Chassis of CU	app 9 kg
		Chassis of BU	app 7 kg
	Mechanical strength accordingly to PN-EN 60255-21-(1,2,3)		Class 1
	Electromagnetic compatibility accordingly to PN-EN 60255-26		Class A
	Ambient pressure		70-110 kPa (0 – 3000 m above See Level)

10. HOW TO ORDER.

For placing an order please use the device code specified by the „**Ordering form**" and provide us with a scheme of the substation.

Exemplary ordering code: **TSL-9r-12-3-00-A-15-G00**

1 - Rated current **1A**
2 - Auxiliary voltage **220 V DC**
-
3 - Activated functions **ZSZ and LRW**
-
0 - Fitting of the central unit: - 16 binary inputs (standard)
0 - 3 × (1NZ, 29NO) signalling outputs (standard)
-
A - Bay unit version **A**
-
15 - number of bay units
-
G - Communication module type **MGB-9G**
0 - Without custom fitting
0 - Without additional demands

Ordering Form

Ordering Code: TSL-9r - [ ][ ] - [ ] - [ ][ ] - [ ] - [ ] - [ ][ ][ ]

Rated current

In = 1 A	1
In = 5 A	5
In = 1 A; 5 A (accordingly to the Attachment)	X

Auxiliary supply voltage

Un = 110 V DC	1
Un = 220 V DC	2

Function

ZSZ	1
LRW	2
ZSZ and LRW	3

Equipment of the central unit

Binary inputs

- 16 *(standard)*	0
- Other, as described in the Attachment	1

Signalling outputs

- 3 × (1 NZ, 29 NO) *(standard)*	0
- Other, as described in the Attachment	1

Type and number of bay units

A - with activation and tripping pulses for each phase separately	A	
B - with activation and tripping pulses for each phase and with additional tripping pulses for the LRW function in one-and-a-half breaker arrangements	B	
C - with a 3-phase activating and tripping pulses separately for each function	C	
D - with activation and tripping pulses for each phase and separately for each function (ZSZ & LRW)	D	
E - with a 3-phase activating and tripping pulses (placement of bay units in chassis as presented in the Attachment)	E	X

Communication

Version A

RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol	A

Version B

RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol GPS – antenna terminal SMA.	B

Version C

Ethernet terminal, RJ45 terminal - IEC 870-5-103 / ZP-6 protocol. RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol. GPS – antenna terminal SMA.	C

Version D

Ethernet terminal, RJ45 terminal - IEC 870-5-103 / ZP-6 protocol. RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. 3 sets of fibre optic terminals, ST terminals - IEC 870-5-103 / ZP-6 protocol.	D

Version E

Ethernet terminal, RJ45 terminal - IEC 870-5-103 / ZP-6 protocol. RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. Fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol. 2 sets of RS485 terminals, Phoenix 8×5.08 - IEC 870-5-103 / ZP-6 protocol.	E

Version F1

RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol. Ethernet terminal, RJ45 terminal - IEC 870-5-103 / ZP-6 protocol. 2 sets of RS485 terminals, SC terminal - IEC 61850 protocol.	F1

Version G

Ethernet terminal, RJ45 terminal - IEC 870-5-103 / ZP-6 protocol. RS232 terminal, DB 9 terminal - IEC 870-5-103 / ZP-6 protocol. Fibre optic terminal, ST terminal - IEC 870-5-103 / ZP-6 protocol.	G

Custom equipment

no custom equipment	0
accordingly to the Attachment	1

Additional requirements

no additional requirements	0
accordingly to the Attachment	1

The scheme of the distribution substation in the Attachment

TSL-9r

OFFER

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

Auxiliary and signalization relays

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

Protection relays type AZT-9, APP-9

Disturbance recorder RZS-9

Energy measurement system and event recorder ZRZ-28

Load Resistors for measuring transformers

DC and AC auxiliary power supply switchgears

Cubicle-contained sets of control and supervision protections

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

PROFIL-L cubicles

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

Servicing, strting-up and post assembly tests

RE line® ENERGETIC STANDARDS

RSH-3, RSH-3S - tripping

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

RMS-2 - signalling

RCW-3, RCDW-1 - circuit continuity monitoring

RKO-3 - power supply circuit continuity monitoring

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

RT-22 - time

RUT-2, RUT-3 - time-voltage

RJT-1, RJT-3 - time-current

RKU-1, RKS-1 - final controlling

LZ-1, LZ-2 - operation counters

RPZ-1 - supply source switching

GPS-1 - time synchronisation

MDD-6, MDS-12 - Diode modules

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

Relay racks

ZPrAE Sp.z o.o.

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