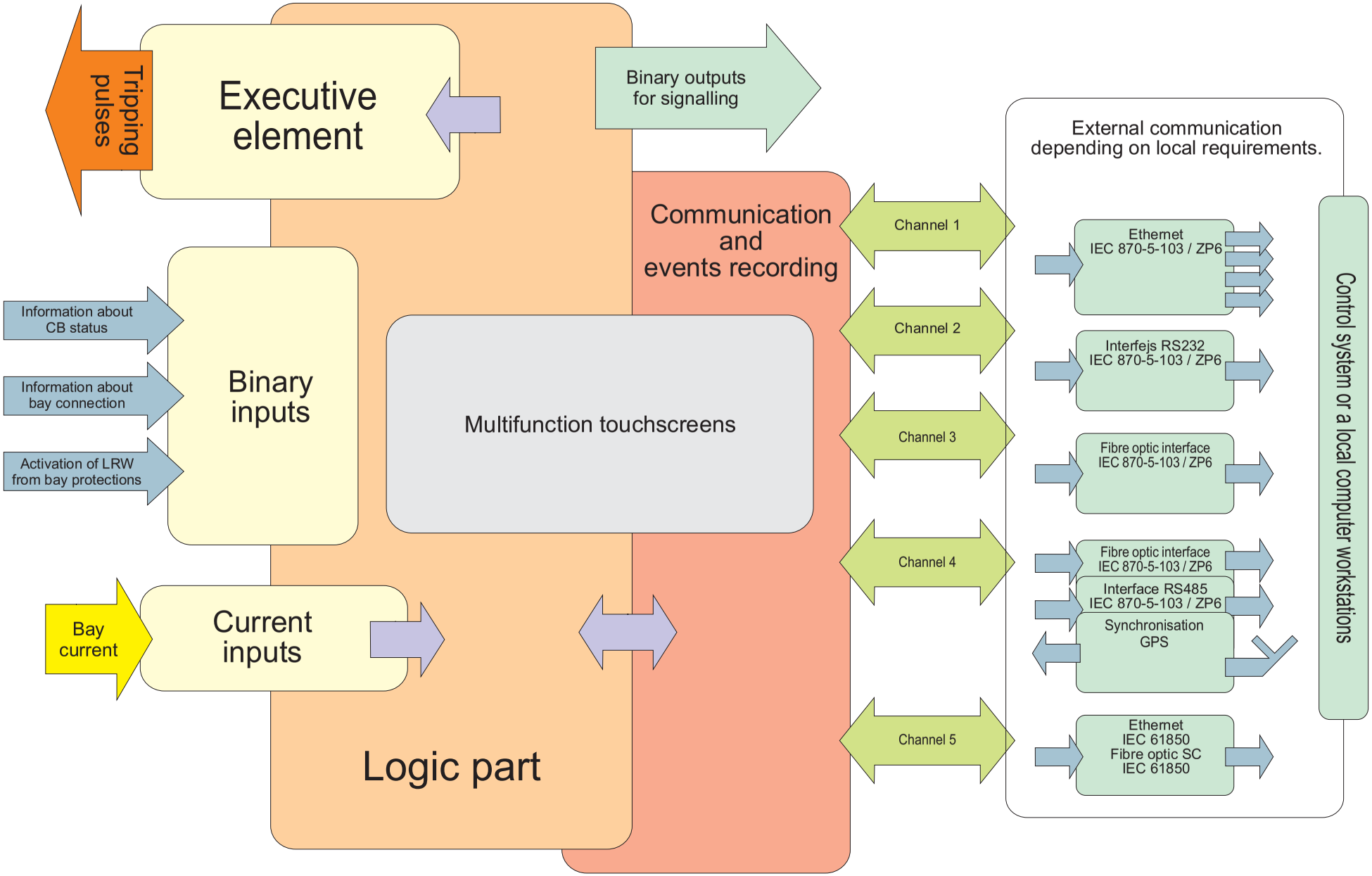
ZPrAE Sp.z o.o.

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

TSL-11

BUSBAR PROTECTION
AND BREAKER FAILURE PROTECTION



Structural diagram of the TSL-11 busbar and breaker failure protection

1. INTRODUCTION.

For years ZPrAE Sp. z o.o. has been manufacturing busbar protection systems and breaker failure protection systems for 110÷400 kV high-voltage substations and supplying them to power industry. We have extensive experience in this area, and for many years we have been manufacturing busbar protection systems integrated with automatic breaker failure protection. Construction and logic of the previous protection systems meet requirements for secondary circuits of the largest highest-voltage substation. The requirements were defined by commercial power industry specialists over the course of many discussions.

Technical progress and access to new technologies led to development of a new **TSL-11** protection system, dedicated to single busbar 110 kV stations, with solutions based on many years of experience in designing, manufacturing and operating TSL-6, TS-7 and TL-7 protections and their predecessors.

2. APPLICATIONS.

Busbar protection is designed to quickly and selectively disconnect all bays of a specific system or substation sections in case of short circuit of busbars. The protection covers busbars, selector switch disconnectors and circuit-breakers. Protection zone is marked by the location of current transformers' installation.
Breaker failure protection automation is designed to selectively open substation circuit-breakers in case of a defect (lack of opening) of a circuit-breaker in one of the bays despite activation of protections of that bay. In that case the automation – after set time T1– sends a tripping impulse to that defective circuit-breaker and if it fails to activate again – after time T2– opens circuit-breakers of all bays connected to the system or the busbar section.

Basic features of the TSL-11 protection:

- dedicated to single busbar sectionalized substations,
- supports up to 8 bays,
- can function as a busbar protection, as a breaker failure protection or both simultaneously,
- supports necessary activation logic for all possible connection configurations of a substation,
- locates and properly reacts to short circuits in the dead zone,
- modular construction of the device provides the ability to adopt the protection to the changing arrangement of a substation – if the substation is extended by additional bays,
- universal modules provide the ability to easily adopt the device to changes of current transformers transformation ratio by software changes of device configuration,
- two tripping circuits per substation circuit-breaker, designed based on the circuit used in the RSH-3 relay ("high break" relay), make it possible to interrupt circuit-breaker coil current in emergency situations.
- two circuit-breaker position criteria: current and auxiliary contact,
- two activation inputs: by protections with current rise; and by protections with no current rise,
- one and two bit representation of disconnectors and circuit-breakers states (*contacts representation*),
- operation algorithm programming depending on the substation arrangement and setup changes can be performed with a portable computer,

- the protection device is equipped with internal disturbance and event recorders.

The TSL-11 is supplied with ZPrAE-EDIT software for independent configuration of the device and facilitating its operation.

The digital TSL-11 automation provides not only standard functions of busbar protection and breaker failure protection but also functions as an event recorder. It enables transmitting data to a station monitoring system, while a service port enables remote communication with the automation, previewing its status, reading recorded data and introducing potential changes to setup.

3. OPERATING PRINCIPLE.

3.1. Busbar protection operating principle.

The TSL-11 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.

Busbar protection transformers and current circuits should be matched so that they prevent oversaturation of the transformer greater than 5 ($m \leq 5$) in case of an external short-circuit in any of the bays of a substation.

3.2. Breaker failure protection operating principle

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

- an impulse opening a breaker sent by substation bay protection systems,
- information on circuit-breaker position.

If the set coincidence time is exceeded it means a circuit-breaker did not open and in order to stop flow of short-circuit current to the location of the short-circuit all circuit-breakers of bays connected to the same bus should be opened.

Information on position of a circuit-breaker can be obtained from one of auxiliary contacts of a circuit-breaker or current modules controlling flow of current through the circuit-breaker.

Breaker failure protection automation works in two stages. The first stage is to repeat a pulse to open its own circuit-breaker immediately or after a short delay (T1) – so-called "re-trip".

After a failed attempt to open its own circuit-breaker at the first stage of breaker failure protection and elapse of time set in delay devices of the second stage (T2), the "breaker-failure protection bus" of the busbar section, to which a given bay is connected, is activated. Information reaches all substation bays and opens circuit-breakers of the bays connected to the same busbar section. If a circuit-breaker in the busbar switch bay is damaged, after a set time (T3) the disconnection logic also includes the second section of a substation. The disconnections are always performed in both tripping circuits.

4. CONSTRUCTION.

Application of FPGA (Field Programmable Gate Arrays) made it possible to create a technologically advanced, reliable, fast and user-friendly device. A TSL-11 device is supplied in a casing suitable for installation in swing frames of cubicles (19”/6U standard version and 19”/9U version with separate tripping circuits). External circuits can be connected via connectors on the rear panel of the unit. A touchscreen and indication LEDs are located on the front panel. Software supplied with the device enables configuring functions of the TSL-11 and its following operation. It provides the ability to preview the present status of protection on-line on a computer screen, read data from a recorder and change configuration as required.

4.1. External dimensions.

The TSL-11 device is built in a EURO-19” rack made of chromate plated aluminium, which provides suitable resistance to EMC interference.

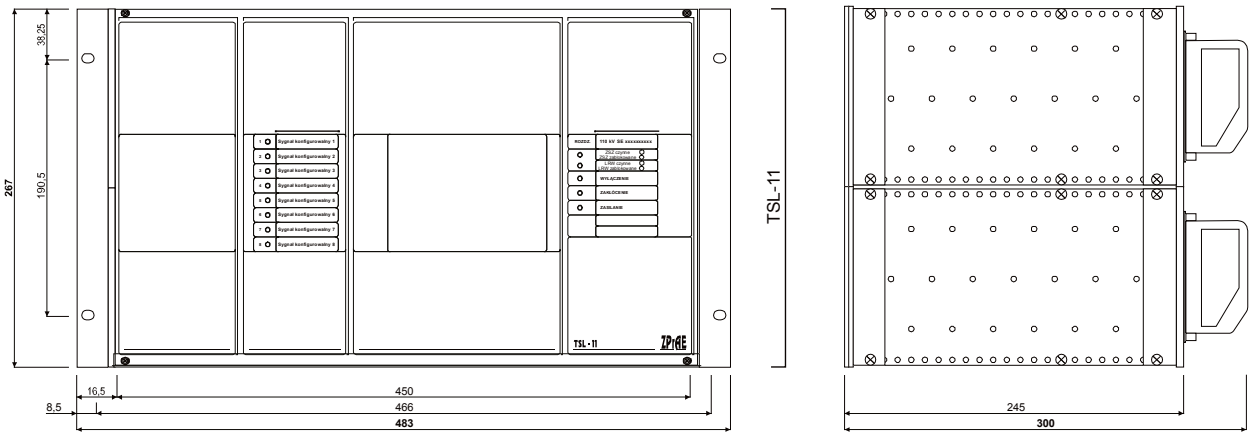


Fig. 1. External dimensions of a TSL-11, EURO-19”/6U unit (standard version).

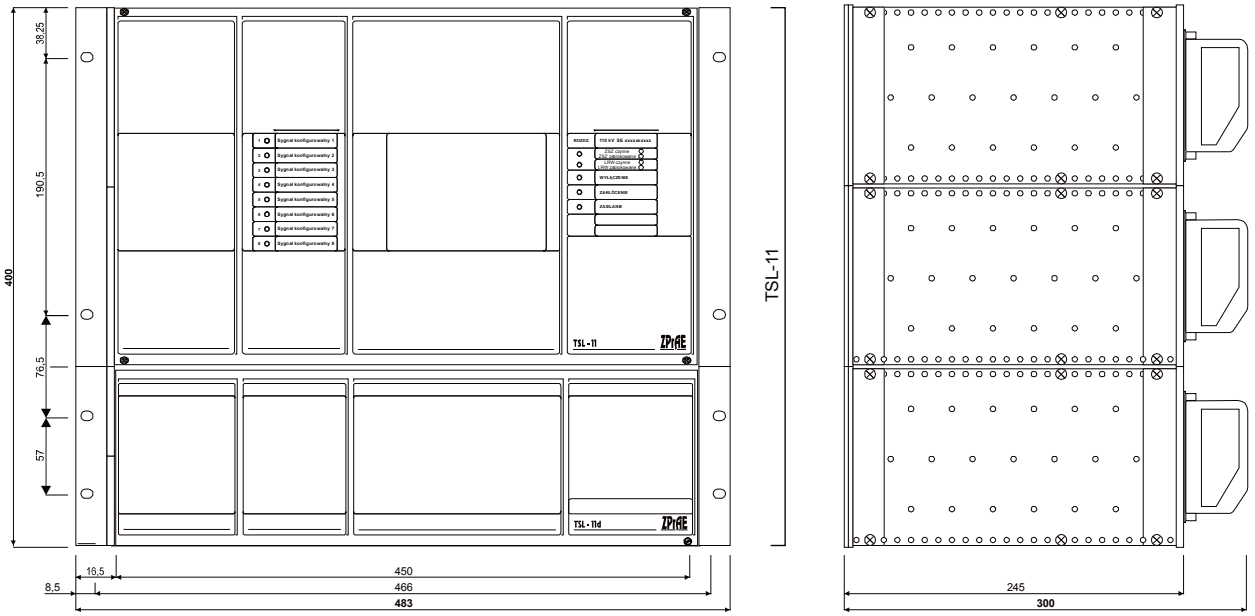


Fig. 2. External dimensions of a TSL-11, EURO-19”/9U unit (version with separate tripping circuits).

4.2. The TSL-11 unit.

4.2.1. Front panel.

The TSL-11 unit is equipped with a power supply part, binary inputs, a part measuring the currents of a bay, logic, relay outputs, an operating part that sends tripping impulses and an external communication module. All connectors and modules are available on the rear panel. A touchscreen and indication LEDs are located on the front panel.

A – Indication LEDs and signal description fields.

This part of the front panel contains 8 indication LEDs and description fields for identification with a suitable name of the signal. Multicolour super-bright RGB LEDs function as optical indicators. It is possible to use the software supplied with the device to select the preferred signals from a list available in the program. The LED colour can also be configured from the software level. Next to the LEDs there are description fields. A description field for one LED is 42 mm ×10 mm (W×H). Signal descriptions can be printed on foil or paper and inserted under the transparent part of the front panel. ZPrAE EDIT software is used to assign a proper signal to the LED. The LEDs configuration is secured with a password.

Standard factory configuration of signals:

- signal 1 “error of contacts representation”
- signal 2 “differential current”
- signal 3 “loss of supply voltage, circuit 1”
- signal 4 “loss of supply voltage, circuit 2”
- signal 5 “loss of auxiliary voltage for contacts representation circuits”
- signal 6 “TSL-11 malfunction”

B - LCD touchscreen.

The centre of the front panel is fitted with a colour touchscreen for previewing the substation i.e. state of circuit-breakers and a section disconnector, if installed. It is also possible to view the device setups and setups of particular bays.

The following operations can also be performed from the touchscreen: locking of busbar protection or circuit breaker failure protection functions and resetting of the protection system signalling.

C - Power, malfunction and working LEDs.

The right side of the unit displays five LEDs indicating the unit operating condition. A green “POWER” LED informs that power supply is applied to the unit; a yellow one, “ERROR”, indicates the device malfunction and a red one, “TRIP”, signals that the device has sent a tripping impulse. The next two LEDs inform about active (green light) or locked (yellow light) function of the device (busbar protection or circuit breaker failure protection). When the light is off it means that the given function is disabled.

Fig. 3. Layout of a TSL-11 unit (standard version).

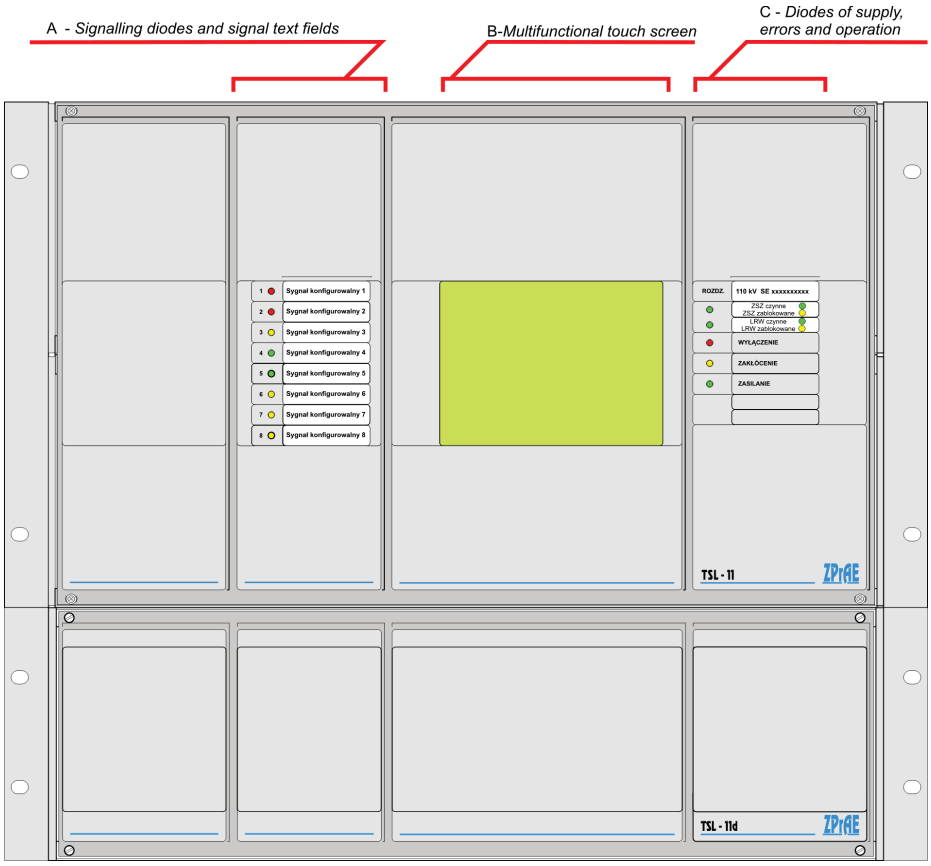


Fig. 4. Layout of a TSL-11 unit (version with separate tripping circuits)

4.2.2. Rear panel.

Terminals for external connections are located on the rear panel of TSL-11. Plugs are supplied together with the device. LgY cables are recommended for external connections.

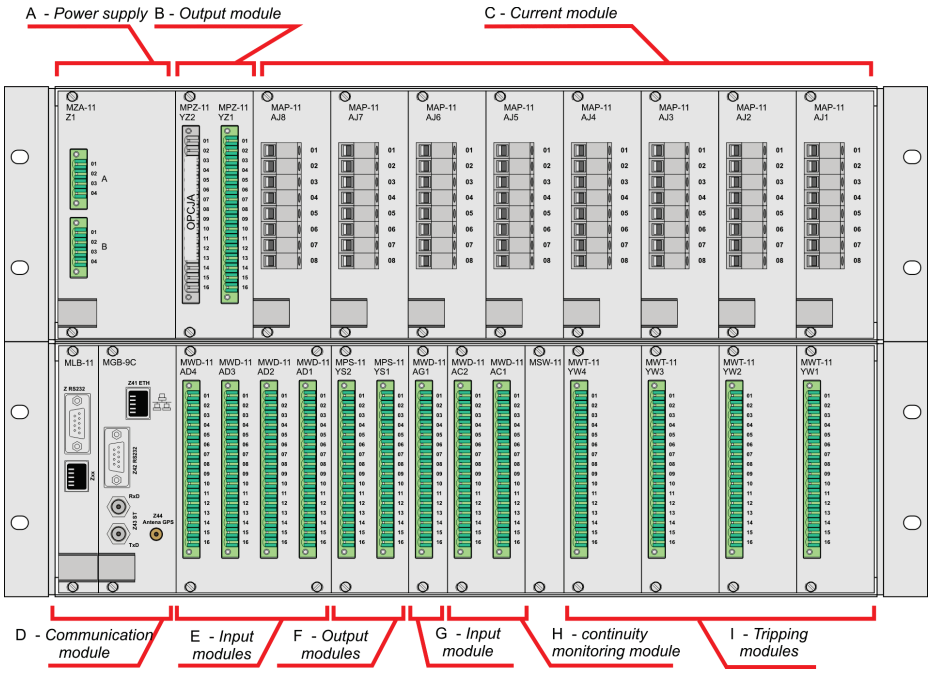


Fig. 5. Connector arrangement on a TSL-11 protection unit (standard version).

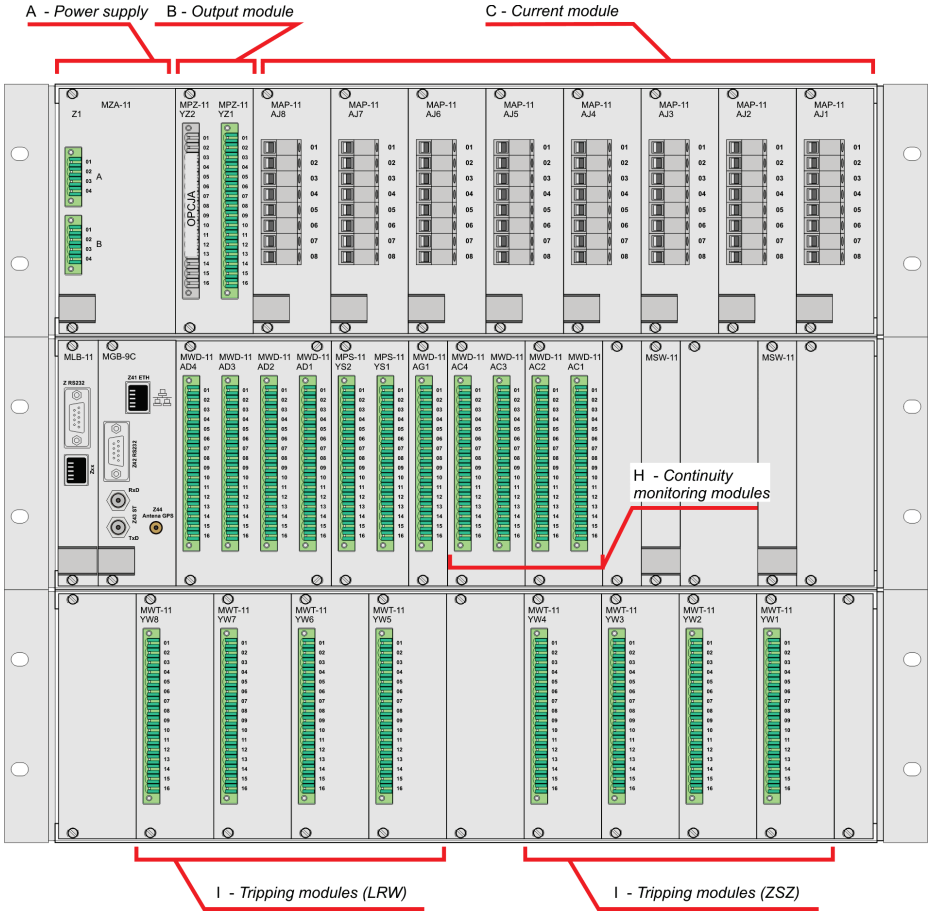


Fig. 6. Connector arrangement on a TSL-11 protection unit (version with separate tripping circuits)

A – Power supply.

Power supply module carries out an ATS function between two supply voltages (primary and back up) by creating voltage for contacts representation circuits and power supply voltage for a converter, which is used to supply the device. Module connectors:

- Z1 A – inputs of power supply voltage circuits,
- Z1 B – voltage output of contacts representation circuits that is supplied from a primary circuit of auxiliary voltage, and in case of its loss, from a backup circuit.

B – Contact signalling outputs.

A group of 15 signals is connected to the terminal strip. Connections of the module - YZ1 (signal output). List of signals in the standard version:

- TSL malfunction (signal 1- at normally closed contact)
- Tripping by busbar protection section 1 (signal 2)
- Tripping by busbar protection section 2 (signal 3)
- Activation of breaker failure protection in 1 stage (re-trip) (signal 4)
- Tripping by breaker failure protection section 1 (signal 5)
- Tripping by breaker failure protection section 2 (signal 6)
- Busbar protection locked (signal 7)
- Breaker failure protection locked (signal 8)
- Contacts representation error (signal 9)
- Differential current (signal 10)
- Operation of busbar protection in a dead zone (signal 11)
- Loss of one of supply voltages (signal 12)
- Loss of voltage for contacts representation (signal 13)
- ------ (signal 14)
- ------ (signal 15**)**

On request, it is possible to reconfigure the signals (except signal 1), use signal 14 and 15, and to add an extra output module YZ2 with 15 other output relays. Configuration of the relays is done by the manufacturer at the utility software level.

C – Current module

The device can be equipped with up to 8 current modules with four current measurement inputs (three phase currents and one neutral current). Module connector:

- AJ1 – AJ8 – current circuits.

D – Communication.

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

The MGB concentrator can have up to four serial transmission channels (over various physical interfaces i.e. RS232, RS485, optical link) and an Ethernet connection. The Ethernet enables connection with maximum of four independent users at the same time. Each channel can utilise IEC 870-5-103 or the proprietary ZP-6 protocol. One of the

channels can be used for communication with GPS module. The RS485 differential connection is a two-wire version. A 4-wire version can also be provided.

Computer monitoring system utilising IEC 870-5-103 protocol can receive events, read present disturbance status as well as control e.g. remote resetting. As per the standard, the supported speeds are 9600 and 19200 bps.

Connection via proprietary software enables reading the events, checking the status of disturbances, remote controlling, changing the configuration and changing the device setups. Speeds available: 4800 bps, 9600 bps, 19200 bps, 57600 bps, 115200 bps.

Communication via IEC61850 protocol is enabled by MGB-9F.1 version of communication module equipped with RJ45 connector and two fibre optic ports with a standard connector (SC).

E – Input modules of circuit breaker positions and activations of breaker failure protection.

The device is equipped with 32 binary inputs that are used to receive information about circuit breakers state (1 or 2 bit contacts representation) and activations by protections („with" and „without current"). Module connectors:

- AD1, AD2, AD3, AD4 – input circuits (circuit breaker position and activation of breaker failure protection)

F – Output modules.

The device is equipped with 16 relay outputs that are used to send information about short circuits in the dead zone of the protection (1 contact output per bay) and supplementary tripping by breaker failure protection (1 contact output per bay). Module connectors:

- YS1 – output circuits of operation in the bay's dead zone
- YS2 – output circuits of supplementary trippings by breaker failure protection

G – General input modules.

The device is equipped with 8 binary inputs that are used for representation of a section disconnector state, resetting, etc.

- AG1 – general input circuits

H – Tripping circuit continuity control modules.

As a standard the device is equipped with 16 inputs that are used to control the continuity of tripping circuits. Version with separate tripping circuits is equipped with 32 inputs for controlling the continuity of tripping circuits in all circuits.
Module connectors in the standard version:

- AC1, AC2 – input circuits (control of tripping module continuity)

Module connectors in the version with separate tripping circuits:

- AC1, AC2 – input circuits for controlling the continuity of tripping circuits activated by busbar protection
- AC3, AC4 – input circuits for controlling the continuity of tripping circuits activated by breaker failure protection

In some bays the control of tripping circuit continuity may already be performed by another device and it is not recommended to duplicate it using TSL-11 device. Selected inputs can be disabled from software service level. The continuity in those bays will not be controlled and the "NCTC" (no continuity of tripping circuit) indicators on the device and software screen will be inactive.

I – Tripping modules.

In a standard version the device is equipped with tripping modules, four contacts per each bay: two „high speed – high break contacts" that make it possible to interrupt the

circuit breaker coil current, one high speed and one signalling contact. The version with separate tripping circuits is equipped with two sets of such outputs, one for busbar protection and one for breaker failure protection.
Module connectors in the standard version:

- YW1 - YW4 – bay tripping circuits.

Module connectors in the version with separate tripping circuits:

- YW1 - YW4 – bay tripping circuits activated by busbar protection,
- YW5 – YW8 – bay tripping circuits activated by breaker failure protection.

5. UTILITY SOFTWARE.

Along with TSL-11 the user receives **ZPrAE-EDIT** software for its configuration and operation, as well as **iREC** software that can be used to visualize and analyse the disturbances recorded in the electrical power system. Installation software is provided on a CD.
The software enables:

- reading and previewing recorder events (binary signals),
- reading and presenting recorded disturbances (analogue and binary signals),
- displaying the entire substation arrangement,
- displaying windows with previews and setups of individual bays,
- configuration of the device indication LEDs and reading of their present status,
- configuration of the auxiliary and signalling relays, as well as reading of their present state.

6. DISTURBANCE RECORDER.

The function of the disturbance recorder is performed by a module with RAM memory, which is a temporary circular buffer, and non-volatile flash memory (1 GB) for recoding disturbances. The memory storage capacity is sufficient for storing the last 100 records. When the memory is full the oldest disturbance records are „overwritten”.

The data is collected, while mutual sync is maintained, and stored in a circular buffer of cache RAM. When the recorder is triggered (started) the data from the specified (pre-set) time before the trigger is stored in the non-volatile flash memory. The data after the trigger is saved for as long as it reaches the total length of recording. The so-called pre-trigger time can be configured using ZPrAE-EDIT software.

The recorder is triggered by one of the following events:
- any external activation,
- protection activation,
  and depending on activation:
- by exceeded pre-set current in phase L1, L2, L3.

Recorder parameters:
- sampling frequency - 1 kHz,
- resolution of analogue-to-digital converter – 16 bits,
- time of single recording - 8 seconds,
- storage capacity 1 GB i.e. buffer for 100 permanently stored records.

7. SCOPE OF SERVICES PROVIDED BY THE MANUFACTURER.

The manufacturer provides support in designing of busbar protection system and (or) automatic breaker failure protection systems using the TSL-11 device (upon request we can provide ready-to-use **project outlines**). The manufacturer supplies the device in any configuration (in a standard version or an agreed special version e.g. with double tripping circuits separate for the busbar protection system and the breaker failure protection) and takes care of the equipment during the warranty period and ensures full service after its expiry.

The manufacturer also provides services in designing of new and revamping existing busbar protection and breaker failure protection systems – including inventory taking of the circuits and on-site installation of the supplied equipment.

INSTYTUT ENERGETYKI
Instytut Badawczy
01-330 Warszawa, ul. Mory 8
tel. +48 22 34 51 299, fax. +48 22 836 63 63,
instytut.energetyki@ien.com.pl

CERTYFIKAT IEn
NR 018/2012
(POŚWIADCZENIE)

Nazwa i adres posiadacza certyfikatu:	Zakład Produkcyjny Aparatury Elektrycznej Sp. z o.o. ul. M. Konopnickiej 13, 41-100 Siemianowice Śląskie
Nazwa wyrobu:	Zabezpieczenie szyn zbiorczych (ZSZ) i układ lokalnego rezerwowania wyłączników (LRW)
Typ (odmiany):	TSL-11
Producent:	Zakład Produkcyjny Aparatury Elektrycznej Sp. z o.o. ul. M. Konopnickiej 13, 41-100 Siemianowice Śląskie
Podstawowe parametry i zastosowanie:	Według załącznika ZSZ służy do wyłączenia wszystkich pól danego systemu lub sekcji rozdzielni, w przypadku zwarcia na szynach zbiorczych. Układ LRW służy do selektywnego otwarcia wyłączników rozdzielni w przypadku gdy nie otworzył się wyłącznik w jednym z pól.
Wyrób spełnia wymagania zawarte w:	PN-EN 60255-1:2010
Zgodnie ze sprawozdaniem z badań wykonanym przez:	Instytut Energetyki
Nr i data sprawozdania:	EAZ/1533/2012
Okres ważności:	od lipca 2012 do lipca 2017

Prawo do posługiwania się certyfikatem w okresie jego ważności dotyczy wyłącznie tych egzemplarzy/partii wyrobów, które spełniają wyżej określone wymagania i posiadają identyczne właściwości (parametry) jak wzory/próbki wyrobów przedstawione do badań.

Zestawienie przypisanych parametrów wyrobu zawiera załącznik do niniejszego certyfikatu.

Model certyfikacji obejmuje:
- badania i ocenę jakości projektowej,
- ocenę systemu jakości dostawcy.

DYREKTOR
INSTYTUTU ENERGETYKI
Dr hab. inż. Jacek Wańkowicz

Warszawa, dnia 13.07.2012 r.

8. DESIGNING A TSL-11

8.1 Connection diagrams

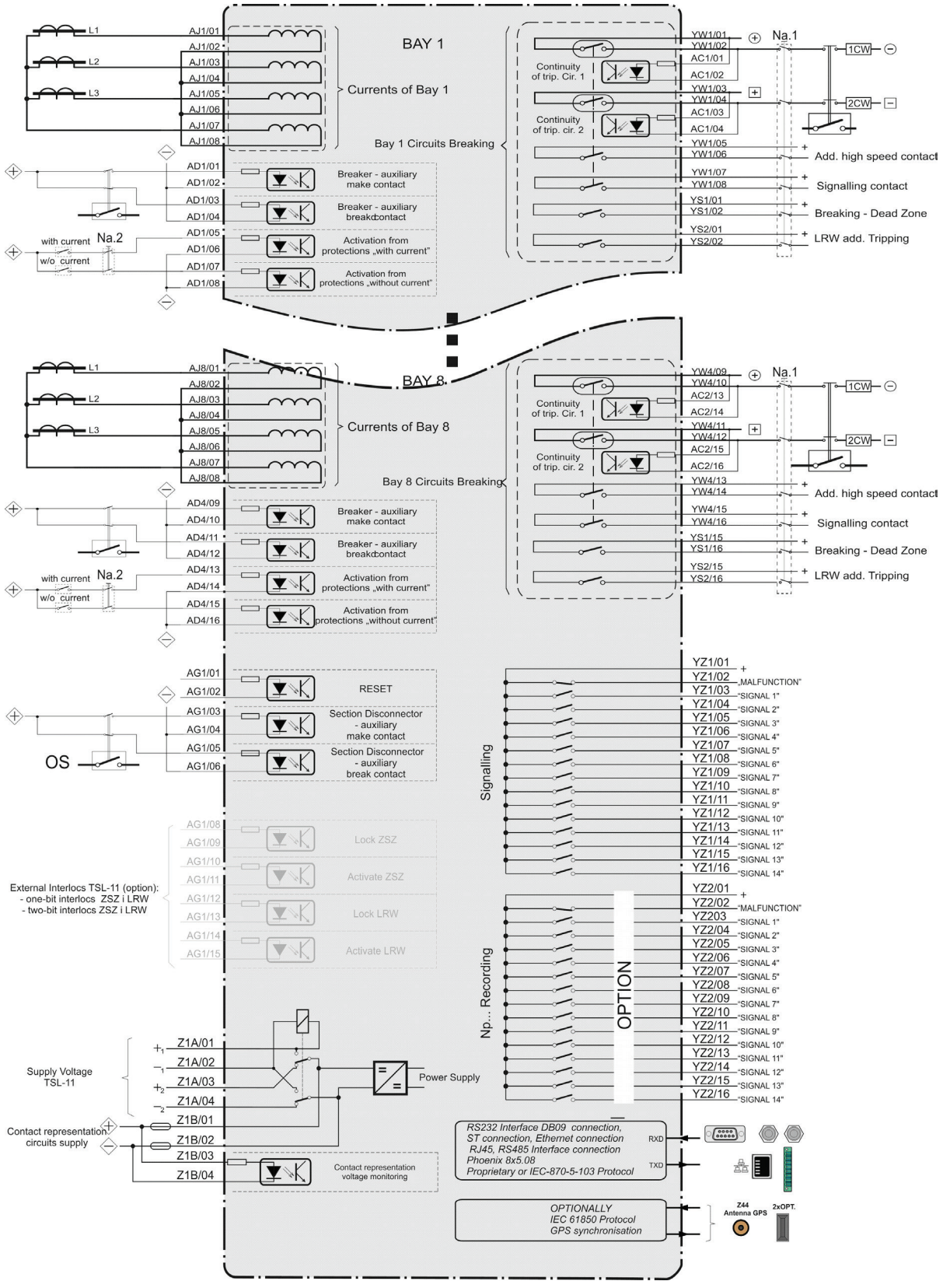


Fig. 7. TSL-11 connection diagram (standard version)

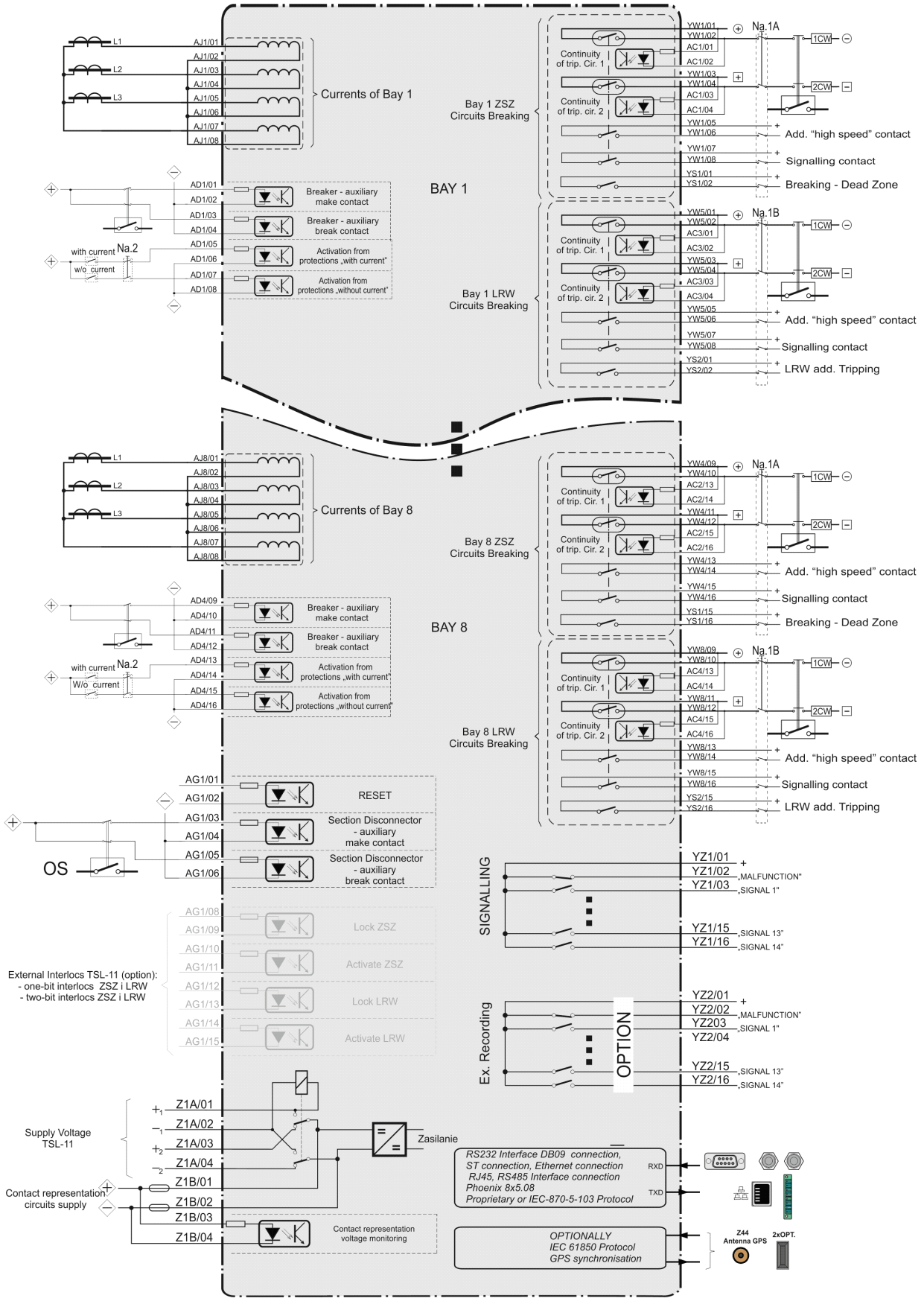


Fig. 8. TSL-11 connection diagram (version with separate tripping circuits)

8.2 Application schematics

a) Outgoing feeder

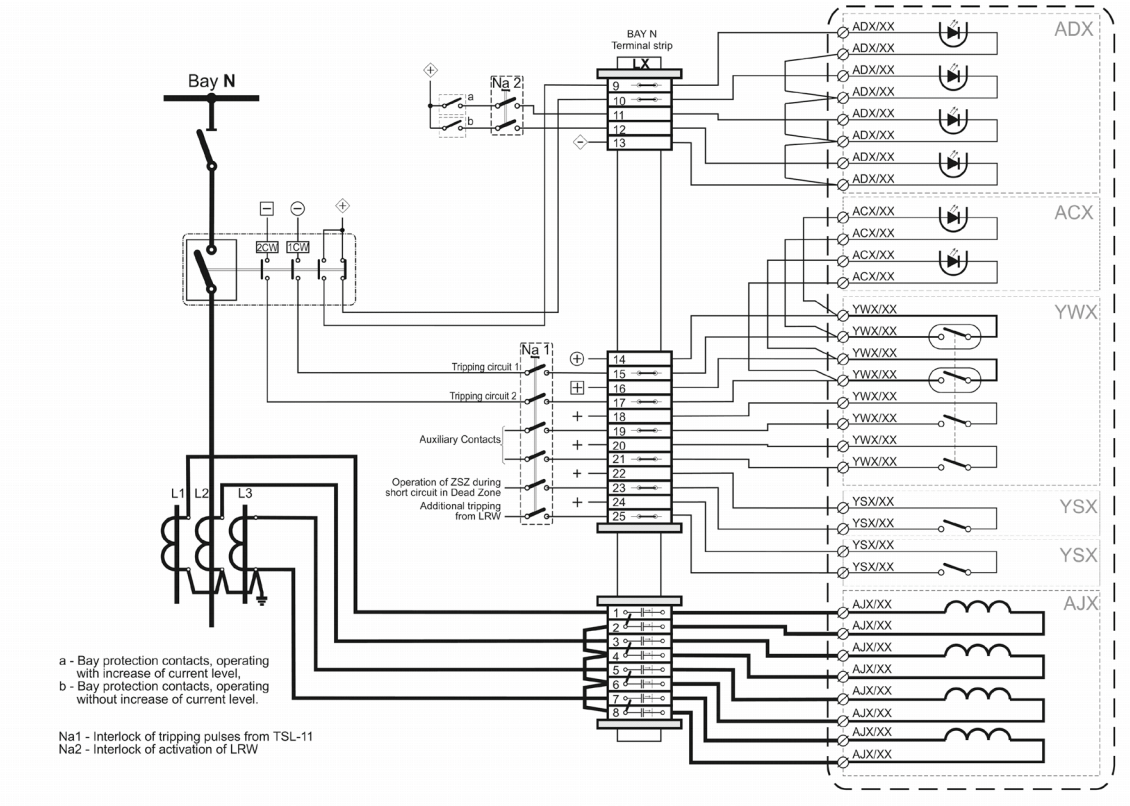


Fig. 9. Example diagram of bay circuits connection (standard version)

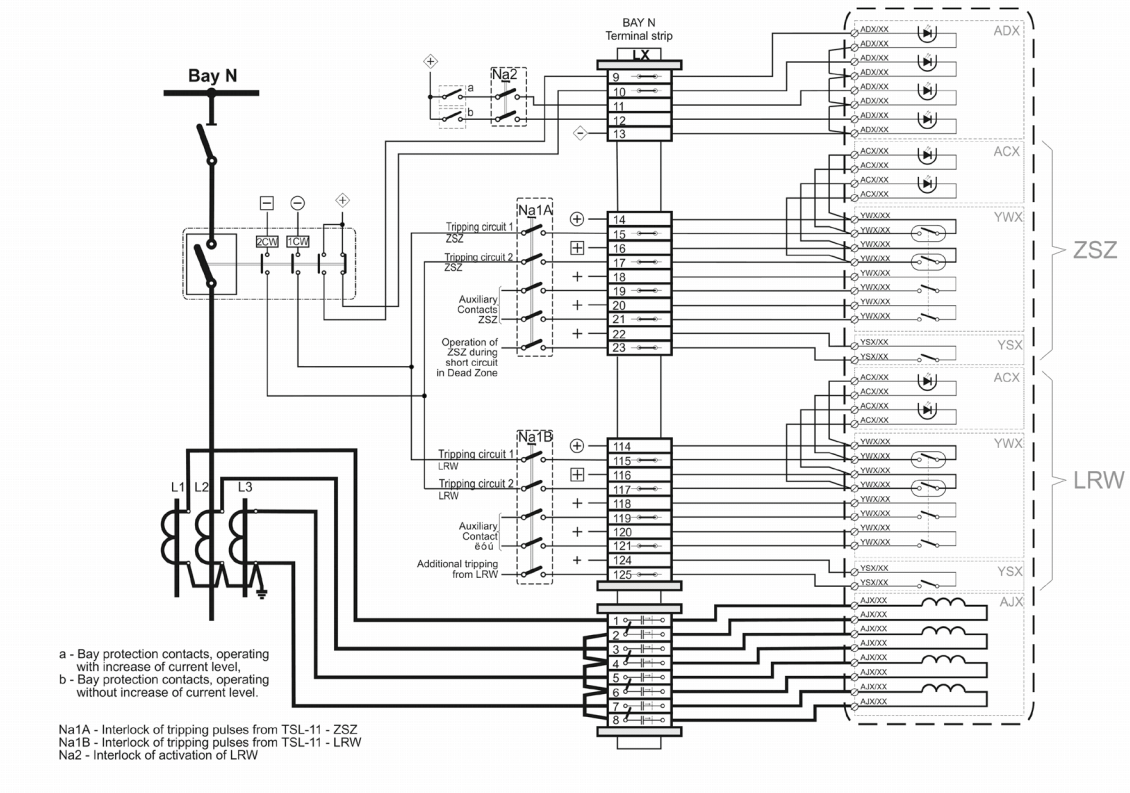


Fig. 10. Example diagram of bay circuits' connection (version with separate tripping circuits)

9. TECHNICAL PARAMETERS OF A TSL-11 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		< 100 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
	II stage time setting range of breaker failure protection		T2 LRW =50…500 ms
	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 … 5000 [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		two circuits per bay
	Making capacity of contacts: - 1 s - continuous current - breaking 220 V DC L/R=40 ms		 10 A 5 A 3,2 A
Auxiliary	Signalling		„Malfunction” + 14 programmable
	Recording		„Malfunction” + 14 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	IP-40

General Data	Ambient temperature range:		248 ÷ 328 K (od -25° do +55° C)
	Ambient humidity (with no water vapour condensation or ice)		95 %
	Dimensions:	Standard	19”/6U/300 (483 × 267 × 345 mm), (W×H×D)
		With separated tripping circuits	19”/9U/300 (483 × 400 × 345 mm), (W×H×D)
	Weight	Standard	10 kg
		With separated tripping circuits	12 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)

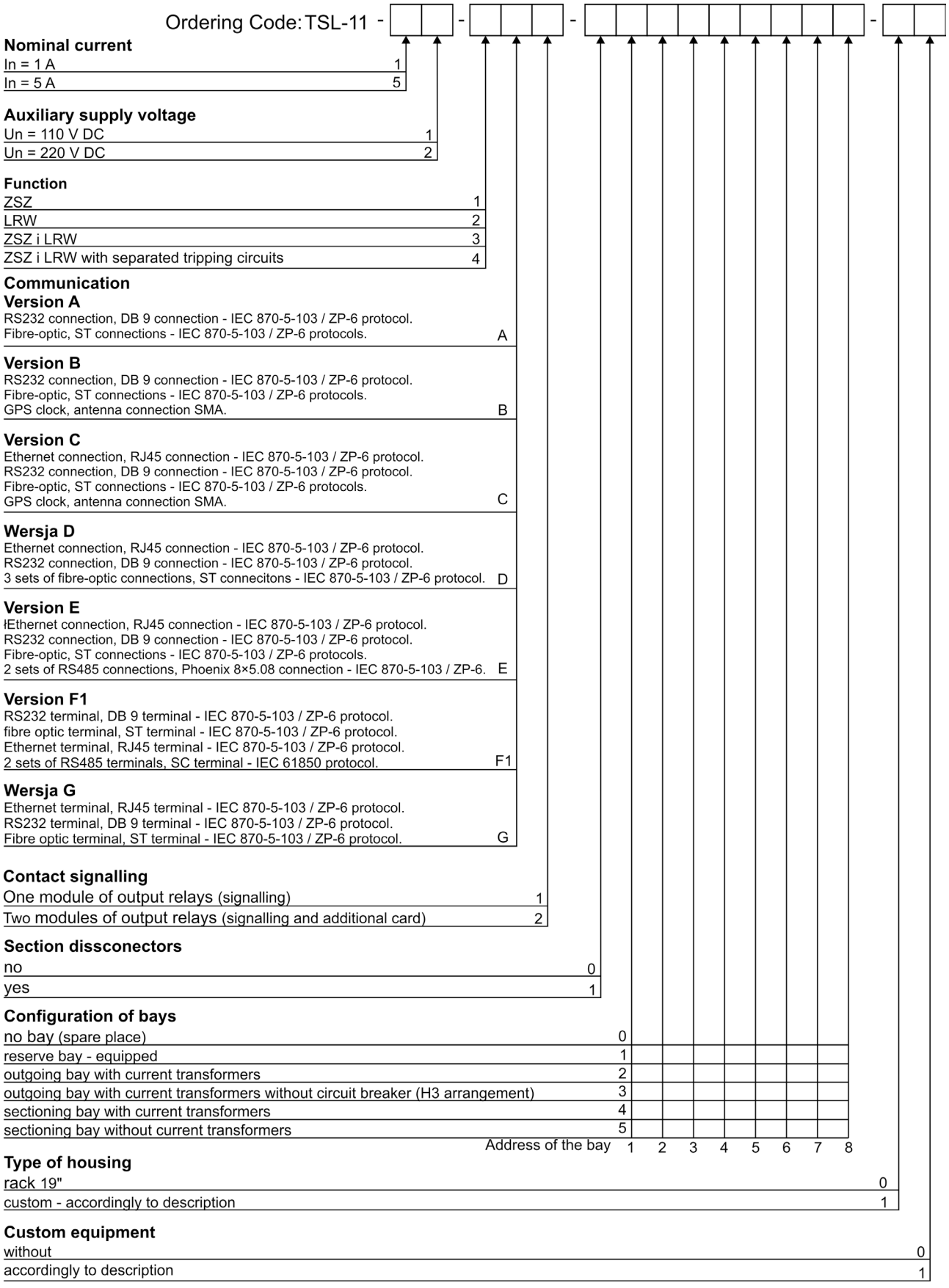
10. HOW TO ORDER.

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

Example of an order code: **TSL-11-52-3C1-002242200-00**

5 – rated current **5A**
2 – Auxiliary power supply voltage **220 V DC**
-
3 – **Busbar protection and breaker failure protection** functions active
C – **MGB-9C** version of the communication module
1 – One signalling relay module
-
0 – Without section disconnectors
0 – Without bay at address 1
2 – Feeder bay with current transformers at address 2
2 – Feeder bay with current transformers at address 3
4 – Busbar switch bay with current transformers at address 4
2 – Feeder bay with current transformers at address 5
2 – Feeder bay with current transformers at address 6
0 – Without bay at address 7
0 – Without bay at address 8
-
0 – Casing - 19” unit
0 – Without non-standard equipment

Order form:


Ordering Code: TSL-11 - - - -
Nominal current
In = 1 A 1
In = 5 A 5
Auxiliary supply voltage
Un = 110 V DC 1
Un = 220 V DC 2
Function
ZSZ 1
LRW 2
ZSZ i LRW 3
ZSZ i LRW with separated tripping circuits 4
Communication
Version A
RS232 connection, DB 9 connection - IEC 870-5-103 / ZP-6 protocol.
Fibre-optic, ST connections - IEC 870-5-103 / ZP-6 protocols. A
Version B
RS232 connection, DB 9 connection - IEC 870-5-103 / ZP-6 protocol.
Fibre-optic, ST connections - IEC 870-5-103 / ZP-6 protocols.
GPS clock, antenna connection SMA. B
Version C
Ethernet connection, RJ45 connection - IEC 870-5-103 / ZP-6 protocol.
RS232 connection, DB 9 connection - IEC 870-5-103 / ZP-6 protocol.
Fibre-optic, ST connections - IEC 870-5-103 / ZP-6 protocols.
GPS clock, antenna connection SMA. C
Wersja D
Ethernet connection, RJ45 connection - IEC 870-5-103 / ZP-6 protocol.
RS232 connection, DB 9 connection - IEC 870-5-103 / ZP-6 protocol.
3 sets of fibre-optic connections, ST connecitons - IEC 870-5-103 / ZP-6 protocol. D
Version E
łEthernet connection, RJ45 connection - IEC 870-5-103 / ZP-6 protocol.
RS232 connection, DB 9 connection - IEC 870-5-103 / ZP-6 protocol.
Fibre-optic, ST connections - IEC 870-5-103 / ZP-6 protocols.
2 sets of RS485 connections, Phoenix 8×5.08 connection - IEC 870-5-103 / ZP-6. 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
Wersja 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
Contact signalling
One module of output relays (signalling) 1
Two modules of output relays (signalling and additional card) 2
Section dissconectors
no 0
yes 1
Configuration of bays
no bay (spare place) 0
reserve bay - equipped 1
outgoing bay with current transformers 2
outgoing bay with current transformers without circuit breaker (H3 arrangement) 3
sectioning bay with current transformers 4
sectioning bay without current transformers 5
Address of the bay 1 2 3 4 5 6 7 8
Type of housing
rack 19" 0
custom - accordingly to description 1
Custom equipment
without 0
accordingly to description 1

TSL-11

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