



# *ext***CZIP®-PV PRO**

## INTEGRATED PROTECTION AND CONTROL RELAY

RES/PV RELAYS TO MV/LV NETWORKS

- **extCZIP®-PV PRO** relay is designed for switchgear at the connection points of **renewable energy sources**, in particular photovoltaic power plants to MV and LV distribution networks, as well as for the micro-installations.
- It performs voltage and current measurements on both the MV and LV sides.
- It enables measurement using low-power measurement transformers (CR/CRR).
- It ensures compatibility with a three-winding transformer, implementing two measurement paths on the LV side.
- It **meets all the requirements** for power system protection in photovoltaic power plants.
- It includes **underimpedance protection** against phase-to-phase faults, which enables the short-circuit detection regardless of the short-circuit current values, making the protection reach independent of the fault type.
- **CZIP®-Set utility software** to support all **CZIP®** system devices, including **extCZIP®-PV PRO**.



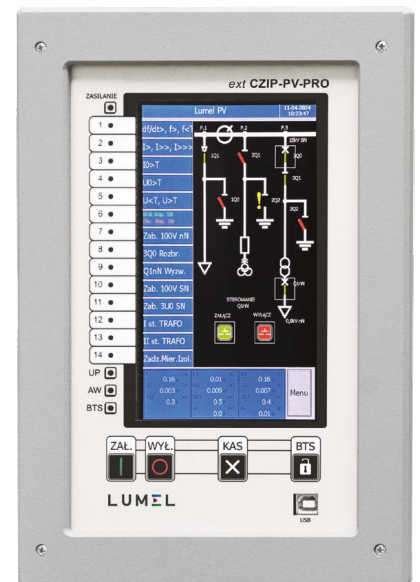
# extCZIP®-PV PRO

## BAY CONTROLLER FOR SWITCHGEAR AT RENEWABLE ENERGY CONNECTION POINTS

The dynamic development of solar power plants, i.e. photovoltaics (PV), requires the use of specialized protection and control relays that ensure protection against various faults. The protection should apply particularly to electrical devices connected to the network and the network itself.

Specific requirements regarding the protection functions were an inspiration to develop the new design of protection relay featured as **extCZIP®-PV PRO**.

The **extCZIP®-PV PRO** relay is intended for switchgear operating at the connection points of photovoltaic plants to the MV or LV distribution networks, as well as for the micro-installations. The device meets all requirements regarding power system protection for PV plants, specified in the Grid Code of the Polish Distribution System Operators (IRiESD) and the PN-EN 50549-1 and PN-EN 50549-2 standards. It includes protections supplied from both MV and LV voltage circuits. To perform the required functions, the new relay is equipped with additional inputs for voltage and current measurement at the LV side.



## extCZIP®-PV PRO

It is built on the basis of proven hardware and software solutions known from the **CZIP®** system, including the **CZIP®-Set** utility software.

It includes the **underimpedance protection**, which is a possible solution to the phase-to-phase short-circuit problems occurring near the PV plants.

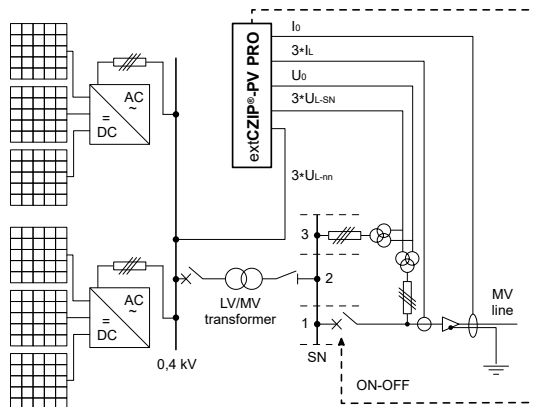
Underimpedance protection solves the problems related to the fact that the short-circuit current generated by PV plants is only 10% greater than their rated current.

### CHARACTERISTICS

- programmable logic support (50),
- colour LCD TFT 7" screen, 800x480, with a touch panel,
- bay synoptic diagram presentation with mapping of the switch states,
- switch control from the synoptic screen and using telemechanics (up to 11 switches),
- presentation of the recorded events, measurement values and input or output states,
- 28 or 56 opto-isolated binary inputs,
- 20 or 40 output relays,
- 14 bi-colour programmable LEDs, with on-screen description,
- ON and OFF buttons – to control the bay circuit breaker from the device keyboard,
- 512 MB internal memory for recording samples of disturbance recorder, event recorder, energy measurements,
- time synchronization via Ethernet network using SNTP,
- independent communication interfaces: USB, 2 x RS-485, Ethernet 10/100 BASE-TX (optional fibre optic port and CAN-BUS/RS-485),
- communication protocols: DNP 3.0, IEC 60870-5-103 and 104, IEC 61850, Modbus® ASCII / RTU (optional PPM2 protocol on CAN-BUS/RS-485 port),
- 2-bit status monitoring of all switches,
- optional phase current measurement inputs adapted for operation with low-power current transformers based on Rogowski coils.

### APPLICATION | RECOMMENDED CONNECTION DIAGRAMS OF A PV PLANT TO THE POWER NETWORK

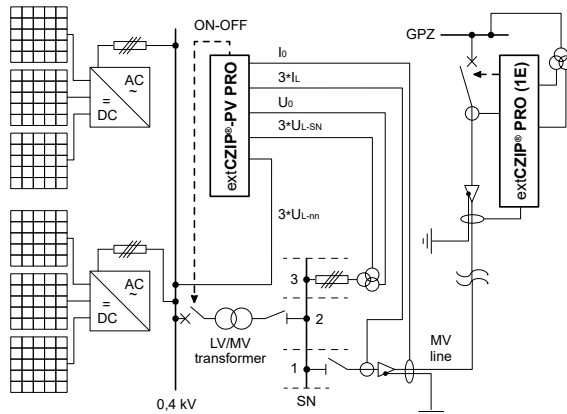
#### PV plant connection to the MV line with consumers



The PV plant includes the MV/LV transformer and the connection point is upstream in the network.

In the PV plant there is a MV circuit breaker and it is controlled by the extCZIP®-PV PRO.

#### PV plant connection to the MV network with the customer's line



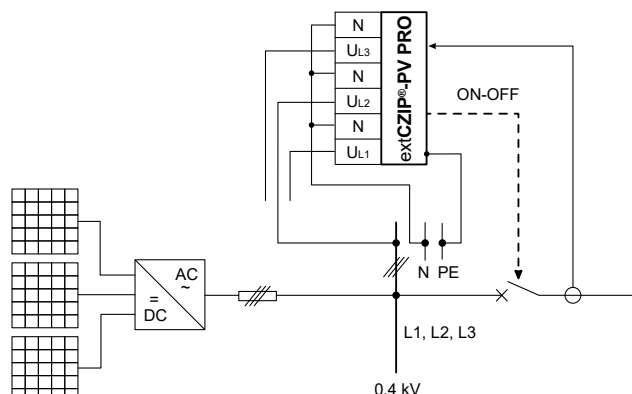
The PV plant includes the MV/LV transformer and it is connected to the MV substation bay (at GPZ or RS) with the customer's line.

If the circuit breaker is located only at the connection point outside the PV plant (e.g. at GPZ substation), then the extCZIP®-PV PRO controls the circuit breaker at LV side.

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## PV plant connection to the LV network (microgeneration)



If a specialized protection relay is used in a micro-installation, then there is no need to install voltage transformers (including the U0 filter) and the 230 V/400 V voltage and phase currents are connected directly from the LV side.

## TECHNICAL DATA

### Phase current inputs (optionally two sets of inputs - for HV and LV)

#### CURRENT TRANSFORMERS

Rated current $I_n$	5 A or 1 A
Current range	0...200 A
Measurement error	$0.05 A >  0.35...50 A  < 200 A$ $< 10\%$ $< 1.5\%$ $< 10\%$
Rated frequency $f_n$	50 Hz
Power consumption at $I=I_n$	$< 0.5 VA$ at rated current

#### LOW-POWER CURRENT TRANSFORMERS CR/CRR

Current range	0.1A...150kA
Measurement Circuit Resistance	50 kΩ

### Phase voltage inputs (MV) two sets of inputs - for compatibility with a three-winding transformer (TWT)

Rated voltage $U_n$	100 V
Voltage range	0...130 V
Measurement error in the measurement range	$0...130 V$ $< 1.5\%$
Rated frequency $f_n$	50 Hz
Power consumption at $U=U_n$	$< 0.4 VA$ at rated voltage

### Phase voltage inputs (LV)

Rated voltage $U_n$	100 V or 230 V
Voltage range	0...300 V
Measurement error in the measurement range	$< 1.5\%$
Power consumption at $U=U_n$	$< 1 VA$
Rated frequency $f_n$	50 Hz

### Zero-sequence current inputs

Rated voltage $I_{0n}$	0.5 A
Voltage range	0...5 A
Measurement error	$0.003 A >  0.02...3.5 A  < 5 A$ $< 10\%$ $< 1.5\%$ $< 10\%$
Rated frequency $f_n$	50 Hz
Power consumption at $I=I_{0n}$	$< 0.1 VA$

### Zero-sequence voltage inputs

Rated voltage $U_{0n}$	100 V
Voltage range	0...130 V
Measurement error in the measurement range	$0...130 V$ $< 1.5\%$
Rated frequency $f_n$	50 Hz
Power consumption at $U=U_{0n}$	$< 0.4 VA$ at rated voltage

### Binary inputs (28 or 56 inputs)

Input type	opto-isolated			
Rated input voltage	230 V AC	24 V DC	220 V DC	110 V DC
Current drain	$< 3 mA$	$< 3 mA$	$< 3 mA$	$< 3 mA$

### Output relays (20 or 40 outputs)

Rated voltage	250 V AC
Continuous current carrying capacity	5 A
Breaking capacity of the induction circuit	
• 220 V DC, L/R = 40 ms	0.1 A
• 220 V AC, $\cos \varphi = 0.4$	2 A

### Circuit breaker connection circuits

Rated voltage	250 V AC
Continuous current carrying capacity	8 A
Breaking capacity of the induction circuit	
• 220 V DC, L/R = 40 ms	1.2 A / 300 cycles
Duration of the switch-off impulse	min. 0.1 s
Duration of the switch-on impulse	0.2 ÷ 1 s

### Power supply

Power supply				
• nominal auxiliary voltage	220 V DC	230 V AC	110 V DC	24 V DC
• voltage tolerance range	110... 220...265 V	85... 230...265 V	90... 110...265 V	19... 24...65 V
• auxiliary power consumption	$< 20 W$			

### Environmental conditions

• operating temperature	-10...+55°C
• storage temperature	-20...+70°C
• altitude	$\leq 2000 m$
• relative humidity	5...95%

Weight	6 kg
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Dimensions	283 x 190 x 155 mm backboard version
	283 x 190 x 233 mm onboard version

Case protection degree	IP 50 acc. to PN-EN 60529
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# extCZIP®-PV PRO

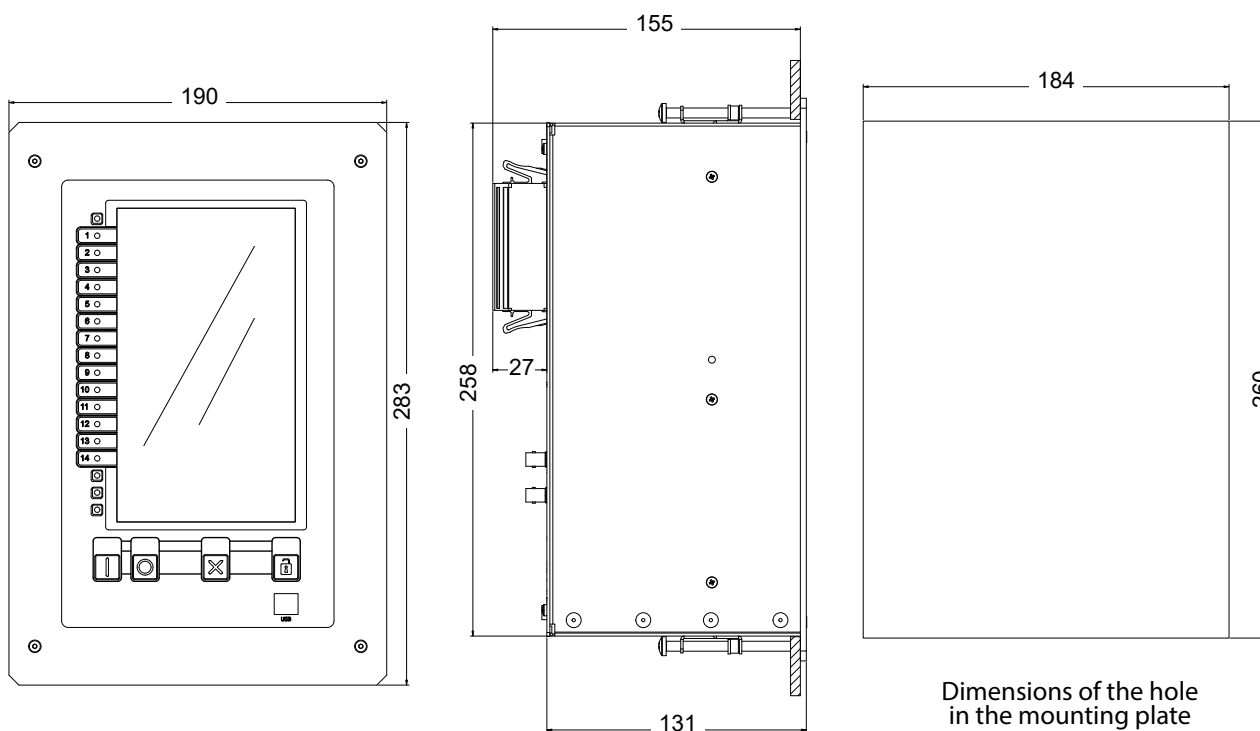
BAY CONTROLLER FOR SWITCHGEAR AT RENEWABLE  
ENERGY CONNECTION POINTS

## WYKONANIE extCZIP®-PV PRO



## DIMENSIONS

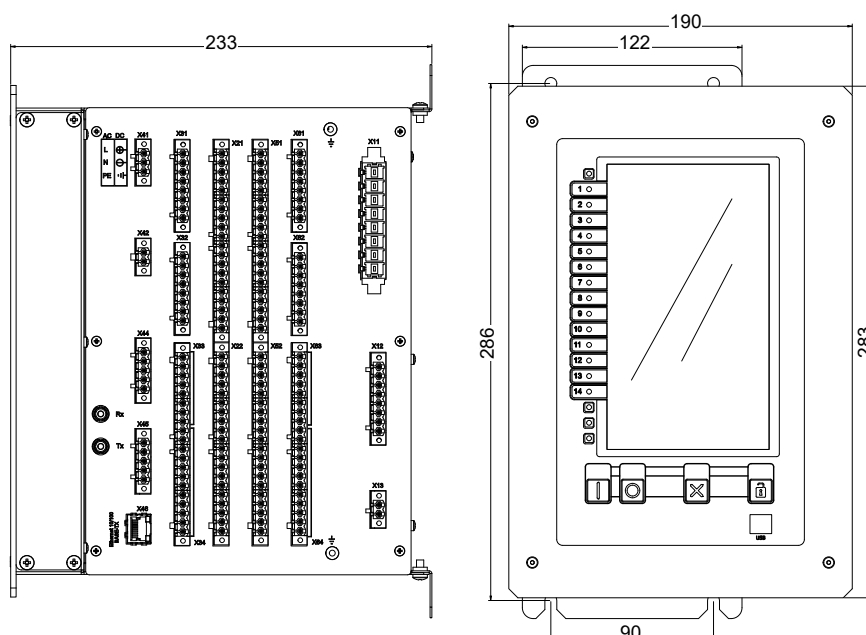
Backboard version



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Onboard version



Holes with a diameter of 6,5 mm for mounting on the board using 4 M5 screws

## PROTECTION FUNCTIONS AVAILABLE AT extCZIP<sup>®</sup>-PV PRO

extCZIP<sup>®</sup>-PV PRO is almost identical to extCZIP<sup>®</sup>-PRO (1E) in terms of protections supplied from MV circuits.

It is equipped with **overcurrent and underimpedance** protection for phase faults, as well as **voltage, frequency and earth-fault** protection. Additionally, the **overvoltage** protection has been introduced, the criterion of which is the average voltage value from the last 10 minutes, in accordance with the standards' requirements. It will operate if the start-up condition is met by one of the three phase-to-phase voltages within the set time.

Protections supplied from MV voltage circuits

Criterion	Symbol	Criterion setting range	Time setting range
Undervoltage I stage	U<	1...100 V	0.05...60 s
Undervoltage II stage	U<<	1...100 V	0.05...60 s
Overvoltage I stage	U>	100...130 V	0.05...60 s
Overvoltage II stage	U>>	100...130 V	0.05...60 s
Overvoltage for the 10 min. average	U10>	100...130 V	–
Negative sequence overvoltage	Uneg>	1...100 V	0.05...60 s
Residual overvoltage autonomous	U0>	2...100 V	0.05...60 s
Underfrequency I stage	f<	45...50 Hz	0.01...10 s
Underfrequency II stage	f<<	45...50 Hz	0.01...10 s
Overfrequency I stage	f>	50...55 Hz	0.01...10 s

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Overfrequency II stage	f>>	50...55 Hz	0.01...10 s
Anti-islanding LoM	dfdt< i dfdt>	0.1...25 Hz/s	0.01...10 s
Rated of change of voltage (increase)	dU/dt narost	1...500 V/s	0.05...60 s
Rated of change of voltage (decrease)	dU/dt opad	1...100 V/s	0.05...60 s
Directional overpower I stage	P3>	10...9900 W	0.1...600 s
Directional overpower II stage	P3>>	10...9900 W	0.1...600 s
Directional overpower (reactive power) I stage	Q3>	10...9900 var	0.1...600 s
Directional overpower (reactive power) II stage	Q3>>	10...9900 var	0.1...600 s

### Protections supplied from LV voltage circuits (with or without the MV/LV transformer)

Criterion	Symbol	Criterion setting range	Time setting range
Undervoltage I stage	U<	1...400 V	0.05...60 s
Undervoltage II stage	U<<	1...400 V	0.05...60 s
Overvoltage I stage	U>	100...500 V	0.05...60 s
Overvoltage II stage	U>>	100...500 V	0.05...60 s
Overvoltage for the 10 min. average	U10>	100...470 V	–
Underfrequency I stage	f<	47...50 Hz	0.01...10 s
Underfrequency II stage	f<<	47...50 Hz	0.01...10 s
Overfrequency I stage	f>	50...52 Hz	0.01...10 s
Overfrequency II stage	f>>	50...52 Hz	0.01...10 s
Anti-islanding LoM	dfdt< i dfdt>	0.1...25 Hz/s	0.01...10 s
Directional overpower I stage	P3>	0.1...10 kW	0.1...600 s
Directional overpower II stage	P3>>	0.1...10 kW	0.1...600 s
Directional overpower (reactive power) I stage	Q3>	0.1...10 kvar	0.1...600 s
Directional overpower (reactive power) II stage	Q3>>	0.1...10 kvar	0.1...600 s

The CZIP®-PV PRO is also equipped with all the protection functions supplied from the current circuits, similarly to the extCZIP-PRO (1E) application for a MV line with local generation.

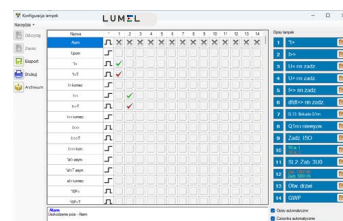
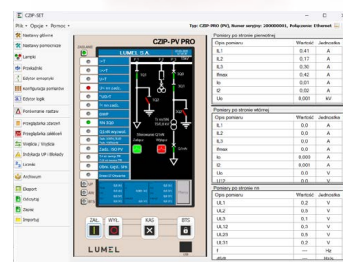
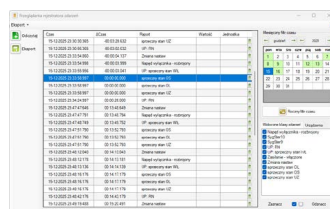
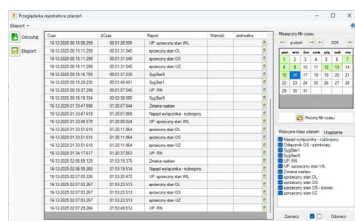


# extCZIP®-PV PRO

BAY CONTROLLER FOR SWITCHGEAR AT RENEWABLE ENERGY CONNECTION POINTS

## CZIP®-SET SOFTWARE

- software supplied with extCZIP®-PRO devices,
- excellent engineering tool supporting the user in specifying settings, configuring all available parameters, checking current configuration, measurement data and event recorder,
- a module enabling reading of samples saved in the disturbance recorder and their comprehensive analysis is also included in the software package,
- the tool includes a programmable logic editor, which enables adaptation of the extCZIP®-PRO device to individual needs and solutions,
- software enables communication with extCZIP®-PRO devices via RS-485 serial ports, optical fiber, USB, Ethernet,
- comparator of configuration files,
- synoptic editor - standard connectors + 11 configurable ones,
- remote control of MV and LV switches via Ethernet (VPN).



## ORDERING CODE

	extCZIP CR4	X	X	X	X	X	X	X	X	X	X	X	XXX	X
Typ	PV PRO	5												
Rodzaj styku wyjścia sygn. ALARM	NC (topologia równoległa)	1												
	NO (topologia szeregową)	2												
Wersja obudowy	Zatabcicowa (złącza śrubowe)	1												
	Natabcicowa (złącza śrubowe)	2												
	Zatabcicowa (złącza sprężynowe)	3												
	Natabcicowa (złącza sprężynowe)	4												
Napięcie zasilania	110...230 V a.c./d.c.	1												
	24 V d.c.	2												
Napięcie wejść binarnych	230 V a.c.	1												
	24 V d.c.	2												
	220 V d.c.	3												
	110 V d.c.	4												
Światłowodowy port komunikacyjny FO	Brak	0												
	Światłowód szklany - złącze ST	1												
Liczba wejść binarnych	28	2												
	56													
Liczba wyjść przekaźnikowych	20													
	40*													
Funkcje specjalne	Brak													
	7U 7I pomiar 7 napięć i 7 prądów SN/nN													
	10U 4I pomiar 10 napięć i 4 prądów SN/nN													
	7U 6IR+IO pomiar 7 napięć i 6 prądów z sensorów**													
Wersja językowa	Polska													
	Angielska													
Wykonanie	Standardowe												000	
	Specjalne												XXX	
Próby odbiorcze	Bez wymagań dodatkowych													0
	Ze świadectwem wzorcowania													2
	Według uzgodnień z odbiorcą													X

\*- wybór niedostępny jeżeli nie wybrano 56 wejść binarnych

\*\*- wybór w trakcie opracowania



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SCAN ME!

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