*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.**

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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.

*ext*CZIP®-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.

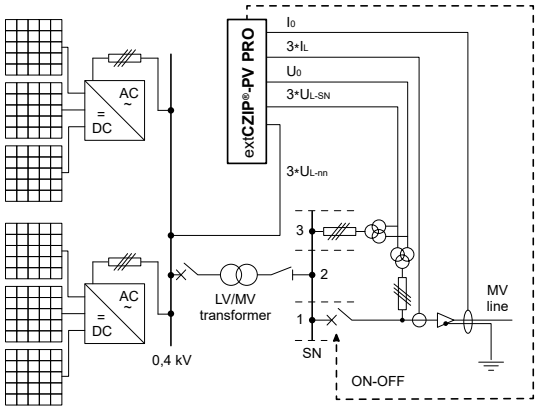
It includes the **underimpedance protection**, which is a possible solution to the phase-to-phase short-circuit problems occurring near the PV plants.
Underimpedance protection solves the problems related to the fact that the short-circuit current generated by PV plants is only 10% greater than their 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

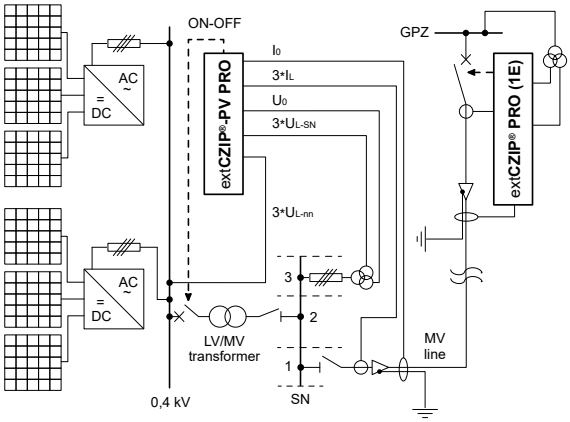
PV plant connection to the MV line with consumers



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



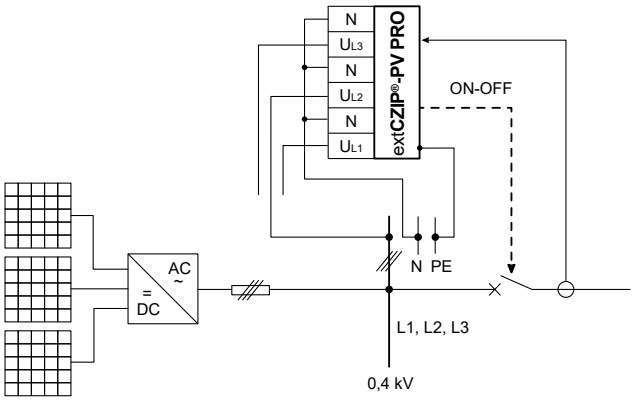
The PV plant includes the MV/LV transformer and it is connected to the MV substation bay (at GPZ or RS) with the customer's line.

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.

extCZIP®-PV-PRO

INTEGRATED PROTECTION AND CONTROL RELAY

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

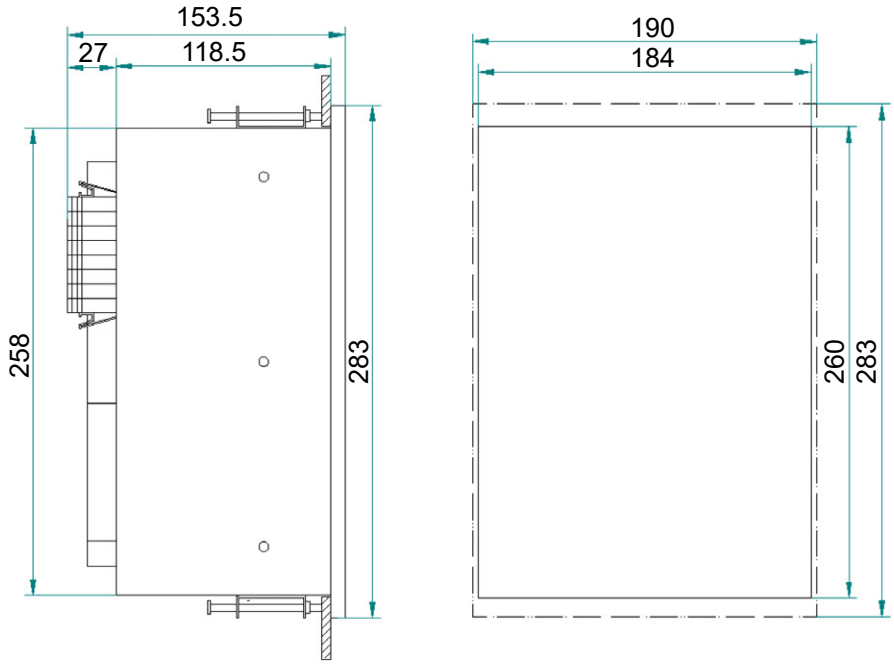
Phase current inputs (optionally two sets of inputs - for HV and LV)		
CURRENT TRANSFORMERS		
Rated current I_n		5 A or 1 A
Current range		0...200 A
Measurement error	0 A > | 0,35...50 A | < 200 A	< 10% | < 1,5% | < 10%
Rated frequency f_n		50 Hz
Power consumption at $I=I_n$		< 0,5 VA at rated current
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
LV phase voltage inputs		
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 $U=U_n$		< 1,5VA
Rated frequency f_n		50 Hz
Continuous voltage withstand		1,4 * U_n
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	24 V DC	220 V DC
Input voltage range	17...32 V DC	88...253 V DC
Current drain	< 3 mA	< 3 mA
Output relays (20 or 40 outputs)		
Rated voltage	220 V	24 V
Continuous current carrying capacity	5 A	
Breaking capacity of the inductioncircuit		
• 220 V DC, L/R = 40 ms	0,1 A	
• 220 V AC, cos φ = 0,4	2 A	
Circuit breaker connection circuits		
Rated voltage	220 V	24 V
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	min. 0,1 s	
Power supply		
Power supply		
• nominal auxiliary voltage	220 V DC 90...300 V DC	230 V AC 85...265 V AC / 24 V DC 19...65 V DC
• auxiliary power consumption	< 20 W	
Environmental conditions		
• operating temperature	-10...+55°C	
• storage temperature	-20...+70°C	
• altitude	≤ 2000 m	
• relative humidity	5...95%	
Weight	6 kg	
Dimensions	283 x 190 x 153,5 mm backboard version	
	283 x 190 x 233 mm onboard version	
Case protection degree	IP 50 acc. to PN-EN 60529	

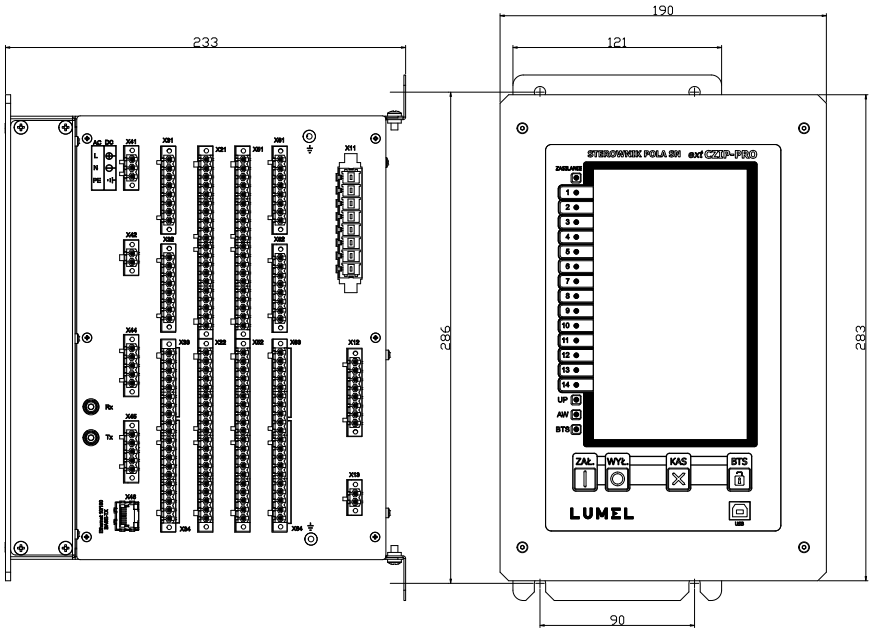
DIMENSIONS

Backboard version

Dimensions of the hole in the mounting plate



Onboard version



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

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PROTECTION FUNCTIONS AVAILABLE AT *ext*CZIP®-PV PRO

extCZIP®-PV PRO is almost identical to **extCZIP®-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>	110...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
Overfrequency II stage	f>>	50...55 Hz	0,01...10 s
Anti-islanding LoM	dfdt< and dfdt>	0,1...25 Hz/s	0,01...10 s
Rated of change of voltage (increase)	dU/dt increase	1…500 V/s	0,05…60 s
Rated of change of voltage (decrease)	dU/dt decrease	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< and 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 ***ext*CZIP-PRO (1E)** application for a MV line with local generation.

RELATED PRODUCTS:

extCZIP®-PRO
PROTECTION RELAY

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POWER NETWORK ANALYZER

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