70 YEARS OF TRUST
LUMEL

PROTECTION
AUTOMATION & CONTROL

ABOUT US

70 YEARS OF TRUST

LUMEL has been known, since 1953, all over the world, as a manufacturer of top quality industrial automation devices.

Lumel offers consists of product categories, such as:
for low voltage:

- Network parameter meters and analyzers,
- Electrical and non-electrical quantity transducers,
- Digital meters,
- Recorders and data loggers,
- Controllers,
- Analog meters,
- Current transformers,
- Shunts.

Depending on the needs of the customer, the automation products and systems our offer relay on various data communication protocols (MODBUS, ETHERNET, PROFINET, BACNET or MQTT).

for medium voltage :

- Protection relays.

Apart from the products, Lumel specializes in complex systems used for:

- monitoring and optimizing the cost of electricity and other utilities (water, gas, compressed air)
- monitoring environmental parameters: temperature, humidity, light intensity, CO_2, volatile gases
- solar energy.

In addition to its manufacturing activity, Lumel offers also:

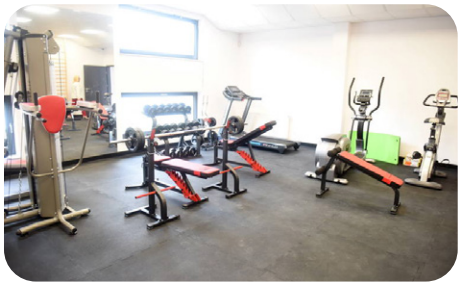
- OEM services in the scope of housing designing, elecctronics, mechanics, hardware and software. All under one roof.
- EMS services.
- ODM services.

We are a member of an international capital group which consists of the following companies: LUMEL S.A., LUMEL ALUCAST Sp. z o.o., Rishabh Instruments Pvt. Ltd., Sifam Tinsley US, Sifam Tinsley UK, Microsys.

LUMEL S.A.
ul. Słubicka 4, 65-127 Zielona Góra, Poland

LUMEL 4.0 - PLANT OF NEW TECHNOLOGIES

OUR NEW PLANT BUILT IN 2020 POWERED BY A 125 KW LUMEL PHOTOVOLTAIC SYSTEM.
LUMEL S.A. - PLANT AREA - 3639 m^2.



LUMEL ARENA
(SPORTS AND RECREATION FACILITY FOR EMPLOYEES AND THEIR FAMILIES) - AREA - 1007 m^2.

CONTENTS

SEE ONLINE:

*ext*CZIP®-PRO
PROTECTION RELAY

DIGITAL PROTECTION, AUTOMATION, MEASUREMENT, CONTROL, RECORDING AND COMMUNICATION

- Underimpedance protection against phase faults in MV lines. An alternative to conventional overcurrent protection in cases where selective coordination and the required sensitivity cannot be achieved.
- Allows measurement using low-power measurement transformers CR/CRR.
- **extCZIP®-PRO extended version of the CZIP® system**
  - flexibility to choose the number of available input and output ports,
  - additional communication ports.

extCZIP®-PRO
PROTECTION RELAY

extCZIP®-PRO digital protection relays for medium voltage switchgear and **extCZIP®-2R PRO** automatic transfer switch system are new versions of devices belonging to the **CZIP®** system. The **extCZIP®-PRO** series protection relays are characterized by great flexibility in choosing the number of available input, output and communication ports.

The **CZIP®** system devices are 100% Polish products, developed in cooperation with the Institute of Electrical Power Engineering of the Poznań University of Technology.

- extCZIP®-PRO – digital protection relay
  for MV switchgear for power utilities and industrial facilities
- extCZIP®-2R PRO – ATS system implementation (automation transfer switch)
  for MV switchgear
- CZIP®-Set – utility software for operating all CZIP® system devices,
  including extCZIP®-PRO

Unique protection functions of the CZIP® system

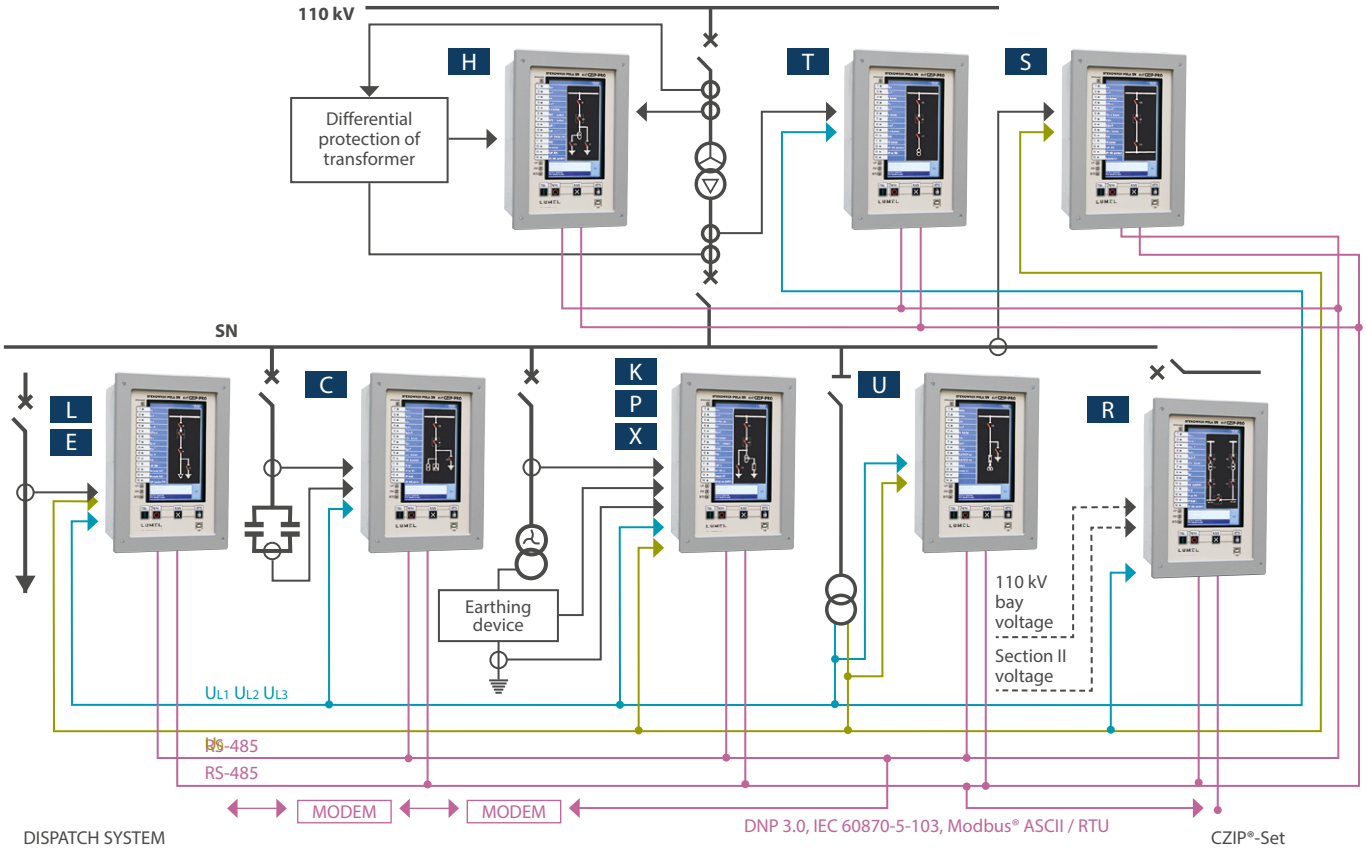
- **underimpedance protection against phase faults**
- detection of high-impedance earth faults (up to 8 kΩ),
- selective protection against earth faults in earthing transformer bays and earthing circuits.

CHARACTERISTICS

- software for all MV (medium voltage) substation bays in one **extCZIP®-PRO** device,
- ATS system (automatic transfer switch) implemented in **extCZIP®-2R PRO**,
- predefined settings of the protection functions and automation systems,
- **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.

extCZIP®-PRO
PROTECTION RELAY

CONNECTION DIAGRAM



FUNCTIONS

Protection functions	L	E	Z	T	C	K	P	X	U	S	H	R
Three-stage overcurrent protection against phase faults	•1	•1	•1			•						
Directional protection for each stage of overcurrent protection	•	•	•									
Current asymmetry criterion based on the negative sequence current component	•	•	•			•	•	•				
Instantaneous switch onto fault protection	•	•	•	•	•	•	•	•		•	•	
Underimpedance protection against phase faults	•	•	•									
Earth-fault overcurrent	•	•	•	•	•	•	•	•		•	•	
Residual overvoltage as start-up element for other protection functions	•	•	•			•	•	•		•		
Residual overvoltage as autonomous criterion		•	•			•	•		•		•	
Earth-fault overcurrent in the neutral point's earthing circuit						•	•	•				
Earth-fault admittance	•	•	•			•	•					
Earth-fault admittance incremental	•	•	•									
Earth-fault conductance (directional and non-directional)	•4	•4	•4			•	•			•2		
Earth-fault susceptance directional	•	•	•									
Wattmetric-based earth-fault I0P>				•								
Adaptive earth-fault conductance RG0adapt. (detection of high-impedance faults)	•	•	•									
Overfrequency		•3	•3						•			
Underfrequency		•3	•3									
Rate of change of frequency df/dt		•3	•3									
Overcurrent busbar protection blocking element	•	•	•		•	•	•	•				
Directional protection for overcurrent busbar protection blocking element	•	•	•									
Overcurrent relay cooperating with busbar protection										•		
Decision element of busbar protection			•	•								
Selective protection against earth faults in earthing transformer and earthing circuit						•	•	•				

Protection functions	L	E	Z	T	C	K	P	X	U	S	H	R
Overvoltage		•3	•3	•	•							
Undervoltage		•3	•3	•	•							
Overload overcurrent				•	•						•	
Time-delay overcurrent against phase faults					•							
Overcurrent against internal faults					•							
Phase overvoltage (criterion: phase-to-phase voltage)									•			
Phase undervoltage (criterion: phase-to-phase voltage)									•			
Overcurrent-logic busbar protection			•	•						•		
Short-circuit overcurrent against internal phase faults						•	•	•			•	
Directional overpower P3>		•	•									
Directional overpower Q3>		•	•									
Voltage asymmetry				•								
Automation systems	**L**	**E**	**Z**	**T**	**C**	**K**	**P**	**X**	**U**	**S**	**H**	**R**
Automatic reclosing	•	•	•									
Circuit breaker failure protection			•	•						•		
Capacitor bank controller				•								
Capacitor bank switching automation (clock)					•							
Underfrequency load shedding - 3 stages									•			
Distributed underfrequency load shedding (applied for line bays)		•	•									
Underfrequency load shedding and restoration									•			
Active current forcing scheme with a controller						•						
Resistor controller							•					
Others	**L**	**E**	**Z**	**T**	**C**	**K**	**P**	**X**	**U**	**S**	**H**	**R**
Cooperation with underfrequency load shedding automation or underfrequency load shedding and restoration system	•	•	•									
Cooperation with circuit breaker failure protection	•	•	•		•	•	•	•			•	
Cooperation with automatic transfer switch			•	•			•	•		•	•	
Operation of automatic transfer switch function for both hot and cold reserve configurations												•
Cooperation with gas detector relay				•		•	•	•				
Cooperation with external differential protection											•	
Second harmonic bias for phase overcurrent protection		•	•									
Synchronism check function when switching on a line with distributed generation		•5	•5									

[1] Settings' change possible after operational switching of the first, second or third stage.
[2] Non-directional.
[3] With separate automatic reclosing system.
[4] Built-in adaptive algorithm supporting effective detection of high-impedance earth faults.
[5] Optional function.

*ext*CZIP®-PRO purpose by bay

- **L** line bay without local power plant
- **E** line bay with local power plant (also wind power)
- **Z** incoming/ outgoing feeder bay
- **T** MV side of the 110 kV/MV transformer
- **C** capacitor bank
- **K** auxiliary services in compensated networks (also networks with an insulated neutral point)
- **P** auxiliary services in networks with resistor-earthed neutral point
- **X** auxiliary services in networks with parallel reactor – resistor earthing system
- **U** voltage measurement
- **S** busbar coupler
- **H** 110 kV side of the 110 kV/MV transformer

*ext*CZIP®-2R PRO purpose

- **R** ATS system (automatic transfer switch)

TECHNICAL DATA

Phase current inputs		
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
LOW-POWER CURRENT TRANSFORMERS CR/CRR		
Current range		0.1A...150kA
Measurement Circuit Resistance		50 kΩ

Phase voltage inputs	
Rated voltage U_n	100 V
Voltage range	0...130 V
Measurement error in the measurement range	< 1,5%
Rated frequency f_n	50 Hz
Power consumption at $U=U_n$	< 0,4 VA

Zero-sequence current inputs		
Rated current I_{0n}		0,5 A
Current range		0...5 A
Measurement error	0,02...3,5 A	< 1,5%
Rated frequency f_n		50 Hz
Power consumption at $I=I_{0n}$		< 0,4 VA

Zero-sequence voltage inputs	
Rated voltage U_{0n}	100 V
Voltage range	0...130 V
Measurement error in the measurement range	< 1,5%
Rated frequency f_n	50 Hz
Power consumption at $U=U_{0n}$	< 0,4 VA

Binary inputs		
Rated input voltage	24 V	220 V
Input voltage range	17...32 V	88...253 V
Current drain	< 3 mA	< 3 mA

Output relays		
Rated voltage	220 V	24 V
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 φ = 0,4	2 A	

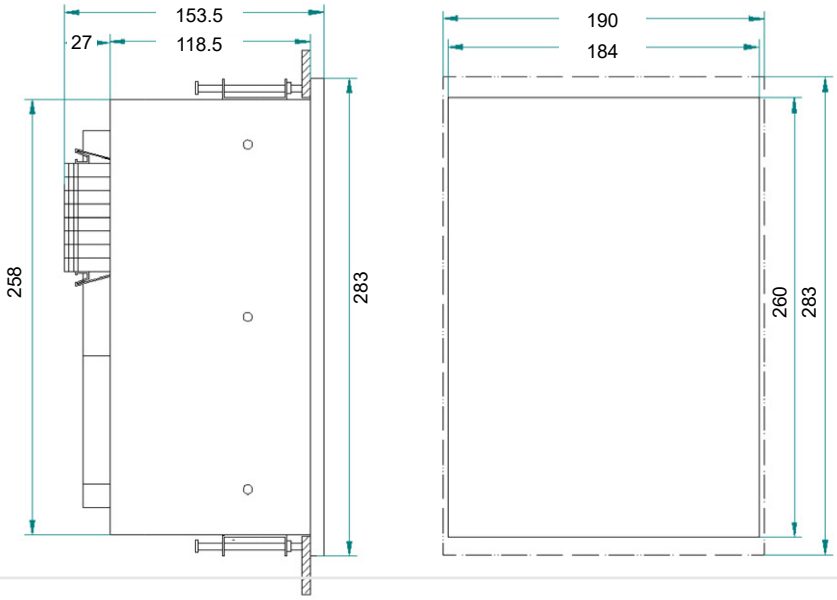
Circuit breaker connection circuits		
Rated voltage	220 V	24 V
Continuous current carrying capacity	8 A	
Breaking capacity of the induction circuit		
• 220 V DC, L/R = 40 ms	1,2 A / 300 cycles	
Duration of the switch-off impulse	min. 0,1 s	
Duration of the switch-on impulse	min. 0,1 s	

Other data			
Power supply			
• nominal auxiliary voltage	220 V DC 90...220...300 V	230 V AC 85...230...265 V	24 V DC 19...24...65 V
• 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		

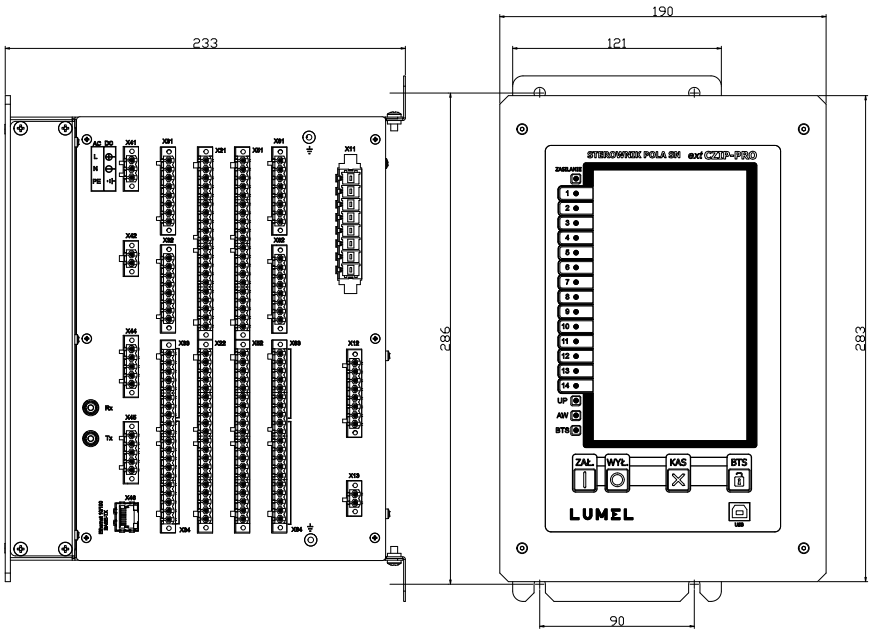
DIMENSIONS

Backboard version

Dimensions of the hole in the mounting plate



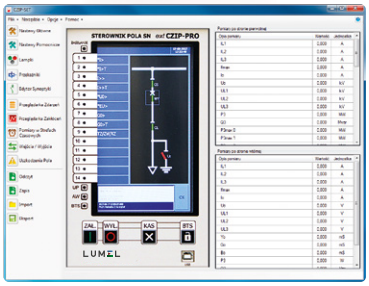
Onboard version

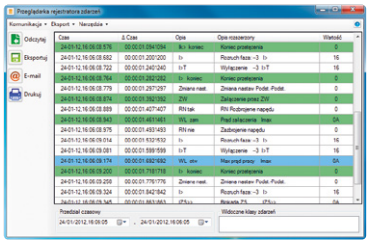


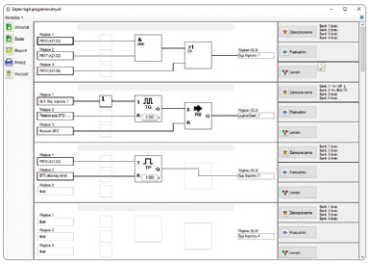
Holes with a diameter of 6,5 mm
for mounting on the board
using 4 M5 screws

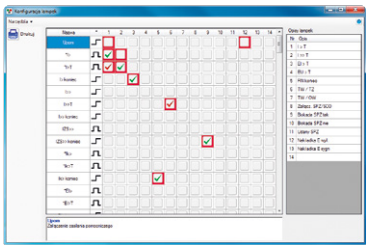
CZIP®-SET extCZIP®-PRO software

- 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).









*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.**

*ext*CZIP®-PV-PRO

INTEGRATED PROTECTION AND CONTROL RELAY

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.

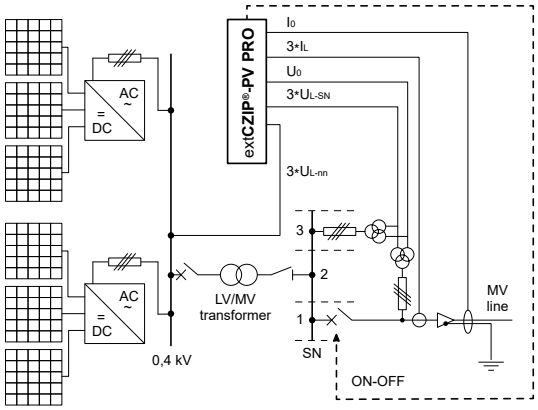
It includes the **underimpedance protection**, which is a possible solution to the phase-to-phase short-circuit problems occurring near the PV plants.
Underimpedance protection solves the problems related to the fact that the short-circuit current generated by PV plants is only 10% greater than their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

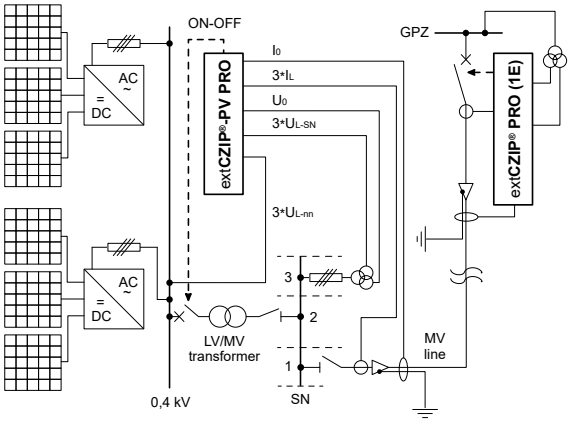
PV plant connection to the MV line with consumers



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



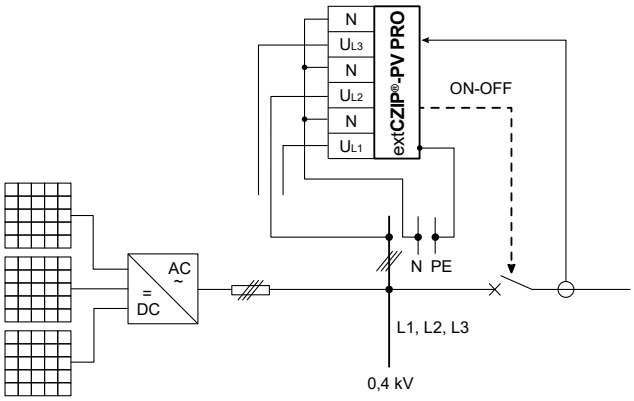
The PV plant includes the MV/LV transformer and it is connected to the MV substation bay (at GPZ or RS) with the customer's line.

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

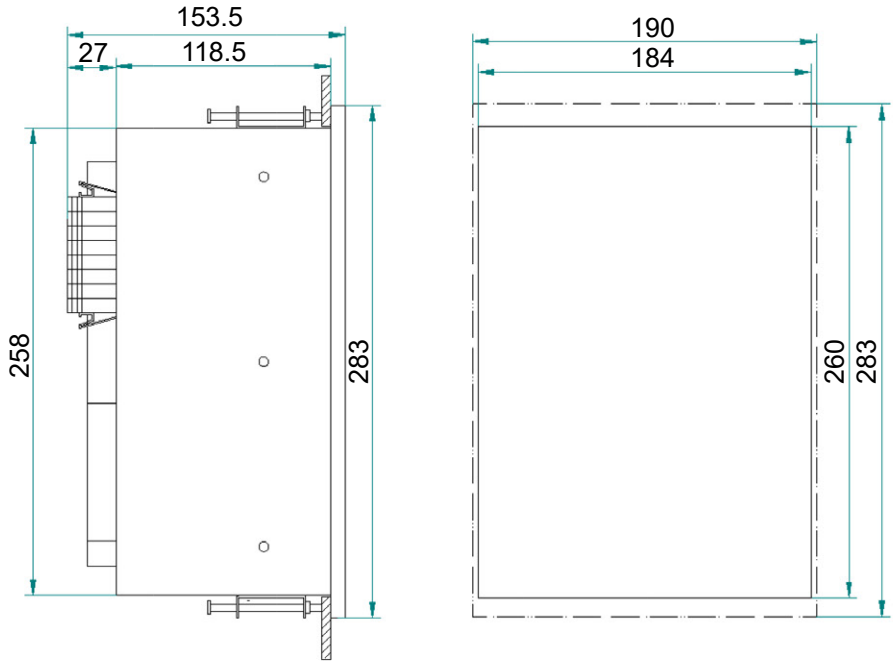
Phase current inputs (optionally two sets of inputs - for HV and LV)		
CURRENT TRANSFORMERS		
Rated current I_n		5 A or 1 A
Current range		0...200 A
Measurement error	0 A > | 0,35...50 A | < 200 A	< 10% | < 1,5% | < 10%
Rated frequency f_n		50 Hz
Power consumption at $I=I_n$		< 0,5 VA at rated current
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	

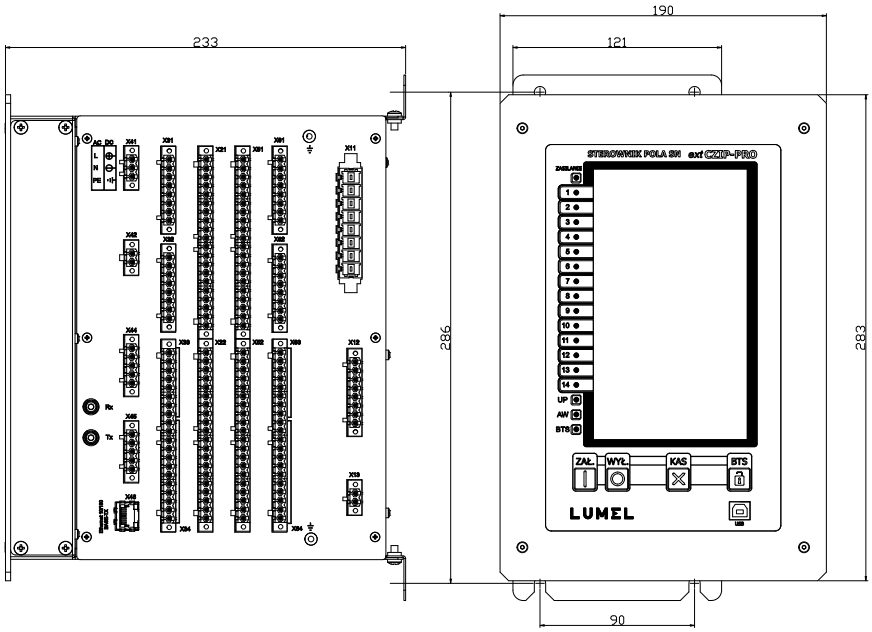
DIMENSIONS

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

*ext*CZIP®-PV-PRO

INTEGRATED PROTECTION AND CONTROL RELAY

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.

LUMEL

SELECTED PARAMETERS CLASS A *

ELECTRICAL CAT III SAFETY

CE

IEC 104

GPS RTC

ND45PLUS

POWER NETWORK ANALYZER

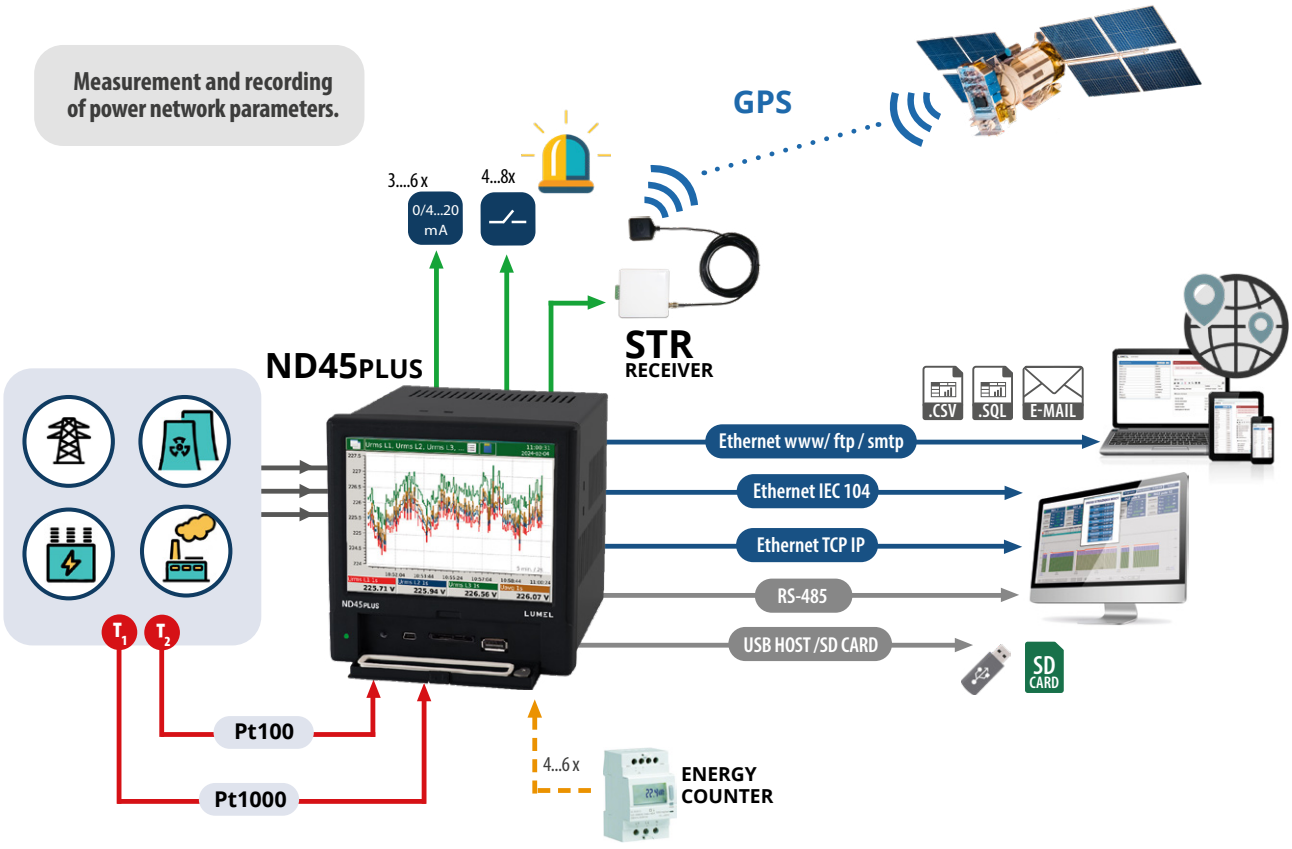
ND45
POWER NETWORK ANALYZER

FEATURES

- Measurement and recording of over 500 electric energy quality parameters acc. to EN 50160, EN 61000-4-30 standards.
- **Measuring class A***.
- Operation in 3 or 4-wire, 3-phase, balanced or unbalanced power networks.
- Analysis of current and voltage harmonics and interharmonics up to the 51 st for **class I**.
- Flicker.
- 4-quadrant energy measurement **in 4 tariffs**.
- **Monitoring up to 6 additional energy meters with pulse output.**
- **Recording of measurements before and after events (dips & swells).**
- Configurable archives of actual values and events recording.
- Data archiving on an SD card - memory up to 32 GB.
- E-mail messages in case of alarm occurs.
- Web server (HTTP protocol), FTP server, DHCP client.
- Interfaces: **RS-485 Modbus Slave**, Ethernet 100 Base-T (Modbus TCP/IP), USB Device & Host.
- Colour touch screen: LCD TFT 5.6", 640 x 480 pixels.
- IP54 protection grade from the frontal side.
- **Time synchronisation using an external GPS receiver - STR receiver** (optional).
- Automatic synchronization of RTC clock with the NTP time server.
- **IEC 60870-5-104 communication protocol for data transmission** in industrial process control systems and energy sector.

* for selected parameters - details in the technical data

EXAMPLE OF APPLICATION



MEASUREMENT AND VISUALIZATION OF POWER NETWORK PARAMETERS

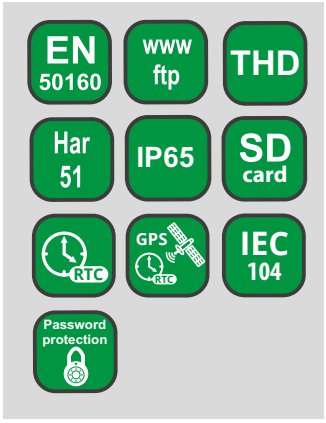
Aggregated values for 3 seconds, 10 minutes and two hours:

- phase voltages U_1, U_2, U_3, U_{123}avg
- phase current I_1, I_2, I_3, I_{123}avg
- active phase powers P_1, P_2, P_3, ΣP_{123}, P_{123}avg
- reactive phase powers Q_1, Q_2, Q_3, ΣQ_{123}, Q_{123}avg
- apparent phase powers S_1, S_2, S_3, ΣS_{123}, S_{123}avg
- active power factors PF_1, PF_2, PF_3, PF_{123}avg
- power factor distortion dPF_1, dPF_2, dPF_3, dPF_{123}avg
- reactive/active power factors $tg\varphi_1$, $tg\varphi_2$, $tg\varphi_3$, $tg\varphi_{123}$avg
- phase-to-phase voltages U_{12}, U_{31}, U_{23}, U_{123}avg
- current in neutral wire I_n
- the angle between the voltage and current φ_1, φ_2, φ_3, φ_1, φ_{123}avg (degrees and radians)
- voltage phase-to-phase angle $\sphericalangle U_{12}$, $\sphericalangle U_{31}$, $\sphericalangle U_{23}$, $\sphericalangle U_{123}$avg

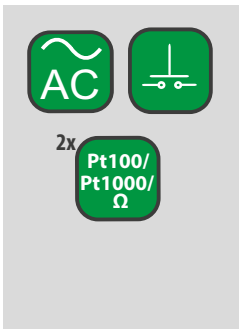
Other parameters:

- frequency (aggregation for 1 and 10 seconds)
- temperature/ resistance values (two channels)
- Demand values: P, Q , S , U , I (15-minute, 30-minute or 1 hour).
- energy: active imported/exported, reactive imported/exported and apparent. All energies are calculated for each phase and 3-phase parametres.
- factors: THD, THDS, THDG, PWHD. Calculated for currents and voltages of each phase and 3-phase parameters.
- harmonics from 1 up to 51st for each phase of currents and voltages
- interharmonics from 1 up to 51st for each phase of currents and voltages
- the half wave voltage of each phase
- recording of dips, swells and overvoltages
- storage of minimun and maximum of measured values.

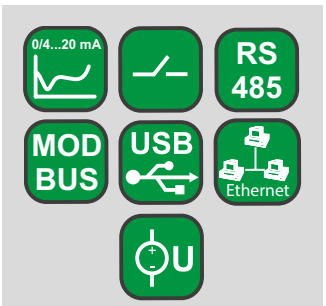
FEATURES



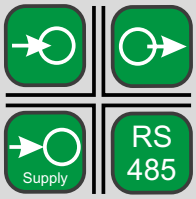
INPUTS



OUTPUTS



GALVANIC ISOLATION



TECHNICAL DATA

INPUTS

Input type	Measuring range			Parameters	Basic error
Voltage input	230/400 V	57,7/100V	69.3/ 120 V	0.05..1.5 Un	± 0.1%
Current input	1 A or 5A			0.005..1.5 In	± 0.1%
Logic input (option)	4 or 6 logic inputs: 0/5..24 V d.c.			switching frequency up to 50 Hz	
Input for temperature measurement	2 inputs: Pt100 (-200...850°C) lub Pt1000 (-200...850°C) , resistance: 0...5000 Ω				± 0.2%

OUTPUTS

Output type	Properties
Analog output (option)	3 or 6 programmable current outputs 0/4...20 mA, load resistance < 500 Ω
Relay output (option)	4 or 8 programmable electromagnetic relays, voltageless NO contacts, load capacity 250 V a.c./1 A a.c.

DIGITAL INTERFACES

Interface type	Properties
RS-485	interface: Modbus Slave, baud rate 300. . . 115200 bit/s, transmission mode ASCII/RTU
USB	2 interfaces: Device & Host, USB v.2.0
Ethernet	100 Base-T, RJ45 socket, Modbus TCP/IP, web server (HTTP), FTP server, DHCP client

ND45
POWER NETWORK ANALYZER

RATED OPERATING CONDITIONS

Supply voltage	85 V..253 V a.c., 40...400Hz	90 V..300 V d.c.	power consumption ≤ 20 VA
Ambient temperature	work: 0 up to 50°C		storage: - 20...50°C
Relative humidity	< 75%		Condensation inadmissible
Reaction against	supply decays		Data and device state preservation
	supply recovery		Continuation of device work
Short term load (5s)	2 Un (max. 1000 V)		10 In
Casing protection grade	IP 54		
Safety requirements	Installation category III		EN 61010-1
	Pollution grade 2		
Maximum phase-to-earth operating voltage	RS485, temperature/resistance input, USB: 50V		EN 61010-1
	measuring circuit, relays, supply: 300 V		

MEASURING RANGES AND ADMISSIBLE BASIC CONVERSION ERRORS

Measuring quantity	Measurement method	Range	Basic error
Voltage U RMS	**U RMS** averaged values: 200 ms class: B 1 s class: B 3 s **class: A or S** 10 min **class: A or S** 2 hrs **class: A or S**	U RMS L-N (150% Un) Un = 230 V 23.0..46..345.0 V (Ku=1) ..1.38 MV (Ku≠1) Un = 57.7V 5.7..11.5 ..86.5 V (Ku=1) ..280 kV (Ku≠1) Un = 69.3V 6.9..13.9 ..104.0 V (Ku=1) ..416 kV (Ku≠1) U RMS L-L (150% Un): Un = 400 V 40.0..80.. 600.0 V (Ku=1) ..2.4 MV (Ku≠1) Un = 100V 10.0 ..20..120.0 V (Ku=1) ..480 kV (Ku≠1) Un = 120V 12.0 ..24..180.0 V (Ku=1) ..720 kV (Ku≠1)	**class A** acc. to EN 61000-4-30 **U RMS L-N** (10% Udin - 150% Udin): ±0.1% Udin.
Current I RMS	**I RMS**: averaged values: 200 ms class: B 1 s class: B 3 s **class: A or S** 10 min **class: A or S** 2 hrs **class: A or S**	**I RMS (150% In)**: In = 1 A - 0.010..0.1..1.5 A (Ki=1) In = 5 A - 0.050..0.5..7.5 A (Ki=1) ..480.0 kA (Ki≠1)	**I RMS** (10% In - 150% In): ±0.1% of measurement
Frequency	Class S appointed from 10 or 12 cycles in 200 ms.	42.5 up to 57.5 Hz for 50 Hz a.c. of supply 51.0 up to 69.0 Hz for 60 Hz a.c. of supply	Class S acc. to EN 61000-4-30 ±0.050 Hz
	Class A appointed from 100 or 120 cycles in 10 s.		**Class A** acc. to EN 61000-4-30 ±0.010 Hz
Active, reactive and apparent power	**Active power:** Measured every 10 cycles (50 Hz) or 12 cycles (60 Hz) **Reactive power:** appointed from apparent and active power. **Apparent power:** appointed from value U RMS and I RMS.	Depends on voltage and actual ratio value.	acc. to EN 61557-12: Active power: ± 0.5% Pn Reactive power: ± 1% Qn Apparent power: ± 0.5% Sn
Measuring quantity	**Measurement method**	**Range**	**Basic error**
Active imported/exported energy, reactive imported/exported energy, apparent energy	Measured every 10 cycles (50 Hz) or 12 cycles (60 Hz). Separate measurement for exporten, imported **active and reactive energy**.	Depends on voltage and actual ratio value.	acc. to EN 61557-12: Active power: ± 0,5% Reactive power: ± 1% Apparent power: ± 2%
Active power factor, Power distortion factor	Active power factor : depends on U RMS, I RMS and active power. Power distortion factor depends on THD I.	-1,000 .. 0 .. 1,000	Power factor PF ± 0.01% Power distortion factor PFdist ± 0.05%
Harmonics of voltages and current	acc. to EN 61000-4-7, up to 51st harmonic Window: 10 cycles (for 50 Hz), 12 cycles (for 60 Hz). FFT: 4096 points	Voltage harmonics: 0.00 .. 100.00 % Current harmonics: 0.00 .. 100.00 %	Voltage harmonics – class I ± 5% Urdg if Urdg > 1% ± 0.05% Un if Urdg < 1% Current harmonics – class I ± 5% Urdg if Urdg > 3% ± 0.5% Un if Urdg < 3%
THD U, THD I, THDG U, THDG I, THDS U, THDS I, PWHD U, PWHD I	acc. to EN 61000-4-7, up to 51st harmonic Window: 10 cycles (for 50 Hz), 12 cycles (for 60 Hz). FFT: 4096 points	THD U: 0.00 .. 100.00 % THD I: 0.00 .. 100.00 % THDG U: 0.00 .. 100.00 % THDG I: 0.00 .. 100.00 % THDS U: 0.00 .. 100.00 % THDS I: 0.00 .. 100.00 % PWHD U: 0.00 .. 100.00 % PWHD I: 0.00 .. 100.00 %	THD U: ±5% (50/60Hz) THD I: ±5% (50/60Hz) THDG U: ±5% (50/60Hz) THDG I: ±5% (50/60Hz) THDS U: ±5% (50/60Hz) THDS I: ±5% (50/60Hz) PWHD U: ±5% (50/60Hz) PWHD I: ±5% (50/60Hz)

where:

Ku - voltage transformer ratio
Ki - current transformer ratio
Udin - declared input voltage
Urdg, Irdg - measurement values
Un, In, Pn, Qn - nominal values

EXAMPLES OF MEASURING DATA PRESENTATION

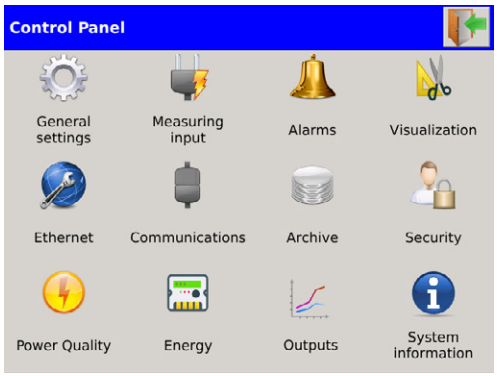
Various forms of data display:

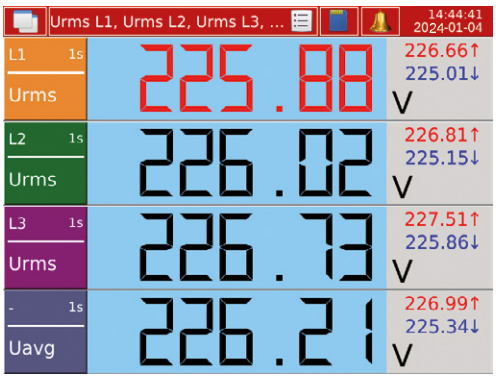
- **digital display**
- **analog view,**
- **bargraphs,**
- **vector diagrams**
- **trends**
- **energy meter**
- **harmonics analysis**
- **energy meter.**

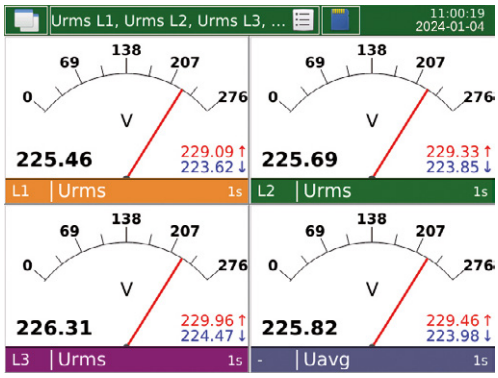
Screen system log files.

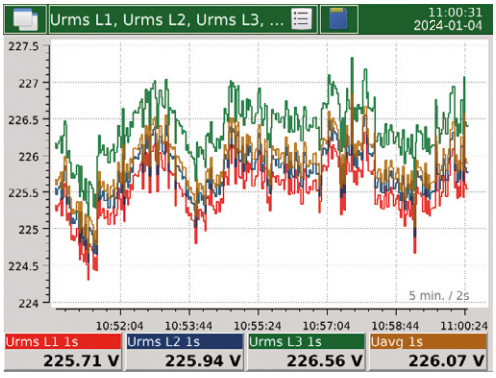
Screens log alarms.

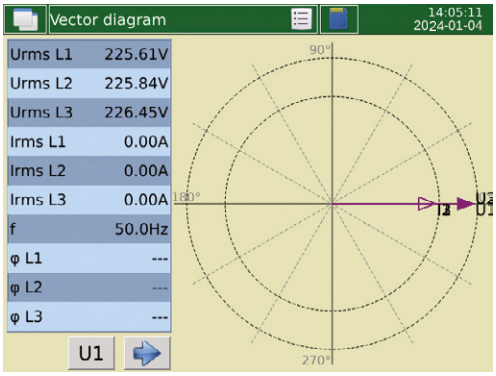
Control panel.

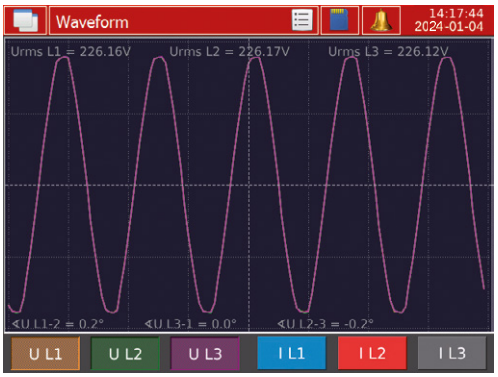


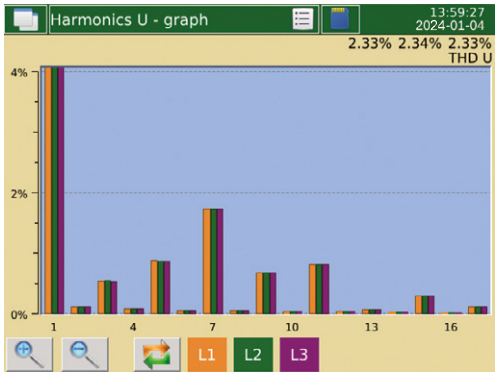


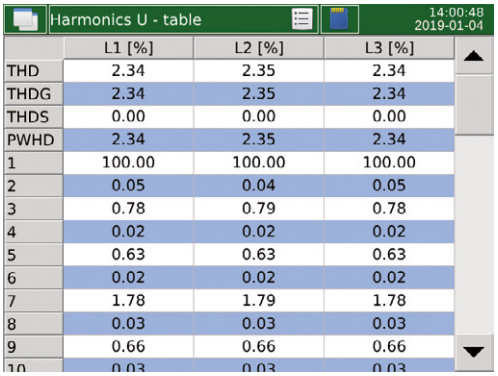






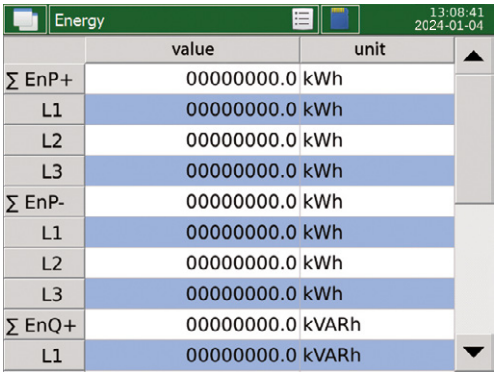




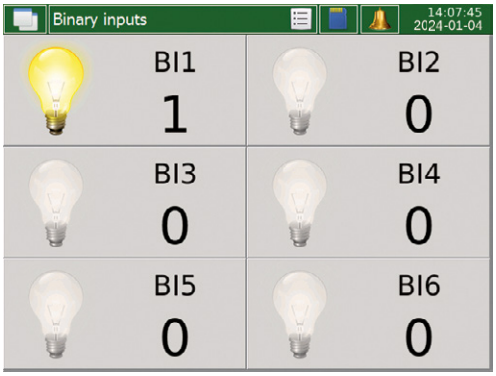


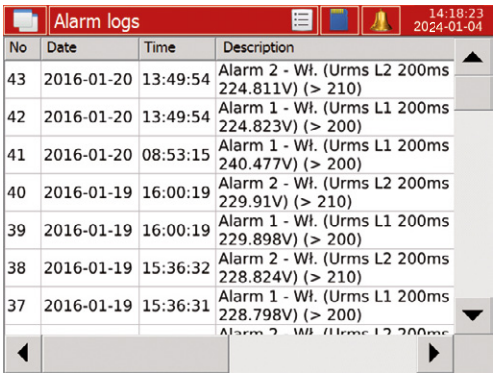
	L1 [%]	L2 [%]	L3 [%]
THD	2.34	2.35	2.34
THDG	2.34	2.35	2.34
THDS	0.00	0.00	0.00
PWHD	2.34	2.35	2.34
1	100.00	100.00	100.00
2	0.05	0.04	0.05
3	0.78	0.79	0.78
4	0.02	0.02	0.02
5	0.63	0.63	0.63
6	0.02	0.02	0.02
7	1.78	1.79	1.78
8	0.03	0.03	0.03
9	0.66	0.66	0.66
10	0.03	0.03	0.03

EXAMPLES OF MEASURING DATA PRESENTATION



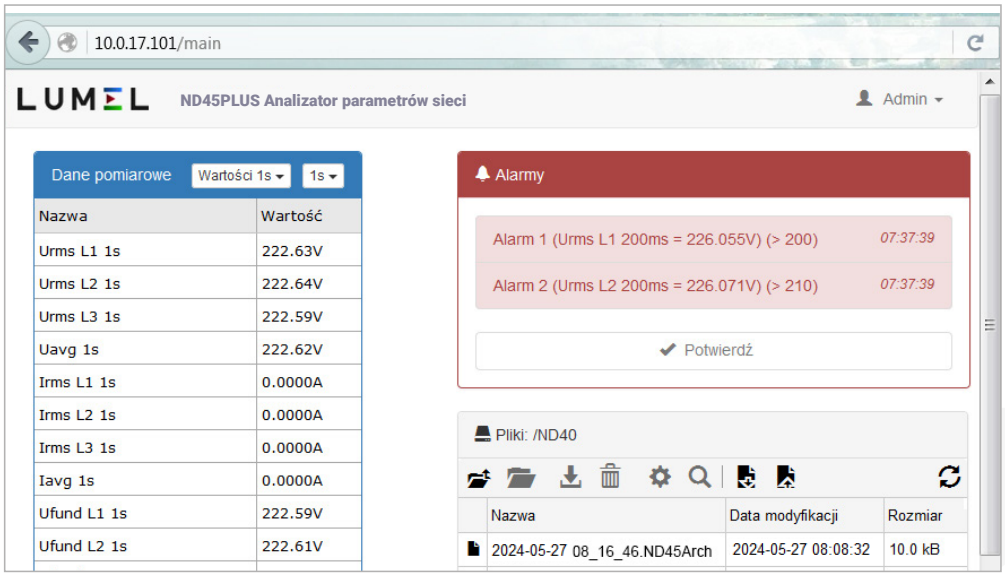
	value	unit
∑ EnP+	00000000.0	kWh
L1	00000000.0	kWh
L2	00000000.0	kWh
L3	00000000.0	kWh
∑ EnP-	00000000.0	kWh
L1	00000000.0	kWh
L2	00000000.0	kWh
L3	00000000.0	kWh
∑ EnQ+	00000000.0	kVARh
L1	00000000.0	kVARh



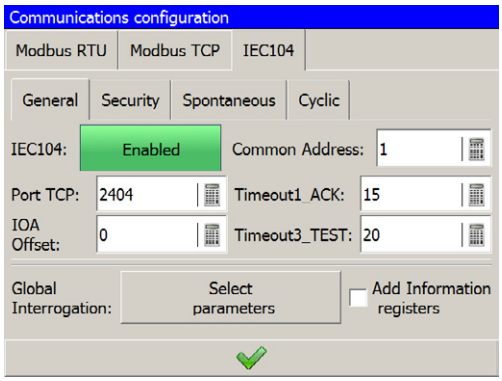


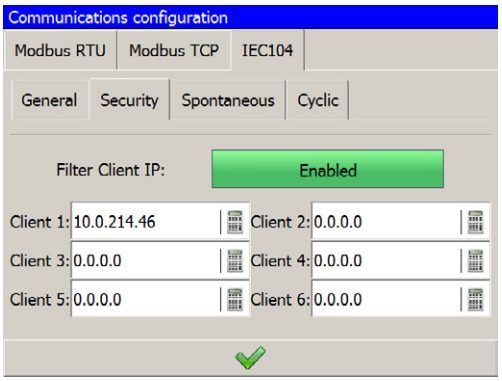
No	Date	Time	Description
43	2016-01-20	13:49:54	Alarm 2 - Wł. (Urms L2 200ms 224.811V) (> 210)
42	2016-01-20	13:49:54	Alarm 1 - Wł. (Urms L1 200ms 224.823V) (> 200)
41	2016-01-20	08:53:15	Alarm 1 - Wł. (Urms L1 200ms 240.477V) (> 200)
40	2016-01-19	16:00:19	Alarm 2 - Wł. (Urms L2 200ms 229.91V) (> 210)
39	2016-01-19	16:00:19	Alarm 1 - Wł. (Urms L1 200ms 229.898V) (> 200)
38	2016-01-19	15:36:32	Alarm 2 - Wł. (Urms L2 200ms 228.824V) (> 210)
37	2016-01-19	15:36:31	Alarm 1 - Wł. (Urms L1 200ms 228.798V) (> 200)

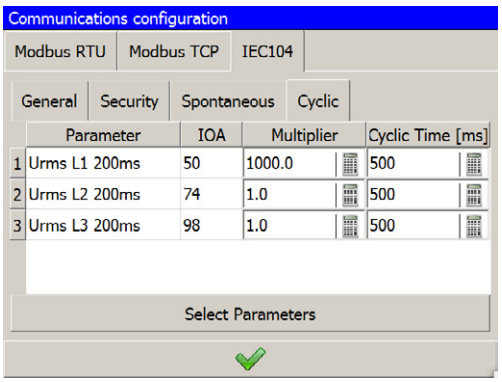
ETHERNET: **WWW SERVER, FTP**

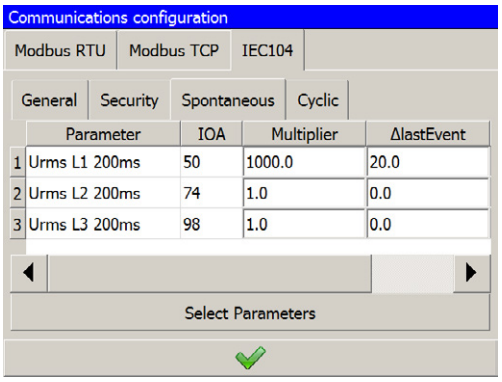


COMMUNICATION PROTOCOL **IEC 60870-5-104**

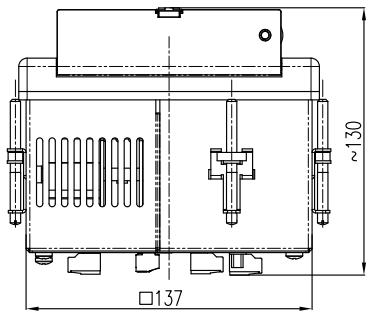


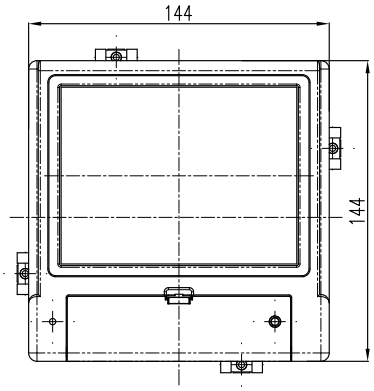


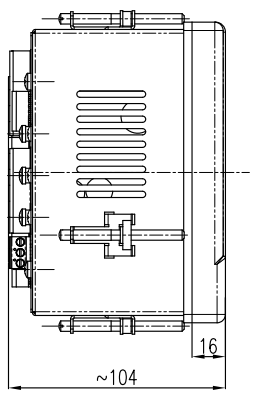


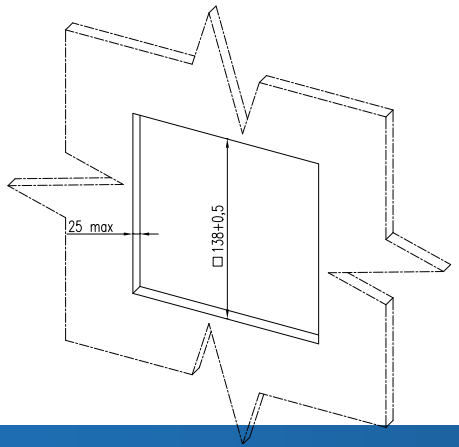


DIMENSIONS AND ASSEMBLY









ORDERING CODE

POWER NETWORK ANALYZER ND45PLUS

Code	Description
ND45PLUS 1010M000*	Power Network Analyzer/ Recorder ND45 Input current 1A/5A, X/1A, X/5A, Input voltage 3x57.7/100V, Measuring class S, Ethernet, RS485, USB interfaces,memory up to 32GB, supply 85-253V a.c. or 90-300V d.c., documentation and descriptions in Polish and English version, test certificate
ND45PLUS 1011M000*	Power Network Analyzer/ Recorder ND45 Input current 1A/5A, X/1A, X/5A, Input voltage 3x57.7/100V, Measuring class A/S, Ethernet, RS485, USB interfaces,memory up to 32GB, supply 85-253V a.c. or 90-300V d.c., documentation and descriptions in Polish and English version, test certificate
ND45PLUS 2010M000*	Power Network Analyzer/ Recorder ND45 Input current 1A/5A, X/1A, X/5A, Input voltage 3x230/400V, Measuring class S, Ethernet, RS485, USB interfaces,memory up to 32GB, supply 85-253V a.c. or 90-300V d.c., documentation and descriptions in Polish and English version, test certificate
ND45PLUS 2011M000*	Power Network Analyzer/ Recorder ND45 Input current 1A/5A, X/1A, X/5A, Input voltage 3x230/400V, Measuring class A/S, Ethernet, RS485, USB interfaces,memory up to 32GB, supply 85-253V a.c. or 90-300V d.c., documentation and descriptions in Polish and English version, test certificate

* Upon agreement, an option to order a calibration certificate for the product is available against payment. Then, in the execution code, in the place of the last character, enter the digit 2, e.g. **ND45PLUS 2011M002**. The customer will then receive a standard test certificate and a calibration certificate (against payment).

ACCESSORIES

Description	GPS SIGNAL RECEIVER	ADAPTER TO CONNECT A GPS RECEIVER
Code	**STR 00M0***	**CZ/20-001-00-00004**
View		
Technical data	Receiver type: 50 channels GPS L1 C/A Accuracy: 2.5 m CEP Digital interface: RS-485 Voltage: 9...28 V d.c. Power consumption: < 2 VA Ambient temp: -20...60°C Dimensions: 71 x 71 x 27 mm Weight: < 0.3 kg	JACK 3.5 mm, plug with 3 screw terminals Dimensions: 12 x 18 x 43 mm Weight: 0.009 kg

* **Note:** The adapter is not included with the STR receiver and must be purchased separately.

70 YEARS OF TRUST

LUMEL has been known, since 1953, all over the world, as a manufacturer of top quality industrial automation devices.

Lumel offers consists of product categories, such as:
for low voltage:

- Network parameter meters and analyzers,
- Electrical and non-electrical quantity transducers,
- Digital meters,
- Recorders and data loggers,
- Controllers,
- Analog meters,
- Current transformers,
- Shunts.

Depending on the needs of the customer, the automation products and systems our offer relay on various data communication protocols (MODBUS, ETHERNET, PROFINET, BACNET or MQTT).

for medium voltage :

- Protection relays.

Apart from the products, Lumel specializes in complex systems used for:

- monitoring and optimizing the cost of electricity and other utilities (water, gas, compressed air)
- monitoring environmental parameters: temperature, humidity, light intensity, CO_2, volatile gases
- solar energy.

In addition to its manufacturing activity, Lumel offers also:

- OEM services in the scope of housing designing, elecctronics, mechanics, hardware and software. All under one roof.
- EMS services.
- ODM services.

We are a member of an international capital group which consists of the following companies: LUMEL S.A., LUMEL ALUCAST Sp. z o.o., Rishabh Instruments Pvt. Ltd., Sifam Tinsley US, Sifam Tinsley UK, Microsys.

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