



Elektrometal Energetyka SA®



e²TANGO[®]-250 Overcurrent Relay





e²ALPHA

Elektrometal Energetyka SA

e²TANGO-250

Elektrometal Energetyka SA

Pole odpływowe
I1 = 98,4
I2 = 98,4
I2 = 98,4



Rej. zakł.

F1

Symulacja pom.

F2

- AL
- AW
- UP
- Zad I>>
- Zad I>1
- Zad IO>
- Zad IO>d1
- Za



NAPIĘCIE NA KABLU



STEROWANIE CZŁONEM RUCHOMYM



STEROWANIE WYŁĄCZNIKIEM



STEROWANIE UZIEMNIKIEM



OŚWIETLENIE POŁA

WUG
GE-16/15

We Create Ideas With Power!

e²TANGO-250 protection relay is the solution developed by ELEKTROMETAL ENERGETYKA SA R&D department consisting of engineers with extensive know-how and many years of experience in the industry. Employed solutions and concepts answer challenges which our customer face in their day-to-day operations. These challenges were our key inspiration during design work. This allowed us to develop this compact, user-friendly and intuitive protection relay, which does not require initial, advanced training for operating personnel. e²TANGO-250 is the perfect addition to e²TANGO protection devices line-up.

We have developed a technologically advanced device, universal in its programming and hardware functionality for operating protection relays, control, measurement, data logging and monitoring of MV switchgear bays.

The protection relay stands out in more than one way but easy and convenient operation is one of its more prominent features. We wanted to develop a uniquely user-friendly and intuitive device capable of operating in SMART GRIDS. e²TANGO-250 versatility and compact size allows easy adaptation to specific requirements of users and protected loads. We fully realize the importance of safety in power engineering, this is why this was one of the key aspects we focused on. All our products including e²TANGO protection devices are fully type-tested and certified by most demanding laboratories.

e²TANGO-250 is the unique protection relay. This knowledge gives us confidence when recommending this device to our customers.



Dariusz Rybak
Main Designer
Elektrometal Energetyka SA



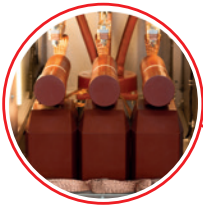
APPLICATION

e²TANGO-250 protection relays feature a complete set of protection functions and station automation schemes making them ideal for any type of bay irrespective of its application and operational characteristics: such as incoming bay, line incoming-outgoing bay, transformer bay, measuring bay, coupling bay, capacitor bank bay for MV grids. In particular, our devices are dedicated to renewable energy power plants such as wind and solar farms.



wind and solar power plants

- undervoltage and overvoltage protection
- frequency protection
- automatic load shedding
- automatic transfer switch



measurement bay

- undervoltage and overvoltage protection
- zero-sequence component overvoltage type protection
- automatic load shedding



motor bays

- thermal model
- PT100/PT1000 sensors
- start-up time protection



transformer bay

- thermal protection
- under-/overvoltage protection
- interoperation with flux-gas protections
- block on 2nd harmonic detection



line bays

- ground-fault protection
- admittance based protection
- automatic load shedding



capacitor bank bays

- capacitor bank internal current
- automatic inclusion of capacitor bank



incoming bay

- ATS interoperation system
- automatic bus-bar protection
- automatic breaker failure protection

PROTECTION RELAY ADVANTAGES



quick device start
 basic configuration assistant, comprehensive database of ready synoptic diagrams and protection sets



service access
 remote and local readout of diagnostic data with possibility of sending it to manufacturer service department



trouble-free battery change
 possible to change battery without turning off the feeder



high resistance to interference
 up to 100% higher than required by the standard



availability of expansion cards
 input and output cards, communication cards



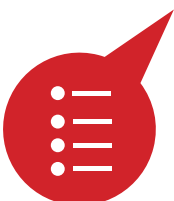
intuitive interface
 legible menus, consistent across all eTANGO protection systems and relays



may be used without training
 handy help system



fully configurable text interface
 up to five configurable screens, widget database



legible menu
 consistent across eTANGO protection systems and relays

```
Overcurrent Prot. 1
Phase1 Imax = 120 A
11-12-2016
12:34:54:125
```

```
  +_+_+_+
INP:12345678910
  +_+_+_+
OUT:12345678
```

```
TRP/WRN/AL
Events
Disturbance
Autom. lock/
```

```
Incoming bay
I1 = 98.4 A
I2 = 98.3 A
I3 = 98.4 A
```

DESIGN

e²TANGO-250 overcurrent relay has an alphanumeric OLED display (4x20 characters) and a keyboard with 8 buttons for easy operation. There are 9 LEDs (6 red and 3 red-green) on the front panel providing visual indication of device statuses.

There are dedicated buttons in the front of e²TANGO-250 for switch control and a set of LEDs for optic device statuses signalizations. There are also two additional function buttons F1 and F2 with dedicated two-colour LEDs which may be customised. A label pocket is provided on front panel for function button and LED/indicator labels.

INTERFACE AND OPERATION	250
Display	OLED
Display resolution	4 x 20 characters
Colour display	-
Operating buttons (number)	8
Control buttons (I,0,(-))	2
Programmable function keys with LED	2
LED	9 (3)
Replaceable labels	•
DESIGN AND STANDARD EQUIPMENT	
current input no.****	4/1
voltage input no.1****	1/4
Max. switching device no.*	0/4
Ethernet input	1
miniUSB	1

AVAILABLE EXPANSION CARDS**	
Binary input cards	0 (39)
Relay output cards	0 (30)
Temperature input cards ***	0 (6)
Flash sensor input cards ***	0 (6)
4-20 mA analogue input cards ***	0 (4)
0-10 V analogue input cards ***	0 (4)
4-20 mA analogue output cards ***	0 (4)
0-10 V analogue output cards ***	0 (4)
Voltage measurement cards	1 (4 for version U)
Communication cards	0 (1)
DATA RECORDERS	
Event recorder	1100
Disturbance recorder	30s / 1.6kHz/s
OTHER	
Widgets	-
Synoptic diagram database	-
No. of configurable screens	5

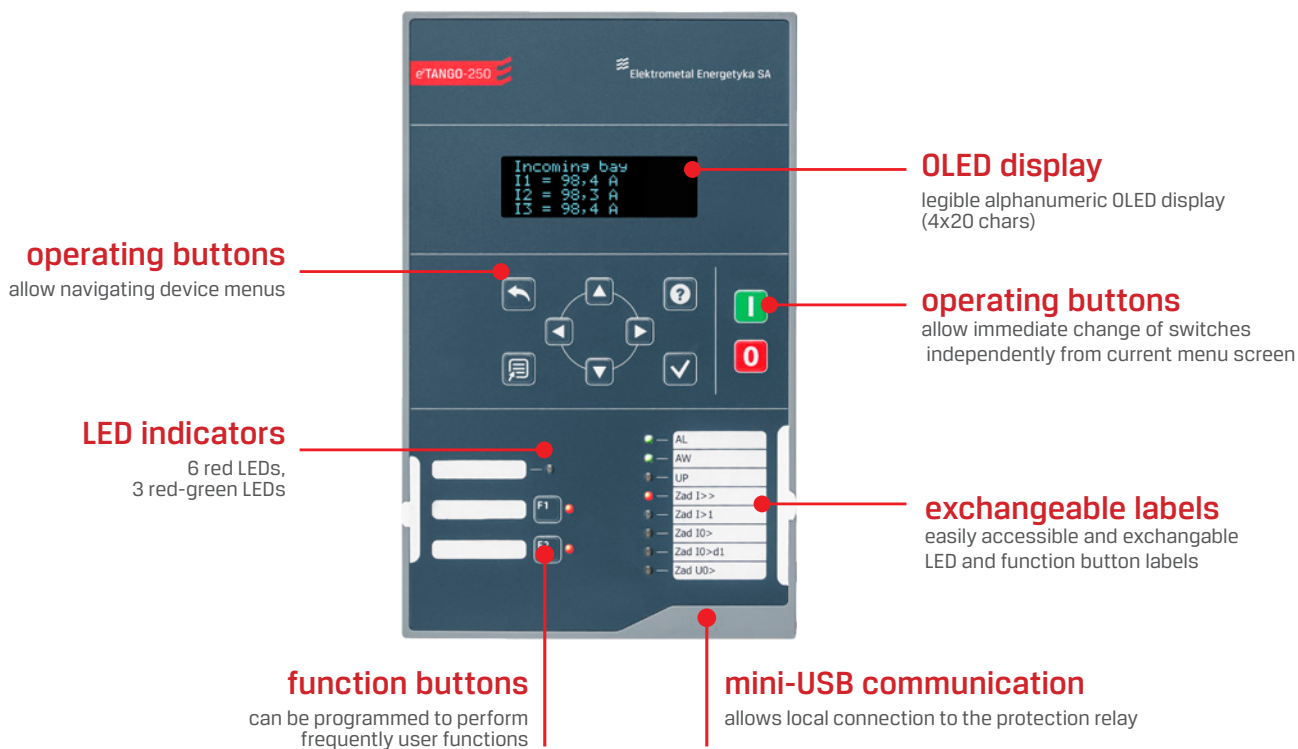
•/o - standard/option

* - requires appropriate number of expansion cards

** - maximum 4 slots available, card 603I inserted in slot A; input/output number provided in brackets relates to the rest of slots for 12IN or 8OUT cards

*** - only 1 module may be installed

**** - available options for e²TANGO-250: 4I+4U (type S or C) or 1I+4U (type U)



PROTECTION FUNCTIONS

PROTECTION FUNCTIONS	250-S	250-U
(50/50N) short-circuit/ground-fault instantaneous	•	-
(51/51N) overcurrent / zero-component overcurrent delayed 2-stage	•	-
(50HS) operate time advance on trip on short-circuit	•	-
(51) inverse overload (IEC characteristic or approximated in 6 points)	•	-
(60/67N) overcurrent / zero-component overcurrent directional	•	-
(49/51) thermal overload	•	-
(46) load unbalance based on current negative component or phase current difference	•	-
(37) undercurrent	•	-
(32P) active power, directional	-	-
(37Q) passive power, directional	-	-
(51VN) zero component overcurrent with voltage control / block	•	-
(59) overvoltage (selectable for phase voltage or line-to-line voltage)	-	•
(27) undervoltage (selectable for phase voltage or line-to-line voltage)	-	•
(47) negative sequence overvoltage	-	•
(81H) overfrequency	-	•
(81L) underfrequency	-	•
(81R) instantaneous frequency change df/dt and df/dt	-	•
(59N) zero-sequence component overvoltage	•	•
(21N) admittance based	•	-
(50C) capacitor bank internal short-circuit protection	-	-
(21IND) directional admittance based	•	-
(66/86) process motor start-up	•	-
(66) start-up number limit	•	-
(48) prolonged start-up	•	-
(50LR) rotor stall	•	-
(25) falling out of synchronism	•	-
(30/74) flux-gas	•	-
(49) thermal (binary input or analogue 4-20 mA input)	•	-
(AFD) arc protection (with arc detectors)	-	-

•/- - available/not available

AUTOMATIC SYSTEMS

AUTOMATIC SYSTEMS	250-S	250-U
accelerated protection automation system	•	-
ATS, 3-stages with circuit-breaker position control and possibility of defining protection functions which trigger ATS	•	-
automatic load shedding	-	•
automatic load shedding interoperation system	•	-
automatic busbar protection	•	-
active component forcing	•	-
interoperation system with automatic inclusion of capacitor bank or timed automatic inclusion of capacitor bank	•	-
simultaneous operation with ATS	•	-
ATS interoperation system	•	-
ATS for island operation	-	-
automatic cold start	•	-

•/- - available/not available

EXPANSION CARDS

BASIC CARDS

- power supply unit
- central processor unit

FUNCTION CARDS

- 6 relay outputs + 3 binary inputs
- 8 relay outputs
- 8 relay inputs
- 12 binary inputs
- 8 binary inputs 24 V
- 12 binary inputs 24 V

OTHER

- voltage measurement card (TR)

ANALOGUE CARDS

- 4 analogue inputs 0-10 V
- 4 analogue inputs 4-20 mA
- 4 analogue outputs 0-10 V
- 4 analogue outputs 4-20 mA

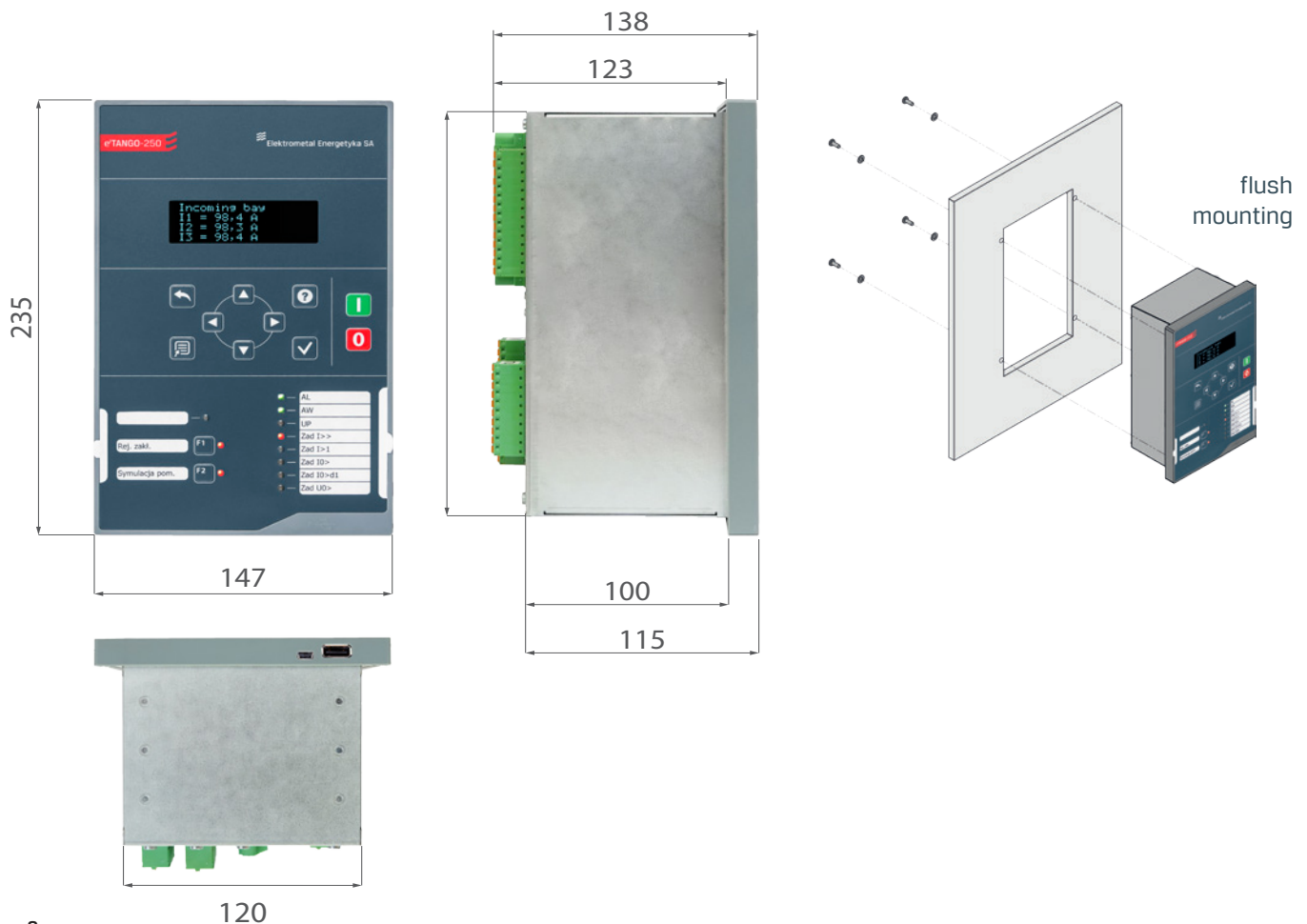
TEMPERATURE SENSORS CARDS

- 6 PT100 inputs
- 6 PT1000 inputs

COMMUNICATION PORTS AND PROTOCOLS

- Ethernet
- Multi-mode glass optical fibre - OPTOMM
- Plastic optical fibre OPTOP
- RS485
- CANbus 2×
- USB 2.0
- Modbus RTU / TCP
- IEC 60870-5-103
- DNP 3.0
- Profibus
- CANbus / PPM 2
- IEC 60870-5-104

DIMENSIONS AND MOUNTING METHODS



TECHNICAL PARAMETERS e²TANGO-250

Auxiliary power supply	
VDC VAC	110 V, 220 V (80-300 V) 230 V (88-265 V)
Maximum power consumption Option	10 W (VA) 24 V, 110 V DC (19-132 V DC)
Current measurement circuits	
Rated current	5 A / 1 A (configurable)
Rated frequency	50 Hz
Phase current measurement range for current transformers	0.05-150A Others for request
I ₀ current measurement range	0,005-1 A/0,1-10 A
Voltage measurement circuits	
Rated voltage	57.7/100/230 V
Voltage measurement range for transformers	3-280 V
U₀ measurement circuit	
Transformer measurement range	3-280 V
Basic protection parameters	
Over protection relay resetting ratio	Configurable
Under protection relay resetting ratio	Configurable
Device operate time	typically - 35 ms
Measurement accuracy	
I ₁ , I ₂ , I ₃ (0.1-30 In / 0.05-0.1 In)	2% / 2.5%
U ₀ measured or calculated (5-280 V)	2%
I ₀ measured (0.005-1 A/0.1-10 A) calculated (0.1-30 In)	2% 3%
U ₁ , U ₂ , U ₃ (5-280 V/)	2%
φ 1, φ 2, φ 3, φ 0 (U>5V, 0.1In<I<30 In)	2°
f (U>0.5Un)	10 mHz
Binary input circuits	

603I card 8IN, 12IN cards 8IN24, 12IN24 cards Others for request	24-230 V AC/ DC 110-230 V AC/ DC 24 V DC (19-58 V AC/DC)
Maximum power consumption: 220 V DC, 230 V AC	2 mA, 15 mA
Relay output circuits (603I card)	
Circuit opening at 220 V DC	5A
Circuit opening at 220 V DC (L/R = 0)	0.4A
Circuit opening at 220 V DC (L/R = 40 ms)	0.3A
Relay output circuits (others)	
Circuit opening at 220 V DC	5A
Circuit opening at 220 V DC (L/R = 40 ms)	0.1A
Circuit opening at 230 V AC (cos = 0.4)	2.0A
Allowable voltage at open contacts	250 V AC/440 V DC
Environmental conditions	
Operating temperature	-25°C ... +55°C
Operating temperature	-25 °C ... +70 °C
Relative humidity	5 to 95%, non-condensing
Vibration and mechanical shock resistance	Class 1 acc. IEC 60255-21
Electromagnetic disturbances	Class B acc. IEC 60255-26
Safety	
Insulation electric strength	2 kV/50 Hz/60 s acc. IEC 60255-27
Dimensions	
Weight (central processing unit/panel)	1 kg
Dimensions (W x D x H mm)	147x115x235
Protection rating (at terminal side)	IP3X
Protection rating (at front panel side)	IP4X / (IP54 optional)

e²TANGO-STUDIO SOFTWARE

e²TANGO-Studio engineering software allows operation of e²TANGO-250 protection relay and also panel configuration. This software provides comprehensive functionality, which together with visual widget configuration is a perfect aid in daily work by enabling creation of projects for multiple devices, bays, switchgears or stations.



quick configuration assistant

helps first time users of the software and facilitates regular use



advanced design functions

ability to prepare device configuration for an entire switchgear on a PC and distribute it using USB

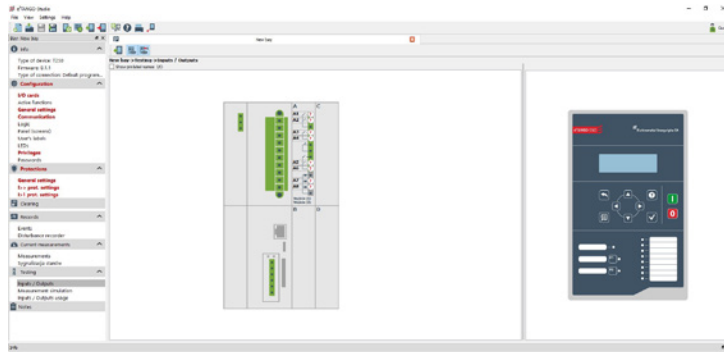


on-line preview

real-time preview of measurement input/output status displaying actual LCD screen content

display conformity

preview of the actual panel screen



visual characteristic modification

graphical and classic protection setpoint configuration

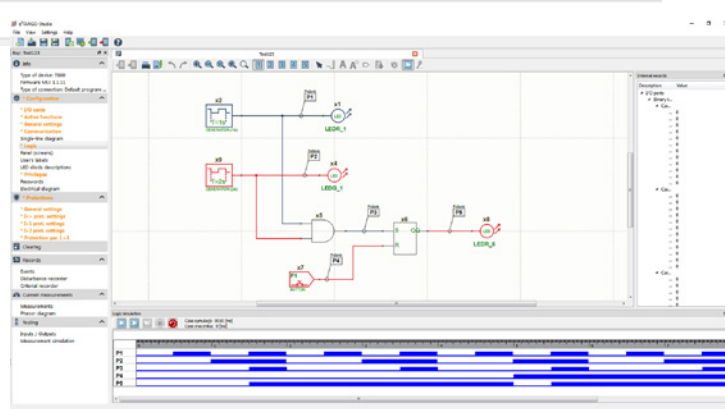
easy setpoint and selectivity verification

displaying setpoints of all related overcurrent protection functions on one chart



full status preview

access to all internal device and protection function statuses



possible expansion using plug-ins

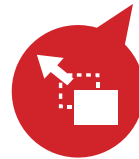


logic simulator

possibility to simulate whole logic without connection with device

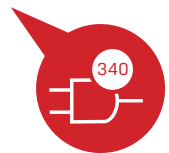
logic clarity

possibility to split logic in blocks and sheets



ultra-fast design of custom screens

drag&drop element placement



support for sophisticated logical dependencies

up to 340 logic gates / elements

„miniSCADA” FUNCTIONALITY

e²TANGO-Studio has possibility to expand with "miniSCADA" functionality that lets you visualise state of switchgear and allows to manipulate switches, alarms and events preview and online access to measured parameters of protection relay (e.g. current, voltage, power, energy) installed in switchgear. Functionality was designed to share engineering link (one communication port) to protection relays, which gives possibilities for costs optimization by wiring and infrastructure simplifying.

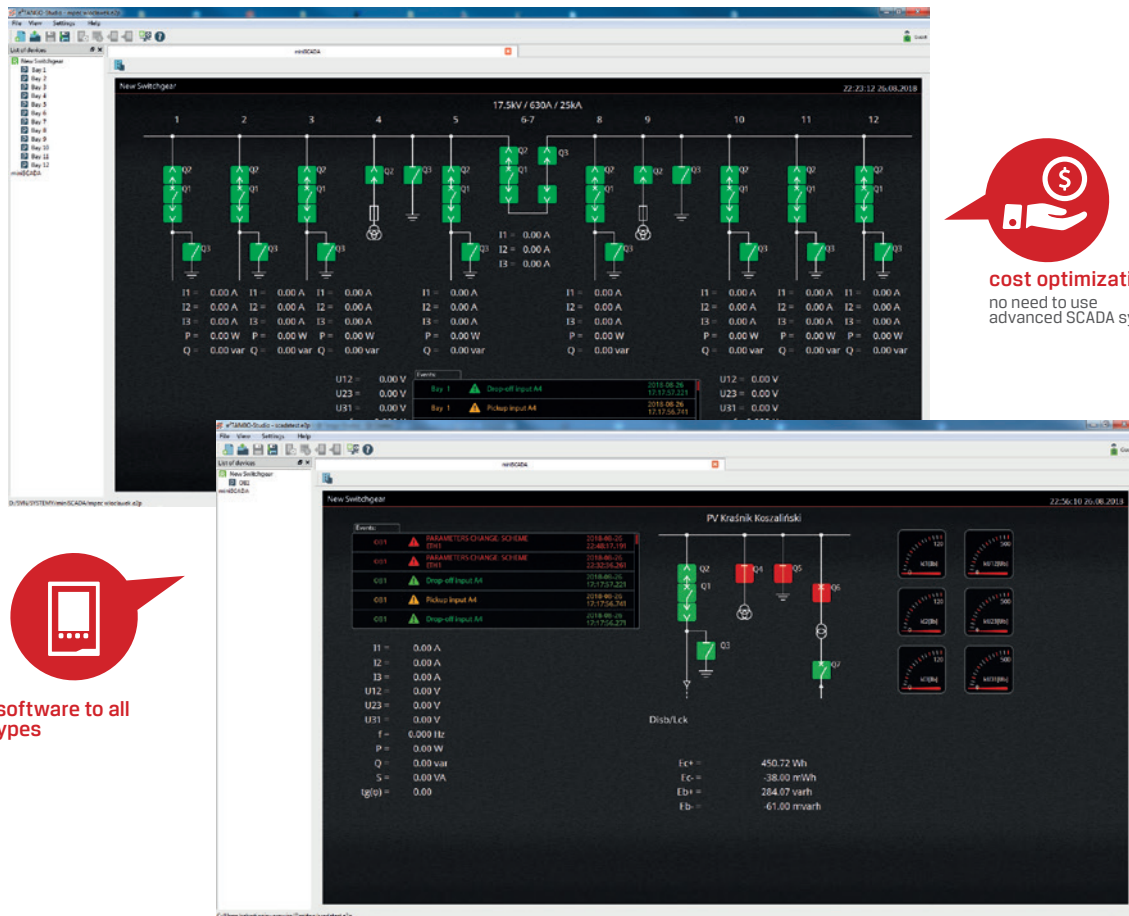
"miniSCADA" plug-in is optional as additional license.



intuitive configuration of screens
possible to use widgets



data transmission using available communication ports
RS485, OPTO, Ethernet and others



cost optimization
no need to use advanced SCADA systems



universal software to all e²TANGO types



possible to work in any operating system



access from mobile devices

ADVANCED LOGIC EDITOR AND SIMULATOR

e²TANGO-Studio provides an advanced and comprehensive logic editor which allows running logic simulation. It gives preview of logic states when used with a device aiding project design, as well as commissioning and servicing of switching stations. The editor allows creating custom logic adapted to customer infrastructure requirements.

STANDARDS

PN-EN 60255-1	Measuring Relays And Protection Equipment. Part 1: Common Requirements
PN-EN 60255-26	Measuring Relays And Protection Equipment. Part 26: Electromagnetic Compatibility Requirements
PN-EN 60255-27	Measuring Relays And Protection Equipment. Part 27: Product Safety Requirements

CERTYFIKATY I NAGRODY



Conformity certificate IEn
no DZC.521.59.1.2023



Masovian Quality Award



The Minister of Energy Cup
ENERGETAB 2018 Fairs



Forbes Diamonds 2023

ELEKTROMETAL ENERGETYKA SA QUALITY

Implemented Integrated Management System according to:

- PN-EN ISO 9001 Quality management systems
- PN-EN ISO 14001 Environmental management systems
- PN-EN ISO 45001 Health and Safety Management System

ORDER FORM

To order e²TANGO-250 protection relay fill in this part of the form following FORM INSTRUCTIONS provided on the next page.

STEP 1

① version	<input checked="" type="checkbox"/> 250
② type	<input checked="" type="checkbox"/> S (standard, 4I+1U) <input type="checkbox"/> U (4U)
③ measurement card rated current	<input checked="" type="checkbox"/> UNI (110/230 V AC/DC) <input type="checkbox"/> 24 V (24/110 V DC)
Ethernet (standard equipment in each central unit)	
④ COM1	<input checked="" type="checkbox"/> x-none <input type="checkbox"/> RS485 <input type="checkbox"/> CAN×2 <input type="checkbox"/> OPTOMM <input type="checkbox"/> OPTOP <input type="checkbox"/> Profibus <input type="checkbox"/> other
⑤ mounting	<input checked="" type="checkbox"/> Z - flush mounting
⑥ protection rating IP	<input checked="" type="checkbox"/> IP4X <input type="checkbox"/> IP54
⑦ language version	<input type="checkbox"/> PL <input checked="" type="checkbox"/> EN <input type="checkbox"/> other (in agreement with manufacturer)

STEP 2

Card name	Code	Slot			
		A	B	C	D
Ethernet	-	standard for the device			
6 relay outputs + 3 binary inputs	603I		X		
8 binary inputs	8IN				
8 binary inputs 24 V	8IN24				
12 binary inputs	12IN				
12 binary inputs 24 V	12IN24				
8 relay outputs	8OUT				
4 0-10 V analogue inputs	A110				
4 4-20 mA analogue inputs	A120				
4 0-10 V analogue outputs	A010				
4 4-20 mA analogue outputs	A020				
6 temperature inputs PT100	PT1				
6 temperature inputs PT1000	PT10				

additional requirements:

STEP 3

Your code:

See FORM INSTRUCTIONS
on the following page

e²TANGO ① ② ③ ④ ⑤ ⑥ ⑦ A B C D TU

FORM INSTRUCTIONS

STEP 1

The table contains basic technical specification of e²TANGO-250 protection relay. In each item 1 through 8 choose only ONE element. If you choose "other", in STEP 3 fill in the requested value in a corresponding field.

Step 1 instructions.

- - recommended basic configuration
- OPTOMM - multi-mode optic fibre
- OPTOP - plastic fibre optic

STEP 2

The table contains a list of available expansion cards and their possible installation locations in e²TANGO-250 protection relay

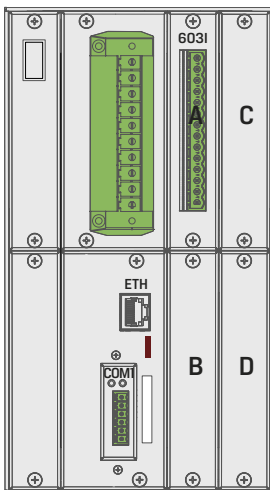
If no check mark field is available the card cannot be installed in a given location. Select desired cards from the list and put an "X" mark next to slot where the card is to be installed.

Step 2 instructions.

- - recommended basic configuration
- max. 1 AI10 card or 1 AI20 card
- max. 1 A010 card or 1 A020 card
- max. 1 PT1 card or 1 PT10 card

Any additional requirements should be described in designated fields.

View of the central unit



STEP 3

e²TANGO-250 protection system parameters selected above should be filled-in in corresponding locations. Send thus created e²TANGO code along with other requirements or a scanned form page and order form to: export@elektrometal-energetyka.pl

Sample e²TANGO-250 protection configuration:

① e ² TANGO-250	⑦ EN
② Standard	A slot A: 6031 card
③ Universal 230 / 110 AC / DC	B slot B: X
④ RS485	C slot C: X
⑤ Flush mounting	D slot D: X
⑥ IP4X	

Sample e²TANGO-250 protection configuration:

e ² TANGO	250	S	UNI	RS485	Z	IP4X	EN	6031	X	X	X
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