Elektrometal Energetyka SA

e²TANGO®
Protection Relay

e²ALPHA
Elektrometal Energetyka SA

1 POLE ODPŁYWOWE

e²TANGO-800

Elektrometal Energetyka SA

Pole 1 | Bank 1

2015-03-26 14:38:11

Q2
Q1
Q3

U12 = 0.00 V
U23 = 0.00 V
U31 = 0.00 V

Zdarzenia:

RESTART e2TANGO   2015-03-19
                        14:31:35.390
BRAK NAPIĘCIA ZASILANIA 2015-03-19
                        15:03:58.921
POB. WE A2   2015-03-19
                        14:08:26.021
ODWZB. WE A1   2015-03-19
                        14:08:26.021

F2
F3
F4

e²ECHO-B

L1
L2
L3
N

Elektrometal Energetyka SA

OBECNOŚĆ
NAPIĘCIA
NA KABLU

STOP

STEROWANIE
CZŁONEM
WYSUWNYM

STEROWANIE
WYŁĄCZNIKIEM

STEROWANIE
UZIEMNIKIEM

OŚWIETLENIE
PRZEDZIAŁÓW

ROZDZIELNICA ŚREDNIEGO NAPIĘCIA
TYP: e²ALPHA

⚡ We create ideas with power!

Protection relay e²TANGO by ELEKTROMETAL ENERGETYKA SA has been developed by our Research and Development Team composed of engineers with vast practical knowledge and many years of professional experience in power engineering industry. Ideas and solutions which has been applied in e²TANGO are solving problems which our customers have to face every day. Finding solutions to this problems was our inspiration during our construction work. In result we have created an exceptionally friendly and intuitive e²TANGO protection relay for every day use which doesn't require an advanced introduction training.

We have designed a technically advanced device, universal in terms of software and hardware, dedicated to protection automatics, controlling, measuring, recording and supervising of MV and HV switchgear bays.

e²TANGO protection relay has a lot of interesting features but easy and convenient use are it's very special advantages. We intended to develop an extremely friendly and intuitive device for every day use, which can be applied in a system of intelligent power grids SMART GRID.

Versatility of e²TANGO enables it to be easily adapted to individual requirements and safe loads. We have strongly focused on safety because we know how it is important in the power industry. All our products, including the family of protection relays, have certificates confirming complete type examination carried out in the most demanding laboratories.

e²TANGO is an exceptional protection relay. We strongly believe it and therefore recommend it as a special one.

Dariusz Rybak
Chief Constructor, Head of Digital Development Department
Elektrometal Energetyka SA

≋ APPLICATION

e²TANGO protection relay is an universal solution in terms of hardware and software. It is equipped in complete set of protection- and station- automatics and can be therefore applied in each kind of bay of various intended use and operation characteristics, eg. incoming-, line-, transformer-, incoming-outgoing-, measurement-, coupler-, capacitor-, wind power plants- bay etc for MV and HV power grid. Additional automatic transfer switch with auto re-transfer allows complete protection in powering the outflows in the objects which require continuous and guaranteed power supply.

wind power plant bay
- synchrocheck
- df/dt
- du/dt

transformer bay
- thermal protection
- flux-gas protection
- 2nd harmonic restraint

capacitor battery bay
- internal current of capacitor battery
- automatic inclusion of capacitor battery

incoming bays
- ARS automation
- Automatic bus-bar protection
- automatic breaker failure protection

motor bay
- thermal protection
- thermal sensors PT100/PT1000
- motor start-up protection

line bays
- earth fault protection
- distance protection
- automatic frequency relieve of the system

ADVANTAGES OF THE PROTECTION RELAY

quick start

first run configuration assistant, predefined synoptic scheme library, predefined protective functions

trouble-free battery change

possible to change battery without turning off the feeder

remote service acces

remote and local read of diagnostic data, allows to send data to manufacturer service
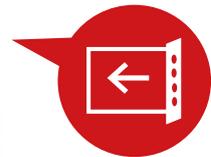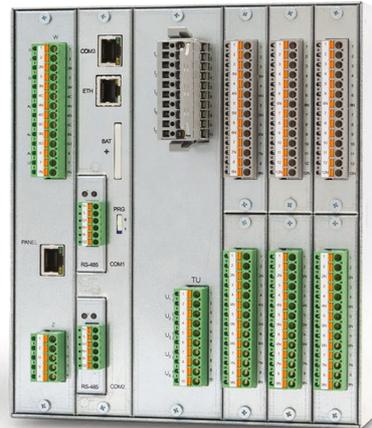
variety of expansion cards

modular construction based on expansion and communication cards, up to 168 input and up to 39 output

hot reserve

restoring within a few minutes functioning of the bay after fail, possibility to recover all bay data such as: settings, logic, events
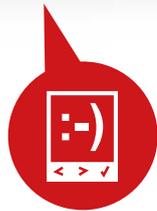
intuitive interface

clear menu layout, graphic expression of menu positions and other designations

strong resistance to interference

up to 100% higher than required by standards

wide array of hardware configuration

main units with 6, 10, 14 expansion slots, avalible in flush, wall and mixed mounting
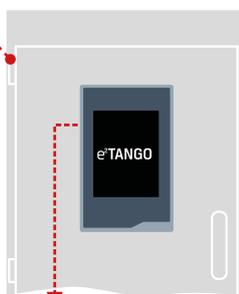
continious data backup

quick exchange of broken hardware
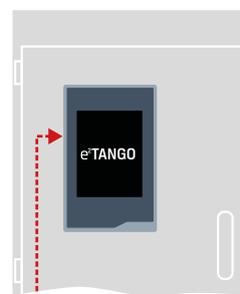
data restoration

ADVANTAGES OF THE PROTECTION RELAY

preview of logic scheme and status
logic scheme, synoptic scheme

full operating manual
quick acces to proper sections of technical documentation

intuitive menu
picturing of descriptions

application scheme of the bay
access to the application scheme from the level of operator's panel

graphic parameter presentation
phasor diagram, harmonic spectrum diagram

HELP

manual-free operating
on-side assistance

fully adjustable graphic interface
up to 5 user configurable screens, widgets

Intuitive e²TANGO protection relay is equipped in fully configurable clear interface, extended configuration, recorders and measurement- functions. Good readability of indicators and signalization, easy access manual, easy verification of logic and graphical verification of protection characteristics as well as remote service access greatly improve everyday work with device.

☰ ADVANTAGES OF THE PROTECTION RELAY WITH TOUCH PANEL
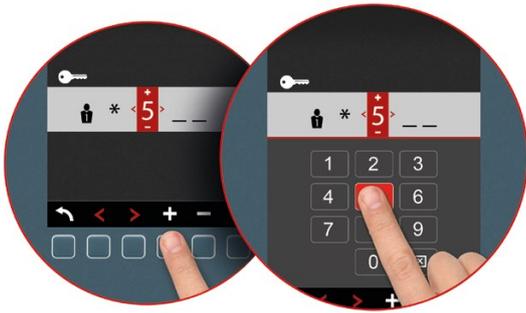
- alphanumeric keyboard
- touch control menu
- touch control for logic through fluent scrolling of diagrams
- screen buttons allowing use of bigger number of functional buttons as well as assigning them short-cuts option
- direct choice of switch for controlling from panel screen
- events scrolling on widget
- camera support

☰ DESIGN

e²TANGO protection relay consists of two elements: operating panel and central processing unit. Central unit is manufactured based on expansion cards and is offered in three versions of metal housing: J6 (six cards), J10 (ten cards) and J14 (fourteen cards) – depending on switchgear's bay configuration complexity and the needs of the user. Operating panels e²TANGO-600 i e²TANGO-800 in big, good readable, 6-inch colour screens. Operating panels e²TANGO-1000 i e²TANGO-1200 have 7-inch, colour touch screens. Panels (depending on the version) are equipped in number of buttons allowing device control.

For small-size switchgears there is possibility to use a set of protections with the smallest available on the market operating panel e²TANGO-600 or e²TANGO-1200 with the external dimension of only 147x235 mm. Despite the small external dimension the panels are equipped in 6- or 7-inch screens, which allow displaying of any configuration, measurements, diagrams or graphs.

LED indicators
12 up to 18 tri-color LED's

removable LED label
easy access to convertible description of diodes and function buttons

virtual screen buttons
user customizable additional screen buttons

function buttons
allows to assign the most used functions, equipped with LED diodes

control buttons
it allows immediate change of connectors status independently from current menu screen

communication interface
USB and USB mini

* Detailed information in e²TANGO TYPES, page 13.

PROTECTION FUNCTIONS

Code	Description
50/50N	short-circuit / ground short-circuit instantaneous
51/51N	overcurrent / ground overcurrent delayed 3-stage
50HS	accelerated action of protection automation
51	inverse overcurrent (IEC/IEEE characteristic or user customized)
60/67N	overcurrent / ground overcurrent directional
49/51	thermal overload
46	phase-balance or reverse sequence current protection
37	undercurrent
32P	reverse active power
32Q	reverse reactive power
51VN	ground overcurrent with voltage interlock
59	over-voltage with two stages [with option for phase voltage or line voltage
27	under-voltage with two stages (with option for phase voltage or line voltage)
81H	over-frequency
81L	under-frequency
81R	rate of change of frequency df/dt
59N	zero sequence over-voltage
21N	admittance
21ND	admittance directional
64S	earth fault stator
66/86	motor start-up protection
66	limitation of motor starts
48	motor starting time supervision
50LR	locked rotor protection
25	synchronism check
87M	motor differential protection
30/74	flux-gas
49	thermal (digital or analogue input 4-20 mA)
74TCS	continuity of control circuits
50C	overcurrent of capacitor bank
AFP*	arc protection (cooperates witch arc detectors)

* - not mentioned on ANSI code list

AUTOMATION SYSTEMS

- Accelerated protection action automation system
- Automatic load shedding equipment
- Automatic releasing equipment with control of circuit breaker's position and possibility to determinate type of protection initializing stimulation of automatic restart
- Automatic breaker failure protection equipment
- Automatic capacitor battery activating equipment
- Automation of the system grounding zero point of the grid*
- Automatic active component forcing equipment
- Automatic bus-bar protection
- Automatic transfer switch with auto re-transfer
- Other based on programmable logic

* in agreement with the producer

⚡ ATS AUTOMATION

Controllers for automatic transfer switch with auto re-transfer - e²TANGO ATS have been developed on the base of e²TANGO controllers and supports the same features and functions. They are available in various configurations for LV, MV and HV network. Standard version allows implementation of automation in 1 or 2-sectional switchgears.

Controller features:
- explicit, implicit stand-by, automatic selection (based on the configuration of switches)
- fast and slow mode
- measurement of 6 phase voltages on the bus-bars and two wire voltages on the top side of power supply transformers or power lines,
- optional measurement of currents,
- optional re-transfer to the normal power supply,
- optional automatic locking of automation after operation,
- two communication ports RS485/optical fibre, Ethernet link to cooperate with the dispatch centre or engineering link. Support for Modbus RTU, Modbus TCP, IEC870-5-103, DNP3.0, Canbus, Profibus protocols.
- event recorder for 1000 events, recording all automation-, interlocks operations and emergency states.
- disturbance recorder recording the measured voltages with configurable recording time after triggering the recorder.

Standard version of automatic transfer switch with auto re-transfer:

The controller in the standard version supports the 2-section switchgear with two transformers or two supply lines, with sections connected by a bus-bar connector or 1-section switchboard with two supply lines. In the case of 2-sectional switchboard the controller performs explicit and implicit automation with optional re-transfer to the normal power supply.

2-section switchgear
with two transformers

2-section switchgear
with two supply lines

1-section switchgear
with two supply lines
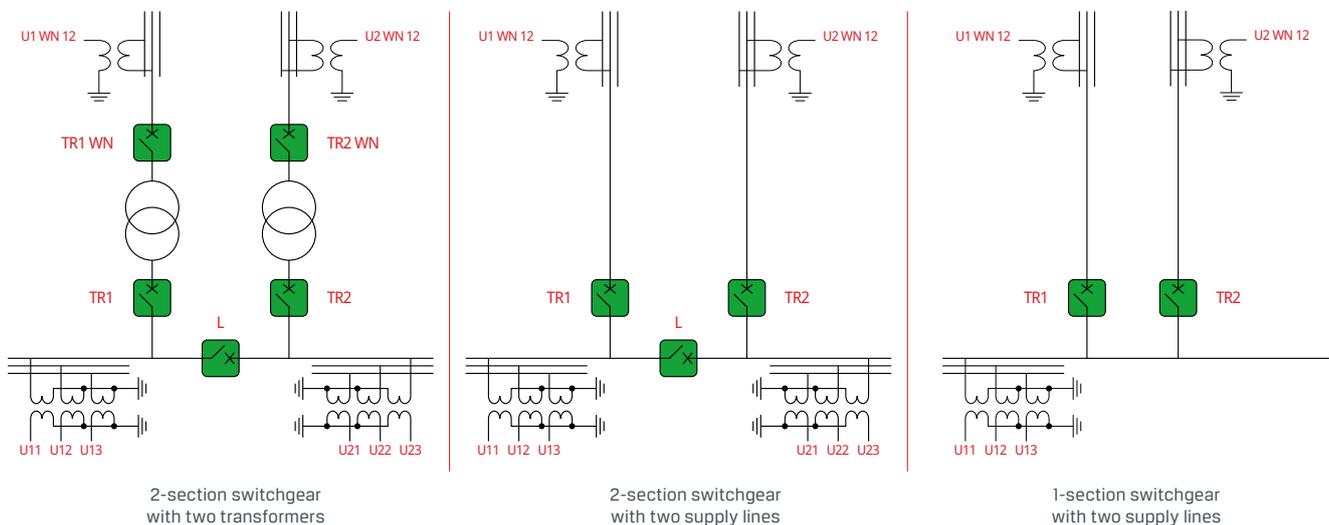
Customized version:

In addition to standard solutions for automatic transfer switch with auto re-transfer we offer to develop special versions, tailored to individual customer needs. Dedicated systems are created in close cooperation between the R&D department and the client.

Examples of custom solutions:
- switchgear with three sections (e.g. 3 power supplies, 2 coupling)
- dedicated switching algorithms
- current measurements and analysis of power supply load.

⚏ EXPANSION CARDS

BASIC CARDS
- power supply
- processor
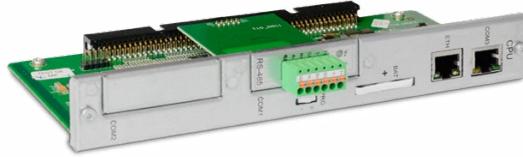
MEASUREMENT CARDS
- standard (5I+4U)
- synchrocheck (4I+5U)
- ATS (9U)
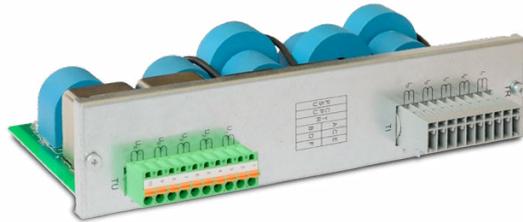
FUNCTION CARDS
- 8 binary inputs
- 12 binary inputs
- 8 binary outputs

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

ARC DETECTOR INPUT CARDS
- 6 arc detector input with CAN communication
- 6 arc detector input passive

TEMPERATURE SENSORS CARDS
- 6 PT100 inputs
- 6 PT1000 inputs

OTHER
- current metering card for differential protection

≋ COMMUNICATION PORTS AND PROTOCOLS

- Ethernet
- USB 2.0
- RS485
- Optic-MM
- Profibus
- CANbus 2×
- WiFi*

- IEC 60870-5-103
- DNP 3.0
- Modbus RTU
- Modbus TCP
- IEC 61850*

* in agreement with the producer

≋ RECORDERS

- event recorder, 1000 events
- disturbances recorder up to 160 s sampling rate 1,6; 3,2 kHz
- criterial recorder up to 600 s
- temporary value recorder, TrueRMS
- power factor recorder
- load profile recorder
- phasor diagram

Criterial recorder example data

⁂ BASIC SIZES

e²TANGO-600

235 × 147

e²TANGO-800

252 × 215

e²TANGO-1000

252 × 215

e²TANGO-1200

235 × 147

J6

187

J10

234

J14

281

222 × 103
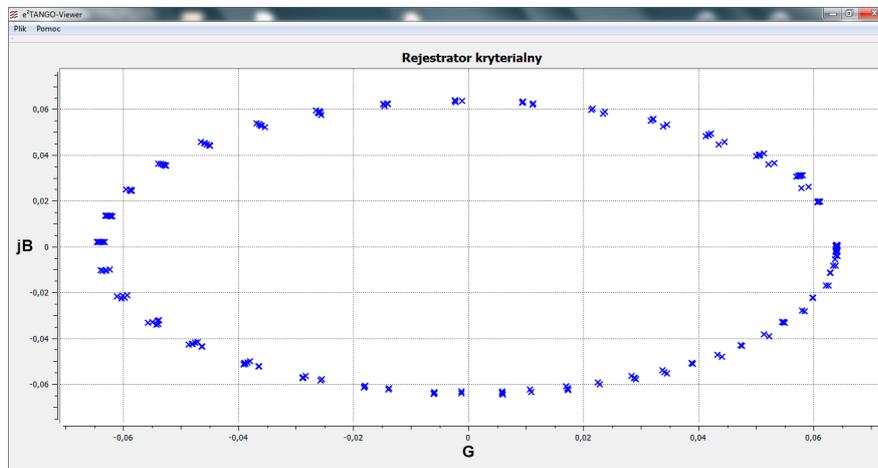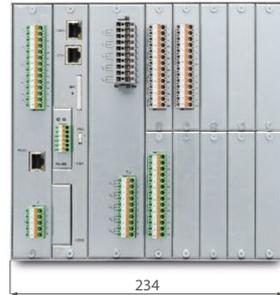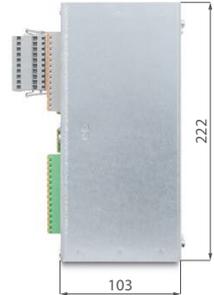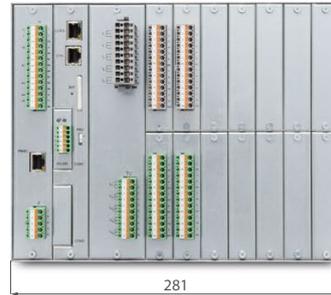
⁂ MOUNTING METHOD

flush mounting
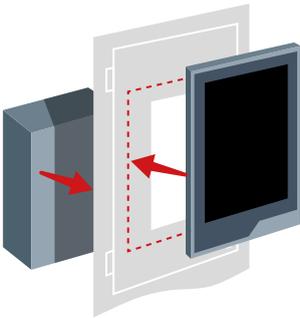
wall mounting
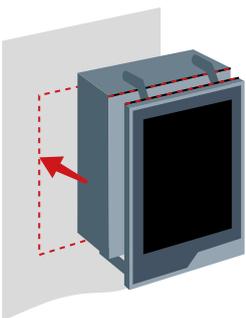
wersja 1
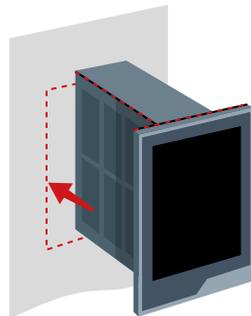
wersja 2

mixed mounting
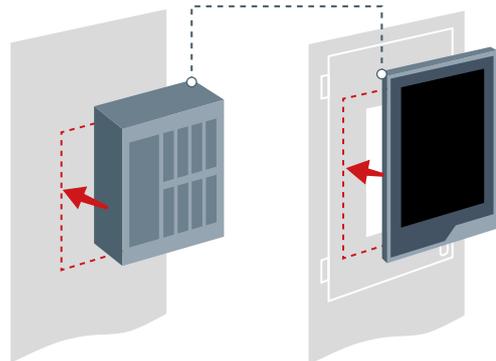
☰ e²TANGO TYPES

	600	800	1000	1200
e²TANGO				

INTERFACE AND OPERATION				
Display	6"	6"	7"	7"
Display resolution	640×480 px	640×480 px	800×480 px	800×480 px
Colour display	•	•	•	•
Touch display	-	-	•	•
Context buttons	6	6	-	-
Control buttons (I,0,⟨-⟩,v)	•	•	•	-
Function buttons with LED (programmable)	2	4	4	-
LEDs	12	14	18	18
Virtual LED (on screen)	4	4	8	8
Virtual function buttons (on screen)	-	-	4	8
Removable LED label	•	•	•	-
DESIGN				
Panel dimensions (H×W×D)	235×147×41,5	252×215×41,5	252×215×41,5	235×147×41,5
Mounting hole dimension in flush mounting version	228×123	228×191	228×191	228×123
Detachable main unit	•	•	•	•
Unit J6 • 6 slots • dimensions: 222 × 187 × 103 (H×W×D)	•	•	o	o
Unit J10 • 10 slots • dimensions: 222 × 234 × 103 (H×W×D)	o	o	•	•
Unit J14 • 14 slots • dimensions: 222 × 281 × 103 (H×W×D)	o	o	o	o
STANDARD EQUIPMENT				
Inputs (max*)	20 (168)	20 (168)	28 (168)	28 (168)
Outputs (max*)	15 (39)	15 (39)	23 (39)	23 (39)
Max number of connectors**	12	12	12	12
Arc detector input (max)**	0 (12)	0 (12)	0 (12)	0 (12)
Analogue input 4-20 mA (max.)**	0 (4)	0 (4)	0 (4)	0 (4)
Analogue input 0-10 V (max)**	0 (4)	0 (4)	0 (4)	0 (4)
Analogue output 4-20 mA (max)**	0 (4)	0 (4)	0 (4)	0 (4)
Analogue output 0-10 V (max)**	0 (4)	0 (4)	0 (4)	0 (4)
PT 100/PT 1000 input (max)**	0 (6)	0 (6)	0 (6)	0 (6)
OTHER				
Widgets	•	•	•	•
Synoptic scheme library	55	55	55	55
Number of screen tabs for configuration	5	5	5	5
Logic scheme preview	•	•	•	•

•/o - standard/option

* - for the biggest main unit filled up with one type of extension card

** - require proper number and types of extension cards

⇛ e²TANGO-STUDIO SOFTWARE

e²TANGO-Studio software intended to operate e²TANGO protection relay. It is at the same time configuration tool for the operating panel. This software has been equipped in extended set of functions, which are combined with clear graphic interface. Finally it creates great tool which supports every-day work and allows creation of projects for many devices, bays, switchgears and stations.

advanced projects developing
possibility to prepare configuration of devices for the whole switchgear on PC and distribute it while using USB

user's elements
defining own graphic elements of synoptic diagram

quick configuration wizard
facilitation of first use and support during regular work
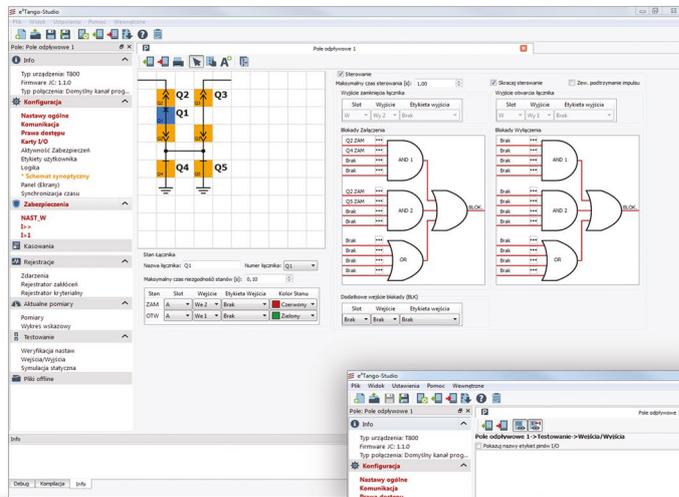
on-line view
On-line view of input and output states, meassurements, real view of the LCD screen.

compatible display
real view of panel screen

extendibilty
through plug-ins
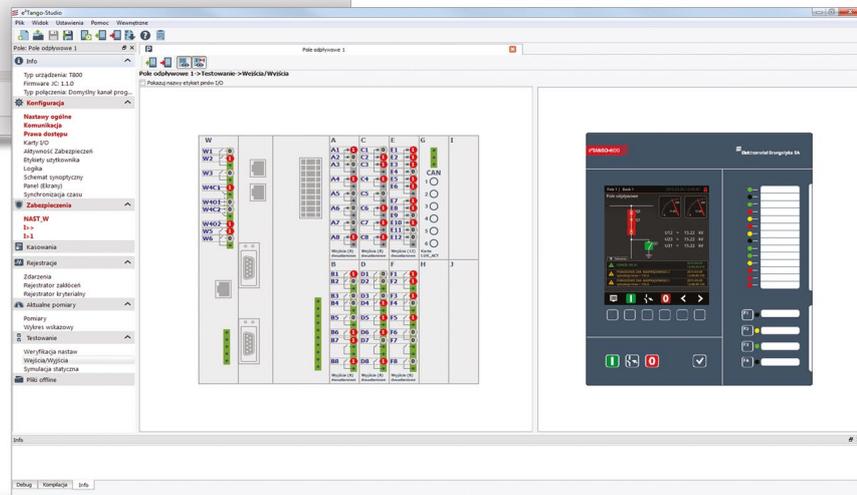
quick design of user's configurable screens
placing elements with drag&drop method.

e²TANGO-STUDIO SOFTWARE
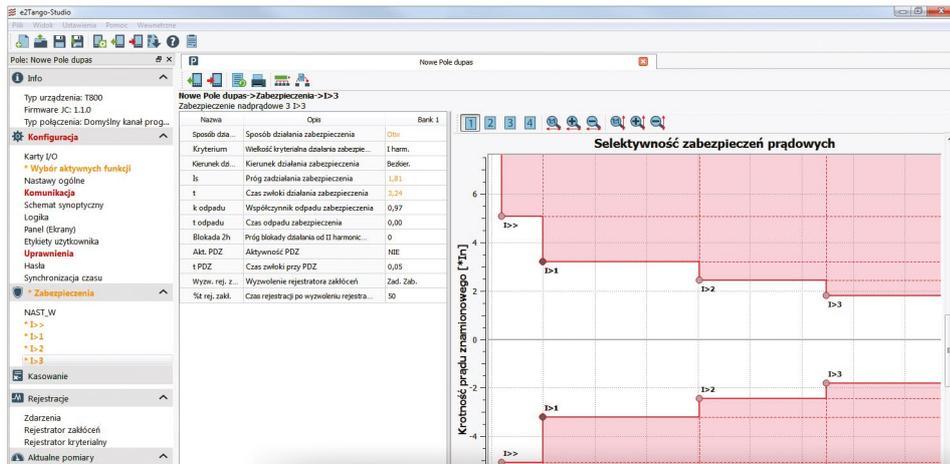
visual characteristic specifying

graphic and text configuration of protection settings

easy verification of settings and selectivity

presentation of the whole overcurrent protection settings on one graph
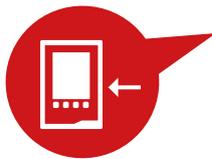
full preview of status

access to all internal device states and protections states
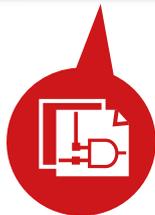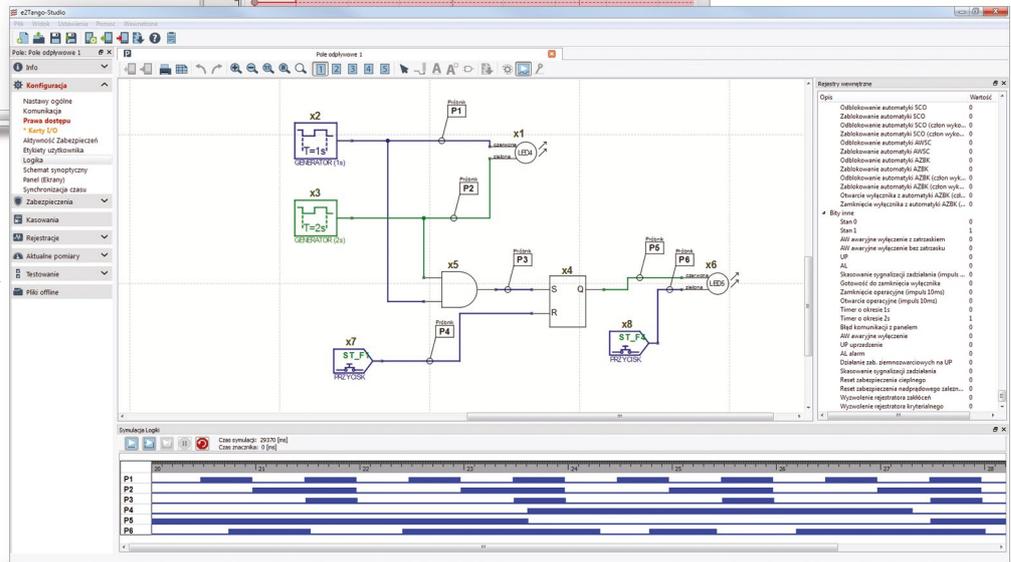
logic simulator

possibility to simulate whole logic without connection with device

logic clarity

possibility to split logic in blocks and sheets
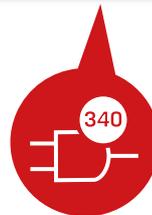
Operating of extensive logical dependence

up to 340 logical gates / functors

ADVANCED LOGIC EDITOR AND SIMULATOR

e²TANGO-Studio is characterized by advanced and extended logic editor which allows to perform logic simulation visible also on the panel level without device connecting. It gives possibility to view logic state while working with the device. It ensures easier project preparation as well as start-up and service of the switching stations. It allows to use non-standard logics dedicated to the specific customer's requirements.

≋ TECHNICAL PARAMETERS

AUXILIARY POWER SUPPLY	
DC Voltage	110 V, 220 V (80-300 V)
AC Voltage	230 V (88-265 V)
Maximal power consumption (central unit with operating panel)	30 W (VA)
CURRENT MEASUREMENT CIRCUITS	
Rated current	5 A (1 A option)
Rated frequency	50/60 Hz
Measurement range for phase currents	0,05-150 A
Measurement range for current I_0	0,001-10 A
Measurement range for current I0 in feeder T_U	0,01-10 A
VOLTAGE MEASUREMENT CIRCUITS	
Rated voltage	57,7/100 V
Rated frequency	50 Hz
Voltage measurement range U, U_0	3-120 V
BASIC PROTECTION PARAMETERS	
Return coefficient for overload protections	Configurable
Return coefficient for under-load protections	Configurable
Operate time Operate time for arc protection	typically 35 ms ‹10 ms
ACCURACY OF MEASUREMENT	
I1, I2, I3 (0.1-150A)	1%
U1, U2, U3, U0 (5-120V)	1%
I0 (0.001-10A)	1%
P, Q, EC, EB (U)5V, 0.1A‹I‹10A, 60°‹ φ ‹-60°)	1%
φ1, φ2, φ3, φ0	1°
BINARY INPUTS CIRCUITS	
Rated voltage	110/230 V AC/DC
Maximal power consumption: 220 V DC, 230 V AC	2 mA, 15 mA
BINARY OUTPUTS CIRCUITS – CONTROLLING CIRCUIT BREAKER	
Permitted voltage with opened contacts	250 V AC / 440 V DC
Closing circuit at 220 V DC	5,5 A
Opening circuit at 220 V DC (L/R = 0)	0,4 A
Opening circuit at 220 V DC (L/R = 40 ms)	0,3 A
BINARY OUTPUTS CIRCUITS – OTHERS	
Permitted voltage with opened contacts	250 V AC / 440 V DC
Long-term current-carrying capacity	5 A
Opening circuit at 220 V DC (L/R = 40 ms)	0,1 A
Opening circuit at 220 V AC (cos φ = 0,1)	2 A
ENVIRONMENTAL CONDITIONS	
Working temperature	-10 °C ... +55 °C
Storage temperature	-25 °C ... +70 °C
Relative humidity	5 to 95%
Vibrations and mechanical shock	Class 1 according to IEC 60255-21
Electromagnetic disturbance	Class B according to IEC 60255-26
SECURITY	
Electric strength of insulation	2 kV / 50 Hz / 60 s IEC 60255-27
Dimensions	
Weight (main unit/operating panel)	5 kg / 1 kg
Main unit size (height x width x depth, mm)	222 x 187/234/281 x 103
Degree of protection for main unit	IP 3X
Degree of protection for operating panel (front side)	IP 4X / IP 54

⚌ STANDARDISATION

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

⚌ CERTIFICATES AND AWARDS

Conformity certificate IEn
no 005/2015

Gold medal
ENERGETAB 2015 fairs

⚌ ELEKTROMETAL ENERGETYKA SA QUALITY

Implemented Integrated Management System based on following standards:
- PN-EN ISO 9001   Quality Management Systems
- PN-EN ISO 14001   Environmental Management System
- PN-N 18001   Health and Safety Management Systems
- BS OHSAS 18001   Occupational Health and Safety Management System

Mazowiecka Nagroda Jakości

⇶ ORDER FORM

To order e²TANGO protection relay, please fill in this form in accordance to FORM INSTRUCTIONS on the next page.

STEP 1

①	panel type	☐ 600	▧ 800	☐ 1000	☐ 1200		
②	main unit type	▧ J6	☐ J10	☐ J14			
③	TR measurement card type	▧ TR (standard, 5I+4U)		☐ TRS (for synchrocheck, 4I+5U)		☐ TRU (for ATS, 9U)	
④	rated current of the measurement card	▧ 5 A	☐ 1 A				
⑤	binary input voltage	▧ UNI (110/230 V AC/DC)	☐ 24V	☐ inne			

communication ETHERNET +

⑥ COM1	▧ x - none	☐ RS485	☐ CAN×2	☐ OPTO-MM	☐ Profibus	☐ other
⑦ COM2	▧ x - none	☐ RS485	☐ CAN×2	☐ OPTO-MM	☐ Profibus	☐ other

⑧	mounting method	▧ Z - flush	☐ N1 - wall version 1	☐ N2 - wall version 2	☐ M - mixed
⑨	panel-main unit cable length	▧ S - 1 m	☐ L - 2 m	☐ other	
⑩	IP protection level	▧ IP 4X	IP 54[1]		

1) IP54 protection level available only in version with flush mount

STEP 2

card type	Code	Slot A	B	C	D	E	F	G	H	I	J	K	L	M	N
processor card CPU	-	installed in each device													
power supply card PSU - 7 binary outputs	-	installed in each device													
8 binary inputs	8IN	▧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12 binary inputs	12IN	☐	☐	▧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8 binary outputs	8OUT	☐	▧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4 analogue input 0-10 V	AI10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4 analogue input 4-20 mA	AI20	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4 analogue output 0-10 V	AO10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4 analogue output 4-20 mA	AO20	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6 PT100 temperature sensor input	PT1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6 PT1000 temperature sensor input	PT10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6 arc detector input with CANbus communication + 3 arc detectors	ARC	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6 arc detector input passive + 3 arc detectors	ARP	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
current metering card for differential protection	TRR						☐								

J6
J10
J14

additional number of arc sensors [ ] only if the ARC or ARP card is ordered

additional requirements:
[ ]

STEP 3

Your code:

e²TANGO	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

A	B	C	D	E	F	G	H	I	J	K	L	M	N

☰ FORM INSTRUCTIONS

STEP 1

In the presented table there are the basic technical parameters of the e²TANGO protection relay. From each position marked with a numbers from 1 to 10 there is only one position to be selected. If you choose "other", in STEP 3 in the corresponding field, please enter the requested value.

Step 1 instructions

- ☐ - recommended basic configuration
- OPTO-MM - multi-mode optic fibre

STEP 2

In the presented table there is a list of available expansion cards and their possible installation locations in the central unit of e²TANGO. Missing field ☐ for marking means that the card cannot be installed in a given place. Please choose from the list the ordered cards and mark with "X" a slot, in which they have to be installed. Arranging the cards has to be started from the A slot. Capacity of the units are marked appropriately with the background colour in the table.

Additional requirements have to be described in a designated area.

Step 2 instructions

- ☐ - recommended basic configuration
- max 4 cards 8OUT
- max 1 card AI10 or 1 card AI20
- max1 card AO10 or 1 card AO20
- max 1 card PT1 or 1 card PT10
- TRR card can be installed only in F slot
- ARP card can be placed in the device only if ARC card is already installed

View of the central unit indicating the arrangement of slots for expansion cards.
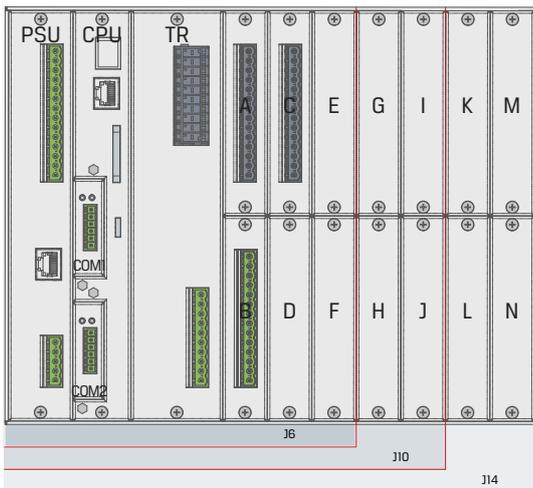
STEP 3

Selected above parameters of the e²TANGO protection relay have to be inserted in the corresponding space. The code created in that way together other requirements or scanned order form page has to be sent along with an order to the following address:
eaz@elektrometal-energetyka.pl

Example of e²TANGO protection relay configuration:

① e²TANGO-1000 panel	⑧	mixed mounting
② J10 main unit	⑨	8 m cable
③ TR measurement card	⑩	IP4X protection level
④ rated current of measurement card 5A	A	slot A: 8IN card
⑤ universal binary input voltage	B	slot B: 8OUT card
⑥ OPTO-MM	C	slot C: 12IN card
⑦ RS485	D	slot D: ARC card

Example of correct filled code:

e²TANGO	1000	J10	TR	5A	UNI	OPTO-MM	RS485	M	8	IP4X

8IN	8OUT	12IN	ARC							

ELEKTROMETAL ENERGETYKA SA
02-830 Warszawa, ul. Mazura 18A
tel. (+48) 22 350 75 50
fax (+48) 22 350 75 51
eaz@elektrometal-energetyka.pl
www.elektrometal-energetyka.pl