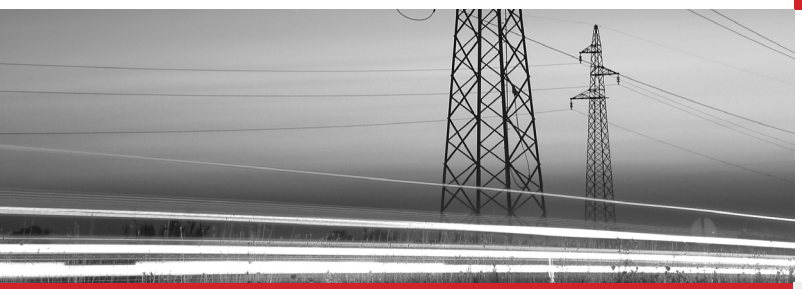


Elektrometal Energetyka SA®

e²TANGO®-400 Overcurrent Relay

K-33.2.2 Catalogue EN

e²ALPHA
Elektrometal Energetyka SA
e²TANGO-400
Elektrometal Energetyka SA
e²TANGO-400 Bank 2 2016-11-29 00:21:45
I1 = 91,5 A
I2 = 90,0 A
I3 = 92,0 A
I0 = 1,00 A
U0 = 6,00 V
ODBLK. ZAB. NADPRĄDOWEGO
2016-08-09 14:12:46.121
ZAB. NADPRĄDOWE 2
f: 123 Imax = 500 A
2016-11-11 12:23:45.127
I>
I0>
F1
F2
AW
UP
P1>
P2>
t>
Usyg
e²ECHO-B
L1
L2
L3
N
Elektrometal Energetyka SA
STOP
NAPIĘCIE NA KABLU
STEROWANIE CZŁONEM RUCHOMYM
STEROWANIE WYŁĄCZNIKIEM
STEROWANIE UZIEMNIKIEM
OŚWIETLENIE POLA
WUG
GE-16/15

We Create Ideas With Power!

e²TANGO-400 protection relay is a 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-400 is a 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-400 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-400 is a unique protection relay. This knowledge gives us confidence when recommending this device to our customers.

Dariusz Rybak

Main Designer

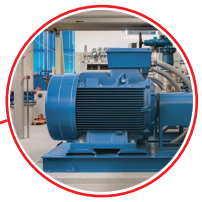
APPLICATION

e²TANGO-400 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

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

no need to replace batteries
a supercapacitor is used

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

availability of expansion cards
input and output cards, communication cards, measurement cards

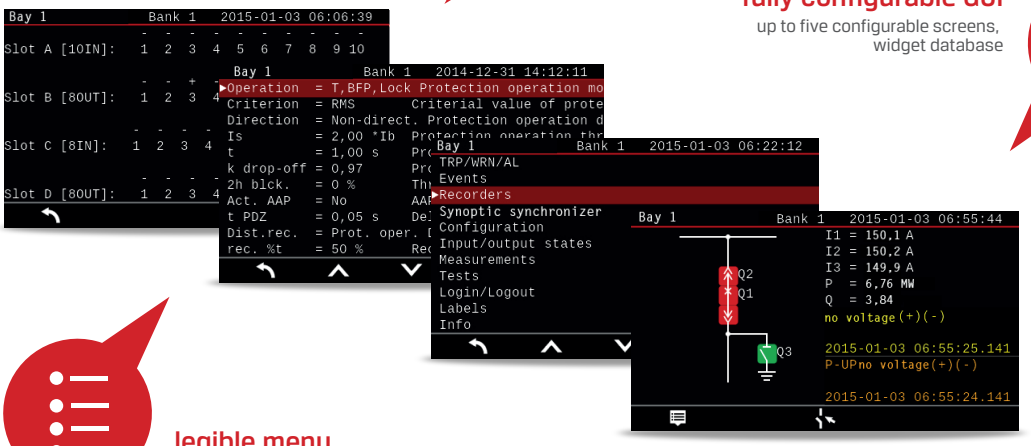
self-supplied version
suitable for operation with autonomic adapter, operation on auxiliary power failure

intuitive interface
legible menus, consistent across all e²TANGO protection systems and relays.

Rogowski coil
for phase current measurement the device may use 1 mV/A sensitivity Rogowski coils

may be used without training
handy help system

fully configurable GUI
up to five configurable screens, widget database



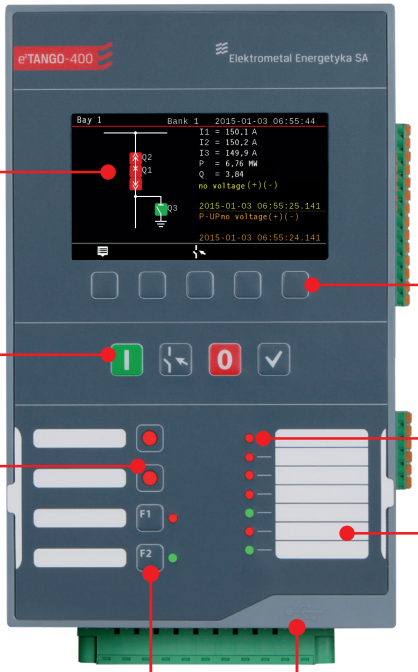
legible menu
consistent across e²TANGO protection systems and relays

DESIGN

e²TANGO-400 protection relay has a 4.3" colour graphical display and a keyboard with 5 context-sensitive buttons for easy operation. Additional four dedicated buttons for switching device control are available. There are 7 LEDs (4 red and 3 red-green) on the front panel providing visual indication of device statuses. There are also two additional function buttons F1 and F2 with dedicated two-colour LEDs which may be customised. Above the function buttons there are two red LEDs or optionally two electromechanical indicators providing indication even in case of power supply failure. A label pocket is provided on the relay front panel for function button and LED/indicator labels.

INTERFACE AND OPERATION	
Display	4,3"
Display resolution	480x272px
Colour display	•
Operating buttons (number)	6
Control buttons (I,0,<->)	5
Programmable function keys with LED	2
LED	7
LED or electromagnetic indicators	2
Replaceable labels	•
DESIGN AND STANDARD EQUIPMENT	
current input no.	4
voltage input no. 1	1
binary input no.	10/26
relay output no.	8/24
Max. switching device no.*	6
AVAILABLE EXPANSION CARDS**	
Binary input cards	o (16)
Relay output cards	o (16)
4 binary input and 4 relay output cards	o (8/8)
Temperature input cards ***	o (6)
Flash sensor input cards ***	o (6)
4-20 mA analogue input cards ***	o (4)
0-10 V analogue input cards ***	o (4)
4-20 mA analogue output cards ***	o (4)
0-10 V analogue output cards ***	o (4)
Voltage measurement cards	o (3)
DATA RECORDERS	
Event recorder	512
Disturbance recorder	10s
OTHER	
Widgets	•
Synoptic diagram database	•
No. of configurable screens	5

•/o - standard/option
* - requires appropriate number of expansion cards
** - maximum 2 slots available; input/output number provided in brackets is for a device with all slots holding cards of one type. This does not apply to voltage measurement card
*** - only 1 module may be installed



PROTECTION FUNCTIONS

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

AUTOMATIC SYSTEMS

- 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 breaker failure protection
- automatic busbar protection
- active component forcing
- interoperation system with automatic inclusion of capacitor bank or timed automatic inclusion of capacitor bank
- ATS interoperation system
- ATS for island operation
- other programmed using logic

EXPANSION CARDS

BASIC CARDS
- power supply unit
- central processor unit

FUNCTION CARDS
- 10 binary inputs
- 10 binary inputs 24 V
- 8 binary outputs
- 8 binary inputs
- 8 binary inputs 24 V
- 4 binary inputs
  and 4 binary outputs

OTHER
- voltage measurement card (TU)

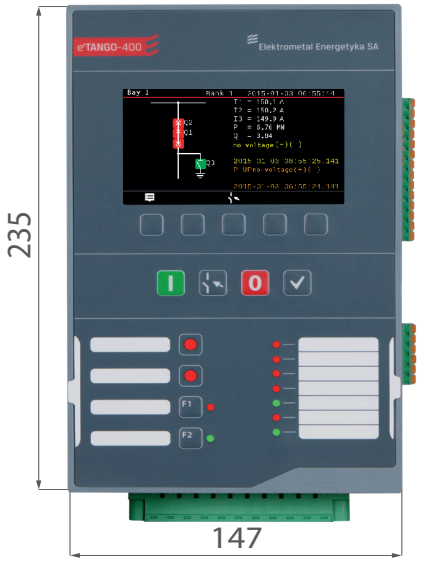
ANALOGUE CARDS
- 4 analogue inputs 0-10 V
- 4 analogue inputs 4-20 mA
- 4 analogue outputs 0-10 V
- 4 analogue outputs 4-20 mA

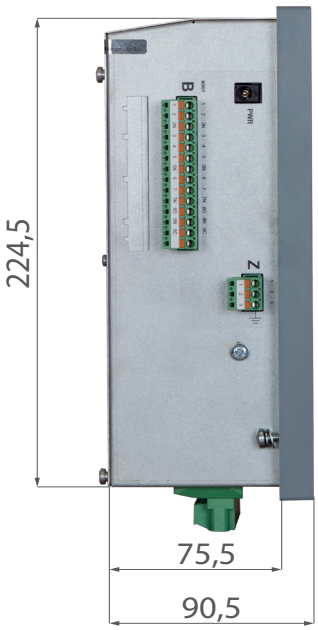
TEMPERATURE SENSORS CARDS
- 6 PT100 inputs
- 6 PT1000 inputs
- 6 arc detector inputs with
  communication CANbus + 3 standard
  sensors (ARC)

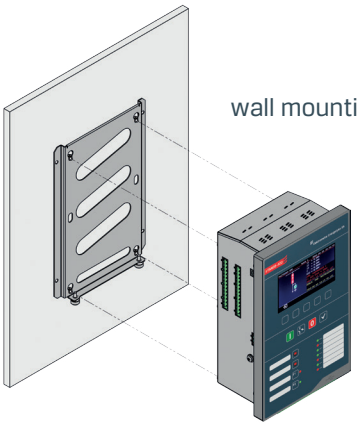
COMMUNICATION PORTS AND PROTOCOLS

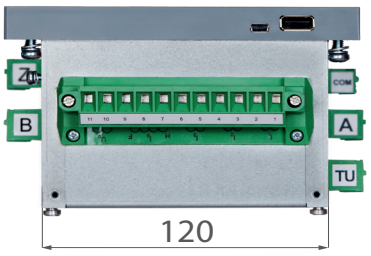
- Ethernet
- Multi-mode glass optical fibre - OPTOMM
- Plastic optical fibre OPTOP
- RS485
- CANbus 2×
- USB 2.0
- Modbus RTU / TCP
- IEC 60870-5-103
- DNP 3.0
- Profibus
- CANbus / PPM 2

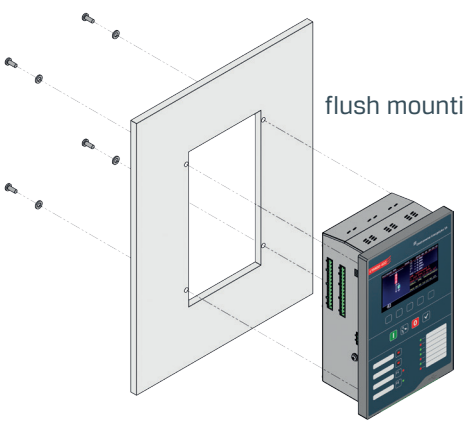
DIMENSIONS AND MOUNTING METHODS











TECHNICAL PARAMETERS

Auxiliary power supply	
VDC	110 V, 220 V (80-300 V) 24V(option)
VAC	230 V (88-265 V)
Option	24 V (19-58 V AC/DC)
Maximum power consumption	10 W (VA)
Input for autonomous power PWR (non-insulated)	12 - 15 V DC
Current measurement circuits	
Rated current	5 A / (1 A option)
Rated frequency	50 Hz
Phase current measurement range for current transformers for Rogowski coils Others for request	 0,1-150 A 10-1400mV(10-1400A)
I0 current measurement range	0,005-1 A / 0,1 - 10A
Ig current measurement range in capacitor bank bay	0,1-10 A
Voltage measurement circuits	
Rated voltage	57.7/100/230 V
Rated voltage for sensors	2/√3 or 3.25/√3
Voltage measurement range for additional set	3-280 V
Voltage measurement range for sensors	0.025-4 V
Basic protection parameters	
Over protection relay resetting ratio	Configurable
Under protection relay resetting ratio	Configurable
Device operate time	typically - 35 ms
Measurement accuracy	
I1, I2, I3 (0.1-150 A/10-1400 mV)	2%
U1, U2, U3 (5-280 V/0.025-4 V: version with voltage measurement)	2%
U0 measured (5-280 V) calculated (5-280 V/0.0025-4 V)	 2% 3%
I0 measured (0.005-10 A) calculated (0.150 A/10/1400 A)	 2% 3%
φ1, φ2, φ3, φ0 for transformers (U>5 V, 0.25 A<I<10 A) φ1, φ2, φ3, φ0 for voltage sensors and Rogowski coils (0.025 V<U<4 V.10 A<I<1400 A)	1° 2°
f (U>5 V/0.05 V)	10 mHz
Binary input circuits	
Rated voltage Optional	110/230 V AC/DC 24 V(19-58 V AC/DC) Other on request
Maximum power consumption: 220 V DC, 230 V AC	2 mA, 15 mA
Relay output circuits	
Allowable voltage at open contacts	250 V AC / 440 V DC
Continuous current-carrying capacity	5 A
Circuit opening at 220 V DC (L/R = 40 ms)	0,1 A
Circuit opening at 220 V AC (cos φ = 0,1)	2 A
Environmental conditions	
Operating temperature	-10 °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)	147 x 90,5 x 235
Protection rating (at terminal side)	IP 3X
Protection rating (at front panel side)	IP 4X / (IP 54 optional)

e²TANGO-STUDIO SOFTWARE

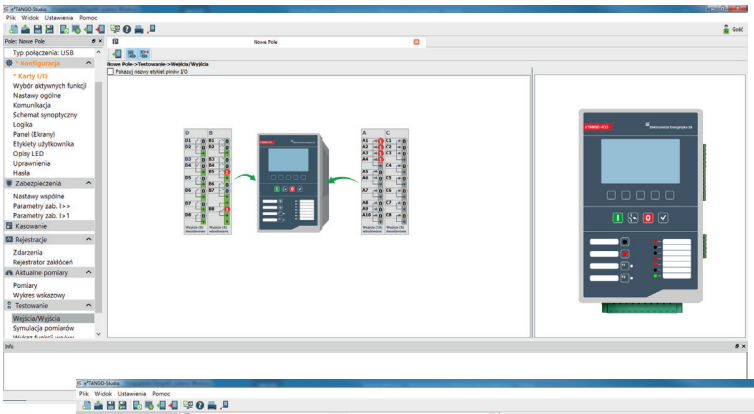
e²TANGO-Studio engineering software allows operation of e²TANGO-400 protection relay and also panel configuration. This software provides comprehensive functionality, which together with visual widget configuration is a perfect aid in daily work by enabling creation of projects for multiple devices, 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

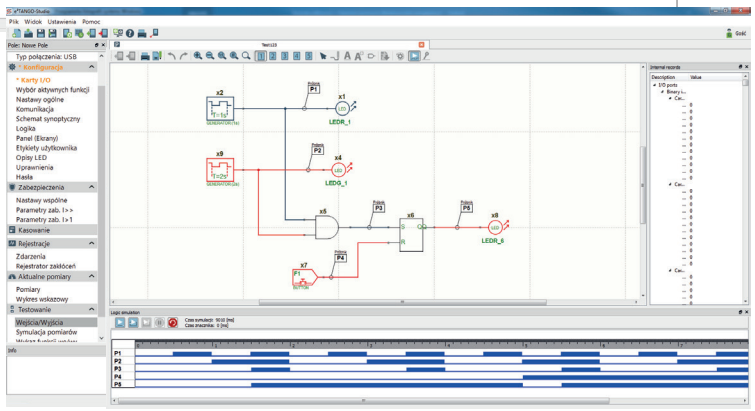


on-line preview

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

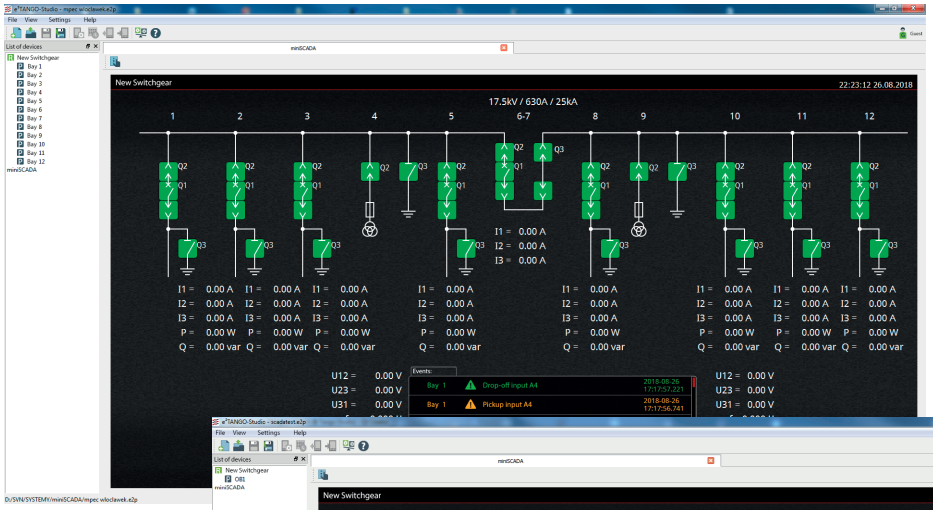
„miniSCADA" FUNCTIONALITY

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

CERTIFICATES & AWARDS

IEn certificate of conformity
no. 008/2017

Masovian Quality Award

The Minister of Energy Cup
ENERGETAB 2018 Fairs

Business Gazelle 2020

GAZELE BIZNESU 2020
Puls Biznesu
21. EDYCJA RANKINGU NAJBARDZIEJ DYNAMICZNYCH MAŁYCH I ŚREDNICH FIRM

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-400 protection relay fill in this part of the form following FORM INSTRUCTIONS provided on the next page.

STEP 1

①	version	☐ 400
②	type change the way of measurement metod(from core transformer)	☐ S (standard, 4I+1U) ☐ C (Rogowski coils $3I_{CR}$ + 1I +1U) ☐ CZ (Rogowski coils $3I_{CR}$ + 1I +1U, voltage sensors 3U)[1]
③	measurement card rated current	☐ 5 A ☐ 1 A ☐ X - for C or CZ
④	binary input voltage	☐ UNI (110/230 V AC/DC) ☐ 24 V (24/48 V AC/DC) ☐ other (on consultation with manufacturer) .....
	Ethernet (standard equipment in each central unit)	
⑤	COM1	☐ x-none ☐ RS485 ☐ CAN×2 ☐ OPTOMM ☐ OPTOP ☐ Profibus ☐ other
⑥	mounting	☐ Z - flush mounting ☐ N - wall mounting
⑦	protection rating IP	☐ IP 4X ☐ IP 54[2]

1) CZ type requires ordering TU card
2) IP54 protection rating is available only for flush mounting

STEP 2

		Slot					
			A	B	C	D	TU
Card name	Code						
Ethernet	-	standard for the device					
10 binary inputs	10IN	standard for the device	☐				
10 binary inputs 24 V	10IN24		☐				
8 relay outputs	8OUT	standard for the device		X	☐	☐	
8 binary inputs	8IN			☐	☐	☐	
8 binary inputs 24 V	8IN24				☐	☐	
4 binary inputs and 4 relay outputs	4IO				☐	☐	
4 0-10 V analogue inputs	AI10				☐	☐	
4 4-20 mA analogue inputs	AI20				☐	☐	
4 0-10 V analogue outputs	AO10				☐	☐	
4 4-20 mA analogue outputs	AO20				☐	☐	
6 temperature inputs PT100	PT1				☐	☐	
6 temperature inputs PT1000	PT10				☐	☐	
6 arc detector inputs with CANbus communication + 3 standard detectors*	ARC					☐	
voltage measurement	TU						☐

*ARC card can only be placed in slot D

ATTENTION: Max. 1 card in clot C and 1 card in slot D

additional arc detectors (max. 3 pcs.) ☐ only if ARC card is ordered.

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-400 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-400 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.

Any additional requirements should be described in designated fields.

Step 2 instructions.

- ▢ - recommended basic configuration
- max. 1 AI10 card or 1 AI20 card
- max. 1 AO10 card or 1 AO20 card
- max. 1 PT1 card or 1 PT10 card
- max. 1 ARC card

Device slot C and D view

STEP 3

e²TANGO-400 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: eaz@elektrometal-energetyka.pl

Sample e²TANGO-400 protection configuration:

① e²TANGO-400	⑦ IP 4X
② Standard	A slot A: 10IN24 card
④ Universal 230 / 110 AC / DC	B slot B: 8OUT card
⑤ OPTOMM	C slot C: 8OUT card
⑥ Flush mounting	D slot D: ARC card
	TU slot TU: TU card

Sample e²TANGO-400 protection configuration:

e²TANGO	400	S	5A	UNI	OPTOMM	Z	IP 4X	10IN24	8OUT	8OUT	ARC	TU

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