

PRODUCT DESCRIPTION

EuroProt+ DTRV E7-TR

IED-EP+/DTRV/E7-TR

AUTOMATIC VOLTAGE REGULATOR (RELAY)

PROTECTA
HUNGARY

EUROPROT+ DTRV E7-TR

AUTOMATIC VOLTAGE REGULATOR (RELAY)

OVERVIEW

The **E7-TR** device is a member of the **EuroProt+** numerical protection relay, made by Protecta Co. Ltd. The **EuroProt+** type complex protection in respect of hardware and software is a modular device. The modules are assembled and configured according to the requirements, and then the software determines the functions.

The **E7-TR** configuration is designed to perform the transformer tap-changer controller function.

GENERAL FEATURES

- Native IEC 61850 IED with Edition 1 & 2 compatibility
- Module layouts with options 42 or 84 HP wide rack size (height: 3U)
- The pre-defined factory configuration can be customized to the user's specification with the powerful EuroCAP tool
- Flexible protection and control functionality to meet special customer requirements
- Different HMI Types: advanced HMI with color touchscreen and black-and-white display with 4 tactile push buttons. An embedded web server and extended measuring, control and monitoring functions are also available for both types
- User configurable LCD user screens, which can display SLDs (Single Line Diagrams) with switchgear position indication and control as well as setting values, measurement values, event and fault information (timestamp, function block, fault phase, fault current...)
- 8 setting groups available as default. The number of setting groups can be up to 20 as user's requirement
- Enhanced breaker monitoring and control
- High capacity disturbance recorder (DRE) and event logging in non-volatile memory:
 - DRE can store more than 64 records
 - Each DRE recording can be configured up to 32 analogue and 64 digital signal channels with duration up to 10s and sampling rate up to 2kHz
 - Event recorder can store more than 10,000 events
 - The records can be read out from IED in the standard COMTRADE file format (IEEE Std C37.111) via exist communication connection (such as IEC61850) or even examined on-line. Every single record stored in 3 files with the same name and the following extensions: .dat, .cfg, .inf
- Several mounting methods: Rack; Flush mounting; Semi-flush mounting; Wall mounting; Wall-mounting with terminals; Flush mounting with IP54 rated cover.
- Wide range of communication protocols:
 - Ethernet-based communication protocol: IEC61850,



DNP3.0 TCP, IEC60870-5-104, Modbus TCP

- Serial communication protocol: DNP3.0, IEC60870-5-101, IEC60870-5-103, MODBUS, SPA
- Legacy network based protocols via 100Base-FX and 10/100Base-TX (RJ45)
- Optional communication ports: Fiber Ethernet (MM/ST, SM/FC), RJ45, Serial POF, Serial glass fiber, RS-485/422
- Handling several communication protocols simultaneously
- Built-in self-monitoring to detect internal hardware or software errors
- Time synchronization protocol: NTP/SNTP, Minute pulse, Legacy protocol, IRIG-B
- Integrated advanced cyber security - Conformity with the Cyber Security requirements in accordance with NERC-CIP, IEEE 1686, BDEW Whitepaper and IEC 62351-8 standard and recommendation. Passwords are required when logging into the device for: access, control, setting, manage,...

APPLICATION

The **E7-TR** is designed to give control over the tap-changer of power transformers. The relay is a member of the DTRV product type in the EuroProt+ product family.

The **E7-TR** relay includes a powerful Automatic Tap Changer Control function (manual control included) along with voltage protection functions.

SCOPE OF APPLICATION

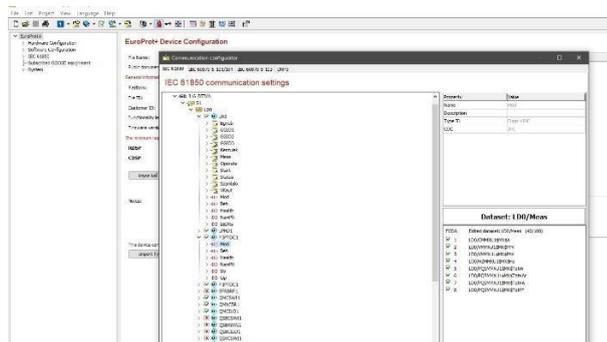
- Automatic or manual voltage regulation (tap changer control) for transformers
- Additional voltage protection functions.
- Tap changer supervision: 6bit tap changer position definition (Binary, BCD, Gray, mA)
- Optional external units: 28 input/ 5 output tap changer transcoder (TRCS) Remote I/O unit (RIO)
- Monitor transformer temperature via analog input module

(AIC) or RTD input module (Pt100/Ni100, Pt250/Ni250...)

- The analog output module (ATO) transmits current or voltage signals. This module can be used in wide ranges in unipolar and bipolar mode

communication

- GOOSE configuration between IEDs

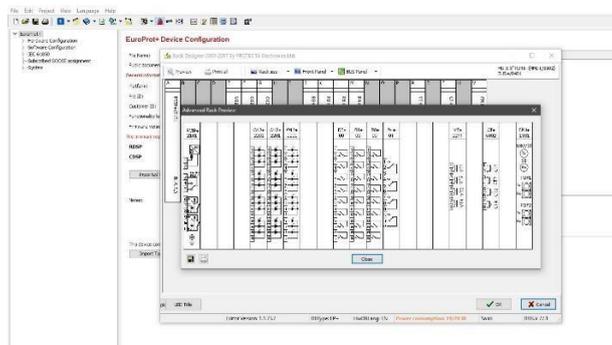


EUROCAP CONFIGURATION TOOL

The EuroCAP configuration tool, which is available free of charge, offers a user-friendly and flexible application for protection, control and measurement functions to ensure that the IED-EP+ devices are fully customisable.

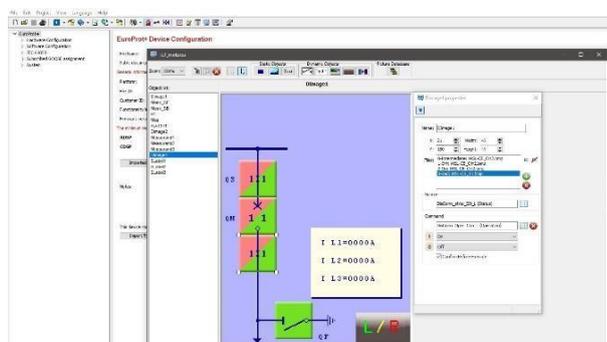
HW configuration

- View the exciting hardware configuration of the IED including card information and slot position
- Modify (add or change) certain HW modules
- Digital and analogue I/O signal definition



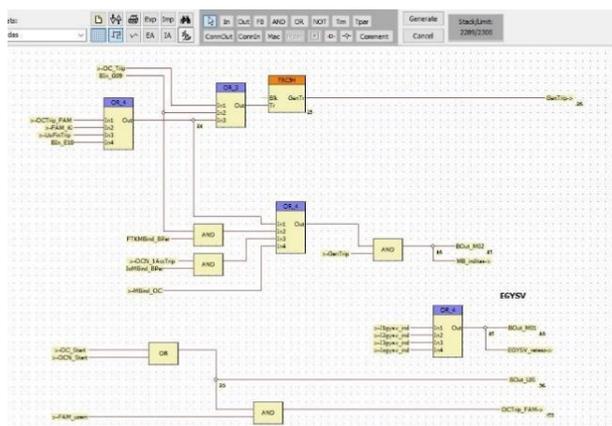
LCD configurator (available with color TFT displays)

- Create/modify user screens with Single Line Diagrams, measuring or status values
- Icon library for effective configuration Own, user-defined symbols can be created as well



Logic editor

- Create/manage logical sheets
- Factory pre-configured logical schemes to speed up the commissioning process



Feedback documentation

Automatic documentation of the configured IED, which can contain the actual connection assignment, on-line measurements, all recorded event channels, all recorded disturbance channels, LED assignment, Logical sheets and the relevant communication settings and collect the protection, control and monitoring parameters.

Offline Parameter Set Editor

- View, set, compare and save the setting of the IED parameters
- Import existing parameter settings into the Offline parameter set editor from the IED
- Import/Export parameters in xls/x format
- Generate and save parameters in RIO/XRIO format for relay tester

Communication configurator

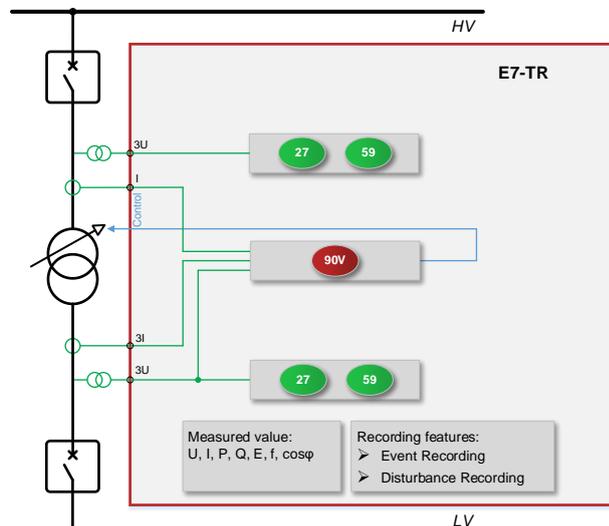
- Set up IEC 61850, 101-104, 103, DNP3 communication protocols
- Configure dataset, report and goose control block properties for IEC 61850 horizontal and vertical

PROTECTION & CONTROL FUNCTIONS

The **E7-TR** configuration is designed to perform the transformer tap-changer controller function. It measures three phase currents and the zero sequence current component and additionally three phase voltages and the zero sequence voltage component from both sides of the transformer. The tap-changer controller function considers also the voltage drop of serial network elements and the healthy state of the supplying high voltage network. Also the voltage limitation functions are included. The realized protection functions are listed in the Table below.

THE IMPLEMENTED PROTECTION & CONTROL FUNCTIONS	IEC	ANSI	*Inst.
Definite time overvoltage protection function	U >, U >>	59	2
Definite time undervoltage protection function	U <, U <<	27	2
Automatic tap-changer controller function	ATCC	90V	1

*The *Inst.* column contains the numbers of the pre-configured function blocks in the factory configuration. These numbers may be different in order to meet the user's requirements.



▪ Definite time undervoltage protection (27)

The definite time undervoltage protection function measures the RMS values of the fundamental Fourier component of three phase voltages. The Fourier calculation inputs are the sampled values of the three phase voltages (UL1, UL2, UL3), and the outputs are the basic Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four). They are not part of the TUV27 function; they belong to the preparatory phase.

The function generates start signals for the phases individually. The general start signal is generated if the voltage is below the preset starting level parameter setting value and above the defined blocking level. The function generates a trip command only if the definite time delay has expired and the parameter selection requires a trip command as well.

The operation mode can be chosen by the type selection parameter. The function can be disabled, and can be set to "1 out of 3", "2 out of 3", and "All".

The signal generated from the undervoltage protection function can be used to block the automatic tap-changer controller function. This can be done by the user via graphic equation editor.

▪ Definite time overvoltage protection (59)

The definite time overvoltage protection function measures three voltages. The measured values of the characteristic quantity are the RMS values of the basic Fourier components of the phase voltages. The Fourier calculation inputs are the sampled values of the three phase voltages (UL1, UL2, UL3), and the outputs are the basic Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four). They are not part of the 59 function; they belong to the preparatory phase.

The function generates start signals for the phases individually. The general start signal is generated if the voltage in any of the three measured voltages is above the level defined by parameter setting value. The function generates a trip command only if the definite time delay has expired and the parameter selection requires a trip command as well.

The signal generated from the overvoltage protection function can be used to block the automatic tap-changer controller function. This can be done by the user via graphic equation editor.

▪ Automatic tap-changer controller (90)

One criterion for power quality is to keep the voltage of selected points of the networks within the prescribed limits. The most common mode of voltage regulation is the application of transformers with on-load tap changers. When the transformer is connected to different taps, its turns ratio changes and supposing constant primary voltage, the secondary voltage can be increased or decreased as required.

Voltage control can take the actual load state of the transformer and the network into consideration. As a result, the voltage of a defined remote point of the network is controlled assuring that neither consumer near the busbar nor consumers

at the far ends of the network get voltages out of the required range.

The automatic tap changer controller function can be applied to perform this task. The automatic tap changer controller function receives the following analog inputs:

- UL1L2 Line-to-line voltage of the controlled secondary side of the transformer
- IL1L2 Difference of the selected line currents of the secondary side of the transformer for voltage drop compensation
- IHV Maximum of the phase currents of the primary side of the transformer for limitation purposes

The parameter "U Correction" permits fine tuning of the measured voltage. The function performs the following internal checks before control operation

- If the voltage of the controlled side UL1L2 is above the value set by the parameter "U High Limit", then control to increase the voltage is disabled.
- If the voltage of the controlled side UL1L2 is below the value set by the parameter "U Low Limit", then control to decrease the voltage is disabled.
- If the voltage of the controlled side UL1L2 is below the value set by the parameter "U Low Block", then the transformer is considered to be de-energized and automatic control is completely disabled.
- If the current of the supply side IHV is above the limit set by the parameter "I Overload", then both automatic and manual controls are completely disabled. This is to protect the switches inside the tap changer

There are two modes for Automatic tap-changer controller function:

- Automatic control mode
- Manual control mode

The tap changer controller receives remote commands from the SCADA system and local commands from the local LCD of the device when Manual mode is selected.

The automatic tap changer control function has the "Operation" parameter which can be set to one of the following:

- Off;
- Single (Independent); with special setting of the voltage compensation can be performed negative reactance circulating current control
- Min Circulating Current;
- Master;
- Slave-Cmd/Slave-Tap;

Up to 4 parallel transformers may be involved. Individual EuroProt+ controllers are assigned to each of them, and these devices co-operate with each other. EuroProt+ CPU+xxxx module SB (station bus) ports or RJ-45 Ethernet user interface on front panel can be used to establish the communication network among the cooperating tap changer controller devices.

The AVR time scheduler function can be used to provide daylong update of the “Uset” value. Each calendar day are divided into seven time intervals where user-defined “U set” value can be applied. Each interval related “U set” value overwrites the “U set” value of the ATCC function when time scheduler function is enabled. Time is based on the device local time (UTC/GMT + GMT offset).

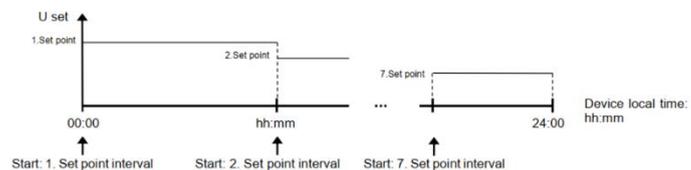


Figure 1-4 Time scheduler function set points and intervals

MEASUREMENT FUNCTIONS

▪ Measurement functions

Based on the hardware inputs the measurements listed in table below are available.

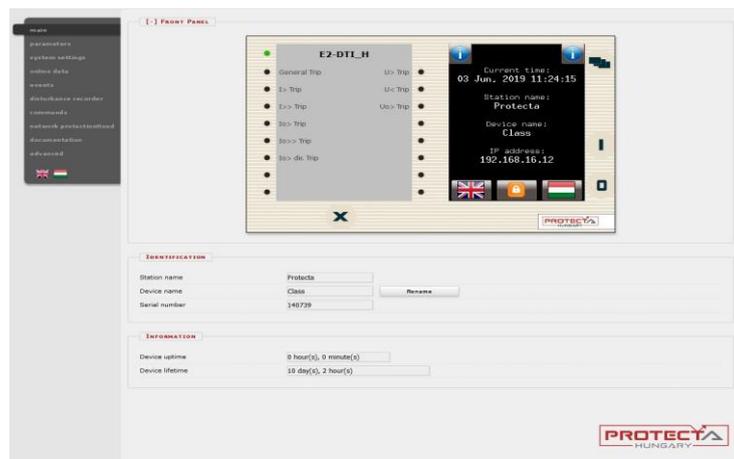
Measurement functions	E7-TR
Current (I1, I2, I3, I4, Iseq (I0, I1, I2))	X
Voltage (U1, U2, U3, U4, U12, U23, U31, Useq (U0, U1, U2)) and frequency	X
Power (P, Q, S, pf) and Energy (E+, E-, Eq+, Eq-)	X

The measurement functions of the E7-TR configuration

HMI AND COMMUNICATION TASKS

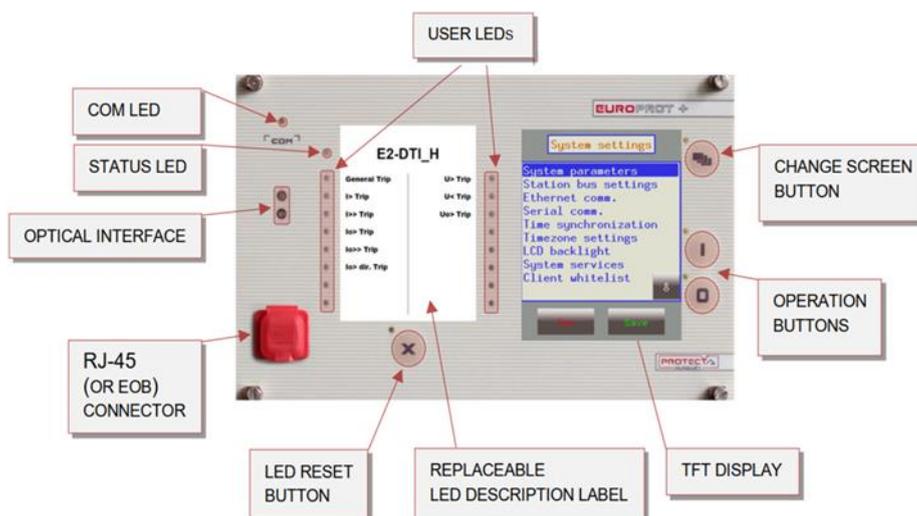
- **Embedded WEB-server:** Allows remote access via Ethernet port of device

- Firmware upgrade possibility
- Modification of user parameters
- Events list and disturbance records
- Password management
- Online data measurement
- Commands
- Administrative tasks



- **Front panel TFT display handling:** the interactive menu set is available through the TFT and the touchscreen interface.

- **User keys:** capacitive touch keys on front panel



- **Communication:**

- The built-in 5-port Ethernet switch allows EuroProt+ to connect to IP/Ethernet-based network. The following Ethernet ports are available:
 - Station bus (100Base-FX Ethernet) SBW
 - Redundant station bus (100Base-FX Ethernet) SBR
 - Process bus (100Base-FX Ethernet)
 - EOB or EOB2 (Ethernet Over Board) or RJ-4 Ethernet user interface on front panel
 - Optional 10/100Base-T port via RJ-45 connector
- PRP/HSR seamless redundancy for Ethernet networking (100Base-FX Ethernet; 10/100Base-TX Ethernet)
- Redundancy RJ-45 for Ethernet networking (10/100Base-TX Ethernet)
- Other communication:
 - RS422/RS485 interfaces (galvanic interface to support legacy or other serial protocols, ASIF)
 - Plastic or glass fiber interfaces to support legacy protocols, ASIF
 - Proprietary process bus communication controller on COM+ module

FUNCTIONAL PARAMETERS

Definite time undervoltage protection (27)	
Operation	Off, 1 out of 3, 2 out of 3, All
Start Voltage	30-130% in 1% steps
Block Voltage	0-20% in 1% steps
Reset Ratio	1-10% in 1% steps
Time Delay	50-60000ms in 1ms steps
Definite time overvoltage protection (59)	
Operation	Off, On
Start Voltage	30-130% in 1% steps
Reset Ratio	1-10% in 1% steps
Time Delay	0-60000ms in 1ms steps
Automatic tap-changer controller function (90V)	
Operation	Off, Single (On), Min.Circulating Current, Master, Slave-Cmd, Slave-Tap
TC Supervision	Off, TCDrive, Position, Both
CodeType	Binary, BCD, Gray, mA
Min Position	1-32 in 1 steps
Max Position	1-32 in 1 steps
I Overload	50-150% in 1% steps
Max Operating Time	1000-30000ms in 1ms steps
Pulse Duration	100-10000ms in 1ms steps
Position Filter	1000-10000ms in 1ms steps
T1 Delay Type	Definite, Inverse, 2powerN
Compensation	Off, AbsoluteComp, ComplexComp
Fast Higher Enable	False, True
Fast Lower Enable	False, True
U Correction	0.950-1.050 in 0.001 steps
U Set	80.0-115.0% in 0.1% steps
U Deadband	0.5-9.0% in 0.1% steps
Deadband Hysteresis	60-90% in 1% steps
(R) Compound Factor	0.0-15.0% in 0.1% steps
X Compound Factor	-15.0-15.0% in 0.1% steps
Voltage Reduction 1	0.0-10.0% in 0.1% steps
Voltage Reduction 2	0.0-10.0% in 0.1% steps
I Comp Limit	0-150% in 1% steps
U High Limit	90.0-120.0% in 0.1% steps
U Low Limit	70.0-110.0% in 0.1% steps
U Low Block	50.0-100.0% in 0.1% steps
Time delay 1	1.0-600.0s in 0.1 steps
Time delay 2	1.0-100.0s in 0.1 steps
Min Delay	1.0-100.0s in 0.1 steps
Reclaim Time	1.0-100.0s in 0.1 steps
Address0 InUse	False, True
Address1 InUse	False, True
Address2 InUse	False, True
Address3 InUse	False, True
UseVLAN	False, True
GroupID	0-4095

Device Address	0-3
Tap Offset	-5-5
Transformer Drop	1.0-30.0% in 0.1% steps
Transformer Sn	1.0-500.0MVA in 0.1MVA steps
Control Drop	1.0-50.0% in 0.1% steps
ControlModel	Direct normal, Direct enhanced, SBO enhanced
sboClass	Operate-once, Operate-many
SBO Timeout	1000-20000ms in 1ms steps
AVR Time Scheduler	
Operation	Disable, Enable
1.Set point (from 0:00)	80.0 - 115.0 % in 0.1% steps
2.Interval Start	0 – 23h in 1h steps
2.Interval Start	0 – 59min in 1min steps
2.Set point	80.0 - 115.0 % in 0.1% steps
3.Interval Start	0 – 23h in 1h steps
3.Interval Start	0 – 59min in 1min steps
3.Set point	80.0 - 115.0 % in 0.1% steps
4.Interval Start	0 – 23h in 1h steps
4.Interval Start	0 – 59min in 1min steps
4.Set point	80.0 - 115.0 % in 0.1% steps
5.Interval Start	0 – 23h in 1h steps
5.Interval Start	0 – 59min in 1min steps
5.Set point	80.0 - 115.0 % in 0.1% steps
6.Interval Start	0 – 23h in 1h steps
6.Interval Start	0 – 59min in 1min steps
6.Set point	80.0 - 115.0 % in 0.1% steps
7.Interval Start	0 – 23h in 1h steps
7.Interval Start	0 – 59min in 1min steps
7.Set point	80.0 - 115.0 % in 0.1% steps
Disturbance recorder	
Operation	Off, On
Resolution	1/1.2 kHz; 2/2.4kHz
Prefault	100-1000ms in 1ms steps
PostFault	100-10000ms in 1ms steps
Max Recording Time	500-10000ms in 1ms steps

TECHNICAL DATA

HARDWARE	
Analog Inputs (Current & Voltage Input Modules)	
Rated current I_n	1A or 5A (selectable)
Rated voltage V_n	110V ($\pm 10\%$)
Rated frequency	50Hz or 60Hz
Overload rating	
Current inputs	20A continuous, 175A for 10s, 500A for 1s, 1200A for 10ms
Voltage inputs	250V continuous, 275V for 1s
Burden	
Phase current inputs	0.01VA at $I_n = 1A$, 0.25VA at $I_n = 5A$
Voltage inputs	0.61VA at 200V, 0.2VA at 100V
Power Supply	
Rated auxiliary voltage	24/48/60VDC (Operative range: 19.2 - 72VDC)
Power consumption	110/220VDC (Operative range: 88 - 264VDC or 80-250VAC) 20W, 25W, 30W, 60W (Depend on type of power supply module)
Binary Inputs	
Input circuit DC voltage	24VDC (Thermal withstand voltage: 72VDC) 48VDC (Thermal withstand voltage: 100VDC) 110VDC (Thermal withstand voltage: 250VDC) 220VDC (Thermal withstand voltage: 320VDC)
Pickup voltage	0.8 U_n
Drop voltage	0.64 U_n
Power consumption	max. 1.6 mA per channel at 220VDC max. 1.8 mA per channel at 110VDC max. 2 mA per channel at 48VDC max. 3 mA per channel at 24VDC
Binary Outputs	
Rated voltage	250VAC/DC
Continuous carry	8A
Maximum switching voltage	400VAC
Breaking capacity	0.2A at 220VDC, 0.3A at 110VDC (L/R=40ms) 2000VA max
Short time carrying capacity	35A for 1s
Operating time	Typically 10ms
Trip Contacts	
Rated voltage	24VDC/48VDC/110VDC/220VDC
Continuous carry	8A
Thermal withstand voltage	72VDC (Rated voltage: 24VDC or 48VDC) 150VDC (Rated voltage: 110VDC) 242VDC (Rated voltage: 220VDC)
Breaking capacity	4A (L/R=40ms)
Making capacity	30A for 0.5s
Operating time	With pre-trip 0.5 ms, without pre-trip typically 10 ms

Analog input module (AIC)	
Measurement method	2 wire inputs
Measurement ranges	± 20 mA, typical 0÷20 mA, 4÷20 mA
Relative accuracy	$\pm 0.5\% \pm 1$ digit
RTD input module	
Measurement method	2, 3 or 4 wire configuration
Sensor type	Pt100/Ni100, Ni120/Ni120US, Pt250/Ni250, Pt1000/Ni1000, Cu10, Service-Ohm(60 Ω ... 1.6 k Ω)
Measurement ranges	-50°C ÷ +150°C
Accuracy	$\pm 0.5\% \pm 1$ digit
Analog output module (ATO)	
Channel number	2 or 4 channel
Output type	2 wire
Maximum load	500 Ω
Output ranges	± 20 mA, typical 0÷20 mA, 4÷20 mA
Mechanical Design	
Installation	Flush mounting
Case	42 or 84 HP (height:3U)
Protection class	IP41 from front side, IP2x from rear side IP54 Rated mounting kit
Key & LED	
Device keys	Capacitive touch keys
Capacitive touch key LEDs	4 pcs yellow, 3 mm circular LEDs indicating touch key actions
Number of configurable LED	16
Device status LED	1 piece three-color, 3 mm circular LED Green: normal device operation Yellow: device is in warning state Red: device is in error state
Local Interface	
Service port on front panel	10/100-Base-T interface with RJ-45 type connector
System Interface	
10/100-Base-TX 100Base-FX	IP56 rated with RJ-45 connector MM/ST 1300 nm, 50/62.5/125 μ m connector, (up to 2 km) fiber MM/LC 1300 nm, 50/62.5/125 μ m connector, (up to 2 km) fiber SM/FC 1550 nm, 9/125 μ m connector, (up to 120 km), with max. 32 dB link attenuation SM/FC 1550 nm, 9/125 μ m connector, (up to 50 km), with max. 27 dB link attenuation
Serial Interface	Plastic optical fiber (ASIF-POF) Glass with ST connector (ASIF-GS) Galvanic RS485/422 (ASIF-G)
PROTECTION & CONTROL FUNCTIONS	
Definite time undervoltage protection (27)	

Pick-up starting accuracy	< $\pm 0,5$ %
Reset time	
U> \rightarrow Un	50 ms
U> \rightarrow 0	40 ms
Operate time accuracy	< ± 20 ms
Minimum operate time	50 ms
Definite time overvoltage protection (59)	
Pick-up starting accuracy	< $\pm 0,5$ %
Reset time	
U> \rightarrow Un	60 ms
U> \rightarrow 0	50 ms
Operate time accuracy	< ± 20 ms
Minimum operate time	50 ms
Automatic tap-changer controller function (90V)	
Voltage measurement	50 % < U < 130 %, accuracy: <1%
Definite time delay accuracy	<2% or ± 20 ms, whichever is greater
Inverse and "2powerN" time delay accuracy	
12 % < U < 25%	<5%
25 % < U < 50%	<2% or ± 20 ms, whichever is greater
MEASUREMENT FUNCTION	
Current	
With CT+/5151; CT+/5153 (Channel 1-3)	Range: 0.05 – 20 In, accuracy: $\pm 0.5\%$, ± 1 digit
With CT+/1500	Range: 0.02 – 2 In, accuracy: $\pm 0.2\%$, ± 1 digit
Voltage	
With VT+/2211	Range: 0.05 – 1.5 Un, accuracy: $\pm 0.5\%$, ± 1 digit
Power (P,Q,S, PF)	
With CT+/5151; CT+/5153 (Channel 1-3)	Range: 0.05 – 20 In, accuracy: $\pm 0.5\%$, ± 1 digit
With CT+/1500	Range: 0.02 – 2 In, accuracy: $\pm 0.2\%$, ± 1 digit
Frequency	
	Range: 40 – 60 Hz (50Hz system); accuracy: ± 2 mHz
	Range: 50 – 70 Hz (60Hz system); accuracy: ± 2 mHz

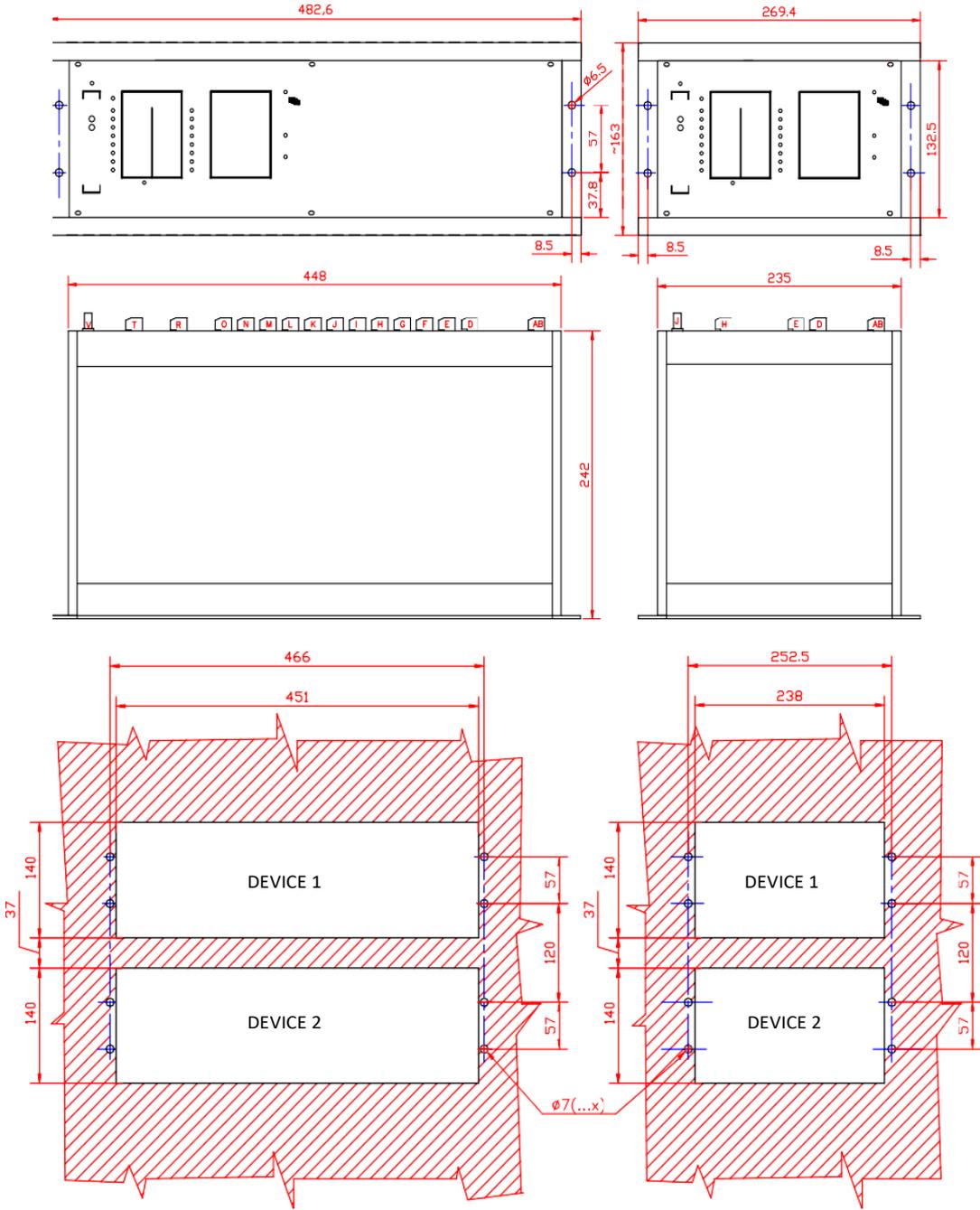


ENVIRONMENTAL PERFORMANCE

Atmospheric Environment		
Temperature	IEC 60068-2-1 IEC 60068-2-2 IEC 60068-2-14	Storage temperature: - 40 °C ... + 70 °C Operation temperature: - 20 °C ... + 55 °C
Humidity	IEC 60255-1 IEC 60068-2-78 IEC 60068-2-30	Humidity: 10 % ... 93 %
Enclosure protection	IEC 60529	IP41 from front side, IP2x from rear side IP54 Rated mounting kit
Mechanical Environment		
Vibration	IEC 60255-21-1	Class I
Shock and bump	IEC 60255-21-2	Class I
Seismic	IEC 60255-21-3	Class I
Electrical Environment		
Dielectric withstand	IEC 60255-27	Test levels: 2 kV AC 50 Hz (0.705 kV DC for transducer inputs)
High voltage impulse	IEC 60255-27	Test levels: 5 kV (1 kV for transducer and temperature measuring inputs)
Insulation resistance	IEC 60255-27	Insulation resistance > 15 GΩ
Voltage dips, interruptions, variations and ripple on dc supply	IEC 60255-26	Voltage dips: 40 % (200 ms), 70 % (500ms), 80 % (5000 ms)
Thermal short time	IEC 60255-27	
Electromagnetic Environment		
Electrostatic discharge	IEC 61000-4-2 IEC 60255-26	Test voltages: 15 kV air discharge, 8 kV contact discharge
Radiated radio frequency electromagnetic field immunity	IEC 61000-4-3 IEC 60255-26	Test field strength: 10 V/m
Electrical fast transient	IEC 61000-4-4 IEC 60255-26	Test voltage: 4 kV, 5kHz
Surge immunity	IEC 61000-4-5 IEC 60255-26	Test voltages: 4 kV line-to-earth, 2 kV line-to-line
Immunity to conducted disturbances, induced by radio-frequency fields	IEC 61000-4-6 IEC 60255-26	Frequency sweep: 150kHz...80 MHz Spot frequencies: 27 MHz, 68 MHz Test voltage: 10 V
Power frequency magnetic field immunity	IEC 61000-4-8 IEC 60255-26	Test field strength: 100 A/m continuous, 1000 A/m for 3 s
Damped oscillatory wave immunity	IEC 61000-4-18 IEC 60255-26	Test frequency: 100 kHz, 1 MHz Test voltage: 2.5 kV in common mode, 1 kV in differential mode

DIMENSION AND PANEL CUT-OUT

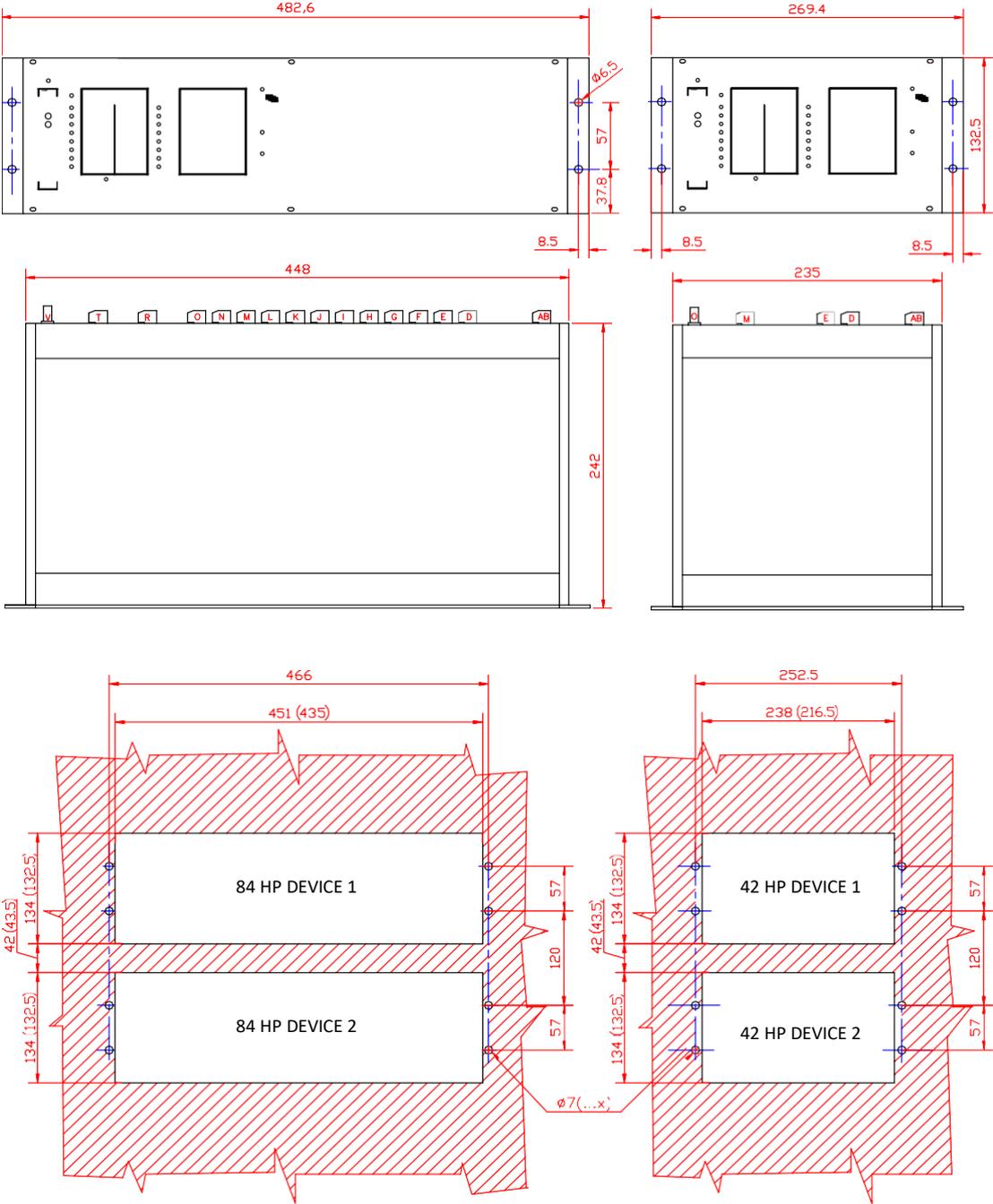
▪ **Flush mounting**



Dimension and panel cut-out for DTRV devices (Flush mounting type)

▪ **Rack mounting**

When rack mounting is used the devices do not have a cover profile fit on. So it is possible to mount them in a 19" rack

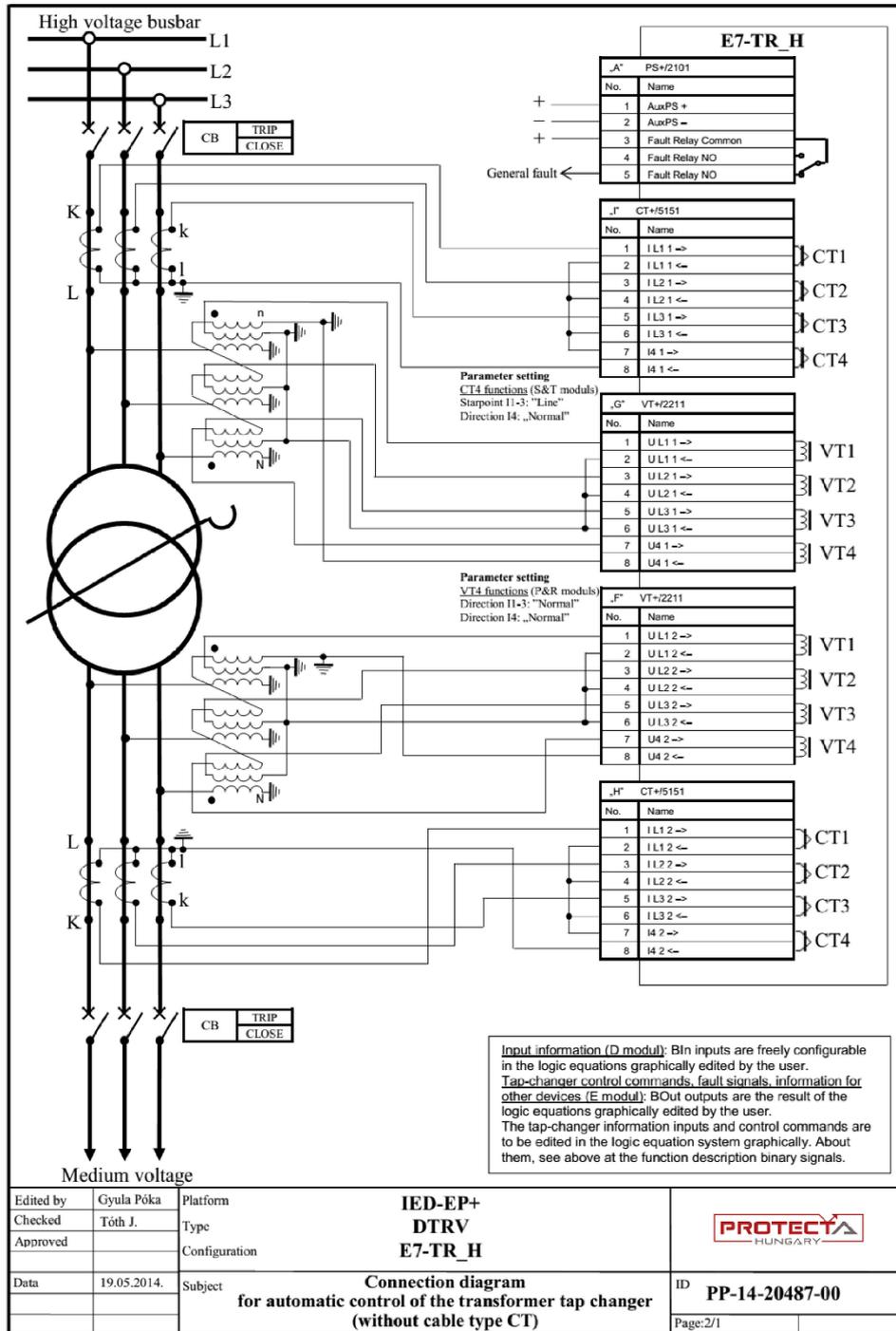


Dimension and panel cut-out for DTRV devices (Rack mounting type)

Note that rack mounting type devices can also be mounted in a cut-out (e.g. on a switchgear door). It is possible to mount them from the front or from the back of the cut-out. The dimensions for rack mounting cut-outs are in the figure below. Dimensions in brackets are applicable in case of mounting from the back.

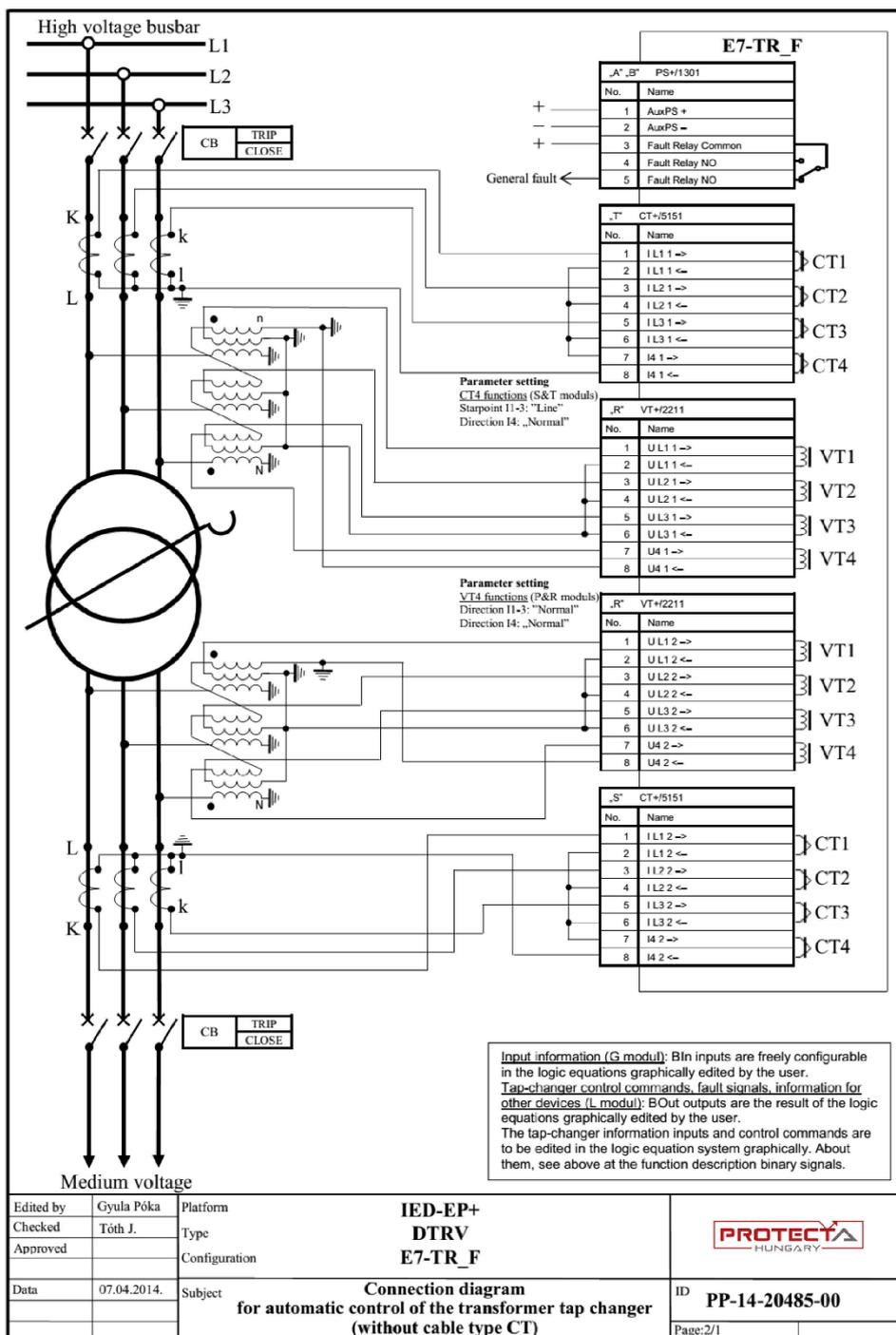
EXTERNAL CONNECTION DIAGRAM

E7-TR_H (42TE)



Typical connection diagram for E7-TR_H (42TE) automatic voltage regulator

E7-TR_F (84TE)



Typical connection diagram for E7-TR_F (84TE) automatic voltage regulator

CONTACT

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