

PRODUCT PORTFOLIO



PROTECTION, AUTOMATION AND
CONTROL FOR POWER INDUSTRY





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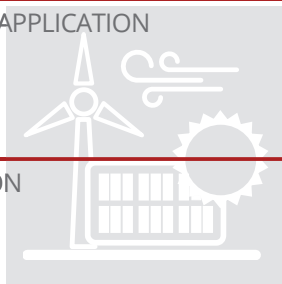
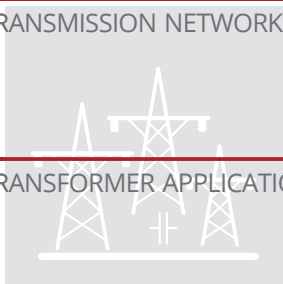
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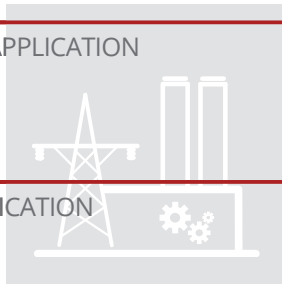
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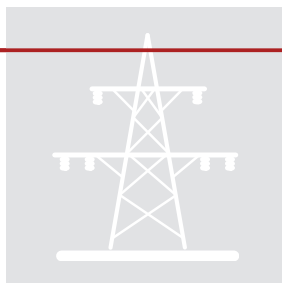
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PROTECTA OFFERS A COMPREHENSIVE SCALE OF FUNCTIONALITY AND HARDWARE OPTIONS TO MEET YOUR PROTECTION, AUTOMATION AND CONTROL REQUIREMENTS; OUR WIDE PRODUCT RANGE GUARANTEES THE MOST COST-EFFECTIVE SOLUTION FOR YOUR APPLICATION.

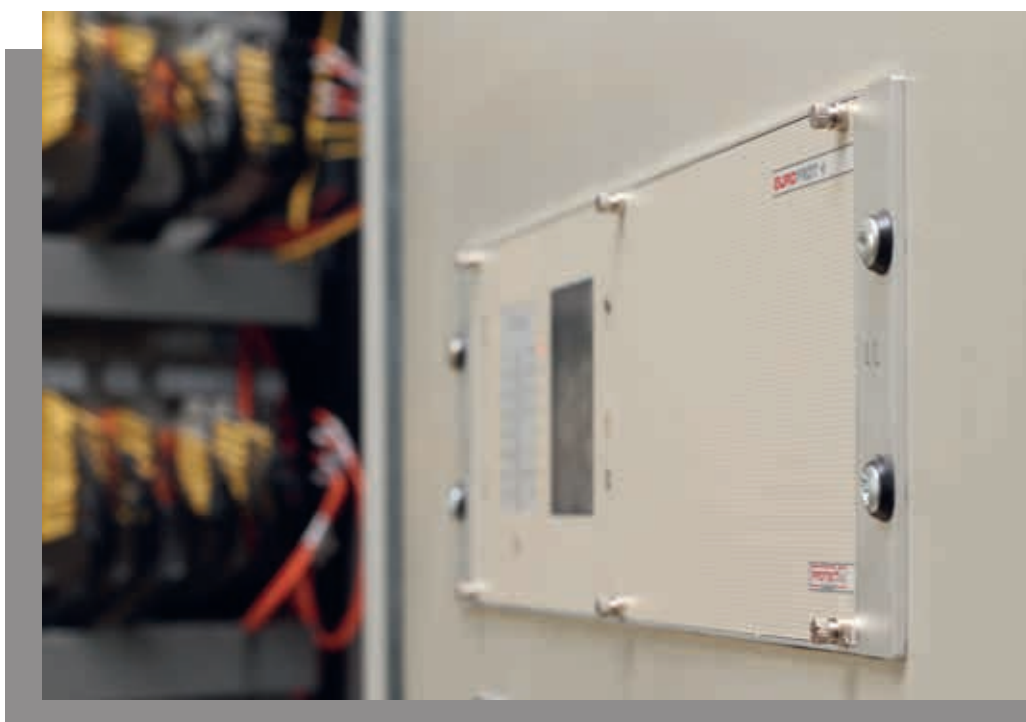
Protecta Ltd. offers intelligent electronic devices (IEDs) for fault protection and for the control of low-, medium- and high-voltage electric power networks. The EuroProt+ product family of IEDs produced by Protecta Ltd. draws on more than 60 years' experience in the field of efficient protection relaying.

The EuroProt+ family complex protection – in respect of hardware and software – is a modular device. Thanks to this modular design it ensures completely customized solution for your needs in the power energy system throughout the life cycle of the device. The modular design allows easy configuration and facilitates future upgrades.

Our Smart Line protection and control relays have been designed to be the main or back-up protection in utility and industrial power system. Smart Line includes the IEDs of the S24 and the S16 series. The Smart Line devices provide an optimized range of protection, monitoring and control functions in a space-saving enclosure, bearing in mind cost-effective implementation.

Tailor-made products to meet even the most demanding user requirements

- ☑ Scalable hardware to adapt to different applications;
- ☑ Flexible protection and control functionality to meet special customer requests and to provide easy upgrade solutions;
- ☑ Because of the customer-focused design in the hardware and the software, the product provides easy-to-handle hardware and software engineering throughout the IED lifecycle;
- ☑ Advanced HMI functionality via color touchscreen and embedded WEB server, extended measuring, control and monitoring functions;
- ☑ The pre-defined factory configuration can be customized to the user's specification with the powerful EuroCAP tool.





RELIABLE, SECURE AND TAILOR-MADE SOLUTION

- ☑ Built-in self-supervisory function minimizes the risk of device malfunctions;
- ☑ Straightforward integrity in retrofit applications;
- ☑ Thanks to the modular architecture in HW and functions, the IEDs are assembled and configured according to the user's requirements;
- ☑ Because of the control, measuring and monitoring functions implemented, the IED can also be used as a bay control unit;
- ☑ Integrated advanced cyber security – Conformity with the Cyber Security requirements;
- ☑ Handling several communication protocols simultaneously.



Flexible, Interoperable & Secure

COMMUNICATION

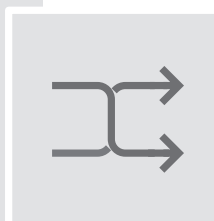
Flexible communication capabilities

- ☑ The relays provide one front port for engineering purposes and several rear communication ports for remote access;
- ☑ The EuroProt+ device family and the S24 Smart Line series support 61850 natively;
- ☑ The EuroProt+ family and the S24 IEDs can handle a comprehensive range of serial or Ethernet-based communications protocols – several parallel communication channels:
 - Serial communication: DNP3.0; IEC 60870-5-101/103; MODBUS, SPA;
 - Ethernet-based communication: IEC61850; IEC 60870-5-104; DNP3.0 TCP; Modbus TCP;
- ☑ 2 independent Ethernet or serial protocols handled in one channel simultaneously;
- ☑ Seamless redundancy protocols PRP, HSR with EuroProt+ family and S24 smart line series.

1101 1010	0110 1011
1110 1011	0101 0110
0110 1011	1001 1101
1011 1100	1010 1100
0110 1011	1101 1010
0101 0110	1110 1011
1001 1101	0110 1011
1010 1100	1011 1100

Interoperability and easy integration solutions

- ☑ Straightforward integration in retrofit applications;
- ☑ Native IEC 61850 IED with Edition 2 compatibility;
- ☑ Interoperability in compliance with IEC 61850 Edition 1 and Edition 2.



Enhanced security features

These enhanced cyber security features have been developed in accordance with NERC-CIP, IEEE 1686, BDEW Whitepaper and IEC 62351-8 standards and recommendations:

- ☑ Secure software update with digital signatures;
- ☑ Encrypted communication protocol available such as HTTPS in order to increase security of data transfer;
- ☑ Configurable Role-Based Access Control (RBAC) with optional remote LDAP server authentication - "CyberProtect" feature;
- ☑ Non-erasable security log for logging of all security-relevant events with optional remote log server reporting through syslog protocol;
- ☑ Security alarm indication;
- ☑ Secure configuration via digitally signed configuration file (.epcs);
- ☑ User password requirement according to the IEEE 1686 standard;





MONITORING AND SUPERVISION CAPABILITY

Secure communication

- ☑ Built-in self-monitoring to detect internal hardware or software errors and thus to minimize the risk of device malfunctions;
- ☑ The relevant information of the self-diagnostics is stored in various log files to help in problem analysis. This can be useful during problem analysis and in designing the appropriate corrective actions.

Equipment condition monitoring

Condition monitoring of primary equipment such as CB, transformer gas or temperature can efficiently help the process of operation and maintenance.

- ☑ CB wear monitoring;
- ☑ Oil or gas insulated switchgear pressure monitoring;
- ☑ Transformer oil temperature monitoring.

Secondary circuit supervision

- ☑ Enhanced breaker monitoring and control;
- ☑ The heavy-duty tripping contacts are integrated with a trip circuit supervision function. An alarm signal can be generated if an interruption is detected in the trip circuit;
- ☑ Monitors the secondary circuits (current and voltage circuits) and detects any abnormal condition in them.

Power system quality monitoring

The EuroProt+ devices are able to monitor and detect current and voltage harmonics, short-duration system disturbances and voltage unbalances:

- ☑ Harmonics contents of each voltage and current channel;
- ☑ Current total demand distortion (TDD);
- ☑ Voltage total harmonic distortion (THD);
- ☑ Sags (Dips), Swells and Interrupts;
- ☑ Voltage unbalance conditions.



EVENT & DISTURBANCE RECORDING FEATURES

- ☑ High capability event recording with 1 ms timestamp (storage capacity of more than 10 000 events with the EuroProt+ family and the S24 series);
- ☑ Integrated disturbance recorder (in EuroProt+ family and S24 series) for up to 32 analogue and 64 digital signal channels (sampling rate 20 or 40 samples/cycle, software selectable). The records can be read out from the IED in the standard COMTRADE file format or even examined on-line;
- ☑ Depending on the chosen standard configuration, integrated fault locator for fault impedance and distance-to-fault calculation is available.





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 customizable.

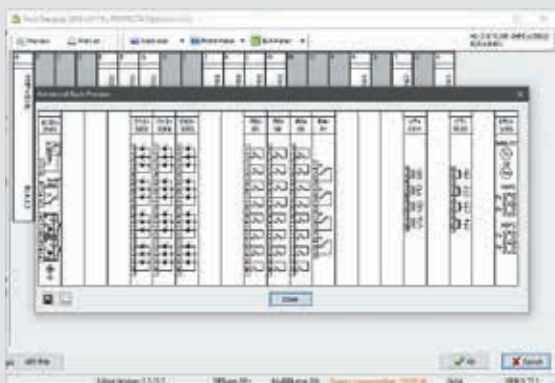
It can be used with the EuroProt+ product family and the S24 Smart Line series.



MODULES INCLUDED

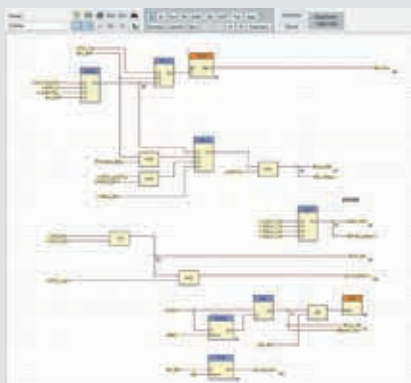
HW configuration

- ☒ View the existing 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.



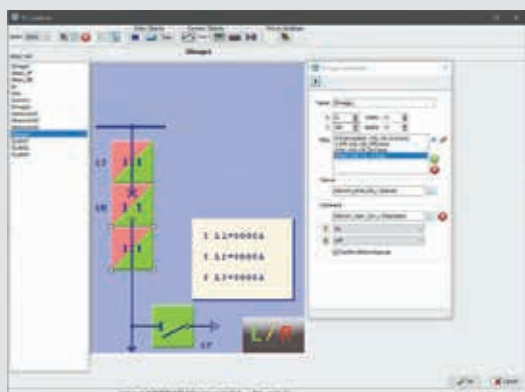
Logic editor

- ☒ Create/manage logical sheets;
- ☒ Factory pre-configured logical schemes to speed up your commissioning process.



LCD configurator (available for 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).



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 communication;
- ☒ GOOSE configuration between IEDs.



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 xlsx format;
- ☒ Generate and save parameters in RIO file generation for distance protection testing.

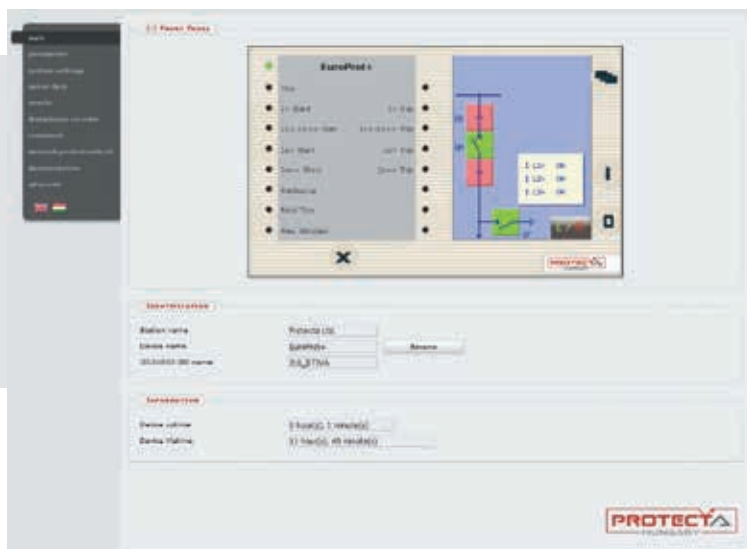
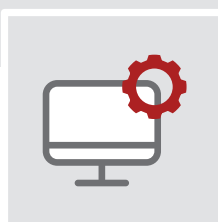
Communication configurator

Generate documentation of the configured IED automatically, which contains the actual connection assignment, on-line measurements, recorded event channels, recorded disturbance channels, LED assignment, logical sheets, relevant communication settings and collect the protection, control and monitoring parameters.



REMOTE USER INTERFACE

The EuroProt+ devices communicate on standard Ethernet networks; parameter setting can be performed using any "standard" browser (Google Chrome, Internet Explorer, Mozilla Firefox, etc.).



S16 SOFTWARE TOOL

The S16 series is mainly designed for sub-distribution applications. In addition it has dedicated motor protection functions for industrial applications.

In accordance with the entry-level, ready-to-use design concept of the S16 series, only application-specific parameters need to be set during the relay's engineering process.

The S16 software tool is a user-friendly, free-of-charge engineering tool for the S16 series. All relay settings and parameters are defined via the S16 software tool.

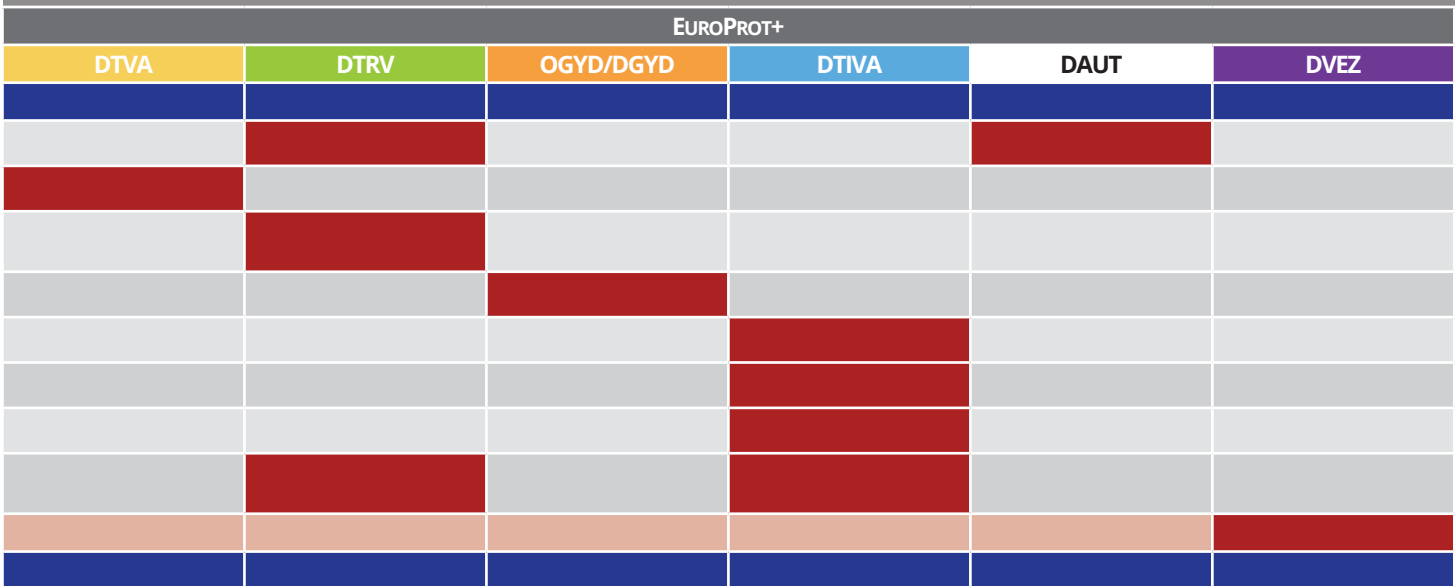
When the user's PC is connected to the device via the USB interface, the device is automatically detected. It is also possible to access the relay parameters through the ASIF interface on the back of the IED using a substation engineering computer. Parameters and events can be also uploaded and stored on the user's computer.



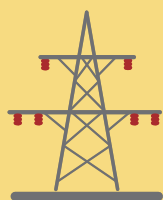


TITLE	SMART LINE	
TYPE	S16 SERIES	S24 SERIES
Field of application		
Power plants generator, transformer protection and control, autosynchroniser		
Transmission lines distance and line differential, protection and autorecloser		
Transformers protection and control, automatic voltage regulator, arc suppression, coil controller, inrush current minimizer, auto-changeover		
Busbar busbar protection, automatic bus transfer		
Distribution networks feeder, capacitor bank protection and control, load shedding		
Industry applications incoming feeder, motor and small generator protection and control		
Railway applications railway catenary and transformer protection and control		
Renewable energy protection against island operation, reverse power flow, inverter control, small generator protection		
Bay control		
Main features		
Power supply	Universal AC/DC power supply module as well as self-power option	Wide range of selectable PS modules
Analog inputs	Conventional	Conventional and/or sensor
Binary inputs	Universal programmable voltage threshold	Wide range of binary input rated voltages
Case type	<ul style="list-style-type: none"> 16HP wide, fix I/O arrangement Din-rail mounting option 	<ul style="list-style-type: none"> 24HP wide, limited module variations (Input / Output quantity selectable based on requirements) Din-rail mounting option
Local HMI	<ul style="list-style-type: none"> 128 x 64 pixel monochrome, with white backlight display 8 programmable + 1 status LED USB 2.0 front port for programming Multi-language HMI 	<ul style="list-style-type: none"> Default 128 x 64 pixel monochrome display optional 3.5" TFT display with resistive touchscreen interface 16 programmable+ 1 status LED Front RJ-45 user interface for programming
Local Command and Control		Controllable object definition on the optional TFT display with customizable user screens
Communication	<ul style="list-style-type: none"> IEC 60870-5-101 IEC 60870-5-103 	<ul style="list-style-type: none"> IEC 61850 Serial protocols (IEC 60870-5-101/103, Modbus RTU, DNP3, ABB-SPA) Network protocols (IEC 60870-5-104, DNP3, Modbus-TCP)
Time synchronization	<ul style="list-style-type: none"> Legacy protocol master Minute pulse IRIG-B000 or IRIG-B12X 	<ul style="list-style-type: none"> NTP server Legacy protocol master Minute pulse IRIG-B000 or IRIG-B12X
Supervision	<ul style="list-style-type: none"> Built-in self supervision CT/VT supervision Built-in trip contact supervision (TCS) 	<ul style="list-style-type: none"> Built-in self supervision CT/VT supervision Trip value recording Built-in trip contact supervision (TCS)
Fault analysis	<ul style="list-style-type: none"> Event recorder with 1 ms timestamp up to 1000 events 	<ul style="list-style-type: none"> High capability event recording with 1 ms timestamp (more than 10 000 events stored) Integrated disturbance recorder for up to 32 analogue and 64 digital signal channels (sampling rate 20 or 40 samples/cycle)
Programming interface	<ul style="list-style-type: none"> Local HMI S16 software tool 	<ul style="list-style-type: none"> Local HMI EuroCAP configuration tool Web browser
Special modules	S16 Self-Power Unit: external unit for the S16 series for allowing them to operate without DC power supply.	

Remote I/O (RIO) server is an IED which provides remote binary inputs and outputs at a distance from an EuroProt+ protection device. It communicates with the EP+ device via COM+1335 module, MODBUS/TCP protocol.



- Detachable display
- Remote I/O unit
- RTD
- mA inputs



TRANSMISSION LINE AND CABLE PROTECTION, CONTROL AND MONITORING

THE DTVA PRODUCT TYPE IS CONFIGURED TO PROTECT, CONTROL AND SUPERVISE THE ELEMENTS OF THE TRANSMISSION NETWORK, WHERE SYSTEMS ARE TYPICALLY SOLIDLY GROUNDED. IN THESE NETWORKS SINGLE PHASE-TO-GROUND FAULTS RESULT IN HIGH FAULT CURRENT, SIMILAR TO LINE-TO-LINE FAULTS; THEREFORE, BOTH TYPES OF FAULTS NEED FAST PROTECTION FUNCTIONS.



TRANSMISSION LINE PROTECTION, CONTROL AND AUTOMATION

					EUROProt+	
	FAMILY				DTVA	
	TYPE					
	CONFIGURATION				E1	E2
HARDWARE	CT inputs				4	4
	VT inputs				4	4
	Digital inputs (max)				128	128
	Signaling relay outputs (max)				60	60
	Fast Trip outputs (max)				12	12
FUNCTIONALITY	Function name	IEC	ANSI	INST.*	E1	E2
	Distance protection HV	Z <, FL	21	1	■	■
	Switch onto fault preparation function			1	■	■
	Synchrocheck	SYNC	25	1	■	■
	Definite time undervoltage protection	U <, U <<	27	2	■	■
	Directional overpower	P >	32	2	■	■
	Directional underpower	P <	37	2	■	■
	Negative sequence overcurrent protection	I2 >	46	1	■	■
	Broken conductor protection	I2/I1	46BC	1	■	■
	Negative sequence overvoltage protection	U2 >	47	2	■	■
	Thermal protection	T >	49	1	■	■
	Three-phase instantaneous overcurrent protection	I >>>	50	1	■	■
	Residual instantaneous overcurrent protection	I0 >>>	50N/50G	1	■	■
	Breaker failure protection	CBFP	50BF	1	■	■
	Three-phase time overcurrent protection	I >, I >>	51	2	■	□
	Residual time overcurrent protection	I0 >, I0 >>	51N/51G	2	■	□
	Definite time overvoltage protection	U >, U >>	59	2	■	■
	Residual overvoltage protection	U0 >, U0 >>	59N	2	■	■
	Fuse failure (VTS)		60	1	■	■
	Current unbalance protection		60	1	■	■
	Three-phase directional overcurrent protection	I Dir >, I Dir >>	67	2	■	■
	Residual directional overcurrent protection	I0 Dir >, I0 Dir >>	67N/67G	2	■	■
	Power swing detection	ΔZ/Δt	68	1	■	■
	Inrush detection and blocking	I2h >	68	1	■	■
	Out-of-step/Pole slip	ΔZ/Δt	78	1	■	■
	Auto-reclose HV	0 → 1	79	1	■	■
	Overfrequency protection	f >, f >>	81O	2	■	■
	Underfrequency protection	f <, f <<	81U	2	■	■
	Rate of change of frequency protection	df/dt	81R	2	■	■
	Line differential protection	3IdL >	87L	1		■
	Busbar sub-unit				□	
	Bay control & supervision functions			1	■	■
	Teleprotection		85	1	■	■

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

■ : Standard

□ : Optional



MAIN FEATURES

Five independent distance protection zones with polygon-shaped or MHO characteristics:

- ☑ Load encroachment characteristics;
- ☑ Analogue input processing is applied to the zero sequence current of the parallel line;
- ☑ The complex earth-fault compensation factor is applied for the correct impedance measurement of single-phase-to-earth faults;
- ☑ The power swing detection function can block the distance protection function in case of stable swings, or it can generate a trip command if the system operates out of step;
- ☑ Numerous transfer tripping schemes available (PUTT, POTT, DUTT, Directional Comparison or Blocking, etc.);
- ☑ Current reversal and weak-end infeed logic.

Phase-selective line differential protection:

- ☑ Adaptive restraint characteristics provide stability against CT saturation detection;
- ☑ Optional redundant communication via two physical links in 2-end topology;
- ☑ 3-end topology handling;
- ☑ Optional capacitive charging current compensation;
- ☑ Wide range of communication schemes supported: dedicated fiber optic channel, pilot wire, communication networks using G703.1 (64 kbit/s);
- ☑ Transformer can be placed in the protected zone;
- ☑ 1-/3-phase tripping and support for double breaker terminals such as breaker and a half or ring bus topologies;
- ☑ 12 binary signals can be transmitted.

Autoreclosing up to four shots:

- ☑ Dead times can be set individually for each reclosing sequence separately for single-phase faults and for multi-phase faults.

SCOPE OF APPLICATION

- ☑ The main application is transmission overhead line and underground cable protection (including series-compensated lines);
- ☑ 1-/3-phase tripping and support for double breaker terminals such as breaker and a half or ring bus topologies.
- ☑ Back-up protection for transformers, lines, generators, motors, busbars;
- ☑ Switchgear automation and control with synchro-check / synchro-switch capability;
- ☑ Optional decentralized busbar protection sub-unit application in the E1-Line version.

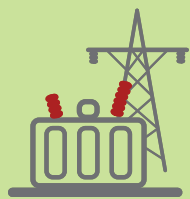
MEASURING AND RECORDING

- ☑ High capability event recording with 1 ms timestamp (more than 10 000 events can be stored);
- ☑ Integrated disturbance recorder for up to 32 analogue and 64 digital signal channels (sampling rate 20 or 40 samples/cycle);
- ☑ Integrated fault locator for fault impedance and distance-to-fault calculation;
- ☑ Metering: currents (IL1, IL2, IL3, Io), voltages (UL1, UL2, UL3, UL12, UL23, UL31, Uo, Useq), power components (P, Q, S, p), energy (E+, E-, Eq+, Eq-), harmonics (Ii; Ui), symmetrical components (Uo, U1, U2, Io, I1, I2) etc.

BAY CONTROL & SUPERVISION FUNCTIONS

- ☑ Switchgear control with User-definable interlocking;
- ☑ Current transformer supervision;
- ☑ Voltage transformer supervision;
- ☑ Circuit breaker wear monitoring;
- ☑ Built-in trip circuit supervision (TCS).





TRANSFORMER PROTECTION AND CONTROL, AUTOMATIC VOLTAGE REGULATOR

FOR PROTECTION AND CONTROL APPLICATIONS OF POWER TRANSFORMERS PROTECTA OFFERS A COMPREHENSIVE RANGE OF IEDs FROM ENTRY-LEVEL, COST-EFFECTIVE RELAYS TO CUTTING-EDGE, TAILOR-MADE DEVICES TO MEET THE USERS' MOST DEMANDING REQUIREMENTS.

The dedicated devices are designed to be the main protection and control IED for two- and three-winding power transformers, including auto-transformers and special railway transformers. The protection relays provide a variety of versatile protection functions along with the main transformer differential protection, such as phase, earth and negative sequence overcurrent protection, thermal overload protection, restricted earth fault protection etc. It can also be used as a back-up protection relay for downstream equipment (e.g. feeders, cables).

A voltage regulator can be integrated in the same device together with the protection functions or in a stand-alone IED.

The voltage control function can be performed automatically or, in manual mode of operation, the personnel of the substation can set the network voltage according to special requirements. The intelligent voltage control function can handle up to 4 parallel transformers depending on the minimum circulating current or master-slave principles. Because of the control, measuring and monitoring functions implemented, the IED can also be used as a bay control unit.



KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Three-phase transformer differential protection:
 - Automatic phase shift and turns ratio compensation of the transformer;
 - 2nd and 5th harmonics restraint for transformer inrush and overexcitation detection;
 - Residual current elimination feature is available if there is a neutral grounding transformer in the protected zone on the secondary side of the transformer;
- ☑ Sensitive restricted earth-fault protection (the number of the REF elements is selected when the order is placed);
- ☑ Several voltage-based protection functions are available through the three-phase voltage measurement;
- ☑ Voltage regulation with automatic tap changer controller (integrated in the protection IED or stand-alone version):
 - For up to 4 parallel transformers depending on the minimum circulating current or master-slave principles;
 - For up to 4 parallel transformers depending on the minimum circulating current or master-slave principles;
 - Type of binary input coding: binary, BCD, Grey;
- ☑ Optional external units:
 - 28 input / 5 output tap changer transcoder (TRCS);
 - Remote I/O unit (RIO);
- ☑ Optional transducer I/Os (RTD/mA);
- ☑ Optional impedance based protection.



TRANSFORMER PROTECTION AND CONTROL | AUTOMATIC VOLTAGE REGULATOR

	FAMILY				EUROProt+									SMART LINE	
	TYPE				DTRV									S24 SERIES	
	CONFIGURATION				E0	E1	E2	E3	E4	E5	E6	E7	E8	Var.5	Var.7
HARDWARE	CT inputs				4	8	8	8	12	12	12	4+4 (op.)	4	8	4
	VT inputs						4	4		4	8	4+4 (op.)	4	4	
	Digital inputs (max)				128	112	112	112	100	100	88	128	128	20	20
	Signaling relay outputs (max)				60	60	60	60	60	60	60	60	60	14	14
	Fast Trip outputs (max)				12	12	12	12	12	12	12	12	12	2	2
FUNCTIONALITY	Function name	IEC	ANSI	INST.*	E0	E1	E2	E3	E4	E5	E6	E7	E8	Var.5	Var.7
	Impedance protection	Z <	21	1									■		
	Overexcitation	V/Hz	24	1			■	■		■	■		■		
	Definite time undervoltage protection	U <, U <<	27	2			■	■		■	■	■	■		
	Negative sequence overcurrent protection	I2 >	46	1	■	■	■	■	■	■	■		■	■	
	Negative sequence overvoltage protection	U2 >	47	1			■	■		■	■				
	Thermal protection	T >	49	1	■	■	■	■	■	■	■			■	
	Three-phase instantaneous overcurrent protection	I >>>	50	2/3	2	2	2	2	3	3	3			2	■
	Residual instantaneous overcurrent protection	I0>>>	50N/50G	2/3	2	2	2	2	3	3	3			2	
	Breaker failure protection	CBFP	50BF	2/3	2	2	2	2	3	3	3			2	
	Three-phase time overcurrent protection	I >, I >>	51	2/3	2	2	2	2	3	3	3		2	2	■
	Residual time overcurrent protection	I0 >, I0 >>	51N/51G	2/3	2	2	2	2	3	3	3		2	2	
	Definite time overvoltage protection	U >, U >>	59	2			■	■		■	■	■	■		
	Residual overvoltage protection	U0 >, U0 >>	59N	2			■	■		■	■		■		
	Current unbalance protection		60	2/3	2	2	2	2	3	3	3		2	2	
	Three-phase directional overcurrent protection	I Dir >, I Dir >>	67	2	■										
	Residual directional overcurrent protection	I0 Dir >, I0 Dir >>	67N/67G	2	■		■	■		■	■		■		
	Inrush detection and blocking	I2h >	68	1	■									■	
	Overfrequency protection	f >, f >>	81O	2			■	■		■	■				
	Underfrequency protection	f <, f <<	81U	2			■	■		■	■				
	Rate of change of frequency protection	df/dt	81R	2			■	■		■	■				
	Restricted earth fault protection	REF	87N	2/3	2	2	2	2	3	3	3		2		
	Restricted earth fault protection (high-impedance)	REF	87N	1											■
	Transformer differential protection	3IdT >	87T	1		2w	2w	2w	3w	3w	3w			2w	
	Transformer differential protection (high-impedance)	3IdT >	87T	1											■
	Automatic voltage regulator (AVR) / tap change control		90V					■			■	■			
	Bay control & supervision functions				2	2	2	2	3	3	3	■	2	2	

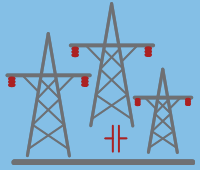
* The 'INST.' column contains the minimum numbers of the pre-configured function blocks in the factory configuration. These numbers may be different in order to meet the user's requirements.
2/3 means 2 INST. for 2w and 3 INST. for 3w transformers.

■ : Standard
□ : Optional





FEEDER PROTECTION & CONTROL



THE EUROPROT+ DTIVA TYPE AND THE DEDICATED SMART LINE S24 & S16 PRODUCTS ARE CONFIGURED TO PROTECT, CONTROL AND SUPERVISE ELEMENTS OF THE UTILITY AND INDUSTRIAL DISTRIBUTION SYSTEMS, INCLUDING RADIAL, LOOPED AND MESHED DISTRIBUTION NETWORKS.

The main areas of application are the not solidly grounded radial networks. Here the application of Petersen coils or grounding resistances results in relatively low currents in case of single phase-to-ground faults. The majority of the protections are based on current measurements only, but the application of distributed generation or loops in the network topology require additional voltage measurement and directional protection functions. The distance and line differential protections are also available to protect compensated or isolated networks.

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Basic non-directional 3Ph+Io overcurrent protection;
- ☑ Directional 3Ph+Io overcurrent, over- and undervoltage, frequency protection are also available;
- ☑ Sensitive directional ground-fault detection for static ground faults;
- ☑ Optional sensitive directional ground-fault detection for transient earth faults;
- ☑ The distance and line differential protections are also capable of protecting compensated or isolated networks:
 - Cross country fault handling with phase preference definition;
 - Special two phases + Io line differential protection to protect non-effective grounding systems.
- ☑ Power quality functions: voltage variation, voltage unbalance, harmonics for voltage and current up to 19th, THD (Total Harmonic Distortion), TDD (Total Demand Distortion).



SCOPE OF APPLICATION

- ☑ Protection against islanding operation for wind farm and photovoltaic applications;
- ☑ Main or back-up protection of overhead lines and cables on distribution networks (or HV systems);
- ☑ Back-up protection for transformers, lines, generators, motors, busbars of all voltage levels;
- ☑ Optional decentralized busbar protection sub-unit application in EuroProt+ devices;
- ☑ Bay control unit application capability in EuroProt+ & S24.

HARDWARE

FUNCTIONALITY

Function name

Distance protection MV
Overexcitation
Synchrocheck
Definite time undervoltage protection
Directional overpower
Directional underpower (low forward power)
Negative sequence overcurrent protection
Broken conductor protection
Negative sequence overvoltage protection
Thermal protection line
Three-phase instantaneous overcurrent protection
Residual instantaneous overcurrent protection
Breaker failure protection
Three-phase time overcurrent protection
Residual time overcurrent protection
Voltage dependent overcurrent protection
Definite time overvoltage protection
Residual overvoltage protection
Fuse failure (VTS)
Current unbalance protection
Three-phase directional overcurrent protection
Residual directional overcurrent protection
Inrush detection and blocking
Auto-redose MV
Overfrequency protection
Underfrequency protection
Rate of change of frequency protection
Vector jump
Line differential
Restricted earth fault
Transformer differential
Busbar sub-unit
Bay control

* The 'INST.' column contains the minimum numbers

■ : Standard
□ : Optional



DISTRIBUTED FEEDER PROTECTION, CONTROL AND AUTOMATION

FAMILY			EUROProt+							SMART LINE								
TYPE			DTIVA							S24 SERIES				S16 SERIES				
CONFIGURATION			E1	E2	E3	E4	E5	E6	E8	E9	Var.1	Var.2	Var.3	Var.4	Var.6	Var.1	Var.3	Var.5
CT inputs			4	4	4	4	4	4		4	4	4	4	4		4		4
VT inputs				4	4	4	4	4	4	4		4	4		4		4	1
Digital inputs (max)			136	128	128	128	128	128	136	128	20	20	20	20	20	4	4	4
Signaling relay outputs (max)			60	60	60	60	60	60	60	60	14	14	14	14	14	5	5	5
Fast Trip outputs (max)			12	12	12	12	12	12	12	12	2	2	2	2	2	2	2	2
IEC	ANSI	INST.*	E1	E2	E3	E4	E5	E6	E8	E9	Var.1	Var.2	Var.3	Var.4	Var.6	Var.1	Var.3	Var.5
Z <, FL	21	1				■		■					■					
V/Hz	24	1										■						
SYNC	25	1			■	■		■	■				■		■			
U <, U <<	27	2		■	■	■	■	■	■	■		■	■		■		■	
P >	32	1		■	■	■		■		■								
P <	37/32LF	1		■	■	■		■		■								
I2 >	46	1	■	■	■	■	■	■			■	■	■	■		■		■
	46BC		■	■	■	■	■	■		■	■	■	■	■				
U2 >	47	1		■	■	■		■				■	■				■	
T >	49	1	■	■	■	■	■	■			■	■	■	■		■		■
I >>>	50	1	■	■	■	■	■	■			■	■	■	■		■		■
IO >>>	50N/50G	1	■	■	■	■	■	■			■	■	■	■		■		■
CBFP	50BF	1	■	■	■	■	■	■		■	■	■	■	■		■	■	■
I >, I >>	51N	2	■	■	■	■	■	□		■	■	■	■	■		■		■
IO >, IO >>	51N/51G	2	■	■	■	■	■	□		■	■	■	■	■		■		■
I > U <	51V	1										■						
U >, U >>	59	2		■	■	■	■	■	■	■		■	■		■		■	
Uo >, Uo >>	59N	2		■	■	■	■	■	■	■		■	■		■		■	■
	60	1			■	■		■				■						
	60	1	■	■	■	■	■	■		■	■	■	■	■				
I Dir >, I Dir >>	67	2			■	■	■	■				■	■					
Io Dir >, Io Dir >>	67N/67G	2		■	■	■	■	■				■	■					■
I2h >	68	1	■	■	■	■	■	■			■	■	■	■		■		■
0 → 1	79	1	■	■	■	■	■	■			■	■	■	■				
f >, f >>	81O	2			■	■		■	■	■		■	■		■		■	
f <, f <<	81U	2			■	■		■	■	■		■	■		■		■	
df/dt	81R	2			■	■		■	■	■		■	■		■		■	
ΔφU>		1								■		■					■	
3IdL >	87L	1					■	■						■				
REF	87N	1					□					□						
3IdT >	87T	1					□											
			□	□	□													
			■	■	■	■	■	■		■								

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



GENERATOR PROTECTION

THE MAIN EUROProt+ FAMILY AND THE SMART LINE SERIES ALSO PROVIDE GENERATOR PROTECTION DEVICES.

POWER GENERATION APPLICATION									
HARDWARE	FAMILY				EUROProt+				SMART LINE
	TYPE				DGEN (DTRV)				S24 SERIES
	CONFIGURATION				E9	E10	E11	E12	Var.2
	CT inputs				8+4 (op.)	8+4 (op.)	12+4 (op.)	12+4 (op.)	4
	VT inputs				4+3 (op.)	7	4+3 (op.)	7	4
FUNCTIONALITY	Digital inputs (max)				96	96	96	96	12
	Signaling relay outputs (max)				60	60	60	60	10
	Fast Trip outputs (max)				12	12	12	12	2
	Function name	IEC	ANSI	INST.*	E9	E10	E11	E12	Var.2
	Impedance protection	Z <	21	1	■	■	■	■	
	Overexcitation	U/f	24	1	■	■	■	■	■
	Automatic generator synchronizer	SYNC	25G	1		■		■	
	Synchrocheck	SYNC	25	1	□	■	□	■	
	Definite time undervoltage protection	U <, U <<	27	2	■	■	■	■	■
	Third harmonic neutral undervoltage protection	U3h <	64/27TN	1	□	□	□	□	
	Wattmetric earth fault protection	Po >	32N	1	■	■	■	■	
	Directional overpower protection	P >	32	1	■	■	■	■	□
	Reverse power protection	-P >	32R	1	■	■	■	■	
	Directional underpower (low forward power) protection	P <	37/32LF	1	■	■	■	■	□
	Temperature (RTD) monitoring		38/49T	4	□	□	□	□	
	Loss of excitation / Loss of field (X-based)	X <	40Q	2	■	■	■	■	
	Loss of excitation / Loss of field (Z-based)	Z <	40Z	2	□	□	□	□	
	Negative sequence overcurrent protection	I2 >	46	1	■	■	■	■	■
	Negative sequence overcurrent protection for generators	I2 >	46G	1	■	■	■	■	■
	Negative sequence overvoltage protection	U2 >	47	1	■	■	■	■	■
	Thermal protection line	T >	49	1	■	■	■	■	■
	Breaker failure protection	CBFP	50BF	1	■	■	■	■	■
	Three-phase instantaneous overcurrent protection	I >>>	50	1/2/3	2	2	3	3	1
	Residual instantaneous overcurrent protection	Io >>>	50N/50G	1/2/3	2	2	3	3	1
	Inadvertent/accidental energizing protection	I >>> U <	50V/27AE	1	■	■	■	■	
	Three-phase time overcurrent protection	I >, I >>	51	2/3	2	2	3	3	2
	Residual time overcurrent protection	Io >, Io >>	51N/51G	2/3	2	2	3	3	2
	Interturn fault protection (split phase/current based)	Ii >	50SP	1	□	□	□	□	
	Voltage dependent overcurrent protection	I > U <	51V	1	■	■	■	■	■
	Definite time overvoltage protection	U >, U >>	59	2	■	■	■	■	■
	Residual overvoltage protection	Uo >	59N	2	■	■	■	■	■
	Start-up residual overvoltage protection	Uo > start	59NS	1	■	■	■	■	
	Interturn fault protection (single-winding, voltage based)	Ui >	59I	1	□	□	□	□	
	100% stator earth fault (3 rd harm. diff. overvoltage) protection	U3hd >	59TD/64TN	1	□	□	□	□	
	Voltage transformer supervision (fuse failure)		60	1	■	■	■	■	■
	Current transformer supervision (current unbalance)		60	1/2/3	2	2	3	3	1
	Rotor earth fault protection		64R	1	□	□	□	□	
	Three-phase directional overcurrent protection	I Dir >	67	2	■	■	■	■	■
	Residual directional overcurrent protection	Io Dir >	67N/67G	2	■	■	■	■	■
	Inrush detection and blocking	I2h >	68	1	■	■	■	■	■
	Pole slip / Out-of-step protection	ΔZ/Δt	78	1	■	■	■	■	
	Overfrequency protection	f >, f >>	81O	2	■	■	■	■	■
	Underfrequency protection	f <, f <<	81U	2	■	■	■	■	■
	Rate of change of frequency protection	df/dt	81R	2	■	■	■	■	■
	Generator differential protection	3IdG >	87G	1	■ **	■ **	■ **	■ **	
	Block differential protection	3IdT >	87T	1	□ **	□ **	□ **	□ **	
	Restricted earth fault protection	REF	87N	2	□	□	□	□	□

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

** Mutually exclusive options: one of them is used in the configuration.

■ : Standard

□ : Optional



Protecting a power generator is a complex task, seeing as how many special conditions have to be taken into consideration during its operation. The EuroProt+ devices cover the functionality of the generator protection and also the protection of generator + step-up transformer + auxiliary transformer blocks.

Configuration type DTRV refers to transformer protection and used here due to historical reasons only, so the title of the configuration type is changed to DGEN to provide unambiguous determination for this product.

With their basic and optional features the EuroProt+ family devices are applicable for small, middle-sized (50-100 MVA) and large (>100 MVA) generators as well.

Basic functions include standard overcurrent protections, voltage protections, frequency protections as well as voltage dependent overcurrent, loss of excitation, reverse power (anti-motoring) protections.

The optional features include rotor earth fault, 100% stator earth fault, interturn fault protections.

The Smart Line series offer solution for very small generators where only one CT is available, thus differential protection cannot be used (mainly photovoltaic applications).

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Differential protection;
- ☑ Reverse power (anti-motoring) protection;
- ☑ Inadvertent/accidental energizing protection;
- ☑ Thermal-based negative sequence overcurrent protection;
- ☑ Loss of excitation (loss of field) protection;
- ☑ Voltage dependent overcurrent protection;
- ☑ 100% stator earth fault protection (based on 3rd harmonic voltage);
- ☑ Rotor earth fault protection for ungrounded (isolated) and middle-grounded rotors;
- ☑ Interturn fault protection (voltage based for single-winding and current based for double-winding generators).





CATENARY PROTECTION

BESIDES THE DISTRIBUTION NETWORK APPLICATION, THE EUROProt+ DTIVA TYPE ALSO PROVIDES DEDICATED RAILWAY PROTECTION DEVICES. RAILWAY CATENARY PROTECTION RELAY IS AVAILABLE FOR SINGLE PHASE AC (16,7 Hz; 50 Hz) TRACTION SUPPLY SYSTEMS.

RAILWAY					
HARDWARE	FAMILY				EUROProt+
	TYPE				DTIVA
	CONFIGURATION				E4-DRFP
	CT inputs				4
	VT inputs				4
FUNCTIONALITY	Digital inputs (max)				128
	Signaling relay outputs (max)				60
	Fast Trip outputs (max)				12
	Function name	IEC	ANSI	INST.*	E4-DRFP
	Distance protection for railway	Z <, FL	21	1	■
	Wrong phase coupling protection	Z <	21	1	■
	Definite time undervoltage protection	U <, U <<	27	1	■
	Thermal protection for railway	T >	49R	1	■
	Overcurrent protection for railway	I >, I >>	51	2	■
	Definite time overvoltage protection	U >, U >>	59	1	■
	Auto-reclose MV	0 → 1	79	1	■
	Circuit breaker wear				■
	Bay control				■

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

■ : Standard
□ : Optional



KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Basic non-directional overcurrent protection;
- ☑ Distance protection function supplemented with teleprotection and switch onto fault detection;
- ☑ Integrated fault locator for fault impedance and distance-to-fault calculation;
- ☑ Wrong phase coupling protection capability;
- ☑ Definite time over-, undervoltage protection;
- ☑ Auto-reclosing.



DISTRIBUTED AND CENTRALIZED BUSBAR PROTECTION

PROTECTA OFFERS TWO TYPES OF BUSBAR PROTECTION. THE DIFFERENCE BETWEEN THE TWO TYPES IS THE STRUCTURE OF THE DIFFERENTIAL PROTECTION SYSTEM.



Distributed (Decentralized) version:

The OGYD product type is designed specifically to be the main unit of a distributed low-impedance busbar protection system to protect bus schemes up to 30 bays; it is a member of the EuroProt+ product family.

In this version other individual protective devices of the bays (distance protection, overcurrent protection, etc., or potentially dedicated bay units) are involved in the busbar protection scheme as bay units.

Their location in the substation depends on the bay structure of the primary system. These devices perform the sampling of the currents and they have access to all information needed for the busbar protection system.

This information is sent by a fiber optic link to the central unit. The calculation and decision is performed by the central unit and the dedicated trip commands are sent back to the devices also via fiber optic links.

Centralized version:

The DGYD type performs fast and stable centralized low-impedance busbar protection in transmission and utility systems. It is a member of the EuroProt+ product family.

If the number of bays connected to the busbar is limited (there are a maximum of 6 bays), the tasks related to the three-phase busbar differential protection function are performed within one device.

If there are more bays, the tasks are divided among three independent devices. Each of them is responsible for the differential protection of one phase (L1, L2 or L3) of the busbar. This version can also be considered as a centralized version.



KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Dynamic busbar replica, based on disconnector status signals;
- ☑ High stability in case of external faults even in case of current transformer saturation;
- ☑ Short tripping time;
- ☑ Selectivity for internal fault, only the bays connected to the faulty busbar section are disconnected, all other bays remain in continuous operation;
- ☑ Easy to extend according to the busbar configuration;
- ☑ Easy adaptation of the function for different primary bus systems:
 - Single busbar up to quadruple busbar;
 - Ring busbars;
 - 1 ½ circuit breaker arrangement;
 - Bus couplers;
 - Bus sectionalizers with one or two current transformers;
 - Transfer bus;
- ☑ Individual numerical calculation and decision for all three phases;
- ☑ Stabilized differential current characteristics;
- ☑ Security and stability are increased through special software features:
 - Voltage breakdown condition;
 - Implemented Check zone criteria to increase stability;
 - Saturated waveform compensation;
- ☑ Integrated breaker failure protection which utilizes the processed status information of the busbar protection to disconnect only the section of the busbar to which the faulty circuit breaker is connected. Consequently, other zones may remain in continuous service.



MOTOR PROTECTION AND CONTROL



THE MAIN EUROPROT+ FAMILY AND THE SMART LINE SERIES CAN ALSO OPERATE AS DEDICATED MOTOR PROTECTION DEVICES.

THEY OFFER A NUMBER OF SPECIAL MOTOR PROTECTION AND SUPERVISION FUNCTIONS THAT ARE TO PROTECT AND RUN THE MOTOR SAFELY: MOTOR THERMAL PROTECTION, MOTOR STARTUP SUPERVISION, ASYMMETRY PROTECTION, LOSS OF LOAD PROTECTION, PROLONGED START, LOCKED ROTOR PROTECTION.

MOTOR PROTECTION AND CONTROL								
					FAMILY	EUROPROT+	SMART LINE	
					TYPE	DTIVA	S24 SERIES	S16 SERIES
HARDWARE	CONFIGURATION					E7	Var.1	Var.2
	CT inputs					4	4	4
	VT inputs							1
	Digital inputs (max)					128	112	112
	Signaling relay outputs (max)					60	60	60
	Fast Trip outputs (max)					12	12	12
FUNCTIONALITY	Function name	IEC	ANSI	INST.*		E7	Var.1	Var.2
	Overexcitation	V/Hz	24	1		■		
	Definite time undervoltage protection	U <, U <<	27	2		■		
	Positive sequence undervoltage protection	U1 <	27D	1		■		
	Loss-of-load	I <	37	1		■	■	
	Negative sequence overcurrent protection	I2 >	46	1		■	■	■
	Negative sequence overvoltage protection	U2 >	47	1		■		
	Motor startup supervision	I ^{start}	48	1		■	■	■
	Thermal protection motor	T >	49	1		■	■	■
	Three-phase instantaneous overcurrent protection	I >>>	50	1		■	■	■
	Residual instantaneous overcurrent protection	I _o >>>	50N/50G	1		■	■	■
	Breaker failure protection	CBFP	50BF	1		■	■	■
	Locked rotor protection	I _{st} >	50LR			■	■	■
	Three-phase time overcurrent protection	I >, I >>	51	2		■	■	■
	Residual time overcurrent protection	I _o >, I _o >>	51N/51G	2		■	■	■
	Definite time overvoltage protection	U >, U >>	59	2		■		■
	Residual overvoltage protection	U _o >, U _o >>	59N	2		■		■
	Fuse failure (VTS)		60	1		■		
	Current unbalance protection		60	1		■	■	
	Starts per hour	I ² t	66	1		■	■	■
	Residual directional overcurrent protection	I _o Dir >, I _o Dir >>	67N/67G	2		■		■
	Inrush detection and blocking	I _{2h} >	68	1		■	■	■
	Auto-reclose MV	0 → 1	79	1			■	
	Motor differential protection	3IdT >	87M	1		□		
	Bay control					■	■	

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

■ : Standard
□ : Optional

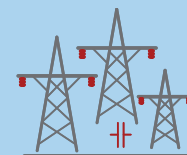
KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Motor startup supervision;
- ☑ Restart inhibit;
- ☑ Locked rotor protection;
- ☑ Loss-of-load protection.
- ☑ Undervoltage protection against instability;
- ☑ Thermal state monitoring of the motor by thermal replica function;
- ☑ Optional temperature monitoring via temperature sensors with RTD module in E7-Feeder relay;
- ☑ Optional motor differential protection.



CAPACITOR BANK PROTECTION

DEDICATED RELAYS CAN BE FOUND FOR PROTECTION AND MONITORING OF SHUNT CAPACITOR BANKS IN THE MAIN EUROPROT+ FAMILY AND THE SMART LINE SERIES AS WELL.



The EuroProt+ DTIVA E10-Feeder relay is designed specifically for power capacitor bank protection and control. Apart from the standard current-based protections, the E10-Feeder relay comes with protection functions specifically designed to protect capacitor banks. The device is able to handle and protect different bank arrangements, such as ungrounded single-wye connection, double-wye (ungrounded) connection, delta-connected banks, "H" configuration.

Voltage measurement is optional in the relay, which includes phase and residual overvoltage protection functions. Another cost efficient solution for capacitor bank protection is implemented in the Smart Line S24 series of the Protecta product range. The S24 Variant 1 relay can also provide a number of dedicated capacitor bank protection and monitoring functions optionally in addition to the basic current based protection.

CAPACITOR BANK PROTECTION AND MONITORING						
HARDWARE				FAMILY	EUROPROT+	SMART LINE
				TYPE	DTIVA	S24 SERIES
				CONFIGURATION	E10	Var.1
				CT inputs	4	8
				VT inputs	4 (op.)	
FUNCTIONALITY				Digital inputs (max)	136	20
				Signaling relay outputs (max)	60	14
				Fast Trip outputs (max)	12	2
	Function name	IEC	ANSI	INST.*	E10	Var.1
	Definite time undervoltage protection	$U <, U <<$	27	2	<input type="checkbox"/> *	
	Loss of load (Undercurrent) protection	$I <$	37	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Negative sequence overcurrent protection	$I2 >$	46	1		<input checked="" type="checkbox"/>
	Thermal protection line	$T >$	49	1		<input checked="" type="checkbox"/>
	Three-phase instantaneous overcurrent protection	$I >>>$	50	1		<input checked="" type="checkbox"/>
	Residual instantaneous overcurrent protection	$I0 >>>$	50N/50G	1		<input checked="" type="checkbox"/>
	Breaker failure protection	CBFP	50BF	1		<input checked="" type="checkbox"/>
	Three-phase time overcurrent protection	$I >, I >>$	51	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Residual time overcurrent protection	$I0 >, I0 >>$	51N/51G	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Definite time overvoltage protection	$U >, U >>$	59	2	<input type="checkbox"/> *	
	Capacitor overvoltage protection		59C		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Residual overvoltage protection	$U0 >, U0 >>$	59N	2	<input type="checkbox"/> *	
	Fuse failure (VTS)		60	1	<input type="checkbox"/> *	
	Current unbalance protection		60	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Capacitor unbalance protection			1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Inrush detection and blocking	$I2h >$	68	1		<input checked="" type="checkbox"/>

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

☒ : Standard

☐ *: Optional if the VT module is included for measurement and protection purposes. These options can be selected only together.



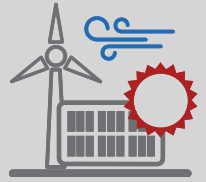
KEY/MAIN FUNCTIONS (FEATURES)

- ☒ Handling of various bank arrangements;
- ☒ Capacitor unbalance protection for blocks in bridge ("H") connection, double-wye connection and double delta connection;
- ☒ Calibration feature to compensate the inherent capacitor bank unbalances to prevent maloperation and increase sensitivity;
- ☒ The protection scheme can be used for both internal and external fuses as well as in fuseless capacitor configurations;
- ☒ Standard current-based protections for feeders;
- ☒ Optional voltage inputs are available for protection or/and measurement purposes in the DTIVA E10-Feeder relay.



PROTECTION FOR MICROGRID

PROTECTA OFFERS A COMPREHENSIVE RANGE OF PROTECTION RELAYS FROM SIMPLE, COST-EFFECTIVE SOLUTIONS TO COMPLEX APPLICATIONS TO MEET THE MOST DEMANDING CUSTOMER NEEDS. THE RELAYS ARE USED FOR A WIDE VARIETY OF APPLICATIONS SUCH AS LINE PROTECTION, SMALL GENERATOR PROTECTION AND LOAD SHEDDING APPLICATIONS TO SUPPORT RELIABLE MICROGRID OPERATION.



The voltage, frequency and overexcitation relays can be applied to protect microgrid systems from operation with high frequency or voltage deviation from the preset values. Load rejections in the interconnected grid can be handled safely and islanding operation can be initiated if required.

The directional over-or under-power protection function can also be used in the S24 Variant 2 relay to protect any element

of the electric power system, mainly small generators, if the active and/or reactive power has to be limited and the reverse power flow should be prevented.

The Protecta relays can be used for load shedding applications to prevent the collapse of the microgrid system because of high power demand that would cause dangerously low system frequency.

Line protection

- ☒ Voltage protection;
- ☒ Frequency protection.

DER (Distributed energy resources) protection

- ☒ Voltage protection;
- ☒ Frequency protection;
- ☒ Overexcitation protection;
- ☒ Reverse power flow protection;
- ☒ Reactive power undervoltage protection.

Load shedding

- ☒ Frequency protection;
- ☒ Rate of change of frequency protection;
- ☒ Active power underfrequency.



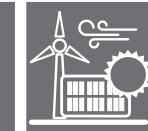


MICROGRID APPLICATION APPLICATION

					EUROPROT+		SMART LINE		
					DTIVA		S24 SERIES	S16 SERIES	
	CONFIGURATION				E8	E9	Var.2	Var.6	Var.3
HARDWARE	CT inputs					4	4		
	VT inputs				4	4	4	4	4
	Digital inputs (max)				128	136	20	20	4
	Signaling relay outputs (max)				60	60	14	14	5
	Fast Trip outputs (max)				12	12	2	2	2
FUNCTIONALITY	Function name	IEC	ANSI	INST.*	E8	E9	Var.2	Var.6	Var.3
	Overexcitation	V/Hz	24	1			■		
	Synchrocheck	SYNC	25	1	■			■	
	Definite time undervoltage protection	U <, U <<	27	2	■	■	■	■	■
	Directional overpower	P >	32	1		■			
	Directional underpower (low forward power)	P <	37/32LF	1		■			
	Negative sequence overcurrent protection	I2 >	46	1			■		
	Negative sequence overvoltage protection	U2 >	47	1			■		■
	Thermal protection line	T >	49	1			■		
	Three-phase instantaneous overcurrent protection	I >>>	50	1			■		
	Residual instantaneous overcurrent protection	Io >>>	50N/50G	1			■		
	Breaker failure protection	CBFP	50BF	1		■	■		■
	Three-phase time overcurrent protection	I >, I >>	51	2		■	■		
	Residual time overcurrent protection	Io >, Io >>	51N/51G	2		■	■		
	Voltage dependent overcurrent protection	I >, U <	51V	2			■		
	Definite time overvoltage protection	U >, U >>	59	2	■	■	■	■	■
	Residual overvoltage protection	Uo >, Uo >>	59N	2	■	■	■	■	■
	Fuse failure (VTS)		60	1				■	
	Current unbalance protection		60	1		■	■		
	Three-phase directional overcurrent protection	I Dir >, I Dir >>	67	2			■		
	Residual directional overcurrent protection	Io Dir >, Io Dir >>	67N/67G	2			■		
	Inrush detection and blocking	I2h >	68	1			■		
	Auto-reclose MV	0 → 1	79	1			■		
	Overfrequency protection	f >, f >>	81O	2	■	■	■	■	■
	Underfrequency protection	f <, f <<	81U	2	■	■	■	■	■
	Rate of change of frequency protection	df/dt	81R	2	■	■	■	■	■
	Vector jump	ΔφU >		1		■	■		■
	Restricted earth fault	REF	87N	1			□		

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

■ : Standard
□ : Optional



BAY CONTROL

DVEZ IEDs ARE USED FOR BAY CONTROL UNIT APPLICATIONS IN TRANSMISSION AND DISTRIBUTION NETWORKS. THEY PROVIDE FULL CONTROL FOR ANY TYPE OF SWITCHGEAR (INCLUDING THE INTERLOCKING FUNCTIONS) AND OTHER SUBSTATION APPLICATIONS. THE DVEZ FACTORY CONFIGURATIONS' FUNCTIONALITY IS AVAILABLE TO BE ENHANCED BY A COMPREHENSIVE RANGE OF OPTIONAL FUNCTIONS THAT CAN BE SELECTED WHILE ORDERING.

KEY/MAIN FUNCTIONS (FEATURES)

- ☒ Solution for comprehensive measurement (U, I, f, P, Q, S, power factor, energies etc.);
- ☒ Switchgear interlocking;
- ☒ Support for three-position disconnectors;
- ☒ Includes breaker failure protection;
- ☒ Optional synchrocheck and synchroswitch function;
- ☒ Power quality functions: voltage variation, voltage unbalance, harmonics for voltage and current up to 19th, THD (Total Harmonic Distortion), TDD (Total Demand Distortion);
- ☒ Automatic reclosing function for HV/MV networks;
- ☒ Load shedding;
- ☒ Up to 128 binary inputs and 96 relay outputs;
- ☒ mA inputs for transducers, RTD temperature measurement inputs;
- ☒ Option for remote binary transmission;
- ☒ Optional automatic voltage regulator (AVR)/tap change control function.



BAY CONTROL						
HARDWARE				FAMILY	EUROPROT+	
				TYPE	DVEZ	
				CONFIGURATION	E1	E2
				CT inputs		
				VT inputs		
				Digital inputs (max)		
FUNCTIONALITY				Signaling relay outputs (max)		
				Fast Trip outputs (max)		
	Function name	IEC	ANSI	INST.*	E1	E2
	Circuit breaker control			*	■	■
	Disconnector control			*	■	■
	Voltage measurement			*		□*
	Current measurement			*		□*
	Line measurement			*		□*
	Average and maximum measurement			*		□*
	Synchrocheck		25	*		□
	Definite time undervoltage protection	U <, U <<	27	*		□
	Thermal protection	T >	49	*		□
	Definite time overvoltage protection	U >, U >>	59	*		□
	Residual overvoltage protection	U _o >, U _o >>	59N	*		□
	Fuse failure protection (VTS supervision)		60	*		□*
	Current unbalance protection		60	*		□*
	Automatic reclosing function for HV/MV networks	0 → 1	79	*	□	□
	Automatic voltage regulator (AVR) / tap change control		90V	*		□
	Remote Binary Communication			*	□	□
	Circuit breaker wear			*		□*
	Load shedding			*		□

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

■ : Standard

□ : Optional

□* : If the HW permits, then basic.

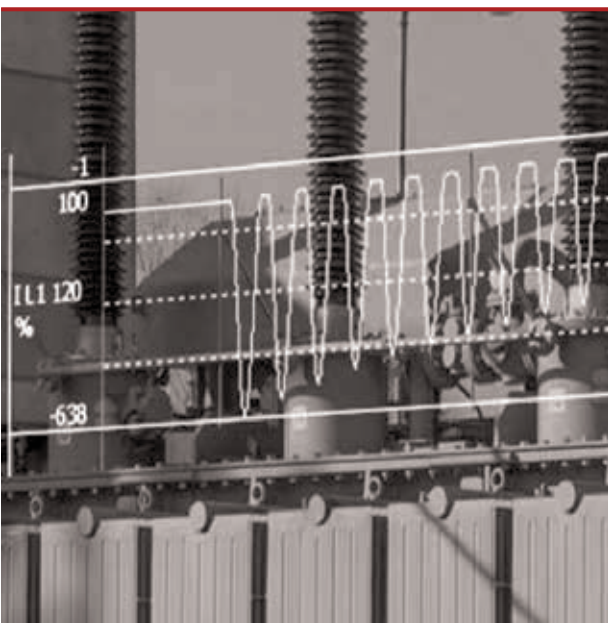
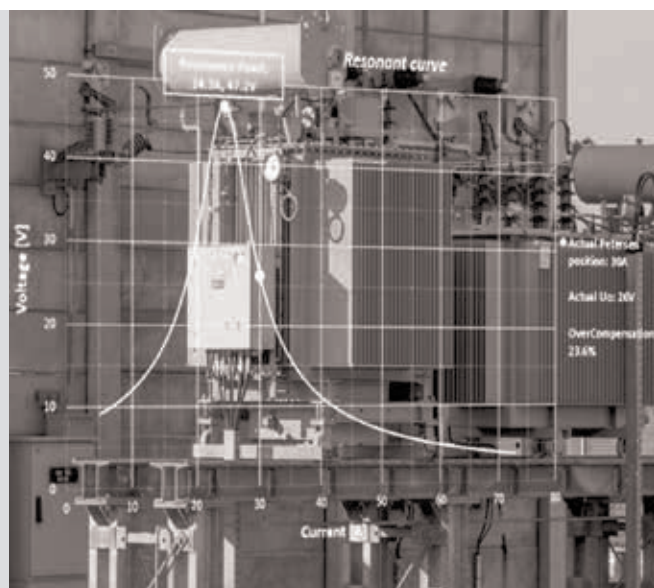


DRL – ARC SUPPRESSION COIL CONTROLLER

The DRL devices provide complex, numerical controller automation for arc suppression coils (Petersen coils); consequently, they can be applied in resonance-grounded networks. The controller tunes the coil by moving the iron core.

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Automatic control of arc suppression coils of the compensated networks based on measuring the zero sequence parameters of the network;
- ☑ The device uses the method of current injection for measuring;
- ☑ Zero sequence overvoltage function for detecting the presence of earth faults on the network;
- ☑ Parallel control of more than one coil on the same network with communication between DRL devices.



POW CONTROL – POINT-ON-WAVE CONTROL OF CAPACITOR BANK, SHUNT REACTOR AND TRANSFORMER

The Point-on-Wave control (PoW) functionality is applicable for controlled energizing and de-energizing of reactors, capacitors and power transformers (as TRansformer Inrush current Minimizer - TRIM function).

KEY/MAIN FUNCTIONS (FEATURES)

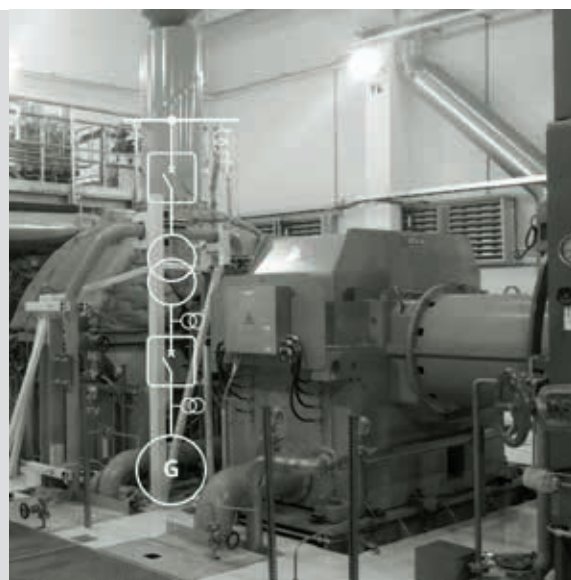
- ☑ 2-winding three- or single-phase transformer control device with a transformer inrush current minimizer function and several additional control functions;
- ☑ The type of the circuit breaker is specified by parameter setting (individual, common with or without fixed delay between the pole switchings);
- ☑ The switching strategy takes into account the object grounding type.

ASZKG – AUTO SYNCHRONIZER FOR GENERATOR

The ASZKG devices are designed to perform automatic synchronizing of synchronous generators to the power grid.

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Synchrocheck and synchroswitch function with output signals for generator frequency and voltage control;
- ☑ Selectable target CB/Bus, deadline detection for automatic choosing;
- ☑ User-configurable start/cancel conditions.





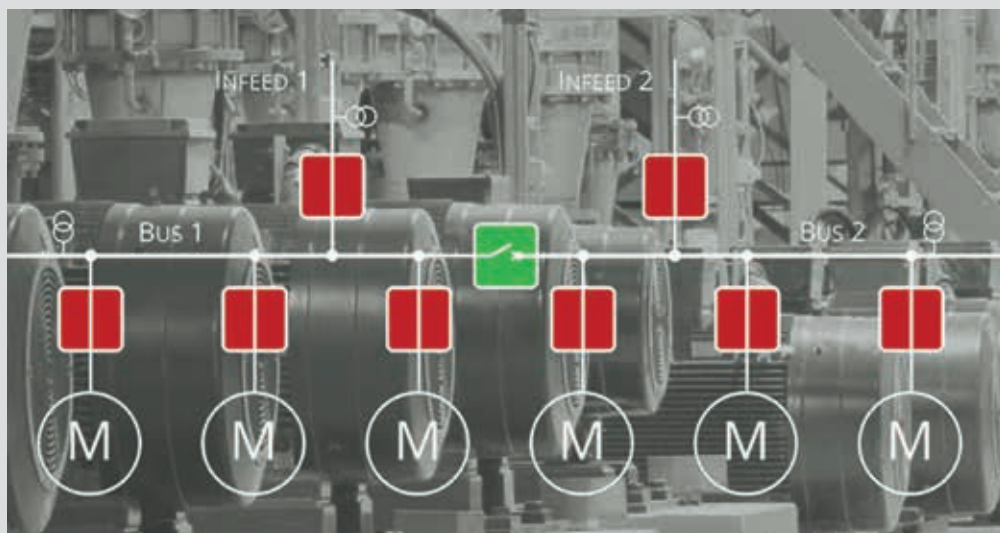
HSBT – HIGH SPEED BUS TRANSFER DEVICE

The TRIM (Transformer Inrush current Minimizer) device is designed for controlled switching of three- or single-phase transformers in order to avoid dangerous inrush currents with high peaks.

The TRIM (Transformer Inrush current Minimizer) device is designed for controlled switching of three- or single-phase transformers in order to avoid dangerous inrush currents with high peaks.

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Provide reliable, safe and uninterrupted supply;
- ☑ Support for simple and complex busbar applications (one HSBT function for each CB);
- ☑ Guarantee of the shortest possible high speed switching time and the highest possible level of safety;
- ☑ Guarantee of an optimum safeguarding of energy supply;
- ☑ Instantaneous/Fast/Slow operation according to frequency, angle, df/dt conditions, status signals and parameters;
- ☑ The bus transfer can be initiated automatically or manually as well.



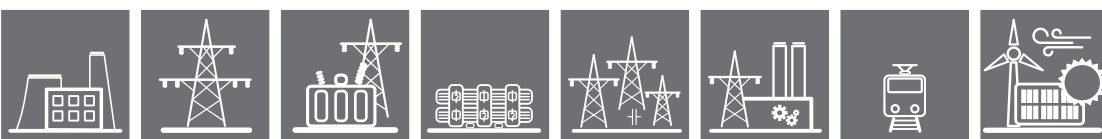
METRA – AUTOMATIC EVENT-DRIVEN BUS TRANSFER

High level of power availability can be achieved by applying one or several HV/ HV or HV/MV standby power transformers to the substation/installation. The METRA device is developed to perform automatic switching from the main utility network supply to backup power supply in case of failure or power interruption of the main supply. Bus transfer is started by defined events (i.e. a binary signal) in the substation, e.g. tripping of a specified circuit breaker.

KEY/MAIN FUNCTIONS (FEATURES)

- ☑ Automatic bus transfer in case of internal fault or power outage in the primary equipment;
- ☑ Control and secure switching between supplies;
- ☑ Customizable bus transfer procedures even for the most complex substation schemes such as double busbar, breaker-and-half etc.;
- ☑ Manually initiated transfers.





COMPLIANCES WITH THE FOLLOWING STANDARDS AND CERTIFICATIONS

INSULATION TESTS

IEC 60255-27

Impulse voltage test

IEC 60664-1
5 kV 1.2/50 μ s 0.5 J

Dielectric voltage test

IEC 60664-1
2 kV 50 Hz 1 min
2.82 kV DC 1 min

Insulation resistance test

IEC 60255-27
> 100 M Ω at 500 V DC

SAFETY RELATED TESTS

IEC 60255-27

Reverse polarity and slow ramp test

IEC 60255-27
Reverse polarity duration 1 min
Slow ramp 1 V/min

Protective bonding resistance test

IEC 60255-27
< 0.1 Ω at 12 V 20 A 1 min

Enclosure protection

IEC 60529
IP 2X, IP 3X or IP 4X depending on
the type of the enclosure

ELECTROMAGNETIC COMPATIBILITY TEST

IEC 60255-26

Immunity tests

IEC 60255-26

Electrostatic discharge test

IEC 61000-4-2
Contact 2, 4, 6, 8 kV
Air 2, 4, 8, 15 kV

Radiated electromagnetic field test

IEC 61000-4-3
80 to 1000 MHz
1400 to 2400 MHz
20 V/m

Power frequency magnetic field test

IEC 61000-4-8
100 A/m continuous
1000 A/m 3 s

Conducted disturbance induced by
radio-frequency fields test

IEC 61000-4-6
0.15 to 80 MHz
10 V

Fast transients test

IEC 61000-4-4
4 kV 5 kHz 1 min

Slow damped oscillatory wave test

IEC 61000-4-18
1 MHz
Differential mode 1 kV
Common mode 2.5 kV

Surge test

IEC 61000-4-5
1.2/50 μ s, 8/20 μ s
Line-to-line 0.5, 1, 2 kV
Line-to-earth 0.5, 1, 2, 4 kV

ELECTROMAGNETIC COMPATIBILITY TEST

IEC 60255-26

Voltage dip tests AC

IEC 61000-4-11
0% > 100 ms
40% > 200 ms
70% > 500 ms

Voltage dip tests DC

IEC 61000-4-29
0% > 100 ms
40% > 200 ms
70% > 500 ms

Voltage interruption tests AC

IEC 61000-4-11
5 s

Voltage interruption tests DC

IEC 61000-4-29
5 s

AC component in DC (ripple) test

IEC 61000-4-17
100 Hz
15% of rated DC value

Gradual shutdown/start-up (for DC
power supply) test

IEC 60255-26
Shut-down-ramp 60 s
Power off 5 min
Start-up-ramp 60 s

Power frequency test on binary
inputs

IEC 61000-4-16
Differential mode 150 V
Common mode 300 V

Emission tests

IEC 60255-26

Radiated emission tests on
enclosure

CISPR 11, CISPR 22

CISPR 11
30 MHz to 230 MHz
40 dB (μ V/m) quasi peak

230 MHz to 1000 MHz
47 dB (μ V/m) quasi peak

Conducted emission tests on
auxiliary power supply

CISPR 22
0.15 MHz to 0.50 MHz
79 dB (μ V) quasi peak
66 dB (μ V) average

0.5 MHz to 30 MHz
73 dB (μ V) quasi peak
60 dB (μ V) average



MECHANICAL TESTS

IEC 60255-1 IEC 60255-27

Vibration test (sinusoidal)	IEC 60255-21-1 1 g
Shock and bump test	IEC 60255-21-2 2 g
Seismic test	IEC 60255-21 1 g

CLIMATIC ENVIRONMENTAL TESTS IEC 60255-1

Dry heat test, operational	IEC 60068-2-2 55 °C
Cold test, operational	IEC 60068-2-1 -20 °C
Dry heat test, storage temperature	IEC 60068-2-2 70 °C
Cold test, storage temperature	IEC 60068-2-1 -40 °C
Cyclic temperature test	IEC 60068-2-14 55 °C -20 °C
Damp heat steady state test	IEC 60068-2-78 55 °C 93 %
Cyclic temperature with humidity test	IEC 60068-2-30 25 °C 97 % 55 °C 93 %

CONTACT PERFORMANCE TESTS IEC 60255-1

Mechanical endurance tests

Unloaded contact test	IEC 61810-1 10 × 10 ⁶ cycles
Making test	IEC 61810-1 ≥ 1000 cycles

Electrical endurance tests

Breaking test	IEC 61810-1 ≥ 1000 cycles
Signaling contacts	0.1 A at 220 V DC 0.2 A at 110 V DC
Tripping contact	4 A at 220 V DC
Limiting making capacity test	IEC 61810-1 ≥ 1000 W at L/R = 40 ms

Contact current test

Continuous test	IEC 61810-1 ≥ 5 A
Short time test	IEC 61810-1 15 A 4 s

OVERLOAD TESTS IEC 60255-27

VT input overload tests

Short time test	275 V AC 1 s 350 V DC 1 s
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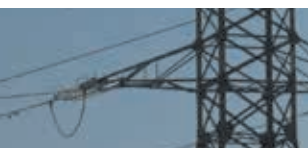
Continuous test	250 V AC
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CT input overload tests

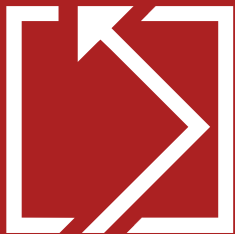
Short time tests	50 A 1 s 100 A 10 ms
Continuous test	20 A

COMMUNICATION TEST IEC 60255-1

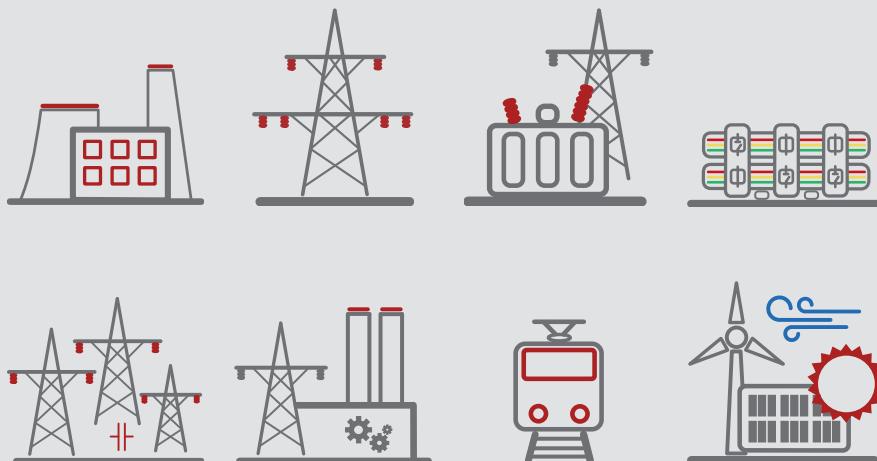
Conformance test	IEC 61850-6 7-1, 7-2, 7-3, 7-4 and 8-1
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PROTECTION, AUTOMATION AND CONTROL FOR POWER INDUSTRY



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