



Relematika



PRODUCT CATALOG

Company overview
MV protection
HV/EHV protection
Software

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About “Relematika”

Welcome to “Relematika”, the world of reliable protection to meet your needs!

Who we are

The company “Relematika” is:

- one of the leading manufacturers and developers on the Russian market of microprocessor relay protection,
- well-known Russian research centre of electro-technical science,
- modern and upcoming company.

We develop and produce a complete range of relay protection and automation systems for power facilities 6-750 kV. When creating solutions we have considered all the current trends and standards, have tested our devices for compatibility with the products of the largest global suppliers.

What we do

The main products are:

- relay protection and automation microprocessor IEDs;
- relay protection and automation cubicles for network up to 750 kV (stations and substations);
- modern SCADA for substations;
- power line fault locator devices;
- hardware-software system solutions for fault location in power line grid;
- single-phase fault selector devices for isolated and compensated neutral networks;
- software for fault currents and settings calculation.



Where we are

Relematika is situated in the town of Cheboksary, Russia, which was de facto the “capital” of relay protection R&D and production in former USSR. Nowadays effective scientific-research school provides high staff skills and knowledge.



How we work

Being a fast-growing company now we have:

- about 7000 sq. meters of production and office areas;
- high-tech equipment for production and research;
- quality management system is certified and comply to ISO 9001:2008;
- more than 400 qualified employees.





Our personnel

We are proud of the scientific and creative potential of our employees. In “Relematika” they conduct fundamental research in the theory of digital relay protection, which brings their results in the form of innovative devices and software products. A big part of the employees is engaged in the research and development of future products. 14 employees have a degree of Ph. D., scientific and technical council of the company is headed by Doctor of Technical Sciences, Professor Yuri LYAMETS. About 10% of total profits the company annually invests into R & D. Achievements of our experts make a great contribution to the development of the industry as a whole.

Our achievements

Annual growth in sales (on average 15 - 20%) on the largest Russian power facilities and growing exports testify to the quality and reliability of the products. The reliability of our products conforms to the strictest requirements of the Russian power systems and international standards. Our products have all necessary certificates of quality, they are 100% finally inspected and included in the lists of recommended equipment of all the major power companies in Russian Federation.

Our company is a collective member of CIGRE and takes an active part in the Russian National Committee B5 (Protection and Automation). Thus the company participates in the development of international industry standards and has the possibility to use them in its products.

Why Relematika?

The equipment meets all modern requirements in terms of IEC 61850 support, provides compatibility with devices from other manufacturers, has friendly interface, can be simply integrated in Automatic Process Control System. Relay cubicles are based on "TOR 300" terminal, which allows you to create advanced solutions in relay protection, opens up new possibilities in the field of automation and control facilities, changes the view of the electric power industry today.

Distinctive features of our products are: **reliability, modernity and compatibility**. Our own innovative solutions, own microprocessor IEDs, proprietary software components of leading world manufacturers – all this allows us to provide the customer with exceptionally modern and reliable devices that are adapted to his specific tasks. Company Relematika offers also non-standard types of our devices, able to solve non-trivial tasks of the customer.



Customers

The devices, designed and manufactured by Relematika, installed in hundreds of power facilities in all regions of Russia. Among the customers are the largest Russian companies: ROSSETI, FGC UES, JSC IDGC holding, OJSC MOESK, GAZPROM, Russian

Railways (RZD), LUKOIL, ROSNEFT and others.

Products are exported to **Kazakhstan, Kyrgyzstan, Uzbekistan, Belarus, Tajikistan, Turkmenistan, Mongolia, Afghanistan.**

Customers



Federal Grid Company
of Unified Energy System



Objects

HV/EHV Substations

Transmission lines

Distribution networks

over 9500 relay cubicles



Railway substations

over 450 relay cubicles



ROSNEFT



Oil and gas-production
substations

over 300 relay cubicles



ROSATOM

Thermal Power Plants

Hydro Power Plants

Nuclear Power Plants

over 100 relay cubicles



TOR 300 series intelligent electronic device

TOR 300 is a microprocessor based device (also IED or terminal) intended for relay protection, wide-area protection, control and alarm functions in 6-750 kV power networks. The terminal is to be installed in relaying compartments of stationary attendant chambers,

switchgears, switchgears for outdoor installation, on boards, in cubicles and control boards of power plants and substations, as well as for installation in smart grids and digital substations.



Powerful

TOR 300 platform allows to protect MV, HV and EHV power equipment, to combine main and backup protection in a single device. It also gives a lot of additional functions, such as fault location, remote and local breaker control, LED signaling, disturbance and event recording, non-commercial energy measuring, etc.

Flexible

The terminal is freely programmable. Functional logical diagrams have been developed with the use of graphical programming tool allowing the configuration of binary inputs and outputs, analog inputs, control buttons, LEDs, disturbance recorder, event recorder, user interface. Freely programmable logic makes it possible to modify typical functional logical diagrams considering a peculiar nature of the protected object. Four basic types of standard 19" case allow to choose the most appropriate solution.

Undemanding

The terminals can be applied on substations with AC, rectified AC and DC auxiliary voltage. Operating auxiliary voltage range is between 88 ... 242 V of 50 or 60 Hz no matter. Low power consumption, not sensitive to auxiliary power interruptions, wide temperature range from -40 to +55°C - these are properties of TOR 300 devices.

Reliable

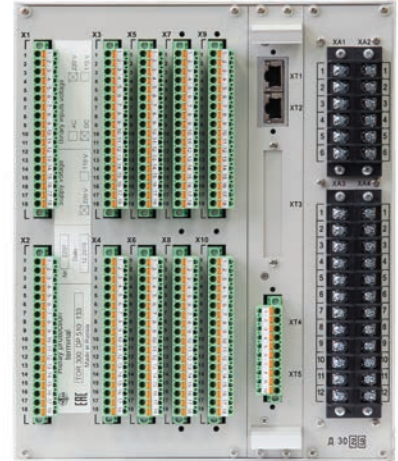
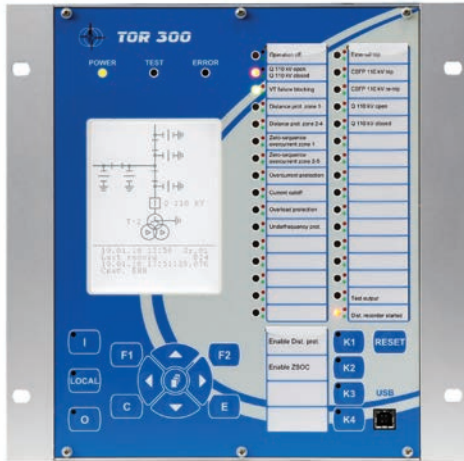
TOR 300 has built-in internal fault detection functions which, being activated, enable detecting and alarming (input signal, LED indication) internal faults. TOR 300 ensure no false connection of output relay contacts when energizing and disconnection of power supply source with any duration of interruption in power supply. The terminal enclosure provides IP40 protection degree in its front part and IP20 in other parts according to IEC 60529.

Communicative

Implementation of various communication protocols, such as IEC 60870-5-103, IEC 60870-5-104, Modbus RTU, Modbus ASCII and IEC 61850-8-1 (MMS, GOOSE), ensures integration of the terminal into substation monitoring and automated process control system, as well as provide data changing with other devices. Protocol IEC 61850-9-2 allows connection to "digital" current and voltage transformers. Built-in optical or HF-ports allows implementing different types of pilot protections (optical line differential, HF-carrier directional and others).

TOR 300 series in brief

- 4 sizes
- up to 140/137 binary I/O
- 96 programmable LEDs
- 24 analog inputs
- 12 electronic keys
- 7 communication ports
- 2 display types
- 1 platform for wide range of applications



IEC 61850 (KEMA) Certified

View	1/4		1/2		3/4		full	
19" case type	1/4		1/2		3/4		full	
Analog inputs	13		16		up to 24		24	
Binary Inputs	20		56		80		140	
Binary Outputs	17		53		77		137	
Front LEDs	16		32		64		96	
Programmable buttons	-		4		8		12	
Breaker control buttons	-		2		2		2	
Display	6x21	6x21	320x240 pix	6x21	320x240 pix	6x21	320x240 pix	

Ready-made relay protection cubicles

Ready-made relay protection cubicles are usually installed at HV/UHV Substation Control Center or in station main control room.

Relay cubicle is a metal construction (by RITTAL) which can be one of the standard sizes depending on the number of IEDs and type of protection.

Relay cubicle can be one-sided or two-sided service with metal, glass or windowed front door. Relay cubicle can consist of two cubicles coupled together.

Standard relay cubicle sizes		
Width, mm	Depth, mm	Height, mm
606	600	2005 (+ 200)
806	600	2005 (+ 200)
1006	600	2005 (+ 200)
1206	600	2005 (+ 200)
1606	600	2005 (+ 200)

Advantages of relay protection cubicles by Relematika

- all cubicles are powerful **TOR 300 IED** based
- customized solutions according to specific requirements
- **fully adapted** to your project
- all assembling, testing and pre-configuring is already **done**
- all required equipment is inside the cubicle



Beside one or more TOR 300 IEDs inside the cubicle and on its front or back board may be placed:

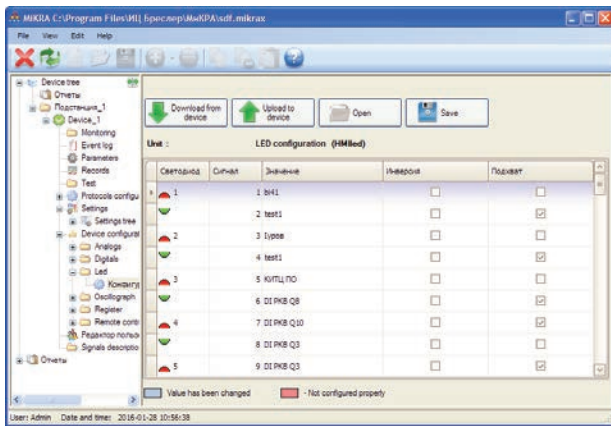
- HF transceivers,
- control switches and buttons,
- test blocks,
- signal lamps,
- power relays,
- insulation monitoring relays,
- communication equipment,
- metering equipment,
- auxiliary power equipment,
- power socket,
- lighting lamp,
- document pocket,
- whiteboard, and etc.

User software

Complex of user software is intended to help user to configure device properly, to operate with it and to analyze faults, abnormal conditions and IED behavior.

RelayTool – parameterization and monitoring

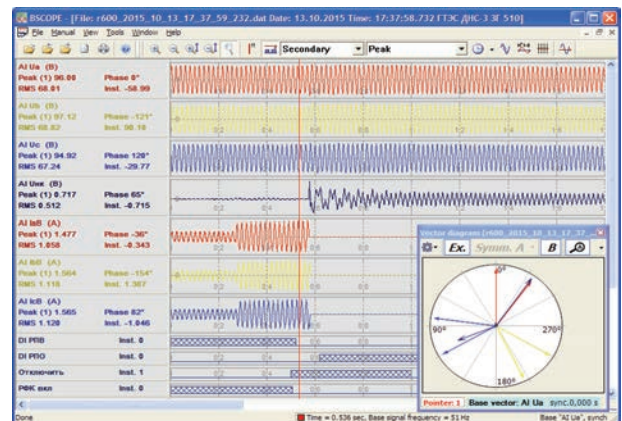
- monitor IEDs on site;
- view and set (edit) settings;
- upload and view disturbances, trigger disturbance recording, change disturbance recorder parameters;
- monitor signals (view their current values), diagnose communication channels with devices;
- upload and view event logs;
- configure signals for binary inputs, outputs, LEDs, disturbance recorder, event recorder, protocols configuration.



BSCOPE – disturbance records viewer

BSCOPE program is designed for viewing and analyzing of disturbance records recorded in COMTRADE format. The program performs the following main functions:

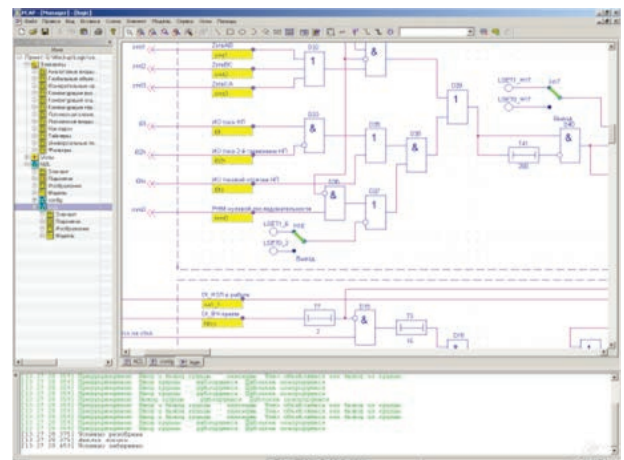
- Reading of COMTRADE format records.
- Multi-view display of the record file.
- Dynamic display of parameters of electrical signals (instantaneous value, RMS value, phase, primary/secondary values).
- Calculation of power system frequency.
- Drawing of phasor diagrams of currents and voltages, as well as their symmetrical components.
- Calculation of arbitrary signals.
- Spectral analysis of signals.
- Hodograph tool.
- Attachment of several disturbance records.
- Preview and print of records.
- Signal export to new record.



PCAP – logic editor

PCAP program is designed for:

- viewing and editing of logical diagram of TOR 300 IED;
- adding/deleting protection functions and modules;
- configuring device main parameters, i.e. input/output signals, internal signals, disturbance recorder, LEDs, buttons and etc.
- checking of logical diagram and uploading it to TOR 300 IED.



Medium voltage application

Solutions for Distribution networks and Stations

Relay protection, automation and control of MV power equipment:

- overhead lines and cables;
- input and bus-section breakers;
- two and three-winding transformers;
- switchgears (busbars);
- synchronous generators and step-up transformers;
- voltage transformers;
- capacitor banks;
- motors.



TOR 300 terminal for MV applications is to be installed in all types of relaying compartments of stationary attendant chambers, switchgears, switchgears for outdoor installation, on boards, in cubicles and control boards.

TOR 300 IEDs are suitable for networks with resistance and reactance earthed, arc compensated, isolated and solidly earthed neutral.



TOR 300 LB — Line protection

A TOR 300 LB terminal is intended to provide relay protection and automatic control of 6 - 35 kV electrical cable lines, overhead lines and auxiliary transformer lines. Also it is able to provide current protection of small motors and lines to capacitor bank.

Functions :

- three-stage overcurrent protection (OCP) with acceleration and voltage triggering;
- two-stage zero-sequence overcurrent protection;
- negative sequence overcurrent protection;
- voltage protection;
- zero sequence overvoltage protection;
- circuit breaker failure protection;
- autoreclosing (AR);
- open-wire protection;
- section voltage monitoring;
- breaker control and monitoring;
- reception of arc protection sensor signal;
- control of static capacitor banks;
- automatic load transfer.



TOR 300 IB — Input breaker protection

A TOR 300 IB terminal is intended to provide relay protection and automatic control of 6 - 35 kV input breaker.

Functions :

- three-stage overcurrent protection (OCP) with acceleration and voltage triggering;
- two-stage zero-sequence overcurrent protection;
- negative sequence overcurrent protection;
- undervoltage protection;
- zero sequence overvoltage protection;
- circuit breaker failure protection;
- autoreclosing (AR);
- open-wire protection;
- logical busbar protection;
- section voltage monitoring;
- breaker control and monitoring;
- reception of arc protection sensor signal.



TOR 300 SB — Bus-section breaker protection

A TOR 300 SB terminal is intended to provide relay protection and automatic control of 6 - 35 kV section breaker.

Functions :

- three-stage overcurrent protection (OCP) with acceleration and voltage triggering;

- two-stage zero-sequence overcurrent protection;
- negative sequence overcurrent protection;
- undervoltage protection;
- zero sequence overvoltage protection;
- circuit breaker failure protection;
- autoreclosing (AR);
- current conductor open-wire protection;
- logical busbar protection;
- section voltage monitoring;
- breaker control and monitoring;
- reception of arc protection sensor signal.

TOR 300 VT – Voltage transformer protection

A TOR 300 VT terminal is intended to provide relay protection and automatic control of 6 - 35 kV instrument voltage transformer.



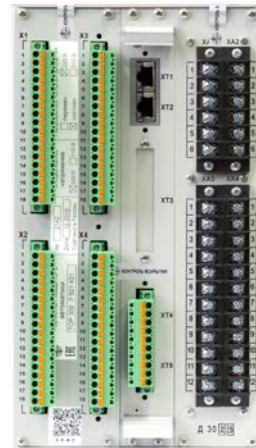
Functions :

- voltage triggering for bay OCPs;
- two-stage under/overvoltage protection;
- earth fault protection using zero-sequence voltage;
- ferro-resonance protection;
- supervision of VT open delta winding circuit integrity;
- tripping of input breaker for automatic load transfer;
- negative sequence overvoltage protection;
- four-stage automatic underfrequency load shedding and frequency autoreclosing, protection by frequency change rate;
- automatic underfrequency load shedding acceleration;
- reception of arc protection sensor signal and etc.



TOR 300 MD – Motor differential protection

A TOR 300 MD terminal is intended to provide relay protection and automatic control of 6 - 35 kV synchronous and asynchronous motors above 5 MVA.



Functions :

- differential current protection;
- overextended motor start protection;
- thermal overload protection;
- starting restriction protection;
- current inrush control;
- three-stage overcurrent protection;
- two-stage zero-sequence overcurrent protection;
- negative sequence overcurrent protection;
- undercurrent protection;
- circuit breaker failure protection;
- locked rotor protection;
- loss-of-synchronism protection
- breaker control and monitoring and etc.



TOR 300 GP – Synchronous generator protection

A TOR 300 GP terminal is intended to provide relay protection and automatic control of synchronous generator.

Relay protection systems for station equipment

- protection of unit generators or generators running on busbars,
- protection of generator-transformer units,
- protection of step-up transformers,
- protection of auxiliary supply transformers.

Functions :

- longitudinal differential current protection and single-system transverse differential current protection;
- overcurrent protection with voltage triggering;
- distance protection with power swing blocking;
- over- and undervoltage protection;
- stator winding earth fault protection of the unit generator;
- zero-sequence overcurrent earth fault protection of the stator;
- stator overload protection;

- asymmetric overload protection by negative sequence overcurrent protection;
- two-point earth fault protection of the rotor;
- excitation current overload protection of the rotor;
- over-excitation protection;
- negative active power protection;
- field-loss protection;
- protection against asynchronous conditions without loss of excitation;
- over- and underfrequency protection;
- protection against unintentional starting of the generator;
- generator breaker failure protection;
- voltage circuit failure blocking;
- overcurrent protection of the rectifier transformer.



High voltage / Extra high voltage application

Solutions for Transmission lines and Substations

Relay protection systems for High voltage (110-330 kV)
Relay protection systems for Extra high voltage (330-750 kV)

Own developments allow us to create a full range of relay protection and automation for high and ultra-high voltage networks:

- main transmission line protection
- backup transmission line protection
- automatic control of breakers (three and single phase drive)
- protection of busbars
- protection of two- and three-winding transformers
- protection of autotransformers
- protection of reactors
- protection of capacitor banks
- local wide-area protection (WAP)
- fault location and monitoring of power equipment

TOR 300 IEDs support three or single-phase tripping and autoreclosing.

TOR 300 DP — Distance protection

TOR 300 DP can provide backup protection of overhead double- or multi-ended electrical power lines and cables in HV and UHV networks. Also it can be used as a backup protection of transformer, shunt reactor, capacitor bank, bus-section or bypass breaker protection. By using HF-carrier telecommunications channels two or more TOR 300 DP devices can provide main protection of power line. If required, TOR 300 DP also can provide automatic control of three-phase/single-phase breaker with three-phase autoreclosing.

Distance protection

Distance protection **operates** selectively at all types of faults in protected objects; **does not operate** at external faults, open-wire conditions, power reverse, power swing, asynchronous conditions, out-of-phase closing and at operating switching, and functioning correctly at switch-on-fault conditions.

Each of distance protection stages includes three impedance measuring units for single phase-to-earth faults and three impedance measuring units for phase-to-phase faults. Distance protection implements impedance measurement principle, polygonal impedance relay operation principle and directional units to ensure direction of DP measuring units.

Directional zero sequence overcurrent protection

Directional zero sequence overcurrent (ZSOP) protection is used for power object protection from earth faults. Eight ZSOP protection stages are realized in TOR 300 DP, and each zone settings are independent from each other by direction and reach zone.

TOR 300 DP is provided with automatic (at circuit breaker first closing) and operative (when main protection of bay is disabled) acceleration modes of DP and ZSOP stages.

Available components of a full-function device are the following:

- five stages of phase-to-phase and phase-to-ground distance protection (DP) provided with high-frequency carrier intertripping (CIT) and HF-interlocking logic;
- eight stages of directional zero-sequence overcurrent protection (ZSOP) provided with carrier intertripping and HF-interlocking logic;
- DP and ZSOP acceleration and remote tripping algorithms via communication channels with protection at the opposite end of the line;
- instantaneous overcurrent protection;
- non-directional time overcurrent protection (OCP),
- circuit breaker failure protection (CBFP);
- undervoltage protection (UVP);
- sectionalizing protection (SP);
- automatic load transfer (ALT);
- double-acting three-phase/single-phase autoreclosing (AR) including voltage / no-voltage control of the bay and busbar, as well as synchronism control and capture;
- automatic breaker control (ABC);
- protection of circuit breaker tripping and closing electromagnets, open-phase protection (OPP) and phase non-switching protection (PNSP);
- circuit breaker opening and closing time check;
- disturbance and event recording function.

Breaker control automation generates signals to trip or close a circuit breaker with due regard to commands received from protections and telecontrol devices or from remote control key. It is possible to use the device for both three-phase and single-phase controlled breakers.

If required, **TOR 300 DP** devices can be provided in assembled, tested and pre-configured relay protection cubicles fully adapted to your project.

TOR 300 DPL —

Line differential protection

TOR 300 DPL realizes the main protection of overhead lines and cables in HV and EHV networks with absolute selectivity. The TOR 300 DPL terminal is intended to provide longitudinal differential protection and backup staged protection of lines with single-breaker bay, bypass breaker transfer, two-breaker bay or bay with a maintenance switch.

Longitudinal differential current protection

Each device has one subset of longitudinal current differential protection. Line differential protection provides selective line tripping from all sides at all types of internal faults and does not trip at all types of external faults. Line differential protection does not trip falsely at power swings and loss of synchronism on power transmission line. Each device carries out a comparison of phase currents at its line end (local currents) with currents received from remote terminal by value and by phase.

Line differential protection is implemented with the use of sensitive (**differential unit with restraint**) and high-set measuring units (**unrestrained differential current unit**). Sensitive measuring unit is made with directional restraint to avoid tripping at external faults due to CT saturation. Differential current operating value changes depending on calculated restraining current value. Unrestrained differential current unit is designed for fast clearing of fault with high short circuit currents. It responds to calculated differential current value and has no restraint.

The terminals provide parallel operation via two communication channels with continuous backup.

Functions of TOR 300 DPL protection device are the following:

- longitudinal differential current protection of the line (DPL);
- three stages of phase-to-phase and phase-to-ground distance protection (DP);
- four stages of directional zero-sequence overcurrent protection (ZSOP);
- instantaneous overcurrent protection;
- non-directional overcurrent protection (OCP);
- voltage transformer failure blocking (VTFB);
- long-time voltage unavailability blocking (LVUB);
- open-wire protection (OWP);

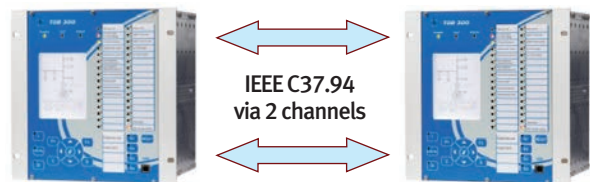


Communication may be provided both using dedicated optical communication lines between devices, or using digital transmission network — networks with multiplexer equipment. Terminal communication ports always operate using the standard **IEEE C37.94**. Using specialized optical amplifiers (not included), the communication via dedicated channel can be performed at distance up to 170 km.

TOR 300 DPL also may include multi-staged full functional distance protection (see TOR 300 DP) for independent backup protection of line in case of communication failure. The device may be provided with the unit of line fault detection in order to prevent false tripping of line differential protection during short circuit over tap transformer on the protected line.

- circuit breaker failure protection (CBFP);
- automatic load shedding (ALS);
- disturbance and event recording function.

If required, TOR 300 DPL devices can be provided in assembled, tested and pre-configured relay protection cubicles fully adapted to your project.



TOR 300 DPT – Transformer protection

TOR 300 DPT terminal provides main and backup protection functions of a two or three-winding transformers and autotransformers. This device is intended to protect a transformer, including its bus arrangement and current limiting reactor.

Differential current protection

Current differential protection operates selectively at internal faults in a protected transformer and all types of short circuits on its leads and does not operate at external faults, magnetizing current inrushes, open-phase conditions, power swings, loss of synchronism, out-of-phase closings and at operative switching.

Current differential protection is three-phase, with maximum current restraint. There is current unrestrained differential current unit implemented without restraint for fast clearing of faults with heavy short circuit current (usually on transformer outputs). Compensation of winding connection groups and fine numerical equalization of differential protection side currents can be configured in TOR 300 DPT. The second and fifth harmonic and current waveform blocking are available to prevent unwanted operations during magnetizing current inrush conditions and transformer overexcitation. CT circuit supervision allows to define a break or a fault of secondary current circuits.

Buchholz protection

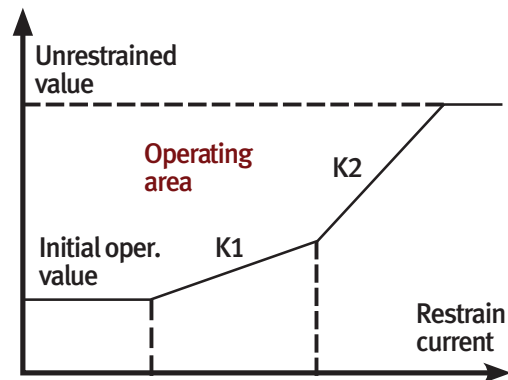
Buchholz protection (BP) is designed for protection from faults inside the transformer tank accompanied by gas emission. It is connected to circuits of leakage current relay, tripping and alarm elements of Buchholz relay. At tripping, BP acts on circuit breaker tripping at all sides of protected element with autoreclosing disabling, and starts CBFP of power supply side breaker.

Available functions of TOR 300 DPT:

- differential current protection of transformer (DPT);
- Buchholz protection (BP);
- overcurrent protection (OCP);
- zero-sequence overcurrent protection (ZSOP);
- logic busbar protection (LBP);
- circuit breaker failure protection (CBFP);
- combined voltage triggering (CVT);
- technological protection (TP);
- power directional units;
- a package of various current and voltage relays;
- disturbance and event recording function.



Differential current



If required, TOR 300 DPT devices can be provided in assembled, tested and pre-configured relay protection cubicles fully adapted to your project. Also it is possible to combine main (TOR 300 DPT) and backup (TOR 300 DP) IEDs in one relay protection cubicle.

TOR 300 DPB — Busbar differential protection

TOR 300 DPB terminal is used for MV, HV and UHV busbar protection from all types of internal faults. This device is designed to protect different bus systems with max. number of bays being 24.

- double bus system equipped with a bus coupler circuit breaker (BCB) and transfer bus, with variable bay fixation;
- double sectionalized bus system with BCB and transfer bus;
- double sectionalized bus system with two circuit breakers instead of BCB;
- double bus system with two circuit breakers (similarly “one-and-a-half-breaker” busbar system) and etc.

For small busbar

One TOR 300 DPB can provide three-phase differential restrained protection of bus arrangement (DPB) and protect all three phases of small busbar:

- for busbar up to 4 bays (TOR 300 DPB in 1/2 of 19" case)
- for busbar up to 8 bays (TOR 300 DPB in 3/4 of 19" case)

For large busbar

In case of busbar with more than 8 bays, bus differential protection is implemented separately for all three phases, i.e. each phase is protected by separate terminal TOR 300 DPB. The terminal implements selective protection of one phase of two bus systems (sections). It includes three single-phase differential zones for this purpose: check-zone and selective zones of 1st and 2nd bus systems:

- for busbar up to 18 bays (one TOR 300 DPB in 3/4 of 19" case for each phase)
- for busbar up to 24 bays (one TOR 300 DPB in full 19" case for each phase)

Differential protection

Each differential zone of DPB consists of main differential unit, sensitive current unit and differential current relay for CT circuit supervision. Fine numerical equalization of bay currents is implemented. Differential unit allows changing fixation of bay currents, i.e. their inclusion in certain differential zone. Sensitive current units are designed for automatic increase of sensitivity of

DPB in busbar autoreclosing cycle, and for consecutive tripping of bays with smaller fault current. Sensitive current units may also be used for tripping the bay at switch-on-fault at busbar. CT circuit supervision prevents unnecessary operation of DPB if current circuits failure happens.

Other protection functions are the following:

- CBFP of all bays;
- bay switch-on-fault logic;
- inhibit of busbar autoreclosing.

Subject to agreement, it is possible to implement other protection functions (for ex., current relay for bar switch-on-fault trip or bay OCP) or logic chains by means of configurable logic. A terminal also provides disturbance and event recording function. Incorporated protection functions provide selective tripping of the protected bus system during its fault.

If required, TOR 300 DPB devices can be provided in assembled, tested and pre-configured relay protection cubicles fully adapted to your project.



TOR 300 BC — Breaker protection and control

TOR 300 BC terminal provides protection and control of circuit-breaker. The device can be used for full bay control according to relay protection commands, remote control commands and manual switching.

Breaker control functions:

- three-phase/single-phase autoreclosing (AR) including voltage / no-voltage control of the bay and busbar, as well as synchronism control and capture;
- protection of circuit breaker tripping and closing electromagnets, open-phase protection (OPP) and phase non-switching protection (PNSP);
- circuit breaker opening and closing time check;

- breaker monitoring;
- mechanical and switching life-time monitoring;
- breaker open/close pick-up;
- circuit breaker failure protection (CBFP);
- analysis of all types of faults generated by the breaker drive;
- measurement of solenoid currents.



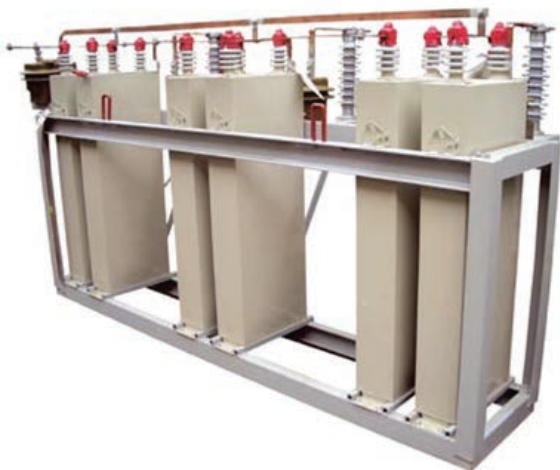
TOR 300 CP — Capacitor bank protection

TOR 300 CP terminal is intended to protect MV and HV capacitor banks. Depending on functionality the TOR 300 CP terminal can provide main differential and backup staged protection as well as circuit-breaker control.

Available components of a full-function device are the following:

- differential current protection with maximum current restraint, unrestrained differential current protection and CT circuits supervision;
- two-stage unbalance protection from internal faults;
- three-stage overcurrent protection;

- negative and zero-sequence overcurrent protection;
- overload protection;
- over- and under-voltage protection;
- circuit breaker failure protection;
- circuit breaker protection and control (see TOR 300 BC).



TOR 300 WAP — Wide area protection

TOR 300 WAP is designed to prevent system crashes upon detection of deviations from normal network operation.

The complex consists of:

- protection against asynchronous conditions;
- thermal overload protection;
- high/low voltage protection;
- high/low frequency protection;
- automatic control of frequency and power and other.

TOR 300 WAP terminal is always filled and configured depending on the project requirements.

Summary

TOR 300 series functionality with ANSI codes

Medium Voltage	
Overhead line, cable, auxiliary transformer, small motor, capacitor bank	
TOR 300 LB	50, 51, 67 - three-stage overcurrent protection (OCP) with acceleration and voltage triggering; 50N/G, 51N/G 67N - two-stage zero-sequence overcurrent protection; 46 - negative sequence overcurrent protection; 27 - voltage protection; 59N - zero sequence overvoltage protection; 50BF - circuit breaker failure protection; 79 - autoreclosing (AR); open-wire protection; section voltage monitoring; breaker control and monitoring; reception of arc protection sensor signal; control of static capacitor banks; automatic load transfer.
Input breaker	
TOR 300 IB	50, 51, 67 - three-stage overcurrent protection (OCP) with acceleration and voltage triggering; 50N/G, 51N/G 67N - two-stage zero-sequence overcurrent protection; 46 - negative sequence overcurrent protection; 27 - undervoltage protection; 59N - zero sequence overvoltage protection; 50BF - circuit breaker failure protection; 79 - autoreclosing (AR); open-wire protection; logical busbar protection; section voltage monitoring; breaker control and monitoring; reception of arc protection sensor signal; loss-of-mains protection (LMP).
Bus-section breaker	
TOR 300 SB	50, 51, 67 - three-stage overcurrent protection (OCP) with acceleration and voltage triggering; 50N/G, 51N/G 67N - two-stage zero-sequence overcurrent protection; 46 - negative sequence overcurrent protection; 27 - voltage protection; 59N - zero sequence overvoltage protection; 50BF - circuit breaker failure protection; 79 - autoreclosing (AR); open-wire protection; section voltage monitoring; breaker control and monitoring; reception of arc protection sensor signal; loss-of-mains protection (LMP).
Voltage transformer	
TOR 300 VT	voltage triggering for bay OCPs; 27, 59 - two-stage under/overvoltage protection; earth fault protection using zero-sequence voltage; ferro-resonance protection; 60 - supervision of VT open delta winding circuit integrity; tripping of input breaker for automatic load transfer; 47 - negative sequence overvoltage protection; 81U/810 - four-stage automatic underfrequency load shedding and frequency autoreclosing, protection by frequency change rate; automatic underfrequency load shedding acceleration; reception of arc protection sensor signal.
Motor	
TOR 300 MD	87M - differential current protection; 48 - overextended motor start protection; 49/49M - thermal overload protection; 66 - starting restriction protection; 68 - current inrush protection; 50, 51 - three-stage overcurrent protection; 50N/G, 51N/G 67N - two-stage zero-sequence overcurrent protection; 46 - negative sequence overcurrent protection; 37 - undercurrent protection; 50BF - circuit breaker failure protection; locked rotor protection; loss-of-synchronism protection; breaker control and monitoring.
Generator	
TOR 300 GP	87G - longitudinal differential current protection; single-system transverse differential current protection; 50, 51, 67 - overcurrent protection with voltage triggering; 21 - distance protection with power swing blocking; 59 - overvoltage protection; 27 - undervoltage protection; 64G - stator winding earth fault protection of the unit generator; zero-sequence overcurrent earth fault protection of the stator; 49G - stator overload protection; asymmetric overload protection by negative sequence overcurrent protection; two-point earth fault protection of the rotor; 24 - excitation current overload protection of the rotor; over-excitation protection; negative active power protection; field-loss protection; 40 - protection against asynchronous conditions without loss of excitation; 81L/H over- and underfrequency protection; protection against unintentional starting of the generator; 50BF - generator breaker failure protection; voltage circuit failure blocking; synchronism detection; overcurrent protection of the rectifier transformer.



High and Ultra High Voltage	
Distance protection (DP)	
TOR 300 DP	21 - five stages of phase-to-phase and phase-to-ground distance protection provided with high-frequency carrier intertripping, HF-interlocking logic, acceleration and remote tripping; 50N/G, 51N/G, 67N - eight stages of directional zero-sequence overcurrent protection provided with carrier intertripping, HF-interlocking logic, acceleration and remote tripping; 50 - instantaneous overcurrent protection; 51 - non-directional time overcurrent protection; 50BF - circuit breaker failure protection; 27 - undervoltage protection; sectionalizing protection; automatic load transfer (ALT); 79 - double-acting three-phase/single-phase autoreclosing; automatic breaker control; protection of circuit breaker tripping and closing electromagnets, open-phase protection and phase non-switching protection; circuit breaker opening and closing time check.
Line differential protection	
TOR 300 DPL	87L - longitudinal differential current protection of the line; 21 - three stages of phase-to-phase and phase-to-ground short-circuit distance protection; 50 N/G, 51N/G, 67N - four stages of directional zero-sequence overcurrent protection; 50 - instantaneous overcurrent protection; 51 - non-directional overcurrent protection; 50BF - circuit breaker failure protection; voltage transformer failure blocking; long-time voltage unavailability blocking; open-wire protection; automatic load shedding.
Line differential protection with distance protection	
TOR 300 DPL+DP	See TOR 300 DPL + TOR 300 DP
Breaker protection and control	
TOR 300 BC	79 - three-phase/single-phase autoreclosing (voltage / no-voltage control, synchronism control and capture); protection of circuit breaker tripping and closing electromagnets, open-phase protection, phase non-switching protection; circuit breaker opening and closing time check; breaker monitoring; mechanical and switching life-time monitoring; breaker open/close pick-up; 50BF - circuit breaker failure protection; analysis of all types of faults generated by the breaker drive; measurement of solenoid currents.
Transformer protection (transformer, autotransformer, shunt-reactor)	
TOR 300 DPT	87T - differential current protection; Buchholz protection; 50, 51 - overcurrent protection; 50 N/G, 51N/G - zero-sequence overcurrent protection; logical busbar protection; 50BF - circuit breaker failure protection; combined voltage triggering; technological protection; a package of various current and voltage relays.
Busbar protection	
TOR 300 DPB	87B - differential current restrained protection (DPB) consisting of check zone (CZ) and selective zones of the first (SZ1) and second (SZ2) busbars; three-phase differential restrained protection of small busbars (DPB); CT circuit supervision; sensitive differential current relay; 50BF - CBFP of all bays; bay switch-on-fault logic; inhibit of busbar autoreclosing.
Capacitor bank protection	
TOR 300 CP	87 - differential current protection, current differential instantaneous relay; CT circuits supervision; 51NC - two-stage unbalance protection from internal faults; 50, 51 - three-stage overcurrent protection; 46, 50N/G - negative and zero-sequence overcurrent protection; 49 - overload protection; 27, 59 - over- and under-voltage protection; 50BF - circuit breaker failure protection; circuit breaker protection and control.
Wide area protection	
TOR 300 WAP	protection against asynchronous conditions; 49 - thermal overload protection high/low voltage protection; 81H/L - high/low frequency protection; 32P/Q - automatic control of frequency and power and other.

Relematika — Reliable protection to meet your needs.

Products:

- powerful TOR 300 series IED for relay protection
- ready-made relay cubicles

Manufacturing:

- 7000 m2 of production and office area
- 11 000 IEDs and 1200 relay protection cubicles annually
- auto-testing software REST

Experience:

- over 10 years on market
- 75 000 installed devices in 9 countries

R&D:

- about 15 R&D projects every year
- 1 D.Sc. and 14 Ph.D.

Personnel:

- over 400 employees
- 30% of personnel in R&D
- 33 years - average age

Educational center

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PRODUCT CATALOG