REG 216.

Generator and generator transformer protection.

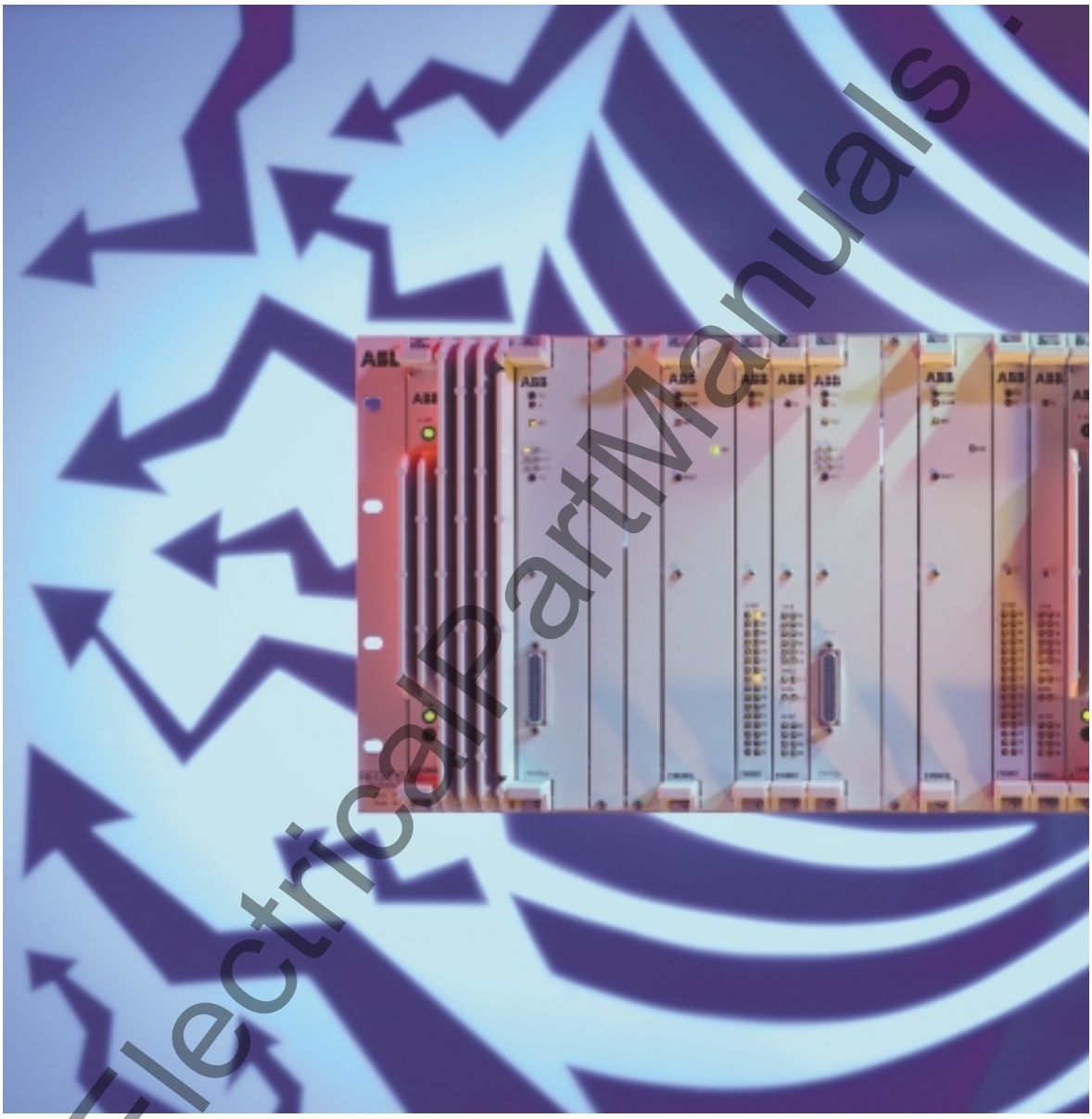


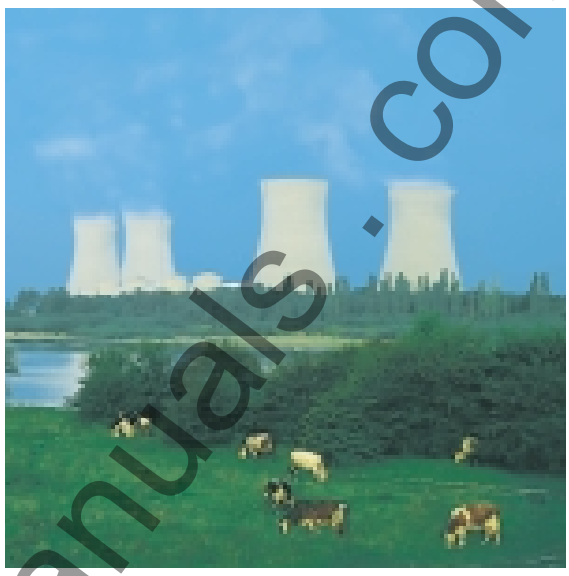
ABB Automation

REG 216 – experience, the basis for confidence.

Generators are the most complex and expensive single elements in a power system. The generator protection system must therefore be designed for maximum dependability and availability. Continuous and secure power delivery is the main objective for power utilities and their customers.

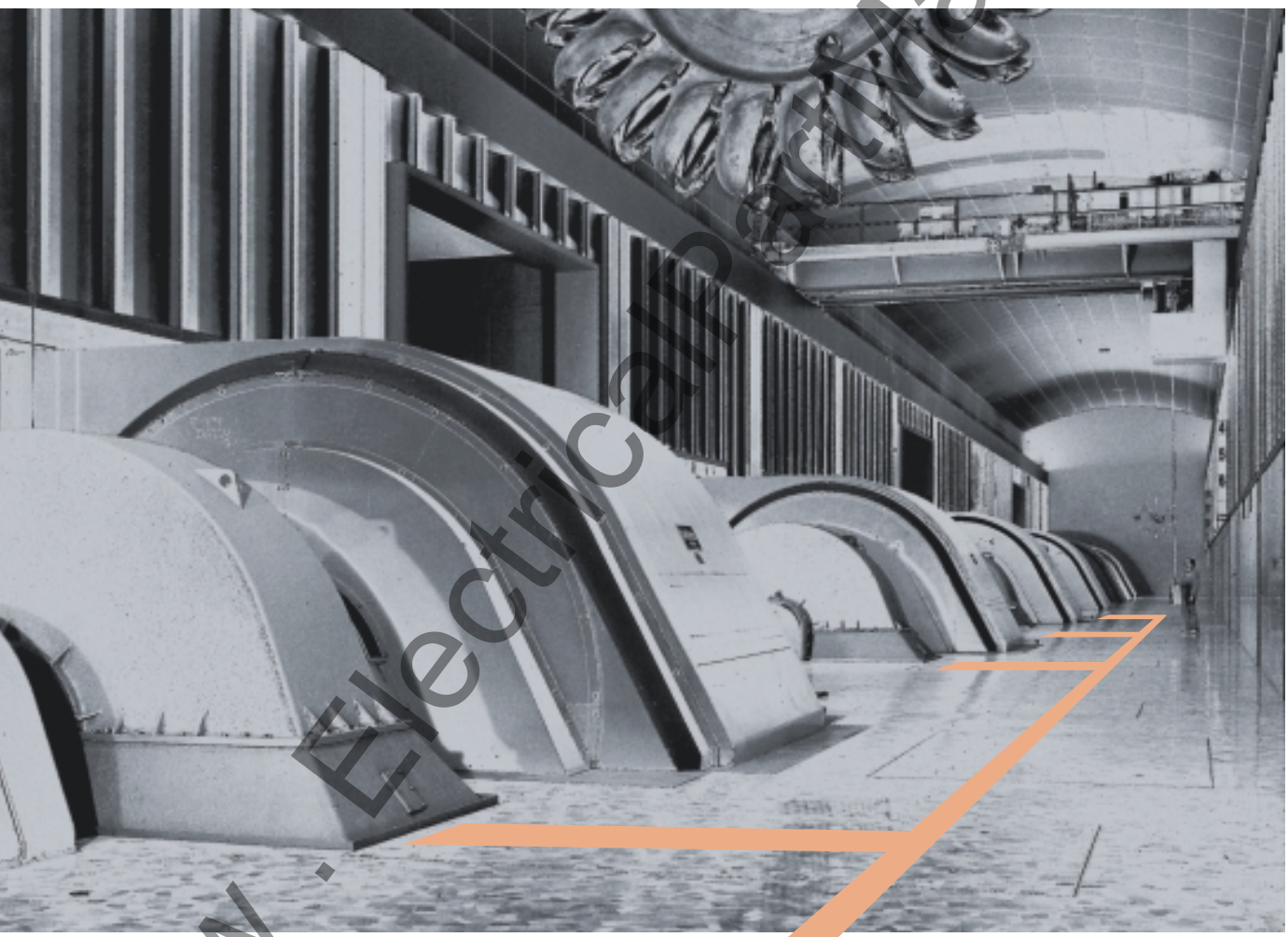
REG 216 systems have already been used successfully in the generator protection field for a number of years. Experience – the basis for confidence – enables us to install this protection for all generator types in power plants around the world. Two different versions are available: REG 216 and REG 216C compact.

The field experiences of the REG 216 systems are numerous. Based on this broad experience and actual knowledge about the increasing customer demands, the REG 216 is continuously being enhanced.



The system is designed to be used with generators and generator transformer units over a wide power range. Applications in Hydro, Pump-Storage, Gas, Combined Cycle, Steam and Cogeneration Stations, either for New, Retrofit or Upgrade Installations, are realized by this flexible system.

The REG 216 generator protection with its system modular hardware and software, its extensive function library and many other features satisfies even the most demanding specifications.



High availability

The availability of protection systems in power generation stations has to be continuously monitored and shall be so high that the preventive shut-down of an important generator in case of a single protection failure will never be required. This high availability is achieved by:

- a minimized number of HW modules
- continuous self-monitoring
- display of actual values
- proven hardware and software concepts.

Accumulated experience

More than 1100 units have been sold in less than 11 years. Different types of installations with customized requirements have been realized. Several fast and successful trips from generator faults have been recorded.

REG 216/REG 216C systems have been installed for generators with power ratings from 10 MVA to 812 MVA in different countries around the world.

Redundancy

Hardware and software redundancy is adapted to the functional requirements.

A fundamental principle of plant operation is that, when a generator's protection is out of operation, the generator has to be isolated. Therefore, two separate systems are the state-of-the-art for generator protection, as it is not possible to provide a remote back-up protection for a faulted generator.

In accordance with this philosophy, two independent groups of protection functions are accommodated in either two separate hardware racks (REG 216) or in only one rack (REG 216C), but with two completely independent hardware groups.

Modularity in software and hardware

The REG 216 are generator protection systems with modular hardware and software.

The systems can be customized to fulfil all specific demands by selecting the corresponding software and hardware modules.

Comprehensive software library

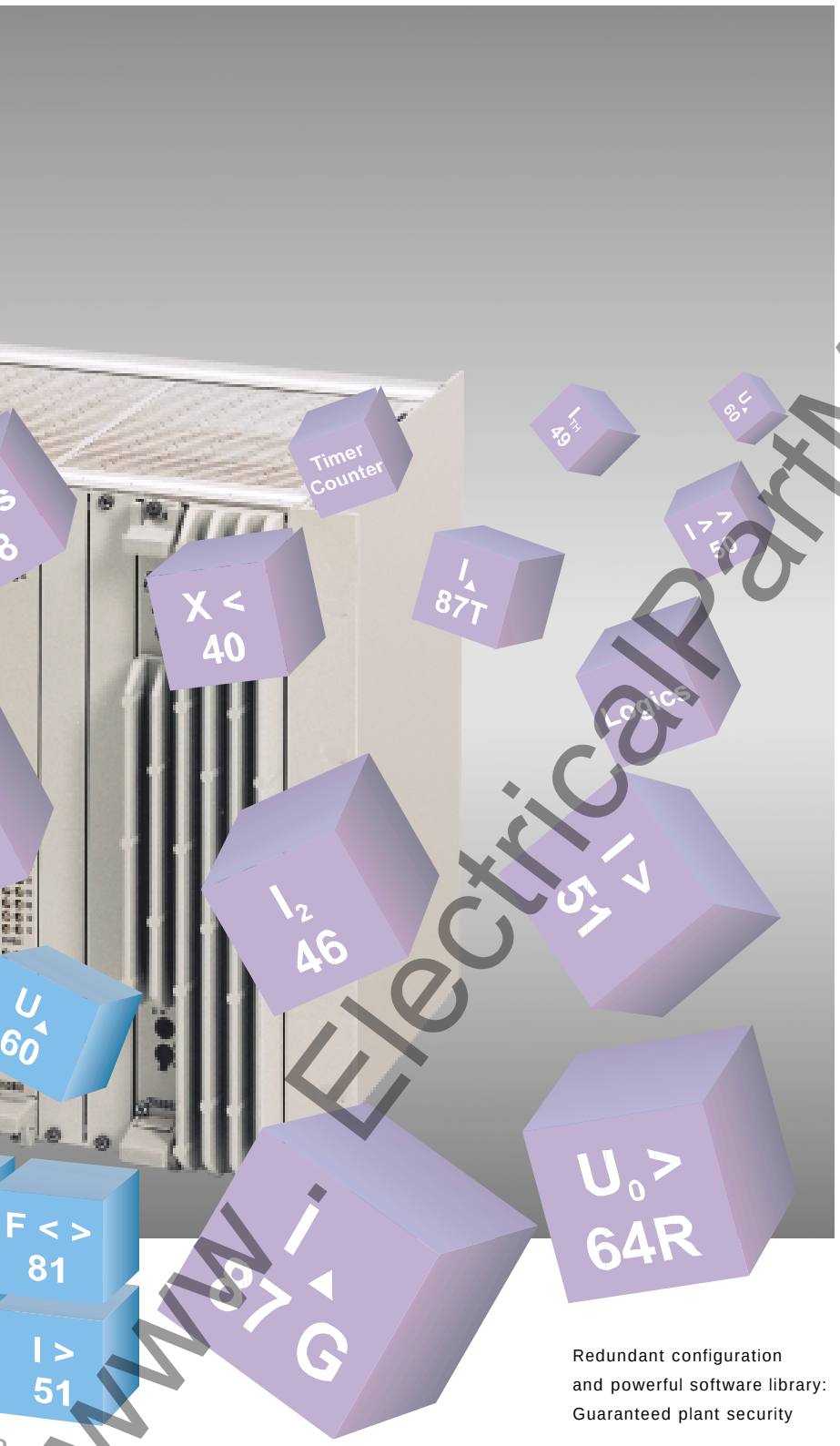
The REG 216 system includes an extensive function library from which any selection for abnormal service and fault conditions can be made.

Any function out of the library can be chosen and activated once or several times. Each function can be combined together with external inputs to provide a total protection scheme.

Comprehensive self-supervision

Self-supervision ensures maximum availability, dependability and security. Hardware and software parts are continuously supervised and information about internal faults is immediately recorded.

An up-to-date overview of the protection system and device status can be requested at any time. System diagnostics information can be provided via the serial interfaces.



Redundant configuration and powerful software library: Guaranteed plant security

Extensibility

The modular structure of the software and hardware permits easy extension for all protection functions matching the increasing application requirements and to achieve the desired redundancy.

User-friendly HMI

- Using a Laptop PC the user is guided by the menu's and help texts.
- Full documentation of all the nettings and recorded information is provided.
- Remote HMI is obtained by using modems.

Open communication strategy

- REG 216 offers several outstanding features including local and remote communication.
- A personal computer can be connected locally and remotely (by modem) for testing and maintenance purposes.
- SA and SMS interfaces according to ABB and international standards are available.

Reduced costs

Besides improved performance the REG 216 protection system offers high flexibility and the possibility of adding new functions using the same hardware set, which has a positive economic impact.

Self-supervision and integrated software testing features save maintenance costs by extended maintenance intervals.

With system monitoring an extension of the lifetime of the protected primary equipment can be achieved.

The use of redundant functions results in savings of potential revenue losses resulting from a power outage.

Application.

The main areas of application for the REG 216 system are the protection of generators and generator-transformer units. Retrofit and new installations can be equipped with REG 216 systems without restrictions.

The modular structure and a large variety of functions available makes this system extremely flexible and suitable for several applications.

Maximum system dependability and availability is achieved by utilizing a multiprocessor concept offering continuous self-supervision.

In addition, diagnostic and post-fault analysis are an integral part of the protection.

The selection of the proper protection concept is based on the generator's importance in the context of the power network and energy supply.

Functionality.

REG 216 / REG 216C is characterized by:

- Modular configuration
- Selectable protection functions from a library
- Planned redundancy
- Wide range of applications
- Settings menu assisted by means of a personal computer
- Fully numerical signal processing
- Continuous self-monitoring by hardware
- Cyclically executed testing routines, mostly by software
- Remote request of diagnostic function
- Online display of measured values
- Display of events and printout
- Disturbance recording (optional)
- Self-documentation, recording of the complete configuration
- Communication and coordination with station control

Software.

The comprehensive software library contains protection functions, measuring functions and monitoring functions. The whole SW functionality is listed below.

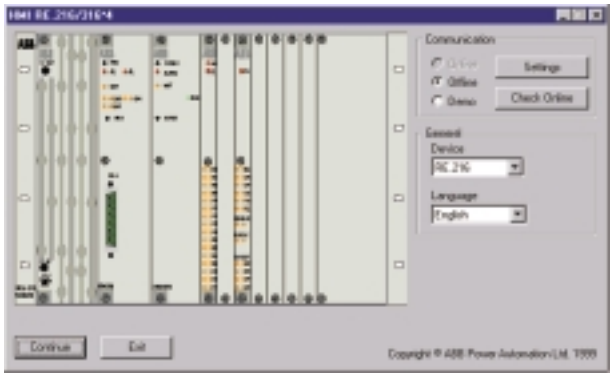
Protection functions

51	Overcurrent (inverse and time-delayed)
49	Thermal overload
59	Overvoltage
27	Undervoltage
87G	Generator differential
87T	Transformer differential
81	Frequency
81	df/dt
32	Reverse Power
87N	Restricted earth fault
59N	Stator earth fault (95 %)
64S	Stator earth fault (100 %)
64R	Rotor earth fault
51/27	Voltage-controlled overcurrent
49S	Stator overload
49R	Rotor overload
46	Negative phase sequence current (inverse and time-delayed)
24	Overexcitation
21	Min. Impedance
40	Loss of excitation
78/21	Pole slipping
27/50	Dead machine
60	Voltage balance
59	Interturn fault

Monitoring functions

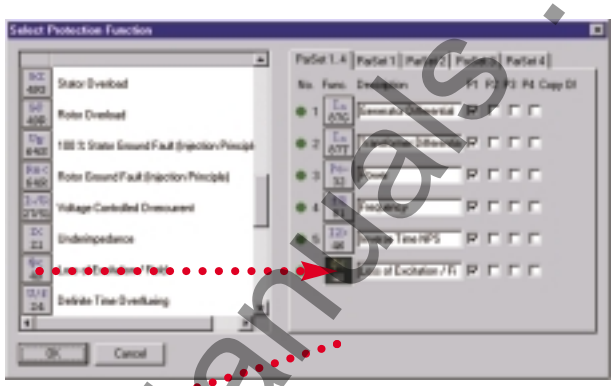
- Event recording
- Disturbance recording
- Measuring functions
- Voltage and current
- Active and reactive power
- Frequency
- Automation functions
- Synchrocheck
- Logics
- AND, OR, Counter
- Flip-flop, Timer, Integrator
- FUPLA
- Function plan language for complex logic

REG 216 HMI.



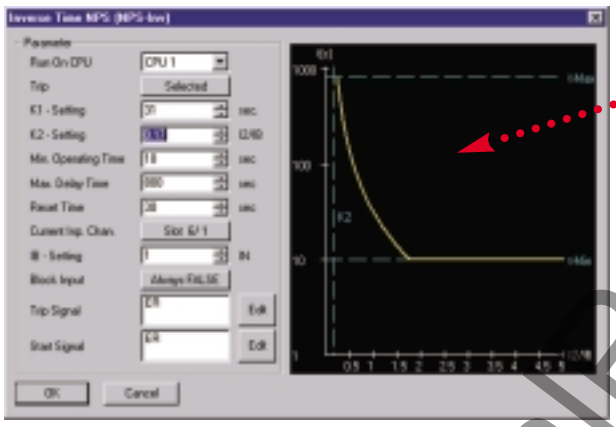
The application software of the REG 216.

The perfect tool for engineering, testing, commissioning and maintenance personnel can be used for ON-LINE or OFF-LINE programming.



Finding the function.

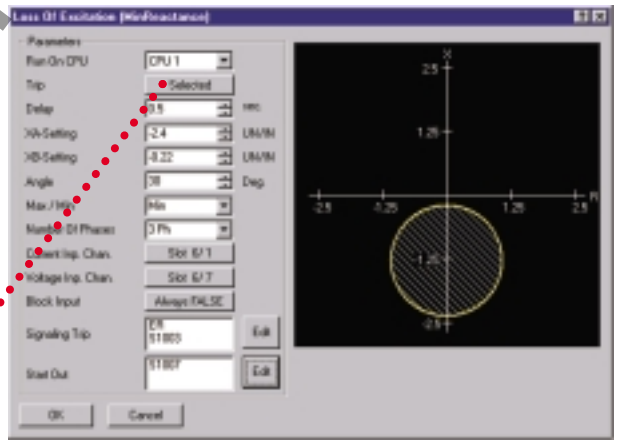
Library with all protection functions necessary for generator and transformer protection. Easy activation of a protective function by "drag&drop" technology.



The interactive characteristic.

Visible tripping characteristics displayed depending on the setting values.

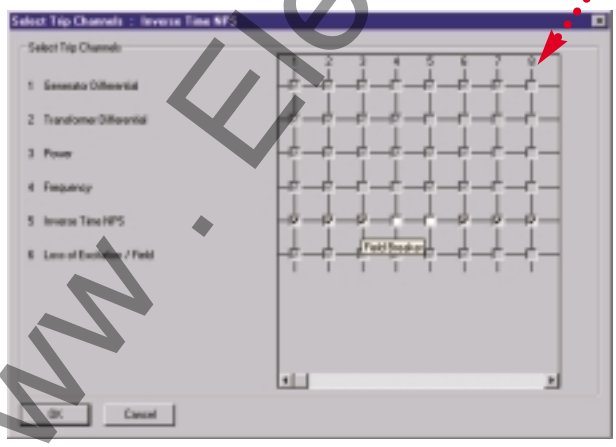
Actual function measurement values can be displayed within the characteristic.



The measurement display.

An analog input channel and protection function measurement window enables ON-LINE testing. Test window for protection function and binary input and output testing simplifies commissioning and maintenance.

Event lists for fast and easy fault analysis.



The tripping matrix.

Tripping matrix gives a perfect overview of the tripping sequence.

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