Station
Automation
& Protection

Transmission Object Terminals

ABB

The total proposition

Panorama is the standard for a comprehensive range of integrated solutions for efficient and reliable management of power networks. Using innovative information technology, Panorama delivers total control of the power process, from generation to consumption. The Panorama standard covers six application areas, each offering specific solutions.

Station Automation

Station Automation includes control, monitoring, and protection for power plant, transmission, distribution, and industry applications. Solutions range from single function units to fully integrated, comprehensive, high-performance substation automation systems.

Network Management

Network Management enhances operation of interconnected power networks. It provides integrated solutions that optimize energy supply while maximizing reliability on both transmission and distribution networks.

Business Management

Business Management provides business tools and solutions to help the power utility become more competitive in today´s changing energy market place. Systems for energy trading, asset management, and customer information provide essential descision support in a competitive environment.

Meter & Load Management

Meter and Load Management comprises products and integrated systems for automatic meter reading, home automation, direct load control, and demand-side management.

Consulting & Services

The range of comprehensive services includes pre-studies, project management, engineering, system configuration, documentation, installation, commissioning, training, upgrading, and maintenance.

Communications

Communications offers solutions for all communications requirements in the transmission and distribution networks of power utilities and industries.

Universal Object Terminals

ABB's universal object terminal allows users the freedom to design terminals that meet a wide variety of protection, control, and monitoring requirements of both present and future Electrical Power Systems.

The object terminal is an integral part of Panorama, the ABB solution for efficient and reliable management of power networks. Panorama offers a complete range of state-of-the-art applications designed to enhance management of electrical power systems. It can serve diverse purposes in any modern power company, rationalising internal processes, as with the ABB object terminal, and acting as a competitive weapon in the electrical market.

The object terminal's universal hardware and software flexibility provide many implementation possibilities. For instance, the terminals can be plug-and-play, pre-programmed and pre-commissioned, and if needed, reprogrammed on-site. The same hardware modules and software functions apply to all terminals – despite their physical size – thus reducing installation, training, operation, and maintenance costs.

The object terminal protection functions fulfil the most stringent requirements in speed, sensitivity, selectivity, security, and dependability. There are optional functions, such as fault localisation, monitoring, manual and automatic control, event recording, and oscillographic disturbance recording.

The object terminal concept is based on extensive engineering experience. ABB designed it for the future – to further improve the performance and efficiency of the power system at a lower cost.

Object Terminals Offers the Freedom to Choose

Choose Partnership or Independence

The universal object terminal offers a full range of solutions. Through a partnership with ABB or through independent efforts, utility engineers can custom-design the protection, control, and monitoring systems needed to match every specific requirement. Such custom-made solutions may include adding: a stand alone fault-locator, a part of a coordinated station automation system, an RTU replacement, or a uniquely configured line terminal with protection, control, and monitoring functions.

Through a partnership with ABB, such custom-made terminals can be offered as unique products delivered from the factory, pre-configured, and ready to plug in.

Choose the Terminal Design

State-of-the-art hardware and software architecture is the foundation of the flexibility offered by the object terminal concept. A large library of type-tested hardware and software modules can be mixed in a suitable fashion to ensure that a variety of requirements can be met.

As an alternative to tailor-made terminals, ABB also offers standard terminals for protection, control, and monitoring of the electrical power system.

Choose the System Design

With either custom-made or standard terminals, users exercise tremendous flexibility in designing their systems. The object terminal concept offers the opportunity to design systems that meet high availability requirements and low cost investments.

The flexibility of protection, control, and monitoring functions, combined with system-wide back-up features, gives design engineers a unique opportunity to improve availability *and* reliability.

Choose Retrofit Installations

Your company's existing installations may be based on available technology and functionality that date back several decades. To ensure network stability, much of this technology must remain, but in an updated form. Also, time and space often pose problems when replacing technology. However, the object terminal concept offers solutions to all of these prospective problems with improved availability.

For instance:

- New equipment may be installed in parallel to existing equipment, thus reducing space requirements.
- Plug-and-play pre-configured system devices ensure short project lead time.
- Custom-made designs (based on a large library of tested modules) ensure compatibility with already existing installations.

An open communication structure allows for integration of third-party devices for protection, monitoring, and control. Several alternatives are available, e.g., the standardised and open protocols SPA and LON. Another alternative is the international standard IEC 870-5-103.

System-oriented tools ensure functional coordination, plausibility checks, and efficient engineering.

The Object Terminal is Simple to Set up

Choose Functions from the Software Library

Choose among a large number of protection, control, monitoring, and communication features. The application library contains type-tested software modules that are developed for the electrical power system. For the complete application library of functions see Function Overview on pages 10-12.

Select the Necessary Hardware Modules

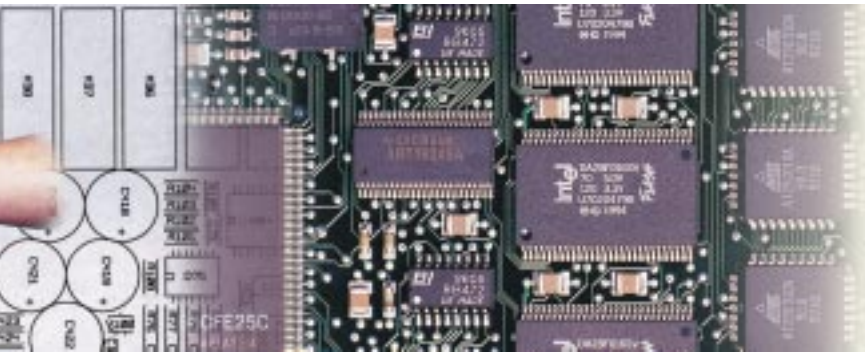
The terminal's modular structure supports multi-processor technology and multiple I/O boards with field upgrading capabilities. The terminal can be delivered with a variety of hardware modules, depending on customer requirements.

Add a Terminal Case

The basic terminal is delivered with a DC/DC converter and a main processing module equipped with a real-time clock that supports the millennium change. The housing can be a one-half, a three-quarter, or a full-size 19" rack, 6 U high (247 mm), and 245 mm deep. The modular system, with standardised plug-in boards, allows for easy modifications and repairs, as well as future field upgrading.

Configure the Terminal

The configuration of the terminal is carried out by means of an IEC 1131-3 PC-based tool, CAP 531, which allows the user to configure the terminal using graphic symbols, and thus makes configuration and documentation very simple and efficient. The configuration can also be made part of a company standard, delivered by ABB as a pre-configured, plug-and-play device.



The Object Terminal's General Functions

Protection, Control, and Monitoring

The object terminal software library consists of several type-tested function blocks. Each function block is specifically designed to meet stringent requirements for dependability and security.

All function blocks can easily be combined into complex functions by using a graphical PC-based tool, CAP 531. A set of standard, logical building blocks, like AND-gates, OR-gates, timers, etc., ensures ease in designing conditional logics. Thus, custom-designed tripping and auto-reclosing logics, as well as control and interlocking logics can be designed by an IEC 1131-3 based human machine interface (HMI).

For available functions, see *Function Overview*, pages 10-12.

Configuration

CAP 531 is used throughout all stages of a project, from engineering to testing, commissioning, documentation, and maintenance. The user can remove and add connections between different function blocks in order to achieve required functionality. A number of free logical elements (AND, OR, Timers, etc.) enables configuration of different requirements for customer-specific solutions.

Various function blocks can be combined either as pre-determined or custom-designed schemes. This means that an output signal from one function block (e.g. start of breaker failure protection from trip logic or block of distance protection from fuse failure supervision. can be used as an input signal to another function block. External signals can be used to block or enable a certain function.

A monitoring function offers an on-line check of all internal signals in an object terminal. This function offers the user a powerful help tool, providing a window into the terminal, where the user can see the changes in a signal status.

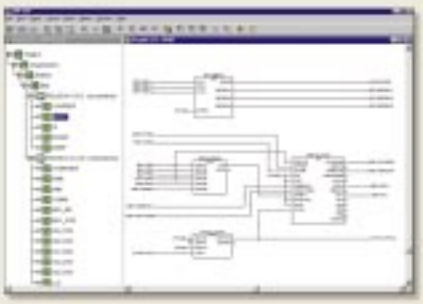
Communication

The object terminal supports multiple communication ports: a front PC connection and two rear serial communication ports, one port with either IEC 870-5-103 or ABB SPA-bus and another port with Local Operating Network (LON)-bus communication.

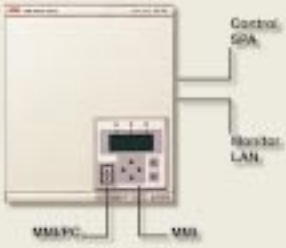
The LON bus is a high speed (1,25 MHz) open-system defacto standard. It allows direct communication between terminals without depending on a central PC or bus-master. To further improve the fault tolerance, the LON bus uses noise-immune fiberoptics with a passive star coupler; so, a faulty fibre optic connection will only affect one terminal.

Information is available, both as time-tagged events with 1 millisecond resolution and load and fault data, and as complete oscillographic disturbance recording. Any function and parameter can be programmed and changed via remote communication

Programmable and interconnectible protection software blocks and logic.



Communication possibilities.



Local Human Machine Interface, HMI

HMI & Information Handling

Each terminal has a built-in, distributed database. This function secures all information locally, ignores disruptions in DC supply, and does not rely on any central memory.

The database acts as a buffer for: event signals, which are time-tagged on-line; fault locator values; and other information. Event recording is not limited to internal events: it can also be used to store any status change in any of the binary inputs. Therefore, the terminal can also be used, for example to monitor switchgear equipment.

A number of terminals can be looped over a fibre optic bus and connected directly to a station PC and a telephone modem. From any remote location with a telephone modem, it is possible to access any station and any terminal: available information includes everything stored in each terminal, even load and fault data.

To verify performance, it is also possible to use the recorded values of current and voltage during a fault for a “playback” via computerised relay test set and simulator program.

Self-supervision

One of the major benefits of microprocessor technology is that no additional hardware is required for self-supervision – a function that increases the availability and reliability of the whole system by ensuring that product faults can be detected immediately.

Messages from the self-supervision system can be available both locally and remotely, which further simplifies fault-tracing, and cuts down repair time by identifying defective parts.

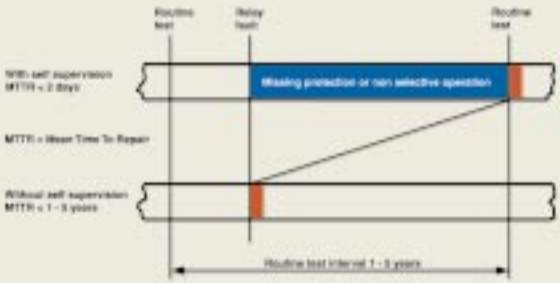
Example: The mean time to repair (MTTR), can be compared with conventional static or electro-mechanical equipment without supervision. With a test interval of, say, 2 years, the MTTR without supervision is 1 year, since a fault will most likely not be detected until the next test is performed. With supervision, a fault can normally be repaired within 48 hours. This means that the MTTR will be 2 days instead of 365 days – a significant improvement.

Documentation Vision

Each terminal is delivered with delivery-specific and user-adapted documentation that corresponds to the hardware and software content. The documentation consists of a user’s manual, terminal schemes, configuration drawings, and apparatus lists. It is available in paper form and on CD-ROM.

Windows based user support programs.

Impact of self supervision.



Delivery specific and user adapted documentation.

Standard Configured Object Terminals

As an alternative to the tailor made terminals, standard terminals are offered for protection, control, and monitoring of the electrical power system.

The REL 500 series

The REL 500 series terminals cover all needs for protection, control and monitoring of overhead lines and cables on all voltage levels, from radial feeders to complex line configurations and series compensated lines.

MV/HV Line Distance Protection Terminals: REL 501 and REL 511

The REL 501 and REL 511 terminals can be applied to distribution and subtransmission overhead lines and cables in a solidly earthed, as well as in isolated or high impedance networks.

The basic protection function is a quadrilateral impedance measurement of full-scheme type for phase-to-phase faults in REL 501 and for phase-to-phase and phase-to-earth faults in REL 511.

A separate general fault criteria (GFC) with advanced characteristics is used in both terminals as an overall measuring function, increasing total operating security.

HV/EHV Line Distance Protection Terminals: REL 521 and REL 531

Both the REL 521 and the REL 531 terminals can be applied to transmission overhead lines and cables in solidly earthed networks; however, the REL 521 places only moderate demands on tripping time, while the REL 531 places very high demands on short tripping time. REL 531 also comes with optional functions for series-compensated networks.

Both terminals have the basic protection function of a quadrilateral impedance measurement of full-scheme type for phase-to-phase and phase-to-earth faults. But, the REL 531 also has a complimentary high-speed zone for carrier send and independent trip functions.

Individual earth-return-compensated, separate-phase selection zone, and scheme communication logics make both terminals optimal for use with parallel lines.

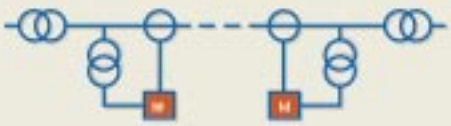
Line Differential Protection Terminals: REL 551 and REL 561

The REL 551 and REL 561 terminals can be applied to distribution, subtransmission and transmission overhead lines and cables in solidly earthed, as well as in isolated or high impedance networks.

The basic function in both terminals is a current differential protection of master/master type, evaluating each phase current separately at both ends, using both the current amplitude and phase angle (segregated vector comparison) for maximum sensitivity with maintained stability.

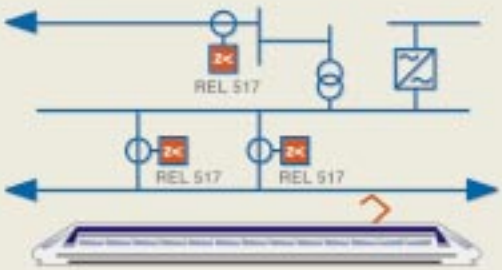
As an option in REL 561 a full-scheme three-zone distance protection function is available as back-up for the communication channel and for the clearing of faults on the remote busbar.

Four different line distance protection terminals.



Two different line differential protection terminals.

REL 517, line protection terminal for railway systems.



Object Terminal for Railway Systems: REO 517

The REO 517 terminal can be applied to single-phase contact lines or two-phase transmission lines for railway systems, both in directly earthed and impedance earthed systems.

The main protection facility is a full-scheme distance protection device featuring three impedance measuring zones with quadrilateral characteristic.

A sudden current change function is used to distinguish between load and fault conditions.

Breaker Protection Terminal: REB 551

The REB 551 breaker terminal provides breaker-related functions associated with protection, such as breaker failure protection, autoreclosing, synchronism and energising check, and pole discordance.

In 1 1/2-breaker, double-breaker, and ringbus arrangements there are two breakers assigned to trip one end of a line or one side of a transformer, and some breakers may be shared by two power circuits or objects.

Control Terminal: REC 561

REC 561 is used for control and supervision of circuits breakers, disconnectors, and earthing switches in any kind of switchgear and busbar arrangement. Functions such as interlocking, autorecloser, and synchrocheck are also included.

The terminal is suitable for various configurations – from cost-effective solutions with a high degree of integration, to optimised, highly available configurations. One REC 561 can handle the supervision and control of three HV bays, with a separate synchrocheck of each bay.

Transformer Protection Terminal: RET 521

RET 521 is a multi-functional transformer protection terminal suitable for fast and selective protection and control of two- and three-winding transformers, auto-transformers, generator-transformer blocks and shunt reactors. Also, an optional voltage control of parallel transformers is provided.

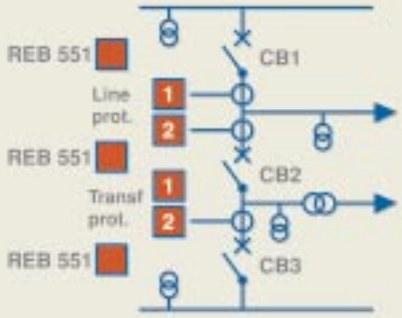
Users can select the transformer size, vector groups, system neutral earthing, and extension of protection functions according to their preferences.

The RET 521, has a compact design for protection and control, with internal programmable logic to provide trip or indication for external protections (e.g. Buchholz and over-pressure relays).

With the new tapchanger position, the differential protection function can be set to optimum sensitivity covering low-fault currents. Furthermore, to guarantee high sensitivity to unwanted operations, RET 521 has selectable and adaptive current bias characteristics for through-fault stability and advanced in-rush restraint methods. No interposing current transformer is required.

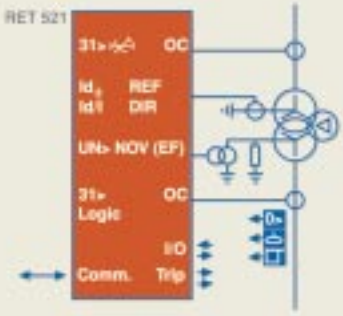
The RET 521 is also a major component in the Intelligent Air Insulated Switchgear (I-AIS) concept.

REB 551, breaker protection terminal.



REC 561, control terminal.

RET 521, transformer protection terminal.



The Object Terminal Function Overview

● Included ○ Optional Not applicable

	REO 517	REL 501	REL 511	REL 521	REL 531	REL 551	REL 561	REB 551	REC 561	RET 521
FUNCTIONS										
Basic										
Self-supervision with internal event recorder	●	●	●	●	●	●	●	●	●	●
Real-time clock with external time syncronization	●	●	●	●	●	●	●	●	●	●
Four groups of setting parameters	●	●	●	●	●	●	●	●	●	●
Local Human Machine Interface (HMI)	●	●	●	●	●	●	●	●	●	●
Configurable logic	●	●	●	●	●	●	●	●	●	●
Service value reading	●	●	●	●	●	●	●	●	●	●
Line Distance										
General fault criteria protection, impedance and current-based		●	●							
General fault criteria protection with phase-preference logic, impedance-based			○							
3 zones phase, phase protection	○	●	●	●	●		○			
3 zones phase, earth protection	○		●	●	●		○			
Additions for series-compensated network	○				○					
Additional zone 4 and 5 protection		●	●	○	●					
High-speed protection					●					
Phase selection logic				●	●		○			
Power-swing detection			○	○	○		○			
Power-swing additional logic				○	○		○			
Scheme communication logic, incl. curr. rev. and WEI logic			○	●	●		○			
Scheme communication logic, phase-segregated	○				○					
Automatic switch onto fault logic		○	○	○	○		○			
Local acceleration logic	○	○	○	●			○			
Sudden current change	○									
Line Differential										
Line differential protection, phase-segregated						●	●			
Charging current compensation							○			
Transformer										
Transformer differential protection, upto 5 restraint groups										○
Restricted earth fault protection										○
Overexcitation protection										○
Phase Current										
Instantaneous phase overcurrent protection		○	○	●	●	○	○		○	
Time-delayed-phase overcurrent protection	○	●	●	●	●	●	●		○	○
Inverse time-phase overcurrent protection	○	○*	○*	○*	○*	○*	○*		○*	○
Thermal-phase overload protection	○	○*	○*	○*	○*	○*	○*		○*	○
Phase-directional check	○	○*	○*	○*	○*		○*		○*	○
Stub protection				○	○		●			
Pole-discordance protection								●	○	
Breaker failure protection	○	○	○	○	○	○	○	●	○	

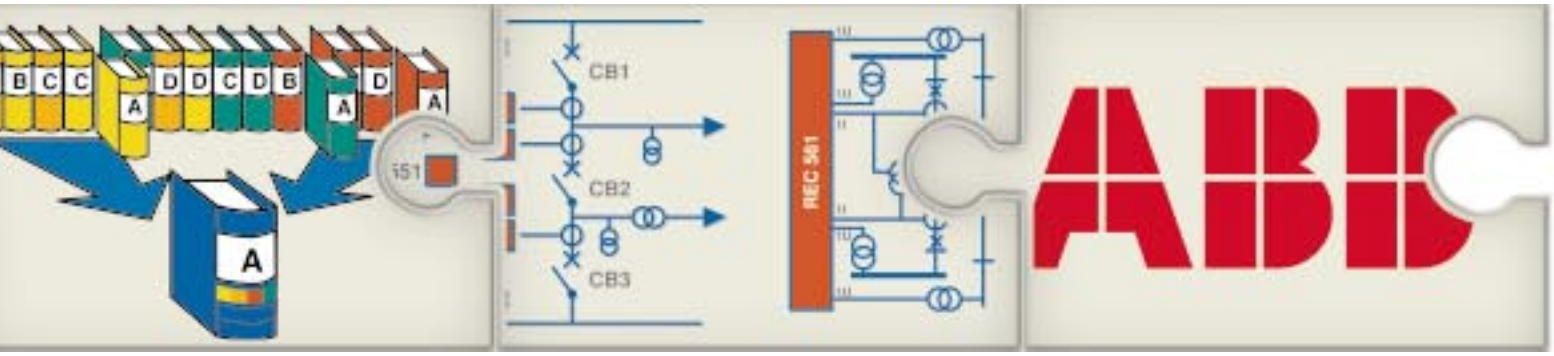
* *to be included in later version*

	REO 517	REL 501	REL 511	REL 521	REL 531	REL 551	REL 561	REB 551	REC 561	RET 521
Residual Current (earth fault)										
Instantaneous residual overcurrent protection (non-dir.)		○	○	○	○	○	○		○	
Time-delayed residual overcurrent protection (non-dir.)	○	○	○	○	○	○	○		○	○
Inverse time residual overcurrent protection (non-dir.)	○	○	○	○	○	○	○		○	○
Residual directional check and communication logic (dir. element)	○	○	○	○	○		○		○	○
Wattmetric residual protection (dir. / non-dir.)*		○	○	○	○		○			
4-step residual overcurrent protection (dir. / non-dir.)		○	○	○	○		○			
Voltage										
Time-delayed under- and overvoltage protection		○	○	○	○		○		○	○
Residual overvoltage protection	○	○	○	○	○		○		○	○
Power System Supervision										
Broken conductor check		○	○	○	○	○	●			
Loss of voltage check		○	○	○	○		●	●	○	
Overload supervision		○	○	○	○	○	●	●		
Secondary System Supervision										
Current circuit supervision, current-based		○	○	○	○	●	●	●		
Fuse failure supervision (negative sequence)		○	○	○	○		○	○	○	
Fuse failure supervision (zero sequence)		○	○	○	○			●	○	
Control, One Bay										
Apparatus control, 8/14 apparatuses	○	○	○	○	○	○	○	○	●	
Interlocking ABC, single or double CB	○	○	○	○	○	○	○	○	●	
Command control (16 signals)	○	○	○	○	○	○	○	○		
Synchro-check and energising-check, single/double CB	○	○	○	○	○		○	○	○	
Synchro-check and energising-check, 1 1/2 breaker arrangement, per breaker								○	○	
Synchro-check with phasing and energising check, single/double CB	○	○	○	○	○		○	○	○	
Autorecloser logic, 1- and/or 3-phase, single/double CB	○	○	○	○	○	○	○	○	○	
Control, Multiple Bays										
Apparatus control for up to 3 bays with up to 24 HV apparatuses									○	
Apparatus control for up to 12 bays with up to 24 HV apparatuses									○	
Synchro-check and energising-check, single/double CB, 1 1/2-breaker diameter									○	
Synchro-check and energising check, 2 bays double CB/3 bays single CB									○	
Autorecloser logic, 1 and/or 3 phase, three CB									○	
Autorecloser logic, 1 and/or 3 phase, six CB									○	
Tap Changer Voltage control										○
Logic										
Three-pole tripping logic		●	●	●		●				
Single- or two-pole tripping logic	●		○	○	●	○	●	●	●	
Pole discordance logic (contact based)	○	○	○	○	○	○	○	○		
Additional configurable logic	○	○	○	○	○	○	○	○	●	○
Binary signal collection and transfer to remote end	○	○	○	○	○			○		
Binary signal interbay communication	○	○	○	○	○	○	○	○	●	

* *to be included in later version*

	REO 517	REL 501	REL 511	REL 521	REL 531	REL 551	REL 561	REB 551	REC 561	RET 521
Monitoring										
Disturbance recorder, 15/40 seconds	○	○	○	○	○	○	○	○	○	○
Event recorder	○	○	○	●	●	○	●	●	●	●
Fault-locator recorder	○	○	○	○	○		○			
Trip-value recorder	○	○	○	○	○	○	○	○	○	●
Increased measuring accuracy for U, I, P, Q	○	○	○	○	○		○	○	○	
Metering										
Pulse-counter logic for metering	○	○	○	○	○	○	○	○	○	
HARDWARE										
Casing										
1/2 of 19" rack (Maximum 3 I/O modules)	○	○	○	○	○	○	○	○	○	
3/4 of 19" rack (Maximum 8 I/O modules)	○	○	○	○	○	○	○	○	○	●
1/1 of 19" rack (Maximum 13 I/O modules)									○	
Analogue Input Modules										
50/60 Hz analogue systems, conventional inputs		●	●	●	●	●	●	●		○
16 2/3 Hz analogue systems, conventional inputs	●									
50/60 Hz analogue systems, low-level voltage inputs (10V)*		○	○	○	○	○	○	○	○	
50/60 Hz analogue systems, optical transducer interface (OITP)*		○	○	○	○	○	○	○	○	○
Power Supply										
Power supply module	●								●	●
Power supply module, with binary in/out module		●	●	●	●	●	●	●		
In/Out Modules										
Binary in/out module, 8 inputs and 12 output relays, 24/36V 48/60V 110/125V 220/250V	○	○	○	○	○	○	○	○	○	○
Binary input module, 16 inputs, 24/36V 48/60V 10/125V 220/250V	○	○	○	○	○	○	○	○	○	○
mA input module, 6 channels	○	○	○	○	○	○	○	○	○	○
Binary output module, 24 output relays.	○	○	○	○	○	○	○	○	○	○
Remote-End Data Communication Modules										
V35/36 co-mode/contra-mode	○	○	○	○	○	○	○	○		
X21	○	○	○	○	○	○	○	○		
RS530/422 co-mode/contra-mode	○	○	○	○	○	○	○	○		
Fibre optical modem	○	○	○	○	○	○	○	○		
Short-range galvanic modem	○	○	○	○	○	○	○	○		
Short-range optical modem	○	○	○	○	○	○	○	○		
Optical Station bus Communication Modules (for SMS and/or SCS):										
Port IEC 870-5-103 / SPA (SPA only for RET 521)	○	○	○	○	○	○	○	○	○	○
Port LON	○	○	○	○	○	○	○	○	●	○
UTILITIES										
Second MMI Language										
French/German/Italian/Russian/Spanish	○	○	○	○	○	○	○	○	○	
Customer-specified 2nd language	○	○	○	○	○	○	○	○	○	
Customer-Specific Ordering										
Customised, specific configuration	○	○	○	○	○	○	○	○	○	○

* *to be included in later version*



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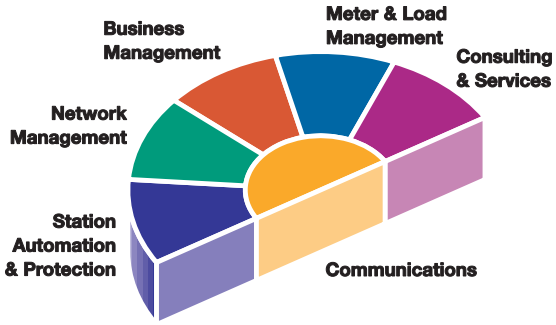

Panorama is the standard for a comprehensive range of integrated solutions for the efficient and reliable management of power networks. Using innovative information technology, Panorama delivers total control of the power process, from generation to consumption. The Panorama standard covers six application areas, each offering specific solutions.

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