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

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

Station Automation & Protection
Station Automation and Protection includes control, monitoring, and protection for power plant, transmission, and distribution applications. Solutions range from single function protection and control 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.

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.

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.
The 500 series
The 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 full-scheme quadrilateral impedance measurement 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 meets basic demands on tripping time, while the REL 531 meets very high demands on short tripping time. REL 531 is also offered with optional functions for series-compensated networks.

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

Individual earth-return-compensated, separate-phase selection zone, and scheme communication logics makes REL 531 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 master/master current differential protection, 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 reserve for the communication channel and for the clearing of faults on the remote busbar.
Line Protection Terminal for Railway Systems: REL 517
The REL 517 terminal can be applied to single-phase lines or two-phase transmission lines for railway systems, both in directly earthed or impedance earthed systems.

The main protection is a full-scheme distance protection terminal 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, 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 one REB 551 assigned to each breaker. Voltage selection and sequential autoreclosing are optional functions that minimise engineering in multi breaker arrangements.

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, pole discordance, autoreclosing, synchrocheck, and back-up protection are also included.

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

Configuration
The configuration of the terminals 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. 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 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 blocking of the distance protection from the 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 by which the user can see the changes in a signal status.
The Terminal Function Overview

<table>
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<th>FUNCTIONS</th>
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<th>REL 501</th>
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<td>Line Differential</td>
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<td>Stub protection</td>
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<td>Breaker failure protection</td>
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<td>Current, Residual (earth fault)</td>
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<td>Instantaneous residual overcurrent protection (non-dir.)</td>
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<td>Wattmetric residual protection*</td>
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<td>4-step residual overcurrent protection (dir. / non-dir.)</td>
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* to be included in later version

[Diagram of terminal function overview]
### Voltage, Phase Wise
- Time-delayed under- and overvoltage protection

### Voltage, Residual (earth fault)
- Residual overvoltage protection

### Power System Supervision
- Stability check*
- Broken conductor check
- Loss of voltage check
- Overload supervision

### Secondary System Supervision
- Current circuit supervision, current based
- Current circuit supervision, current-/voltage-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

### 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

### Monitoring
- Disturbance recorder, 40 seconds
- Event recorder
- Fault-locator
- Trip-value recorder
- Increased measuring accuracy for U, I, P, Q

### Metering
- Pulse-counter logic for metering

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* to be included in later version
**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 optic
- Short range galvanic modem
- Short range optical modem

**Optical Serial Communication Modules (for SMS and/or SCS):**
- Port IEC 870-5-103 / SPA
- Port LON

**ENGINEERING FACILITIES**

**Second HMI Language**
- French/German/Italian/Russian/Spanish
- Customer-specified 2nd language
- Customer-Specific Ordering
- Customised, specific configuration

* to be included in later version
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.