**Features**

- Protection for all applications
- Control with flexible system functions
- Communication with fibre optics
- Self-supervision and diagnostic
- Support of hardware and software
- State of the art microprocessor technology
- Distributed intelligence
- User-friendly workplaces
- High performance and availability
- Step by step implementation possible
- A total substation automation concept
- User friendly software tools

**Application**

**General**

Substation Automation includes a complete range of flexible object terminals, including all necessary functions for substation control and substation monitoring systems. All of the building blocks are based on state of the art numerical technology, compatible with conventional equipment. The new, improved technology can thus be implemented step by step from stand-alone protective relays to complete coordinated protection and control systems.

ABB can offer a comprehensive range of numerical object terminals for generation, transmission, distribution and industry. These state of the art products offer many new possibilities in protection and control. Communication of load and fault data gives a new dimension to protection and control. The Substation Automation concept even allows the connection of existing or new static/electromechanical relays.
However the information from these relays is limited to data from signal contacts included in the relays.

Separate transducer for voltage and currents can however be added to conventional relays.

Signals from the conventional relays can be hardwired to the numerical ones. By this arrangement both existing relays and new numerical relays can communicate via a common fibre-optic bus. This makes the concept suitable for partial retrofit as well as completely new installations.

The ABB Substation Automation concept has five cornerstones:
- Protection
- Communication
- Control
- Monitoring
- Tools

One of the main advantages of ABB Substation Automation is that it may include building blocks from various product ranges and generations. High performance and total quality are the major requirements for each building block.

Continuity for old and new products including openness for the future such as for new sensors or intelligent switchgear.

The ABB Substation Automation concept enables efficient power network management by providing modular solutions for protection, control, monitoring and communication for substations.

A two-level communication structure
The entire station is controlled and supervised from the higher station level, while individual lines, transformers, etc. are controlled and protected from the lower bay level. A number of dedicated object terminals are provided for bay level protection and control. This structure simplifies future retrofit or expansion; i.e. the installation of additional bays.

The distributed structure increases the availability, because an internal fault will affect only a small part of the equipment. Since the most important functions are located at the bay level, the operation of a bay can be maintained even if an internal fault occurs at the station level. The equipment for each bay is housed in one or more cubicles which can be assembled and tested at the factory. This reduces on-site erection and commissioning work. Information is transferred between the two levels via a serial interbay bus.

Station-oriented signal collection and the serial transmission of information between the two levels considerably reduces the amount of cabling required. Disturbance free transmission has been achieved by using a fibre-optic bus.

ABB has the experience
Over the years, ABB has designed and manufactured protective relays and control equipment for substations in power transmission and distribution systems. The experience thus gained has served as the basis for designing modern numerical protection and control equipment which can ensure more efficient and reliable operation.

The first commercial microprocessor-based control system in a substation was installed by ABB in 1983. Since then, ABB has delivered numerous systems throughout the world. This unique experience has been very valuable when designing the building blocks of the today’s Substation Automation concept.

**Functions**

<table>
<thead>
<tr>
<th>Human system interface (HSI):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operation and supervision of HV equipment</td>
</tr>
<tr>
<td>• Data presentation</td>
</tr>
<tr>
<td>• Engineer’s support</td>
</tr>
<tr>
<td>• System supervision</td>
</tr>
<tr>
<td>Remote control interfacing:</td>
</tr>
<tr>
<td>• Adaptation for serial communication with control centres via various protocols</td>
</tr>
</tbody>
</table>

**Automatic functions and control sequences:**

| • Interlocking of switching devices within a bay and between bays |
| • Synchro-check function |
| • Tap-changer control for voltage regulation |
| • Load transfer for parallel transformers |
| • Switching sequences |
| • Automatic power restoration |
| • Load shedding |
| • Autoreclosing |
| • Control of reactive power |
Data acquisition and handling:
- Remote data acquisition
- Data evaluation
- Energy measurement
- Event list
- Alarm list
- Reports
- Printed output: event logs, reports
- Disturbance recording

Condition monitoring:
- Gas density monitoring (GIS)
- Switchgear monitoring
- Transformer monitoring

Protection functions:
- Generator protection
- Line protection
- Busbar protection
- Transformer protection
- Feeder protection
- Motor protection
- Protection and Control terminal for Railway power system
- Phasor measurement terminal

Conceptual structure

![Conceptual diagram of ABB Substation Automation](en03000029.vsd)

**Series 100 Terminals**
Each module in the terminals is based on rack mounted printed board assemblies. Analogue auxiliary functions can be added in a separate rack.

Series 100 is based on existing stand-alone relays for transmission and generation. The 100 number series is used to describe different hardware combinations of each terminal.

The REB 100-series includes the busbar protection. REB 100 is based on the well known ultra-high speed differential measuring method used in RADSS. This allows CT-saturation as well as sharing of CT-cores with other protections. One 19” 6U rack can adapt 12 lines with test switch and 18 lines without.
Protection and control terminals (cont’d)

**Series 200 Terminals**
The same terminal can be used for more than one object and various functions. The selection is made in the software and choice of CPU capacity.

Series 200 is dedicated to complex applications which require many functions included in one hardware module.

The terminals have unique flexibility - a large number of software modules are available for system adaption. The terminal can be used for more than one object by selecting pretested software modules and the appropriate CPU capacity.

REG 216 is designed for generator and transformer applications. A complete generator transformer block protection unit, including disturbance recording, can be accommodated. It can be divided into sub 1 and sub 2 for maximum redundancy. A personal computer can be used for the on-site configuration and setting of the software library provided.

**Series 300 Terminals**
Each terminal is mounted within one compact case which also has all interfaces. The function selection is made in software and internal hardware.

REG 316, the numerical generator protection terminal can include all important functions required for protection and monitoring of generators, motors and unit transformers.

The desired functions can be selected from a comprehensive library.

**Series 500 Terminals**
The Substation Automation Concept provides a full range of numerical protection and control terminals. Depending on the application each terminal is named according to the following designation system, “REx 5xx”.

The letter indicates the terminal type, e.g. L for Line and T for Transformer. The three digits indicates in what series the terminal is designed.

The 500-series is the latest serie in state-of-art-technology terminals for protection, control and monitoring. A common hardware and software platform is used.

These IT based terminals are suited for generation, transmission and distribution applications. A local HMI and PC connection at the front gives fast access to terminal data at commissioning and service. In addition listed terminals below all have two independent communication ports for control and monitoring.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>REB 551</td>
<td>Breaker protection terminal</td>
</tr>
<tr>
<td>REC 561</td>
<td>Bay terminal with a vast array of functions for one or several bays at transmission and subtransmission level</td>
</tr>
<tr>
<td>RED 521</td>
<td>General differential protection terminal</td>
</tr>
<tr>
<td>REL 501</td>
<td>Line distance protection terminal</td>
</tr>
<tr>
<td>REL 511</td>
<td>Line distance protection terminal</td>
</tr>
<tr>
<td>REL 521</td>
<td>Line distance protection terminal</td>
</tr>
<tr>
<td>REL 531</td>
<td>Line distance protection terminal</td>
</tr>
<tr>
<td>REL 551</td>
<td>Line differential protection terminal</td>
</tr>
<tr>
<td>REL 561</td>
<td>Line differential protection terminal</td>
</tr>
<tr>
<td>REO 517</td>
<td>Protection and Control terminal for Railway power system</td>
</tr>
<tr>
<td>RES 505-C1</td>
<td>Disturbance recording and fault location terminal</td>
</tr>
<tr>
<td>RES 521</td>
<td>Phasor measurement terminal</td>
</tr>
<tr>
<td>RET 521</td>
<td>Transformer protection terminal</td>
</tr>
</tbody>
</table>

Several options are available for all terminals such as e.g., disturbance recorder, event recorder and breaker related functions. All terminals can be configured with a large amount of binary inputs and outputs that are programmable. These can e.g. be used for control of switchgear equipment.

The REO 500 object terminal has a unique flexibility. It can be delivered as e.g. a basic overcurrent relay or as an integrated protection and control terminal, depending on selected options.

Pre-configured terminals (C-terminals) for cost-effective engineering and commissioning are also available.
**Terminals**

**REB 551** breaker protection terminal is used for breaker related protection and control functions in all types of network. The terminal is specially suitable in 1 1/2 breaker and double breaker switchgears.

**REC 561** control terminal is used at bay level in a Substation Control system to control and supervise circuit breakers, disconnectors and earthing switches, in any kind of switchgear/ busbar arrangement. Control functions such as interlocking, autoreclosing and synchron-check can also be included as well as protection and monitoring functions.

**RED 521** general differential protection is used for protection of single and double busbars, autotransformers, generators etc. The terminal has a typical operating time of 12 ms and very low CT requirements.

**REL 501** line distance protection terminal is used for protection of overhead lines and cables in high impedance or solidly grounded distribution and subtransmission networks. The terminal can also be used in transmission networks up to the highest voltage levels. The terminal performs three-pole tripping.

**REL 511** line distance protection terminal is used for protection of overhead lines and cables in high impedance or solidly grounded distribution and subtransmission networks. The terminal can also be used in transmission networks up to the highest voltage levels. The terminal performs one-, two- and/or three-pole tripping.

**REL 521** line distance protection terminal is used for protection of overhead lines and cables in solidly grounded networks. The terminal performs one-, two- and/or three-pole tripping.

**REL 531** high speed line distance protection terminal is used for protection of overhead lines and cables in solidly grounded networks at high requirements for fast operating times (less than one cycle). The terminal is also suitable for series compensated networks and performs one-, two- and/or three-pole tripping.

**REL 551** line differential protection terminal is used for protection of overhead lines and cables. Phase-segregated current differential provide excellent sensitivity and phase selection in complex network configurations. The terminal can perform one-, two- and/or three-pole tripping.

**REL 561** line differential protection terminal is used for protection of overhead lines and cables. Phase-segregated current differential provide excellent sensitivity and phase selection in complex network configurations. The terminal can perform one-, two- and/or three-pole tripping.

Charging current compensation can be included in order to increase the sensitivity at high capacitive currents. A three-zone line distance protection can also be included and the included distance protection can also be used for series compensated networks.

**REO 517** protection and control terminal is used for catenary lines as well as overhead lines and cables feeding the railway power system. The terminal is available for 16 2/3, 50 and 60 Hz systems.

**RES 505-C1** disturbance recording and fault location terminal is a stand-alone disturbance recorder and fault locator terminal. It is suitable for use in any power system application where the recording (to a high resolution) of power system voltages, currents and binary signals is required to facilitate analysis of disturbances that occur in the power system.

**RES 521** phasor measurement terminal is used for synchronized measurements (GPS) of phase angles between corresponding phasors in different locations within the power system. Increased power transfer, operational security and profit can be achieved.

**RET 521** transformer protection terminal is used for protection of two or three winding power transformers, generator-transformer blocks and reactors.

Voltage regulations for single or parallel transformers with on load tap changers can be included.

The above terminals can communicate with a Substation Automation system, see Fig. 1. In addition to this, local printout from event recorder and disturbance recorder can be included separately or as back-up.
Tools

CAP 540 Terminal tool box

Application
CAP 540 is used throughout all stages of normal operation from engineering, parameter setting, commissioning and power system disturbance evaluation. It can also be used to clear front indications, switch setting groups and turn autoreclosure on/off. The engineering work can be done off-line on the PC.

A disturbance upload and an analyzer tool is included in the tool box for fault data presentation.

Design
The default configuration in the terminals and the pre-configured terminals can easily be adapted to the customer’s needs with the configuration tool. The configuration consists of function blocks, logic gates and timers etc. The functions blocks included in a terminal are available in a library of functions, where the engineer can pick a function and connect it according to the requirements.

SMS 510 Substation Monitoring system

Application
The SMS 510 substation monitoring system is an overall substation monitoring system that gives you essential information about your electrical transmission and distribution process. This information comprises all measured, recorded and calculated data such as indications, settings and diagnostic information available in the protection and control terminals from ABB. Setting and resetting facilities for the protection and control terminal are also provided by the product.

LIB 520 High voltage software modules

Application
The high voltage software modules are a complement to the standard MicroSCADA software and provides an easy-to-build and easy-to-use HSI for supervision, control, disturbance collection and SMS functionality in MicroSCADA.

Fig. 2  CAP 540 basic package and full version
**System structure**

The system structure is divided into two levels: bay level and station level. The bay level consists of distributed terminals, whereas operator stations and gateways belong to the station level.

Together all units combine control, monitoring, recording and report generation in a hierarchy system that supervise its own hard- and software.

The entire substation is controlled and supervised from the station level, while individual lines, transformers, etc., are protected, controlled and monitored from the terminals at bay level.

Information is transferred between the two control levels via a serial data bus. The station level equipment is connected to the bay level computers via the interbay bus. Bay-oriented signal collection and the serial transmission of information between the two control levels considerably reduces the amount of cabling required.

Disturbance-free communication is achieved by using fibre-optic links.

**Station level**

**Design**

The result of high requirements of availability is the use of two independent and autonomous units on station level; the operators workplace (HSI) for control and monitoring of the substation in the station, and the gateway (GW), for communication with a remote control centre. Whenever the independence requirements are lower the function of all these units can be combined in the HSI.

**Human system interface (HSI)**

**Design**

Using a “mouse”, the operator can operate, control and supervise the substation by moving the cursor on a color video display unit (VDU) to symbols or text. The necessary information is displayed in windows. Along with the windows and data, symbolic push-buttons of any size can be located anywhere on the VDU.

From the HSI, the operator can also read and change the settings of all numerical protective relays which are connected to the system via the fibre-optic bus. This HSI provides the operator with an excellent overview of the complete substation, and gives easy access to the various functions.

**Fig. 3** System structure for transmission and subtransmission voltage applications
Bay level

Design
Functions related to a particular bay are located at the bay level. This is why the bay terminals are independent of each other, which increases the availability. Since the most important functions are located at the bay level, the operation of a bay can be maintained even if a fault occurs at the substation level. The equipment for each bay is housed in one or more cubicles which can be assembled and tested at the factory. This reduces on-site erection and commissioning work.

The protection functions in the bay terminals are at all time unaffected by the status of the station level equipment.

Communication

Application
ABB Substation Automation offers a very flexible and open system which can be designed to combine both the comprehensive ABB range of terminals, numerical relays from other manufacturers as well as existing and new conventional relays. Furthermore, ABB Substation Automation can communicate to different types of Network Control Systems as well as third party HSI’s via an OPC server.

One of the major differences between numerical technique and conventional technique is that numerical technique can store and memorize information, both digital, analogue and processed information. To structure and communicate the “right” information to the “right” person at the “right” time is essential for the overall performance of the system. How we arrange human system interface is a task for both user and manufacturer. Furthermore, efficient and safe substation operation requires well-structured means of communication that meet the present and future needs of the user.

ABB Substation Automation provides communication facilities that can be adapted to the safety and efficiency requirements of operators and management, with capabilities for future expansion as needs increase and new technology is introduced.

Design
The information is structured on three levels: operator’s workplace, engineer’s workplace and local human machine interface (HMI) or portable PC. The local HMI (which is a menu driven alpha-numerical display located on the front of the IED) or portable PC provides easy access and readability. The last ten disturbance recordings are stored in the IED memory, and a summary for the last disturbance is automatically displayed at IED operation.

The setting of the IED is normally done from a portable PC or from the local HMI. Four different sets of values can be programmed. Remote setting can in principle be done, but this has to be carefully studied by the user to prevent outside persons from gaining access to this possibility.

The operator’s workplace monitor can display all information relevant to the substation operation. The depth and the detail of information is selected by the operator, step by step, not to create information pollution.

The engineer’s workplace monitor presents the information stored in the terminal at trip operation. All terminal data and settings are accessible and are used for post-fault evaluation and disturbance recording. Once the data has been transferred to the data base, the terminal’s event memory can be reset from the master station.

The communication between the different terminals and the operator’s workplace is performed via a fibre-optic object bus type LON. All numerical ABB Substation Automation protection and control IED’s can be connected to this bus.

Non LON bus compliant devices such as a conventional relay may be connected the interbay bus via any 500 terminal.

The unique structure in combination with a full range of versatile terminals provides outstanding flexibility with high availability and redundancy. It is an “open” system which can be tailored to the specific need of each user and each application. It offers a step by step implementation, including both new and existing protection relays.

For communication with an existing Network Control System a separate Gateway or the HSI can be used. Today more than 50 different Protocols have been implemented.

Protocol implementations for any other type of Network Control System, not yet included in our library, can be quoted on request.
Control and Monitoring

Application
The traditional control system consists of a number of control panels with instruments, switches, alarm annunciators and other equipment. It also provides a number of sub-systems such as interlocking, Automatic Voltage Regulation for power transformers, sequence-of-event recorders, etc. Large space and cabling requirements, extensive maintenance and difficulties in modifying the system for future expansion are characteristics of traditional control systems.

The ABB Substation Automation concept eliminates these disadvantages. In addition, the system provides statistics for the reporting of history, trends, etc.

Self-supervision minimizes maintenance and fault tracing. Once the system is programmed for a specific application, the user can, with little effort, modify and add functions himself.

The numerical monitoring and control system is the key to safe and efficient substation operation. This system, which has been offered by ABB for several years, is thoroughly tried and tested.

The two independent communication interfaces in the 500 series allows for a separate off-line monitoring system.

Self-supervision

Application
One of the major benefits of microprocessor technology is that no additional hardware is required for self-supervision; a function which increases the availability and reliability by ensuring that product and system faults can be identified without extensive fault-tracing, so the equipment can be returned to service quickly.

Self-supervision of the protection and control hardware and software thus reduces maintenance costs. The CT and VT circuits, the dc supply and trip circuits, and the communication links are also monitored continuously, which further increases the availability.

Messages from the self-supervision system are available both locally and remotely. This simplifies fault-tracing and cuts the time for repair. The resulting reduction in down time increases the dependability and security.

Functionality

The main benefit of ABB Substation Automation self-supervision is that it covers the entire system. Moreover, back-up functions are included, for high reliability.

With a test interval of two years, the Mean Time To Repair (MTTR) without supervision is approximately one year, since a fault will not be detected until the next test is performed. With supervision a fault can normally be repaired within 24 hours. This means that the MTTR will be one day instead of 365 days - a significant improvement.

In the system supervision display in the station HSI, according to Fig. 4 below, the following information is presented:

- System configuration
- Status of installed equipment e.g. IEDs, communication devices etc.
Workplaces

In the ABB Substation Automation concept the human system interface is structured in workplaces/levels.

The operator’s workplace centrally in the substation and with remote gateway.

The protection and control engineer’s workplace with local and/or remote PC.

These workplaces can be used separately or combined. The important thing is that the Substation Automation offers this very comprehensive and flexible way of working.

The operator’s workplace

The operator’s workplace is continuously connected to each terminal. Via fibre-optic cables all information is immediately transferred to the operator. This information is selected to give a clear and fast view about what is happening. Printout from the disturbance recorder modules can be obtained.

Fig. 5a shows an example of pictures which the operators can select from the monitor.

The single line diagram gives rapid information about the status. Each bay, for example a transformer bay can be monitored and load, oil temperature, etc. can be logged.

In Fig. 5b the event list is shown which is continuously updated.

Fig. 5c and Fig. 5d shows an example of a trend logging.
Substation Automation concept

Fig. 5a) Single line diagram with system status

Fig. 5b) Event list

Fig. 5c) Trend logging
The protection and control engineer’s workplace

The protection and control engineer’s workplace can be located locally (in the substation) and/or remotely. It is possible to call any station via the local telephone system and order information to be transferred. Data compression and local expert programs can be used to limit this information.

CAP 540 is a software package installed in the workplace, locally and/or remotely, for support to the protection and control engineer.

CAP 540 architecture

CAP 540 supports the architecture shown in figure Fig. 6. Computers with CAP 540 installed can be connected to both the front and rear SPA port. When CAP 540 is installed on a station local PC automatic upload of disturbance data and transfer of disturbance reports to a remote fax is possible. It is also possible to only have a modem in the station. From the remote CAP 540 PC it is possible to connect to both stations with a station local PC and stations with only a modem connection. In order to work with remote IEC 61131-3 configuration it is required to only have a modem connection in the station without the station local PC. With CAP 540 it is possible to save disturbance data in COMTRADE format on a ftp server. This requires LAN/WAN connection.
The CAP 540 Terminal Tool Box offers the user all the necessary functionality in order to work efficiently with the protection and control terminals in every step of the terminal life cycle. The terminal function libraries in the tools can be automatically adjusted to match the ordered terminal.

**Parameter setting tool**

With the parameter setting tool, you can read parameters from the terminal, edit the parameter values and write them to a terminal. You can also change parameter setting groups, compare terminal and PC-file parameters or edit your parameters in advance and write them to the terminal later when it is available.

In addition, an simple monitoring function with access to service values is included. The simple monitoring functionality lets you upload several power system values like currents, voltages and frequency. Service values include list of terminal events, current status of internal signals, self supervision, LED status, etc. The tool can also monitor communication for the line differential function and display internal measurements from functions like the automatic reclosing function.

![Fig. 7 Example parameter view in PST of line protection function](image)

**Setting Visualisation Tool**

Settings Visualisation Tool, SVT, is a tool for visualizing PST steady-state parameters for under impedance protection functions. You can run SVT while editing parameters in PST and see the effect of the changes in the terminal settings. Analysis of the zones can also be carried out.

The program allows export of figures available in SVT to test set software by RIO-format de-facto standard. This file is supposed to be used by test equipment software and contains zone characteristics and trip time. Impedance measurement zones are cut by the General Fault Criteria, GFC, (if switched on) in the RIO-file. On the screen these characteristics remain the same, because SVT presents settings, rather than operation. It is also possible to export a graphical plot to the Clipboard. A plot displays a part of the impedance plane in accordance to the current scale and position. All zones and faults are shown on the plot.
Disturbance handling
After the disturbance list has been uploaded the fault data can be uploaded and displayed with the graphical disturbance viewer and analysis program.

Curve forms and data can then be printed for documentation by the operator.
**Grapical configuration tool**

The configuration tool offers a compilation check to help the engineer to make a correct configuration.

The monitoring function provides an on-line check of all internal signals in a 500-terminal. It offers a window into the terminal, where the commissioner can see all changes in signal status. With this tool, the commissioner obtains a powerful help.

It is also used by the control system constructor that for example adapts the interlocking logic to the switchgear configuration of the station.

The configuration can be printed on a user-defined form which gives documentation of the configuration that matches the terminal completely.

**The Intelligent terminal**

The Substation Automation concept can be adapted to various degrees of requirements and complexity. Fig. 11 shows an example of a terminal which is appropriate for a 220 kV line. Main 1 protection is REL 521 and main 2 protection is REL 531 which means the disturbance recorder module is included in REL 521. For a substation with one and a half breaker arrangement the panel layout is shown in Fig. 12. The equipment related to the breakers are installed in panel 1. In panel 2 the line 2 equipment can be placed and in panel 3 the line 3 equipment can be placed. As an alternative, the subsystem 1 equipment, with main 1 protection for both lines, can be placed in cubicle 2 and subsystem 2 equipment in panel 3.

These line bays are operated through the workplaces in Fig. 3.
Fig. 11  Single breaker arrangement, one transmission line and duplicate protection.

Fig. 12  Breaker and a half arrangement with three breakers, two transmission lines and duplicate protection per bay.
ABB Substation Automation offers a unique range of state of the art components which can be combined with conventional relays to give total coordinated protection and control.

These products can be used as stand-alone but can also be upgraded, step by step, to form the “Intelligent substation”. ABB Substation Automation offers workplaces for the operator, relay engineer and service engineer. These workplaces include software packages for statistics, setting calculation, disturbance evaluation, automatic testing and other expert programs.

ABB Substation Automation also offers great flexibility and can give technical and economical optimum solutions for different requirements on performance and availability.

For a technical proposal please contact your nearest ABB representative. The following information is required:
- One line diagram of the high voltage system
- Protection, control and monitoring functions included per terminal
- Performance level required for main functions
- Functions included per workplace
- Existing equipment to be interfaced with
- Remote communication required

The selection of suitable terminals is based on customer requirements on performance and the functions to be included.
References

CAP 540
Terminal Tool box 1MRK 511 112-BEN

LIB 520
High voltage software modules 1MRK 511 126-BEN

REB 100
Busbar protection terminals 1MRK 505 007-BEN

REB 551
Breaker protection terminal 1MRK 505 093-BEN

RED 521
General Differential protection 1MRK 505 031-BEN

REF 541/543/545
Feeder terminals 1MRS 751818-MDS

REG 216
Generator protection terminal 1KHA-000 602-SEN

REG 316
Generator protection terminal 1MRK 502 004-BEN

REM 543/545
Motor and Generator terminals 1MRS 751406-MDS

RE0 517
Multi-functional terminals for railway application 1MRK 506 135-BEN

RER
LON bus Connection Devices 1MRS 750435-MBG

RES 521
Phasor measurement terminal 1MRK 511 115-BEN

RES 505-C1
Overcurrent protection terminal 1MRK 505 121-BEN

RET 521
Transformer protection terminal 1MRK 504 013-BEN

REx 5xx
Protection, Monitoring and Control Solution for Transmission Networks 1MRK 500 049-SEN

SMS 510
Substation Monitoring System 1MRS 751973-MBG

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