An introduction to protection and control systems  
page 2

Introducing IEC 61850  
page 3

Delivering results  
page 4&5

Global solutions for every application  
page 6&7

Integrated control & protection  
page 8&9

IED 670 series – protection, control and monitoring in a single unit  
page 10

COM 600 for interoperability  
page 11

Introducing REF 615  
page 12

Over 20 years of experience in protection and control projects
At the most basic level, lost power equals lost money. Utility networks have a duty to keep the lights on, and their performance is regulated by measures such as Customer Minutes Lost/Customer Interruptions. In the same way, industrial networks demand continuity and security of power supply to keep their processes running. A halted process can soon result in massive losses. For example, if an oil refinery loses its supply, it can be two weeks before it is back up and running. Automation schemes can help to keep power interruptions to a minimum.

Protection is used to detect power system faults and other abnormal conditions. It also protects human life and properties closer to the power network. In the home, this protection comes in the form of fuses in plugs, and fuses and MCBs (miniature circuit breakers) in the consumer unit that measure the current flowing. There are also (RCD) residual current devices, which essentially use Kirchoff’s current law to detect an earth fault, which could be a current about to pass through a human, and so trip the circuit before any serious harm occurs.

POWER NETWORK PROTECTION
The protection used on power networks is essentially the same, just on a much larger scale. The quality of a protection scheme tends to be measured in terms of reliability, speed and selectivity:
- A reliable protection relay operates correctly when there is a power system fault, but doesn’t make an incorrect operation when no fault is present.
- Speed is the minimum operating time to clear a fault – to avoid damaging equipment and causing system instability.
- Selectivity means only disconnecting the faulted section of the network or plant – this helps maintain continuity of the rest of the supply or system.

MAIN AND BACK-UP PROTECTION
In general, main and back-up protection is applied. Main protection operates every time a fault is detected. Back-up protection is set to operate should the main protection fail to operate.

OVERCURRENT
Overcurrent is most the basic form of protection and is used at all voltage levels. To achieve selectivity, the protection is graded according to time and/or current (higher fault current = faster operating time, lower fault current = slower operating time). If circuits are in parallel, or if there are multiple sources, the direction of the current needs to be considered, so directional overcurrent protection is used.

DIFFERENTIAL
Differential (unit) protection is applied to lines, transformers, motors, generators and bus-bars. This is absolutely discriminative / selective protection, but it requires communication either via copper pilots or other more advanced forms such as telephone circuits or optical fibres.

DISTANCE
Distance (non-unit) protection discriminates between faults by measuring the impedance of the line. The line generally has a constant impedance (independent of current and voltage levels). It doesn’t require communications but can use them to help increase speed, or selectivity/security.

SIGNALLING
Teleprotection signalling can be used in conjunction with distance protection to provide increased selectivity and faster tripping times, using communications infrastructure such as pilot wires or SDH/PDH networks.

LOADSHEDDING
When generation capacity cannot support the load then the balance between generation and load needs to be addressed. The indication that generation is not matching the load is a drop in voltage and/or frequency. Loadshedding schemes are used to disconnect less important loads to help redress the balance. Of course, measuring power in and out would also indicate the loss of balance.
There are well over 4,000 substation automation systems installed worldwide. But until quite recently, there was no overall standard for the serial communications in substation automation, so the majority of these systems are based on proprietary standards. This meant that each system was limited to using components from a single supplier, or complex and costly protocol conversions had to be applied.

It is natural for power utilities to want to safeguard their investment in substation automation equipment. This has resulted in a growing demand for flexible, future-proof systems able to cope with changing requirements, philosophies and technologies. In the early years of this century, the industry responded by developing and releasing a new standard, IEC 61850 ‘Communication Networks and Systems in Substations’ which is the first and only global standard that considers all the communication needs within substations.

ABOUT THE STANDARD

IEC 61850 essentially defines standardized data models and sets, communication mechanisms and the system configuration language (SCL) in order to achieve a number of goals:

- interoperability of system components and software tools
- free allocation of functions as well as choice of different system architectures
- reuse of system configuration data
- understanding of the system description and functionality.

The standard is future-oriented, taking into consideration that developments in communication technology move faster than developments in the functionality of substation automation, protection and control equipment.

ABB LEADS THE WAY IN IEC 61850

- Continuous engagement in the elaboration and validation of the standard
- Consistent implementation of IEC 61850 as a key technology in products, systems and tools for best possible system integration
- Efficient introduction of systems based on the standard with modularized solutions for station control and monitoring as well as bay control and protection
- Guaranteed system openness for future hardware and functional extensions through fully standard-compliant documentation
- Development of state-of-the-art tools for efficient design, engineering, assembly, testing and commissioning, as well as maintenance of substation automation systems
- Integration of third-party devices and systems in ‘multi-vendor’ systems
- Quality assurance by ABB’s in-house System Verification Centre (SVC) in Baden, Switzerland – the world’s only vendor test centre with official qualification by UCA International, an independent user organization for IEC 61850
Delivering results worldwide

Building reliability into crucial Austrian power corridor

In 2006 the Austrian utility, Verbund-Austrian Power Grid (APG), installed ABB’s PSGuard 850 WAMS (Wide Area Monitoring System) to oversee the power flow along a crucial and heavily loaded transmission corridor between the cities of Vienna and Ternitz, connecting northeastern and southern Austria.

The challenge for this corridor is that much of the 1,900MW of surplus power produced in the northeast is transferred to the south of the country, which has a deficit of 1,400MW, over three 220kV power lines which have a total capacity of 1,200MW. Increased congestion restricts the flow of electricity and threatens the security of supply. Compounding the congestion is the gradual addition of another 1,000MW of electricity from wind generation in the northeast, as well as the closure of coal-fired power plants in the south, which is creating even greater demand for power from the north.

ABB’s WAMS solution stabilizes and protects the corridor in conjunction with three phase-shifting transformers installed at critical nodes in the network. The system coordinates the operation of the phase-shifting transformers for maximum performance, line over- and underloads can be balanced, and losses caused by uncoordinated loop flows (inadvertent power losses as electricity is transmitted through the network) are also minimized. This helps APG to get the most out of its existing transmission capacities, and at the same time significantly reduce the risk of a black-out caused by overloaded lines.

ABB has also installed monitoring systems for utilities around the world, including Swissgrid (ETRANS) in Switzerland; the Tennessee Valley Authority in the USA; Hrvatska Elektroprivreda in Croatia; Hellenic Transmission System Operator in Greece; Comisión Federal de Electricidad / Centro Nacional de Control de Energía in Mexico; Eskom in South Africa; Statnett in Norway; Electricity Generating Authority of Thailand and Fingrid Oyj in Finland.

First IEC 61850-based substation automation solution in successful operation

In 2006, ABB’s first IEC 61850-based substation automation solution entered successful operation at EGL’s 380kV Laufenburg substation in Switzerland. The project was carried out as part of the Swiss utility’s general refurbishment of the substation - including five line bays, one transformer and one bus coupler and had to be performed during continuous operation within a highly critical time span.

ABB’s solution and migration scenario for the primary and secondary refurbishment was based on the feeder-by-feeder installation and commissioning of highly integrated gas-insulated switchgear (GIS) on the primary side as well as new IEC 61850 compliant control and redundant protection equipment on the secondary side. This involved integration of a third-party Main 2 device, as well as communication to the existing station-level system via a gateway for protocol conversion.

Airport power supply secured for Beijing Olympics 2008

ABB has helped Beijing International Airport (BCIA) to secure a stable power supply for its new terminal 3 (T3) in readiness for the 2008 Summer Olympics. The project, covering one 110kV substation and more than 50 10kV switching stations, included over 940 sets of REX 521 terminals. These provide multi-functionality – including protection, control, metering and monitoring – within the same terminal – for the 10kV feeders and 10kV transformers to meet all protection requirements. Remote monitoring and control enables BCIA to speed up fault analysis and clearance should a network fault occur.
Weaving a power control web for London Underground

The London Underground (LU) power supply system is kept under continuous control by control room engineers and operators. They are responsible for the safe and reliable operation of a 22kV sub-transmission system with load delivered via an 11kV system to 158 delivery points. Local transformer rectifiers provide 630VDC for the train motive power, as well as lower-voltage supplies for auxiliary services such as signalling, lighting and ventilation. The DC supply is switched off at night, to allow track maintenance work to be carried out safely while trains are not running, and this typically results in over 500 switching operations each day.

In August 1998, LU signed a 30-year, £1 billion Private Finance Initiative (PFI) contract with EDF Energy, Balfour Beatty and ABB – to operate, maintain, finance and renew the Underground’s high-voltage power supply system. One of ABB’s main roles has been the design, installation and commissioning of a new integrated, high-performance, SCADA (Supervisory Control and Data Acquisition) SPIDER system. It provides overall control of the power distribution network for four out of seven LU regions (Eastern, Western, Victoria and Metropolitan) as well as the primary 22kV distribution network. It replaces six previous SCADA systems that were either at the end of their working life or were temporary installations.

The SPIDER SCADA system is fully integrated with LU’s communications system. Control of the network is centralized in two replicated command centres (main and emergency), with dual application servers interconnected by a high-speed fibre-optic communications link.

Remote terminal units (RTUs) provide the local interface with the power network equipment (transformers, switchgear, SVCs and so on), and they are linked into the SCADA system by copper lines converging on six data concentrators. One of the key technical challenges in the project was in developing the protocol conversion software that enabled the legacy RTUs to communicate with the new SCADA system.

The SPIDER system has proved its capability to ensure a high level of power availability to meet LU’s stringent operating targets. In particular, greater visibility of the power system enables any issue to be flagged and identified, so that early action can be taken to prevent it escalating into a fault.

Breakthrough for generator protection schemes in France

ABB is pioneering multi-functional generator and transformer protection, and has now won the largest protection project of this kind to date using REG 670 devices. Over the next eight years, these will be retrofitted to 28 generator and transformer protection systems in seven of EDF’s 900MW nuclear power plants in France.

Protection schemes, each comprising three REG 670 devices, will replace the original GSX5b protection systems supplied by ABB in the 1970s. It was EDF’s satisfaction with their long and reliable operation that enabled ABB to win this upgrade project.

The enhanced schemes will provide duplication in hardware and functionality – a significant gain in operational safety. They will also help to prolong the service life of the generators and transformers, raising productivity and availability and ensuring continuous, optimal power delivery.

Substation automation for Mumbai oil refinery

ABB has completed a major contract for the Hindustan Petroleum Corporation Limited (HPCL) to supply substation automation systems for 6.6kV and 415V substations for the expansion of an oil refinery in Mumbai, India.

The ABB solution is based on the verified implementation of IEC 61850 and includes nearly 500 terminals and relays. High availability is ensured by full redundancy at the station level. For maximum performance and security, physically separated communication networks have been implemented for the substations.

Successful RED 670 trial with National Grid

In 2007 ABB completed a successful nine-month site trial with National Grid in which the GPS-based RED 670 line differential protection IED was installed on 400kV substation circuits in North Wales. The extended trial demonstrated the RED 670’s capabilities in a realistic ‘in-service’ environment, without exposing the power system to undue risk.

RED 670 devices were installed in a three-ended 400kV substation circuit between Traffswynd, Legacy and Deeside. They were connected alongside the existing protection systems where they were subjected to the same working environment and fed the same live input data. The only difference from a fully live installation was that the RED 670 devices didn’t perform any actual tripping. Instead, their outputs were monitored to check that they were analysing the data correctly and making the right decisions.

As well as mimicking the behaviour of the existing site protection systems, the RED 670 devices were subjected periodically to additional tests to monitor their stability under abnormal conditions. This involved planned route switching of the communications channels and simulation of the loss of the GPS signal, both individually and simultaneously. There were also times when the devices were subjected to unplanned communications interference. They performed appropriately under these circumstances and then even better when the problem was resolved.

Near the end of the test programme there was a lightning strike that created a transient primary fault on the overhead line close to Traffswynd. This type of event causes a lot of different things to happen very quickly on a network, especially a large, sudden increase in current. The RED 670 responded perfectly, providing exactly the right switching response.
TOTAL SUPPORT
A 20-year track record in global substation automation makes ABB a proven and reliable solution provider. It has the resources to create the company cost-effective integrated solutions as well as supplying stand-alone products for coordinated protection, signalling and control for any transmission and distribution application.

ABB’s customers are mainly electrical utilities, transmission, distribution and generation companies as well as the manufacturing and processing industries. The company works in close cooperation with channel partners such as OEMs, EPCs and main contractors.

ABB’s substation automation service, support and training capabilities provide the comprehensive support that enables customers to operate more efficiently, profitably and competitively.

BROAD SCOPE OF SUPPLY
ABB’s scope of supply includes:

- solutions for efficient control, protection, automation and monitoring of new and existing substations of any type, size and topology
  - IEC 61850-compliant solution portfolio of interoperable systems, products and tools
  - full system integration and verification
  - consulting and system design optimization
- protection schemes for generators, busbars, lines, transformers, shunt reactors, capacitors and motors as well as station protection systems with decentralized structure and functional integration
- service and support in all project phases:
  - consulting, power system studies, disturbance analysis, relay setting calculations, CT / VT calculations
  - system design and engineering, project management, assembly, testing, commissioning, training and maintenance
  - main contracting for turnkey installations as well as upgrades of existing substation automation systems

Product portfolio
Global solutions for...
Training is vital in helping customers to improve their understanding of how to use the individual equipment or system and how to operate the whole power distribution and transmission process most efficiently. Furthermore, training provides:

- improved economy in process operation
- faster and safer operational decision making
- improved knowledge in adapting products to specific requirements
- one-to-one contact with ABB’s fully trained and experienced instructors.

Training can be provided at the ABB universities in Vaasa, Finland, Västerås Sweden, Baden, Switzerland and by ABB’s local organization in the UK.
ABB has developed an Integrated Control and Protection (ICP) approach that offers significant benefits for substation automation projects, both for upgrading existing schemes and for new build. ICP uses pre-engineered, pre-tested and pre-approved equipment, which enables ABB to condense the same functionality into a much smaller footprint and reduce the amount of on-site work, as well as achieve significant reductions in delivery time. ABB Substation Automation Manager, Andy Osięcik, looks at some of the challenges involved in the delivery of an ICP project.

The type-registration of standard solutions addresses the strategic challenge of providing a standardized modular design scheme. There is also a further major strategic challenge in marrying a standardized solution to the particular requirements of a specific substation. Several factors may affect this second strategic challenge. Many are present from the start, and some run concurrently, exponentially increasing the challenges to delivery.

During tendering, it is not logistically possible to do a detailed risk analysis of each site. There is, therefore, an inherent risk at the start of the project. There are technical and commercial components to this inherent risk, which need to be managed carefully, to ensure successful and cost-effective delivery.

Detailed below are the major challenges that ABB faced in executing NICAP (National scheme for Integrated Control and Protection) 2, an ICP contract for National Grid, after the award of the contract.

### ENGINEERING

- National Grid (NG) has an on-line repository for drawings known as the LiveLink in order to facilitate seamless interfacing of design work. However, the dynamic nature of substation refurbishment and associated site work means there are some cases when ongoing work is not fully reflected in the drawings in the repository. We bridge this gap by doing a scan of the drawings existing at the actual site, and recreating master drawings.

- In some block houses and GIS buildings, space considerations necessitate the installation of new equipment in the space occupied by old equipment, posing additional constraints in areas such as mounting and cable trunking while housing the new solution.

- It is not uncommon for ABB’s planned outage on a protection feeder to take place at the same time as another contractor’s outage on a transformer associated with the feeder. This concurrent engineering with mutual design impact requires close co-ordination between the two suppliers. We work closely with NG and other suppliers in such cases.

- Even with type registration, there is the potential for preferential engineering to suit operating practices that specific sites are accustomed to. To avoid revisiting designs, we try to get key site personnel involved as early in the design as possible.

- Some of the equipment to be refurbished has proprietary components whose functionalities need to be retained in the new installation, but which do not lend themselves to easy interfacing or replication. This requires design work-arounds addressing existing operational practices and overcoming resistance to change.

- ICP has introduced new requirements into the portfolio of solutions required. Software interlocking on triple and double busbar stations was tested and type registered on the ICP platform.

- The UK’s Construction Design Management Regulations require installation risks to be designed out as far as possible. This takes the design from a largely office-based activity into a more comprehensive risk mitigation design environment. This also necessitates design vigilance to ensure continuous improvement of the design from one outage to the next.
DOCUMENTATION

- NG has given timescales for the submission of documentation in relation to return to service dates. Some are milestones with associated liquidated damages. With several outages running in close proximity, some of them even concurrently, this becomes a delicate balancing act. ABB has a good record in ICP, and our commissioning files have been particularly well received.

- Since the outage period is fixed and the return to service date is sacrosanct, it is vital that equipment is integrated and tested fully before shipping to site. At site, an Site Acceptance Test (SAT) is conducted to ensure readiness for installation once the outage begins. SCS databases and cross-site fibre-communication links are tested as far as possible to mitigate potential issues during the outage.

MANUFACTURING

- The tight transmission network scenario imposes constraints on the programming of circuit outages. This influences the notice that NG is able to give its suppliers for the start of any works. To meet equipment manufacture and delivery times under such conditions, it becomes necessary to issue manufacture packs when the design is still not complete, and modify the pack as the design progresses.

INSTALLATION

- In some earlier ICP installations, it was common practice to use labour hired on an as-required basis to complete site work. In a refurbishment scenario, there are several unknowns which constitute risks to the cost and programme of the site installation, and work could extend to fill the time available and beyond. ABB has used fixed price installation contracts, which significantly limit the risk on programme and cost, and ensure consistency and quality of the labour.

- Apart from space constraints, there could be other constraints at site that affect the timely completion of the work. Examples include water ingress in cross-site cable trenches and chemical contamination of existing equipment. Elimination of such problems is NG's responsibility; however, we work closely with NG to arrive at optimum solutions without compromising health and safety.

- Concurrent work with other contractors at site requires advance planning and close coordination of the site work to minimize lost time and effectively address access, health, safety and other issues. This is implemented through a series of co-ordination meetings.

- Many NG sites have asbestos areas such as floor tiles, ceilings, walls and MCB boxes. It is NG's responsibility to provide an asbestos-free work environment. If the programme of asbestos removal in an area where we have to work impacts our work programme, it poses a challenge in managing the return to service without compromising the company policy on asbestos-related working. We did this effectively at a recent installation under the ICP programme.

COMMISSIONING

- From 1 Jan 2005, NG introduced a mandatory authorization (known as the TP141 authorization) aimed at ensuring acceptable standards for commissioning engineers on NG sites. The authorization process is rigorous, and there are not enough authorized engineers across the industry to support the on-going commissioning work. This poses substantial resourcing challenges; shifting and cancellation of outages, necessitating the use of non-ABB specialist engineers. ABB reduces the impact by bringing commissioning engineers on board on a long-term basis for sites with multiple outages, as well as getting non-ABB specialist engineers on board early enough for them to become familiar with ABB equipment and testing.

- A circuit under outage may be called back to service in an emergency. When an Early Return to Service (ERTS) is called, the circuit is to be returned to service with certain minimum protections, within a few hours. The possibility of an ERTS requires carefully planned staged installation or the availability of temporary protection panels. The upstream impact of this is in engineering, manufacturing and the commissioning strategy.

The successful return to service of several major circuits in 2007 called on ABB's commitment to quality and safety as well as our customer focus, and demonstrated our strong capabilities to:
- execute projects successfully in a refurbishment environment
- be responsive and adopt a pragmatic approach to problems
- be flexible to address challenges proactively, working in partnership with the customer, sub-contractors and third parties
- deliver excellence through continuous improvement.
New product

IED 670 series – protection, control and monitoring in a single unit

ABBB’s IED 670 series provides reliable, efficient and flexible protection, monitoring and control for all applications in sub-transmission and transmission systems.

IED 670 products are based on a common powerful hardware platform and an extensive hardware-independent, modular function library. This opens up a whole new range of possible applications. It also offers the potential to achieve an exceptional cost/performance ratio by combining multi-object protection and control capability with the traditional protection of an IED. Setting, commissioning and maintenance procedures are made fast and simple since the user only has to learn about one product to know them all.

The state-of-the-art IED 670 series has inherited the time-proven algorithms from ABB’s previous generations of IEDs. These algorithms have been further developed, and together with the IED 670’s outstanding I/O capability series they set a new standard for performance. So, for example, one IED can control several bays with complete monitoring and back-up protection.

DESIGNED TO COMMUNICATE

The IED 670 series complies with the stringent requirements of the IEC 61850 standard. They also interoperate with other IEC 61850 compliant IEDs tools and systems to provide extensive communication capabilities and interfaces enabling unrivalled compatibility for new and retrofit installations.

EASY TO HANDLE

Each IED 670 device is delivered ready-to-use, pre-configured and type-tested for different types of application. This makes them easy to use, from selection to operation and maintenance. There are also a number of option packages available for each device, so they can easily be adapted to meet specific customer requirements.

SIMPLIFIED SOLUTIONS

The IED 670 series offers simplified solutions for complex applications that previously required the installation of several discrete pieces of equipment. This approach reduces costs and minimizes spare parts handling. For example, a one and a half breaker arrangement that would normally need seven individual IEDs can now be replaced by just two RED 670 devices that provide both line distance and line differential protection and monitoring functions as well as the switchgear control plus functions such as synchro-check, breaker failure and so on.

Another typical smart solution offered by the IED 670 concept is for transformer and shunt capacitor bank protection. Here, thanks to its 24 analogue inputs, just one RET 670 device can provide a comprehensive suite of protection and control functions.

GPS LOSS – NO PROBLEM

ABB’s most recent development has focused on eliminating any concerns regarding the potential loss of the GPS (Global Positioning System) signals used to time synchronize the RED 670 line differential protection devices with a very high level of accuracy.

Locally measured current values are time-stamped by the RED 670 and the records are transmitted to the other end of the protected line. Here, a second RED 670 compares this information with its own measured values and then makes the appropriate ‘smart’ decision about tripping the circuit breaker.

Should the device lose its GPS signal – possibly due to bad weather – it is essential that the device does not make an incorrect tripping decision.

Based on extensive site experiences in different utilities, ABB has refined the GPS functionality of the RED 670 to improve security and functionality.

IED 670 SERIES DEVICES

- REL 670 for line distance protection, monitoring and control
- RED 670 for line differential protection, monitoring and control
- RET 670 for transformer protection, monitoring and control
- REB 670 for busbar protection and monitoring
- REC 670 for bay control
- REG 670 for generator protection and monitoring
COM 600 – A future-proof concept for substation system integration and interoperability

ABB’s substation automation
COM 600 series is designed to provide interoperability between industrial or utility substation IEDs and local operator interfaces as well as with higher-level Network Control Centres (NCC) or Distributed Control Systems (DCS).

The series features gateway functionality and support a variety of commonly used substation device communication protocols. It comprises three products.

COM 605 COM 610 AND COM 615 – CONTROL AND MONITORING UNIT
The COM 605 Control and Monitoring Unit offers Web server functionality, providing a human machine interface (HMI) for local substation monitoring and control.

COM 605 is used mainly in applications requiring a basic level of local and/or remote access using Web technology. Secure communication enables authorized users with a standard PC and Web browser to access the substation HMI over the Internet or LAN/WAN. Local connection of a laptop PC to the unit provides full monitoring and control functionality at the substation level.

COM 610 – COMMUNICATION GATEWAY
The COM 610 Communication Gateway maps signals and data between the protection and control IEDs in industrial or utility substations and higher-level systems. The gateway interfaces with any master system using de facto master protocols.

COM 615 – STATION COMPUTER
The COM 615 Substation Computer offers the combined features and functionality of the COM 605 and the COM 610. It provides gateway functions for mapping data and signals between substation level equipment and higher-level systems. In addition, it offers HMI functionality to meet local and remote monitoring and control needs.

OPEN ACCESS TO REAL-TIME INFORMATION
COM 600 products incorporate OPC server functionality that provides a single entry point for all the substation information. They are also fully compliant with the IEC 61850 standard for substation automation. This enables them to provide full interoperability with any IEC 61850 compliant IEDs, tolls and systems, simplifying system design and commissioning.

FAST COMMISSIONING OF ABB IEDS
COM 600 products make ABB IEDS fast and straightforward to commission thanks to the support of ABB’s unique connectivity package. This simplifies system configuration and reduces the risk of errors in system integration, minimising device configuration and set-up times.
ABB’s new REF 615 is a dedicated feeder protection relay designed specifically for the protection, measurement and supervision of utility substations and industrial power systems.

The REF 615 has been engineered to unleash the full potential of the IEC 61850 standard for communication and interoperability of substation automation devices. It provides main protection for overhead lines, cable feeders and busbar systems of distribution substations. The feeder protection relay suits any distribution network, regardless of the applied power system earthing principle.

PROTECTION AND CONTROL
The REF 615 feeder protection relay offers short-circuit, time overcurrent and thermal overload protection. It also features directional and non-directional earth-fault protection, sensitive earth-fault protection (SEF) and transient-measuring earth-fault protection including detection of intermittent earth-faults in cable networks. Finally, the relay incorporates a flexible three-phase multishot auto-reclose function for automatic extinguishing of arc faults on overhead lines.

When enhanced with an optional plug-in card, the relay offers a three-channel arc-fault protection system for supervision of the switchgear circuit breaker, cable and busbar compartment. REF 615 also integrates basic control functionality, which facilitates the control of one circuit breaker via the relay’s HMI or remote control system. To protect the relay from unauthorised access and to maintain the integrity of information, the relay has been provided with a four-level, role-based user authentication system, with individual passwords for the viewer, operator, engineer and administrator level.

THE POWER OF COMMUNICATION
REF 615 supports the new IEC 61850 standard for inter-device communication in substations. It also supports the industry standard Modbus® protocol. The implementation of IEC 61850 covers both vertical and horizontal communication, including GOOSE messaging and parameter setting according to IEC 61850-8-1. The substation configuration language (SCL) enables the use of engineering tools for automated configuration, commissioning and maintenance of substation devices.

PRE-EMPTIVE CONDITION MONITORING
To ensure optimized system availability, REF615 features a comprehensive choice of monitoring functions to supervise the relay itself, the CB trip circuit and the circuit breaker. Depending on the chosen device configuration, the relay monitors the wear and tear of the circuit breaker, the spring charging time of the CB operating mechanism and the gas pressure of the breaker chambers. The relay also supervises the breaker travel time and the number of CB operations to provide basic information for scheduling CB maintenance.

RAPID SET-UP AND COMMISSIONING
Since REF 615 is designed specially for feeder protection, it can be rapidly set up and commissioned, once it has been given the application specific relay settings. It also offers the flexibility to be adapted to meet the particular requirements of an individual application.

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