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# Relion® 615 series

## Protection and control relays



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**The wide coverage of  
ABB's Relion® 615 series of relays  
makes it the ideal choice for  
the great variety of applications  
within distribution protection  
and control.**

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The 615 series relays have been designed for protection, control, measurement and supervision in utility, industrial, and transport and infrastructure applications.



## 615 series

# Compact and versatile solution for utility and industrial power distribution systems

The 615 protection and control series of relays is a member of ABB's Relion® product family. The 615 series relays are characterized by their compactness and withdrawable plug-in unit design.

### **Ready-made adaptations to application-specific requirements**

The 615 series relays are available in ready-made standard configurations for fast and easy setup. All standard configurations can be tailored to meet application-specific requirements using the IEC 61850-compliant Protection and Control IED Manager PCM600.

### **Human-machine interface**

The 615 series relays are equipped with a large graphical display which can show customizable single-line diagrams (SLD) with position indication for the circuit breaker, disconnectors and the earthing switch. Also measured values provided by the chosen standard configuration can be displayed. The SLDs are customized using PCM600 and can have multiple pages for easy access to selected information. The SLDs can be accessed not only locally but also via the web browser-based HMI that has now been enriched with a number of usability enhancing features.

### **Standardized communication and redundancy**

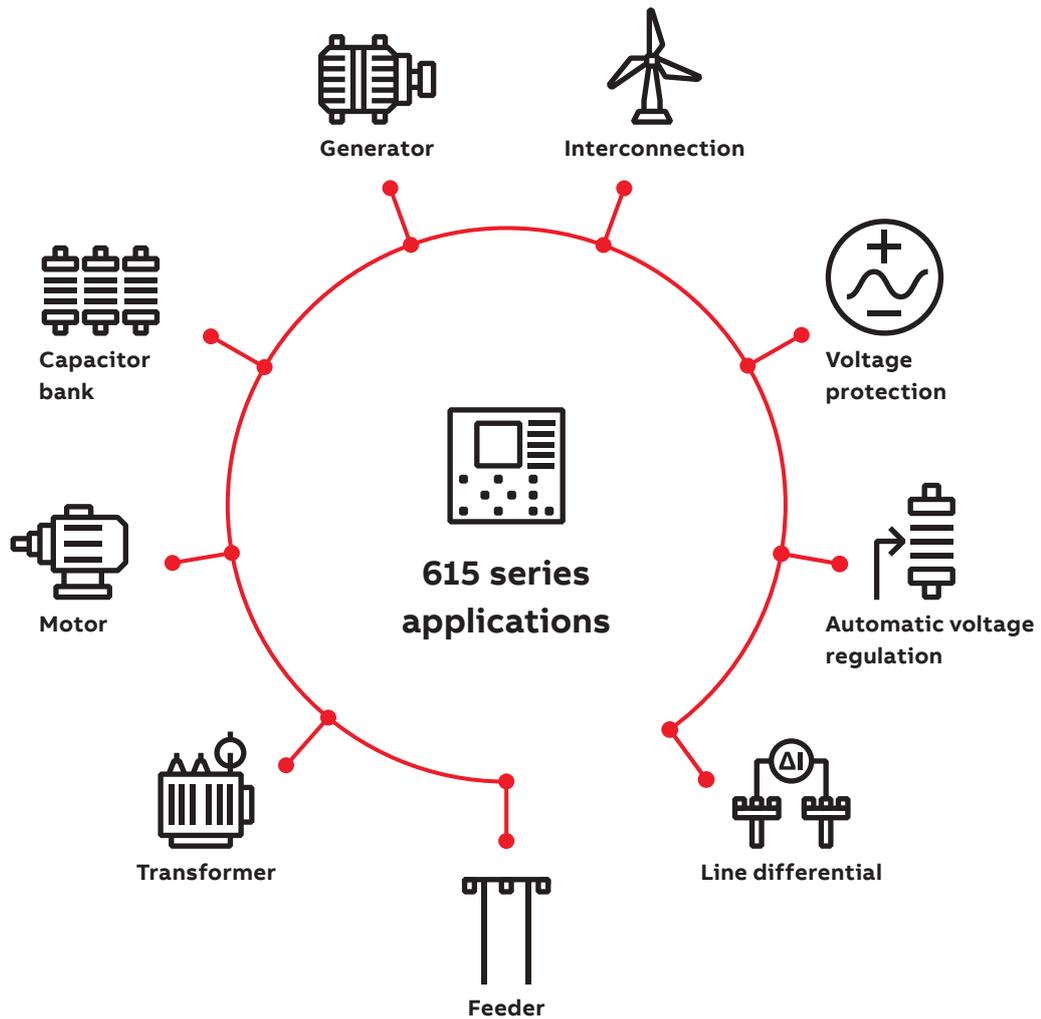
The 615 series relays fully support the IEC 61850 standard for communication and interoperability of substation automation devices, including fast GOOSE messaging and IEC 61850-9-2 LE, and can now also benefit from the extended interoperability provided by Edition 2. The relays further support both the parallel redundancy protocol (PRP) and the high-availability seamless redundancy (HSR) protocol, together with the DNP3, IEC 60870-5-103 and Modbus® protocols. With the protocol adapter SPA-ZC 302, Profibus DVP1 can also be used. The relays are able to use two communication protocols simultaneously.

For redundant Ethernet communication, the 615 series relays offer either two optical or two galvanic Ethernet network interfaces. A third port with a galvanic Ethernet network interface provides connectivity of any other Ethernet device to an IEC 61850 station bus inside a switchgear bay. RED615 differs in that it offers only two optical network interfaces. The redundant Ethernet solution can be built on the Ethernet-based IEC 61850, Modbus® and DNP3 protocols.

The implementation of the IEC 61850 standard covers both vertical and horizontal communication, including GOOSE messaging with both binary and analog signals as well as parameter setting according to IEC 61850-8-1. Also IEC 61850-9-2 LE process bus with sending sampled values of not only analog voltages but now also currents, in addition to receiving sampled values of voltages, is supported. The sampled values can now be used for synchro-check as well, both in conventional instrument transformer and now also sensor-based applications, to ensure safe interconnection of two networks. For process bus applications, which require high-accuracy time synchronization, IEEE 1588 V2 is used, with a time stamp resolution of not more than four microseconds. IEEE 1588 V2 is supported in all variants with a redundant Ethernet communication module. In addition, the relays support synchronization over Ethernet using SNTP or over a separate bus using IRIG-B.

### **Life cycle services**

ABB offers full support for all protection and control relays throughout their entire lifecycle. Our extensive life cycle services include training, customer support, maintenance and



modernization.

#### Main customer benefits

- Compact and versatile solution for utility and industrial power distribution systems with integration of protection, control, monitoring and supervision in one relay
- Wide application coverage – feeder, transformer, motor, line differential, voltage, capacitor bank as well as generator and interconnection protection and control
- Extensive range of protection and control functionality, either with sensors or conventional instrument transformers
- Withdrawable plug-in unit design for swift installation and testing
- Ready-made standard configurations for fast and easy setup with tailoring capabilities
- IEC 61850 Edition 2 and Edition 1 support, including HSR and PRP, GOOSE messaging and IEC 61850-9-2 LE for less wiring and supervised communication
- IEEE 1588 V2 for high-accuracy time synchronization and maximum benefit of substation-level Ethernet communication
- Large graphical display for showing customizable SLDs, accessible either locally or through a web browser-based HMI
- Extensive life cycle services

# Feeder protection and control

## REF615

REF615 has been designed to protect overhead line and cable feeders in utility and industrial power distribution systems, including radial, looped and meshed distribution networks, with or without distributed power generation.

### Application

REF615 has been designed to be the main overcurrent and earth-fault protection for overhead lines and cable feeders, in either isolated neutral, resistance-earthed, compensated or effectively-earthed distribution networks, depending on the standard configuration.

REF615 is available in twelve standard configurations. In addition to standard configuration N, also L now provides maximum functionality to allow fully flexible tailoring. The major difference is that L includes support for three combi-sensor inputs for phase currents (Rogowski coil) and voltages (voltage divider), whereas N supports conventional current and voltage instrument transformers.

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Unique earth-fault protection for higher sensitivity and selectivity

The extensive earth-fault protection portfolio has been expanded to include a unique multifrequency admittance-based protection for higher sensitivity and selectivity, in response to the requirements of today's growing cable networks. The new earth-fault protection is intended for all types of earth faults – continuous, transient and intermittent – and combines both reliability and sensitivity in one function.

REF615 includes a fault locator which locates short circuits in radial distribution networks and earth faults in effectively and low-resistance earthed ones. If the fault current is as high as or higher than the load current, earth faults in isolated neutral distribution networks will also be located. To minimize the effects of an arc fault, REF615 can be equipped with high-speed outputs decreasing the operate time by four to six milliseconds compared to conventional binary outputs.

To further ensure grid stability and reliability, an interconnection protection package is introduced. Other additions include high-impedance based differential protection with CT supervision, switch on to fault, reverse power/directional overpower protection and voltage unbalance to further strengthen the maximum functionality offering.

### Product highlights

- Extensive range of protection and control functionality, either with sensors or conventional instrument transformers
- Extensive earth-fault protection portfolio with unique multifrequency admittance-based protection for higher sensitivity and selectivity
- Advanced and fast fault location of short circuits and earth faults

Functionality	REF615
Control	•
Overcurrent protection	•
Earth-fault protection	•
Advanced earth-fault protection for high-impedance networks	•
Thermal overload protection	•
Multipurpose protection with RTD/mA	○
Voltage protection	•
Frequency protection	•
Fault locator	○
High-impedance differential protection	•
Interconnection protection	○
Power protection	•
Arc protection	○
Synchro-check	•
Auto-reclose	○

• = Supported ○ = Optional add-on

# Line differential protection and control RED615

RED615 has been designed for phase-segregated, two-end line differential protection of feeders in utility and industrial power distribution systems. RED615 is also ideal for applications with an in-zone transformer.

## Application

RED615 has been designed to be the main protection for overhead line and cable feeders, in either isolated neutral, resistance-earthed, compensated or effectively earthed distribution networks, depending on the standard configuration.

RED615 is available in five standard configurations, one of which is a plain line differential protection with overcurrent backup protection two with added earth-fault protection functionality in particular, and another two further extended with directional overcurrent as well as phase-voltage and frequency-based protection. Switch on to fault is now introduced in all standard configurations and voltage

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Ideal selectivity for two-end line differential protection

unbalance in the two extended ones. They both also include a fault locator which locates short circuits in radial distribution networks and earth faults in effectively and low-resistance earthed ones. If the fault current is as high as or higher than the load current, earth faults in isolated neutral distribution networks will also be located. In addition, one of the two extended standard configurations includes support for three combi-sensor inputs for phase currents (Rogowski coil) and voltages (voltage divider), whereas the other supports conventional current and voltage instrument transformers as the rest of the standard configurations.

Two RED615 relays interconnected over a communication link form an entirely selective unit protection scheme. Protection of ring-type and meshed distribution networks generally requires unit protection solutions, also applied in radial networks containing distributed power generation.

## Product highlights

- Selective unit protection as phase-segregated two-end line differential protection, either with sensors or conventional instrument transformers
- Line differential communication between substations either over a fiber-optic link or a galvanic pilot wire connection
- Ideal for line differential applications with an in-zone transformer

Functionality	RED615
Control	•
Overcurrent protection	•
Earth-fault protection	•
Thermal overload protection	•
Multipurpose protection with RTD/mA	○
Voltage protection	•
Frequency protection	•
Fault locator	○
Line differential protection	•
Synchro-check	•
Auto-reclose	○

• = Supported ○ = Optional add-on

# Transformer protection and control

## RET615

RET615 has been designed to protect power transformers, including step-up transformers, and power generator-transformer blocks in utility and industrial power distribution systems.

### Application

RET615 has been designed to be the main protection for two-winding power transformers and power generator-transformer blocks. RET615 is available in eight standard configurations to match the most commonly employed power transformer vector groups, and to coordinate the applied transformer neutral earthing principle with the relevant earth-fault protection scheme.

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Compact protection and control for two-winding power transformers

The standard configurations are intended for either power transformers with earthed HV-side neutrals or with effectively earthed LV-side neutrals, alternatively with a neutral earthing resistor on the LV-side. There is also a choice between either low or high-impedance restricted earth-fault (REF) protection. Some standard configurations include phase-voltage protection and measurement functions which provide two-stage power transformer overvoltage and undervoltage protection and/or supervision.

RET615 features three-phase transformer differential protection, one multi-slope stabilized (biased) stage and one instantaneous stage, providing a fast and selective protection for phase-to-phase short circuits, winding interturn-faults and bushing flash-overs. To minimize the effects of an arc fault, RET615 can be equipped with high-speed outputs, decreasing the operate time by four to six milliseconds compared to conventional binary outputs.

Functionality	RET615
Control	•
Overcurrent protection	•
Earth-fault protection	•
Thermal overload protection	•
Multipurpose protection with RTD/mA	○
Voltage protection	•
Differential protection for two-winding transformers	•
Low-impedance restricted earth-fault protection	•
High-impedance restricted earth-fault protection	•
Arc protection	○

• = Supported ○ = Optional add-on

### Product highlights

- Extensive range of protection and control functionality for two-winding power transformers, including advanced and fast differential protection with high inrush stability
- Support for various neutral earthing options, matching either high-impedance or numerically low-impedance restricted earth-fault principles

# Voltage protection and control

## REU615

REU615 has been designed for voltage and frequency-based protection in utility and industrial power distribution systems, including networks with distributed power generation. REU615 is also ideal for voltage regulation.

### Application

REU615 is available in two standard configurations. One has been exclusively designed for busbar under- and overvoltage supervision, load-shedding (disconnection) and restoration (reconnection) applications. It can also be used for over- and underfrequency protection of power generators and other AC equipment such as capacitor banks. In generator and motor applications, REU615 provides

supplementary protection by detecting any deviation from the permitted frequency and voltage values. An integrated synchro-check function ensures a safe connection of the equipment to the network.

The other of the two standard configurations has been exclusively designed for automatic and manual voltage regulation of power transformers with a motor-driven on-load tap-changer. In small substations with a single power transformer and in substations with two or more power transformers operating in parallel, REU615 can be used for load-side voltage regulation. The standard configuration also includes protection functionality.

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Compact voltage protection and automatic voltage regulation

To minimize the effects of an arc fault, REU615 can be equipped with high-speed outputs decreasing the operate time by four to six milliseconds compared to conventional binary outputs.

Functionality	REU615 voltage protection	REU615 voltage regulation
Control	•	•
Overcurrent protection	–	•
Thermal overload protection	–	•
Multipurpose protection with RTD/mA	–	○
Voltage protection	•	•
Frequency protection	•	–
Automatic voltage regulation	–	•
Arc protection	○	–
Load-shedding	•	–
Synchro-check	•	–

• = Supported ○ = Optional add-on

### Product highlights

- Extensive range of protection and control functionality for busbar voltage supervision, load-shedding and restoration, including over- and underfrequency protection for power generators and other AC equipment
- Automatic voltage regulation of power transformers with a motor-driven on-load tap-changer

# Motor protection and control

## REM615

REM615 has been designed to protect asynchronous motors in the manufacturing and process industry.

### Application

REM615 has been designed to be the main protection for asynchronous motors and their drives in manufacturing and process industry. Typically, the motor relay is used with circuit-breaker and contactor-controlled MV motors and medium-sized and large contactor-controlled LV motors in a variety of drives. The drives include both continuously and intermittently operated asynchronous motor drives with varying load, such as pumps and conveyors, crushers and choppers, mixers and agitators, fans and aerators.

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Compact protection and control  
for asynchronous motors

REM615 is available in four standard configurations, one of which includes support for three combi-sensor inputs for phase currents (Rogowski coil) and voltages (voltage divider) and the other for conventional current and voltage instrument transformers.

To minimize the effects of an arc fault, REM615 can be equipped with high-speed outputs decreasing the operate time by four to six milliseconds compared to conventional binary outputs.

### Product highlights

- Motor protection both during motor start-up and normal run, with protection and fault clearance also in abnormal situations
- Motor protection with motor start-up and loss of load supervision as well as thermal overload, motor load jam and phase-reversal protection, either with sensors or conventional instrument transformers

Functionality	REM615
Control	•
Overcurrent protection	•
Earth-fault protection	•
Thermal overload protection	•
Multipurpose protection with RTD/mA	○
Basic voltage protection for motor	•
Frequency protection	•
Protection for asynchronous motors	•
Arc protection	○

• = Supported ○ = Optional add-on

# Capacitor bank protection and control

## REV615

REV615 has been designed to protect capacitor banks used for compensation of reactive power in utility and industrial power distribution systems.

### Application

REV615 has been designed to be the main protection for H-bridge, double Y and single Y-connected capacitor banks and feeder cables. Additionally, REV615 can be used to protect harmonic filter circuits when no significant harmonic component is higher than the 11<sup>th</sup>.

REV615 is available in two standard configurations, both of which offer three-phase overload protection, current-based unbalance protection with compensation for natural unbalance, and current-based switching resonance protection for capacitor banks.

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Protection and control for capacitor banks in various connections

The overload protection includes an integrated undercurrent function which detects disconnection of a capacitor bank and inhibits the closing of the circuit breaker for as long as the capacitor bank is partially charged. The three-phase thermal overload protection can be used for reactors and resistors in harmonic filter circuits. REV615 also offers non-directional overcurrent and earth-fault protection for capacitor banks and their feeder cables. The other of the two standard configurations additionally offers directional earth-fault, residual voltage, voltage-based unbalance, and over- and undervoltage protection.

One has been preconfigured for H-bridge connected capacitor banks and has a three-phase unbalance protection, whereas the other has been preconfigured for double Y-connected capacitor banks and has a single-current unbalance protection.

### Product highlights

- Extensive range of protection and control functionality for H-bridge, double Y and single Y-connected capacitor banks and feeder cables as well as for harmonic filter circuits
- Current-based unbalance protection with compensation for natural unbalance as well as current-based switching resonance protection for capacitor banks

Functionality	REV615
Control	•
Overcurrent protection	•
Earth-fault protection	•
Thermal overload protection	•
Multipurpose protection with RTD/mA	○
Voltage protection	•
Capacitor bank protection	•
Arc protection	○

• = Supported ○ = Optional add-on

# Generator and interconnection protection REG615

REG615 has been designed to protect power generators and interconnection points of distributed generation units in utility and industrial power distribution systems.

### Application

REG615 has been designed to be the main protection for small synchronous generators, and offer full protection during start-up and normal run for both the generator and the prime mover. REG615 can also be used as backup protection for medium-sized generators in applications where an independent and redundant protection system is required. The main protection functionality includes generator differential protection, out-of-step protection and 100% stator earth-fault protection. REG615 is typically used in small and medium-sized diesel, gas, hydroelectric, combined heat and power (CHP), and steam power plants.

Compact generator and extensive interconnection protection for power generation

To further ensure grid stability and reliability, REG615 has also been designed to be the main protection for interconnection points of distributed generation units. A low-voltage ride-through protection allows monitoring of distributed generation during low-voltage fault ride-through, in order to determine whether and when to disconnect, for instance, a solar or wind farm from the grid. A reactive power undervoltage protection does the same but specifically at the grid connection point, whereas a voltage vector shift protection, further supported by a frequency protection, detects islanding from the grid.

One of the three available standard configurations has been exclusively designed for interconnection applications and two for generator applications.

To minimize the effects of an arc fault, REG615 can be equipped with high-speed outputs decreasing the operate time by four to six milliseconds compared to conventional binary outputs.

Functionality	REG615 interconnection protection	REG615 generator protection
Control	•	•
Overcurrent protection	•	•
Earth-fault protection	•	•
Thermal overload protection	•	•
Multipurpose protection with RTD/mA	○	○
Voltage protection	•	•
Frequency protection	•	•
Differential protection for machines	–	•
Interconnection protection	•	–
Power protection	•	•
Protection for synchronous generators	–	•
Arc protection	○	○
Synchro-check	•	•

• = Supported ○ = Optional add-on

### Product highlights

- Extensive range of protection functionality for both synchronous generators and interconnection points of distributed generation units
- Extensive generator protection with 100% stator earth-fault, generator differential and out-of-step protection
- Advanced interconnection protection fulfilling the latest grid codes for higher grid stability and reliability





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