



Relion® 615 series

Line-differential protection and control RED615

Compact and versatile solution for utility and industrial power distribution systems

RED615 is a phase-segregated, two-end, line differential protection and control IED perfectly harmonized for utility and industrial power distribution networks. The RED615s communicate between substations over a fibre-optic link or a galvanic pilot wire connection.

RED615 is a member of ABB's Relion® protection and control product family and its 615 series. The 615 series IEDs are characterized by their compactness and withdrawable-unit design. Re-engineered from the ground up, the 615 series has been designed to unleash the full potential of the IEC 61850 standard for communication and interoperability of substation automation equipment.

Application

RED615 provides phase-segregated high-speed, longitudinal differential protection for overhead line and cable feeders in utility and industrial distribution networks. Three standard RED615 configurations are available, a pure line-differential protection configuration with overcurrent back-up stages and two extended configurations with additional protection functions. Two RED615s interconnected over a communication link form an absolutely 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.

Protection and control

RED615 features two-stage, phase-segregated line differential protection, four-stage phase overcurrent protection, two-stage phase unbalance and loss-of-phase protection, and circuit-breaker failure protection. Further, RED615 incorporates a lockout relay and a second harmonic restraint function to identify inrush current conditions. Depending on the standard configuration chosen, the basic functionality can be extended by thermal overload protection, directional or non-directional earth-fault protection, sensitive earth-fault protection, phase discontinuity protection, transient/intermittent earth-fault protection and three-pole multi-shot auto-reclose functions for overhead line feeders. Further, admittance-based earth-fault protection is offered as an alternative to the directional earth-fault protection. The admittance-based earth-fault protection ensures a correct operation of the protection even though the connection status information of the Petersen coil would be missing.

A standard configuration can be adjusted using the signal matrix functionality (SMT) or the optional graphical application

configuration functionality (ACT) of the Protection and Control IED Manager PCM600. The ACT supports creation of multi-layer logic by combining function blocks along with timers and flip-flops. By combining protection and logic functions the IED can be modified to fit the requirements of the application.

Besides protection RED615 also integrates functionality for the control of one circuit breaker via the local HMI or by means of remote control.

Binary signal transfer

Binary Signal Transfer (BST) can be used for transferring up to eight blocking and intertrip signals, and status and position information between line the ends. The BST transfer goes in both directions and the signal transfer time is extremely short, in the order of a few milliseconds.

Standardized communication

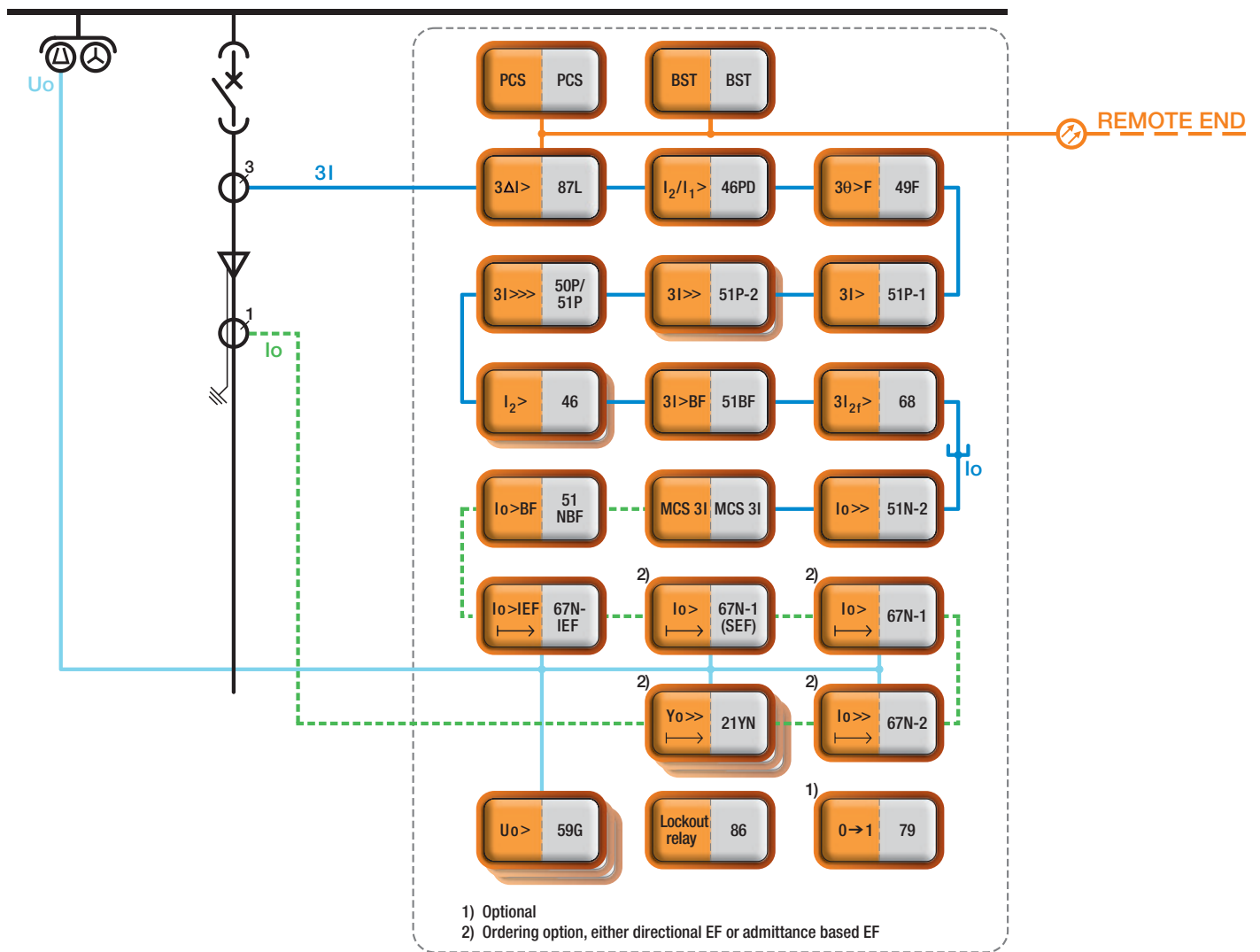
RED615 features native support for the new IEC 61850 standard for communication in substations. The IED also supports the industry standard Modbus® protocol, and the well-established DNP3 and IEC 60870-5-103 protocols.

For increased communication availability and reliability the IED offers an optional second Ethernet network interface. The self-healing Ethernet solution constitutes a cost efficient communication loop controlled by a managed switch. The managed switch controls the consistency of the loop, routes the data and corrects the flow of data in communication disturbance situations. The self-healing Ethernet ring can be built on the Ethernet based IEC 61850, Modbus® and DNP3 protocols.

The implementation of the IEC 61850 substation communication standard in RED615 covers both vertical and horizontal communication, including GOOSE messaging with binary and analog signals and parameter setting according to IEC 61850-8-1. For time-critical applications RED615 supports synchronization over Ethernet using SNTP or over a separate bus using IRIG-B.

Protection communication and supervision

The RED615s can be interconnected via a dedicated fibre-optic communication channel, or an optional galvanic pilot wire link with RPW600 communication modems. The entire set of protection features is fully available regardless of the chosen protection communication method.



Protection function overview of the B configuration of RED615.

The protection communication channel between the line ends is continually supervised. Interruptions and severe interference of the channel block the fast-acting line differential protection and all other functions, which rely on a continuous availability of the communication channel.

Pre-emptive condition monitoring

To secure the operational availability of the protection, RED615 incorporates a range of monitoring and watchdog functions to supervise the hardware and software, the communication system, the circuit-breaker trip circuit and the CTs. A fast CT supervision system blocks the operation of the line differential protection function and the phase unbalance protection function on detection of an erratic CT

signal. Certain device configurations also monitor the circuit breaker wear, the spring charging time of the CB operating mechanism and the gas pressure of the breaker chambers. The IED also supervises the breaker travel time and the number of CB operations to provide basic information for scheduling CB maintenance.

Single line diagram

RED615 with a large display offers customizable single line mimic diagrams (SLD) including position indication of switching devices and display of relevant measured values. The SLD is also available via the web-browser based HMI. The default SLD can be modified with the graphical display editor of PCM600.

Standard configurations

Standard configurations

Description	Standard configuration
Line-differential protection	A
Line-differential protection with directional earth-fault protection	B
Line-differential protection with non-directional earth-fault protection	C

• = included
o = optional

Supported functions, codes and symbols

Functionality	IEC 61850	IEC 60617	IEC-ANSI	A	B	C
Protection						
Three-phase non-directional overcurrent protection, low stage, instance 1	PHLPTOC1	3I> (1)	51P-1 (1)	•	•	•
Three-phase non-directional overcurrent protection, high stage, instance 1	PHHPTOC1	3I>> (1)	51P-2 (1)	•	•	•
Three-phase non-directional overcurrent protection, high stage, instance 2	PHHPTOC2	3I>> (2)	51P-2 (2)	•	•	•
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	PHIPTOC1	3I>>> (1)	50P/51P (1)	•	•	•
Non-directional earth-fault protection, low stage, instance 1	EFLPTOC1	Io> (1)	51N-1 (1)	-	-	• ²⁾
Non-directional earth-fault protection, low stage, instance 2	EFLPTOC2	Io> (2)	51N-1 (2)	-	-	• ²⁾
Non-directional earth-fault protection, high stage, instance 1	EFHPTOC1	Io>> (1)	51N-2 (1)	-	-	• ²⁾
Non-directional earth-fault protection, instantaneous stage	EFIPTOC1	Io>>>	50N/51N	-	-	• ²⁾
Directional earth-fault protection, low stage, instance 1	DEFLPDEF1	Io> → (1)	67N-1 (1)	-	• ¹⁾²⁾⁵⁾	-
Directional earth-fault protection, low stage, instance 2	DEFLPDEF2	Io> → (2)	67N-1 (2)	-	• ¹⁾²⁾⁵⁾	-
Directional earth-fault protection, high stage	DEFHPDEF1	Io>> →	67N-2	-	• ¹⁾²⁾⁵⁾	-
Admittance based earth-fault protection, instance 1	EFPADM1	Yo> → (1)	21YN (1)	-	• ¹⁾²⁾⁵⁾	-
Admittance based earth-fault protection, instance 2	EFPADM2	Yo> → (2)	21YN (2)	-	• ¹⁾²⁾⁵⁾	-
Admittance based earth-fault protection, instance 3	EFPADM3	Yo> → (3)	21YN (3)	-	• ¹⁾²⁾⁵⁾	-
Transient / intermittent earth-fault protection	INTRPTEF1	Io> → IEF	67NIEF	-	• ⁵⁾⁶⁾	-
Non-directional (cross-country) earth fault protection, using calculated Io	EFHPTOC1	Io>> (1)	51N-2 (1)	-	• ³⁾	-
Negative-sequence overcurrent protection, instance 1	NSPTOC1	I2> (1)	46 (1)	•	•	•
Negative-sequence overcurrent protection, instance 2	NSPTOC2	I2> (2)	46 (2)	•	•	•
Phase discontinuity protection	PDNSPTOC1	I2/I1>	46PD	-	•	•
Residual overvoltage protection, instance 1	ROVPTOV1	Uo> (1)	59G (1)	-	• ⁵⁾	-
Residual overvoltage protection, instance 2	ROVPTOV2	Uo> (2)	59G (2)	-	• ⁵⁾	-
Residual overvoltage protection, instance 3	ROVPTOV3	Uo> (3)	59G (3)	-	• ⁵⁾	-
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR1	3Ith>F	49F	-	•	•
Binary signal transfer	BSTGGIO1	BST	BST	•	•	•
Line differential protection and related measurements, stabilized and instantaneous stages	LNPLDF1	3dI>L	87L	•	•	•
Circuit breaker failure protection	CCBRBRF1	3I>/Io>BF	51BF/51NBF	• ⁴⁾	•	•

Supported functions, codes and symbols

Functionality	IEC 61850	IEC 60617	IEC-ANSI	A	B	C
Protection						
Three-phase inrush detector	INRPHAR1	3I2f>	68	•	•	•
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)	•	•	•
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)	•	•	•
Control						
Circuit-breaker control	CBXCBR1	I ↔ O CB	I ↔ O CB	•	•	•
Disconnecter position indication, instance 1	DCSXSUI1	I ↔ O DC (1)	I ↔ O DC (1)	•	•	•
Disconnecter position indication, instance 2	DCSXSUI2	I ↔ O DC (2)	I ↔ O DC (2)	•	•	•
Disconnecter position indication, instance 3	DCSXSUI3	I ↔ O DC (3)	I ↔ O DC (3)	•	•	•
Earthing switch indication	ESSXSUI1	I ↔ O ES	I ↔ O ES	•	•	•
Auto-reclosing	DARREC1	O → I	79	-	o	o
Condition Monitoring						
Circuit-breaker condition monitoring	SSCIBR1	CBCM	CBCM	-	•	•
Trip circuit supervision, instance 1	TCSSCIBR1	TCS (1)	TCM (1)	•	•	•
Trip circuit supervision, instance 2	TCSSCIBR2	TCS (2)	TCM (2)	•	•	•
Current circuit supervision	CCRDIF1	MCS 3I	MCS 3I	•	•	•
Protection communication supervision	PCSRTPC1	PCS	PCS	•	•	•
Measurement						
Disturbance recorder	RDRE1	-	-	•	•	•
Three-phase current measurement, instance 1	CMMXU1	3I	3I	•	•	•
Sequence current measurement	CSMSQI1	I1, I2, I0	I1, I2, I0	•	•	•
Residual current measurement, instance 1	RESCMMXU1	I _o	I _n	-	•	•
Residual voltage measurement	RESVMMXU1	U _o	V _n	-	•	-

¹⁾ Admittance based E/F can be selected as an alternative to directional E/F when ordering

²⁾ I_o selectable by parameter, I_o measured as default

³⁾ I_o selectable by parameter, I_o calculated as default

⁴⁾ I_o calculated is always used

⁵⁾ U_o measured is always used

⁶⁾ I_o measured is always used

Note that all directional protection functions can also be used in non-directional mode.

The instances of a protection function represent the number of identical function blocks available in a standard configuration.

By setting the application specific parameters of an instance, a protection function stage can be established.

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or contact us:

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