

# Feeder protection and control REF615

The REF615 is a dedicated feeder IED perfectly aligned for the protection, control, measurement and supervision of utility substations and industrial power systems. REF615 is a member of ABB's Relion® family and a part of its 615 protection and control product series. The 615 series IEDs are characterized by their compactness and withdrawable design. 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 devices.

## Unique REF615 ANSI features

- Six setting groups
- Drawout design
- Underground, overhead cable fault detection (CFD)
- High-speed (< 1 ms) outputs
- High impedance (HIZ) fault detection
- Arc flash detection (AFD)
- Thermal overload protection of feeder cable
- Ring-lug terminals for all inputs and outputs
- Large, easy to read LCD screen
- Environmentally friendly design with RoHS compliance

## Application

The REF615 provides main protection for overhead lines, cable feeders, and busbar systems of distribution substations. It can be applied for protection and control of grounded and ungrounded distribution systems. Flexible order coding allows for choosing current-only or current-and-voltage configurations to best fit your distribution feeder application needs.

## Protection and control

The REF615 is the most powerful, advanced and simplest feeder protection relay in its class, perfectly offering time and instantaneous overcurrent, negative sequence overcurrent, phase discontinuity, breaker failure, thermal overload, and voltage metering and protection. The relay also features optional high impedance fault (HIZ) and sensitive earth fault (SEF) protection for grounded and ungrounded distribution systems. Also, the relay incorporates a flexible three-phase multi-shot auto-reclose function for automatic feeder restoration in temporary faults on overhead lines.

Enhanced with safety options, the relay offers a three-channel arc-fault detection system for supervision of the switchgear.



The REF615 also integrates basic control functionality, which facilitates the control of one circuit breaker via the relay's front panel human machine interface (HMI) or remote control system. To protect the relay from unauthorized 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 levels. The access control system applies to the front panel HMI, embedded web browser based HMI, and the PCM600 relay setting and configuration tool.

## Standardized communication

REF615 supports the new IEC 61850 standard for inter-device communication in substations. The relay also supports the industry standard DNP3.0 and Modbus® protocols. The implementation of the IEC 61850 substation communication standard in REF615 encompasses both vertical and horizontal communication, including GOOSE messaging and parameter setting according to IEC 61850-8-1. The substation configuration language enables the use of engineering tools for automated configuration, commissioning, and maintenance of substation devices.

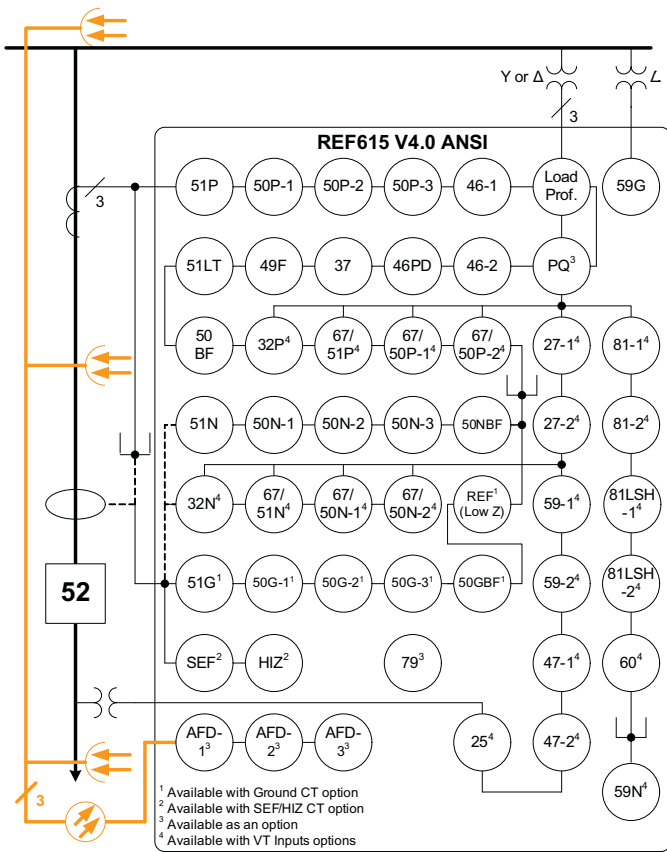
## Pre-emptive condition monitoring

For continuous knowledge of the operational availability of the REF615 features, a comprehensive set of monitoring functions to supervise the relay health, the trip circuit, and the circuit breaker health is included. The breaker monitoring can include checking the wear and tear of the circuit breaker, the spring charging time of the breaker operating mechanism and the gas pressure of the breaker chambers. The relay also monitors the breaker travel time and the number of circuit breaker operations to provide basic information for scheduling breaker maintenance.

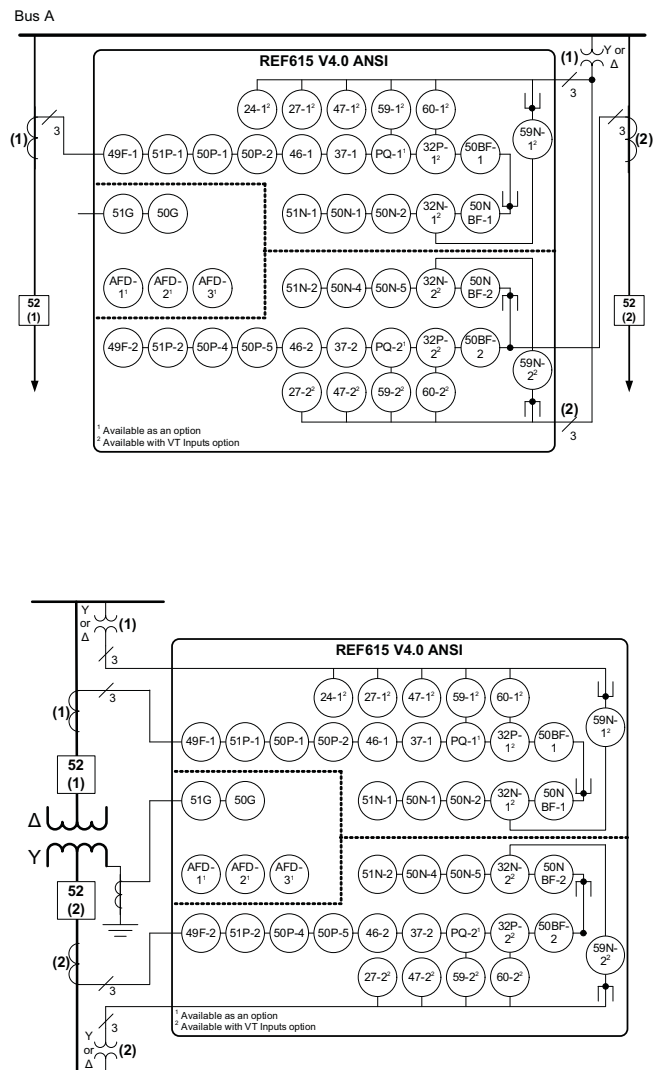
## Bus protection via GOOSE

The IEC 61850 implementation in REF615 also includes fast peer-to-peer communication, over the substation bus. Use GOOSE communication between REF615 IEDs of the incoming and outgoing feeders of a substation cooperate to form a stable, reliable, and high-speed busbar protection system. The cost-effective GOOSE-based busbar protection is obtained by configuring the IEDs and the operational availability of the protection is assured by continuous supervision of the protection IEDs and their GOOSE messaging over the station bus. No separate hard-wiring is needed for the horizontal communication between the switchgear cubicles.

REF615 V4.0 ANSI Functional Applications A, C & D



REF615 V4.0 ANSI Functional Applications B & E



Functions and Features	ANSI Function Name	Functional Application				
		A	B	C	D	E
<b>Included = ●, Optional = ○</b>						
<b>Protection</b>						
Phase overcurrents	51P, 50P	●	●	●	●	●
Phase long time overcurrent	51LT	●		●	●	
Directional phase overcurrents	67P			○	●	
Phase power directional	32P			○	●	●
Neutral overcurrents	51N, 50N	●	●	●	●	●
Ground overcurrents	51G, 50G	○	●	○	○	●
Directional neutral overcurrents	67N			○	●	
Neutral power directional	32N			○	●	●
Sensitive earth fault (SEF)	50SEF	○		○	○	
Negative sequence overcurrents	46	●	●	●	●	●
Load sheds and restorations	81LSH			○	●	
Underfrequencies, overfrequencies, rate-of-changes	81			○	●	
Cable fault detection (CFD) for underground and overhead feeder cables	CFD	○	○	○	○	○
High impedance fault (HIZ)	HIZ	○		○	○	
Thermal overload	49F	●	●	●	●	●
Phase discontinuity	46PD	●		●	●	
Cold load inrush detection (seconds, minutes)	62CLD	●	●	●	●	●
Undercurrent	37	●	●	●	●	●
Restricted earth fault(REF), low impedance	REF	○		○	○	
Phase undervoltages	27			○	●	●
Phase overvoltages	59			○	●	●
Phase sequence overvoltages	47			○	●	●
Ground overvoltage	59G				●	
Neutral overvoltage	59N			○	●	●
Circuit breaker failure	50BF, 50NBF	●	● <sup>1</sup>	●	●	● <sup>1</sup>
Electrically latched/self-resetting trip digital outputs	86/94-1, 86/94-2	●	●	●	●	●
Arc flash detection via three lens sensors	AFD-1, AFD-2, AFD-3	○	○	○	○	○
<b>Control</b>						
Circuit breaker control	52	●	● <sup>1</sup>	●	●	● <sup>1</sup>
Autoreclose	79	○		○	○	
Synchronism check	25				●	
<b>Monitoring and Supervision</b>						
Trip circuit monitoring	TCM	●	● <sup>1</sup>	●	●	● <sup>1</sup>
Breaker condition monitoring	52CM	●	● <sup>1</sup>	●	●	● <sup>1</sup>
Fuse failure	60			○	●	●
Open CT secondary monitoring	CCM	●		●	●	
<b>Measurement</b>						
Three-phase currents	IA, IB, IC	●	●	●	●	●
Sequence currents	I1, I2, I0	●	●	●	●	●
Ground current	IG	○	●	●	●	●
Demand phase currents		●	●	●	●	●
Maximum and minimum demand values		●	●	●	●	●
Three-phase voltages	VA, VB, VC			●	●	●
Sequence voltages	V1, V2, V0			●	●	●
Ground voltage	VG				●	
Power and energy (1-phase, 3-phases) and power factor	P, E and PF			●	●	●
Fault location	FLO			●	●	
Power quality	PQ	○	○	○	○	○
<b>Automation &amp; Communications</b>						
100Base-TX Ethernet (RJ45)		○	○	○	○	○
100Base-FX Ethernet(LC)		○	○	○	○	○
100Base-TX Ethernet(RJ45) + RS-485(1x4-wire or 2x2-wire) + IRIG-B		○	○	○	○	○
100Base-FX Ethernet(LC) + RS-485(1x4-wire or 2x2-wire) + IRIG-B		○	○	○	○	○
100Base-TX and -FX Ethernet (1 * LC, 2 * RJ45) + serial glass fiber (ST)		○	○	○	○	○

<b>Automation &amp; Communications (continued)</b>		<b>Functional Application</b>				
		<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>Included = ●, Optional = ○</b>						
100Base-TX Ethernet (3 * RJ45) + serial glass fiber (ST)		○	○	○	○	○
Ethernet 100Base-TX (RJ45) + configurable RS232/RS485 + [RS485 or serial glass fiber (ST) + IRIG-B] <sup>2</sup>		○	○	○	○	○
<b>Records</b>						
Sequence of events recorder	SER	●	●	●	●	●
Fault recorder	FLR	●	●	●	●	●
Digital fault (waveform) recorder	DFR	●	●	●	●	●
Load profile	LoadProf	●		●	●	

<sup>1</sup> Applicable for two breakers

<sup>2</sup> May not be combined with Arc Flash Detection (AFD) option

### Analog inputs

- Three phase currents: 5/1 A programmable
- Ground current: 5/1 A programmable or 0.2 A
- Rated frequency: 60/50 Hz programmable
- Three-phase and ground voltages: programmable nominal secondary voltage (available as options)

### Binary inputs and outputs

- Four, eight with VT inputs, binary inputs standard
- Two NO outputs with trip circuit monitoring
- Three NO outputs
- One Form C output
- One Form C self-check alarm output
- Additional binary inputs and outputs available as options

### Communication

- IEC 61850-8-1 with GOOSE messaging
- DNP3.0 Level 2+ over TCP/IP
- Modbus over TCP/IP
- Time synchronization via SNTP (primary and backup servers)
- Optional serial RS-485 port programmable for DNP3.0 Level 2+ or Modbus RTU
- Optional IRIG-B time synchronization

### Control voltage

- Option 1: 48 ... 250 V dc, 100 ... 240 V ac
- Option 2: 24 ... 60 V dc

### Product dimensions and weights

- Frame: 6.97" (177 mm) W x 6.97" (177 mm) H
- Case: 6.57" (165 mm) W x 6.30" (160 mm) H x 6.10" (155 mm)
- Weight: Relay - 7.72 lbs. (3.5 kg); Draw-out unit - 3.97 lbs. (1.8 kg)

### Tools

- PCM600 V2.3 for setting, configuration and data retrieval
- COM600 Station Automation series products V3.4
- Web browser based user interface (IE 7.0 or later)

### Certificates

- UL Listed product, File E103204

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