

# Feeder Protection Relay REF615

Protection and Control



**ABB**

# IEC 61850 compliant **Connectivity and Interoperability** for Distribution Substations

## Area of application

REF615 is a dedicated feeder protection relay perfectly aligned for the protection, measurement and supervision of utility substations and industrial power systems. Re-engineered from the ground up, the new feeder protection relay has been designed to unleash the full potential of the IEC 61850 standard for communication and interoperability of substation automation devices.

The relay provides main protection for overhead lines, cable feeders and busbar systems of distribution substations. The feeder protection relay fits any radial distribution network regardless of earthing principle.

## Protection and control

The feeder protection relay offers short-circuit, time overcurrent and thermal overload protection. The relay 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 multi-shot auto-reclose function for clearing arc faults on open-wire overhead lines.

Enhanced with an optional plug-in card, the relay offers a three-channel arc-fault protection system for supervision of the switchgear CB, cable and busbar compartment.

REF615 also integrates basic control functionality, which facilitates the control of one circuit breaker via the relay's HMI or a remote control system. To protect the relay from unauthorized access and to maintain the integrity of information, the relay incorporates a four-level, role-based user-authentication system with individual passwords for the viewer, operator, engineer and administrator level. The access control applies to the front panel HMI, the web browser based HMI and the PCM600 relay setting and configuration tool.

## Standardized communication

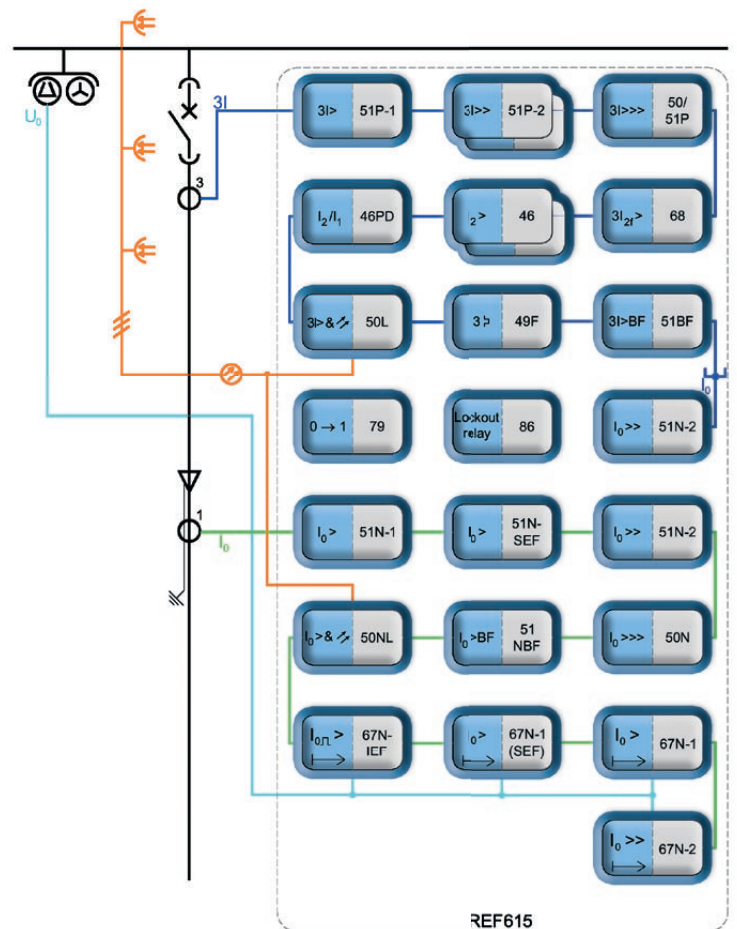
REF615 supports the new IEC 61850 standard for inter-device communication in substations. The relay also supports the industry standard Modbus® protocol.

The implementation of the IEC 61850 substation communication standard in REF615 encompasses both vertical

and horizontal communication, including relay-to-relay communication (GOOSE) and parameter setting services according to IEC 61850-8-1.

## Busbar protection à la GOOSE

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





## Pre-emptive condition monitoring

To secure the operational availability of the protection, the REF615 relay incorporates a comprehensive range of monitoring functions to supervise the relay hardware and software, the relay communication, the CB trip circuit and the circuit breaker. Depending on the device configuration chosen, 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 measures the breaker travel-time and counts the number of CB operations, thus collecting basic information for scheduling timely CB maintenance.

## Rapid set-up and commissioning

Due to the ready-made adaptation of REF615 for the protection of feeders, the relay can be rapidly set up and commissioned, once it has been given the application-specific relay settings. If the relay needs to be adapted to the special requirements of the intended application, the flexibility of the relay allows the relay's standard signal configuration to be altered by means of the signal matrix tool (SMT) included in the PCM600 relay setting and configuration tool.

By means of Connectivity Packages containing detailed descriptions of ABB's protection relays, with data signals, parameters and addresses, the relays can be automatically configured via the MicroSCADA Pro system, the COM600 Station Automation series devices or the PCM600 relay setting and configuration tool.

## Unique plug-in design relay

The plug-in type relay design speeds up installation and testing of the protection. The factory-tested relay units can be withdrawn from the relay cases during factory and commissioning tests. The relay case provides automatic short-circuiting of the CT secondary circuits to prevent hazardous voltages from arising in the CT secondary circuits when a relay plug-in unit is withdrawn from its case.

The handle locking the relay unit into its case can be provided with a seal to prevent unintentional withdrawal of the relay unit.



## REF615 highlights

IEC 61850  
COMPLIANT

- Directional & non-directional earth-fault protection, sensitive earth-fault protection, and transient-measuring earth-fault protection also covering intermittent earth-faults on cable feeders
- Device connectivity and system interoperability according to the IEC 61850 standard for next generation substation communication
- High-speed busbar protection using horizontal GOOSE messaging over the station bus. No hard-wired copper cabling needed between switchgear cubicles.
- Super-fast, three-channel arc-fault protection for increased personal safety, reduced material damage and minimized system down-time
- Enhanced disturbance recorder functionality including high sampling frequency, extended length of records, 12 analog and 64 binary channels and flexible triggering
- Plug-in type relay unit and a unique relay case design for a variety of mounting methods and fast installation, routine testing and maintenance
- One single tool for relay setting, signal configuration and disturbance record handling

Standard Configurations

	IEC	ANSI	Overcurrent and directional earth fault		Overcurrent and non-directional earth fault	
			A	B	C	D
<b>Protection</b>						
Three-phase overcurrent, 4 stages	3I>, 3I>>(1), 3I>>(2), 3I>>>	51P-1, 51P-2, 51P-3, 50P/51P	●	●	●	●
Directional or non-directional earth fault, 3 stages	I <sub>0</sub> >→, I <sub>0</sub> >>→, I <sub>0</sub> >>>→	67N-1,67N-2, 67N-3	●	●	-	-
Double earth fault	I <sub>0</sub> >>	51N-2	●	●	-	-
Transient/intermittent earth fault	I <sub>0</sub> >→ IEF	67N-IEF	●	●	-	-
Non-directional earth fault, 3 stages	I <sub>0</sub> >, I <sub>0</sub> >>, I <sub>0</sub> >>>	51N-1, 51N-2, 50N/51N	-	-	●	●
Non-directional sensitive earth fault	I <sub>0</sub> > SEF	51N SEF	-	-	●	●
Negative phase sequence overcurrent, 2 stages	I <sub>2</sub> >, I <sub>2</sub> >>	46	●	●	●	●
Phase discontinuity	I <sub>2</sub> /I <sub>1</sub> >	46PD	●	●	●	●
Thermal overload	3I <sub>th</sub> >	49F	●	●	●	●
Circuit-breaker failure	3I/I <sub>0</sub> > BF	51BF/51NBF	●	●	●	●
Inrush current detection	3I <sub>2f</sub> >	68	●	●	●	●
Lockout function		86	●	●	●	●
Arc protection with three sensors	ARC	50L/50NL	○	○	○	○
<b>Control</b>						
Circuit-breaker control	1 ↔ 0 CB		●	●	●	●
Auto-reclosing of a circuit breaker	0 → 1	79	○	○	○	○
<b>Supervision and Monitoring</b>						
Circuit-breaker condition monitoring			-	●	-	●
Trip-circuit supervision for two trip coils			●	●	●	●
<b>Measurement</b>						
Transient disturbance recorder			●	●	●	●
Three phase currents	3I	3I	●	●	●	●
Current sequence components	I <sub>1</sub> , I <sub>2</sub> , I <sub>0</sub>	I <sub>1</sub> , I <sub>2</sub> , I <sub>0</sub>	●	●	●	●
Residual current	I <sub>0</sub>	I <sub>N</sub>	●	●	●	●
Residual voltage	U <sub>0</sub>	V <sub>N</sub>	●	●	-	-

● = included, ○ = optional

**Energizing inputs**

Three phase currents: 1/5 A  
 One residual current: 1/5 A or 0.2/1 A  
 One residual voltage: 100/110/115/120 V  
 Rated frequency: 50/60 Hz

**Binary inputs and outputs**

Three binary inputs with common ground  
 One additional binary input if no U<sub>0</sub> measurement  
 Two NO double-pole outputs including TCS  
 Two NO single-pole outputs  
 One change-over signal outputs  
 One NO signal output  
 One change-over IRF signal output  
 Seven binary inputs plus three binary outputs with one optional extension card and another six binary inputs and three binary outputs with a second optional extension card, applies to standard configurations B and D

**Communication**

IEC 61850-8-1 with GOOSE messaging  
 MODBUS TCP and RTU (optional)  
 Time synchronization over Ethernet station bus using SNTP or over separate wiring using IRIG-B signal

**Auxiliary power supply**

Variant 1: 48-250 V dc, 100-240 V ac; Variant 2: 24-60 V dc

**Dimensions**

177 mm (4U) height, 177 mm (4U) width, 140 mm depth, weight 3.5 kg

**Tools**

PCM600 ver. 2.0 SP1 for setting, signal configuration and disturbance record handling  
 Web browser based user interface (IE 7.0 or later)  
 COM600 Station Automation series products Ver. 3.2



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