

# Protection, Remote Monitoring and Control

## REC615

### Numerical feeder protection in medium voltage networks

The dedicated grid automation relay is intended for remote control and monitoring, protection, fault indication, power quality analysis and automation in medium-voltage secondary distribution systems, including networks with distributed power generation, with secondary equipment such as medium-voltage disconnectors, switches and ring-main units.

#### Mechanical and construction details

- The relay shall have compact dimensions not exceeding 4U in height. The depth of the relay shall, without any additional raising frame, not exceed 160 mm when flush mounted so as not to foul with other equipment mounted inside the cabinet. The weight of the relay must not exceed 5 kg to permit use of optimized sheet metal thickness in construction of panels.
- The relay shall support flush, semi-flush, rack and wall mounting options.
- As flush mounted, the relay shall meet the IP54 ingress protection requirements on the front side and IP20 on the rear side and connection terminals.
- To facilitate quick unit replacement, the relay design shall be of draw-out type with secure current transformer (CT) shorting. It shall be possible to quickly replace a faulty unit with a spare without disturbing the majority of the wiring. The mean time to repair (MTTR) shall be less than 30 minutes.
- To prevent unauthorized detachment of the relay plug-in unit, the relay shall be provided with an integrated seal.
- The relay shall have a graphical display with at least 7 rows of characters and up to 20 characters per row.

#### Control and Automation functions

- The relay shall support local and remote control of at least one circuit breaker and up to eight load break switches or sectionalizers.
- The relay shall support automatic sectionalizing.

#### Protection functions

- The relay shall have directional and non-directional phase overcurrent and earth-fault protection (50/51/67) with three stages (low-set, high-set and non-directional instantaneous stage), definite time (DT) and inverse definite minimum time (IDMT) characteristics, and IEC and ANSI/IEEE operating curves.
- The relay must have three-stage directional phase overcurrent protection (67) with voltage memory and positive and negative-sequence polarization.
- The relay must have three-stage directional earth-fault protection (67N) with selectable negative and zero-sequence polarization.  $I_0$  and  $U_0$  shall be derived either from the phase voltages and currents or from the measured neutral current and residual voltage.
- In compensated, unearthed and high-resistance earthed networks, the relay shall be able to detect transient, intermittent and continuous earth faults. The fault direction determination criterion of the protection function must include multiple harmonics.
- In compensated, unearthed and high-resistance earthed networks, the relay shall have admittance (21YN/67YN) and wattmetric-based (32N) earth-fault protection.
- The relay shall include phase unbalance, voltage and frequency protection.
- The relay shall include a fault-locating algorithm to calculate the fault location with +/- 2.5 % accuracy for phase-to-phase and phase-to-earth faults in effectively and low-resistance earthed networks.
- For overhead line applications, the relay shall have an optional multishot auto-reclose function.
- The relay shall include load shedding and restoration function

**Inputs and outputs**

- The relay shall have 8 binary inputs and 10 binary outputs and all of them freely configurable.
- The threshold voltage of the relay's binary inputs shall be settable to 16...176 V DC.
- The binary inputs of the relay shall, when energized, utilize a higher inrush current to facilitate the breaking of possible dirt or sulfide from the surface of the activating contact.
- The phase current inputs and the residual current input of the relay shall be rated 1/5 A. The selection of 1 A or 5 A shall be software-based.
- For applications requiring sensitive earth-fault protection, the relay shall offer an optional 0.2/1 A residual current input. The selection of 0.2 A or 1 A shall be software-based.
- The relay must offer optional current and voltage sensor inputs and support the use of combined current and voltage sensors connected with one connector per phase. The current sensor inputs must facilitate the usage of sensors within the nominal range of 40...1250 A without any external adapters.

**Measurements, alarms and reporting**

- The relay shall have three-phase current and voltage measurement (fundamental or RMS-based as selectable options) with an accuracy of  $\pm 0.5\%$  and zero, negative and positive-sequence current and voltage measurement with an accuracy of  $\pm 1\%$  within the range of  $\pm 2\text{Hz}$  of the nominal frequency.
- To collect sequence-of-events (SoE) information, the relay must include a non-volatile memory with a capacity of storing at least 1024 event codes with associated time stamps.
- The relay must support the storage of at least 128 fault records in the relay's non-volatile memory.
- The fault record values must at least include phase currents, phase voltages, zero, negative and positive-sequence currents and voltages, and the active setting group.
- The relay shall have a disturbance recorder supporting a sampling frequency of 32 samples per cycle and featuring up to 12 analog and 64 binary signal channels.
- The relay's disturbance recorder shall support not less than 6 three-second recordings at 32 samples per cycle for 12 analog channels and 64 binary channels.
- The relays shall support up to 100 disturbance recordings in the relay's non-volatile memory.
- The relay must have a load profile recorder for phase currents and voltages supporting up to 12 selectable load quantities and more than 1 year of recording length. The load profile recorder output shall be in COMTRADE format.
- The relay shall support power quality measurement, such as total harmonic values for both current and voltage, voltage sags and swells and voltage unbalance

### Communication

- The relay must support IEC 61850.
- The relay must support, besides IEC 61850, simultaneous communication using one of the following communication protocols: IEC 60870-5-104, IEC 60870-5-101, DNP3 (serial/TCP) or Modbus® (RTU-ASCII/TCP)
- The relay must have an Ethernet port (RJ45) on the front for local parametrization and data retrieval.
- The relay shall support up to five IEC 61850 (MMS) clients simultaneously.
- The relay must support IEC 61850 GOOSE messaging and meet the performance requirements for tripping applications (<10 ms) as defined by the IEC 61850 standard.
- The relay shall support sharing analog values, such as temperature, resistance and tap positions using IEC 61850 GOOSE messaging.
- The relay shall also support the SNTP (Simple Network Time Protocol) and IRIG-B (Inter-Range Instrumentation Group - Time Code Format B) time synchronization methods.

### Engineering and configurability

- The relay must have 6 independent settings groups for the relevant protection settings (start value and operate time). It must be possible to change protection setting values from one setting group to another in less than 20 ms from the binary input activation.
- The relay must have a web browser-based human-machine interface (WHMI) with secured communication (TLS) and shall provide the following functions:
  - Programmable LEDs and event lists
  - System supervision
  - Parameter settings
  - Measurement display
  - Disturbance records
  - Phasor diagram
  - Single-line diagram (SLD)
  - Importing and exporting of parameters

- When a protection function is disabled or removed from the configuration, neither the relay nor the configuration tool shall show the function-related settings.
- The relay HMI and configuration tool shall have multilingual support.
- The relay HMI and configuration tool shall support both IEC and ANSI protection function codes.
- The relay shall have at least 11 freely configurable and programmable two-color LEDs.
- The relay must have at least 10 user-configurable local HMI views including measurements and SLDs.
- The relay shall have a graphical configuration tool for the complete relay application including multi-level logic programming support, timers and flip-flops.
- The relay configuration tool must include online visualization of the relay application state.
- It must be possible to keep the relay configuration tool up-to-date using an online update functionality.
- The relay configuration tool shall support viewing of relay events, fault records and visualization of disturbance recordings.
- The relay configuration tool must include the complete relay documentation including operation and technical details.
- The relay configuration tool must include functionality for comparing the archived configuration to the configuration in the relay.
- The relay configuration tool must allow configuration of IEC 61850 vertical and horizontal communication including GOOSE and sampled values.
- The relay configuration tool must support importing and exporting of valid IEC 61850 files (ICD, CID, SCD, IID).
- The relay configuration tool must be compatible with earlier relay versions.

**Type tests and other compliance requirements**

- The relay shall have an operating temperature range of -25 ... +55°C and short time service temperature range of -40...+85°C (less than 16h).
- The relay must fulfill the mechanical test requirements according to IEC 60255-21-1, -2 and -3, Class 2 for vibration, shock, bump and seismic compliance.
- The relay must conform to IEC 61850.
- The relay must fulfill the electromagnetic compatibility (EMC) test requirements according to IEC 60255-26.
- The relay must be tested according to the requirements of the IEC or an equivalent standard.

**Additional information**

For more information, please contact your local ABB representative or visit our website at:

**[www.abb.com/substationautomation](http://www.abb.com/substationautomation)**

**[www.abb.com/mediumvoltage](http://www.abb.com/mediumvoltage)**