

# Feeder Protection and Control REF630

## Numerical feeder protection in medium voltage networks

The freely configurable relay is intended for protection, control, measurement and supervision of the outgoing or incoming feeder in complex and demanding applications with a high number of switching devices in medium voltage networks.

### Mechanical and construction details

- The relay shall have compact dimensions not exceeding 4U in height for panel door mounting installations.
- The relay shall support flush, semi-flush, rack and wall mounting options.
- As flush mounted, the relay shall meet the IP40 (with detached HMI IP42) ingress protection requirements on the front side and IP20 on the rear side and connection terminals.
- To facilitate quick replacement, the relay shall have detachable connectors with secure current transformer (CT) shorting. It shall be possible to quickly replace the faulty unit with a spare without disturbing any of the wiring.
- The relay shall have an integrated human-machine interface (HMI) or alternatively be offered with a detached HMI. The detached HMI shall enable flexible installation for reduced wiring and weight impact on the panel door of the low voltage (LV) compartment.
- The power supply to the detached HMI shall be provided using Power over Ethernet (PoE) to avoid additional wiring for the auxiliary voltage.
- The HMI of the relay shall have a large graphical display with dimensions no less than 70 mm x 100 mm and 320 x 240 pixel resolution, allowing the display of at least 10 switching objects. The HMI shall also include 5 freely configurable push buttons.

### Protection and control 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 sequence component current-based phase unbalance protections.
- The relay shall have comprehensive voltage protection functionality, including at least overvoltage, undervoltage, positive-sequence overvoltage, positive-sequence undervoltage, negative-sequence overvoltage and residual overvoltage protection.
- The relay must have five-stage frequency protection, including at least overfrequency, underfrequency, and frequency rate-of-change protection with rate-of-rise or rate-of-fall freely selectable for each stage.

- 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 a multishot auto-reclose function.
- The relay shall have distance protection with selectable circular (mho) or quadrilateral (quad) zone characteristics. The protection shall include three flexible, configurable impedance zones for protection and two impedance zones for auto-reclosing schemes. In addition, the relay shall include permissive underreach and overreach transfer trip capability. The ground distance elements of the relay shall include the zero-sequence compensation factor  $K_0$  to allow compensation for remote faults when there are intermediate sources of zero-sequence current.
- The relay shall include six-stage frequency-based load-shedding and restoration functionality for automatic disconnection and reconnection of less important loads in network overload situations.
- The relay shall have circuit breaker failure protection (51BF/51NBF) including independent timers for repeated tripping of the same breaker and back-up tripping of the upstream breaker. The function shall allow higher selectivity by avoiding tripping of the upstream breaker if the repeated tripping of the breaker closest to the fault is successful.
- The relay shall support the control of at least 10 objects, including at least 2 circuit breakers and 8 disconnectors/earthing switches freely selectable for control or indication only.
- It shall be possible to apply the relay as a bay controller, including an HMI with push buttons, interlocking logic for the station and bay level, supervision, indication and monitoring functionality as well as optional auto-reclosing and backup overcurrent protection.

#### **Inputs and outputs**

- The relay shall have a scalable amount of binary inputs and outputs. The number of binary inputs shall be scalable up to 50 and the number of binary outputs to 45.
- The relay shall have at least 3 trip output relays with integrated trip circuit supervision (TCS). The trip output relays shall be rated to make and carry 30 A for 0.5 s
- The threshold voltage of the relay's binary inputs shall be independently settable between 15...221 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 relay shall optionally include 8 RTD/analog inputs and 4 mA outputs settable between -20 mA and +20 mA. The RTD/analog input shall support various options, e.g. RTDs, mA signals, voltages and resistance arrays.
- The RTD inputs shall support both 2-wire and 3-wire measurements for RTD and resistance modes.
- 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 0.1/0.5 A residual current input. The selection of 0.1 A or 0.5 A shall be software-based.

### Measurements, alarms and reporting

- The relay shall have three-phase current, residual current and voltage measurement with an accuracy of  $\pm 0.5\%$ , and positive and negative sequence current and voltage measurement with an accuracy of  $\pm 1\%$ .
- The relay shall support current and voltage phase-angle measurement viewing via the local HMI.
- To collect sequence-of-events (SoE) information, the relay must incorporate a non-volatile memory with a capacity of storing at least 1000 event codes with associated time stamps and user-definable event texts with a minimum resolution of 1 ms.
- The relay shall include a numerical disturbance report containing information on the fault. The report shall incorporate the recording time, pre-fault and post-fault time, pre-fault amplitude, pre-fault angle, fault amplitude and fault angle trip values. The report shall be stored in a non-volatile memory and be accessible via the local HMI.
- The relay shall have a disturbance recorder supporting a sampling frequency of 20 samples per cycle and featuring up to 40 analog and 64 binary signal channels.
- The relay shall support not less than 100 recordings with a sampling frequency of 20 samples per cycle, each recording 3.4 seconds in length, 10 analog channels and 64 binary channels.

### Communication

- The relay must support IEC 61850 Edition 1.
- The relay must support, besides IEC 61850, simultaneous communication using one of the following communication protocols: IEC 60870-5-103 or DNP3 (TCP).
- The relay shall have an Ethernet port with a galvanic (RJ45) or an optical (LC) interface.
- 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 must 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 4 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 values to another via the local HMI, using a binary input signal, and remotely through the communication link.
- The relay must have a web browser-based human-machine interface (WHMI) that shall provide access to:
  - Sequence-of-events (SoE)
  - Device status
  - Parameter settings
  - Measurements
  - Disturbance records
  - Phasor diagram
  - Programmable LED status
- 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 15 freely configurable programmable three-color LEDs.
- The relay must have at least 4 user-configurable local HMI pages including measurements and single line diagram (SLD).
- 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, disturbance reports 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.
- 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.
- It shall be possible to freely assign current and voltage inputs to protection and measurement functions.

#### **Type tests and other compliance requirements**

- The relay shall have a continuous operational temperature range of -25 ... +55°C and transport and storage temperature range of -40...+85°C.
- The relay must fulfill mechanical tests IEC 60255-21-1, -2 and -3 according to Class 1 for vibrations, shock, bump and seismic compliance.
- The relay must fulfill the electromagnetic compatibility (EMC) tests 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)**

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