

DATASHEET

Transformer protection RET670

Relion® 670 series version 2.2

Application

- Complete protection, control and monitoring for two- and three- winding transformers, autotransformers, step-up transformers, generator-transformer block units, phase shifting transformers, special railway transformers and shunt reactors and capacitor banks
- Operates over a wide frequency range in order to accommodate power system frequency variations during disturbances or generator start-up/shutdown
- Low impedance differential protection function is fast, offers high sensitivity for low-level internal faults and places low requirements on CTs
- Additionally supports transformer voltage control, circuit breaker/disconnector control, circuit breaker condition and transformer loss-of-insulation monitoring
- Easy integration to conventional or digital substations

Features

- Fully IEC 61850 compliant, Edition 1 and Edition 2
- Extensive I/O capability
- Protection, monitoring and control of several primary objects integrated in one IED
- Extensive self-supervision including analog channels
- Six independent parameter setting groups
- Ethernet interface for fast and easy communication with PC and SA system
- Large number of Ethernet ports to support several system topologies and redundancy methods
- Large HMI for visualization of single line diagrams
- Settings via IEC 61850 for some protections
- Cyber security support for compliance to NERC CIP and IEC 62351-8 with Centralized Account Management using Microsoft Active Directory

Pre-configured solutions

- Pre-configured and type-tested solutions including default settings for:
 - 2 winding transformer in single/multi breaker arrangements
 - 3 winding transformer in multi breaker arrangements
 - Voltage control for up to 2/8 parallel transformers

- Back-up protection for transformers and shunt reactors

Most important protection functions

- Transformer differential protection
 - High sensitivity for interturn faults
 - Fast differential protection
 - Automatic CT ratio matching and vector group compensation
 - Waveform and second harmonic restraint for transformer inrush
 - Fifth harmonic restraint for overexcitation
- Transformer differential protection for phase shifting transformers (PST)/phase angle regulating transformer (PAR)
 - Self adaptive features in terms of transformation ratio and phase angle shift
- 3-phase high impedance differential protection
- Restricted earth-fault protection
 - Extremely fast operation
 - High and/or low impedance based
- Distance protection

Full-scheme distance protection with quadrilateral, Mho compensation characteristics for up to 7 zones with load encroachment discrimination and compensation of mutual coupling from parallel line. Consisting of 2 fixed zones, one each for reverse and forward, while 5 zones settable as forward or reverse.

 - Series/non-series compensated lines
- Back-up under impedance protection
- Pole slip protection
 - Detection of slips in power system from 0.2Hz to 8Hz
 - Discrimination between generating and motoring direction of rotor phase angle
 - Discrimination between local and external power swing center
 - Trip after a set number of slips or rotor angle
- Loss of/under excitation
 - Positive sequence measurement
 - Two offset-mho zones
 - Directional element for zone restriction
- Voltage functions
 - Two step phase- and residual overvoltage protection with definite and inverse time characteristics

- Two step undervoltage protection with definite and inverse time characteristics
- Voltage three-phase differential protection for capacitor banks
- Overexcitation protection
- Loss of voltage check
- Current functions
 - Instantaneous phase- and residual overcurrent protection
 - Four step phase- and residual directional overcurrent protection
 - Average power based transient earth fault protection
 - Four step directional negative sequence overcurrent protection
 - Two step negative sequence overcurrent protection
 - Sensitive directional earth-fault protection
 - Broken conductor check
 - Over current protection with binary release
 - Thermal overload protection
 - Breaker failure protection
 - Stub protection
 - Pole discordance protection
 - Capacitor bank protection
 - Voltage controlled/restraint overcurrent protection

Capacitor bank unbalance protection

- A set of current and voltage based unbalance protection functions for shunt capacitor banks. Suitable for grounded, ungrounded single/parallel capacitor banks
 - Cascading failure protection
 - Current unbalance protection
 - Voltage unbalance protection
 - Phase voltage differential protection
- Power functions
 - Directional under- and overpower protection
- Secondary system supervision
 - Fuse failure supervision
 - Fuse supervision based on voltage differential
 - Current circuit supervision
 - Current/Voltage/Real Value based delta supervision
- Frequency functions
 - Under- and over frequency protection
 - Rate-of-change frequency protection

Multi-purpose function

- Multi-purpose filter with possibility to detect, alarm, and trip for special operating conditions, e.g. Sub-Synchronous Resonance (SSR)
- General current and voltage protection

Control functions

- Automatic voltage control for a single transformer

- Automatic voltage control for up to 8 parallel transformers in a group based on the minimum circulating current principle or master-follower principle
- Setpoint voltage can be controlled via IEC 61850
- Synchronizing, synchro check and energizing check
- Tap position via mA or BCD code
- Control, interlocking for up to 30 switching devices
- Selectable operator place allocation
- Software based multi-position selector switches

Logic

- Tripping and trip matrix logic
- Extensive math and logic block library for application customization

Monitoring

- Phasor monitoring for up to 24 phasor values
- Adjustable breaker monitoring with capability to handle multiple breaker types
- Estimation of transformer insulation loss of life based on top oil measurement or calculation
- Monitor mechanical stresses on transformer via advanced transformer through fault monitoring and reporting functionality
- Monitoring and reporting of currents and voltages during faults
- Disturbance recorder with disturbance report supporting COMTRADE 1999 and 2013 formats
 - 200 disturbances
- 40 analog channels (30 physical and 10 derived)
 - 352 binary channels
- All protection settings during a disturbance
- Event list for 5000 process and 10240 security events
- Event and trip value recorders
- Fault locator
- Event counters
- Current/Voltage based harmonic monitoring
- (up to 9th order) including total harmonic distortion
- Running hour meter
- Supervision of AC and mA input quantities
- Large HMI with virtual keyboard, function push buttons, and three color LED indications with alarm descriptions

Measurements

- U, I, P, Q, S, f and $\cos \Phi$
- Frequency measurement with accuracy of ± 2 mHz
- Inputs for mA measuring

Metering

- Energy metering function for energy statistics
- Pulse counting support for energy metering

Communication

- IEC 61850-8-1 including GOOSE messaging
- IEC 62439-3 Parallel Redundancy Protocol (PRP)

- IEC 62439-3 High-availability Seamless Redundancy (HSR)
- IEEE 802.1D Rapid Spanning Tree Protocol (RSTP)
- IEC/UCB 61850-9-2LE Process bus for up to 8 MUs
- Phasor monitoring reporting via IEEE 1344 and IEC/IEEE 60255.118 (C37.118)
- IEC 60870-5-103, DNP 3.0, SPA, LON protocols
- Remote end communication for signal transfer
 - 64 kbps: 3 analogs & 8 binary or 192 binary
 - 2 Mbps: 9 analogs & 192 binary

Engineering, testing, commissioning and maintenance

- Protection and control IED manager, PCM600, for configuration, parameterization, Ethernet port/protocol configuration, online debugging and disturbance handling
- Forcing of binary inputs and outputs for faster and easier test and commissioning
- Flexible product naming by mapping utility IEC 61850 model to that of 670 series model

Hardware

- 1/1 x 19", 3/4 x 19" or 1/2 x 19" 6U height case selected according to the number of required I/O modules
- Power supply modules from 24 to 250 V DC \pm 20 %
- TRM modules each with 12 analog inputs protection class and optionally measurement

- Up to 14 I/O modules in 1/1 x 19" case
- Binary input module with 16 inputs
- Binary output module with 24 outputs
- Static binary output module with 6 heavy-duty static and 6 change-over outputs
- Binary input/output module with 8 inputs and 12 outputs
- mA input module with 6 transducer channels
- Connector types: compression or ring-lug
- Accurate time-synchronization through
- PTP (IEC/IEEE 61850-9-3), GPS, SNTP, DNP 3.0, IEC 60870-5-103 or IRIG-B
- Remote end data communication modules for C37.94, galvanic X.21 up to 10 m, fiber for direct connection up to 130 km or via multiplexer
- Up to six Ethernet ports (optical LC or RJ45) that can be freely configured as single or redundant pairs

Accessories

- COMBITEST test system
- COMBIFLEX auxiliary relays
- Mounting kits

Documentation

- Role based documentation for high efficiency in engineering, commissioning, operations and maintenance

Technical details are available in the RET670 Product Guide.