



PCS-974

Transformer Auxiliary Relay

PCS-974 is an auxiliary relay, which can provide mechanical and backup protections for a transformer, a shunt reactor or generator in any voltage level. It provides up to 20 high-power-pickup binary inputs for mechanical element monitoring, alarming and tripping. The high-power-pickup design reduces the risk of Electro-Magnetic Interference (EMI) in order to improve reliability. Generally, mechanical relays include winding temperature relays, oil temperature relays and buchholz relays.

The PCS-974 is compatible with IEC 61850 station bus and process bus applications. It supports IEC 61850-8-1 MMS, GOOSE and IEC 61850-9-2 Sampling Value. The RJ-45 faceplate port is provided for testing and setting in effort to make commissioning and maintenance easier.

Functions

Protection and Control

- Overexcitation protection (24)
Overexcitation protection is based on the ratio of voltage to frequency (V/Hz). The overexcitation protection can be configured into any side of the transformer using PCS- Explorer software.
- Underfrequency and overfrequency protection (81U/81O)
Four-stage underfrequency protection and four-stage overfrequency protection are provided in each relay. The change-of-rate (df/dt) element is integrated for underfrequency protection. Zero-sequence voltage and out-of-limit frequency are detected in order to block under-/over-frequency protection.

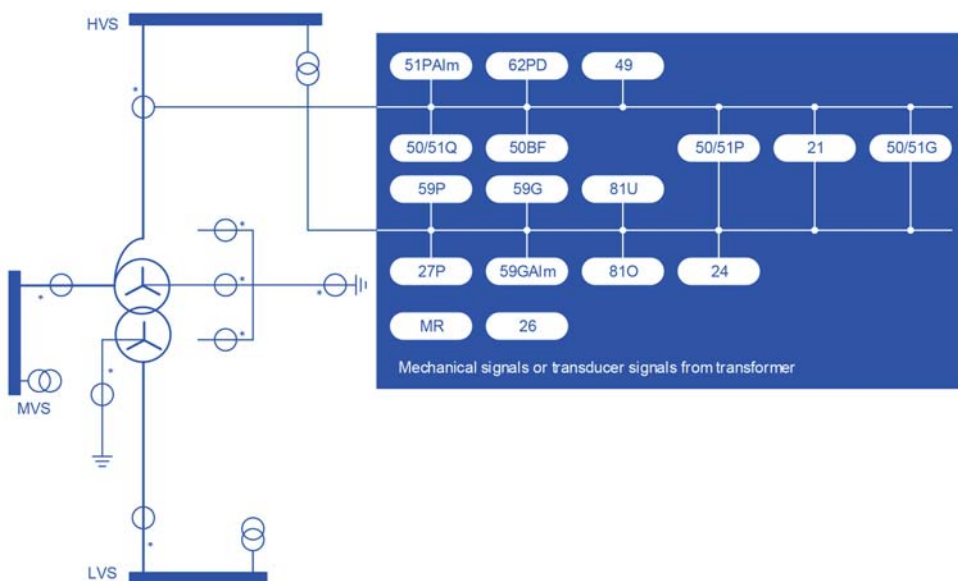


Figure 1 PCS-974 Functional Block Diagram

- Two-stage phase-to-phase impedance protection (21)
They are selectable to forward direction or reverse direction by logic setting. The power swing blocking logic is integrated to improve reliability.
- Two-stage phase-to-ground impedance protection (21)
They are selectable to forward direction or reverse direction by logic setting. The power swing blocking logic is integrated to improve reliability.
- Power swing blocking releasing (PSBR)
The unique power swing blocking releasing logic is integrated to prevent the mal-operation of impedance protection due to power swings.
- Four-stage phase overcurrent protection (50/51P)
Overcurrent protection is supervised by the voltage element, harmonic element and directional element. Inverse-time curves take into account both IEC/IEEE curves and a self-definable curve.
- Four-stage earth fault protection for each side (50/51G)
Overcurrent protection is supervised by the voltage element, harmonic element and directional element. Inverse-time curves take into account both IEC/IEEE curves and a self-definable curve.
- Two-stage negative-sequence overcurrent protection (50/51Q)
Inverse-time curves take into account both IEC/IEEE curves and a self-definable curve.
- Two-stage phase overvoltage protection (59P)
Phase voltage and phase-to-phase voltage can be selected as calculation values. The '1-out-of-3' and '3-out-of-3' criterions are provided for flexible protection logic. Inverse-time curves take into account both IEC/IEEE curves and a self-definable curve.
- Two-stage residual overvoltage protection (59G)
Inverse-time curves take into account both IEC/IEEE curves and a self-definable curve.
- Four-stage undervoltage protection (27P)
Generally, undervoltage protection is employed for load-shedding in order to keep the system's voltage in normal operation range. The positive-sequence voltage is used as the calculation value. To differentiate between the low-voltage due to short-circuit faults and the low-voltage due to the lack of reactive power, the voltage rate-of-change (du/dt) element, the negative sequence voltage element and the low positive sequence voltage elements are integrated.
- Thermal overload protection (49)
A thermal model is adopted to continuously calculate the heat capacity of a transformer. Two stages are integrated for alarm and tripping. Up to three thermal protections are provided for the different sides of transformer.
- Breaker failure protection (50BF)
Breaker failure protection for each breaker is supplied to initiate re-tripping and adjacent breaker tripping.
- Pole disagreement protection (62PD)
External binary input and zero-sequence/negative-sequence current are used to detect a pole disagreement state of the circuit breaker.
- Phase overcurrent alarm (51PAIm)
A dedicated overcurrent element is employed to detect the load current of the transformer. If an overload condition is detected, the relay can initiate the cooling system and block the tap changer. The phase overcurrent alarm element is not supervised by Fault Detector elements.
- Residual overvoltage alarm (59GAIm)
The element is generally used in ungrounded systems to detect ground voltage and to issue potential alarm signals.
- Mechanical protection (MR)
Up to 20 input channels of mechanical protection It adopts high-power relays to improve the anti-interference ability of mechanical protection. 12 mechanical signal input channels for tripping instantaneously or with time delay at most.
- Temperature protection (26)
The relay provides six analog inputs (0-20mA/0-5V) for temperature transducers in effort to detect possible over temperature states.
- Voltage and current drift auto adjustment
The relay continually and automatically traces the voltage and current drifts, then it adjusts the zero point to the normal value.
- Frequency tracking
Frequency tracking is provided to accommodate the frequency shifts in the power system.

Monitoring

- CT failure supervision
- VT failure supervision
- Self diagnostic
- Event recorder including 1024 change-of-binary-input events, 1024 supervision events and 1024 operating logs
- Clock synchronization using IRIG-B, SNTP, PPS (Pulse-Per-Second) and PPM (Pulse-Per-Minute)

Communication

- Up to four 10Base-T/100Base-TX copper Ethernet ports using IEC 61850, DNP3.0 or IEC 60870-5-103 over TCP/IP
- Up to two 100Base-FX optical Ethernet ports using IEC 61850, DNP3.0 or IEC 60870-5-103 over TCP/IP (Sharing two copper Ethernet ports)

- Two RS-485 serial ports using IEC 60870-5-103
- One RS-485 serial port for clock synchronization

User Interface

- HMI interface with large-size LCD and 9-button keypad on the front panel
- One front RJ-45 port for testing and setting
- One RS-232 or RS-485 rear port for printer
- Language selection – English + selected language
- Assistant software - PCS-Explorer

Features

- To eliminate the interference from switchyard field, high-power-pickup binary inputs are designed for dedicated mechanical inputs, in order to improve the protection reliability.
- A unique two-out-two logic is adopted in hardware design to improve security. Coordinating with the redundant scheme, this solution improves both security and dependability of

protection system. The two independent data acquisition paths are provided to prevent mal-operation caused by component failure. One works as a fault detector and the other is designed for protection logic. Tripping outputs are supervised by both data acquisition paths.

- Comprehensive flexibility is provided via the modular hardware design, scalable function library, programmable logics, configurable I/Os and definable LEDs. This allows
- users to create customized schemes for specific projects. Two fixed LEDs and 18 definable 3-color LEDs (Green/Yellow/Red) are provided.
- The relay is designed based on NR Electric's well-established and proven hardware platform with multi-processor architecture. The multi-CPU technology supports parallel operation of CPU modules.
- The relay is fully compatible with IEC 61850, it includes station bus communication and process bus communication. The relay provides up to 6 Ethernet ports for process bus with IEC 61850-9-2 Sampling Value and IEC 61850-8-1 GOOSE, as well as up to 4 Ethernet ports for station bus with IEC 61850-8-1 MMS.