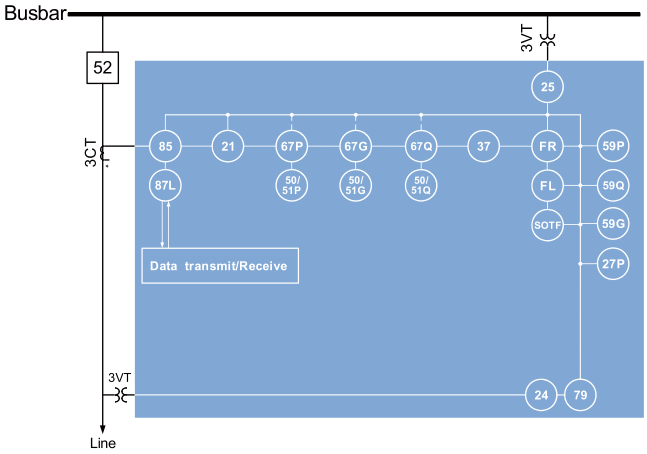
PCS-931S Line Differential Relay

PCS-931S line differential relay integrates main and back-up protection functions, which is designed for overhead line, cables and hybrid transmission lines of various voltage levels and provides comprehensive protection and control solutions. With its flexibility and the powerful PCS-Studio configuration tool, PCS-931S offers future-oriented system solutions with high investment security and low operating costs.



Features

- Two-terminal transmission line application, including overhead line and cable, support steady-state and transient capacitive current compensation
- Differential Protection
  - Phase-segregated differential protection employs DPFC and steady quantities as protection criteria, easy to set, quick to clear the fault, high sensitivity and immune to power swing and load fluctuation.
  - Self-adaptive floating threshold which only reflects deviation of power frequency components improves the sensitivity and reliability during load fluctuation and system disturbance.
  - Current differential protection adopts three-segment philosophy, each slope can be set by user.
  - Current differential protection has the excellent resistance to CT saturation when external fault. As long as the correct transfer time is no less than 3ms, current differential protection will ensure fast clearance of internal fault and non-operation of external fault.
  - Innovative dynamic capacitive current compensation is introduced to the device, in order to compensate both steady-state capacitive current and transient capacitive current, which can increases the sensitivity to high-impedance faults in long distance transmission lines.
  - Current differential protection supports double fiber channel, parallel and independent, either can be selected as main channel and seamlessly switched to standby channel when main channel is abnormal.
  - Unique and reliable differential logic and it can be set non-operation when CT circuit failure under normal conditions.
- Distance Protection
  - Distance protection adopted the half-wave algorithm is also supported, and its typical operation time is 12-15ms.
  - 6 zones distance protection, independent zero-sequence compensation factor for each zone, the phase-to-ground and phase-to-phase characteristic of distance protection can be set independently.
  - The unique power swing blocking releasing logic and can properly supervise distance protection during power swing, which ensures distance protection to operate correctly for internal faults during power swing, and prevents distance protection from mal-operation during power swing.
- Unique phase selector has the same protection zone as operation element. The phase selection is automatically resulted according to the reliability of phase selector, so that to avoid probable mistaken multi-phase selection by adopting overreaching phase selector.
- The overcurrent protection is combined with harmonic blocking and cold load starting logic, which can prevent from mal-operation affected by impulse current while the transformer is initiated on no-load.
- Selectable IEC, ANSI inverse-time characteristic curves, also the curve can be defined by users and the inverse-time dropoff curve selection is supported.
- Support single-ended impedance-based fault location, mutual compensation for parallel lines arrangement is also available.
- Support ping-pang synchronization mode.
- Both dedicated fiber channel and multiplexing fiber channel are supported, and single mode and multi-mode channel combination operation mode is enable. Communication rate supports 64kbit/s and 2Mbit/s, and communication protocol supports C37.94 and G.703.

Functions

Protection and Control

- DPFC current differential protection (87L)

  Phase-segregated percentage differential characteristic, reflects superimposed quantities which can recognize the sensitive protection for high impedance faults. Dynamic capacitive current compensation, adaptive restraint threshold and CT saturation detection are integrated to achieve a combination of both dependability and security.

- Steady-state current differential protection (87L)

  Phase-segregated percentage differential characteristic, dynamic capacitive current compensation, adaptive restraint threshold and CT saturation detection are integrated to achieve a combination of both dependability and security.

- Neutral current differential protection (87L)

  Improve the sensitivity to the earth faults during heavy load state. Dynamic capacitive current compensation, adaptive restraint threshold and CT saturation detection are integrated to achieve a combination of both dependability and security.

- Six zone phase-to-phase distance protection (21Q/21M)

  Mho or quadrilateral characteristic, directional, load encroachment, power swing blocking releasing and unique low-voltage elements are provided for phase-to-phase distance protection.

- Six zone phase-to-ground distance protection (21Q/21M)

  Mho or quadrilateral characteristic, reactance characteristic, directional, load encroachment, power swing blocking releasing and unique low-voltage elements are provided for phase-to-ground distance protection.

- Pilot distance protection (85)

  one of selectable six zone for pilot scheme, such as PUTT, POTT, Blocking, Unblocking, DTT & Zone Extension. The scheme integrates current reversal logic, weak-infeed echo and open breaker echo.

- Pilot directional earth-fault protection (85)

  Directional zero-sequence comparison element for pilot scheme, such as PTT, Blocking and Unblocking. The scheme integrates current reversal logic, weak-infeed echo and open breaker echo.

- Six stages phase overcurrent protection (67P, 50/51P)

  Selectable time characteristics (definite-time or inverse-time) and directional elements (forward, reverse or non-directional) are provided. A harmonic blocking function is integrated to restrain each stage independently.

- Six stages earth-fault protection (67G, 50/51G)

  Selectable time characteristics (definite-time or inverse-time) and directional elements (forward, reverse or non-directional) are provided. A harmonic blocking function is integrated to restrain each stage independently.

- Four stages negative-sequence overcurrent protection (67Q, 50/51Q)

  Selectable time characteristics (definite-time or inverse-time) and directional elements (forward, reverse or non-directional) are provided. Stage 3 can be selected as alarm purpose.

- One stage undercurrent protection (37)

- Four stages undervoltage protection (27P)

  Time characteristics is selectable between definite-time and inverse-time. Phase voltage or phase-to-phase voltage can be selected for protection calculation. “1-out-of-3” or “3-out-of-3” logic can be selected for protection criterion.

- Four stages overvoltage protection (59P)

  Time characteristics is selectable between definite-time and inverse-time. Phase voltage or phase-to-phase voltage can be selected for protection calculation. “1-out-of-3” or “3-out-of-3” logic can be selected for protection criterion.

- Four stages negative-sequence overvoltage protection (59Q)

- Four stages zero-sequence overvoltage protection (59G)

- Switch-onto-fault (SOTF) logic

  Switch-onto-fault logic is used to acceleratedly clear the faults during manual closing and auto-reclosing based on distance element or overcurrent element (phase current and residual current).

- Unique power swing blocking releasing logic (PSBR)

  The power swing blocking releasing logic prevents mal-operations during external faults in power swing situations. It quickly clears the internal faults in power swing scenarios.

- Auto-reclosing (79)

  Single-/Three-pole reclosing mode is provided. Up to four-shot

breaker auto-reclosing with synchronism and voltage check logic.

- Remote/local control

  The control of circuit breaker, disconnector and earth switch can be implemented via communication, LCD menu and binary inputs. User programmable interlocking logics are available by PCS-Studio.

- Synchrocheck (25)

  Synchrocheck can be used for auto-reclosing and manual closing for single-breaker and dual-breaker. The synchronism check function compensates for breaker close time, frequency, magnitude, and angle differences between the two voltage sources used for synchronism.

- Voltage and current drift auto adjustment

  The relay continually and automatically traces the voltage and current drifts and adjusts the zero point to acquire accurate measurements.

- Single-ended impedance-based fault location

Monitoring and Measurement

- Energy measurement (active and reactive energies for import and export)
- CT circuit failure supervision
- VT circuit failure supervision
- Fault phase selection
- Fault Locator with parallel-line compensation
- Self diagnostic
- Event recorder including 1024 change-of-binary-input events, 1024 supervision events, 256 control logs and 1024 device logs
- Disturbance recorder including 32 disturbance records with waveforms (The format is compatible with COMTRADE.)
- Pilot communication channel supervision
- System frequency supervision
- Clock synchronization using IRIG-B, SNTP, PPS (Pulse-Per-Second) and PPM (Pulse-Per-Minute) , IEEE1588

Communication

- Optional single- or dual- pilot channels (fiber optic)
- Support G.703 and C37.94
- 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 four 100Base-FX optical Ethernet ports using IEC 61850, DNP3.0 or IEC 60870-5-103 over TCP/IP
- Two RS-485 serial ports using IEC 60870-5-103
- One RS-485 serial port for clock synchronization
- Support GOOSE communication module using IEC 61850-8-1 GOOSE
- Full compatibility between IEC 61850 Editions 1 and 2
- Redundancy protocols PRP and HSR
- One front RJ-45 port for debugging