PCS-993

Out-of-Step Controller

Power systems are required to remain stable after experiencing any disturbance, which may be caused by a fault, loss of a generator, or loss of a transmission line. Some disturbances may cause out-of-step between the interconnected systems, which may lead to blackouts and equipment damages if no remedial measures are taken to prevent this. In order to avoid these results, the PCS-993 out-of-step controller presents an effective way to prevent system collapse caused by out-of-step.

When the out-of-step condition is detected, the PCS-993 controller will take corresponding actions to maintain a balance between load and generation. These measures include tripping associated circuit breakers to separate the power system into two or more smaller islands at the pre-selected points, shutting down some generators, shedding appropriate loads and triggering other related synchronizers preparing for the system synchronism after the system separation.

The PCS-993 controller adopts the advanced multi-processor platform, supporting IEC 61850-8-1 MMS. In addition, it incorporates the RJ-45 faceplate port for testing and setting in order to make commissioning and maintenance easier.

Functions

Protection & Control

- Out-of-step discrimination
  Based on measurement impedance, R-X plane is divided into six sequential zones. The PCS-993 controller provides two tripping modes for different oscillation cycles; which are the fast tripping mode and the slow tripping mode. The fast tripping mode can operate in the first cycle of out-of-step for oscillation cycles of 200ms and above. The slow tripping mode operates in the second cycle of out-of-step for oscillation cycles of 100ms~200ms. The slow tripping mode operates with the same criteria as fast tripping mode but after 2~15 cycles out-of-step subject to the setting. Therefore, it only serves as a backup operation.

- Protection zone restriction
  According to dedicated zone measurement elements, the operating zone is individually determined.

- Out-of-step Protection (78)
  - Separation
  - Shutdown
  - Trigger synchronism

Monitoring and Measurement

- VT circuit supervision (VTS)
- CT circuit supervision (CTS)
- Self diagnostic
- Event recorder including 1024 change-of-binary-input events, 1024 supervision events and 1024 operating logs
- Disturbance recorder including 32disturbance records with waveforms (The format of disturbance recorder is compatible with COMTRADE.)

Communication

- Up to 4 10Base-T/100Base-TX copper Ethernet ports using IEC 61850 protocol, DNP3.0 protocol or IEC 60870-5-103 protocol over TCP/IP
- Up to 2 100Base-FX optical Ethernet ports using IEC 61850 protocol, DNP3.0 protocol or IEC 60870-5-103 protocol over TCP/IP (Sharing with 2 copper Ethernet ports)
- 2 RS-485 serial ports using IEC 60870-5-103 protocol
- 1 RS-485 serial port for clock synchronization

User Interface

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

Features

- Measured impedance characteristic with perspicuous physical conception employed for out-of-step condition detection.
- Data measurement, protection calculation, logic discrimination, event recording and protection logic calculation are processed within one sampling period.
- Out-of-step discrimination for parallel lines is integrated for diverse parallel-line applications.
- Fast tripping mode and slow tripping mode are provided for different oscillation cycles.
- The patented adaptive floating threshold is immune to system unbalance and disturbance.
- Unique two-out-two logic is adopted in hardware design to improve security, coordinating with a redundant protection scheme, which improves dependability. 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. Both data acquisition paths supervise tripping outputs.
- 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.