

Automated detection and isolation of phase-to-phase and phase-to-ground feeder faults

Restores primary and secondary feeder sections

Fault detection, isolation and restoration (FDIR) software detects, isolates and restores service in radial or open-loop distribution systems with 1-, 2- or 3-phase feeder sections. The application runs on the distribution automation system (DAS) from Advanced Control Systems and provides several fundamental control functions.

The total time requirement for FDIR to complete all the necessary actions from the moment the fault is detected to the display of feeder re-energization data at the dispatcher console is less than 20 seconds.

Substation RTUs will backup FDIR when the DAS master station is unavailable or if FDIR fails to detect and/or isolate the fault within the time interval specified by the dispatcher.

Secondary restoration

Secondary restoration (downstream of the fault) starts after all upstream faults are cleared, and no new faults occur within a dispatcher-specified interval. The FDIR determines a switching sequence by reconfiguring the available tie-switches to reenergize the feeder sections downstream of the fault.

Fault detection isolation and restoration

Re-routes de-energized feeder sections to alternate power sources

Dispatcher-activated return to pre-fault configuration

More information at www.acsatlanta.com

Faults and primary restoration

FDIR activates when a substation RTU returns a feeder breaker trip signal. If the breaker has reclosing relays, the FDIR postpones fault detection until after recloser failures are detected.

The application identifies the fault location by analyzing real-time feeder data from RTUs on the faulted line. After isolating the fault, FDIR begins primary restoration (upstream of the fault) by reenergizing upstream feeder sections.

There is no fixed limit on the number of simultaneous feeder faults that FDIR can process. Restoration times depend on the number of tie-switches and feeder sections in the restoration path.

The switching sequence is dispatcher-activated. It restores as many de-energized feeder sections as possible, with a minimum number of switching actions within the allowed overload and voltage drop limits. Whenever possible, the recommended switching sequence will not cause service interruption on other feeder sections.

The dispatcher may reject, accept, modify, abort or reverse the sequence switching procedure before and after it is initiated. The switching sequence can be programmed to automatically abort if a feeder fault occurs during execution. FDIR will automatically cancel a recommended switching sequence if it is not implemented in a dispatcher-specified interval.



Substation faults

Substation faults include phase-to-phase and phase-to-ground faults that occur in the substation side of feeder breakers. Normally, these faults are cleared by system protection facilities at the transmission level, causing a loss of feeder voltage. The loss-of-voltage signal will trigger the FDIR, which will analyze real-time data from substation RTUs and other relevant sources, while monitoring the continuous loss of feeder voltage for a dispatcher-specified interval. If a false fault is detected, FDIR will take no further action. If a true fault is detected, FDIR will isolate the fault and develop a switching sequence to connect the de-energized feeders to alternative energy sources.

Return to pre-fault configuration

When faulted feeders become available for service, FDIR can restore the system to the pre-fault configuration upon the dispatcher's request. FDIR devises a recommended switching sequence. As in secondary restoration, the sequence can be accepted, rejected, or modified prior to execution.

Storm mode

FDIR can be suspended (Storm Mode) at any time during normal operation. The automatic restoration capability is disabled, but fault detection and isolation capabilities remain active.

The same control point that activates the Storm Mode can also suspend alarm annunciation and voice alarms. In this case, FDIR will be fully suspended, i.e., fault detection and isolation is also disabled.

When normal operation is resumed, FDIR will not attempt to resolve any event that may have occurred during suspension.

User interface

The recommended switching sequence can be displayed in a tabular list, along with the impact on feeder loads. The applied configuration can be displayed graphically as well. Alarm messages occur if feeder sections cannot be restored due to topology constraints or overload and voltage drop limits.

