

Arcteq Innovation: Cable end differential protection

Cable end faults and arc flash incidents

Arc flash faults within the switchgear are typically caused by reasons such as human errors, equipment failures, foreign objects, or animals in the gear or by combination of aging materials, dirt and lack of maintenance. As per empiric data, the most common non-human intruded fault location is the cable compartment, and more precisely the cable end. Degrading insulation level or faulty cable connections are the most common causes for cable end faults. Cable faults often start by a small earth-leakage developing to full single-phase faults. Further, if not detected and tripped, the single-phase faults may develop to cross country or 3-phase faults.

Compensated cable end differential protection

Arcteq has developed a proactive cable end protection in its AQ-200 series protection and control IEDs. The aim of the protection function is to provide an early detection of cable end fault. Typically cable end protection is implemented as an alarming function indicating the need of preventive maintenance.

Operating principle is based on low impedance differential protection with settable bias characteristics. Differential current is calculated in between of summed phase currents and selected residual current input measured by a core balance CT.

The function provides natural measurement unbalance compensation to have higher operating sensitivity for monitoring cable end faults. When calculating the residual current from phase currents the natural unbalance may be in total up to 10% with CT's of class 5P. When the natural unbalance current is compensated in this same situation the differential settings may be set more sensitive and the natural unbalance does not affect into the calculation.

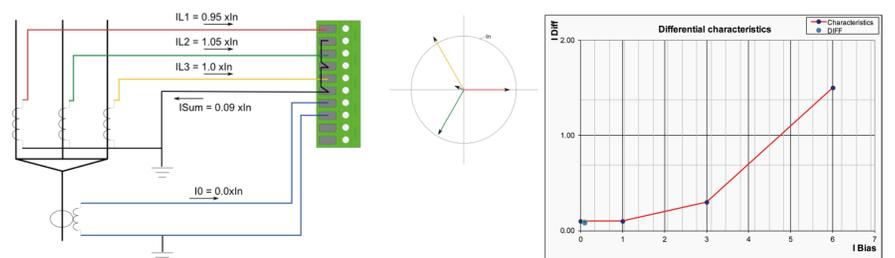


Figure 1: Cable end differential protection without natural unbalance compensation in use. Phase current CT errors are causing significant differential current. Compensation is essential to have a sensitive protection setting.

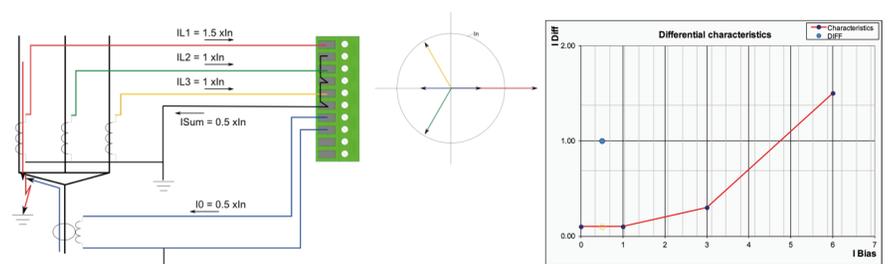


Figure 2: Compensated cable end differential protection during a small earth-leakage current. Due to natural unbalance compensation the function can alarm correctly even on small differential currents.

If in the cable end should occur any starting faults the cable end differential catches the difference in between of the ingoing and outgoing residual currents and the resulting signal can be used for alarming or tripping purpose for the feeder with failing cable end. The sensitivity of the algorithm and settings can be freely user settable.

The benefit

Cable end differential protection uses the elements already available in the protection scheme: 3-phase CT's and residual core balance CT. There is no need for extra hardware or wiring. The sensitive compensated cable end differential protection can be used with no extra cost to provide additional switchgear and personnel safety.