

Connections for directional phase-fault relays

- Although wattmetric in principle, if directional relays responded to the actual fault power, their operation would not always be satisfactory. The fault power-factor is usually low, and therefore a true power measuring relay would develop a much lower torque and would be much slower than might be expected. This is, however, not the only issue.
- The system voltage falls to zero at a point of short circuit. For a single-phase fault, it is the voltage across the short-circuited points which is collapsed.
- As shown in the figure below, a short circuit across Y-B phases moves the Y and B phasors together, their ends remaining on the original line Y-B. At the fault location the two phase phasors will coincide, with zero voltage across the fault and half the initial phase voltage to earth. Elsewhere the phasor displacement will be less but unbalance in magnitude and phase will exist.
- The large degree of unbalance in currents and voltages would cause the torque developed by wattmetric elements connected to each phase to vary widely and even be of opposite sign as will be seen from the figure.
- To correct this situation, voltages are chosen to polarise each relay element which will not be reduced excessively except by a three-phase fault and which will retain a satisfactory phase relation to the current under all probable conditions.

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Page 5 of 6