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## Solving Earth Fault Protection in Resonant Earthing and Compensated Neutral Networks: Addressing the Challenges of Earth Fault Magnitude Reduction

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Australian utilities for many years have enjoyed simplicity of protection engineering against earth faults driven by low fault impedance and solid earthing techniques deployed in Substations and on Rural Feeders. Whilst this practice provides excellent visibility of network faults, it generates large earth fault currents which result in significant energy delivery to fault sites. However, in a climate of changing safety standards and the need to minimise bushfire risk, Australian utilities are progressing to the deployment of resonant earthing and compensated neutral systems to reduce Earth Fault severity.

The reduction of earth fault magnitude has significant benefits for safety of operators and the public, but these connection schemes result in the removal of the earth fault detection clarity which utility engineers have grown accustomed to. In networks where the earth fault currents have been compensated, new techniques must be implemented to provide sensitivity and selectivity to fault scenarios where neutral current is no longer a clear indicator of network malfunction.

This paper addresses some of the techniques used for identifying faults in compensated networks, where traditional Sensitive Earth Fault and Earth Fault detection practices no longer are completely reliable. The use of Admittance Protection, Neutral Voltage Displacement and Broken Conductor Protection techniques are explored and evaluated as possible solutions to the challenges posed by future network with reduced earth fault current. Finally, suggestions for practical methods of deploying and testing these capabilities are proposed.

Keywords: Earthing and Protection, Grid Resilience, Network Issues, Rapid Earth Fault Current Limiters, Bushfire Mitigation.

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