ANALISIS RESETTING DISTANCE RELAY PASCA PENGGANTIAN CURRENT TRANSFORMER PADA BAY GEJAYAN 2 GI
KENTUNGAN BERBASIS VERIFIKASI SCANNING DISTANCE DAN SIMULASI DIGSILENT POWERFACTORY
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INTISARI

Pemasangan sistem *busbar protection* di GI Kentungan mengharuskan penggantian *current transformer* (CT) pada Bay Gejayan 2 dari rasio 500/1 A menjadi 600/1 A. Perubahan rasio CT ini mengubah faktor konversi impedansi dari $k = 0{,}333$ menjadi $k = 0{,}400$, sehingga seluruh setting zona proteksi *distance relay* CSC-103 merk SIFANG menjadi tidak sesuai. Apabila setting lama dipertahankan, relay berpotensi mengalami *underreach* sehingga gangguan tidak terdeteksi sebagaimana mestinya dan berpotensi mengganggu keandalan sistem penyaluran tenaga listrik. Penelitian ini bertujuan menghitung nilai *resetting distance relay* pasca penggantian CT, menganalisis kesesuaian hasil pengujian *scanning distance* terhadap hasil simulasi, serta menganalisis kinerja relay pada kondisi pra-*resetting* dan pasca-*resetting* maupun pada titik krusial batas zona melalui simulasi DIgSILENT PowerFactory.Metode yang digunakan adalah kombinasi perhitungan manual impedansi sekunder, analisis data pengujian *scanning distance* menggunakan Omicron CMC 356, dan simulasi gangguan hubung singkat tiga fasa menggunakan DIgSILENT PowerFactory versi 2024. Simulasi dilakukan pada dua skenario, yaitu pra-*resetting* dengan CT baru menggunakan setting lama, dan pasca-*resetting* dengan CT baru menggunakan setting hasil perhitungan ulang. Hasil penelitian menunjukkan bahwa perubahan rasio CT mengubah nilai impedansi sekunder zona proteksi, dengan setting baru Zone 1 = 0,3037 Ω, Zone 2 = 0,4556 Ω, dan Zone 3 = 0,8352 Ω, menggantikan setting lama Zone 1 = 0,2531 Ω, Zone 2 = 0,3796 Ω, dan Zone 3 = 0,6960 Ω. Seluruh nilai *error* impedansi hasil pengujian *scanning distance* berada di bawah 5%, di bawah batas toleransi standar PT PLN (Persero). Simulasi pra-*resetting* membuktikan terjadinya *underreach* pada seluruh zona, di mana gangguan pada Zone 1 terdeteksi sebagai Zone 2 dengan waktu *tripping* 0,43 detik, gangguan pada Zone 2 terdeteksi sebagai Zone 3 dengan waktu *tripping* 1,63 detik, dan gangguan pada Zone 3 sama sekali tidak terdeteksi. Pasca-*resetting*, seluruh zona bekerja sesuai jangkauan dan waktu *tripping* yang seharusnya. Pengujian titik krusial pada 79% dan 81% saluran menunjukkan relay mampu membedakan gangguan di dalam dan di luar batas Zone 1, meskipun dengan margin impedansi yang sangat tipis. Hasil penelitian ini diharapkan dapat menjadi referensi metodologi analisis *resetting distance relay* akibat perubahan rasio CT pada bay transmisi 150 kV.

Kata kunci: *Current Transformer*, *Distance Relay*, *Resetting*, *Scanning Distance*, Simulasi

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ABSTRACT

The installation of a busbar protection system at GI Kentungan required the replacement of the *current transformer* (CT) at Bay Gejayan 2, changing the ratio from 500/1 A to 600/1 A. This change in CT ratio altered the impedance conversion factor from $k = 0{,}333$ to $k = 0{,}400$, rendering all protection zone settings of the SIFANG CSC-103 *distance relay* no longer valid. If the old settings were retained, the relay would potentially experience *underreach*, causing faults to go undetected as intended and threatening the reliability of the power transmission system. This study aims to calculate the *resetting* values of the *distance relay* after CT replacement, analyze the conformity of *scanning distance* test results against theoretical calculations, and evaluate the relay performance under pre-*resetting* and post-*resetting* conditions as well as at the critical points of the zone boundaries through DIgSILENT PowerFactory simulation. The method used is a combination of manual calculation of secondary impedance, analysis of *scanning distance* test data using the Omicron CMC 356, and three-phase short-circuit fault simulation using DIgSILENT PowerFactory version 2024. Simulations were carried out in two scenarios, namely pre-*resetting* with the new CT using old settings, and post-*resetting* with the new CT using recalculated settings. The results show that the change in CT ratio altered the secondary impedance values of the protection zones, with new settings of Zone 1 = 0.3037 Ω, Zone 2 = 0.4556 Ω, and Zone 3 = 0.8352 Ω, replacing the old settings of Zone 1 = 0.2531 Ω, Zone 2 = 0.3796 Ω, and Zone 3 = 0.6960 Ω. All impedance error values from the *scanning distance* testing remained below 1%, well within the PT PLN (Persero) standard tolerance limit. The pre-*resetting* simulation demonstrated *underreach* across all zones, where a fault at Zone 1 was detected as Zone 2 with a *tripping* time of 0.43 seconds, a fault at Zone 2 was detected as Zone 3 with a *tripping* time of 1.63 seconds, and a fault at Zone 3 was not detected at all. After *resetting*, all protection zones operated according to their intended reach and *tripping* times. Critical point testing at 79% and 81% of the line length showed that the relay was able to distinguish faults inside and outside the Zone 1 boundary, albeit with a very thin impedance margin. The findings of this study are expected to serve as a methodological reference for *distance relay resetting* analysis due to CT ratio changes on 150 kV transmission bays.

Keywords: Current Transformer, Distance Relay, Resetting, Scanning Distance, Simulation