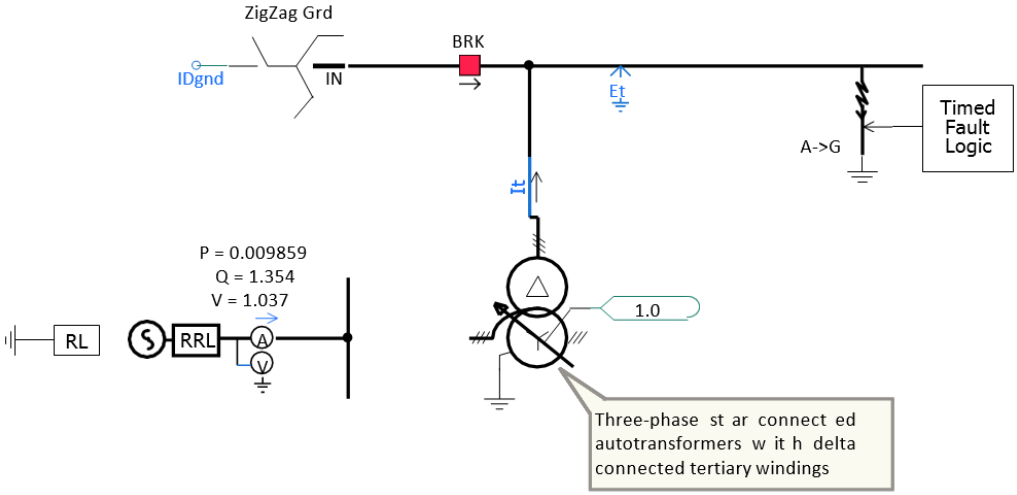
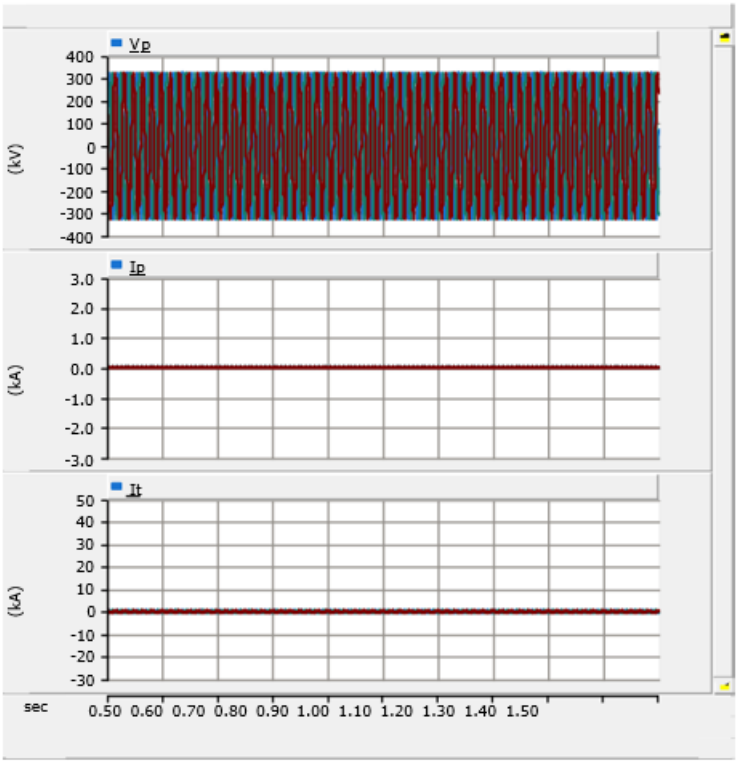
Auto Transformer Example 2

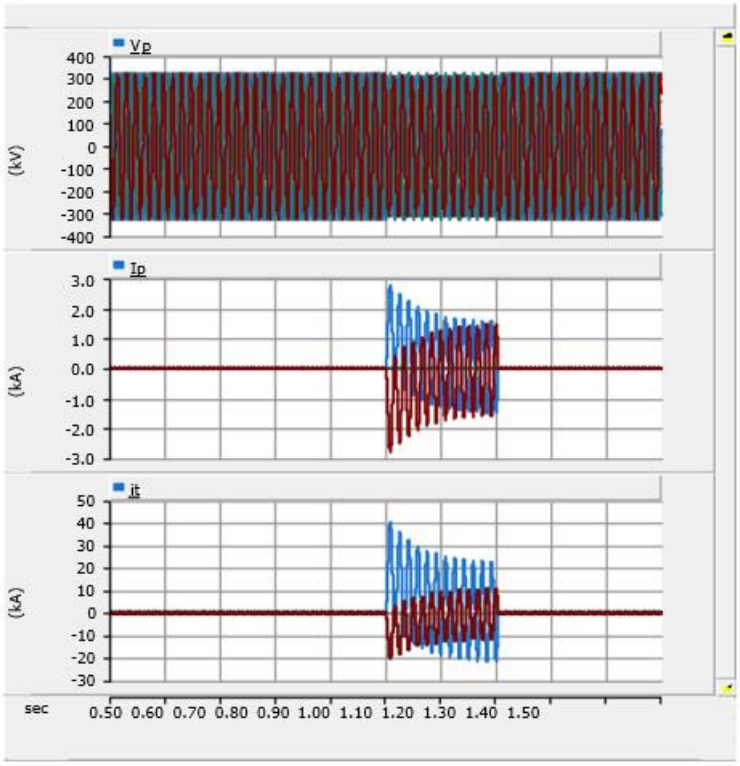
This example models a three-phase star connected autotransformer with delta connected tertiary windings. The tertiary winding in high power auto transformers supplies a local load or station service. The tertiary winding can connect to zigzag grounding transformer banks via a circuit breaker (BRK). The zigzag transformer is served to provide adequate protection for all connected feeders. The power system with the auto transformer is shown as follows:



A single phase to ground fault occurs on the tertiary winding at time equal to 1 sec. If the breaker is open and the zigzag transformer does not in the tertiary (It is zero) and primary (Ip is zero) windings. The primary voltage (Vp) is not distorted. This leads to malfunctions in the system and the protection system can't detect a fault in the system.

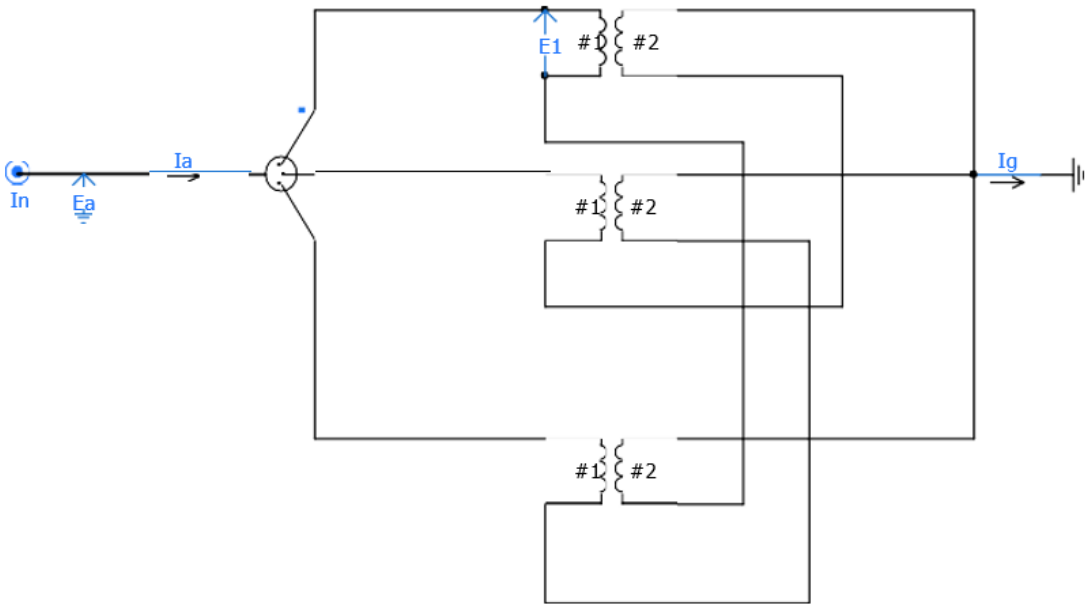


If the breaker is open and the zigzag transformer is in the circuit then the fault current appears on the tertiary (It) and primary (Ip) windings. Also the primary voltage experiences a sag voltage. Although the fault is on one phase but due to delta connections the other phases also has some currents.



Zigzag Transformer and its function

The zig-zag grounding banks transformer is shown in the following figure:



In an event of an unsymmetrical fault (A-G) on the tertiary winding the fault current in the three phases (Iabc) has same magnitude and same phase (See the following figure). The ground current (Ig) is equal to the summation of the phase currents in each branch. The positive negative and zero sequences of the three phase current (Iabc) are also shown in the figure. All the sequences are equal in magnitude and phase at the fault. Therefore during the fault the health phases in zigzag transformer have zero sequence currents.