

HOW TO: Model Single Phase Systems in EasyPower

This knowledgebase article describes how to use EasyPower to calculate short circuit currents for single-phase tap-off transformers coming off a 3-phase system. It also notes how to determine the TCC damage curve for these 1-phase transformers. In the future, EasyPower will fully support unbalanced systems. At this time, however, the EasyPower analysis assumes a 3-phase balanced model. Hence, the workaround described below is needed for single-phase tap-off transformers and may be used in Coordination and Arc Flash studies in addition to the discussed Short Circuit representation.

Given

Model the following system in EasyPower:

- a) A single-phase transformer tapped off a 3-phase system.
- b) A 50 foot cable extended off the secondary of the single-phase transformer.

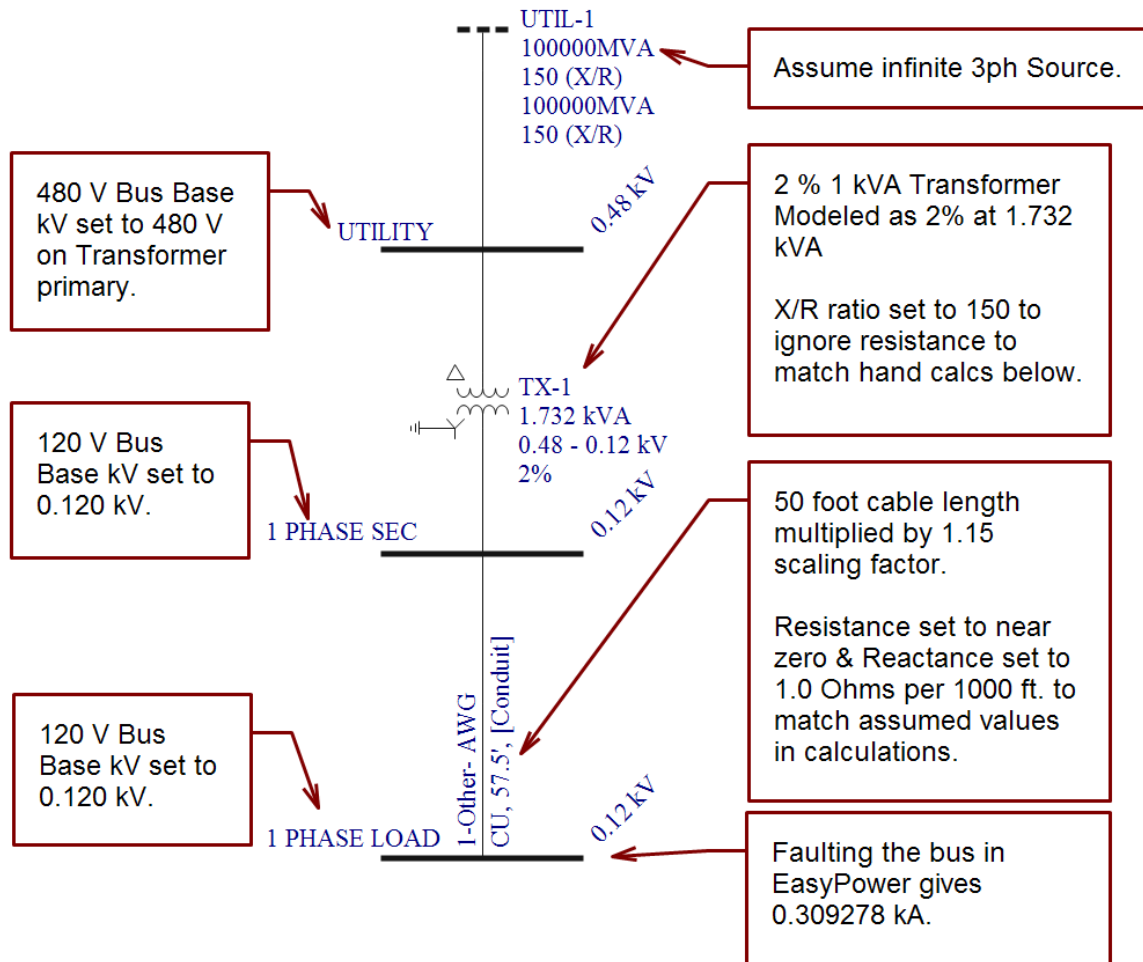
Model (in EasyPower)

- 1) For the transformer:
 - a. Multiply the transformer kVA size by 1.732.
 - b. Keep the transformer impedance as-is.
 - c. Keep the bus voltage as-is.
- 2) For the Cable:
 - a. Multiply the length by 1.15.

Solution

- 1) For short circuit fault simulations, fault buses in EasyPower using the **3- Φ fault type**.
This properly accounts for SLG faults, for the single line model used above. *(In a similar fashion, Using line-line voltage will account for LL faults)*
- 2) For the TCC damage curve of the transformer, use the 100% 3-phase curve in EasyPower – not the unbalanced de-rating curve.

Example: The following example demonstrates the model described above. To simplify the hand calculations, some assumptions are made. For example, resistance is neglected and the incoming 3-phase source is assumed infinite.



Hand Calculations for 1 Phase System Modeled in EasyPower

- 1) Ignore the infinite source.
- 2) Transformer 1-phase impedance is 2% on 1.0 kVA base. Use 1.0 kVA base for calcs.
- 3) $I_{Base} \text{ 1-Phase} = (1 \text{ kVA}) / (0.120 \text{ kV}) = 8.333 \text{ A}$.
- 4) $Z_{Base} \text{ 1-Phase} = (120 \text{ V}) / (8.333 \text{ A}) = 14.4 \Omega$.
- 5) Transformer impedance already on 1 kVA base.
- 6) To simplify hand calculations, only use reactance in cable impedance.
- 7) Cable reactance is 1.0Ω per 1000 feet.
- 8) Cable reactance is then $((1.0 \Omega) / (1000 \text{ feet})) * (100 \text{ feet}) = 0.1 \Omega$.
- 9) Cable reactance is then $(0.1 \Omega) / (14.4 \Omega_{Base}) = 0.006944 \text{ pu}$.
- 10) Total reactive impedance for fault calcs is $(0.02 \text{ pu}) + (0.006944 \text{ pu}) = 0.026944 \Omega \text{ pu}$.
- 11) Confirm Short Circuit Options "Driving Point Voltage" is set to 1.0 pu.
- 12) Fault current = $(1.0 \text{ pu}) / (0.026944 \text{ pu}) * 8.333 \text{ A} = 309.278 \text{ Amps}$.
- 13) Performing a 3-Phase fault on Bus '1 Phase Load' shows the same answer as in 12.