



Impedance Relay TCC Calculator Help Documentation

This calculator has been developed the time-current characteristic for an impedance relay for coordination with overcurrent relays or fuses. The coordination between these two types of devices is typically a problem on subtransmission systems utilizing impedance relays for line protection and overcurrent protection on either transformers or some of the lines within the system. The design of the calculator makes several assumptions:

1. The coordination will be performed on a radial basis. In other words the only source will be behind the impedance relay and any other sources between the impedance relay of interest and the overcurrent relay are considered open and isolated. Note that the tool can be run numerous times for all of the various sources for each of the radial conditions. A radial coordinating condition will typically be the worst case scenario.
2. No fault impedance is considered. All fault calculations are performed at the line impedance angle entered for the line. The impedance angle of the driving point impedance is taken into consideration in all calculations.

The first step in using the calculator is to enter the driving point impedance values. These values are entered in per unit on the bases entered. To determine these values, typically a short circuit analysis program is utilized. After the driving point impedance values are entered, the line impedance values are entered in per unit on the base utilized for the driving point impedance values.

The relay setting values are then entered for the relays of interest. If only phase impedance relays are used, the default value of 0 should be left in for the reaches of the ground impedance relays.

In the event that ground impedance relays are used and to be included in the calculations, the reach impedance values must be entered as the positive sequence equivalent reach of the ground impedance relays for a phase to ground fault. The description of the calculation methods to be used for each manufacturers' relays are outside the scope of this document and the user should consult with the appropriate instruction manual for the relay of interest.

The calculator calculates the total ground impedance using the following formula:

$$Z_{gr} = \frac{2(Z_{dp1}) + Z_{dp0} + (2(Z_{l1}) + Z_{l0}) * Reach_{pu}}{3}$$

Where,

Z_{dp1} = Positive sequence driving point impedance

Z_{dp0} = Zero sequence driving point impedance

Z_{l1} = Positive sequence line impedance



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ZI0 = Zero sequence line impedance

Reachpu = input ground reach/positive sequence line impedance

Once all of the input quantities have been entered, the Calculate button can be depressed to perform the calculations. The results are provided in a tabular format at the bottom of the screen and displayed graphically on the log-log display at the right of the calculator. Close-in fault values are provided for comparison with the short circuit results utilized to determine the driving point impedance. This close-in fault refers to a short circuit direction on the line side of the circuit breaker that the impedance relay is connected to.

For a hardcopy of the results, the printing function of the internet browser may be used.

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