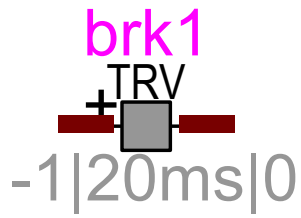
Breaker for TRV



Henry Gras, Jean Mahseredjian, 2019-10-11 11:48:00

1 Description

This device is a breaker modelled by ideal switches. It has a zero resistance (zero voltage drop) when closed and infinite resistance when open.
Parameters of rated TRV from IEC standards are available (see [1]-[3]). Rated TRVs are harmonized in IEC and ANSI standards.

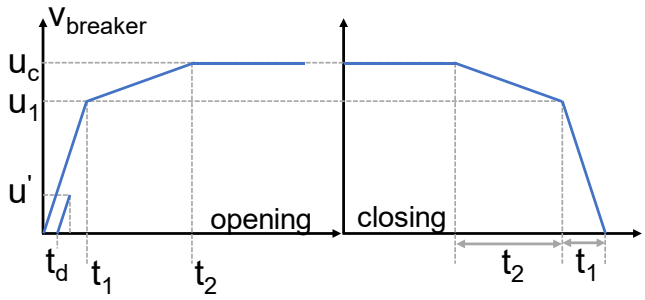
2 Parameters and rules

2.1 Data tab

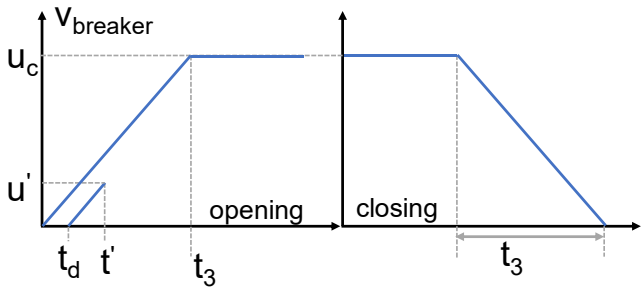
This tab contains options to display the Transient Recovery Voltage (TRV) rating of breaker and to include stray capacitances.

- **Envelope**: select a **Standard** for pre-defined data or **User-defined** to use your own data.
- **Breaker class**: Defined in [1] and [3].
  - **Class S1** for cables and **Class S2** for lines with a rated voltage below 100kV.
  - **>100kV effectively earthed:** for breakers with a rated voltage higher than 100kV in an effectively earthed system.
  - **>100kV non-effectively earthed:** for breakers with a rated voltage higher than 100kV in a non-effectively earthed system.
- **Rated voltage**: Rated voltage of the circuit breaker in kV (RMS line-to-line). Value predefined in the standards [1] and [3].
- **Rated short-circuit current**: Symmetrical interrupting capability for three-phase faults (Rated short-circuit breaking current in IEC).
- **Rated TLF current**: Symmetrical interrupting capability for transformer-limited-fault as defined in IEEE C37.06.1.

TRV shape: **2-parameter** or **4-parameter** as defined in [1]. (see Figure 2-1).



a) 4-parameter envelope



b) 4-parameter envelope

Figure 2-1: 4-parameter and 2-parameter envelopes of TRV

- **Include stray capacitances**: when enabled, two stray capacitances, one on each side of each pole of the circuit breaker, are added.
- **Breaker type**: Type of breaker as defined in [2].
- **Stray capacitance k**: stray capacitance at the right pin k (+) of the breaker.
- **Stray capacitance m**: stray capacitance at the left pin of the breaker
- **Chopping current**: Instantaneous value of current the circuit breaker chops after contact separation. The chopping current is due to arc instability and vary depending of the breaker technology and the capacitance of the circuit. See [4] for more information.
- **Include grading capacitor**: add a grading capacitance in parallel of the breaker.
- **Simulate point-on-wave switching:** If this box is checked, the breaker is modeled as a controlled gab. The TRV envelope starts increasing at this moment of contact separation instead of at the current zero-crossing. User should be aware that using the standard TRV envelopes is a simplification as the cold-gas withstand voltage of the breaker contact gap should be used for better results.
- **t_{arc}:** Arcing time. Delay between the first-pole to clear contact separation instant and the current interruption of this pole considering the breaker chopping current (see Figure 2-2). Because the worst TRV is assumed on the first pole to clear, t_{arc} applies only to the first-pole to clear.

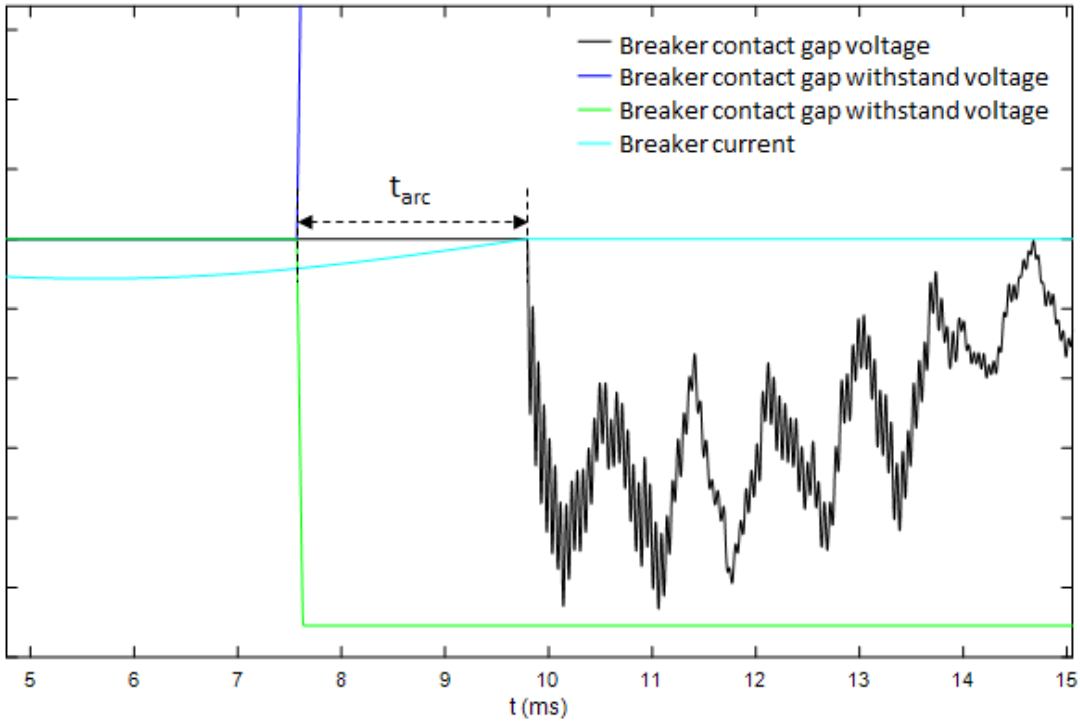


Figure 2-2: Arcing time modeling in the ETRV tool. First-pole-to-clear.

3 References

[1] IEC 62271-100. High-Voltage switchgear and control gear – Part 100: Alternating-current circuit-breaker. Edition 2.0, 2008-04

[2] IEEE C37.011: Guide for the Application of transient Recovery Voltage for AC High-Voltage Circuit Breakers. IEEE Power & Energy Society, 2011.

[3] IEEE C37.06: AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis Preferred Ratings and Related Required Capabilities. IEEE Power & Energy Society, 2008.

[4] Interruption of small inductive currents, Working Group 13.02, CIGRE Brochure 50, December 1995