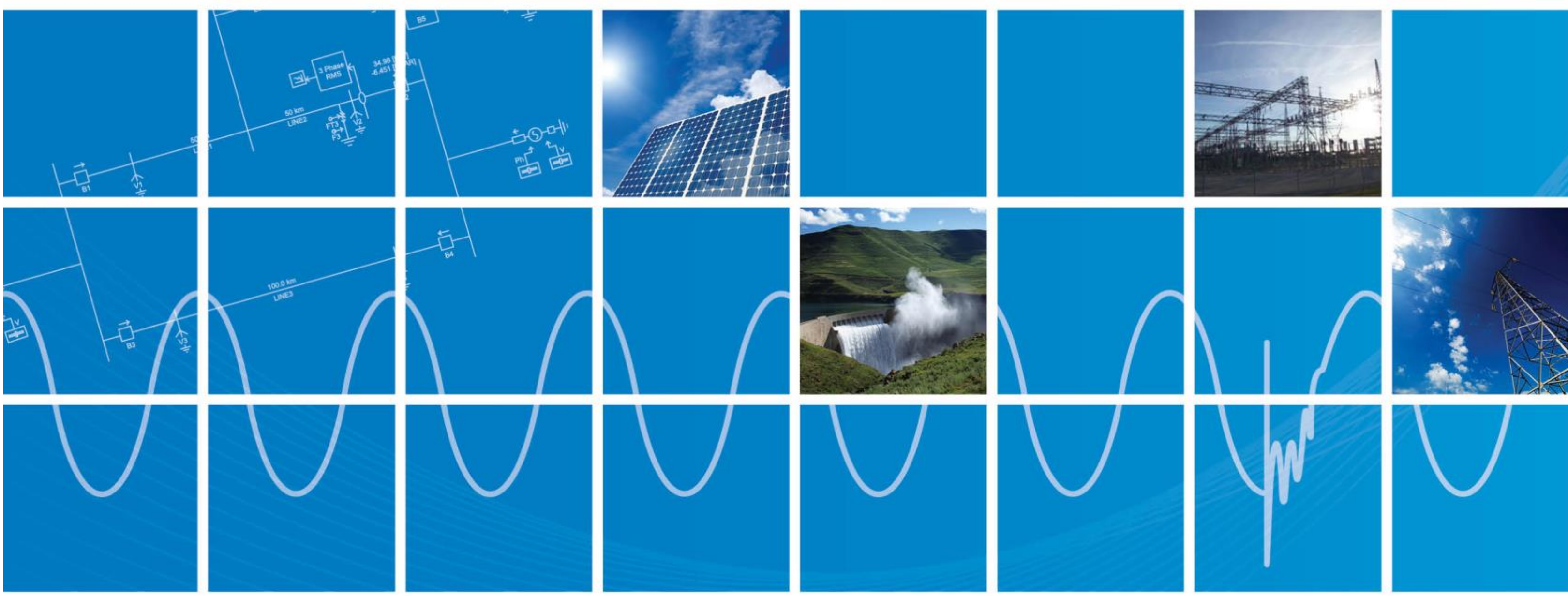
Breaker, Faults and Timed Logic

For PSCAD Version v5.0

January 30, 2020

Initial



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1. PSCAD/ EMTDC EXAMPLE DESCRIPTION

1.1. Example 1: Initial State

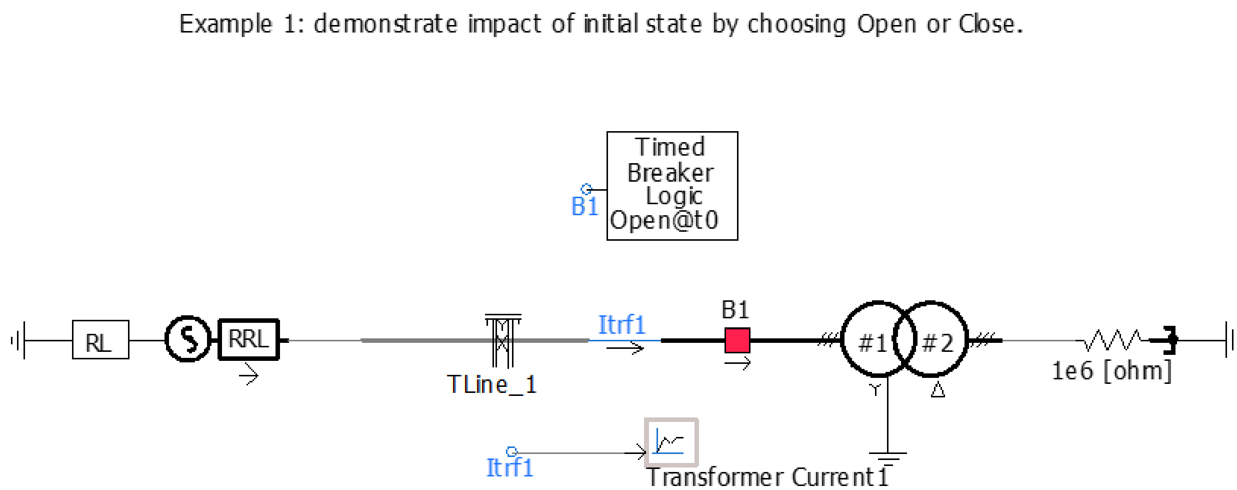

Figure 1: Application of Breaker and Timed Breaker Logic

This example illustrates how the initial breaker status can impact the transformer inrush current. Figure 2 demonstrates the transformer's inrush current when energizing at 0.5 s.

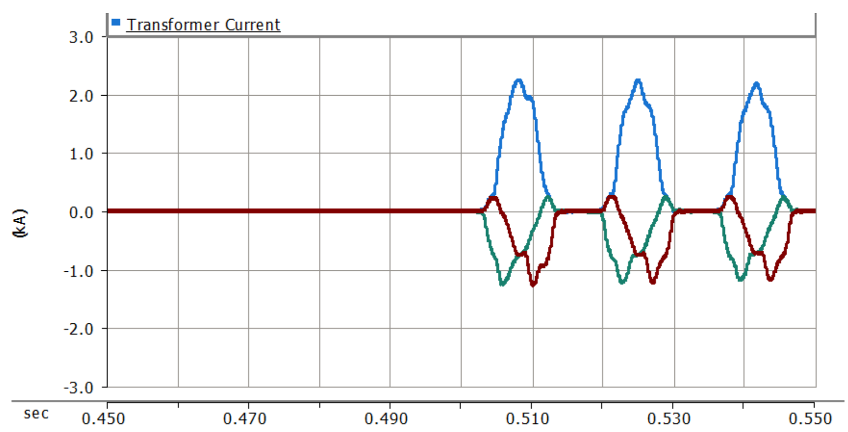

Figure 2: Transformer's current after energizing

1.2. Example 2: Impact of Number of Breaker Operations

The number of breaker operations allows the breaker to operate twice at the specified time. Figure 3 illustrates the impact of multiple breaker operation on the transformer's current as follows,

- Breaker is initially open
- At t = 0.5s, the breaker is closed.
- At t = 0.8s, the breaker is opened.

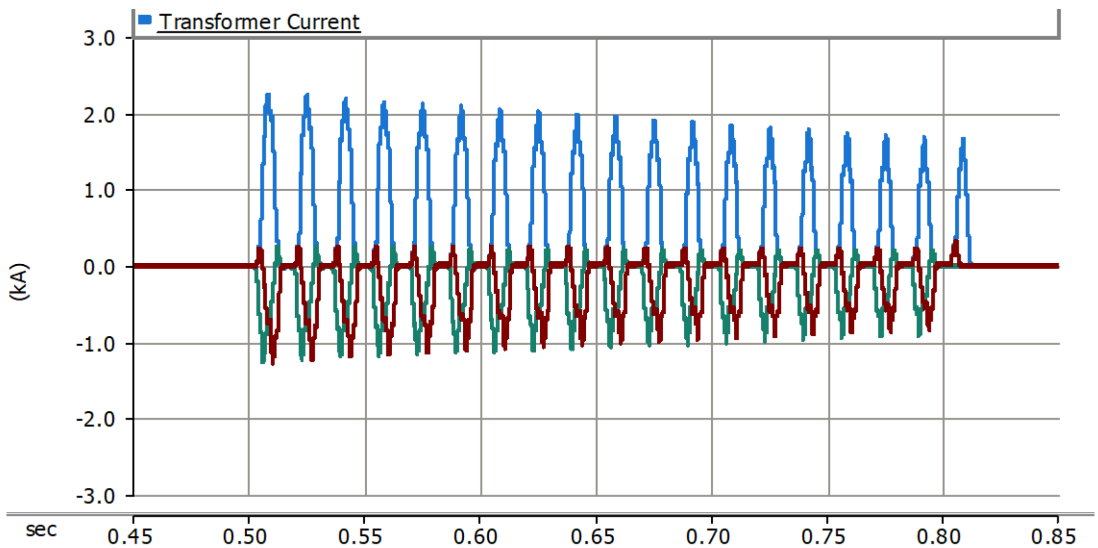

Figure 3: Transformer's Current

1.3. Example 3: Impact of Pre-Insertion Resistance Time Delay for Closing Breaker and Time Delay for Bypassing Pre-Insertion Resistance

A pre-insertion resistance may be represented if required. If this option is selected, the pre-insertion resistance is inserted following the ON (close) signal and a specified time delay for Closing Breaker. Pre-insertion resistance is removed after the delay specified by "Time Delay" for Bypassing Pre-Insertion. Both these times are counted from the instant when the control signal changes from 1 (open) to 0 (close).

When an OFF (open) signal is received, the breaker will open and the pre-insertion resistance will be inserted instantaneously, or at the next current zero, depending on the configuration. Pre-insertion resistance will be removed at the following current zero.

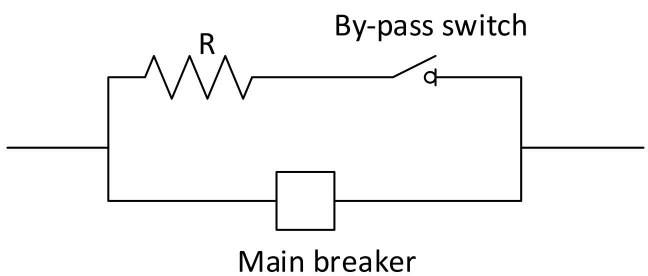

Figure 4: PSCAD/EMTDC implementation of pre-insertion resistance

Figure 5 indicates the impact of pre-insertion resistance when energizing a compensated cable.

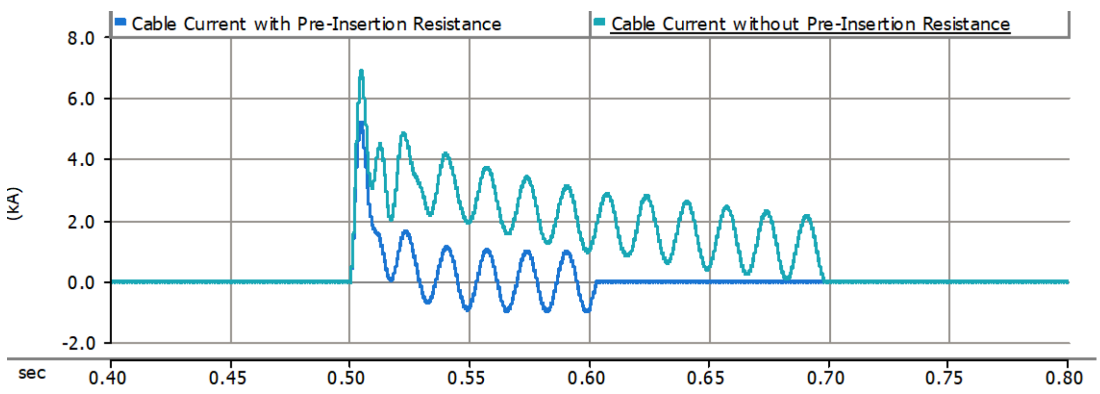

Figure 5: Cable's current with and without pre-insertion resistance

The time delay for closing breaker (Tdelay1) is used to delay the closing time as specified by the user as shown in Figure 6.

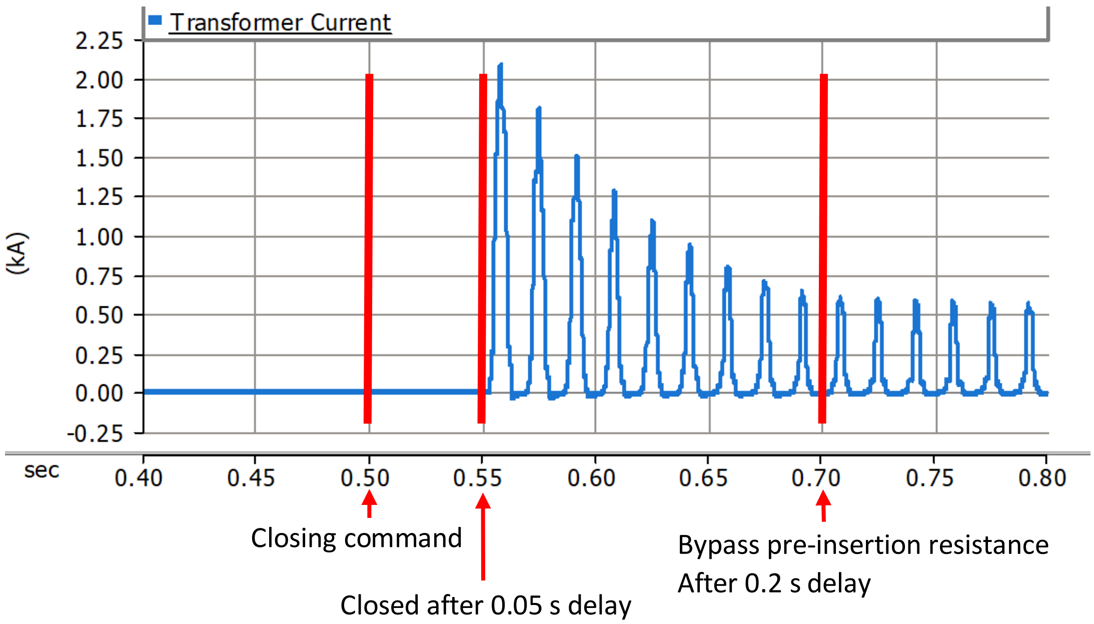

Figure 6: Current Waveform when Time Delay for Closing Breaker is 0.05s and bypass pre-insertion resistance is at 0.2s respectively

1.4. Example 4: Impact of Time to Apply Fault and Duration of Fault

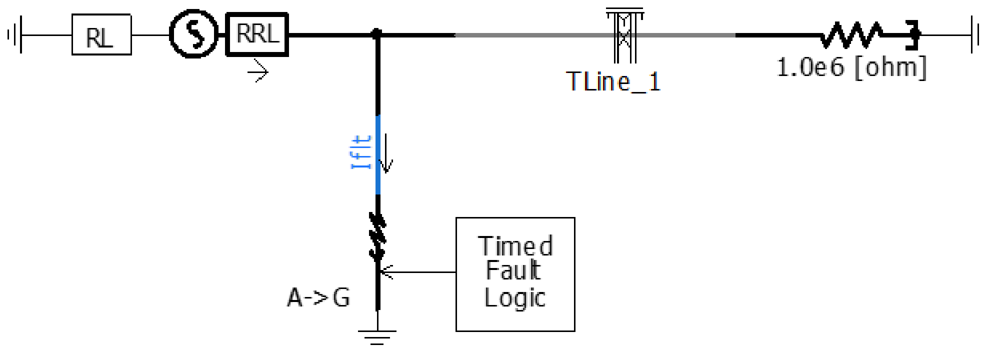

Figure 7: Simple Application of Internal Fault Control and Timed Fault Logic

This example illustrates how to set the time and duration of the fault. Figure 8 shows the 1-phase fault current. A solid 1-phase to ground fault was applied at 0.5 s for a duration of 0.2 s.

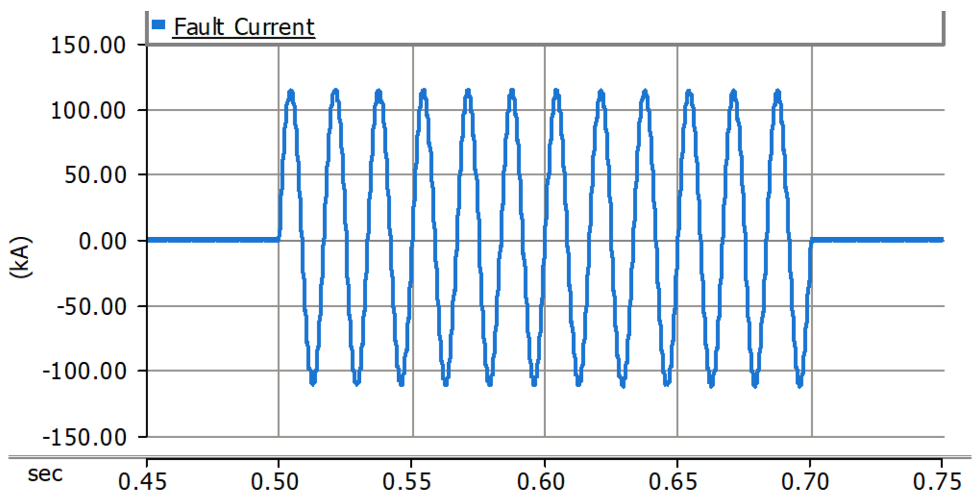

Figure 8: The fault current during a solid 1-phase to ground fault

1.5. Example 5: Fault Type Control

The “fault type control” option allows user to select the type of faults to be either internal or external as shown in Figure 9. Figure 10 compares the fault current for a single phase to ground fault both using internal and external option.

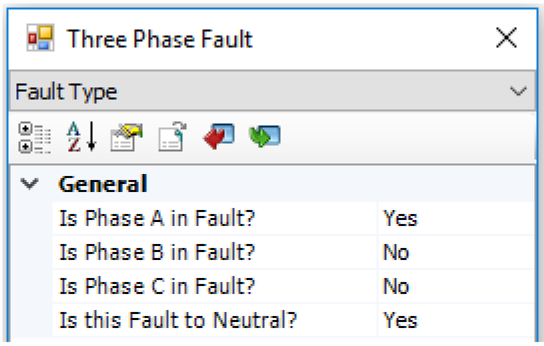

Figure 9: Fault Type Control

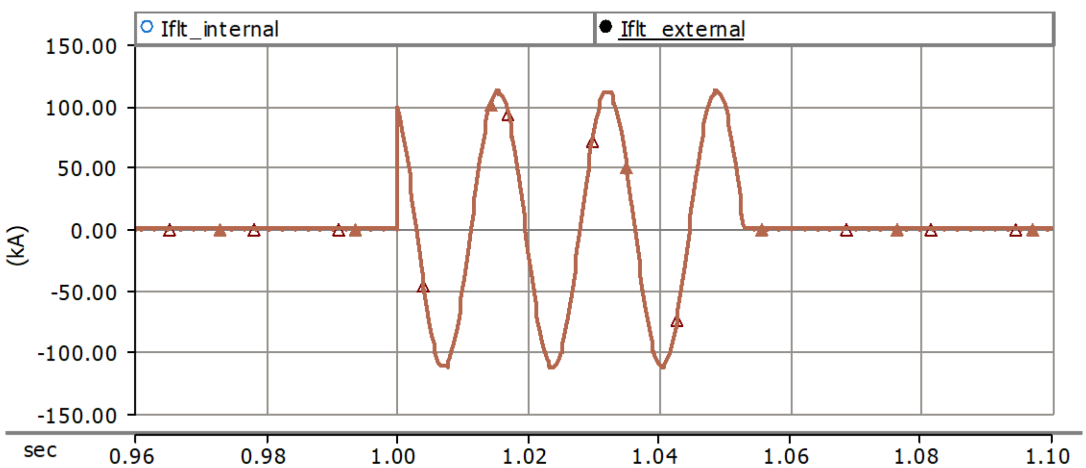

Figure 10: Same Fault Type Using Internal and External Control

1.6. Example 6: Determine the maximum transient fault current using Multiple Run

This example demonstrates how to setup a PSCAD/EMTDC case to capture the worst case mid-line fault current using the multiple-run component.

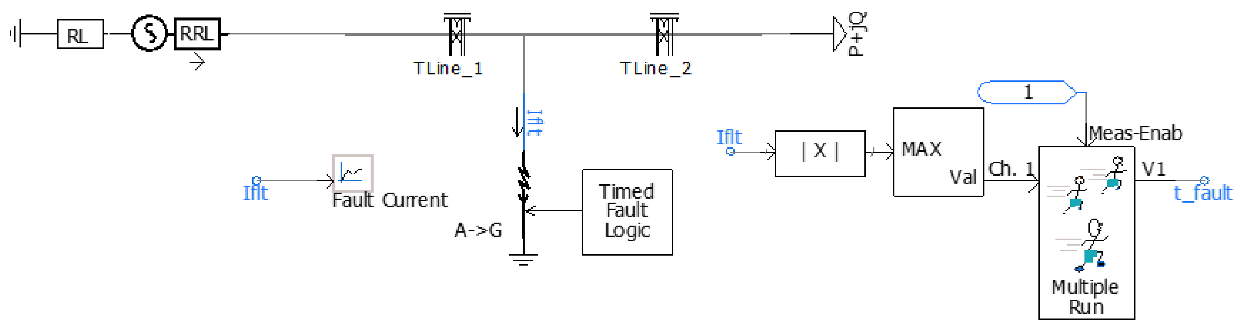

Figure 11: Application of Faults and Multiple Run

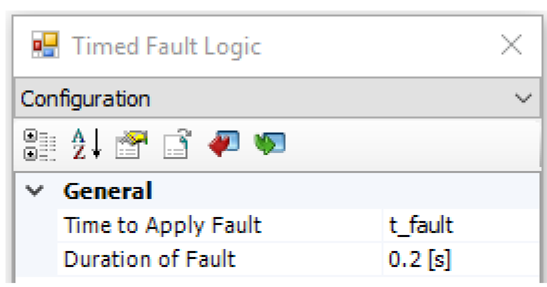

Figure 12: Timed Fault Logic Configuration

1.7. Example 7: Change fault time, fault type, fault location and fault impedance using multiple-run

This example demonstrates how to automatically control fault time, fault type, fault location and fault impedance using multiple-run.

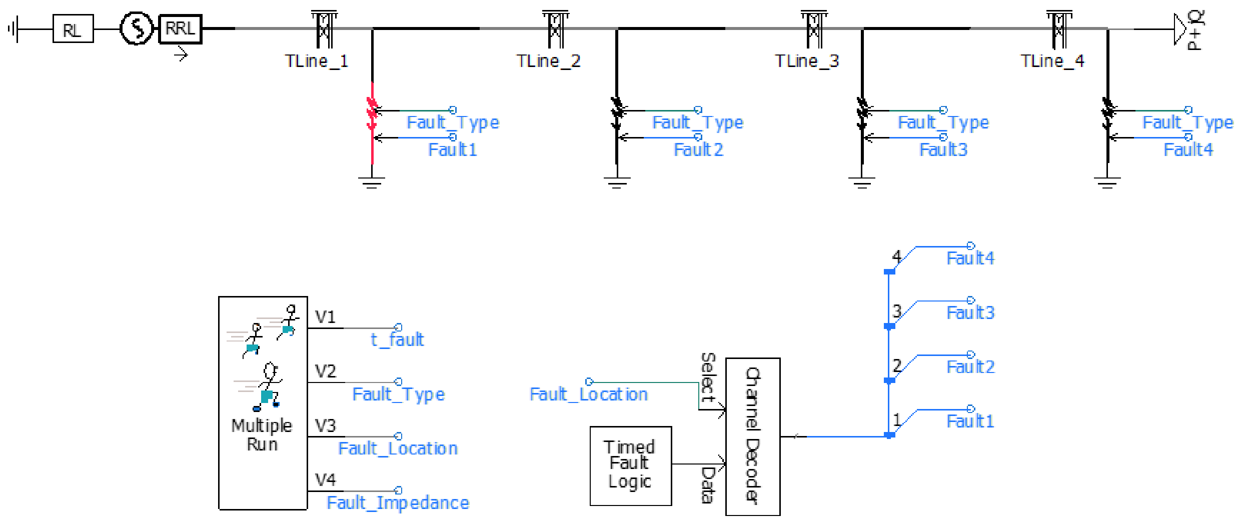

Figure 13: Application of Automated Control

DOCUMENT TRACKING

Rev.	Description	Date
0	Initial	30/Jan/2020