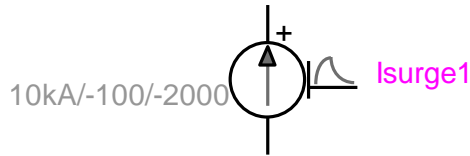


# Surge current source



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Jean Mahseredjian, 4/21/2020 2:18 PM

## 1 Available versions

The “I surge” device accepts both 1-phase (general) and 3-phase signals. The 3-phase version is the equivalent of 3 decoupled sources (one for each phase).

### 1.1 When changing phases

- ❑ When the device is in its 1-phase state and its signal is changed to 3-phase, but the device is not double-clicked, balanced conditions are assumed and the 3 sources have the 1-phase parameters. The Netlist is generated for the 3-phase version.
- ❑ When the device is in its 3-phase state and its signal is changed to 1-phase, but the device is not double-clicked, phase-A quantities are automatically retained for the 1-phase version. The Netlist is generated for the 1-phase version.

### 1.2 The generic version of “I surge”

#### 1.2.1 Parameters

The current source equation is given by:

$$i(t) = I_m \left[ e^{\alpha t} - e^{\beta t} \right] \quad (1)$$

The following model parameters are required:

- ❑  $I_m$  maximum voltage of the source
- ❑  $\alpha$  Alpha coefficient
- ❑  $\beta$  Beta coefficient
- ❑  $t_{start}$  start time, if  $t < t_{start}$  the source is an open-circuit
- ❑  $t_{stop}$  stop time, if  $t > t_{stop}$  the source is an open-circuit. The stop time must be greater than the start time.

The sample simulation waveform shown in Figure 1 is using the data:

$I_m = 10\text{kA}$   
 $\alpha = -100$   
 $\beta = -2000$   
 $t_{\text{start}} = 1\text{ms}$   
 $t_{\text{stop}} = 50\text{ms}$

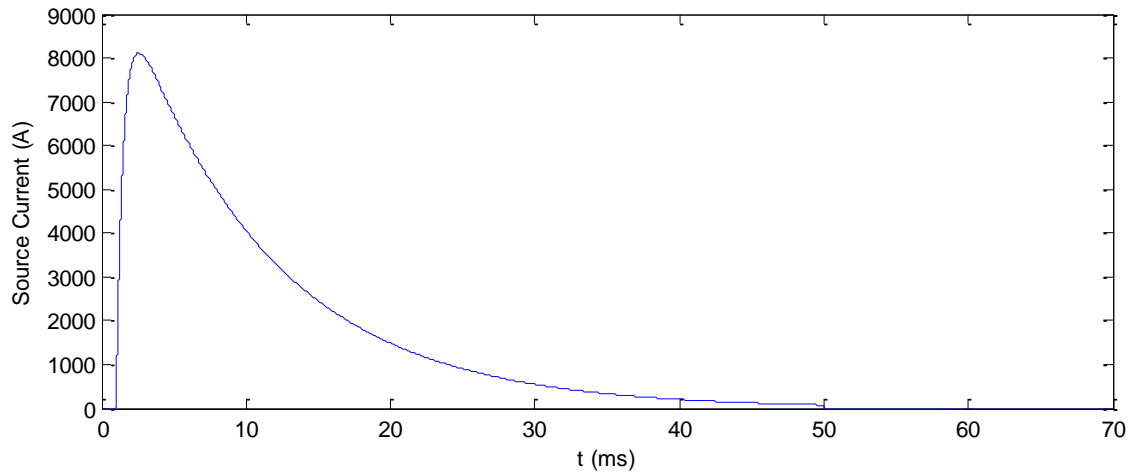


Figure 1 Sample waveform

## 1.2.2 Netlist format

```
_l surge;l surge1;2;2;s1,s2,
10kA,-100,-2000,1ms,50ms,?v,?i,?p,
```

Field	Description
<code>_l surge</code>	Part name
<code>l surge1</code>	Instance name, any name.
<code>2</code>	Total number of pins
<code>2</code>	Number of pins given in this data section
<code>s1</code>	Signal name connected to k-pin (positive), any name
<code>s2</code>	Signal name connected to m-pin, any name
<code>I<sub>m</sub></code>	Maximum current
<code>α</code>	Coefficient of the first exponential
<code>β</code>	Coefficient of the second exponential
<code>t<sub>start</sub></code>	Start time
<code>t<sub>stop</sub></code>	Stop time
<code>?v</code>	Request for voltage scope, sent to scope group vb (branch voltages), optional
<code>?i</code>	Request for current scope, sent to scope group ib (branch currents), optional
<code>?p</code>	Request for power scope, sent to scope group p (branch power), optional

For the 3-phase version, an example of the Netlist gives:

```
_l surge;l surge1a;2;2;s1a,s2a,
10kA,-100,-2000,1ms,10ms,?v,?i,?p,
```

```
_Isurge;Isurge1b;2;2;s1b,s2b,  
10kA,-100,-2000,1ms,10ms,?v,?i,?p,  
_Isurge;Isurge1c;2;2;s1c,s2c,  
10kA,-100,-2000,1ms,10ms,?v,?i,?p,
```

EMTPWorks automatically generates 3 separate (decoupled) sources, one per phase. The phase identification character (a, b or c) is automatically appended to the device instance name and signals.

## 2 Steady-state model

The steady-state model of this device is an open-circuit.

## 3 Frequency Scan model

The frequency scan model of this device is an open-circuit.

## 4 Time-domain model

The device is evaluated at each simulation time-point according to its function given by equation (1).

The source is active (not an open-circuit) for  $t_{\text{start}} \leq t \leq t_{\text{stop}}$ .