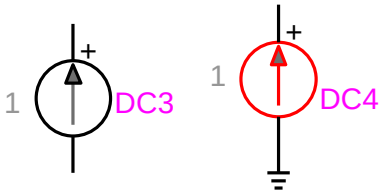
DC current source device



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1 Available versions

The “I dc” 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 become identical to the 1-phase (phase-A) version. 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 Default color coding

The default color coding changes the device line color to red to indicate that the source is active in steady-state. The source is active in steady-state when its start time is smaller than 0.

1.3 The generic version of “I dc”

1.3.1 Parameters

The generic version of “I dc” has two pins. The generic version of “I dc allows entering all required parameters:

- I_m amplitude of the waveform, any value, default units are A.
- t_{start} start time, if $t < t_{start}$ the source is an open-circuit. If $t_{start} < 0$, the source is active in the steady-state solution.

- t_{stop} stop time, if $t > t_{stop}$ the source is an open-circuit. The stop time must be greater than the start time.

1.3.2 Netlist format

```
_Ip;DC1;2;2;s1,s2,
1,1ms,32ms,
```

Field	Description
_Ip	Part name
DC1	Instance name, any name.
2	Total number of pins
2	Number of pins given in this data section
s1	Signal name connected to k-pin (positive), any name
s2	Signal name connected to m-pin, any name
I_m	Amplitude
t_{start}	Start time
t_{stop}	Stop time
?v	Request for voltage scope, sent to scope group vb (branch voltages), optional
?i	Request for current scope, sent to scope group ib (branch currents), optional
?p	Request for power scope, sent to scope group p (branch power), optional

Source data fields are saved in ParamsA, ParamsB and ParamsC device attributes.

The m-pin of this device can be deleted to create an automatic ground connection.

A 3-phase example for an unbalanced source:

```
_Ip;DC1a;2;2;s1a,s2a,
1.5,10ms,32ms,
_Ip;DC1b;2;2;s1b,s2b,
1,1ms,32ms,
_Ip;DC1c;2;2;s1c,s2c,
1,1ms,32ms,
```

EMTPWorks automatically generates 3 separate sources, one per phase. The phase identification character (a, b or c) is automatically appended to the device instance name and signals.
When a source phase is changed, but the source is not double-clicked, the Netlist generator places a code <b> to indicate to EMTP that the source is balanced and the data for phases B and C must be automatically copied from phase-A.

```
_Ip;DC1a;2;2;s1a,s2a,
1,1ms,32ms,
_Ip;DC1b;2;2;s1b,s2b,
<b>,,,
_Ip;DC1c;2;2;s1c,s2c,
<b>,,,
```

2 Steady-state model

The “I dc” device is represented in steady-state for automatic harmonic initialization. The harmonic initialization process must solve the network for all available source frequencies. The steady-state phasor value of a given source is only evaluated if the source frequency (dc) is equal to the solved frequency and $t_{start} < 0 < t_{stop}$. The source is an open-circuit otherwise. This phasor is given by:

$$i_{ss} = I_m \quad (1)$$

3 Frequency Scan model

The source automatically participates at each scan frequency according to equation **Error! Reference source not found.**. The source frequency is set to the scanned frequency. The source participates only if $t_{start} < 0 < t_{stop}$, it is an open-circuit otherwise.

4 Time-domain model

The device is evaluated at each simulation time-point according to the equation:

$$i(t) = V_m \qquad \text{for } t \geq t_{start} \tag{2}$$

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