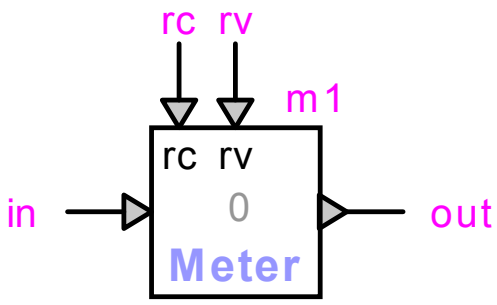
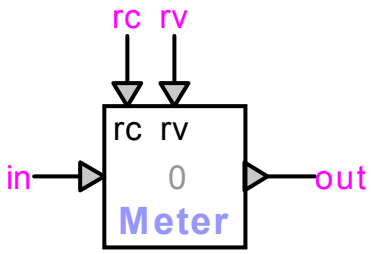
Control signal meter



1 Description

This device measures the rms value or the frequency of a control signal connected as input.

1.1 Pins



This device has four signal pins:

pin	*description*	*value when unconnected*
in	input	0
out	output	as calculated
rc	reset control	0
rv	reset value	0

1.2 Parameters

Selection options for the type of meter:

meter type	*output value*
no meter	0
rms meter	rms value of input signal at given frequency
frequency meter	frequency of input signal in given frequency range

Base frequency of the rms meter:

parameter	*description*	*units*
frequency	base frequency of the measured signal	Hz

Frequency range of the frequency meter:

parameter	*description*	*units*
minimum frequency	minimum frequency of the measured signal	Hz
maximum frequency	maximum frequency of the measured signal	Hz

1.3 History

Selection options for the history value of the output signal:

option	*value*	*rules*
not defined	history(t) = undefined	
zero	history(t) = zero	
constant value	history(t) = user-defined value	any value
function value	history(t) = user-defined function	constant or f(t)

1.4 Scopes

Setting the scope flag enables monitoring of the output signal during the simulation.

1.5 Output signal interpolation

During the simulation, the output value of this device is calculated at successive instants *t* at intervals Δt. Between these simulation instants, the output value can be set to vary in one of two modes, ramped or stepped:

mode	*output value between* $t - \Delta t$ *and* t^-	*value at* t^-	*value at* t
ramped	interpolated linearly between values out($t - \Delta t$) and out(t^-)	calculated at t^-	calculated at t
stepped	remains at out($t - \Delta t$)	remains at out($t - \Delta t$)	calculated at t

2 Time-domain representation

In the time-domain calculation at t>0, the output value is calculated as follows:

- rms meter:
  - when rc(t) >0

    $out(t) = rv(t)$ (1)
  - else

$$\text{out}(t) = \sqrt{\frac{1}{\text{period}} \cdot \int_{t-\text{period}}^{t} \text{in}(t)^2 \cdot dt} \qquad (2)$$

- frequency meter:
  - when rc(t) >0

    $$\text{out}(t) = \text{rv}(t) \qquad (3)$$

  - else

    $$\text{out}(t) = \frac{0.5}{\text{interval between successive zero crossings of in(t)}} \qquad (4)$$

    intervals outside given frequency range are ignored
    the input signal is assumed to have no dc offset

3 Steady-state representation

In the steady-state calculation at t=0, the output value is calculated as follows:

if history is defined, out(0) = history(0)
else out(0) = 0 (5)

4 Netlist

4.1 Netlist format for no meter

Netlist format:

```
_c_cst;name;4;4;out,in,rc,rv,
0,step/ramp,scope,
```

field	*description*	*value*
c_cst name 4 4	part name instance name pin count pin count	
out in rc rv	signal name of the output signal name of the input signal name of the reset control signal name of the reset value	
0	output value	
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled

The comma separated data is saved into the ParamsA attribute of this device.

4.2 Netlist format for rms meter

Netlist format:

```
_c_rms;name;4;4;out,in,rc,rv,
history,frequency,step/ramp,scope,
history function expression
```

field	*description*	*value*
c_rms name 4 4	part name instance name pin count pin count	
out in rc rv	signal name of the output signal name of the input signal name of the reset control signal name of the reset value	
history	history	constant value or "H" for function
frequency	base frequency of measured signal	constant value
step/ramp	calculation mode	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

The comma separated data is saved into the ParamsA attribute of this device. The history function expression is saved into the ModelData attribute.

4.3 Netlist format for frequency meter

Netlist format:

```
_c_freq;name;4;4;out,in,rc,rv,
history,fmin,fmax,step/ramp,scope,
history function expression
```

field	*description*	*value*
c_freq name 4 4	part name instance name pin count pin count	
out in rc rv	signal name of the output signal name of the input signal name of the reset control signal name of the reset value	
history	history	constant value or "H" for function
fmin	minimum frequency	constant value
fmax	maximum frequency	constant value
step/ramp	calculation mode	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

The comma separated data is saved into the ParamsA attribute of this device. The history function expression is saved into the ModelData attribute.