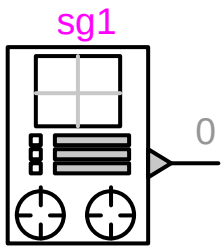
Control device : signal generator



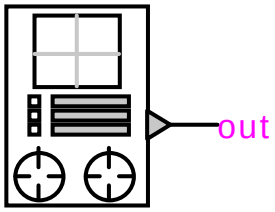
1 Description

This device can be used for generating signals of the following types:

- cosine
- step
- ramp
- user-defined

The generated signal may be single-shot or periodic. The user-defined parameters include time-shifting and amplitude-shifting (bias).

1.1 Pins



This device has one signal output (out) pin.

1.2 Cosine signal parameters

The output value of the cosine signal is calculated as follows:

$$\text{out}(t) = \text{Bias} + A \cdot \cos(2\pi \cdot f \cdot t + \phi) \quad (1)$$

The parameters for the cosine signal are:

parameters	*definition*	*rules*
Amplitude (A)	required	> 0
Frequency (f)	required	> 0
Bias	optional, default=0	
Phase shift	optional, default=0	

1.3 Step signal parameters

The output value of the step signal is calculated as follows:

$$\begin{aligned} &\text{if } 0 \le t - t_{shift} < \text{Width}, && \text{out}(t) = \text{Bias} + A \\ &\text{else} && \text{out}(t) = \text{Bias} \\ &\text{optionally repeated every period} \end{aligned} \quad (2)$$

The parameters for the step signal are:

parameters	*definition*	*rules*
Amplitude	required	
Width	required	> 0
Bias	optional, default=0	
t_{shift}	optional, default=0	
Period	optional, default=not repeated	> 0

1.4 Ramp signal parameters

The output value of the ramp signal is calculated as follows:

$$\begin{aligned} &\text{if } 0 \le t - t_{shift} < \text{Width}, && \text{out}(t) = \text{Bias} + \text{slope} \cdot t \\ &\text{else} && \text{out}(t) = \text{Bias} \\ &\text{optionally repeated every period} \\ &\text{where slope} = \text{Amplitude}/\text{Width} \end{aligned} \quad (3)$$

The parameters for the ramp signal are:

parameters	*definition*	*rules*
Amplitude	required	
Width	required	> 0
Bias	optional, default=0	
t_{shift}	optional, default=0	
Period	optional, default=not repeated	> 0

1.5 Math signal parameters

The output value of the user-defined math signal is calculated as follows:

out(t) = function(shifted t)
optionally repeated every period
where function = user-defined expression
shifted $t = t - t_{shift}$ (4)

The parameters for the user-defined math signal are:

parameters	*definition*	*rules*
function expression	required	Variable t refers to $t - t_{shift}$
t_{shift}	optional, default=0	
Period	optional, default=not repeated	> 0

1.6 History

No user-defined history is required. The output is automatically initialized if the signal exists for $t \leq 0$.

1.7 Scopes

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

1.8 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 according to defined signal source.

3 Steady-state representation

In the steady-state calculation at t=0, the output value is calculated according to defined signal source.

4 Netlist

4.1 Netlist format for cosine signal

Netlist format:

```
_c_gcos;name;1;1;out,
amplitude,frequency,offset,shift,step/ramp,scope,
```

field	*Description*	*value*
c_gcos name 1 1	part name instance name pin count pin count	
out	signal name of the output	
amplitude frequency offset shift	amplitude value frequency value amplitude Bias phase shift value	>0 >0
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled

4.2 Netlist format for step signal

Single-line netlist format:

```
_c_gstep;name;1;1;out,
amplitude,width,offset,shift,period,step/ramp,scope,
```

field	*description*	*value*
c_gstep name 1 1	part name instance name pin count pin count	
out	signal name of the output	
amplitude width offset shift period	amplitude value width value amplitude Bias time shift period	 >0 ≥ 0
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled

4.3 Netlist format for ramp signal

Netlist format:

```
_c_gramp;name;1;1;out,
amplitude,width,offset,shift,period,step/ramp,scope,
```

field	*description*	*value*
c_gramp name 1 1	part name instance name pin count pin count	
out	signal name of the output	
amplitude width offset shift period	amplitude value width value amplitude Bias time shift period	 >0 ≥ 0
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled

4.4 Netlist format for user-defined math signal

Netlist format:

```
_c_gfun;name;1;1;out,
shift,period,step/ramp,scope,
function expression
```

field	*description*	*value*
c_gfun name 1 1	part name instance name pin count pin count	
out	signal name of the output	
shift period	time shift period	 ≥ 0
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
function expression	user function expression	