# Slope Amp

**Version h, 2022-03-12, edit 2022-03-12**



**Slope Amp** is rather an electronic potentiometer / attenuator than an amplifier. Nevertheless it can amplify a signal.

Instead of potentiometer *change speed, slope time* term will be used in this manual. This slope time describes duration of a level change from 0 to 5 volts (0 to 100 %) or reverse. If slope has to be processed within a span of more than 100 %, duration will enlarge.

## 1. Main functions

- Slope time range up to 10 minutes per 5 volt, with reduced input signal and 200 % processing level 20 minutes can be achieved.

- Signal value from -5 to +5 volts. Values lower than -5 or higher than +5 will be clipped.

- CV values from 0 ("off") to + 5 volts ("on"). CV > 2.5 v means "*ON*".

- *Pre amp*lifier can modifiy input signal level by a rate of 0 to 10.

- Main amplifier offers a rate from 0 to 200 %.

- LED indicate *Clip*ping after pre amp and after main amp.

- Clipping after processing activates *clip CV output*.

- *Auto limit*er can reduce greater distortions. During limiting an up slope CV will be ignored.

- Up and down slope time are adjustable separately or *link*ed.

- Up and down slopes can be controlled with separate CV. When both CV inputs are active at same time, down CV will be ignored.

- In *single CV* mode both slopes are commonly controlled by *up CV in* only. "On" means up (fade in), "off" means down (fade out).

- A 5 volt CV at *mute CV in* sets output signal to 0. Signal processing will be continued even when *mute* is active.

- *Max CV* out / *min CV* out signalize, when up / down slopes have reached max / min levels. This can be used to activate depending processes on other modules.
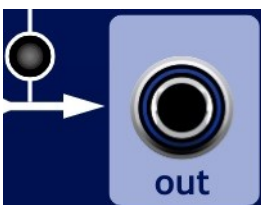
## 2. Controls and connectors



Pre-amplification knob.

default: 1

LED indicates clipping.

Signal input Jack.



LED indicates clipping.

Signal output Jack.



When output signal is clipped, *clip CV out* jack sends an "on" CV. While LEDs are lit for at least 200 milliseconds, *clip out CV* is only active just during clipping. That may be one only scan.
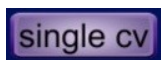
**up**

**cv in**

Up slope push button, can be used even when a cable is connected to CV in jack.

An "on" CV will activate up slope.

(see also *single CV mode*)

**down**

**cv in**

Down slope push button, can be used even when a cable is connected to CV in jack. Button is ignored when up slope is active.

An "on" CV will activate down slope. CV is ignored when up slope is active.

single cv

When this button is toggled on, only *up CV in* is used for slope control. Other push buttons and *down CV* in jack get disabled.

"On" CV means up (fade in), "off" means down (fade out).

0     200
**max %**

This knob sets the level, up slope will go up to.

range:   0.0001 to 200.00 %

default: 100 %

0     200
**min %**

This knob sets the level, down slope will go down to.

range:   0.00 to 199.9999 %

default: 0 %

600 s
60 s
6 s
0.6 s
**range**

These slider switches determine, which ranges slope adjust knobs will work with.

3,00    3,00
real
x0    x1  x0    x1
**up slope**  **down slope**

With these knobs, slope time can be adjusted with in selected range. Displays show slope times in seconds.

Time is calculated by multiplying range with knob value. Time is valid for a 0 to 5 volt (0 to 100 %) change. That means, when *max %* is set to 200, up slope will need double the time.

range:     0.001 to 1.00

default: 0.5

**real** With this button toggled on, displays will show real time, the slopes will need from *min %* to *max %* or reverse.

**LINK** When this button is toggled on, both slopes use same parameters. Down slope range switch and knob become disabled. They will follow up slope controls, which work as "masters" now.

**max cv out** LED and *max CV out* jack will get active, when up slope has reached it's *max %* level.
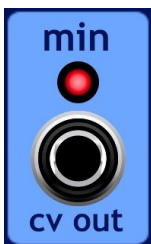
**min cv out** LED and *min CV out* jack will get active, when down slope has reached it's *min %* level.

**auto limit** This toggle button activates *auto limit* function. One can say, **Slope Amp** contains a limiter. Response time depends from down slope settings.

**1 V 5 V limit** With *limit* knob you can set a threshold, the limiter should get active at. This knob is only available in *auto limit* mode.

When signal value exceeds this value, down slope will be activated, ignoring any other controls.

It is recommended to set limit value far enough from 5 volt clipping value in order to prevent, that even little exceeds will get clipped instantly. Default is 4.5 volts. For dynamic signals it may be helpful to set limit value a little more lower.

For a satisfying limiter operation down slope time should be set rather short. So only first few samples will eventually be clipped.

See chapters 4 and 5 for examples.

An "on-off" change at **reset CV in** lets signal level fall to **min %** immediately. A short fade out (5 ms) is used to prevent cracking noise. Then regular operation will contintue.

# 3. Functional Principle

Kernel of **Slope Amp** is a virtual *VCA*. It's amplification rate follows up and down *slope generators*. *Control unit* has to manage up / down direction depending on incoming CV and button states. *Comparator* recognises, when signal exceeds limit value and sends it's result to control unit.



Slope Amp (version h) – schematic circuit, 2022-03-12
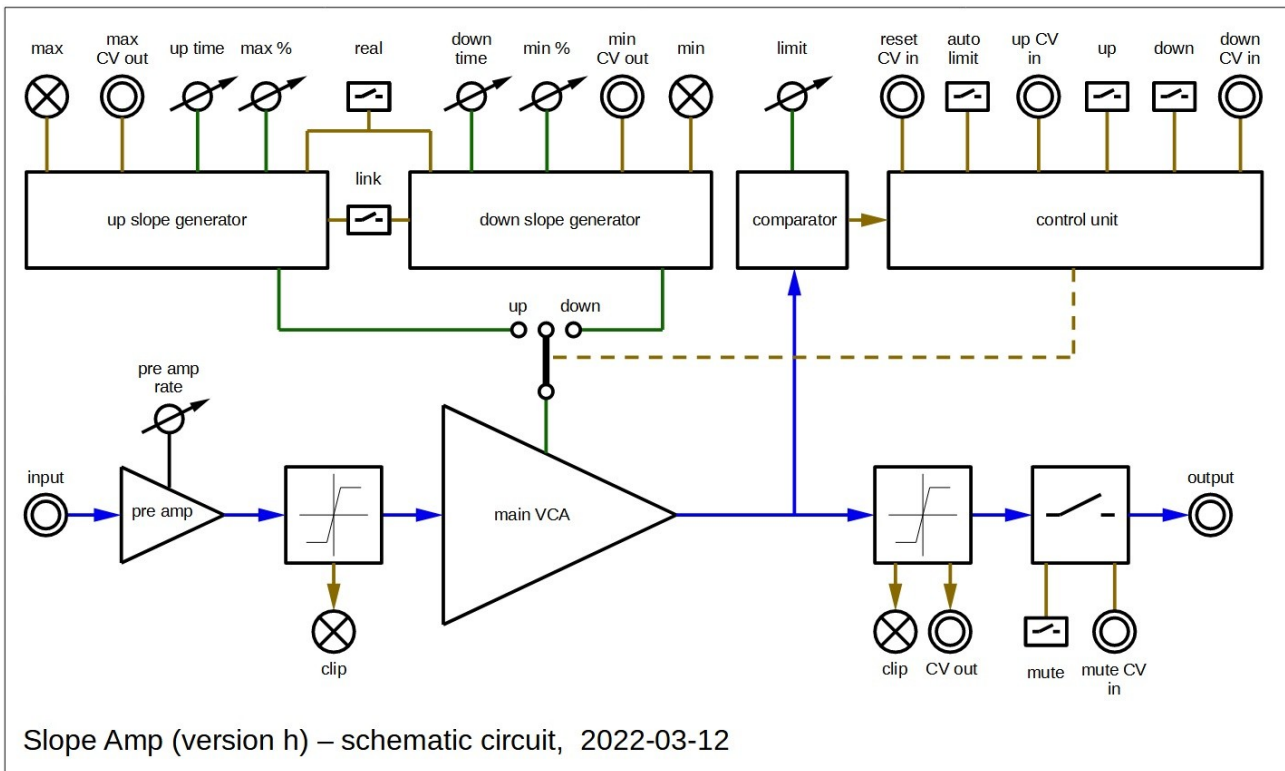
Basically Voltage© modules could operate with any voltage level. In order to provide compatibility to hardware modules, signal voltage range is defined from -5 to +5. Signals which exceed this range, will be clipped.

Because clipped signals are mostly unwanted, **Slope Amp** offers a limit function. A regular limiting function is only possible, when **min %** knob is set to less than 100. (See next chapter for examples.)

Signal muting is not done by simple interrupting signal path. That would create a noise, when switch would go on or off. A soft out fade / in fade is done, when

mute gets activated / deactivated. This fading happens within a very short period. (about 25 milliseconds)

# 4. Examples for parameter settings

Output diagrams show signals, when up slope has reached it's set *max %* level.

## 4.1. Normal operation

| | |
|---|---|
| input level | 3.00 |
| pre amp rate | 1.50 |
| max % | 100 |
| auto limit | not active |
| limit | not valid |
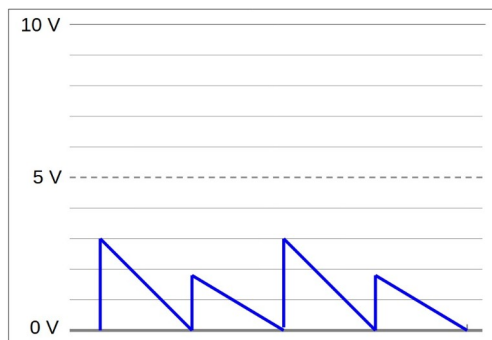
### input signal
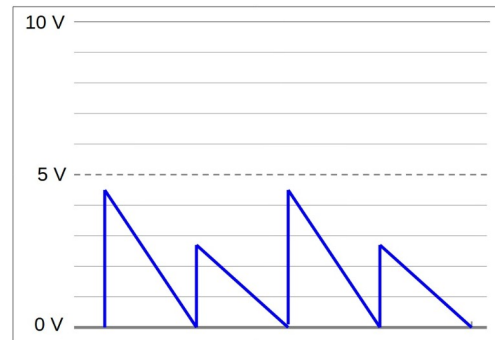


### main VCA input
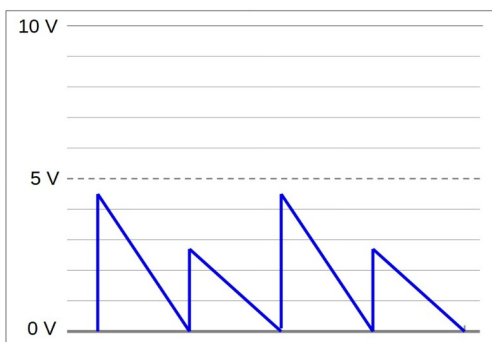


### main VCA output



### signal output
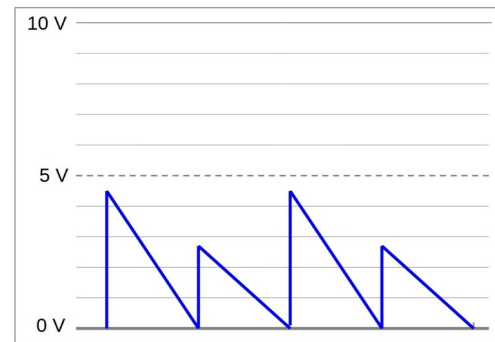
## 4.2. Clipping after pre amplification

Signal is clipped just behind pre amp. During processing no further distortions happen.

| | |
|---|---|
| input level | 3.00 |
| pre amp rate | 2.00 |
| max % | 100 |
| min % | 0 |
| auto limit | not active |
| limit | not valid |
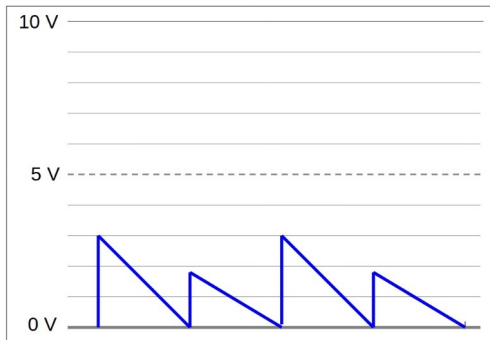
input signal
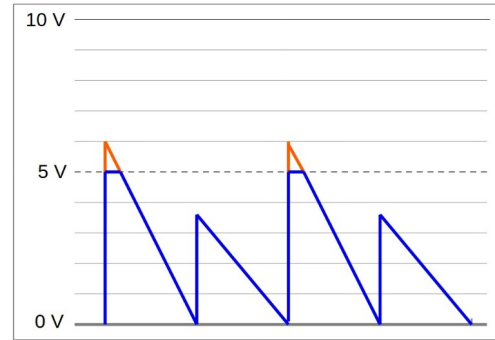
main VCA input
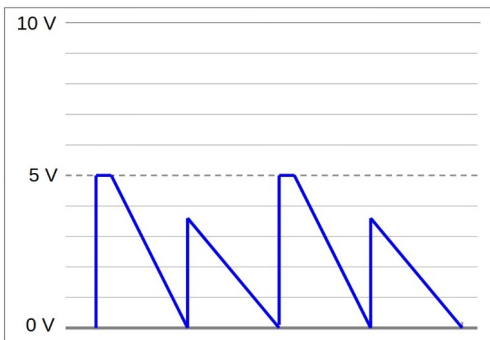
main VCA output
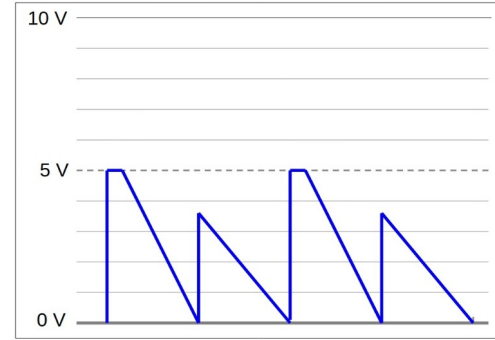
signal output

## 4.3. Clipping before output

Signal is processed normally. Because of main VCA amplification signal is clipped before output.

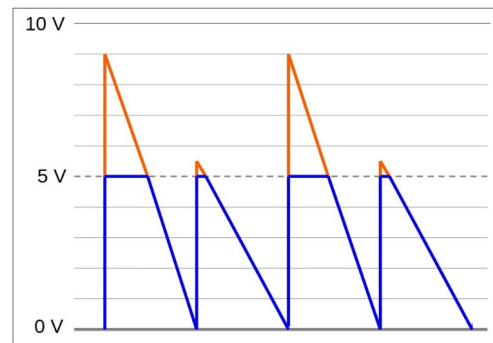| | |
|---|---|
| input level | 3.00 |
| pre amp rate | 1.50 |
| max % | 200 |
| min % | 0 |
| auto limit | not active |
| limit | not valid |
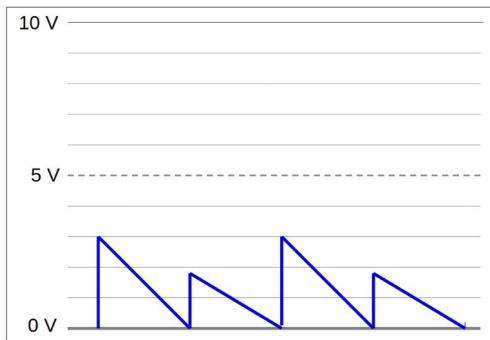
### input signal



### main VCA input
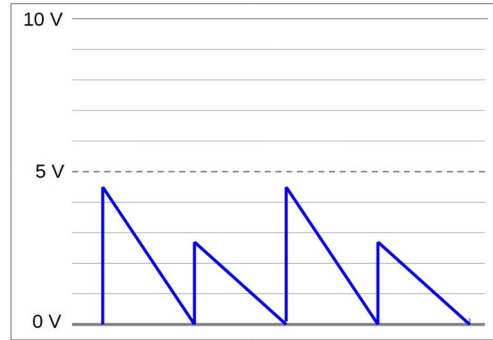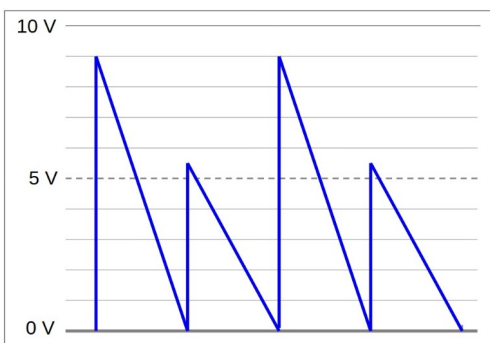


### main VCA output



### signal output

## 4.4. Auto limiting, variant a

Without limiter, signal would be clipped as shown in example 4.3. Limiter forces down slope as long as signal level behind main VCA exceeds limit value.
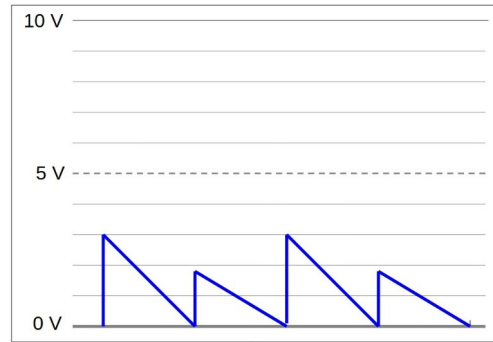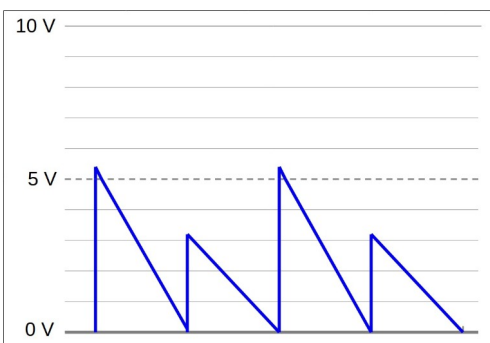Because of needed slope time, level reducing cannot prevent from clipping short peaks.

| | |
|---|---|
| input level | 3.00 |
| pre amp rate | 1.50 |
| max % | 200 |
| min % | 0 |
| auto limit | active |
| limit | 5.0 |

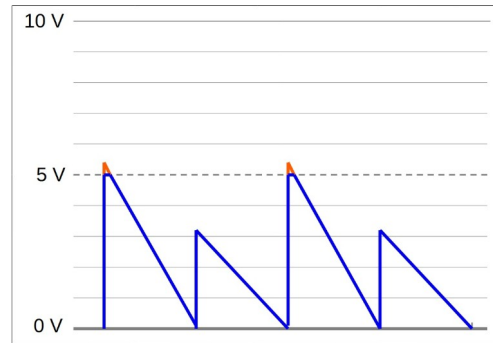### input signal
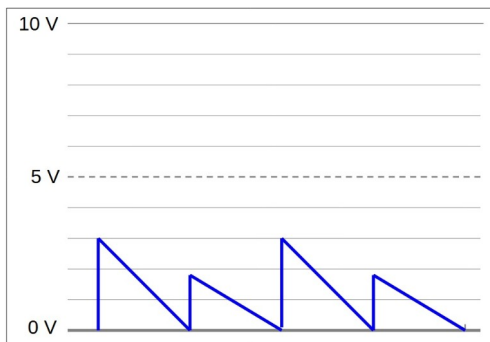


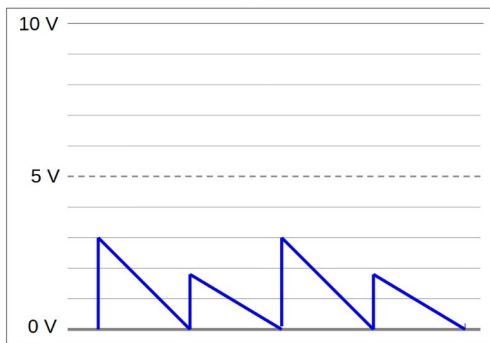### main VCA input



### main VCA output



### signal output

## 4.5. Auto limiting, variant b

This example is similar to 4.4, but limit value is set a little lower. So there is a safe area between limit level and clipping level. Moderate signal amplitude changes do not reach clipping level. When signal is rather dynamic, you could reduce input level or pre amp rate or use an extra compressor module.

| | |
|---|---|
| input level | 3.00 |
| pre amp rate | 1.50 |
| max % | 200 |
| min % | 0 |
| auto limit | active |
| limit | 4.8 |

### input signal



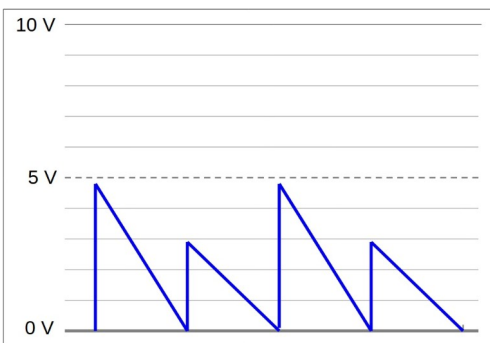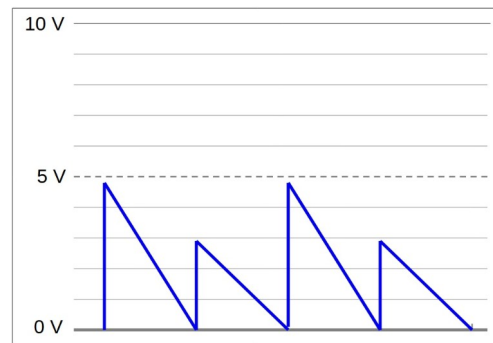### main VCA input
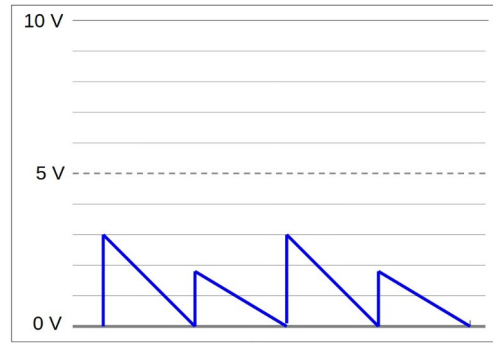


### main VCA output



### signal output



Best limiting results with audio signals you will get with very short down slope time. For low frequencies (f < 10 Hz) it recommended to set *limit* a little lower and *down slope* time higher. With *limit* = 4.0 and *down slope* time = 6.00 s limiter works fine also with signals, that differ from sine shape, like saw or small square.

# 5. Example presets

[PM Slope Amp – crescendo.voltagepreset](#)
[PM Slope Amp - CV level control.voltagepreset](#)
[PM Slope Amp – fader.voltagepreset](#)
[PM Slope Amp - follower.voltagepreset](#)
[PM Slope Amp - limiter.voltagepreset](#)
[PM Slope Amp - tremolo.voltagepreset](#)