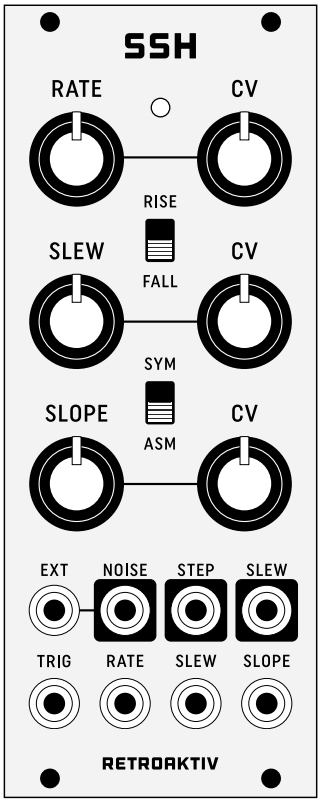
RETROAKTIV

SSH

COMPLEX SAMPLE & HOLD



OPERATION MANUAL

OVERVIEW

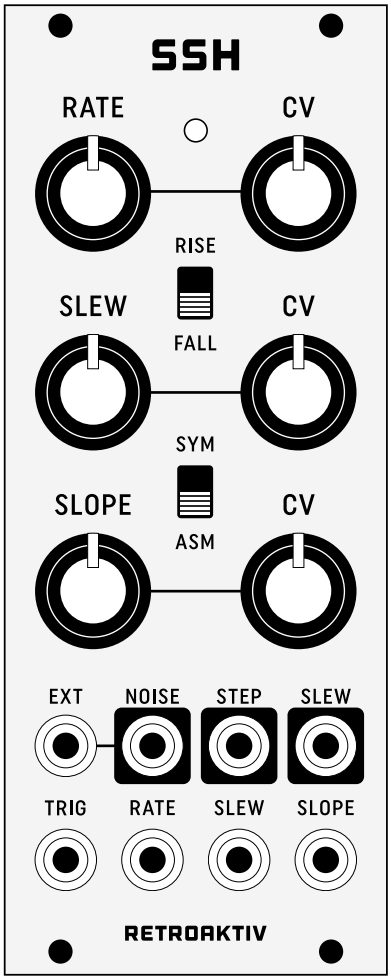


Figure 1- SSH Front Panel

INPUTS:

- **EXT**: For external sample & hold signal (+8v to -8v)
- **TRIG**: For external trigger signal (3v min, 10v max)
- **RATE**: For controlling internal clock rate (+5v to -5v)
- **SLEW**: For controlling slew amount (+5v to -5v)
- **SLOPE**: For controlling the shape of slew (+5v to -5v)

OUTPUTS:

- **NOISE**: Noise generator output (+5v to -5v)
- **STEP**: S&H staircase output
- **SLEW** Slewed S&H output

SWITCHES:

- **RISE/FALL**: (3-position) Toggles when slew is active.
- **SYM/ASM**: (2-position) Toggles the symmetry of the slew shaping circuit.

KNOBS:

- **RATE**: Sets rate of internal S&H clock
- **CV** (RATE): Attenuates RATE input signal
- **SLEW**: Sets slew amount
- **CV** (Slew): Attenuates SLEW input signal
- **SLOPE**: Sets the shape of the slewing effect
- **CV** (SLOPE): Attenuates SLOPE input signal

LED:

- Indicates rate of internal S&H clock

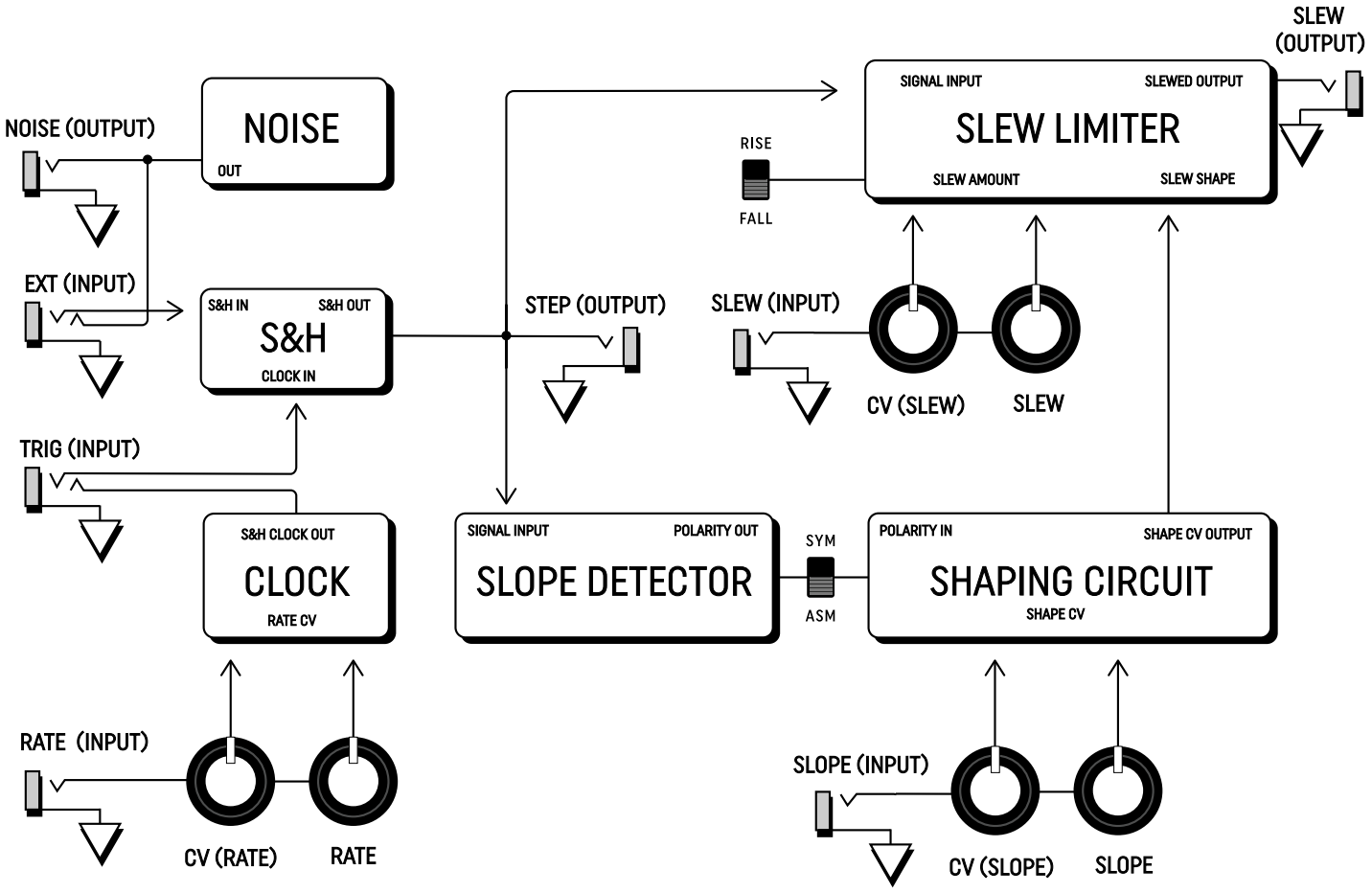


Figure 2 - SSH Block Diagram

INTERNAL CLOCK

The built-in clock generator determines the interval at which the sample and hold generator samples incoming signals. The clock ranges from about .25Hz to 100Hz. The minimum rate of the clock can be set by the MIN RATE trimmer located on the rear of the module. The rate of the clock can be controlled with external CV (+5v to -5v signals recommended.) External CVs can be attenuated using the CV (RATE) knob.

The internal clock is normalized to the S&H trigger input via the TRIG jack. When a cable is inserted into the TRIG jack, this connection is broken, and the S&H generator will be clocked by the external trigger signal. External trigger signals should be a pulse such as those from a typical LFO. (3vpp minimum. Input tolerant of pulses 10vpp)

SAMPLE & HOLD

The sample & hold generator generates a staircase-type waveform by sampling an input signal (8v to - 8v recommended) at an interval set by the internal sample & hold clock or an external trigger signal. The input signal is sampled at the positive leading edge of incoming clock signals. The stepped S&H waveform can be accessed at the STEP output jack.

The internal white noise generator is normalized to the S&H signal input, which will generate a random staircase waveform. External signals (8v to -8v) can be sampled by plugging into the EXT input jack. This will break the normalized connection between the noise source output and the S&H signal input.

NOISE GENERATOR

The noise circuit is a 5vpp white noise source. This can be accessed at the NOISE output jack. The noise generator is normalized to the sample & hold input, which generates a random staircase output waveform.

SLEW LIMITER & WAVESHAPING CIRCUIT

The SSH contains a complex slew limiter circuit which is used to limit the rate at which the staircase waveform can change. By adding slew, a sharp edged staircase waveform becomes rounded as the slew effect limits the rate at which the voltage can change. The slope of the slewing is set by the SLOPE knob. With SLOPE set to fully counter-clockwise position, the slope of the slewing effect will be exponential. When set to center position, the slope will be linear. The slope of the slew can morph between exponential and linear when set to any position between EXP and LIN. (See figure 3)

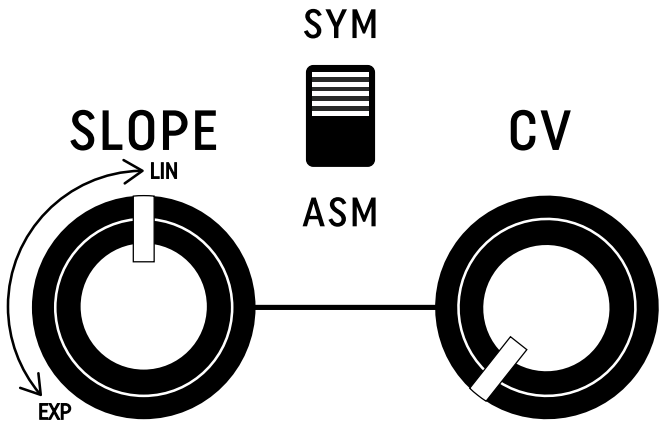


Figure 3 - Slope knob function (SYM mode)

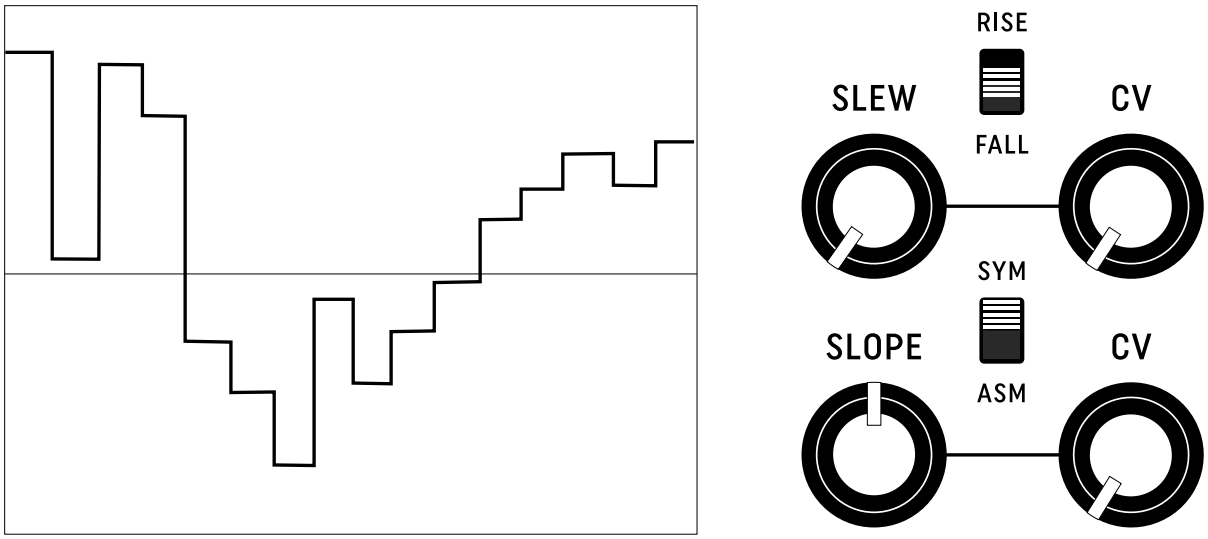


Figure 4 - Staircase with no slew applied

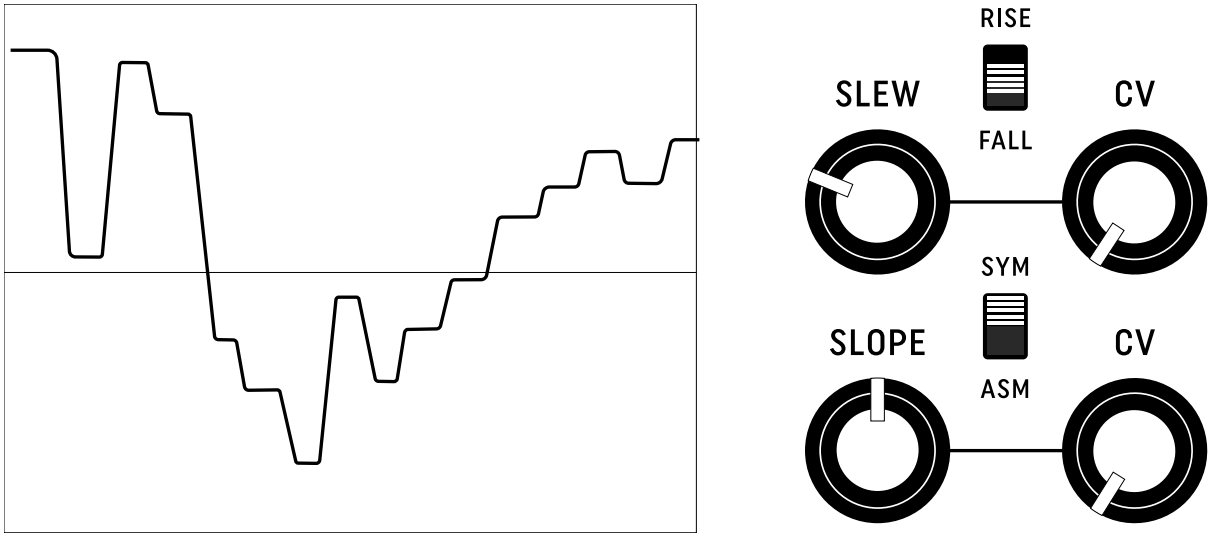


Figure 5- Staircase with 30% slew applied, linear slope

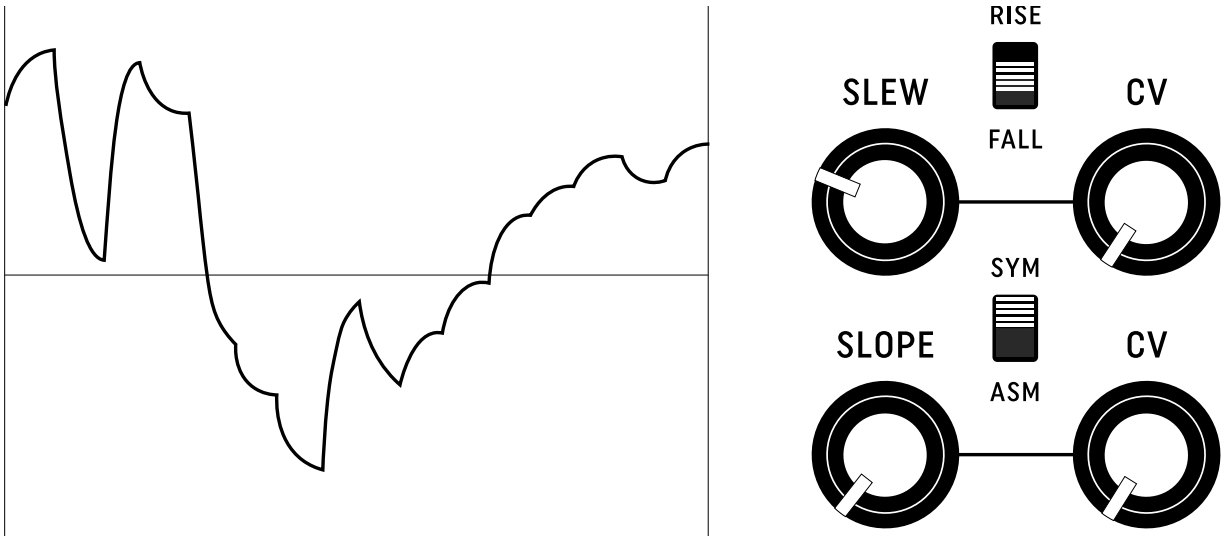


Figure 6- Staircase with 30% slew applied, exponential slope

Figure 4 shows a staircase waveform from the S&H generator. No slew is applied. Note the sharp edges of the staircase waveform.

In figure 5, some slew has been applied to the staircase waveform. Since the SLOPE knob is in the LIN (center) position, the slewing from step to step is linear. Similarly, in figure 6, slew is applied to the staircase waveform. In this case, the slewing has an exponential (RC) curvature.

In the examples given in figures 4-6, notice that the RISE/FALL switch is in the center position. The RISE/FALL switch determines when the SLEW is active. In the center position (BOTH), SLEW is active when the staircase waveform is rising and falling (Always active). It is possible to disable the SLEW effect during rising or falling steps of the staircase waveform. To enable SLEW only when the staircase is rising, set the switch to RISE. To enable SLEW only when the waveform is falling, set the switch for FALL. Figure 7 illustrates the function of the RISE/FALL switch.

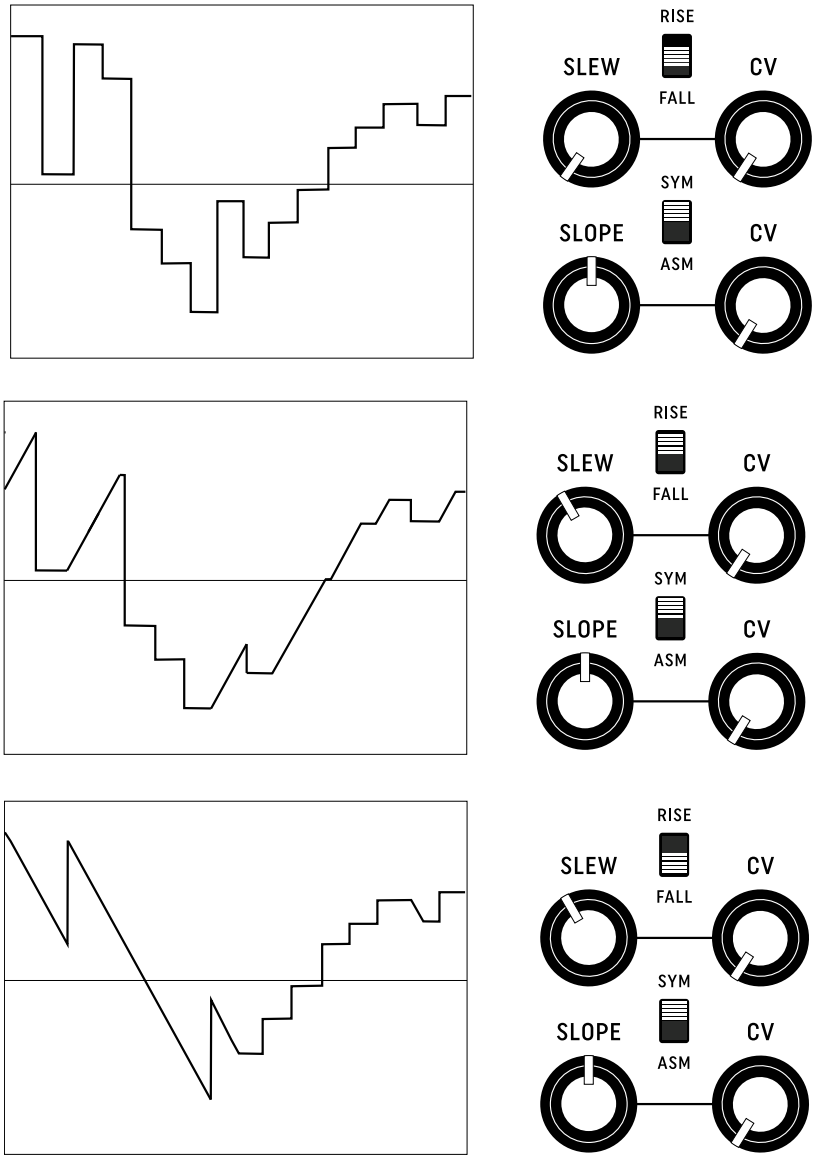


Figure 7 - RISE/FALL switch function (Linear slope)

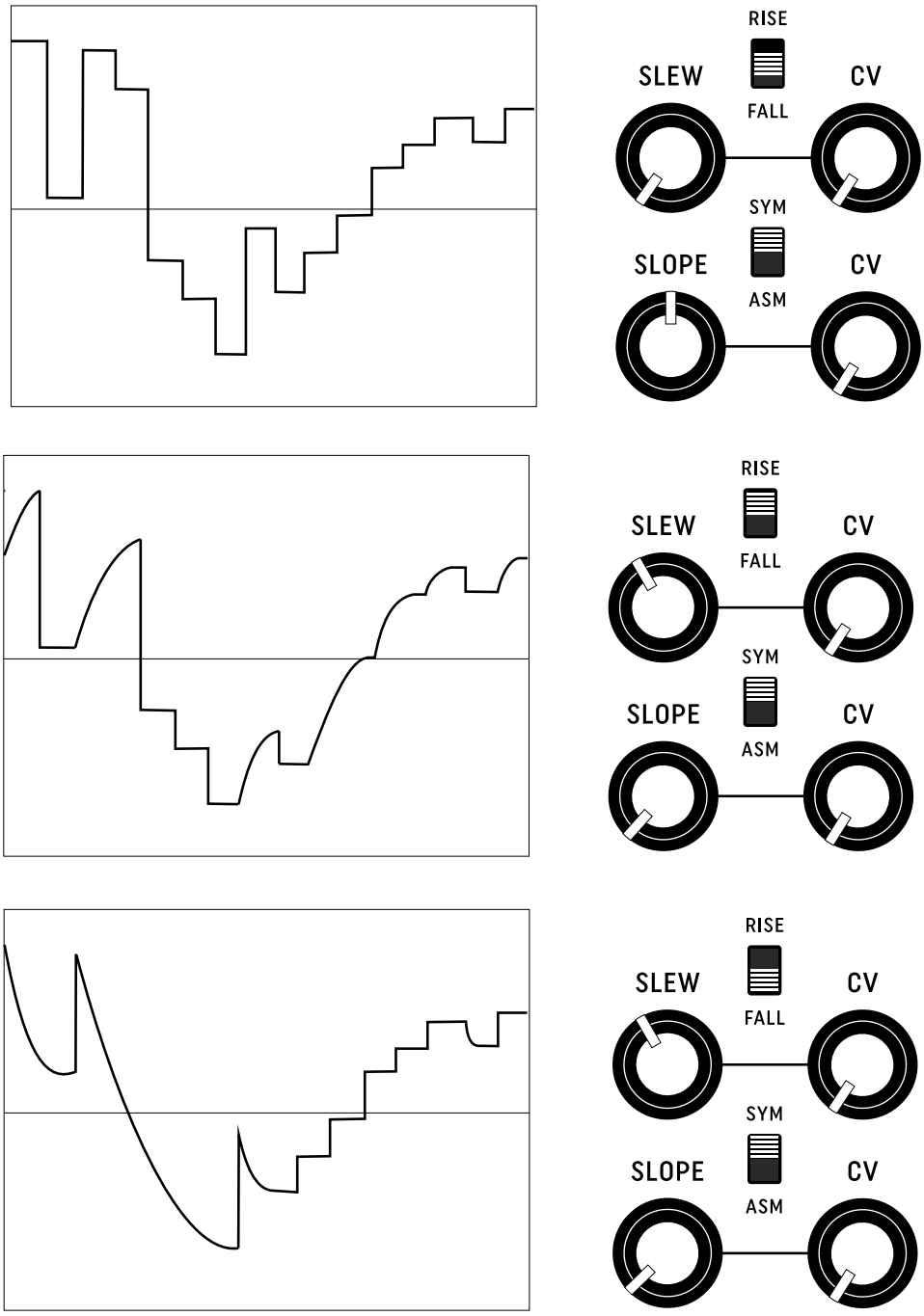


Figure 8 - RISE/FALL switch function (EXP slope)

The SYM/ASM switch controls how the SLOPE circuit funtions. When the switch is in top position (Symmetrical mode), the slope set by the SLOPE and CV knobs will be applied to both rishing and falling steps of the S&H waveform.

Setting the switch to the bottom position (Asymmetrical mode) will change the way the slope knob functions. In ASM mode, the SLOPE knob will function as shown in figure 9.

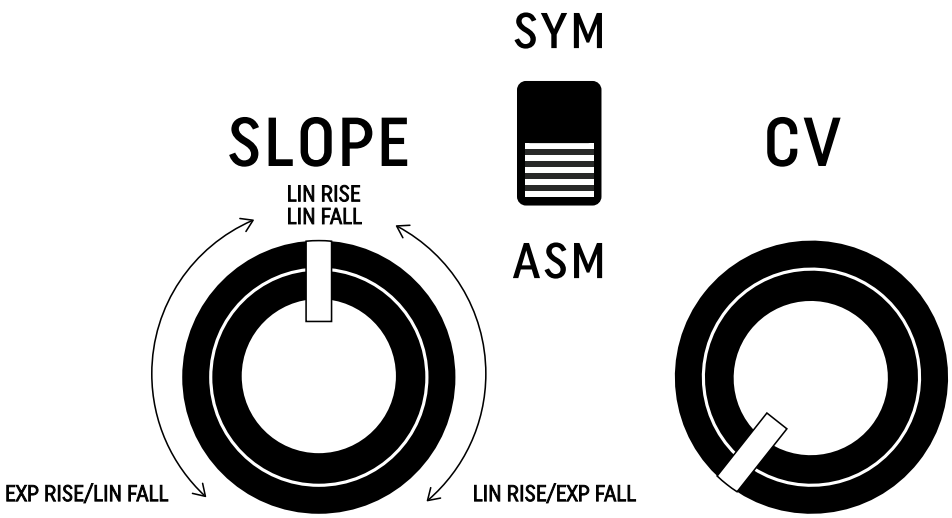


Figure 9- Slope knob function (ASM mode)

ASM mode allows the slewed S&H waveform to have a different slew shape on rising steps and falling steps. Figure 10 illustrates how the slew/slope is applied in ASM mode.

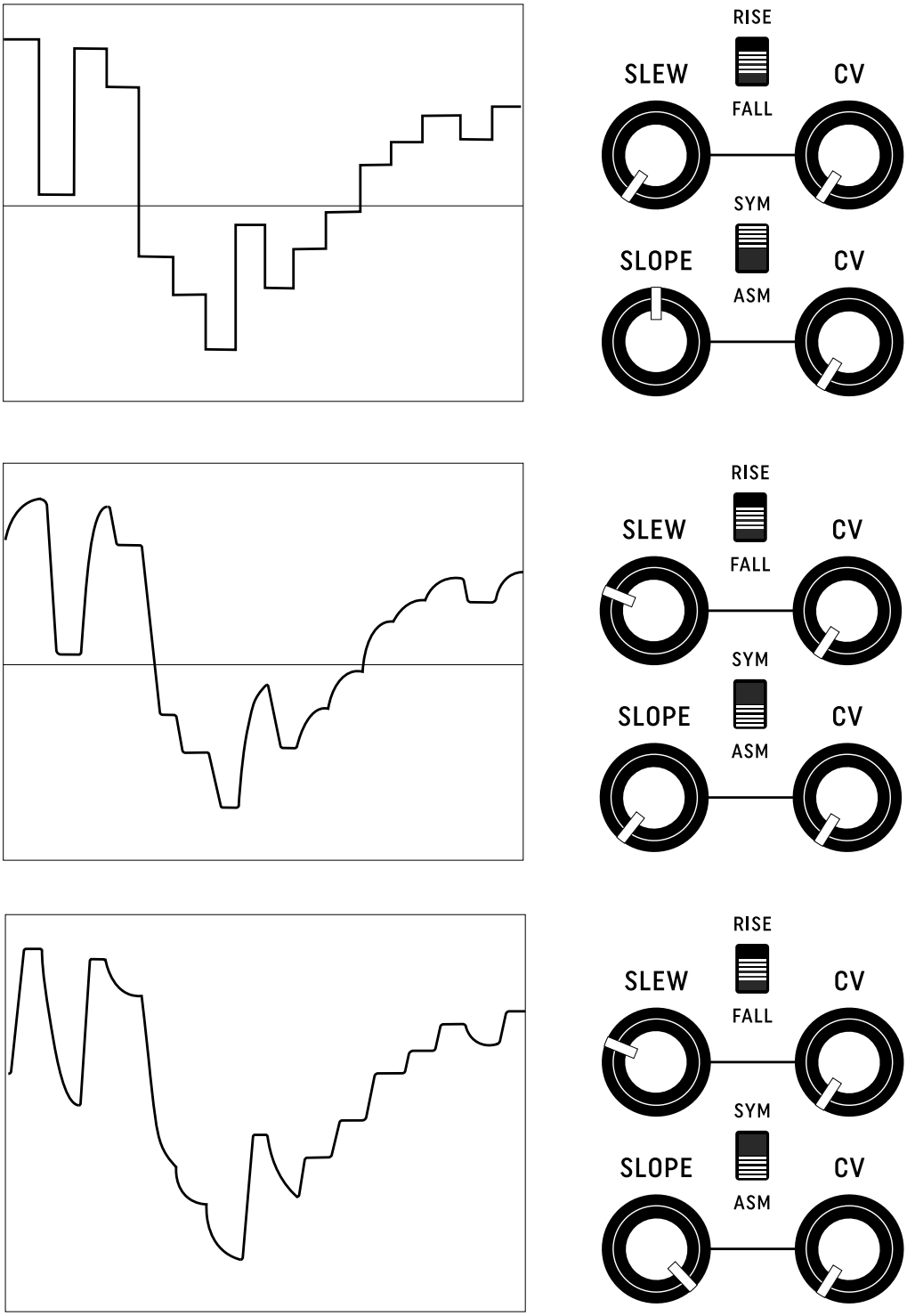


Figure 10- Slope knob function (ASM mode)

TRIM PROCEDURE

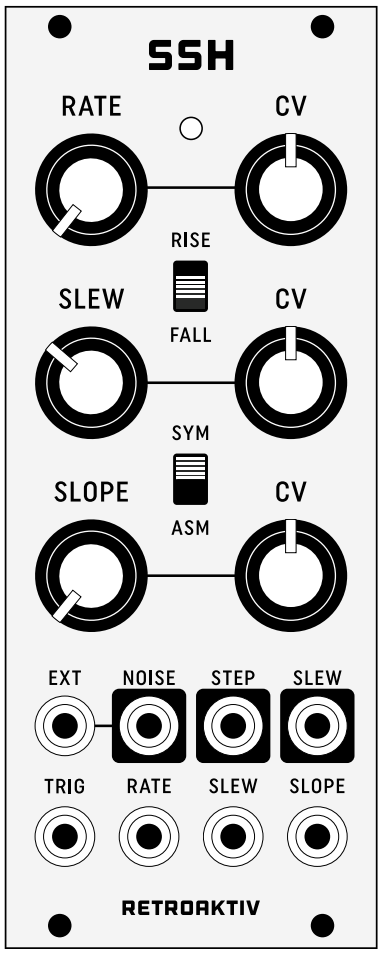


Figure 11 - Panel settings for trimming

MIN RATE TRIM

- Set front panel knobs as shown in Fig 11. RATE should be set at minimum.
- Use the MIN RATE trimmer on the PCB to adjust the minimum rate of the internal clock. Monitor the rate using the panel LED indicator. If this trimmer is set too low, the clock LFO will no longer oscillate. A recommended minimum rate is .25Hz (period of about 5 seconds.)

SLOPE CIRCUIT TRIM

- It is recommended that an oscilloscope be used to monitor the SSH output signals when trimming the SLOPE circuit. This can be done by ear as well, but it can take more work.
- Set the front panel knobs as shown in figure 11. Set RATE knob to center position. Monitor the SLEW output signal at the SLEW test point at the rear of the SLEW output jack.
- Use the SHAPE trimmer on the PCB to dial in an exponential waveform, then sweep the SLOPE knob to center position. Slewing should morph from EXP to LIN as the SLOPE knob is swept from fully counter-clockwise to mid-position. If the trimmer is set too high, the slew will not be EXP when SLOPE is set to its minumum. If the trimmer is set too low, the slew effect will become extreme.
- When satisfied with the range of the slope knob, set the SYM/ASM switch to ASM position. Turn SLOPE knob fully clockwise. Monitor the SLEW output and use the INV trimmer to trim the falling portions of the SLEW waveform such that they match the EXP curve set in the previous step.
- Setting SHAPE and INV can be done by ear if the SLEW output is connected to the pitch CV input of a VCO. Monitor the pitch and adjust the shape by ear.

BUILD NOTES

This section is for people building the SSH DIY kits. Read this section before building an SSH kit.

- Populate 0603 resistors and capacitors, 3904, 3906, 2N7002, BC847, BC857, BAV99 first. Clean all flux from PCB. Then populate ICs, headers, electrolytic caps, and through hole film caps, being careful to clean any remaining flux. The sample & hold and slew circuits are senstive to excess flux.
- Solder jacks and pots to front of PCB. Be aware that the through-hole film caps need to be soldered into the PCB before soldering the jacks.
- Place switches and LED into respective holes. Attach front panel to pots and jacks. Switches need to be soldered into place when held flush against the front panel. In the case of the RISE/FALL 3-position switch, the switch must be centered so the switch can move through all 3 positions.
- The top of the cylindrical LED should be flush with the front panel. Position the LED before soldering. If done successfully, the LED should appear to be a part of the surface of the front panel.
- Before powering up, check the orientation of you power cable. The red stripe must line up with the -V printed to the left of the power header.
- To increase the amplitude of the noise source, try a few different 3904 transistors. Different transistors have different amounts of noise. Change R12 to 47k to increase noise amplitude.