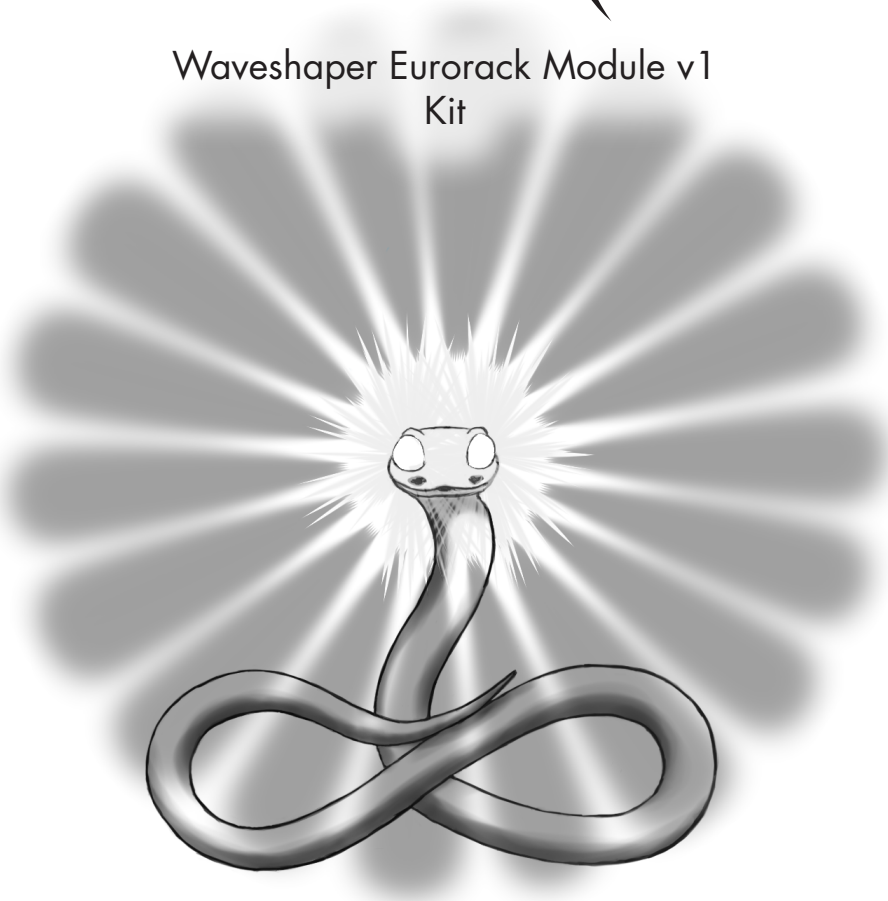
flight of harmony

Sinner

Waveshaper Eurorack Module v1
Kit



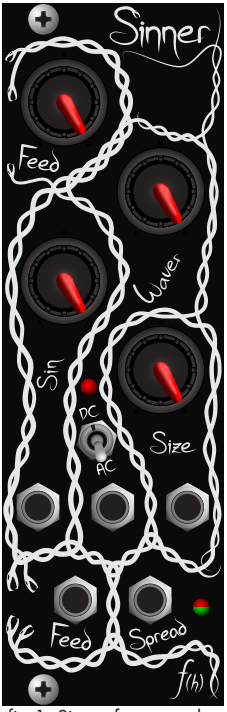


fig.1: Sinner front panel.

Specifications @ ±12VDC

Supply Voltage	±12VDC[1]	
Supply Current (max draw @ ±12V)	I_{+12V}= 27mA	I_{-12V}= -22mA
Max. Input Voltage	±5V / $10V_{p\text{-}p}$	
Max. Output Voltage	±6V / $12V_{p\text{-}p}$	
Input & Ouput (I/O) coupling	Input: Direct	Output: Selectable
Max. output DC bias	±4.8V	
Output Impedance	1kΩ	
Control Voltage (CV) inputs	±5V / $10V_{p\text{-}p}$	
CV input coupling	Direct	
CV input impedance	100kΩ	
Number of pieces (nuts & washers of pots & jacks not counted)	108	
Kit Difficulty	Medium	

[1] Has been tested and performs well with supply voltages from ±9VDC to ±15VDC.

Contents

(1) Front Panel
(3) PCB- Main, Potentiometer, Jack
(3) Resistor Card
(1) Semiconductor Card
(1) Capacitor Card

(1) Hardware bag
- (1) 9″ ribbon cable
- (1) 2x5 box header
- (1) 2x5 IDC socket connector with strain relief
- (1) 2x8 IDC socket connector with strain relief
- (2) M3x0.5 eurorack mounting screw
- (2) M3 nylon washer
- (1) 1x3 0.235" post pin header
- (2) 1x4 0.235" post pin header
- (1) 1x6 0.318" post pin header
- (1) 1x9 0.318" post pin header
- (1) 1x3 socket header
- (2) 1x4 socket header
- (1) 1x6 socket header
- (1) 1x9 socket header
- (2) Nylon PCB Standoff (long)
- (2) Nylon PCB Standoff (short)
- (1) 3mm (T1) LED, red
- (1) 3mm (T1) LED, bicolor, green/red
- (1) SPDT toggle switch

(1) Potentiometer bag
- (1) A100k Potentiometer (Feed)
- (3) B100k Potentiometer
- (4) Washer
- (4) Nut
- (4) Knob

(1) Jack bag
- (5) 3.5mm TS jack
- (5) Washer
- (5) Nut

(1) Reference manual (this thing)

Overview (taken from SIN-E manual)

FYI

As with all f(h) products, the Sinner was engineered towards maximizing functionality while keeping cost as low as possible. If some aspects of the unit seem awkward, it is most likely due to this. The goal is to make unique, useful, enjoyable, and affordable instruments, not just hoover[1] out your bank account.

And remember: every instrument has its quirks and unexpected aspects, so RTFM[2] all the way through! Specific quirks are mentioned in the description of the particular feature they apply to, so please read this through before emailing!

What is it?

Sinner is based on a sine-shaping circuit that applies logarithmic distortion to the input signal, causing ramp, saw, triangular, and similar, signals to be more rounded and approximate a sine wave. Pretty freaking boring when you read it like this, so it has a few extra features that allow you to twist and wring your signal into much more excruciating and exciting shapes. Part of this is accomplished via a four-quadrant multiplier (4QM), which also offers ring modulation (RM) as well as typical voltage-controlled amplifier (VCA) capability.

Sinner is direct-coupled (DC) all the way through, so you can use it to control and process control voltages (CV) and other DC signals in addition to sculpting audio. If, after blowing a few speaker cones, you decide you've had enough of *that* fun, it also has a full-bypass toggle switch to change the output to capacitive coupling (AC) and block the DC bias from the signal. The LED above the switch is lit in DC mode, and off in AC mode. The output LED is bicolor: red for positive signals, green for negative, and gives you something fun to stare at, at 3:50 am, when you haven't slept in two days, and your vision is a blurry tunnel and the fuzziness in your head is pulsing to the sounds and your fingers and cheeks are tingling and probably warning you of something important but *wow* that flashy thing is hypnotic, isn't it?

The secret message of the Sneks[3]

Them twisty Sneks tell you the basic function of the controls and jacks:

- Heads curling in like fangs: signal inputs and their controls
- Tails curving out: signal outputs and their controls
- Completely encircled: CV and internal device functions

1) Hoover is a company that manufactures vacuum cleaners.
2) RTFM = Read The F*cking Manual!
3) Snakes

Overview (cont.)

Feature summary:

- Waveshaping
- Sine shaping
- CV processing
- Ring modulation
- Amplitude modulation
- Has Sneks

Controls and Behavior

Usage note: **Feed**, **Sin**, and **Size**, can each reduce output to 0V when turned fully CCW.

Feed: Input level attenuator. Clockwise (CW) to increase, counterclockwise (CCW) to decrease (fig. 2). This control is mainly for reducing strong signals to give more responsiveness to the other controls, so it is recommended to leave this fully CW for standard usage.

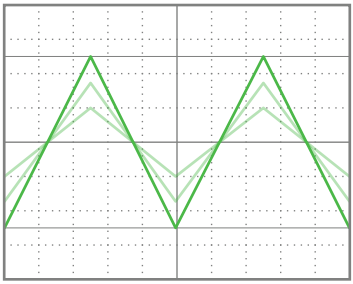


fig.2: Effect of increasing Feed control.

Sin: Amount of rounding applied to signal. CW for more, CCW for less. **Sin** also affects the amplitude of the signal (fig. 3). The amount of rounding applied also depends on the signal amplitude, which is controlled by **Feed** (fig. 4).

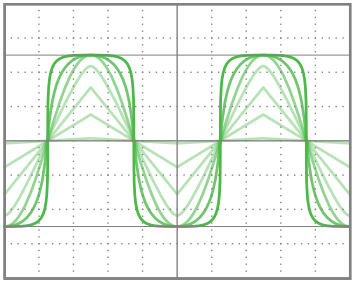


fig.3: Effect of increasing Sin control.

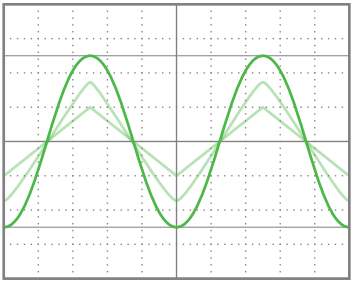


fig.4: Effect of Feed on Sin.

Overview (cont.)

Waver: Applies from 0 to ±4.8VDC bias to the signal. CW for positive, CCW for negative.

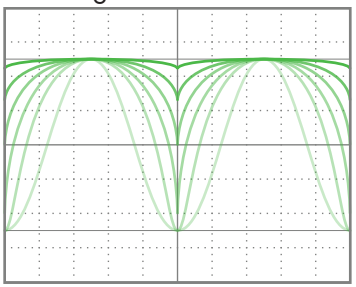


fig.5: Effect of Waver positive increase.

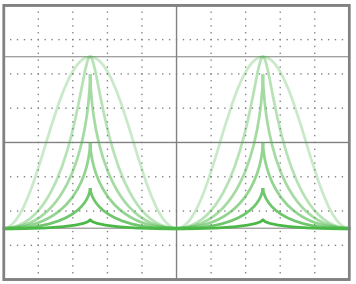


fig.6: Effect of Waver negative increase.

Size: Post-effect gain, the amplitude of the output signal. CW to increase, CCW to decrease.

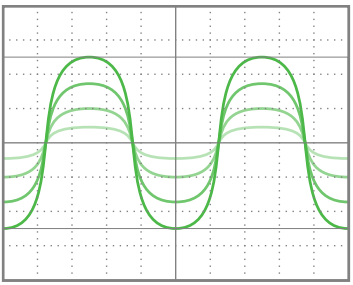


fig.7: Effect of Size control.

Jacks

fig.8: Jacks.

The jacks are linked to their associated control knob (if any) by the Sneks. All hail Snek.

Signal Input

Feed: Signal input, either AC or DC. Level adjusted (0-100%) by the **Feed** knob.

CV Input

Sin: CV Version of **Sin** control knob. Positive increases rounding, negative decreases rounding. Knob and CV levels are summed.

Waver: CV version of **Waver** control knob. Positive applies positive bias, negative applies negative bias. Knob and CV levels are summed.

Overview (cont.)

Size: CV version of **Size** knob. Positive increases gain, negative decreases gain. Knob and CV levels are summed.

Usage note: Some compromises occur when trying to maximize options for user control. One such situation: With control knobs and CV inputs, when both are used, when one is towards either extreme, the other will have less effect. Example: Negative signal at Sin CV input has little to no effect with Sin control fully CW. Whichever control is most extreme takes priority over the other. Just nudge whichever is largest back a bit to increase the range of the smaller.

Output

Spread: Signal out. Led indicates bias of output relative to 0V; red for positive, green for negative.

Output coupling

DC-AC: Selects if output is DC- or AC-coupled. Lever up for DC, which will also light the LED, when process CV or when DC is not otherwise a concern. Flip down for AC coupling, which turns the LED off, to remove any DC bias from the signal and protect speakers.

In case you have not heard the speaker thing before, a DC signal present in a signal can (and eventually *will*) damage a speaker receiving it. Speakers are driven by a coil that generates a magnetic field. This field then reacts with the magnetic field generated by the large magnet around the coil. The coil field is generated by current travelling through the coil, and a DC bias causes current to flow when it normally would not, which increases the generated field strength and causes the coil to work harder than it should. This can often exceed the intended limits of the speaker and burn out the coil, warp the coil, overextend the cone travel and damage the support web, or all of the above.

tl;dr: don't drive a speaker directly from Sinner in DC mode. Sinners are known for doing bad things.

Overview (cont.)

Power

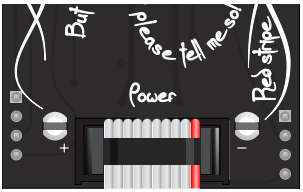


fig. 9: Rear power connection.

The power connector header is a 2x5/10-pin shrouded box header which accepts the standard Doepfer power cable. This header style is polarized, meaning the connector can only be inserted one way, to prevent connecting the power backwards and damaging the unit.

This assumes that you are using either the supplied cable or one manufactured by Doepfer.

Looking at the rear of the module, the negative supply (red stripe) is on the left, positive supply is on the right (see fig.9).

Stuff

A big thank you to those who have sent in suggestions and comments, keep them coming!

Comments, samples, suggestions, complaints to: flight@flightofharmony.com

http://www.flightofharmony.com

From now on, whatever may be...

Kit Notes

Static Discharge Warning

Some pieces in this kit are static-sensitive and can easily be destroyed by Electrostatic discharge (ESD). Make sure to discharge yourself and your work surface while handling components from the semiconductor card.

How to safely discharge static: Use an ESD wrist strap and work mat. *Do not just connect everything directly to ground;* that just creates a low-resistance path for large currents to discharge through and will cause damage if the static-sensitive component is in the path. ESD wrist straps have a high resistance built in to safely limit the amount of current to below destructive levels. Keep in mind: current does the damage, voltage creates the path for current to flow through.

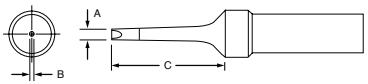
Skills

This kit assumes that you have a basic understanding of electronics, electronic components, and soldering and assembling electronics. Note that this kit is almost entirely Surface Mount Technology (SMT), so the assumption is that you understand how to work with Surface Mount Devices (SMD) and have some experience.

This doesn't mean that you're *completely* on your own, just that I'm not going to hold your hand[1]. Below are a few things to help get you started. Feel free to ignore them.

Tips

- Use the smallest soldering iron tip that you have. My favorite is the Weller ETR: (Not an endorsement, nor do I get anything from it, it's just a good reference



Narrow Screwdriver

Cat.	A		B		C	
No.	in.	mm	in.	mm	in.	mm
ETR	0.062	1.60	0.044	1.12	0.625	15.90

1) For many reasons, but two in particular: First, I'd have to leave my house, and I hate doing that. Second, it's really hard to solder with only one hand.

point.)

- Good, fine-tip tweezers are a must. The Wiha 4b and 7a tweezers are great[2].
- One helpful trick for soldering SMD with wire solder is to pre-solder one pad for each component location. Next, hold the component in place and touch your soldering iron tip to the pre-soldered pad to reflow the solder. Then you can solder the other side normally.
- *Flux is your friend.* Use flux. Water-soluble flux is best for a clean finish, but you have to make sure to get it all off when done, as it can corrode the joint and some fluxes may also be capacitive. You can also use no-clean flux.
- *Smallest first.* Solder the components in increasing order of size.
- *Minimize heat exposure.* Heat destroys components, and SMD are particularly sensitive because they have less mass to distribute the heat. Flux helps with this too.
- Use the face plate to line up the potentiometers and jacks before soldering; much easier than resoldering them to line them up correctly afterward.
- Headers: The easiest way to align headers is to plug the related pin and socket headers together, insert them into the circuit boards, then solder. A rubber band — or even some tape — around the boards works to hold them in place if you don't have some small clamps.

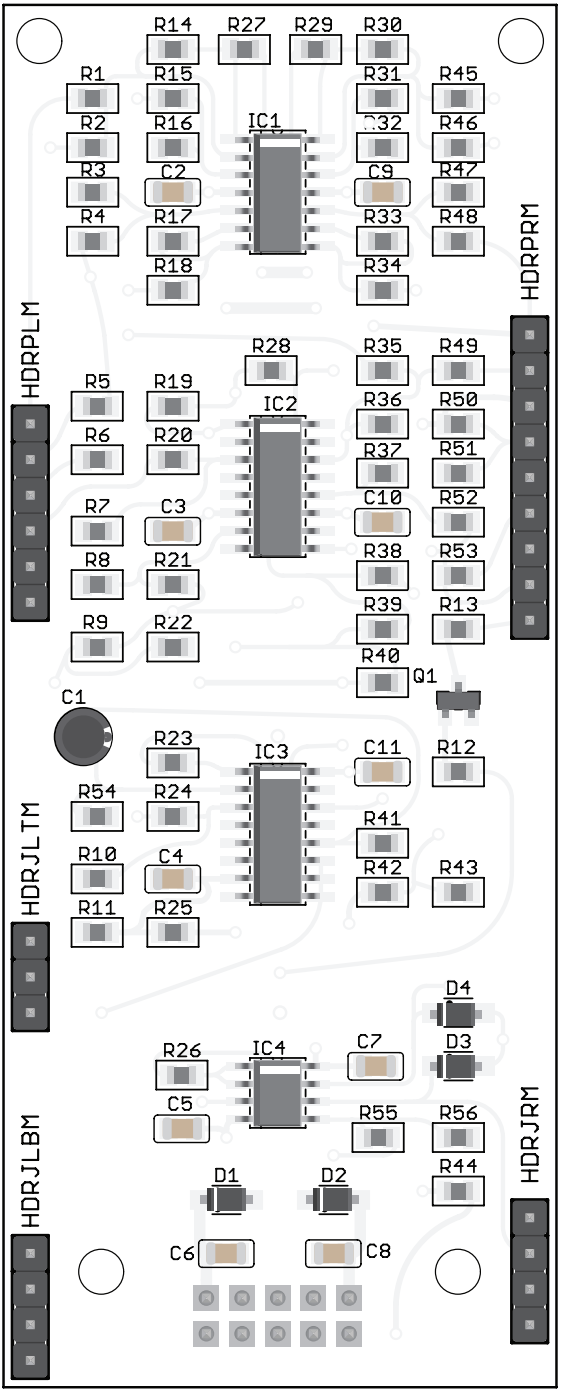
Help

If you're still having problems, email me! I am always happy to help. When emailing, please include high-resolution pictures of your circuit boards.

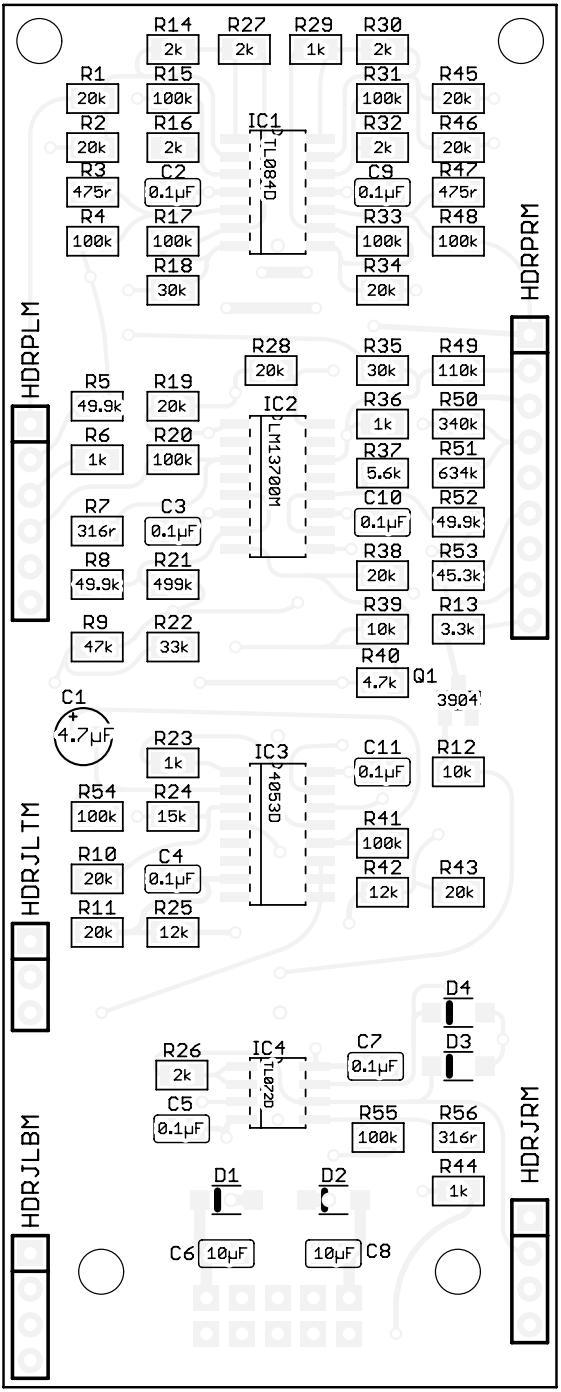
Most of the troubleshooting requests I have received were solved by zooming in and closely examining the pictures. Cold solder joints are sneaky and hard to spot if you haven't dealt with them before. A cold solder joint is where the solder doesn't adhere to both the pad and the component lead, and just flowed around one of them without making contact. They happen, and they suck, but they're easy fixes once you find them.

2) IMO, their 5abb were the best, but they discontinued them so FML. No, you can't have mine.

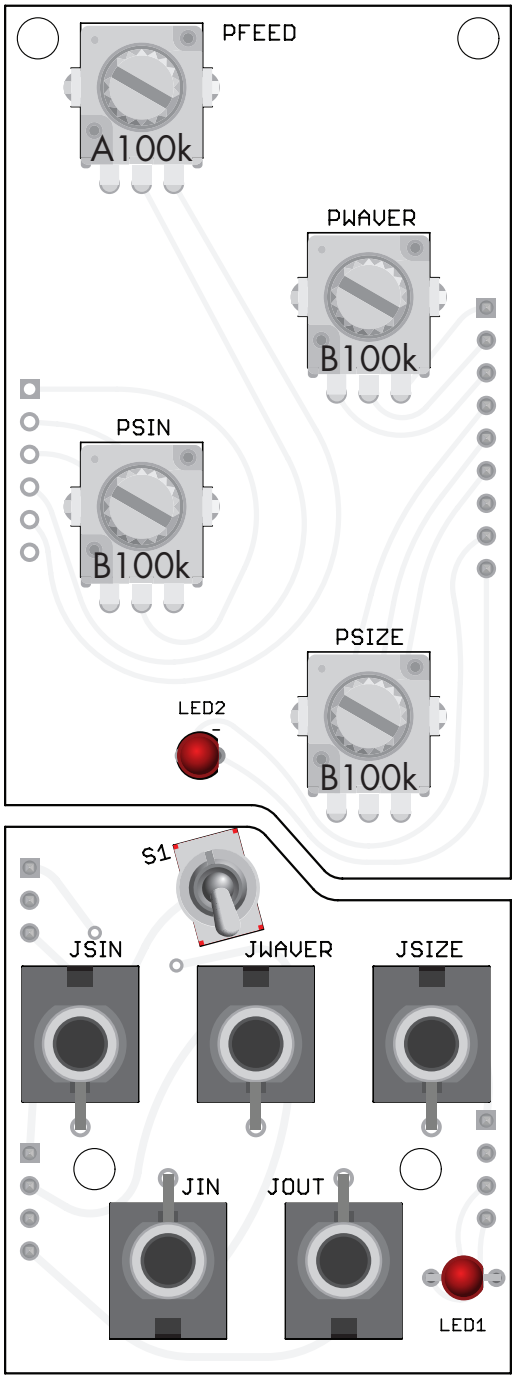
Main PCB Assembled View



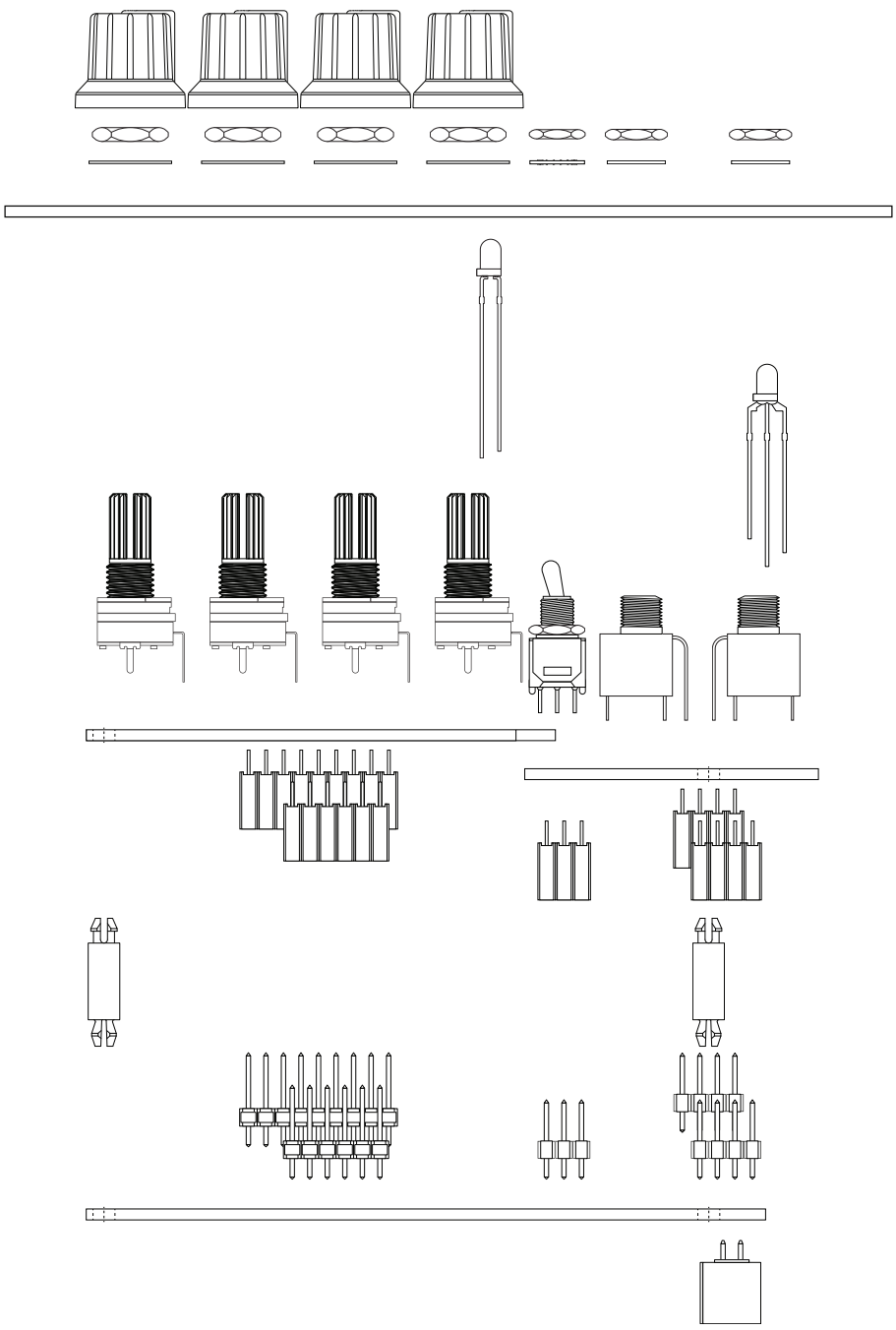
SMD Reference



Control & Jack Reference

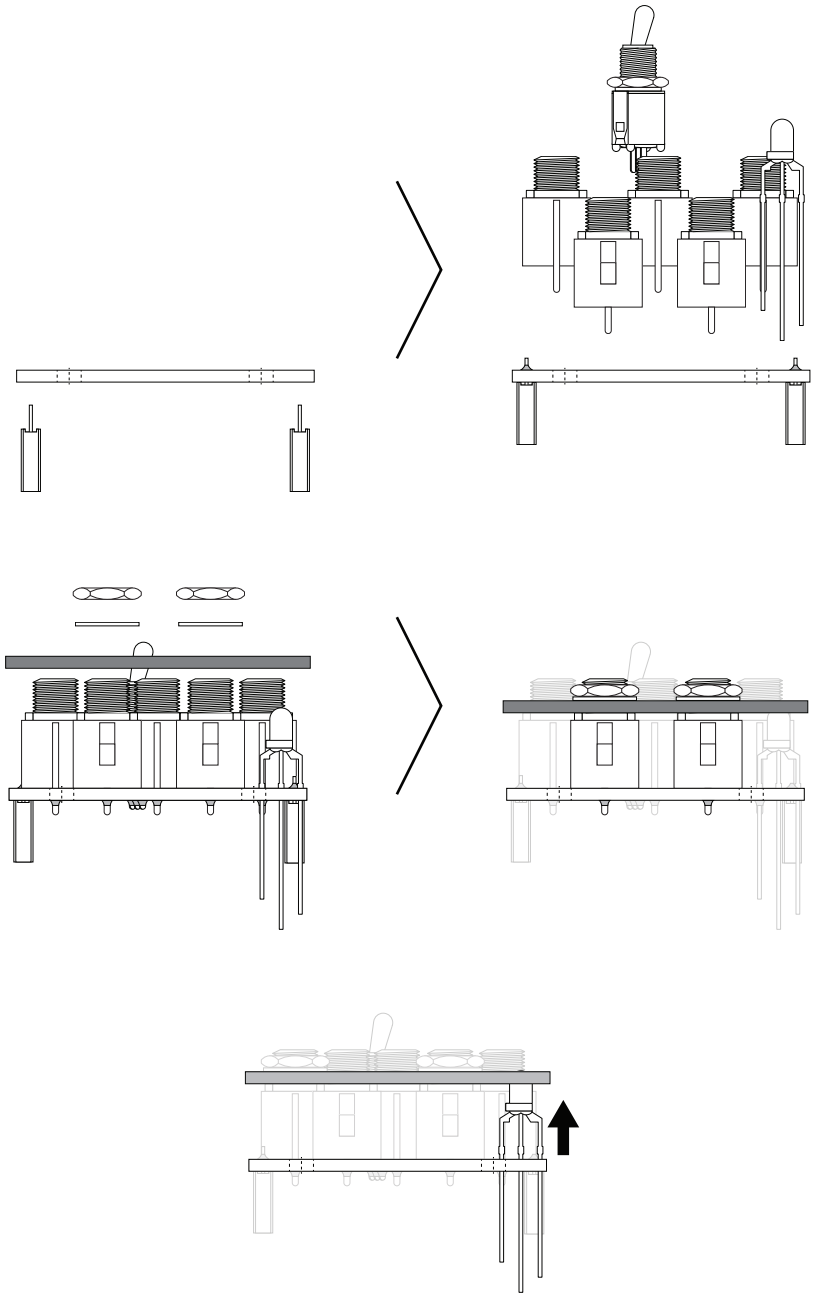


Exploded View

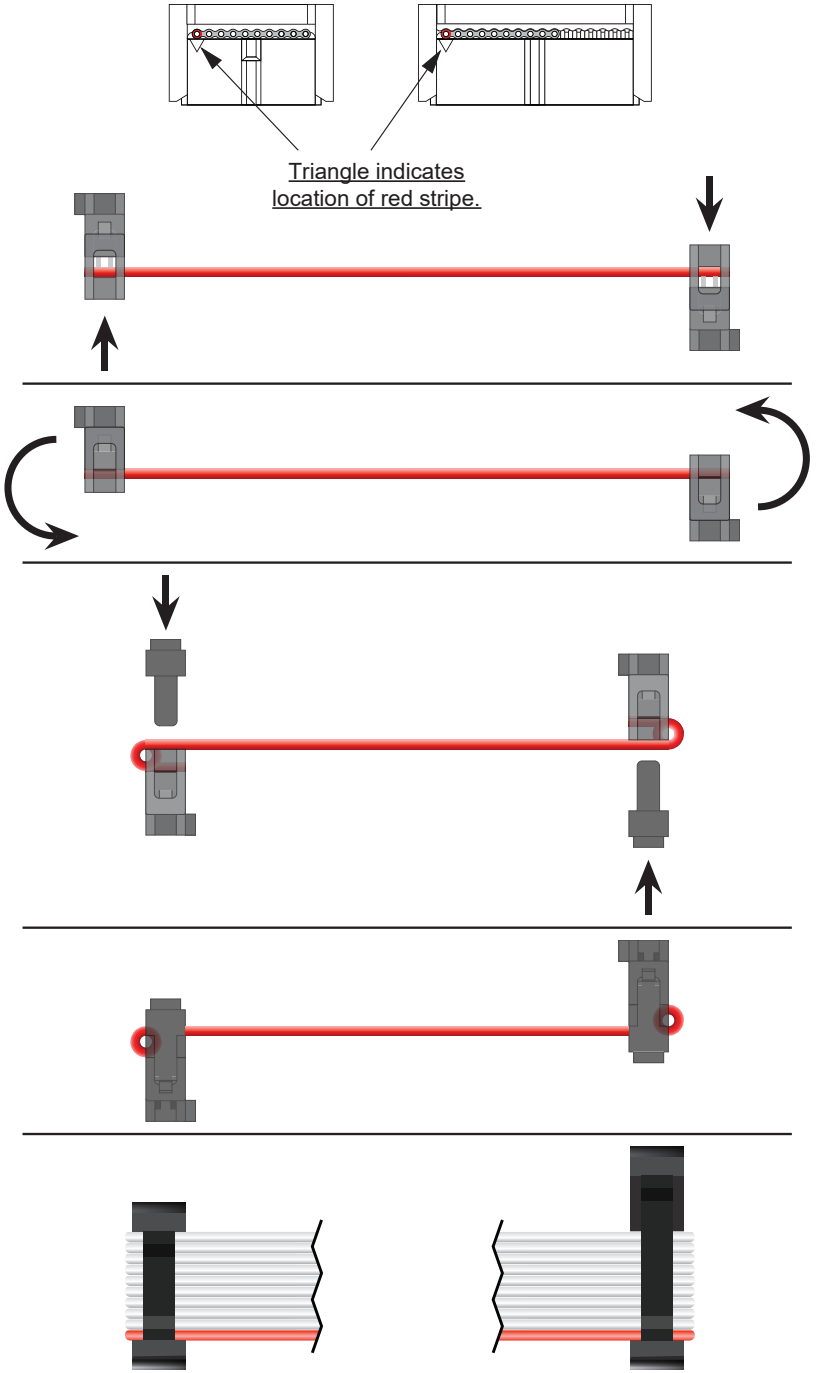


LED Installation

Solder LEDs last. Use panel as stop guide.

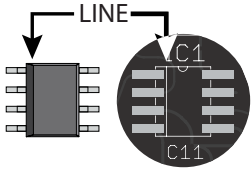


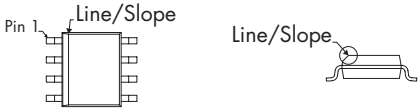
Power Cable Assembly



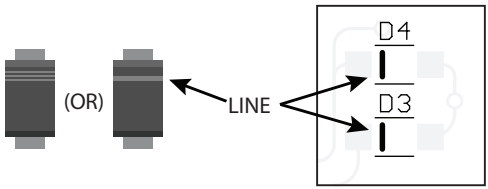
Miscellaneous

IC Orientation





Diode Orientation



LED and capacitor Orientation