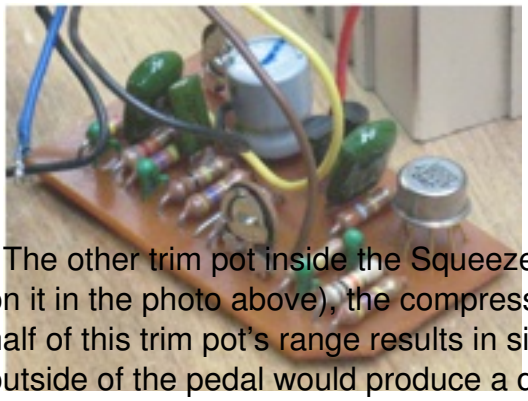
By Theo Hartman - GJD Contributor

Read Part 1 here

One of the early compressors, the Dan Armstrong Orange Squeezer, had no external user controls (unless you count screwdriver access to one of the two internal trim pots). It was originally designed for “set-it-and-forget-it” use. The two variables that could be set internally were output volume and the amount of compression.

An early Orange Squeezer.

At first blush, moving these controls to the exterior would seem an obvious and straightforward way to modernize or improve the utility of the pedal. In the case of the volume control (the silver/brown circle standing on two legs in the foreground of photo above) it is indeed straightforward. The early Squeezers I’ve examined used linear taper trim pots for the internal volume setting. This makes sense—sort of. All volume settings are available (via screwdriver), and with no need to establish a correspondence between the physical position of the internal trim pot and the apparent loudness, the original designers could get by with linear taper just fine. Physical space issues aside for the moment, moving this control to the outside of the pedal requires little more than replacing the internal linear volume trimmer with an external log-taper potentiometer. You can reach the volume now, and when you turn it, what you hear makes sense.



The other trim pot inside the Squeezer (hiding behind the big gray capacitor with the blue line on it in the photo above), the compression setting, is a different story. Forget about taper. Fully half of this trim pot’s range results in silence (no output) from the unit. Putting this on the outside of the pedal would produce a device that could be unintentionally disabled by a user who thinks it’s safe to casually browse various settings of its knobs. Or worse, the knob gets bumped by accident and the unit goes silent: this is a sure way to send somebody looking for a dead battery, faulty cable or loose connection when in fact it’s an inappropriate range of control that’s the culprit.

Notice I didn’t say Operator Error. I’m a strong believer that “it just does that” is not, by itself, reason enough to leave guitar players with more ways to accidentally disable their rigs than

they've already got. It might be fine for a control on a bank of analog synth modules; it's not ideal for guitar pedals in a live setting.

In setting out to restrict the operating range of the compression control to make it suitable for external manipulation, it is necessary to examine what it's doing in the circuit. At this point it becomes clear why the original designers left this as an internal control.

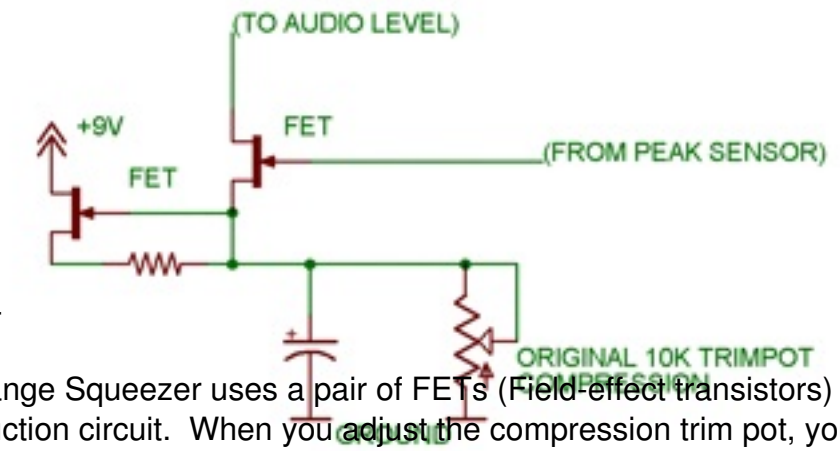


Figure 4

The Orange Squeezer uses a pair of FETs (Field-effect transistors) as part of its gain-reduction circuit. When you adjust the compression trim pot, you alter the threshold of one of the FETs, which in turn influences the audio level to produce more or less pronounced compression effects. Unfortunately, the threshold varies quite a bit from FET to FET. Manufacturing tolerances are greater than the level of precision we need here, so the trim pot is actually serving double-duty: it's tuning the FET threshold to function properly with the rest of the circuit, but it's also compensating out the variation between FETs so that any 2 Orange Squeezers can behave exactly the same no matter how much the individual FET characteristics might deviate.

To successfully externalize this control we need to break down the two functions of this trim pot and isolate them. Tuning the compression level goes to the outside. FET compensation stays inside.

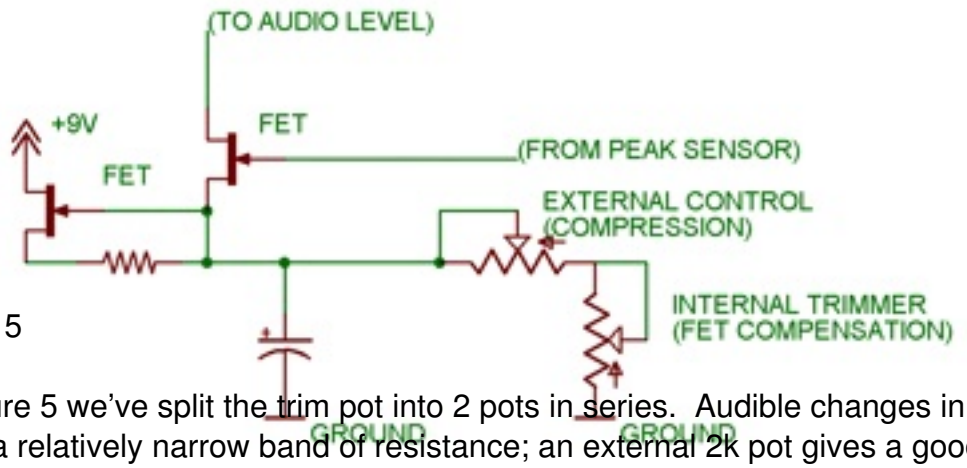


Figure 5

In Figure 5 we've split the trim pot into 2 pots in series. Audible changes in compression occur across a relatively narrow band of resistance; an external 2k pot gives a good range for adjusting the amount of compression. The pot is linear, not because the original trim pot was linear, but because it seems "right" to the ear (imho, obviously). The second of the two pots remains internal, and is set as needed to compensate out the FET variation.

Doing this at a production level requires that the circuit be tested for consistent voltages while the internal trim pot is set so that the external compression range is the same from unit to unit. Remember, they're resistances in series. The operating range of the one is "riding atop" the value set by the other. I've rarely seen the internal FET compensation resistance need to exceed 4.7k, but a 10k trimmer still works just fine here. You just tune it down to the resistance you need. It's internal, so an excessive operating range won't confuse anyone during a gig.

The outside is a different story, however. We make it so by expecting—tacitly or otherwise--gear to behave in a certain way. Figuring out those expectations is one of the most challenging and fun parts of designing control logic. It's not about whether it works--it's about whether it's useful. It's about designing for people, and we all know how picky we are….