Some of the technical stuff I had on the old forum

by **Laurie** » 09 Dec 2011, 14:51

My old site is still up and has some of the stuff that was in the "FAQ" section of BA.
http://members.shaw.ca/lauriepedals/
(website doesn't exist anymore)

Boss Switch Clean instructions
(current link: http://www.dingotone.com/wordpress/wp-content/uploads/2012/05/Boss-Switch-Clean.pdf)

CE2 and CE3 pot adjustment (saved in this document; see below)
DM2 pot adjustment (saved in this document; see below)
SG-1 discussion (saved in this document; see below)
OC2 tracking graph (vanished from the internet)
Pedal impedance notes (saved in this document; see below)
Pedal power supply notes (saved in this document; see below)

PW-2 corrected schematic
(current link: http://www.dingotone.com/wordpress/wp-content/uploads/2012/05/Boss-PW-2-corrected-schematic.pdf)

And the MT-2 Stormchaser mod.
(current link: http://www.dingotone.com/wordpress/wp-content/uploads/2012/05/MT-2-Stormchaser-MOSFET-mod.pdf)

Pot tapers: http://www.keikocorp.co.jp/components/p ... tails.html
(link invalid, but original content saved in this document; see below)

I'll post more as I get the time.

Laurie

Re: Some of the technical stuff I had on the old forum

by **Dirk** » 09 Dec 2011, 17:14

Those switch clean instructions of yours are invaluable Laurie.
I had dirty switches on a BF-2 and a DD-5, sometimes I had to hit the pedal 3 or 4 times to turn it on, after cleaning them, they worked like new again.

Awesome.

Dirk

Re: Some of the technical stuff I had on the old forum

by **Pepe** » 09 Dec 2011, 17:21

Huh? The one I sent to you had a bad switch?!

Pepe

Re: Some of the technical stuff I had on the old forum

by **Dirk** » 09 Dec 2011, 17:24

Yeah, it started acting up after a few weeks or so, but it's fixed now.

Dirk

Re: Some of the technical stuff I had on the old forum

by **Pepe** » 09 Dec 2011, 17:36

Okay, things like these can happen.

Pepe

CE2 and CE3 pot adjustment

This is a quick how-to for the CE-2 trimpot adjustment, or more correctly "how to set the BBD operating point".

Just done this to my MIT ACA CE-2 and it will work on any CE-2.

Tools
- You will need a scope. No way around it. I bought an old Tektronix 2215A off eBay for $100. A worthwhile investment...
- Phillips screwdriver to remove the back plate.
- Small flat-blade screwdriver to adjust the pot.

Procedure
0) Go get the service notes from here: http://www.godiksennet.com/images/sch/CE2.jpg

1) Remove the backplate and swing the board out

2) Obtain a 200Hz +3dBm signal source. I used CoolEdit on my PC to generate a 200Hz wave, then put it through a little Behringer mixer I have to boost it up to +3 dBm. Power the pedal with a known good battery (or the correct Boss power supply). Plug a lead carrying the +3dBm signal into the pedal input and turn on the pedal. Turn the "rate" pot fully anti-clockwise and the "depth" pot fully clockwise.

3) Set the scope to 500mV/division, 1ms/division sweep, and "AC" in. Use the service notes to locate Q3 on the board. It is quite near the trimpot. Connect the scope probe to the emitter of Q3 - it is leg of Q3 furthest from the trimpot. I just held my probe tip onto the solder pad on the solder side of the board.

4) Increase the incoming signal until you see one of the three waveforms on the service notes. If your signal is too low, the waveform will look like a perfect sine wave - wind up the signal until it starts to clip and looks like one of the three waves. Once you see a clipped waveform, "center" the waveform by turning the trimpot (i.e. until there is equal clipping on top and bottom of the waveform).

5) Once the waveform is centered, lower the incoming signal until one of the sides of the waveform stops clipping - this will look like either the top or bottom waveform on the service notes. When this happens readjust the trimpot until the waveform is again "centered" (there is equal clipping on top and bottom of the waveform).

6) Disconnect everything, and close up the pedal. You are done!

Note that at no point in the adjustment are we looking at DC-offset. Just leave the scope input set to "AC".

Looking at the CE-3 schematic, this same process will also work for the CE-3 (only change is the measuring point is Q8 in the CE-3, not Q3). You are on your own finding the emitter of Q8...

Boss DM-2 trimpot adjustment.

Instructions are at the web site below, but this is to further explain:
http://www.godiksennet.com/images/sch/DM2PG2.jpg

You will need a scope (no way around it) and a 200Hz test tone (I generated mine out of my computer sound card).

STEP 1
Take the base off the pedal and swing the board out. Identify TP-1 (written on the board), VR1, VR2 and VR3.

STEP 2
Hook the scope up to TP-1 (with the ground clip of the scope clipped to the metal pedal body. Plug a lead into the input - but don't plug the other end of the lead in (this is only so the pedal will turn on). Plug the ASA adapter into the pedal if you are using one. Turn the pedal on. The clock signal is "free running" - it doesn't need an input signal to be there. On the scope, set the sweep to 50 micro-seconds/division, and volts per division to 2. Check that you can see a clean square wave. Don't worry about the service note that says "power supply 8V". Make sure the pedal knobs are set to fully counterclockwise (e.g. set to "minimum"). Adjust VR-3 until the square wave you see ("T" in the service notes) is just less than 3 divisions on the scope. That's it.

STEP 3
Put a 200Hz sine-wave tone into the input of the pedal (I just used a test tone WAV file I made using cool edit, sent out of my laptop's sound card). Check the "size" of the tone with the scope - the input is at terminal 3 of the circuit board. Make sure the signal is about 300 milli-volts peak-to-peak. Hook the scope up to terminal 7 on the circuit board (purple wire on my DM-2). Set the scope to 3 milliseconds/division and volts per division to 0.5 Set the pedal knobs to "off" (maximum counterclockwise). You may not see anything but a flat line on the scope at this point. Turn VR-1 until you see a sine-wave appear. Adjust the volts/division on the scope until it fills the screen on the scope. Now carefully adjust VR-1 until the waveform on the scope is as pure a sine wave as it can be, with the maximum amplitude you can get - a smooth wave is what you are looking for (it won't be exactly perfect, but it will be close). That's it.

STEP 4
Leave everything as it was for Step 3, but set the scope input to "AC" and change the volts/division to 0.1. Touch the scope probe to the wiper of VR-2 (of the 3 solder pads for VR-2, it's the one closest to the NE570 chip). You should see what appears to be two strange waveforms. When you adjust VR-2, the waveforms will move "closer together" or "further apart". Adjust VR-2 until the two waveforms sit exactly on top of each other. That's it. Close up the pedal, you are done.

I've just looked at the schematic for the DM-3 and from a trim-pot setting perspective, it appears to be identical to the DM-2:
- in step (2) you would adjust RT-3 in the DM-3. I'm not sure if "TP-1" exists in a DM-3, if not the signal you want is on pin 4 of the 3102 IC.
- in step (3) you would adjust RT-1 in the DM-3
- in step (4) you would adjust RT-2 in the DM-3

Boss SG-1, the "mystique" of the vintage pedal…

SG-1 pedals are expensive because they are rare, not because they are "vintage-and-awesome". They are rare because nobody bought them way back when they were made because they were… "*different*".

So what does that mean?

Technically, the SG-1 looks like this:

[Image]

The heart of the swell effect is the FET.

Imagine things start out with no signal coming into the pedal, and everything sitting at "zero". In this state the FET is turned fully on (zero volts on the FET gate turns it on) and the input signal is shorted to ground. No sound will come out of the pedal.

If a note is plucked on the guitar, the following things happen:

1) The input buffer passes signal, but the signal can't pass to the output buffer because the FET is shorted to ground.
2) The amplifier and rectifier take the input signal and turn it into a DC voltage that it proportional to the strength of the input signal. The attack control circuit then applies a "ramp" voltage to the FET which slowly turns the FET off. As the FET turns off, it allows more and more signal to pass to the output buffer and we have a swell. Technically, the attack control contains an RC filter and the attack knob adjusts the "R" part of the filter – which changes the time-constant.
3) The signal decays and eventually the voltage coming out of the rectifier falls to zero turning the FET fully on again which mutes the sound and the system is ready for the next swell.

The sensitivity knob is used to control the gain of the amplifier. Modern guitar pickups have high output and they drive the gating amplifier properly with very little gain needed – usually setting the sensitivity control to around 9 o'clock is about right. Increasing the sensitivity will eventually saturate the gating amplifier and the swell effect will be lost.

There are quite a few implications from this design.

***Only one of the knobs changes the sound of the pedal*.** Only the "attack" knob is designed to change the sound of the pedal. The "sensitivity" knob is used to match the pedal to the output level of the instrument connected – it is essentially a *set-once-then-forget* kind of control, it is not a control that you would use dynamically to change the character of the sound.

***The attack control is somewhat limited*.** The attack only goes out to about 300ms which gives a nice bit of a swell, but not as much as you might expect (300ms is about the time it takes to say the word "and" if you say it quickly). Also, it is hard for the ear to tell the difference between 300ms (knob fully clockwise) and 150ms (knob at 12 o'clock) - so the attack control seems like it doesn't do much.

Held notes decay "strangely". If you hold a note, the decay of the note gets "lumpy" when it starts to tail off. This is because the amplifier/rectifier pair does not produce a smooth output at low drive levels.

***The tracking might not be as good as you expect*.** Longer attack times will require slower picking, possibly with gaps between the notes. When using longer attack times, careful adjustment of the sensitivity will be required to get the best results. Strong, even picking will be required.

***The pedal is slightly noisy – there is a hint of fizz or "hash" that can be heard along with the decaying note*.** In the Boss design, the amplifier is driven "to the rails" and every time output voltage of the opamp is hits a rail it puts a tiny noise into the power supply. Add up all these tiny bits of noise and you get just that hint of "fizz" in the audio in this pedal. This is completely normal and unavoidable with the Boss design.

Pedal impedance and signal loss

"Impedance matching" of pedals is not as straightforward as it might appear at first glance.

For the record, "matched impedance" is a wonderful thing because it gives maximum power transfer. This is important when you are transferring substantial quantities of power around, like in a power-amp to speaker connection.

In pedals, however, the thing we are most interested in is signal transfer. Here are a couple of examples that look at impedance vs. signal transfer, and show why "matched" impedance is not what we seek for pedal connections.

Assume a guitar is plugged into a high impedance pedal input (pedal #1) - the pickups won't be loaded down and the guitar will perform as required (there is a lot of literature on pickup loading and the effect on tone - I won't go into it here).

Now imagine a second pedal connected to the output of the first pedal (pedal #2).

Situation 1: Assume that pedal #1 has a low impedance output and that pedal #2 has a high impedance input. In any circuit like this the maximum voltage is developed across the highest impedance in the circuit. If pedal #2 has an input impedance 100 times bigger than the output impedance of Pedal #1, then 100/101 of the signal will be applied to the input of pedal #2 (and 1/101 of the signal will drop across the output of pedal #1).

Situation 2: Assume that pedal #1 has a high impedance output and pedal #2 has a high impedance input (the output of pedal #1 is "matched" to input of pedal #2). Again, the maximum voltage is developed across the highest impedance in the circuit, but if both pedals are the same impedance, then half of the signal will be applied to the input of pedal #2 (and half of the signal will drop across the output of pedal #1)...

So what does this mean?
In situation 1 the input voltage to pedal #2 is 100/101 (or close to 100%) of the output of pedal #1, and 100% = no signal loss with a low-to-high impedance connection.

In situation 2 the input voltage to pedal #2 is 50% of the output of pedal #1, and 50% = 3dB signal loss with a "matched" impedance connection.

Conclusions
A "perfect" pedal would have infinitely high input impedance (in reality Meg-Ohms) and zero output impedance (in reality a few hundreds of Ohms).

The Boss FA-1 is a pretty good example of this...

Pedal Power Supply Notes

G'day!

I've been using the power supply in the attached schematic to power pedals for about 3 years now (I've built six so far). It is the "standard" form of power supply for 78XX style regulators (from the spec sheet). It works with no problems powering my assorted pedals - analogue and digital, Boss and others, single and dual pedals.

Total cost was about $20. The 15VDC 1000mA "wall wart" that I use to drive it was bought at a thrift store for $1 - I think it's from a printer.

Notes:
1) The high output blue LED is optional. If you use a normal LED, change the resistor from 2k2 to 560 ohms (I used 2k2 resistor with the high output blue LED because with a 560 ohm resister, it was blinding... use a 560 ohm resistor if blinding floats your boat!). A LED should be used - the 7809 regulator needs a small load if there are no pedals plugged in, plus it tells you if the supply is actually working.

2) The bridge rectifier could be a 5 amp type if you want the whole thing to be more robust (but more expensive). I have built three of these now with the 1 Amp bridge and haven't had any problems.

3) The 7809 *must* be bolted to a heatsink (preferably aluminium, preferably at least 10 square cm in size) and heatsink compound *must* be used. The metal tab on the 7809 is at "ground" potential, so be careful with ground loops - you can use a mica washer isolating kit if you are having trouble.

4) The 1000µF and 10µF capacitors are "electrolytic" type. Higher voltages are OK, but they will be bigger physically.

5) The 0.1µF capacitors are "metal film" type. Higher voltages are OK, but they will be bigger physically. I just used some 25V ones I had in the junk box. These capacitors should be as physically close to the 7809 as possible - I soldered mine directly to the leads of the 7809.

6) To be completely safe, a fuse should be added before the bridge rectifier (1 amp slo-blow). I've never bothered because of the extra cost and haven't had problems so far.

7) To get the power to the pedals, I bought some old cheap "plug packs" at the thrift store, cut the leads off them and joined the leads all to the 9VDC output (a sort of octopus coming out of the power supply). You could also buy new connectors from the electronics store and build a chain. Be careful with polarity... center of the connector is negative/ground.

THIS INFORMATION IS PROVIDED FOR THOSE WHO WANT TO EXPERIMENT. IT IS PROVIDED WITH NO WARRANTY OF ANY SORT...

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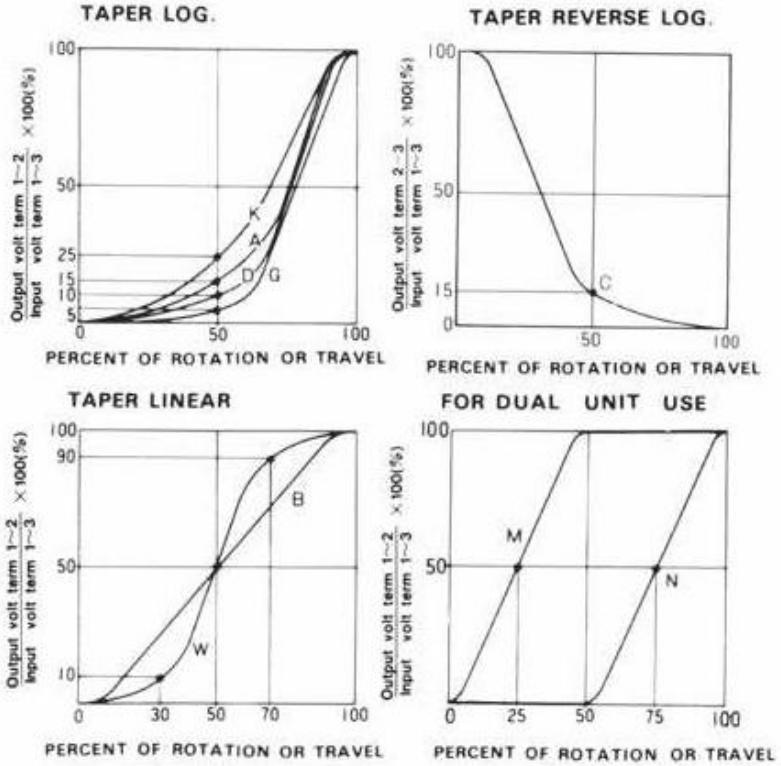
- Home
- About us
- Products
- What's New
- Contact Us
- Japanese

Potentiometer
- Top
- Flat type
- Slide type
- Specification

Electrical characteristics & Application notes

Standard resistance value	500, 1K, 5K, 10K, 50K, 100K, 500K, 1M, 2M
Resistance tolerance	500 ohms to 2M ohms - +-20% over 2M ohms - +-30%
Resistance taper	
Residual resistance	Ask us.
Switch contact resistance	Less than 50m ohms
Rotational (sliding) life	15,000 cycles for normal, 300,000 cycles for long life type
Switch endurance	The contact resitance after 5,000 cycles is less than 0.2 ohm
Rotational (sliding) noise	Less than 47mV at DC 20V (except 103-N and 103-S2) Less than 68mV for 103-N and 103-S2
Matching tolerance	Tone control - Use +- 3dB at 50% rotation Volume control - Use +-3dB between 0to -40dB Volume control of higher grade will be provided upon request

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