

The Blue Guitar

Electar Tube 30: Conversion to **BLUES EXPRESS PLUS**

Introduction

After playing my **BLUES EXPRESS** amp in all of its various incarnations over the past year, I had to admit that while the amp could produce some clear and chimey sounds, it really didn't get into the cranked Marshall territory also associated with the real Trainwrecks. After reading what Dr Z. had to say about **CONJUNCTIVE FILTERS** in Tonequest last January [see **DISCUSSION**], I decided to experiment with them in my **BLUES EXPRESS** amp, first using a 10k/2200pF RC network across the plates of the EL84 output tubes. While this combination produced an interesting effect that sounded like a well-tuned bandpass filter, it also produced a strong oscillation with certain settings of the amp controls. I tried raising the value of the cap to the 0.05uF value suggested in an RCA manual from the 50's and found that it drained much of the highs from the sound, almost like listening to the amp through a pillow.

If you read the article on the original **BLUES EXPRESS** you might remember that I was jumping through hoops last summer trying to cut back on the excessive highs without "neutering" the sound. So I proceeded to undo most of the tweaks I added in last summer to reduce the highs, finally ending up with a preamp design very similar to the schematics posted on the various Trainwrecks and clones. Without the conjunctive filter, the sound was extremely harsh, but switching in the c-filter would smooth it out dramatically. I eventually eliminated the center-off position of the c-filter switch since the amp was not usable at all with the filter switched off; I did leave in a two-position switch so that I could choose between a more stable setting and one that was "on the edge".

This amp does not use negative feedback so my ordeals may not be typical for conjunctive filters, but it was very touchy trying to find the right combination of caps for the c-filter switch: every time I did anything to change the gain structure or timbre of the preamp, it would change the effect of the c-filter. The combination I settled on was a 0.033uF/630v poly cap always in the circuit plus a switched 0.047uF cap added in series to bring the net capacitance down to ~0.02uF. Incidentally, I replaced the stock OT with a tweed deluxe OT from New Sensor and ended up using the same values in the c-filter. My conclusion is that a conjunctive filter can be an effective way to cut excessive highs in a circuit without having to dump them through caps to ground throughout the preamp. They are also supposed to even out the response of the power amp throughout the normal frequency range.

In addition to the oscillations mentioned above, there was a separate problem I encountered with all of the controls dimed (except for the treble control set to "0"). I suspect that with these settings there was too much voltage on the grid of the 3rd stage and it was causing the sound to drop out erratically. I eventually solved that problem by replacing the 100k plate resistor for the second stage with a split load combination of 33k going to the plate and 68k going to B+; the split load can be thought of as a voltage divider right on the plate which will reduce the signal level without drastically altering the tone or timbre of the signal. [See **BLUE PAPER #010629** for more information on split load plate resistors.]

With the conjunctive filter smoothing out the sound of the amp radically, one of my favorite control settings is "everything at 10", with a Marshall Power Brake used to reduce the room volume to a level acceptable to my neighbors. Alternately, I will set the treble, bass and mid controls back to 7 for more clarity and definition. I added two other switches to this amp design. The **GAIN** switch toggles the grid load for the 3rd from 56k (in the **LOW GAIN** mode) to 103k (in the **HIGH GAIN** mode); the **FAT**

switch toggles the value of the capacitor going into the PI from 0.0068uF to 0.032uF (which consists of a 0.02uF Sprague Orange Drop Type 418P cap in parallel with a 1200pF ceramic cap). The **LOW-FAT** mode runs the 0.032uF blended capacitance in series with a 0.01uF 418P cap, which is jumpered out of the circuit by the switch. One advantage to such a wiring scheme is that the DC voltage is blocked by the first cap (or pair of caps in this case); in this particular circuit you also get the benefit of mixed capacitor types in both modes.

Details

These mods were done to my existing **BLUES EXPRESS** rebuild of the Electar Tube 30 so you need to consult [that article](#) for all of the details of the basic conversion. The same eyelet board was used, with just a few parts replaced. I did rewire the controls a bit, and added in a 3 position **BRIGHT** switch (using switched series caps to select between 250pf and 129pF). And also added the **CONJUNCTIVE FILTER** switch as well as the **GAIN** and **FAT** switches. I will now proceed through the audio signal path pointing out the changes made and the reasons for making the changes.

The original **BLUES EXPRESS** used a 47k grid stopper on the first stage along with a pot to vary the grid load from 22k to 1022k. This pot had very little effect in the **BLUES EXPRESS PLUS** so it was removed, as was the grid stopper. None of the "Wreck sightings" have reported a grid stopper on the input; I think that without a grid stopper the controls on the guitar have a bigger effect on the sound. You typically turn down the guitar volume pot a bit to get the cleaner sounds; with a 250k audio taper pot set to "8" you might consider the top part of the resistive path inside the pot to be not completely unlike a grid stopper equal to perhaps 50k.

There were a few changes that I made to the tone stack. Most of the earlier incarnations of this amp used a 50pF/1kV ceramic treble cap, but the pictures of a Liverpool being sold on ebay showed a mica treble cap so I decided to try one out. With the mica cap, the highs seemed to be fuller and stronger, while the ceramic cap gave the amp a certain "warm fuzzy" quality that was very responsive to playing techniques, with picked harmonics jumping out of the speakers. I ended up using a 22pF mica cap in parallel with a 39pF ceramic cap for a total capacitance of 61pF and a blend of the better qualities of each cap. The highs dropped off fairly fast as I turned down the 1M audio taper **TREBLE** pot from 10, so I replaced that with a 1M linear taper pot (incidentally with a SPST push-pull switch that I use to activate the **HIGH-FAT** mode.)

After the **VOLUME** control, the 100k grid stopper on the second stage of the earlier **BLUES EXPRESS** amp was replaced with the 820 ohm one reportedly seen on many Trainwrecks. I had used a 100k grid stopper here to cut the highs a bit; I will not attempt to guess the effect of a grid stopper as small as 820 but I put it in anyway. I used a 0.0015uF 715P Orange Drop resistor to bypass the 2nd stage plate resistor, primarily to eliminate oscillations accentuated by the conjunctive filter, but it also smooths out the sound a bit. By adding a cap here, I was able to use considerably smaller caps in the conjunctive filter for an improvement in the overall sound of the amp. Depending on the OT and specific values used in the c-filter, the value of this cap may need to be adjusted.

The coupling cap after the 2nd stage and the grid load for the 3rd stage have been subject to much discussion. I stuck with the questionable values of 0.001uF and 56k in my **BLUES EXPRESS** because I thought that they delivered some very chimey sounds. But I experimented with many different caps and combinations of caps here and settled on a 0.001uF 418P cap bypassed with a 1200pF/1kV ceramic cap for a total capacitance of 0.0022uF. As for the 3rd stage grid load, I used trim pots to experiment with different values between 56k and 150k. The higher values will give you a lot more gain and distortion, but I didn't feel that they "cleaned up" as nicely when you backed off the amp or guitar volume controls

so I ended up using 56k here in conjunction with a 47k resistor toggled in and out of the circuit with the **GAIN** switch.

Proceeding to the 3rd stage, I ended up using a 50pF/1kV ceramic cap across the plate resistor to reduce oscillations in the amp (the original **BLUES EXPRESS** had used 250pF caps across the 2nd and 3rd stage plate resistors). For the coupling cap into the cathodyne phase inverter I tried adding a 1200pF/1kV ceramic cap across the 0.02uF 418P Orange Drop cap and was pleased with the results (Thanks to Trace at AMPAGE for telling us about that trick!) The amp was still fairly heavy on the bass so I decided to wire in the **FAT** switch mentioned earlier which reduces the 0.032uF blended capacitance going into the PI to approximately 0.0068uF for the **LOW-FAT** mode.

The rest of the amp was basically unchanged except for the addition of the conjunctive filter and switch on the plates of the EL84's. I have been using a 5 lug terminal strip to secure the screen resistors, which left me two ungrounded lugs to mount a 10k/10W resistor and a 0.033uF poly cap. One end of the components is soldered to the tube socket pins while the other is soldered to the terminal strip. I measured the peak voltage across the 10k resistor using my DMM and got readings as high as 325vac, hence the use of a 10 watt resistor here (which does get very warm when the amp is cranked up). Alternately, one of the chassis-mount 50W resistors could be used here.

The **CONJUNCTIVE FILTER** switch was originally a center-off SPDT full-sized toggle switch so that I could compare the sound of the amp with and without a c-filter, as well as trying out two different capacitances. As I proceeded to rewire the preamp, the unfiltered sound got so harsh that I eliminated that option by using a two-position toggle switch. At this time, I am switching in a 0.047uF/630v poly cap in series with the 0.033uF/630v poly cap to drop the capacitance down to approximately 0.02uF.

Incidentally, the **CONJUNCTIVE FILTER** switch is located on the bottom of the chassis and can make a loud "pop" when toggled; you would want to turn the amp off before toggling the switch, or at least turn the volume down. Furthermore, the voltages I measured are in excess of the switch rating so I keep my other hand away from any grounds when toggling the switch (if you have ever seen a broken switch you can see how it would be possible for the metal bat to conduct the full voltage present on the terminals).

Final notes

They say that you can't teach an old dog new tricks but this rebuild of my older **BLUES EXPRESS** amp has pushed it into completely different directions. While the original **BLUES EXPRESS** could get the clear and chimey sounds of a Vox AC-30 (along with the more gnarly sounds of an AC-30 cranked up), it did not have enough gain and low frequency response to get the sounds of a cranked Marshall. With the Gain and Fat switches kicked in the **BLUES EXPRESS PLUS** has a lot of gain and a nice thick bottom, although I usually toggle those switches off for bluesier sounds. However, if clear and chimey is your cup of tea you might want to look into the original **BLUES EXPRESS** design instead.

Good luck!

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Trainwreck Express and Blues Express/Plus files:

Blues Express Plus schematic

<http://www.blueguitar.org/bluexp12.pdf>

Blues Express Plus pictures

<http://www.blueguitar.org/bluexpix.zip>

Blue Paper #010629: Split Load Plate Resistors

<http://www.blueguitar.org/bp010629.pdf>

The original Blues Express article

<http://www.blueguitar.org/bluesxpr.pdf>

Trainwreck Express schematics

<http://www.blueguitar.org/wreckxpr.pdf>

Blues Express schematics

<http://www.blueguitar.org/blxprsch.pdf>

Blues Express pictures and drawings

<http://www.blueguitar.org/e30xprss.zip>

Blues Express sound samples

<http://www.blueguitar.org/bluesxpr.mp3>

Spec sheets on vulcanized fibreboard

<http://www.blueguitar.org/fishpapr.zip>