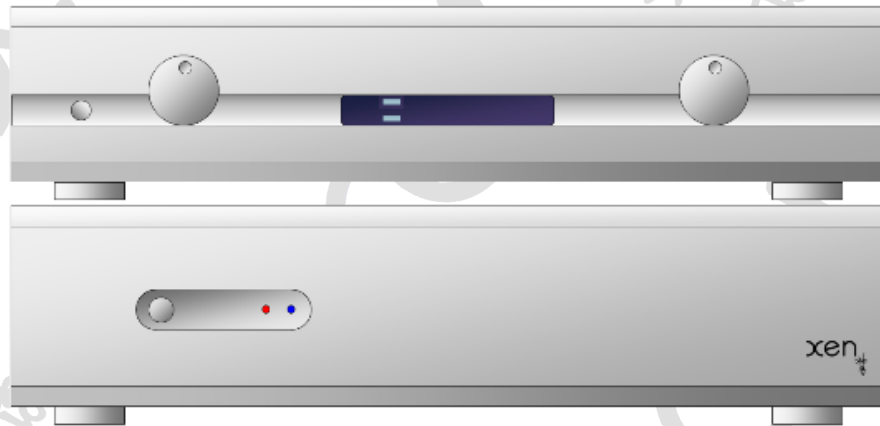


## NoQuiPas — A Pure Dual-Mono, JFET-Buffered, Fully-Balanced Passive Preamp

XEN Audio

April 2022



Designed by

xen



### Background

As posted earlier at the F5X thread, one XEN team member made a summer amp with LM4780 wired as bridged inverting amp. As this has a closed loop gain about 2x that of the F5X, the F5X Pre has too much gain for his audio chain, and he wish to have a very simple, mostly passive solution without gain.

### Why Buffered ?

A passive preamp is essentially a source selector, followed by an attenuator for volume control. But as well explained by Nelson Pass in his First Watt B1 manual, a discrete buffer after the attenuator has many advantages. In our particular case, as the LM4780 is wired in inverting mode, a low ( <100R ) and constant output impedance of the preamp, independent of volume level, is essential. Which is what the name stands for -- **Not Quite Passive Pre**.

After some detailed discussions and considerations, we decided on the following configuration :

1. Selection between 6 signal sources, 4 RCA and 2 XLR
2. Single-ended to balanced conversion by low-distortion audio transformer
3. Volume control by pot, or switched attenuator after balanced conversion
4. Discrete unity-gain buffers with JFET inputs
5. External power supply followed by local regulators, totally separate for each channel
6. Complete dual-mono construction with channels in separate compartments, maximum separation
7. All switches mechanical, no relays, and no additional digital electronics

A word about the decision to use (1:1) transformers. While we can also deploy a SE to balanced converter, such as our NEXEN module, a transformer not only allows the simplest conversion, but also source-preamp Gnd isolations, and simple configuration for either single-ended or balanced outputs. There are well-made input transformers available with distortion levels equal to if not better than a

NEXEN. It saves all the trouble of additional power supplies, etc., and guarantees there is no DC offsets at the output.

### Dual Mono Construction

The dual mono construction is a particular feature of our design. We actually started off, like most commercial solutions, with one source selector knob on the left, and one volume knob on the right. This implies a 4-deck rotary switch and a 4-gang attenuator, and no physical separation between left and right channels. This makes a dual-mono construction impossible. And in many cases, the wiring also becomes chaotic and unnecessarily long. An alternative is of course to use four knobs at the front panel, each channel having its separate source selection and volume knobs. It is not a solution we want to use.

Our unique solution is the representation of the strong mechanical background of our team members. We started off the layout with the ideal placement of the electronics, following the same principles of the F5X Pre. There are two separate compartments, each housing the source selector, input transformer, attenuator and output buffers for the respective channel. The separate left and right selector switches, as well as the separate attenuators, are then linked together, and to the manual knobs at the front, via timing belts and pulleys. It is this unique mechanical transmission system that enables a truly dual-mono electronic layout.

As we are accommodating balanced inputs and outputs, the selector switch and attenuator for each channel have to be 2-pole and 2-gang respectively. But because they only need to take care of one channel each, “normal stereo” source selection switch and attenuator can be used, allowing a much wider selection.

### Component choice

For the source selector, a 2-pole 6-position rotary switch is required. The Elma 01 series is chosen as because of its compactness and PCB mounting option, which greatly simplifies wiring. There are quite a few 10k:10k input transformers for great quality to choose from, such as Jensen JT-11P-1 or Lundahl LL1540. But we settled on the Cinemag CMLI-15-15B because of availability and distortion specifications. Compatible PCBs have been designed for all 3 candidates on the same footprint, allowing easy component swap as desired.

We firmly believe in switched attenuators, even though the JFET buffer downstream makes the wiper contact of a normal potentiometer much less critical. The TKD 2P-2511 (not the same as 2CP-2511) is first choice for its build quality and compactness, but the layout can accommodate almost any commercial switched attenuators or potentiometers, including DACT, Grayhill Ladder, ALPS RK27, etc. Some team members like the build quality of the EIZZ switched attenuator, but not the carbon resistors. So we got our own gold-plated PCBs made and replaced all resistors by Dale RN55, and changed the values to suit our own attenuator taper.

The inverted LM4780 we intend to use downstream has a  $Z_{in}$  of 10k. And as published before<sup>[1]</sup>, a source follower using 2SK117BL has only 3dB difference in distortion compared with 2SK170BL. So 2x 2SK209GR, or 1x selected 2SK2145GR can be used in parallel as an equivalent to 2SK170BL. This is what we have used successfully in our active crossovers<sup>[2]</sup>, and also becomes the natural choice here. But since it is on a DIP8 footprint, one can have fun also with opamp rolling.

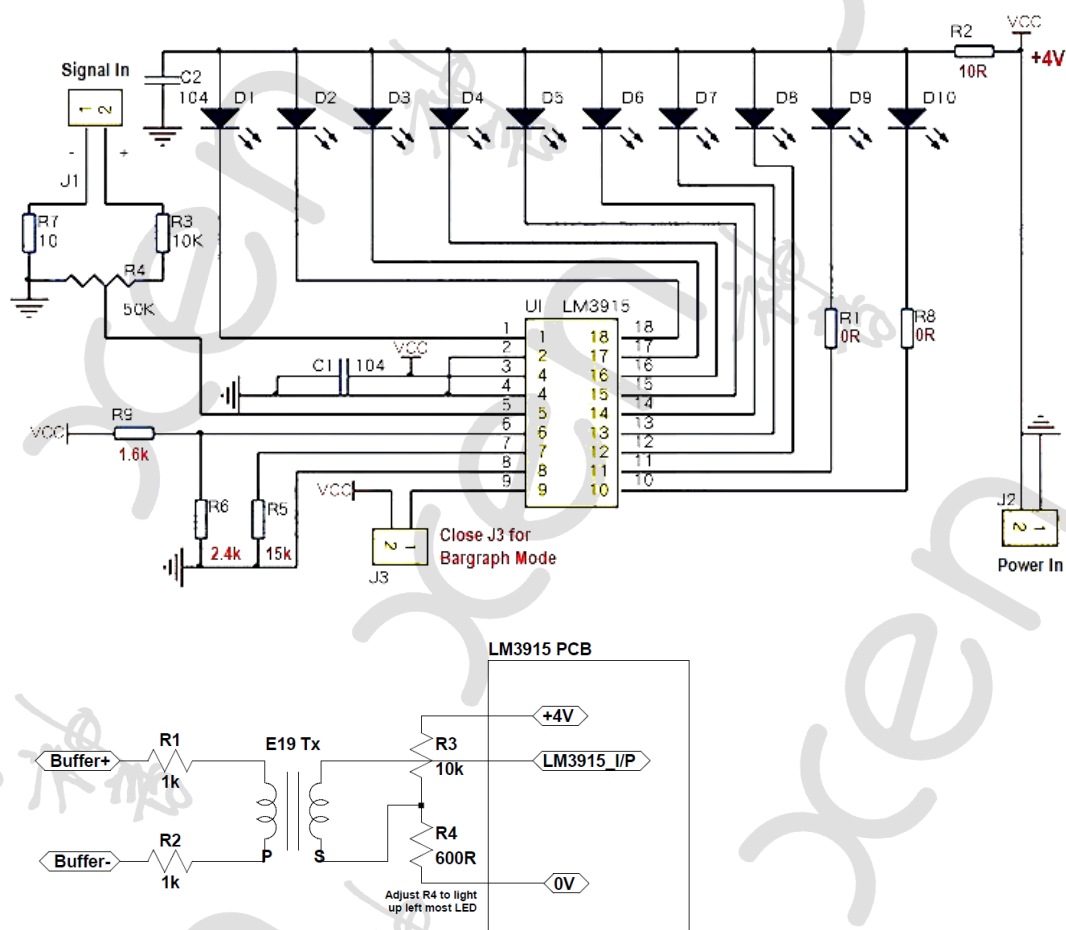
For a best possible preamp solution, especially when largely passive, it is an easy decision to go for external power supplies. This also open up all options such as transformer based linear regulators, or battery power. The choice is individual. One of the first prototypes uses 2x 2.8VA Block EI

transformers with BYV26C diodes, 78L12/79L12 pre-regs, and a 8-core screened cable with Neutricon connectors at the preamp case, just like the F5X Preamp. This is followed by XEN 9V discrete regulators inside the preamp case, right next to the JFET buffers.

## For the Aesthetics

The case is based on the same design of the F5X Pre, but 5mm lower in height. With minimalistic features of 2 knobs and one push button for power, a slim display window in the middle provides a break in width and a central focus point visually. Adhering to the no-digital requirement, two bar-graph VU meter with white and red LEDs provides the perfect analogue solution. These are based on the very versatile LM3915 IC, and a kit can be had from the internet for very little expense.

To make it even more minimalistic, we want have an option to use the left-most LED as power indicator. That means the lowest level LED has to light up at 0V input signal. A simple means of level shifting is required. This is achieved by using low-cost audio transformers to couple the buffer outputs to the LM3915 inputs. The transformers offer additional advantages, namely the ability to couple the balanced output to the VU meter, and more important ground isolation between the two. The additional expense is very well spent.



## Powering the VU Meters

The 2 VU meters have a total of twenty LEDs. When they all light up in bar-graph mode, they consume a minimum of 40mA, which is rather a lot. To avoid additional complexity, we want to make

use of the same supply as the buffers. And to use the 24V power efficiently, we decided on a switching DC-DC converter ( Recom RO-2405s at 100kHz ) with 5V output. This also allows galvanic isolation of the LM3915s from the buffers. When converted down to 5V, the current consumption is reduced by a factor of 4. Since the switcher output is not particularly well regulated, a 4V LDO is added in between. An additional CRC filter isolates the switcher from the buffer regulators. And of course, there is always the ultimo-option to add an additional 5V linear supply for the bar-graphs alone.

## References

1. <https://www.diyaudio.com/community/threads/njfets-for-source-follower-applications.329131/>
2. <https://www.diyaudio.com/community/threads/a-modular-analogue-active-crossover-filter-solution.329458/>