

# The Pass Labs X.8 Amplifiers

## Introduction

For many years there has been considerable faith that if we simply keep improving the measurements of components such as amplifiers then they will sound better. Initially this was truly the case – equipment was sufficiently flawed from an objective standpoint that better measurements matched up with subjective experience.

At some level of objective quality there started to be a disconnect, and some audiophiles began to lose the faith. One of the responses to this was to examine more exotic sources of distortion in the equipment while some others simply worked to continue to reduce the flaws that were already understood. There's no doubt that some real progress resulted from these efforts, and now you can purchase products at reasonable prices which measure far better than the old stuff.

But the disconnect between the customer's perceptions and the measurements persists, and there have been cases of state-of-the-art engineering resulting in economic failure, apparently because people didn't care for the sound.

Well, of course you are dealing with people, and that will complicate any endeavor. The customer wants what the customer wants. I have heard arguments that audiophiles are irrational, that decisions are based on appearance or cost or advertising. Certainly there is plenty of that, and there have been plenty of blind tests that have demonstrated that “audiophiles can't hear the difference”, *at least in the context of that test*.

But I don't think that's the whole story. My experience is that under the right conditions the customer can often hear the difference, and his observations are not to be ignored.

First, it has to be acknowledged that the science of cognitive perception is still in its infancy, and the ear is not really a microphone and the brain is not a tape recorder. The data we do have on this subject is a little like quantum mechanics – we have to change our view to make sense of the illusions and paradoxes that accompany the interpretation of sensory input.

With regard to amplifiers at least, I think we already have the measurement data in hand. The problem is in our failure to interpret it with respect to human perception.

This puts some emphasis back on listening tests - extensive long-term tests with reliable listeners and familiar equipment and environments. This is not a cheap and easy procedure. Even assuming that the listener(s) really can hear, we still have the vagaries of individual taste, and not a large population of qualified listeners and systems.

In the end, even if we can design around the perceptions of a small qualified listening panel, we are still inevitably aiming at a minority audience in the real world. That's OK with me – One percent of this market is still a lot of amplifiers.

The thing is, I don't think the audiophile wants technical perfection. He wants to be happy.

Look at it this way: In the market there are rows of bottled drinking water. Some are contaminated with natural mineral content and carbonated, some have sugar-based substances added, some have been harvested from glaciers. They all appear to be more expensive than gasoline. Where is the pure distilled water? Probably on the bottom shelf, possibly even elsewhere in the store. It seems to be the least popular, even if it is cheaper than gasoline.

Since the release of the X.5 series seven years ago we began working on what has now become the X.8 amplifiers. They embody everything we know, and while I can't divulge all the details, I can tell you about some things which might interest you.

### More is More

There are times when “less is more”, particularly if you are building little “flea watt” amplifiers, where simple Class A circuits sound exceptionally good when the loudspeaker is easy and the musical material isn't too complex or dynamic. Arguably I pioneered the solid state genre with the 1994 single-stage “Zen Amp” and subsequent designs.

The X.8 series is intended to deliver some of the qualities found in these little amplifiers, but with dramatically more power and accuracy. The formula is simple: More hardware for more power with fewer stages and lower distortion with less feedback. In addition, The various elements of the amplifiers have to be individually adjusted to operate in the harmony that delivers the musical experience.

### More Class A

The redesigned output stages of the X.8 series takes the lessons learned from the Xs amplifiers – bigger hardware biased more deeply into the Class A operating region. In turn, the Xs design was inspired by the successes of the X.5 series of amplifiers from 2006.

Two important things emerged with the X.5 series, the first being the value of a large push-pull Class A operating envelope for low distortion and good control of a loudspeaker. Even the Class AB models of the X.5's had large Class A bias values, so that the performance enjoyed Class A operation at ordinary listening levels.

The second element is the higher level of single-ended Class A bias current applied to the output stage, allowing arbitrary control of the values and ratios of the second and third harmonic characteristic. The subtle qualities of this approach result in a sonic signature which is unique to the X.8 series, but goes back to character of previous amplifiers which have had a particularly successful sound. These amplifiers had good measurement specs – low distortion, wide bandwidth, high current, and so on, but were not “state of the art” in any particular category, simply a good balance of these qualities.

One thing they also had in common was that the distortion they did have was a balance of low order harmonics, dominantly second at low levels and dominantly third at high power.

Are we deliberately creating distortion to achieve this? No. We are optimizing the remaining distortion character of an already low distortion amplifier for a superior musical character.

#### More Heat Sink

Part of the “more and bigger hardware” is more metal. One of the first things you will notice is that the smaller amplifier models, the X150.8, X250.8, XA30.8, XA60.8 and XA100.8 have new and larger heat sinks (and also more output devices). This upgrade was essential to dissipate the energy of the larger bias currents.

#### More Front End

Some of the biggest improvements come from the design of the “front end” circuit which contains the first two of the three stages of the amplifier - the input stage and the voltage gain stage. In the X.5 series, all the amplifiers had essentially the same front end circuit, usable interchangeably. This is not quite true of the X.8 series, where each model has subtle differences design to most perfectly complement the differences found in each output stage. Each amplifier in the X.8 series has a individual characteristic depending on the number of devices, heat sinking, supply voltage and push-pull versus single-ended bias currents.

The output stages of each model have individual transfer curves and its their favorite feedback figures which must be complemented by the front ends. This was accomplished by using measurements to set a baseline objective performance and then adjusting the circuitry through extensive listening on six different systems.

The front ends use a mix of four each of complementary Jfet, Mosfet, and Bipolar devices by Toshiba. These have been discontinued, but we had the wisdom to have a large inventory of these superior parts. We run these matched input Jfet devices undegenerated for the square-law character, followed by Bipolar cascodes and matched Common Source mode Mosfets.

We have carefully adjusted the bias and loading off the Drains of the gain devices, which selects the most appropriate load-line character and the feedback around the output stage.

The voltage gain stages of the amplifiers also sport much larger heat sinks for much higher bias currents, critical to low distortion and driving the large output stages.

The result is a front end with high stability, low distortion and noise. It has a very high input and is DC coupled. There are no compensation capacitors – in fact there are no capacitors in the amplifier circuit except across the shunt bias regulators and (obviously) the power supply.

## More Power Supply

The power supplies for the X.8 series are generally larger than their predecessors. The models X150.8, X250.8, XA30.8, XA60.8, and XA100.8 have a third more storage capacitance and all have new CRC filtering to round out the edges of the supply ripple.

We have incorporated additional RF filtering in the AC primary circuits. The supplies still use paralleled fast/soft rectifiers and very large toroidal transformers from Plitron. The power on/off switching is new, with a 400 amp Triac taking the inrush surge and then paralleled by a high current relay. The new system has a stand-by draw in conformance to 1 watt requirements.

The front end circuits of the amplifiers have massively larger power supply decoupling – the ripple is now measured in microvolts. This coupled with interleaved layout techniques has reduce the output noise of the amplifiers by another 10 dB. The range between peak output and average noise floor is greater than 130 dB.

## Conclusion

So there you have it. Pass Laboratories celebrates its twenty-second year by presenting the best amplifiers we have ever made. If you have heard the qualities of the highly acclaimed Xs series of amplifiers you will have had a taste of what we offer here – amplifiers that bridge the gap between measured performance and subjective experience: Amplifiers that invite you into the music.

## Product Summary:

### X.8 AMPLIFIERS – PRELIMINARY SPECIFICATIONS

	# CH	8 OHM POWER RMS /CH	CLASS A WATTS PEAK	# OUTPUT DEVICES	CURRENT AMPS PEAK	POWER CONSUMED WATTS
X150.8	2	150	15	40	20	200
X250.8	2	250	25	56	25	300
X350.8	2	350	35	72	30	500
X600.8	1	600	100	72	40	500
XA30.8	2	30	60	40	15	200
XA60.8	1	60	120	40	20	200
XA100.8	1	100	200	56	25	300
XA160.8	1	160	320	72	30	500
XA200.8	1	200	400	72	40	600