



Xs

amplifiers / preamplifiers

2014 PASS

P a s s L a b o r a t o r i e s

Xs Amplifiers

We began thinking about and working on a new amplifier design, initially referred to as the "Concept Amp" about four years ago. We felt that it was time for us to improve and build on the "X" amplifier design but to extend it to higher sonic performance.

Our first decision was that the amplifier should exist in a two chassis format so that we could make the power supply larger and isolate it physically from the amplifier channel for improved noise. We also decided to build it with as much heat sinking as possible so that we had a wide margin to use high bias on the output stages of the amplifier.

Desmond immediately went to work designing the physical package, very similar to what you see now and which has been exhibited at three CES displays.

Initial work on the audio circuit began with the design of high power constant current sources. The X.5 series successfully demonstrated the value of applying single-ended bias current to the output stage in lowering the distortion and shaping the transfer curve in a manner which allowed some additional control of the harmonic structure of that distortion. We felt that this could be greatly extended by dramatically increasing the amount of single-ended bias current by a factor of more than ten times, from a few watts of single-ended output power to hundreds of watts. The constant current sources were also newly designed to be far more neutral in their character than anything previously. Their DC value is controlled by an optically isolated control loop, and the AC value is run without loop feedback but is degenerated by a factor of about 20. The result is that they supply high bias current to the output stage of the amplifier but make no other contribution to the sound. Conveniently, the large heat sinks of the power



Xs 300

supply chassis were available for these high power constant current sources. They are considered part of the power supply, and dissipate slightly less than one-half the heat of the amplifier. At about the same time in 2009, Nelson Pass was examining the potential for SIT devices in his First Watt designs, which are low power amplifiers.

Through his relationship with SemiSouth he had the opportunity to commission a custom run of these power transistors whose character is very much like a Triode tube. It took nearly a year for the small quantity of these parts to arrive, and he began working on them with a view to creating a low power single-ended Class A amplifier using them.



Xs 300 Specifications

| | |
|-----------------------------|----------------|
| Low Frequency (Hz) | 1.5 |
| High Frequency (kHz) | 150 |
| Power at 8 Ohms | 300 |
| Power at 4 Ohms | 600 |
| Leaves Class A at pk | 600 |
| Power Consumption | 1000 |
| Temperature (°C) | 53 |
| Dimensions each (W x H x D) | 19 x 11.5 x 28 |
| Unit Weight (lbs) | 298 |
| Shipping Weight (lbs) | 346 |

PASS

Pass Laboratories

Xs Amplifiers

Work on both improvements to the "Concept Amps" and the SIT amplifiers proceeded in parallel through late 2010 and into 2011. In mid 2011 Nelson and the partners in Pass Labs heard the results of the work with the SIT devices in the form of a prototype of what would later be developed into the SIT-2 amplifier.

They found the sound of the SIT to have truly remarkable properties, and it was quickly decided "Whatever this is, we need to find a way to bottle it!". Not only did we need to bottle it, but we needed to put it in a much bigger bottle.

In a subjective arena where engineering has limitations, it is extremely helpful if you can recognize what you want when you hear it. If you have an example of the sound you are looking for, there is great advantage.

Because this sonic quality was so striking, it became easier to discover what modifications to the circuit would make it go away, and by the process of varying the design and listening to the result, Pass was able to objectively identify the qualities of the sound—information which remains proprietary. He began to alter the circuits of the prototype Concept Amp to bring out these qualities. In the end, a new output stage topology was chosen using power Mosfets with new values of single-ended and push-pull bias. A small amount of feedback was employed around the output stage.

The front end of the amplifier also was redesigned to a new topology which employed Cascode Local Feedback newly developed by Pass. The circuit bias was raised to a much higher Class A bias. It has a



Xs 150

higher input impedance, a lower output impedance, wider bandwidth, and most important, it specifically can be adjusted to complement the sonic qualities of the output stage.

Eight months later, the listeners at Pass Labs judged the amplifier design ready, and the two versions were named the Xs 150 and Xs 300.



Xs 150 Specifications

| | |
|-----------------------------|----------------|
| Low Frequency (Hz) | 1.5 |
| High Frequency (kHz) | 150 |
| Power at 8 Ohms | 150 |
| Power at 4 Ohms | 300 |
| Leaves Class A at pk | 300 |
| Power Consumption | 700 |
| Temperature (°C) | 53 |
| Dimensions each (W x H x D) | 19 x 11.5 x 22 |
| Unit Weight (lbs) | 230 |
| Shipping Weight (lbs) | 270 |

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Xs Preamplifier

There are people who do not know that Wayne Colburn has designed the Pass Labs preamplifier products for the last 20 years. Wayne's modesty has tended to keep him out of the spotlight. When we began development of the Xs power amplifier five years ago, we knew that we would also need a companion piece. Of course, back then we thought we could have this done in a year or so... Wayne was given carte blanche on the design and an unlimited budget, and lots of time to play with many exotic parts and materials.

Naturally the comparison will be made with its predecessor, the XP-30 line stage preamp. The most obvious difference is that the Xs comes in only two chassis, where the XP-30 had at least three chassis, one for supply and control, and one chassis per channel for as many channels as you might reasonably want.

The Xs is designed solely for two-channel operation, and it fits in two (larger) boxes. The volume controls are improved in performance with 0.5 dB steps, expanded dynamic range and lower noise.

The buffer stage for the volume control has been eliminated, giving an even simpler gain path. Improved circuit boards layout puts the cherry on top. Some of the materials are more exotic—the gain stages are mounted on ceramic circuit boards with gold plating.

The channel motherboards are made of Panasonic Megtron with immersion gold, which performs about as well as Teflon or Polyamide but without the adhesion properties. The power supplies use 4 ounce high temp FR406. While the two channels share a chassis, they are isolated on separate board systems with distance between them, crosstalk figures between channels are as good as the XP-30 separate chassis.



Xs Preamp

The three separate power supplies use the lowest noise transformers available and they incorporate filters on the AC line input, fast/soft recovery rectifiers, large storage capacitance and extensive regulation. The active regulation is followed by passive filtering using polypropylene capacitors. All this in machined aluminum cases. If like me, your eyesight is not what it once was, you will also appreciate the larger display. It does not automatically follow that more money and more exotic parts and such will result in a better sounding product. Fortunately there was lots of time available, and the back-and-forth process between Wayne and the four other listeners assured the finest product we could possibly make.



Xs Preamp Specifications

| | |
|---|----------------|
| Overall Gain (dB) | -90 to 10 |
| Frequency Response (dB) 2 and 60 kHz | -3 |
| Impedance (Ohm) | |
| Input, Balanced | 42,000 |
| Output, Balanced | 120 |
| Single Ended | 120 |
| CMRR (dB) 1 kHz | -65 |
| Cross-Talk (dB) 1kHz, Ref 1V | -100 |
| Signal to Noise Ratio (dB) 1kHz, Ref 5V | -110 |
| Power Consumption (W) | 55 |
| Dimensions (W x H x D) | |
| Control | 19 x 6.25 x 14 |
| Supply | 19 x 6.25 x 14 |
| Shipping Weight (lbs) | 80 |



PASS
Pass Laboratories

Our Goal

At Pass Labs we have one goal—to create products that invite you to listen. We want you to enjoy the experience so much that you go through your entire music collection—again and again... Each time a joyous discovery of something new. We want music lovers for the long haul.

To reach that goal, we continually strive to design amplifiers that deliver great sound, measure well and are reliable. This is achieved through ongoing R&D, and lots and lots of listening. Oscilloscopes and distortion analyzers are excellent tools, but they historically make lousy customers. Our real customers care most about the experience they get when they sit down to listen to their music.

Nelson Pass

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