

Pass Laboratories

X0 Owner's Manual

Introduction

The **X0** is a Class A audio preamplifier, the first X remote preamp produced by Pass Laboratories. It combines completely new design thought applied to a new topology and the experience of thirty five years of amplifier design.

This preamplifier flows from a commitment to create the best sounding product: a simple circuit with the most natural sonic characteristics. The X0 integrates power Mosfet and Fet devices in Class A operation in a simple topology in order to deliver the finest sound possible. This circuit is covered by US Patent # 5,376,899.

The circuitry of the X0 breaks new ground in simplicity and performance. Each gain stage consists of a dual monolithic Fet feeding power Mosfets. It is unique in providing superior flexibility and performance with balanced and unbalanced inputs and outputs, converting one to the other as desired without switches or adapters. It provides both balanced and unbalanced outputs independent of each other.

The X0 minimizes the number of components in the signal path, and yet retains exemplary objective performance specifications. More importantly, it pushes the edge of the art in exploring how much subjective quality is obtainable with a new but very elementary gain stage. The X0 employs a new type of volume control that offers an order of magnitude better performance than seen before in an electronic control. It provides over 70 dB of range, large voltage swing and very good measured performance. Most importantly it is subjectively outstanding.

Very few people are involved in the production of this product. I supervise all phases of the construction, and I test each preamplifier myself. If you have questions, comments, or problems, please feel free to contact me directly.

Thank you for purchasing this preamplifier. It is my sincere hope that you will enjoy its sound as much as I do.

Wayne Colburn

Serial #

Date:

Setup

The preamplifier has five sets of input connections, two sets of output connections, a tape loop and a full function remote control that mirrors the front panel functions.

It also has an AC line power connection. The amplifier's voltage and current rating are indicated on the rear. It will be either 240 volts, 120 volts, or 100 volts. A .5 amp 3AG slow blow fuse is provided with 100-120 volt units, and a .25 amp slow blow fuse is provided with 220-240 volt units. The frequency rating of the power supply is 50 to 60 Hz. The preamplifier typically draws 30 watts during operation.

The individual gain channels connect to the power supply control unit with 4 cables that are provided. The cable jacks are labeled on the rear of the three chassis. The only difference between the left and right gain units is the color of the RCA input jacks. The left channel gain module has the white spacers. The right channel gain module has the red spacers. **The cables must be installed before the preamp is powered up.** They plug into and then screw into the rear panel. These are a tight fit but don't need to be forced. The unmarked jack on the rear of the power supply is for future expansion and is not used at present.

Each gain module has an XLR connector above the 25 pin DIN connector marked CONTROL. This connector is provided to allow the preamp to function in MONO mode. It is not absolutely necessary to have this cable installed unless you plan to operate the X0 in mono operation. There is a male XLR on the left channel gain module and a female XLR on the right channel gain module. This allow you to use the cable supplied with the preamp or to use a cable of your choosing.

We have provided a standard AC power cord that fits into the line receptacle at the rear. The preamplifier is equipped for operation with an earth ground provided by the AC outlet. Do not defeat this ground. The chassis and circuit ground of the preamplifier is connected to earth through a power thermistor, which gives a ground connection but helps avoid ground loops.

The six input connections on the rear are pairs of XLR and RCA connectors with right channels on one chassis and left on the other. If your signal source is balanced, you may use the XLR input connectors. On these connectors, pin 1 is grounded, pin 2 is the positive signal input, and pin 3 is the negative signal input.

If your signal source is unbalanced, input will occur through the RCA input connector, which is in parallel with the XLR connections 1 and 2. For operation with unbalanced inputs, a shorting plug is provided between pins 1 and 3, shorting the negative input to ground, and providing optimal performance.

The unbalanced input impedance of the preamplifier is at worst case 10 kOhms. In balanced mode, the input impedance is higher, with a differential impedance of at least 20 kOhms.

Next to the inputs on the rear panel, the preamplifier offers tape inputs through both XLR and RCA connectors. This output is a direct connection to inputs 1, 2, 3,4 and 5 when they are selected from the front panel. Input 6 (TAPE IN) is deliberately not available through the tape output connection. Input 6 is designated for use with a tape recorder if you have one, and we

have arranged that it will not place its output on the tape out, which will prevent you from accidentally creating a feedback connection with your tape machine.

At the left-hand side (viewed from the rear) of the rear panel, two male XLR connectors, and two RCA connectors, labeled OUTPUT 1 and OUTPUT 2, are used for the main output. The two XLR outputs are wired in parallel and may be used at the same time. The RCA connector's ground is in parallel with pin 1 of the XLR outputs and the RCA hot is feed from an independent summer that maximizes the X circuit benefits. The RCA, single-ended, outputs are buffered from the balanced outputs. You may use both the single ended and balanced outputs at the same time. On the XLR, pin 1 is ground, pin 2 is positive, and pin 3 is negative.

The operation of the front panel is straightforward. The Mode switch moves between 8 different functions. They are Volume, input, mute, tape, balance, display, mono and unity gain. The Mode < switch moves left and > moves right. The Select switch then alters the function. The knob on the right is always the volume control. The Select ^ button turns on a function or increases its value it is also balance right. The select v turns a function off or decreases its value it is also balance left.

The remote control uses the same four-button system. The far left button is mode < left the far right button is mode > right. The top button is select ^ up and the bottom is select v down. The display shows the active function. The display has two brightness levels and off. If any control is used the display reverts to the last level.

The electronic volume control allows greater than 70 dB range and is driven by a microcontroller that reads the optical encoder that serves as a front panel volume control. In this manner tracking of the volume of the two balanced channels is possible with accuracy unavailable on any ordinary volume control, assuring precise level steps and high common mode rejection in balanced circuits.

Product Philosophy and Design Theory

- 1) Circuit simplicity and a minimum number of components is a key element. The fewer parts in series with the signal path, the better. Adding more parts and gain stages may improve measured specs but will seldom improve the perceived sonic quality.
- 2) The characteristic of gain devices and their specific use is important. Individual variations in performance between like devices are important, as are differences in topological usage. All signal bearing devices contribute to the degradation, but there are some different characteristics that are worthy of attention. Low order nonlinearities are additive in quality, bringing false warmth and coloration, while abrupt high order nonlinearities are additive and subtractive, adding harshness while losing information.
- 3) Maximum intrinsic linearity is desired. This is the performance of the gain stages before feedback is applied. Experience suggests that feedback is a subtractive process; it removes information from the signal. In many older designs, poor intrinsic linearity has been corrected out by large application of feedback, resulting in loss of warmth, space, and detail.

We recommend the use of the balanced output mode whenever possible. It will retain the character of the input mode, but offers less distortion, less noise, more gain, and more voltage swing, all without compromising the sound in any way.

The common mode rejection of the preamp reflects the intrinsic common mode rejection of the topology, the matching of the gain devices, and the matching of the attenuator channels. In this case we have been able to keep the total mismatch to about .1%, for a common mode rejection of approximately -60 dB.

The input system of the preamplifier will exhibit full common mode noise rejection with passive balanced sources, where the negative input is connected to ground at the source through the appropriate source impedance. This allows adaptation of unbalanced sources to balanced operation with passive cable connections in a manner that achieves the noise rejection of active balanced sources.

The use of a micro controller allows all of the convenience of a single chassis preamplifier with all of the advantages of a dual mono preamplifier. The micro processor only controls the functions of the preamplifier. At no time does any of the input or output signal come into contact with the digital control signals. All of the digital control circuitry is contained in the power supply chassis where the display is located. Should it ever be necessary to update the software that controls the functioning of the preamp only the socketed micro processor need be changed. The four cables that connect the power supply to the individual gain modules only carry power from the power supply and control signals. They do not carry any audio signal or digital clock lines. These cables are custom manufactured for the X0 and are shielded.

The power supply for the X0 is contained in a separate chassis and consists of a toroidal power transformer delivering an unregulated + and - 45 volts which is actively regulated before feeding passive filtering and powering the constant current sources which bias the gain stages. Each channel has its own regulation. The power supply noise reaching the circuit is on the order of a microvolt, and is differentially rejected at the output in a balanced system. The relays and control systems are regulated independently from a separate toroidal transformer. All digital circuitry is isolated in the power supply control unit.

Muting relays, which delay connection during turn-on and shut off the output when insufficient power supply is available to maintain regulation, guards the output of the preamplifier. The preamplifier is designed to run constantly, and will exhibit optimum measured performance within about 10 hours of turn-on.

The X0 consists of three separate chassis made entirely of machined aluminum. The chassis are all milled from solid aluminum material on computer controlled vertical milling machines. No sheet metal is employed. All engraving is done by laser to make it easy to read and provide a long life.

The X0 is warranted by Pass Laboratories to meet performance specifications for 3 years from date of manufacture. During that time, Pass Laboratories will provide free labor and parts at the manufacturing site. The warranty does not include damage due to misuse or abuse or modified products and also does not include consequential damage.

SPECIFICATIONS

Gain	12 dB bal in / bal out	12 dB unbal in / bal out
Freq. Response	-3 dB @ 2 Hz	-3 dB at @ 100 kHz
Distortion	< .1 % THD typically .003% @ 2 volts @ 1KHZ	
Maximum Output	20 volts rms. bal out 7 volts rms. unbal out	
Output Impedance	200 ohms unbalanced	
	750 ohms balanced	
Input Impedance	10 kOhm unbalanced	20 kOhm balanced
CMRR	typical -80 Db, 20-20 KHz	
Crosstalk	typical -90 dB, 20-20 KHz	
Output Noise	Noise floor < -110 dBV, 20-20 KHz	
Power Consumption	45 watts	
Dimensions	17 " W x 11.5 " D x 3.5" H	
Shipping Weight	75 lb. All 3 units	



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