



Introduction

The X1 is an ultra high quality minimalist audio preamplifier that features a remote control and external power supply. It combines a completely new circuit topology with traditional construction representing 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. Derived from US Patent # 5,376,899, the X1 integrates power MOSFET and JFET devices in a simple Class A topology in order to deliver the finest sound possible.

The patent-pending Super-Symmetric gain circuitry is unique in providing superior flexibility and performance with both balanced and unbalanced inputs and outputs, converting one to the other as desired without extra circuitry and without performance degradation.

The X1 minimizes the number of components in the signal path, and yet retains exemplary objective performance specifications. It pushes the edge of the art in exploring how much subjective quality is obtainable with a new but very elementary gain stage.

The X1 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 60 dB of range, large voltage swing and very good measured performance. Most importantly it is subjectively outstanding; better than any potentiometer we know of. We are justifiably proud of this new device, which is registered as having a patent pending.

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,

Vice President, Design

The preamplifier main chassis / control unit has four sets of input connections, both single-ended and balanced output connections, a tape loop and a full function remote control that mirrors the front panel functions.

The main chassis also has a DB-25 connector that connects to the remote power supply and a single pair of 5-way binding posts that are used for remote amplifier turn-on. The preamplifier's voltage and current rating are indicated on the bottom of the power supply. It will be either 240 volts, 220 volt, 120 volts, or 100 volts. A 0.5 amp 3AG slow blow fuse is provided with 100-120 volt units, and a 0.25 amp slow blow fuse is provided with 220-240 volt units. The frequency rating of the power supply in all cases is 50 to 60 Hz. The preamplifier typically draws 30 watts during operation. Please verify that the pre-amplifier's indicated voltage requirements are consistent with the voltage available at your location, prior to operation.

The main preamplifier chassis is connected to the power supply with a custom shielded cable that carries both the analog and digital power. **Please note this power cable must be installed before the preamp is powered up.** The power cable plugs, into and then screws into, the rear panel of the main chassis and the power supply. The connectors are a tight fit but should never need to be forced. The X1 will function with either DB-25 on the power-supply chassis. The additional DB-25 is for future performance enhancements.

We have provided a standard AC power cord that fits into the IEC line receptacle at the right rear of the power supply chassis. The preamplifier is equipped for operation with an earth ground which is provided by the user's AC outlet. Never defeat this ground, its use will not adversely affect the performance of this product. The chassis and circuit ground of the preamplifier are connected to earth through a power thermistor, which gives a ground connection for safety but helps avoid troublesome ground loops.

The X1 has a total of four inputs and a separate tape loop. Two of the four inputs (Input numbers 1 & 2) can be used single-ended or balanced. The other two inputs (inputs 3 & 4) are single-ended only. The tape loop has both single-ended and balanced inputs and outputs. Balanced inputs and outputs are via XLR connectors. Single-ended inputs and outputs are via RCA connectors. On the XLR connectors, pin 1 is grounded, pin 2 is the positive signal, and pin 3 is the negative signal. Left channel RCA connectors are marked with white spacers. Right channel RCA connectors are marked with a red spacers. Balanced XLR inputs and outputs are marked with "L" for left and "R" for right channel.

If your signal source is unbalanced, input will always occur through the RCA input connector. Inputs 1 and 2 give you a choice of either single ended or balanced inputs. When single-ended inputs are used on input 1 and input 2, a shorting plug, which is provided, should be inserted between XLR pins 1 and 3 of the associated connector. This plug shorts the negative input to ground thus optimizing the input connection. You can run the X-1 without this shorting plug, but performance will not be ideal. (NOTE: inputs 3 & 4 are single ended only and do not have XLR's associated with them.) You are free to use any combination of balanced and unbalanced connections with the X1. The unbalanced input impedance of the preamplifier is 33 kOhms. In balanced mode, the input impedance is higher, with a differential impedance of at least 66 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, and 4 when they are selected from the front panel. Input 5 (TAPE IN) is deliberately not available through the tape output connection. Input 5 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.

The main outputs are located at the left-hand side (viewed from the rear) of the rear panel, two male XLR connectors, and two RCA connectors, "R" (right) and "L" (left). The RCA connectors ground is in parallel with pin 1 of the XLR outputs and the RCA hot is fed from an independent summing junction 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 X1 takes maximal advantage of four identical gain paths (two identical paths per channel) very much unlike the typical two gain path (one signal path per channel) pre-amplifier you may be familiar with. Almost without exception traditional audio pre-amplifiers, unlike their science and industry counterparts, have maintained single signal path per channel (two identical paths in a stereo pair).

In order to manage balanced signals these two gain path pre-amplifiers must utilize phase combining networks to process incoming signals and subsequently drive outputs via phase splitting circuits to re-establish a quasi-balanced signal. This manipulation of signal typically adds additional gain stages and degrades the inherent

noise and distortion superiority of balanced signal, coloring what you eventually hear.

Pass labs through its unique patented “Supersymmetry” topology maintains the advantages of a true balanced signal throughout the electronics chain. The salient point of this approach affords significantly less signal manipulation, higher input impedance, as much as a 100:1 (20dB) reduction in distortion while providing greater gain, and twice the dynamic headroom of identical circuits running single ended.

The X1 maintains the integrity of its received signal by treating all sources internally as balanced signals and converts seamlessly between balanced and unbalanced inputs and outputs without any additional components in the signal path. This was a conscious effort by Pass Labs to enhance the consumer’s ability to integrate source components and power amps with otherwise incompatible requirements through a virtually transparent control center.

The rear mounted pair of five-way binding posts are intended to control the on/off function of our own X series power amplifiers from the X1’s front panel, or via the four button remote. When the preamp mode “Amp” is selected it allows the user to switch a nominal 12 volts DC at maximum draw of 50 milliamps to these binding posts. In some instances this voltage may have the ability to control products from other manufacturers, but we by no means have a comprehensive listing of their compatible features. If you have questions about compatibility, your service technician and dealer are an excellent source of information.

Description of Operation

In application the X1’s front panel controls and alphanumeric display are quite straightforward and intuitive. We encourage you to become familiar with their operation prior to establishing any input connections with this unit. Experience indicates that engaging in a few minutes of exploration and playtime will add much to your ultimate enjoyment of this exceptional Pass Labs product.

The Mode switch moves between 10 different functions. They are Volume, Input, Mute, Tape, Balance, Display, Mono, Unity, Amplifier (power amplifier turn on / turn off), and Gain adjust. Actuating the Mode “<” switch moves the display to the function one step to the virtual left and “>” button moves to virtual right, one step. The Select switch then alters the function of the displayed mode. The knob on the right is always the Volume control, and it is always active. 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; and is also balance left. If any control is used the display reverts to the last saved output level, therefore we suggest you reduce the volume before switching inputs.

The remote control uses the same four-button protocol, though it is physically arranged slightly different than the X1's front panel. The far left button "<" is mode left and the far right button ">" is mode right. The top button "^" is select up, and the bottom button "v" is select down. The display shows the active function, just as it would when using the front panel controls. The display has two brightness levels and off, selected by the up "^" and down "v" buttons when the mode "display" is visible.

The electronic volume control allows greater than 60 dB range and is driven by a microcontroller that reads an 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.

Wayne has included some unique features on the X1 that give it unprecedented versatility.

At the extreme virtual right of the mode selection is the function labeled "gain". This control allows you, the user to adjust the gain of the X1 to extract the best possible performance out of a variety of source components of different manufacturers. The "Low Gain" setting allows for 4 dB of gain from the X1 and the "Hi Gain" allows for 14 dB of gain. The 10 dB difference between these two settings require that you pay attention to volume as you switch back and forth between High and Low Gain. With a number of products one setting may convey a greater sense of musicality than the other. Let your ears be the final arbiter. With our own X series amplifiers which are quite high gain (30 dB), we find the +4 dB setting to be most satisfying.

The unity function too bears special attention. This control is associated only with input number 4 and has two positions selected with the up/down arrows. The up arrow toggles to a straight-through function with neither attenuation nor gain. This function is useful in that it allows the preamplifier to function as a unity buffer for use with components that best function with their own volume controls, such as surround processors. When the right-front and left-front outputs of the processor are routed through input 4 of the X1 (with the gain of the X1 set for Unity gain), the volume will be under full control of the processor and the X1's action will be

totally transparent. When the user chooses “Unity” this sets the X1’s gain to the low (+4dB) setting, regardless of how it was previously configured. When at Unity both left and right level controls on the X1 will have a displayed value of 24, and any previous balance settings will be lost. Both of these default conditions are intentional, and intended to make the most advantageous use of your source electronics. You may also set any of the four inputs to unity (0dB gain) by selecting low gain and setting the volume to indicate 24 on the front panel display.

Before selecting this option, it is imperative that the input device on input number 4 has its gain set to minimum. Failure to follow this precaution could result in a volume level intolerable to both ears and speakers. To further protect your hearing and valuable audio equipment, Wayne has designed this product so that the volume setting of the preamplifier will always revert to zero as you change inputs. We trust that the remote control, with its four buttons that duplicate those of the preamp front panel will enable you to quickly select inputs and establish levels of output.

Product Philosophy

- 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. For example, smooth low order nonlinearities are additive in quality, bringing false warmth and coloration, while abrupt high order nonlinearities add harshness and false brightness.
- 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 factored out by large application of feedback, resulting in loss of warmth, space, and detail. The trick is to get good performance without this excessive reliance on feedback.

The art of high end audio design lies in the approach to combining these elements to get high reliability and simplicity, high quality measured performance, and high quality subjective performance. It

Other Design Comments

takes imagination and hard work to get as much of these as possible at once without trading them off adversely against each other.

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

With balanced operation, 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 preamplifier functions to be repeatable and accurately controlled. 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. The digital circuits are powered by a power supply that is completely separate from the analog supply. Should it ever be necessary to update the software that controls the functioning of the preamp only the socketed micro processor need be changed. There is a single custom made shielded cable that connects the power supply to the main preamplifier module. The power supply cable does not carry any audio signals or digital clock lines and is filtered against noise.

The power supply for the X1 is contained in a separate chassis and consists of a toroidal power transformer delivering an unregulated +/- 45 volts which is actively regulated before feeding passive filtering which powers the constant current sources that 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 the little of that which gets through the circuit is 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. The power

supply cable does not carry any audio signals or digital clock lines and is filtered against noise.

Muting relays, which delay connection during turn-on and shut off the output when insufficient power supply is available to maintain regulation, guard the output of the X1. The preamplifier is designed to run constantly, and will exhibit optimum measured performance within about 10 hours of turn-on. The omission of a power switch is intentional.

The X1 consists of two full-size aluminum chassis. Both chassis are machined from solid aluminum stock by computer controlled milling machines. There are no stamped or sheetmetal products in this product. One of the full-size chassis houses the control functions, active elements and display. The second chassis houses the power-supply.

For more information please contact:

Pass Laboratories Inc.

P.O. Box 219,
24449 Foresthill Rd.,
Foresthill, CA 95631

Tel: 530.367.3690
Fax: 530.369.2193

www.passlabs.com

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X1 Specifications

Gain	4dB or 14dB
Gain adjustment	menu setting
Number of volume control steps	32
Freq. Response	-3dB @ 2Hz, -3dB @ 100kHz
Distortion @ 1KHz	<0.1% THD typ, 0.003% @ 2V
Output Voltage	10 Balanced, 7 Single-ended
Output Impedance	360 Balanced, 150 Single-ended
Input Impedance	66K Balanced, 33K Single-ended
Number of gain paths	4
Separate analog channels	No
Remote control	Yes
Input voltage before overload	10 volts
CMRR	-55dB 20 - 20kHz
Output noise floor	-125dBV ref to 10V output
Crosstalk	<95dB 1kHz, <75dB 20kHz
External amp turn on	Yes
Single-ended only inputs	2
Balanced / single ended inputs	3
Mono operation setting	Yes
Unity gain setting	Yes
Power Supply	External
Power consumption	25 watts
Number of chassis	2
Dimensions	2 @ 17"W x 3.5"H x 11.5"D
Weight	46lbs

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Warranty Information

Please check with the factory-authorized distributor in the country you are purchasing this product for specific warranty information.

All Pass Laboratories products purchased from an authorized Pass Laboratories dealer in North America are covered by a transferable, limited 3-year warranty. This warranty includes all parts and labor charges incurred at the repair facility in addition to return shipping to the domestic customer, exclusive of subsequent damages. Damage due to physical abuse is specifically not covered under this warranty.

For this warranty to apply the customer is responsible for returning the product unmodified to the factory within the warranty period. The customer assumes all responsibility for shipping and insurance to the factory or a factory specified repair facility. The conditions and stipulations of this Pass Laboratories warranty only applies to units sold new in North America.

Non-North America customers should consult with their original Pass Labs dealer or distributor for warranty repair instruction prior to contacting the factory or shipping product for repair.

Non-North American product must be returned to the country of origin for warranty service. Foreign distributors are only required to offer warranty service on Pass Laboratories product that they have imported.

Please note: Conditions of warranty service and customer rights for product purchased outside the United States may vary depending upon the distributor and local laws. Please check with your local distributor for specific rights and details.

Any modifications to Pass Laboratories products that have not received written factory approval nullify all claims and void the warranty. Should a modified product be returned to the factory for repair the owner will be required to pay all necessary charges for the repair in addition to those charges required to return the product to its original configuration.

In the case of safety issues, no product shall be returned to the customer without those safety issues being corrected to the most recent accepted standards.

Removal or alteration of original Pass Labs serial numbers voids the factory warranty. Product with altered or missing serial numbers will be suspected as counterfeit product.

Pass Laboratories will not repair or in any way indemnify any counterfeit or cloned product.

Pass Laboratories does not offer products in voltages intended for international markets either to authorized Pass Labs dealers or to third parties located in the United States or Canada.

For your protection please read the following:

Water and moisture: Electrical devices should not be used near water (as per example, near a bathtub, washbasin, kitchen sink, laundry tub, wet basement or swimming pool). Care should be taken such that objects do not have the opportunity to fall, and that liquid is never spilled onto or into the device enclosure through openings.

Power Sources: An electrical device must be connected to a mains power source in strict accordance with the supplied product owner's manual. Please verify that the AC mains voltage specified in the product manual matches those requirements indicated on the unit and the AC voltage provided to your location by the power company.

Grounding: Adequate precautions should be taken so that the grounding provisions built into an electrical product are never defeated.

Power Cords: Pass Laboratories provides a power supply cord that meets all legislated requirements for the market in which the product was originally sold. If you choose to substitute an after-market product we urge you to choose one that is fully safety rated by the necessary local authority.

Power Cord Protection: Power supply cords should be routed so that they are not likely to be walked on, abraded, or pinched by items placed on or against them, paying particular attention to cords where they enter plugs or exit from a device. Never under any circumstance insert a cut or damaged power cord into a mains power socket.

Power and Signal: Cables should never be connected / disconnected with equipment powered up. Failure to heed this warning may damage or destroy equipment.

Ventilation: Power-amplifiers run hot, but you should be able to place your hands on them without discomfort. You must allow for this heat in installation, by providing for free air circulation around the product. Electronics should not be subjected to sources of excessive radiant heat. Excessive heat can shorten the life of the product and may cause the electronics to self-protect and shut down.

Servicing: To reduce the risk of fire, electrical shock or other injuries, the user should not attempt to service the device beyond that which is described in the operating instructions. All other servicing must be referred to qualified service personnel.