



## Introduction

The X2.5 is an ultra high quality linestage audio preamplifier featuring remote control and internal power supply. It combines a completely new circuit topology with traditional construction representing thirty five years of preamplifier 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 X2.5 integrates power MOSFET and JFET devices in a simple Class A topology in order to deliver the finest sound possible.

The 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 X2.5 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 X2.5 employs a patented new type of volume control that offers significantly better performance than seen before in an electronic control. It provides over 60 dB of range, large voltage swing and very good measured performance. The distortion and noise is at 1/10 and the dynamic range 100 times the previous state of the art in active attenuation. Most importantly it is subjectively outstanding; better than any potentiometer we have evaluated.

The fluorescent display is a very special device. Not only will you find its blue color highly attractive and readable, it is far more reliable than the usual LED or LCD display.

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 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.

It also has a 5-way binding post that is used for remote amplifier turn-on. The preamplifier's voltage and current rating are indicated by affixed tag on the bottom of the preamplifier. It will indicate either 240 volts, 220 volts, 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 is 50 to 60 Hz. The preamplifier typically draws 30 watts during operation. Please verify that the indicated voltage requirement of this preamplifier is consistent with the voltage at your location.

We have provided a standard IEC AC power cord that fits into the IEC line receptacle at the rear of the preamplifier chassis. The preamplifier is equipped for operation with an earth ground provided by the users 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 for safety but helps avoid ground loops.

There are a total of four inputs and a separate tape loop. Two of the four inputs can be used single-ended or balanced. The other two inputs 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 "L" from below. Right channel RCA connectors are marked with "R" from below. Balanced XLR inputs and outputs are marked with "L" for left and "R" for right channel.

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. When single-ended inputs are used on input 1 and input 2, a shorting plug is provided between pins 1 and 3 of the XLR connection, shorting the negative input to ground, and providing optimal performance.

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.

## Description of Operation

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 connector’s 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 rear 5-way binding post can be used to turn on any X series power amplifier.

In application the X2.5s front panel controls and alphanumeric display are quite straight forward, 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 two front panel mode switches move the preamplifier and it’s display through 10 different functions. From left to right these functions are as follows: Volume, Input, Mute, Tape, Balance, Display, Mono, Unity, Amp (power-amplifier control), and Gain. Actuating the mode < switch moves the function to the feature immediately to the left, and conversely actuating the mode > switch moves the function to the feature that is immediately to the right.

The two Select switches (designated by up and down pointing arrows) then alter the displayed active function. The select arrows toggle the following functions either off or on (the up pointing arrow representing “on” and the down pointing arrow representing “off”) Mute, Tape, Mono, and Amp.

The leftmost function as selected by the two mode switches is

volume, and the up/down arrows select 32 steps incrementally, indicated on the display as 0 - 31. A more traditional knob, located at the far right of the front panel, which is always active, exactly duplicates this control function.

The next mode to the right is the input selector, for inputs 1 through 4. Input 4 is unique in that it is linked with the Unity function. (The UNITY FUNCTION is discussed at length later in this manual.) The two select arrows logically control selections of the various inputs to the preamplifier.

The channel balance function is affected by the up and down arrows. The up arrow is balance right and the down arrow conversely balance left.

The display function has three iterations of brightness selectable by the up/down arrows; they are bright, dim and off.

The unity function 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 X2.5 (with the gain of the X2.5 set for Unity gain), the volume will be under full control of the processor and the X2.5's action will be totally transparent. When the user chooses Unity this sets the X2.5'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 X2.5 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 input to unity by selecting low gain and setting the volume at 24.

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.

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 X2.5 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 manufactures, but we by no means have comprehensive listing of their compatible features. If you have questions about compatibility your service technician and dealer are an excellent resource of information.

The X2.5 to our knowledge is unique in that its gain may be attenuated to match the requirements of a wide variety of electronics and speakers. The gain control toggles between two settings, offset from one another by 10 dB. The up pointing arrow selects +14 dB and the down pointing arrow selects +4 dB. When used with our own X series power amplifiers, which are quite high gain (30 dB), we find the +4 dB setting to be most satisfying. With other product we suggest that you let your ears determine which setting conveys the most sonic benefit.

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 off mode shows the display for about 7 seconds and then turns off.

The electronic volume control allows greater than 60 dB range and is driven by a micro-controller that reads the optical encoder serving 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 Colburn’s exceptional volume control in conjunction with the fluorescent display give the user ability to replicate volume levels with absolute accuracy in steps of roughly 3dB.

## 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 or reliability of a product.

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

## Other Design Comments

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.

The power supply for the X2.5 consists of a toroidal power transformer delivering an unregulated +/- 45 volts which is actively regulated before feeding passive filtering and powering the constant current sources which bias the gain stages. Each channel has it's own regulation. The power supply noise reaching the circuit is on the order of one microvolt, and the little of that which get through the circuit is rejected at the output in a balanced system. The relays and control systems are regulated independently, and all digital circuitry is isolated from the power supply.

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 preamplifier. The preamplifier is designed to run constantly, and will exhibit optimum measured performance within about 10 hours of turn-on.

The X2.5 consists of a single chassis.

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## X2.5 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	4
Remote control	No
Input voltage before overload	Yes
CMRR	10 volts
Output noise floor	-55dB 20 - 20kHz
Crosstalk	-125dBV ref to 10V output
External amp turn on	typ. -85dB 1kHz
Single-ended only inputs	Yes
Balanced / single ended inputs	2 3
Mono operation setting	Yes
Unity gain setting	Yes
Power Supply	Internal
Power consumption	25 watts
Number of chassis	1
Dimensions	17"W x 3.5"H x 11.5"D
Weight	30lbs

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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.