



## Introduction

Analog designer Nelson Pass has over the years produced some truly great solid-state amplifiers, each unique in its own way. Not surprisingly, the Pass Laboratories™ XA160 monoblock amplifier is no exception. The XA160's sleek industrial design is a stunning understatement of artistic form integrated with state of the art function.

Since the introduction in 1997, the X amplifier series using the patented Supersymmetry™ circuit topology have been the mainstay of amplifier offerings from Pass Laboratories™. These amplifiers are heavily biased Class A/B designs with only two gain stages and an absolutely minimal component count in the signal path. In spite of this simplicity and thanks to the unique characteristic of the X topology, these amplifiers achieve very high power with outstanding subjective and objective performance.

With the introduction of the XA160 Pass Laboratories™ significantly raises the performance standard of excellence by introducing an entirely new series of power amplifiers. The new "XA" series of amplifiers feature a refined and elegantly simple, very highly biased, pure Class A mode of operation. This is a new and unique circuit topology that we descriptively characterize as being Single-ended Class A. This new topology combines the very best characteristics of Pass Laboratories™ "X" series amplifiers and the highly rated "Pass Laboratories Aleph™". The XA series is the marriage of a highly refined Aleph™ output stage with the patented Supersymmetry™ "X" front end.

The emphasis of the XA series is to accentuate performance over power. The XA series has the characteristic warm midrange and sweet top end of the Aleph™ product conjoined with the extreme dynamic range and definitive bass control of the X series amplifiers.

The XA160 is packaged in an artistically refined variant of the massive chassis previously reserved for the 600 watt X-600.5 monoblock amplifier, but running more than twice the Class A bias current of our other amplifiers.

The Pass Laboratories™ XA160 will deliver 160 watts rms into 8 ohms of impedance. This is the amplifiers class A limit, driving the XA160 harder or reducing the impedance of the load will not convey any additional power. Driving into a short will not convey any additional power. These are not design oversights or flaws in the XA160, but rather a condition of the very highly biased Class A operation. However; as an interesting point of reference, 160 watts driving a 87dB/1W/1m speaker will deliver close to 110 dB (quite loud) average acoustic signal in a 100 cubic meter room.

The XA160 has a massive toroidal transformer coupled to a high current DC reservoir. Recognizing that the XA160's ability to resolve microdynamics is best experienced with clean power, the extreme low-level resolution of the XA-series benefits from a specially designed power supply that significantly reduces and rejects power line borne noise.

The XA amps open the sonic soundstage to the very limits of the recording format. Through the XA160 complex musical passages reveal themselves in the most dramatic manner. With the XA160 you will hear everything within the upper octaves, which includes any recording, source or loudspeaker issues. Keep this in mind when choosing complementary equipment, remembering that recordings and the other components in the signal chain will strongly dictate soundstage width and imaging and likely be the limiting factors in your listening environment. The room itself will also add its acoustic signature, and should be considered an audio component.

Speaker selection should be strictly a matter of personal taste. The XA160 is unconditionally stable into any load presented by a loudspeaker, but will provide less power into other than 8 ohms. The XA160 accommodates both single ended (RCA) and balanced inputs (XLR). Input impedance's are 11 kohm unbalanced and 22 kohm balanced to permit integration with the widest possible range of upstream components.

## Requirements

You can position this amplifier anywhere you wish, but it must have ventilation. We do not recommend placing it in enclosed cabinets or small closets without means for air to circulate freely. Stacking these power amplifiers directly upon each other is not recommended for the same reason. This amplifier idles at approximately 550 watts, the equivalent of a small hand held hair dryer. At idle most of that energy is dissipated across the heat sinks, so the heat generated by each XA160 is equivalent to a small hair dryer. To dissipate this heat the product should have about 6 inches clearance to the top and sides for adequate air circulation.

Let's talk about power requirements. The amplifier draws about 5 amps (continuous rms) at 120 volts out of the wall during operation, and this reflects mostly the idle current that we run through the output stage. When not actually intending to play music the XA160 should be left in standby mode. In standby mode it draws only a few watts of power, that necessary to keep the capacitors charged.

We have provided a standard IEC power cord that fits into the standard 15 amp IEC receptacle at the rear of the amplifier chassis.

Two XA160's may be run on a single 15-amp circuit. This amplifier is equipped for operation with an earth ground provided by the users AC outlet. **Never defeat this ground connection.** The signal ground of this amplifier is connected to earth through a power thermistor, which provides a safety ground but provides protection from irritating ground loops.

**As a safety issue we suggest that the power cord should be the last cable installed on your power-amplifier. You may, if you wish, substitute a 15-amp aftermarket power cord for the one we have supplied. Only use power cords, which meet all local safety standards and carry acceptance marks from the local regulatory authority. The power cord should be attached to the amplifier prior to plugging into house power. Place the rear mounted switch in the off (down) position before plugging in this amplifier.**

The amplifier's voltage and current rating are indicated on the rear panel. It will be either 240 volts, 220 volts, 120 volts or 100 volts, all with a restorable type circuit breaker of the appropriate ampacity. The inclusion of this re-settable circuit breaker does away with the need for disposable fuses. The frequency rating of the AC line source is 50 to 60 Hz in all cases. Please verify that the amplifiers indicated voltage requirements are consistent with the supplied voltage and current at your location. Transformers are input voltage specific and their change is not a trivial matter.

## Setup

Looking at the rear panel you will see the AC power cord receptacle, a power switch / breaker, two pairs of output connectors which allow for speaker bi-wiring, a single pair of 5 way connectors for remote turn-on, a single RCA input connector and a single XLR balanced input connector.

Make sure that the rear panel power switch/breaker is off (down). Plug the AC cord into the back of the amplifier, and then into the wall. Then turn the power switch/breaker on (up). The lights in your house will blink when the power supply charges the capacitors. (Note: The power switch/breaker is never to be used as a "safety device" or "emergency disconnect" for this product. This device provides current limiting which will protect the amplifier, it will not provide personal shock protection in the event of a reversed hot / neutral, lack of grounding or other improper wiring in the supplied mains voltage.)

On the front panel, the "Standby" LED indicator should be glowing blue, indicating that AC power is available and the capacitor banks

are charged. The “Power” LED should not be on. If the “Power” LED is on, don’t get excited, just use the front panel stand-by button to go to stand-by mode, with the “Standby” LED on and the “Power” LED off.

OK, so the amplifier is sitting there in stand-by mode with just the single blue LED lit. No speaker connected yet. You can go ahead and connect the source and speakers. Make sure you are in standby mode to protect your speakers from transients. The prudent installer will unplug the XA160’s power cord from the mains while attaching speaker cables.

To avoid the possibility of short circuits always connect speaker cables to the speakers prior to connecting to the amplifier. The output binding posts will accept either bare wire or spades. (Regulatory agencies in many countries have banned binding posts that will accept a banana plug, forcing us to abandon this option.) Make sure that your speaker wires only attach to the outputs of the amplifier, not to each other and never to the amplifier case.

Some powered subwoofers require an audio signal ground reference and their makers may suggest that a black speaker terminal is where this voltage reference might be found. On complementary designs, which would be typical of all power amps produced by Pass Laboratories™, this is an incorrect and unsafe assumption. On all Pass Laboratories™ power amplifiers a reference of 0 volts will be found only at pin 1 of the XLR input or at the shell of the RCA input.

Reference connections for these devices require special consideration when used with our product. If you have such a device, and wish to use it with our product, please contact our Foresthill, California factory for specific instructions.... you have been warned.

The amplifier may be driven single-end or balanced, your choice. Single-ended input will always occur through the RCA connector and balanced input will always occur through the XLR connector. If driving the amplifier single-ended leave the supplied jumpers in place between pins 1 & 3 on the input XLR. On the XLR connector pin 1 is ground, pin two is positive input and pin 3 is inverted (negative) input. Pin numbers are marked on the XLR. If you re-install the jumper incorrectly or leave it lying about, the amplifier will not work properly. You must choose either XLR or RCA inputs it is not advised to try and run both concurrently.

XLR input connector showing proper placement of jumper pin for use with single-ended (RCA) input.



## You are ready to play music

Now that the source component is connected, make sure there is no signal coming from it, probably by turning the volume all the way down.

With the speakers connected, make sure the power cord is attached and plugged into mains power; push the front panel button to activate the amplifier. The “Power” LED will come on.

Do everybody a favor and try not to have shorted output cables. It happens accidentally all the time, and the amplifier is designed to survive, but why tempt fate. If you accidentally cause the breaker to trip, it can be reset by first cycling the breaker handle to the off position (down) and then on (up). The fault, which caused the “trip”, will need to be corrected prior to resetting this breaker.

Of course it's always possible that something may go wrong. If so, don't get excited. It's really aggravating when a product doesn't work, we understand, but it will get fixed. We go to a lot of trouble to make products reliable, and the failure rate of our amplifiers is very low. This is small comfort to the few, but take it easy and give us a call if you have problems.

People are interested in how long it takes for these amplifiers to break in. Depending on the resolution of the rest of your audio chain, you may or may not notice any break in of the XA160 beyond the first 50 hours of operation. You will likely notice the difference in sonic character between cold and normal operating temperature, so we recommend letting these amplifiers warm up before any serious listening.

It takes about an hour for them to warm up, and this is where we adjust them first. Then we adjust them again and again over a couple of days, keeping the bias and offset in the sweet spot. Our environment is about 23 degrees Centigrade, room temperature, and the heat sinks will rise to about 25 degrees C. above that, for a heat sink temperature of about 48 degrees C. This is where they operate best.

In your setup the heatsink temperature may vary a bit due to line voltage and ventilation, but it is not a big deal. You should be able to put your hands on the heat sinks without discomfort for 10 seconds or so.

The amplifier has a thermal cutout that will disconnect AC power if the temperature exceeds 75 degrees Centigrade. This thermal cutout should never occur in real life.

## More things to know

You may remotely operate the stand-by mode by applying 12 volts DC to the single pair of 5 way connectors on the rear of the amplifier. The positive of the 12 volts DC goes to the red connector, negative to the black. This connection has an actual operating range of about 9 volts to 15 volts. This switching feature will override the front panel button, only when the front panel button is in the standby position.

## Speaker Interface

The XA160 is optimized for 8-ohm speaker loads. Having said that, we are not aware of any speaker on the market that presents an unusual or difficult load for these amplifiers.

The XA amplifiers do not care particularly about the reactivity of the load. Reactive loads typically will have slightly less distortion at a given voltage/current level than resistive loads. The XA circuit was designed to be quite happy driving electrostatic speakers and any other esoteric loads we know of.

## Interconnects and Speaker Cables

We have a general recommendation about interconnects, and speaker cables; which is that they should cost less than the amplifier, and contain at least some conductive material. We have tried a lot of products and most work well, but as a practical matter we cannot make blanket recommendations.

The amplifier is not sensitive to source interconnects. It is also not sensitive to radio frequency pickup, which allows some flexibility in choosing source interconnects without shields, though shields are always in good taste. For long runs balanced cables are highly recommended for their inherent rejection of common mode noise.

We prefer speaker cables that are short and stout, oxygen free copper and silver are the suggested materials. If you find any really exceptional cable made of gold, please gift us a couple hundred feet.

Fortunately this amplifier is not sensitive to the capacitive/inductive character of some of the specialty speaker cables, so feel free to experiment.

We have found that about 90 per cent of bad sounding cables are really bad sounding connections, and we recommend that attention be paid to cleanliness of electrical contact surfaces and proper connector fit.

## Fun Hardware Facts

Speaker cables should be firmly tightened down at the speaker output terminals, but not with a wrench. Output terminals will not withstand the levels of torque that may be easily applied by wrench. Hand tightening without excessive force is plenty. Cleaning contact surfaces with one of the commercially available electronic contact cleaners should be part of your annual system maintenance.

The XA160 has a single large power transformer, under actual conditions in the amplifier, it supplies but a fraction of its rated power. This very conservative rating contributes to exceptional voltage regulation figures and low noise figures at the loudspeaker.

The XA160 has a significant number of power supply filter capacitors. These caps are used to create the unregulated output stage rails at plus and minus 30 volts at 7 amps. RC filtering is used to passively remove ripple from the supply rails.

All the power transistors in the product are hyper-matched parts, with gate voltages matched to 0.5% and all devices taken from the same manufacturing lot codes (made on the same wafer).

So how long will this hardware last? It is our experience that, barring abuse or the odd failure of a component, the first things to go will be the power supply capacitors, and from experience, they will last 15 to 30 years. Fortunately they die gracefully and are easily replaced by a good technician. After that, the longevity will depend upon the number of operating thermal cycles, but we can say that we have had amplifiers operating in the field in excess of 20 years with no particular mortality, and we don't have good information beyond that. More to the point, you should not worry about it. This is a conservatively built industrial design, not a frail tube circuit run on the brink of catastrophic failure. If it breaks, we will simply get it fixed, so sleep well.

## XA160 Specifications

All figures obtained after 1 hour warm-up, with regulated 120 VAC power line. See manual notes about AC power line regulation.

Gain	26 dB
Freq. Response	-3 dB at 1.5 Hz, -3 dB at 100 kHz
Power Output	160 watts max @ 1% THD, 1 kHz, 8 ohms
Distortion @ 1KHz	0.01% @ 10 W, 0.1% @ 80 W, 1% @ 160 W
Maximum Output Voltage	plus, minus approx. 50 volts
Maximum Output Current	plus, minus approx. 7 amps
Input Impedance	22 kohm balanced 11 kohm unbalanced
Damping factor	30 ref @ 8 ohms nominal
Slew rate	approx. plus, minus 50 V/uS
Output Noise	approx. 300 uV unweighted 20-20 kHz
Random noise floor	approximately 2 uV
Dynamic range	154 dB (random noise floor to peak output)
Balanced CMRR	approx. -60 dB @ 1 kHz
DC offset	< 100 mv
Power Consumption	approx. 550 watts
Dimensions	19 " W x 11.5" H x 22" D
Weight	150 lbs.

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](http://www.passlabs.com)

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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.

Sometimes two designs complement each other so well that you are surprised when you learn they weren't invented together. So it is with the X Supersymmetry™ amplifier and the Aleph single-ended Class A output circuit.

The Supersymmetry™ “X” amplifier repeatedly demonstrates the possibilities for very high power, dramatic dynamic contrast, and effortless control by a simple circuit utilizing absolutely minimal feedback. As with the art of Aikido, the X circuit works with the intrinsic character of a balanced circuit and deftly turns that character toward perfection. This has been the basis for a very successful Pass Laboratories™ product series, which has won numerous prestigious awards and garnered critical acclaim worldwide.

For over ten years, the Aleph™ series of single-ended Class A amplifiers have received praise for their outstanding sonic definition, warmth, and smoothness; and have often been compared favorably with the very best tube amplifiers. The Aleph™ topology achieves state-of-the-art performance with a very simple linear design, and is additionally one of the most stable and reliable audio amplifiers in existence.

A considerable number of audiophiles have found themselves bi-amping their loudspeakers, putting Pass Laboratories™ X amplifiers on the bottom for power and control, conjoined with Alephs™ on the top for that smooth warm midrange and top end. We well appreciate these complementary differences, and for the past few years Pass Laboratories™ has been at work marrying these two design concepts into a single amplifier topology. The trick was to create an amplifier, which carries the best of both designs, and not otherwise.

### **X Supersymmetry™**

The Supersymmetry™ X amplifier uses a new radical approach to achieving high performance from a simple 2-stage circuit. The design exploits the symmetry of a matched balanced amplifier so that distortion and noise are cancelled at the output to the loudspeaker, then uses a small dose of a unique new form of feedback to make that symmetry more perfect.

US Patent # 5,376,899 describes our topology, which takes advantage of the character of specially matched balanced amplifiers that are cross-coupled to provide cancellation of distortion and noise. The result provides high performance with very simple linear circuits, better than previous similar efforts by an order of magnitude. It was named Supersymmetry™ as an homage to particle physics, but it is popularly known as the X circuit.

Balanced amplifiers improve performance by differentially rejecting distortion and noise. To the extent that distortion and noise are identical,

they vanish at the output, typically by a factor of 10 or so for matched single-ended Class A circuits.

Supersymmetry™ extends this concept by using feedback only to make the distortion and noise more identical on each half of a balanced circuit, not to eliminate it as such. This gives as much as a 100:1 reduction in unwanted distortion and noise without requiring the equivalent amount of negative feedback. It is simply much easier to tweak the two halves of the circuit into identical symmetry than to eliminate all the distortion in each half of the circuit.

The result has been a successful series of high power amplifiers offering low distortion, and stunning dynamic range and control, with only two gain stages and very minimal feedback.

Supersymmetry™ is ideally used to obtain high quality performance from very simple gain circuits, and particularly favors single-ended Class A topologies due to their smooth second harmonic characteristic, which cancels easily.

### **Aleph Single-Ended Class A**

Single-ended Class A has long been known as the “King of the Class A’s”, the simplest, most pure and least efficient form of audio amplification. Before the Aleph™ amplifiers, it was reserved for preamplifier circuits, high quality amplifier front-ends, and other very low power output stages.

US Patent # 5,710,522 describes the single-ended Class A power amplifier biased by a constant DC current source which negatively “ghosts” the speaker load with simple but effective current modulation. If you have followed developments in audio for the last 10 years, you know this design as the Pass Laboratories Aleph™. The Aleph™ is an incredibly successful ground breaking amplifier design, hailed in Stereophile magazine as “The Amplifier of the Decade” and winner of virtually every international design award for audio that we know of.

The key virtue of the Aleph™ design lies in its simplicity and effectiveness. With only two stages and no adjustments it delivers measured performance rivaling the most complex designs, but retains the sonic elegance and nuance of a truly minimalist gain path – only two gain devices in series from input to output.

### **The Supersymmetry Aleph™**

The two design concepts are not mutually exclusive, and we approached the development of the XA series with an eye to creating a warm/sweet X amplifier, or conversely, a powerfully dynamic Aleph™. The successful result is a circuit which is described as balanced single-ended Class A, consisting of two balanced Aleph™ amplifiers sharing a single differential input pair of transistors.

The amplifier has only the two stages, an input stage of a balanced pair of input devices, and the output stage, a balanced pair of single-ended Class A power Mosfets. Like the Aleph™, you can trace a path from input to output through only two gain devices. Like the X amps, feedback is used only to set the gain and correct for dissimilarities between the two matched output stages.

There are no adjustments. There are no frequency compensation capacitors. The amplifiers are unconditionally stable and reliable into any load. They are not fragile, temperamental or prone to failure.

The XA amplifiers operate at approximately 33% efficiency, which is to say they idle at three times their rated output. The XA200 is rated at 200 watts output into 8 ohms and draws something over 600 watts of AC power. This design is an exercise in highly conservative engineering, which provides exceptional reliability and product longevity. The output devices are exposed to no more than a fraction of the voltage and wattage they are designed to endure.

These rugged power devices are matched to about .3% and mounted on Mica insulators. Their massive heat sinks run at about 25 degrees C. above ambient temperature, so that actual chip temperatures are about 70 degrees below their rating. The output devices are designed to last a very long time under these conditions, with a probable life of about 50,000 hours.

The power supply of the XA 200 uses elaborate RF filtering and noise suppression designed to block AC noise and line DC. The substantial toroidal power transformer is followed by high speed rectifiers, and significant uF of computer grade capacitors in a passive filter arrangement. In addition to a main power switch the amplifier has a standby mode, which shuts down the bias to the circuit while keeping the supply active, significantly extending the life of the filter capacitors.

The sound of the XA amplifiers is a quantum leap over the parents. They retain the sweet warmth and lushness of the Aleph™ series without the fluffy coloration's. The dynamic contrast is even better than the X series; transients leaping from black to crescendo and back again with no telegraphing or hangover.

The bass has as much control over the speaker as the original X amps, but is a bit more neutral and carries subtler nuance. The midrange is a little deeper and the soundstage wider than the Alephs™.

Are the XA's better than Alephs™ and X's in every respect?

Yes, except for the higher power/current ratings of the X amps.

Are they the best audio amplifiers that money can buy? Absolutely!