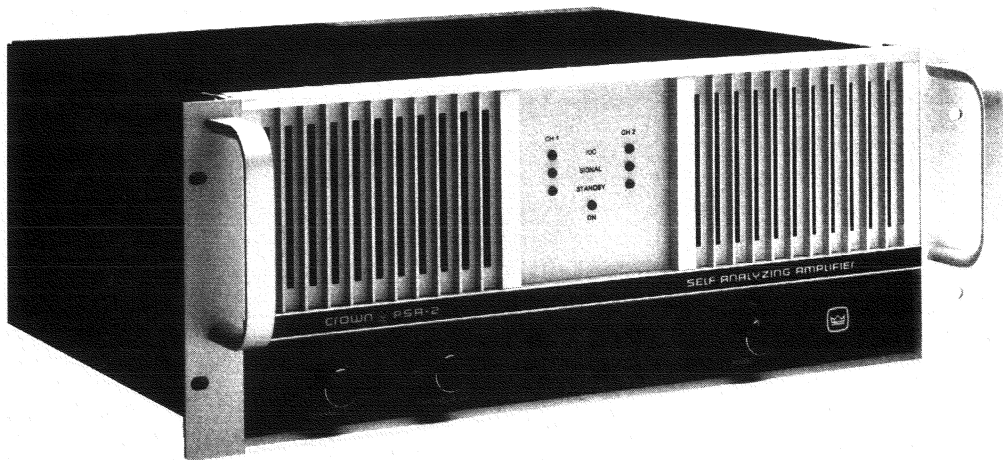




DISTRIBUTED IN NORTH AMERICA AS CROWN. EXPORTED AS AMCRON.®



# PSA-2X

**PROFESSIONAL SELF-ANALYZING AMPLIFIER**

## OWNER'S MANUAL

©1991 by CROWN INTERNATIONAL, INC.

*Mailing Address:*  
P.O. Box 1000  
Elkhart, IN 46515-1000

*Shipping Address:*  
57620 C.R. 105  
Elkhart, IN 46517

*Crown*®, *Amcron*® and *IOC*® are registered trademarks of Crown International, Inc.



The body of this manual is  
printed on recycled paper.

K80008D6  
8/91

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY  
5408 S. UNIVERSITY AVENUE  
CHICAGO, ILLINOIS 60637

PHYSICAL CHEMISTRY

PHYSICAL CHEMISTRY

PHYSICAL CHEMISTRY

1980

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If you need special assistance, beyond the scope of this manual, please contact our Technical Services Department.

Crown/Amcron Technical Services Dept., P.O. Box 1000, Elkhart, Indiana 46515-1000  
Phone: 800/342-6939 or 219/294-8200. Crown Fax: 219/294-8329. Amcron Fax: 219/294-8346

## **CAUTION**

**RISK OF ELECTRIC SHOCK—DO NOT OPEN.  
NO USER SERVICEABLE PARTS INSIDE.  
REFER SERVICING TO QUALIFIED PERSONNEL.**

## **ATTENTION**

**RISQUE DE CHOC ÉLECTRIQUE—  
NE PAS OUVRIR**



## **WARNING**

**TO REDUCE THE RISK OF ELECTRIC  
SHOCK, DO NOT EXPOSE THIS  
EQUIPMENT TO RAIN OR MOISTURE!**



# FULL THREE-YEAR WARRANTY



## SUMMARY OF WARRANTY

We, AMCRON, a division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana U.S.A. 46517-4095 warrant to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Amcron product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Amcron product is free of defects in materials and workmanship, and we further warrant the new Amcron product regardless of the reason for failure, except as excluded in this Amcron Warranty.

## ITEMS EXCLUDED FROM THIS AMCRON WARRANTY

This Amcron Warranty is in effect only for failure of a new Amcron product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Amcron Warranty also does not extend to the new Amcron product if the serial number has been defaced, altered, or removed.

## WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers. We will remedy the defect and ship the product from the service center within a reasonable time after receipt of the defective product at our authorized service center. All expenses in remedying the defect, including surface shipping costs to the nearest authorized service center, will be borne by us. (You must bear the expense of all taxes, duties and other customs fees when transporting the product.)

## HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by our authorized service center. If the repairs made by our authorized service center are not satisfactory, notify our authorized service center immediately.

## DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW AMCRON PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

## WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Amcron Warranty. This Amcron Warranty is not extended by the length of time which you are deprived of the use of the new Amcron product. Repairs and replacement parts provided under the terms of this Amcron Warranty shall carry only the unexpired portion of this Amcron Warranty.

## DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

## LEGAL REMEDIES OF PURCHASER

No action to enforce this Amcron Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

## THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR AMCRON PRODUCTS.

Amcron, P.O. Box 1000, 1718 W. Mishawaka Rd., Elkhart, Indiana  
U.S.A. 46515-1000. Phone: 219/294-8000. Fax: 219/294-8346.





# FULL THREE-YEAR WARRANTY



## SUMMARY OF WARRANTY

We, CROWN, a division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana U.S.A. 46517-4095 warrant to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship, and we further warrant the new Crown product regardless of the reason for failure, except as excluded in this Crown Warranty.

## ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

## WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at the factory. We will remedy the defect and ship the product from the service center or our factory within a reasonable time after receipt of the defective product at our authorized service center or our factory. All expenses in remedying the defect, including surface shipping costs in the United States, will be borne by us. (You must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

## HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack, which, if needed, may be obtained from us free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our authorized service center. If the repairs made by us or our authorized service center are not satisfactory, notify us or our authorized service center immediately.

## DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

## WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

## DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

## LEGAL REMEDIES OF PURCHASER

THIS CROWN WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

## THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

Crown, P.O. Box 1000, 1718 W. Mishawaka Rd., Elkhart, Indiana U.S.A. 46515-1000.  
Phone: 219/294-8000. Crown Fax: 219/294-8329, Amcron Fax: 219/294-8346.

# CONTENTS

<b>1</b>	<b>Welcome .....</b>	<b>1-1</b>
	1.1 Unpacking .....	1-1
	1.2 Features .....	1-1
<b>2</b>	<b>Facilities .....</b>	<b>2-1</b>
<b>3</b>	<b>Installation .....</b>	<b>3-1</b>
	3.1 Mounting .....	3-2
	3.1.1 Preventing Ground Loops .....	3-2
	3.2 Cooling .....	3-2
	3.3 Wiring .....	3-2
	3.3.1 Mode of Operation .....	3-3
	3.3.2 Input .....	3-3
	3.3.3 Output .....	3-4
	3.3.4 Load Protection .....	3-5
	3.3.5 Inductive Loads .....	3-5
	3.3.6 Power .....	3-5
	3.3.7 Converting Voltages .....	3-5
<b>4</b>	<b>Operation .....</b>	<b>4-1</b>
	4.1 Precautions .....	4-1
	4.2 Front Panel Displays .....	4-1
	4.3 Controls .....	4-1
	4.4 Protection .....	4-1
	4.5 Cleaning .....	5-1
<b>5</b>	<b>Service .....</b>	<b>5-1</b>
	5.1 Service at a Crown Service Center .....	5-1
	5.2 Factory Service .....	5-1
<b>6</b>	<b>Technical Information .....</b>	<b>6-1</b>
	6.1 Overview .....	6-1
	6.2 Circuit Theory .....	6-1
<b>7</b>	<b>Specifications .....</b>	<b>7-1</b>
	7.1 Performance .....	7-1
	7.2 Power .....	7-1
	7.3 Controls .....	7-1
	7.4 Indicators .....	7-1
	7.5 Input/Output .....	7-1
	7.6 Protection .....	7-2
	7.7 Construction .....	7-2
<b>8</b>	<b>Balanced Input Module .....</b>	<b>8-1</b>
	8.1 Features .....	8-1
	8.2 Circuit Theory .....	8-4
	8.3 Specifications .....	8-4

## ILLUSTRATIONS

1.1	PSA-2X Amplifier .....	1-1
2.1	Front Facilities .....	2-1
2.2	Rear Facilities .....	2-2
3.1	System Connection for Stereo and Mono .....	3-1
3.2	Mounting Dimensions .....	3-2
3.3	Input Capacitor Selection .....	3-3
3.4	Unbalanced RFI Filters .....	3-3
3.5	Wire Size Nomograph .....	3-4
3.6	Fuse Selection for Loudspeaker Protection .....	3-5
6.1	Circuit Block Diagram .....	6-2
7.1	PSA-2X Power Matrix .....	7-3
7.2	Typical Frequency Response .....	7-4
7.3	Typical Output Phase Response .....	7-4
7.4	Typical Crosstalk .....	7-4
7.5	Typical IM Distortion .....	7-5
7.6	Typical Noise Spectrum .....	7-5
7.7	Typical Damping Factor (8 ohm) .....	7-6
7.8	Typical Power Output: 16, 8, 4 and 2 ohm .....	7-6
7.9	Typical Output Impedance .....	7-7
7.10	Typical Low-Frequency Protect Action .....	7-7
8.1	Balanced Input Module .....	8-1
8.2	Low/High Pass Conversions Formulas .....	8-2
8.3	AGC Threshold Control Positions .....	8-3
8.4	Typical Freq Response, Balanced Input Mod .....	8-5
8.5	Typical CMR Through Balanced Input Mod .....	8-5
8.6	Typical AGC Action .....	8-5

---



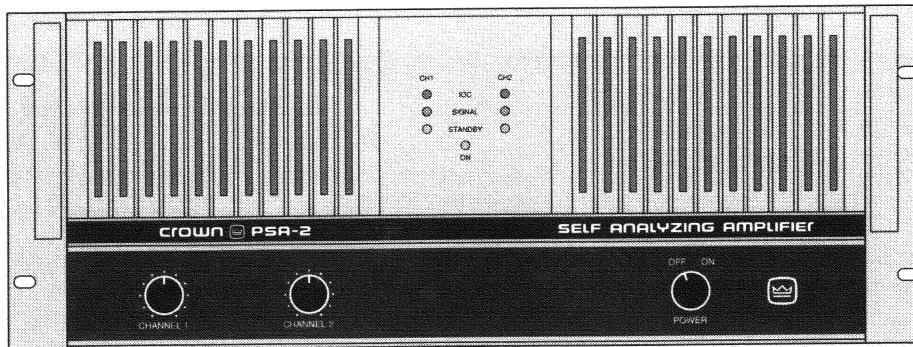


Fig. 1.1 PSA-2X Amplifier

## 1 Welcome

Congratulations on your purchase of the PSA-2X professional self-analyzing power amplifier. The PSA-2X is designed for precision amplification, high power output, and dependable performance in demanding professional use.

It incorporates unique on-board analog computers to monitor the *safe operating area (SOA)* of its output transistors to provide higher power without the arbitrary voltage or current restrictions of most amplifiers. The result: maximum output as well as maximum safety.

Crown has engineered your new amplifier for high reliability, using only the finest materials and protecting your investment with the most comprehensive three-year warranty in the music industry.

This manual will help you successfully install and use your PSA-2X amplifier. In order to gain maximum benefit from your amp we strongly recommend you read all the instructions, warnings and cautions contained within. Also for your protection, please send in your warranty registration card today and save your bill of sale since it is your **official proof of purchase**.

### 1.1 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim with the carrier for damage resulting during shipment. Crown will be happy to cooperate fully as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, as most do, save all packing materials so you will have them if you ever need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

You should find these items when you unpack:

- 1 15 A-20 Amp AC adapter
- 4 mounting screws
- 4 nylon washers

### 1.2 Features

- Front panel of extra rugged extruded aluminum features Signal Presence, Standby, and IOC® indicators as well as level controls for each channel.
- Stereo-Mono switch on back panel allows quick conversion from stereo mode to bridged-mono mode for higher-powered single-channel operation.
- IOC (Input/Output Comparator) circuitry immediately alerts of any distortion over 0.05%.
- Patented Crown circuitry handles extreme voltage swings without putting output transistors in series, resulting in lower distortion, greater reliability.
- Very low harmonic and intermodulation distortion give best *dynamic transfer function* in the industry.
- Full protection against shorted outputs, open circuits, mismatched loads, general overheating, and high-frequency overloads.
- Separate voltage supplies for each channel provide excellent crosstalk characteristics as well as provide improved reliability.
- Efficient heat sinks and a self-contained forced air cooling system prevent overheating and prolong component life.
- Mounts in a standard 19-inch (48.3 cm) equipment rack; also can be stacked on its rubber feet.

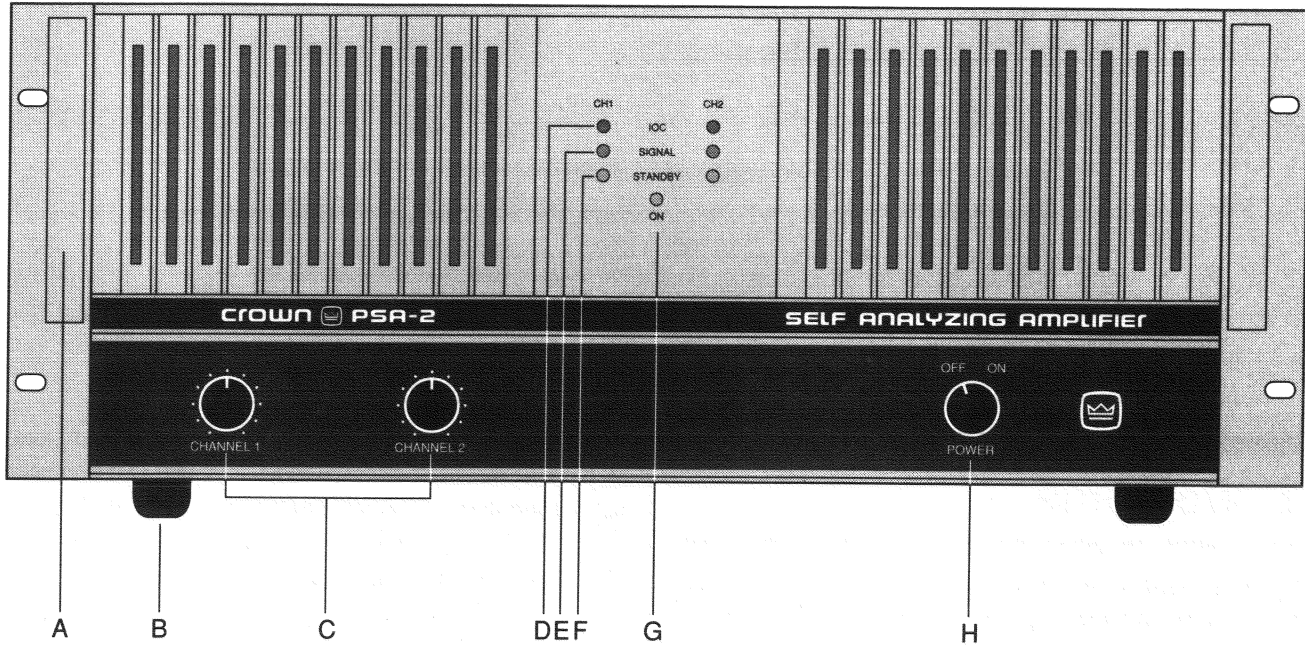


Fig. 2.1 Front Facilities

## 2 Facilities

### A. Front Panel

Rugged satinized aluminum panel with rack mount holes and sturdy handles.

### B. Rubber Feet

Removable heavy-duty rubber feet permit stacking of amplifiers.

### C. Level Controls

Separate level controls for each channel.

### D. IOC® Indicators

Red LEDs show *Input/Output Comparator (IOC)* status for each channel. The LEDs light up when the output waveform differs from the input waveform by more than 0.05%. Factors which can cause such distortion are too high an input level and improper load impedance.

(NOTE: occasional flashing of *IOC* after turn-off is normal; also, *IOC* and Signal Presence indicators will NOT illuminate simultaneously.)

### E. Signal Indicators

Green LEDs indicate signal presence of at least 1.2 peak volts at the output of that respective channel. Under normal operation, the Signal lights will be on.

### F. Standby Indicators

Yellow LEDs glow when either channel is in the standby state. This will occur when utilizing the DELAY feature.

### G. Power On Indicator

Amber LED indicates the presence of AC power. The power switch engages only the cooling system and low-voltage power supply.

### H. Power Switch

A two-position switch turns the unit on and off.

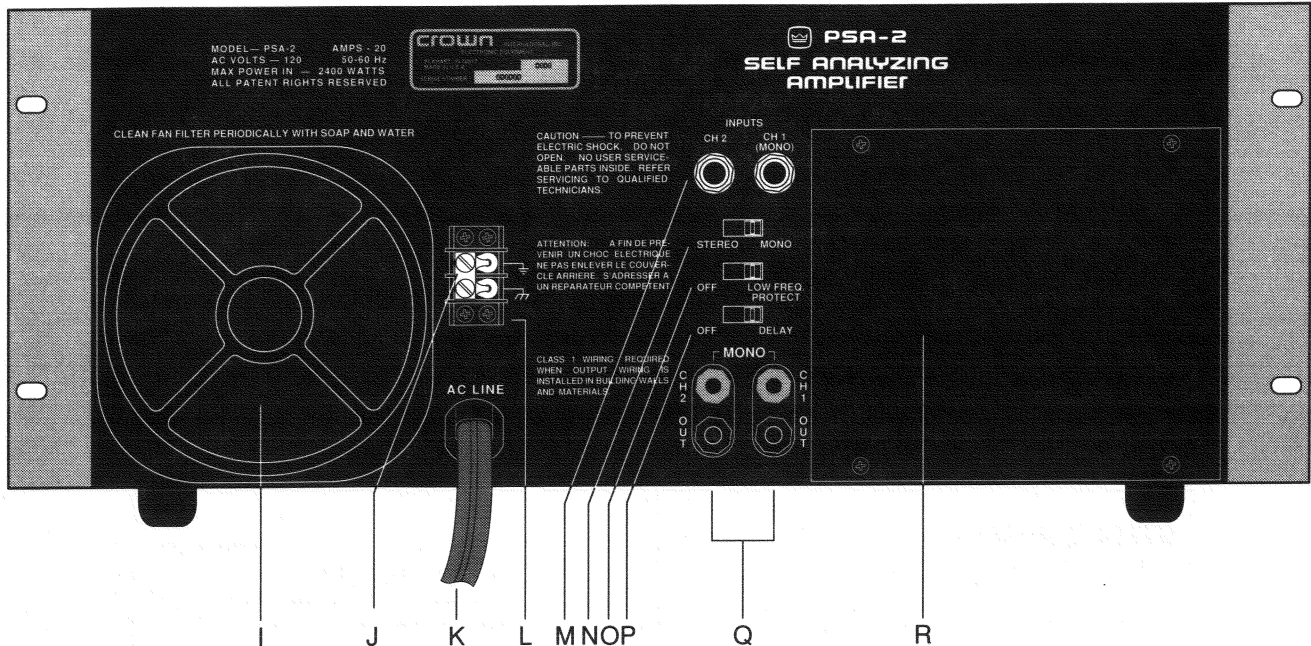


Fig. 2.2 Rear Facilities

**I. Fan Intake**

The PSA-2X has a dust filter on the air intake to the cooling system. The filter may be removed for cleaning.

**J. Shorting Strap**

Isolation of chassis ground from signal ground is easily accomplished by removing the shorting strap from the terminal strip. This may correct hum problems caused by ground loops.

**K. Power Cord**

20-amp power cord with standard three-wire grounded connector.

**L. Ground Barrier Strip**

2-lug terminal block with removable shorting strap provides a means for isolating or uniting chassis and signal grounds.

**M. Input Jacks**

Unbalanced 1/4-inch phone jacks are provided for input.

**N. Stereo-Mono Switch**

Slide left for Stereo operation, right for Bridged Mono.

**O. Low Frequency Protect Switch**

Engaging this switch causes the unit to cycle through the "STANDBY" mode if low frequency (DC-10 Hz) appears at the output.

**Caution: Whenever the LOW FREQ PROTECT switch is engaged, also engage the DELAY switch.**

**P. Delay Switch**

This switch activates a four-second delay in the transition state from "turn-on" to high-voltage power supplies on.

**Q Output Connectors**

Banana jacks are provided at the output of each channel. It is recommended that banana plugs be used on the loudspeaker cables for connection to the output jacks.

**R. Cover Plate**

Allows installation of optional Balanced Input Module (PSA-2 MOD). See Section 8 for details.

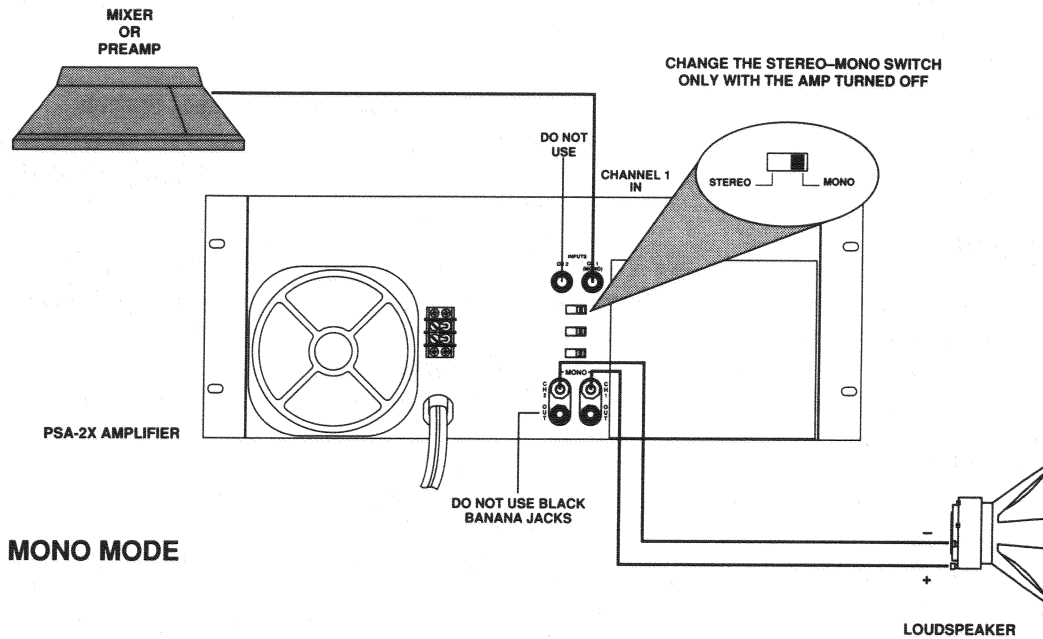
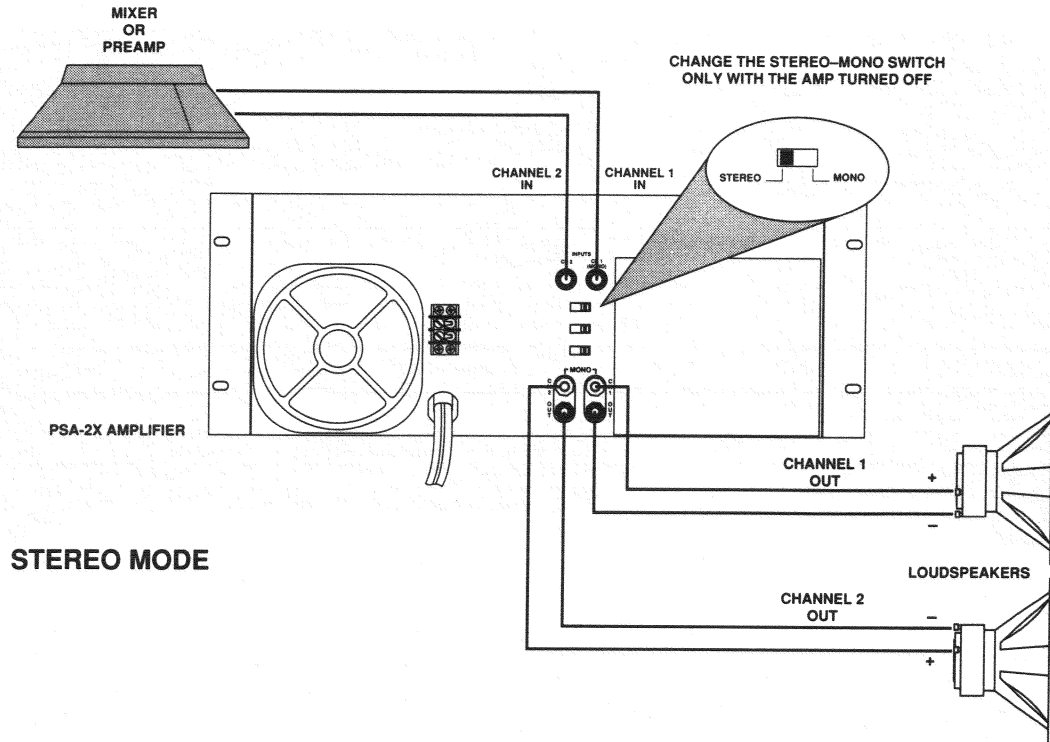


Fig. 3.1 System Connection for Stereo and Mono Operation



## 3 Installation

### 3.1 Mounting

The PSA-2X amplifier is designed for standard 19-inch (48.3 cm) rack mounting as well as stack mounting without a cabinet. Please pay close attention to the cooling requirements (see Section 3.2).

When rack mounting is chosen, take care to protect the amplifier if the rack is likely to be subjected to usage that could result in mechanical shock.

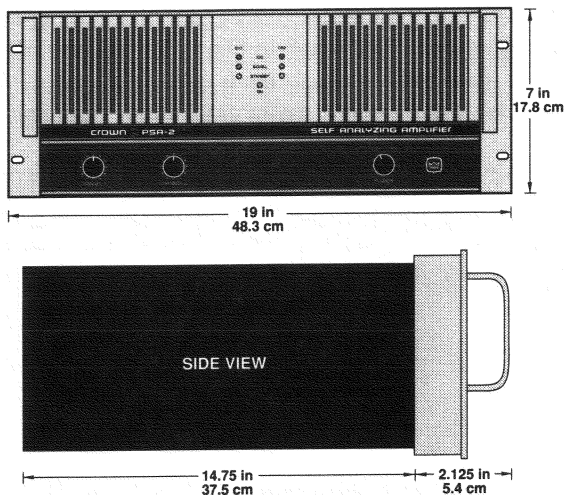


Fig. 3.2 Mounting Dimensions

**Important:** Because of the weight of the unit, the rear should be securely supported.

The simplest form of support is to use end supporting angles joined to the sides of the rack. These support the amplifier from beneath. If chassis slides are used, care should be taken to avoid toppling the rack when the slides are extended. The center of gravity of the amplifier is approximately 5.4 inches (13.7 cm) behind the front panel.

#### 3.1.1 Preventing Ground Loops

If a number of units are being racked on electrically common rails, and a very high signal/noise ratio is to be maintained, it may be necessary to separate the chassis ground from the signal ground. Do this by removing the strap from the rear-panel ground-terminal strip. This will reduce the possibility of ground loop hum.

### 3.2 Cooling

NEVER block the air vents in the sides, front, and back of the amplifier. A clearance of 1.75 inches (4.5 cm) should be allowed above the unit for hot air discharge.

A source of cooling air should be provided for the fan intake. A vent tube to the outside of the rack may be necessary if the rack ventilation is poor and/or the amplifier heat output is high. Never install the amp in a small unventilated cabinet; automatic thermal derating or transformer shutdown will occur after prolonged operation under such conditions.

If the air supply is unusually dusty, you will want to pre-filter it using commercial furnace filters, etc., to prevent rapid loading of the unit's own air filter. When needed, the unit's filter can be cleaned with mild detergent and water (see Section 4.5).

### 3.3 Wiring

Figure 3.1 shows how to install a PSA-2X amplifier into a sound system for either STEREO or MONO operation. Please use care in making connections, selecting signal sources and controlling the output level.

*It is always wise to remove power from the unit and turn the input level controls off while making or changing connections—especially if the load is a loudspeaker system. This will eliminate any chance of loud blasts or damage to the loudspeakers. The load you save may be your own! Crown assumes no liability for damaged loads resulting from careless amplifier use and/or deliberate overpowering.*

#### Input Wiring Tips

1. Use only shielded cable. The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.
2. When using unbalanced lines, keep the cables as short as possible. Avoid cable lengths greater than 10 feet (3 meters).
3. Do not run signal cables together with high-level wiring such as loudspeaker wires or AC cords. (This greatly lessens the chance of hum or noise being induced or picked up from asymmetrical ground loops.)
4. Turn the entire system off before changing any connections and turn the Level control all the way down before powering the system back up. Crown is not liable for damage incurred when any transducer or component is overdriven.

### 3.3.1 Mode of Operation

The PSA-2X may be operated in STEREO or BRIDGED MONO by switching the stereo/mono slide switch on the rear panel. There are VERY IMPORTANT wiring differences between these modes which are detailed next.

#### STEREO

The installation is very intuitive in STEREO mode. The Channel 1 input signal is amplified at the Channel 1 output. The same is true of Channel 2. To put the amplifier into STEREO mode, first turn the amplifier off, then slide the Stereo-Mono switch to the STEREO position, and properly connect the output wiring. Observe correct loudspeaker polarity (see the first example in Figure 3.1) and be very careful not to short the two outputs together while in STEREO mode.

**CAUTION: Never parallel the two outputs by directly tying them together or paralleling them with the output of any other amplifier.** Such connection does not result in increased power output and can cause premature activation of the protection circuitry to prevent overheating.

#### MONO

When the switch is in the MONO position, the input circuitry of the PSA-2X is altered so that the two channels are "added" (bridged) for mono output.

Care must be taken in the external hook-up to assure proper operation. Observe the following:

1. Plug the input line into the Channel 1 input jack. The level is adjusted with the Channel 1 level control only. Unplug the input to Channel 2 and completely turn down the Channel 2 level control (CCW).

Note: the Channel 2 input jack and level control are not defeated in the MONO mode. **DO NOT USE THE CHANNEL 2 INPUT OR THE SIGNAL LEVEL AND QUALITY MAY BE GREATLY DEGRADED.**

2. Connect the load across the two red banana posts with the positive lead from the load attaching to the red post of Channel 1 and the negative lead of the load attaching to the red post of Channel 2 (see the second example in Figure 3.1).

Because of the panel mounting configuration of the dual banana output jacks, it is possible to use only one banana plug. Both load leads are connected to the red connectors only. **THE TWO BLACK BANANA OUTPUT POSTS ARE NOT USED AND SHOULD NOT BE SHORTED. The load must be balanced** (neither side shorted to ground).

**CAUTION: All equipment (meters, switches, etc.) connected to the mono output lines must be balanced. To prevent oscillations, isolate both sides of the line from the input grounds.**

### 3.3.2 Input

Unbalanced 1/4-inch phone input jacks are provided for each channel on the rear panel. When you connect the inputs, take precautions to prevent problems in three areas: 1) undesirable signals to the inputs, 2) ground loops, and 3) feedback from output(s) to input(s).

Large **subsonic (subaudible) frequencies** are sometimes present in the input signal and can overload, overheat or otherwise damage loudspeakers.

A simple visual test for DC on the inputs (providing the woofer is visible) is to slowly turn up the input level control with the amp on and watch for displacement of the loudspeaker cone. If much displacement is observed, the DC content of the input may be excessive.

To remove such frequencies, place a capacitor in series in the input signal line. The graph in Figure 3.4 shows how the value of the capacitor affects the frequency response. Use only a low-leakage paper, mylar or tantalum capacitor.

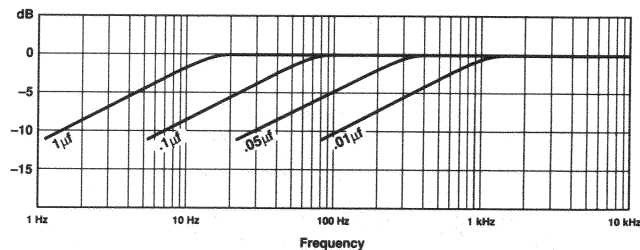
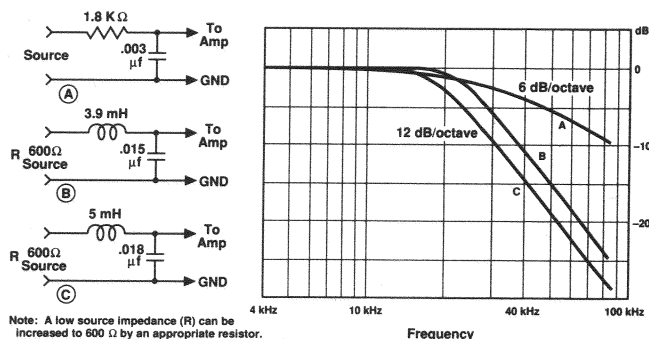


Fig. 3.3 Input-Capacitor Selection

If large amounts of **ultrasonic frequencies** or RF (radio frequency) are found on the input, such as bias from tape recorders, radio stations, etc., put a low-pass filter on the input.

While the highest RF levels that can be reasonably expected may not damage the amplifier, they can burn out tweeters or other sensitive loads, activate the amplifier's protection system or overload the controlled-slewing-rate stage of the amp. (This stage provides RF overload protection.)

The following filters are recommended for such situations:



Note: A low source impedance (R) can be increased to 600 Ω by an appropriate resistor.

Fig. 3.4 Unbalanced RFI Filters

Another problem to prevent is **ground loops**—undesirable currents flowing in a grounded system, possibly causing hum in the output. A common form of loop is a pair of input cables whose area is subjected to a magnetic hum field. To prevent ground loops causing magnetic induction, lace both cables together along their length and keep them away from the power transformer. **DO NOT CONNECT THE INPUT AND OUTPUT GROUNDS TOGETHER.**

**Feedback oscillation** can occur when input and output grounds are tied together as in testing or metering. When the amp is driving an AC-grounded device such as a meter, follow this procedure. For safety, plug all the devices' 3-prong AC plugs into grounded outlets. Then, to break up the ground loop, disconnect the cable shield from the output of the device driving the amp input.

To isolate the signal ground from the AC (chassis) ground, remove the ground shorting strap between the ground terminals on the rear panel (Fig. 2.2).

### 3.3.3 Output

Consider the power handling capacity of your load before connecting it to the amplifier. Crown is not liable for damage incurred at any time due to the load being overpowered. The use of loudspeaker protection fuses is highly recommended (see Section 3.3.4). Please also pay close attention to the Operating Precautions (Section 4.1).

Use speaker cables of sufficient gauge (thickness) for the length used. Otherwise, power is lost through cable heating and the damping factor decreased due to cable resistance. Refer to the nomograph (Fig. 3.6) for wire size.

Use the nomograph as follows:

1. Note the load resistance of the speakers connected to each channel of the amplifier. Mark this value on the nomograph "Load Resistance" line.
2. Choose an acceptable system damping factor (50 is typical). Mark this value on the "Damping Factor" line.
3. Draw a pencil line through these two points, intersecting the "Source Resistance" line.
4. On the "2-Cond. Cable" line, mark the length of cable run.
5. Draw a pencil line from the intersection point on the "Source Resistance" line through the mark on the "2-Cond. Cable" line.
6. Note where the pencil line intersects the "Annealed Copper Wire" line. This value is the required gauge of speaker cable.
7. If the cable size exceeds what you want to use, settle for a lower damping factor and try again or use more than one cable for each line. A rule of thumb for the latter choice is: Every time you double the number of conductors (of equal gauge) the resulting apparent gauge is three less.

For example, you determine that you need #10 AWG wire but this is too large, so you decide instead to use two #13 AWG wires in place of each #10 wire and achieve the same effect. In this same example you could also substitute four #16 AWG wires.

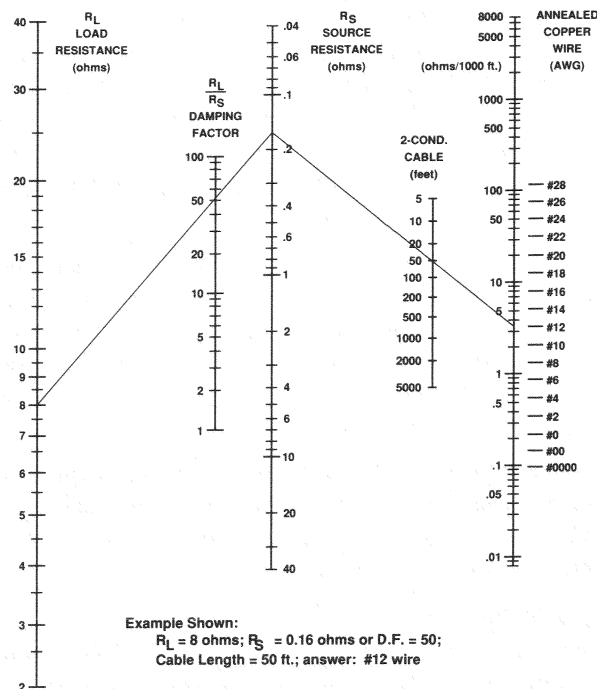


Fig. 3.5 Wire-Size Nomograph

To prevent high-frequency oscillations:

1. Lace the loudspeaker cables together.
2. Keep speaker cables well separated from input cables.
3. Never connect the amplifier's input and output grounds together.
4. Install a low-pass filter on the signal input line (see preceding Input section).

### Use Good Connectors

1. To prevent short circuits, be sure male connectors on speaker cables are not exposed.
2. Do not use connectors which might accidentally cause the two channels to be tied together during connecting or disconnecting. (A common example is the standard 3-wire 1/4-inch stereo phone plug.)
3. Do not use connectors which can be plugged into AC receptacles.
4. Do not use connectors having low current-carrying capacity.
5. Do not use connectors having any tendency to short, or having shorted leads.

### 3.3.4 Load Protection

Since PSA-2X amplifiers generate high power, you may desire to protect your loudspeakers (or other sensitive loads) from damage resulting from excessive power. A common way to do this is to put a fuse in series with the load. The fuse may be single, fusing the overall speaker system or it may be multiple, with one fuse on each driver.

Fuses help prevent damage due to prolonged overload, but provide essentially no protection against damage from large transients. To minimize this problem, use high-speed instrument fuses such as the Littlefuse 361000 series. Figure Fig. 3.7 is a nomograph showing fuse size versus loudspeaker peak power ratings.

If, on the other hand, the loudspeaker is only susceptible to damage caused by overheating, use a fuse or circuit breaker having the same slow thermal response as the loudspeaker itself (such as a slow-blow fuse).

### 3.3.5 Inductive Loads

Loads that are primarily inductive, such as 70-V step-up transformers and electrostatic loudspeakers, require special attention. To prevent large low-frequency currents from damaging them, it may be necessary to install a high-pass filter at the input.

We recommend a 3-pole (18 dB/octave) filter that rolls off at 80 Hz or higher. Such a filter, installed at the input, will protect the load and isolate the amplifier from the unwanted low-frequency problems discussed in Section 3.3.2.

### 3.3.6 Power

The PSA-2X comes with a three-wire 20 A, 120 VAC plug and a 15 A wall-socket adapter as standard equipment. A 20 A wall outlet should be used whenever possible.

Use the third-wire ground with caution since it may introduce a ground loop in a system (opening the ground shorting strap on the back panel will remove this loop). Power must be at 50-60 Hz. (Operation at 400 Hz is not possible unless a cooling fan motor rated at 400 Hz is utilized; NOT AVAILABLE from Crown.)

### 3.3.7 Converting Line Voltages

The amplifier power supplies offer multiple connections for operation at different line voltages. The serial plate indicates which voltage the amplifier was wired for at the factory.

Converting from one voltage to another is a fairly complex operation and should be attempted only by a competent technician. Voltage conversion instructions are given on the last page of this manual.

The high-voltage supplies use dual power transformers which must be wired identically. Failure to properly wire the primaries can result in transformer damage.

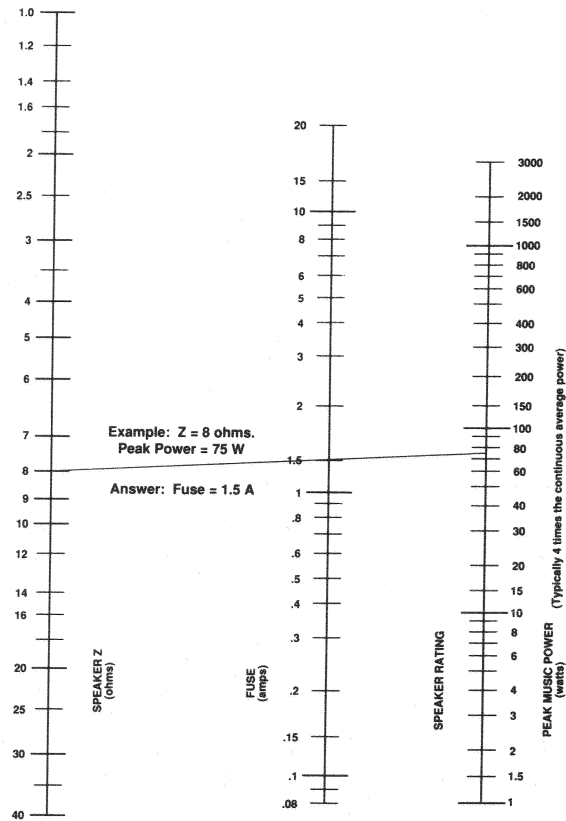


Fig. 3.6 Fuse Selector Nomograph for Loudspeaker Protection

**Note:** To change the voltage, first disconnect power and remove the bottom cover from the unit. (**Caution—the main supplies often remain charged for several minutes.**) The voltage connections are made with push-on connectors and terminal strips.

After the correct operating voltage has been chosen and all the primary leads identified, the conversion can be performed by following the connect drawing located on the interior of the bottom cover. Be sure to also make all necessary fuse changes (if needed).

When testing the amplifier, the line voltage must be the peak equivalent to a sinusoid of the indicated line voltage when at full load. Line regulation problems can introduce a substantial reduction in the available output power on an amplifier of this size.

Voltages above 150 V (100 V and 120 V connection) or 300 V (200 V and 240 V connection) are potentially damaging to the +15 V regulator, filter capacitors and output transistors and should be avoided.

## 4 Operation

### 4.1 Precautions

Although your amplifier is well protected from any external faults, we recommend the following precautions be taken for safe operation:

1. There are important differences between Stereo and Mono operating modes. Refer to section 3.3.1 for information on system hookup.
2. **WARNING: Do not change the position of the Stereo-Mono switch unless the amplifier is first turned off.**
3. Use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own.
4. Do not short the ground lead of an output cable to the input signal ground. This may form a ground loop and cause oscillations.
5. Never parallel the output with any other amplifier's output. Such connection does not result in increased power output. Damage incurred by such operation is not covered under warranty.
6. Never drive a transformer-coupled device or any other device which appears as a low-frequency short (less than 3 ohms at DC) without a series isolating capacitor. Such operation may damage the device and/or needlessly waste output power.
7. Operate the amplifier from AC mains of not more than 10% variation above or below the selected line voltage and only the specified line frequency.
8. Never connect the output to a power supply output, battery or power main.
9. Turn the amp off and unplug it from the AC line before removing and cleaning the dust filter.
10. Tampering in the circuit by unqualified personnel or making unauthorized circuit changes invalidates the warranty.

**Remember:** Crown is not liable for any damage resulting from overdriving other components in your system.

### 4.2 Front Panel Displays

The front panel contains several helpful indicator LEDs (see Figure 2.1). An amber **Power On** LED, driven by the low-voltage power supply, will glow to indicate that power is on.

Two green **Signal** LEDs indicate signal presence of at least 1.2 volt peak at the output of that respective channel.

Red LEDs show **IOC** (Input/Output Comparator) status for each channel. When more than 0.05% distortion (of any type) occurs, they will illuminate. Since transient distortion

can occur very rapidly, a delay circuit ensures that these LEDs will remain on long enough to be easily noticed. **Note: occasional flashing after turn-off is normal.**

The yellow **Standby** lights illuminate at any time the amplifier is in the standby state. This will occur most often when using the DELAY feature immediately after turn-on.

### 4.3 Controls

Front Panel Controls:

**Level** controls for both channels are located on the left side of the front panel. Turn these full counterclockwise BEFORE turning on the power switch.

The AC **Power** switch, at the lower right-hand corner of the unit, is a simple 2-position on/off control. If the power switch is set at ON, the power indicator LED should be on unless power is not connected or an internal problem exists.

Rear panel controls:

The **Stereo-Mono** Switch sets the mode of operation.

The **Low Frequency Protection** switch, when turned on, causes the unit to go into standby mode if low frequency (DC-10 Hz) appears at the output. The unit will cycle back on from standby after the excessive low-frequency output subsides. Protects sensitive loads from low-frequency damage. **Note: When Low-Freq protect switch is engaged, always engage the Delay switch as well.**

The **Delay** switch causes a 4-5 second delay of main power supply turn-on. This protects the loads against turn-on transients.

### 4.4 Protection

The PSA-2X is protected against all common hazards that plague high-power amplifiers, including shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain-destruction phenomena, input-overload damage, and high-frequency blowups. The unit protects loudspeakers from DC in the input signal and from turn-on/turn-off transients. **It also detects and prevents unwanted DC on the outputs.**

The basic output-protection mechanism represents a dramatic departure from conventional designs. Computer analysis of transistor stress-test data, leading to design of appropriate dynamic transistor environment analog circuits, forms the heart of the system.

A continuous flow of operating data produces an analog output proportional to the changing Safe Operating Area (SOA) of the transistor. This output controls the limits imposed by a current gain stage ahead of the output section. The output limits this change along with actual operating conditions. The maximum advantage may then be taken of