

User's Guide

for the

CRATE PRO AUDIO

SPA-400



Rack Mount

Power Amplifier

In order to achieve maximum performance from your new Crate Pro Audio SPA Series Power Amp we recommend that you read this user's guide prior to its use.







CRATE PRO AUDIO

CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

IMPORTANT NOTE ABOUT THIS OWNER'S MANUAL:
 This Owner's Manual covers two variations of the SPA-400: One, referred to as "Domestic," which has 1/4" jacks and 5-way binding posts for its speaker outputs; the other, referred to as "Export," which has Speakon® connectors only for its speaker outputs. Please use the "DOMESTIC/EXPORT" headers on the appropriate pages to ensure the information pertains to your particular amplifier. Thank You.

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THIS EQUIPMENT HAS BEEN DESIGNED AND ENGINEERED TO PROVIDE SAFE AND RELIABLE OPERATION. IN ORDER TO PROLONG THE LIFE OF THE UNIT AND PREVENT ACCIDENTAL DAMAGES OR INJURY, PLEASE FOLLOW THESE PRECAUTIONARY GUIDELINES:	CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT OPEN CHASSIS; DO NOT DEFEAT OR REMOVE THE GROUND PIN OF THE POWER CORD; CONNECT ONLY TO A PROPERLY GROUNDED AC POWER OUTLET.	WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE. CAUTION: NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.	CAUTION: OUR AMPLIFIERS ARE CAPABLE OF PRODUCING HIGH SOUND PRESSURE LEVELS. CONTINUED EXPOSURE TO HIGH SOUND PRESSURE LEVELS CAN CAUSE PERMANENT HEARING IMPAIRMENT OR LOSS. USER CAUTION IS ADVISED AND EAR PROTECTION IS RECOMMENDED IF UNIT IS OPERATED AT HIGH VOLUME.																								
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CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

Introduction:

Congratulations. You have selected one of the finest pieces of sound reinforcement equipment available, the Crate Pro Audio SPA-400 Rack Mounted Amplifier. Our many years of experience in high-performance audio equipment, combined with our extensive research and development procedures, have enabled us to produce an amplifier which provides the highest quality and reliability possible.

Like all Crate products, your SPA-400 amplifier was designed and manufactured using only the finest components and materials. Each amplifier design must satisfy our team of highly-trained technicians and musicians before it is approved, and each individual amplifier must pass a barrage of bench tests before it leaves the factory. We insist upon this extreme level of quality control to insure us that each amplifier produced will provide its owner with years of trouble-free, ear-pleasing performance.

Your new SPA-400 is a flexible part of any sound system – simple to connect and easy to operate – if you first know how to incorporate it into your application. Several configurations are covered in this manual, along with important information regarding impedance ratings and output power. In order to get the best performance and highest level of quality and reliability from your new amplifier, please read this owner's manual before operating the unit.

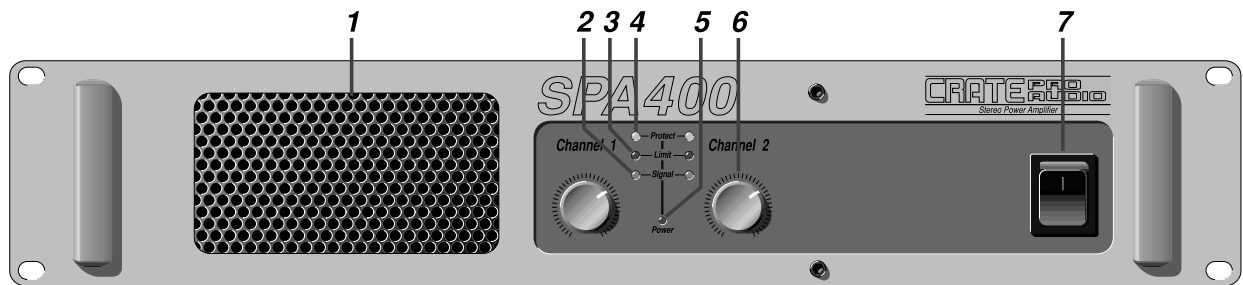
Features:

The Crate SPA-400 is a ruggedly constructed high quality power amplifier designed to give you continuous performance with professional results. The amplifier mounts into a standard 19" rack, requiring only 3-1/2 inches of vertical rack space. The automatic variable-speed internal cooling system uses the rear and the front of the amplifier - not the top and bottom - for its air intake and exhaust, allowing you to stack multiple amplifiers closer together in a rack mount situation.

The SPA-400 produces up to 125 watts of power per channel @ 8 ohms, 200 watts per channel @ 4 ohms stereo mode, or 400 watts @ 8 ohms in the bridged mono mode. Several "professional" features have been built into the SPA-400, such as 1/4" phone and XLR input jacks with electronically balanced Low or High impedance operation. Built-in automatic limiting circuitry with LED indicators constantly monitors the output of each channel and provides protection against clipping, thus preventing the generation of speaker-damaging square waves. A built-in protection circuit guards the amplifier against damages from overloads, short circuits, or overheating. In addition, each channel features a Signal LED to assist in hookup and troubleshooting, and a Fault LED which indicates when the internal protection circuitry is activated. Output connections can be made by either 1/4" phone jacks or high current five way binding post sets (Domestic units; Export units feature 1/4" phone jacks and high current Speakon® connectors for their speaker outputs).

CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

Front Panel Information:



1: FRONT PANEL EXHAUST VENT: The SPA-400 employs a variable-speed internal cooling fan to draw air through the unit to keep it running cool even under extreme operating conditions. The air is drawn in through the unit's rear and side intake vents and is forced out through the front panel exhaust vent. This method of cooling draws air out from the interior of the rack and provides more efficient cooling than methods which bring air in from the front and exhaust it through the back. Keep these vents clear and free from obstruction at all times to insure proper cooling.

2: SIGNAL INDICATOR LED: This LED will illuminate when signal is detected at the amplifier's output terminals, providing accurate visual confirmation of signal presence, often helpful in hookup and troubleshooting. The level of the signal must be at least 1% of the amplifier's full rated output to make the LED illuminate.

3: LIMIT INDICATOR LED: The SPA-400 employs an internal "Automatic" limit circuit to prevent the amplifier from clipping. The Limit LED will illuminate whenever the input signal attempts to overdrive the amplifier's output section, indicating that the Limiter has been called upon to prevent clipping. (Not only does clipping produce harsh sounding distortion, it is also capable of damaging speaker components – particularly high frequency drivers.) Periodic flashing of the Limit LED indicates operation at or near full output and is no cause for alarm. Steady illumination of the LED indicates constant operation of the Limiter, with the possibility that the input signal should be reduced by means of the Sensitivity control (#6). The Limiter within the SPA-400 is fully automatic, with no defeat switch, insuring you complete protection against clipping at all times.

4: FAULT INDICATOR LED: This LED will illuminate whenever the internal protection relay for the channel is activated. The protection relay is activated for a short period upon initial turn-on and at turn-off to prevent transient "spikes" from being reproduced through your speakers. A fault condition is also indicated in the event of an overtemperature status, or if DC voltages are present at the output. During thermal protection, both channels are shut down until the temperature returns to a safe operating level. In the event of DC voltage on the output, only the affected channel will be disconnected. The circuitry associated with the LED indicator provides valuable protection for both the amplifier and your speakers.

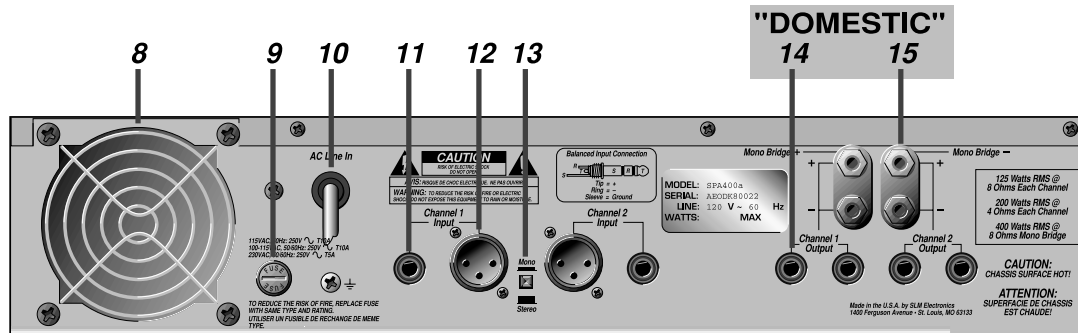
5: POWER INDICATOR LED: This LED will illuminate when AC power is applied by means of the Power switch (#7). If the LED fails to illuminate, check the AC outlet or the fuse on the rear panel (#9).

6: SENSITIVITY CONTROLS: These rotary potentiometers control the level or gain of each channel, with the fully-clockwise position of each providing a sensitivity of +2dBv. Normal calibration of the SPA-400 to a mixer would cause the Limit LED to flash at the same time that the mixer's VU meters indicate full output.

7: POWER SWITCH: This switch applies the power to the amplifier. The amp is on when the top of the switch is depressed, off when the bottom of the switch is depressed. The Power LED indicator (#5) will illuminate when the amplifier is on.

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Rear Panel Information – “Domestic”:



8: FAN INTAKE AREA: Air for cooling the SPA-400 is drawn in by the fan at the rear and side, directed through the amplifier, and exhausted through the front panel vent. Do not block or impede the airflow through these vents and keep the area free of foreign materials.

9: FUSE HOLDER: The SPA-400 employs an AC line fuse to help protect it from damages due to excessive current demands. If the amplifier does not function, check this fuse. If it is blown, replace it *ONLY* with the same size and type as indicated below the holder. If the fuse blows repeatedly, have the amplifier checked by a qualified service person.

10: POWER CORD: This heavy duty power cord must be connected to a grounded AC outlet of the proper voltage for the amplifier to operate. **IN ORDER TO AVOID THE POSSIBILITY OF ELECTRIC SHOCK, DO NOT REMOVE OR BYPASS THE GROUND PRONG OF THE POWER CORD.**

11: 1/4" PHONE JACK INPUTS: These jacks accept line level signal sources by means of cables fitted with standard 1/4" phone plugs. Low impedance balanced or unbalanced, as well as high impedance sources are acceptable for these inputs. Low impedance balanced inputs are to be wired as follows: Tip = Signal +, Ring = Signal -, Sleeve = Ground.

Both 1/4" jacks are wired in parallel; when one jack is used as an input, the remaining jack may be used to obtain a line out signal. In the Mono Mode, Channel 1's input jacks are used; Channel 2's input jacks are disconnected.

12: XLR BALANCED INPUT JACKS: These jacks will accept any balanced or unbalanced low impedance line level source by means of a three-pin XLR plug. The wiring for the plug is as follows: Pin 1 = Ground, Pin 2 = Signal +, Pin 3 = Signal -.

Both XLR jacks are wired in parallel; when one jack is used as an input, the remaining jack may be used to obtain a line out signal. In the Mono Mode, Channel 1's input jacks are used; Channel 2's input jacks are disconnected.

The input channel circuitry is transformerless electronically balanced, and requires a line level signal of 1V RMS or greater to drive the amplifier to full output.

13: MONO/STEREO MODE SWITCH: This push/push switch selects the operating mode of the amplifier. With the switch "out" (switch button flush with chassis) the amplifier is in the Stereo Mode; with the switch depressed (switch button indented below surface of chassis) the amplifier is in the Mono Mode. In the Mono Mode, Channel 1 functions as the input channel; Channel 2 inputs will be disconnected.

NOTE: Caution should be exercised! Improper hookup or misuse of the Mode switch could cause damage to your speakers. See the specific hookup configurations in the Installations sections of this manual.

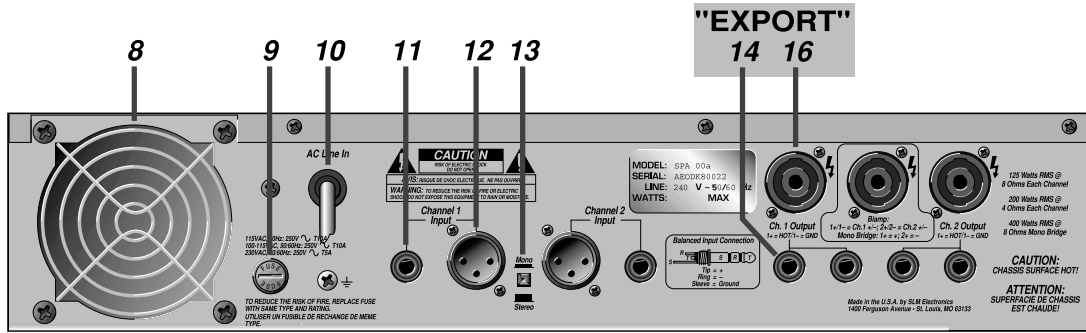
14: 1/4" PHONE JACK OUTPUTS: These paralleled output jacks offer an additional method of connecting to your speakers, using cables terminated with 1/4" phone plugs. Since these jacks are not as well suited to high current applications as the binding posts, they are **NOT** recommended for extended use at high power levels, or when driving 4 ohm loads. (Methods of connecting are shown on pages 7 – 13 of this manual.)

15. 5 WAY BINDING POST OUTPUTS: These output connectors offer an excellent method of connecting the amplifier to your speakers using cables terminated with spade lugs, banana plugs, or bare wire. Use of these connectors is highly recommended for high power operation. When using the amplifier in the Mono Mode, you **MUST** use these binding posts. (Methods of connecting are shown on pages 7 – 13 of this manual.)

On each channel, the binding posts (#14) are wired in parallel with the 1/4" jacks (#15): the tip of the 1/4" jack is connected to the red ("+") terminal of the binding posts and the sleeve is connected to the black ("-") binding posts. Use of both the 1/4" jack and the binding posts simultaneously to connect two cabinets in parallel is possible, provided that proper polarity and impedance are observed.

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Rear Panel Information – “Export”:



#8-14, same as “Domestic” (page 5); #15 does not apply.

16: SPEAKON® JACKS: These heavy-duty output jacks are used to connect the amplifier to your speakers using cables terminated with Speakon® type plugs. (Methods of connecting are shown on pages 7 – 13 of this manual.)

Each channel has a single Speakon® connector. A third Speakon® connector is provided for Mono Bridged use and can also be used for biamping. The Channel 1 and 2 Speakon® jacks are wired as follows: pin 1+ = “+”, pin 1- = “-”. The Mono Bridge/Biamp (middle) Speakon® jack is wired as follows: Pins 1+ and 1- = Channel 1 + and - respectively; pins 2+ and 2- = Channel 2 + and - respectively.

Speaker Impedances And Power Ratings:

When connecting speaker cabinets, you must observe proper load impedances. Whenever connecting multiple cabinets to an amplifier, the total load impedance must be calculated to insure proper performance from the amplifier. The impedance chart which follows shows the total load impedances of many common parallel speaker combinations:

IMPEDANCE CHART:

		SYSTEM ONE				
		SINGLE SPEAKER		TWO SPEAKERS IN PARALLEL		
		8Ω	16Ω	8:16Ω	16:16Ω	
SYSTEM TWO	ONE SPKR	8Ω	4Ω	5.3Ω	3.2Ω	4Ω
	TWO IN PARALLEL	8:16Ω	3.2Ω	4Ω	2.7Ω	3.2Ω
		16:16Ω	4Ω	5.3Ω	3.2Ω	4Ω

Note that some combinations result in impedances less than 4 ohms. (the shaded areas) These combinations are **not recommended** for the SPA-400 and should be avoided. They are included on the chart for reference only. Too low an impedance will activate the amplifier's protection circuit.

The formula for this chart is:

$$\frac{1}{1/R_1 + 1/R_2 + \dots + 1/R_N}$$

Where “R” is the speaker impedance. So, using two 16 ohm speakers in combination with one 8 ohm speaker, the impedance would be:

$$\frac{1}{1/8 + 1/16 + 1/16} = \frac{1}{.125 + .0625 + .0625} = \frac{1}{.250} = 4 \text{ ohm load impedance}$$

You can also figure this on the table. On System One, match the “16:16” column with the System Two “8” row.

Power Output:

The power output of an amplifier changes as the total load impedance increases or decreases. The total output power of the SPA-400 increases as the total load impedance decreases as follows:

total load impedance (in ohms):	8 (stereo mode)	4 (stereo mode)	16 (mono mode)	8 (mono mode)
total output power (watts RMS):	125/channel	200/channel	250	400

Output Power Per Speaker Cabinet:

If each parallel connected speaker cabinet has the same rated impedance, divide the total power output by the number of cabinets used. For example: Four 16 ohm cabinets have a total load impedance of 4 ohms (see the impedance chart above), which allows a total output power of 200 watts RMS (Stereo Mode): 200/4 = 50 watts RMS for each cabinet.

Speaker cabinets with different rated impedances will draw different amounts of power. To calculate the power output per cabinet, obtain the total load impedances from the impedance chart above and divide it by each speaker impedance. For example: Three speaker cabinets, one with a rated impedance of 8 ohms and two at 16 ohms are connected in parallel. According to the impedance chart, the total load impedance is 4 ohms, which means a total power output of 200 watts as above. Divide the total impedance by the impedance of each speaker and multiply the results by 200.

$$\frac{R_{\text{total}}}{R_N} = \frac{4}{8} = 1/2 \times 200 = 100 \text{ watts for the 8 ohm cabinet}$$

$$\frac{4}{16} = 1/4 \times 200 = 50 \text{ watts for each of the 16 ohm cabinets}$$

CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

Installations and Operation:

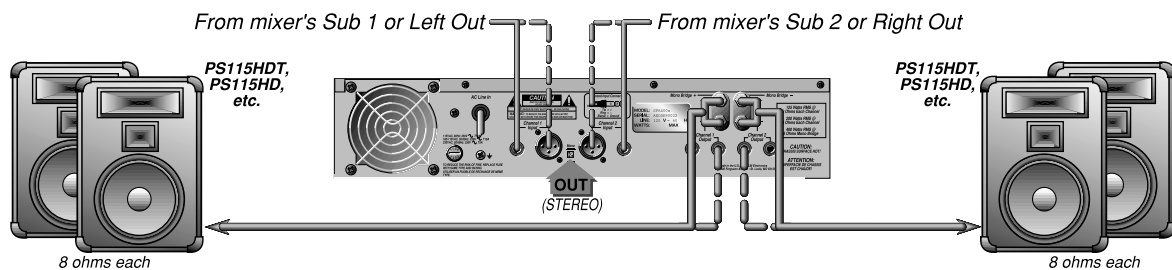
Stereo Operation:

The SPA-400 can be used in the Stereo Mode as two separate 200 watt units, each capable of driving loads down to 4 ohms. Each channel operates independently and has its own input connectors, sensitivity level controls, signal indicator LEDs, automatic limiter, fault protection circuitry, power amp, and speaker outputs. In the Stereo Mode, the Mono/Stereo switch (#13 on the rear panel) must be in the OUT position.

One application of the Stereo Mode is using one channel of the amplifier for the left house speakers and the other for the right. The mixing board channels can be panned left or right according to the position of the instruments on the stage. This way the house sound is a more faithful reproduction of the performance.

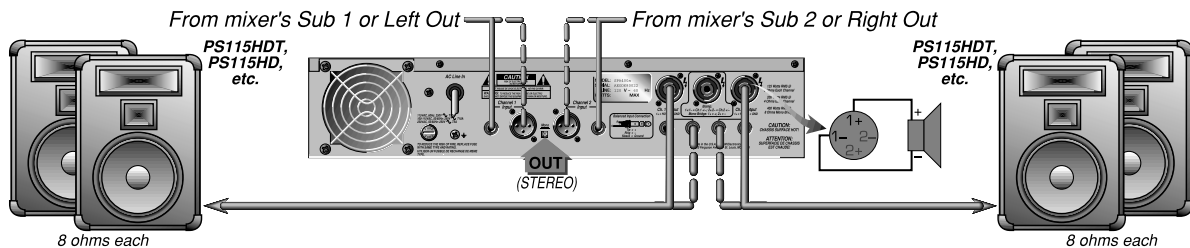
“DOMESTIC”: Either the binding posts or the 1/4” jacks may be used to connect the amplifier to the speakers.

Stereo operation – “Domestic”:



“EXPORT”: Either the Channel 1 and 2 Speakon® jacks or the 1/4” jacks may be used to connect the amplifier to the speakers.

Stereo operation – “Export”:



CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

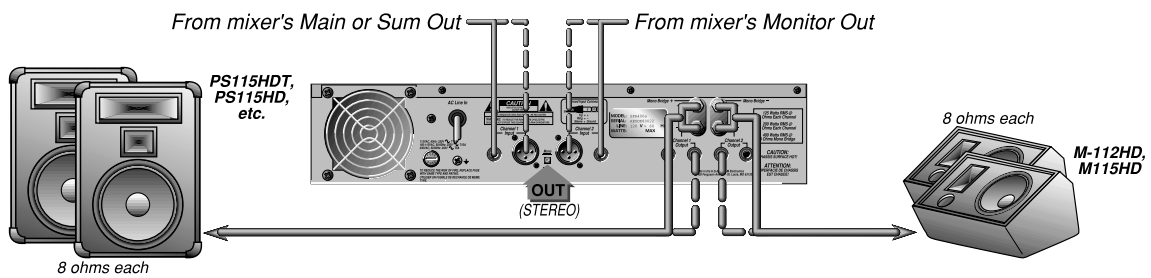
Installations and Operation:

Main / Monitor Combination:

Another application of the Stereo Mode (see page 7) is using one channel of the amplifier for the house speakers and the other for the monitors. The Mono/Stereo switch (#13 on the rear panel) must be in the OUT position.

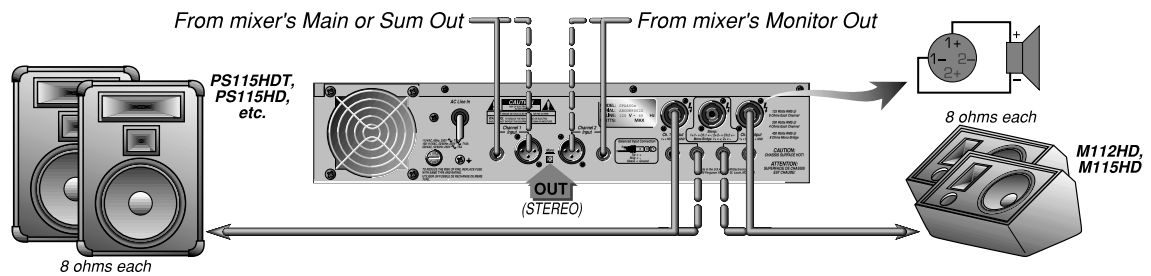
“DOMESTIC”: Either the binding posts or the 1/4” jacks may be used to connect the amplifier to the speakers.

Main/Monitor Combinations – “Domestic”:



“EXPORT”: Either the Channel 1 and 2 Speakon® jacks or the 1/4” jacks may be used to connect the amplifier to the speakers.

Main/Monitor Combinations – “Export”:



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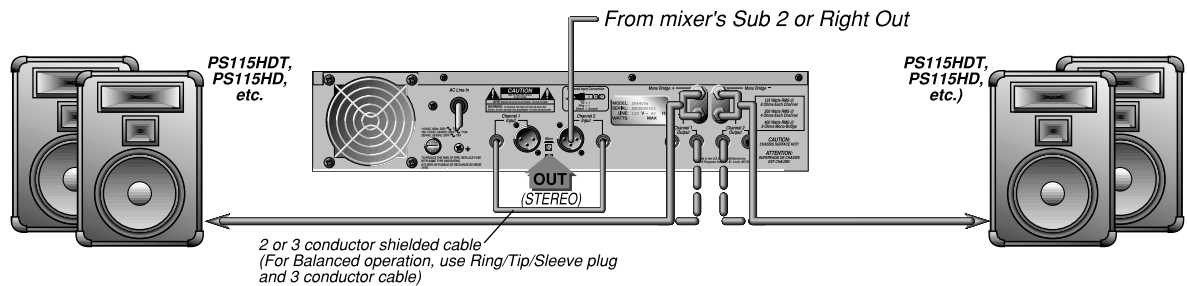
Installations and Operation:

Channel Patching:

If many speakers must be driven from the same signal, it is possible to “slave” or “patch” Channel 2 to Channel 1. One method is to connect a short cable from the unused Channel 1 input jack (either XLR or 1/4”) to one of the Channel 2 input jacks. In this way, up to four 8 ohm speakers may be driven at once. The Mono/Stereo switch (#13 on the rear panel) must be in the OUT position.

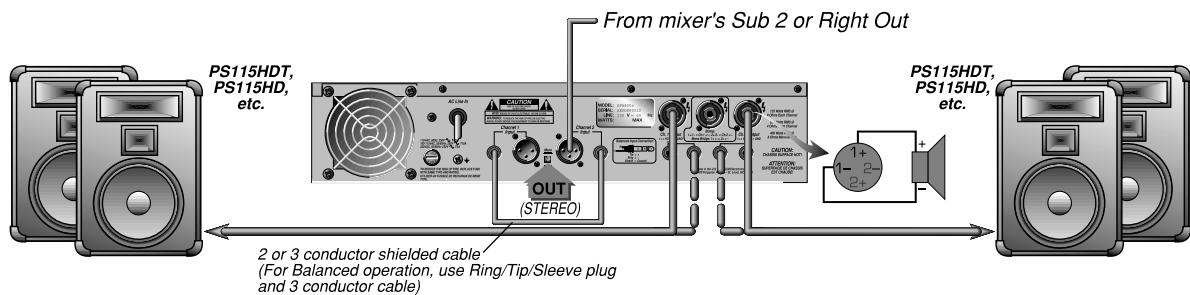
“DOMESTIC”: Either the binding posts or the 1/4” jacks may be used to connect the amplifier to the speakers.

Channel Patching – “Domestic”:



“EXPORT”: Either the Channel A and B Speakon® jacks or the 1/4” jacks may be used to connect the amplifier to the speakers.

Channel Patching – “Export”:



CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

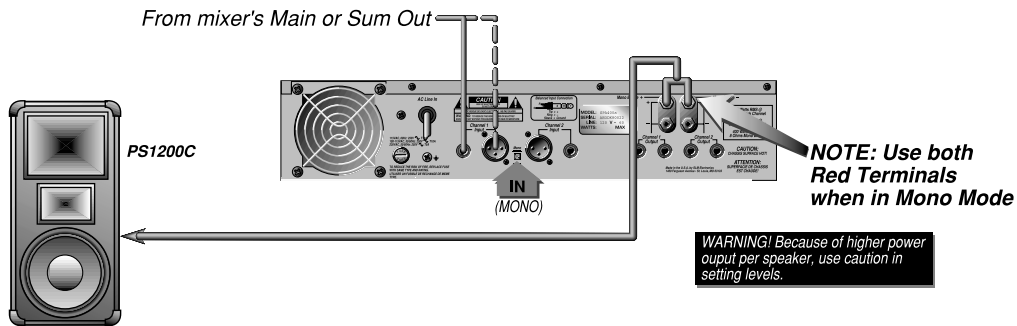
Installations and Operation:

Bridged Mono Operation:

The two internal power amplifiers (Ch. 1 and Ch. 2) can be bridged together to form a single, higher-powered amp. In the Bridged Mono Mode, the amplifier uses Channel 1's input jacks and Sensitivity control; Channel 2's are disconnected. Channel 2's power amp receives its signal from a tap after Channel 1's Sensitivity control, but prior to Channel 2's Limiter, so each channel is independently protected. To select the Mono Mode, the Mono/Stereo switch (#13 on the rear panel) must be depressed. Because both channels are being used (bridged in series), the minimum speaker load impedance must be 8 ohms.

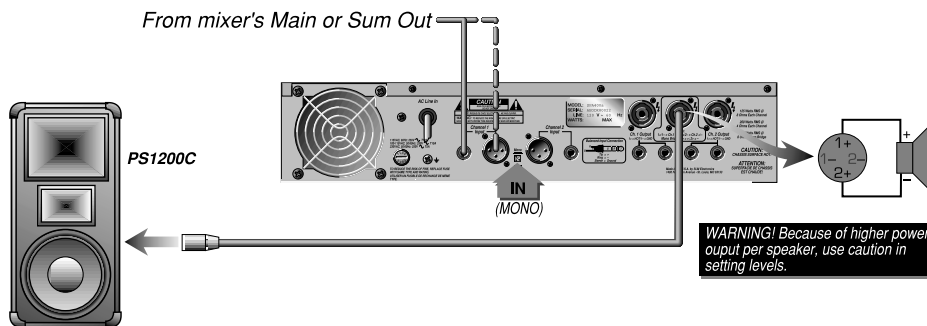
"DOMESTIC": The RED binding post terminals must be used to connect the amplifier to the speakers: Channel 1 = "+", Channel 2 = "-". The 1/4" jacks are not used in this mode.

Bridged mono mode operation – "Domestic":



"EXPORT": The middle Speakon® jack must be used to connect the amplifier to the speakers. (Pin 1+ = "+", pin 2+ = "-".)

Bridged mono mode operation – "Export":



CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

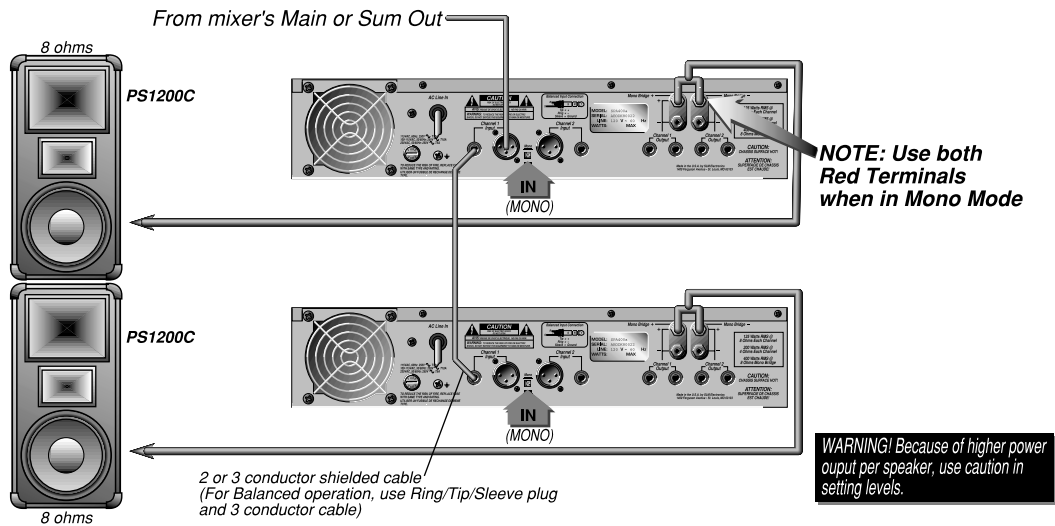
Installations and Operation:

Patching Two Bridged Mono Mode Systems:

Two Bridged Mono amplifiers can be patched together by connecting a signal cable between their input jacks. The Mono/Stereo switch (#13 on the rear panel) of each amplifier must be depressed.

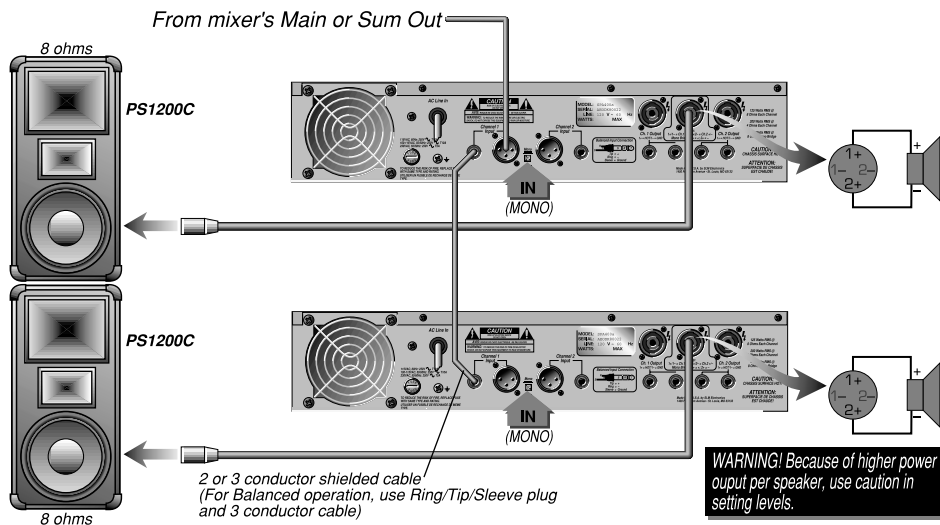
“DOMESTIC”: The RED binding post terminals must be used to connect the amplifier to the speakers: Channel 1 = “+”, Channel 2 = “-”. The 1/4” jacks are not used in this mode.

Patching two bridged mono mode systems – “Domestic”:



“EXPORT”: The middle Speakon® jack must be used to connect the amplifier to the speakers. (Pin 1+ = “+”, pin 2+ = “-”.)

Patching two bridged mono mode systems – “Export”:



CRATE PRO AUDIO SPA-400 Rack Mount Power Amplifier

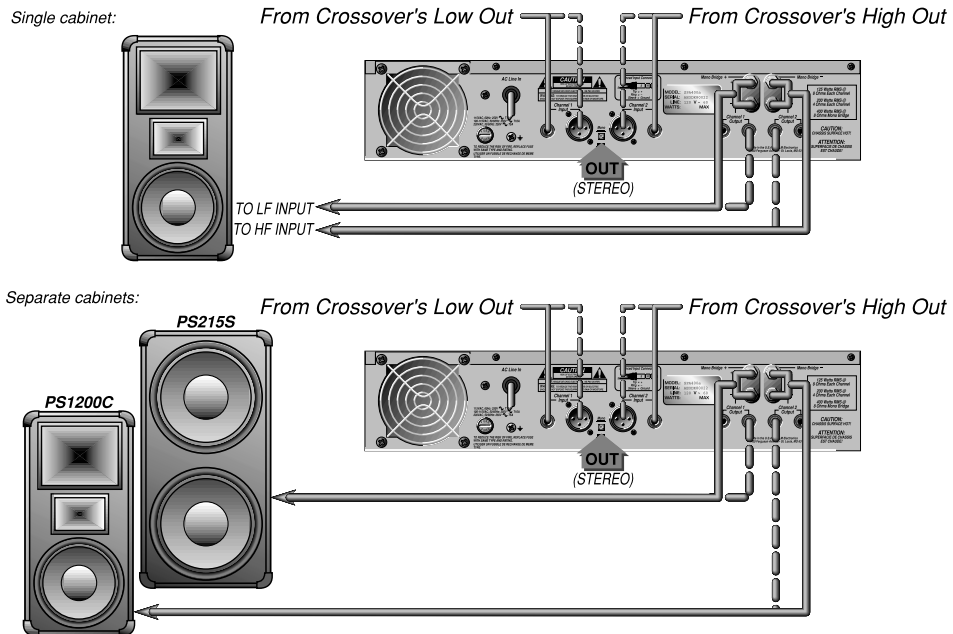
Installations and Operation:

Biamping With A Single Amplifier:

One SPA-400 can be used to separately power the lows and highs of a cabinet with biamp inputs, or a separate low and high frequency cabinet. For Biamp Operation, the Mono/Stereo switch (#13 on the rear panel) must be in the OUT position. Use Channel 2 for the high frequencies and Channel 1 for the lows.

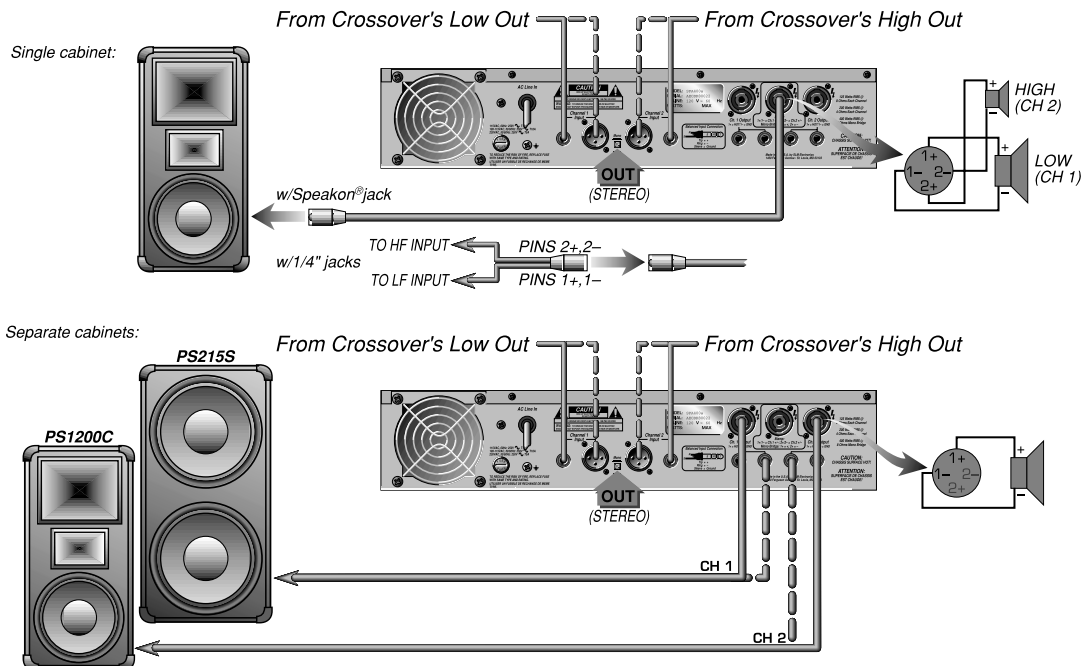
“DOMESTIC”: Either the binding posts or the 1/4” jacks may be used to connect the amplifier to the speakers.

Biamping with a single amplifier – “Domestic”:



“EXPORT”: The middle Speakon® jack may be used to connect the amplifier to a speaker cabinet with a 4-pin Speakon® Biamp input. Other cabinets may be connected by use of a pigtail connector and/or other adapters as needed.

Biamping with a single amplifier – “Export”:



Speakon® is a registered trademark of Neutrik USA

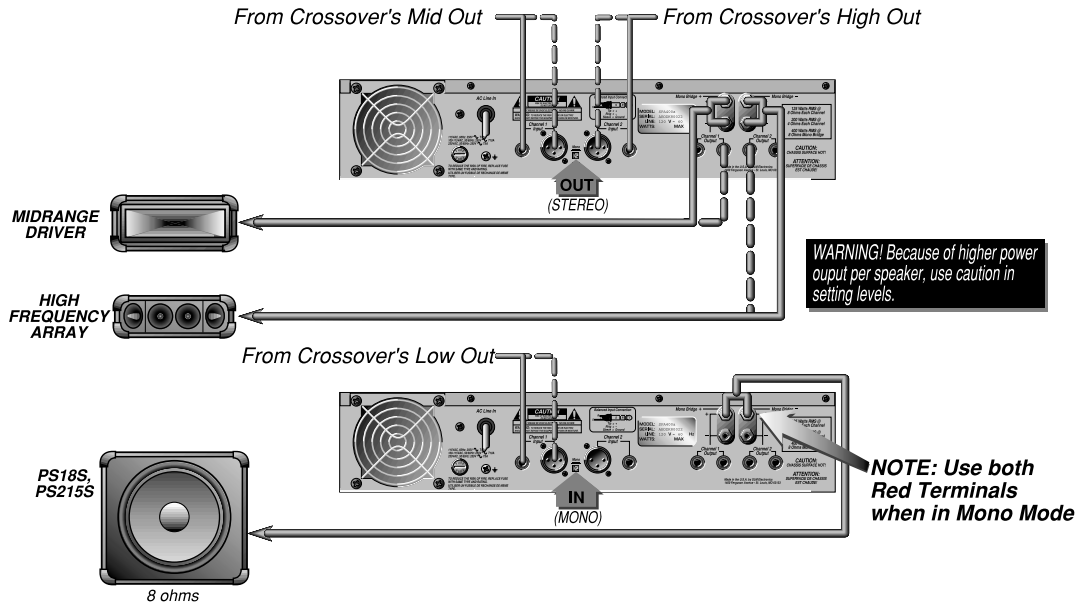
CRAFTER PRO AUDIO SPA-400 Rack Mount Power Amplifier

Installations and Operation:

Triamping With Two Amplifiers:

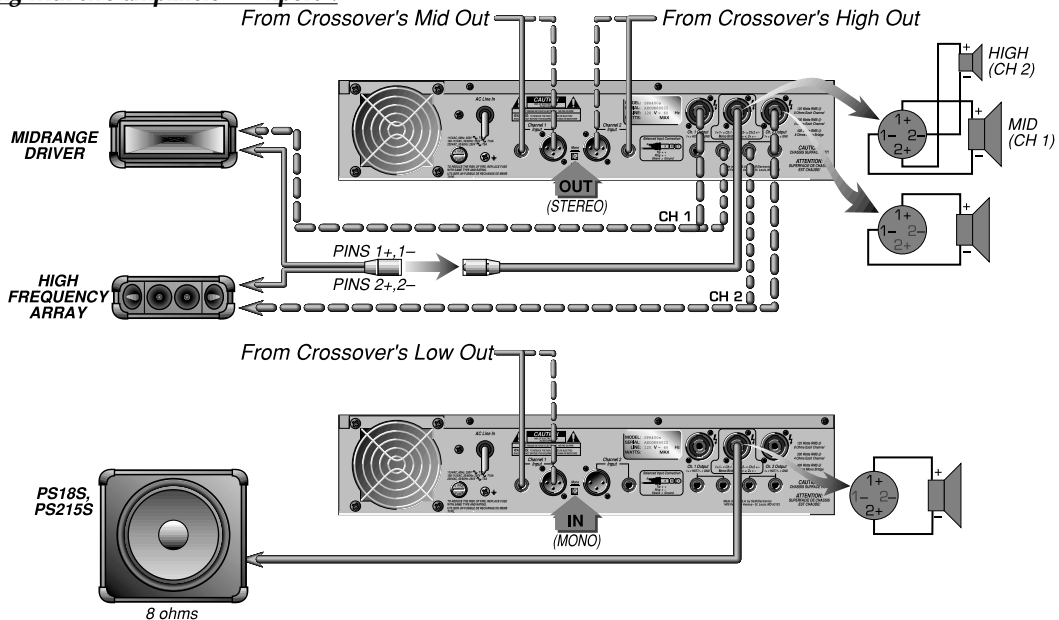
“DOMESTIC”: Either the binding posts or the 1/4” jacks may be used to connect the “High Freq” amplifier to the high frequency speakers. The Red binding posts must be used to connect the “Low Freq” amplifier to the low frequency speaker.

Triamping with two amplifiers – “Domestic”:



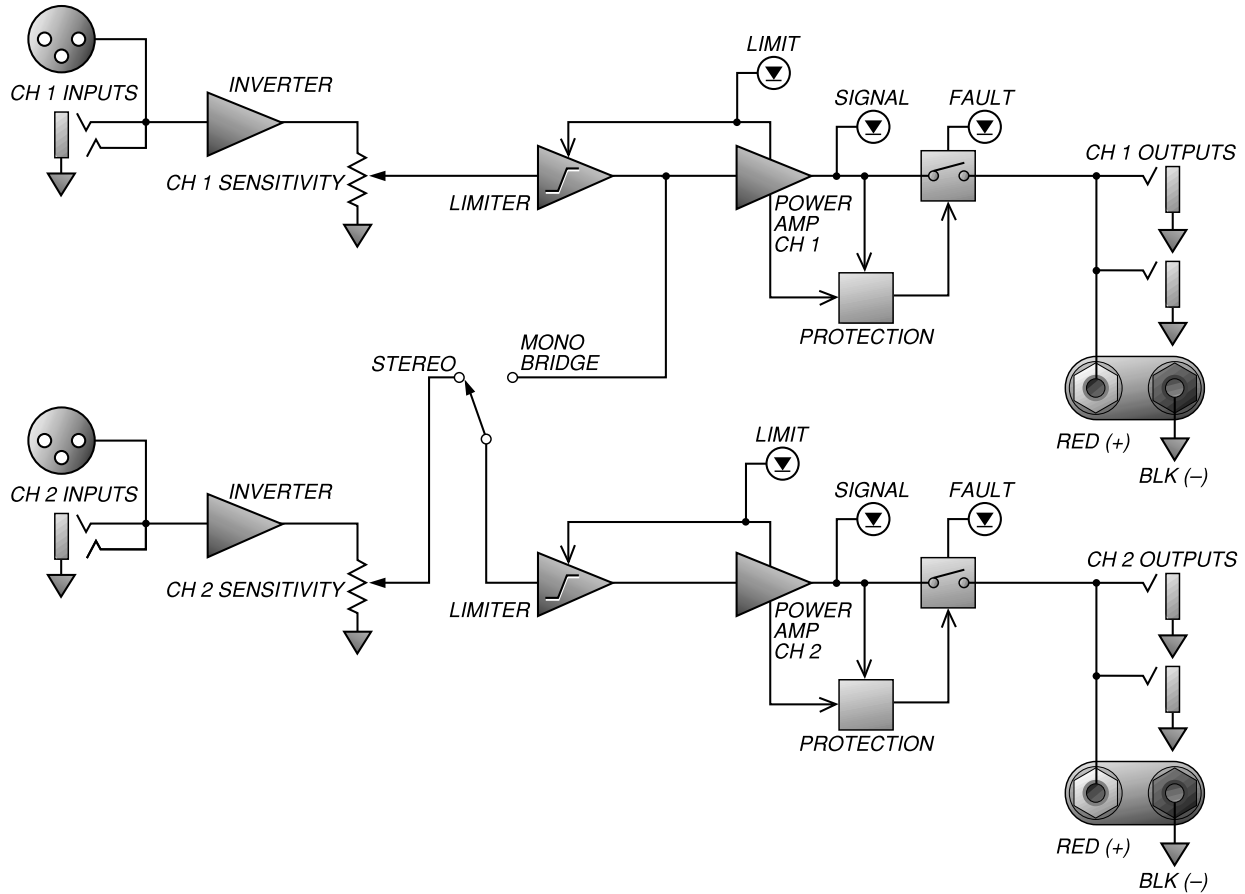
“EXPORT”: Either both channel Speakon® jacks or the 1/4” jacks, or only the middle Speakon® jack may be used to connect the “High Freq” amplifier to the high frequency speakers. The middle Speakon® jack must be used to connect the “Low Freq” amplifier to the low frequency speaker.

Triamping with two amplifiers – “Export”:



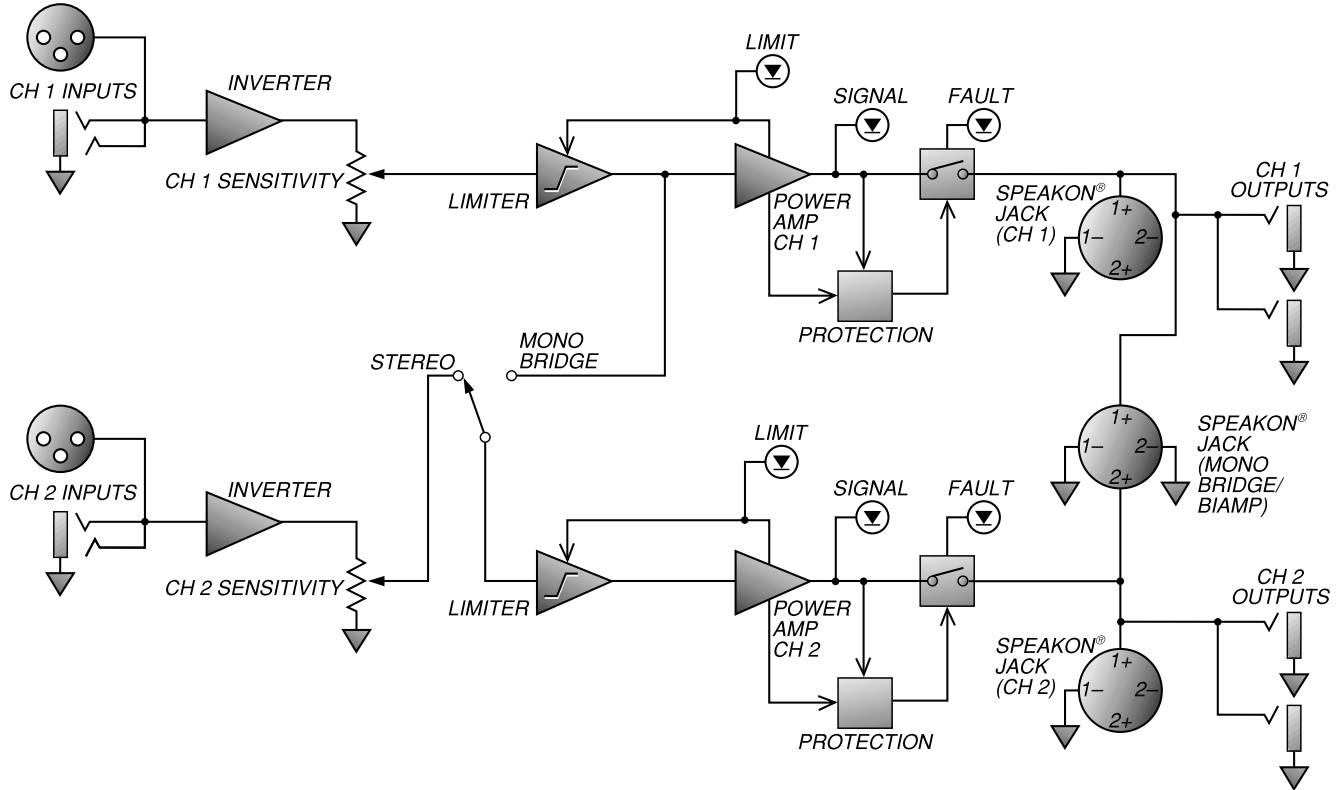
CRAETE PRO SPA-400 Rack Mount Power Amplifier

System Block Diagram – “Domestic”:



CRAETE AUDIO SPA-400 Rack Mount Power Amplifier

System Block Diagram – “Export”:



CRATE AUDIO SPA-400 Rack Mount Power Amplifier

Technical Specifications

POWER OUTPUT	200 Watts RMS @ 4 ohms, each channel, stereo 400 Watts RMS @ 8 ohms, bridged mono 125 Watts RMS @ 8 ohms, each channel, stereo 250 Watts RMS @ 16 ohms, bridged mono
FREQUENCY RESPONSE	+0/-.35dB, 20Hz – 20kHz @ full rated power
TOTAL HARMONIC DISTORTION	Less than .25%, 20Hz – 20kHz @ 200W / 4 ohms Typical .02% @ 1kHz
INTERMODULATION DISTORTION	Less than .05% @ 400W / 4 ohms
SLEW RATE	30 volts per microsecond
SIGNAL TO NOISE RATIO	Greater than -100dB from 200W / 4 ohms
INPUT TYPE AND IMPEDANCE	Transformerless electronically balanced, 20k actual load impedance. Suitable for Low or High-Z balanced line. 3 pin "XLR" plus 3 conductor 1/4" phone jack input per channel.
INPUT SENSITIVITY	1.0 V RMS (+2dBv) for 200W / 4 ohms
LOAD IMPEDANCE	Stereo Mode: 4 ohms or greater Bridged Mono Mode: 8 ohms or greater Stable into any load configuration
DAMPING FACTOR	Typical 250 (1kHz, 8 ohms)
OUTPUT CONNECTIONS	DOMESTIC: 1/4" phone jacks, plus 5-way binding posts each channel EXPORT: 1/4" phone jacks, plus Speakon® jacks (one for each channel plus one for Mono Bridge/Biamp)
PROTECTION CIRCUITRY	Short circuit, RF burnout, overtemp, speaker protection relays, turn on/off transient protection, DC protection and built-in auto-limiter (Anti-clip)
DISTRIBUTED SPEAKER COMPATIBILITY	Directly compatible with 50V Line in Bridged Mono Mode (400W) SYSTEM Directly compatible with 25V Line in Stereo Mode (200W/channel)
COOLING	Forced air fan cooling, rear intake, front exhaust
POWER REQUIREMENTS	DOMESTIC: 120 VAC 60Hz, 500VA EXPORT: 100-115 VAC 50/60Hz, 500VA 220-240 VAC 50/60Hz, 500VA
SIZE AND WEIGHT	19" W x 3.5" H x 15" D; 27 lbs.

Speakon® is a registered trademark of Neutrik USA

*Due to ongoing product development and improvement, the specifications
contained herein are subject to change without notice.*

CRATE AUDIO

www.crateamps.com

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