1200/2400

Operation Manual

BIAMP®

SYSTEMS

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Introduction

The Biamp 1200 and 2400 power amplifiers are the latest in a long line of quality equipment for professional audio from Biamp Systems Inc. Each one has been designed to be a high performance, economical unit for a wide variety of sound reinforcement and reproduction requirements. Biamp's extensive experience in making high quality professional sound equipment, along with valuable inputs from soundmen and musicians have combined to produce two of the finest amplifiers ever produced. The result is a powerfully clean, transparent, natural sound– an accurate reproduction of the sound you want. From the 50,000 seat stadium to the small recording studio, Biamp amplifiers are unmatched for performance, reliability and value.

One look at the front panel will tell you that the 1200 and 2400 amplifiers are designed for safe and reliable operation. Biamp amplifiers are the perfect combination of raw power, total reliability, sonic purity and elegant design. If you are looking for rock solid dependability with superb sound quality, the 1200 or 2400 are the obvious choices.

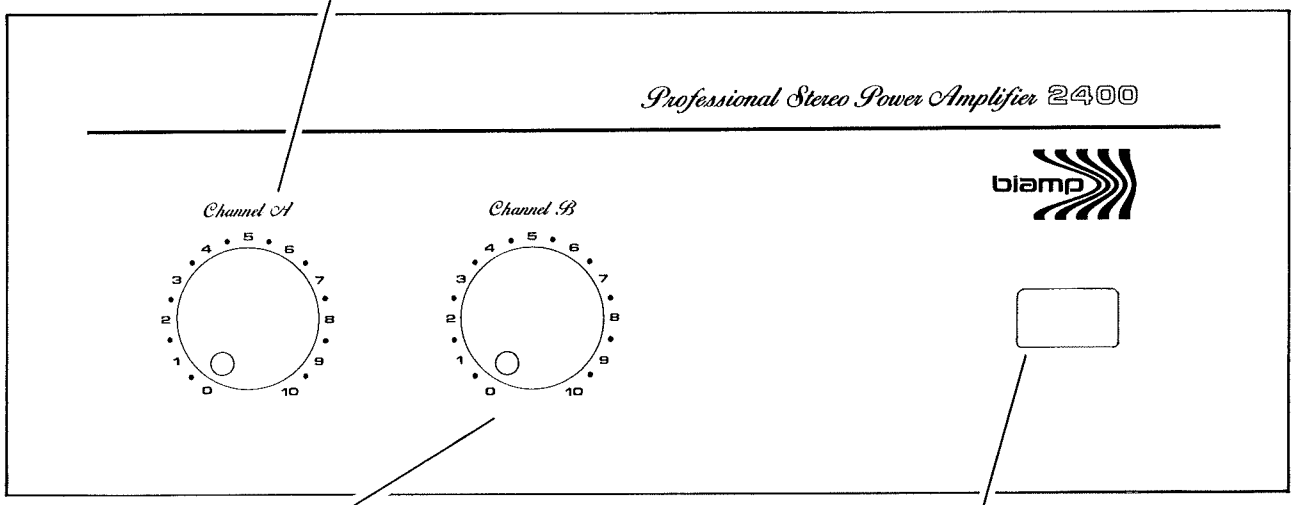
Both amplifiers feature a fully balanced and symmetrical design from the input connectors to the output transistors. The inputs are electrically balanced, including the input gain control, yielding a high CMRR (common mode rejection ratio) which does not degrade with adjustments of signal level. A built-in Auto Limit™ circuit provides overload protection without any audible side effects. Since the limiter does not work on the envelope of the signal, it will not dunk or breathe and limits only the offending peaks. Separate positive and negative limiters, coupled with a soft clipping low feedback amplifier design insures that they will never sound bad, no matter how hard you drive them. By using a proprietary gain control technique the limiters never introduce distortion of their own. The amplifier stages are all high speed, high linearity design for low inherent distortion—far below the threshold of audibility. The result is an amplifier that sounds twice as loud as any other amp in its power range, and twice as clean—one you'll have to hear to believe.

Proprietary heat sink assemblies, coupled with massive power supply components provide plenty of reserve power. The rear panel provides balanced phone plug and XLR inputs along with stacking outputs for connection to almost any system without the need of adaptors. Heavy duty binding posts are used for the outputs, outputs which can deliver hundreds of watts per channel into 2 ohm loads without stability or distortion problems. At the touch of a switch the amplifiers will provide a mono bridge mode with vastly increased power into loads as low as 4 ohms.

As with all Biamp products the 1200 and 2400 amplifiers are built to exacting standards. The lightweight yet rugged construction should provide years of reliable service. In the unlikely event servicing should be required, the thoughtful layout of circuit boards and modular construction technique should make servicing simple.

Front Panel Description

CHANNEL A INPUT LEVEL CONTROL
This knob controls the gain of the channel A power amplifier. This may be adjusted to match the sensitivity of the power amplifier to the source output level. This control is active in both the stereo and mono bridge modes. In the mono bridge mode channel B is slaved to the channel A input level control.

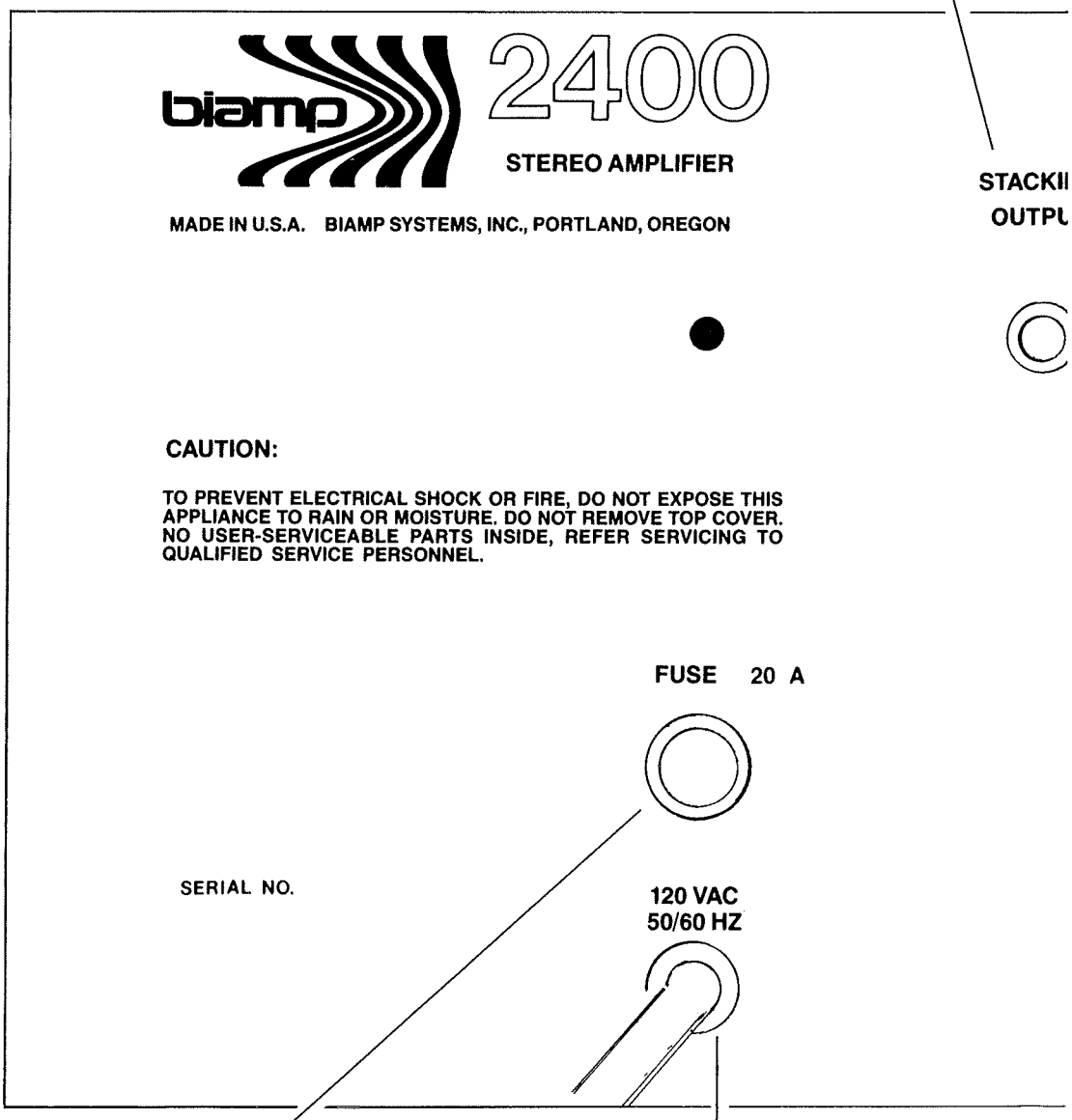


CHANNEL B INPUT LEVEL CONTROL
This knob controls the gain of the channel B power amplifier. This may be adjusted to match the sensitivity of the power amplifier to the source output level. This control is only active in the stereo mode. When the mono bridge mode is selected the channel A input level control adjusts both channel gains.

POWER SWITCH AND INDICATOR
This rocker switch controls the master power to the amplifier and provides indication of the on state. If the circuit breaker interrupts power, the indicator light will go out. However, if the thermal cutout on the power transformer opens the light will remain on.

Rear Panel Description

CHANNEL B STACKING OUTPUT
The input signal from the channel B input jacks may be obtained from this connector for patching to another amplifier input. This jack is not buffered so any additional amplifiers connected to it will be seen by the console or other source as additional loads. In the mono bridge mode this jack is not used.



POWER LINE CIRCUIT BREAKER
This 15 amp circuit breaker provides protection against internal failures of amplifier and against excessive load current draw from the amplifier outputs.

POWER CORD
This carries the input power to the amplifier. This is a three wire line cord, THE SAFETY GROUND WIRE SHOULD NEVER BE DEFEATED. If hum problems are encountered use the balanced input connection procedures in this manual.

MONO BRIDGING SWITCH

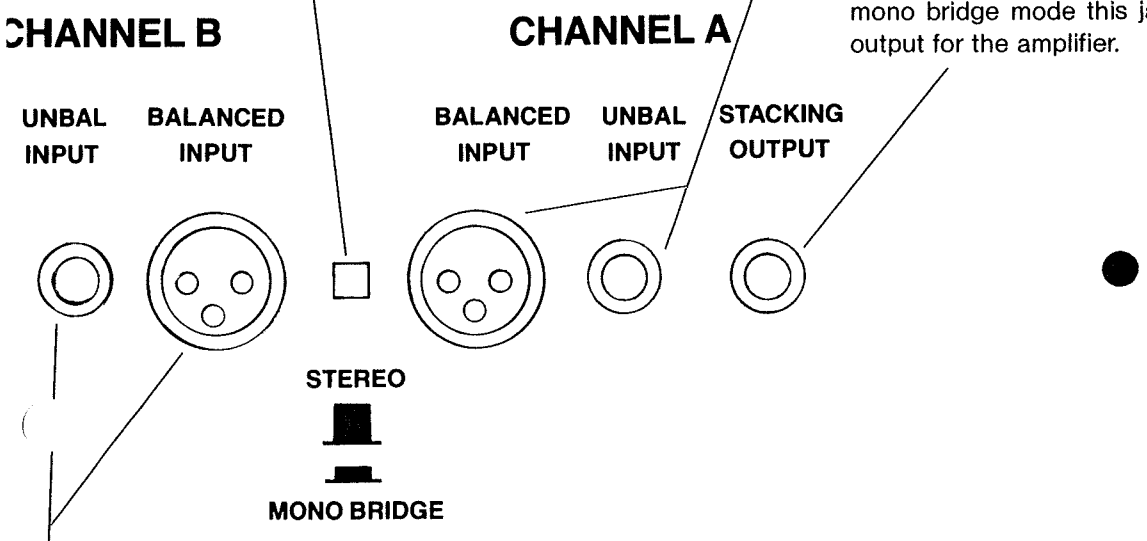
This switch connects the two amplifier channels together in opposite phase to convert the amplifier to a high voltage, high power mono amplifier. When this switch is depressed the channel B input connectors, stacking connector and level control are disconnected. In this mode the output signal is taken from the two red binding posts.

CHANNEL A INPUT JACKS

Signals from mixing consoles or other high level, low impedance sources may be connected to either the 1/4" phone jack or XLR connector. Both inputs are fully balanced but will accept unbalanced inputs with no performance reduction. In the mono bridge mode these jacks become the only inputs to the amplifier.

CHANNEL A STACKING OUTPUT

The input signal from the channel A input jacks may be obtained from this connector for patching to another amplifier input. This jack is not buffered so any additional amplifiers connected to it will be seen by the console or other source as additional loads. In the mono bridge mode this jack becomes the stacking output for the amplifier.



CAUTION:

NEVER DIRECTLY CONNECT THE LOUDSPEAKER TERMINALS OF ONE CHANNEL IN PARALLELL WITH THOSE OF ANY OTHER. ANY RESULTING DAMAGE IS NOT COVERED UNDER WARRANTY.

CHANNEL B AMPLIFIER OUTPUT

These 5 way binding posts provide the output signal from the channel B amplifier. The red terminal is the hot lead while the black terminal is connected to chassis. In the mono bridge mode only the red terminal is used.

CHANNEL B INPUT JACKS

Signals from mixing consoles or other high level, low impedance sources may be connected to either the phone jack or XLR connector. Both inputs are fully balanced but will accept unbalanced inputs with no performance reduction. In the mono bridge mode these connectors are not used, all connections are made to the channel A inputs.

CHANNEL A AMPLIFIER OUTPUT

These 5 way binding posts provide the output signal from the channel A amplifier. The red terminal is the hot lead while the black terminal is connected to chassis. In the mono bridge mode only the red terminal is used.

Unpacking and Repacking

Upon receipt of the amplifier inspect the shipping container for damage. Remove the amplifier from its packaging and perform a physical inspection. Be sure to read the safety warnings printed on the rear of the amplifier. Connect the amplifier and perform basic electrical checks for proper operation. The unit was tested by the Biamp quality control department before leaving the factory. If anything is damaged report it to your dealer, and if appropriate to the shipper, immediately.

Record the serial number of the unit on the warranty card and on the first page of this manual. This information will be helpful as a means of identification if the unit is ever stolen. Fill in the remainder of the warranty card and mail it to validate the warranty. You may want to engrave identification information on the front and rear of the amplifier to assist authorities in tracing ownership back to you. If you plan to engrave the amplifier make sure it is working properly first. Some dealers will replace units which are defective at purchase and handle warranty service themselves. Amplifier replacement is not possible if the unit is engraved making it unsuitable for resale.

You may want to save the original packing material for use in shipping the unit at a later date. If this is done be sure to keep the cardboard dry so it will retain its strength. If it is ever necessary to ship the unit without the original packing, place the amplifier in a box at least six inches larger in each dimension than the amplifier itself. Surround the unit on all sides with at least three inches of cushioning material, preferrably styrofoam or trapped air type material.

Mounting

The Biamp 1200 and 2400 series amplifiers may be used as received by placing them on top of the speakers or other convenient surface. Care should be taken not to block any of the cooling vents in any way. The amplifiers have vents on both top and bottom. Therefore, nothing should be placed on the amplifier which would block air flow. Cables should not be run under or over the amplifier or stuffed under to get them out of the way. If the amplifier is placed on carpet, books or other large flat items should be placed under the feet to insure adequate air flow. The 1200 and 2400 amplifiers are intended for mounting in a standard EIA 19" rack. The 1200 occupies 5 ¼" of rack height while the 2400 occupies 7" of rack height. The amplifiers mount by four bolts through the front panel. This is adequate for fixed installations but if the amplifier is to be used on the road or if the rack it is mounted in is to be transported, more support may be required. A shelf may be installed under the amplifier to help support the weight of the massive transformer used in the amplifier. Under no circumstances should the feet be removed and the amplifier placed directly on a shelf. Brackets may be fabricated which may replace the shelf by attaching to the sides or back of the amplifier and also bolt to the rear channel of standard racks. If a shelf is employed it is necessary to provide adequate ventilation holes in the shelf which allow unobstructed air flow through the amplifier. In dense racks or situations where several pieces of equipment are mounted above or below the amplifier it may be necessary to add fans to the rack which will blow air through the amplifier. Best results will be obtained if the fans obtain cool air from the front of the rack and blow through the amplifier, expelling the heated air out the rear of the rack.

Connections

The inputs of the Biamp 1200 and 2400 amplifiers are of the balanced bridging type. They may be placed directly across balanced or unbalanced lines with no signal degredation and almost no loss of level. The high input impedance allows stacking several units together with no appreciable loading of the driving source. If it is desired to have the inputs appear as a 600 ohm load for line termination purposes a 620 ohm resistor may be wired between the tip and ring pins of a 3 conductor phone plug inserted in the stacking output jack. If several amplifiers are stacked together place the termination plug in the last amplifier's stacking output.

If the amplifiers are being used with an unbalanced source, the signal may be applied using a standard two conductor (tip and sleeve) phone plug. The XLR inputs may be used but it is necessary to wire the unused input pin of the plug to ground. If hum is encountered in an unbalanced system, it may help to ground the unused amplifier input at the driving source using a shielded two conductor twisted pair. The common mode rejection of the amplifier will then ignore currents induced magnetically in the wiring as well as differences between the ground potentials of the amplifier and the source.

When routing wires in a sound system it is advisable to keep other wires away from input wires, especially

when making long runs. If for example the power cord to the amplifier is run alongside the input wires, substantial hum would result. It is best to bundle the input wires together and to bundle the power wires together and to keep the two bundles at least two feet apart. If the input wires are run alongside the speaker outputs of the amplifier they are likely to introduce crosstalk.

The 1200 and 2400 input stages are fairly immune to radio frequency interference (RFI). However, if an installation is attempted in a high RFI area such as near a transmitter, it may be necessary to take some precautions. If you are not already doing so, try running a balanced, shielded system. If this does not cure the problem it may be necessary to add RFI filtering. The simplest RFI filtering is to connect a pair of 100 pF disc capacitors from each input terminal to ground inside the connector of the cable where it meets the amplifier. If necessary a pair of 100 ohm resistors may be added in series with the signal before the 100 pF capacitors. Cables vary greatly in their susceptability to RFI. Braided shield types, while more durable than metalized Mylar shield types, do not provide as good a shielding action at high frequencies because of the space between the conductors of the shield. Even among cables of the same type the shielding effectiveness varies greatly between manufacturers due to the density of the shield and the quality of manufacture.

Output connections to speakers may be made using dual banana connectors, bare wire or spade lugs. The size of the wiring used is important if the high damping factor of the amplifier is to be maintained. Damping factor is the ratio of the load impedance to the output impedence of the amplifier. It represents the ability of the amplifier to stop the speaker from coasting after being moved by signal energy. Since wire has resistance, the wire connecting the amplifier to the speaker raises the output impedance of the amplifier as seen by the speaker resulting in less damping. Larger gauge wire has lower resistance and permits longer cable runs for the same reduction in damping. Resistance in the wire between the amplifier and the speaker will also result in a loss of power delivered to the speaker. The damping factor is the inverse of the power loss in the wire. For a damping factor (DF) of 100 there will be 1/100=0.01 or 1% of the power lost in the wire. A DF of 50 means 2% of the power will be lost while a DF of 10 means 10% of the power will be lost. The table below gives the allowable wire length for different wire gauges and three different load impedances.

The model 1200 and 2400 power amplifiers are a very rugged design which is capable of large amounts of power (up to 300 watts per channel into 2 ohms). As such they should be treated with some care to avoid damaging loudspeakers to which they are connected. If your loudspeakers cannot handle the power available from the amplifier, fuses should be installed in the lines between the amplifier and the speakers. A good place to mount these fuses is on the rear of the speaker cabinets. One fuse should be used for each speaker system, preventing an entire channel from going dead if a fuse should blow. This will also allow each speaker to be protected close to its rated power. The fuses should be fast blow or instrument speed (faster than fast blow) to prevent having the speaker protect the fuse by blowing first.

DAMPING FACTOR TABLE

Wire	Ohms per	# of ft. for DF=100			# of ft. for DF=50			# of ft. for DF=10		
Gauge	1000 ft.	4 Ohm	8 Ohm	16 Ohm	4 Ohm	8 Ohm	16 Ohm	4 Ohm	8 Ohm	16 Ohm
4	.5	80	160	320	160	320	640	800	1600	3200
6	.8	50	100	200	100	200	400	500	1000	2000
8	1.2	33	67	134	67	134	268	335	670	1340
10	2	20	40	80	40	80	160	200	400	800
12	3.2	13	25	50	25	50	100	125	250	500
14	5.2	8	16	31	15	31	62	75	155	310
16	8	5	10	20	10	20	40	50	100	200
18	13	3	6	13	6	12	25	30	60	120

CAUTION

Speakers should be protected by a fuse of the size recommended by the speaker manufacturer. Biamp Systems is not responsible nor liable for any damage to speakers, drivers or speaker systems.

The power amplifiers are internally protected against most fault conditions such as short circuits and overheating. However, some cautions are in order.

1. Never connect the two power amplifier outputs together. This may result in damage to one or both of the amplifier channels. When connecting cables to the amplifier outputs care should be taken that the other end of the cable really does go to the speakers and does not snake back around to the other amplifier channel.

2. Never block the cooling vents underneath or on top of the amplifier. If it is placed on carpet it is important that it be raised (with books or small pieces of wood) up off the carpet enough to allow an inch of cooling space underneath. Cables should not be run under the amplifier since they may block the vents. If both channels of the amplifier shut down during use it is probably because the unit overheated. Allow it to cool, clear all vents of obstructions and turn the unit on again.

3. If the amplifier outputs are shorted, the amplifier will protect itself but the temperature rise will be somewhat faster than if the outputs were connected to speakers. Therefore, to prevent eventual thermal shutoff it is advisable to remove shorts as quickly as possible.

4. If the amplifier is used to drive a transformer based signal distribution system it may see a very low impedance at low frequencies due to the many transformers in parallel. The highly reactive low impedance load may trip the protection circuits. To prevent this it is wise to insert a large (greater than 500 microfarads) non-polar capacitor in series with the output lead. Such capacitors are used for industrial motor starting applications and have voltage ratings of 120V or greater. The capacitor should be paralleled with a 10 ohm 25 watt resistor to reduce low frequency rolloff and prevent any tendency to ring.

5. Never connect the outputs of the amplifier to the power line. It is common practice to use twist lock connectors on speaker lines. These are also used in many places for power connection. The potential misconnection would cause serious damage which would not be covered by the warranty.

Power connections should be kept as short as practical to prevent loss of power in the wire and a corresponding loss in the amplifier's power output. If extensions are used they should be of as heavy a wire as practical. To reduce lost power in both the speaker wiring and the power wiring it is often desirable to place the amplifier near the speaker and plug it into a nearby outlet. The amplifier input cable is then the long connection in the system, resulting in negligible power loss. If hum pickup becomes a problem, use the balanced characteristics of the input to eliminate the ground loops.

The amplifier should never be run off of dimmers or electronically controlled power sources. Although this will not normally harm the amplifier there will be a reduction of output power, the possibility of noise coupling into the output and a very significant chance the dimmer will be destroyed.

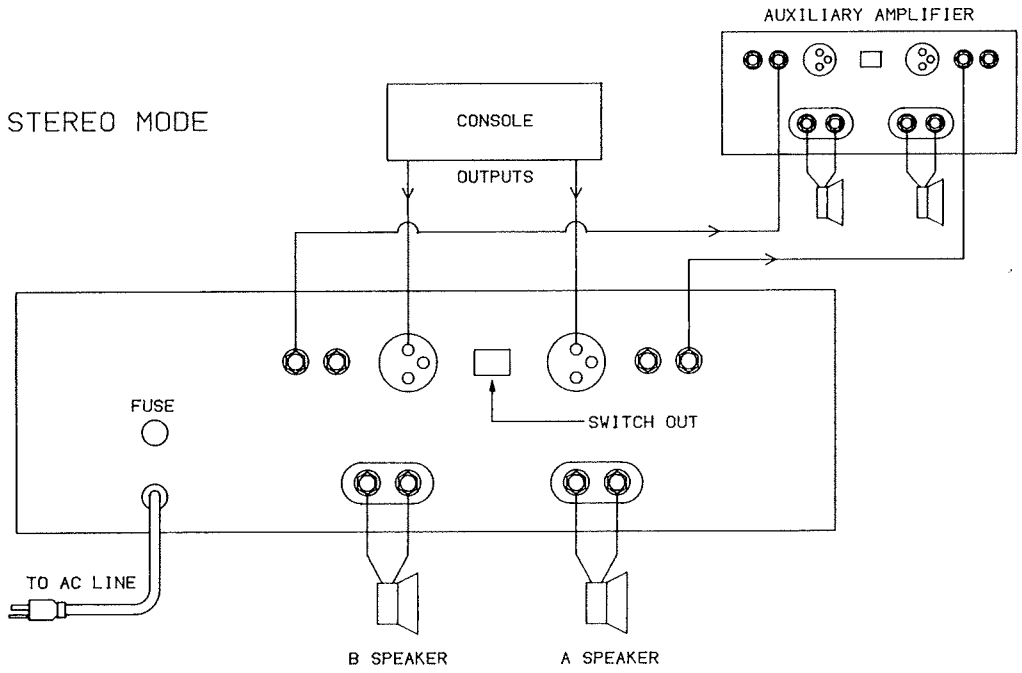
Mono Bridge Mode

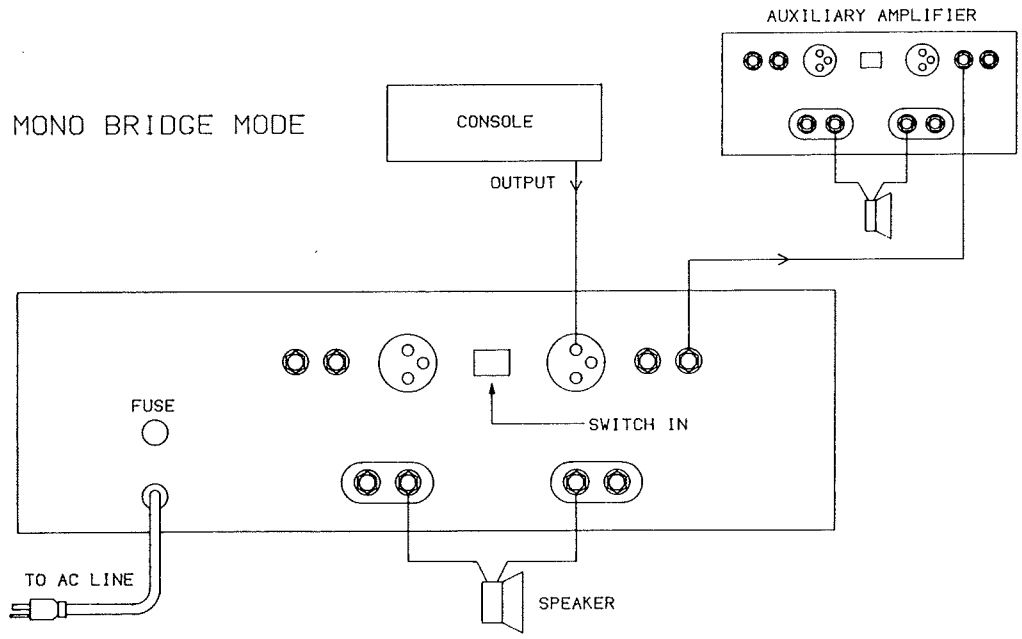
The 1200 and 2400 series amplifiers are capable of being operated as single channel amplifiers with vastly increased power output. A switch located on the rear of the amplifier between the input connectors converts the amplifier to this mode. In this mode the output signal is taken from the two red bindng post connectors (the two "hot" terminals). Only the A channel INPUT and STACKING output connectors are used, the B channel INPUT and STACKING OUTPUT jacks are disconnected. The A channel input level control is used for adjusting gain of the amplifier in this mode. The B channel input level control has no effect. The two output terminals should never be shorted together. The operator should also be aware that the available output voltage is doubled, resulting in even more hazardous voltages at the output. For example the 2400 can deliver 140 volts peak at the output, more than enough to kill. Treat the amplifier with respect and caution.

CAUTION

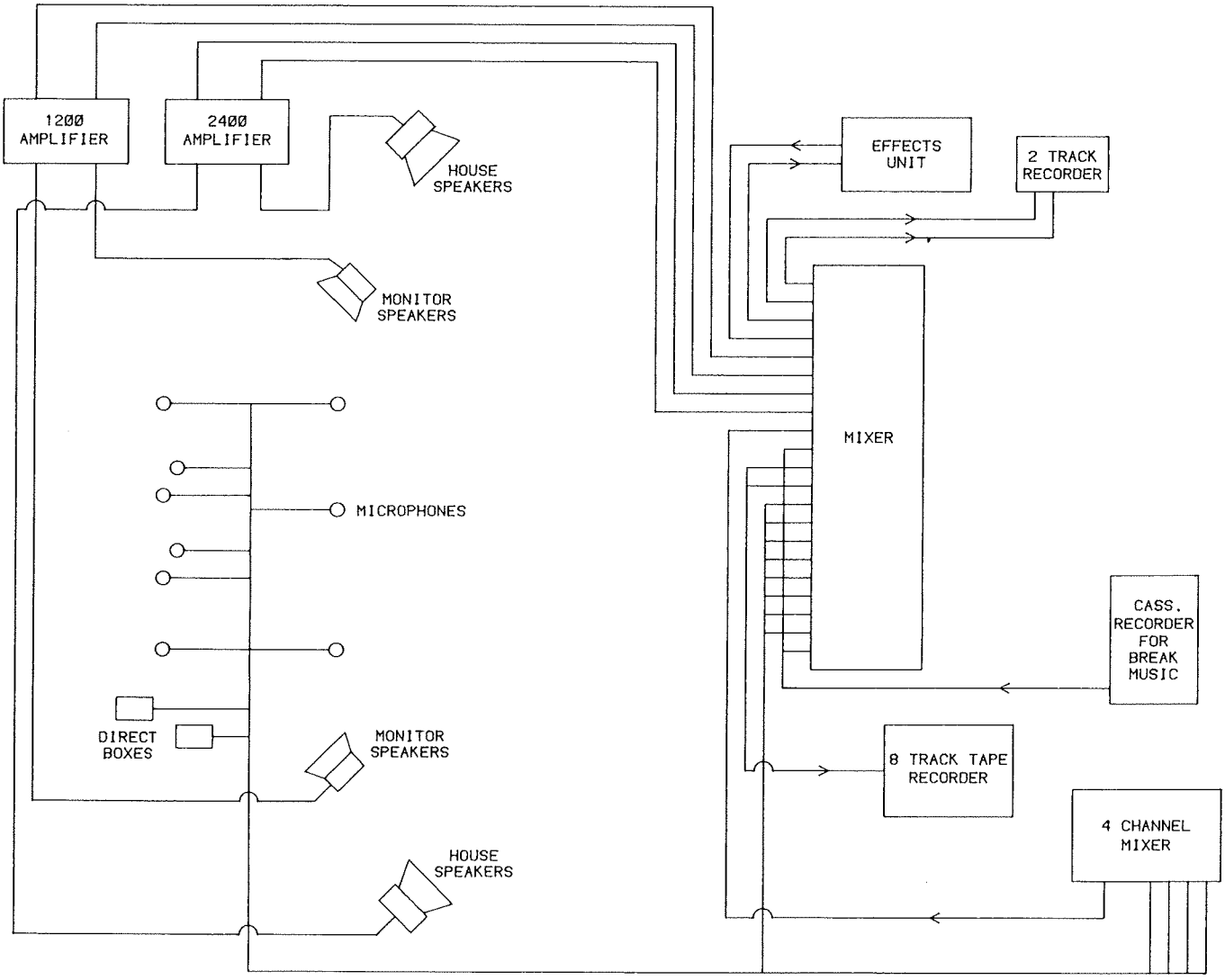
The amplifier is capable of producing lethal voltages at its terminals. Care should be exercised at all times when dealing with the outputs of the amplifier and the subsequent outputs of cable connected to them. Biamp Systems assumes no liability for damage or injury resulting to personnel or property from use or misuse of this amplifier.

Hookup Diagram





Installation Diagram



CAUTION

When installing the amplifiers, it is important that none of the cooling vents be blocked in any way. The amplifiers have vents in both the top and bottom. Therefore, nothing should be placed on them which would block air flow. Cables should not be run under the amplifier or stuffed under to get them out of the way. If the amplifier is placed on carpet, books or other large flat items should be placed under the corners to insure adequate air flow.

Grounding and Shielding

One very important aspect of any sound system is hooking it all up and making it run. All too often the sound system is plagued with hums and buzzes that stubbornly refuse to go away. The best defense against this happening is to understand where they come from and what can be done to eliminate them.

The chassis of electronic equipment are carriers of currents related to the power obtained from the wall outlet. Most professional equipment has a three prong power plug to bring the mains power in. One of the flat prongs is the high side of the line, the other flat prong is the low side. The round prong is the ground connection (this scheme is similar to the arrangement on the XLR connectors of most professional equipment, including the 1200 and 2400 inputs). The power from the line is applied to the power transformer inside the mixer, but a small amount leaks into the chassis and is returned to ground by the ground connection on the plug. Since wires have resistance, there is a small voltage developed by these ground currents. When two pieces of equipment are connected together there is usually a difference in the chassis voltages, causing some of the ground current to flow through the shields of the signal wires. This current (which is at 60Hz or 50Hz, depending on the power lines) is mixed with the signal currents and cannot be separated out.

One approach which is often used is to break all of the ground connections on the power cords. The chassis are strapped together with heavy wires which meet at one piece of equipment, usually the mixer. The mixer is then grounded to the wall outlet, providing a path for the leakage currents. This technique will work, but it has some severe safety ramifications. Even though the leakage currents are small under normal conditions, if a fault occurs in one of the pieces of equipment the currents can be quite large. The three wire cord insures that each piece of equipment has a good connection to ground, reducing greatly the risk of electrocution. If the common ground wire scheme is used, the integrity of the grounds cannot be guaranteed.

BIAMP DOES NOT RECOMMEND THE LIFTING OF GROUND CONNECTIONS ON POWER CORDS, AND CANNOT ASSUME ANY LIABILITY FOR INJURY OR DAMAGE RESULTING FROM SUCH ACTIONS BY THE USER.

One thing which does retain the safety of the power grounds and usually helps reduce ground related hum is the use of a common power connection. Often the outlets in a room are not all on the same power circuit, creating additional differences in the ground potentials of the various pieces of equipment used in the system. Plugging all of the equipment into the same outlet (this will normally require a multi-outlet power strip) insures that the power circuit is common. If some of the equipment is mounted a large distance from the rest, it may be necessary to use several extension cords to be able to plug it into the same outlet. If this is done, the mixer and other low power equipment should be plugged into the extension cord. Running the 1200 or 2400 amplifiers on extension cords will likely result in a reduction of power output from the amplifiers because of the voltage drop in the extension at high output levels.

If any of the equipment in the system uses a two prong power plug, it is wise to try reversing the plug in the outlet to see which position gives the lowest hum. Another approach which can be tried is the use of isolation transformers on offending equipment.

Quality cables can do a lot to reduce the resistance of the shield grounds, as well as improving the shielding against electromagnetic interference. The better quality cables will also tend to hold up better under heavy use, preventing connections from becoming intermittant or dying in the middle of a show. This is especially important when dealing with the microphone inputs, since they are at a very low level and have a high gain to the output.

In some balanced input situations, depending on the method of grounding used, it is possible to reduce the hum generated by ground currents by lifting the shield connection at ONE END of the cable. Rather than cut the shield every time you want to test this it is wise to make a short test cable with a male XLR connector at one end and a female XLR connector at the other. The low and high connections (pins 2 and 3) would be wired at both ends but the shield would only be tied at one end. This cable could then be inserted in line with the offending input to test the effect of lifting the shield without actually having to cut the cable. If an improvement is noted, the cable may then have its shield cut. This technique is not applicable to unbalanced phone plug inputs and outputs on other equipment but it is adaptable to the balanced input and output phone jack connectors on the 1200 and 2400 amplifiers.

Input and output cables from the console should always be kept away from power and speaker cables. All wires generate magnetic fields when current flows

through them. The strength of the field is proportional to the current in the wire. This is why power lines can cause hum in low level signal lines in and out of the mixer. Speaker cables also carry large currents, but these contain audio signals instead of just 60Hz. These cables can therefore cause crosstalk of the speaker feed into any low level cables running parallel to them. Keeping low level cables on one side of the room and speaker and power cables on the other will greatly reduce the possibility of such problems.

If a mixer is operated very close to the power amplifier it is possible for radiated magnetic fields to induce hum into the input circuits. The balanced transformerless configuration used in Biamp mixers helps eliminate this problem in all but the most severe cases.

If you suspect an interference problem, try moving the console or the offending equipment apart to see if any improvement can be made.

The problem of grounding and shielding is a complicated one. The following references should prove helpful if you still have trouble:

Brown, H.; Don't Leave System Grounding to Chance, EDN Jan. 15, 1972.

Davis, D. and C.; Sound System Engineering, Howard Sams Pub.

Morrison, R.; Grounding and Shielding in Instrumentation, J. Wiley.

Tremaine, H.; The Audio Cyclopedia, Howard Sams Pub.

Installation Checklist

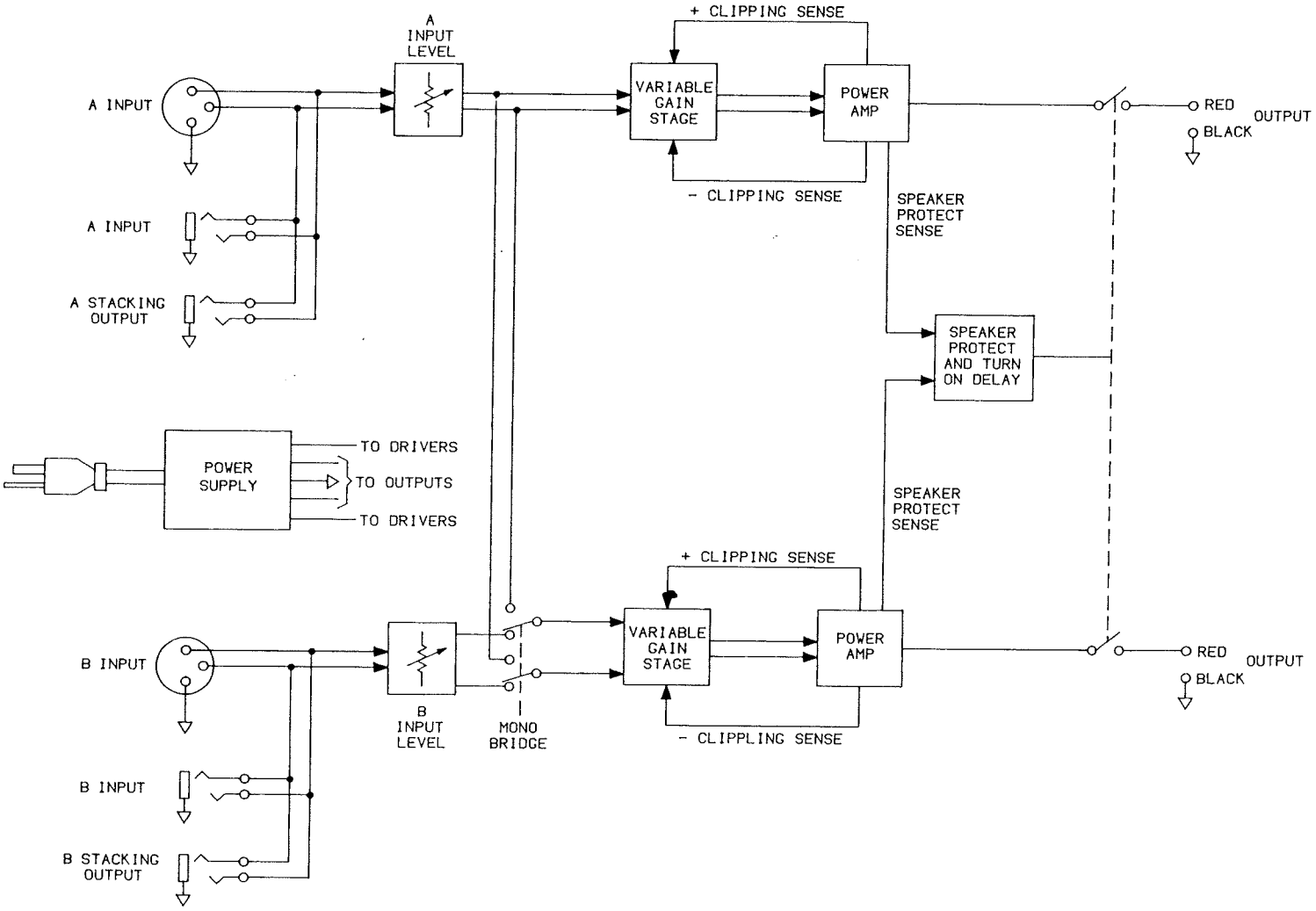
1. If the amplifier is mounted in a portable rack is the rear adequately braced?
2. Are the vent holes clear of obstructions allowing good air flow?
3. If the amplifier is mounted in a closed rack are fans mounted under it?
4. Are the balanced inputs used to their full advantage to eliminate hum?
5. Is there any danger of the outputs shorting together?
6. If a transformer is used on the output, is it isolated with a capacitor?
7. Are the outputs properly fused?
8. Are there any male plugs at the end of the speaker cables whose pins could short together when touching metal objects?
9. Is there a proper ground on the power cord?
10. Are power conductors and output signals kept away from input cables?

Specifications

	1200	2400
Frequency Response	+0, -1dB 10 Hz to 27kHz	+0, -1dB 10 Hz to 27kHz
Slew Rate	50v per microsecond	50v per microsecond
Power Output, Watts		
Both channels driven @ 1 kHz less than 0.05% THD +N		
8 ohm load	120	310
4 ohm load	240	510
2 ohm load	240*	350*
4 ohm mono bridge	480*	700*
8 ohm mono bridge	470*	950
Single channel driven @ 1 kHz less than 0.05% THD+N		
8 ohm load	170	340
4 ohm load	290	570
2 ohm load	400	800
Total Harmonic Distortion 20 to 20kHz 8 ohm load	0.05%	0.05%
SMPTE Intermodulation Distortion	0.05%	0.05%
Signal to Noise Ratio	103 dB	108 dB
Input Sensitivity	1.4V	2.0V
Input Impedance	Greater than 10,000 ohms, balanced	
Rise Time	6 microseconds	
Phase Shift	33° at 20kHz	
Channel Separation	80dB at 1kHz	
Offset Voltage	less than 50mv	
Damping Factor	120, 20Hz to 20kHz	255, 20Hz to 20kHz
Connectors, per channel	Inputs: XLR, ¼" 3 conductor phone jack	
	Stacking Output: ¼" 3 conductor phone jack	
Dimensions:		
height	5¼"	7"
width	19"	19"
depth	10"	14"

*Line Current Limitation (1200 12A, 2400 20A)

Block Diagram



CAUTION

Modifications to the 1200 or 2400 series amplifiers should be made by qualified service technicians only. There are hazardous voltages inside the amplifiers and Biamp Systems, Inc. assumes no liability for injury or damage to personnel or property resulting from such modifications or their installation. Any modifications performed to the amplifiers without written factory authorization will void the warranty and may, depending on their nature, prevent servicing at all.

Limited Warranty

BIAMP SYSTEMS, INC. warrants to the original consumer purchaser of each BIAMP product that the unit is free from defects in materials and workmanship. This express warranty commences on the date of purchase from an authorized BIAMP dealer and extends for one year. Completion and return of the warranty registration card enclosed with each unit within ten days of the date of purchase is a condition precedent to coverage and performance under this express warranty.

EXCLUSIONS AND LIMITATIONS: This warranty will be VOIDED if the serial number has been removed or defaced, or if the unit has been subjected to abuse, alterations, attempted repair by any person not authorized by warrantor to make repairs, accident, or installation contrary to the warrantor's instruction. Cosmetic blemishes, such as handles, feet, and knobs are not warranted. All implied warranties, including the warranty of MERCHANTABILITY are limited to the duration of this express warranty, and, if the registration card is not promptly returned, the implied warranties are limited to the duration of the express warranty if it had been effective. In no event will BIAMP SYSTEMS, INC. be responsible for incidental or consequential damages, except for injury to the person.

HOW TO OBTAIN REMEDY: Carefully pack your BIAMP product and return it to one of the BIAMP Authorized Service Centers, or write the BIAMP Customer Service Department at the address below for instructions on how to return your unit to the factory. Pack a letter with the unit explaining the nature of the problem and giving your name and address. You are responsible for freight and insurance charges to the Authorized Service Center or the factory.

WHAT BIAMP WILL DO: BIAMP will repair or, at its option, replace each unit covered by this warranty. Units sent to the factory will be returned to the owner freight collect. Units brought to Authorized Service Centers will be held for pickup by the owner for a period of time established by the individual Authorized Service Center, or, at the owner's option, returned to the owner freight collect.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. For instance, some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidiental or consequential damages, so the above limitations or exclusions may not apply to you.

Glossary

AMPLITUDE
The size of a signal. This may be expressed as a voltage, a current or a power.

ATTENUATE
The process of making a signal smaller. The amount of attenuation is the LOSS of the device.

ATTENUATOR
A device (usually a potentiometer) which makes signals smaller, i.e. attenuates them.

AUXILIARY INPUT
A general purpose input for feeding in equipment of the user's choice which may be needed at a particular time. Aux inputs, as they are usually called, are almost always line level jacks.

BALANCED
A connection scheme in which the two signal wires are at equal potential with respect to ground. The wires are therefore said to be balanced with respect to ground. In balanced connectors there are three pins, one for each signal lead and one for ground.

BASS BOOST
The action of making the low frequency sound louder. Adding 10dB of bass boost to a signal makes the low sounds 10dB louder (twice as loud).

BASS CUT
The action of making the low frequency sounds softer. Adding 10dB of bass cut to a signal makes the low sound 10dB softer (half as loud).

BIAMP
The fastest growing sound equipment company in the world. Also the name to look for when you buy your next piece of sound equipment.

BIAMPLIFICATION
The technique of driving low and high frequency speakers from their own amplifiers while splitting the low and high frequency sounds apart at line levels before the amplifiers. In a normal system there is a common amplifier for both types of speakers and the splitting is done at speaker levels.

BREATHING
An undesirable side effect introduced by some limiters and compressors. When it occurs, the background noise appears to be changing in level constantly, sounding much like a person breathing.

BRIDGING INPUT
A type of input which has a very high impedance from each of its two terminals to ground. This allows connecting it across balanced or unbalanced, high or low impedance lines without affecting the signal level on the line.

BUS
A bus is a signal line inside a console which adds together inputs that are fed to it. If three signals are assigned (fed into) a bus, the bus output will contain all three of them in the relative amplitudes at which they were applied.

CENTER FREQUENCY
The frequency at the center of a filter's response. In the case of a band pass filter it is the frequency of maximum gain. For a band reject or notch filter it's the frequency of minimum gain. Center frequency of a peaking equalizer is the frequency that has its gain changed the most.

CLIPPING
When an electronic circuit is driven beyond the maximum voltage it can deliver it is said to be clipping. This word comes from the appearance of the output waveform when clipping occurs; it looks as though the top and bottom have been clipped off.

CLOSE MIKING
Close miking refers to the placement of microphones very close to the sound sources to be picked up. This reduces the pickup of room reverberation and helps prevent crosstalk of sound between microphones.

CORNER FREQUENCY
The frequency at which the response of a filter starts to roll off or to rise. In a high pass filter it is the frequency above which there is flat response and below which it has reduced gain.

CUTOFF FREQUENCY
The upper or lower frequency limit of a device's response. When referring to loudspeakers, tape recorders, amplifiers, etc. it is the highest or lowest frequency they can reproduce without significant attenuation.

DECIBEL (dB—also dBm, dBv, dBV, SPL)
The dB is a logarithmic measure of the ratio of two quantities. When dealing with voltages or sound pressures it is 20 times the logarithm of their ratio. When dealing with powers, it is 10 times the logarithm of their ratio. (This is because powers are voltages squared and their logarithms are twice as big.) The use of dB always requires a reference level. Reference levels are often signified by a letter such as dBm, dBv, etc. (see below). If no reference is specified it is implied to be the previous value or the normal value of the quantity being measured. For example, saying that a low EQ control gives 15dB boost means that the low frequency output is 15dB greater than it was before the control was turned. To get a feel for what a dB sounds like consider the following:

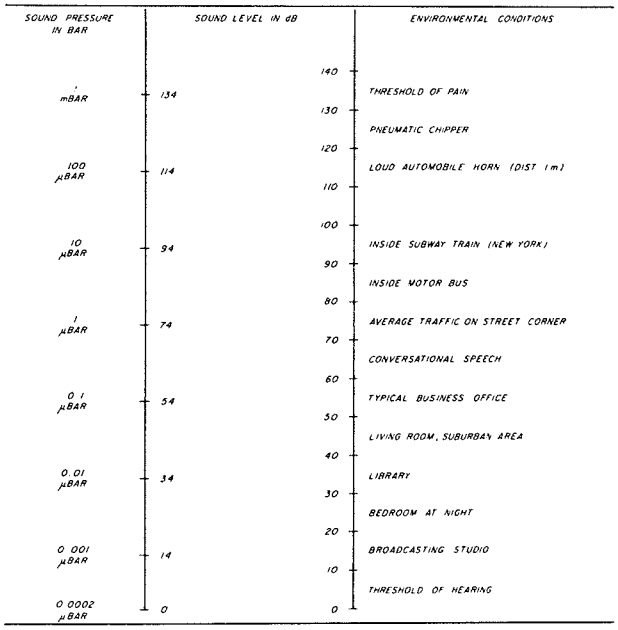
1dB is a barely audible difference.
3dB is a noticeable change.
10dB is twice as loud.

dBm
This is a dB measurement which uses 1 milliwatt in 600 ohms as the reference. This is equal to 0.775 volts in a 600 ohm line but is meaningless if the impedance is changed.

dBv
This is a dB measurement which uses 0.775 volts as its reference level. It is independent of the impedance of the circuit under considreation. In a 600 ohm system it is equivalent to dBm.

dBV
This is a dB measurement which uses 1 volt as its reference. It is independent of the impedance of the system under consideration.

dB SPL
This is a measure of acoustic sound pressure level in which the reference is 0.0002 dynes/sq. centimeter. This reference is approximately the softest sound the average person can hear. For a comparison of sound pressure levels of various everyday sounds, see the figure below.



DELAY LINE
A delay line is a device which delays signals in time by preset or selectable amounts. This is usually done digitally or with special IC's called CCD's (charged coupled devices) or BBD's (bucket brigade devices). All three of these techniques sample the signal at a high speed and store the values of the signal away until the required time is over. The samples are then used to reconstruct the signal which is then fed out of the unit. CCD's and BBD's store the sample values in an analog form while the digital techniques store it in a computer.

DIRECT FEED
An audio signal path that avoids the normal output amplifier and gain control states of a console. The effects send output is a good example of such a feed.

DIRECT OUTPUT
The name of the newsletter which keeps you up to date on what's happening with the fastest growing company in the business—Biamp!

DISTORTION
A change in the waveshape and spectrum of a signal, usually referring to a nonlinear process which adds extra frequency components which were not present in the original signal. See also distortion, total harmonic and distortion, intermodulation.

DISTORTION, TOTAL HARMONIC (THD)
Harmonic distortion is a name for distortion components which are harmonics or multiples in frequency of the original signal. For example, harmonic distortion of a 1 kHz signal would be 2kHz, 3kHz, 4kHz, etc. This is not always objectionable because all sounds contain harmonics. The added harmonics may not be noticiable over the ones already present.

DISTORTION, INTERMODULATION (IM)
Intermodulation distortion (IM) is the name for distortion components which are caused by the presence of two or more tones at the input of a device. These components are at frequencies which are the sum and difference of the input frequencies. Since the original signal did not contain these signals they tend to be more noticeable than harmonic components.

DRY SIGNAL
A dry signal is any signal in which there are no effects or reverberation applied.

DYNAMIC RANGE
The range of amplitudes which a device can handle, from its noise floor to its overload point. This is a measure of the range in levels the unit can handle without audible side effects of noise or excessive distortion.

ECHO
A delayed version of a sound which is discernible as a separate entity. Echoes may be created by hard reflective surfaces near the sound source or by special devices which delay a signal and feed both the delayed and original sounds into the signal chain again.

EFFECTS BUS
A summing circuit inside a mixer which adds all of the effects feeds from the individual input channels together.

EFFECTS RETURN
The input on a mixing console which receives the effects signal after it has been processed by the external effects units.

EFFECTS SEND
The output on a mixer which drives the external effects unit. This also refers to the gain control on the mixer which adjusts the amplitude of the effects output signal.

EQUALIZATION
The intentional increase or decrease in level of some frequency bands of a signal for the purpose of changing the tonal character of the sound or compensation for deficiencies in equipment.

EQUALIZER
A device which is used to change the tonal balance of a signal or compensate for deficiencies in equipment. This is accomplished by boosting or cutting some of the frequencies present.

EQUALIZER, GRAPHIC
A device which has many controls, each of which boosts or cuts a small band of frequencies. These controls are arranged so that a graph of the resulting frequencies is displayed.

EQUALIZER, PARAMETRIC
A device which can boost or cut several frequencies while allowing adjustment of the frequency, sharpness (also called Q) and the amount of boost or cut.

EQUALIZER, SHELVING
A type of equalizer whose response resembles a shelf, in which all frequencies past the specified frequency of maximum boost or cut are changed approximately the same amount. In practice the equalizer starts to have an effect at a frequency called the turnover frequency. For a low frequency shelving equalizer the affected frequencies are below the turnover frequency. In the case of a high frequency equalizer the bands above the turnover frequency are affected.

EQUALIZER, PEAKING
A type of equalizer which boosts or cuts a specific band of frequencies around some specified center frequency. The equalizer gets its name because the response characteristic in the boost mode resembles a mountain peak.

FADER
A gain control or attentuator. May be a linear (straight line) or rotary control.

FEEDBACK
Acoustic feedback, also known as howling, is when a sound system's output gets coupled back to its input with sufficient gain to come out louder than it went in. The amplified signal is then picked up again and comes out louder still. This process continues until the system starts to scream or howl at a very loud level.

FREQUENCY
A measure of how fast something oscillates back and forth, usually expressed in cycles per second or Hertz (Hz). Under most circumstances this is directly related to the pitch of the sound it produces. The higher the frequency, the higher the pitch.

FREQUENCY RESPONSE
The change in gain of a device as a function of frequency. This is usually expressed as a permissible range of gain change over a specified frequency range (i.e. ± 1dB from 20 to 20KHz).

GAIN
The increase in level of a signal passing through a device, usually expressed in dB. When the gain is 0dB the amplitude coming out is the same as that going in (also called unity gain). When the gain is a positive number of dB the output amplitude is greater than that going in. A negative number of dB gain represents a loss (smaller output than input).

GROUND
A point in an electrical or electronic system which is designated the zero potential and is used as a reference for signal voltages.

GROUND LOOP
A connection of grounds between two or more pieces of equipment which causes currents to circulate through the ground conductors. This happens because the various grounds are not exactly zero potential.

GROUPING
A technique in mixing, whereby several signals are combined and controlled simultaneously with a single fader.

HARMONICS
Harmonics are frequency components present in a sound at multiples of the main or fundamental frequency of the sound. The second harmonic is at twice the fundamental, the third harmonic is at three times the fundamental, etc.

HEADROOM
The available room for increasing a signal amplitude before encountering excessive distortion or clipping. Headroom is usually expressed in dB, being the ratio of the present signal amplitude to the allowable signal amplitude.

HERTZ (Hz)
A measure of frequency, formerly cycles per second (cps).

IMPEDANCE
The opposition of flow of alternating current (AC) in a circuit. Impedance is to AC circuits what resistance is to DC circuits.

IMPEDANCE, INPUT
The impedance presented to the signal source by the input jack. This does not mean that the signal sources output impedance should necessarily be this value. This is also the load impedance the source must drive if this input is the only one connected to the source.

IMPEDANCE, LOAD
The total impedance a source must drive in a particular application.

IMPEDANCE, MATCHING
The practice of connecting outputs and inputs together only when their impedances are equal. If they are unequal, transformers or resistive pads are used to correct the mismatch. This technique is not used much any more and is not recommended.

IMPEDANCE, OUTPUT
The impedance in series with the signal from the output jack. This is not normally the impedance that the output wants to drive (not the recommended input impedance of the load).

INPUT LEVEL
The amplitude (in volts, dBm or dBv) of the signal applied to the input under consideration.

JUNCTION BOX
A device containing several jacks which is used to connect several pieces of equipment together.

kHz (KiloHertz)
A thousand Hertz (Hz).

LED
Light-emitting diode, a solid state device which emits light when current is passed through it.

LEVEL
The amplitude of a sound or signal, expressed in dB.

LEVEL INDICATOR
A device for displaying the dB amplitude of a signal. VU meters are examples of level meters, but modern equipment is tending to use LED level indicators because of their greater reliability, ease of use and greater accuracy.

LIMITER
A compressor with a very high compression ratio above an adjustable threshold. For signals below this threshold there is no effect. Signals above the threshold are attenuated as much as necessary to maintain their level at or near the threshold. The signals are therefore "limited" to the threshold value.

LINE INPUT
An input designed to handle line level signals. These inputs are often unbalanced and are normally 2-conductor ¼" phone jacks.

LINE LEVEL
Line level refers to a nominal signal of +4dBv or +8dBv, depending on the particular application. Broadcast systems normally use +8dBv (1.95 volts), while recording studios and sound reinforcement systems normally use +4dBv (1.23 volts).

LINE OUTPUT
An output jack that supplies a line level output signal.

MICROPHONE LEVEL
The average signal level out of a microphone. Microphones vary widely in their output level, both between microphone types and with the particular sound being picked up. Microphone levels are normally assumed to be around 0.001 volt or -57dBv. Signal levels 50dB higher than this are not uncommon when miking such instruments as drums.

OHMS
A unit of measure for electrical resistance. A one-ohm resistor will draw one amp of current when one volt is applied to its terminals. The larger the resistance (the more ohms) the less current will flow when a given voltage is applied.

OVERLOAD
A condition in which a device is forced to handle a signal which is too large, causing the device to distort the signal or in some way behave incorrectly.

PAD
A network of resistors which is used to reduce the level of a signal, normally to prevent it from overloading an input.

PAN
A process whereby a signal may be continuously split between two outputs or mix busses. The total level in the two outputs remains relatively constant while the balance between the outputs is adjusted.

PARALLEL
When two or more devices are connected with their corresponding terminals together they are said to be in parallel. To connect two speakers in parallel the positive or red terminals would be connected together and the two negative or black terminals would be connected together.

PHANTOM POWER
A technique for powering microphones from a main power supply without adding power wires to the microphone cable. It consists of using the shield for a ground connection while the power (normally a positive DC voltage) is applied to both signal leads of the balanced cable. This technique is used to avoid having to use batteries in microphones that require power.

PHONE PLUG
A standard connector that is used for audio signals. It is ¼" in diameter and 1¼" long (excluding the handle portion which comes in many shapes and sizes).

PHONO PLUG (also called RCA plug)
A plug which is normally used on Hi-Fi equipment for interconnecting signals.

POST EQ
A signal output from a mixer which taken after the equalization controls is said to be post eq.

POST FADER
A signal output from a mixer which is taken after the channel fader is called post fader.

PRE EQ
A signal output from a mixer which is taken before the equalization controls is called pre eq.

PRE FADER
A signal output from a mixer which is taken before the channel fader is called pre fader.

PUMPING
An undesirable side effect introduced by some limiters and compressors. When it occurs the music or voice can be heard to be changing in level at times when it is not supposed to. It sounds like someone is twisting the volume control or master fader up and down continuously.

REACTIVE
A load is said to be reactive if it stores some of the energy fed to it by the amplifier driving it and feeds it back again slightly later in time. Capacitors and inductors have this property, which is why reactive loads are sometimes referred to as capacitive or inductive. Most loudspeakers are reactive loads.

RESISTOR
An electronic component which absorbs power thereby reducing the current or voltage in a circuit.

REVERB
A device which adds an artificial room sound to a signal.

RISE TIME
The time required for a signal waveform to rise from 10% of its instantaneous amplitude to 90% of its instantaneous amplitude.

SERIES
A series connection is one in which a signal must flow through each of the devices in the connection. To connect two loudspeakers in series, the positive lead of the signal would be connected to the positive lead of the first speaker. The negative lead of the first speaker would go to the positive lead of the second speaker. The negative lead of the second speaker would then go to the negative lead of the source.

SLEW RATE
The speed with which a device can change its output voltage.

SUBMASTER
A fader which controls the level of a group of signals after they have been mixed together but before they have been sent to the main output fader.

TRANSFORMER
A device which changes the input or output impedance of one device to match the output or input impedance of another device.

UNBALANCED
A signal line or connector which has its voltage referenced to chassis ground.

VA
A shorthand term for volts times amps. The product of volts and amps is watts if the load is purely resistive and not reactive. If the load is reactive the wattage is lower even though the VA may be the same. Power amplifiers are normally VA limited and deliver their highest power when driving a resistive load.

WET SIGNAL
A wet signal is any signal in which an effect or reverb has been applied.

XLR
A type of connector, normally having three pins, which is usually used for connecting microphones.