Series One

- Model 1100
- Model 1200
- Model 1400
- Model 1700

Owner's Manual

QSC AUDIO

TD-000027-00
Rev. C

Series One Power Amplifier Operation Manual

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EXPLANATION OF GRAPHICAL SYMBOLS

The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to humans.

The exclamation point within an equilateral triangle is intended to alert the users to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

EXPLICATION DES SYMBOLES GRAPHIQUES

Le symbole èclair avec point de flèche à l'intrérieur d'un triangle équilatéral est utilisé pour alerter l'utilisateur de la présence à l'intérieur du coffret de "voltage dangereux" non isolé d'ampleur suffisante pour constituer un risque d'elétrocution.

Le point d'exclamation à l'intérieur d'un triangle équilatéral est employé pour alerter les utilisateurs de la présence d'instructions importantes pour le fonctionnement et l'entretien (service) dans le livret d'instruction accompagnant l'appareil.

CAUTION: To reduce the rish of electric shock, do not remove the cover. No user-serviceable parts inside. Refer servicing to qualified service personnel.

WARNING: To prevent fire or electric shock, do not expose this equipment to rain or moisture.

ATTENTION: Pour enviter les risques de chock electrique, ne pas enlever le courvercle. Aucun entretien de pieces interieures par l'usager. Confier l'entretien au personnel qualifie.

AVIS: Pour enviter les risques d'incendie ou d'electrocution, n'exposez pas cet article a la pluie ou a l'humidite.

SAFEGUARDS

Electrical energy can perform many useful functions. This unit has been engineered and manufactured to assure your personal safety. Improper use can result in potential electrical shock or fire hazards. In order not to defeat the safeguards, observe the following instructions for its installation, use and servicing.

PRECAUTIONS

L'énergie électrique peut remplir de nombreuses fonctions utiles. Cet appariel a été conçu et réalisé pour assurer une sécurité personnelle entiére. Une utilisation impropre peut entraîner des risques d'électrocution ou d'incendie. Dans le but de ne pas rendre inutiles les mesures de sécurité, bien observer les instructions suivantes pour l'installation, l'utilisation et l'entretien de l'appareil.

I. INTRODUCTION

1.1 WELCOME

Thank you for selecting a QSC Series One power amplifier for your audio system. Our goal is to ensure your complete satisfaction with your amplifier purchase. Please do not hesitate to call your QSC Dealer or QSC Audio Products if you have any service problems or questions not answered in this manual.

Your QSC Series One power amplifier can be readily operated by anyone familiar with professional audio systems. The four models covered by this manual, the 1100, 1200, 1400 and 1700, have similar features and connections. Any differences will be covered in the following detailed instruction sections of this manual. Because not all amplifier features and characteristics are standardized, we recommend that both experienced and first-time users review the contents of this manual.

Please consult the table of contents for quick reference to sections of interest. We recommend that all users review the "Basic Instructions" section of this manual before installing or operating the amplifier.

1.2 WARRANTY AND DISCLAIMERS

QSC Audio Products, Inc. is not liable for any damage to speakers, amplifiers, or any other equipment that is caused by negligence or improper installation and/or use of the Series One Amplifier.

Product Warranty

QSC Audio Products, Inc. guarantees the Series One Amplifier to be free from defective material and/or workmanship for a period of three years from date of sale, and will replace defective parts and repair malfunctioning products under this warranty when the defect occurs under normal installation and use—provided the unit is returned to our factory via prepaid transportation with proof of purchase (sales receipt). This warranty provides that examination of the returned product must disclose, in our judgement, a manufacturing defect. This warranty does not extend to any product which has been subject to misuse, neglect, accident, improper installation, or where the date code has been removed or defaced.

Warranty and Service Repair Instructions

1. Pack the product safely making sure to include a copy of the sales receipt, your name, return address, and phone number. Mark the package: Attention Service Department.
2. Call QSC's Service Department—1-800-772-2834—and obtain a "Return Authorization" (R.A.) number.Ship the product prepaid to QSC Audio Products. We recommend UPS.
3. We will determine if the product is under warranty:
   a. If it is, we will repair and ship it back to you at no charge.
   b. If it is not, we will contact you and inform you of the charges. Upon your approval, we will repair the product and ship it back freight and services charges collect (COD).

1.3 OVERVIEW OF AMPLIFIER

The basic Series One circuit design is the result of years of QSC product development, combined with a host of new features, a number of circuit improvements, and the use of premium components. The result is superb audio performance, exceptional reliability, and a flexible interface system.

To begin with, each channel has a balanced bipolar power supply which assures proper dynamic response during program peaks. We then combine a superior series of complementary power transistors with a modern high-performance integrated circuit at the input, in order to deliver the required power with the minimum number of amplifying stages. This ensures minimum signal degradation with maximum reliability and consistency. The circuit accepts balanced or unbalanced input signals and provides the high internal gain needed for low overall distortion and wide frequency response. Due to the circuit simplicity and the fact that we can use direct-mounted output transistors, Series One power amplifiers offer higher power, smaller size and lower weight than older designs.

In order to ensure that users get the full benefit of high performance amplification despite real-world hazards, our circuit includes many operational and protective features. Complete protection is provided for open-circuit, short-circuit, and mismatched loads; the amplifier will shut down temporarily if it over-heats, and AC circuit breakers protect against excessive power levels. Our protection circuits are designed to ensure a minimum of false triggering and unwanted interruptions and except for the AC breaker, which replaces the usual AC fuse, all protection systems will reset

automatically as soon as safe operation is assured. An equally important muting circuit protects the loudspeakers from unexpected damage, by muting the amp during turn-on and turn-off and by blocking DC faults, whether caused by the amplifier or preceding components.

The front panel presents essential user information and is recessed to prevent damage. The green power indicator serves as a pilot light and individual red clip indicators monitor overall performance of each channel. The AC switch and circuit breaker are front mounted for convenience and quick resetting. Except for the Model 1100, the Gain controls and input programming switches have been placed on the back of the amplifier to protect them from damage, inadvertent adjustment, or tampering. The Gain controls, as well as a pair of headphone jacks, have been placed on the front panel of the Model 1100 to allow easy access in monitoring applications.

The amplifiers use a separate bipolar power supply for each channel, for minimum crosstalk, cross-distortion, and greater reliability. A single dual-secondary transformer feeds isolated, separately fused rectifiers and filter capacitors for each channel. Thus the remaining channel can keep running in case of breakdown.

In order to interface properly with a variety of pro-audio systems, we have included all of the popular input and speaker connectors. Balanced or unbalanced inputs can be made using XLR plugs, screw lugs to the barrier strip, or 1/4-inch phone plugs (ring-tip-sleeve for balanced inputs). Speaker connections are made with 5-way binding posts.

The steel chassis, of the 1200, 1400 and 1700, is a 14 gauge, single piece design with integral rack mounting ears. The 1100 chassis features single piece aluminum extrusions that form the sides of the chassis and feature integral rack mounting ears and heatsinks. The extra strength chassis and rugged mounting of internal parts contributes greatly to QSC's reputation for reliability by protecting the circuitry from years of road abuse.

All of these points are more fully explained in the following Sections.

1.4 SPECIFICATIONS

	1100	1200	1400	1700
OUTPUT POWER (per channel)				
Both Channels Driven				
8 ohms, 20-20 kHz, 0.1% THD	50w	100w	200w	325w
4 ohms, 20-20 kHz, 0.1% THD	70w	150w	300w	500w
Bridged-Mono Operation				
8 ohms, 20-20 kHz, 0.1% THD	140w	300w	600w	1000w
DYNAMIC HEADROOM dB				
8 ohms	2.0	2.0	2.0	1.9
4 ohms	2.3	2.5	2.5	2.9
DISTORTION, THD @ 8 ohms				
20-20 kHz, at rated power	Less than 0.1%, 0.01% typical			
SMPTE-IM at rated power	Less than 0.025%			
FREQUENCY RESPONSE	20-20 kHz, +0, -1.0 dB at 1 watt			
DAMPING FACTOR @ 8 ohms	Greater than 200			
NOISE (A-weighted)	100 dB below rated power			
VOLTAGE GAIN, dB	26	29	32	34
SENSITIVITY, V RMS (for rated power, 8-ohms)	1.0	1.0	1.0	1.0
INPUT IMPEDANCE	10K unbalanced inverting 20K balanced or unbalanced non inverting			
CROSSTALK	-70dB, 20-20 kHz			
CONTROLS	AC Switch, Circuit Breaker, Gain Knobs, Input Programming DIP Switches, and Bridging Switch			
INDICATORS	Power: Green LED Clip: Red LED			
COOLING	Convection	Convection	2 speed fan	2 speed fan

AMPLIFIER PROTECTION	Full Short Circuit, Open Circuit, Over-Temp, Ultrasonic and RF Protection. Stable into reactive or mismatched loads.			
SPEAKER PROTECTION	DC Load Fault Protection 3 Second Turn-on, Instant-off Muting			
COMPLEMENTARY OUTPUT DEVICES	4	8	16	32
POWER SUPPLY	Single Transformer with Independent Isolated Secondary Windings, Fault Fuses, Rectifiers, and Filter Capacitors			
DIMENSIONS				
Faceplate Width	Standard 19" Rack Mounting			
Faceplate Height	1.75"	5.25"	5.25"	7.0"
Chassis Depth	8.7"	9.5"	9.5"	11.75"
WEIGHT				
Shipping, Lbs	15	28	37	57
Net, Lbs	12	24	34	55

II: BASIC INSTRUCTIONS

2.1 UNPACKING AND INSPECTION

All QSC Series One amplifiers are fully tested and inspected before they leave the factory. Despite the protective carton and rugged amplifier design, it is possible for shipping abuse to damage the amplifier. Check for obvious carton damage while unpacking the unit. After removing the amp from the box, rotate it in all directions to check for loose parts inside.

Please save the carton for return shipment, if required. QSC does not warranty against damage caused by sending amplifiers back in the wrong carton.

If shipping damage is evident, notify the transportation company immediately. Only the consignee can file a claim with the carrier for shipping damage. QSC will cooperate fully in such an event. Be sure to save the carton for the shipper to inspect.

2.2 IMPORTANT PRECAUTIONS

2.21 The power must be OFF when making any connections. If you connect plugs with the power on, especially in dry environments, static sparks or bad cables can cause pops or hums which can damage speakers.

2.22 When first powering up the amp, have the amplifier Gain controls all the way off, in case of defective cables or hookups. Turn the Gain controls up gradually until normal operation is verified.

2.23 Check the AC voltage printed on the serial number label to ensure your amplifier is properly configured for the AC voltage supplied in your area before connecting the AC plug.

CONNECTION TO A VOLTAGE SOURCE OTHER THAN THE ONE SPECIFIED WILL IMMEDIATELY DAMAGE THE AMP, AND VOIDS THE WARRANTY.

2.24 Never connect the speaker terminals (red binding posts) for two channels together on any power amplifier. The two channels will fight each other and possibly fail. Do not connect the speaker ground terminals (black binding posts) to chassis or signal grounds, as the resultant ground loop could cause ultrasonic oscillations. In other words, keep all speaker wiring separate for each channel, and separate from input wiring.

2.25 Do not remove the amplifier cover, as there are dangerous voltages inside. Do not expose to rain or moisture. Refer all servicing to qualified personnel. The warranty will be void if the amp is tampered with by non-QSC repair centers or personnel.

2.26 The QSC Warranty does not cover tampering by unqualified personnel, or repairs made at non-QSC repair centers. Please call the factory for Service Center information and locations.

2.27 High voltages can be present on the speaker terminals. Always connect speaker terminals with the power off, and use heavy gauge cable with no frayed strands or damaged insulation.

2.28 Please be aware that power amplifiers have high power circuitry inside with potential for fire and shock hazard; never plug in a damaged amplifier until the condition of the internal insulation is checked. If a circuit breaker blows quickly when turning the amp on, the amplifier is defective and should not be restarted until the amplifier has been repaired. Failure to observe these precautions could lead to fire or shock hazard.

2.29 Power amplifiers are inherently heavy and may become hot after use; provide adequate support and be careful how you hold the amplifier when handling it.

2.3 QUICK INSTRUCTIONS

2.31 **Stereo Operation** These instructions cover the normal use of the amplifier in two-channel or stereo applications. See Section 3 for detailed installation instructions and special cases.

2.32 **AC Power** Connect the AC cord to a standard GROUNDED outlet only. The amplifier will operate satisfactorily over a +/- 10% range of voltages, but full rated performance will be met only at the rated voltage. Failure to properly ground the amplifier may result in unwanted hum and noise and will create a potential shock hazard.

2.33 **Floating Chassis Ground** There is no provision for lifting signal ground relative to chassis ground on Series One amplifiers. For safety reasons do not lift the ground pin on the AC cord. Electronic balanced inputs are provided for hum rejection. Use balanced input cables to avoid hum, interference and ground loops.

2.34 **Input Programming Switches** 8-pole mini DIP switches are located on the rear panel—see the rear panel illustration for details. They come factory set for normal stereo operation (switches 1,2 and 7,8 up). See section 3.5 for other cases.

2.35 **Octal Socket** For normal operation, nothing should be plugged into the octal socket. It comes from the factory with a protective label to prevent corrosion of the pins.

2.36 **Input Connections** The input polarity is as follows:

1/4-inch plug:	tip is “minus” or inverting input ring is “plus” or non-inverting input barrel is ground, as always
XLR plug:	pin 1 is ground, as always pin 2 is “plus” or non-inverting input pin 3 is “minus” or inverting input (AES Standard)
Barrier Strip:	“GND” is circuit ground “+” is “plus” or non-inverting input “-” is “minus” or inverting input

When making unbalanced connections, the barrel of an ordinary two-wire 1/4 inch plug will ground the “plus” side of the balanced input; XLR plugs will need to have the unused pin grounded inside the plug, and the installer will need to ground the unused screw on the barrier strip. It is still possible to use the balanced inputs to reject hum with an unbalanced signal. See Section 3.3 for details.

2.37 **Speaker Connections** Banana plugs, spade lugs, or bare wire ends can be connected to the 5-way binding posts. Be sure to observe correct polarity (red/black terminals) for each speaker to insure that all speakers move in the same direction.

The 1100 features a pair of standard 1/4" headphone jacks on the front panel. They are connected to the speaker outputs of the amplifier through a resistive pad that prevents excessive power levels from damaging the headphones.

2.38 **Power Up** Start with the gain controls off until proper operation is verified. Upon turning on the switch, the power LED should come on green. After three seconds, the muting circuit should release and turn on the sound. The amp should now be working, and the Gain controls can be advanced. In case of difficulty consult Section 3.9.

2.39 Operation and Indicators Note that the Gain controls are calibrated in dB. As you turn the Gain down, it takes more input signal to reach full power, so the Gain should be kept in the upper 12 dB of its range for full power output from normal signal sources. The “0 dB” reference indicates that the amplifier gain is at 26 dB when the knob is adjusted to this position.

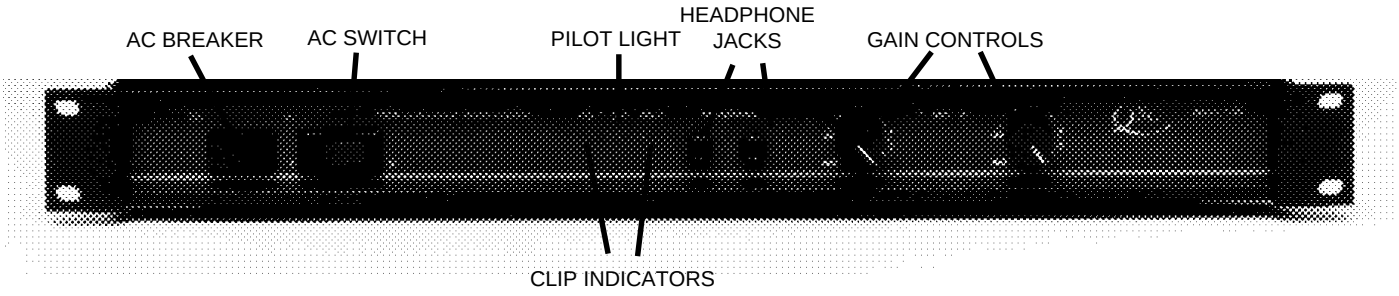
Note that full amplifier output power may be achieved even if the gain controls are not turned fully up. However, a larger input signal will be required to produce full rated output.

LED (Light Emitting Diode) indicators monitor the operation of the amplifier. A green LED serves as the pilot light to indicate that power is on. Each channel has a red “Clip” indicator that will show any distortion in the amplifier. Upon power up, these may not flash symmetrically. This does not necessarily indicate that there may be a problem.

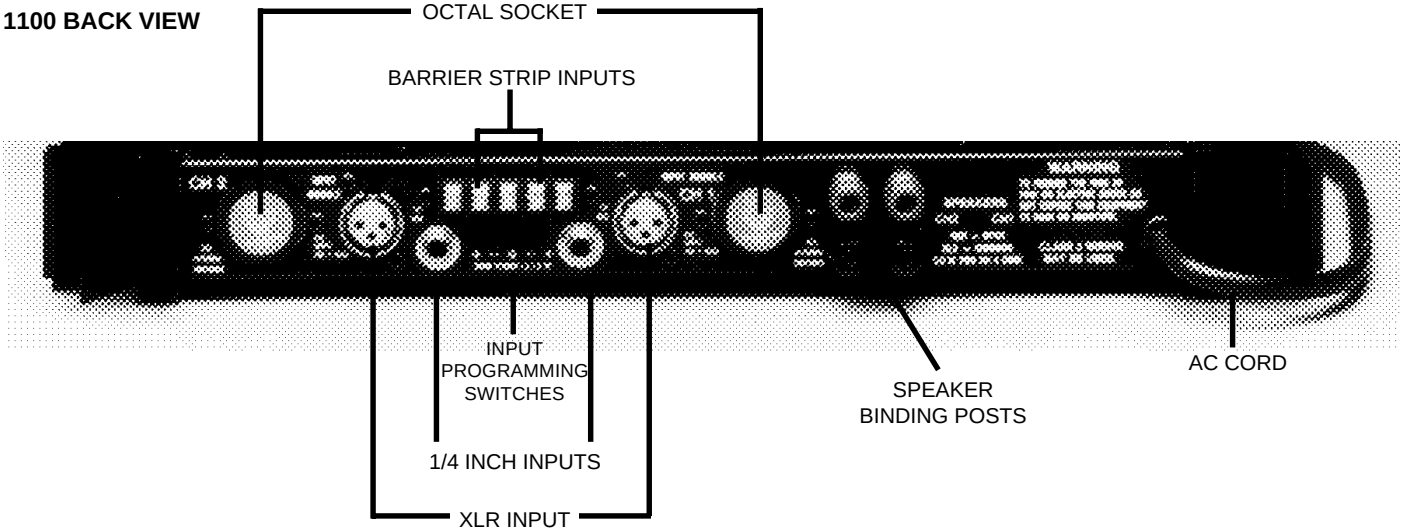
The muting circuit blocks the sound for three seconds after turn-on and immediately after turn-off. This prevents turn-on and turn-off thumps and transients from reaching the speakers.

Please refer to Section 3 for more detailed instructions.

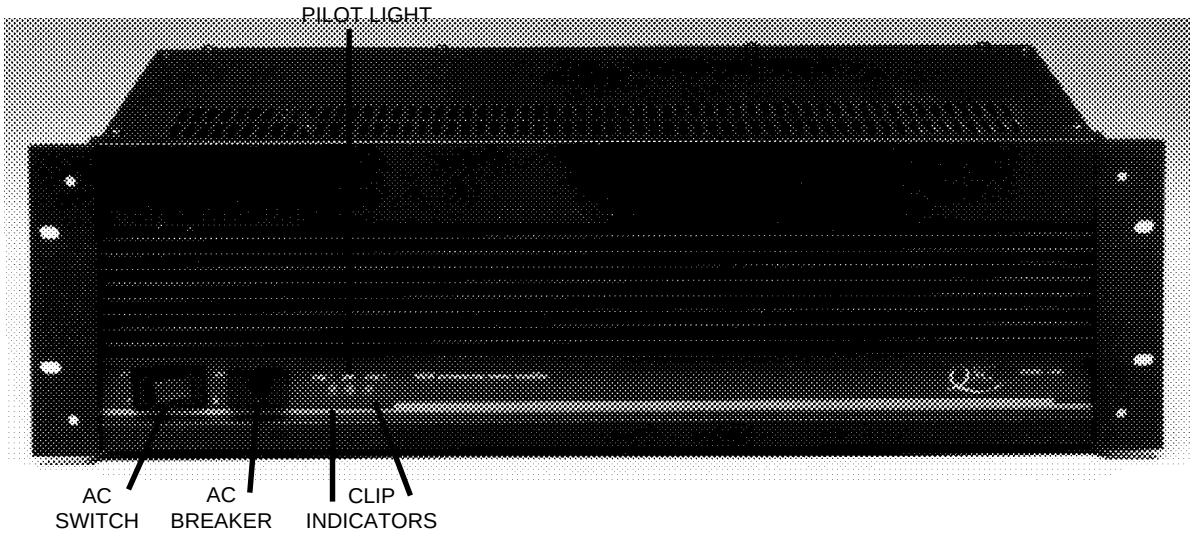
1100 FRONT VIEW



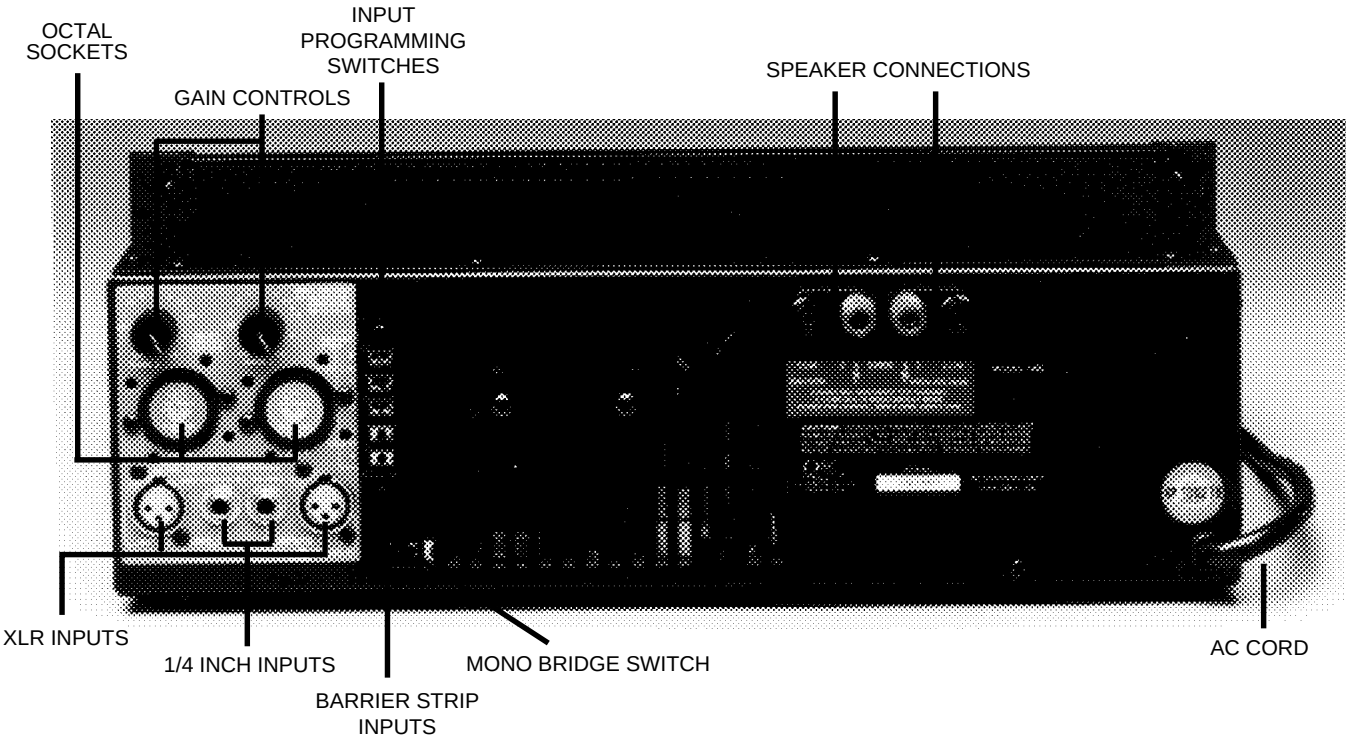
1100 BACK VIEW



MODEL 1200/1400 FRONT



MODEL 1200/1400 BACK, SIMILAR TO 1700



III: OPERATION

3.1 COOLING

3.11 **The Model 1100** uses side-mounted, convection-cooled heat sinks for power transistor cooling. When rack mounted, temperature rise should not be excessive for eight-ohm loads at normal listening levels, but operation into lower impedances at high powers may cause heat build-up unless good access to cool air is provided at the sides of the rack. If side clearance and/or louvers cannot be provided, some space should be provided over and under the amplifier for air circulation.

3.12 **The Model 1200** uses an internal heat radiator, top ventilation slots, and the faceplate for cooling. The faceplate will get quite warm in severe usage, but this heatsink system will serve adequately when the amp is used in the open air.

If the amps are mounted in tightly confined racks, we recommend that a fan be located so that it blows air into the rear of the rack. If the back of the rack is sealed, the airflow will be guided into the rear vents of each amp and out through the faceplate vents. This will provide the same flow-through cooling as the 1400 and 1700 have. A normal sized "muffin" or computer fan should provide enough cooling air to service several amps. In addition, an optional fan kit for the Model 1200 is available from QSC which can be installed by qualified service personnel.

3.13 **The Model 1400 and 1700** amplifiers feature High Turbulence Flow-Through Cooling. An internal, two-speed fan forces air across a light-weight, high-turbulence heat radiator. Air flow is from the rear, so that warm air is exhausted to the front rather than baking the rest of the rack. This prevents the recirculation of heated air and reduces internal rack temperatures. Be sure that plenty of inlet space is allowed in the rack for free air flow.

Dust filters are not provided on the amplifiers since small filters tend to clog quickly and reduce airflow. However, dust can be a problem and it should be removed from the insides of the amplifiers by using a compressed air jet through the vents several times a year. If amps are used in a fixed installation, where removal is not convenient, consider an additional fan pack in the bottom of the rack with a large external dust filter. The additional fan will maintain air flow, and the external filter can be removed and cleaned from the front of the amp rack.

When installing the 1400 or 1700 in the same rack with passively cooled amps or fan cooled amps that exhaust into the rack, locate the 1400 or 1700 on the bottom. This will assure the coolest air for all amps.

3.14 **Thermal cut-out** The amplifier should normally run a little warm to the touch, and under high-power operation may get quite warm, especially around the heat sinks. If the heat sink temperature becomes excessive, internal thermostats for each channel will remove power temporarily. (See Section 3.8)

3.2 AC REQUIREMENTS

3.21 **AC tolerances** Series One amplifiers are designed for safe operation at AC voltages l0% higher than rated; however, temperature rise and transformer hum may increase somewhat. Operation on lower-than-normal AC voltages is not harmful to the amp, but performance will be progressively lost. For voltages down to 75% of rated voltage, no effect other than loss of peak power should be noticed. If voltage declines further, short-circuit protection (current limiting cutback) may be experienced during heavy peaks into low impedance loads. The muting circuit may not come on at less than 70% of rated voltage, but once on, it should stay on down to about 30% of rated voltage. There should be no sub-audio or DC transients caused by fluctuating AC voltages; you should suspect poorly regulated preceding components if thumps or voice-coil excursions are observed during peaks.

3.22 **AC supply** In order to maintain full rated power, power amplifiers require well-regulated AC voltage of the proper rating. This is not always easy to assure when large banks of amps are used. The problem is further complicated by the fact that virtually all practical amplifier power supplies use peak rectification of the AC waveform. This means power is drawn only from the tips of the AC sine wave. When many amps are used, or there is an excessive length of inadequate gauge AC wiring to the amps, these tips can be seriously eroded without a major effect on measured RMS voltage.

Bulk-power devices, such as lamps, on the same circuit may not be greatly affected, but other electronic components, which normally use the same type of rectification, may be seriously affected during high-power peaks. This is especially true of sensitive devices like computers, video gear, etc. This is why power amps should have their own electrical circuit if possible.

3.3 INPUT CONNECTIONS

(See illustrations in Section 2.3 for location)

3.31 **Input Labeling** All input functions are located on the rear panel of the amplifier and are labeled.

3.32 **Input Jacks** 1/4-inch ring-tip-sleeve, female XLR, and three-circuit barrier strip terminal blocks are provided for input connections.

3.33 **Input Circuit** An electronic balanced input is standard. This uses matched, 20 kΩ resistive dividers and the differential input of a high performance 5532 op-amp to accept balanced input signals and reject common-mode signals. For best performance in the balanced-input mode, the source should have equal impedances for both signal conductors, so that the loading effect on each leg will be the same for common mode (noise) signals. Minor

mismatches will result in slight loss of common-mode rejection, but will still have much greater noise rejection than unbalanced inputs.

3.34 **Balanced Inputs** For proper balanced-line operation, the cable shield should be connected at the power amplifier end only and kept separate from both signal conductors. The cable shield should be connected to the barrel of a 1/4-inch plug, to pin 1 of an XLR plug, or to the “GND” terminal of the barrier strip. Balanced-line cables contain two signal conductors, a “plus” polarity, often called “high” or “hot”, and a “minus” polarity, often called “low” or “return”. The “plus” conductor should go to the ring of a 1/4-inch plug, to pin 2 of an XLR plug or to the “plus” input of the barrier strip, for the amplifier to reproduce the signal in the same polarity (non-inverting operation). This conforms to the international standard for XLR connections. The “minus” conductor goes to the tip of a 1/4-inch plug, to pin 3 of an XLR connector, or to the “minus” terminal of the barrier strip.

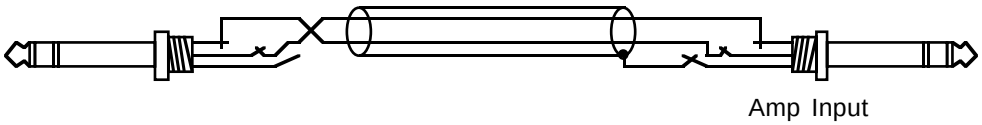


Figure 3.34a *1/4-inch RTS Balanced Output Connection*

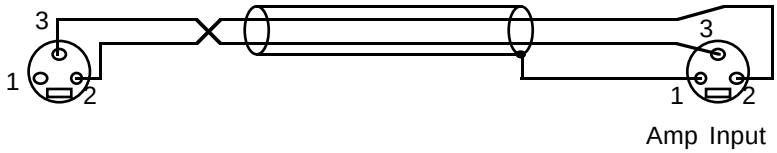


Figure 3.34b *3-Pin XLR Balanced Output Connection*

3.35 **Unbalanced inputs** Since the input signal responds to the difference between the plus and minus signals, if only a single-ended, unbalanced signal is available, the unused input terminal must be grounded for operation without loss of gain. The ability to reject cable-induced hum and noise is lost, but this may not be needed in well-shielded environments with short distances between audio components.

For unbalanced signals, the barrel of an ordinary two-conductor (mono) 1/4-inch plug will ground the sleeve terminal when pushed all the way into the 1/4-inch jack, so no special wiring is required. For XLR plugs, the signal conductor should be connected to pin 2, and pin three should be connected, inside the plug , to pin 1 (ground). On the barrier strip, the “minus” terminal is tied to the adjacent “GND” terminal, and the signal conductor should be connected to the “plus” terminal. In all cases, of course, the shield goes to the ground terminals. The tip of an unbalanced 1/4-inch plug has been made negative (inverting) because it is far more stable in systems which are subject to complex ground loops.

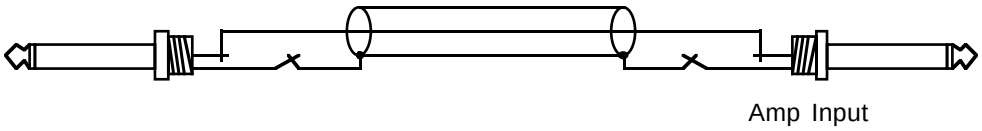


Figure 3.35a *1/4-inch RTS Unbalanced Output Connection*

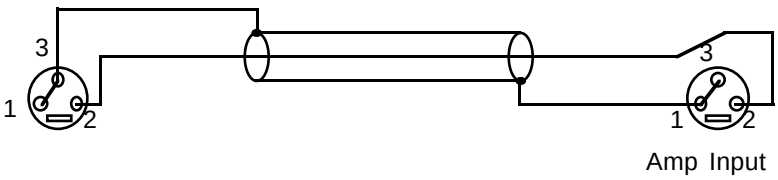


Figure 3.35b *3-Pin XLR Unbalanced Output Connection*

3.36 Unbalanced Inputs and Polarity Unbalanced operation raises an interesting question regarding the trade-offs between maintaining standard system polarity and optimal stability. Normally, an amplifier is expected to reproduce input signals in the same polarity, which is called the non-inverting mode, so that a drum beat, for instance, pushes the speaker out instead of in. However, if there is any leakage from high-power (speaker) circuits to the amplifier inputs, the amplifier is much more stable in the inverting mode, since the leakage then tends to add negative, or stabilizing, feedback.

Using an inverting-mode power amp is the opposite of normal practice, but we have observed many cases where "mystery problems" occurring in wide-band amplifiers used in the non-inverting mode are solved by switching to the inverting mode. Balanced line operation corrects this problem without regard to polarity, but is not always available.

We feel that in most situations, it is of very little importance to worry about overall amplifier polarity, as long as all the speakers are matched, because the polarity of mics, mixers, recordings, speakers, etc. may be unknown. For this reason, we have used the safest or most stable assignment (inverting) for the input polarity of the 1/4-inch plug, to give average users with unbalanced equipment the most stable connection without getting bogged down in very subtle nuances of reproduction.

NOTE **You can always reverse the red-black polarity to all the speakers to restore correct overall polarity even when using the "more stable" inverting mode. In any case, be sure to use the same polarity for all of the speakers so they work together. If you can determine the polarity of the rest of the chain, you can always obtain positive overall reproduction polarity, by selecting the appropriate final polarity to the speakers.**

The next section suggests an easy way to make a "quasi-balanced" line for unbalanced components.

3.36 Quasi-balanced lines Even if a balanced-line output is not available, some benefits of a balanced-line input can still be obtained. Special cables will need to be made as follows:

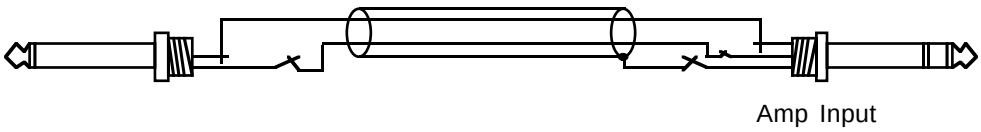


Figure 3.36 *1/4-inch Quasi-balanced Output Connection*

The cable end which connects to the power amplifier would be made as described in Section 3.34, using balanced-line cable. At the other end, using whatever plug matches the unbalanced output, connect the "plus" conductor to the signal terminal, and connect the "minus" conductor to ground. Do not connect the shield conductor.

Do not connect the "minus" and shield conductors together at the power amplifier (balanced input) end of the cable. This maintains the separation of signal ground and shield (circuit) ground needed to obtain balanced-line noise rejection. This scheme is recommended to remove the last traces of hum and interference from systems which use unbalanced-line pre-amps and processors, such as ordinary consumer stereo and audiophile gear.

As a further refinement, a small variable resistance can be connected in series with the "minus" conductor, with a value roughly equal to the output impedance of the signal (usually less than 600 ohms). This resistance can be adjusted to null out any residual hum or interference.

3.37 Cross Connecting Both Channels You can always connect the inputs of two or more channels to the same signal, but NEVER CONNECT TWO CHANNELS TO THE SAME SPEAKER. Connect separate speakers to each channel to avoid amplifier damage.

Rather than using a patch cable or connecting the inputs together at the barrier strip, the two inputs can be connected by turning on switches 5,6 of the input programming switches. This internally connects the inputs for Ch. 1 and Ch. 2 in parallel. Additional amps can now be cross-connected by using the connector style of your choice to plug into Ch. 1, and using the same (or different) type connector to come out of an input jack for Ch. 2. This second cable can now be connected to a second amplifier, and by using the same procedure, can be patched to as many amps as desired. Each channel's Gain control will remain effective for that channel only, allowing you to balance the output coming from each channel.

See Section 3.5 for details on mono-bridging, which is a different way of combining the power of both channels.

3.38 Good Quality Connections A tight and corrosion-free contact at all connections is essential for good sound and to avoid erratic noises or unstable performance. 1/4-inch connectors are suitable for low-cost portable systems, but must be removed and replaced frequently to avoid corrosion build-up. 1/4-inch plugs are not recommended for long, undisturbed service, especially in corrosive environments. The "military" brass-type plugs are especially bad in this respect, because they don't match the plating of the input jacks. XLR plugs are preferred by professional users for reliable contact and better retention.

For permanent wiring harnesses, the barrier strip is the cheapest and best. The signal wiring can be stripped and wrapped around the terminal screws, or spade terminals can be soldered or crimped onto the ends of the signal conductors. When crimping, be sure to use the proper tool with generous pressure, and test the resultant crimp by pulling while closely inspecting. If the wire wiggles inside the crimped terminal, the contact will go bad. The spade lug, or bare wire ends, can then be tightly screwed down to the proper positions on the barrier strip. If high pressure is maintained in the crimp and the screw terminal, a "gas-tight" connection is formed which will exclude corrosion for many years.

3.4 OCTAL MODULE ACCESSORIES

3.41 Octal Socket Each channel has an octal socket for active and passive plug-in accessories. This is shipped with a protective label to prevent corrosion of the pins. See the schematic in the back of this manual for pin assignments.

3.42 Input Transformer Although the audio benefits of transformerless coupling are well recognized, certain users still prefer the security of a transformer-coupled input in severe environments. In addition to the QSC model T-1 input transformer, the Bauer Communication model RE-11P-QN is available for QSC amplifiers.

3.43 Active Accessories In a number of special cases, the user needs built-in power limiting, bi-amp capability, etc. In order to serve these needs without adding to the basic cost of the amplifier, the octal socket has been designed with low-level DC power tapped off the internal supply of the amplifier. Ask the QSC Sales Department for details on availability.

3.44 Octal Module Installation Peel away the protective cover and plug in the module, observing correct alignment of the guide post in the middle. The input bypass switches for that channel must be turned off (See Section 3.5). Certain other switches may need to be set in accordance with the type of module and combination of channels desired. See the instruction sheet for each module for these details. Input to the module occurs automatically through the amplifier's input jacks.

3.5 INPUT SWITCHES AND MONO BRIDGING

3.51 Input Programming Switch An 8-pole input programming DIP switch will be found on the rear panel of the amplifier. The switch functions are as follows: (move levers up to turn on, down for off)

Switches 1,2: Bypass the Octal Socket for Channel 2. Keep "on" for normal operation (i.e. when no octal accessory in used). Turn "off" when an octal accessory is plugged in (see the instructions with the octal accessory).

Switches 7,8: Same as above for Channel 1.

Switches 3,4: Connects the output from an octal accessory plugged into Channel 1 to both amplifier channels. Turn "on" to feed the octal accessory to both channels. Turn "off" for normal operation or for using separate octal accessories.

Switches 5,6: Connects the inputs of Ch. 1 and Ch. 2 in parallel (see Section 3.37). If octal accessories are used, the inputs (not the outputs) of both accessories will be combined. This may be used in place of a Y-cord for feeding a common input signal to both channels.

3.52 Mono Bridging Most stereo amplifiers have a method of combining both channels in series to give the combined power into a single load. This is a way to fully use both channels when only a single speaker is driven.

To engage the bridged-mono mode of the Model 1100, a slide switch must be set through a hole in the bottom of the amplifier. Due to the danger of touching live terminals inside the amplifier, BE SURE TO REMOVE ALL POWER AND DISCONNECT THE AC PLUG before resetting the switch. In accordance with the label on the bottom, set the switch towards the front for bridged-mono use, and towards the rear for normal stereo use.

To engage the bridged mono mode on the Model 1200, 1400, or 1700, there is a separate slide switch located below the barrier strip inputs on the rear panel. Follow the directions on the label to engage the switch in the "Bridge" position.

Connect the amplifier input to Ch. 1 only, and use only the Ch. 1 Gain control, which now controls the entire amplifier. Do not feed another input into Channel 2. The Ch. 2 Gain control should be kept off for safety. An 8 or 16 ohm speaker load should be connected across the two red speaker terminals, using the red terminal of Ch. 1 as the "+" or "hot" terminal, the red terminal of Ch. 2 is the "-" or "common" terminal.

Mono Bridge Precautions

a. Minimum load impedance is 8 ohms, which will be the equivalent, to the amp, of 4 ohms per channel. If a four-ohm load is used, the amp will have to work very hard and may overheat.

b. Both sides of the speaker cable are "hot" or active. Be sure there is no ground or other circuit connected to either side of the speaker cable.

c. If the parallel-channel switches (#5,6, see Section 3.51) are switched on,the signal into Ch. 2 will cancel the mono-bridge signal. To prevent this, and still permit patching to additional amps, keep the Gain for Ch. 2 fully off.

3.6 SPEAKER CONNECTIONS

3.61 Speaker Terminals Red and Black 5-way binding posts, on standard 3/4-inch centers, are located on the rear of the chassis of all Series One amplifiers.

The 1100 features a pair of standard 1/4" headphone jacks on the front panel. They are connected to the speaker outputs of the amplifier through a resistive pad that prevents excessive power levels from damaging the headphones. Always fully turn down the Gain controls before plugging in headphones to prevent accidental exposure to excessive sound levels that can cause permanent hearing damage.

3.62 Terminal Polarity The Red binding post carries the positive or "hot" speaker output. The Black binding post is the ground return for the speaker.

3.63 Speaker Cables In order to obtain the full benefit of the high power and high damping factor of the amplifier, the user must avoid cable losses. The best way is to use the heaviest-gauge, finely stranded wiring possible. 12-gauge speaker cable is available, and heavier gauge "specialty" cable is sold by audio dealers.

3.64 Cable Termination A major problem with heavy-gauge cables is that the ends are too large to fit most speaker terminals. Usually, it is necessary to install spade lugs on each end, which must be soldered or soundly crimped. These must then be screwed firmly under the binding posts. Dual banana plugs are more convenient for portable systems, and will normally accept at least 12-gauge wires.

3.65 Cable Polarity Be sure to observe correct polarity at both the speaker and amplifier end. Most present-day speaker cable is color-coded or polarized in some way. Adopt a consistent wiring convention and stick to it. We suggest Black for "Com" (ground or negative) and Red for "Spkr" (hot or positive). These colors match the binding posts. By the same logic, we can assign the copper-colored wire to the Red ("Spkr") terminal, and the silver-colored wire to the Black ("Com") terminal.

3.66 Bridged Mono Please see Section 3.52 for the bridged-mono speaker connection.

3.67 Speaker Impedance The Series One amplifiers have adequate current capability to fully drive loads down to two ohms. However, many high-performance "8-ohm" loudspeakers, especially multiple-way systems with passive crossovers, have impedances at some frequencies which are far lower than the average rating. An impedance minimum of 2 ohms or less is not uncommon. For this reason, speaker impedance curves should be consulted before connecting speakers in parallel.

We would expect the amplifier to do an outstanding job with any 8-ohm, full-range speaker system, and we expect equally outstanding performance when driving 4-ohm loads without passive crossovers (as part of a bi-or-tri-amped system, for instance). 2-ohm loads should be approached with caution, as there is no further margin for impedance dips. The amp should not be damaged, but high-power operation into reactive 2-ohm loads may result in overheating or excessive AC current consumption, causing shutdowns. In addition, some power may be lost at those frequencies where the impedance dips below 2 ohms. For these reasons, operation with 2-ohm loads should be tested thoroughly before putting into use.

3.69 Speaker Wire Table The following table is presented to assist in selection of appropriate speaker wire. Power losses and net damping factors (including the amplifier, with a Damping Factor of 200) are shown for a variety of lengths and gauges. Note that loss of power and damping factor are more severe for longer lengths, lower impedance loads, and higher (thinner) gauges. One should maintain a minimum damping factor of 20, and preferably 50 for high-quality systems; this will automatically prevent significant power loss. Although a power

loss of 10% is barely audible, the resultant low damping factor will prevent the amplifier from fully controlling the peaks and dips in frequency response caused by speaker impedance variations. This will result in greater coloration and muddiness.

Cable Length	Wire Gauge	Cable Resistance	Power Loss, 8Ω Load	Power Loss, 4Ω Load	Damping Factor, 8Ω Load	Damping Factor, 4Ω Load
5 ft.	18	0.063Ω	0.79%	1.58%	78	39
	16	0.040Ω	0.50%	1.00%	100	50
	14	0.025Ω	0.31%	0.63%	123	62
	12	0.016Ω	0.20%	0.40%	143	71
	10	0.010Ω	0.13%	0.25%	160	80
10 ft.	18	0.126Ω	1.58%	3.15%	48	24
	16	0.080Ω	1.00%	2.00%	67	33
	14	0.050Ω	0.63%	1.25%	89	44
	12	0.032Ω	0.40%	0.80%	111	56
	10	0.020Ω	0.25%	0.50%	133	67
20 ft.	18	0.252Ω	3.15%	6.30%	27	14
	16	0.160Ω	2.00%	4.00%	40	20
	14	0.100Ω	1.25%	2.50%	57	29
	12	0.064Ω	0.80%	1.60%	77	38
	10	0.040Ω	0.50%	1.00%	100	50
40 ft.	18	0.504Ω	6.30%	12.60%	15	7
	16	0.320Ω	4.00%	8.00%	22	11
	14	0.200Ω	2.50%	5.00%	33	17
	12	0.128Ω	1.60%	3.20%	48	24
	10	0.080Ω	1.00%	2.00%	67	33
	8	0.050Ω	0.63%	1.25%	89	44
80 ft.	16	0.640Ω	8.00%	16.00%	12	6
	14	0.400Ω	5.00%	10.00%	18	9
	12	0.256Ω	3.20%	6.40%	27	14
	10	0.160Ω	2.00%	4.00%	40	20
	8	0.100Ω	1.25%	2.50%	57	29
160 ft.	14	0.800Ω	10.00%	20.00%	10	5
	12	0.512Ω	6.40%	12.80%	14	7
	10	0.320Ω	4.00%	8.00%	22	11
	8	0.200Ω	2.50%	5.00%	33	17
320 ft.	12	1.024Ω	12.80%	25.60%	8	4
	10	0.640Ω	8.00%	16.00%	12	6
	8	0.400Ω	5.00%	10.00%	18	9

Table 3.69 *Speaker Wire Table*

3.7 25 AND 70 VOLT SYSTEMS

3.71 Introduction Commercial sound systems commonly use dozens or even hundreds of speakers for sound distribution. Special methods for connecting and controlling many separate speakers have been worked out by commercial sound contractors.

3.72 25 Volt lines 25 volt distribution systems are popular in small to medium sized installations where local codes require conduit for 70-volt lines.

The Model 1100 amplifier will deliver up to 120 watts directly to 25 volt lines by using the mono-bridge mode. Please note that, as with any system using the mono-bridge mode, neither side of the speaker line should be grounded.

The Model 1200 amplifier will deliver up to 150 watts per channel directly to 25 volt lines. The Model 1400 and 1700 have excessively high output voltages and are not recommended for directly driving 25 volt lines.

3.73 70 Volt lines All Series One amplifiers may be used with our 70-volt output transformers, the OT-300a and OT-600, to power 70 volt distribution systems. See the following table for details on transformer model and power ratings. Consult the transformer Owner's Manual for additional information on 70 Volt distribution applications.

Model	Output Transformer	Voltage Tap	Power,Per Channel
1100	OT-300a	17 V	70w
1200	OT-300a	25 V	150w
1400	OT-300a	35 V	300w
1700	OT-600	45 V	500w

Table 3.73 *70 Volt Output Power*

3.74 Low Frequency Rolloff In commercial sound systems, a rolloff below 50 Hz or so is desirable to prevent excess wasted power at frequencies below the range of the speakers and their small transformers. Contact the QSC Sales Department regarding the availability of Octal Modules for this application. The roll-off may also be provided by preceding signal processing equipment, such as EQ's, active crossovers and mixers.

3.8 PROTECTION FEATURES

3.81 Summary We have ensured that accidents, mistakes, and abuse will have the minimum possible chance of harming the amplifier or speaker . The major challenge was to do this without impairing the audio performance into normal loads.

3.82 Short Circuit Protection The active region in a power transistor is surprisingly small—perhaps 1/5 of a inch wide. This little piece of silicon must control hundreds of watts of power. If not managed properly, this can burn out the silicon, instantly destroying the transistor.

Under normal conditions, most of the power passes through the transistor, into the speaker, producing useful power and only some waste heat. If too many speakers (too low of an impedance) are connected, excessive power will be drawn through the transistor, and more heat will be wasted. If the load impedance drops to zero, which might happen if the speaker wires are shorted together, then there would be almost no limit to the power drawn through the transistor, and the waste heat will be so high that the transistor will burn out. This is why solid state amps need short circuit protection.

The patented QSC "Output Averaging" short circuit protection acts by monitoring the load impedance. As long as it is within rated limits (above 2 ohms), the amount of waste heat in the power transistors is acceptable, and full audio power is allowed to continue. If the output impedance is reduced below 2 ohms the instantaneous current peaks will be limited, but to a fairly high value, which the transistors can handle for a short time; if a strong signal persists for more than a fraction of a second, the current limit is smoothly cut back to a lower value which the transistors can handle indefinitely.

The result is full performance into rated loads, ability to handle normal program peaks into marginal loads, and good protection into short circuits. At no time will the circuit cause abnormal distortion spikes or loss of sound.

3.83 **Thermal Protection** In case of blocked ventilation, improper loading or prolonged short-circuit operation, the temperature of the power transistors can rise to excessive levels. If the temperature of the heat sink rises to 85C, a thermostat will remove power to that channel. Power will be automatically restored when the channel has been allowed to cool down.

Please note that Channel 1 can shut down without affecting channel 2, but if channel 2 shuts down, the muting circuit for both channels will operate and mute channel 1 as well. This was done so that whichever channel might overheat in the bridged-mono mode, it would remove the signal for both channels and prevent damage to the muted channel. The amplifier should come back on within a minute or two.

If thermal problems occur, check for blocked ventilation, proximity to a heat source, short circuit, or improper load (too many speakers).

3.84 **DC Fault Protection** The Model 1100, 1200, and 1400 amplifiers employ a unique Bi-Capacitive output circuit that combines the tight, well controlled audio performance of direct-coupled (DC) designs with the inherent ability to block DC output in the event of amplifier failure. Because this circuit requires dual power supplies, protection is independent on each channel. A DC fault in one channel will not affect operation of the other. Since no relays or other external devices are employed, the amplifiers are free from any false triggering or degradation problems associated with other protection schemes. In the event of an actual fault, DC will be blocked at the output until an internal protection fuse blows. This will remove power from the defective channel until repair can be made. In the unlikely event this should happen, disconnect the inputs and speakers from the defective channel and take the amplifier in for service as soon as possible, to prevent any further damage.

The Model 1700, due to its higher power rating, employs the same dual power supply scheme, but has a more conventional direct coupled (DC) output circuit. It uses a heavy duty Load Grounding™ speaker relay for load protection. This has the advantage of connecting the defective channel's load to ground for extra protection.

3.85 **Turn-on/turn-off Muting** There will be a three-second muting interval after turn-on. After turn-off, or loss of power for any reason, the amplifier will mute within a quarter of a second.

The outputs of all Series One power amplifiers are DC protected and the circuits have no inherent turn-on or turn-off thumps.

Protective muting for the Model 1100 is handled by a small relay at the input. The signal does not pass through the relay contacts, but is shunted to ground during the muting interval. Thus any degradation of the relay contacts will only affect the muting, and not the audio quality.

The Model 1200, 1400 and 1700 make use of an electronic muting circuit to mute the input of the amplifier. The Model 1700 also makes use of the Load Grounding™ relay to mute the output of the amplifier by grounding the speaker output.

3.86 **Input/Output Protection** Series One amplifier inputs are isolated by 10K resistors, which are part of the balanced-input circuit. This protects the inputs from burn-out due to extremely high input signals or RF interference. The amplifier output is isolated from capacitive and inductive loads by a high frequency RLC network, which decouples the speaker terminals slightly at frequencies above about 50 kHz.

3.87 **Indicators** The green pilot LED indicates AC power, but does not signal status of the muting circuit. After the muting interval is passed, the red clip LED's will indicate the presence of distortion for each channel. If distortion is heard without clip indication, you should suspect other parts of the system.

3.9 OPERATIONAL TROUBLESHOOTING

3.91 **Summary** This Section contains troubleshooting hints which should help you locate a problem. By using a step-by-step evaluation, by comparing the function of both channels, and by using one channel to check the inputs and outputs of the other, a problem can usually be isolated. Please refer to Section 2.3 for an illustration of the front panel and indicators.

3.92 **No Sound**

Power LED does not come on: There is no AC power. Check AC plug. Depress the AC circuit breaker reset on front of amplifier, next to AC switch. The 1700 features a combination AC Switch/Circuit Breaker—turn it off then back on to reset. Test the wall outlet with another device to check for power.

Power LED comes on: Either the input or output has a bad connection, or the channel is faulty. If one channel is working, use it to test the input and speaker cable from the bad channel. If it still doesn't work, the fault is somewhere else—the speaker, input source, or cabling. If the good channel works using the bad channel's cables,

then the fault is somewhere in the bad channel. Check the input program switches, octal accessory (if any) or jacks. See Section 3.5 for correct switch settings. Inspect the binding posts for damage, and try a different input jack or the parallel channel switches before giving up on the channel.

3.93 Weak But Clear Sound This usually indicates lack of input signal or incorrect Gain adjustment at some point. Again, if the other channel is working, try swapping connections to see if the problem is in the channel or elsewhere. If the sound is very thin or muffled, one driver in a multiple-way speaker may have failed.

3.94 Weak and Distorted Sound If the amplifier clip light comes on during the distortion, there is a shorted speaker cable, the speaker is blown, or the amplifier channel is defective. If the clip light does not show during the distortion, this shows that the distortion is happening outside of the amplifier. You will have to check for misadjusted or defective units before the amplifier, or defective speakers. Also verify that amplifier Gain is in the normal range (half-way up or higher).

3.95 Sound Cuts In and Out This is usually caused by a bad connection. See if shaking the amp or the input/output connectors causes the problem. If the sound cuts out for a minute and then comes back on by itself, check the amplifier for overheating (thermal cut-out). An intermittent connection to one side of the balanced input can cause a 6 dB fluctuation of input level.

3.96 Sound Has Bad Tone (poor treble or bass) The amplifier itself is very unlikely to develop a frequency response problem, without more serious effects. Therefore, lack of frequency range must be traced to the speakers or preceding units.

3.97 Lacks Power This is a common but indefinite complaint. Is there a lack of power in the sense that it is soft but clear (see Section 3.93) or does it seem to distort too easily (see Section 3.94). Also, be aware that speaker efficiency will drop perceptibly after heavy usage, due to the increased resistance of the voice coils as they heat up; volume will return when the speakers cool down.

In a multi-speaker system, be sure all of the speakers are still working. Finally, of course, your ears get used to high sound levels, and as the room fills up with people, the sound will be absorbed more greatly. Only a sound level meter, used with a standard signal level and at a standard distance from the speaker, can really tell if you are getting the expected output.

3.98 UNWANTED NOISES

Hum—in this case, defined as a fairly rounded 60-cycle tone. Severe hum usually is caused by broken cables or jacks, with a disconnected ground (shield). This problem can also be caused by corroded connectors, especially 1/4-inch types. For this reason, high-reliability systems should use the XLR or barrier-strip inputs.

A milder form of hum, often with a little more “tone” or harmonic content, is usually the result of ground loops. This problem is caused by 60-cycle magnetic fields, which radiate from power transformers, including the ones in the amplifier. Try re-positioning the cables away from the various components. Note that tape recorder heads, phono cartridges, and electric guitar pick-ups are especially sensitive to this type of interference, and must be kept away from high power electronics.

Buzz—defined as a very “razzy” kind of hum. This is usually caused by interference from solid-state light-dimmer circuits. Follow the same precautions shown above, and make sure the electronics are not connected to an AC outlet which has a dimmer control.

Hiss—defined as a smooth “shhh” noise. This is always a problem with sensitive, high-gain electronic inputs, and usually starts at the point of weakest signal. First, check the power amp by unplugging the input cables. Any residual noise (hiss and hum) should be barely audible even with your ear right up to the speaker. Assuming that the amp is OK, you will have to trace the hiss to an earlier part of the system. In a properly designed system, this will be the initial microphone, phono, or tape source.

There is a noise “floor” caused by random atomic vibrations. This limits the signal-to-noise ratio of the original signal; the goal of a proper system is to immediately amplify that signal well above the noise floor so that further degradation does not occur. “Gain-staging” is a subject in itself, but the principle is to maintain a reasonably constant signal level after leaving the initial pre-amp. The signal must be kept below the point of distortion, and well above the noise floor.

To isolate the source of unwanted hiss, start at the amp, and work backwards, reducing and then restoring gains. You should hear a reduction of hiss and audio together at each point, showing that the hiss is coming in earlier. When you find a control which lowers the audio volume, but not the hiss level, you know the hiss is coming in after

that stage. Assuming that the hiss has not always been there, this indicates defective electronics. Certain special-effects units are rather noisy, so compare with other users.

Crackles—defined as a "popcorn" noise. If the crackle persists during pauses in the program material, this indicates defective electronics and must be traced down using the above procedures. Crackles which occur during audio peaks or when the electronics are vibrated usually indicate bad connections.

IV: SPEAKER PROTECTION

4.1 BACKGROUND

Speakers have several limits which should not be exceeded for reliable operation. It is the user's responsibility to determine these limits and operate the amplifier accordingly. We offer several ways to avoid unexpected accidents, but you must still select speakers of appropriate type and power capacity and operate them within their limits.

4.2 DC PROTECTION

The design of the 1100, 1200 and 1400 amplifier circuit eliminates the DC fault problem at its source, so no special protection is required. The QSC grounded collector output circuit is AC coupled and cannot pass DC to the load. The Model 1700 features a Load Grounding™ relay and special protective circuitry to protect the load from any DC fault condition.

All Series One amplifiers feature a low frequency roll-off below 20 Hz to protect the amp and load from possible damage caused by large subsonic transients, such as breath pops, dropped microphones, etc.

4.3 HORN DRIVER PROTECTION

The compression drivers used with horns for high-frequency reproduction have special protection requirements. These devices are more delicate than large cone speakers, and more vulnerable to overload damage. In particular, the driver has a low-frequency limit which must be carefully observed. Below this frequency, the driver diaphragm can "bottom out" which will immediately alter the frequency response, and quickly cause failure. To prevent this, the user must make sure that a proper crossover network is installed.

In bi-and-tri-amp systems, where the driver is connected directly to the amplifier, the user must be especially certain that the correct frequency is used on the electronic crossover, and that no low-frequency signals, such as loud hums, get into the signal path between the electronic crossover and the power amplifier. As further protection, especially against accidental mis-adjustment or bad cables, many users install "horn protection capacitors" wired in series between the amp and driver. This part inherently blocks lower frequencies and DC, but must be selected so as not to disturb the crossover frequency. A reasonable rule of thumb is to let the capacitor roll off one octave below the intended crossover frequency. A table of values is presented below. Be sure to use non-polarized capacitors, of at least 50V rating.

Frequency	8-ohm Driver	16-ohm Driver
500 Hz	80	40
800 Hz	50	25
1000 Hz	40	20
1200 Hz	33	16
2000 Hz	20	10
3500 Hz	12	6
7000 Hz	6	3

Table 4.3 *Horn Protection Capacitors. (Values in micro farads)*

You may have some problems finding the larger value capacitors in the preferred film-type construction. If necessary, several can be paralleled; simply add the individual capacitances together to get the total rating. You will probably have to locate non-polar electrolytics for values greater than 10-20uf.

4.4 POWER CAPACITY

All speakers have a maximum long-term power limit which is determined by the temperature rise of the voice coil. The speaker can withstand short peaks above this level, since the voice coil takes a little while to overheat. The time lag depends on the size and mass of the voice coil and ranges from a fraction of a second to several seconds. The required speaker rating for a given amplifier power depends on the type of program material. Extreme cases such as lead guitar work may require speaker ratings of twice the RMS power of the amplifier to withstand the full peak power. The average power of signals where some attempt is made to prevent overdrive distortion will be less than the amplifier RMS rating; how much less depends on the dynamic range and headroom allowance. In live-performance situations where feedback and high-energy artists can push the system to its limits, it would probably be wise to match the RMS ratings of the speakers and the amplifiers.

4.5 POWER LIMITING

There are several ways to limit the power to safe levels without operator intervention. Some speaker systems have protective circuits, or at least fuses. Fuses can be added which will blow in case of overloads; the problem is to select a fuse with the correct time lag and overload characteristics to match the speaker limitations. The speaker manufacturer is in the best position to specify these values; the following table is presented for rough guidance only. The fuse values shown are calculated for fast-blow fuses, which will carry 135% of their rating for an hour, and which blow within 1 second at 200% current. The RMS power rating shown is correlated to 135% of the fuse current. The fuse voltage is not critical; 32 volt fuses should have the lowest resistance which will avoid loss of damping factor.

RMS Power	4-ohm Load	8-ohm Load	16-ohm Load
30w	2.0	1.5	1.0
50w	2.5	1.6 or 2.0	1.25
75w	3.0	2.0 or 2.5	1.5
100w	4.0	2.5	1.6 or 2.0
200w	5.0	3.0 or 4.0	2.5
400w	7.5	5.0	3.0 or 4.0

Table 4.5 *Fuse Ratings (values in amps)*

The power may also be limited with active circuitry. QSC offers a plug-in Octal PowerLimit Module (PL-1) which can be adjusted to put a ceiling on the power level; the circuit acts to reduce volume as necessary to keep the power below the desired ceiling. The PL-1 lets you set the power ceiling independently for each channel, without the interruptions of fuse protection. Please contact the QSC Sales Department for specific information on the Octal Modules.

4.6 USER RESPONSIBILITY

Remember that your Series One amplifier has extra peak power (dynamic headroom) in reserve. Observe the hook-up and operating precautions. QSC is not liable for any damage to loudspeakers caused by overpowering, wrong-frequency operation or electronic faults.

V: MAINTENANCE AND SERVICE

5.1 CLEANING

The faceplate and chassis can be cleaned with a soft cloth and mild non-abrasive cleaning solution, such as Windex. Avoid cleaning powders or scrubbing pads, as these will scratch and dull the paint. Be sure to unplug the unit prior to cleaning. Do not apply liquid directly to the surface. Dampen the cloth with the cleaning solution and wipe gently. You may wish to buff the surface lightly with a dry soft cloth.

5.2 DUST REMOVAL

After prolonged use, especially in dusty environments, the heat sinks may become clogged with dust. This will interfere with cooling and lead to higher temperature operation and reduced life. Dust build-up can be most easily removed by brushing or directing an air jet between the fins of the heat sinks.

5.3 USER MAINTENANCE

There are no periodical “tune-up” adjustments required; the amplifier should provide stable performance until parts fail from age. Internal servicing must be referred to qualified personnel. The amplifier may be inspected for loose screws on the outside. If any loose parts rattle around on the inside when the amp is turned over in all directions, please have it serviced immediately, as a loose part could lodge in a dangerous place and cause further damage or shock hazard.

5.4 OBTAINING SERVICE

If the amplifier isn’t working properly, please consult the troubleshooting chart in Section 3.9. If proper operation cannot be restored, the amplifier may require service. This must be performed by qualified technical personnel, to avoid shock hazard or improper repairs. To obtain the location of the nearest authorized Service Center, please contact your QSC dealer or the QSC Service Department—**1-800-772-2834**.

Please note that the Series One warranty does not cover repairs made by non-authorized service personnel, and that improper repairs may void future warranty coverage.

If the amplifier is returned to the factory for service, you must first obtain an R.A. number (“Return Authorization) from the QSC Service Department. The amplifier must be sent in the original type shipping carton. If you have not saved your carton, see if your dealer has one, or call the QSC Service Department to have an empty carton sent for shipping. The Series One warranty does not cover shipping damage caused by returning an amplifier in the wrong carton.

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