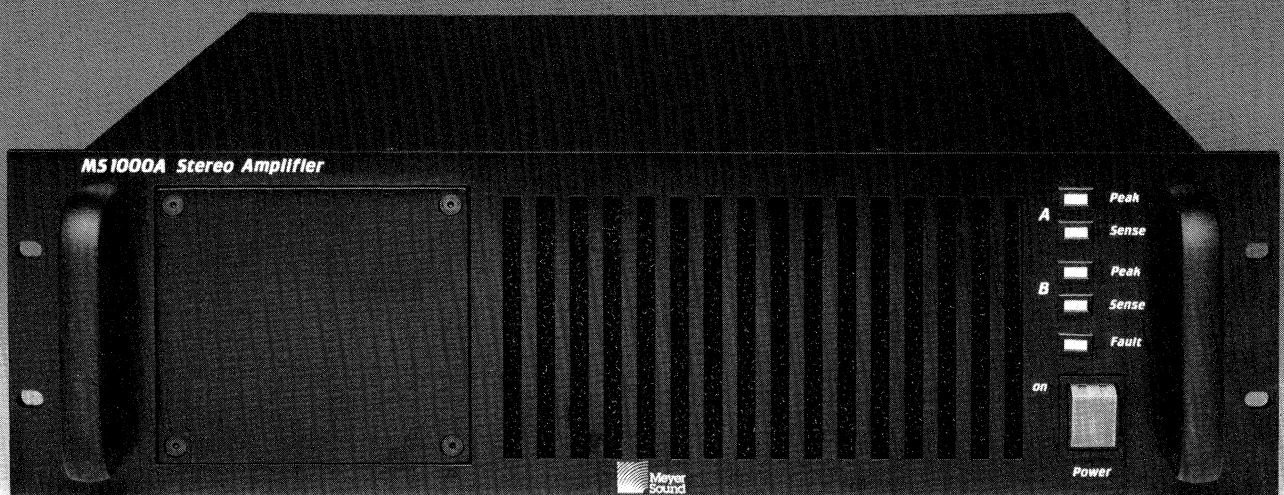


# MS 1000A Stereo Power Amplifier Owner's Manual



Meyer Sound Laboratories, Inc.  
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Berkeley, CA 94702

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**MS 1000A Stereo Power Amplifier**  
**Owner's Manual**

Meyer Sound part number 05100073.02, July '88  
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## Section I

### Introduction

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#### 1.1 About This Manual

This manual has been designed to provide you with all the information necessary to install, connect and operate your Meyer Sound MS 1000A Stereo Power Amplifier.

**Section I** contains introductory information of interest to all users of the MS 1000A. Section 1.4, "Summary of Operating Precautions," is particularly important. We urge you to read this section carefully before attempting to operate the MS 1000A.

**Section II** presents simplified operating instructions for the MS 1000A. Input and output connections, power requirements and basic operation are covered in a step-by-step fashion. This section is intended both as a guide for the first-time user and as a quick reference for more experienced users.

**Section III** provides detailed application information for the use of contractors, consultants and other audio professionals. Overseas users will

find in this section instructions for operating the MS 1000A from 220 volt mains.

**Section IV** is a detailed description of the design of the MS 1000A. Audio technicians and engineers will find this section, which presents the principles underlying the performance of the MS 1000A, to be of particular interest.

**Section V** contains complete specifications for the MS 1000A Stereo Power Amplifier. A set of schematics for the unit is provided as an appendix.

The Meyer Sound MS 1000A is designed to provide years of trouble-free service in the most demanding professional applications. We recommend that you study this manual thoroughly before connecting and operating your new MS 1000A, in order to take full advantage of its unique capabilities.

Thank you for selecting the Meyer Sound MS 1000A Stereo Power Amplifier.

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#### 1.2 Unpacking and Inspecting Your MS 1000A

The Meyer Sound MS 1000A Stereo Power Amplifier is shipped in a single carton. **Save all packing material.** When unpacking your MS 1000A, immediately inspect the unit for shipping damage. If the amplifier has been damaged in shipment, you must place a claim with the carrier: Meyer Sound and its dealers are not responsible for shipping damage.

Your shipment should consist of:

- (1) MS 1000A Power Amplifier
- (1) Instruction Manual
- (1) Envelope containing:
  - Meyer Sound Product Warranty Statement
  - Warranty Reply Card

Please fill out the Warranty Card and return it immediately for our records.

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### 1.3 Description of Controls and Features

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The Meyer Sound MS 1000A is a high-performance audio power amplifier for professional use. Originating in an engineering philosophy which stresses both long-term reliability and sonic quality, the MS 1000A offers a combination of features that is unprecedented in professional power amplifier design. As a result, it is equally at home in studio monitoring, sound reinforcement and contracting applications.

Housed in an all-steel rack-mountable unit construction chassis, the MS 1000A is entirely modular and easily serviced. A removable front-panel option plate, internal auxiliary circuit card slot and expansion connectors have been provided to allow for installation of meters, special input and output connectors, remote control circuitry and other factory (or custom) options.

For highest reliability in professional applications, the MS 1000A design incorporates

protection against overheating, excessive output power, output shorts, and output DC offsets. In contrast to the more conventional VI limiter designs, the MS 1000A protection circuitry features true current sensing (using current coils to sample the outputs); this eliminates "glitching" under highly reactive load conditions. Input and output shunting relays protect loudspeakers from latch-up as well as from turn-on and turn-off transients. Primary protection is provided by a pair of resettable circuit breakers.

The dynamic protection circuits of the MS 1000A have been designed for graceful action with minimum sonic disturbance. The voltage/current limiting circuitry acts instantaneously, and is free of compromising time constants that can introduce "motorboating" and other signal anomalies. A unique, instantaneous soft-clipping circuit, which engages when the amplifier reaches its voltage or current limits, provides overload characteristics similar to the saturation qualities of analog recording tape and tube-type equipment.

The MS 1000A Amplifier is rated at 1200 watts continuous (600 per channel) for up to 10 seconds and 1000 watts continuous long-term, with a full power bandwidth of 10 Hz to 30 kHz (with TIM filter). Typically, SMPTE distortion is 0.003%, and dynamic range is 100 dB ("A" - weighted). The damping factor is extremely high, so the MS 1000A controls the motion of loudspeaker drivers with a very high degree of accuracy. The MS 1000A will drive any combination of capacitive, resistive and inductive loads to a minimum impedance of approximately 2 ohms.

The design of the MS 1000A Amplifier utilizes an FET output stage and bipolar drive circuitry, with integral error-correction amplifiers to linearize the junction between the FET and bipolar stages for greatly reduced distortion. The signal path is complementary-symmetry throughout. Both the high and low-voltage power supplies are fully regulated, and employ circuitry to eliminate inrush currents on turn-on. This greatly prolongs the life of all power circuit components.

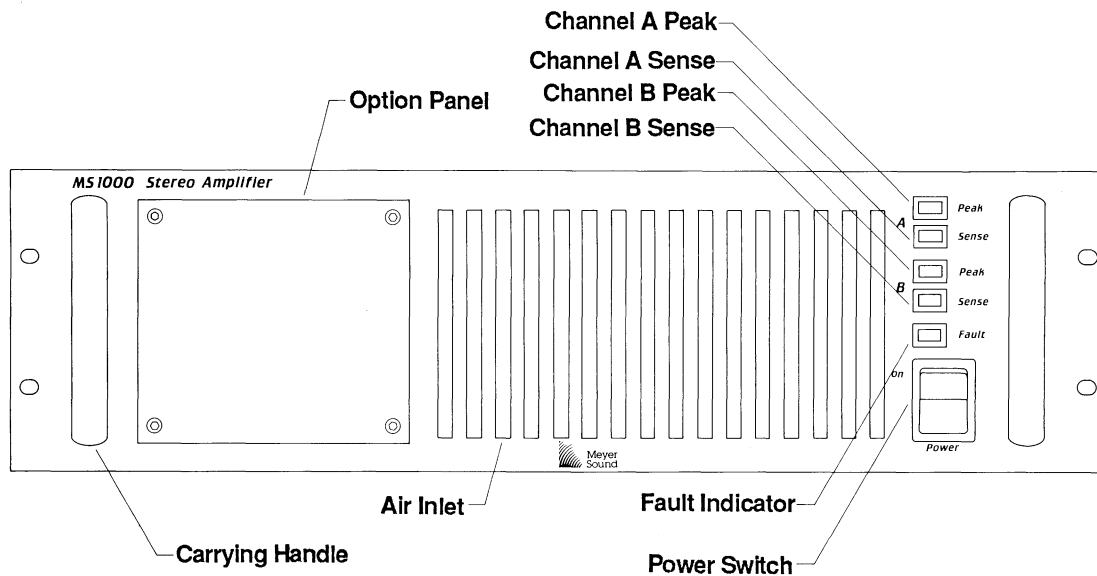


Figure 1-1 MS 1000A Front Panel

Finally, the MS 1000A Amplifier incorporates a revolutionary new proprietary input circuit (patented), which greatly simplifies interfacing in all professional audio applications. Affording the advantages of true transformer isolation without the drawbacks of conventional audio transformer designs, this input circuit may be driven from either single-ended or balanced signal sources with equal immunity from ground loops (see Section 3.1, below).

### 1.3.1 Front Panel Controls and Indicators

**Power Switch:** A rocker switch controlling the primary mains power circuit. The power switch will glow green when the amplifier is connected to a proper mains circuit and the switch is turned on.

**Sense Indicators:** Green LED (light-emitting diode) signal-presence indicators which monitor the output section of the unit. The Sense indicators will flicker at low

signal levels, and glow steadily at moderate or high levels, when the amplifier is on and is passing audio signals.

**Peak Indicators:** Red LED indicators whose threshold is set near the operating limits of the MS 1000A Amplifier. The Peak indicators will light when the MS 1000A has been driven to its maximum output voltage and/or current capabilities.

**Fault Indicator:** A multi-purpose red LED indicator which lights when a potentially

## Section I

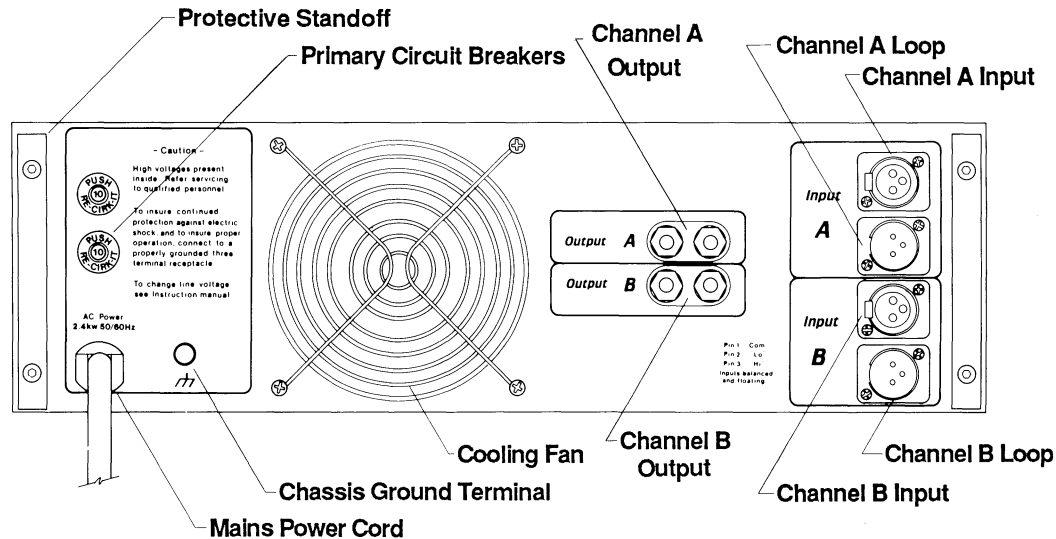


Figure 1-2 MS 1000A Rear Panel

damaging fault condition is sensed by the MS 1000A protection circuitry. When the Fault indicator is lit, the amplifier will have automatically shut down to protect itself against the fault condition (see Section 2.3, "Troubleshooting").

**Air Intake:** The MS 1000A Amplifier is fan-cooled, and the flow of air is from the front to the back of the chassis. The air intake is backed by a dust filter screen which may be cleaned with an ordinary household vacuum cleaner. Blocking the air intake -- or inlet air temperature of greater than 45° Centigrade (113° Fahrenheit) -- may result in an

automatic thermal shutdown (especially if the amplifier is driven to high continuous power levels).

**Carrying Handles:** Heavy-duty contoured aluminum handles for convenience in transporting the unit.

### 1.3.2 Rear Panel Features

**Signal Input Connectors:** Three-pin XLR-type female balanced floating signal inputs (pin 3 hot). Input impedance is approximately 5k ohms unbalanced, and 10k ohms balanced (pins 2 and 3). (For further information on the MS 1000A Amplifier input circuit,

see Sections 3.1 and 4.1.)

**Input Looping Connectors:** Three-pin XLR-type male looping connectors provided to simplify operating two or more MS 1000 amplifiers from the same signal source. Each channel Input Looping connector is connected pin-for-pin with the corresponding Signal Input connector.

**Output Connectors:** Five-way binding posts for connections to the load. See Sections 2.1 and 3.4 for further information on loudspeaker connections.

**Mains Power Cord:** The inlet for AC power. The MS 1000A Amplifier must be connected

to a properly-wired grounded three-terminal receptacle with a circuit breaker capacity of 20 amperes minimum at 115 volts (10 amperes at 230 volts).

**Chassis Ground Terminal:**

A screw terminal which is internally connected to the MS 1000A chassis and mains earth lead. This terminal may be used either for earthing an adjacent equipment chassis, or for earthing the MS 1000A chassis if a grounded mains outlet is not available. It will accommodate up to 10 AWG wire, and can be tightened by hand.

**Primary Circuit Breakers:**

Resettable circuit breakers which provide primary protection for the MS 1000A Amplifier.

**Cooling Fan:** The cooling fan is of all-metal construction, and is sealed against dust. Flow of air in the MS 1000A chassis is from front to back. Do not attempt to reverse the air flow. This may cause damage to the power supply components.

**Protective Standoffs:** Rugged plastic supports protect the MS 1000A Amplifier rear panel connectors when the unit is placed on its back.

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**1.4 Summary of Operating Precautions**

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◇ Save this Owner's Manual and refer to it whenever you connect and operate your MS 1000A Amplifier.

◇ To ensure proper operation and protection against electrical shock, make sure that the power outlet conforms to the requirements listed in Section 2.1.3 of this manual.

◇ Do not disconnect the grounding pin on the MS 1000A Amplifier power cord. Do not use the MS 1000A Amplifier if the power cord appears frayed or broken.

◇ Do not spill liquids into or on the MS 1000A Amplifier chassis.

◇ Do not block the fan intake or exhaust ports. Check the air intake filter periodically for

dust accumulation, and vacuum it clean if it becomes clogged.

◇ Never operate the MS 1000A with either the cover or the front-panel option plate removed. The thermal design of the MS 1000A is very carefully controlled, and these chassis components complete the design of the air flow channels within the unit. Altering the path of cooling air will result in damage to circuit components.

◇ Do not operate the MS 1000A Amplifier in close proximity to a heat source such as a furnace, radiator or heating vent.

◇ Hazardous and potentially lethal voltages are present within the MS 1000A Amplifier chassis. Do not under any circumstances remove the amplifier cover unless the mains is unplugged.

◇ Use of light-gauge extension cords will create a fire hazard. Mains extension cords used with the MS 1000A Amplifier should be 14



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## Section II

### Basic Operating Instructions

gauge cable or larger (for lengths up to 50 feet).

♦ Never connect the MS 1000A Amplifier outputs to any other voltage source such as a battery, power supply, mains source, or the output of another amplifier.

♦ The minimum allowable load impedance for the MS 1000A Amplifier is 2 ohms. Connecting loads with a total impedance of less than 2 ohms to the MS 1000A Amplifier will result in an automatic system shutdown.

♦ Any attempt to modify the components of the MS 1000A Amplifier in any way will invalidate the warranty, and may result in damage to the system. Servicing must be performed by your Meyer Sound dealer, or by Meyer Sound.

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### Basic Operating Instructions

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The information in this section is provided to guide you quickly through setting up and operating your MS 1000A Stereo Power Amplifier. Detailed application information may be found in Section III, below.

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#### 2.1 Connections

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Read this section before connecting and operating your MS 1000A Amplifier. Be sure to follow all precautions stated here and in Section 1.4, above. Particular attention should be paid to the power outlet requirements listed in Section 2.1.3.

When connecting and operating the MS 1000A Power Amplifier, follow this sequence of steps:

1) Connect the loudspeakers to the MS 1000A Amplifier. Do not use coiled cords or other musical instrument cables for loudspeaker connections.

2) Connect the outputs of your signal source to the MS 1000A Amplifier signal inputs.

3) Connect the MS 1000A Amplifier to a mains circuit with a breaker capacity of at least 20 amperes at 115 volts or 10 amperes at 230 volts. (Note: Higher breakers are preferable under continuous high power use or low load impedances.)

4) Be sure that the output level control of your signal source is turned down.

5) Turn on power to the signal source before turning on the MS 1000A Amplifier.

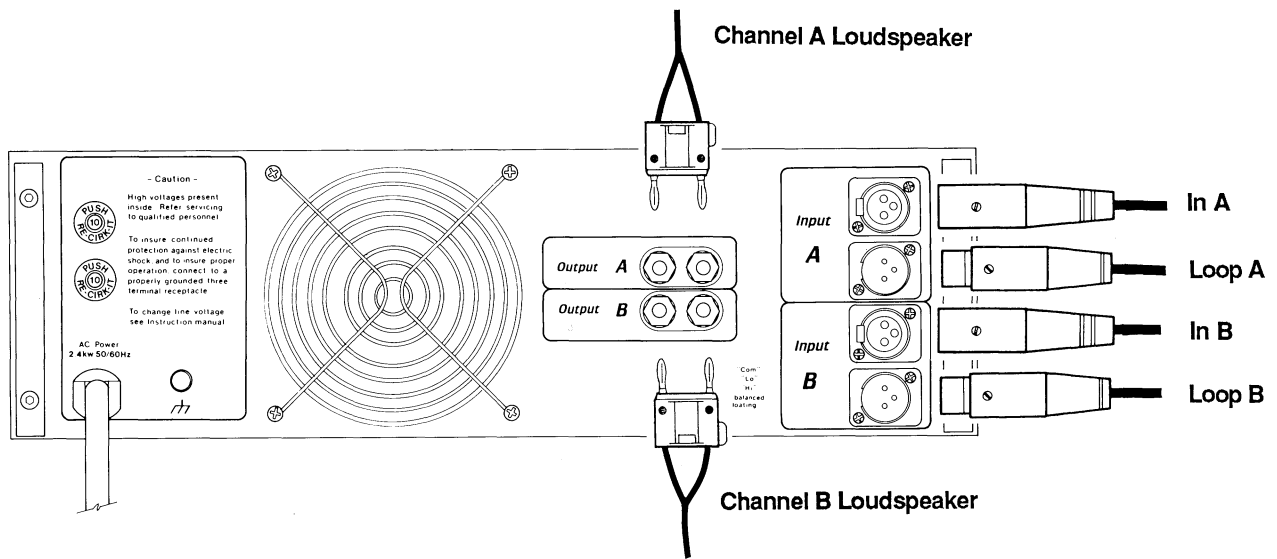
The specific information necessary to perform these steps is given below. Refer to Figure 2-1 when making connections to your MS 1000A Amplifier. Be sure to observe Left (A) and Right (B) channel assignments.

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#### 2.1.1 Output Connections

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The MS 1000A output connectors are five-way binding posts which may be used in any one of several ways, as shown in Figure 2-2.



**Figure 2-1 Connecting the MS 1000A**

♦ Bare wire can be inserted through the hole in the post (or wrapped around the post), after which the binding post nut is tightened to secure the wire in place.

♦ Spade-type lugs of appropriate size may be installed on the loudspeaker cable end, then inserted around the post and tightened in place as above.

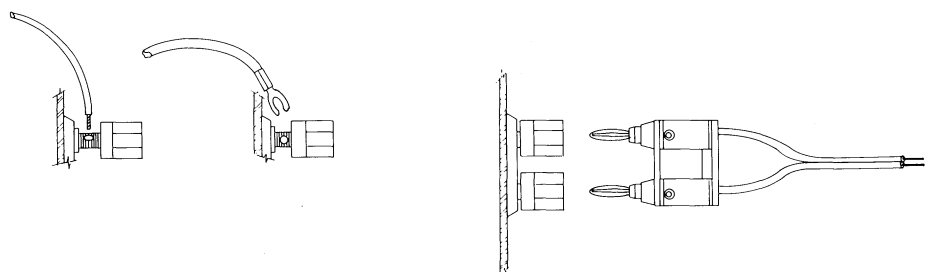
♦ Mating dual banana connectors may be installed on the loudspeaker cable ends; these are then inserted in the binding posts. The deep construction of the MS 1000A binding posts allows banana connectors to engage fully,

providing for a secure connection and minimizing shock hazard.

The minimum allowable load impedance for each MS 1000A output channel is 2 ohms. In professional applications which demand large amounts of continuous power,

we recommend keeping the load impedance to 4 ohms or above, in order to insure against temporary thermal shutdowns.

For further information on output connections (including bridged operation of the MS 1000A), refer to Section 3.4.



**Figure 2-2 Connections to Five-Way Binding Posts**

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## Section II

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### 2.1.2 Signal Input Connections

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Before making input connections, get the following information from the instruction manual for your chosen signal source:

- ◇ **Output driver type:** Is it balanced or unbalanced?
- ◇ **Pin assignments:** Which connector pin is hot, or high? Which is low (balanced outputs only)? Which is common?
- ◇ **Nominal operating level:** Professional equipment will normally operate at +4dBm, while semi-professional and consumer equipment is more likely to operate at -10dBV.

The voltage gain of the MS 1000A is factory-set at 20 dB, to work with professional audio equipment operating at +4 dBm. "Semi-professional" and HiFi equipment, which normally operates at -10 dBV, will therefore not be capable of driving the amplifier to its full rated output. The gain of the MS 1000A is internally

adjustable over a range of approximately 10 to 30 dB. Refer to Section 3.2 for further information.

The XLR-type connector pin assignments for the MS 1000A Amplifier signal inputs are as follows:

- Pin 1 -- Common
- Pin 2 -- Low
- Pin 3 -- High

If your signal source does not conform to this standard, you will need to use an in-line adapter. If you are uncertain of how your adapters are wired, test them with an ohmmeter or continuity tester before making connections.

Standard audio cables with XLR-type connectors may be used when connecting balanced signal sources to the MS 1000A Amplifier **as long as no connector pin is shorted to the connector shell**. If you are uncertain about the wiring of the cables you wish to use, test with an ohmmeter or continuity tester to be sure that the shell is not connected to the signal pins or to common.

Unbalanced signal sources will normally require a connection adapter. Refer to Section 3.1.3 for instructions on wiring of cables for unbalanced sources.

The input stage of the MS 1000A Amplifier has been designed to provide a high level of input isolation and freedom from ground loops -- attributes which are particularly desirable in professional applications. To take full advantage of these capabilities, it is necessary to follow specific signal connector wiring practices, as described in Section 3.1. If you are intending to use your MS 1000A Amplifier in professional contracting, reinforcement or studio monitoring, turn to that section for information on input connector wiring.

### 2.1.3 Mains Power Connection

The MS 1000A Stereo Power Amplifier draws a full 2.4 kVA from the mains. For this reason, it must be connected to a mains circuit having breakers with a current capability of at least 20 amperes at 115 volts (10 amperes at 230 volts). At higher or lower line voltages, larger breakers should be used.

To ensure proper operation and guard against potential shock hazards, the MS 1000A Amplifier must be connected only to a properly-wired, grounded three-prong receptacle. Figure 2-3 illustrates use of a VOM (Volt-Ohm Meter) to test for proper wiring of mains receptacles. Exercise extreme caution when making these measurements. If you are uncertain whether your outlets are wired correctly, don't use them: consult a qualified electrician.

Never cut the ground pin from the MS 1000A Amplifier power plug, and do not use a ground-lifting mains adapter unless absolutely necessary. If your mains circuit does not provide an earth ground, you

must earth the MS 1000A chassis externally by connecting a wire from the rear-panel chassis ground terminal to a good earth ground (such as a cold water pipe).

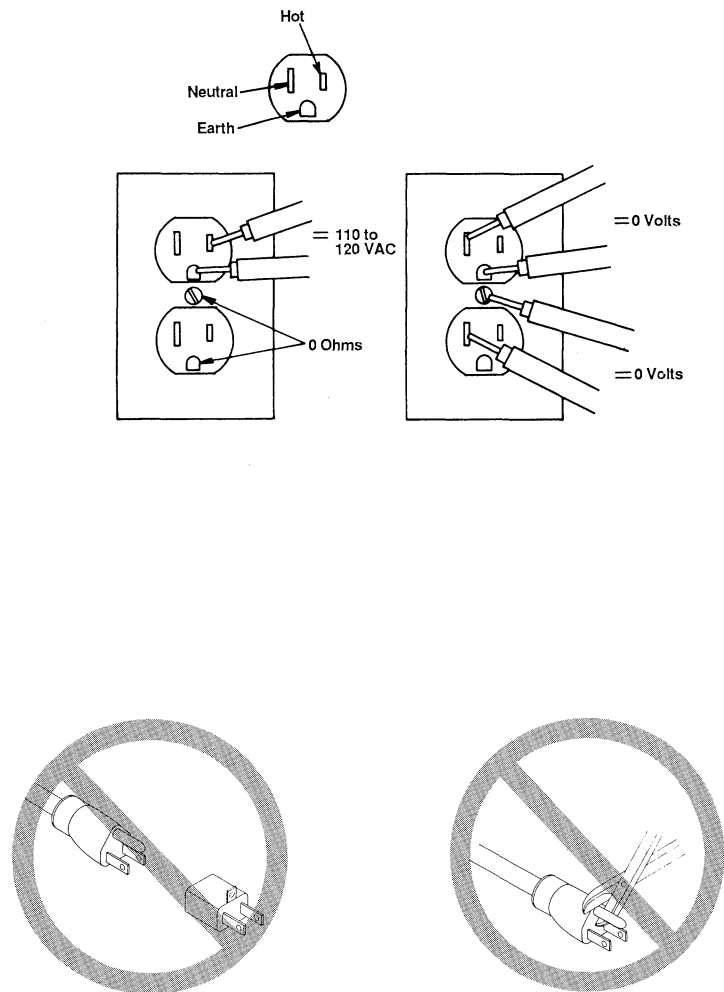


Figure 2-3 The Mains Connection

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## Section II

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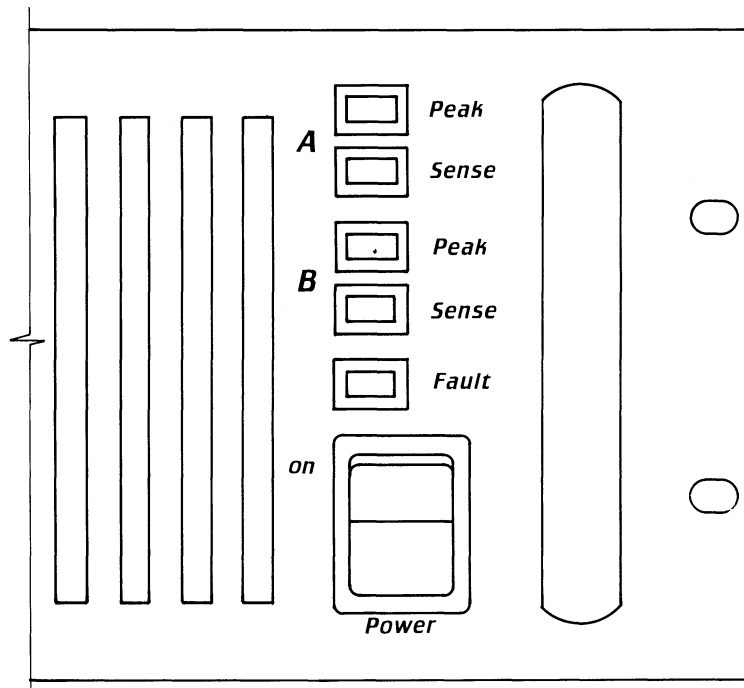
### 2.2 Operation

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Before turning on the MS1000A Amplifier, make sure that your signal source is plugged in and its power switch is on: this will avoid annoying (and potentially harmful) pops through the loudspeakers from transients generated by the source equipment when power is applied.

When you first turn on the MS 1000A Amplifier, you will notice that the fan comes on at high speed for approximately 1 second, then drops to low speed. You should also hear a sequence of two clicks, caused by the closing of the input and output relays. If your amplifier does not go through this cycle at turn-on, return it to be checked by your Meyer Sound dealer.

The MS 1000A front panel indicators (see Figure 2-4) are designed to provide a visual indication of normal operation and assist in troubleshooting. The power switch will glow green when the unit is connected to a proper mains circuit and the switch is turned



**Figure 2-4 Front Panel Indicator Detail**

on. In normal operation, the front-panel Sense indicators should light whenever there is signal present. At high listening levels, the Peak indicators may flash on program peaks.

If the Fault indicator lights at any time, or if the rear panel circuit breakers are activated, the system is protecting itself from a potentially damaging fault condition. Do not attempt to defeat the protection

circuits. Discontinue operation and refer to Section 2.3, "Troubleshooting," below. If servicing is indicated, contact your Meyer Sound dealer.

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### 2.2.1 The MS 1000A Load Protection Circuit

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The MS 1000A design incorporates a unique long-term integrator (LTI) circuit which is designed to protect the load from overheating due to excessive continuous power over long periods (it also guards against tripping the rear-panel primary circuit breakers under those conditions). This circuit, the operating point of which is tailored to the capabilities of Meyer Sound loudspeaker products, monitors the amplifier's output power on a continuous basis and accumulates a predictive "history" of the heating of the load. When the LTI circuit's factory-preset threshold is reached, the MS 1000A shuts down and the front-panel Fault light flashes. After a preset timing period, the unit resets for normal operation.

Unless you operate the MS 1000A at (or very near) the clipping point on a continuous basis, you may never cause the LTI to trip. Most loudspeakers, in fact, will almost

certainly be destroyed before the MS 1000A reaches a high enough continuous power level to shut down (though this will not be true with Meyer Sound loudspeaker systems). If you do encounter an LTI shutdown (see Section 2.3, "Troubleshooting"), remember that the amplifier will reset to normal operation after a brief (approximately 35 seconds) timing period.

The LTI circuit can be disabled for bench testing, or for applications where its protective action is not desired, however this is not recommended, especially when using the amplifier to drive low impedances. The procedure is given in Section 3.5 of this manual.

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### 2.3 Troubleshooting

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The Meyer Sound MS 1000A Stereo Power Amplifier has been designed to be as reliable as practical contemporary technology allows. If you have followed the setup instructions (above) and observed the cautions in Section 1.4, you may never need the information given here. Nonetheless, it is recommended that you briefly study this section in order to understand how the MS 1000A responds to fault conditions, and in order to know what corrective action to take in the event of an apparent (or real) system malfunction.

The following three pages present a logical table for use in troubleshooting the MS 1000A Stereo Power Amplifier.

---

## Section II

Problem	Symptom	Probable Cause	Action
No sound	Power switch on, but not lit	Bad mains connection	Check mains outlet and power cord.
		Unit's circuit breakers have tripped	Verify that amplifier is set for correct line voltage. Check mains outlet and reset breakers. If they trip again, have amplifier serviced.
	Power switch on and lit, Sense indicators lit	Speakers disconnected	Check speaker connections and cables.
	Power switch on and lit, no other indicators lit	Source disconnected	Check input connections and cables. Check signal source.
	Power switch on and lit, Fault indicator flashing, fan on high speed	Thermal shutdown	Turn down or disconnect signal source. Wait. Amplifier should recover in approximately 2 minutes. Check air filter and clean if necessary. Be sure the unit has unobstructed supply of air at front and good exhaust path at rear.
	Fault indicator flashing	LTI shutdown	Turn down or disconnect signal source. Wait. Amplifier should reset in approximately 45 seconds. Resume operation at a lower level.
	Power switch on and lit, Fault and Sense indicators flashing every 5 seconds (with input signal applied)	Output short	Disconnect speaker cables. If Fault indicator goes out and Sense indicators light, check speakers and cables.

Problem	Symptom	Probable Cause	Action
Low sound levels		Load impedance too low	Check that load impedance is $\geq 2$ ohms. If not, correct by either disconnecting some speakers or having speakers serviced.
	Fault indicator lit continuously	DC on output	Have amplifier serviced.
Distorted sound at low levels		Insufficient drive from signal source	Increase source output level.
		Amplifier gain incorrectly set	See Section 3.2.1 of this manual.
		Bad input connection	Check and secure input cables and connectors.
	Input cables OK	Defect in signal source	Substitute a known signal source. If problem stops, replace source equipment.
Intermittent sound	Source OK	Damaged speaker or amplifier malfunction	Swap or replace loudspeakers. If problem stops, service speakers. If problem stays, service amplifier.
	Sense indicators lit when sound stops	Bad speaker connection	Check speaker cables. Replace if necessary.
	Speaker cables OK	Damaged speaker	Have speaker serviced.
	Sense indicators off when sound stops	Bad input cables	Check input cables. Replace if necessary.
	Input cables OK	Source malfunction	Substitute a known signal source. If problem stops, replace source.



## Section II

Problem	Symptom	Probable Cause	Action
Loss of dynamic power		Low mains voltage	Check outlet and mains circuit. Substitute another circuit if necessary.
	Outlet OK	Bad extension cable	Check extension and replace if necessary.
	Extension cable OK	Amplifier malfunction	Have MS 1000A serviced
Hum		Ground loop	See Section 3.1.
	No ground loop	Source malfunction	Substitute a known signal source. If problem stops, replace source.
	Problem remains when source is disconnected	Amplifier malfunction	Have MS 1000A serviced
Hiss		Bad system gain structure or defective source	Disconnect input to MS 1000A. If problem stops, check source components and program. See Section 3.2 of this manual for information on system gain structure.
	Problem remains when source is disconnected	Amplifier malfunction	Have MS 1000A serviced
Crackling		Bad input connection	Check input cables.
	Input cables OK	Source malfunction	Disconnect input to MS 1000A. If problem stops, check source components and replace if necessary.

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## Section III

### Application Information

This section presents detailed application information about the MS 1000A Stereo Power Amplifier for use by contractors, consultants and other audio professionals. For overseas users, instructions on 220 volt operation may be found in Section 3.3, below.

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#### 3.1 Input Connector Wiring

This section explains the capabilities and advantages of the MS 1000A Amplifier input circuit, and describes the connector wiring practices that will enable you to best utilize those attributes. The connection configurations given here should be particularly attractive to those who are intending to use the MS 1000A in permanent installations such as theatre sound and studio monitoring systems.

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##### 3.1.1 The MS 1000A Amplifier Signal Input

The MS 1000A Stereo Power Amplifier input circuit (patented) constitutes a three-port floating balanced signal input system. The primary advantages of this new circuit are:

◇ True transformer isolation without the drawbacks normally associated with transformer-coupled designs

◇ Maximum flexibility of input connector pin assignment with no change in gain

The MS 1000A Amplifier input circuit makes use of specially-designed custom transformers having a high-inductance nickel core and Faraday shield. The circuit achieves a full 500 volts of common-mode isolation, allowing it to amplify differential signals in the presence of very high common-mode voltages without danger to the input components.

The transformers used in the MS 1000A input are designed specifically for voltage sensing rather than power transfer: in contrast to conventional audio transformers, they operate in the microwatt power range. For this reason, they do not exhibit the core eddy losses, hysteresis problems, ringing and phase shift normally associated with transformer designs. As a direct result, distortion in the MS 1000A Amplifier input stage is held to

under .01% (even at 20 volts), and phase shift at 20 kHz (without TIM filter) is less than 10°.

They are also virtually insensitive to variations in source impedance (a major concern with conventional audio transformers) and, since they employ a humbucking design, do not require costly, heavy external shielding in order to maintain immunity from hum. The MS 1000A input thus offers all the advantages of active balanced circuits, but with the far superior electrical isolation characteristics that only transformers can provide.

Perhaps most important from the standpoint of professional audio applications, however, is the fact that the MS 1000A Amplifier input will accept a wide variety of input pin connections, with **no change in gain**. Figure 3-1 is a truth table which shows all of the input connection combinations that will work with the MS 1000A. In every case, the gain of the input stage will be the same: given equal input signal drive levels, every connection listed in the table will produce the same output

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## Section III

level from the MS 1000A. Only the output polarity will vary. (Note, however, that push-pull output drivers provide 6 dB greater drive level than transformer-coupled or unbalanced outputs, all other factors being equal.)

Notice that there is no input connection that will short the output of the signal source -- other than connecting the hot lead directly to the input connector shell. In fact, driving any two input pins will work, and the gain of the amplifier will remain the same: only the signal polarity will be affected. This unique attribute allows the MS 1000A to accommodate virtually any three-pin connection "standard," and permits the user to employ a variety of types of phase-reversing adapters without fear of shorting out the signal source or suffering an unwanted change in gain.

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### 3.1.2 Hum-Free System Design

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One of the most frustrating and difficult problems in audio system design and operation is line-frequency hum injection.

The phenomenon is most often caused by ground loops -- duplicate signal common paths carrying circulating currents which modulate the audio signal.

Ground loops can be eliminated by conventional transformer isolation schemes, of course, and well-engineered transformers with excellent performance characteristics have been available for some time. But well-engineered transformers are very costly. Frequently, therefore, audio professionals are deprived of the benefits of transformers by budgetary limits, and are forced instead to design systems using only active balanced inputs and outputs -- or, worse yet, unbalanced inputs and outputs.

In such systems, signal common must be brought through with every interconnection in order to force all the system power supplies to the same common potential. Grounding must be handled with great care in order to avoid the formation of ground loops while maintaining protection against shocks, RFI and static potentials. Every system

design then becomes a compromise -- and a very complicated one, at that.

By contrast, the MS 1000A Amplifier input is completely isolated and floats both with respect to signal common within the amplifier and with respect to the chassis (which is connected to earth). This attribute greatly simplifies the design of hum-free audio systems: **as long as no pin of the MS 1000A input connector is linked to the connector shell, it will be literally impossible for ground loops to form.**

Several MS 1000A Amplifiers can be driven in parallel from a single audio source using "standard" connection cables, and no ground lifting adapters will be necessary as long as signal common is kept separate from earth at the MS 1000A Amplifier input connector. Even in relatively complex systems, the isolation between components will be as good as that provided by opto-isolators, and each MS 1000A can operate as a self-contained, floating unit.

Signal Source Output Configuration	Wiring of MS 1000A Input			Polarity	Comments
	Pin 1	Pin 2	Pin 3		
Balanced	n/c	-	+	+	Best CMR Lowest hum
	n/c	+	-	-	
	C	-	+	+	
	C	+	-	-	
	-	-	+	+	
	-	+	-	-	
	-	n/c	+	+	
	-	+	n/c	-	
	+	n/c	-	-	
	+	-	n/c	+	
Unbalanced	n/c	C	+	+	Best per- formance unbalanced
	n/c	+	C	-	
	C	C	+	+	
	C	+	C	-	
	C	n/c	+	+	
	+	n/c	C	-	
	C	+	n/c	-	
	+	C	n/c	+	

**Figure 3-1 MS 1000A Input Truth Table**

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## Section III

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### 3.1.3 Connections to Standard Audio Equipment Outputs

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This section details the input connector wiring practices that must be followed in order to implement the principles discussed in the previous section. These wiring practices differ from those that are normally used today, having more in common with traditional transformer-isolated designs.

Particularly notable is the use of "telescoping shields." When shields are connected at only one end of the cable, and are not used for carrying common between the two devices, the potential for ground loops is greatly diminished. The connection is most ideal when a telescoping shield is connected only to mains earth, and not to signal common in either device. That way, static potentials and

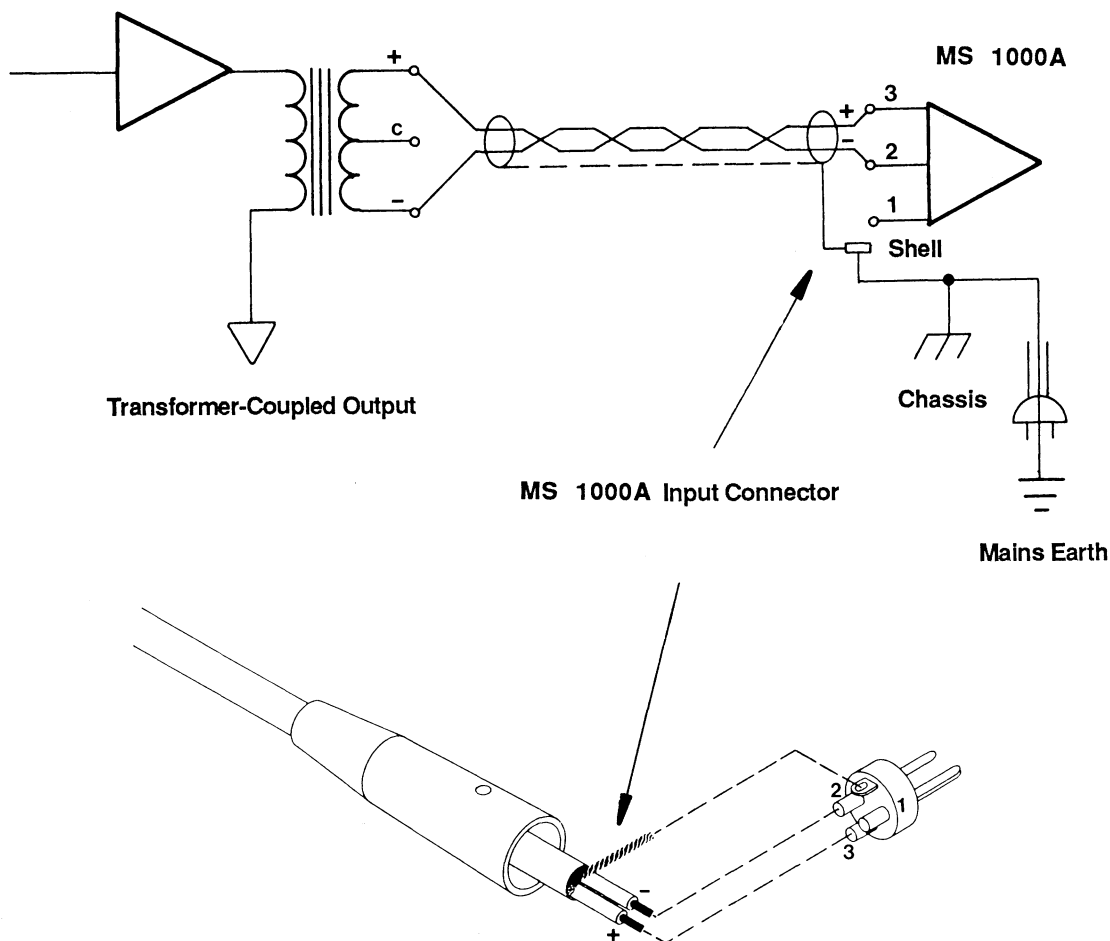
RFI are kept entirely separate from the signal path. This is the principle on which the balanced connections given in this section are based.

**Note** that, in all cases, the following connection instructions assume that the MS 1000A chassis is connected to earth ground. If a three-wire grounded mains source is not available (which is the case, for example, in Japan and some European countries), then the chassis **must** be earthed by an external connection between the rear-panel chassis ground terminal and a reliable earth ground point.

Since the MS 1000A works very well with "standard" audio cables (again, so long as no pin is linked to the connector shell) -- and since cables wired as described here will not be interchangeable with standard cables -- it may be more practical to use

standard cables for portable systems. In permanent installations, however, the benefits of wiring the system as described here are substantial.

Figure 3-2 illustrates the cable wiring scheme to use when the MS 1000A Amplifier is to be driven from a source having a transformer-isolated output. (The transformer center tap may or may not be present, depending upon the design of the source equipment -- in any event, it is not used.) The MS 1000A Amplifier input is wired in a floating differential configuration (sometimes called an "instrumentation input"). While this figure shows the signal input wired to pins 2 and 3, any combination of input pins may be used with no change in gain. The connection shown in the diagram yields best performance, however.



**Figure 3-2 Transformer-Coupled Output Stage Connection**

Notice that the cable shield is connected only to the shell of the MS 1000A Amplifier input connector, so RFI and static potentials in the shield will drain directly to earth. There is no ground loop path, re-

gardless of whether or not signal common of the source is connected to earth.

Figure 3-3 shows how the same connection scheme may be used for source

equipment having a push-pull output (as do all Meyer Sound electronic products). The same observations apply to this figure as to Figure 3-2. However, the push-pull output stage provides 6 dB greater

## Section III

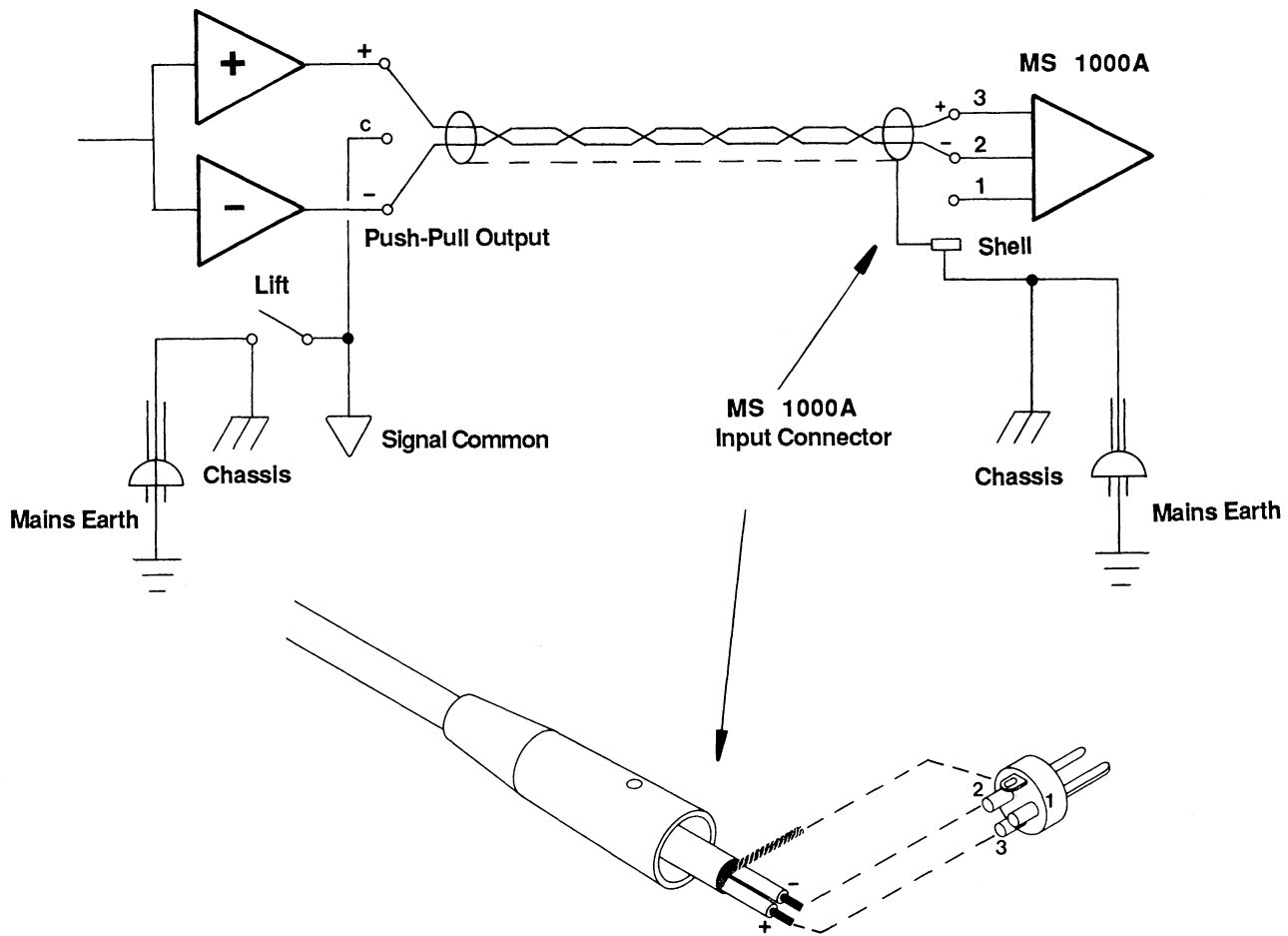


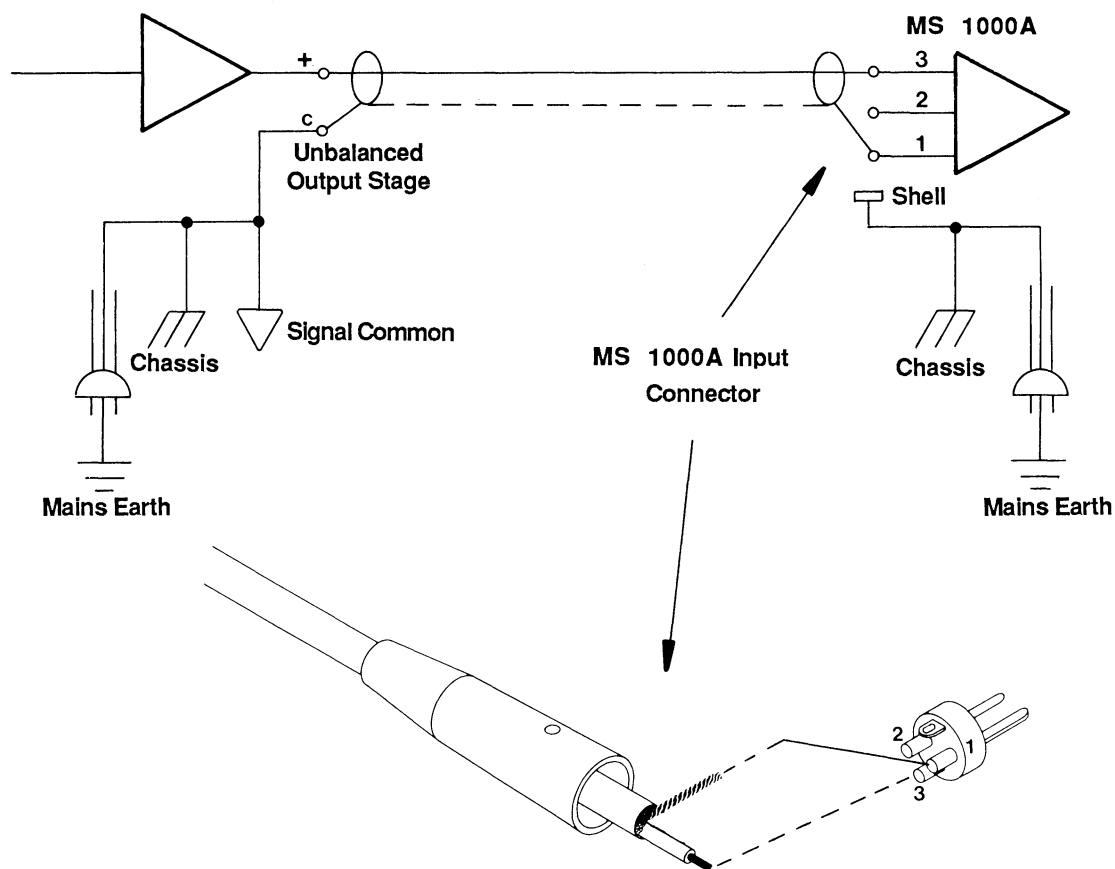
Figure 3-3 Push-Pull Output Stage Connection

drive than the transformer output. This may be compensated, if necessary, by dropping the gain of the MS 1000A Amplifier (see Section 3.2.1). Again, regardless of whether or not signal common of the

source is connected to earth, there is no ground loop path.

When connecting unbalanced inputs using single-conductor shielded cable, wire the connectors as shown in Figure

3-4. Notice that the shield is connected to pin 1, and **there is no connection between pin 1 and the shell**. In this case, the connection between signal common of the source and earth provides the path



**Figure 3-4 Unbalanced Output Stage Connection, Single-Conductor Shielded Cable**

by which RFI and static potentials in the shield are drained to earth. This connection scheme may be used with any unbalanced equipment that has a grounding AC plug (such as semi-pro mixers or

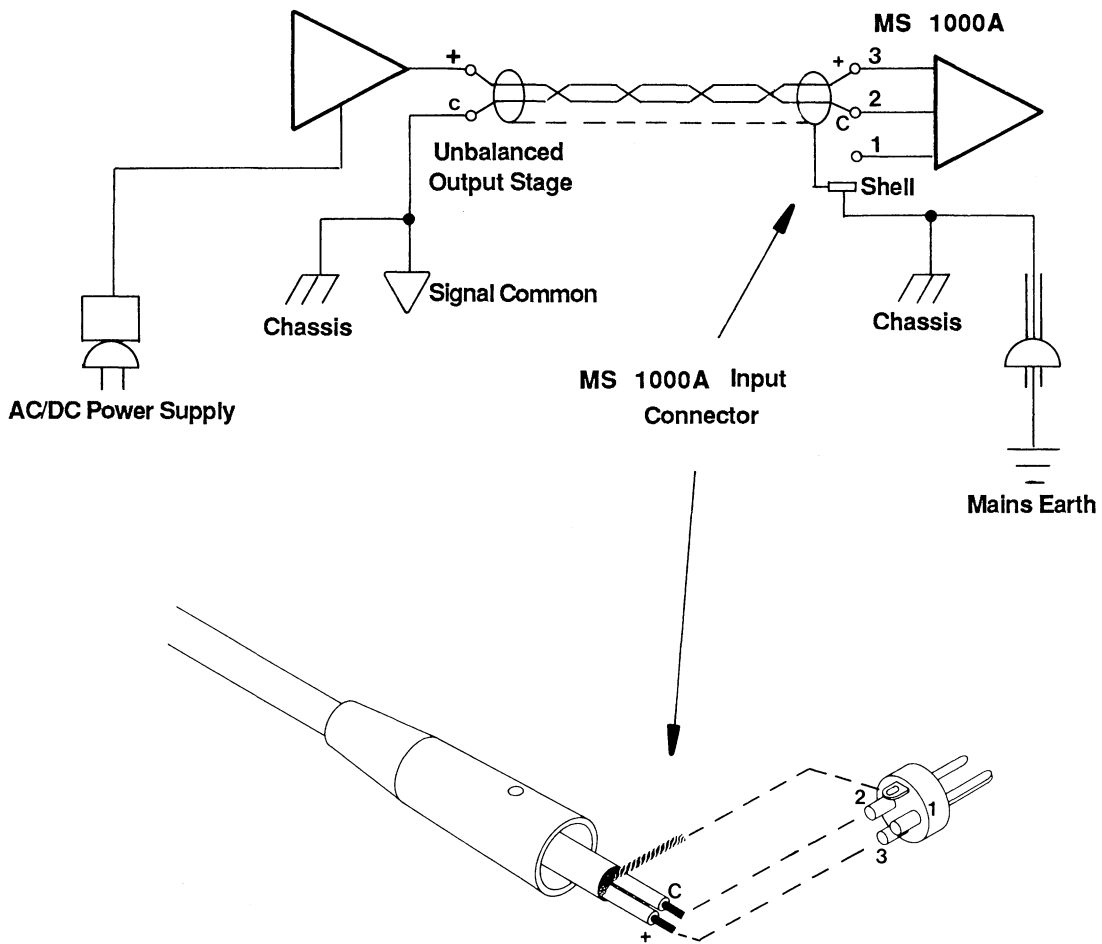
tape recorders).

A different and more optimal method for handling unbalanced equipment is shown in Figure 3-5. This treatment is similar to that shown for

balanced drivers, above, and yields equivalent performance. Unbalanced equipment that is battery-operated (or for other reasons floats from earth) should be connected in this manner, so that there is a



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**Figure 3-5 Achieving Balanced Performance With Unbalanced Equipment**

path from the shield to earth. (This scheme is particularly effective with battery-operated Compact Disc players and other high-quality floating unbalanced equipment.)

Even if signal ground of the source is connected to earth, however, there still is no ground loop path. This connection scheme can therefore be used for all unbalanced

equipment. It will yield balanced performance, since the shield is not connected at the source output.

### 3.2 Input Signal Level and System Gain Structure

Among the most important tasks in designing an audio system is control of the system's gain structure. The process involves analyzing the nominal and peak signal level capabilities of equipment at each stage of the audio chain, and developing a rational structure of gains at each stage. The whole point of the exercise is to minimize system noise (which intrudes on the listening experience) while avoiding distortion. As a general principle, the best approach to the problem is to keep the signal level as high as possible at each stage while allowing adequate headroom to avoid anything more than occasional peak clipping.

The appropriate amount of headroom is largely dependent upon the intended program material. For example, classical music, some types of jazz and other acoustic music generally present a wide dynamic range, and may require 20 dB or more of headroom above the average sound pressure level. Rock

music, by contrast, is usually compressed, and needs perhaps 10 dB or less of headroom. In paging and announcing applications, intelligibility is the paramount criterion -- sometimes in very noisy environments -- and extreme compression is normally used; here, 6 dB of headroom may be more than sufficient.

Once headroom requirements are known, the maximum nominal operating level at each stage can be determined. All components in the signal chain should then be set so that they clip at roughly the same time (which is to say, when the input to the system as a whole reaches a given peak level). That way, the noise contribution of each individual component is minimized, since all are "working" equally hard.

This task is often complicated by the fact that, in many situations, budgetary limits may force the use of "semi-professional" equipment whose operating signal level capabilities do not match those of the rest of the system. It is particularly difficult

to integrate semi-pro components (which usually operate at -10 dBV) within a +4 dBm system. On the one hand, the system noise increases (since the output signal of such equipment must be boosted to conform with the nominal operating level of professional components) and, on the other, there is a greater potential for distortion, since the input signal handling capabilities of semi-pro equipment are more restricted.

The quality and utility of "semi-pro" equipment has steadily increased in recent years, however. Particularly in home studios, the entire system may operate at this level, yet with near-professional quality. Moreover, there are some consumer audio products (again operating at -10 dBV) that are very attractive for professional use.

The voltage gain of the MS 1000A is factory-set at 20 dB, to work with audio equipment conforming to the more-or-less standard professional operating level of +4 dBm. This gain setting has been carefully determined to yield optimal results with Meyer

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Sound electronic products, such as our loudspeaker system Control Electronic Units or the CP-10 Parametric Equalizer (see Section 3.7). In order to use the MS 1000A with equipment operating at -10 dBV, then, the gain must be changed, or the amplifier will never reach full power before the signal source clips. The procedure for doing this is given in the following Section.

### 3.2.1 Modifying the Gain of the MS 1000A

The gain of the MS 1000A is internally adjustable over a range of approximately 10 to 30 dB. A sinewave oscillator and an RMS-reading voltmeter are required. The procedure is as follows:

- 1) Be certain that the MS 1000A is unplugged. Remove the eight screws securing the amplifier cover and take the cover off to expose the interior circuitry.
- 2) Position the MS 1000A on the bench with the front panel facing you, and locate the input circuit card. (It is fas-

Gain	Output Voltage
dB	Volts
20	10.0
23	14.1
27	22.4
30	31.6

tened to the interior face of the left-hand side of the chassis.) Refer to Appendix A, "MS 1000A Plan View."

- 3) At the end of the input circuit card nearest the amplifier front panel, you will find a multi-pin Molex-type connector with a mating connector attached. Installed on the mating connector are two trimpots; these set the gain of

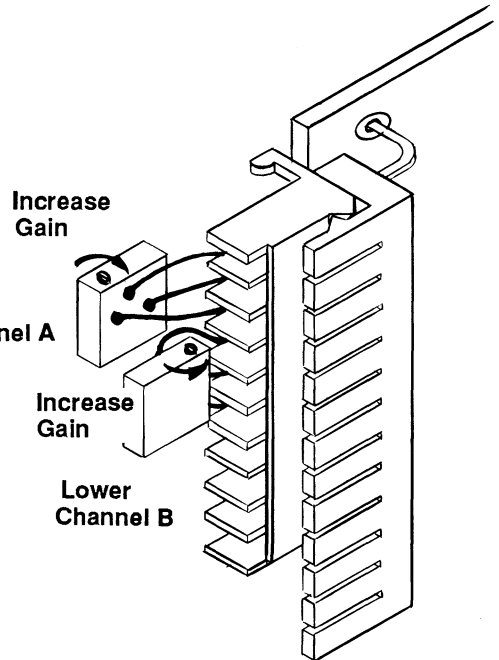


Figure 3-6 Gain Trimmer Detail

the MS 1000A. (See Figure 3-6.)

- 4) Connect the sinewave oscillator to the MS 1000A Channel A input. Set the oscillator's frequency to 1 kHz and its output level to 1 volt RMS (if the oscillator is not calibrated, measure its output level with the RMS-reading voltmeter).

5) Connect the RMS-reading voltmeter to the MS 1000A Channel A output. Plug in the amplifier power cable and turn on the power switch. When the MS 1000A comes on, the voltmeter should read 10 volts RMS.

6) Referring to Figure 3-6, adjust the Channel A gain trimmer until the amplifier's output voltage accords with the table.

7) Repeat steps 4 through 6 for Channel B.

8) Turn off the amplifier and disconnect the test equipment.

9) Replace the MS 1000A cover and secure it with the eight screws.

---

### 3.3 220 Volt Operation

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Units that are distributed in countries having a mains voltage in the range of 200 to 260 volts are wired for 220 volt operation at the factory, and are identified with a sticker on the mains power cord. If your MS 1000A has such a sticker, it has already

been converted for a 220 volt mains. If there is no sticker on the amplifier power cord, and you wish to operate the unit from a 220 volt line, check the wiring of the internal mains voltage selector block before plugging in the unit (see Section 3.3.2, below).

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#### 3.3.1 Mains Connector Installation

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The MS 1000A Amplifier must be connected to a properly-wired grounded mains receptacle, for two reasons. First, the chassis (which is connected to mains earth) acts as an electronic shield against both static charges and radio frequency interference. Second, earthing the chassis protects against shock hazards that may be caused by mains shorts or by large ground potential differences (when properly connected, the MS 1000A is electrically isolated and floats from the input signal ground).

If earthed three-wire mains receptacles are available in your area, **use them**. Don't install an ungrounded plug on

the power cord: you will be risking the chance of incurring a serious shock hazard.

The color code for the MS 1000A Amplifier power cable is as follows:

Hot -- Brown  
Neutral -- Blue  
Earth -- Yellow/green

If you are uncertain about the pin assignments of the mains connector you wish to use, don't guess. Consult an electrician.

In countries which do not use earthed mains circuits, the MS 1000A chassis must be hard-wired to earth ground externally. You can do this by connecting a wire from the chassis terminal (located on the MS 1000A rear panel -- see Figure 1-2) to a conductive cold water pipe or other earth ground. If you are in doubt about where to find a good earth ground, **don't guess**. Consult a qualified electrician.

---

### 3.3.2 Mains Voltage Selection

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Mains voltage selection for the MS 1000A is a simple operation which may be performed in the field. Refer to Figures 3-7 and Appendix A, and follow these steps:

- 1) Make sure that the MS 1000A Amplifier is unplugged.
- 2) Remove the eight screws securing the amplifier top cover.
- 3) Lift the amplifier cover off and identify the voltage selector terminal block (see Appendix A).

4) Wire the terminal block as shown in Figure 3-7.

5) Replace the amplifier top cover and secure with the eight screws.

6) Plug the unit in. If the mains circuit breakers trip, open the amplifier and check to be sure that the terminal block is wired correctly. If the wiring looks correct but the problem remains, have the amplifier serviced.

---

### 3.4 Output Connections

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The MS 1000A output connectors are color-coded five-

way binding posts. Their deep construction allows mating banana connectors to engage fully, providing for a secure electrical and mechanical connection and minimizing shock hazards. If you intend to use banana connectors, choose a high-quality connector with good tip spring tension.

Particularly when making up racks for portable use, you may wish to secure each output connection wire beneath the binding post nut (either by inserting the stripped wire through the hole in the post, or by using spade lugs). Never use a wrench to

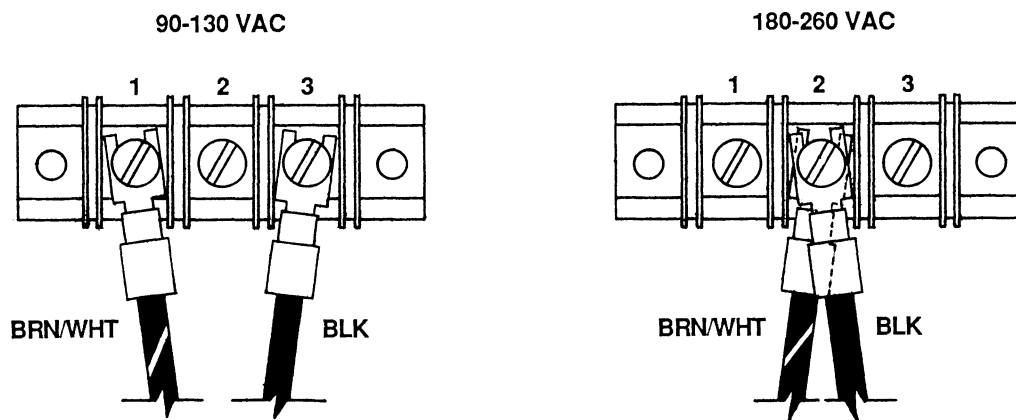
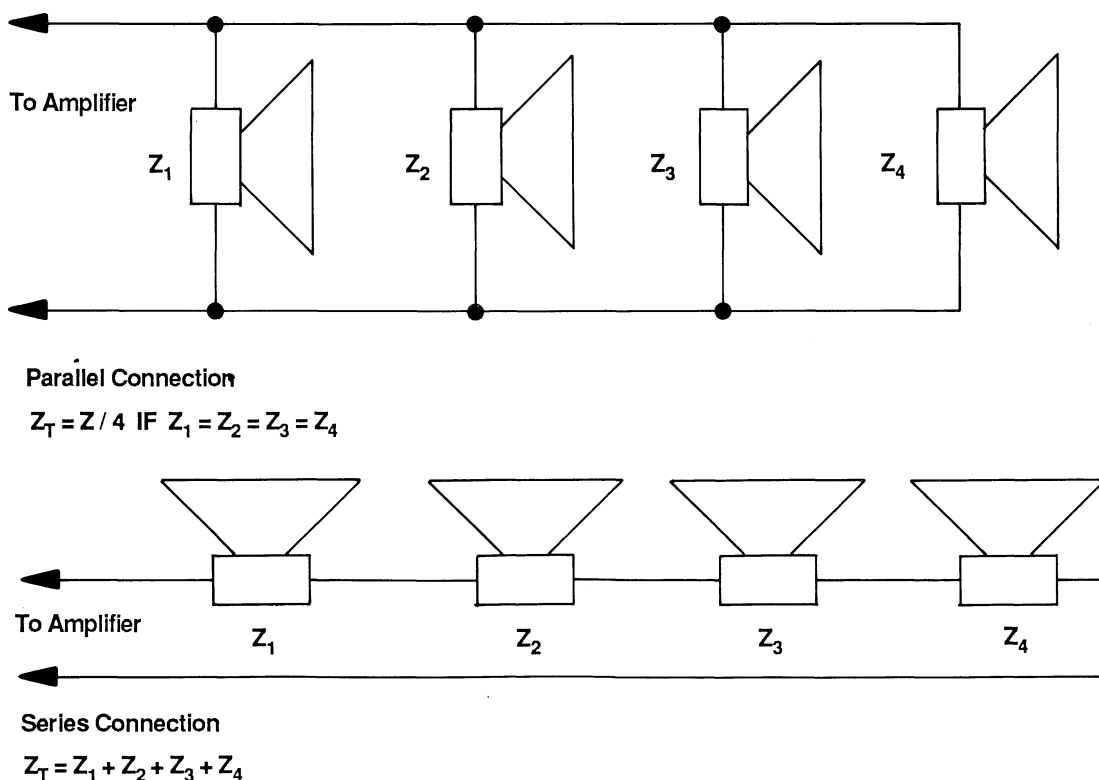


Figure 3-7 Voltage Selector Block Detail



**Figure 3-8 Calculating Impedance for Multiple Loudspeakers**

tighten the nut: you will risk breaking the post by over-tightening.

### 3.4.1 Load Impedance

The minimum allowable load impedance for each MS 1000A output channel is 2 ohms. The protection circuitry for the MS 1000A incorporates true load impedance sensing by calculation from the voltage across and current

through the load. If the load impedance is calculated to be less than about 1.5 ohms, the amplifier will automatically shut down, and the Fault indicator will light.

While the MS 1000A can safely drive a 2 ohm load, we recommend keeping the load impedance to 4 ohms or above in professional applications which demand large amounts of continuous power. This will prevent the amplifier

from over-heating and possible thermal shutdown

When multiple loudspeakers are connected to a single amplifier output, the resulting load impedance must be determined by calculation. Two basic connection configurations can be used: series and parallel. The methods for calculating the net impedance differ for each (see Figure 3-8).

When loudspeakers are connected in series, the net impedance is simply the algebraic sum of the individual impedances, so in series connections the impedance increases. The higher net impedance presents a less demanding load to the amplifier, since it draws less power than any of the individual loudspeakers would by itself.

A serious drawback of connecting loudspeakers in series is that it is an inherently unreliable method. When loudspeakers fail, they almost inevitably become an open circuit, rather than a short. If one of the speakers in a series-connected string fails, then, the whole group becomes inactive, since the circuit connection is broken. As might be expected, series connection is rarely, if ever, used in professional applications -- nor do we recommend it.

When loudspeakers are connected in parallel, the net impedance becomes lower. If all the loudspeakers are of the same impedance, the resulting load is simply the impedance of any single unit divided

by the number of units connected. The calculation becomes somewhat more complicated if we use loudspeakers of different impedances. For this reason, the norm is to use loudspeakers with the same impedance.

Since the impedance drops with parallel connection, more power is drawn from the amplifier. Within the load-handling limits of the amplifier, then, parallel connection represents the most efficient use of the amplifier's capabilities. Parallel connection is therefore the norm in the professional world.

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### 3.4.2 Special Load Conditions

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Despite what loudspeaker specification methods might imply, practical loudspeakers actually present not a constant load, but an impedance that changes with frequency. The phase angle between the voltage across the load and the current through it changes with frequency, as well. This can present problems for some power amplifiers.

The situation is even more pronounced with unusual loads. For example, autotransformers are often used in professional applications for impedance transformation or to limit the peak voltage applied to a loudspeaker. But the impedance of an autotransformer (and the phase angle between the voltage across it and the current through it) can change radically with frequency, since it is basically an inductor with taps. At DC, the impedance will be very near zero.

For these reasons, and despite the fact that autotransformers are in wide use in professional sound, most power amplifiers handle them quite poorly. Severe waveform distortion often appears, particularly at low frequencies. Conventional VI limiting protection circuits (found in virtually every professional power amplifier) are easily confused by the complex voltage-to-current phase relationships. This results in objectionable glitching and bursts of oscillation. If there is any significant DC offset at the input, DC-coupled amplifiers will have a terrible time

with an autotransformer load: they will either shut down in self-protection, or else fail.

The 70 volt transformers that are used in distributed sound systems present similar problems. Especially in the case of inexpensive systems, the impedance of these transformers falls off very rapidly at low frequencies. In an attempt to avoid amplifier damage and/or system shut-downs, therefore, system designers usually filter out low frequencies at the system input. This may be perfectly acceptable in paging systems (and even desirable, since it may increase intelligibility), but in foreground music sys-

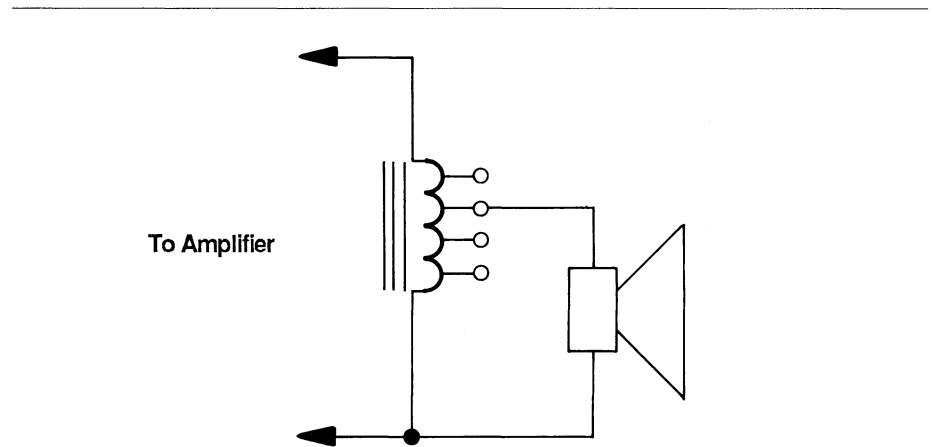


Figure 3-9 Typical Autotransformer Connection

tems, it represents a very real compromise.

Piezoelectric drivers are often used as the high-frequency component of sound systems.

Not only are they quite efficient; they also introduce very little distortion, and their frequency response can be made very flat. But piezoelectric elements act electrically

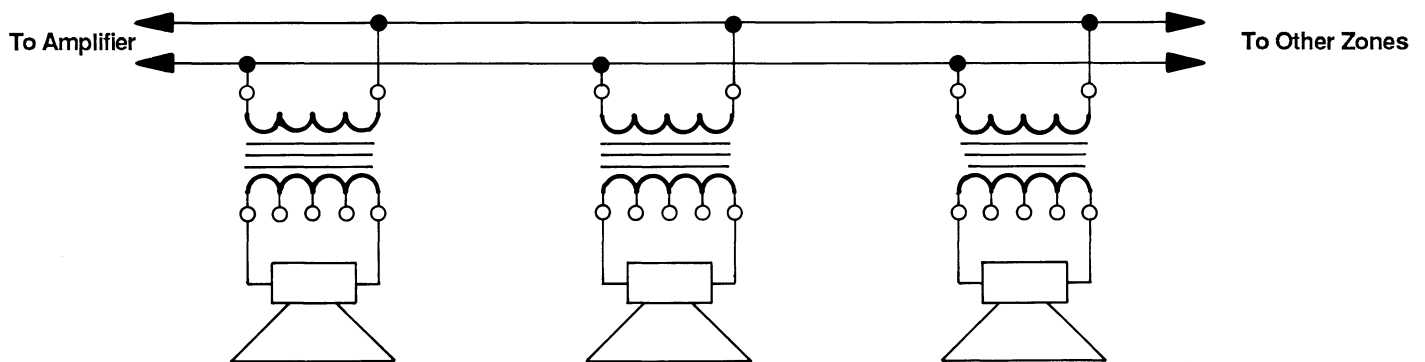


Figure 3-10 Typical 70 Volt Transformer Connection



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as capacitors, so their impedance characteristic is the opposite of that of a transformer. At low frequencies, the impedance is very high; but at high frequencies (precisely where they are useful), the impedance falls off rapidly. As with inductors, then, most power amplifiers have trouble driving them.

The MS 1000A Stereo Power Amplifier is unique among professional power amplifiers in that its design makes use of error-correction amplifiers as an integral component of the power output stage (see Section 4.2, below). These stages are driven by a complex local feedback system which derives error signals from the amplifier's actual output. The error-correction circuitry is substantially responsible for the unit's extraordinarily high damping factor, but it also permits the MS 1000A to handle complex loads with ease.

Furthermore, the MS 1000A's protection circuitry uses true current and voltage sensing, rather than the predictive methods and VI limiting that is the norm in professional

power amplifier design. It is therefore virtually immune to the discrepancies in phase between voltage and current that confound other amplifiers. The result is clearer sound, predictable system characteristics and greatly enhanced reliability.

In touring reinforcement and sound contracting, then, the MS 1000A far outperforms all other amplifiers. It handles any combination of resistive, capacitive and inductive loads (to a minimum impedance of 2 ohms). Systems using autotransformers will experience an immediate improvement in clarity and peak handling. In distributed systems, less low-frequency filtering will be necessary; foreground systems, in particular, will sound much better with the MS 1000A. Finally, the amplifier's extremely high damping factor will benefit even relatively simple systems with passive crossovers.

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### 3.4.3 Loudspeaker Cable Selection

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The selection of loudspeaker cable is a very important

consideration in sound system design, affecting both sonic quality and system efficiency. Especially over long runs, cable resistance can result in substantial power losses. Cable resistance can also diminish the effective damping factor of the amplifier, limiting its ability to control the motion of loudspeaker drivers with accuracy.

Figure 3-11 is a table relating cable wire gauge (given as American Wire Gauge values) to the load impedance and length of the run. Refer to it when selecting cable for connections to the MS 1000A outputs.

You may find that there will be very little difference in sonic quality when audiophile-type loudspeaker cables are used with the MS 1000A -- even though you may have found that such cables dramatically improve the sonic characteristics of conventional amplifiers. This is because the MS 1000A has a far higher damping factor than any other currently available amplifiers (professional or otherwise), due in large part to the error-correction circuits and feed-

	16 ohms	8 ohms	4 ohms
10 meters	16 ga.	16 ga.	16 ga.
25 meters	16 ga.	16 ga.	14 ga.
50 meters	16 ga.	14 ga.	12 ga.
75 meters	16 ga.	12 ga.	10 ga.
100 meters	14 ga.	12 ga.	
150 meters	12 ga.	10 ga.	

**Figure 3-11 Loudspeaker Cable Selection Chart**

back scheme employed in its design (see Section 4.2).

#### **3.4.4 Bridging The MS 1000A**

When very high continuous and peak power output is desired, the MS 1000A may be operated in "bridged" mode.

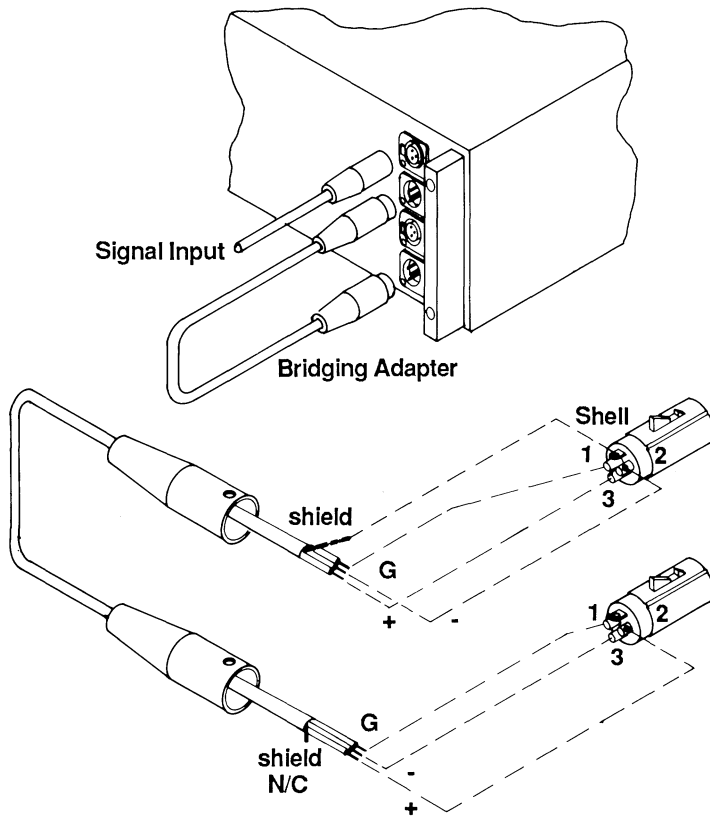
In bridging operation, the same input signal is routed to both channels, the polarity of one channel being reversed with respect to the other. The load is then connected across the two "hot" (red) output terminals, and the output ground terminals are left

unconnected. This results in a push-pull drive to the load: the effective voltage across the load is doubled, with a consequent increase in power.

In bridging, the minimum permissible load impedance is twice the per-channel minimum. Since the minimum load impedance for each channel of the MS 1000A is 2 ohms, the lowest load impedance it will drive in bridging is 4 ohms. In applications where high continuous output power is required, the load in bridge should be kept to 8 ohms or more to avoid the possibility of thermal shutdowns.

Most professional power amplifiers incorporate a rear-panel switch that selects between stereo and "bridged" modes. The bridging position of the switch is often labeled "Mono", however, and this has resulted in some confusion among users who are accustomed to the HiFi usage of that term (i.e. both channels producing the same output signal in the same polarity). That confusion has sometimes resulted in not only audible phase cancellation but also destruction of loudspeaker components. Moreover, in the typically hectic environment of professional sound reinforcement, users often forget to check the position of the switch -- again, occasionally with undesirable consequences. So, while a rear-panel bridging switch may seem like a convenient feature, it is definitely a double-edged sword.

Bridging of the MS 1000A is accomplished by external connection, rather than by a switch. This design feature minimizes any possible confusion about bridged operation, greatly reducing the risk of improper connections and the



**Figure 3-12 Bridging a Single MS 1000A**

attendant potential for destruction of loudspeakers and/or amplifier output devices.

Two possible bridging connections are suggested. When the MS 1000A is operated alone in bridged mode, a three-pin XLR-type female-female phase reversing adapter may be used, as

shown in Figure 3-12. Notice that three-conductor shielded cable is used in order to preserve the MS 1000A input's ability to accommodate any connector wiring standard.

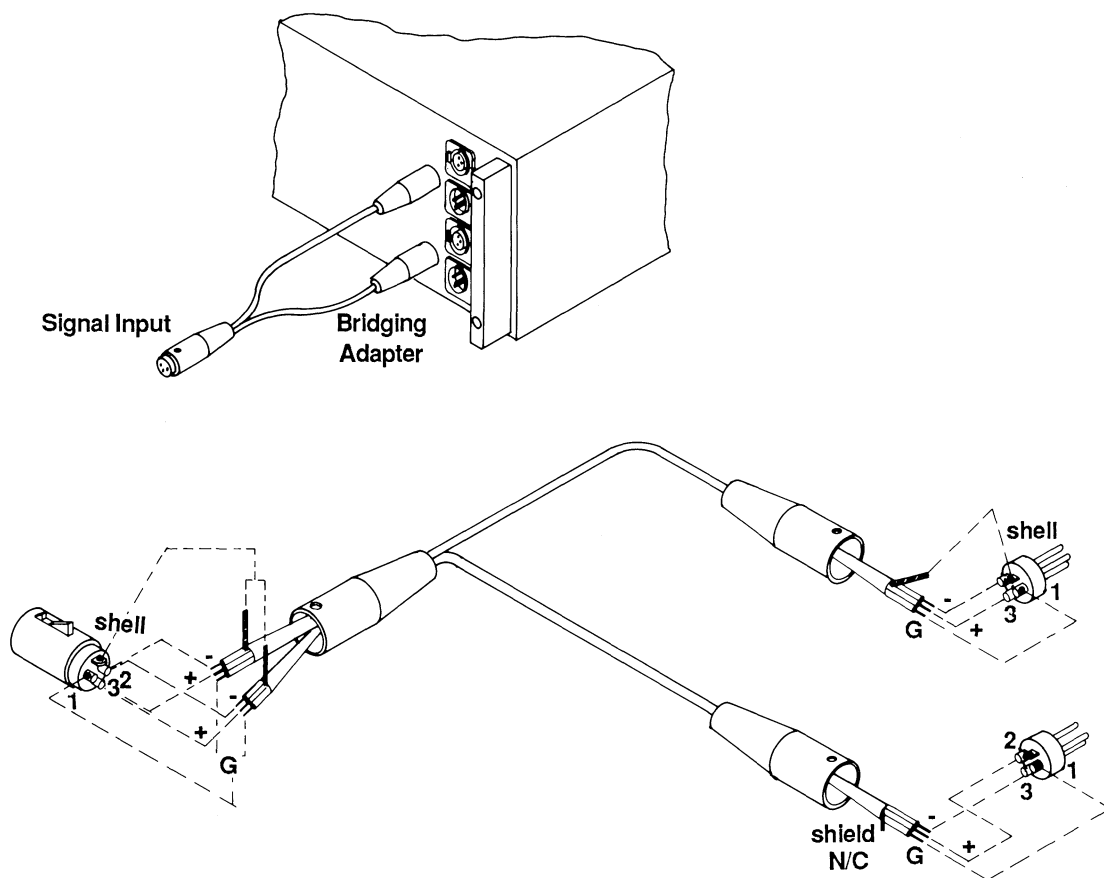
The input signal is fed to the channel A input, with the adapter connected between

the channel input looping connectors. The load is then wired across the two "hot" (red) output binding posts; channel A is the "+" output, and channel B is the "-" output.

A convenient alternate bridging connection method is shown in Figure 3-13. Here, the phase reversal between the two input channels is accomplished in a specially-wired 'Y' connector. Again, the channel A input is connected in phase, and the phase of the channel B input is reversed. This method has the advantage of leaving the input looping connectors free, so that standard XLR-type cables can be used to loop the input signal to additional MS 1000As (all of which will then operate in bridged mode, since the phase of the original MS 1000A channel B input is reversed).

### 3.5 The MS 1000A Load Protection Circuit

The MS 1000A design incorporates a unique long-term integrator (LTI) circuit which is designed to protect the load



**Figure 3-13 Bridging Connection With Input Looping**

from overheating due to long periods of high continuous power. This circuit, the operating point of which is tailored to the capabilities of Meyer Sound loudspeaker products, monitors the amplifier's output

power on a continuous basis and accumulates a "history" of the heating of the load. When the circuit's factory-preset threshold is reached, the MS 1000A shuts down and the front-panel Fault light flashes.

After a preset timing period, the unit resets for normal operation.

The LTI circuit may be disabled (for bench testing, or for applications where its protec-

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tive action is not desired) by the following procedure (refer to Appendix A and Figure 3-14).

**Note: We do not recommend disabling the LTI circuit, especially when driving loads lower than 4 ohms.**

1) Be certain that the MS 1000A is unplugged. Remove the eight screws securing the amplifier cover and take the cover off to expose the interior circuitry.

2) Position the MS 1000A on the bench with the front panel facing you. The power control

circuit card, which contains the LTI circuit, is fastened to the interior face of the right-hand side of the chassis (see Appendix A).

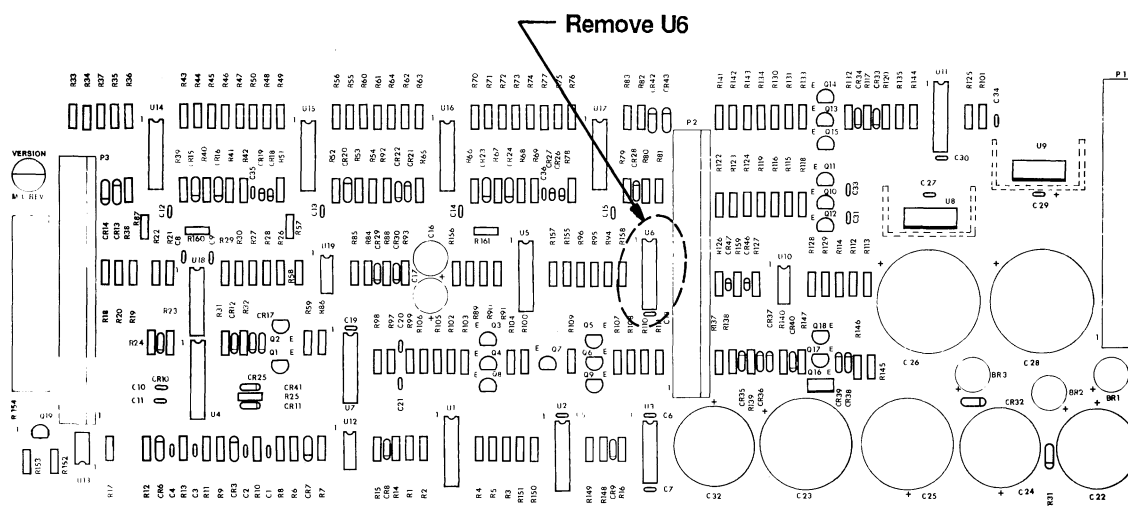
3) Locate U6 on the power control card (see Figure 3-14). This integrated circuit (the only one that is mounted on a socket) is installed next to P2, the long multi-pin connector that is located approximately midway on the card.

4) Carefully remove U6 from its socket and install it in the storage socket which is mounted on the output FET cooling tunnel flange opposite

the mains voltage selector terminal block.

5) Replace the MS 1000A cover and secure it with the eight screws.

If you are uncertain whether or not an MS 1000A's LTI circuit has been disabled, you can easily test it. Simply disconnect any load on the outputs, and input a sinewave at 1 kHz to either channel. Advance the signal level until the channel Peak indicator lights. The amplifier should shut itself down within about 10 seconds, and the Fault indicator should flash. If the unit does not shut down after



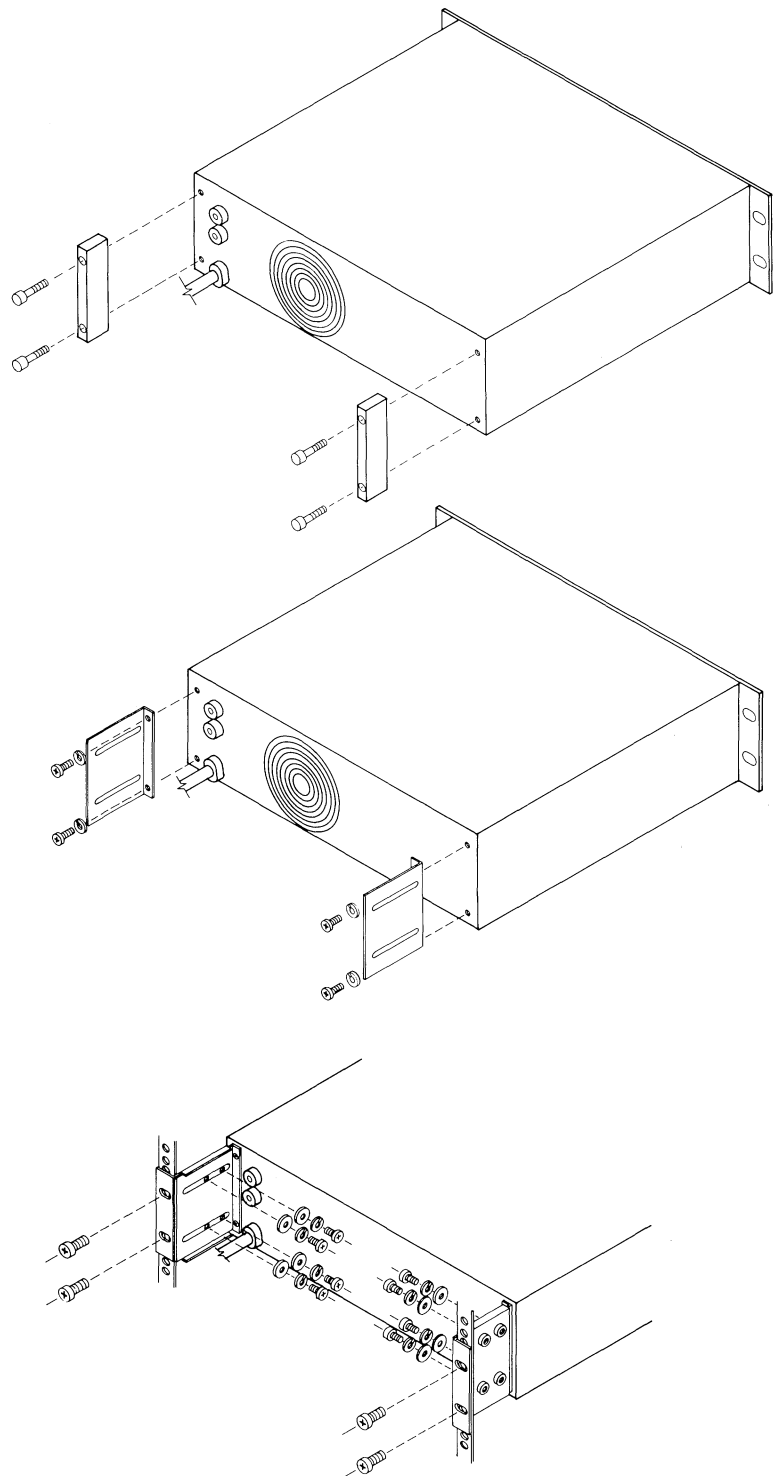
**Figure 3-14 Disabling the MS 1000A Load Protection Circuit**

about 20 seconds of operation in clipping, then the LTI circuit is either disabled or malfunctioning.

### 3.6 Mounting Instructions

The MS 1000A Amplifier is designed for mounting in a standard 19-inch equipment rack, and occupies a 5  $\frac{1}{4}$  inch high rack space. The front panel is  $\frac{3}{16}$  inch aluminum backed by a  $\frac{1}{16}$  inch cold-rolled steel support plate, and will provide a very secure support for the unit. Particularly when the MS 1000A is to be used in portable applications, however, the amplifier must be supported at the rear. A support bracket kit designed for this purpose is available from your Meyer Sound dealer. Figure 3-15 illustrates the procedure for installing the brackets (hardware is supplied with the bracket kit).

If you are making your own rack cases, bear in mind that the MS 1000A Amplifier weighs 69 pounds. Use tapped steel mounting brackets rather than wood, and #10 or larger steel machine screws.



**Figure 3-15 Installing the Rack Mounting Rear Support Brackets**

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## Section III

In both fixed installations and portable systems, it is important to ensure an unobstructed flow of air to the MS 1000A Amplifier. Note that the flow of cooling air is from the front to the back of the chassis. The thermal design of the MS 1000A is carefully controlled, and components that are the most temperature-sensitive are placed nearest the front-panel air inlet (these include the power transformer, power rectifiers and supply filter inductors and capacitors). This placement has the effect of greatly prolonging the life of the components, helping to assure the long-term reliability of the unit.

For this reason, it is not advisable to alter the direction of air flow by reversing the fan: this will almost certainly result in damage to the power supply components, and will invalidate your warranty. It is also essential that the MS 1000A be installed and operated with its cover and option plate in place. These chassis components complete the design of the air flow channels within the chassis. Removing them alters the path of the air, destroying the foundations of

the amplifier's thermal design; this will result in circuit component damage.

In all cases, be sure that the amplifier's air inlet (front panel) is not obstructed, and never locate amplifier racks near a heat source such as a furnace, radiator or heating vent. Finally, if several MS 1000A Amplifiers are mounted in a single rack, it may be advisable to mount an exhaust fan in the rack, to move warm air away from the units and vent the back pressure caused by the action of the cooling fans.

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### 3.7 The MS 1000A Option Panel

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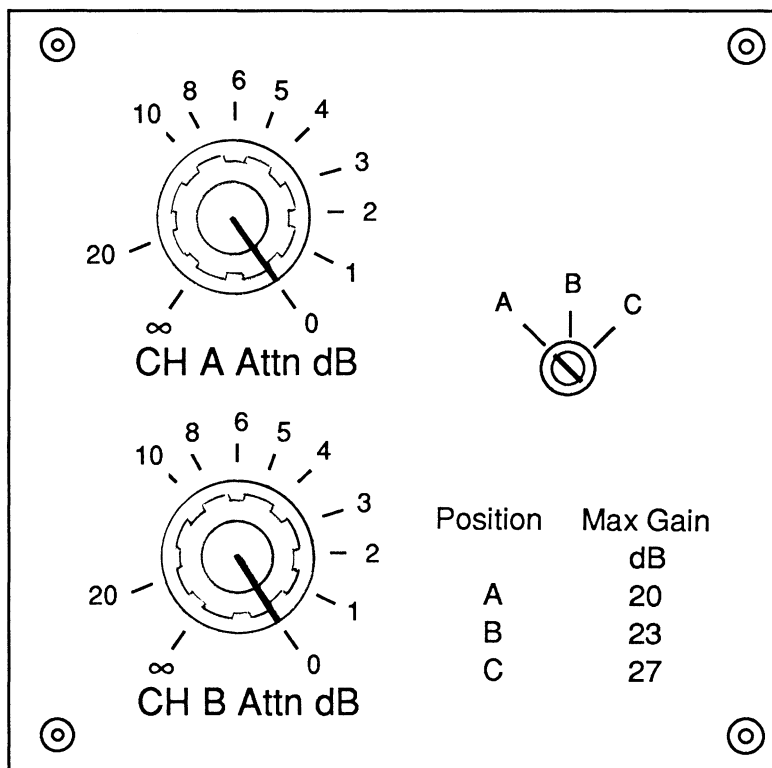
In the design of the MS 1000A chassis and circuit cards, provision has been made for installing various factory (or custom) options to enhance the unit's functionality and utility in specific applications.

The front panel option plate (see Figure 1-1) is removable, and may be replaced with a similar panel holding options such as meters, gain controls, input and/or output connec-

tors. Internally (see Appendix A), connection tabs mounted on the Output Buildout circuit card allow access to the individual amplifier channel outputs. A pair of multi-pin connectors mounted on the Input Circuit card provide access to several circuit nodes.

Currently, the only option available is the Dual Gain Controls (see Figure 3-16), a panel fitted with two linear attenuation potentiometers and a recessed three-position switch to select absolute voltage gain for both channels. The attenuation is adjustable from 0 to  $-\infty$  dB, and the potentiometer knobs are calibrated in decibels. This option is designed to permit precise adjustment of individual channel gains, in order to accommodate various operating levels and/or slight level differences between channels in a system.

In addition to the option described above, further expansion options will be announced as they become available.



**Figure 3-16 Dual Gain Controls**

### 3.8 Using the MS 1000A With Meyer Sound Loudspeaker Systems

All Meyer Sound loudspeaker products are integrated systems which incorporate active signal-processing electronics as an integral component of the design. This approach allows a high degree of flexibility in balancing design parameters: the loudspeaker components can be optimized

for those performance aspects that are best handled at the mechanical level (distortion, diaphragm resonance and power handling, for example), while other parameters are managed electronically.

From input to output, the MS 1000A has been designed to offer outstanding performance with Meyer Sound loudspeaker systems. The input

circuit acts as an ideal line receiver for the active balanced output stage that is common to all Meyer Sound Control Electronics Units. The peak and continuous power capabilities of the power amplifier stage match the power-handling capacity of Meyer Sound loudspeakers, as does the threshold of the LTI load protection circuit (see Sections 2.2.1 and 3.5). Finally, the extraordinarily high damping factor of the MS 1000A allows you to take full advantage of the accuracy of Meyer Sound loudspeakers.

If you are not familiar with Meyer Sound loudspeaker systems, contact your dealer or write to Meyer Sound and request a data sheet package.

#### 3.8.1 Full-Range Systems

**The Meyer Sound UPA-1A and UM-1A UltraMonitor™** are closely-related full-range professional loudspeakers. The UM-1A is designed specifically for stage monitoring, while the UPA-1A is an arrayable loudspeaker for sound reinforcement. Both are biamplified systems, and both



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## Section III

work with the M-1A Control Electronics Unit. The low-frequency driver impedance is 8 ohms, and the high-frequency driver impedance is 16 ohms. When a single MS 1000A is used with these systems (one channel being used for the high frequencies and the other for the lows), a maximum of four loudspeakers can be connected to the amplifier. The resulting low-frequency load impedance will be 2 ohms, while the high-frequency load will be 4 ohms.

In high-power applications, we suggest a maximum of two UPA-1As or UM-1As per MS 1000A. This will keep the low-frequency channel load impedance above 4 ohms, minimizing the chance of a thermal shutdown when the system is driven to high continuous power levels.

**The Meyer Sound MSL-3** is a high-power arrayable full-range loudspeaker designed for use in concert main PA systems, large music clubs, and outdoor paging applications. It is a biamplified system and works with the M-3T Control Electronics Unit. The MSL-3 incorporates two 12-

inch low-frequency drivers which are wired in parallel in the cabinet, resulting in a load impedance of 4 ohms. The high-frequency driver impedance is 8 ohms.

When a single MS 1000A is used with the MSL-3, a maximum of two loudspeakers can be connected to the amplifier. The resulting low-frequency load impedance will be 2 ohms, and the high-frequency impedance will be 4 ohms. In high-power applications, connect no more than one MSL-3 low-driver pair per amplifier channel.

**The M-1A and M-3T Control Electronics Units** incorporate driver protection circuitry tailored to the loudspeakers' capabilities. The MS 1000A LTI circuit affords an additional measure of driver protection, complementing the action of the CEU's protection circuits. When the Safeguard switch of the M-1A or M-3T is engaged, it will be very difficult to drive the amplifier hard enough to trigger an LTI shutdown due to the limiting action of the CEU. When the Safeguard switch is not engaged, however, driving the

system into continuous limiting may result in an LTI shutdown.

**The Meyer Sound UPM-1** is a very compact full-range loudspeaker system designed specifically for under-balcony fill, medium-level stage monitoring, foreground music systems, theatre surround systems and other low-to-medium power applications. It is a two-way system with a passive crossover, and presents a 16 ohm load impedance. The UPM-1 works with the P-1A Control Electronics Unit. Up to eight UPM-1s can be connected to each channel of the MS 1000A (for a total per-channel load of 2 ohms).

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### 3.8.2 Subwoofer Systems

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**The Meyer Sound USW-1 and 650-R2** are high-power subwoofers systems for professional applications. The USW-1 comprises two 15-inch MS-15 cone drivers in a single vented enclosure, while the 650-R2 uses two 18-inch MS-18 cone drivers. In each of these units, the drivers are to be connected in parallel at the amplifier output,

resulting in a 4 ohm load. Both work with the B-2A Control Electronics Unit.

Because the bulk of the energy in music lies in the low frequencies, the power demand presented to the amplifier by subwoofers is almost inevitably quite high. It is therefore best to connect no more than one USW-1 or 650-R2 to a single MS 1000A channel output (two subwoofers per amplifier).

**The B-2A** Control Electronics Unit's driver protection circuitry features a continuously-variable limiting threshold control labeled Power. When the Power control is set at 12 o'clock or lower, the CEU's limiting circuits will virtually prevent LTI shutdowns. When the Power control is set wide open, however, an LTI shutdown could result if the system is driven into continuous hard limiting.

---

### 3.8.3 Studio Monitoring

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**The Meyer Sound 833 System** is a high-power, ultra low distortion loudspeaker system for recording studio monitor-

ing. It incorporates a passive crossover and presents an 8 ohm load. Optional model 834 Subwoofers are available for the system; these connect in parallel with the 833s, dropping the load impedance to 4 ohms. The 833 System works with the C833 Control Electronics Unit.

The MS 1000A is the ideal power amplifier for the 833 System. Its extremely low distortion and wide dynamic range complement the system's own sonic characteristics. The high damping factor of the MS 1000A permits extremely precise control of the 833 System drivers, resulting in unparalleled accuracy in critical monitoring applications. The phase response of the MS 1000A is highly controlled and linear, preserving the excellent phase characteristic of the 833 System.

Most importantly, the MS 1000A Amplifier's ability to handle inductive loads with ease (see Section 3.4.2) offers distinct advantages in use with the 833 System. The passive crossover in the 833 cabinet presents a complex reactive load, and some

amplifiers introduce audible distortion when attempting to drive it. An A/B comparison between the MS 1000A and other power amplifiers using the 833 System (particularly at high listening levels) will immediately demonstrate the increased clarity that the MS 1000A makes possible.

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## Section IV

### The Design of the MS 1000A

This section describes the design features of the MS 1000A Amplifier, and is intended for technicians and engineers who desire a deeper understanding of its design. Schematic diagrams are provided as an Appendix to this manual for reference. This is not a service manual. All servicing of the MS 1000A Amplifier must be performed by Meyer Sound or your dealer.

Refer to Figure 4-1 throughout this discussion.

---

#### 4.1 Input Circuitry

The input stage of the MS 1000A constitutes a three-port floating balanced signal input system; it is described in detail in Section 3.1.1, above. The input stage is followed by a variable level control wired as a simple attenuator. The gain adjustment range is limited to between 10 and 30 dB (see Section 3.2.1). A reed relay, controlled by the amplifier protection timing circuit, shorts the signal to common when a fault condition is detected.

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#### 4.2 Power Amplifier Section

The MS 1000A power amplifier section was designed for open-loop stability: in the absence of negative feedback, it functions as a stable, wide-bandwidth, low-distortion amplifier with flat frequency response. Negative feedback is employed to control gain and further reduce distortion. This design approach affords a high degree of stability with reactive loads.

The input to the power amplifier section is a differential stage implemented with an ultra low distortion, low noise, high-speed operational amplifier. The differential input stage includes unique soft-clipping circuits which simulate a tube-type clipping characteristic. These circuits, which are controlled by the current and voltage sensors that monitor the amplifier output, also provide a drive signal for the front-panel Peak indicator (the current and voltage clamp drive signals are combined in an OR gate).

The differential amplifier feeds a complementary-symmetry

bipolar driver stage, which in turn feeds an error-correction amplifier system. The primary function of the error-correction amplifiers is to linearize the junction between the bipolar drivers and the output MOSFETs, resulting in greatly reduced distortion. (Though this design approach is based on principles that have been known in the engineering community for decades, Meyer Sound is, at this writing, the only audio manufacturer to employ it in a commercially-available power amplifier.) Error correction is accomplished by a complex local feedback system which derives error signals from the amplifier output.

The output stage is complementary-symmetry, and is implemented with power MOSFETs. Overall positive feedback is used to sense and correct for nonlinearities across the load, increasing the damping factor of the system.

The power MOSFETs are located on an aluminum tunnel heatsink which floats from chassis ground and is

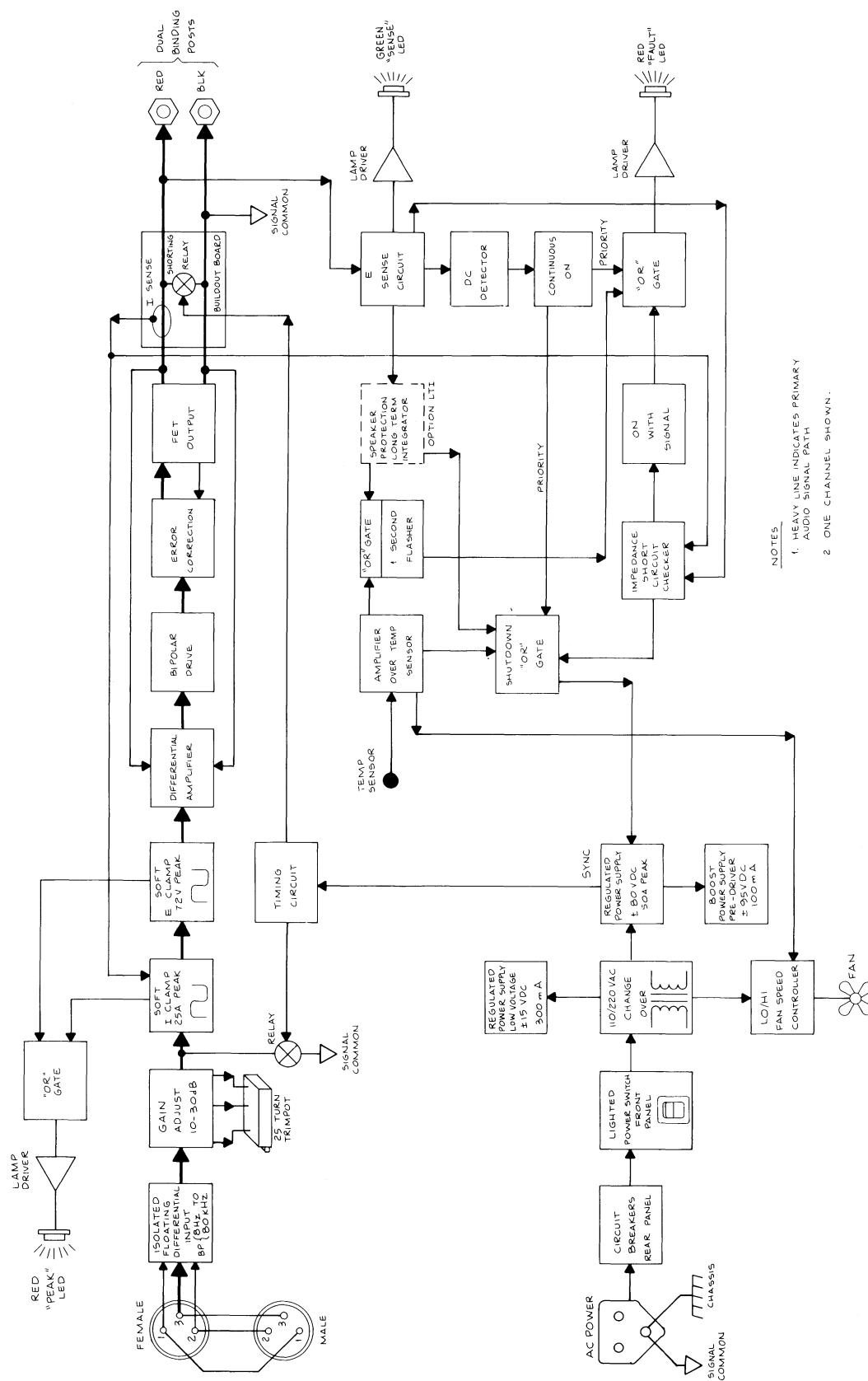


Figure 4-1 Block Diagram of the MS 1000A Power Amplifier

mounted on flanges made of a special, high-temperature polycarbonate material.

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### 4.3 Power Supply and Control Circuitry

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The MS 1000A power supply is fully regulated and incorporates a soft-start circuit which controls the full-wave rectified, unfiltered high-voltage supply through a pair of opto-isolated SCRs. The soft-start function protects the power switch and power supply components from high-current surges at turn-on, prolonging their life for highest reliability. It also obviates the need for cycled turn-on of systems in which several MS 1000A Amplifiers are employed.

The MOSFET output drivers operate from a high-current regulated  $\pm 80$  volt supply. Since the system incorporates error correction circuitry, the bipolar predriver stages operate from a  $\pm 95$  volt booster supply, allowing them to swing above the limits of the supply for the MOSFETs to assure linear operation. Low-voltage circuitry operates from a regulated  $\pm 15$  volt supply.

Primary protection for the system is provided by two resettable circuit breakers in the mains circuit.

The MS 1000A control circuitry affords protection for the system against output DC offsets, excessive continuous power, output shorts and overheating. The outputs of all the protection circuits control the high-voltage supply, using the same SCRs that soft-start the supply. A sensing path is provided to allow the protection circuitry to monitor the amplifier output on a continuous basis.

A true DC detector circuit monitors the amplifier output, shutting down the supply when DC is detected and turning the front-panel Fault indicator on continuously. This circuit is sensitive only to DC, and will not falsely trigger on low-frequency audio signals.

A long-term integrator monitors the continuous power applied to the load, shutting down the high-voltage supply and flashing the Fault indicator when a factory-preset limit is exceeded (see Section 3.5).

A true impedance-sensing circuit monitors load impedance on the amplifier output by calculation from the voltage across the load and the current through the load (as sensed by a pair of current coils on the channel outputs). If the load impedance is calculated to be less than 1.5 ohms, the circuit lights the Fault light and then shuts down the high-voltage supply, actuating the input and output relays. In the Fault shutdown condition, then, all the front-panel indicators go out, since a signal is required to perform the impedance calculation. After a brief timing period, the amplifier resumes normal operation; if the load impedance is still too low, the cycle repeats.

A temperature sensing circuit monitors the temperature of the output MOSFETs through an integrated temperature sensor located on the heatsink. The circuit controls the speed of the cooling fan through an opto-isolated triac. It shuts down the high-voltage supply and flashes the Fault indicator if the amplifier's temperature limit is exceeded.

## Specifications

### Signal Inputs

Type

Balanced ISO-INPUT™ (Female XLR;  
1, 2 & 3 are transformer isolated, shell is  
connected to chassis/AC Mains ground.)

Impedance

10k ohms resistive balanced  
(XLR pin 3 to 2)

5k ohms resistive unbalanced  
(XLR pin 3 to 1 or pin 2 to 1)

500 volts peak

Maximum Common-Mode Voltage

Common-Mode Rejection Ratio

100 Hz

50 dB

1 kHz

45 dB

10 kHz

30 dB

### Power Output¹

Continuous Sine Wave

With LTI²	Without LTI²
500 watts	1000 watts
1200 watts	1200 watts

Sine Wave Burst

### Minimum Load Impedance

2 ohms per channel (use only with LTI)

### Damping Factor

Greater than 1000

### Frequency Response

20 Hz to 20 kHz  $\pm 0.5$  dB

-3 dB at 8 Hz and 80 kHz

### Full Power Bandwidth

10 Hz to 30 kHz

### Slew Rate

See note (8)

### SMPTE Distortion³

Less than .01% at full power

### Transient Distortion⁴

Less than .03% at full power, load  $\geq 4$  ohm

### Dynamic Range⁵

Greater than 100 dB

### Voltage Gain

20 dB (internally adjustable from 10  
to 30 dB)

### Amplifier Protection

True load impedance calculation and  
power supply shutdown⁶

True current and voltage sensing and  
clamp⁶

Thermal sensing and shutdown⁶

True DC sensing and shutdown⁷

Dual primary mains breakers⁷

---

## Section V

### Load Protection

Peak limiting, long-term power  
integrator and power supply shutdown<sup>6</sup>  
Output relays shunt under all fault and  
shutdown conditions

### Indicators

Sense  
Peak  
Fault  
Power

Green LEDs  
Red LEDs  
Red LED  
Green lighted switch

### Connectors

Input

Three-pin XLR-type female input  
Three-pin XLR-type male looping  
Five-way binding posts, color-coded

Output

### Power Supplies

Type  
Operating mains voltage range

Fully regulated  
90 to 130 VAC (180 to 260 VAC in 220 volt  
configuration), 50 or 60 Hz, see graph on  
page 45 for maximum output under AC  
Mains voltage range

### Power Consumption

2.4 kVA

### Operating Temperature Range

0 to 45 degrees Centigrade

### Physical Dimensions

19"W x 5.25"H x 16.8"D

Standard rack mount

### Weight

69 lbs.

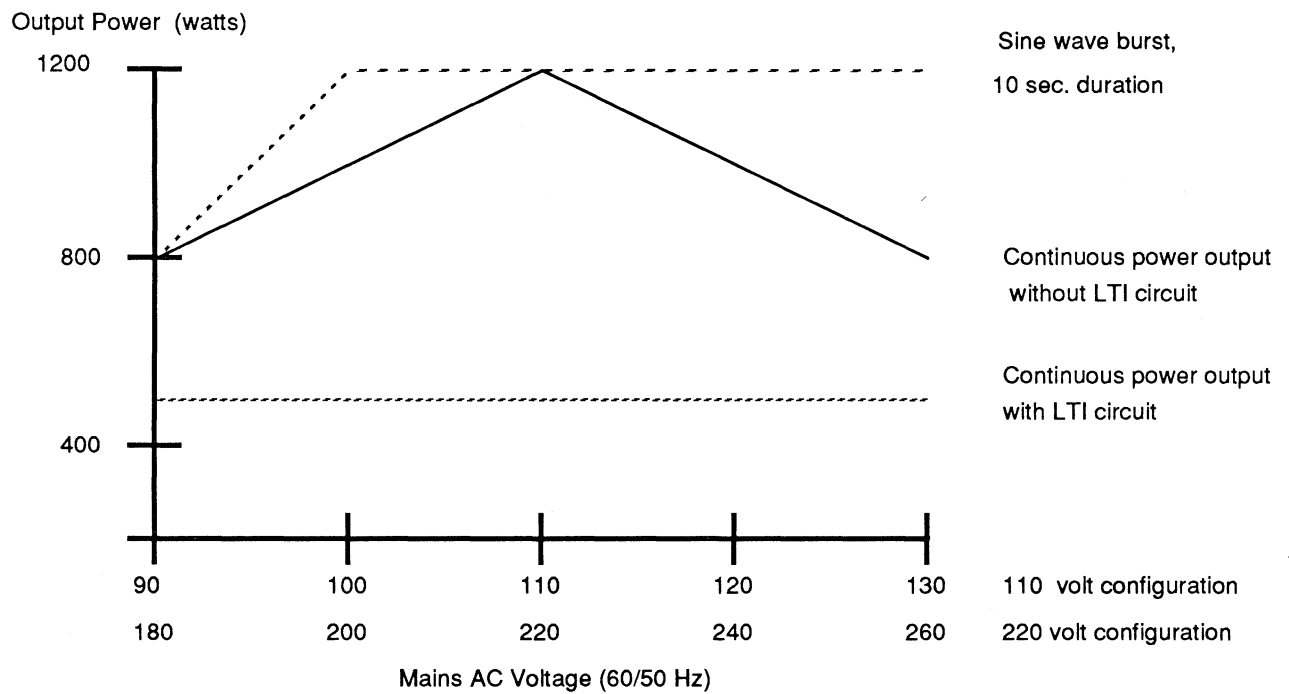
Conditions for specifications (unless otherwise stated):

115 VAC, 60 Hz Mains, 600 ohms balanced source, 4 ohm resistive load each channel,  
amplifier gain set at 20 dB

### Notes:

- (1) Both channels driven, 4 ohm load.
- (2) Long term integrator load protection circuit with shutdown.
- (3) 60 Hz + 4000 Hz sinewaves in a 1:1 amplitude ratio.
- (4) 3.18 kHz square wave + 15 kHz sinewave in a 4:1 amplitude ratio.
- (5) Noise floor 'A' weighted.
- (6) Automatically self-resetting.
- (7) Requires manual resetting.
- (8) The MS 1000 is risetime limited by the input TIM filter. (See Power Bandwidth specification.)

## Power Output

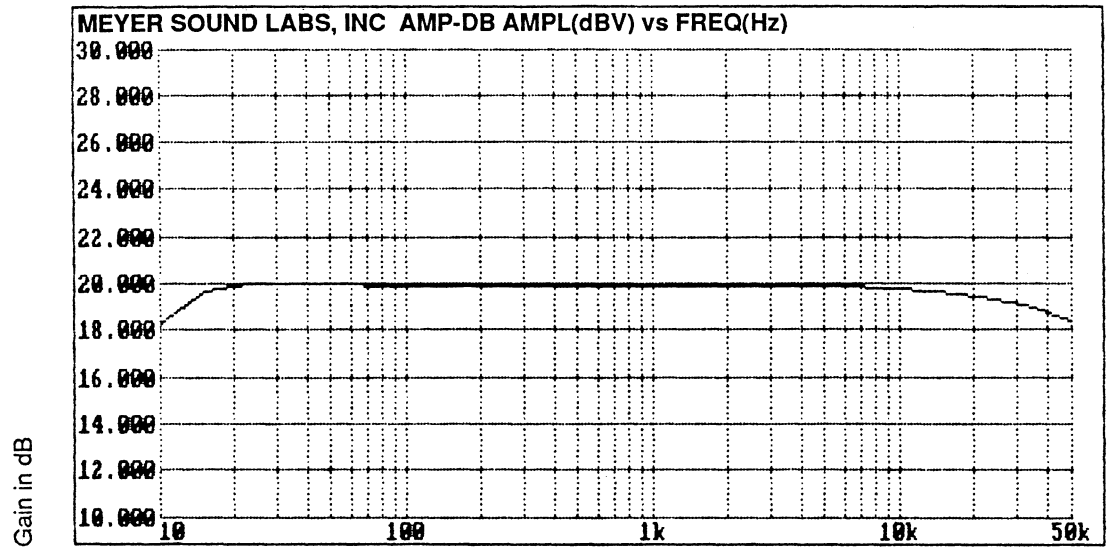


**Note:** Both channels driven, 4 ohms per channel.



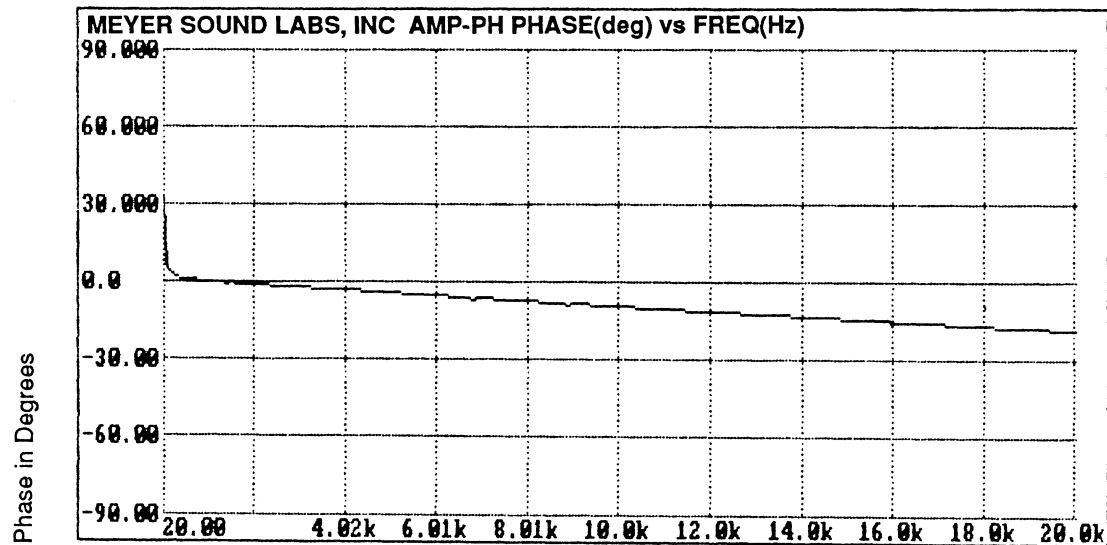
## Section V

### Frequency Response



Frequency in Hz

### Phase Response



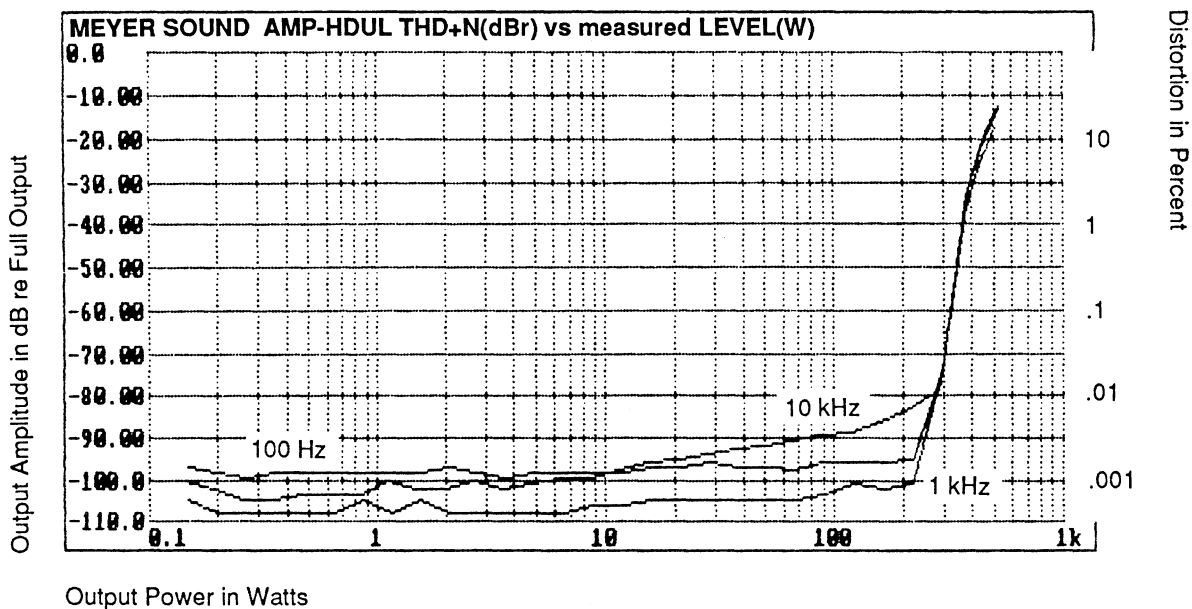
Frequency in Hz

#### Conditions of Measurement:

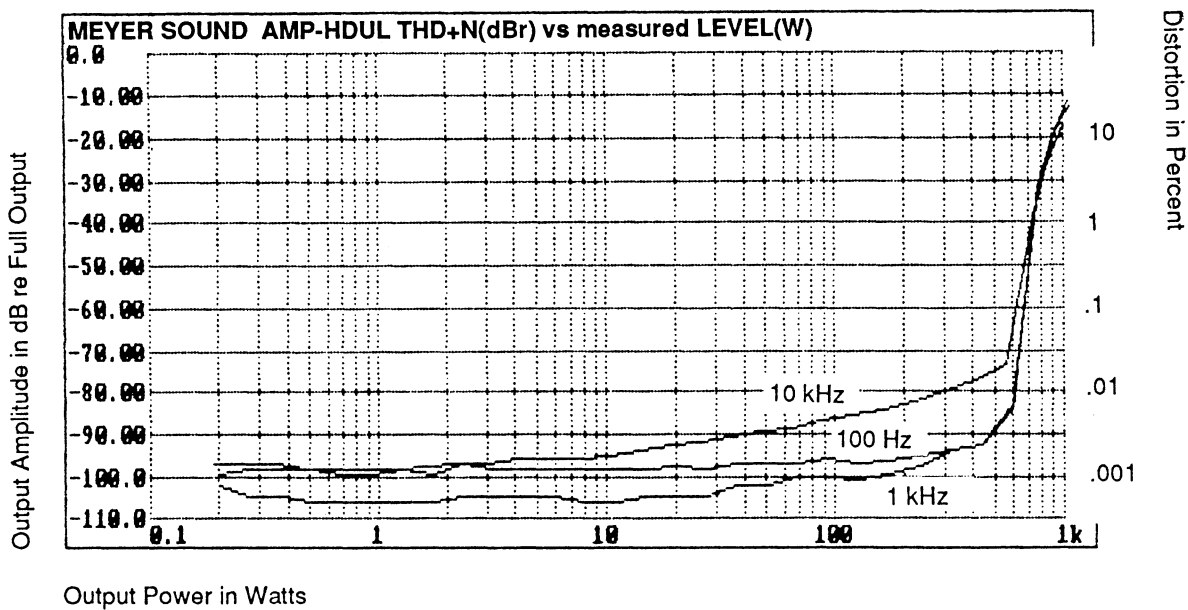
Balanced input, pins #2 and #3  
Pin #1 grounded  
8 ohm load

## Harmonic Distortion vs Output Power

8 ohm load



4 ohm load



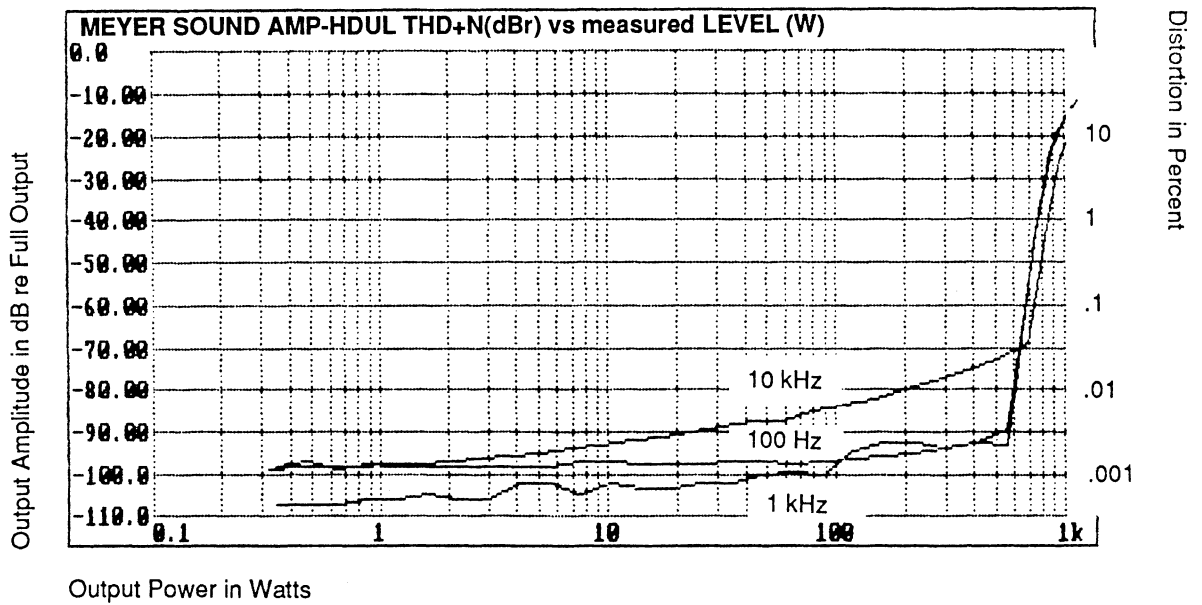
### Conditions of Measurement:

Balanced input, pins #2 and #3  
Pin #1 grounded

## Section V

### Harmonic Distortion vs Output Power

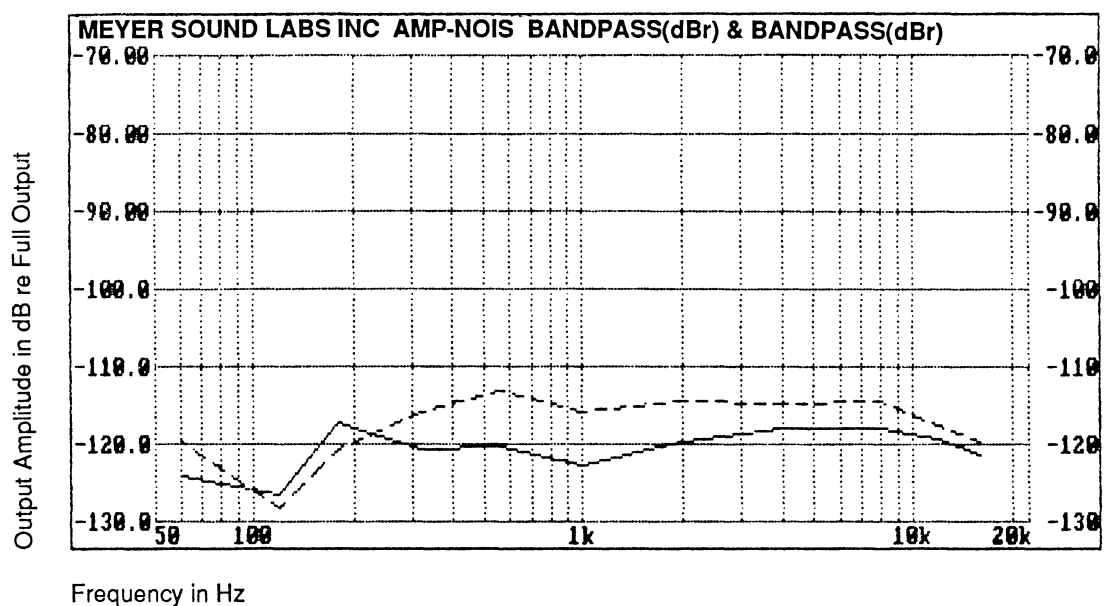
2 ohm load



#### Conditions of Measurement:

Balanced input, pins #2 and #3  
Pin #1 grounded

## "A" Weighted Spectral Distribution of Noise



— Channel A

---- Channel B

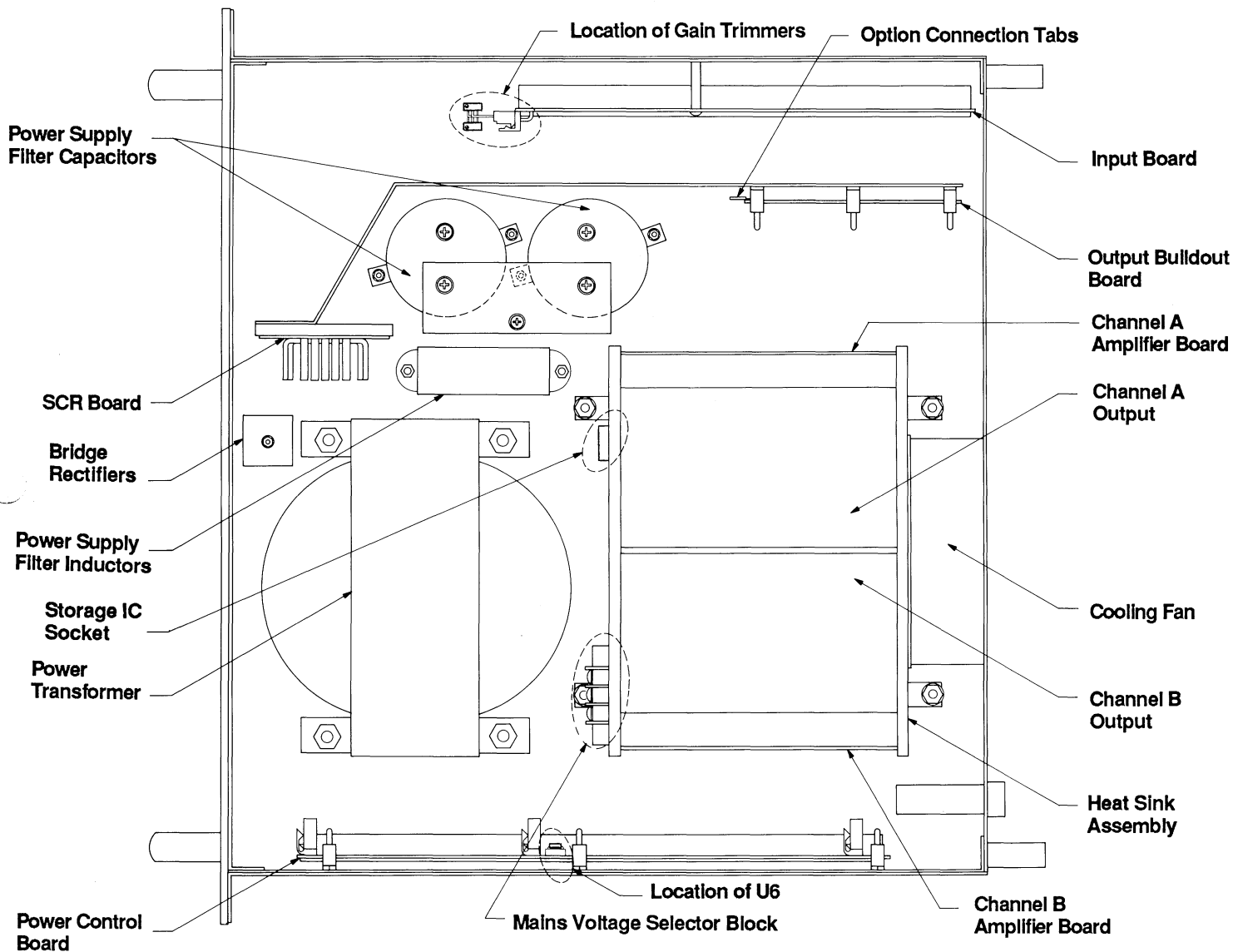
### Conditions of Measurement:

Balanced input, pins #2 and #3  
 (150 ohm source impedance)  
 Pin #1 grounded  
 4 ohm load



# Appendix A

MS 1000A Interior Plan View





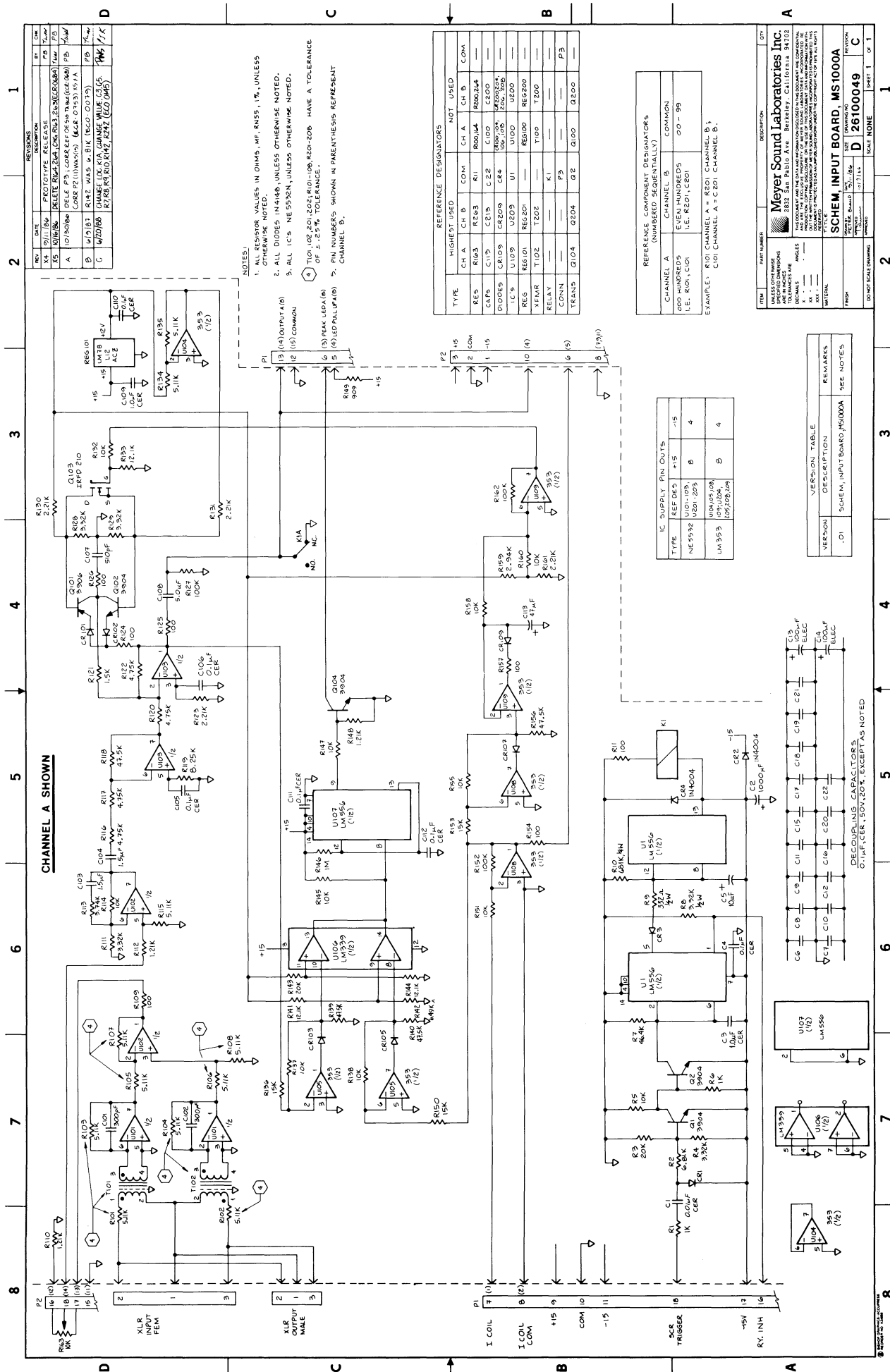
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## Appendix B

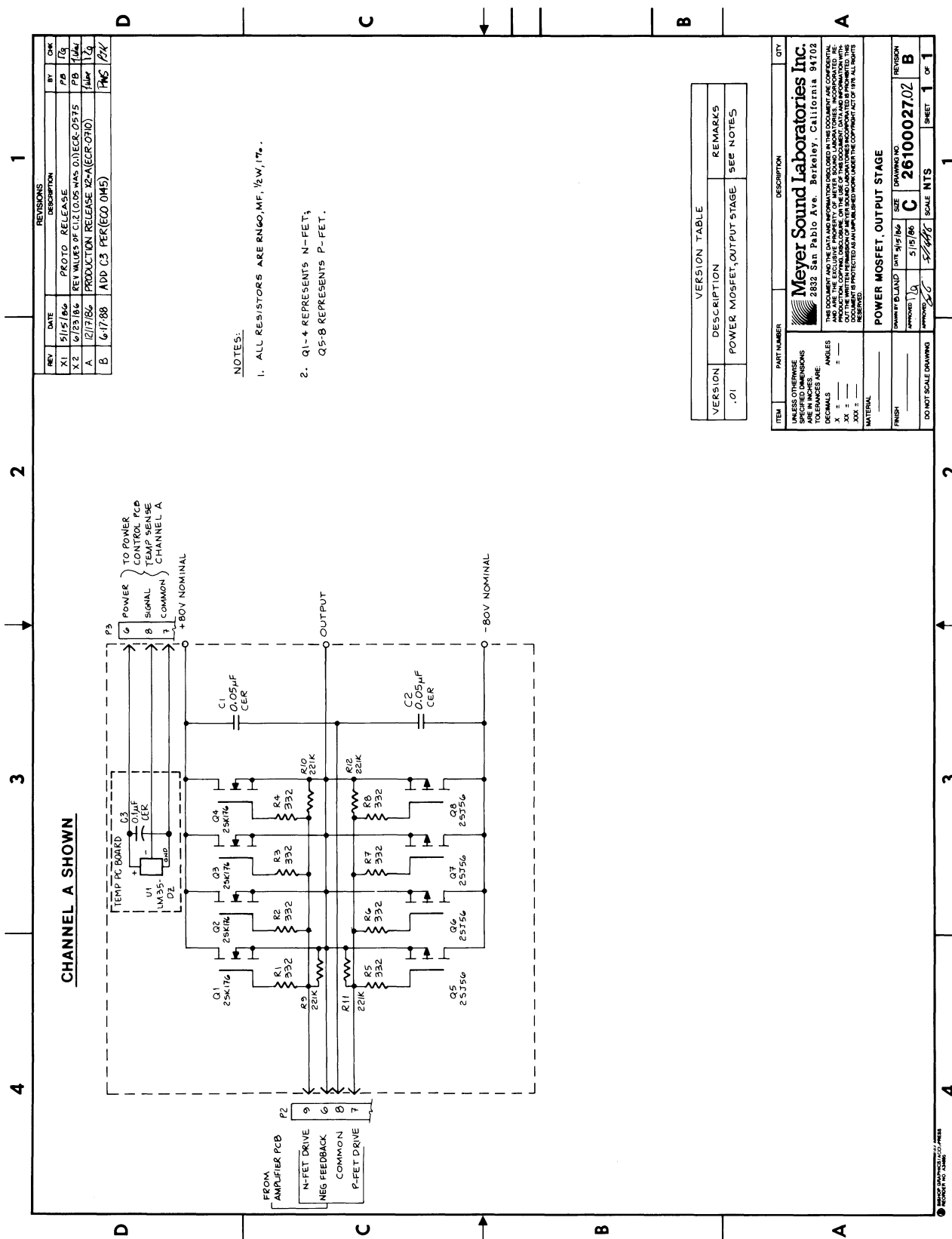
### MS 1000A Schematics











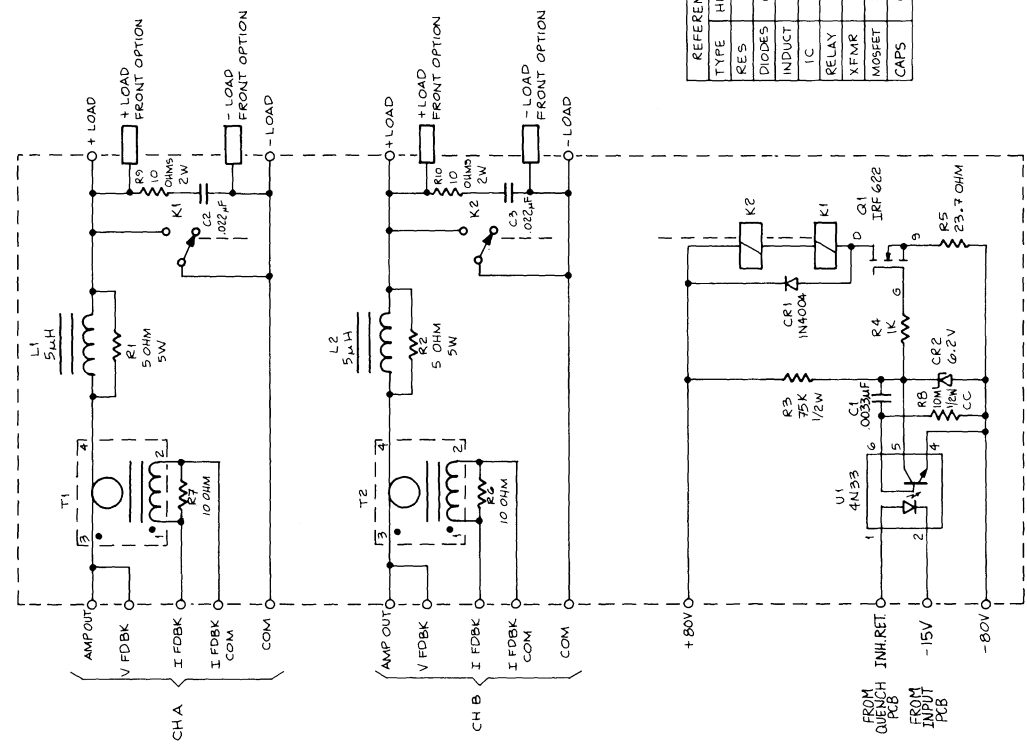
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A2	7/24/87	SHOW R9, R10, C2, C3 WITH VISIBLE LINE DRAWING	PLB	PB
B	11/23/87	UPDATE FOR PLG REVISION	PB	PB
C	6/16/88	UPDATE FOR PLG REVISION CHANGES	PB	PB
D		UPDATE PER (ECO 0145)	PLS	1/2/88
		AT INH RET AND -15V		

NOTES:

- ALL RESISTORS 1/4 W UNLESS OTHERWISE SPECIFIED.



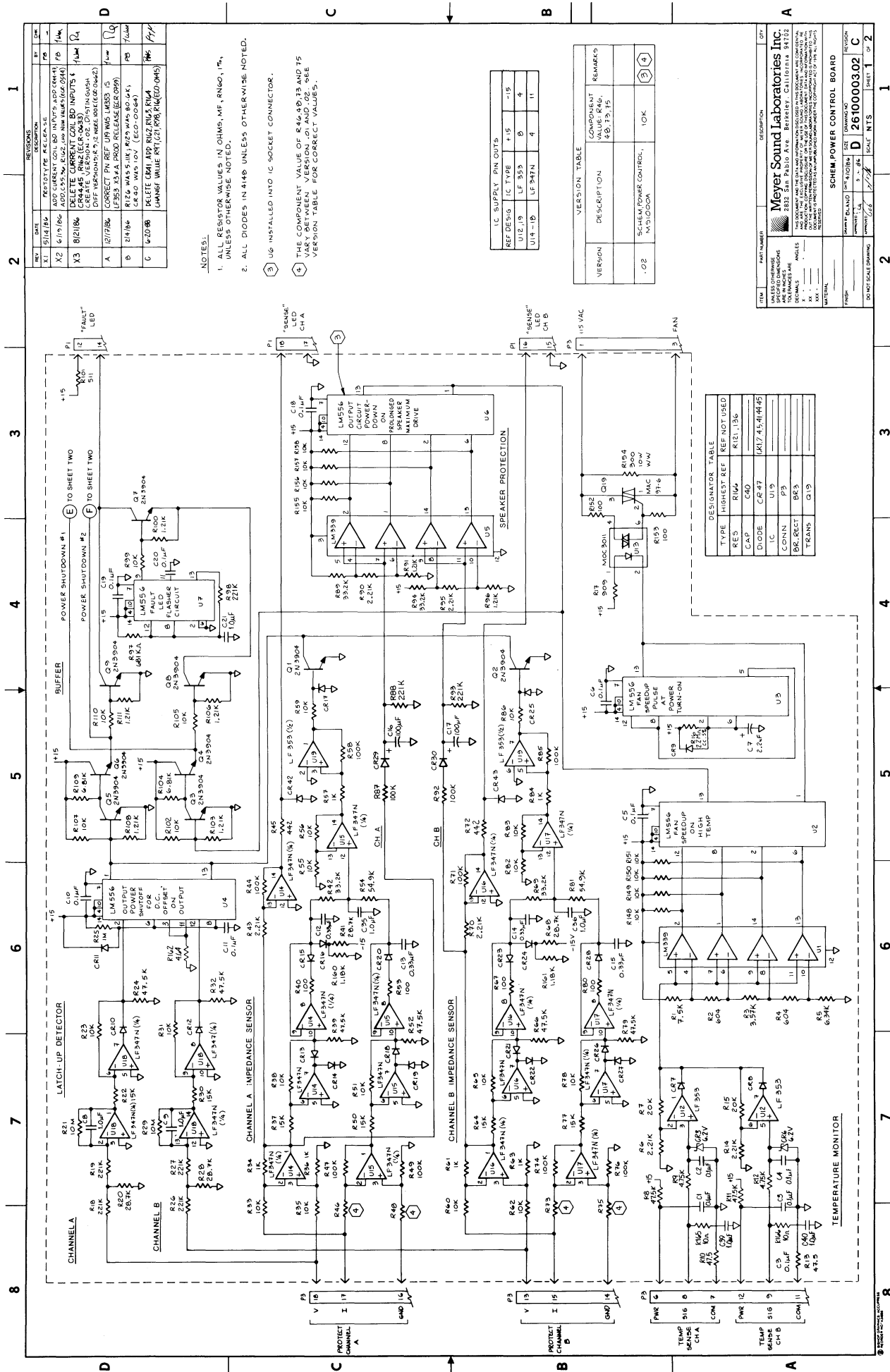
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DIODES	CR2	---
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XFMR	T2	---
MOSET	Q1	---
CAPS	C3	---

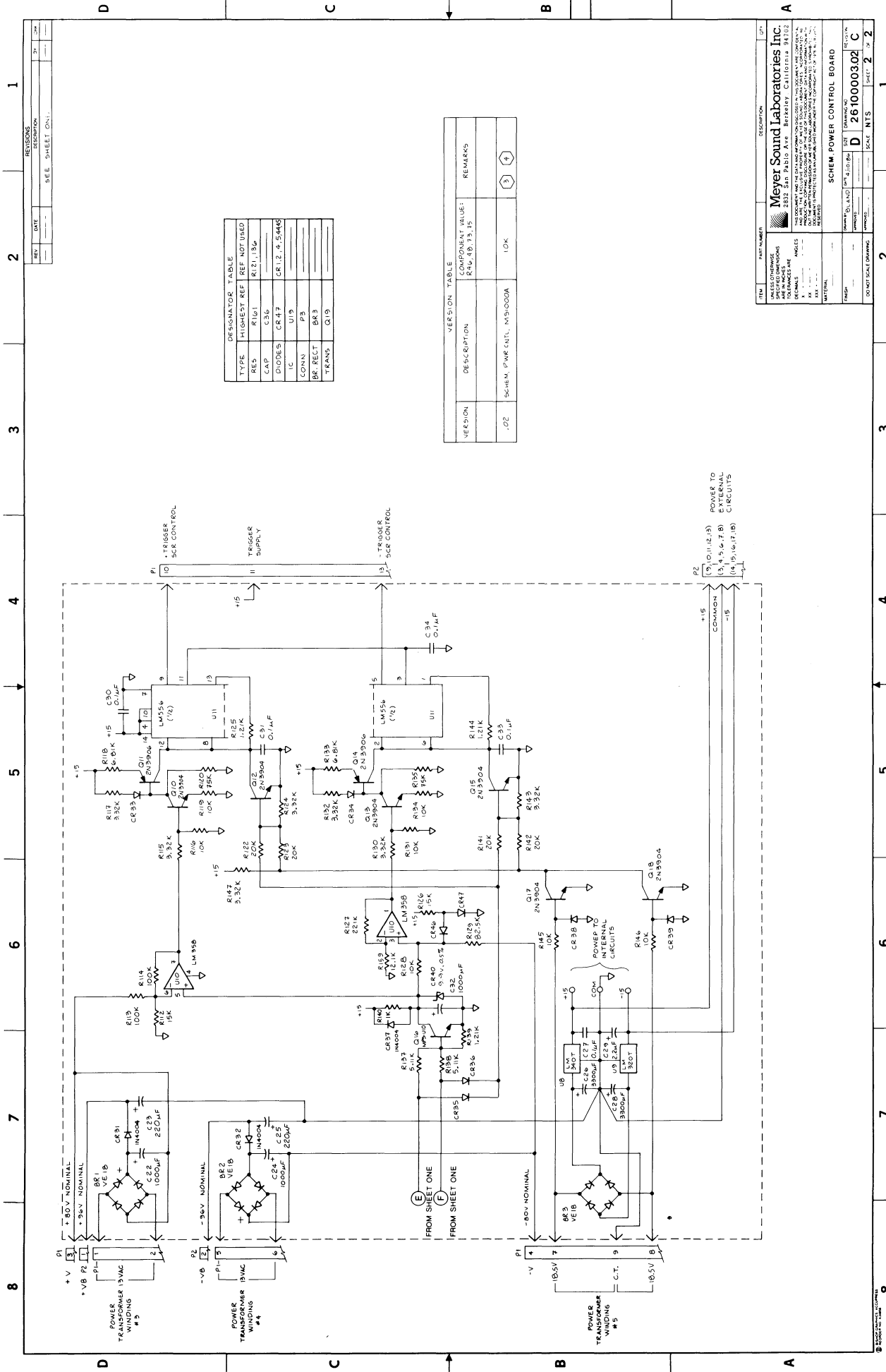
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XXX = .XXX	XXX = .XXX		
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FINISH	DATE: 9/9/86	SIZE: C	REVISION: C
APPROVED: [Signature]	10/1/88	SCALE: NONE	SHEET 1 OF 1
DO NOT SCALE DRAWING			

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2822 San Pablo Ave. Berkeley, California 94702

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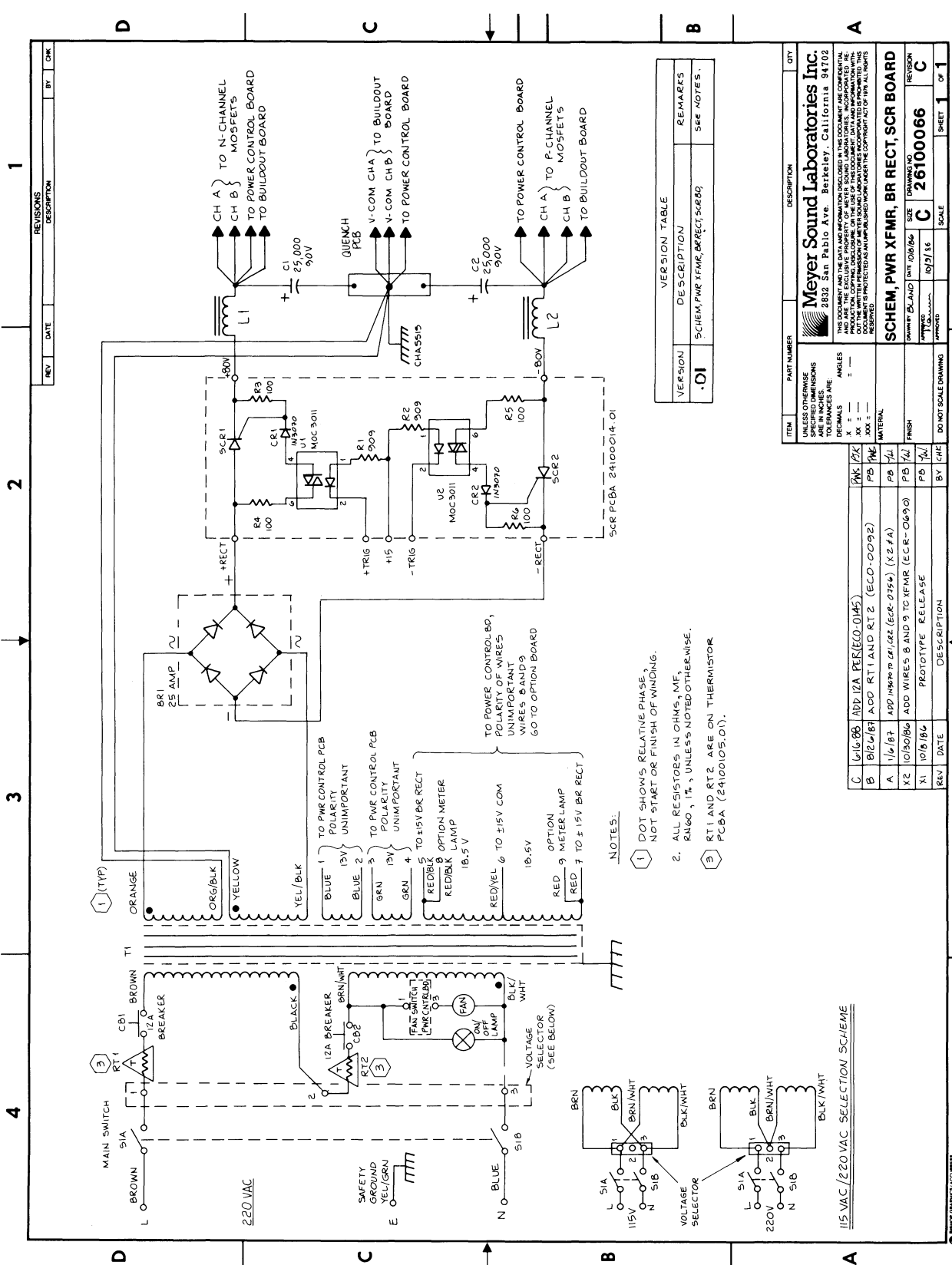




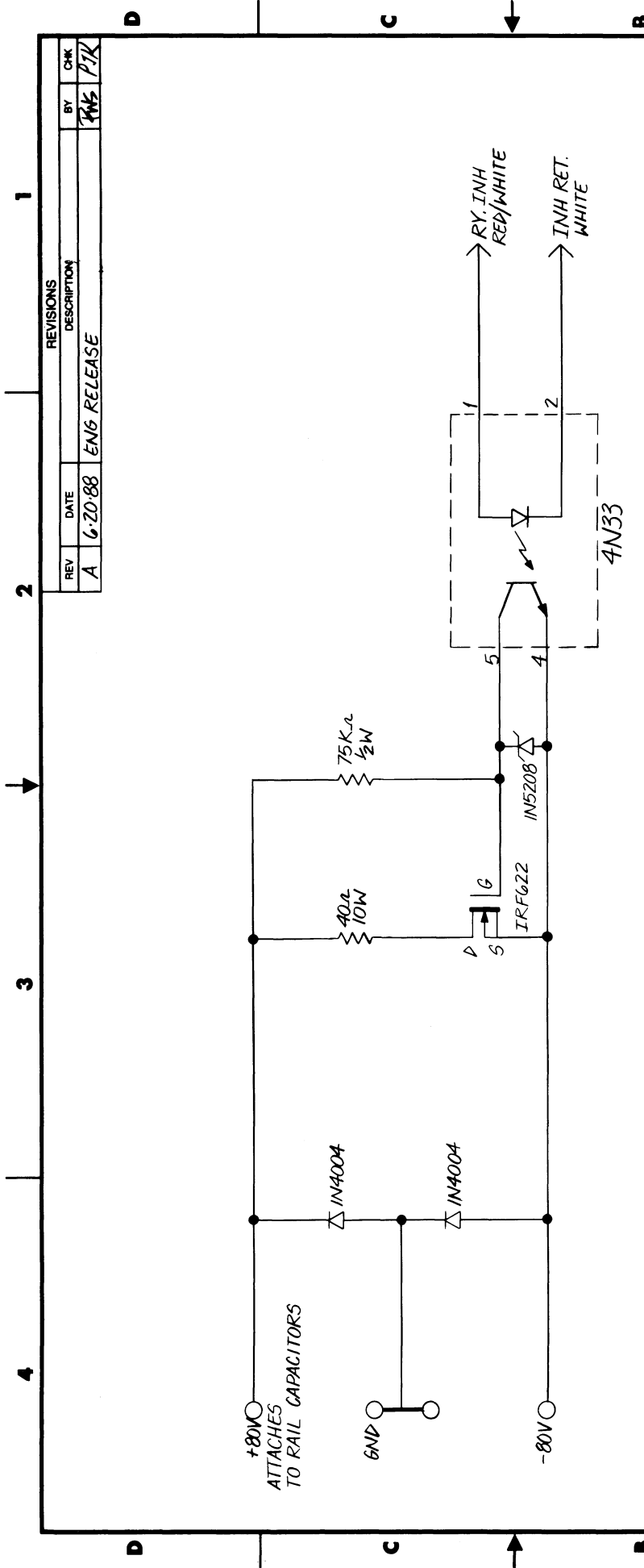
**Meyer Sound Laboratories Inc.**  
2832 San Pablo Ave. Berkeley California 94702

**SCHEM. PWR CNT. BOARD**

DATE: 10/1/75  
DRAWN BY: D  
CHECKED BY: C  
SCALE: NTS  
SHEET: 2 OF 2







REVISIONS			
REV	DATE	DESCRIPTION	BY
A	6-20-88	ENG RELEASE	PKK
			PTK

ITEM	PART NUMBER	DESCRIPTION	QTY
<p><b>Meyer Sound Laboratories Inc.</b>  2832 San Pablo Ave. Berkeley, California 94702</p> <p>THIS DOCUMENT AND THE DATA AND INFORMATION DISCLOSED IN THIS DOCUMENT ARE CONFIDENTIAL AND ARE THE EXCLUSIVE PROPERTY OF MEYER SOUND LABORATORIES, INCORPORATED. REPRODUCTION, COPYING, DISCLOSURE, OR THE USE OF THIS DOCUMENT, DATA AND INFORMATION WITHOUT THE WRITTEN PERMISSION OF MEYER SOUND LABORATORIES INCORPORATED IS PROHIBITED. THIS DOCUMENT IS PROTECTED AS AN UNPUBLISHED WORK UNDER THE COPYRIGHT ACT OF 1976. ALL RIGHTS RESERVED.</p>			
<p><b>SCHMATIC, QUENCH PCB (MS1000A)</b></p>			
<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.</p> <p>TOLERANCES ARE:</p> <p>DECIMALS ANGLES</p> <p>.X ± ±</p> <p>.XX ± ±</p> <p>.XXX ± ±</p>		<p>DATE 6-20-88</p> <p>DRAWING NO. B</p> <p>SIZE 26100109.01</p> <p>REVISION A</p>	
<p>MATERIAL</p>		<p>DO NOT SCALE DRAWING</p>	
<p>FINISH</p>		<p>APPROVED</p>	
<p>DO NOT SCALE DRAWING</p>		<p>SHEET 1 OF 1</p>	

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