500 Series Loudspeaker Systems
Owner's Manual

Meyer Sound Laboratories, Inc.
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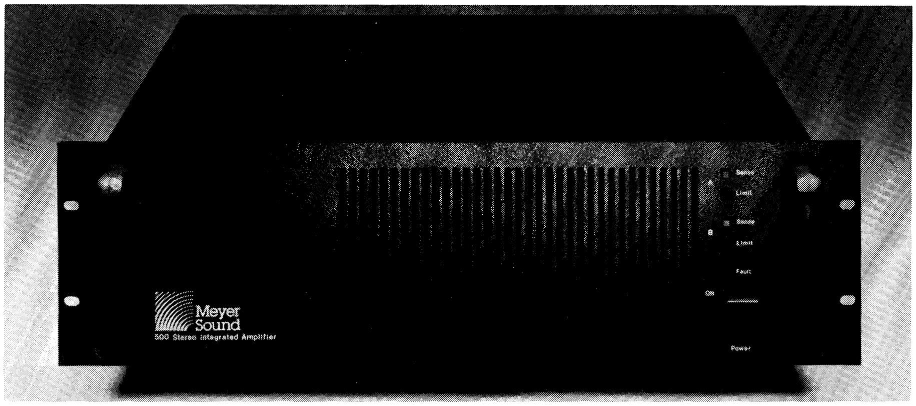
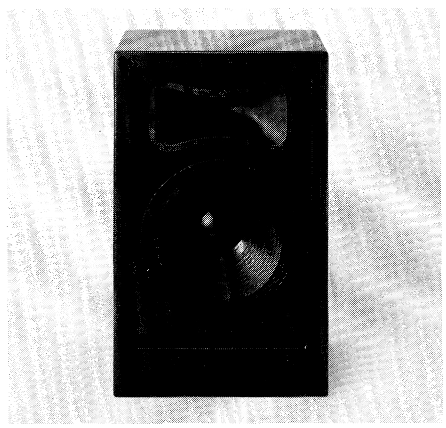
The 500 Series



500 Stereo Integrated Amplifier

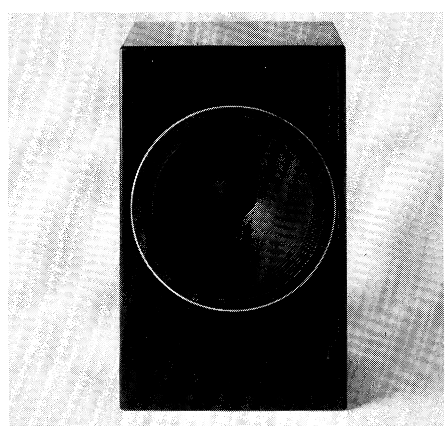
500 Full-Range Loudspeaker



500R Full-Range Loudspeaker

500RW Stage Monitor Loudspeaker

501 Subwoofer



518R Subwoofer

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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 500 Series Loudspeaker System.

Section 1 contains introductory information of interest to all users of 500 Series Systems. Section 1.4, "Summary of Operating Precautions," is particularly important. Please read this section before attempting to connect and operate your system.

Section 2 provides basic operating instructions for 500 Series Systems. System connections, loudspeaker placement, operation and troubleshooting are described in step-by-step fashion. This section is intended to serve both as a guide for the first-time user and as a quick reference.

Section 3 presents application information about 500 Series Systems and is intended for the use of contractors, consultants and other audio professionals. Information about 220 volt operation and alternate input connection standards is included in this section.

Section 4 is a detailed discussion of the design of the 500 Series. Professional audio technicians and engineers will find in this section an introduction to the principles that underly the performance of the 500 Series.

Section 5 presents complete specifications for the 500 Series. Schematic diagrams for the 500 Stereo Integrated Amplifier are included as an Appendix. This is not a service manual, however. Service must be performed by Meyer Sound or by your dealer.

Meyer Sound 500 Series Loudspeaker Systems are designed to provide years of trouble-free performance in a broad range of sound reinforcement and monitoring applications. We recommend that you study this manual before connecting and operating your 500 System, in order to make best use of the system's unique advantages and capabilities.

Thank you for selecting a Meyer Sound 500 Series System.

1.2 Unpacking and Inspecting Your 500 System

All Meyer Sound 500 Series Loudspeaker Systems are delivered in separate packages: each loudspeaker cabinet is shipped in its own corrugated cardboard container, and the 500 Integrated Power Amplifier is shipped in a separate carton.

Save all packing material.

Upon unpacking your 500 System, immediately inspect all components for shipping damage. In the event that any components have been damaged in transit, you must place a claim with the shipping carrier. Meyer Sound and its dealers are not responsible for shipping damage.

Your shipment should consist of:

(2) 500 Series Loudspeakers with grills
(1) 500 Integrated Power Amplifier
(2) 10-meter loudspeaker cables
(1) Envelope containing:
- Operating Instructions
- Meyer Sound Product Warranty Statement
- Warranty Reply Card

1.3 Description of Features and Controls

The Meyer Sound 500 Series represents a flexible modular approach to sound reinforcement and reproduction systems. Comprising a family of compatible loudspeakers and a single matching amplification unit, the 500 Series is designed to offer absolutely professional performance in cost-effective, easily installed packages.

The 500 Series incorporates loudspeaker models suited to a wide range of professional applications, covering both permanent installations and portable reinforcement. All 500 Series loudspeakers must be used with the 500 Amplifier, which contains complementary-phase equalization and protection circuitry that is tailored specifically for their performance characteristics.

1.3.1 Full-Range Loudspeakers

All full-range loudspeakers in the 500 Series are two-way systems comprising a 15-inch low-frequency cone driver and 1.4-inch throat high-frequency driver with 40° by 80° horn and passive crossover, housed in a vented cabinet with a locking, polarized three-pin AXR-type connector.

Features of 500 Series full-range loudspeakers include:

◊ Ultra low distortion cone driver
◊ New high-efficiency horn driver
◊ Phase-accurate passive crossover
◊ High continuous and peak power handling

The Model 500 is designed for permanent installation, and features a utility cabinet finished with a paintable, black textured coating. Internally mounted reinforcement blocks permit secure installation of hanging hardware, and simple hand grips provide for ease of handling. A removable fiberglass grill screen protects the components from dirt and foreign objects.

The Model 500R is optimized for portable reinforcement applications, and features a ruggedized roadworthy enclosure with recessed handles and black textured finish. The cabinet is internally reinforced to accommodate rigging hardware, and a removable stamped steel grill provides increased protection for the driver components.

The Model 500RW is a companion full-range stage monitor for portable reinforcement. The roadworthy slant enclosure, which is fitted with recessed carrying handles, features a unique design that affords a choice of two different degrees of tilt when placed on the floor. The components are protected by a removable stamped steel grill.

1.3.2 Subwoofer Loudspeakers

500 Series subwoofers comprise a single 18-inch low-frequency cone driver housed in a vented cabinet fitted with a locking, polarized three-pin AXR-type connector. An integral passive filter network is provided for simple parallel connection to the 500 Amplifier, so no modification to the existing 500 System is required for proper operation with subwoofers. Adding subwoofers to a full-range 500 System will extend the system power bandwidth and

reduce low-frequency distortion at high sound pressure levels.

Features of 500 Series subwoofers include:

- ◊ Ultra low distortion cone driver
- ◊ High continuous and peak power handling
- ◊ Resonance-damped cabinet
- ◊ Internal passive filter network

The Model 501 is a companion to the Model 500 full-range cabinet, and is designed for permanent installation. The 8 cu. ft. enclosure is coated with a paintable black textured finish, and is fitted with a removable fiberglass grill screen and recessed handles. Reinforced areas are provided for installation of hanging hardware.

The Model 518R is a compact subwoofer for portable reinforcement. Its 4 cu. ft. enclosure is fitted with recessed handles and a removable stamped steel grill. The special design of the 518R dictates specific placement rules for proper operation (see Section 3.3.2).

1.3.3 The 500 Integrated Power Amplifier

The 500 Amplifier is an integral and necessary component of all 500 Series loudspeaker systems.

Housed in an all-steel rack-mountable chassis of unit construction, the 500 Amplifier is entirely modular and easily serviced. An auxiliary circuit card slot within the chassis holds complementary-phase equalization and protection circuitry tailored to the characteristics of 500 Series loudspeakers. For highest reliability in professional applications, the amplifier's design incorporates protection against overheating, excessive output power, output shorts, and output offsets. Primary protection is provided by a pair of resettable circuit breakers.

Rated at 1200 watts continuous (600 per channel) for up to 10 minutes and 800 watts continuous long-term, the 500 Amplifier weighs 55 lbs. and occupies a 5 1/4 inch high rack space. Its power bandwidth is 100 kHz, with THD of less than 0.01% (20 Hz to 20 kHz) and a signal-to-noise ratio in excess of 110 dB.

The damping factor is immeasureably high, so the unit controls the motion of the loudspeaker drivers with a very high degree of accuracy. A unique, instantaneous soft-clipping circuit simulates tube-type amplifier clipping, providing graceful overload characteristics.

The design of the 500 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, and is DC coupled. Both the high- and low-voltage power supplies are fully regulated, and power supply turn-on is controlled by a unique soft-start circuit which eliminates high inrush currents, greatly prolonging the life of all power circuit components.

Finally, the 500 Amplifier incorporates a revolutionary new proprietary input circuit (patents applied for) which greatly simplifies interfacing in all professional audio applications. Affording the advantages of true transformer isolation without the draw-

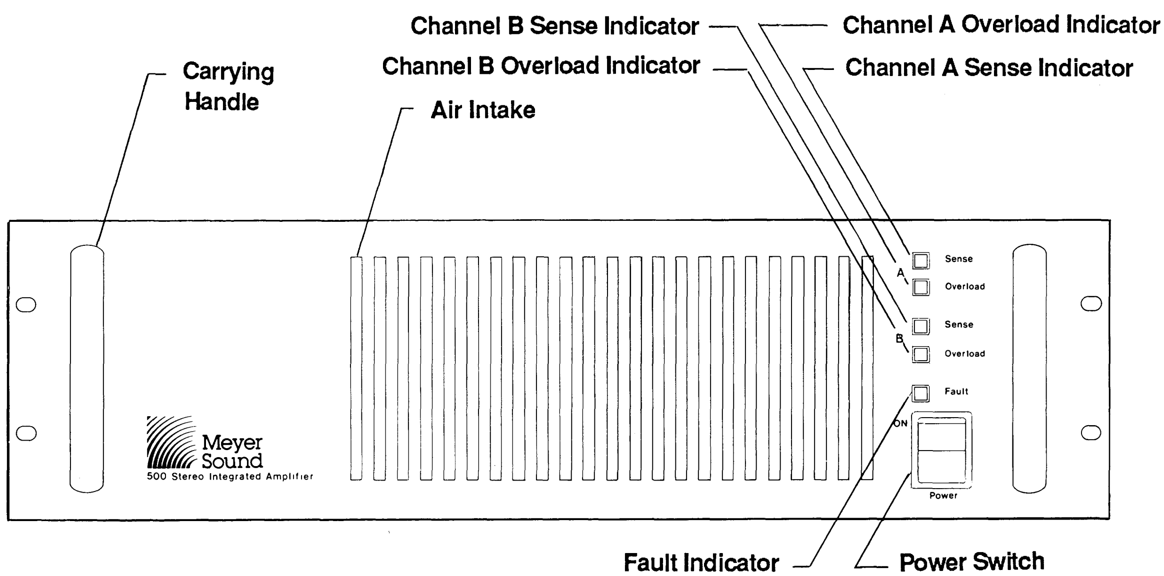


Figure 1-1 500 Stereo Integrated Amplifier Front Panel

backs 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).

1.3.4 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 monitoring the amplifier 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.

Overload Indicators: Red LED indicators whose threshold is set near the operating limit of the 500 System. At moderate-to-high power levels, the Overload indicators will flash intermittently on program peaks. If the Overload indicators are lit continuously, the system is being overdriven: unless the input signal level is reduced, the amplifier will shut itself down and go through an automatic rest cycle.

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

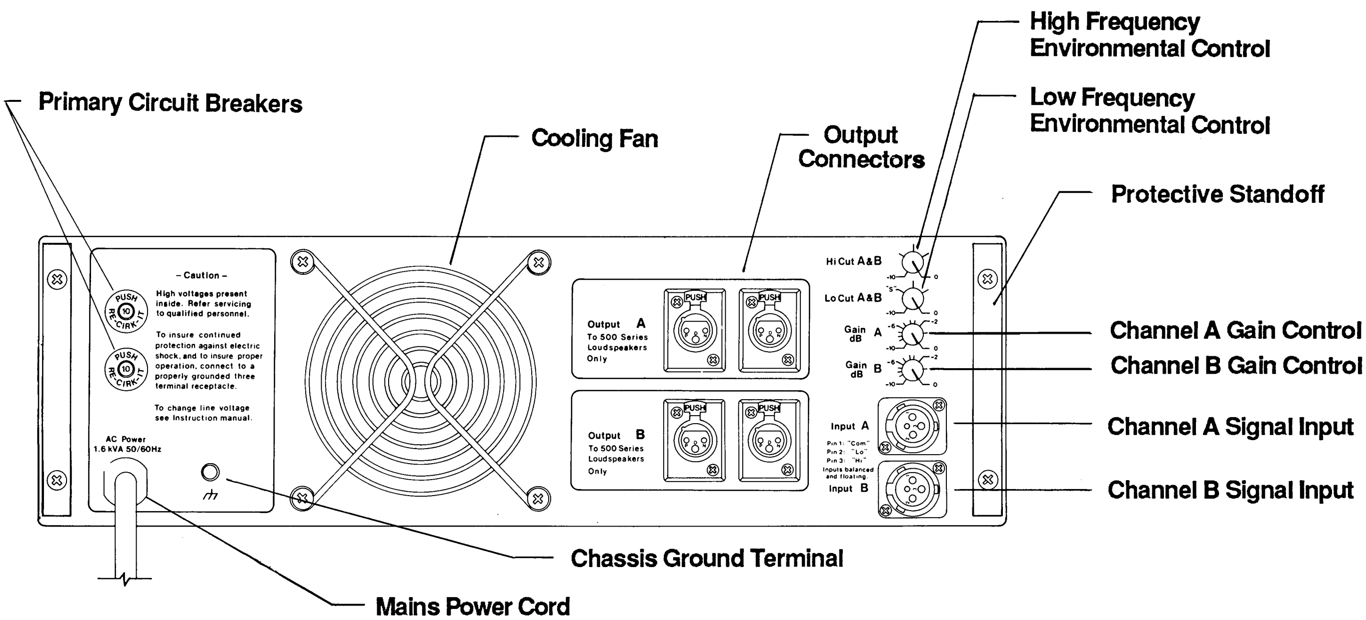


Figure 1-2 500 Integrated Stereo Amplifier Rear Panel

tially damaging fault condition is sensed by the 500 Amplifier protection circuitry. When the Fault indicator is lit, the amplifier will have automatically shut down to protect itself against the fault condition (see Section 2.4, "Troubleshooting").

Air Intake: The 500 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 foam dust filter which may be removed for cleaning. Blocking of the air intake — or inlet air temperature of greater than 45 degrees Centigrade (113 degrees Farenheit) — may result in an automatic thermal shutdown.

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

1.3.5 Rear Panel Controls and Connectors

Signal Input Connectors: XLR-type balanced floating signal inputs (pin 3 hot). Input impedance is 5k ohms unbalanced, 10k ohms balanced. (For complete information on the 500 System input circuit, see Section 3.1.)

Gain Controls: Single-turn calibration potentiometers with a gain adjustment range of 10 dB. The Gain controls are used to calibrate the 500 System for the nominal operating level of the signal source (see Section 2.1.4, "Setting the Amplifier Gain").

Lo Cut Environmental Control: A single-turn equalization control affecting the low-frequency response of both channels of the 500 System. At moderate settings, the Lo Cut circuit exhibits a shelving response with 3 dB per octave rolloff; at extreme cut, it introduces a 6 dB per octave highpass function. Turnover frequency is approximately 500 Hz. The Lo Cut control is used to adjust the system response for various boundary conditions (See Sections 2.2 and 3.6).

Hi Cut Environmental Control: A single-turn equalization control affecting the high-frequency response of both channels of the system. Response varies from 3 dB per octave at moderate settings to 6 dB per octave at maximum cut, and the turnover (-3 dB) frequency at maximum cut is 5 kHz. The Hi Cut control is used to set broad high-frequency equalization characteristics such as studio "room curves" and SMPTE theatre equalization curves (see Sections 2.2 and 3.6).

Note: When both Environmental Controls are set fully clockwise (knob pointer at 0 on the dial), the frequency response of any 500 Series full-range loudspeaker connected to the amplifier will be flat within ±3 dB from 40 Hz to 16 kHz in free field, measured on a third-octave basis with pink noise.

Output Connectors: Three-pin AXR-type receptacles for the 500 System loudspeaker connections. Two connectors are provided for each channel. The minimum allowable load impedance for each channel is 4 ohms. See Sections 2.1.1 and 3.2 for further information on loudspeaker connections.

Mains Power Cord: The inlet for AC power. The 500 Amplifier must be connected to a properly-wired grounded three-terminal receptacle with a circuit breaker capacity of 20 amperes minimum at 110 volts (10 amperes at 220 volts).

Chassis Ground Terminal: A screw terminal which is internally connected to the 500 Amplifier chassis and to the mains earth lead. This terminal may be used either for earthing an adjacent equipment chassis, or for earthing the 500 Amplifier 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 500 Amplifier.

Cooling Fan: The cooling fan is of all-metal construction, and is sealed against dust. Flow of air in the 500 chassis is from front to back. Do not attempt to reverse the air flow. This will cause damage to the power supply components.

Protective Standoffs: Rugged plastic supports protect the 500 Amplifier rear panel controls when the unit is placed on its back.

1.4 Summary of Operating Precautions

◊ Save this Owner's Manual and refer to it whenever you connect and operate your 500 System.

◊ 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 500 Amplifier power cord. Do not use the 500 Amplifier if the power cord appears frayed or broken.

◊ Do not spill liquids into or on the 500 Amplifier chassis.

◊ Do not block the fan intake or exhaust ports. Check the air intake filter periodically for dust accumulation, and remove and clean it if it becomes clogged.

◊ Do not operate the 500 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 500 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 500 Amplifier should be 14 gauge cable or larger.

◊ Never connect the 500 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 500 Amplifier is 4 ohms. Connection of more than four 500 Series loudspeakers (in any combination) to the 500 Amplifier will result in an automatic system shutdown.

◊ Never connect the 500 Amplifier outputs to the chassis or to mains earth ground.

◊ The 500 Amplifier output may be measured only with test equipment having a floating balanced input. Use of test equipment having a single-ended input will result in spurious readings and may damage the output MOSFETs.

◊ Any attempt to modify the components of the 500 System 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.

The information in this section is provided to guide you quickly through setting up and operating your 500 Series Loudspeaker System. Detailed application information for the 500 System may be found in Section III, below.

2.1 Connections

Read this section before connecting and operating your 500 System. Be sure to follow all precautions stated here and in Section 1.4. Particular attention should be paid to the power outlet requirements listed in Section 2.1.3.

The recommended procedure for connecting 500 Series loudspeaker systems is as follows:

1) Connect the loudspeakers to the 500 Stereo Integrated Amplifier using the cables supplied.

2) Connect the 500 Amplifier to a mains circuit with a breaker capacity of 20 amperes or more at 110 volts (10 amperes at 220 volts).

3) Connect the desired signal source to the 500 Amplifier inputs.

4) Set the 500 Amplifier gain controls for the output line level of the signal source (see Section 2.1.4).

5) Set the 500 Amplifier Low Frequency Environmental Controls to adjust for your chosen loudspeaker placement (see Section 2.2.1).

6) Turn on power to the signal source before turning on the 500 Amplifier.

The specific information necessary to perform these steps is given below. Refer to Figure 2-1 when making connections to your 500 System. Be sure to observe Left (A) and Right (B) channel assignments.

2.1.1 Loudspeaker Connections

A 10-meter loudspeaker cable is supplied with each 500 Series loudspeaker. If you require longer cable runs, loudspeaker cable wiring information is given in Section 3.2, below. If you are making your own loudspeaker cables, be sure to observe the precautions given in that section regarding cable gauge and polarity of the connector wiring.

2.1.2 Signal Input Connections

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 XLR-type connector pin assignments for the 500 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 ohmeter or continuity tester before making connections.

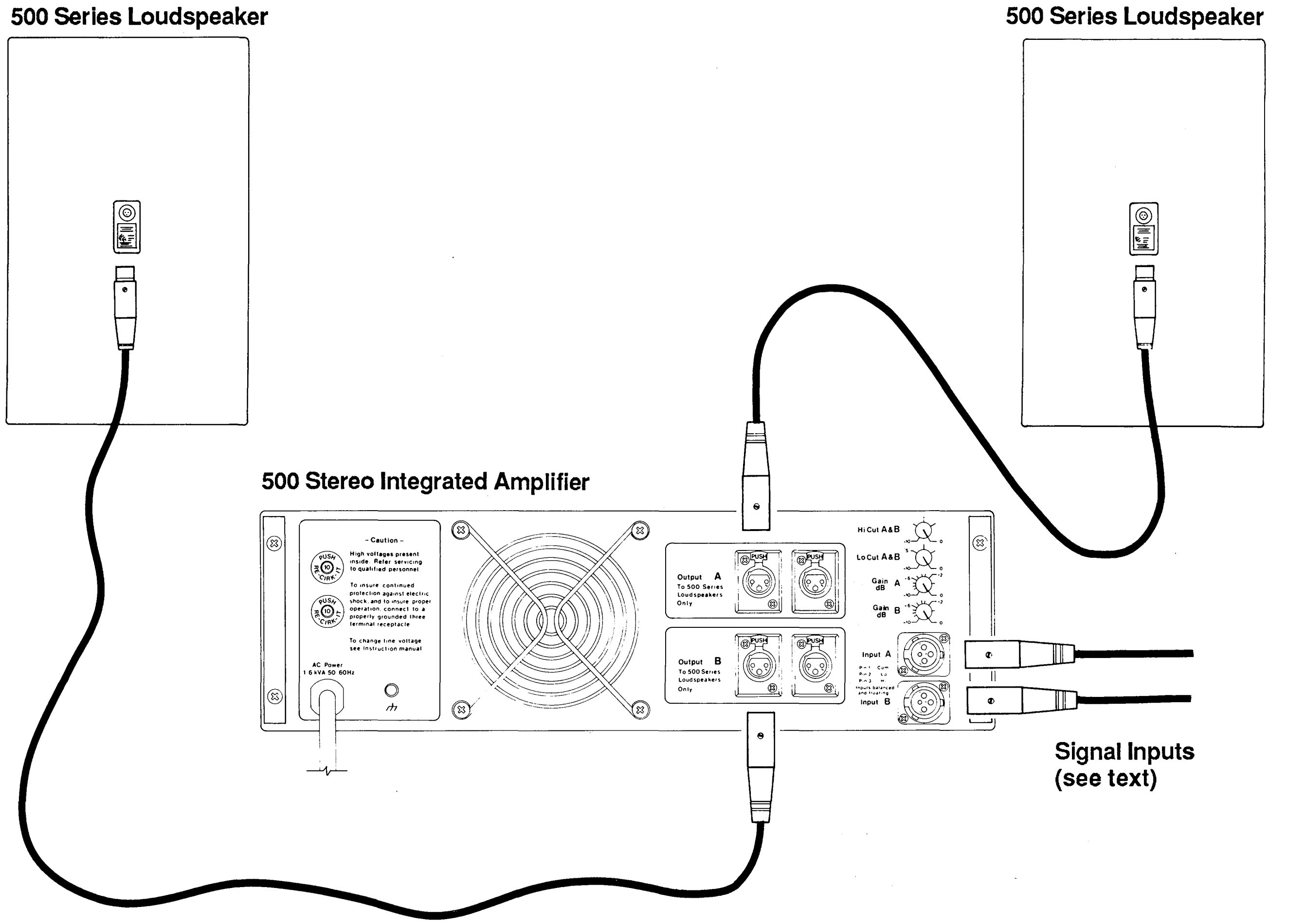


Figure 2-1 Connecting 500 Series Systems

Standard audio cables with XLR-type connectors may be used when connecting balanced signal sources to the 500 System **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 ohmeter or continuity tester to ensure 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 500 Amplifier has been designed to provide a high level of isolation and freedom from ground-loop-induced hum (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, below. If you are intending to use your 500 System in professional contracting, reinforcement or studio monitoring, turn to that section for information on input connector wiring.

2.1.3 Mains Power Connection

The 500 Stereo Integrated Amplifier draws a full 1.6 kVA from the mains in operation. For this reason, it must be connected to a mains circuit having breakers with a current capability of 20 amperes or greater at 110 volts (10 amperes at 220 volts).

To ensure proper operation and guard against potential shock hazards, the 500 Amplifier must be connected only to a properly- wired, grounded three-prong receptacle. Figure 2-2 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.

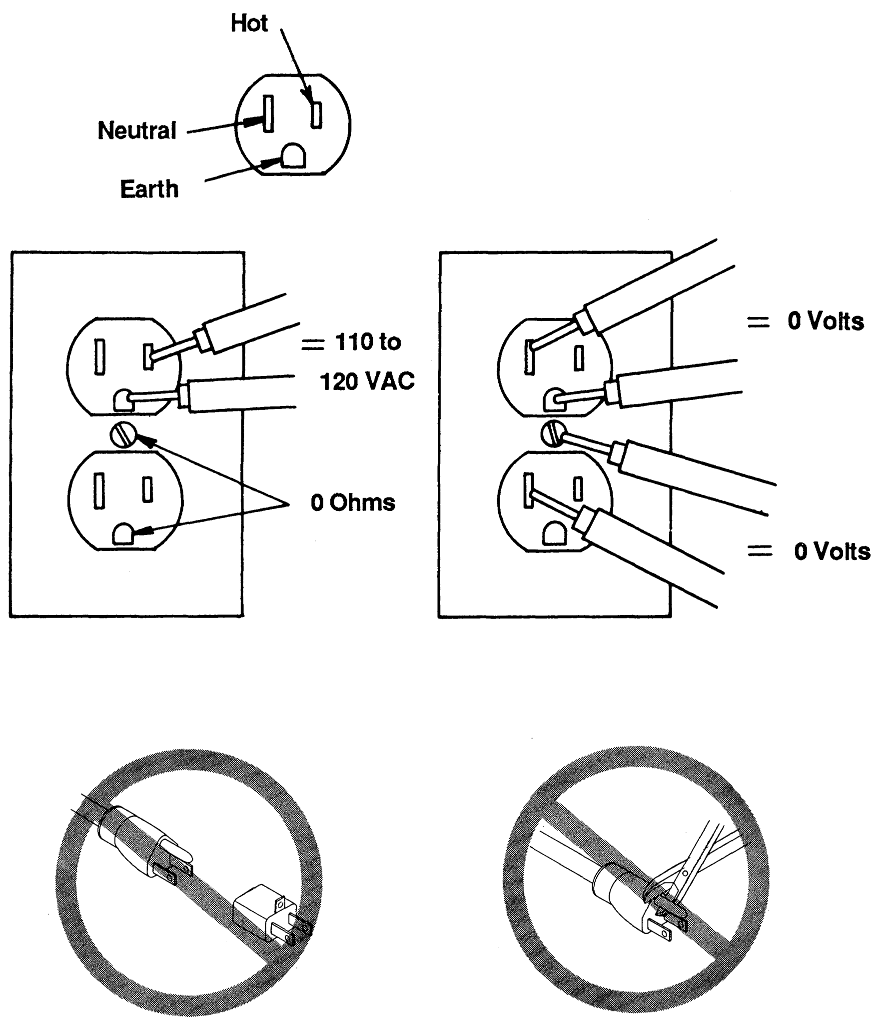


Figure 2-2 The Mains Connection

Never cut the ground pin from the 500 Amplifier power plug, and do not use a ground-lifting mains adapter unless absolutely unavoidable. If your mains circuit does not provide an earth ground, you **must** earth the 500 Amplifier externally by connecting a wire from the rear-panel chassis terminal to a good earth ground (such as a cold water pipe).

2.1.4 Setting the Amplifier Gain

The 500 Amplifier has been designed to accommodate either +4dBm or -10dBV input levels, allowing the use of high-quality consumer equipment (such as Compact Disc players or HiFi preamplifiers) as well as professional tape recorders and mixers. Adjustments for different source operating levels are made using the amplifier Gain controls, located on the rear panel above the input connectors (see Figure 1-2).

For professional (+4dBm) equipment, set the Gain control fully counterclockwise (gain setting of -10).

Since consumer and semi-pro equipment operates at a lower signal level (-10dBV) than professional equipment, the gain must be set higher. If you are using such equipment, set both Gain controls fully clockwise (the knob should point to the 0 mark on the dial).

Settings between the two extremes may be used to accommodate nonstandard operating levels.

2.1.5 Adding Subwoofers

500 Series subwoofers, available as an option from your Meyer Sound dealer, may be used to extend the power bandwidth of your 500 System and provide even lower distortion at high sound pressure levels. Two models are available: the Model 501, a utility cabinet designed for permanent installation; and the Model 518R, a compact roadworthy subwoofer for portable sound reinforcement. Each is fitted with an AXR-type connector, and plugs directly into the 500 Amplifier output as shown in Figure 2-3 (overleaf).

Note that this is a simple parallel connection: the subwoofer cabinet contains the necessary passive filter networks to provide a crossover to the full-range loudspeaker. If you desire, you may connect the subwoofer in parallel at the full-range cabinet, using a 'Y' connection — but the loudspeaker cable used to connect to the 500 Amplifier should then be 12 gauge minimum, and cable runs should be limited to a maximum of 100 feet. Refer to Section 3.2 when wiring loudspeaker cables.

Special placement restrictions apply to the Model 518 Subwoofer. See Section 3.3.2 for further information.

2.2 Placement and Adjustments

The 500 Series is designed to provide excellent performance in a wide variety of locations. Sound behaves according to the laws of physical acoustics, however, and good audio practice takes those laws into account. For this reason, certain simple rules must be followed when setting up your 500 System.

In stereo playback systems, the 500 Loudspeakers will perform best if they are placed 8 to 10 feet apart. Angle the speakers slightly inward

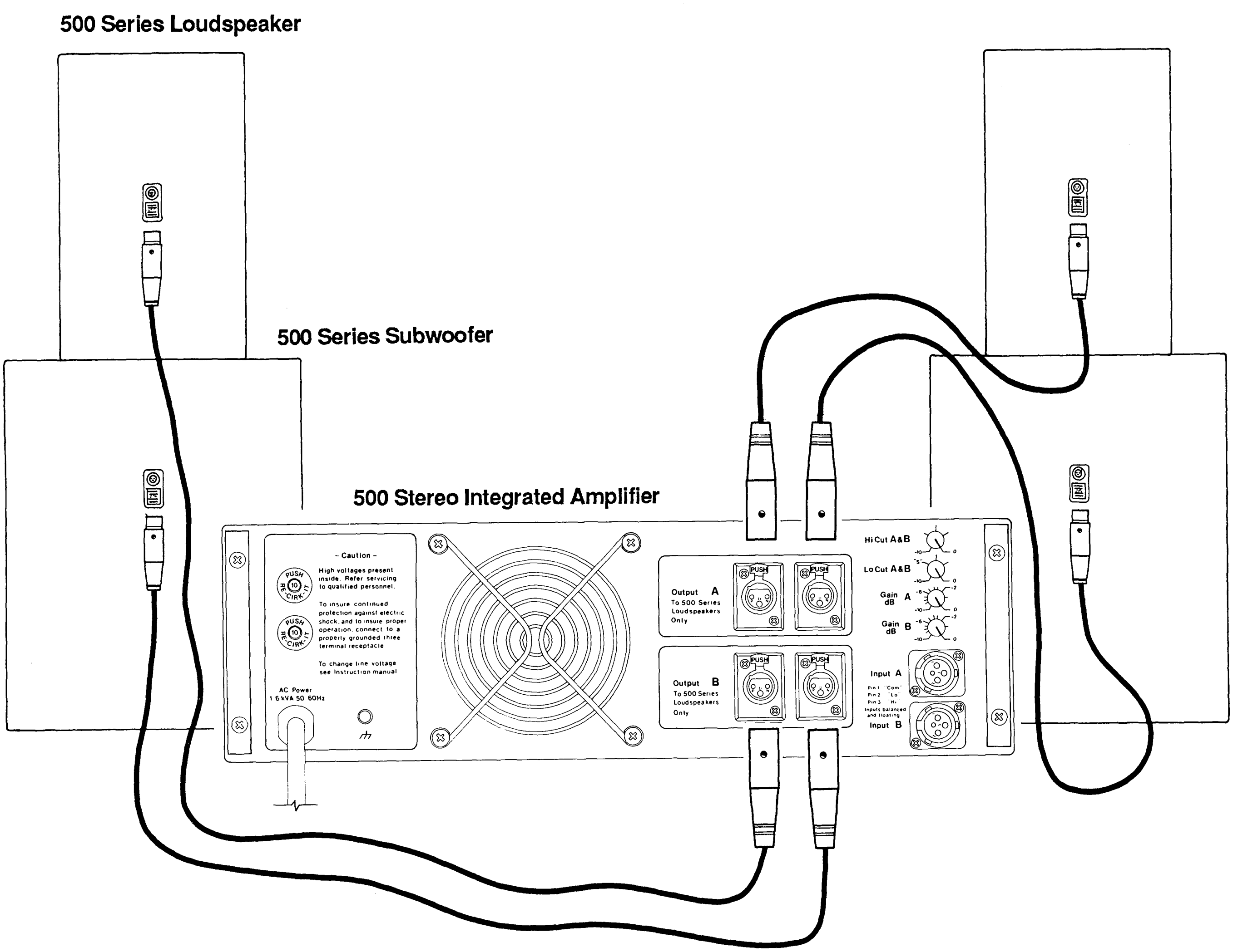


Figure 2-3 Adding Subwoofers

to get good coverage of the listening area. Speaker stands may be used if desired. If you are using subwoofers, you can place the speakers on top of, or next to, the subwoofers (see Figure 2-4).

For best performance, loudspeakers should be placed in similarly structured locations. For example, don't put one loudspeaker in a corner and hang the other in the middle of a wall: either put each loudspeaker in a corner, or hang both. Take care to ensure

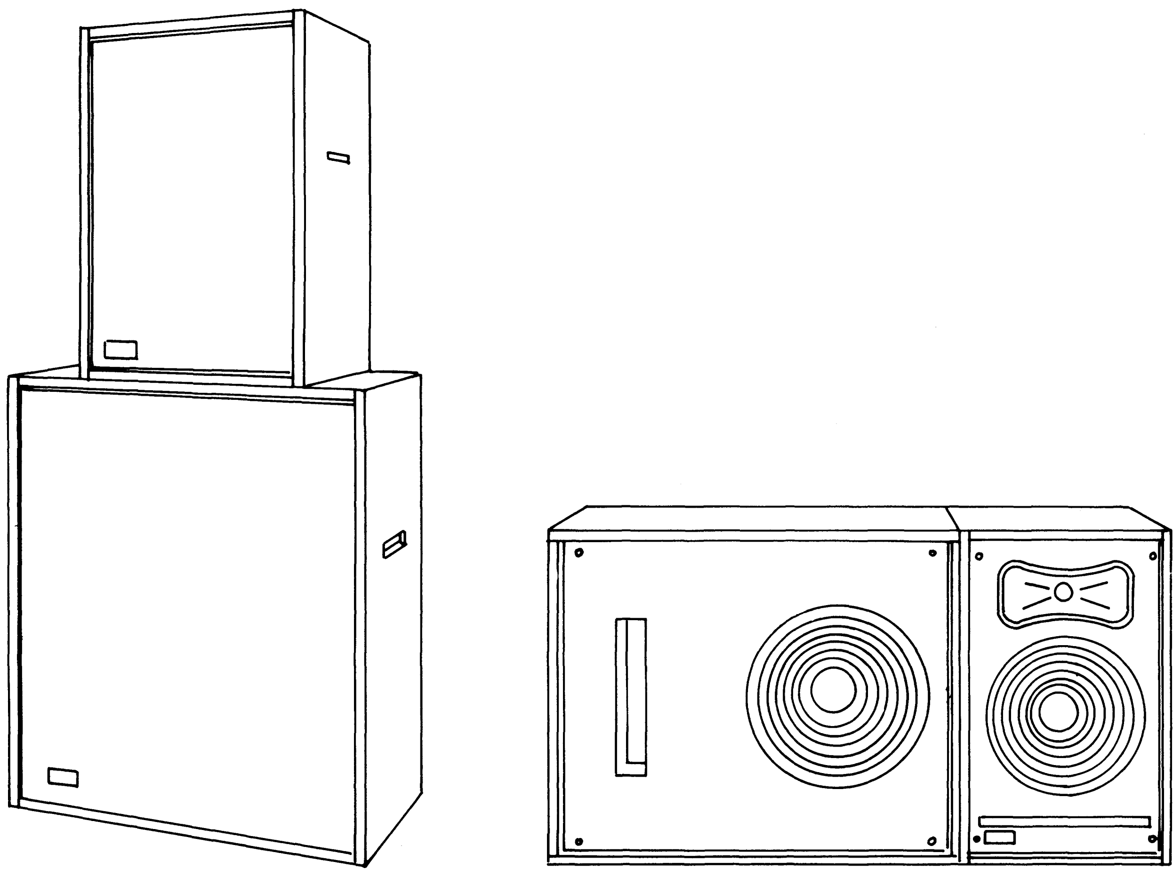


Figure 2-4 Stacking With Subwoofer

that the listening area lies within the 40° by 80° coverage pattern of the loudspeakers.

In reinforcement and contracting applications, sound systems are rarely operated in stereo. Since the same signal is normally applied to all the speakers, there is a greater potential for interference. If the speakers are placed less than 15 feet apart, then, they should not be angled into the same coverage area. If the speakers are placed side-by-side, they should be splayed so that there is a minimum 80° angle between the adjacent cabinet faces, each being aimed to cover a separate area.

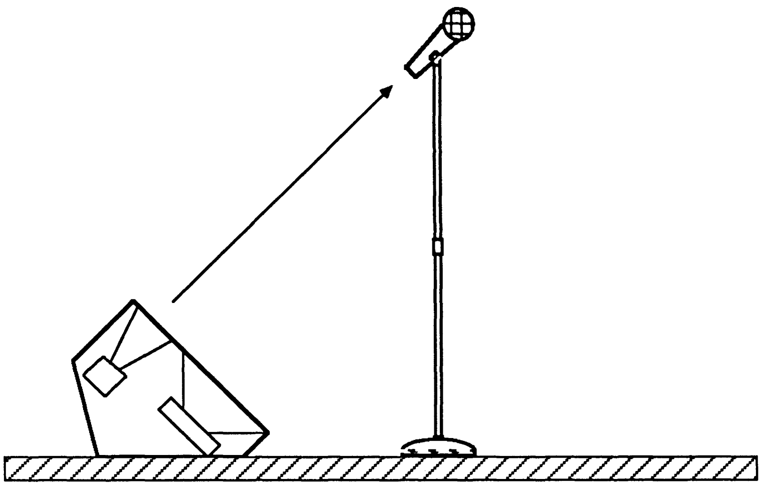


Figure 2-5 Stage Monitor Placement

Stage monitors are normally placed on the floor near the base of the microphone stand, aimed so that the performer is on axis of the high-frequency horn, as shown in Figure 2-5. The 500RW is designed for this application.

To control feedback, cardioid microphones are invariably used onstage. Figure 2-6 illustrates a typical cardioid microphone pickup pattern. Notice that the microphone is most sensitive to sound arriving in the forward direction. The rearward pickup lobe (indicating some sensitivity to sound arriving from directly behind the microphone) typically occurs at 5 kHz and above.

For the best gain before feedback, the 500RW should be placed so that it lies in the maximum rejection area of the microphone's pickup pattern, as indicated by the arrows in the figure.

Further details regarding loudspeaker installation may be found in Section 3.3.

2.2.1 Low-Frequency Adjustments

Since sound is reflected by rigid surfaces (such as walls, floors and ceilings), the performance of any loudspeaker is affected by the boundaries and shape of its environment.

Placing a loudspeaker on or near a hard surface will cause reinforcement of its sound output, resulting in an increase in level. But the effect is not consistent at all frequencies: the increase in

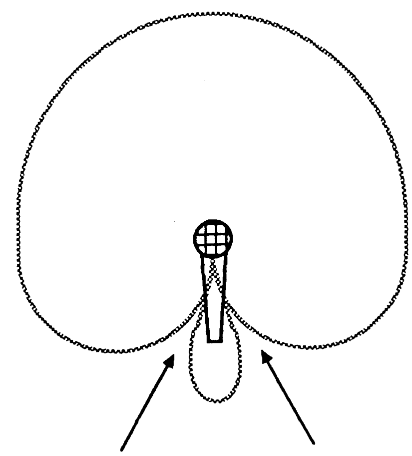
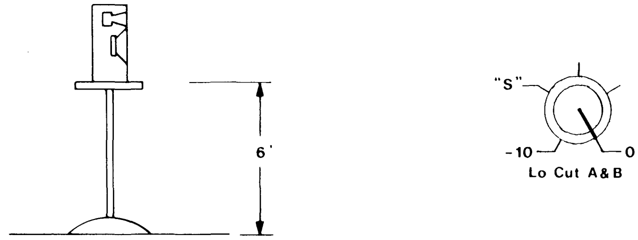


Figure 2-6 Cardioid Microphone Pickup Pattern

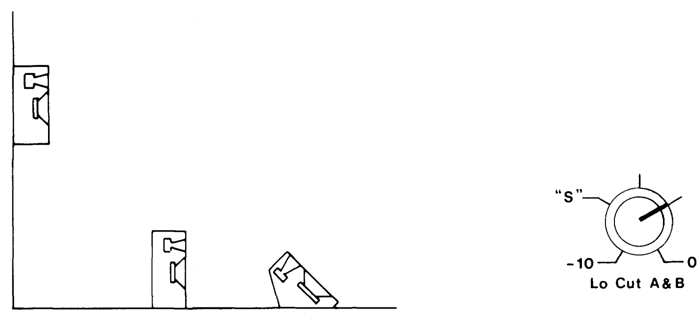
level will be greatest at low frequencies, and will diminish at higher frequencies. Above about 1kHz, the effect is negligible.

As a result, if you place a loudspeaker near a wall (this is called "half-space loading"), its frequency response will change, and the sound will appear to have more bass energy. The effect is greater when the speaker is placed at a wall-floor junction ("quarter-space loading"), and still greater if it is placed in a corner ("eighth-space loading"). To achieve flat frequency response, then, loudspeakers placed on or near a boundary surface normally require equalization.

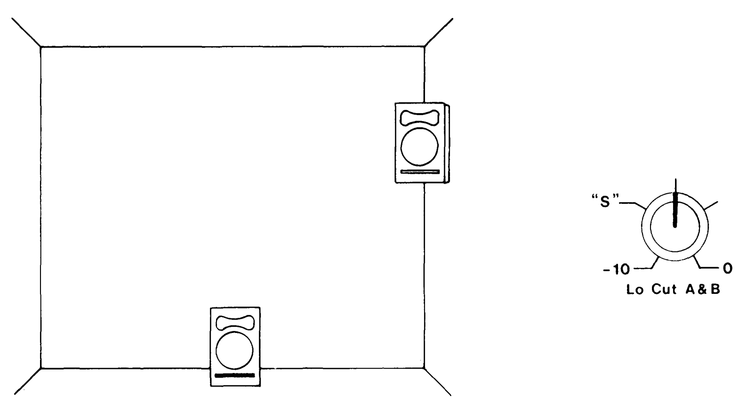
The 500 Stereo Integrated Amplifier incorporates frequency response controls termed "Environmental Controls." One is a Lo Cut control, and the other is a Hi Cut. Both are located on the rear panel (see Figure 1-2 on page 5). These controls affect both channels at the same time: when they are set fully clockwise (knob pointers at "0" on the dial), any 500



Free-Field Environment

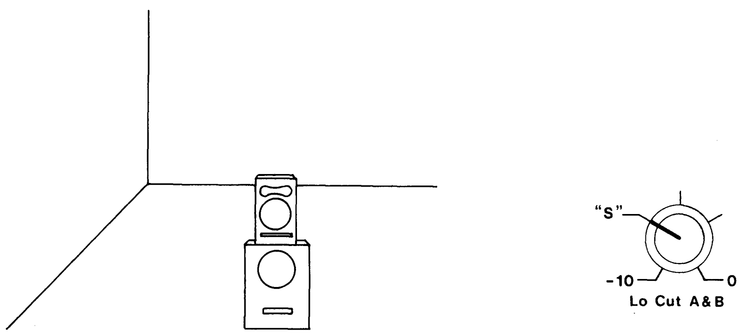


Half-Space Environment
(Single Boundary)

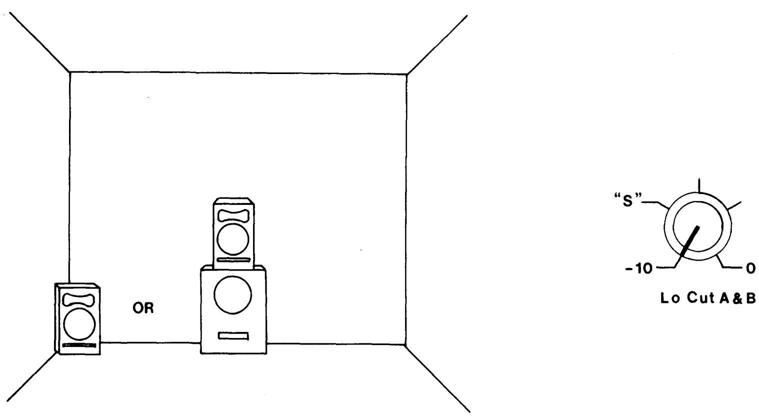


Quarter-Space Environment
(Double Boundary)

Figure 2-7 (A) Adjusting the Low-Frequency Environmental Control to Compensate for Boundary Conditions



500 Series Full-Range Loudspeaker with Subwoofer
Half-Space Environment



Eighth-Space Environment (Triple Boundary)
OR
500 Series Full-Range Loudspeaker with Subwoofer
Quarter-Space Environment

Figure 2-7 (B) Low-Frequency Adjustments with Subwoofers

Series full-range loudspeakers connected to the amplifier will exhibit flat frequency response in free field (outdoors, with no reflective boundaries).

The Lo Cut control is used to compensate for the bass buildup caused when a 500 Series loudspeaker is placed near a boundary or boundaries. Figure 2-7 illustrates the proper settings for various boundary conditions and loudspeaker combinations. When you have placed your loudspeakers where you want them, find your placement configuration in the figure and set the Lo Cut control as indicated.

The Lo Cut control may also be used to improve intelligibility and vocal blend in stage monitoring applications. For example, when a directional microphone is placed very close to the sound source (as is very often the case with on-stage vocal mikes), its low frequency response becomes accentuated, creating a boomy, bass-heavy sound. This phenomenon is known as "proximity effect." By adjusting the Lo Cut control, you can compensate for the exaggerated bass response, creating a more natural sound for the performers.

2.2.2 High Frequency Adjustments

The effects of boundary conditions at high frequencies tend to be far more complex than they are at low frequencies, because the wavelengths are far shorter at high frequencies. Typically, high-frequency effects take the form of complex comb-filtering caused by multiple reflections, resulting in closely-spaced ripples in the frequency response. Such anomalies are not easily equalized.

Often, however, specific applications call for specific types of general high-frequency rolloffs. In most recording studios, for example, the control room monitors are rolled off at a rate of 3dB per octave above about 5 kHz; this characteristic is referred to as a "house curve." Cinema projection standards dictate an even steeper high-frequency rolloff. The Hi Cut Environmental Control of the 500 Amplifier is designed to accommodate such requirements.

The Hi Cut Environmental Control may also be used in playback applications to adjust for the varying quality of commercial recordings. For example, engineers have traditionally introduced high frequency boost to their recordings, with the intention of compensating for a loss of highs in the record mastering process. There is no such loss in the Compact Disc production process, however, so CDs sometimes sound bright and harsh when played on a flat system. In such a case, you may find that adjusting the Hi Cut control to introduce a small amount of high frequency rolloff will result in a more natural and pleasing sound quality.

Similarly, you may wish to use the Hi Cut control in stage monitoring applications, to adjust the system high-frequency response according to taste. For control of feedback, however, more sophisticated equalization techniques should be employed (see Section 3.6).

2.2.3 High Power Loudspeaker Configurations

On occasion, circumstances arise where high levels of continuous output, and the ability to "throw" the sound over long distances, are needed from a loudspeaker system. This is normally the case in outdoor sound reinforcement, for example, or in rock club instal-

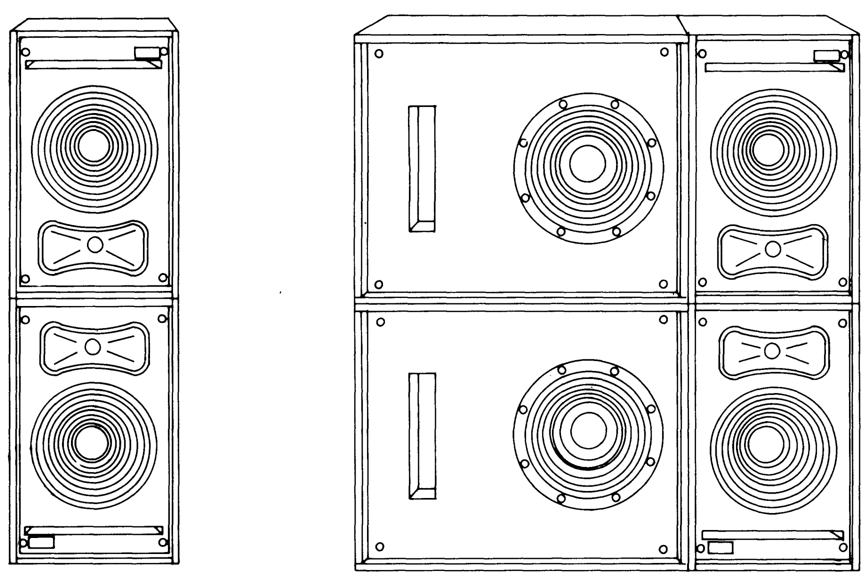


Figure 2-8 (A) High-Power "Monoblock" Configurations

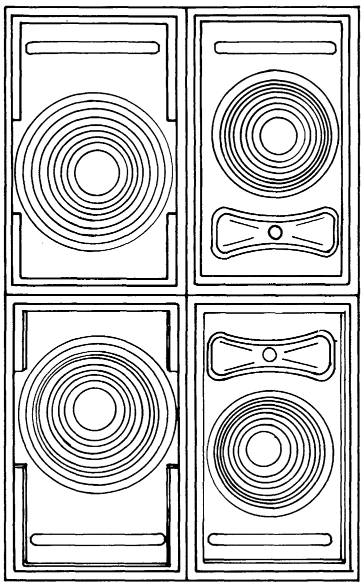


Figure 2-8 (B) With 518R Subwoofer

lations. In such applications, the loudspeaker configurations shown in Figure 2-8 may be used.

Note that, in these speaker configurations, the 500 or 500R Loudspeakers (and, optionally, 501 or 518R Subwoofers) are stacked as a single block. The high frequency horns are placed together, so that they couple to approximate a single horn. When the speakers are placed in this manner, the vertical dispersion of the system narrows to approximately 30 degrees (±15 degrees). This gives the system the ability to "throw" the sound farther, since the sound waves disperse less quickly as they travel through the air. It also increases the on-axis sound pressure level by 6 dB (double the pressure). (This is the equivalent of quadrupling the amplifier power being fed to the loudspeakers.)

All speakers in a single high-power block must be fed exactly the same signal for these configurations to work. If you are using two amplifier channels for a single block, then -- as would be the case for a high-power block with subwoofers -- you must 'Y' the input signal to both channels of the 500 Amplifier.

2.3 Operation

Before turning on the 500 Stereo Integrated Amplifier, make sure that your signal source is plugged in and turned on: this will avoid annoying pops through the loudspeakers.

When you first turn on the 500 Amplifier, you will notice that the fan comes on at high speed for approximately 10 seconds, then drops to low speed. This cycle helps clear accumulated dust from the chassis, and also serves as a check that the fan speed control circuitry is operating properly. If your amplifier does not go through this cycle at turn-on, return it to be checked by your Meyer Sound dealer.

You will also notice that the 500 Amplifier generates a transient through the loudspeakers, both at turn-on and at turn-off. This is entirely normal for the 500 System, and poses no threat to the loudspeakers.

In normal operation, the front-panel Sense indicators should light whenever there is signal present. At higher listening levels, the Overload indicators will flash on program peaks. If the Overload indicators are lit continuously, you are operating the system at too high a level. Unless the input level is reduced, the 500 Amplifier will shortly shut itself down and go through an automatic rest cycle.

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 2.4, "Troubleshooting," below. If servicing is indicated, contact your Meyer Sound dealer.

2.4 Troubleshooting

The Meyer Sound 500 Series 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 have need of the information given here. Nonetheless, it is recommended that you study this section in order to understand how the 500 Amplifier responds to fault conditions, and know what corrective action to take in the event of an apparent (or real) system malfunction. In the event that service is required, contact your Meyer Sound dealer.

Below is a logical table for use in troubleshooting 500 Series systems.

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 or flashing.	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

Problem	Symptom	Probable Cause	Action
(No sound)			supply of air at front and good exhaust path at rear.
	Fault indicator flashing, Overload indicator lit	Overload shutdown	Turn down or disconnect signal source. Wait. Amplifier should reset in approximately 35 seconds. Resume operation at a lower level.
	Power switch on and lit, Fault indicator on continuously (with input signal applied)	Output short	Disconnect speaker cables. If Fault indicator goes out and Sense indicators light, check speakers and cables.
		Load Impedance too low	Check that no more than two loudspeakers. are connected to each output. If not, have speakers serviced.
	Fault indicator remains lit when speakers and source are disconnected	DC on output	Have amplifier serviced.
Low sound levels		Insufficient drive from signal source	Increase source output level.
		Amplifier gain incorrectly set	See Section 2.1.4 of this manual.
Distorted sound at low levels		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.

Problem	Symptom	Probable Cause	Action
(Distorted sound at low levels)	Source OK	Damaged speaker or amplifier malfunction	Swap or replace 500 Loudspeakers. If problem stops, service speakers. If problem stays, service amplifier.
Intermittent sound	Sense indicators lit when sound stops	Bad speaker con-nection	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.
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 amplifier 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 amplifier serviced

This section presents detailed application information about the 500 Series for use by contractors, consultants and other audio professionals. For overseas users, instructions on 220 volt operation may be found in Section 3.4.

3.1 Input Connector Wiring

The 500 Amplifier input stage has been designed to provide a higher level of isolation and freedom from ground-loop-induced hum than has been previously achievable. In order to take full advantage of the capabilities of this new type of input stage, specific wiring practices must be followed.

This section describes the capabilities and advantages of the 500 Amplifier input circuit, and details the connector wiring practices that will enable you to best utilize those attributes. The connection configurations given here should be particularly attractive to those intending to use the 500 Series in permanent installations such as theatre sound systems.

3.1.1 The 500 Amplifier Signal Input

The 500 Stereo Integrated Amplifier features a unique new input circuit (patents applied for) which constitues 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 500 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 components.

The transformers used in the 500 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 500 Amplifier input stage is held to under .01% (even at 10 volts), and phase shift at 20 kHz (without TIM filter) is less than 10 degrees. Since they employ a humbucking design, the transformers do not require costly, heavy external shielding in order to maintain immunity from hum.

Perhaps most important from the standpoint of professional audio applications, however, is the fact that the 500 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 500 System. 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 level from the 500 System. Only the output polarity will vary. (Note that push-pull output

Signal Source Output Configuration	Wiring of 500 Amplifier Input Pin 1	Pin 2	Pin 3	Polarity	Comments
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	-	

Figure 3-1 500 System Input Truth Table

drivers produce 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 signal "hot" directly to the input connector shell. In fact, driving any two input pins will work, with the gain of the amplifier remaining the same: only the signal polarity will be affected. This unique attribute allows the 500 Amplifier to accommodate virtually any three-pin connector "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.

3.1.2 Hum-Free System Design

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 allowing 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 500 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 500 Amplifier input is linked to the connector shell, it will be literally impossible for ground loops to form. Several 500 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 500 Amplifier input connector. Even in relatively complex systems, the isolation between components will be as good as that provided by opto-isolators since each 500 System can operate as a self contained, floating unit.

In short, the 500 Amplifier input circuit allows audio professionals to design systems that are within the budgets of their clients, while attaining the freedom from hum and ease of use that is normally associated only with expensive, transformer-isolated professional equipment.

3.1.3 Connections to Standard Audio Equipment Outputs

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. In this case, static potentials and RFI are kept entirely separate from the signal path. This is the philosophy on which the balanced connections given in this Section are based.

Note that, in all cases, the following connection instructions assume that the 500 Amplifier chassis is connected to earth ground. If a grounded mains 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 500 System works very well with "standard" audio cables (again, as long as no pin is linked to the connector shell) — and 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 (overleaf) illustrates the cable wiring scheme to use when the 500 Amplifier is to be driven from a source having a transformer-isolated output. (The center tap may or may not be present, depending upon the design of the source equipment; in any event, it is not used.) The 500 Amplifier input is wired in a floating differential configuration (sometimes called an "instrumentation input"). While this figure shows the signal input wired

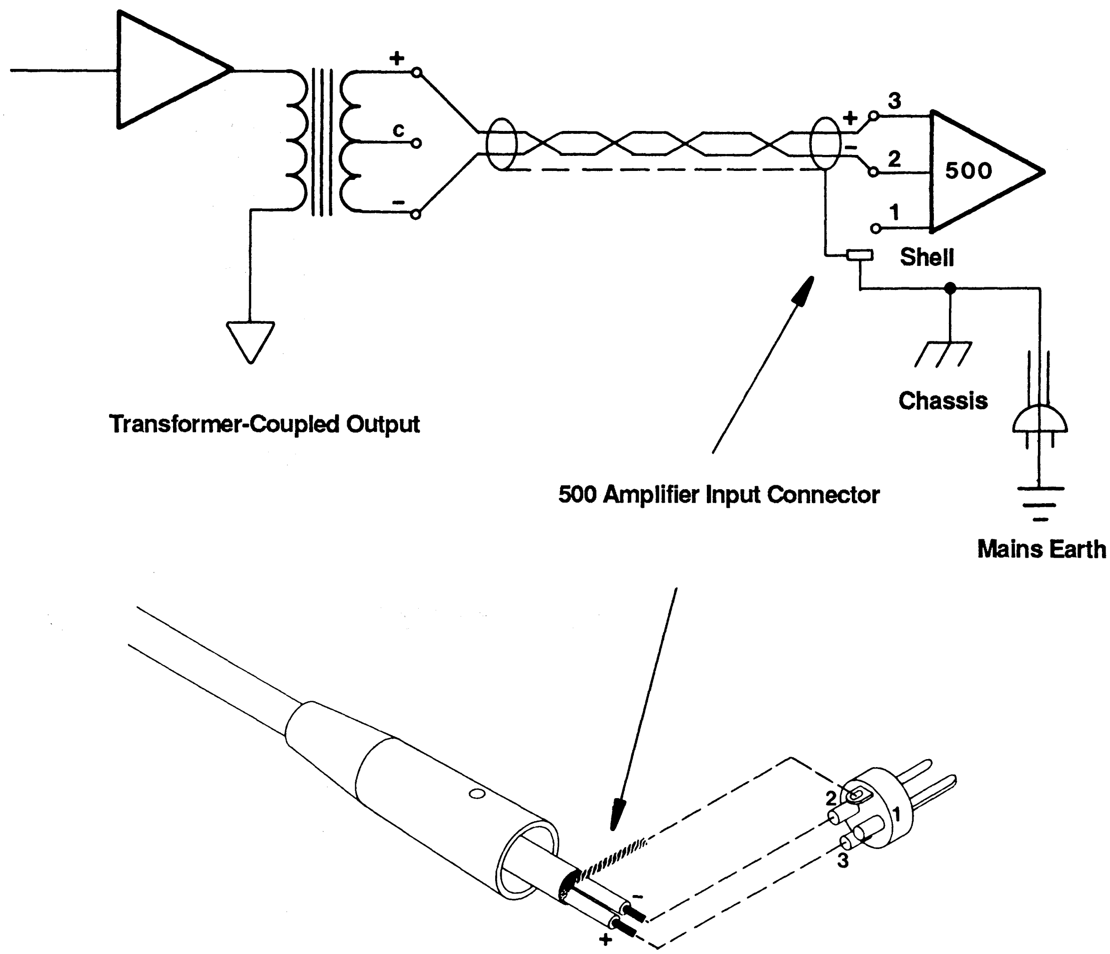


Figure 3-2 Transformer-Coupled Output Stage Connection

to pins 2 and 3, any combination of input pins may be used with no change in gain. The connection shown yields best performance, however.

Note that the cable shield is connected only to the shell of the 500 Amplifier input connector, so RFI and static potentials in the shield drain directly to earth. There is no ground loop path, regardless 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 a source having a push-pull output (as do

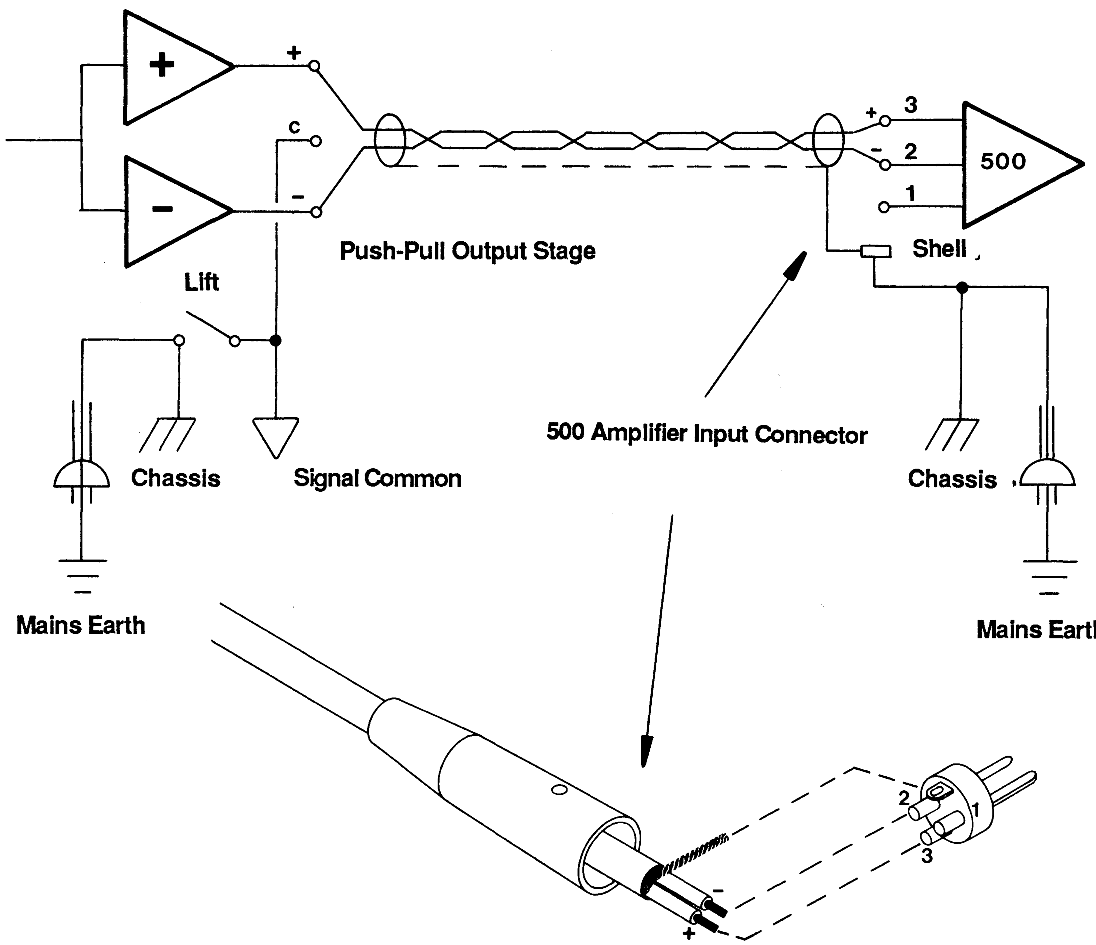


Figure 3-3 Push-Pull Output Stage Connection

all Meyer Sound electronic products). The same observations apply to this figure as to Figure 3-2. The push-pull output stage provides 6 dB greater drive than does the transformer output, however (all other factors being equal). This may be compensated by dropping the gain of the 500 Amplifier, if desired. 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, the connectors should be wired as shown in Figure 3-4. In

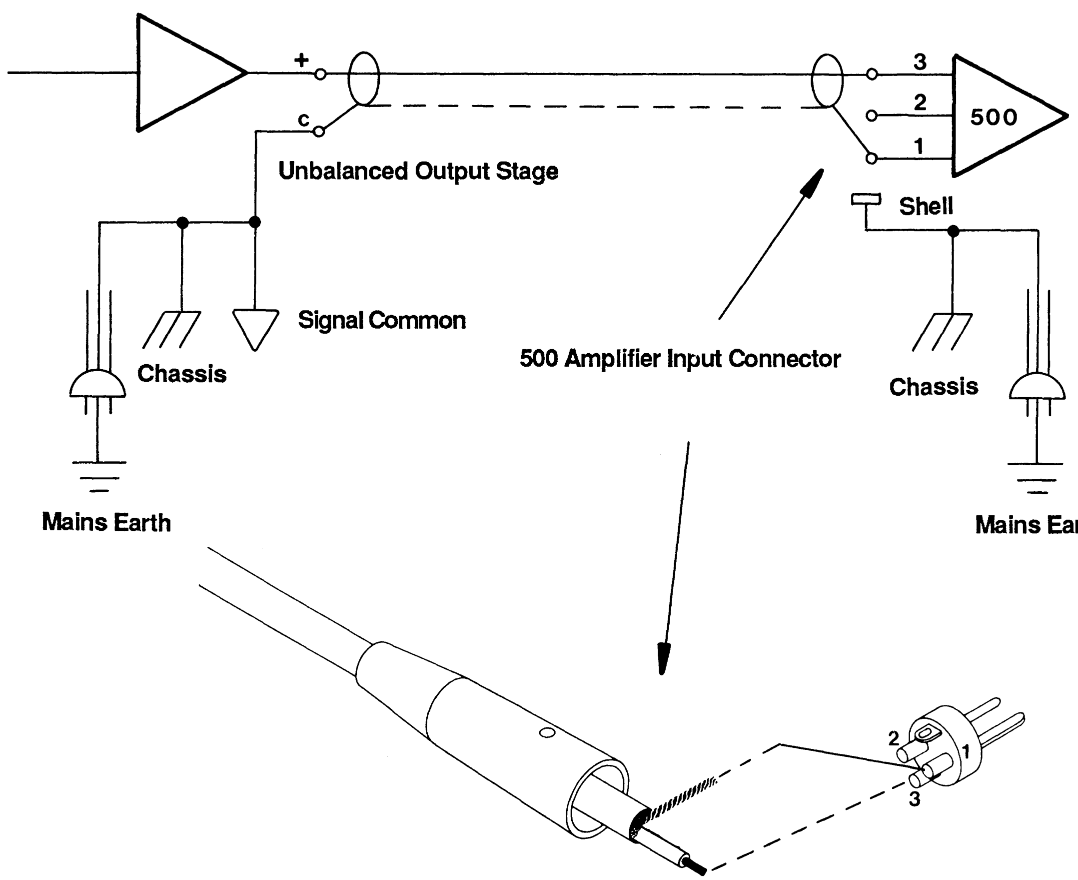


Figure 3-4 Unbalanced Output Stage Connection, Single-Conductor Shielded Cable

this case, the connection between signal common of the source and earth provides the path by which RFI and static potentials in the shield are drained. 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 -

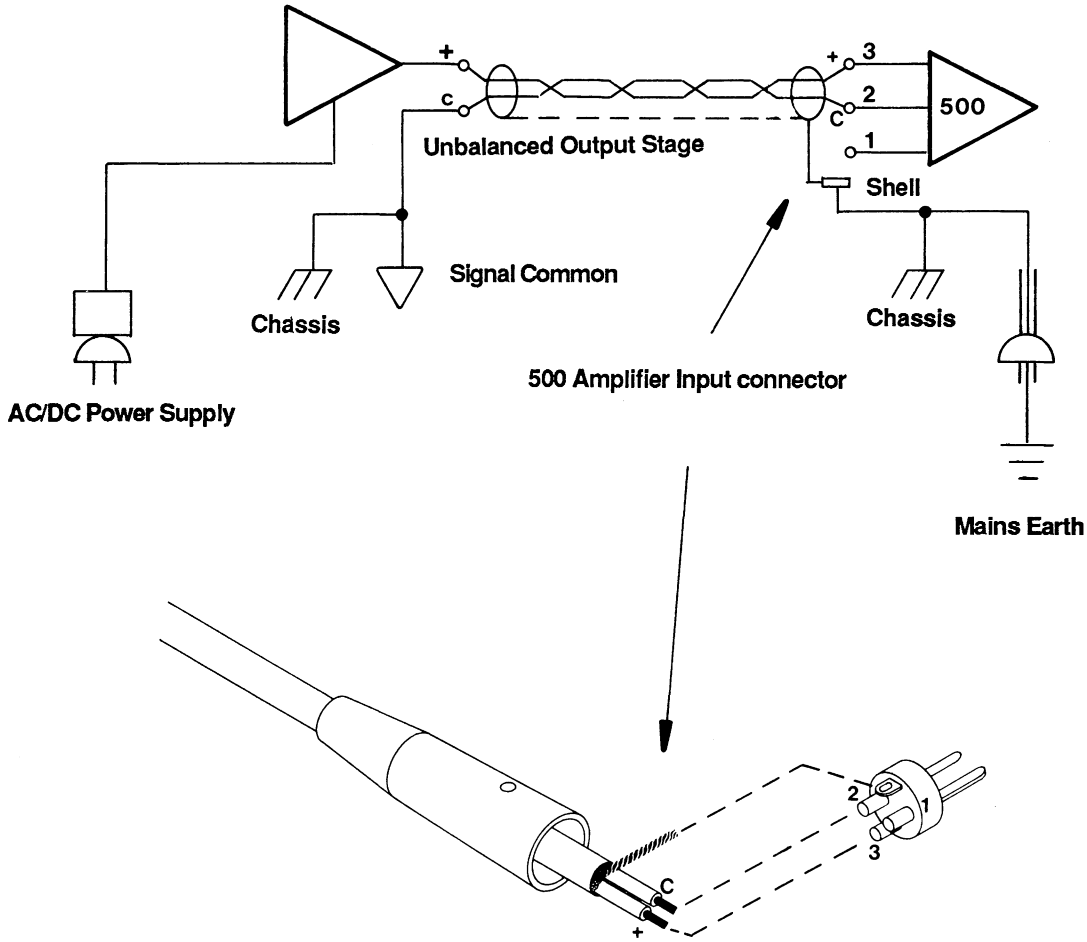


Figure 3-5 Achieving Balanced Performance With Unbalanced Equipment

or for other reasons floats from earth - should be connected in this manner, so that there is a path from the shield to earth. (This scheme is particularly effective with battery-operated Compact Disc players and other high-quality floating unbalanced equipment.) Note, however, that even if signal ground of the source is connected to earth, there still is no ground loop. This connection scheme may therefore be used for all unbalanced equipment, and will yield balanced performance since the shield is not connected at the source output.

3.2 Loudspeaker Connector Wiring

All loudspeaker connections in the 500 System are made using locking three-pin AXR-type connectors. The two pins which are used for loudspeaker connections (labeled 'N' and 'P' respectively) are rated at 25 amperes (the maximum current in each conductor of the 500 System loudspeaker cable is about 7 amperes RMS, 10 amperes peak). The third pin, which has a lower current rating, is intended for use as a drain connection. In the case of the 500 Amplifier outputs, this pin is connected to the chassis.

Figure 3-6 illustrates wiring of the AXR connector for the 500

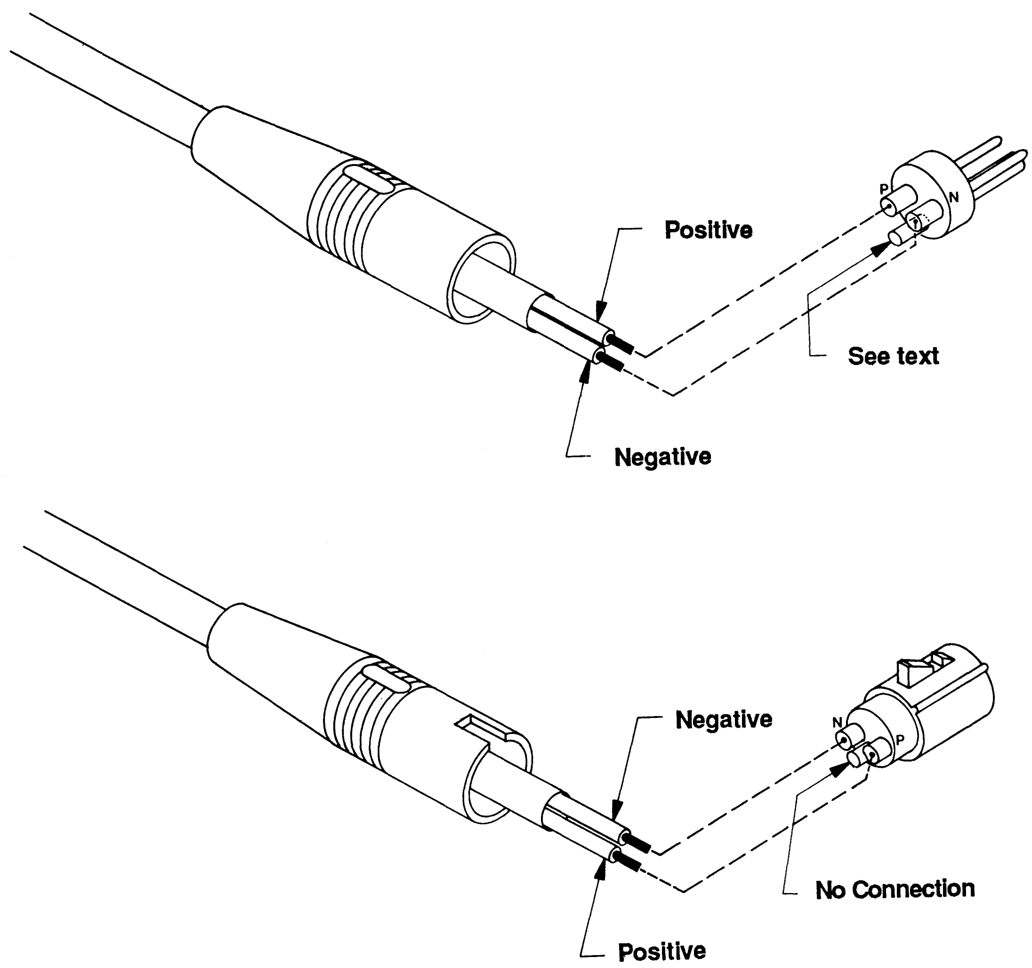


Figure 3-6 Wiring Loudspeaker Connectors

Series. If you are using shielded speaker cables, connect the shield to the drain pin at the amplifier end (male AXR connector).

The minimum wire size for loudspeaker connections in the 500 Series is 14 gauge. For runs longer than 100 feet, use 12 gauge cable.

If you are augmenting your system with subwoofers, it is recommended that you run separate cables from the amplifier to the subwoofers. If you wish to wire the subwoofers in parallel using a 'Y' connection at the loudspeakers, then limit your cable runs to 100 feet or less and use 12 gauge cable.

Note: The minimum allowable load impedance for the 500 Amplifier is 4 ohms. Connecting more than four 500 Series Loudspeakers (in any combination) to the 500 Amplifier will result in an automatic system shutdown. Do not wire loudspeakers in series.

You may find that there will be very little difference in sonic quality when audiophile-type loudspeaker cables are used with the 500 System — even though you may have found that such cables audibly improve the sonic characteristics of conventional systems. This is because the 500 Amplifier 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 feedback scheme employed in its design (see Section 4.2.2).

3.3 Loudspeaker Installation

The 500 and 501 Loudspeakers are the preferred 500 Series components for permanent installation, since they are specifically designed for sound contracting use. The cabinets are finished in a textured black primer coat that accepts most common paints and adhesives, so they may be finished with paint or veneer to match the requirements of your installation.

If you are installing either or both units in a sofit, we urge you not to remove the components from the cabinet and substitute an alternate enclosure. The 500 and 501 enclosures are integral to the system design. Their characteristics are carefully controlled in the manufacturing process, and the signal processing electronics in the 500 Amplifier are tailored to those characteristics. On the other hand, surrounding the cabinets with a secondary enclosure will not affect the system response, so the performance of the 500 System will be preserved.

The 500R, 518R and 500RW Loudspeakers are designed for portable use, and are better suited to temporary installation. They are finished with a highly durable two-part paint; if you wish to refinish them, first sand the cabinet surfaces so that the new finish will adhere well.

3.3.1 Hanging Instructions

Since the 500 Series is equalized for flat frequency response in free field, systems can be "flown" without requiring external equalization. Provision has been made for the installation of hanging hardware, as shown in Figure 3-7: the cabinets are reinforced on the sides at the top and bottom with a secondary internal layer of 3/4-inch plywood. For maximum convenience, use flush-mounted rigging hardware with mating quick-disconnect fittings.

Figure 3-8 illustrates the positions where hanging hardware may be located on the 500 and 500R cabinet in order to get various degrees of cabinet tilt. For greater degrees of tilt, pullback lines can be run to separate hardware installed at the bottom of the cabinet sides.

When installing hanging hardware, be sure that the hardware joint is well sealed. Air leaks resulting from improperly installed hardware will cause extraneous noises at moderate-to-high sound pressure levels.

Hanging hardware must be rated to sustain the full weight of the system with an adequate safety margin. Refer to the manufacturer's documentation for the hardware that you intend to use -- and applicable mechanical engineering standards -- to determine the suitability of the hardware. Meyer Sound bears no responsibility for direct or consequential damages arising from the use of incorrect hanging hardware.

The handle cups also may be used to hang the 500 Loudspeaker or 501 Subwoofer, using either hooks or expansion hardware. It is **not** advisable to hang any of the 500 Road Series units by the handles, however, since the handles are not integral to the cabinet sides and may become weakened by impact during hard road travel.

3.3.2 Subwoofer Placement

501 Subwoofers: The 501 Subwoofers need not be placed directly next to the 500 Loudspeakers. Since they

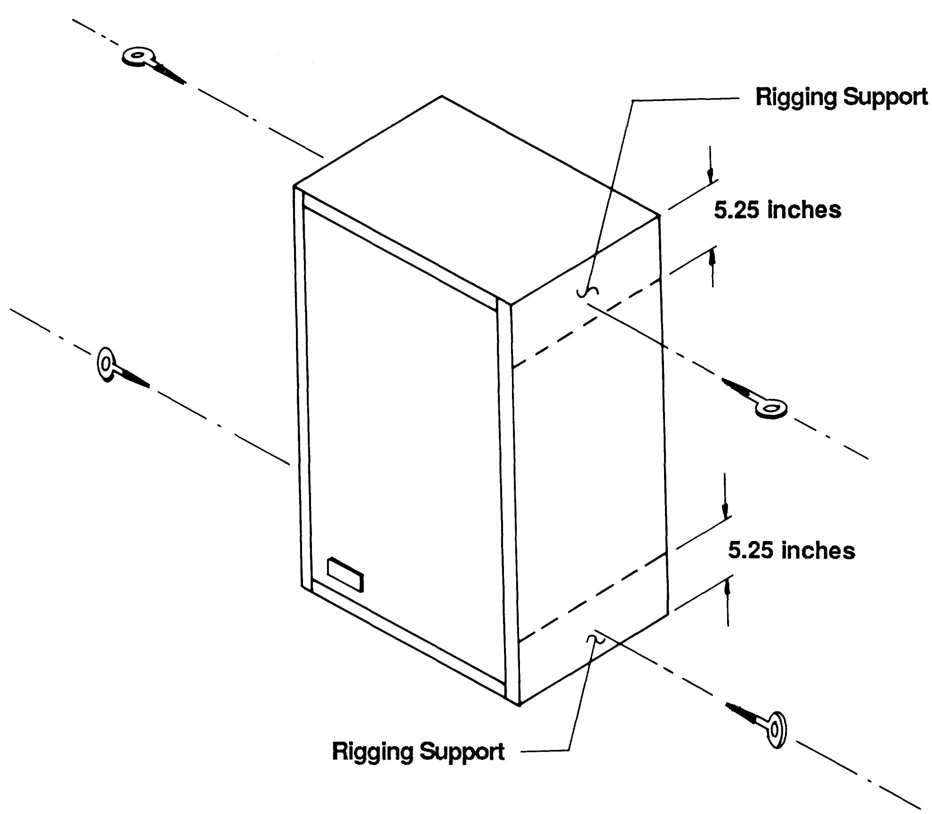


Figure 3-7 Installing Hanging Hardware

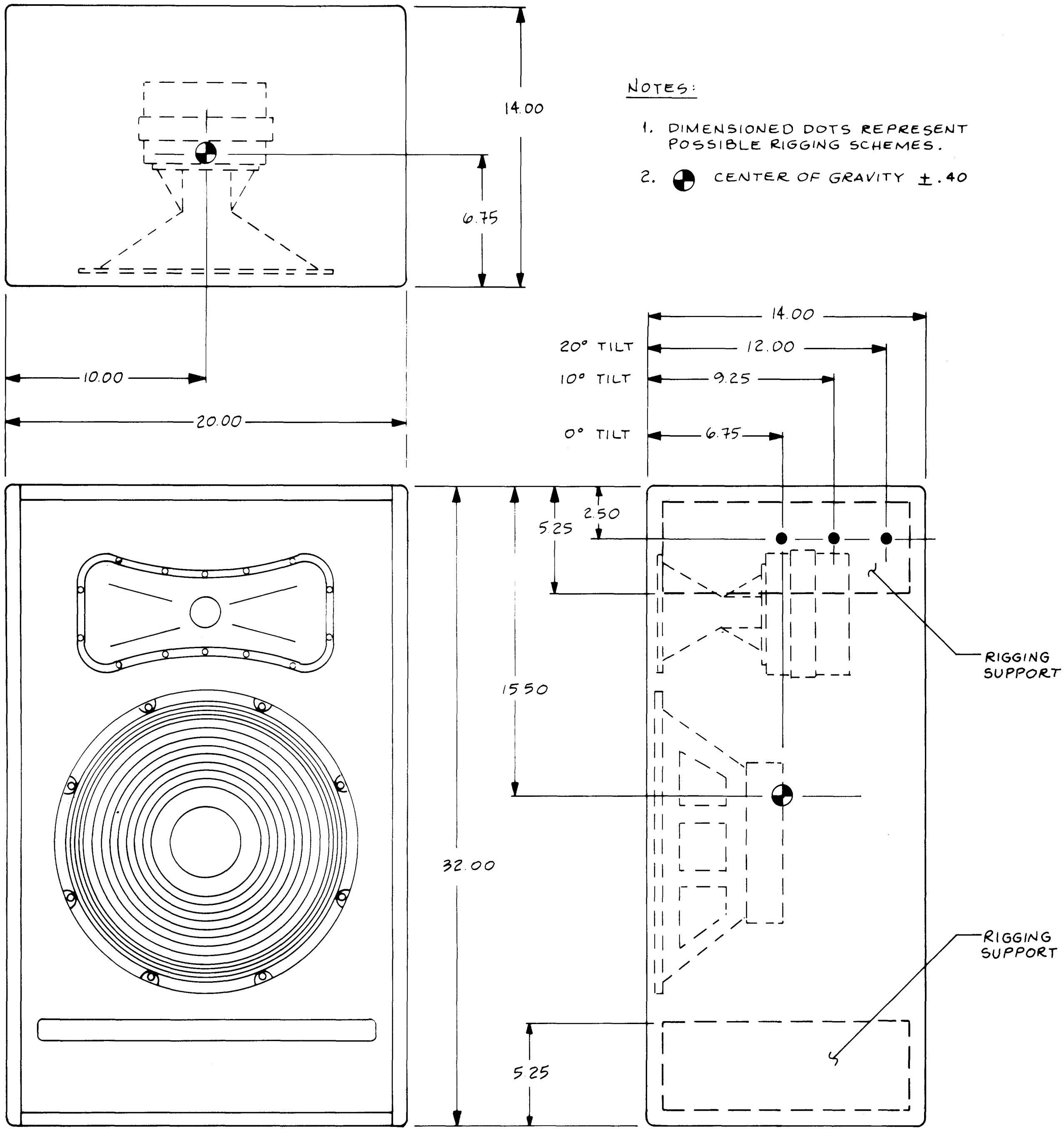


Figure 3-8 Suggested Locations for Hanging Hardware

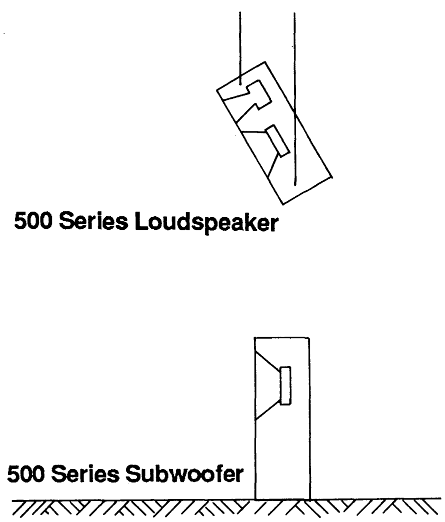


Figure 3-9
Placement of Subwoofers

operate only below about 100 Hz (corresponding to a wavelength of over 10 feet), their output will contain relatively few directional clues, and a fairly large physical offset will be required to produce significant phase cancellation.

For these reasons, subwoofer placement can be somewhat discretionary. For example, when the 500 Loudspeakers are "flown," subwoofers may be placed on the floor to take advantage of half- or quarter-space loading. For best results, however, they should be located in the same propagation plane as the 500 Loudspeakers, as is shown in Figure 3-9.

The placement shown in Figure 3-10 is quite common in theatre installations. The 500 Loudspeakers are flown on either side of the stage in this example. But hanging the 501 Subwoofers with the 500 Loudspeakers might obstruct sight lines; at any rate, it would make for a somewhat obtrusive speaker stack - and in the theatre, the speakers should be invisible if at all possible. In this case, the subwoofers may be placed on the floor beneath the 500 Loudspeakers. Central placement of the subwoofers (shown in the diagram as an alternate) is sometimes used in cinema sound systems.

518R Subwoofers: Designed for maximum convenience in portable sound reinforcement applications, the 518R Subwoofer features an enclosure with roughly half the volume of the 501 cabinet. This design affords greatly increased

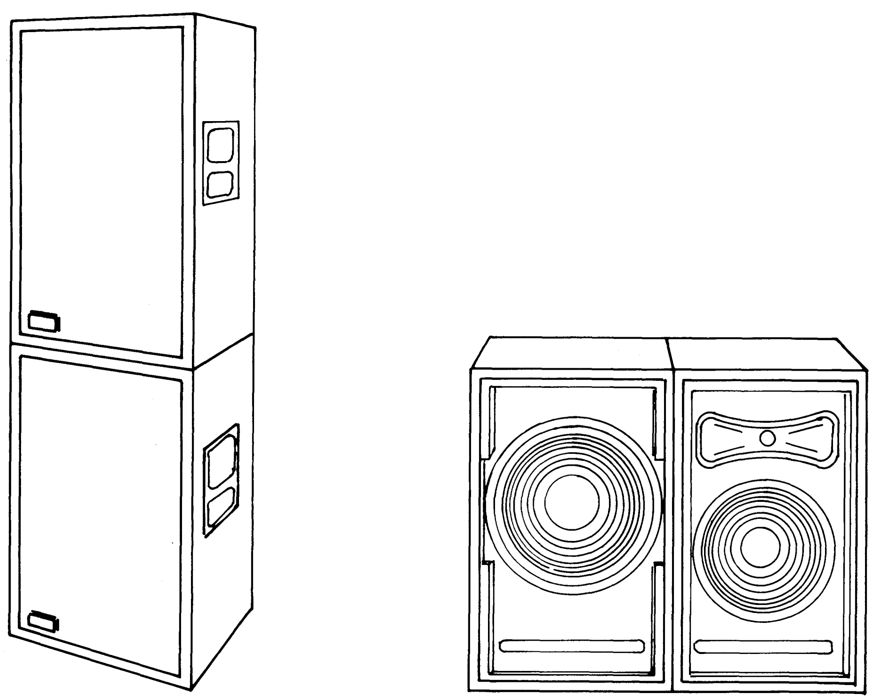
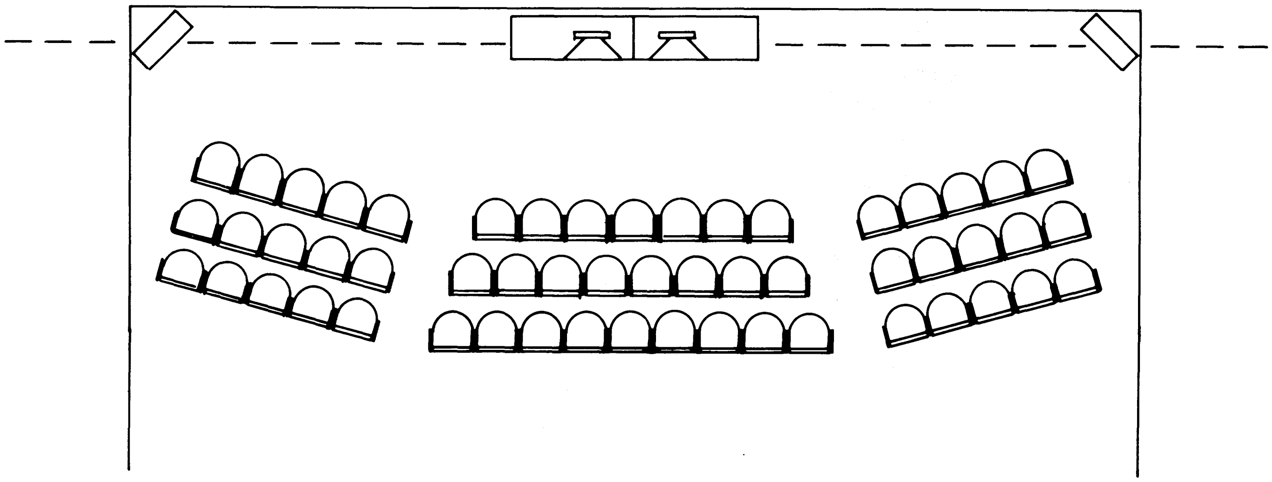


Figure 3-11 518R Subwoofer Placement



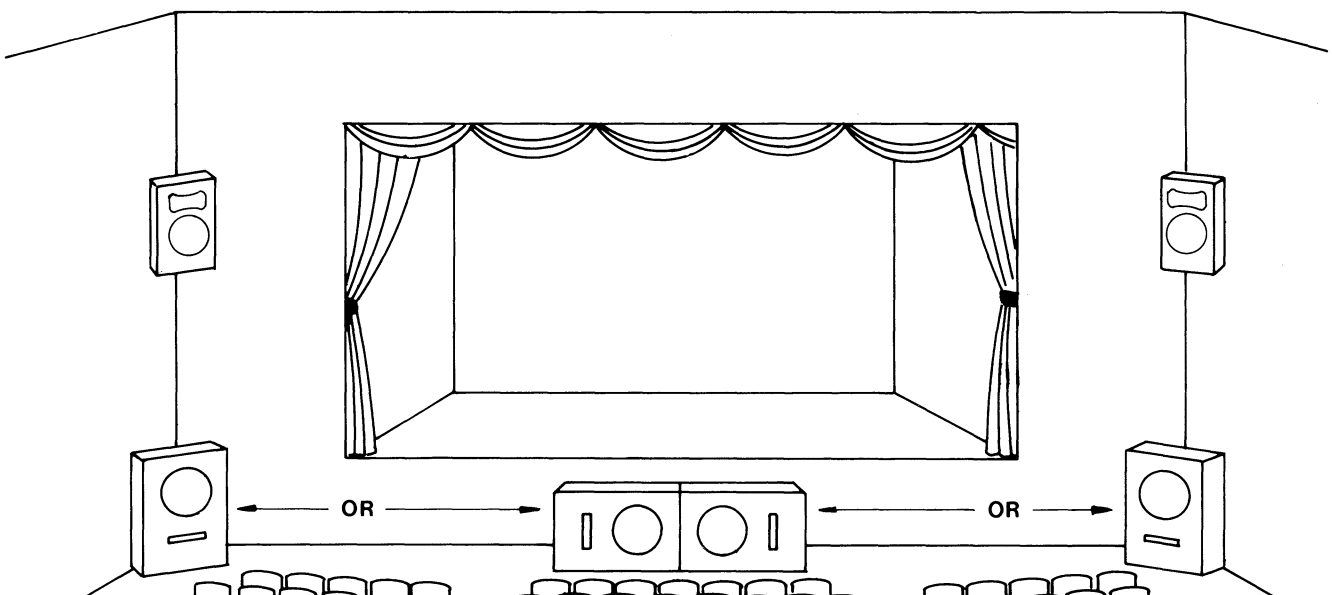


Figure 3-10 Subwoofer Placement Example

ease of handling and transportation, but it requires a crossover that relies on good acoustical coupling with the 500R low-frequency driver in order to produce equivalent acoustic power. The 518R crossover is set at 125 Hz, but with a relatively gentle slope (-20 dB at 1kHz), so the subwoofer produces significant output at low mid-range frequencies. The 518R therefore contributes substantial directional information, and is more susceptible to path-length phase cancellation than is the 501.

For these reasons, the 518R **must** be placed in close proximity with the 500R, as shown in Figure 3-11. If this simple condition is followed, the 518R achieves equivalent performance to that of the 501 above 40 Hz, with very flat frequency response.

3.3.3 Stage Monitor Systems

The purpose of a stage monitoring system is to provide an appropriate sound balance for each performer, allowing each to hear what he or she needs in order to play (or sing) properly. Since the particular needs of each performer will vary, stage monitor systems are usually designed to provide several different mixes, with each mix being fed to only one or two localized loudspeakers.

The inherent complexity of stage monitor systems requires a high degree of skill from the monitor mix operator. It is therefore essential that the monitor system offer the mixer the maximum amount of control, so that he or she can do the job effectively while avoiding feedback. Loudspeaker placement is one very important way of attaining that control.

As a general rule, stage monitors should be placed to create independent sound "zones" onstage, with minimum overlap of their coverage areas. This not only will enhance the effectiveness of each separate mix, but also will minimize the comb filtering that results from multiple-path phase cancellations — improving the sound that each performer hears, and helping to control feedback.

Figure 3-12 500RW Stage Monitor Placement

Stage monitor systems require careful equalization. Section 3.6.4 describes the procedure for equalizing stage monitors; refer to that Section before connecting and operating your 500 Series monitor system.

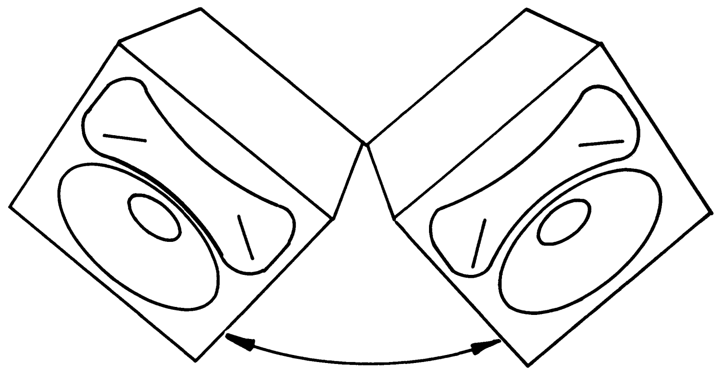


Figure 3-13 Wide Coverage Monitor Placement

Vocal monitors are generally placed on the floor, close to the base of the microphone stand; the Model 500RW is designed for this application. As Figure 3-12 shows, the 500RW cabinet has been designed to provide two different aiming angles — 45° or 60° as measured from the floor surface. The 60° surface is especially useful in close-monitoring applications; use the 45° surface for more distant placements.

Singers need to hear the pitched instruments — guitar and keyboards — along with the lead vocal, so that they can stay in tune. Since these requirements are easily handled by the 500RW alone, subwoofers are never used with vocal monitors.

Particularly in very large venues, it is important that the lead vocalist have maximum freedom of movement on-stage. In fact, it is increasingly common for lead vocalists to demand a wireless microphone, so that they can cover the entire width of the stage without having to constantly manage a mike cable. To provide good coverage for an active lead vocalist, the placement shown in Figure 3-13 can be used. Splay the cabinets so that there is an 80° to 90° angle between the interior cabinet faces.

It is best to avoid angling two adjacent cabinets to cover a single mike position. This results in severe phase cancellation, causing a comb-filter effect that greatly increases the possibility of feedback. It also degrades the quality of the sound heard by the performer.

Keyboard monitors are often placed behind, or to the side of, the performer, where they least obstruct sight lines. Since keyboardists often stand while playing, and since the low profile of a slant monitor enclosure is not required, the 500R may be used in this application.

Keyboard players need to hear the drums and bass (and, to a lesser extent, the guitar), so that they can stay in time and "lock" with the rhythm section. While not absolutely necessary, then, a subwoofer is often used to augment the low-frequency power of the keyboard monitor. Being relatively small in size, the 518R is an ideal choice.

Drum monitors are usually placed behind, or to the side of, the drum kit. Since the drummer needs to feel the music and lock with the bass and guitar, a 518R subwoofer is usually used to provide more power and "punch."

Either the 500RW or the 500R may be used in this application, depending on how the cabinet must be aimed. If the cabinet is placed on the floor below the drummer, the 500RW is the natural choice; if it is placed atop the subwoofer at ear level, use the 500R.

Sidefill monitors are placed to either side of the stage and aimed to cover the entire stage area. Their function is to adjust the overall onstage balance so that the band can play as a unit. A good choice for this application is a 500R placed on top of a 518R subwoofer. In permanent installations for live music clubs, a popular alternative is to hang a 500R or 500 cabinet on each side of the stage near the ceiling, angled down to cover the stage area.

3.4 220 Volt Operation

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 500 Amplifier has such a sticker, it has already been converted for a 200 volt mains. If there is no sticker on the 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 3.4.2, below).

3.4.1 Mains Connector Installation

The 500 Amplifier must be connected to a properly-wired grounded mains receptacle. Do not 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 500 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 500 Amplifier must be hardwired to earth ground externally. You can do this by connecting a wire from the rear-panel chassis terminal to a conductive cold water pipe or other earth ground. If you are in doubt about where to find a good earth ground, consult an electrician.

3.4.2 Mains Voltage Selection

Mains voltage selection for the 500 Amplifier is a simple operation which may be done in the field using common hand tools. Refer to Figures 3-14 and 3-15. The procedure is as follows:

1) Make sure that the 500 Amplifier is unplugged.

2) Remove the four screws securing the amplifier top cover.

3) Lift the amplifier cover off and identify the voltage selector terminal block (see figure 3-15, overleaf).

4) Wire the terminal block as shown in Figure 3-14.

5) Replace the amplifier top cover and secure with the four 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.

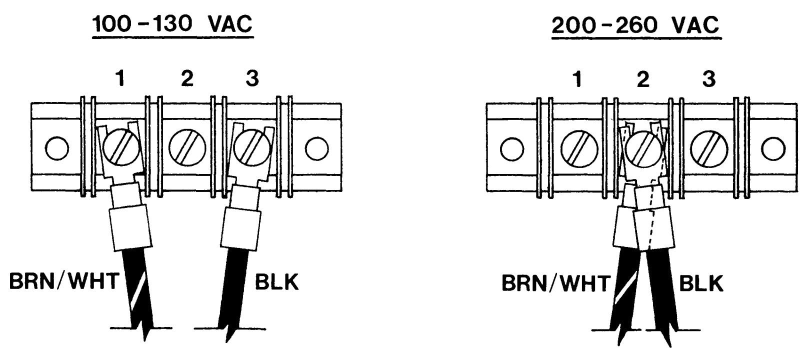


Figure 3-14 The Mains Voltage Selector Block

3.5 Amplifier Mounting

The 500 Amplifier is designed for mounting in a standard 19-inch equipment rack, and occupies a 5 1/4 inch high rack space. The front panel is 3/16-inch aluminum backed by a cold-rolled steel panel, and will provide a secure support for the unit in fixed installations. If the system is to be used for 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 3-16 shows how these brackets are installed (hardware is supplied with the bracket kit).

If you are making your own rack cases, bear in mind that the 500 Amplifier weighs 55 pounds. Use tapped steel mounting brackets rather than wood, and #10 or larger steel machine screws.

In both fixed installations and portable systems, it is important to ensure an unobstruc-

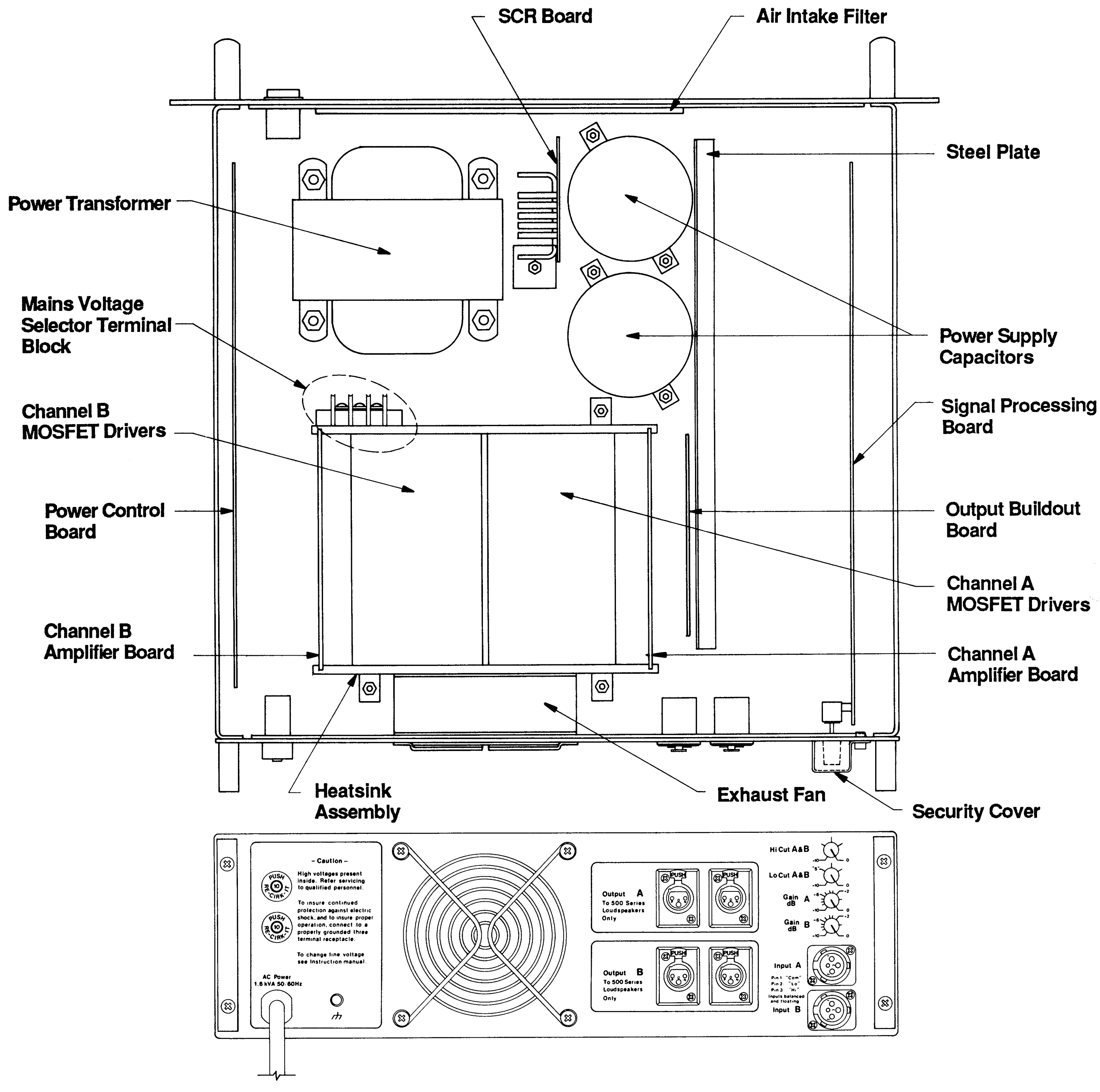


Figure 3-15 500 Amplifier Interior Plan

ted flow of air to the 500 Amplifier. Note that the flow of cooling air is from the front to the back of the chassis. Do not attempt to reverse the direction of air flow by reversing the fan: this will result in damage to the power supply components. If several 500 Amplifiers are mounted in a single rack, it may be adviseable to mount an exhaust fan in the rack, to move warm air away from the units and vent the back pressure in the rack.

In all cases, be sure that the amplifier's air inlet (front panel) is not obstructed. Never locate amplifier racks near a heat source such as a furnace, radiator or heating vent.

3.6 Testing and Equalization

The 500 Series is designed to offer extremely reliable performance in high-quality sound reinforcement, contracting and monitoring applications. By the time that you receive the system, it will have undergone extensive quality control procedures, burn-in and operational tests. If you have followed the connection, installation and adjustment guidelines given in this manual, the system should

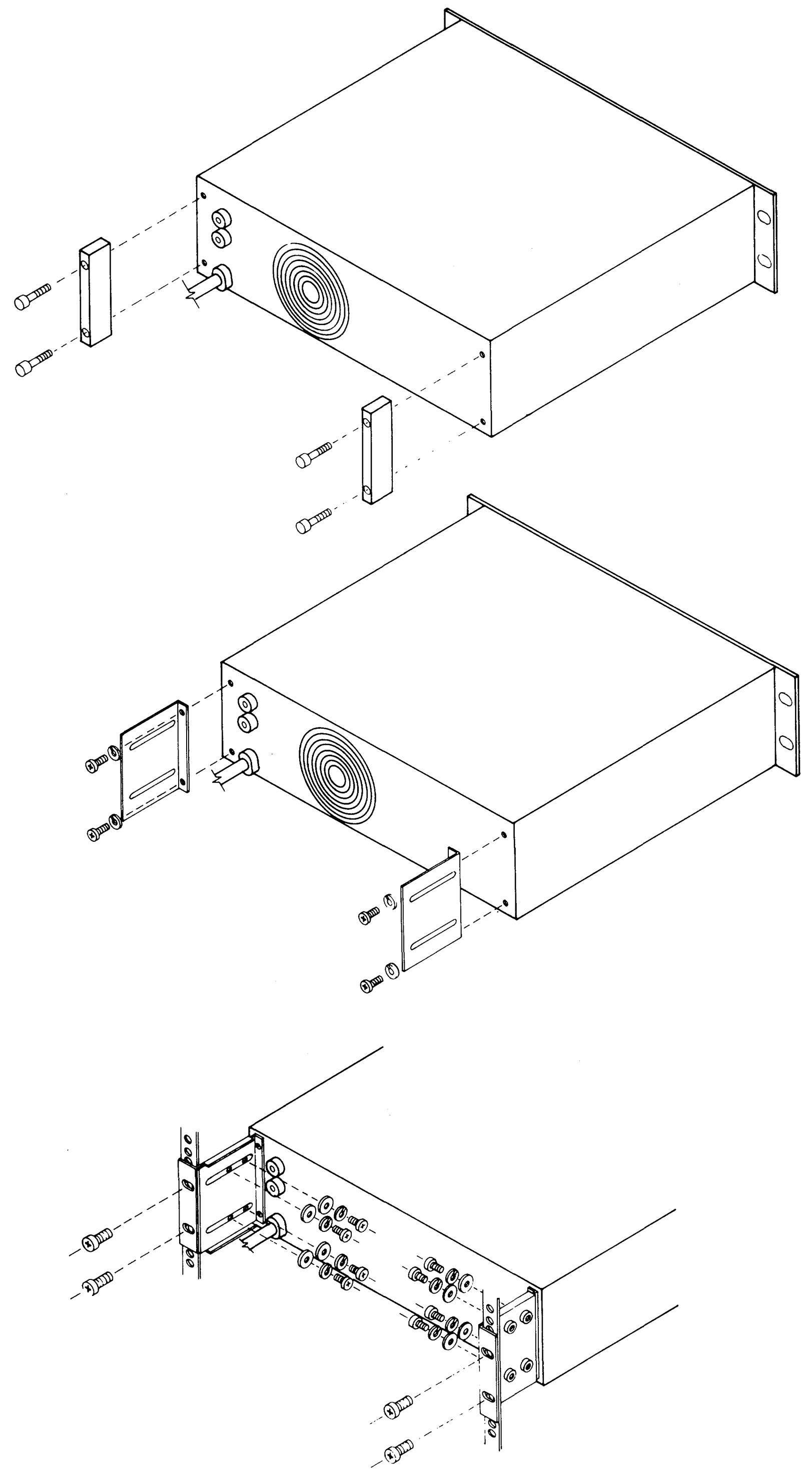


Figure 3-16 Installing the Rack Mounting Rear Support Braces

perform very well from the moment that it is turned on.

Particularly in fixed installations, however, you will undoubtedly wish to verify the performance of your 500 System, and equalize the system for flat response onsite. This section contains information that can help you to accomplish that aim. We strongly recommend that you read this section before attempting to test and equalize your 500 System.

3.6.1 Acoustic Testing Methods

Many different acoustic testing methods are used in professional audio, and each method has specific advantages and drawbacks. In sound contracting and consulting, the most common method is third-octave analysis, favored chiefly because it is quick and allows observation of general trends in the system frequency response. Third-octave analysis is a relatively low-resolution technique, however: when employed to test systems that have not been verified at higher resolution, it can yield misleading results.

The prevalent high-resolution audio measurement techniques generally employ sinewave sweeps (sometimes with a tracking filter) or some implementation of the FFT (Fast Fourier Transform). Such techniques offer significant benefits in data accuracy, but at a price. Swept sinewave techniques are relatively time-consuming when high resolution is required, and thus are inefficient for field use. FFT analyzers can gather and display data very quickly and efficiently, but are generally quite expensive.

Meyer Sound employs high-resolution FFT analysis both in the design stage and in production quality control. Every 500 Series component is subjected to rigorous testing at several levels of manufacture, and frequency response is verified before shipping. Because all of these procedures are done at high resolution, the end user is assured that there are no aberrations in the system response that a third-octave analyzer might not display — for example, high-Q peaks or dips that can introduce substantial coloration and increase the potential for feedback.

For these reasons, third-octave analysis is a perfectly acceptable method of testing 500 Series systems in the field, as long as the analyzer used is of high quality and the data gathered is interpreted correctly. If you own a swept-sinewave or FFT-type analyzer, of course, by all means use it: the higher resolution will permit more accurate equalization.

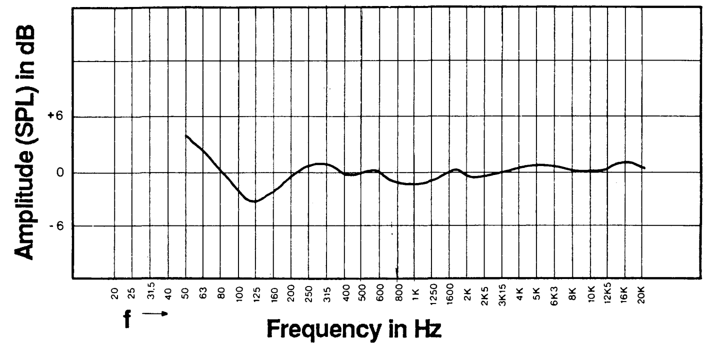
3.6.2 Interaction of the Loudspeakers With the Environment

When a full-range 500 System is installed in a practical application, its response will be affected by the boundary conditions of the space. Figure 3-17 shows the typical types of response deviations that may be encountered when the 500 System is measured at 1 meter in a practical installation. These curves are indicative only of general trends that can be expected to appear in the system response: every room will behave a little differently.

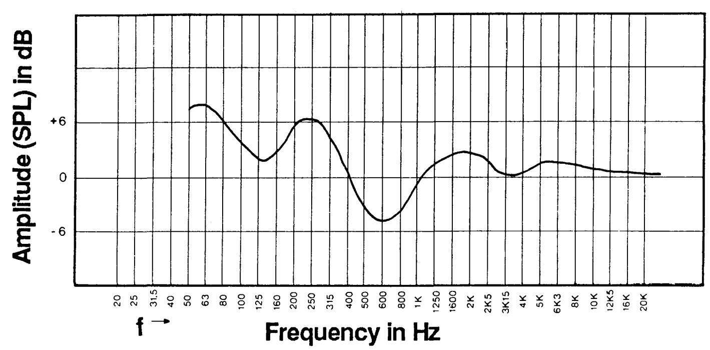
Several distinct characteristics can be seen in these curves. There is the typical low-frequency boost that is inherent in, and dependent in magnitude on, the loading conditions. Additionally, low- and mid-frequency peaks and dips have appeared: these indicate resonant (and, possibly, anti-resonant) room modes. Last, a degree of ripple has appeared in the high frequencies. These ripples are caused by reflections from the boundary, and are indicative of a small amount of delayed sound adding back into the incident sound from the loudspeaker.

The 500 Amplifier Lo Cut Environmental Control is designed to be used in correcting the low-frequency boost caused by the loading conditions. Figure 3-18 shows the frequency response characteristics of the Environmental Controls. Notice that the Lo Cut control allows a fair degree of flexibility over its full range. At minimum settings, it introduces a gradual response rolloff. At intermediate settings, it becomes a shelving control, and at maximum settings there is a 6 dB per octave rolloff with a turnover (-3 dB) frequency of 500 Hz.

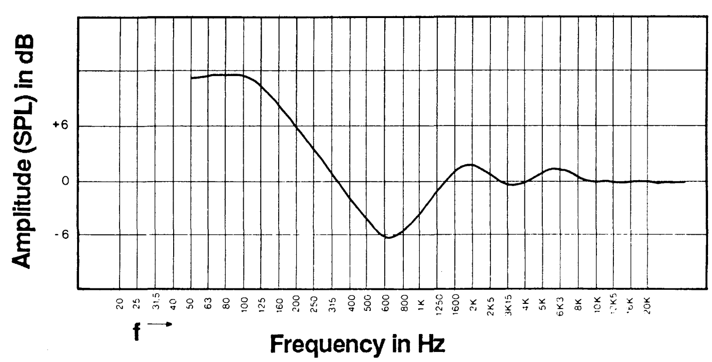
This characteristic is quite effective for use in broadband



Half-Space Loading



Quarter-Space Loading



Eighth-Space Loading

Figure 3-17 Typical Frequency Response Variations for Various Boundary Conditions

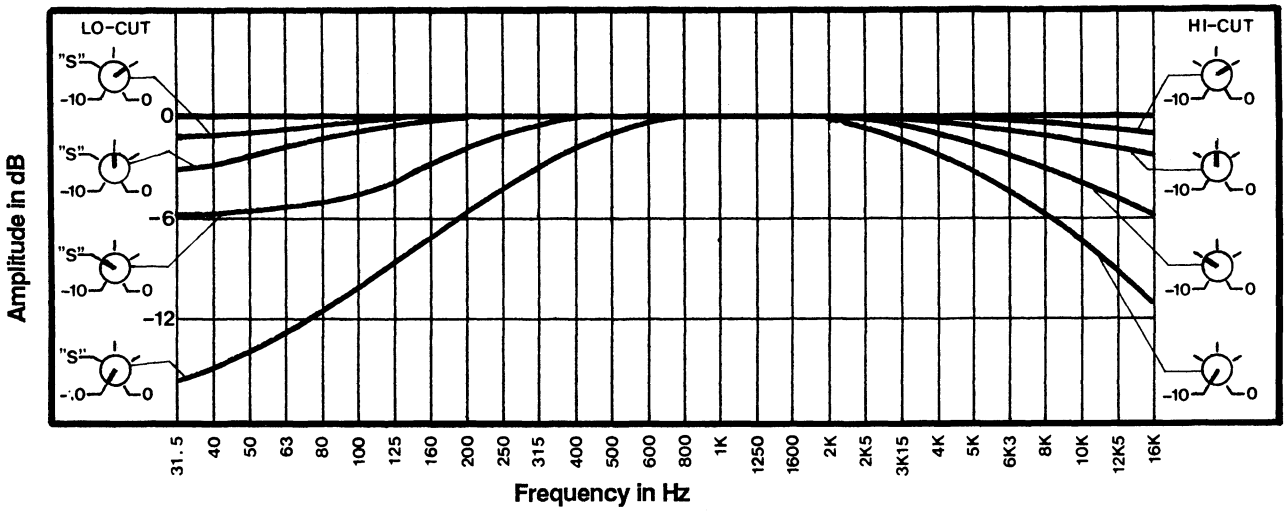


Figure 3-18 The 500 Amplifier Environmental Controls

equalization of general trends in the low-frequency response of the system. Low- and mid-frequency peaks and dips which result from room modes must be handled with external equalization, however. The ideal type of equalizer to use for such applications is a parametric type - preferrably a complementary-phase design such as the Meyer Sound CP-10. In lieu of that, a graphic equalizer may be used, but some cautions apply.

Graphic equalizers are only useful for correcting broad trends in a system's response, since narrow-band resonances rarely fall precisely on the center frequencies that have been chosen as an engineering standard. (If that ever occurred, the Q of the resonance would undoubtedly still be different from that of the filter.) For this reason, graphics should only be used for correcting peaks or dips that are wider than an octave -- and these should be equalized using at least three adjacent filter bands set in a gradual curve.

High-frequency ripple is very difficult to equalize with any degree of reliability, because the ripple effects will vary radically depending upon the position of measurement. Generally speaking, the best techniques for dealing with frequency response variations occurring above about 2 kHz are acoustical, rather than electronic.

Loudspeaker placement and aiming, for example, will substantially affect the far-field high frequency response, since the amount of ripple is directly proportional to the number of reflection paths in the space. It is best to aim the loudspeakers so that the bulk of their energy is directed at the audience, rather than onto reflective surfaces such as walls and floors. This will not only improve the frequency response, but also increase the system's intelligibility (see Section V for complete specifications on the 500 System's dispersion characteristics). If you encounter extreme ripple problems, acoustical treatment is probably necessary.

3.6.3 Guidelines for Testing and Equalizing 500 Series Systems

All 500 Series full-range loudspeakers exhibit flat frequency response within ±3 dB from 40 Hz to 16 kHz as measured on a third-octave basis with pink noise at a distance of 1 meter on axis of the high-frequency horn in free field. This specification may be verified by measuring the loudspeaker on its back on a suitable stand outdoors, so that the unit is at least 6 feet off the ground and aimed toward the sky.

The recommended procedure for testing 500 Series Systems in practical installations is as follows:

1) Verify that all connections have been made correctly and the system is functional.

2) Begin by testing one channel at a time in the near field. Select the channel to be tested, and place the measurement microphone on axis with the high-frequency horn at a distance of 1 meter from the cabinet face.

3) Apply the test signal to the corresponding 500 Amplifier input channel, and set a convenient measurement level.

4) While monitoring the analyzer display, set the 500 Amplifier Lo Cut control to compensate for any low-frequency boost caused by the loading conditions.

5) Once the general low-frequency curve is established, fine-tune the low-frequency response using an external equalizer, then move on to mid-frequency equalization.

6) Repeat the process with the other channel(s).

7) Move to the far field and trim the system equalization. Far field measurements are best taken in several locations, so that position dependent response deviations can be identified. Those effects that change substantially in different parts of the room can be handled in one of two ways: either choose to ignore them, or establish a "sweet spot" and trim the equalization for that position.

When working in the far field, some cautions apply:

◊ Little benefit will be realized from attempting equalization of narrow-band peaks or dips (particularly those occurring above about 2 kHz), since these will vary considerably with changes in the measurement position.

◊ It is unwise to introduce large amounts of high frequency boost in an attempt to force the system to compensate for the natural loss of highs that occurs because of air absorption: the result will be highly unnatural sonic quality. Moreover, the degree to which high frequencies are absorbed by air varies with temperature and humidity, so the far-field high-frequency response may change on an hourly basis.

◊ When working outdoors, resist the temptation to introduce excessive low frequency boost in an attempt to compensate for the lack of boundaries: this will result in a loss of system headroom and cause premature clipping. Always use subwoofers to augment the system in outdoor applications, and place the system in the high-power configuration discussed in Section 2.2.3, above.

3.6.4 Equalizing Stage Monitor Systems

In designing and operating practical stage monitor systems, the most important concerns are achieving clarity and maximizing the onstage level while suppressing feedback. These tasks are interrelated, and are primarily a function of equalization.

In stage monitoring, more than in virtually any other loudspeaker application, it is extremely important to start with a loudspeaker system whose frequency response is verified at high resolution to be flat in free field (as described in Section 3.6.1, above). Narrow-band peaks in the system response (such as are created by diaphragm resonances, for example) will drastically reduce the gain before feedback: the system tends to lock onto such peaks and begin ringing before the average broadband gain reaches an adequate level. This is why the 500RW is an excellent choice for stage monitoring: its free-field response is verified at the factory to be flat and free of resonant peaks.

The most common technique for equalizing stage monitors is called "ringing out" the system. It requires a separate equalizer for each monitor channel. The procedure is as follows:

1) Select a single monitor / microphone combination to work with.

2) With all other monitor channels turned off or muted, begin increasing the gain of the selected microphone channel. At some point, the system will reach the "singing point" and begin to feed back. The frequency at which the feedback occurs will be a natural acoustic resonance of the stage area, and will be partially dependent upon the mike and monitor positions.

3) Set the equalizer for dip response at the feedback frequency, adjusting it to suppress the ringing.

4) Continue increasing the channel gain until the system again begins to feed back. The feedback will occur at a new frequency, corresponding to another natural resonance.

5) Select another equalizer band and adjust it to suppress the feedback.

6) Repeat the process until an adequate system gain is attained, then move on to the next monitor channel.

Note that each microphone / monitor combination must be equalized independently. In practice, a maximum of about four or five resonant modes can be suppressed using this technique.

While the graphic equalizer is the tool most often used for this procedure, it is a relatively poor choice for the job, since in this case we are concerned less with correcting broad trends in the system response than with suppressing specific narrow-band resonances. Nor is a notch filter an appropriate tool since, among other problems, notch filters introduce substantial phase distortion.

The ideal choice for equalizing stage monitor systems is a complementary parametric such as the Meyer Sound CP-10. When using a parametric, set the filter bandwidth to approximately 1/3 octave (referred to the center frequency). Set the filter response for about 3 dB of dip and, with the system ringing, sweep the filter center frequency until you null the resonance.

Like all Meyer Sound loudspeaker products, the 500 Series incorporates active signal-processing electronics as an integral and necessary component of the system design. This approach allows a high degree of flexibility in balancing design parameters: the loudspeaker components can be optimized for those aspects of system performance that are best handled at the mechanical level (distortion, diaphragm resonance and power handling, for example), while other parameters are managed electronically.

In the 500 Series, the signal-processing electronics are combined in a single chassis with a high-quality professional power amplifier. The result is that 500 Series Systems are fully-engineered, cost-effective functional blocks which are application-ready, so very little effort is required to achieve the highest level of professional performance in a wide variety of applications.

This section describes the design features of the 500 Series in detail, and is intended for technicians and engineers who desire a deeper understanding of the system's design.

4.1 500 Series Full-Range Loudspeakers

Each 500 Series full-range loudspeaker is a two-way system comprising a 15-inch cone low-frequency driver and a 1.4-inch throat high-frequency driver with 40° by 80° horn, housed in a vented cabinet with passive crossover.

The 15-inch low-frequency driver is the model MS-15, a component which has been used in Meyer Sound subwoofer products since 1979. Its response to excitation signals is extremely linear, so distortion is held to a minimum — even at extreme excursion. The voice coil is fluid-cooled, and both the gap and pole piece are vented in the back for high power handling; voice coil impedance is 8 ohms. The cone is damped against resonance for smooth frequency response and treated for moisture resistance. MS-15 drivers used in the 500 Series are tested at several levels of the manufacturing process, and are selected for low distortion.

The 1.4-inch throat high-frequency driver is the model MS-1402, a new driver designed specifically for the 500 Series (patents applied for). The voice coil and diaphragm diameters are both 2.80 inches; the coil is edge-wound of copper-clad aluminum wire and its impedance is 16 ohms. The magnetic field strength in the voice coil gap is in excess of 17,000 Gauss, affording high efficiency. The phasing plug is of the radial type.

The MS-1402 has been optimized for consistent frequency response with minimum ripple, so its phase-domain characteristics are excellent (see the "Specifications" section, below). Since the crossover frequency of all 500 Series full-range systems is 1 kHz, the MS-1402 driver has been designed to maintain good performance characteristics to below 500 Hz. MS-1402 drivers used in the 500 Series are tested at several levels of the manufacturing process, subjected to a 24-hour dynamic burn-in cycle, and selected for low distortion and flat frequency response.

The MS-1402 is coupled to a 40° by 80° horn which is injection-molded of a self-damping urethane material. The particular urethane composition has been selected both for strength and for its ability to absorb shocks. The injection-molding process was chosen for its high degree of precision and repeatability. As a result, the horn's physical and acoustical characteristics are controlled and consistent, permitting precise electronic equalization of the system's high-frequency response on a production basis.

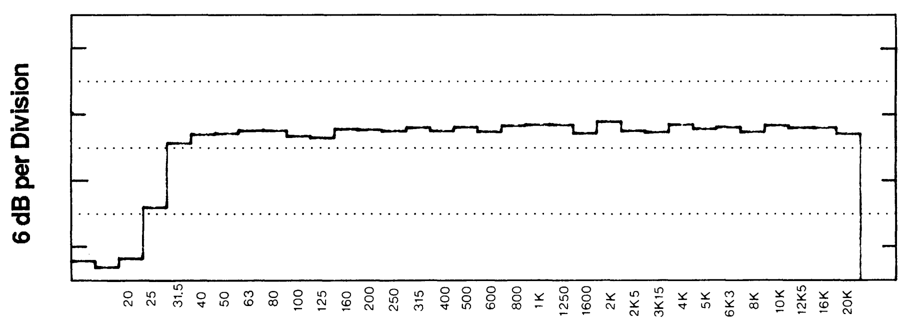
The components are housed in a vented cabinet, tuned such that the Q of the cabinet resonance is low so that, if boundary reinforcement is available, the system will have good response to 30Hz. The cabinet is highly damped against resonance.

The crossover between the 500 System components is a passive type which is specifically fitted to the characteristics of the components and optimized for good phase addition at the crossover frequency, as illustrated in Figure 4-1. Notice that when the high-frequency driver is wired out of phase (lower curve), a 6 dB cancellation trough appears in the frequency response at the crossover frequency (1 kHz). This signifies near-perfect phase cancellation, and is indicative of excellent phase coherence between the low- and high-frequency drivers at crossover.

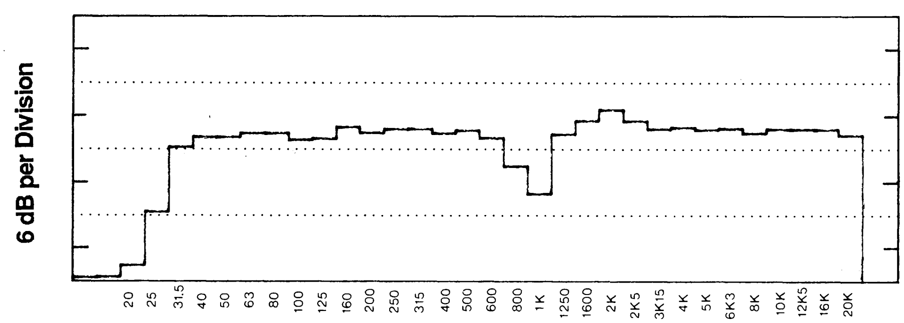
A second-order (12 dB per octave) rolloff is employed for the MS-1402 high-frequency driver in order to assure control of excursion at high power levels. The low-pass rolloff for the MS-15 is first-order (6 dB per octave).

4.2 The 500 Stereo Integrated Amplifier

The 500 Amplifier integrates complementary-phase equalization and driver protection for 500 Series loudspeakers with a high-performance professional power amplifier in a



500 Loudspeaker at 1 meter



Same, high-frequency driver out of phase

Figure 4-1 Effect of Driver Phase Reversal on Frequency Response

single rack-mountable chassis. This section describes the design of the 500 Amplifier in detail. Refer to Figure 4-2 (overleaf) throughout this discussion.

4.2.1 Signal Processing Section

The functions of the 500 Amplifier signal processing section are:

◊ Complementary-phase equalization to achieve flat frequency and phase response from 500 Series loudspeakers

◊ User-adjustable high- and low-frequency room equalization controls (referred to as "Environmental Controls")

◊ Signal limiting and dynamic filtering to protect the 500 Loudspeaker at high power levels

In total, the signal processing section constitutes a 20-order network when the Environmental Controls are set to the flat position.

The input stage of the 500 Amplifier constitutes a three-port floating balanced signal input system; it is described in detail in Section 3.1.1, above. The input stage has been designed to provide true transformer isolation while avoiding the drawbacks of conventional transformer-coupled designs. It allows a full 500 volts of common-mode isolation, and accomodates a wide range of input pin connections while maintaining unity gain. Distortion is held under .01% to 30 Hz, and a TIM filter is included; the input's low-frequency -3 dB point is 25Hz. The 500 Amplifier input eliminates power frequency hum injection by breaking the connection between the signal source chassis ground and the 500 Amplifier signal ground.

The differential input stage is followed by a simple variable attenuator which functions as the channel Gain control. The control has a 10 dB range, and is used to calibrate the 500 Amplifier to the source equipment's operating level.

The Gain control is buffered by a peaking circuit tuned for a center frequency of 40 Hz, which serves as low-frequency equalization for the loudspeaker. It is followed by the high-pass and low-pass Environmental Control circuits, respectively. The rear-panel controls for these circuits are tracking ganged potentiometers: the Environmental Controls affect both channels simultaneously.

The high-pass section (designated the Lo Cut control) is used to compensate for various boundary conditions, and to adjust the system for flat response with subwoofers. It exhibits a complex response, varying from a gentle rolloff at minimum settings, through a shelving response at intermediate settings, to a 6 dB per octave rolloff at maximum setting. The turnover (-3 dB) frequency at maximum cut is 500 Hz.

The lowpass section (designated the Hi Cut control) is used to set "house curves" — various degrees of high-frequency rolloff that are considered desirable in certain specific applications. It exhibits a simple, gentle variable rolloff; at maximum cut, it introduces a 6 dB per octave lowpass characteristic with a turnover (-3 dB) frequency of 5 kHz.

The lowpass stage is followed by the first of the speaker protection circuits: a high-

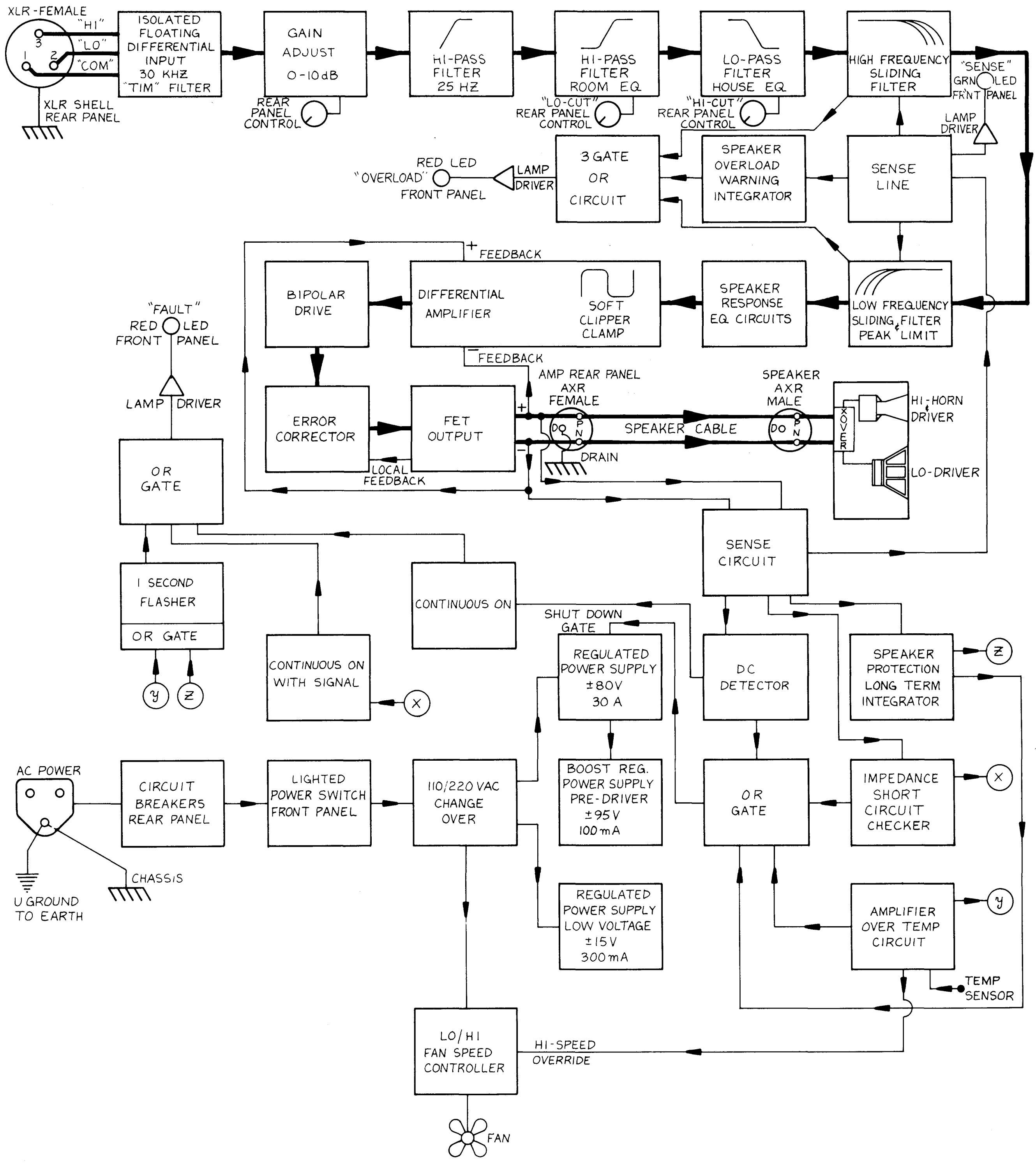


Figure 4-2 500 System Block Diagram

frequency filter which is controlled by a feedback path taken from the output of the power amplifier stage (this feedback signal also drives the Sense indicator on the amplifier front panel).

The high-frequency filter circuit serves a dual function. At amplifier power levels up to 3 dB below the clipping point, it acts as a peaking equalizer with a center frequency of 16 kHz; this compensates for the natural high-frequency rolloff of the MS 1402 horn driver. On high-power program peaks containing large amounts of high-frequency information, the circuit's peaking action is defeated by a fast-attack control circuit, protecting the high-frequency driver from over-excursion. The control circuit reacts symmetrically to positive and negative peaks.

The high-frequency filter is followed by a low-frequency sliding filter which serves to protect the MS-15 low-frequency driver from excessive excursion at high power levels. This filter is controlled by the same feedback path that controls the high-frequency filter. At low to moderate amplifier power levels, the filter's turnover (-3 dB) frequency is 25 Hz. At high power levels, the filter's tuning slides upward to a maximum of 300 Hz; thereafter, it acts as a peak limiter.

Note that the sliding filters are not activated until the power amplifier section is driven to within 3 dB of clipping: at this level, the 500 System is nearing its 10% distortion point. Above that level, the sliding filters activate and cause the system frequency response to collapse symmetrically at both extremes, providing a graceful overload characteristic. Whenever the sliding filters are activated, the front-panel Overload indicator will flash.

When the 500 System is pushed to its absolute power limit, its frequency response will narrow to the range between 500 Hz and 5 kHz. This is the frequency range in which 500 Series full-range loudspeakers are most efficient. The sliding filter circuits thus allow the user to push the system to extremely high continuous sound pressure levels without endangering the loudspeaker drivers.

The low-frequency sliding filter circuit is followed by a set of six complementary-phase equalization circuits. These are fixed-frequency peak/dip circuits which are used for broadband equalization of the loudspeaker; they are factory-set during the quality control process. Two equalizers are used to compensate for small amounts of ripple in the high horn response, the other four being used for low- and mid-frequency adjustments. The equalizer output stage feeds the power amplifier section, and incorporates a final 25 Hz highpass pole. This pole keeps DC from the input to the power amplifier stage (the power amplifier is DC-coupled throughout).

To provide advanced warning to the user of an impending shutdown by the amplifier's overload protection circuitry, a long-term integrating circuit is provided. The input to this circuit is the same feedback path (from the amplifier output) that feeds the speaker protection limiter circuits. The long-term integrator circuit models a similar circuit in the power amplifier section (see Section 4.2.2). It monitors the continuous power applied to the 500 Loudspeakers, and causes the front-panel Overload indicator to light continuously when an overload shutdown is imminent. Note that this circuit operates regardless of whether or not the loudspeakers are connected.

4.2.2 The Power Amplifier Section

The power amplifier section of the 500 Amplifier unit is rated at 1200 watts continuous output (600 per channel, both channels driven) for a maximum of 10 minutes, and 800 watts continuous long-term. Its power bandwidth is 100 kHz, with THD of less than 0.01% (20 Hz to 20 kHz) and a signal-to-noise ratio in excess of 100 dB. The unit's damping factor is immeasureably high. The signal path is complementary-symmetry throughout, and is DC coupled.

The 500 Amplifier circuit 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 a unique soft-clipping circuit which simulates a tube-type clipping characteristic.

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 (the 500 Amplifier is the first commercial amplifier to use this scheme, though it is based on principles that have been known in the engineering community for decades). 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 500 Amplifier is forced-air cooled by an all-metal fan which is sealed against dust. Air flow is from the front to the rear of the chassis: those components which are particularly heat-sensitive (power transformer, power rectifier, power supply regulators and filter capacitors) have been located at the front of the chassis so that they receive an unobstructed flow of cooling air. The power MOSFETs are located on an aluminum tunnel heatsink which floats from chassis ground and is mounted on flanges made of a special, high-temperature polycarbonate material. The chassis is all-steel construction.

4.2.3 Power Supply and Control Circuitry

The 500 Amplifier 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 500 Amplifiers are employed.

The MOSFET output drivers operate from a high-current regulated ±80 volt supply. Since the system incorporates error correction circuitry, the bipolar predriver stages operate from a ±95 volt booster supply, allowing them to swing above the limits of the supply for the MOSFETS. Low-voltage circuitry operates from a regulated ±15 volt supply. Primary protection for the system is provided by two resettable circuit breakers in the mains circuit.

The 500 Amplifier 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 are used to 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 500 Loudspeaker, shutting down the high-voltage supply and flashing the Fault indicator when the continuous power limit of the loudspeakers is exceeded.

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 represented by the voltage across a series resistance). If the load impedance is calculated to be less than 3.5 ohms, the circuit shuts down the high-voltage supply and lights the Fault light continuously.

A temperature sensing circuit monitors the temperature of the MOSFET heatsink using 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.

500 Series Full-Range Loudspeaker Systems

Frequency Response[1]	
Half space	30 Hz to 16 kHz
Free field	40 Hz to 16 kHz ±3 dB
Maximum SPL[2]	
Single Speaker	
Continuous sine wave 100 Hz to 16 kHz	110 dB
10 sec. tone burst 150 Hz to 10 kHz	120 dB
Peak pressure (program)	130 dB
Monoblock Configuration[3]	
Continuous sine wave 35 Hz to 16 kHz	120 dB
10 sec. tone burst 40 Hz to 10 kHz	125 dB
Peak pressure (program)	135 dB
High Frequency Coverage (-6 dB points)	
Horizontal	90 degrees
Vertical	40 degrees
Relative Delay[4]	±.0001 sec. 150 Hz to 16 kHz
System Noise (including 500 Amplifier)	Less than 30 dBA SPL

500, 500R, 500RW Loudspeakers

Driver Complement	(1) MS-1402 high-frequency horn driver (1) MS-15 low-frequency cone driver
High Frequency Horn	Modified radial
Crossover Type	Passive
Highpass Slope	12 dB per octave
Lowpass Slope	6 dB per octave
Acoustical Crossover Frequency	1000 Hz

Enclosure	
Models 500 and 500R	3.75 cu. ft. vented
Model 500RW	2.6 cu. ft. vented
Construction	
Model 500	Plywood-braced medium-density fiberboard with mesh screen grill
Models 500R and 500RW	Multilaminate hardwood with perforated steel grill
Finish	
Model 500	Flat black textured, paintable
Models 500R and 500RW	Black textured
Connector	Male three-pin AXR-type
Cable (included)	10-meter 14-gauge two-conductor
Physical Dimensions	
Models 500 and 500R	20"W x 32"H x 14"D
Model 500RW	20"W x 26 3/4"H x 17 1/2"D
Shipping Weight	
Model 500	110 lbs.
Model 500R	100 lbs.
Model 500RW	90 lbs.

501 Subwoofer

Frequency Response[1]	30 to 90 Hz ±4 dB (- 20 dB at 300 Hz)
Maximum SPL[5]	
Continuous	120 dB
Peak	130 dB

Connector	Male 3-pin AXR-type
Physical Dimensions	20"W x 32"H x 14"D
Shipping Weight	90 lbs.

500 Stereo Integrated Amplifier

Signal Inputs	
Type	Floating balanced, AC coupled, transformer-isolated; pin 3 hot
Impedance	
Unbalanced (pins 1&2 or 1&3)	5k ohms
Balanced (pins 2&3)	10k ohms
Maximum Common-Mode Voltage	500 volts peak
Common-Mode Rejection Ratio	
100 Hz	80 dB
1 kHz	70 dB
10 kHz	60 dB
Power Output[6]	1200 watts average sine wave, total both channels, floating (72V and 18A peak per channel)
Total Harmonic Distortion	Less than .1%
Crosstalk	70 dB, "A" weighted
Dynamic Range	Greater than 100 dB
Driver Protection	Peak limiting, sliding high- and low-frequency filters, long-term power integrator, DC protection
Amplifier Protection	Protects against shorted output, over-temperature operation and incorrect mains voltage selection

Cooling System	Two-speed all-metal fan; airflow from front to rear of chassis
Fan Noise Level[7]	35 dBA front of chassis 45 dBA rear of chassis
Indicators	
Sense	Green LEDs
Limit	Red LEDs
Fault	Red LED
Power	Green lighted switch
Controls	
Front Panel	Rocker-type power switch
Rear Panel	(2) 10-amp resettable circuit breakers Hi Cut Environmental Control Lo Cut Environmental Control Individual channel Gain calibration controls
Connectors	
Input	Three-pin XLR-type female
Output	Three-pin AXR-type female (2 per channel)
Power Supplies	
Type	Fully regulated
Operating mains voltage range	100 to 130 VAC (200 to 260 VAC in 220 volt configuration, field-changeable), 50 or 60 Hz
Power Consumption	1600 watts maximum (2400VA/10 sec.; 1200VA/8 hr.; 350VA idle)
Operating Temperature Range	0 to 45 degrees Centigrade
Physical Dimensions	19"W x 5.25"H x 16"D
Shipping Weight	60 lbs.

Notes:

1. Measured at one meter on axis of the high-frequency horn in third-octave bands with pink noise input. Loudspeaker driven by 500 Stereo Integrated Amplifier.

2. Measured at one meter on axis in half space.

3. See Section 2.2.3 of this manual.

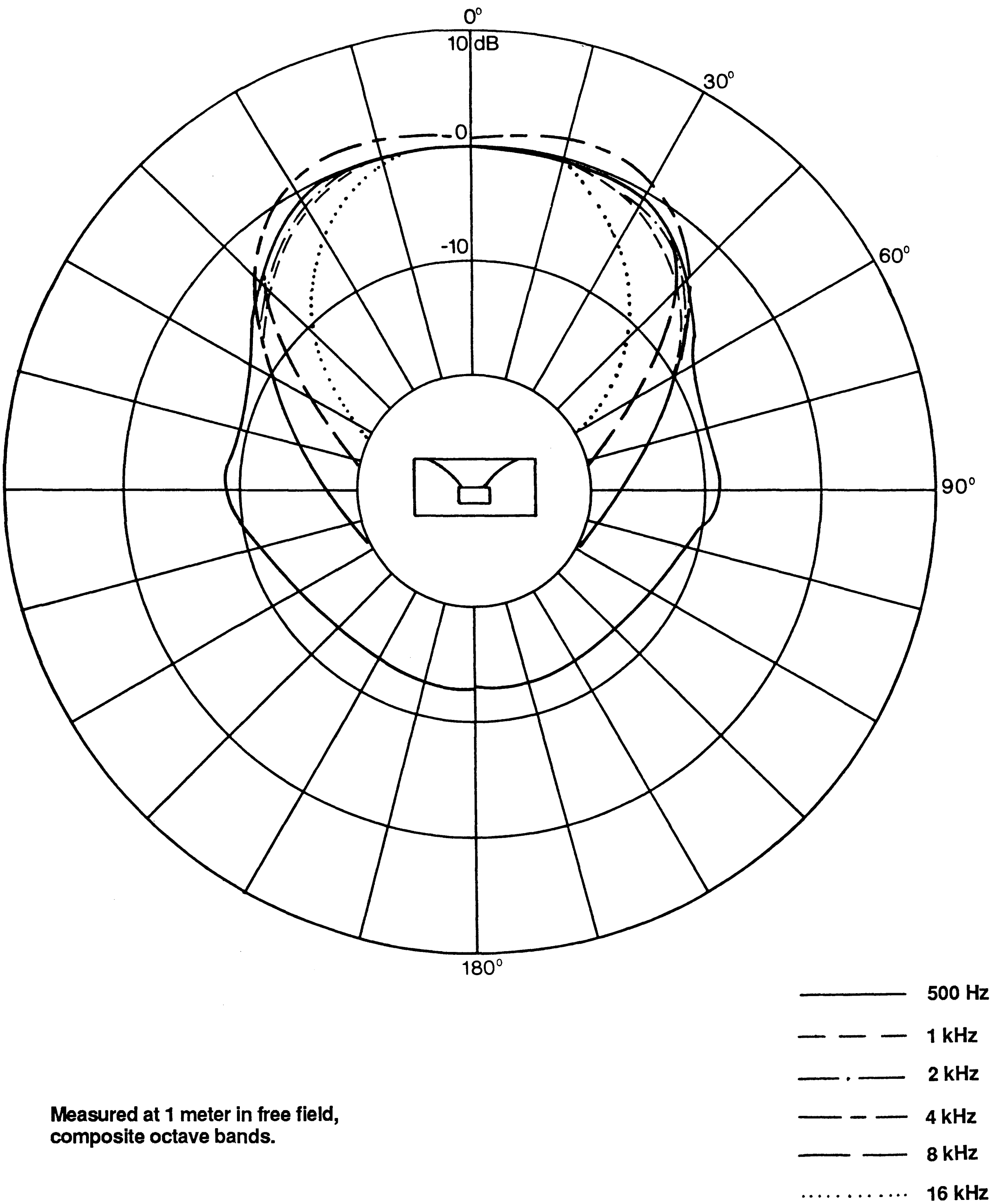
4. Measured with a sine wave sweep in half space, delay response averaged on an octave-band basis.

5. Measured at one meter on axis in quarter space, Loudspeaker driven by 500 Stereo Integrated Amplifier.

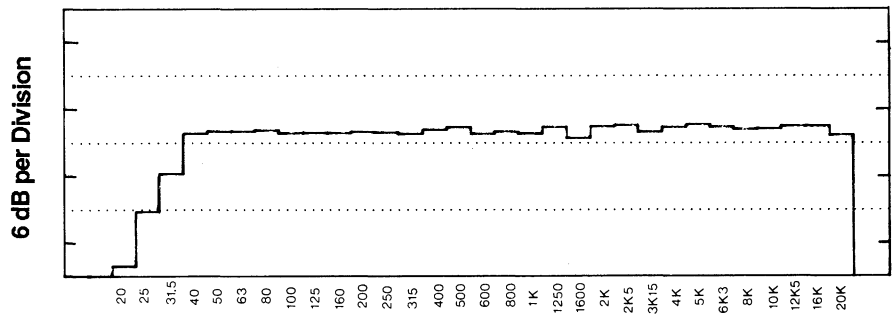
6. Electronic protection limits continuous power output to speakers in order to maintain safe operating parameters.

7. Measured at one meter, fan on low speed, normal operating temperature. For high speed operation, add 10 dB.

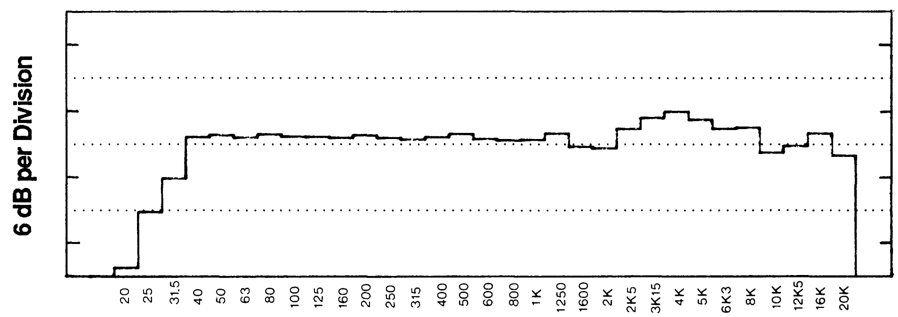
Horizontal Polar Pattern



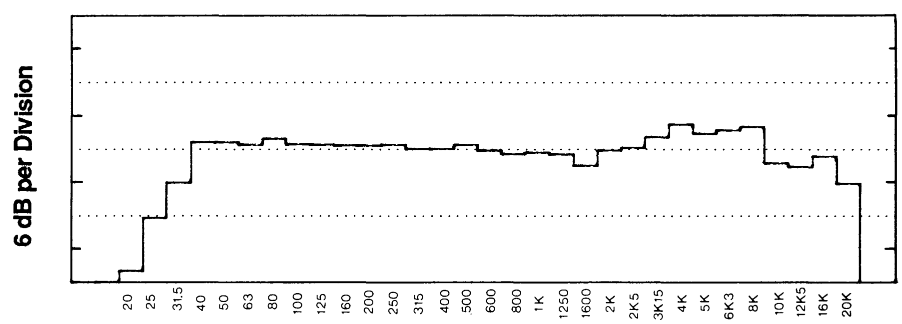
Measured at 1 meter in free field, composite octave bands.



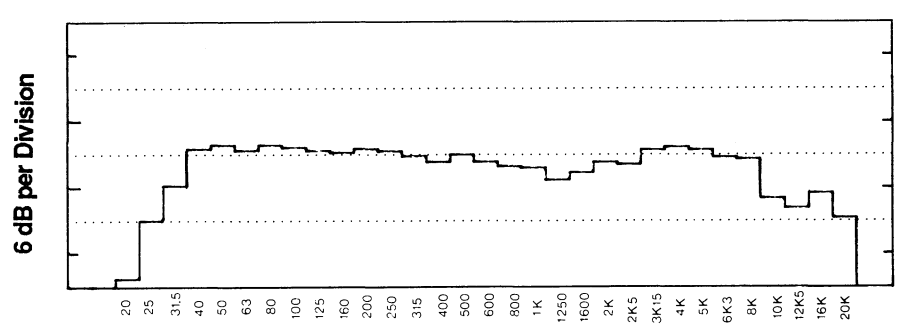
On Axis



15° Horizontal

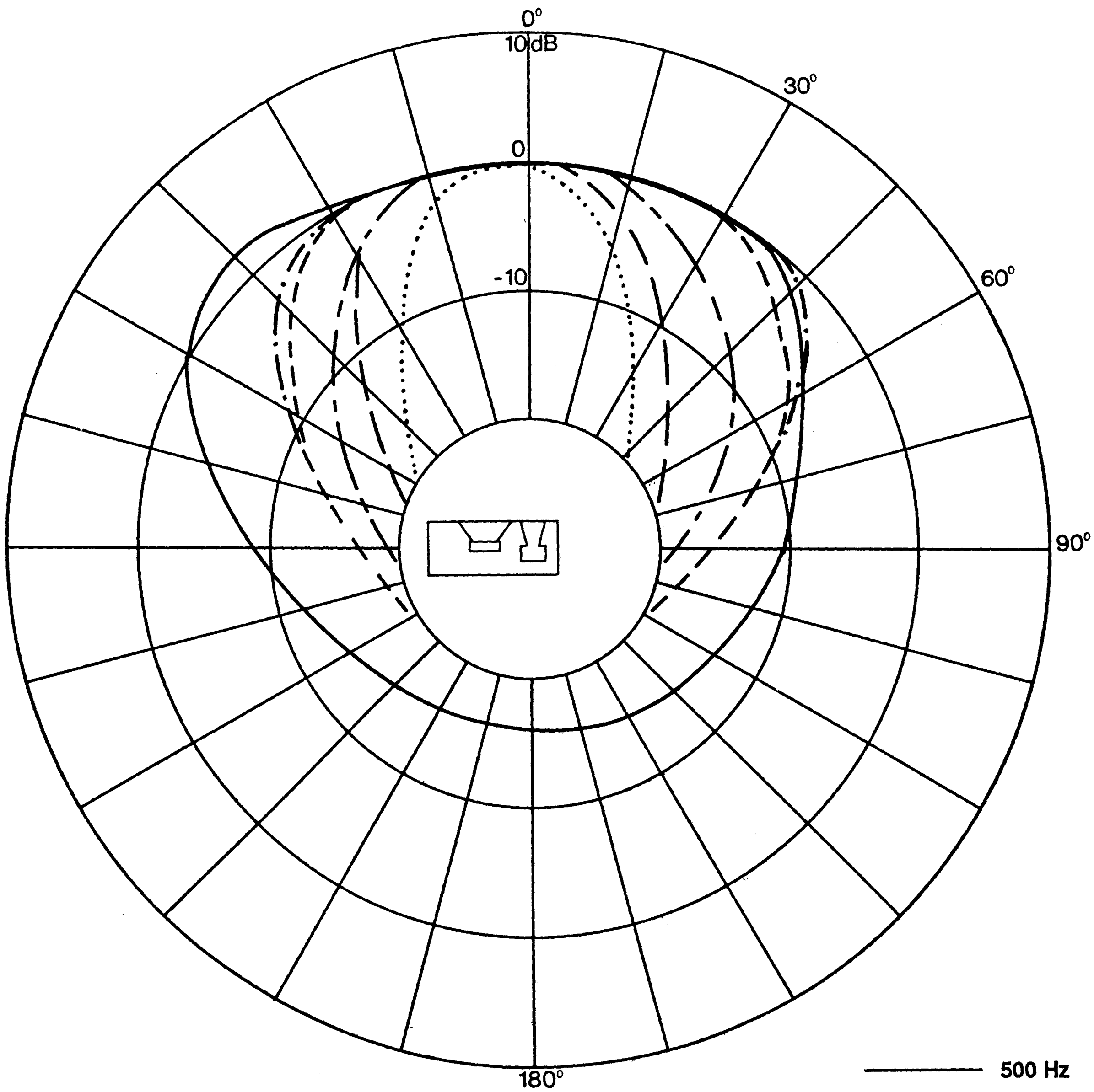


30° Horizontal



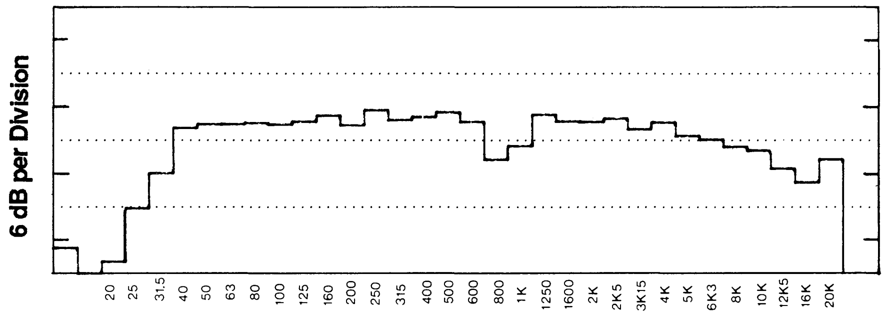
45° Horizontal

Vertical Polar Pattern

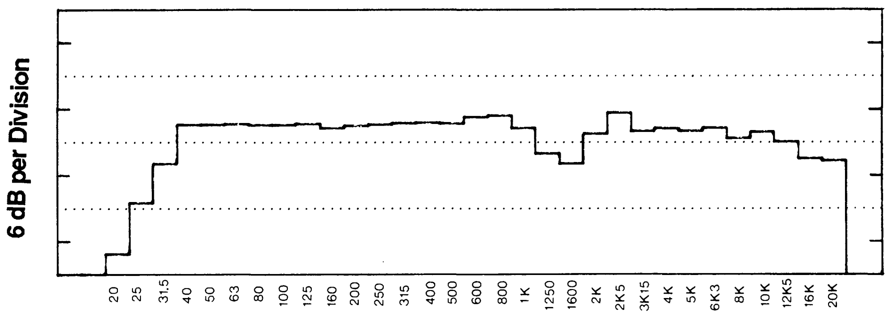


————	500 Hz
— — —	1 kHz
—— · ——	2 kHz
—— — ——	4 kHz
—— ——	8 kHz
············	16 kHz

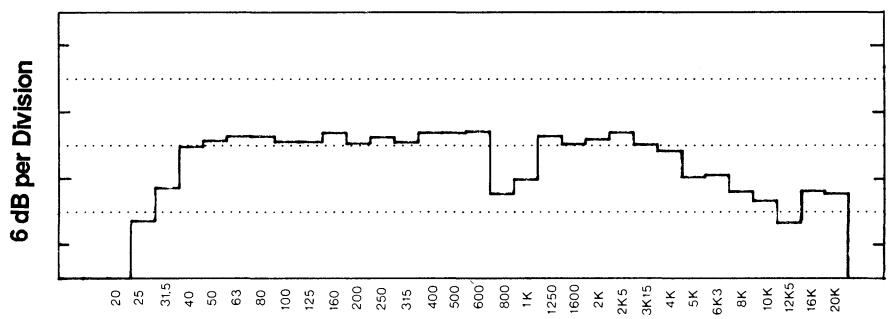
Measured at 1 meter in free field, composite octave bands.



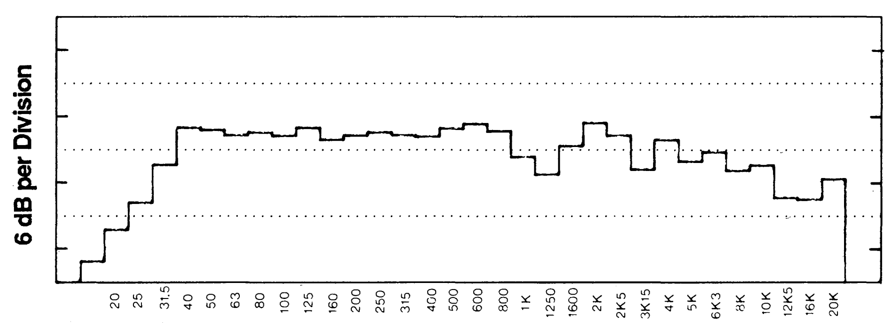
+ 15° Vertical



- 15° Vertical

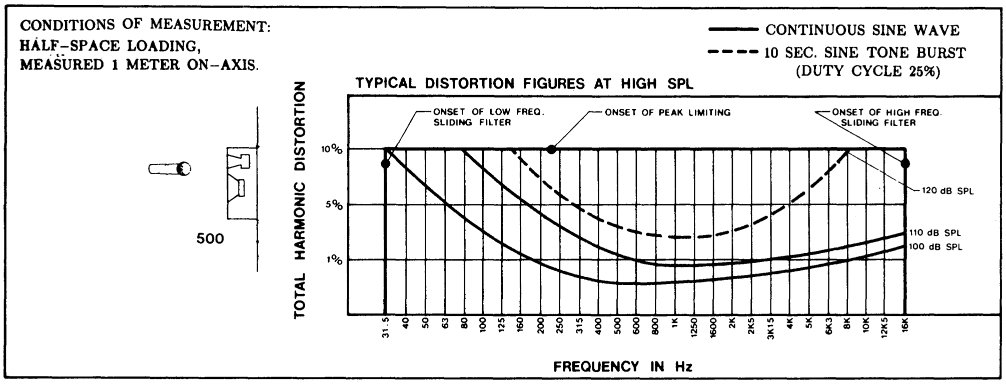


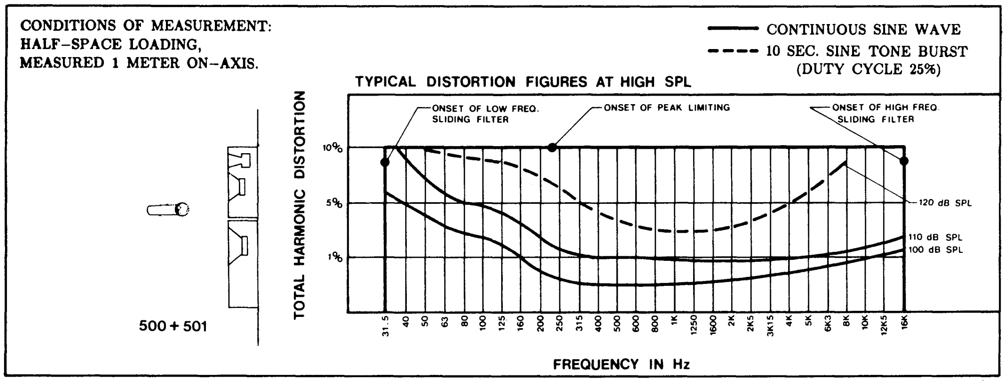
+ 30° Vertical

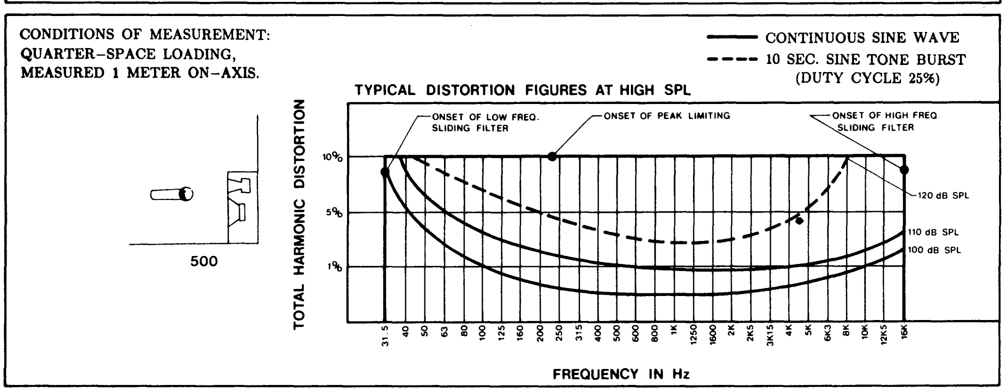


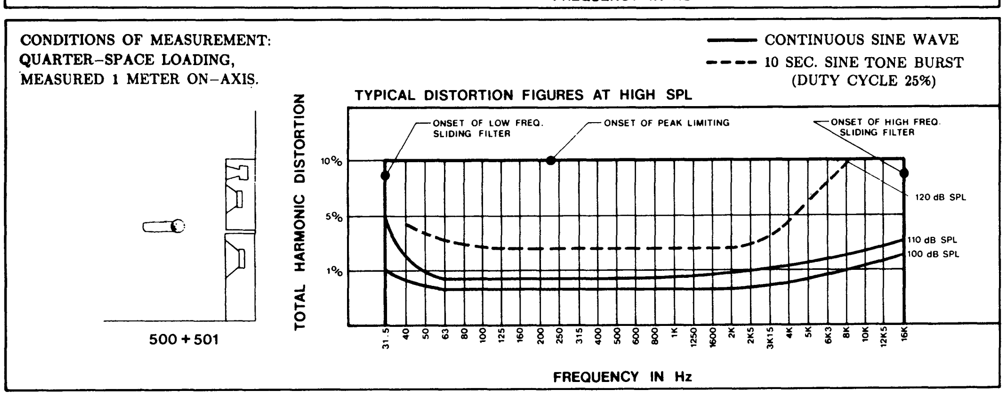
- 30° Vertical

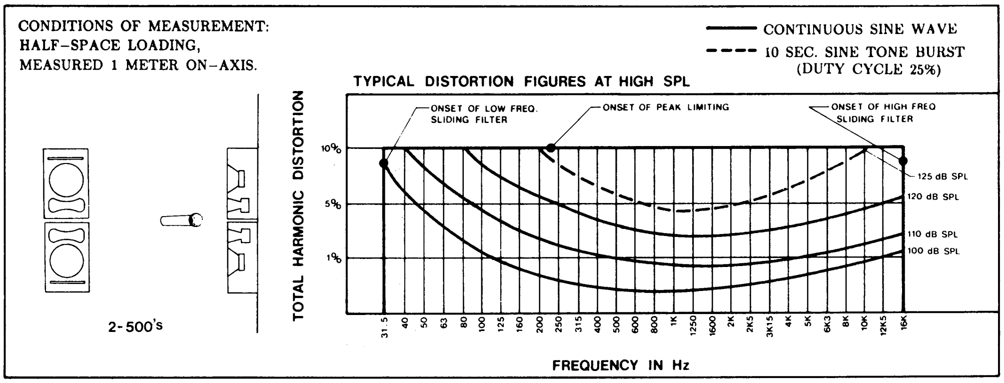
Typical Distortion Characteristics

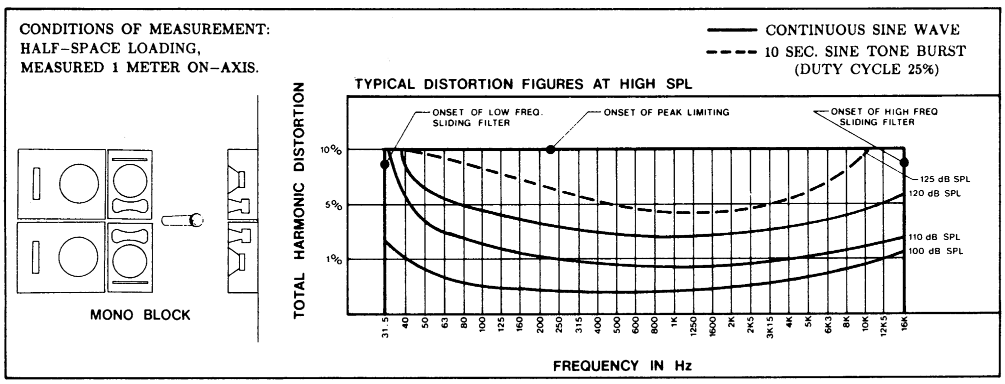




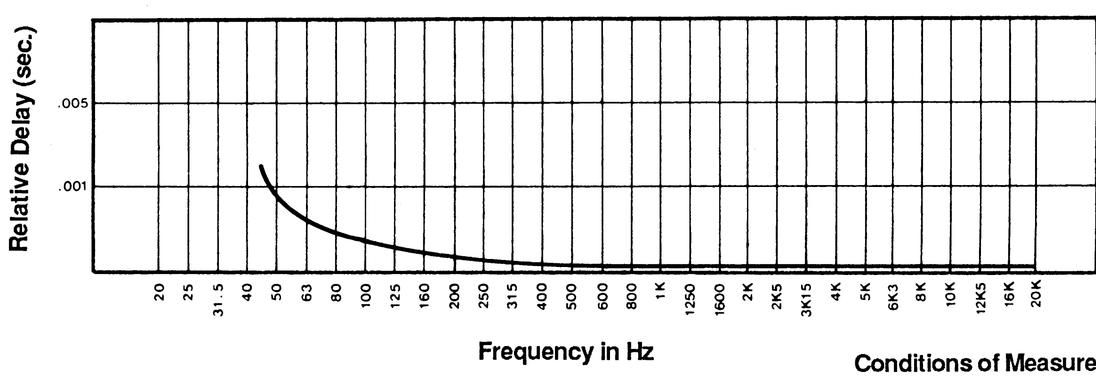








Relative Delay Response With 500 Integrated Amplifier



Conditions of Measurement:

Half-space loading, measured 1 meter on axis from horn lip, averaged on an octave band basis.

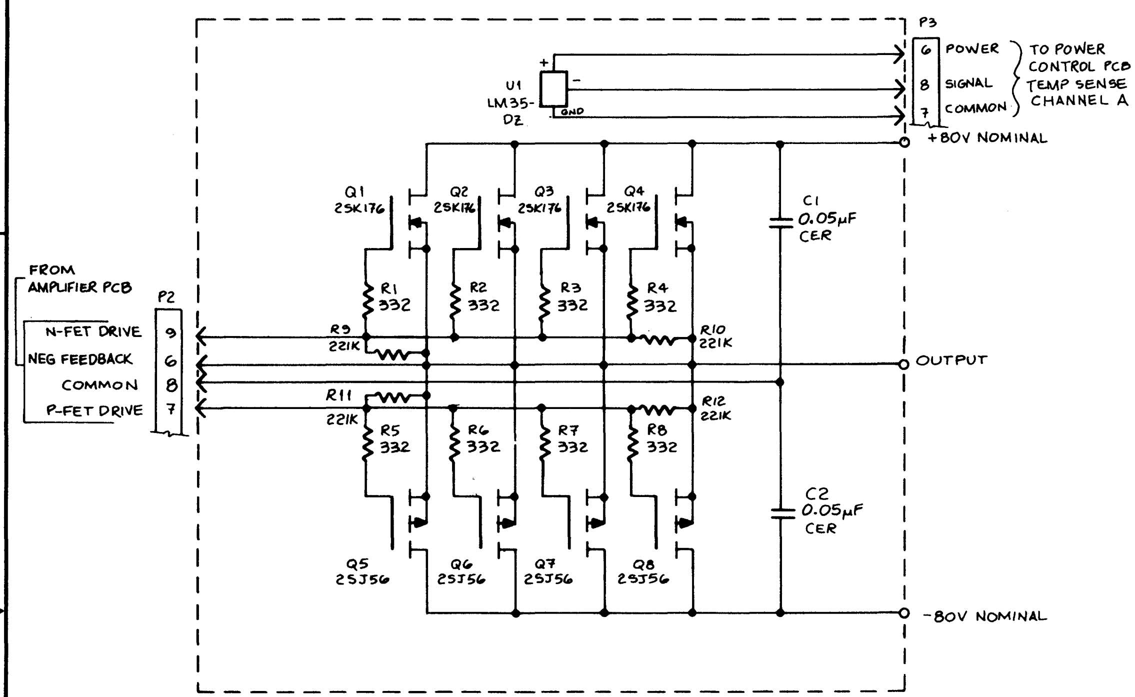
Acoustical Power in Watts, Half-Space Loading

Frequency in Hz	500 or 500R	501 Subwoofer	500 with 501	518R Subwoofer	500R with 518R
32	0.1	0.5	1	0.1	3
40	0.2	3	15	1.5	5
50	0.4	45	45	5	15
63	0.45	45	50	5	40
80	0.6	45	45	15	45
100	1	20	30	15	40
125	4	15	20	5	40
160	5	5	10	3	20
200	5	0.1	5	2	5
250	5	0.1	5	2	5
315	4	0.1	4	1	4
400	4	0.1	4	0.5	4
500	3.5	0.1	3.5	0.5	3.5

Appendix
Schematic Diagrams for the 500 Stereo Integrated Amplifier

REVISIONS				
REV	DATE	DESCRIPTION	BY	CHK
X1	5/15/86	PROTO RELEASE	PB	
X2	6/23/86	REV VALUES OF C1,2 (0.05 WAS 0.1) ECR-0575	PB	
A	12/17/86	PRODUCTION RELEASE X2=A (ECR-0710)		

CHANNEL A SHOWN



NOTES:

1. ALL RESISTORS ARE RN60, MF, 1/2W, 1%.
2. Q1-4 REPRESENTS N-FET; Q5-8 REPRESENTS P-FET.

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	POWER MOSFET, OUTPUT STAGE	SEE NOTES

ITEM	PART NUMBER	DESCRIPTION	QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
DECIMALS .X ± .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

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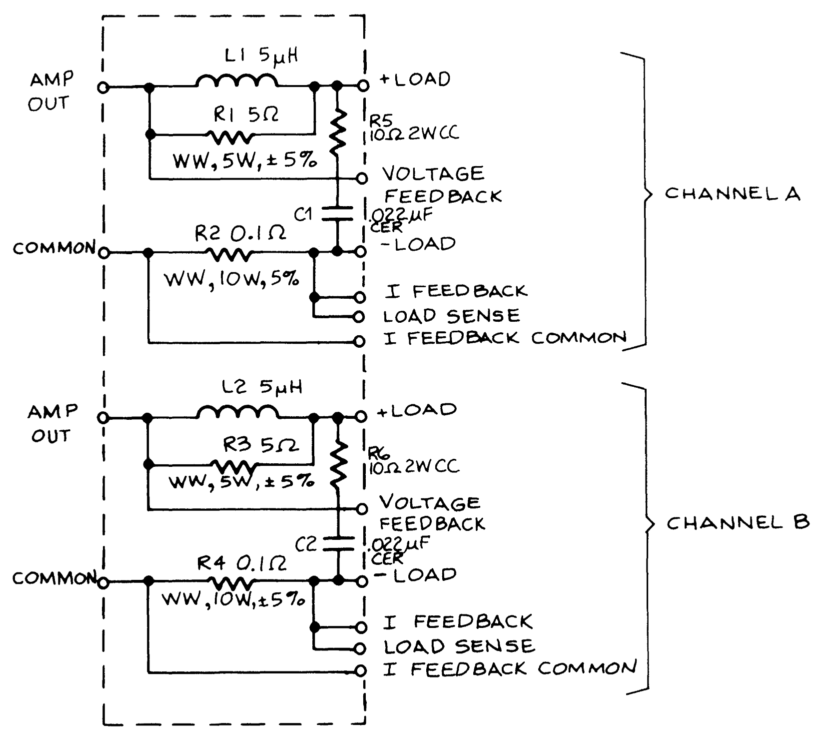
POWER MOSFET, OUTPUT STAGE

DRAWN BY BLAND DATE 5/15/86 | APPROVED 5/15/86 | APPROVED 5/14/86 | SIZE C | DRAWING NO. 26100027 | REVISION A | SCALE NTS | SHEET 1 OF 1



REVISIONS				
REV	DATE	DESCRIPTION	BY	CHK
X1	5/14/86	PROTOTYPE RELEASE	PB	Rq
A	12/17/86	ADD C1;C2 & R5;R6. X1→A PROD.R'LEASE(ECR-0705)	TWM	Rq

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	SCHEM, OUTPUT BUILDOUT PCB	———

ITEM	PART NUMBER	DESCRIPTION	QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
DECIMALS .X ± —— .XX ± —— .XXX ± —— ANGLES ± ——

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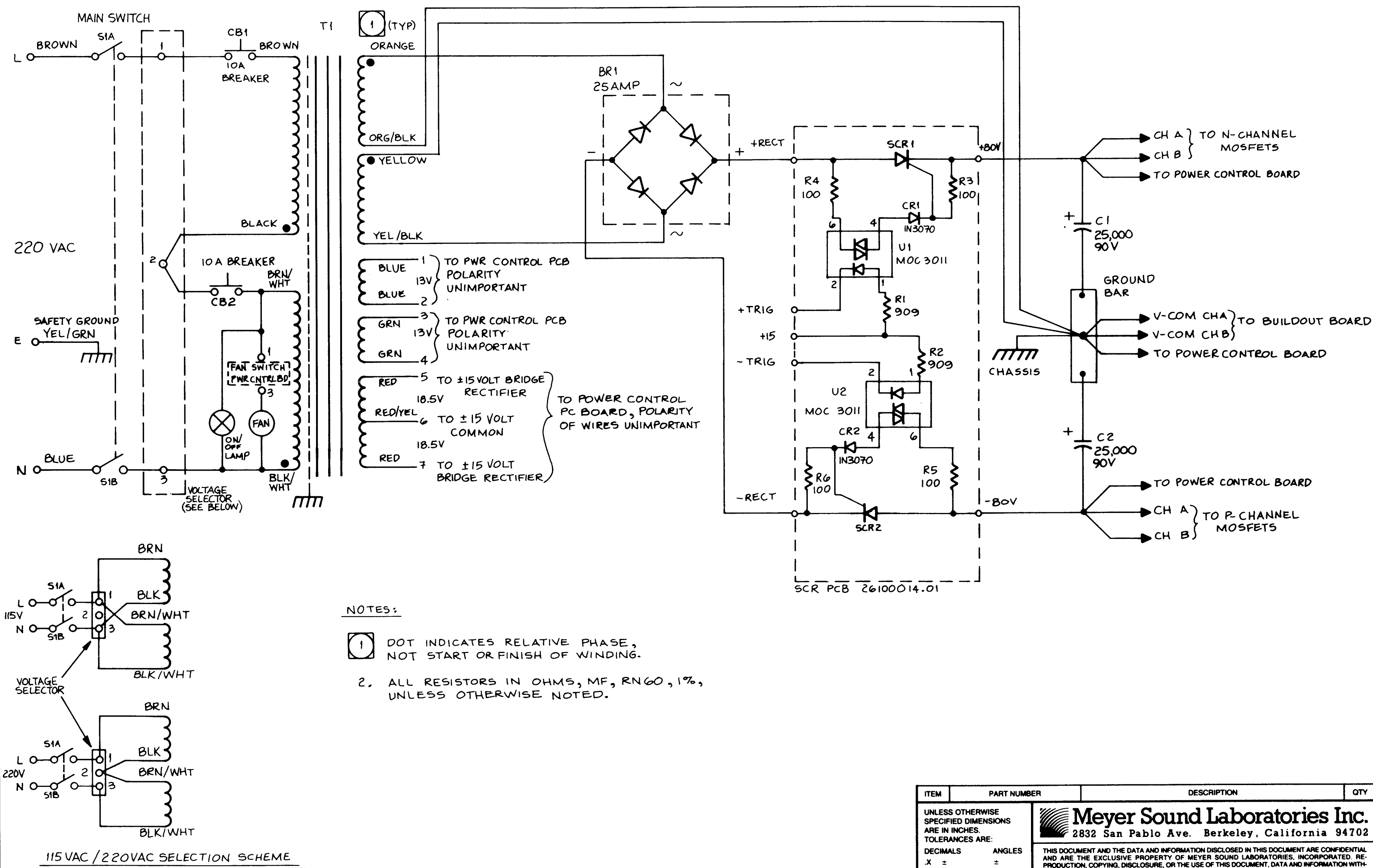
MATERIAL

SCHEM, OUTPUT BUILDOUT, 500 AMP

FINISH	DRAWN BY BLAND	DATE 5/13/86	SIZE B	DRAWING NO. 26100013	REVISION A
	APPROVED Rq	5/14/86			
DO NOT SCALE DRAWING	APPROVED GG	5/16/86	SCALE	SHEET 1 OF 1	

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A34854



NOTES:

1. DOT INDICATES RELATIVE PHASE, NOT START OR FINISH OF WINDING.
2. ALL RESISTORS IN OHMS, MF, RN60, 1%, UNLESS OTHERWISE NOTED.

REV	DATE	DESCRIPTION	BY	CHK
A	12/17/86	PRODUCTION RELEASE (ECR-0756) REV S1; SHOW VOLT. SELECT CORRECT; X3#A		
X3	8/25/86	DELETE CURRENT COIL BOARD, REV. C1 & C2 (ECR-0633)		PB
X2	6/23/86	ADD CURRENT COIL BOARD (ECR-0545)	PB	
X1	5/12/86	PROTOTYPE RELEASE	PB	

ITEM	PART NUMBER	DESCRIPTION	QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
DECIMALS .X ± .XX ± .XXX ± ANGLES ±
MATERIAL
FINISH
DO NOT SCALE DRAWING

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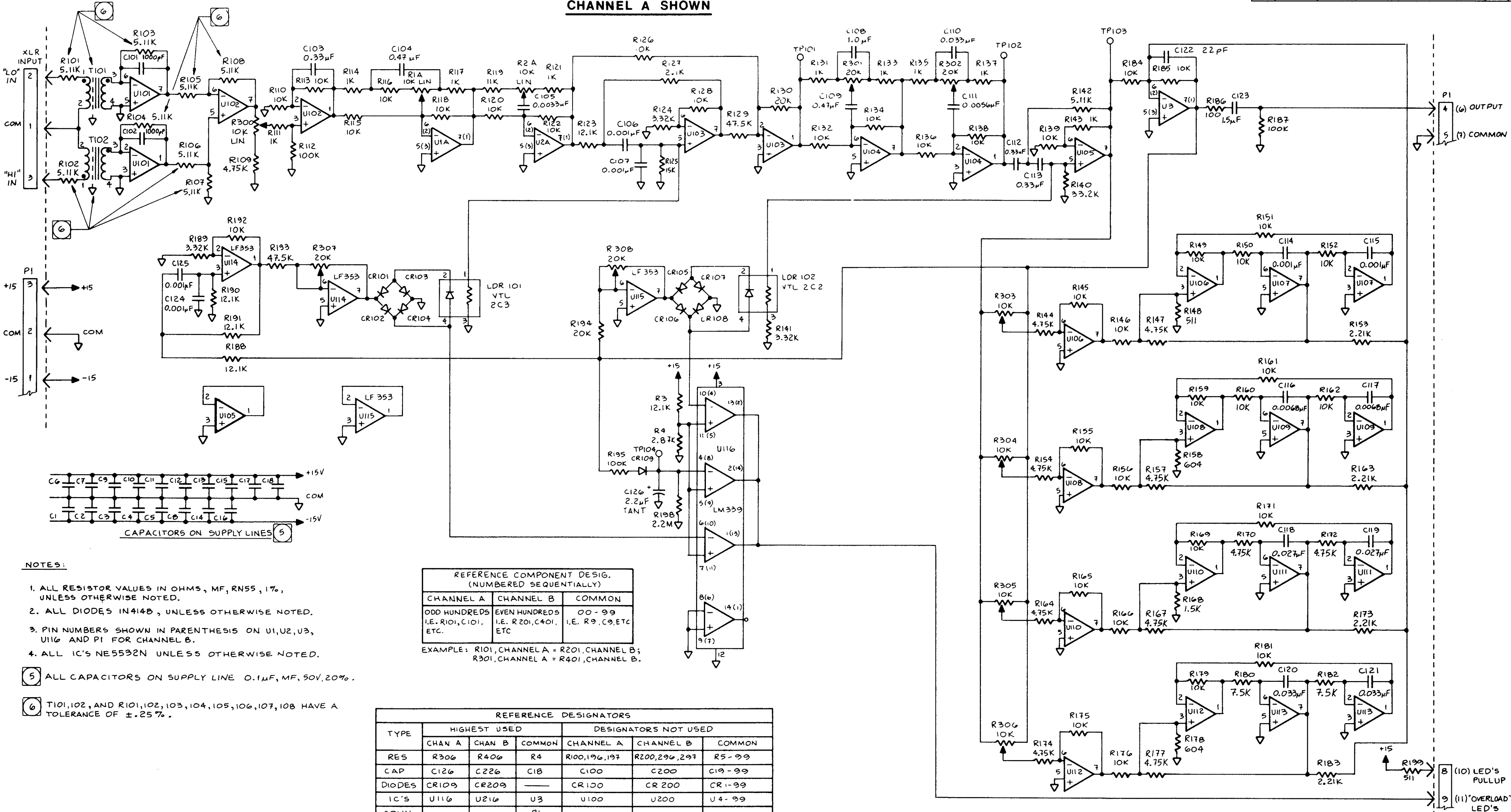
SCHEM, PWR XFMR, BR RECT, SCR BOARD, 500 AMP.

DRAWN BY BLAND DATE 5/15/86
APPROVED 5/15/86
APPROVED 5/16/86
SIZE C
DRAWING NO. 26100024
REVISION A
SCALE
SHEET 1 OF 1



NOTES:

1. ALL RESISTOR VALUES IN OHMS, MF, RN55, 1%, UNLESS OTHERWISE NOTED.
2. ALL DIODES IN4148, UNLESS OTHERWISE NOTED.
3. PIN NUMBERS SHOWN IN PARENTHESIS ON U1, U2, U3, U116 AND P1 FOR CHANNEL B.
4. ALL IC'S NE5532N UNLESS OTHERWISE NOTED.

(5) ALL CAPACITORS ON SUPPLY LINE 0.1μF, MF, 50V, 20%.

(6) T101, 102, AND R101, 102, 103, 104, 105, 106, 107, 108 HAVE A TOLERANCE OF ±.25%.

REFERENCE COMPONENT DESIG. (NUMBERED SEQUENTIALLY)		
CHANNEL A	CHANNEL B	COMMON
ODD HUNDREDS I.E. R101, C101, ETC.	EVEN HUNDREDS I.E. R201, C401, ETC	00 - 99 I.E. R9, C9, ETC

EXAMPLE: R101, CHANNEL A = R201, CHANNEL B; R301, CHANNEL A = R401, CHANNEL B.

REFERENCE DESIGNATORS						
TYPE	HIGHEST USED			DESIGNATORS NOT USED		
	CHAN A	CHAN B	COMMON	CHANNEL A	CHANNEL B	COMMON
RES	R306	R406	R4	R100, 196, 197	R200, 296, 297	R5 - 99
CAP	C126	C226	C18	C100	C200	C19 - 99
DIODES	CR109	CR209	——	CR100	CR 200	CR 1 - 99
IC'S	U116	U216	U3	U100	U200	U4 - 99
CONN	——	——	P1	——	——	——
LDR'S	LDR102	LDR 202	——	LDR 100	LDR 200	LDR 1 - 99
XFMR	T102	T202	——	T100	T200	T1 - 99

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	SCHEM, 500 PROCESSOR	——

REV	DATE	DESCRIPTION	BY	CHK
4	12/17/86	C104 WAS .33μF. X3 A PROD RELEASE (ECR 0902)		
X3	8/6/86	R193 WAS 20K (ECR-0582)	PB	
X2	6/18/86	ADD NOTE 6; CHG VALUES OF R101-108. MOVE R147, 157, 167, 177; ADD NEW VALUES (ECR-0544)	PB	
X1	5/6/86	PROTOTYPE RELEASE	PB	

REVISIONS: REV | DATE | DESCRIPTION | BY | CHK

ITEM | PART NUMBER | DESCRIPTION | QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS X - XX - XXX - ANGLES

MATERIAL

FINISH

Meyer Sound Laboratories Inc.
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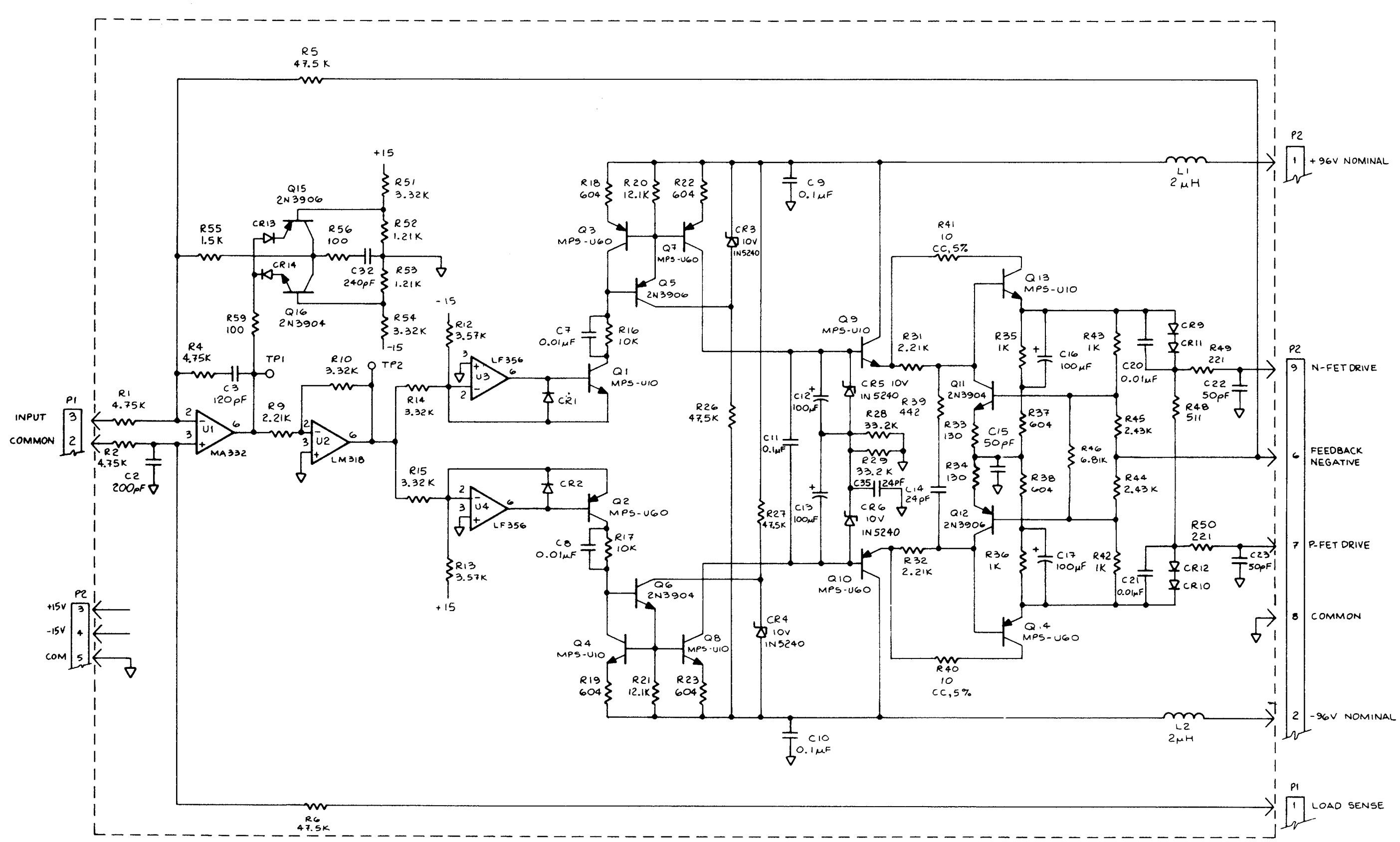
SCHEMATIC, 500 PROCESSOR BOARD

DRAWN BY BLAND DATE 5/6/86 SIZE D DRAWING NO. 26100015 REVISION A

SCALE NTS SHEET 1 OF 1

DO NOT SCALE DRAWING

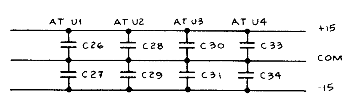
REV	DATE	DESCRIPTION	BY	CHK
X1	4/18/86	PROTOTYPE RELEASE	PB	
X2	6/24/86	REVERSED P1 (2,3) ECR-0576	PB	
X3	8/25/86	REV. VALUES R46 & R47; ADD C35 (ECR-0633)		PB
A	11/12/86	CORR +15 @ R13 (WAS -15); CORR -15 @ R12 (WAS +15); DELE R7, R8, R47, C4, C5; SWITCHED C14, R39 (ECR-0713)	PB	



NOTES:

1. ALL RESISTOR VALUES IN OHMS, MF, RN60, 1% UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ON DIAGRAM 0.1µF, 50V, 20%.
3. ALL DIODES IN4148 UNLESS OTHERWISE NOTED.

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	SCHEM, POWER AMPLIFIER	SEE NOTES



CAPACITORS LOCAL TO U1 THROUGH U4 2

IC SUPPLY PIN OUTS			
REF. DESIG	IC TYPE	+15	-15
U1	MA332	7	4
U2	LM318N	7	4
U3, U4	LF356	7	4

DESIGNATOR TABLE		
TYPE	HIGHEST REF	REF NOT USED
RES	R59	R3, R7, R8, R47
CAP	C35	C1, C4, C5
DIODE	CR14	CR7, CR8
IC	U4	
CONN	P2	

ITEM	PART NUMBER	DESCRIPTION	QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS X . XX . XXX . ANGLES

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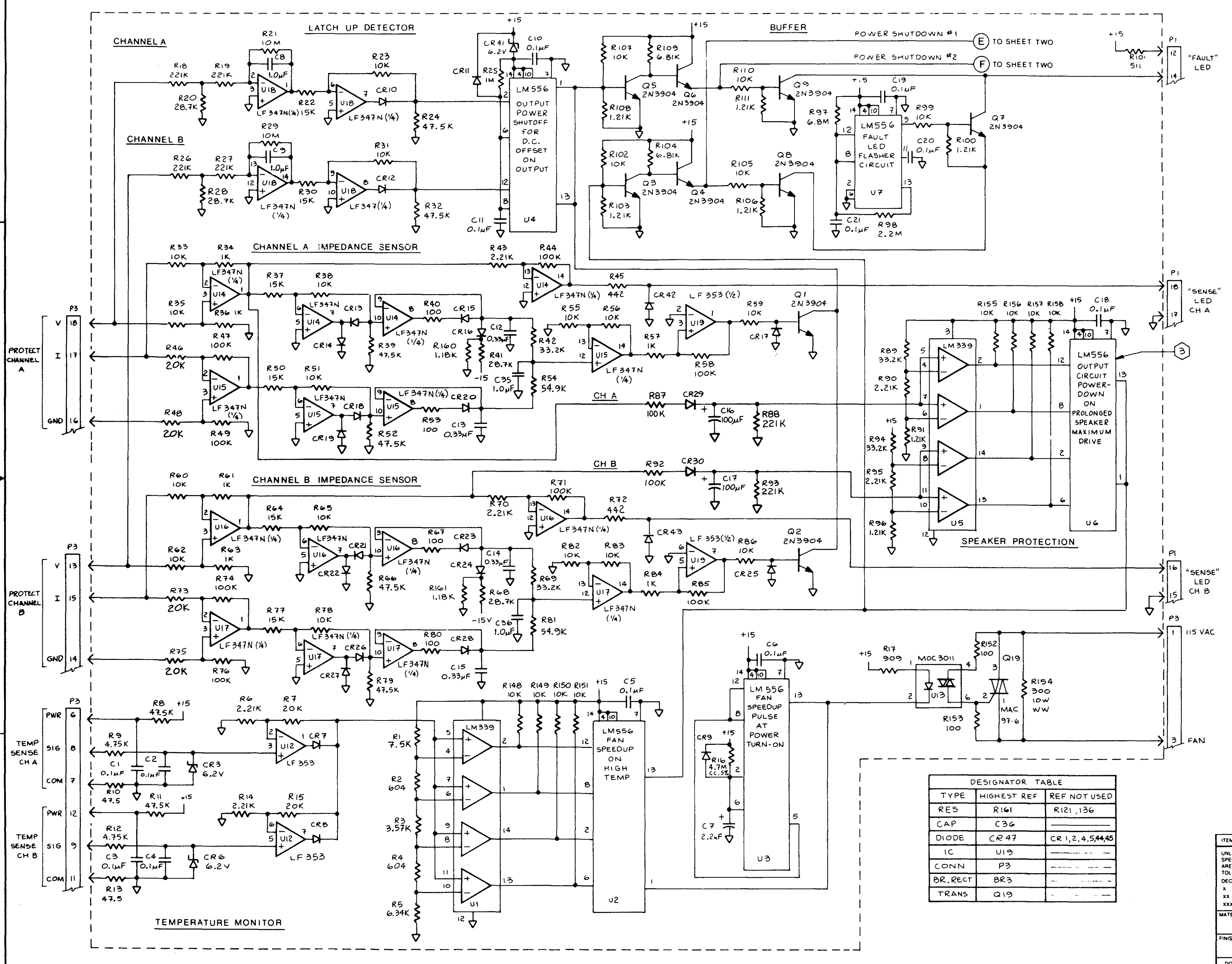
MATERIAL
FINISH

SCHEMATIC, POWER AMPLIFIER BOARD

DRAWN BY BLAND DATE 4/10/86 SIZE D DRAWING NO 26100001 REVISION A
APPROVED 5/14/86
APPROVED 5/15/86 SCALE NTS SHEET 1 OF 1
DO NOT SCALE DRAWING



REVISIONS				
REV	DATE	DESCRIPTION	BY	CHK
X1	5/14/86	PROTOTYPE RELEASE	PB	
X2	6/19/86	ADD CURRENT COIL BD INPUTS, ADD CR44,45, ADD C35,36, R162, CHG NUM VALUES (ECR-0544)	PB	
X3	8/21/86	DELETE CURRENT COIL BD INPUTS & CR44,45, R162 (ECR-0633) CREATE VERSION -02, DISTINGUISH DIFF VERSIONS; R9,12 WERE 100K (ECR-0662)		
A	12/17/86	CORRECT PN REF U19 WAS LM353 IS LF353 X3*A PROD RELEASE (ECR-0759)		
B	2/4/86	R126 WAS 5.11K; R129 WAS 80.6K; CR40 WAS 10V (ECO-0064)	PB	

NOTES:

1. ALL RESISTOR VALUES IN OHMS, MF, RN60, 1%, UNLESS OTHERWISE NOTED.
2. ALL DIODES IN 4148 UNLESS OTHERWISE NOTED.

IC SUPPLY PIN OUTS			
REF DESIG	IC TYPE	+15	-15
U12,19	LF 353	8	4
U14-18	LF 347N	4	11

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	SCHEM, POWER CONTROL 500 AMP	

DESIGNATOR TABLE		
TYPE	HIGHEST REF	REF NOT USED
RES	R161	R121,136
CAP	C36	
DIODE	CR47	CR1,2,4,5,44,45
IC	U19	
CONN	P3	
BR. RECT	BR3	
TRANS	Q19	

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS ANGLES

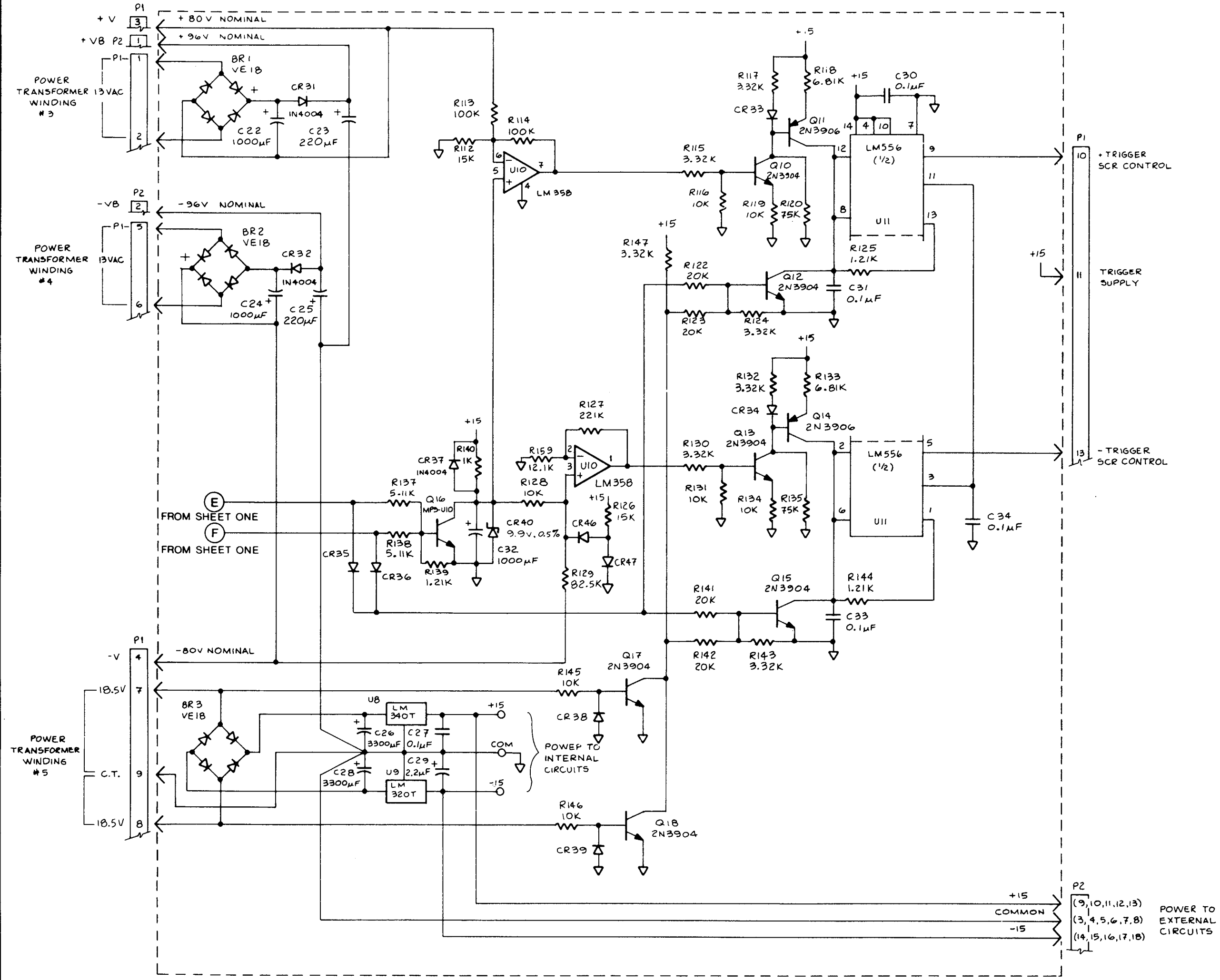
SCHEM, POWER CONTROL BOARD

DRAWN BY BLAND DATE 4/10/86 — SIZE D — DRAWING NO 26100003 — REVISION B

APPROVED 5/14/86 — SCALE NTS — SHEET 1 OF 2

DO NOT SCALE DRAWING

REVISIONS				
REV	DATE	DESCRIPTION	BY	CHK
-	-	SEE SHEET ONE	—	—



DESIGNATOR TABLE		
TYPE	HIGHEST REF	REF NOT USED
RES	R161	R121, 136
CAP	C36	———
DIODES	CR47	CR1,2,4,5,44,45
IC	U19	———
CONN	P3	———
BR. RECT	BR3	———
TRANS	Q19	———

VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	SCHEM, PWR CNTL, 500 AMP	

ITEM	PART NUMBER	DESCRIPTION	QTY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS ANGLES
X ± ——— ± ———
XX ± ———
XXX ± ———
MATERIAL ———
FINISH ———

Meyer Sound Laboratories Inc.
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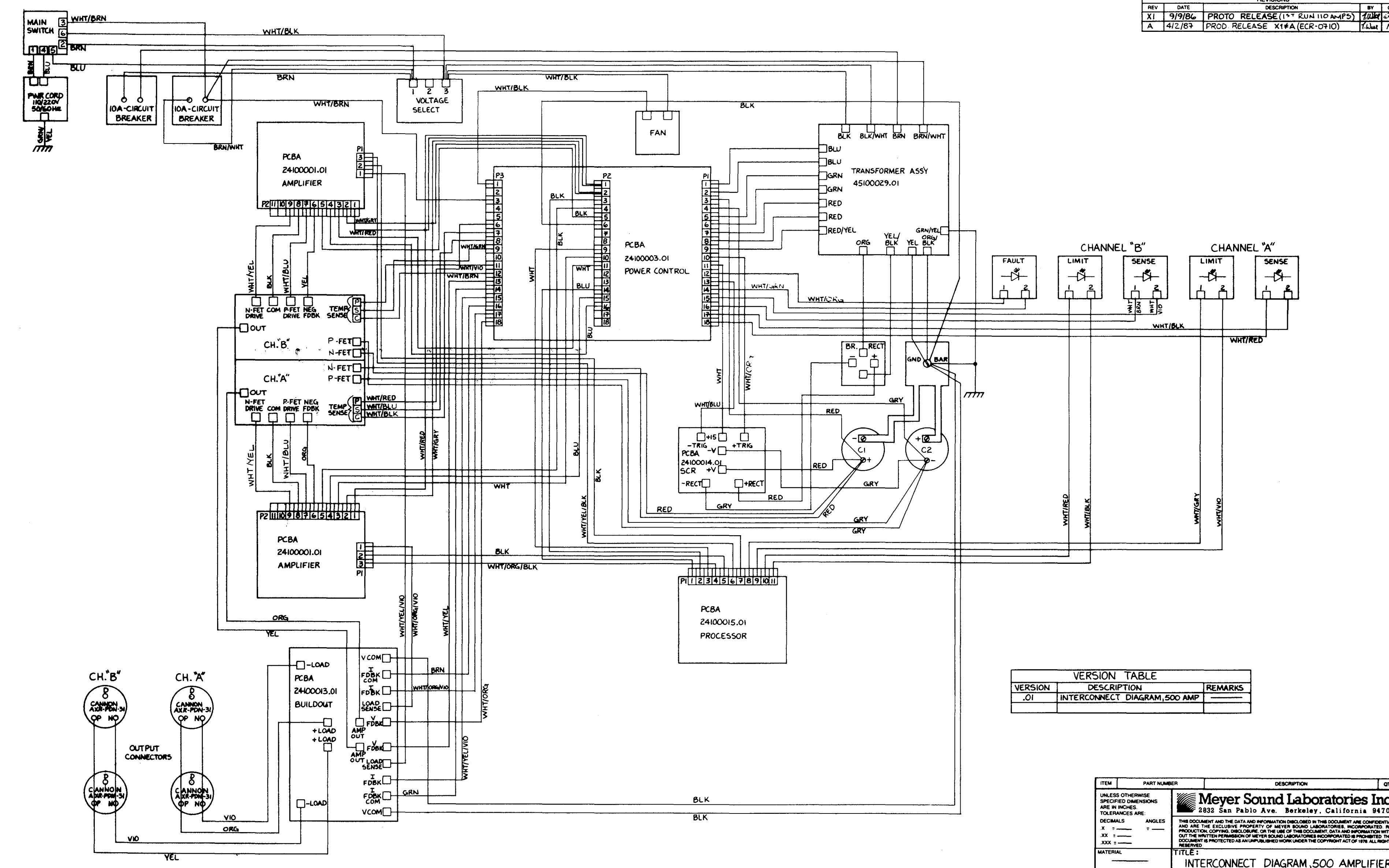
SCHEM, POWER CONTROL BOARD

DRAWN BY	DATE	SIZE	DRAWING NO	REVISION
BLAND	4/10/86	D	26100003	B

APPROVED ——— APPROVED ———
DO NOT SCALE DRAWING — SCALE NTS — SHEET 2 OF 2

REVISIONS				
REV	DATE	DESCRIPTION	BY	CHK
X1	9/9/86	PROTO RELEASE (1ST RUN 110 AMPS)		
A	4/2/87	PROD RELEASE X1#A (ECR-0710)		PB



VERSION TABLE		
VERSION	DESCRIPTION	REMARKS
.01	INTERCONNECT DIAGRAM, 500 AMP	———

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