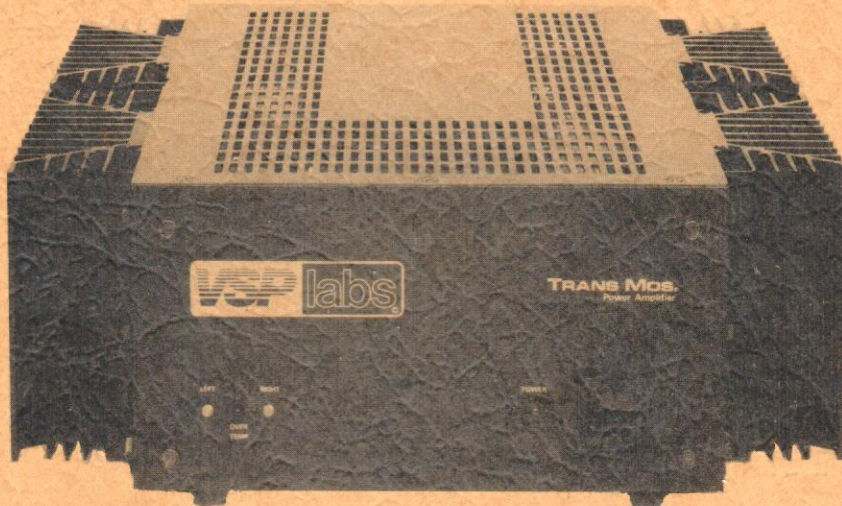




*Trans Mos Amplifier*



**INSTRUCTION MANUAL**  
**Trans Mos "150"**  
**Power Amplifier**

## CONGRATULATIONS

*... On your purchase of the finest and most advanced stereophonic power amplifier on the market today. Your amplifier represents the culmination of many years of thorough research and development by VSP LABS engineers into the modern techniques of amplifier design. It is constructed utilizing the most advanced technology coupled with the highest quality electronics and components available. Innovative and sophisticated design combined with painstaking testing methods assure you of truly exceptional performance and operating value.*

*In order to ensure continuing high performance from your TRANS MOS power amplifier, please read this manual carefully before connecting it to your system. If you have any further questions concerning operation or maintenance of your unit, contact your dealer or VSP LABS Customer Service, 670 Airport Blvd., Ann Arbor, MI 48104.*



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**WARNING**  
**TO PREVENT FIRE OR SHOCK HAZARD DO NOT EXPOSE**  
**THIS APPLIANCE TO RAIN OR MOISTURE**

# SECTION 1

## GENERAL INFORMATION

### 1.1 Introduction

The VSP Labs Trans Mos "150" is a single or dual channel, high output power amplifier. Because of recent exciting advances in MOSFET (Metal Oxide Semiconductor Field Effect Transistor) technology, VSP Labs is able to use the transconductance amplifier design, until now only possible with vacuum tube amplifiers.

**What is a Transconductance Output Stage?** It is an output topology where by the output current is a direct function of the input voltage. It is the circuit topology used in the finest tube power amplifiers.

**What are the Benefits?** Greatly reduced distortion, most significantly at the lower power levels!! Plus reliability and stability under extreme operating conditions the design is actually "self protecting" to ensure the reliability of the Trans Mos "150."

**Versality?** The Trans Mos "150" will handle output speaker loads from 1 ohm to open current which allow you to drive a vast number of speakers plus the most demanding electrostatic speakers.

### 1.2 Features

The Trans Mos "150" power amplifier has an output capability of 150 watts per channel minimum RMS into an 8 ohm load over a band with of 20Hz-20KHz. When operated in the mono mode of operation the Trans Mos "150" will deliver a minimum of 300 watts into a 16 ohm load and a peak output of 2,940 watts at 6 ohms (140VX21A). Extremely low distortion and noise produces the natural smoothness and warmth which underlies live music in the most intimate of settings.

A green "on/off" lamp illuminates when the power switch is depressed to the on position, allowing visual observation of the amplifiers power status even at long distances.

If by any chance the Trans Mos "150" becomes to hot during operation a red "OVER TEMP" light will begin to flash.

If this happens the amplifier will reduce the input signal by 24 decibels, and the red light will continue to flash while the amplifier cools down. Once the Trans Mos "150" has cooled to a safe operating temperature normal operation will resume automatically.

Two amber clipping indicated lamps (left channel & right channel) are provided. Clipping occurs when the amplifier reaches its actual voltage or current limit. In contrast to many amplifiers that simply look at a predetermined voltage value the Trans Mos "150" has a true clipping circuit which activates the clipping lamp for the "exact" time duration that the music is "clipped."

All amplifiers clip, the key is how "softly" or how controlled the amplifier remains when it does clip and it is here that the Trans Mos "150" excels.

Conventional RCA type phono jacks provide for the input signal to the amplifier.

A built in, switch activated, infrasonic filter is provided which prevents harmful subsonics which may be caused by warped records or feedback vibrations from the speaker system. In small quantities subsonics can cause the music to sound muddy or brittle. In large quantities they may create:

- Howling or screeching at higher volumes.
- Low rumbling background when playing records or tapes.
- Fluttering or flopping from the speaker.
- Premature failure of tweeter and midrange drivers.
- Blown speaker fuses at moderate or long volumes.
- Overheating and shut down of the amplifier

The output signal uses standard output binding posts designed to accept standard banana jacks.

An optional rack mounting kit is available.

### 1.3 Glossary of Terms

**A-B Test:** Evaluating relative performance of two (or more) components or systems by changing quickly from one to the other. Most high fidelity dealers have A-B test facilities.

**Attenuation:** A decrease in signal magnitude from one point to another or the process causing this decrease.

**Biamp:** The use of independent amplifiers to feed the bass and treble portions of a loudspeaker or loudspeakers with a crossover network. The purpose is to help reduce intermodulation between bands when a system is overloaded. It also reduces the cost of implementing good, low loss precision crossover networks.

**Capture Ratio:** The ability of a receiver to reject a weaker station whose frequency is the same as that of the desired station. This measurement will be in dB. The smaller the figure, the better the specification.

**Ceramic Filter:** A bandpass filter using a piezoelectric substrate material.

**Channel:** A channel is a complete sound path. A single channel, or monophonic system, has one channel. A stereophonic system has at least two full channels designated as left (A) and right (B). Monophonic material may be played through a stereo system; both channels will carry the same signal. Stereo material, if played on a monophonic system, mixes and emerges as a monophonic sound.

**Channel Separation:** Specified in dB, channel separation is the ratio of the measurable output of one channel to the unwanted output of the (undriven) opposite channel.

**Clipping:** the truncation of peaks of a signal due to exceeding the operating range of an electronic circuit. Normally, it refers to the result of voltage limitations in the circuit.

**Corner Frequency:** The frequency at which a filter goes from a condition of passing the signal unattenuated to "rolling off" or attenuating the signal according to its frequency. It is sometimes referred to as the "cutoff" frequency or the "break" frequency. It is also defined as 3dB below the unattenuated output level of the signal.

**Crossover Network:** A selective network used to divide the audio frequency output of an amplifier into two or more bands of frequency. The band below the crossover frequency is fed to the woofer of the loudspeaker while the high frequency band is fed to the tweeter. Also called dividing network and loudspeaker dividing network.

**Crosstalk:** Signal leakage from one signal source into another.

**Damping:** Controlling of vibrations, response, or resonances which if unchecked, would cause coloration of the sound.

**Damping Factor:** A numerical indication of an amplifier's ability to decrease unwanted loudspeaker movements. Damping factor can be found by dividing the load impedance by the amplifier's output impedance.

**Decibel:** A numerical expression of acoustic or electrical ratios, such as the relative intensity of a sound or the relative strength of a signal. One (dB) is about the smallest change in sound perceptible to the ear.

**Distortion:** Unwanted noise, or sounds which didn't exist in the studio when the original recording was made. Harmonic distortion produces tones harmonically related to a single, pure tone. Intermodulation distortion (IM) introduces new tones caused by mixing of two or more original tones. Phase distortion, or non-linear phase shift, disturbs timing sequence between a tone and its related overtones. Distortion which creates new spectra are expressed in percentages and phase distortion in degrees of phase shift or seconds of group delay vs. frequency errors.

**Dynamic Range:** The difference between the most intense and the least intense levels in a sound system.

**Feedback:** Sending a "part" of a system's output back to the input. Positive feedback may lead to unstable conditions such as PA system "howling" due to sound from the speakers being fed back thru the microphone and amplified again. Another form is low frequency interference created when vibrations from loudspeakers are picked up by the cartridge and amplified again. However, carefully controlled negative feedback in electronic circuits can be used to help reduce distortion and control stability.

**Flutter:** Rapid variation in the speed of a turntable or tape transport. Flutter causes a wavering of musical pitch.

**Frequency Response:** This term indicates any amplitude variations in a system output signal with respect to frequency. This measurement is made with a constant level input signal.

**Gain:** The ratio of an amplifier's output voltage to its input voltage.

**Headroom:** Stated in dB, headroom is the difference between the signal level and the limits of the sound system ie; the ratio of power available to power used.

**Hertz:** Cycles-per-second.

**IF:** An Intermediate Frequency is a frequency to which a signal wave is shifted locally as an intermediate step in FM transmission or reception.

**Input Sensitivity:** The input voltage required to drive an amplifier to its rated output.

**LED:** Light Emitting Diode. A PN junction that emits light when biased in the forward direction.

**Limiters:** A circuit in which the output amplitude is substantially linear with regard to the input up to a predetermined value and substantially constant thereafter.

**Load:** A device that absorbs power and converts it into the desired form.

**Music Power:** This rating expresses the ability of an amplifier to handle short duration power peaks, as opposed to sustained power levels. An amplifier may only be capable of putting out 45 watts if that level is continuous, but it may be able to handle 60 watt peaks (such as might occur in a musical passage), if the peaks do not last too long.

**Sensitivity:** A receiver specification indicating the smallest input signal strength required to produce an output signal whose characteristics are standardized and used as a reference.

**Signal:** A visible, audible or other conveyor of information.

**Signal-To-Noise-Ratio:** Measure in dB, signal to noise ratio is relative term meaning the ratio between the desired output signal and the interference or noise. A typical figure would be 60dB which stands for a ratio of 1000-1.

**Triamp:** The use of three separate amplifiers to drive the high, middle and low frequency sections of a speaker system.

**Wow:** Distortion caused in sound reproduction by slow variation in speed of the turntable or tape. (See flutter.)

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## SECTION 2

# SPECIFICATIONS AND PERFORMANCE

### 2.1 General Specifications

**Hum and Noise (20 Hz-20KHz)** > 112 db below rated output.

**Input Impedance:** 130 K ohm (resistive 20-20KHz)

**Overall Protection:** AC line fused. Thermal switch in transformer plus control logic protects against over heating caused by insufficient ventilation. Input overload protection is furnished by resistance at inputs of the amplifier.

**DC Output Offset:**  $\pm$  50 millivolts or less, typical 5-10 millivolts, internally adjustable.

**Power On:** Optimally balanced output stage assuring instant power-on without thump, eliminating the need for distortion—adding relays in the signal path.

**Power Supply:** 650 watt transformer with massive computer-grade filter capacitors storing 98.4 Joules of Energy. Eight regulated supplies for complete isolation and stability.

**Power Requirements:** Requires 50-400 Hz AC. Factory set for either 110 or 220 vac +10%-20% draws 85w at idle, 600 watts at 300 watts total output. Note: A 10 amp circuit is recommended.

**Heat Sinking:** Over 1100 sq. inches of black-anodized heat sink are thermally joined with the chassis. Thereby utilizing the entire amplifier as a heat sink.

**Controls:** 16A/250V self wiping power on/off rocker switch; front panel leds: power clipping & over temp; rear panel infrasonic slide switch; rocker stereo/mono switch.

**Connectors:** AC line 3 wire male connector RCA type phono input jacks, output-color coded dual binding posts.

**Dimensions:** 5" h x 15" w x 14" d

**Weight:** 40 pounds

### 2.2 Stereo Specifications

**Output Power:** 150 watts per channel minimum RMS (both channels operating) into an 8 ohm load over a bandwidth of 20Hz to 20KHz

**Headroom:** at 8 ohm > 2.8 dB

**Frequency Response:** 20 Hz to 50 KHz

**Harmonic Distortion:** < .05% @ 150W, 20 Hz to 20 KHz

**IM Distortion:** .02% from 100W to 150W, 20 Hz to 20 KHz

**Slew Rate:** > 70 volts/usec.

**Damping Factor:** > 200 (20Hz to 20KHz)

**Output Current:** Instantaneous 44 amps peak to peak

**Input Sensitivity:** 2v rms to 150w output at 8 ohm

**Rise Time:** Exponential \*(-3dB at 100KHz)

### 2.3 Mono Specifications

**Output Power:** 300 watts at 16 ohm 20Hz to 20KHz

**Frequency Response:** 20 Hz to 50 KHz

**Harmonic Distortion:** < .05%

**Imdistortion:** < .04% from 100w to 150w, 20 Hz to 20 KHz

**Damping Factor:** > 200 @ 16 ohms

**Input Sensitivity:** 2v RMS to 300w output @ 16 ohms

# SECTION 3

## INSTALLATION AND OPERATION

### 3.1 Unpacking

Before leaving VSP Labs, your Trans Mos "150" was carefully inspected for any physical imperfections as a routine part of our systematic quality control to insure flawless appearance and operation of your amplifier.

Always save the original carton and packing materials, as they are designed to reduce the possibility of transportation damage should you wish to transport your amplifier.

After unpacking the amplifier, inspect the unit visually for any physical damage.

In the unlikely event that damage has occurred, immediately notify your dealer and request the name of the carrier so that a written damage claim can be initiated.

THE RIGHT TO ANY CLAIM AGAINST A PUBLIC CARRIER CAN BE FORFEITED IF THE CARRIER IS NOT NOTIFIED PROMPTLY AND IF THE SHIPPING CARTON AND THE PACKING MATERIALS ARE NOT AVAILABLE FOR INSPECTION BY THE CARRIER. ALWAYS SAVE ALL PACKING MATERIALS.

### 3.2 Installation

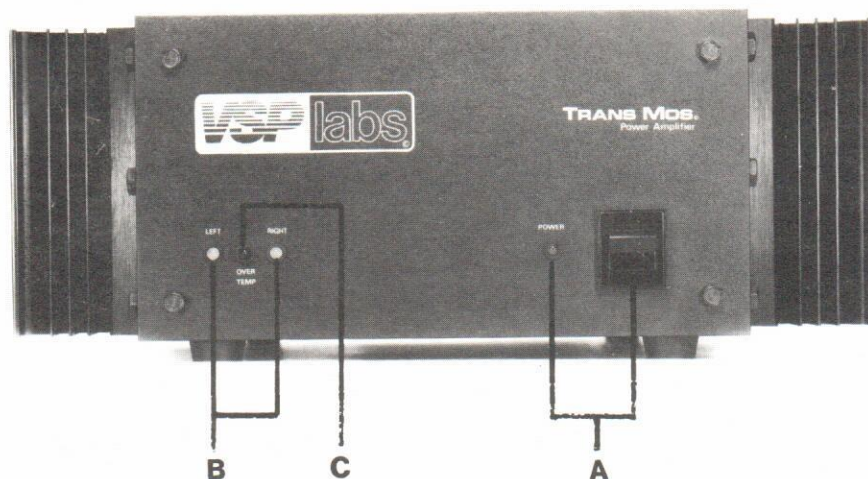
The Trans Mos "150" may be used either free standing or mounted in a standard 19 inch rack. Rack mounting requires the use of an optional kit (RM 150) available from your dealer. Regardless of how the unit is installed, proper ventilation must always be provided. Never place the amplifier on any surface which may inhibit proper air flow around and through the unit such as carpet or foam. Allow at least 1.5 inches of free air space from each surface to insure proper ventilation.

### 3.3 Operating Precautions

The following are a number of operating precautions given as an aid to understanding proper and improper amplifier usage.

1. Use care in making connections, selecting signal sources and controlling the output level. VSP Labs is not liable for any damage done to loads.
2. Never parallel the output with any other amplifier's output. Such connection does not result in increased power output. Damage incurred by such operation is not covered under warranty.
3. Never drive a transformer coupled device or any other device which appears as a low frequency short (less than 3 ohms at DC) without a series isolating capacitor. Such operation may damage the device and/or needlessly waste output power.
4. Do not short the ground lead of an output cable to the input signal ground as oscillations may result from forming such a ground loop.
5. Because of potential shock hazard or damage to the unit, never remove the covers!
6. Operate the amplifier from AC mains of not more than 10% above or below the selected line voltage and only 50-60 Hz. Failing to comply with these frequency limits will also invalidate the warranty.
7. Never connect the output to a power supply output, battery, or power mains. Damage caused by such hookup is not covered by the warranty.
8. Tampering in the circuitry by unqualified personnel or the making of unauthorized circuit modifications, invalidates the warranty.

Fig. 1.0 Trans Mos "150" Front Panel



### 3.4 Controls and Indicators

The following paragraphs refer to the front and rear panel diagrams (Fig 1.0 and Fig 1.1).

#### A. Power Switch/Indicator

In the up position the green power LED will glow indicating the Trans Mos "150" amplifier is operating.

Make sure the volume is turned down at the pre amp before turning the amplifier on.

Although the Trans Mos "150" will not cause any harmful "thumps" through the speakers when turned on or off, your pre amp may. To eliminate this always turn the pre amp on first, set the volume to it's minimum setting, and wait several seconds for it to warm up before applying power to the Trans Mos "150." When turning your system off reverse this operation by turning the amplifier off first.

#### B. Clipping Indicators

The yellow left and right clipping LED's will flash when its respective channel begins to clip. Occasional flashing of these indicators is quite normal and will increase at louder volume settings or when playing extremely dynamic music.

#### C. Over Temp Indicator

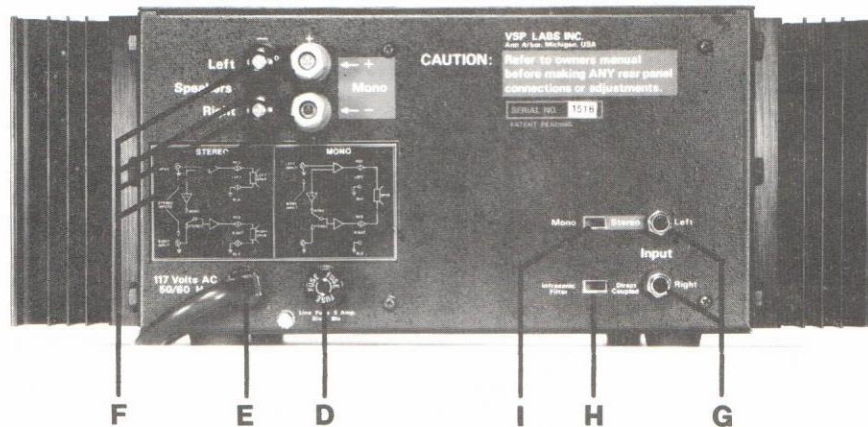
This RED LED will flash when the maximum permitted preset temperature is reached. When this happens the input signal of the amplifier is attenuated 40 decibels for each channel. The "Over Temp" indicator will continue to flash as the Trans Mos "150" cools to a safe operating temperature. Once the amplifier reaches a safe operating temperature "normal" operation will resume automatically. "Over Temping" will not harm the amplifier and only occurs during prolonged periods of extremely high output.

#### D. AC Line Fuse

The line fuse needs only to be checked if the Trans Mos "150" does not operate. The 8 amp SLO-Blow AC fuse is part of the amplifiers protection circuit and must only be replaced with a fuse of the same type and value! Replacement with a different type and value may create a safety hazard and will void the warranty.

IF THE PROPER FUSE BLOWS WITH NO SIGNAL APPLIED TO THE INPUT THERE MAY BE AN ELECTRONIC COMPONENT FAILURE. NO FURTHER ATTEMPTS TO REPLACE THE FUSE SHOULD BE MADE. CONTACT YOUR DEALER OR VSP LABS CUSTOMER SERVICE DEPT. FOR ASSISTANCE!

Fig. 1.1 Trans Mos "150" Rear Panel



### E. AC Line Cord

The power line cord is furnished with a three wire, heavy duty plug as standard equipment. Instructions for connecting power are located in section 3.5.

### F. Output Jacks

The cables from one or two speakers may be connected to the speaker output jacks. See section 3.6 for stereo operation or section 3.7 for mono operation.

### G. Input Jacks

One or two cables from the preamplifier to the input jacks. See Stereo or Mono operation for additional information.

### H. Infrasonic Filter

This switch introduces an active 18db per octave filter at the beginning of the signal path. Current state of the art has improved the overall bandwidth of high performance audio systems to the point where turn table rumble and other subsonics caused by record warp and/or tone arm cartridge resonances have resulted in less than satisfactory enjoyment to the listener. These signals, although inaudible by themselves, have caused the following effects in various magnitudes and combinations:

- 1) Audible modulated signals in the signal band.
- 2) Excessive cone excursion in the loudspeaker system which could result in damage to the voice coil and/or suspension system especially on rented loudspeakers.
- 3) Premature overload of the power amplifier causing signal clipping which generates large amounts of high frequency signals. This in turn can overload and damage tweeters.

The subsonic filter located within the Trans Mos is designed to eliminate unwanted information below 20Hz, while at the same time increasing overall dynamic range. The filter aids in protecting both amplifier and speaker.

**NOTE! POWER MUST BE OFF BEFORE CHANGING SWITCH SETTING!!**

### I. Mode Selector

This switch allows the Trans Mos "150" to be used either as a stereo or monophonic amplifier. In mono the Trans Mos provides 300 watts per channel. And two units are required for mono operation. For additional information refer to section 3.7.

**NOTE! POWER MUST BE OFF BEFORE CHANGING SWITCH SETTING!!**

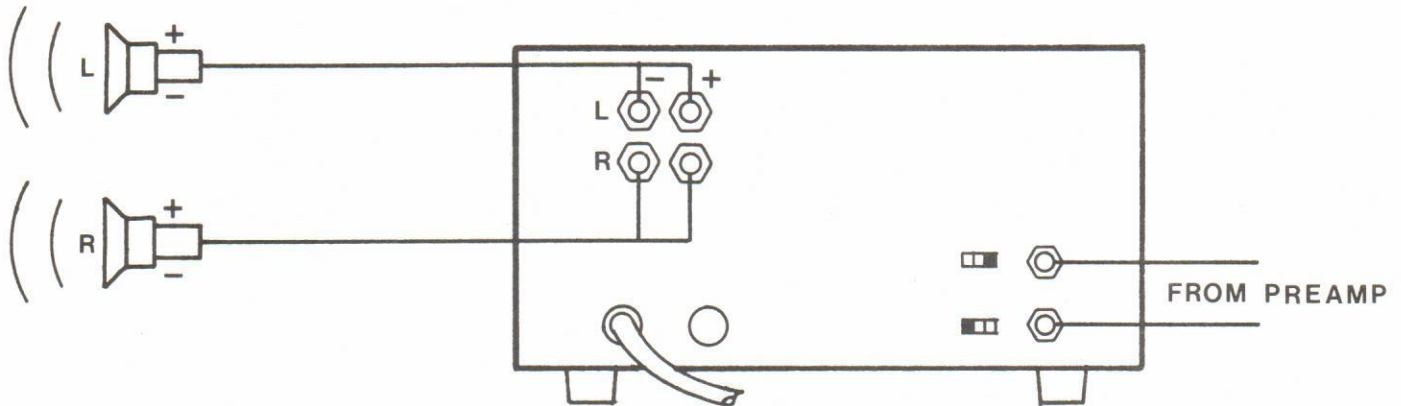


Fig. 2.1 Typical Stereo Hookup

### 3.5 Electrical Connection

The Line cord of the Trans Mos "150" should always be plugged into a grounded AC outlet providing 120v 50/60 Hz. The AC, power cord of your unit is terminated with a three-prong grounded plug. The ground pin (round) should under no circumstances be defeated either by removing it or utilizing an improperly connected three-to-two contact reducing adapter.

**NEVER OPERATE THE AMPLIFIER UNLESS PROPERLY GROUNDED.** Because of high voltage consumption of the Trans Mos "150" it should be plugged directly into a wall outlet. If you should desire to draw AC power from another piece of Electronic equipment make sure the outlet used has a voltage rating of at least 800 watts.

### 3.6 Stereophonic Operation

Prior to making or changing any connection, turn the volume setting on the preamplifier fully counter clock-wise and turn the power OFF on both the preamplifier and the Trans Mos "150."

1. Set the mode selector switch on the rear panel to the STEREO position.
2. Connect the output from the preamplifier to the inputs marked LEFT and RIGHT on the rear of the Trans Mos "150."
3. Connect the speakers as shown in fig. 2.1. All standard or electrostatic loudspeakers may be connected to the speaker binding posts. The BLACK binding posts are connected to the "ground" or NEGATIVE terminal of the loudspeakers. The RED binding posts are connected to the "HOT" or positive terminal of the loud speaker. 16 Gauge or heavier wire is recommended.

**NEVER PARALLEL THE TWO OUTPUTS BY TYING THEM TOGETHER, OR PARALLEL THEM WITH ANY OTHER AMPLIFIER'S OUTPUT! SUCH A CONNECTION MAY RESULT IN DAMAGE TO THE OUTPUT DEVICES AND IS NOT COVERED BY WARRANTY!**

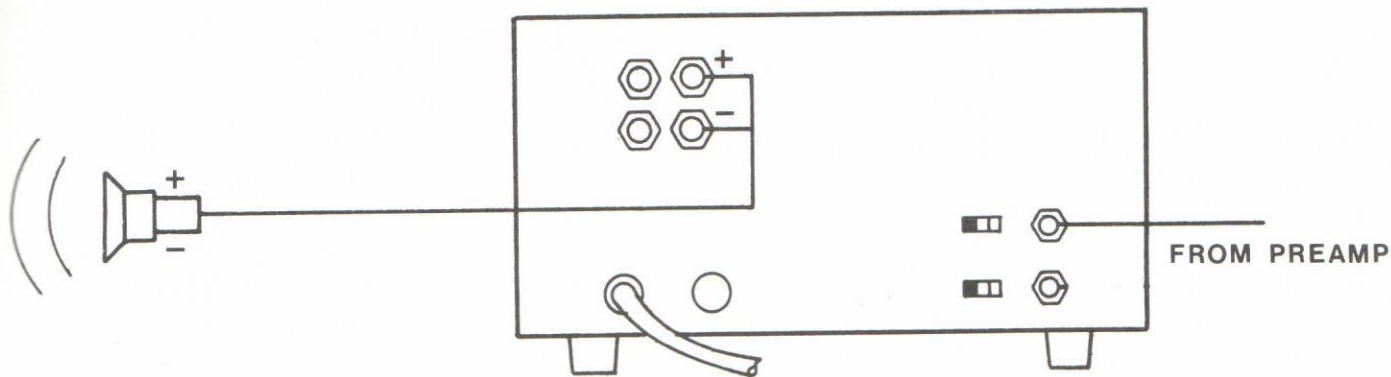


Fig. 2.2 Typical Mono Hookup

### 3.7 Monophonic Operation

Prior to making or changing any connections, turn the volume setting on the preamplifier fully counter clock-wise and turn the power off on the preamplifier and the Trans Mos "150"

1. When the Trans Mos "150" is operated in MONO mode, only one output from the preamplifier (right or left) is used, and is always connected to the LEFT input on the amplifier.

2. Connect the speaker as shown in figure 2.2 only the RED or "hot" (+) speaker terminals are used. The positive side of the speaker is connected to the left RED terminal on the Trans Mos. The negative side of the speaker is connected to the RIGHT RED terminal on the Trans Mos.

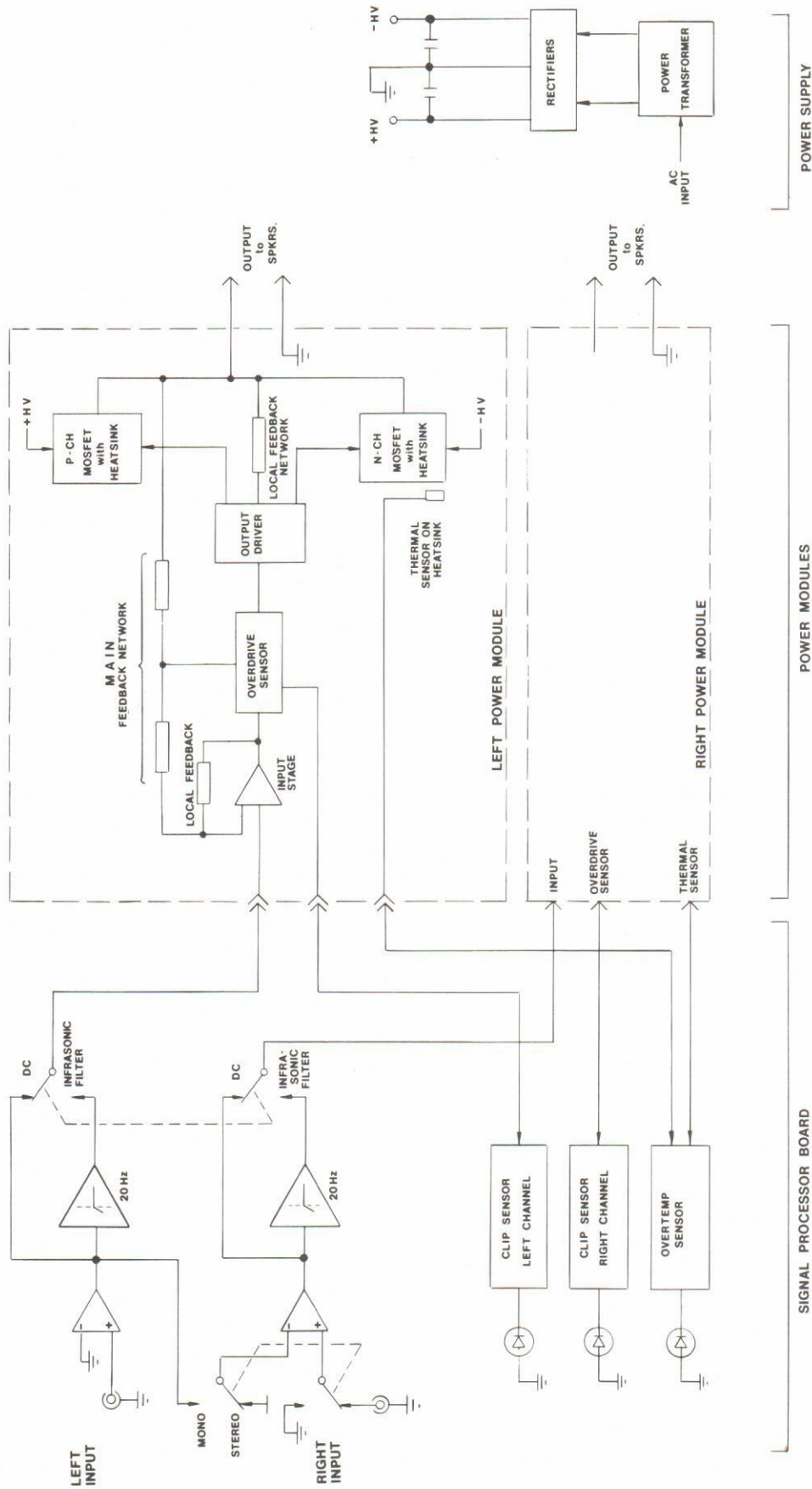
3. Make sure the mode selector switch is in the MONO position. CAUTION: Do not attempt to change the switch setting when the amplifier is in operation.

### 4.0 Theory of Operation

The TM150 power amp electronics is comprised of three boards. Two of these boards are called power modules; one is assigned to the left channel, the other to the right channel. The third board is called a signal processor board and it contains the low level input stage, subsonic filters and switching network for the infrasonic filter and monostereo. It also contains the clip sensors for the left and the right channel, as well as the overtemp electronics to mute the audio in cases where the power module exceed their designed limit and overtemp indicator. The Functional Block Diagram is shown on page 00. From the block diagram, the input signals from the preamp is fed into the left input and right input,

respectively. The signal is received by a low level input stage which presents a resistive 130 KM load to the preamp. The output of the first stage is then fed into an infrasonic filter. The switch at the back of the amplifier allows the user to select either DC coupling or the output of the infrasonic filter which has a cutoff of 20 hertz with an effective roll off rate of 18 DB per octave. The input stage of the amplifier is not included in the main feedback network. This feature was deliberately chosen so that in those instances where the amplifier is momentarily clipped, the main feedback network does not change the effective input impedance of the amplifier and thereby not overload the output of the preamp. From the signal processor, the signal is now fed into the power module. The power module is comprised of a second low level input stage with its own local feedback. From here it drives the output driver which in turn drives the mosfet output stage. The output stage contains a local feedback network for two reasons. The first one is to define the open loop gain of the output stage as well as the frequency and phase response. The main feedback network of the amplifier connects the output back into input for error correction. However, as compared to conventional amplifiers, the main feedback network is split into two sections. In situations where the output stage goes into a clipping mode, the overdrive sensor injects a false current into the main feedback network, thereby preventing the input stage of the power module from going into clipping. This allows for the earliest possible recovery of the amplifier from clipping and at the same time it reduces spikes or ringing in the output of the amplifier at the instant the amplifier goes into clipping or comes out of clipping.

The last section in the Functional Block Diagram is the power supply. It consists of a power transformer, rectifiers, and a bank of filter capacitors.



# FUNCTIONAL BLOCK DIAGRAM

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**"ONLY THE MUSIC REMAINS"**