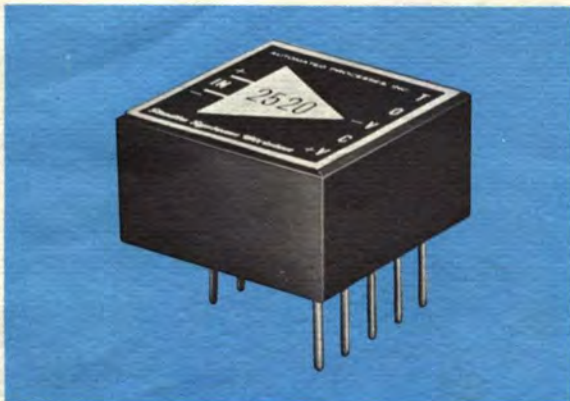


# Audio Operational Amplifier

## MODEL 2520



### Features

- Extremely low noise
- High output power
- Operation under a wide range of supply voltages
- Low quiescent current
- Low distortion
- Wide power bandwidth
- Standard OP-AMP connections (Plug-in or P.C. mount)
- Stable operating characteristics
- Electrostatically shielded
- Short-Circuit and overload protected

### Applications

- Microphone Preamplifiers
- Line or Booster Amplifiers
- Lossless Combining Amplifiers
- Balanced Transformerless Amplifiers
- Equalizers and Equalized Preamplifiers
- Earphone or Small Speaker Drivers

The Model 2520 is a high gain, wide band, direct coupled amplifier with differential input, designed specifically for audio amplifier applications. Several Operational Amplifier circuits typical of those most often used in the audio field are shown on the following page, along with their characteristics. These circuits have been tested and the data shown has been validated in Automated Processes laboratories.

The virtually perfect performance of the Model 2520 in audio operational amplifier applications makes possible the design of complete systems utilizing this low cost device as the only active element.

Since Operational Amplifier circuits derive their characteristics almost entirely from the performance of the passive elements connected into the feedback loop, accurate, predictable, and stable performance is assured. The use of this single active plug-in element reduces maintenance and service costs to a minimum.

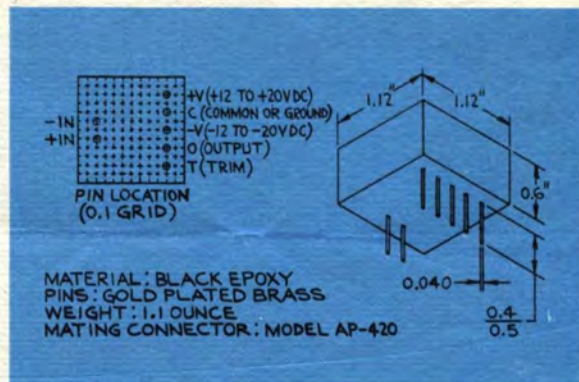
The specially formulated, thermally conductive epoxy in which this nine transistor amplifier is encapsulated, protects the internal circuitry against thermal shocks, vibration and humidity. Conservative design based upon "worst case analysis" plus thorough in-process inspection and performance test after "burn-in" assure long life and reliable performance.

### Specifications

<b>Gain:</b>	Greater than 110 dB, DC
<b>Frequency Response:</b>	Small signal Gain Bandwidth Product—50 mHz Full Output Frequency—40 kHz
<b>Equivalent Input Noise:</b>	Less than 0.5 microvolts
<b>Input Impedance:</b>	Greater than 10 megohms, DC
<b>Input Current Offset:</b>	25 nA Typ.; 75 nA Max.
<b>Input Voltage Offset:*</b>	4 mV Typ.; 10 mV Max.
<b>Common Mode Input:</b>	±12 Volts with ±15 VDC supply ±15 Volts with ±20 VDC supply
<b>Distortion:</b>	0.2% THD, 20 to 20,000 Hz at rated output
<b>Output Voltage:</b>	Greater than 7.75 Volts RMS, ±15 VDC supply Greater than 11 Volts RMS, ±20 VDC supply
<b>Minimum Load Impedance:</b>	75Ω for full output voltage
<b>Continuous Power Output: (Minimum Load Impedance)</b>	0.8 Watts RMS @ ±15 VDC supply 1.5 Watts RMS @ ±20 VDC supply
<b>Quiescent Current:</b>	15 Milliamperes @ ±15 VDC supply 26 Milliamperes @ ±20 VDC supply
<b>Current at Rated Output 600Ω Load:</b>	18 Milliamperes @ ±15 VDC supply 32 Milliamperes @ ±20 VDC supply
<b>75Ω Load:</b>	60 Milliamperes @ ±15 VDC supply 85 Milliamperes @ ±20 VDC supply
<b>Power Supply Voltage:</b>	Bi-polar, ±12 VDC to ±20 VDC

\*Output offset may be nulled to zero by means of a 100 kΩ trim pot between the +V and T terminals. This is normally not necessary in Audio applications.

Our staff is fully equipped and stands ready to provide engineering services, from applications assistance to complete system design, and fabrication.

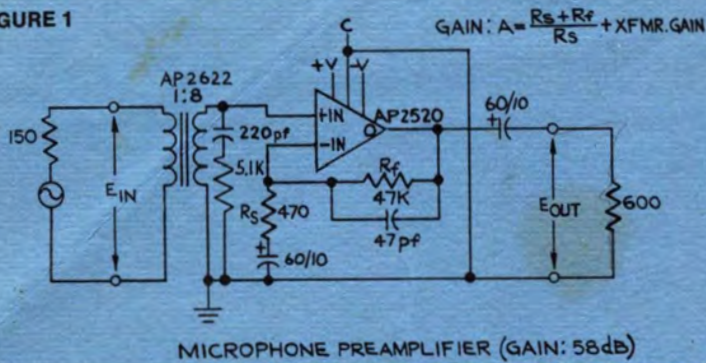


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# Circuit Specifications

FIGURE 1



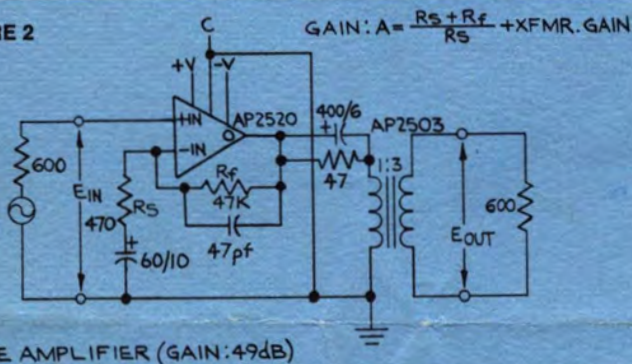
**GENERAL (Figures 1-5)**

- Load Impedance:** 600Ω
- Frequency Response:** ±0.25 dB, 20 to 20 kHz at rated output power
- Distortion:** Less than 0.2% THD, 20 to 20 kHz at rated output power

**MICROPHONE PREAMPLIFIER (Figure 1)**

- Gain:** 58 dB
- Equivalent Input Noise:** -129 dBm, 20 to 20 kHz, unweighted
- Input Impedance:** Greater than 1500Ω
- Output Impedance:** Less than 5Ω
- Power Output:** +21 dBm, ±15 VDC supply  
+24 dBm, ±20 VDC supply

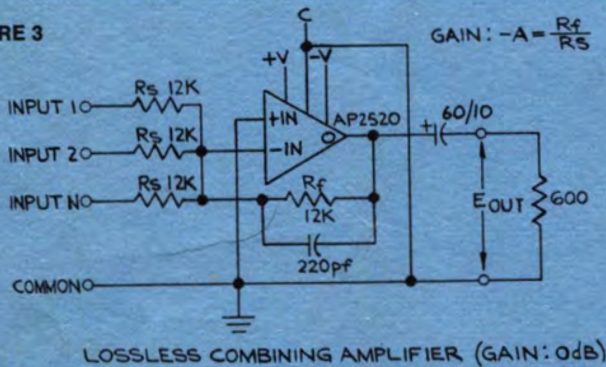
FIGURE 2



**LINE AMPLIFIER (Figure 2)**

- Gain:** 49 dB
- Equivalent Input Noise:** -125 dBm, 20 to 20 kHz, unweighted
- Input Impedance:** Greater than 2 megohms
- Output Impedance:** Less than 100Ω
- Power Output:** +28 dBm, ±15 VDC supply  
+30 dBm, ±20 VDC supply

FIGURE 3

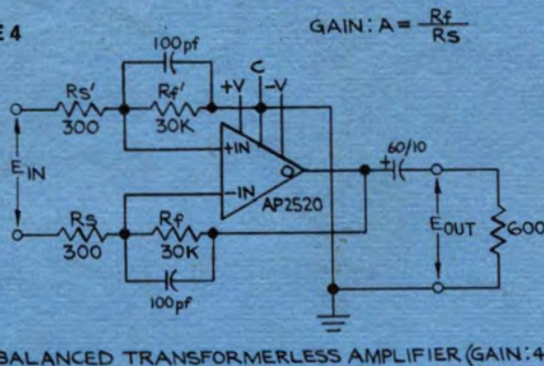


**LOSSLESS COMBINING AMPLIFIER (Figure 3)**

- Gain:** 0 dB
- Maximum Crosstalk:** -100 dB
- Maximum Gain:** 20 dB for 10 inputs  
10 dB for 32 inputs
- Equivalent Input Noise:** -105 dBm for 10 inputs  
-95 dBm for 32 inputs
- Input Impedance:** 12kΩ
- Output Impedance:** Less than 5Ω
- Power Output:** +21 dBm, ±15 VDC supply  
+24 dBm, ±20 VDC supply

Note: This circuit produces a 180° phase reversal. An output transformer of such as that shown in Figure 2 may be used to correct the phase, and can also provide additional gain.

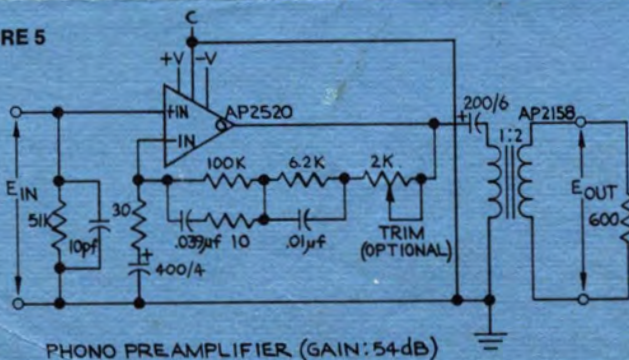
FIGURE 4



**BALANCED TRANSFORMERLESS AMPLIFIER (Figure 4)**

- Gain:** 40 dB
- Equivalent Input Noise:** -124 dBm, 20 to 20 kHz, unweighted
- Input Impedance:** 600Ω
- Common Mode Rejection:** Greater than 90 dB (with matched resistors)
- Maximum Common Mode Voltage:** ±8 Volts peak
- Output Impedance:** Less than 2Ω
- Power Output:** +21 dBm ±15 VDC supply  
+24 dBm ±20 VDC supply

FIGURE 5



**PHONO PREAMPLIFIER (Figure 5)**

- Equalization:** RIAA
- Gain:** 54 dB (2.5 mV at 1 kHz produces +4 dBm output)
- Input Impedance:** 50kΩ
- Output Impedance:** Less than 100Ω
- Power Output:** +25 dBm ±15 VDC supply  
+28 dBm ±20 VDC supply