Accuphase

BALANCED CLASS-A STEREO POWER AMPLIFIER

P-102

- Class-A parallel push-pull output stage
- Low-impedance load drive capability
- Full twin mono construction
- Balanced input circuits

ALL-STAGE PUSH-PULL DESIGN AND FULLY BALANCED CONFI
(50 WATTS/CHANNEL INTO 8 OHMS) AND DRIVES EVEN LOW-I

The Accuphase power amplifier P-102 is the ideal performer for the age of high-quality program sources.
It employs a fully balanced circuit configuration throughout, with two bridged push-pull power amplifiers for each channel, resulting in an impressive total of 4 amplifiers within one enclosure.
The balanced signal transmission used in the P-102 offers a perfect solution which ensures that the voltage potential in the ground line is zero at all times. This effectively prevents any kind of external interference. The output devices of the amplifier operate always in the linear range, thanks to the class-A drive principle. Crossover distortion is completely eliminated, and the current supply is always kept constant, which has the same effect as using a power supply with infinite capacity. Construction of the amplifier is totally monophonic, with separate power transformers for the left and right channels.
The design of the P-102 stands in the same tradition as the top-of-the-line P-500, with large, wide level meters behind a thick glass panel and all controls and functions arranged behind a subpanel. This gives the amplifier an appearance of beautiful and uncluttered elegance.

By using the P-102 in combination with the preamplifier C-202, an entire system with fully balanced signal transmission can be created, which offers the ultimate in reproduction quality. The sound quality potential of truly accurate program sources can now be fully appreciated in the home, for unlimited musical enjoyment.

1

FULLY BALANCED POWER AMPLIFIER WITH TWO ALL-STAGE PUSH-PULL POWER UNITS IN BRIDGED CONFIGURATION

For the transmission of signals in an audio system, two basic patterns are available: the unbalanced principle as shown in Fig. 1-(a) and the balanced principle of Fig. 1-(b). Unbalanced circuits are widely used in home-use components, as they are simple and easy to design. In this type of circuit, the ground line not only serves for the negative signal flow but also carries the direct current to drive the amplifier, and often induced noise from external interference sources. This approach therefore involves a possibility of sound quality degradation. The more elaborate balanced approach on the other hand requires two symmetrical, separate lines to carry the "hot" (positive) and "cold" (negative) signal with exactly opposite phase. An inherent advantage of this principle is that it can cancels out not only noise induced during the transmission process but also distortion components arising within the amplifier. This cancellation takes place in the output circuits, leaving only the pure signal. The balanced circuit configuration therefore offers ideal conditions. The P-102 features balanced signal transmission throughout, from input to output, for clean power and uncompromised performance.
The circuit configuration of the P-102 is shown in Fig. 2. The top and bottom half are made up by two exactly identical amplifiers arranged in parallel, one for the positive and one for the negative input signal. The output power is derived from the output terminals of the two amplifier units. The signal supplied to the speakers consequently does not pass through the ground line. The bridged connection has another advantage, as even the slight distortion arising during the amplification process is cancelled when the signal passes the load (the speakers). The overall result is unsurpassed reproduction purity.

2

PARALLEL PUSH-PULL CLASS-A OPERATION COMPLETELY ELIMINATES CROSSOVER DISTORTION AND PROVIDES AMPLE POWER RESERVES WITH 50 WATTS PER CHANNEL INTO 8 OHMS AND 70 WATTS PER CHANNEL INTO 2 OHMS. DRIVE or PRE-DRIVE STAGE EMPLOYS IDEAL MOS-FET DRIVE.

Another distinguished feature of the P-102 is its use of class-A operation. This principle is applied not only to the input circuits, but it extends right through to the powerful output stage. The total absence of crossover distortion preserves the most subtle nuances and lets the music emerge in unsurpassed detail. As can be seen from Fig. 2, wide-band power transistors with a maximum power dissipation (P_c) of 80 watts each are used in the output stage in a parallel push-pull configuration. Therefore the total P_c of one amplifier unit is 320 watts. This enormous power capacity is called upon to supply only one half of the 50 watts of rated output power, i.e., 25 watts. Effortless speaker drive even under the most demanding conditions is the result of this approach. The design also ensures that the amplifier will remain stable even with very low-impedance loads, delivering a maximum output of 70 watts per channel into 2-ohm loads. To achieve this performance, the predriver stage which sends the signal to the output devices is also a vital aspect. It must possess low output impedance and supply a high swing voltage to the output stage. This requires the use of high-quality power-amplifying elements which can withstand high voltages. In the P-102, the original MOS-FET driver developed by Accuphase is used, to provide a high-quality signal voltage free from switching distortion to the output circuits.

3

CASCODE PUSH-PULL DIFFERENTIAL INPUT STAGE FOR FURTHER IMPROVED DEFINITION AT LOW LEVELS AND STABLE OPERATION INTO THE HIGH FREQUENCY RANGE.

In order to make full use of the performance capabilities of the balanced class-A output circuits, the amplifier's input stage must also conform to highest quality standards. To achieve this aim, Accuphase uses a class-A cascode push-pull differential circuit configuration in the input stage of all its power amplifiers. As the circuit diagram shows, the transistors Q1a and Q5, Q2a and Q6, Q1b and Q13, Q2b and Q14 in the upper amplifier block are connected in a cascode bootstrap configuration (the l[illegible] block employs the same principle).
The cascode-connection principle was originally developed for radio-frequency amplification. It ensures stable operation over a wide range, resulting in outstanding input linearity and wide dynamic range.

4

TWIN MONO CONSTRUCTION USING TWO MONOPHONIC AMPLIFIERS AND COMPLETELY SEPARATE POWER SUPPLIES FOR LEFT AND RIGHT CHANNEL

With class-A amplifiers, the power provided by the power supply is almost constant (except for designs which modulate the bias voltage of the output stage), and there is usually little interference between the two stereo channels. To prevent even the slightest possibility of interference, the P-102 employs a dual monophonic construction. In combination with the class-A operation, this no-compromise design results in ideal performance characteristics.

RATION ASSURE OPTIMUM SIGNAL TRANSMISSION. CLASS-A PUSH-PULL OUT
EDANCE LOADS WITH EASE (70 WATTS/CHANNEL INTO 2 OHMS).

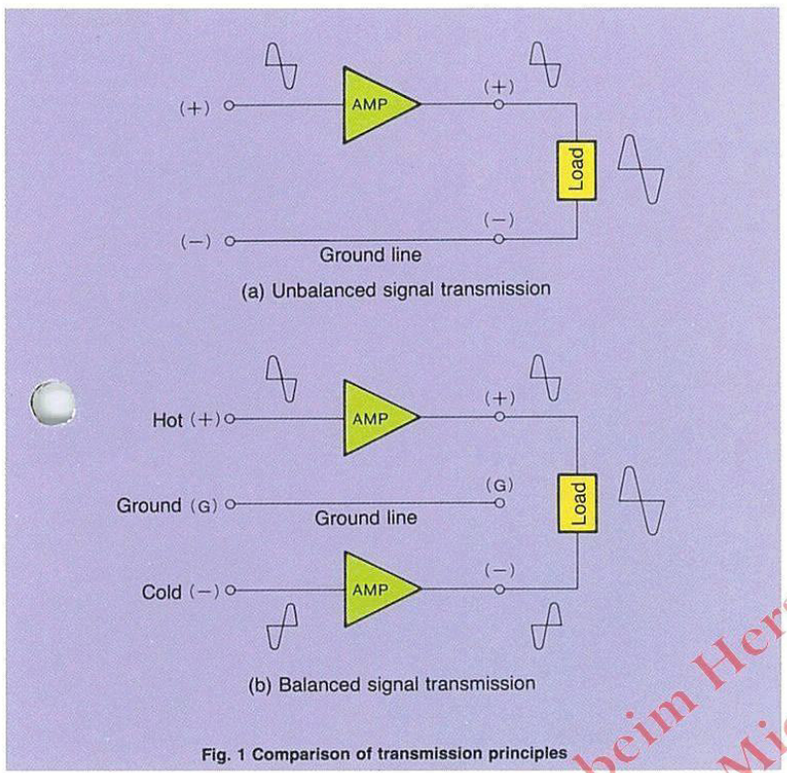


Fig. 1 Comparison of transmission principles

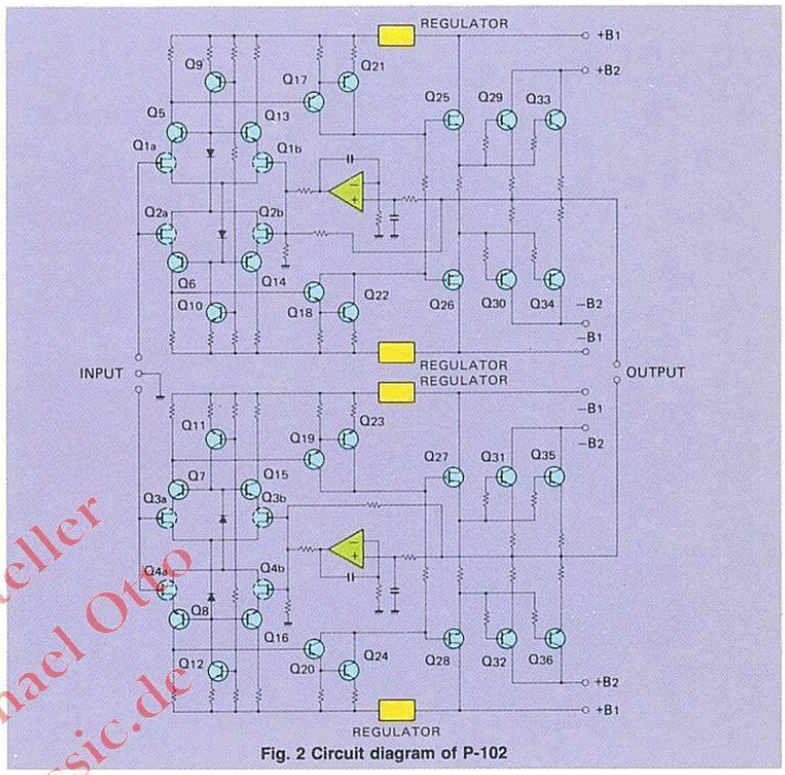
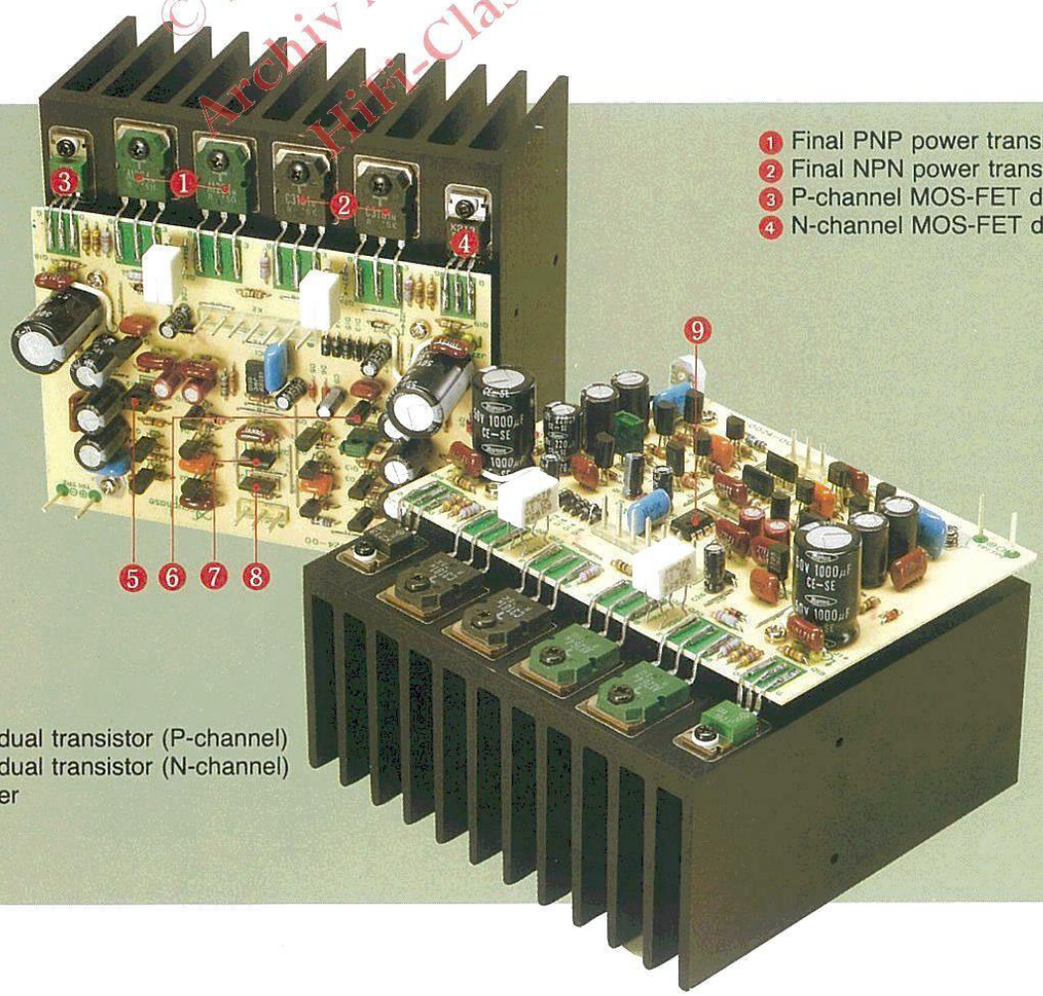


Fig. 2 Circuit diagram of P-102



■ Fully balanced amplifier circuits (two power units for one channel)

STAGE DELIVERS AMPLE POWER

Accuphase P-102
STEREO POWER AMPLIFIER

5

DIRECT-COUPLED AMPLIFIER WITH DC SERVO CONFIGURATION

The signal from the input jacks is supplied directly to the INPUT point (Fig. 2), without any coupling capacitors in the signal path. This design ensures optimum sound purity, but if the preamplifier has a large amount of DC drift, a conventional DC connection may lead to the DC voltage being amplified and fed to the speakers, which of course can prove fatal. To reliably prevent this possibility, Accuphase has developed the DC servo principle. This circuit effectively blocks direct current. It contributes also to thermal stability and prevents internal DC drift within the amplifier.

6

FLEXIBLE INPUT CONFIGURATION WITH BALANCED 40-KILO-OHM CONNECTORS AND UNBALANCED 20-KILOHM JACKS

In order to obtain the maximum performance from this power amplifier, the use of a preamplifier with balanced output circuits is preferable. But the P-102 is also capable of delivering superior performance with an unbalanced signal. To accommodate this type of equipment, an unbalanced input with RCA-type phono jacks is provided. A switch below the subpanel on the front side of the amplifier serves to select the input type.

7

LARGE ANALOG METERS PROVIDE DIRECT READING OF PEAK POWER OUTPUT FROM −40 TO +3 DB

The easy-to-read output meters are calibrated in decibels and watts, for direct verification of output levels at a glance. The meters employ a logarithmic scale covering a wide range of −40 dB (0.005 W into 8 ohms) to +3 dB (100 W into 8 ohms).

8

SIMPLE AND ATTRACTIVE DESIGN WITH CONTROLS ARRANGED BEHIND A CONVENIENT SUBPANEL

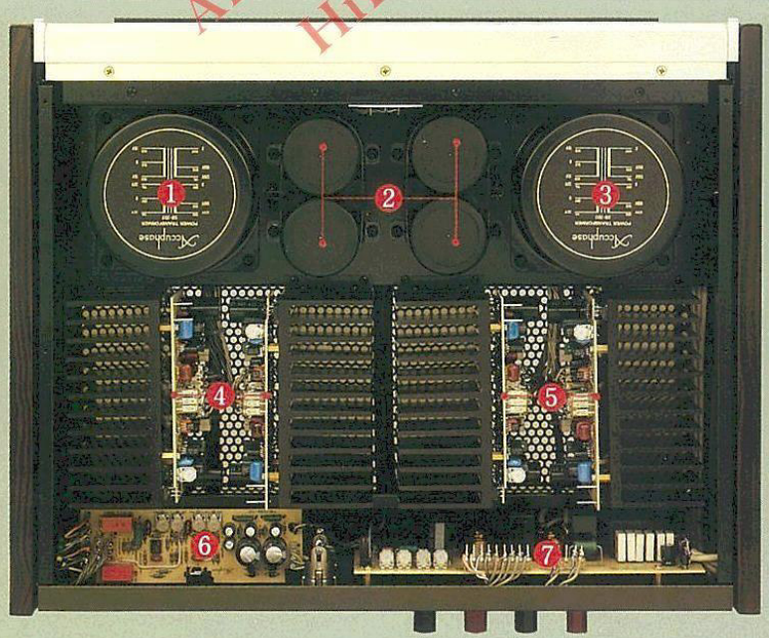
The P-102 presents an elegant and uncluttered appearance, with only the large output meters and the power switch being visible during normal operation. A slight push on the subpanel reveals level controls for each channel (calibrated from 0 to -20 dB in 1-dB steps), and two pushbutton switches for meter operation/illumination and balanced/unbalanced input selection.

9

NATURAL PERSIMMONS WOOD SIDE PANELS

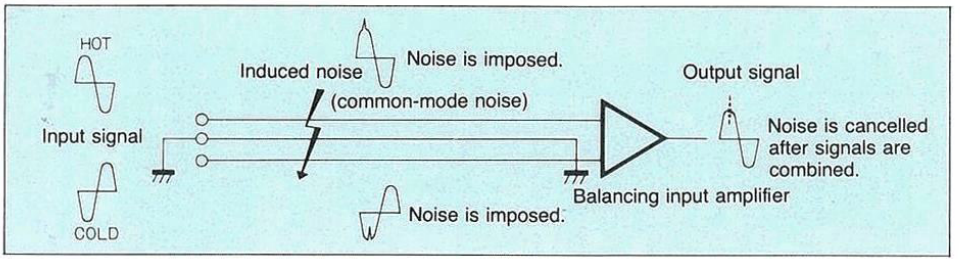
In the Accuphase tradition, the front panel of the P-102 is finished in brushed gold aluminum. The side panels of exquisite persimmon wood further enhance the refined visual appeal of the amplifier, for a harmonious blend with the listening room.

■ Internal layout



1. Right-channel toroidal power transformer
2. Filter capacitors (22,000 μF × 4)
3. Left-channel toroidal power transformer
4. Right-channel balanced power amplifier units
5. Left-channel balanced power amplifier units
6. Unbalanced-to-balanced input converter circuitry
7. Meter drive and protection circuitry

The principle of balanced signal transmission



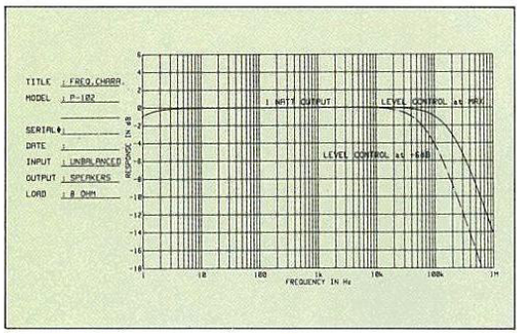
For balanced signal transmission, two signals are created which are at identical potential with respect to ground but have exactly opposite phase. These hot (positive) and cold (negative) signals are then sent along the balanced transmission path. Any imposed noise occurring during the transmission process appears with identical phase in both the hot and the cold line. Its influence upon the signal waveform therefore is as shown in the illustration. When the hot and cold signal are summed in the balancing amplifier at the end of the line, the noise components are neatly cancelled and only the original waveform appears at the output. This is the principle underlying balanced circuits. In unbalanced signal transmission, noise induced during the transmission will be fed to the next stage along with the signal.

Although the theoretical superiority of balanced circuits is clearly obvious, the audible differences can be quite subtle when using first-grade equipment that reflects recent advances in cable and circuit technology.

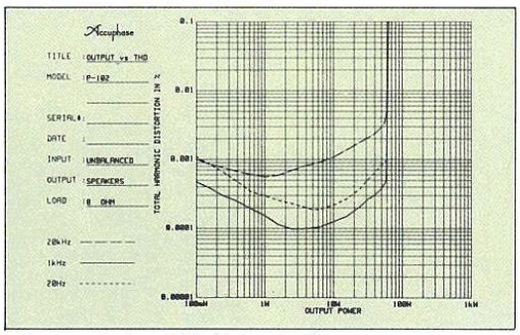
1. Left-channel level meter
2. Output level dB scale
3. Output wattage scale
4. Right-channel level meter
5. **POWER** switch
6. **METER** operation/illumination switch **ON/OFF**
7. Subpanel magnetic lock
8. Unbalanced/balanced **INPUT** selector **UNBALANCED/BALANCED**
9. **LEFT**-channel **INPUT LEVEL** control (1-dB steps)
10. **RIGHT**-channel **INPUT LEVEL** control (1-dB steps)
11. **INPUT** jacks (**UNBALANCED**, 20 kilohms)
12. XLR **INPUT** connectors (**BALANCED**, 40 kilohms, XLR-3-31 type, for XLR-3-12C type plug) Pin layout ①:GND, ②: cold, ③: hot
13. **RIGHT**-channel **SPEAKER** terminals
14. **LEFT**-channel **SPEAKER** terminals
15. AC outlet (**UNSWITCHED**)
    The unswitched outlets may not be supplied depending on the safety standards or regulations applicable in the particular country where the units destined.
16. AC power cord

Accuphase P-102

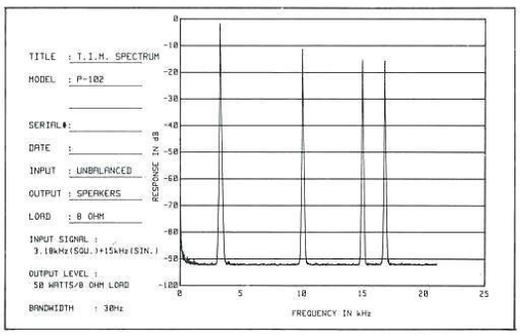
STEREO POWER AMPLIFIER



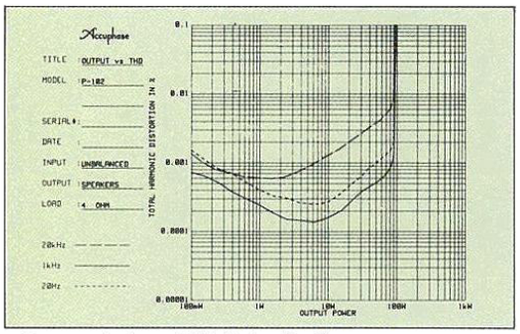
• **Frequency response**



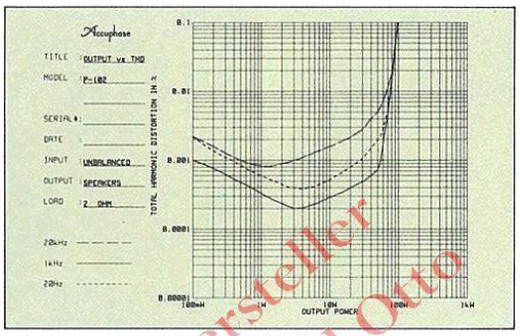
• **Power output vs. THD (8-ohm load)**



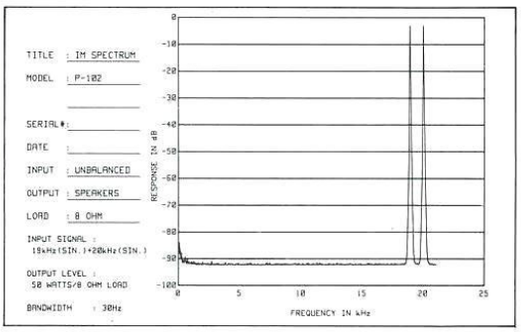
This graph shows the transient intermodulation distortion (TIM) spectrum. To measure this parameter, a square wave of 3.18 kHz and a sine wave of 15 kHz are mixed and supplied to the input. The square wave signal contains almost unlimited odd-number higher harmonics, with components at 9.54 kHz (third harmonic), 15.9 kHz (fifth harmonic), etc. When these components intermodulate with the 15-kHz signal, modulation products show up at frequencies where there is no input signal, for example at 5.46 kHz (15 kHz – 9.54 kHz). As the reading confirms, there are no distortion products at all above −9 which means that TIM is less than 0.0022%.



• **Power output vs. THD (4-ohm load)**



• **Power output vs. THD (2-ohm load)**



This graph shows the intermodulation distortion (IM) spectrum, as measured by the IHF method. A 19-kHz and a 20-kHz signal are fed to the input. Any intermodulation product of these two signals would show up at their frequency difference, i.e., 1 kHz. The reading confirms that such products are below −93 dB (0.0022%). Another intermodulation product would appear at 39 kHz, the sum of the two input signal frequencies. Such distortion, even if it existed, would be inconsequential because it is far beyond the audible range. In the P-102, this form of distortion is also below −93 dB.

GUARANTY SPECIFICATIONS (in accordance with EIA-490 standard measuring methods)

CONTINUOUS AVERAGE POWER OUTPUT
(Both channels driven, from 20 Hz to 20,000 Hz with no more than 0.02% total harmonic distortion)
70 watts per channel, min. RMS, at 2 ohms
80 watts per channel, min. RMS, at 4 ohms
50 watts per channel, min. RMS, at 8 ohms
25 watts per channel, min. RMS, at 16 ohms

TOTAL HARMONIC DISTORTION
(Both channels driven, from 20 Hz to 20,000 Hz)
0.02% max., at 2 ohms to 4 ohms
0.01% max., at 8 ohms to 16 ohms

INTERMODULATION DISTORTION
0.003%

FREQUENCY RESPONSE
20 Hz to 20,000 Hz; +0, −0.2 dB (Rated output at the maximum level control)
0.5 Hz to 200,000 Hz; +0, −3.0 dB (1 watt output at the maximum level control)
0.5 Hz to 80,000 Hz: +0, −3.0 dB (1 watt output at −6 dB attenuation)

VOLTAGE AMPLIFICATION IN DECIBELS
28.0 dB

OUTPUT LOAD INPEDANCE
2 ohms to 16 ohms

DAMPING FACTOR
70

INPUT SENSITIVITY (at 8 ohms load)
0.8V (for Rated output at the maximum level)
0.11V (for 1 watt output)

INPUT IMPEDANCE
BALANCED; 40k ohms
UNBALANCED; 20k ohms

A-WEIGHTED SIGNAL-TO-NOISE RATIO
(below Rated output, input shorted)
BALANCED; 120 dB
UNBALANCED; 112 dB
(1 watt output, terminated with 1k ohm)
BALANCED; 100 dB
UNBALANCED; 96 dB

POWER LEVEL METER
Logarithmic Scale Peak Level indication of the dynamic range from −40 dB to +3 dB.

SEMICONDUCTOR COMPLEMENT
81 Tr's, 16 FETs, 8 ICs and 89 Di's

POWER REQUIREMENT
Voltage selection; 100V, 117V, 220V and 240V, 50/60 Hz
Power consumption;
245W (Zero signal output)
300W (Rated power output into 8 ohms load)

DIMENSIONS
Width 475 mm (18-11/16 inches), max. height 170 mm (6-11/16 inches), depth 408 mm (16-1/16 inches)

WEIGHT
22 kg (48.4 lb) net, 26.5 kg (58.3 lb) in shipping carton

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