

# Accuphase

## STEREO POWER AMPLIFIER

# P-500L

- 10-parallel push-pull power stage 270W×2(8 ohms)
- Low impedance speaker can be fully driven
- DC servo direct-coupled throughout
- XLR connectors (balanced input) provided

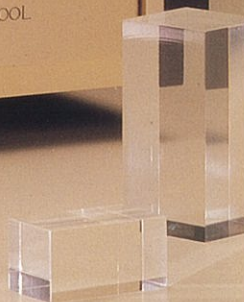


POWER



stereo power amplifier

model P-500L



# All-stage push-pull circuitry. DC servo direct-coupled throughout.

## 10-parallel push-pull power stages guarantee stereo = 270W/ch (8 ohms), mono = 540W (4 ohms)

### By using the low impedance setting, even an extreme low impedance speaker

From the overwhelming impact of an orchestra in full crescendo down to the breathless tension of a delicate pianissimo passage, all encompassed in the ambience of the hall and the audience, such is the scope and excitement of live music. In order to faithfully recreate this enormous dynamic range, to beautifully paint all details of the musical "picture," an amplifier must be capable of delivering ample energy levels while at the same time maintaining fine resolution over the entire loudness spectrum. A large, high-quality power supply and high-powered output stage are important requirements to ensure ample current and drive capability. This in turn makes it possible to precisely control the loudspeakers whose impedance varies considerably depending on the frequency. However, reproduction of very low-level signals, reaching down to and even beyond the noise threshold, is equally important. This is an area where conventional high-power amplifiers often fall short.

The P-500L was designed to fulfill both of these requirements perfectly. It belongs to a new amplifier breed which fully reflects the advanced technological know-how incorporated in the top-of-the-range models Accuphase M-1000 and P-800. A power supply with low output impedance, high efficiency and large capacity forms the basis of the P-500L's solid performance. In each channel of the output stage, ten wide-band transistor pairs with a high power dissipation (Pc) of 150 watts per device are used in a parallel push-pull configuration, resulting in a total power dissipation of an amazing 3 kilowatts per channel. This manifests itself in the output rating of 550 watts per channel into 2 ohms, 420 watts into 4 ohms and 270 watts into 8 ohms. To obtain even higher power levels, the amplifier can be driven in bridged operation at the simple flick of a switch, resulting in 1,100 watts into 4 ohms and 840 watts into 8 ohms. In bridged mode, the amplifier is totally balanced for ultimate operation characteristics.

The drive stage features the sophisticated MOS-FET cascode push-pull design developed by Accuphase, and a push-pull differential input stage further increases sonic and electrical precision. Large power meters arranged symmetrically on the front panel and the traditional Accuphase styling in champagne gold complement an amplifier which is not only an exhilarating listening experience but also a delight to look at and a lasting joy to own.

## 1 Powerful output stage with 10 parallel push-pull transistor pairs delivers 550 watts per channel into 2 ohms, 420 watts into 4 ohms and 270 watts into 8 ohms

Fig. 1 shows a circuit diagram of the P-500L. In order to drive the loudspeakers with optimum precision, the output impedance of an amplifier should be as low as possible. By using large amounts of negative feedback (NFB), impedance ratings can be lowered quite impressively on paper, but this approach does not result in the kind of sonic performance Accuphase is famous for. Therefore the P-500L employs a total of ten transistor pairs connected in parallel, which lowers the output impedance to one-tenth of each single device. The use of transistors with high power dissipation (150 watts each, total 3,000 watts) further reduces the output impedance. Even under very difficult load conditions, such as when driving speakers with highly irregular impedance curves, the P-500L performs absolutely stable and delivers precisely the required amount of energy. This no-holds-barred design lets the amplifier handle any real-life application with ease. Current capability is outstanding, as illustrated by the rating of 550 watts per channel into 2 ohms.

## 2 Bridged operation mode creates a balanced monophonic amplifier with 1,100 watts into 4 ohms and 840 watts into 8 ohms

By driving its two amplifiers in a symmetrical configuration, the already impressive output power of the P-500L can be further increased. This is called bridged operation. The principle is shown in Fig. 2. An identical signal with opposite phase is fed to the input of each stage, resulting in two output signals of opposite phase, which form an ideal balanced amplifier with double the output power. In this type of application, considerable demands are placed on the load handling capacity of the amplifier. When for example an 8-ohm speaker is connected, each of the amplifier stages actually "sees" a 4-ohm load impedance. Therefore the circuit ratings and current capability must be up to this task. In the P-500L, the extraordinary potent output stage with its ten parallel push-pull transistor pairs ensures total operation safety, and a switch makes it easy to access bridged operation. In conventional designs, the input of one amplifier section has a phase inverter circuit which can

detract from signal purity. In the P-500L, the polarity of the differential input circuits is used in an ingenious design, permitting a simple switching arrangement without the need for any additional amplifier stages.

## 3 "Cascode push-pull + MOS FET cascode push-pull" drive stage for minimum distortion at low levels and superior high-range stability

The dynamic impact of an orchestra playing at resounding levels and the minute detail of a delicate pianissimo passage—both of these aspects are essential for true music reproduction. With conventional high-power amplifiers, performance at low levels often leaves much to be desired. Not so in the case of Accuphase components, which are built to deliver utterly convincing performance at both ends of the loudness spectrum.

In the output stage, the operating points of the PNP and NPN transistors are carefully adjusted so as to avoid cutoff (current flow interruption) thereby eliminating switching distortion at low signal levels. The final predriver stage employs MOS-FET devices (Q<sub>13</sub>, Q<sub>14</sub>) in an arrangement which is equivalent to non-switching class A drive. Cascode push-pull topology further improves performance.

The devices Q<sub>13</sub>, Q<sub>15</sub> and Q<sub>14</sub>, Q<sub>16</sub> in Fig. 1 form the cascode connection. This principle was originally developed for radio-frequency amplification. It guarantees stable operation over a wide range, resulting in outstanding input linearity and wide dynamic range. The drive current for this stage is supplied by another class A cascode push-pull arrangement. The overall result of this approach is absolutely negligible distortion and totally stable operation, from the noise threshold up to full rated power, under any load condition.

## 4 Cascode differential push-pull input stage turned for perfection

In order to make full use of the performance capabilities of the balanced output circuits, the amplifier's input stage must also conform to the highest quality standards. To achieve this aim, all Accuphase power amplifiers use a class A cascode differential push-pull circuit configuration in the input stage. High-frequency phase characteristics are outstanding, and dynamic range is significantly improved.

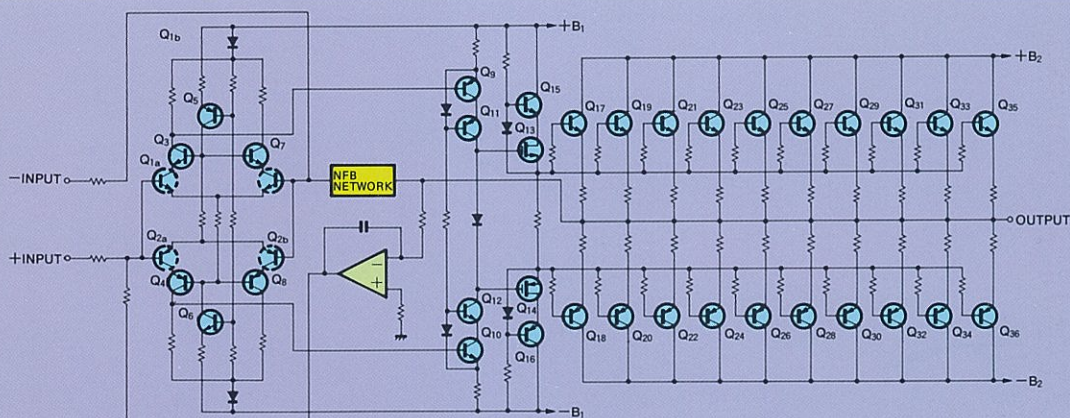
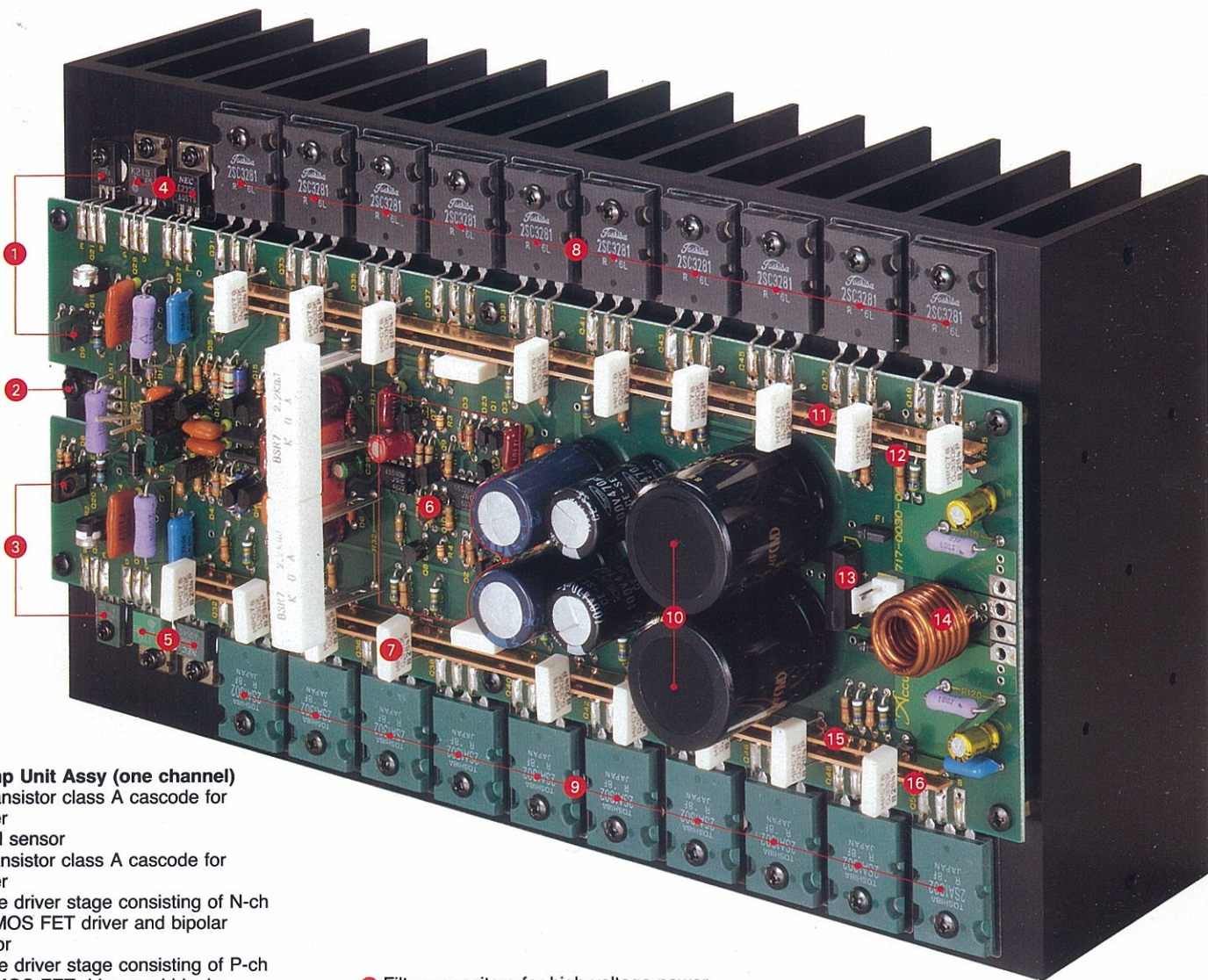


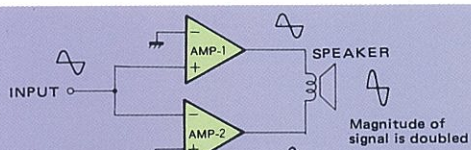
Fig. 1 P-500L Circuit Diagram

Phonic = 840W (8 ohms).  
 2 ohms (stereo = 550W/ch) can be fully driven.

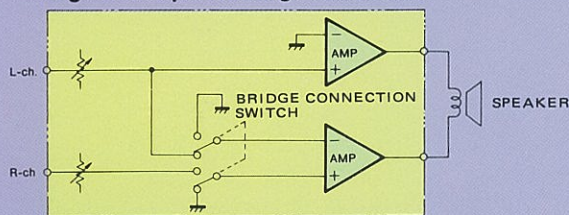


**Power Amp Unit Assy (one channel)**

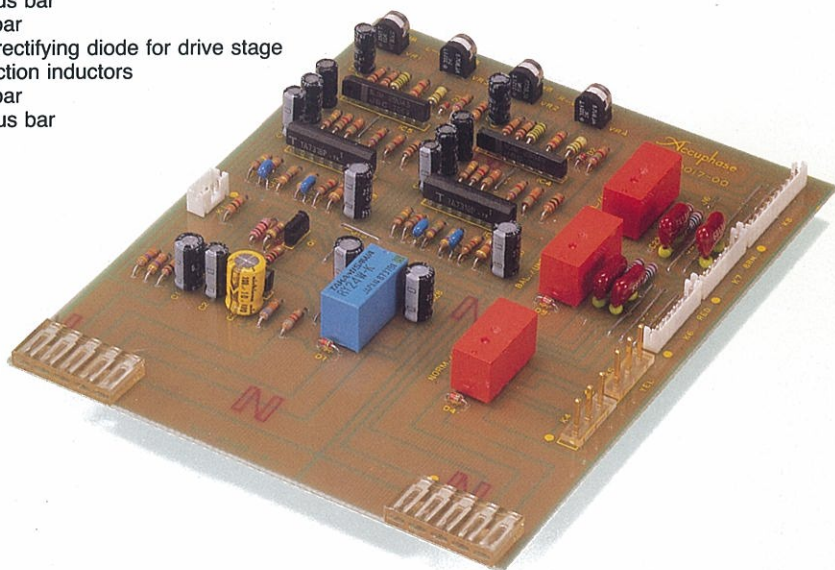
- 1 NPN transistor class A cascode for predriver
- 2 Thermal sensor
- 3 PNP transistor class A cascode for predriver
- 4 Cascode driver stage consisting of N-ch power MOS FET driver and bipolar transistor
- 5 Cascode driver stage consisting of P-ch power MOS FET driver and bipolar transistor
- 6 Input buffer amps
- 7 Emitter resistors for final transistor
- 8 NPN power transistors (These transistors form 10-parallel push-pull power stage)
- 9 PNP power transistors (These transistors form 10-parallel push-pull power stage)
- 10 Filter capacitors for high-voltage power supply
- 11 +B power bus bar
- 12 Output bus bar
- 13 High-speed rectifying diode for drive stage
- 14 Phase correction inductors
- 15 Output bus bar
- 16 -B power bus bar



**Fig. 2 Principle of Bridge Connection**



**Fig. 3 Bridge Connection of the P-500L (with Bridge circuit ON/OFF Switch in ON position.)**



Meter driver circuit and relays for selection of balanced/unbalanced input, bridge connection, etc. are mounted on this board.

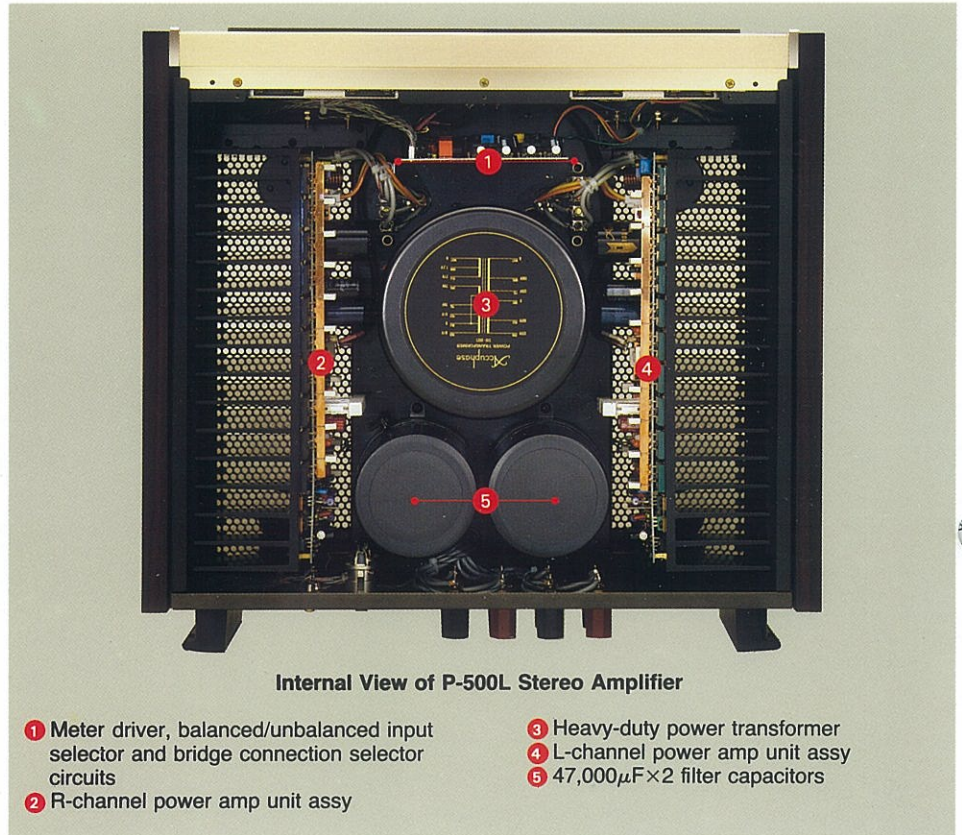
## 5 Separate power supplies for right and left channels in differential input and drive stages guarantee perfect stereo imaging

Because a power amplifier has a gain of only about 30 dB, using a common power supply for both channels is said to have less adverse effects than for example in a high-gain preamplifier. However, Accuphase has provided for a wide safety margin in this respect also. Separate windings of the power transformer are used to power the predriver and output stages, and separate rectifier and filtering circuits are used for the two stereo channels in the predriver stage. This reliably prevents any unwanted interaction between stages or between stereo channels. The result is precise stereo imaging with pinpoint localization of sound sources.

## 6 Balanced inputs shut out any external noise

In addition to the regular 20-kilohm RCA type phono jack connectors, the P-500L also provides balanced inputs using the international XLR standard. This permits connection to any component with balanced output. The principle of balanced signal transmission is shown in Fig. 4. At the output, an identical voltage signal is provided on two lines, one which carries the NON-INVERTED signal and one which carries the INVERTED signal with exactly opposite phase. At the input, these two signals are again combined. As any noise induced during the transmission process has the same phase in both lines, it is canceled out, leaving only the pure and undiluted signal. Especially with long cable runs between components, balanced signal transmission is highly superior.

The balanced input circuit of the P-500L is shown in Fig. 5. Due to the advanced design of this amplifier, the positive and negative signals can be supplied directly to the differential input circuit, which is ideal for optimum signal purity. A separate input level attenuator is required in this case, but as Accuphase uses high-precision ganged attenuators with 1-dB steps, there are no adverse influences on signal quality or frequency response.



Internal View of P-500L Stereo Amplifier

- 1 Meter driver, balanced/unbalanced input selector and bridge connection selector circuits
- 2 R-channel power amp unit assy
- 3 Heavy-duty power transformer
- 4 L-channel power amp unit assy
- 5 47,000 $\mu$ F $\times$ 2 filter capacitors

## 7 Direct-coupled amplifier with DC servo configuration

As can be seen from Fig. 1, the signal from the input jacks is supplied directly to the INPUT point, without any coupling capacitors in the signal path. This design ensures optimum sound purity. However, 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 DC current. It contributes also to thermal stability and prevents internal DC drift within the amplifier.

## 8 Large analog power meters show direct level readings from -60 to +3 dB

The output level meters are calibrated in decibels and in watts, to let the user check current levels at a glance. Logarithmic compression is used to achieve a wide range extending from -60 dB (0.00027 watts into 8 ohms) to +3 dB (540 watts into 8 ohms). A pushbutton switch turns the meters and illumination off when not needed.

## 9 Terminals for two speaker pairs or biwiring connection

The P-500L provides connectors for two pairs of loudspeakers which can be switched to operate either separately or together. Biwiring (connecting the low range drivers and mid/high range drivers of a speaker with separate cables) is also possible, for maximum flexibility.

## 10 Natural Persimmons Wood Side Panels

Except for the power switch, all controls are located behind a hinged sub panel door in the lower section of the front panel. The panel is finished in brushed gold aluminum, giving the P-500L an appearance of simple elegance. The visual appeal of the amplifier is further enhanced by the side panels made of exquisite persimmons wood.

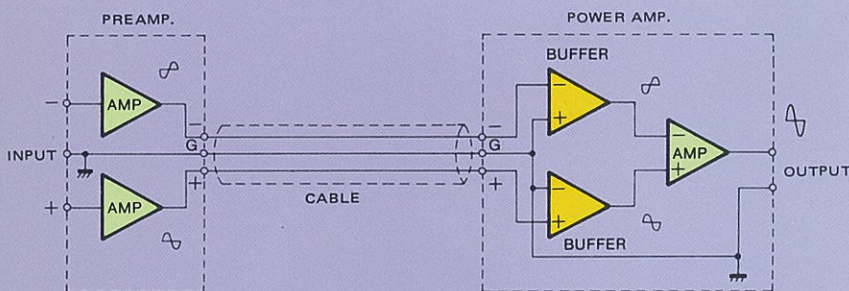


Fig. 4 Principle of Balanced Type Network

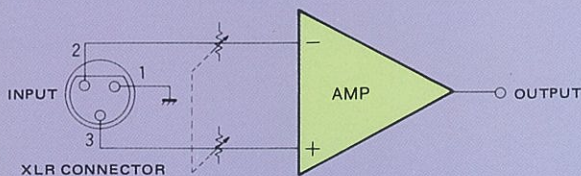
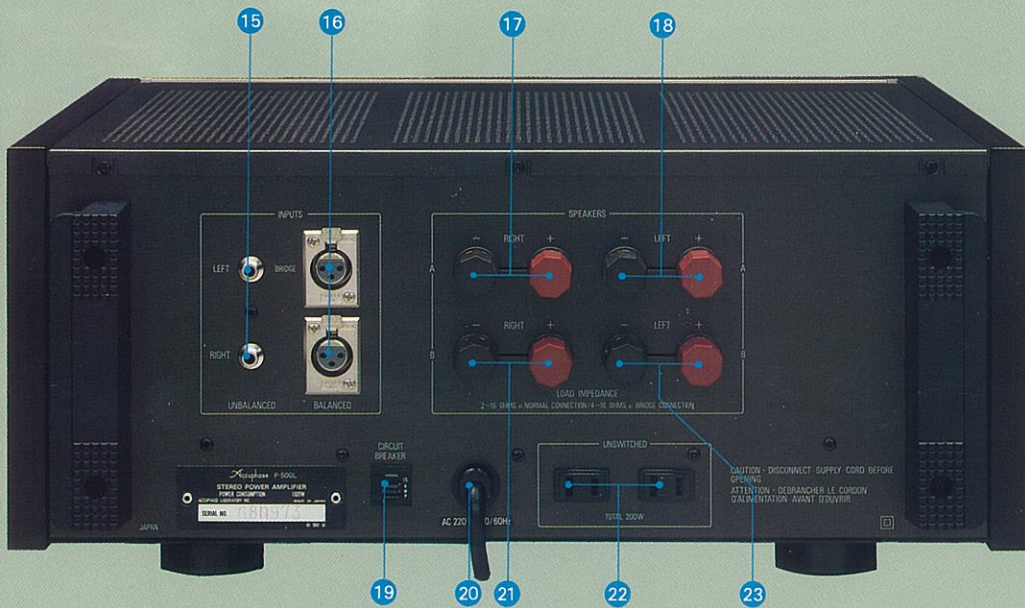
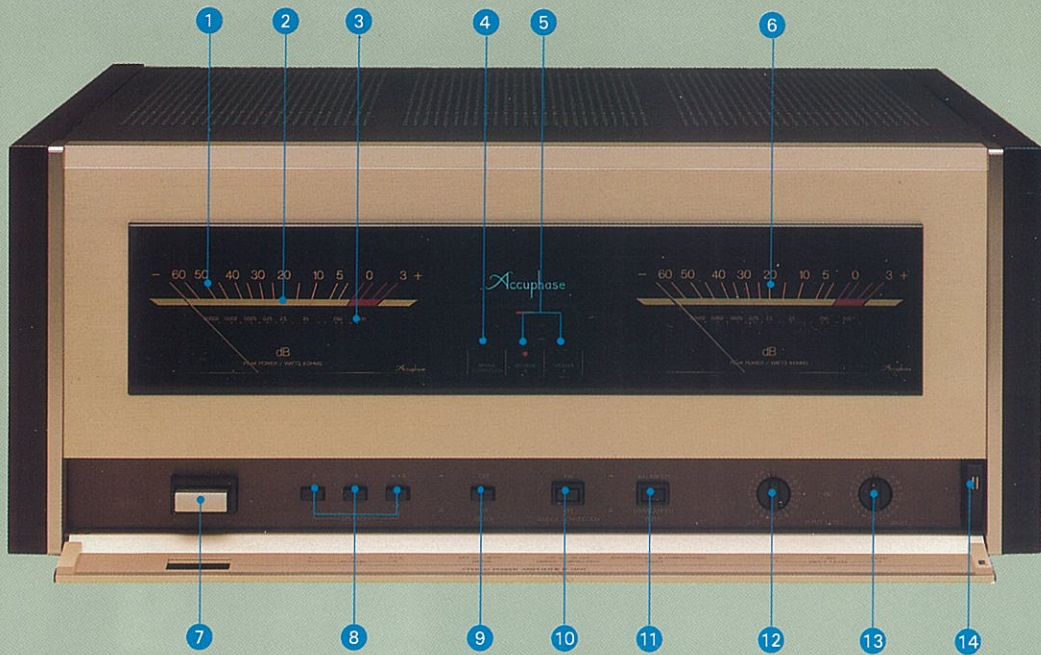


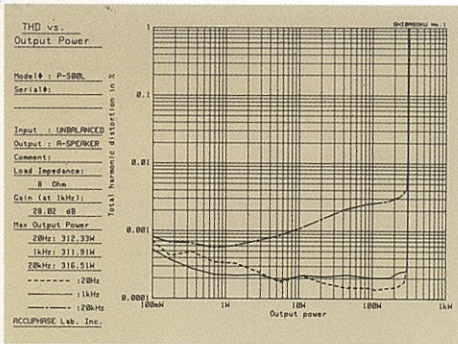
Fig. 5 P-500L Balanced Input Circuit



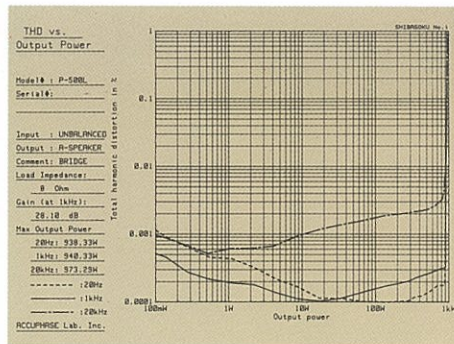
- 1 L-channel power level meter
- 2 dB scale
- 3 Wattage scale
- 4 Bridge connection indicator
- 5 SPEAKER system A and SPEAKER system B indicators
- 6 R-channel power level meter
- 7 POWER switch
- 8 SPEAKER selector switch A + B

- 9 METER operation/light ON/OFF switch ON OFF
- 10 BRIDGE CONNECTION ON/OFF switch
- 11 UNBALANCED/BALANCED input selector switch
- 12 INPUT LEVEL control (1 dB step) for L-channel and bridge connection
- 13 INPUT LEVEL control (1 dB step) for R-channel
- 14 Magnetic catch for subpanel

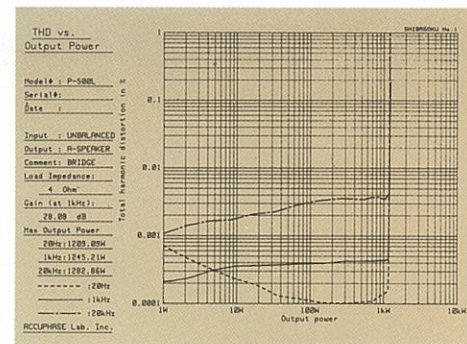
- 15 INPUT jacks (UNBALANCED/20k ohms)  
Use the LEFT jack for bridged monophonic operation.
- 16 3P XLR type input jacks (BALANCED/40k ohms)
- 17 Speaker A R-channel output
- 18 Speaker A L-channel output
- 19 Circuit breaker
- 20 AC power cord
- 21 Speaker B R-channel output
- 22 AC outlet (UNSWITCHED)
- 23 Speaker B L-channel output



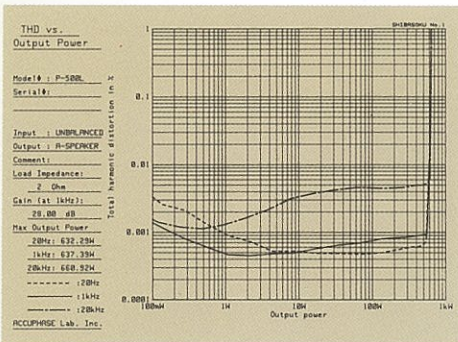
● P-500L Total Harmonic Distortion vs Power Output (at 8 ohm load, as stereo amp)



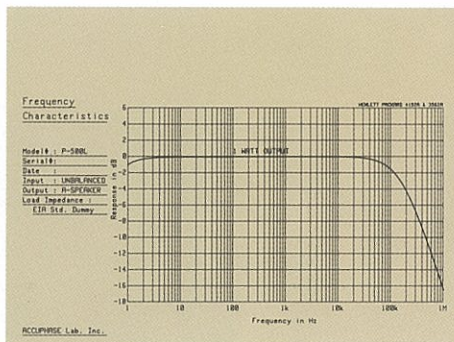
● P-500L Total Harmonic Distortion vs Power Output (at 8 ohm load, as monophonic amp)



● P-500L Total Harmonic Distortion vs Power Output (at 4 ohm load, as monophonic amp)



● P-500L Total Harmonic Distortion vs Power Output (at 2 ohm load, as stereo amp)



● Frequency Response

## GUARANTY SPECIFICATIONS

(guaranteed specifications are measured according to EIA standard RS-490)

- **Performance guaranty:**  
All Accuphase product specifications are guaranteed as stated.
- **Continuous average power output (20 – 20,000 Hz)**  
Stereo operation (both channels driven)  
550 watts per channel into 2 ohms  
420 watts per channel into 4 ohms  
270 watts per channel into 8 ohms  
Monophonic operation (bridged connection)  
1,100 watts into 4 ohms  
840 watts into 8 ohms
- **Total harmonic distortion**  
Stereo and monophonic operation  
0.01%, with 4 to 16 ohms load  
0.02%, with 2 ohms load
- **Intermodulation distortion**  
0.003%
- **Frequency Response**  
20 – 20,000 Hz +0, -0.2 dB  
(for rated output, level controls at maximum)  
0.5 – 180,000 Hz +0, -3 dB  
(for 1 watt output, level controls at maximum)  
0.5 – 150,000 Hz +0, -3 dB  
(for 1 watt output, level control at -6dB)
- **Gain**  
28.0 dB (in stereo and monophonic operation)
- **Output Load impedance**  
2 to 16 ohms in stereo operation  
4 to 16 ohms in monophonic operation (bridged connection)
- **Damping Factor**  
500 in stereo operation  
250 in monophonic operation (bridged connection)
- **Input Sensitivity (with 8 ohm load)**  
Stereo operation  
1.85 V for rated output  
0.12 V for 1 watt output  
Monophonic operation (bridged connection)  
3.26 V for rated output  
0.12 V for 1 watt output
- **Input Impedance**  
Unbalanced: 20 kilohms  
Balanced: 40 kilohms
- **Signal-to-Noise Ratio (A-weighted)**  
120 dB with input shorted, at rated output  
95 dB with 1-kilohm input termination, at 1 W output (in stereo and monophonic operation)
- **Output Level Meters**  
Logarithmic scale, -60 dB to 3 dB range  
Direct watt-reading scale
- **Semiconductor Complement**  
88 transistors, 16 FETs, 8 ICs, 60 diodes
- **Power Requirements**  
100 V, 117 V, 220 V, 240 V 50/60 Hz AC
- **Power Consumption**  
185 watts idle  
920 watts at rated power output into 8 ohms  
1,100 watts in accordance with IEC-65
- **Dimensions**  
Width 480 mm (19 inches), Height (including feet) 218 mm (8.6 inches), Depth 445 mm (16 inches)
- **Weight**  
35.0 kg (77.1 lb) net,  
41.5 kg (91.4 lb) in Shipping Carton