Accuphase

CLEAN POWER SUPPLY

PS-500

● Waveform shaping technology creates rock-stable AC power ● Highly effective waveform compensation ● Ample current capability ● Outstanding interference rejection ● Built-in meter for monitoring of output power, input/output voltage, input/output distortion ● Sophisticated protection features ● Large "Super Ring" toroidal transformer

Tap into a totally clean source of AC energy. Revolutionary waveform shaping technology compares the AC input to an ideal sine waveform and provides highly precise compensation. High-frequency interference components are reliably blocked, for further improved sonic purity. High capacity of 500 VA accommodates a wide range of audio equipment. Monitoring of output power, input/output voltage, and input/output distortion is also possible.

The Clean Power Supply PS-500 is a product that breaks entirely new ground. Designed for audiophiles and music lovers who will accept no compromises when it comes to sound quality, the PS-500 reflects the extensive audio expertise accumulated by Accuphase. It is a unique type of audio component that goes far beyond conventional power supply designs. Adding the PS-500 to a high-grade music reproduction system will result in sonic purity that is nothing short of breathtaking.

The AC power lines in ordinary homes as well as in office buildings, recording studios, and practically everywhere else are supplying power to equipment containing digital circuits and microprocessors, which includes not only computers but also many other kinds of electrical appliances. High-frequency noise components originating in such equipment can enter audio components via the power supply and severely affect sound quality by causing intermodulation noise and distortion. Only when such noise interference is removed and totally clean power is supplied, audio components become able to develop their full potential. Consequently, upgrading the quality of the AC power source of an audio system is bound to result in a drastic improvement in overall sonic performance.

In pursuit of the ideal, clean power, Accuphase has developed a revolutionary new technique which constantly monitors the input voltage waveform and adds or subtracts exactly the required amount of compensation to achieve a perfectly regular, sinusoidal waveform. The PS-500 incorporates this technique, which allows it to supply extremely stable and clean energy to the components of an audio system. Using the model of an ideal power supply waveform, a reference voltage is generated which serves as the yardstick for adding or subtracting just the right amount of power to the input. The end result is output power with perfectly clean waveform at all times. Since the required compensation typically is only a fraction of overall power, the PS-500 operates with high efficiency and produces little heat, which allows it to be designed as a fairly compact and lightweight unit. Of course, the PS-500 also has the ability to completely block any high-frequency noise components, resulting in total absence of modulation noise. Since it contains no oscillators or switching circuitry, the PS-500 itself does not act as a source of spurious high-frequency noise.

Power Supply Waveform

The power generated by the power plant originally is fed into the electrical grid with a clean sine waveform. However, when power is withdrawn from the local AC outlet, the waveform almost invariably is clipped. The reason for this phenomenon lies in the electrical appliances used in the household. Conventional TV sets, personal computers, audio components, as well as many other appliances convert AC input into a DC current for powering the internal circuits. This task is performed by a rectifier consisting of a diode and capacitor arrangement. As shown in photograph (a), the rectifier load current has a pulse waveform. In the vicinity of the voltage peak of the sinus waveform, a large current flows momentarily which causes a voltage drop, or in other words a clipping of the voltage waveform, as shown in photograph (b). A clipped waveform with a high amount of distortion contains many unwanted frequency components, or harmonics. When entering the audio circuitry of an amplifier through the power supply, such harmonic components can interfere with the audio signal and cause intermodulation distortion which has a highly detrimental effect on sound quality.

Photo (a) Current waveform of rectified load

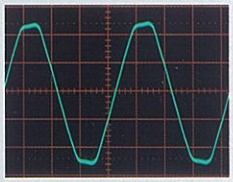


Photo (b) Voltage waveform of AC line (distortion approx. 3%)

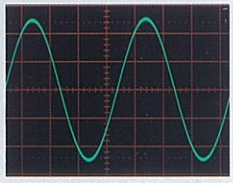


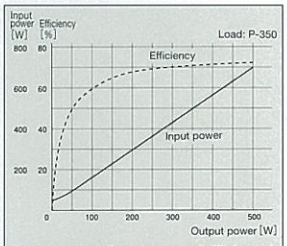
Photo (c) PS-500 output waveform (distortion approx. 0.2%)

When passing through the PS-500, the deformed waveform is restored to its original sine wave pattern, as shown in photograph (c). This clean power, when supplied to an audio component, causes a drastic improvement in sonic purity.

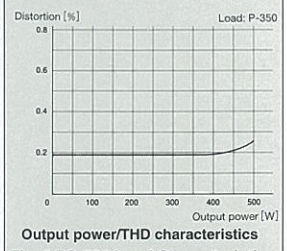
AC Voltage Stabilizer Based on Waveform Shaping Technology

The PS-500 accepts AC power on the input side, processes it using internal control circuitry, and supplies it as clean AC power on the output side. Most of the AC energy from the input is carried over to the output. The loss introduced by the PS-500 is very small, since it consists only of the power required for waveform compensation. Compared to conventional AC voltage stabilizers, efficiency is much higher and excess thermal energy is low, allowing the unit to be made relatively small and lightweight. Since the power supply frequency is synchronized to the input, an internal oscillator is not required. Therefore, the unit itself does not generate any high-frequency noise.

Figure 1 shows the circuit diagram of the unit. The signal from the secondary winding S_1 of the transformer is routed through the adding/subtracting circuit and appears at the output as output voltage (e_0). The S_2 signal from the transformer is supplied to the reference waveform generating circuit where it is turned into the high-precision sine waveform (e_i) synchronized to the input frequency. This sine wave signal is then routed to the waveform comparator to be used as reference signal. By comparing the output voltage (e_0) to this reference sine waveform (e_i), the differential component is detected. Based on this information, the adding/subtracting circuit can provide exactly the required amount of compensation for turning the output into a high-precision sine waveform.



Output power/input power (efficiency) characteristics



Output power/THD characteristics

Fig. 2 PS-500 Load Characteristics

Superior Waveform Compensating Power

Generally speaking, if the input voltage is for example 110V/220V, 10 volts must be added to bring it to 120V/230V, as shown in Figure 3 (a). Conversely, if the input is 130V/240V, 10 volts must be subtracted to yield 120V/230V. (Actually, the peak value of 10 V, namely 14.1 V is subtracted.)

By comparing a precise sine wave synchronized to

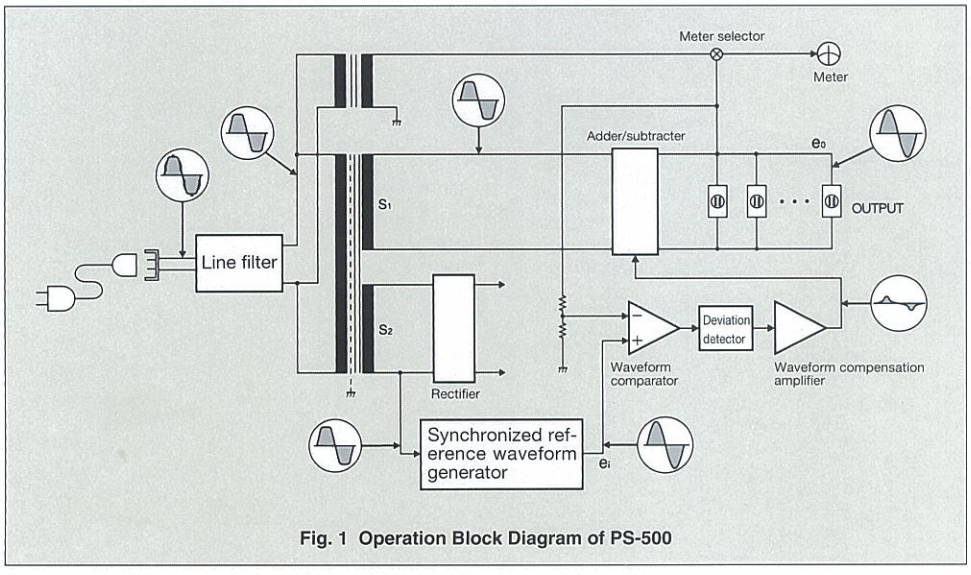
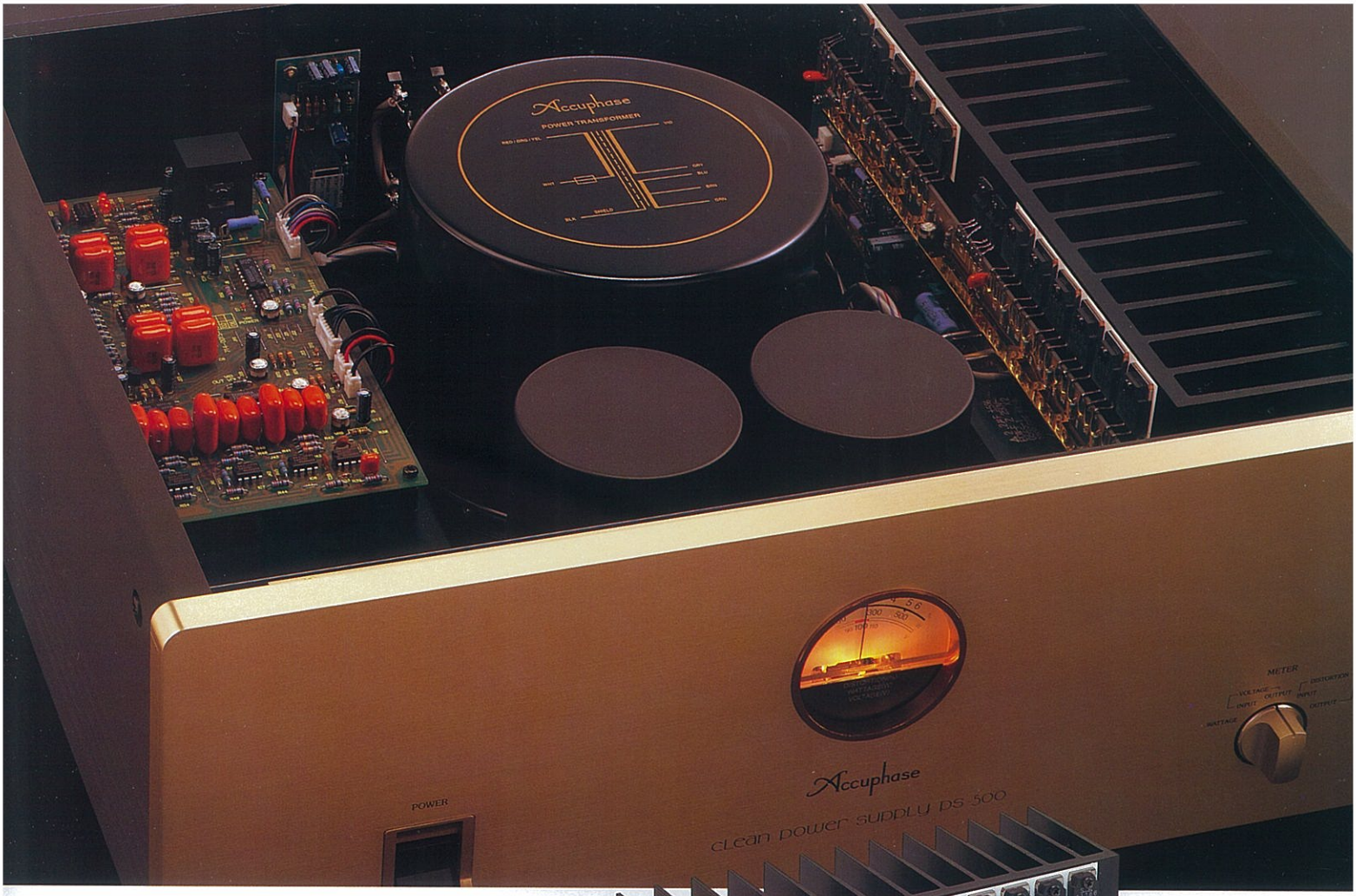
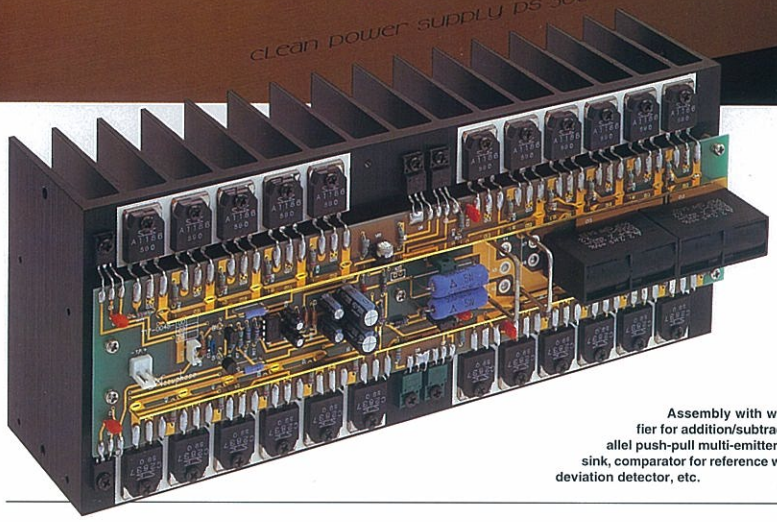


Fig. 1 Operation Block Diagram of PS-500



Meter scale (voltage indication) is different for 120 V and 230 V AC versions.



Assembly with waveform compensation amplifier for addition/subtraction, output stage with 10-parallel push-pull multi-emitter devices mounted to large heat sink, comparator for reference waveform and output waveform, deviation detector, etc.

the input frequency with the output voltage, a compensation waveform is created which is then imposed on the output voltage. Consequently, for an input voltage range of 108-132V/200-253V AC and a constant load of 500 W, the output voltage is kept constant at 120V/230V (±2%), with a maximum distortion ratio of 0.3%. These values demonstrate the outstanding waveform compensation ability of the PS-500.

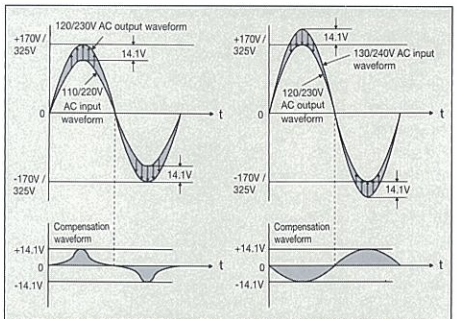


Fig. 3 Waveform Shaping Principle of PS-500

Excellent Current Capability

The power amplifier which performs waveform compensation is configured as a pure complementary symmetrical circuit using current feedback for unsurpassed operation stability. The output stage uses transistors rated for a maximum current of 10 amperes. These devices are connected in a 10-parallel complementary push-pull arrangement which boasts a rated output current of 4.2A/2.2A and an instantaneous peak current rating of 60A/30A. This kind of current capability is an order of magnitude better than that of conventional power supplies.

Highly Effective Interference Rejection

The input side of the PS-500 also contains a line filter for removing high-frequency noise components that may be present in the power line. The primary and secondary windings of the power transformer are kept totally separate, and the fully shielded design shuts out any externally induced noise.

Since the PS-500 uses the AC feedback principle, output impedance is extremely low. This prevents any possibility of mutual interference between components connected to the outputs of the PS-500.

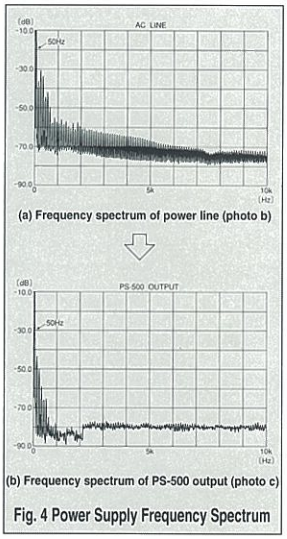
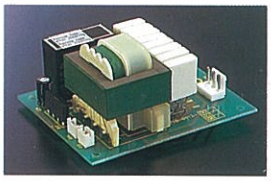


Fig. 4 Power Supply Frequency Spectrum

Figure 4 shows the frequency spectrum of the power supply line and the PS-500 output. It clearly demonstrates that unwanted high-frequency components within the audible range are effectively suppressed by the PS-500.

Built-in Meter Allows Monitoring of Output Power, Input/Output Voltage, Input/Output Distortion

The meter of the PS-500 lets the user see at a glance how much power the connected equipment is consuming at any given time. This is especially helpful for components such as integrated amplifiers or power amplifiers whose power consumption differs considerably depending on the volume setting and actual music signal.



Assembly with input voltage/distortion monitoring circuitry

A meter selector also allows monitoring of input/output voltage or input/output distortion in real time, parameters which were difficult to check until now.

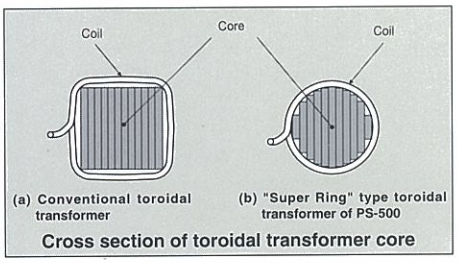
Strong Power Supply With Large "Super Ring" Toroidal Transformer and High Filtering Capacity

The power transformer plays a vital role in any power supply. The PS-500 uses a large toroidal type rated for 750 VA. In general, toroidal power transformers have very low impedance and achieve high efficiency with compact dimensions. In particular, the "Super Ring" transformer used in the PS-500 has the following advantages:

① **Near-circular core caliber allows near-circular coil windings with high packing density, resulting in low weight, low losses, low leakage flux under actual load conditions, and minimum vibrations.**

② **Smaller ferrite core diameter and copper windings with high specific gravity mean low ferrite losses and low inrush current.**

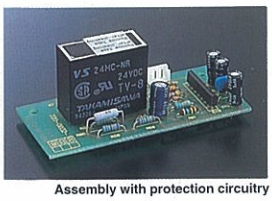
These and other characteristics make this transformer type ideally suited for audio applications.



Cross section of toroidal transformer core

Elaborate Protection Features Assure Total Operation Safety

If any of the conditions described below should arise during operation, the circuit breaker integrated in the power switch immediately shuts off the power, to protect the unit and any connected components.


Assembly with protection circuitry

① **Input current overload protection**
The protection is activated when:
-the combined power consumption of equipment connected to the AC outputs of the PS-500 exceeds 500 VA, causing the rated input current to surpass 7.5A/3A.
-an output connector is short-circuited.

② **Instantaneous output current overload protection**
For operation safety, a 60A/30A current limiter provides protection against momentary power overload such as caused by inrush current when a component is switched on.

③ **The protection is also activated if a problem in the PS-500 should cause any DC voltage to appear in the output, or if the output should exceed 130V/248V AC.**

Multiple Output Connectors

The PS-500 can supply a number of components such as a CD player, DAT recorder, preamplifier, power amplifier etc., provided the combined power consumption is less than 500 VA.

Note:
** When two figures are given in this document, these refer to the 120V AC and 230V AC version of the PS-500 respectively.*

■ FRONT PANEL

❶ Meter *
(Output power, Input/output voltage, Input/output distortion)

❷ Power switch / Circuit breaker

❸ Meter selector
WATTAGE, VOLTAGE INPUT/OUTPUT
DISTORTION INPUT/OUTPUT

❹ Output connector *

❺ AC connector
(for supplied power cord) *

■ REAR PANEL (The photograph shows the 230 V AC model.)

Remarks
** The actual allowable voltage is indicated on the rear panel. Be sure to check this indication before using the PS-500.*
** The 120V AC and 230V AC versions of the PS-500 differ regarding meter voltage indication, AC output connector shape, etc. Make sure that you have the correct version.*
** The shape of the plug of the supplied power cord depend on the voltage rating and destination country*

A Word About Power Ratings

The power consumption of electrical equipment as indicated on the equipment itself and in catalogs and other documentation is given in watts (W). This figure represents the so-called effective power which is stated according to legal requirements. However, the actual power drawn by the equipment is larger than the effective power. This is called the apparent power which is calculated by multiplying the applied voltage (120V/230V) with the actual current. The unit for apparent power is VA (volt-ampere).

Since the value shown by the power meter of the PS-500 in the "Wattage" position is the apparent power, the reading will be higher than the power consumption (W) given in catalogs and the like.

- The rated power limit of the PS-500 is 500 VA. When deciding on equipment to be connected, power consumption figures given in catalogs and the like can be used for a general estimate, but actual power consumption should be checked using the meter.
- The power consumption of integrated amplifiers and power amplifiers varies considerably depending on the actual audio output. After connecting such equipment, you must monitor playback and high volume level peaks to verity that power consumption does not exceed 500 VA.
- For reference, the ranking of Accuphase products is shown in the table below.

Can be connected	Preamplifiers, CD players, tuners and other low-power components E-406, E-306, E-210 A-20, P-102, P-350
Can be connected at moderate volume settings *	P-360, P-500L, P-550, P-700
Cannot be connected	A-100, A-50, M-1000, P-800

* When loudspeakers with 8-ohm impedance are driven to normal listening levels.

※ This product can be used only on a regular household AC circuit rated for 120 V or 220-240 V. Using the product with portable AC generators, ship power generators or similar equipment is not possible.
※ This product is designed to improve the quality of AC power supplied to audio components. Do not use it with any other kinds of electrical appliances.

GUARANTEED SPECIFICATIONS

PS-500 Guaranteed Specifications
(Dual figures refer to 120V AC and 230V AC versions)

Rated output capacity	500 VA (continuous)
Rated output voltage	120 V AC ± 2% / 230 V AC ± 2%
Rated output current	4.2 A / 2.2 A
Output frequency	50 Hz or 60 Hz (identical to input frequency)
Instantaneous peak current capacity	60 A / 30 A
Output waveform THD	0.3% or less
Input voltage range	108-132 V AC / 200-253 V AC
Input frequency	50 Hz or 60 Hz
Input capacity	750 VA (at rated output)
No-load power consumption	55 W
Cooling principle	Natural air cooling
Meter	WATTAGE : 0-500 W VOLTAGE INPUT/OUTPUT : 120 V / 230 V ± 5% (red zone) DISTORTION INPUT/OUTPUT : 0-6%
Maximum dimensions:	475mm (18-11/16") width, 180mm (7-1/16") height, 378.5mm (14-1/4") depth
Weight	21.8kg (48.1lbs.) net 26.8kg (59.1lbs.) in shipping carton

※ Specifications and design subject to change without notice for improvements.

Accuphase
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