

# Accuphase

CLEAN POWER SUPPLY

## PS-520

- AC voltage stabilizer based on waveform shaping technology
- Supplies up to 510 VA of extremely clean energy
- Low-distortion reference waveform generator
- Highly effective waveform compensation
- Outstanding current capability
- Superb interference rejection
- Built-in meter for monitoring vital parameters: output power, input/output voltage, input/output distortion
- Sophisticated protection features
- Large, high-efficiency toroidal transformer



The photograph shows the 230 V version.



**Solve power supply problems once and for all — Revolutionary waveform shaping technology made even more precise, to create a pure energy source of up to 510 VA, rated for 120 V  $\pm$ 1.5 V/230 V  $\pm$ 3 V with max. 0.1% THD. Connect audio or video equipment for a drastic improvement in sound and picture quality. Visually monitor the quality and efficiency of the power source using the built-in meter with AUTO-MONITOR function.**

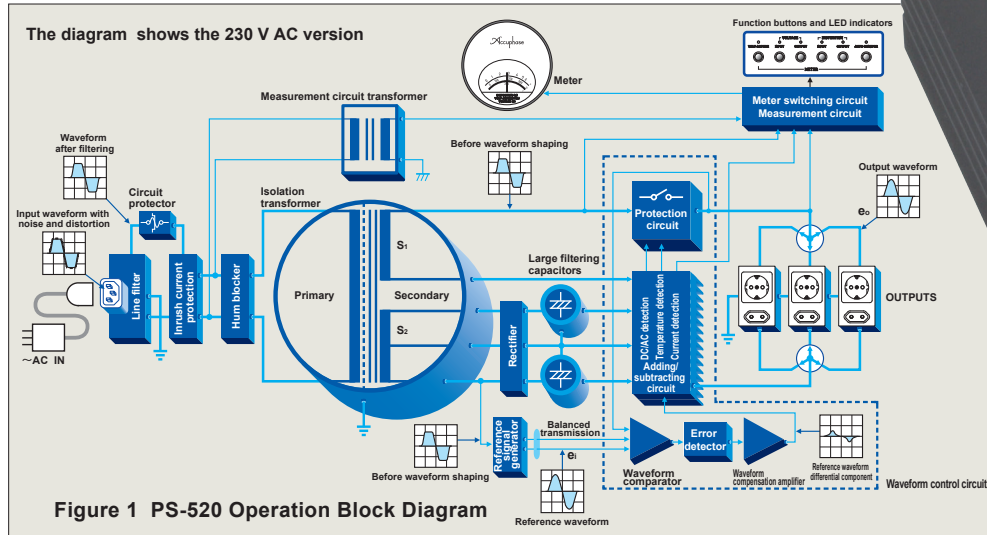
The Clean Power Supply components from Accuphase are the result of intensive research into every aspect of powering demanding equipment from the AC grid. They are designed to ensure ideal conditions without compromise. Noise and impurities are removed from the AC power line and signal quality is improved by continually monitoring and shaping the power supply waveform in real time. Revolutionary high-speed circuitry adds or subtracts exactly the required amount of compensation, thereby minimizing distortion and creating a perfect waveform. The result is a drastic improvement in the sound and picture quality of audio and video equipment. The PS-520 features a differential push-pull arrangement of power MOS-FETs for the waveform compensation amplifier, which further improves the precision of the reference signal and thereby the sound quality and performance of the power supply. Balanced transmission is used for the link to the power section, resulting in a cleaner output waveform with minimal distortion. The use of high-quality AC outlets meeting exacting standards with regard to electrical safety, and impedance matching of all outlets means greatly improved reliability. All circuitry in the PS-520 is analog. The power source waveform containing noise and distortion is compared to a highly accurate and stable reference waveform. Based on this comparison, the PS-520 then adds or subtracts exactly the required amount of correction to create a clean power supply. The required compensation typically is only a fraction of overall power, which allows the PS-520 to operate with high efficiency while producing little heat. Since there are no oscillators or switches, the PS-520 itself does not act as a source of spurious high-frequency noise.

**AC Voltage Stabilizer Based on Waveform Shaping Technology**

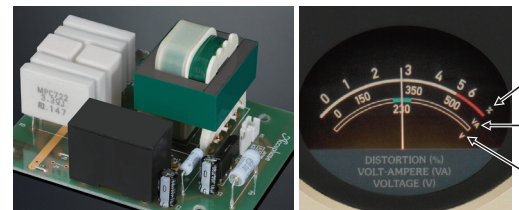
The PS-520 accepts AC power on the input side, processes it with internal control circuitry, and supplies it as clean AC power on the output side. Most of the AC energy from the input is carried over to the output. The introduced loss consists only of the power required for waveform compensation. As shown in Figure 1, the signal from the secondary winding S<sub>1</sub> of the transformer reaches the adding/subtracting circuit and appears at the output as output voltage e<sub>o</sub>. The secondary winding S<sub>2</sub> signal from the transformer goes to the reference waveform generating circuit where it becomes a high-precision sine waveform e<sub>r</sub> synchronized to the input frequency of 50/60 Hz. This reference sine wave e<sub>r</sub> is then used as reference signal to be compared to the output voltage. The differential component is extracted and used by the adding/subtracting circuit to provide exactly the required amount of compensation for turning the output into a high-precision waveform.

**Superb Interference Rejection**

The input side of the PS-520 is equipped with a line filter, an isolation transformer with shielding between



the primary and secondary side, and a high-speed adding and subtracting circuit. This thorough, three-stage approach reliably removes any high-frequency noise components present in the power line, such as generated by digital equipment. The output impedance of the amplifier section is extremely low, which minimizes the risk of mutual interference between components connected to the outputs of the PS-520.

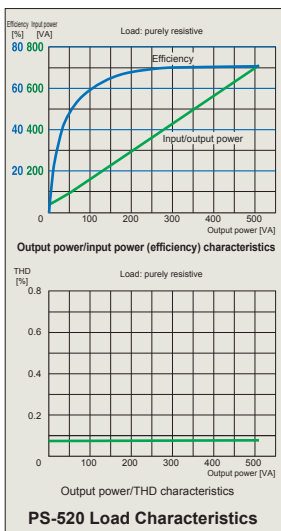


Assembly with input voltage/distortion monitoring circuitry Meter scale of 230 V AC version

**Built-in Meter Allows Easy Monitoring of Output Power (VA), Input/Output Voltage (V), Input/Output Distortion (%). Excessive Load Indicated by Flashing LEDs.**

The constantly fluctuating voltage and distortion at a regular household AC outlet can be monitored in real time.

The meter also lets the user see at a glance how much power (VA) the connected equipment is consuming at any given time, which is especially helpful for components such as power amplifiers whose power consumption differs considerably depending on the actual volume. An AUTO-MONITOR function that automatically switches the meter indication is also provided.



**Power Supply Waveform and Clean PS-520 Output Waveform**

Almost all electrical devices used in a household convert the AC supplied by the outlet into a DC current for powering internal circuits. This task is performed by a rectifier consisting of a combination of diodes and capacitors. The rectifier load current has a pulse characteristic with a large current flowing momentarily in the vicinity of the peak of the voltage waveform (sine waveform). The resistance of electrical in-wall wiring and power cords affects the waveform and leads to a drop in voltage, which is seen as clipped waveform with higher amounts of distortion. The clipped waveform results in less power being available, so that connected equipment does not receive enough energy to develop its full potential. The distorted waveform also 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. The AC power therefore not only is subject to noise and distortion while being delivered to the load, it is then further degraded in the equipment itself through the process of power consumption. When passing through the PS-520, practically all unwanted harmonic components in the audible range are removed (see frequency spectrum in the graph below), and the waveform is restored to its original sine wave pattern as shown in photograph (c).

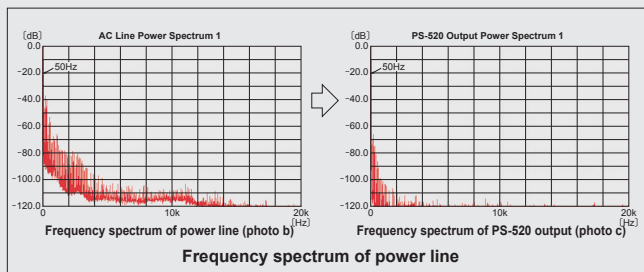
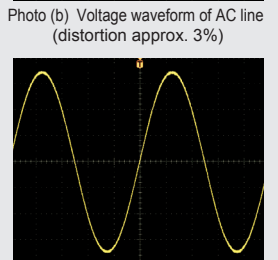
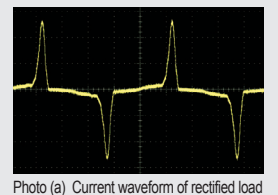


Photo (c) PS-520 output waveform (distortion approx. 0.06%)



The photograph shows the 230 V version.

◀ Clean internal layout designed for optimal power and signal flow

Distortion scale (%)  
 Volt-Ampere scale (VA)  
 Voltage scale (V)

▼ Assembly with 10 parallel push-pull power MOS-FETs mounted to large heat sink, waveform compensation amplifier for addition/subtraction, etc.

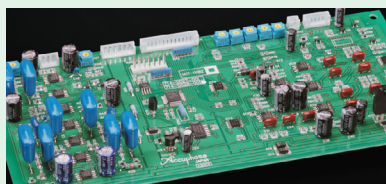
### Outstanding Current Capability

The power amplifier which performs addition/subtraction for waveform compensation uses the pure complementary push-pull differential principle for high gain, excellent precision, and complete operation stability. In the output stage, a 10-parallel complementary arrangement (10 P channel pairs, 10 N channel pairs) of power MOS-FETs rated for max. 30 A is used. This reduces the load of the preceding stage and reliably absorbs even rapid load fluctuations, providing a rated output current of 2.2 A (4.2 A), with an instantaneous peak current (inrush current) rating of 30 A (60 A). This demonstrates the excellent current capability of the PS-520.

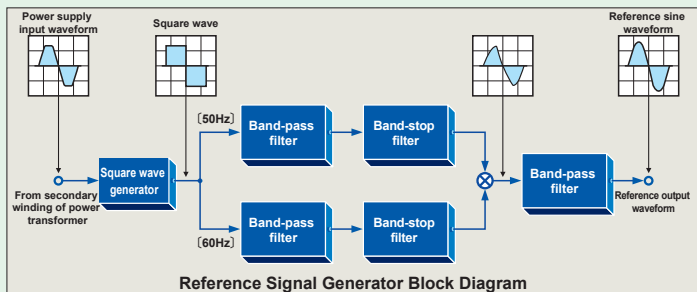
### Compensation Amplifier Based on High-Precision Reference Signal Creates Pure 230 V (or 120 V) AC Source

#### Low-Distortion Reference Signal Generator

In the PS-520, the power supply output frequency is matched to the input frequency without the use of an oscillator that can become a source of noise and interference. The zero-cross point of the signal at the  $S_2$  winding of the power transformer (see Fig. 1) is detected and used as AC voltage sine wave reference to generate a highly accurate square waveform. A newly developed 50/60 Hz band-pass filter and band-stop filter is then applied to the waveform. The filter frequency is switched in sync with the input frequency, for automatic 50 Hz and 60 Hz support. By routing the signal through another band-pass filter, a low-distortion sine wave (reference signal) is created that is not dependent on the input voltage.



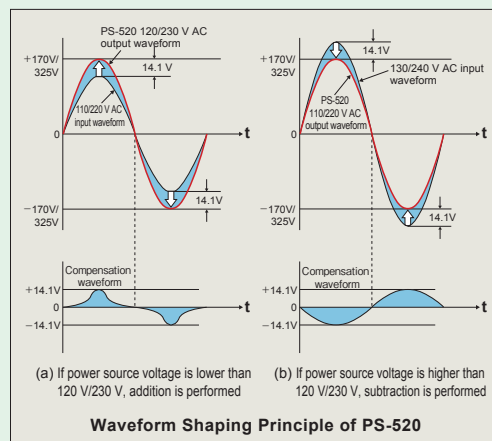
Assembly with reference signal generator and other circuitry



Reference Signal Generator Block Diagram

#### Superior Waveform Compensating Power

The waveform compensation capability of the PS-520 not only eliminates noise and distortion, it also deals with sudden and rapid voltage fluctuations in real time. When the input voltage is 110/220 V, the voltage at the secondary side of the transformer will also be 110/220 V. To bring this to 120/230 V, 10 volts must be added, as shown in Figure (a). Conversely, if the input is 130/240 V, 10 volts must be subtracted to yield 120/230 V. (As the figures show, in actual operation, the peak voltage of 120/230 V is 170/325 V, and the peak value of 10 V, namely 14.1 V, is added or subtracted.) The sine wave (e) is synchronized to the input frequency and the output voltage (e<sub>o</sub>) are compared, and for any excessive or missing component, a compensation waveform up to a maximum of ±10 V (peak value ±14.1 V) is generated and imposed on the output voltage. Consequently, for an input voltage range of 108 V - 132 V/207 V - 253 V at the rated load of 510 VA, the output voltage is kept constant at 120 V ±1.5 V/230 V ±3 V, with a maximum distortion ratio of 0.1%. These values demonstrate the outstanding waveform compensation ability of the PS-520.

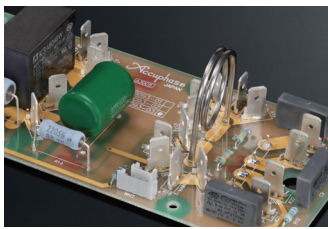


Waveform Shaping Principle of PS-520

## Sophisticated Protection Features

All operation factors including voltage, current, power, DC components, temperature etc. are constantly monitored, for reliable protection in case of any problem.

- When the combined load of connected equipment exceeds the maximum rated output power of 510 VA, the indicator LEDs of the meter selector buttons flash as a warning indication.
- When input current overload occurs, the circuit protector shuts off the power. Reduce the connected load and turn power on again.
- In case of momentary power overload such as caused by inrush current when a component is switched on or when a power amplifier reproduces a peak passage in the music, a 30/60 A current limiter becomes active to ensure safe use.
- Internal operation is monitored constantly. When a problem such as DC voltage in the output or output voltage exceeding the maximum rating is detected, the output is switched off instantly to protect connected components.
- When the temperature of the internal heat sink or power transformer is very high for an extended period, the circuitry is automatically shut down.



Assembly with protection circuitry

## Strong Power Supply With Massive High-Efficiency Toroidal Transformer and Large Filtering Capacitors

The power transformer, a crucial component, is a massive toroidal type. Toroidal power transformers employ large-gauge copper wiring on a donut-shaped core, which creates a smooth and closed magnetic path with minimal external leakage. The result is extremely low impedance and high efficiency. Two specially designed high-quality 22,000  $\mu\text{F}$  filtering capacitors selected for outstanding sound provide ample smoothing capacity.



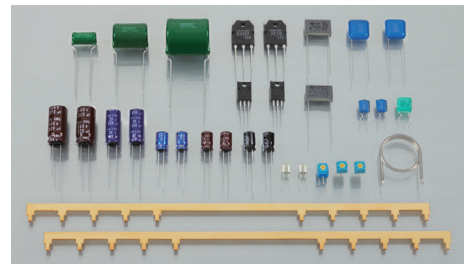
Filtering capacitors

## High-Performance Parts Selected for Sound Quality

The six (for 230 V) or eight (for 120 V) AC outlets of the PS-520 are high-quality types. Internal circuitry makes ample use of gold-plated parts and customized parts. The circuit protectors are quality devices that react with higher speed than conventional circuit breakers. Vibration-damping rubber parts are used for mounting. This attention to detail is evident throughout the PS-520.



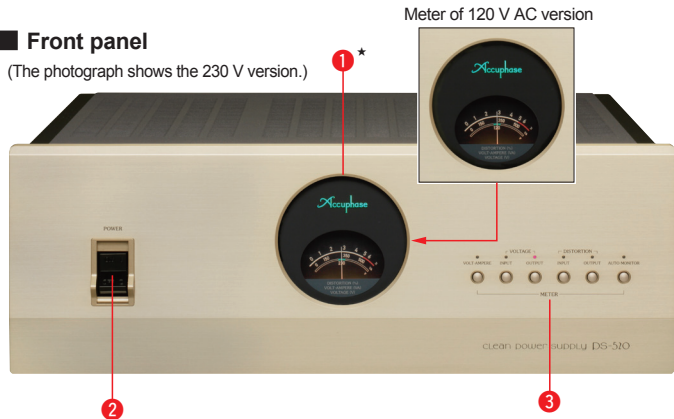
Line filter, vibration-damping rubber, circuit protector



Parts selected for high sound quality and high reliability

## Front panel

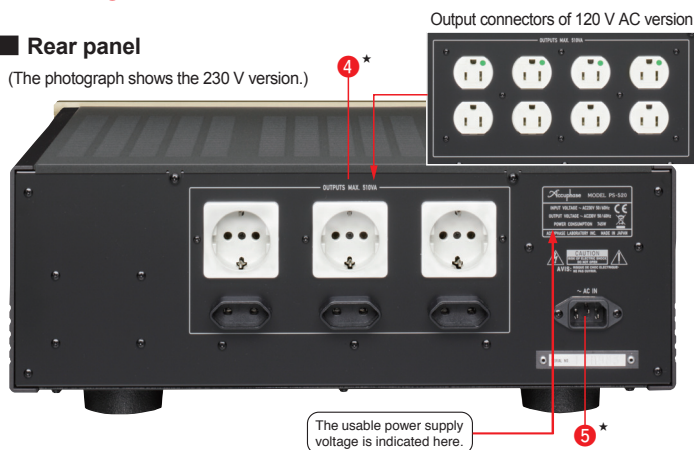
(The photograph shows the 230 V version.)



Meter of 120 V AC version

## Rear panel

(The photograph shows the 230 V version.)



Output connectors of 120 V AC version

The usable power supply voltage is indicated here.

- Meter (Output power, input/output voltage, input/output distortion)\*
- Power switch/Circuit protector
- Meter operation selector buttons  
VOLT-AMPERE (VA) VOLTAGE INPUT/OUTPUT (V)  
DISTORTION INPUT/OUTPUT (%) AUTO-MONITOR
- Output connectors (AC outlets)\*
- AC power connector\*

## Remark

\* The 230 V AC and 120 V AC versions of the PS-520 differ regarding meter voltage indication, AC output connector shape, supplied power cord, etc. Make sure that you have the correct version.



- \* The PS-520 is available in 230 V AC and 120 V AC versions. The actual allowable voltage is indicated next to the AC power connectors on the rear panel. Be sure to check this indication before using the PS-520.
- \* This product can be used only on a regular household AC circuit rated for 230 V or 120 V AC, 50/60 Hz. Using the product with portable AC generators, airplane or ship power generators or other types of power sources is not possible.
- \* This product is designed to improve the quality of AC power supplied to audio or video components. Do not use it to power industrial type equipment or common household electrical appliances.
- \* Do not use this unit for powering equipment where failure incurs a risk of injury or fatal accidents (medical equipment, aviation equipment, traffic control equipment, furnace and heating control equipment, safety devices, etc.). Accuphase will not be liable for any problem occurring due to use of the PS-520 with the above type of equipment.

■ Supplied accessories: • AC power cord 2 m

## PS-520 Meter (Power) Indication and Load

The power consumption of electrical equipment, as indicated on the equipment itself and in catalogs and other documentation according to legal requirements, is usually given in watts (W). This figure represents the so-called effective power. 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 (230 V or 120 V) with the actual current. The unit for apparent power is VA (Volt-Ampere). Since the value shown by the meter of the PS-520 is the apparent power, the reading will be higher than the power consumption (W) given in catalogs and specification sheets.

- The rated power limit of the PS-520 is 510 VA. When deciding on equipment to be connected, select components so that the total remains within this limit, and check actual power consumption using the meter.
- High-output class-A power amplifiers, such as the A-65, which constantly draw a high idling current when switched on cannot be connected to the PS-520.
- In case of overload, the indicator LEDs of the meter operation selector buttons flash. Reduce the load by reducing the number of connected components until the indicator LEDs stop flashing and stay constantly lit.
- The power consumption of integrated amplifiers and power amplifiers varies considerably depending on the actual audio output. After connecting such equipment, perform playback and verify that the meter indication does not exceed 510 VA also at the highest volume level setting.

## PS-520 GUARANTEED SPECIFICATIONS

	120 V version	230 V version
<b>Rated output capacity</b>	510 VA (continuous)	
<b>Rated output voltage</b>	120 V AC $\pm 1.5$ V	230 V AC $\pm 3.0$ V
<b>Rated output current</b>	4.2 A	2.2 A
<b>Output frequency</b>	50 Hz or 60 Hz (identical to input frequency)	
<b>Instantaneous peak current capacity</b>	60 A	30 A
<b>Output waveform THD</b>	0.1% or less	
<b>Rated input voltage</b>	120 V AC	230 V AC
<b>Input frequency</b>	50 Hz or 60 Hz	
<b>No-load power consumption</b>	50 W	
<b>Cooling principle</b>	Natural air cooling	
<b>Meter</b>	* In case of overload, the indicator LEDs of the meter selector buttons flash.	
<b>VOLT-AMPERE</b>	0-510 VA	
<b>VOLTAGE INPUT/OUTPUT (green zone of scale)</b>	120 V AC $\pm 5\%$	230 V AC $\pm 5\%$
<b>DISTORTION INPUT/OUTPUT</b>	0-6%	
<b>AUTO MONITOR</b>	Cycles through VOLT-AMPERE -- DISTORTION DISTORTION OUTPUT indication in 4-second intervals	
<b>Maximum Dimensions</b>	Width 465 mm (18-5/16") Height 181 mm (7-1/8") Depth 386 mm (15-3/16")	
<b>Mass</b>	24.1 kg (53.1 lbs.) net 30.0 kg (66.1 lbs.) in shipping carton	23.5 kg (51.8 lbs.) net 30.0 kg (66.1 lbs.) in shipping carton