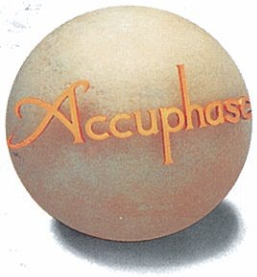
Accuphase

MONOPHONIC POWER AMPLIFIER

# M-2000

● Ultra-powerful output stage with 22 parallel push-pull transistors delivers 250W into 8Ω and remains linear down to extremely low load impedance (2,000W into 1Ω) ● Current feedback circuit topology assures great sound and stable operation ● Bridged use of two units possible for four times the output power ● Large toroidal power transformer rated for 1.5kVA ● Balanced inputs




**Hear music as it was meant to be – with an amplifier designed for stable drive of any low-impedance loudspeaker load. A massive toroidal power transformer with a maximum capacity of 3kVA and 22 parallel push-pull transistors deliver high power with linear progression over an extremely wide impedance range. The amplifier is rated from 250W into 8Ω to a full 2,000W into 1Ω. Current feedback circuit topology assures great sound and operation stability.**

The impedance of a loudspeaker often fluctuates drastically depending on the music signal that is being supplied. Sometimes impedance can drop to very low levels, especially in many high-end models. In order to tame this extreme fluctuation and showcase the best sonic characteristics of a speaker, the amplifier must have very low output impedance (Note 1), and it must be able to supply a constant drive voltage (Note 2). When an amplifier is designed to cope with low load impedances, this also means that it will be fully able to absorb the counterelectromotive force generated by the voice coil, thereby preventing the occurrence of intermodulation distortion.

The Accuphase M-2000 was designed to realize the ideal of constant voltage drive. This no-compromise approach inevitably resulted in a single-channel monaural unit. A complement of 22 output transistors with a collector dissipation (Pc) of 130W each is used in the output stage. Connected in parallel, these devices have a combined collector dissipation of 5,700W. At the extremely low load impedance of 1Ω, the amplifier is rated to deliver 2,000 W (actual measurement 2,370W). The output rating into 2Ω is 1,000W (actual measurement 1,570W), and into 4Ω 500W (actual measurement 890W). This progression demonstrates the amazing linearity of the amplifier which is close to the absolute ideal. The top-notch level of performance is sustained by no-holds-barred construction, including a massive Super Ring toroidal transformer (rated for 1,500VA, max. 3,000VA) housed in a diecast enclosure with directly mounted heat sinks, and serviced by two extra-large filtering capacitors with a capacity of 40,000μF each. This assures more than ample reserves and allows the M-2000 to meet even the most demanding and rapidly fluctuating power requirements.

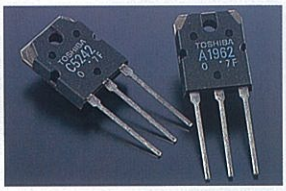
The massive aluminum diecast heat sinks at the right and left of the amplifier achieve highly efficient dissipation of thermal energy. Together with the front panel, chassis, and rear panel, they form an extremely strong and sturdy entity. A large analog power meter located in the center of the front panel provides useful information, and the faceplate in traditional Accuphase brushed gold aluminum blends favorably with the decor of any listening room. Besides being a joy to behold, the M-2000 of course sounds absolutely stunning. It handles the entire dynamic spectrum from fortissimo to pianissimo with ease and authority, letting the music emerge as never heard before.

**(Note 1) The reasoning for low amplifier output impedance:**
The load of a power amplifier is the loudspeaker which generates a counterelectromotive force that can flow back into the amplifier via the NF loop. The signal fed back in this way is influenced by fluctuations in speaker impedance, and interferes with the drive performance of the amplifier. The output impedance of a power amplifier should therefore be made as low as possible by using output devices with high current capability.

**(Note 2) The constant drive voltage principle:**
Even in the presence of a load with wildly fluctuating impedance, the ideal power amplifier should deliver a constant voltage signal to the load. When the supplied voltage remains constant for any impedance, the output power will be inversely proportional to the impedance of the load. A conventional amplifier can be easily made to operate in this way down to a load impedance of about 4Ω. In the region from 3 to 2Ω , an increase in thermal energy becomes a problem and can lead to the destruction of the output transistors. At 1Ω, eight times the output of an 8-Ω load is called for, which can only be sustained by an extremely well designed and capable output stage and a highly robust and powerful power supply section. To build such an amplifier is a task that requires not only considerable experience and resources but also a thorough reevaluation of basic principles.

## Ultra-powerful output stage with 22 parallel push-pull transistors delivers 2,000W into 1Ω, 1,000W into 2Ω, 500W into 4Ω and 250W into 8Ω

The M-2000 uses a complement of 22 high-power transistors with a collector dissipation (Pc) of 130W and a collector current of 15A each. These devices are excellent in every regard, including frequency response, current amplification linearity, and switching characteristics. Because the 22 devices are connected in a parallel push-pull configuration, the output stage has extremely low impedance. Since the devices are directly mounted to the extra-large aluminum diecast heat sinks, heat produced during operation is dissipated with high efficiency. As a result of this no-compromise design with a high performance margin, the power amplifier is capable of delivering enormous output power in a linear progression towards lower load impedances. It also is able to drive reactive loads with ease. Figure 1 shows the output stage of the M-2000. Figure 2 is a graph plotting the output voltage versus current characteristics, based on actual measurements for various load impedances. Thanks to the extremely low impedance of the output stage, the output voltage remains approximately constant also when the load changes, and only the current increases, as is clearly evident from the chart. This demonstrates the advanced performance of the constant voltage drive.



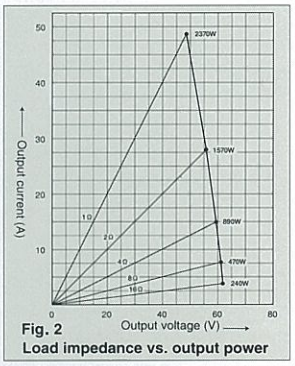



**Fig. 2**
**Load impedance vs. output power**

## Current feedback circuit topology prevents phase shifts

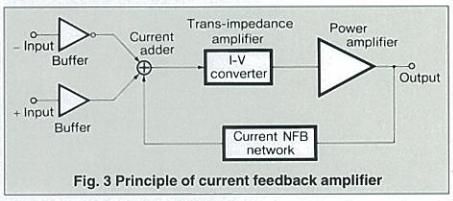


**Fig. 3 Principle of current feedback amplifier**

Negative feedback (NFB) is a commonly employed technique in conventional amplification circuits, routing part of the output signal voltage back to the input. In the M-2000, the signal current rather than the voltage is used for feedback. Figure 3 shows the operating principle of this circuit. At the sensing point of the feedback loop, the impedance is kept low and current detection is performed. An impedance-converting amplifier then converts the current into a voltage to be used as the feedback signal. Since the impedance at the current feedback point (current adder in Figure 3) is very low, there is almost no phase shift. Phase compensation can be kept to a minimum, resulting in excellent transient response and superb sonic transparency. Figure 4 shows frequency response for different gain settings of the current feedback amplifier. The graphs demonstrate that response remains uniform over a wide range.

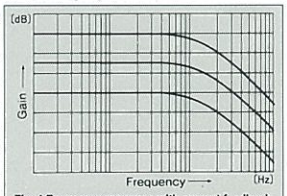


**Fig. 4 Frequency response with current feedback**
(Response does not change when gain is varied)

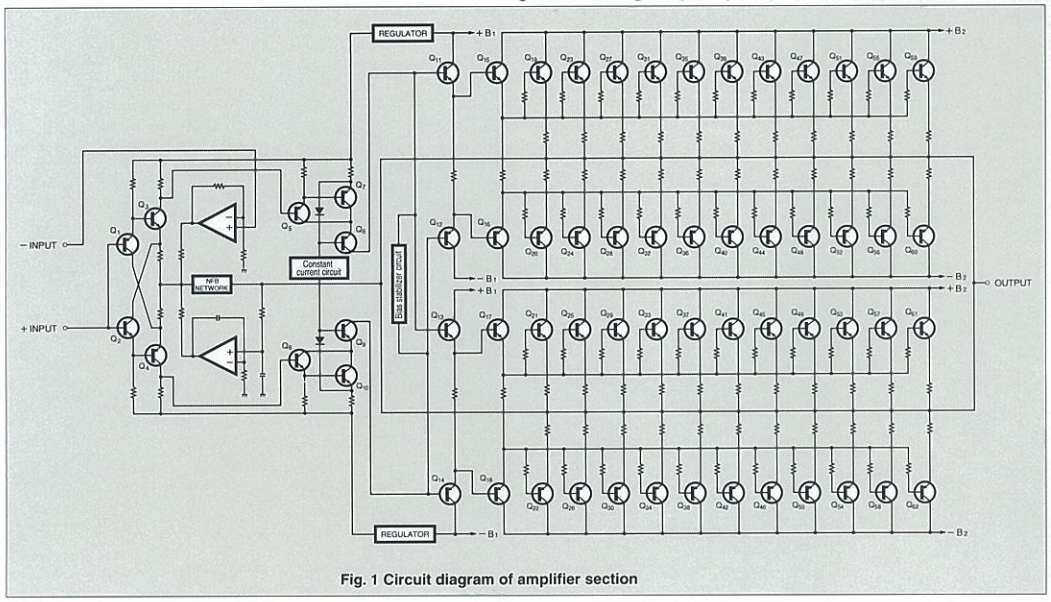


**Fig. 1 Circuit diagram of amplifier section**

### Use of two M-2000 in bridged configuration possible, resulting in a mono amplifier with four times the power

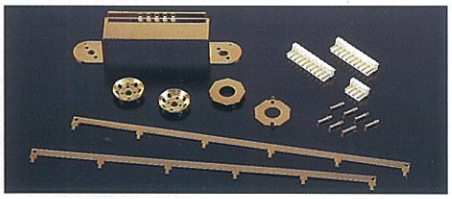
Bridged operation means that two amplifiers are driven by the same signal voltage but with opposite phase. The speaker load is then connected between the positive output terminals of the amplifiers. This results in a fourfold increase in output power. When used in a bridged configuration, two M-2000 units form a single mono amplifier with awesome power capabilities: 4,000W into 2Ω, 2,000W into 4Ω, or 1,000W into 8Ω.

### Balanced connection blocks induced noise

Balanced signal transmission means that two signal lines are used which carry the same signal with opposite phase. On the receiving side, the signals are mixed. Since any noise interference that has arisen during transmission will be present in both lines with identical phase, such noise is canceled out, leaving only the pure original signal. Balanced connection therefore keeps the signal transfer free from any kind of interference.

### All major signal path components are gold-plated

High-purity copper is commonly being used in audio components for signal leads and traces. The M-2000 does this one better, by providing gold-plating for all parts carrying the audio signal. This includes not only the copper traces on printed circuit boards but extends even to ground bars carrying large ripple currents, capacitor bus bars, input jacks, and speaker terminals.



### Robust power supply with "Super Ring" toroidal transformer and high filtering capacity

The power supply section is a critical aspect of any power amplifier. The M-2000 features a large toroidal power transformer with a rating of 1.5kVA. The transformer is housed in a non-resonant aluminum enclosure filled with damping material that has excellent heat transfer characteristics. Toroidal transformers which use heavy-gauge copper wiring on a ring-shaped core have various advantages, such as very low impedance, small size, and high conversion efficiency. The "Super Ring" type transformer used by Accuphase is ideally suited for audio applications. It has the following characteristics:

■ Power amplifier assembly with current feedback amplifier circuitry and 22 parallel push-pull transistors mounted directly to two aluminum diecast heat sinks

① Near-circular core caliber allows near-circular coil windings with high packing density, resulting in low leakage flux and minimum vibrations.

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

In addition, two enormous electrolytic capacitors, each rated for 40,000μF/120WV provide more than amplefiltering capacity for the rectified current.

### Large, direct-reading analog power meter

The large analog power meter has a peak hold function which lets the user easily monitor the output level of the rapidly fluctuating music signal. Thanks to logarithmic compression, the meter covers a wide dynamic range. An on/off switch controls meter operation and illumination.

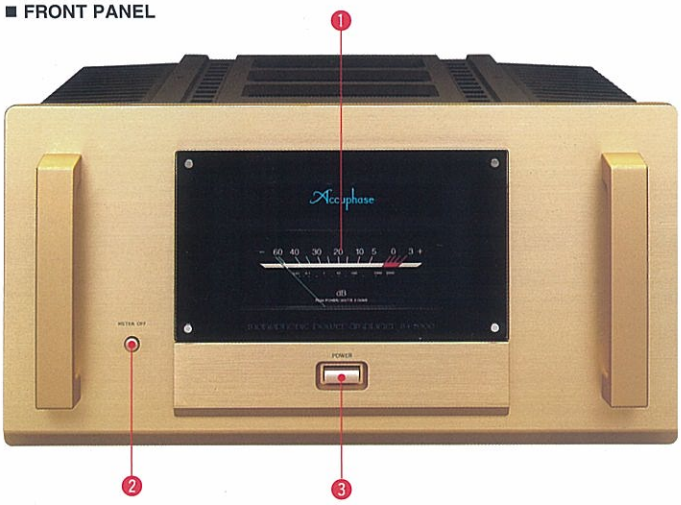
### Phase switching without sound quality degradation

A switch is provided which allows inverting the overall phase of the entire component. Switching is performed by changing the (+) (–) assignment of the balanced amplifier, thereby avoiding the sound quality degradation associated with conventional switching methods.

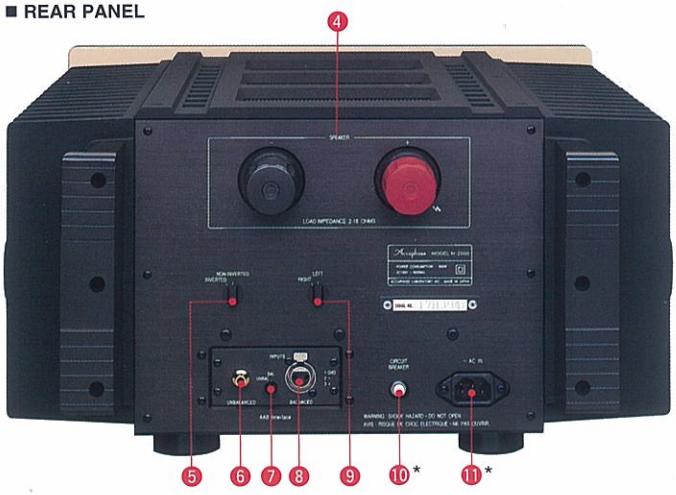

### Extra-large speaker terminals

The oversize speaker terminals are made of extruded high-purity brass material and are gold-plated. A molded cap design provides effective insulation.

■ FRONT PANEL




■ REAR PANEL




❶ Peak power meter
(dB scale, direct-reading for 2-ohm load)
❷ Meter operation/illustration switch
ON OFF
❸ Power switch
❹ Speaker output terminals
❺ Phase selector
NON-INVERTED INVERTED
❻ Unbalanced input
❼ Input selector
UNBAL BAL
❽ Balanced input connector
(1) GND
(2) Inverted (–)
(3) Non-inverted (+)
❾ Channel selector
(reserved for future expansion)
❿ AC circuit breaker*
⓫ AC input connector*
(for supplied power cord)

***Remaks***

**The shape of the plug of the supplied power cord, and the circuit breaker current rating depend on the voltage rating and destination country.*

### Parallel connection of output devices

Semiconductor devices for high-frequency applications often use the multi-chip principle where many small transistors or FETs are internally connected in parallel. This reduces internal noise and the internal impedance of the device. It also results in a larger surface area of the chip, allowing the heat to disperse more easily. This in turn contributes to operation stability. The M-2000 is based on a similar principle. By using multiple devices connected in parallel, current load is distributed. Signal attacks and transients which require a high amount of current to be available almost immediately can be handled with ease. But parallel connection in an Accuphase amplifier means more than simply stringing together a number of devices. Various sophisticated techniques are used to accommodate temperature characteristics and to optimize the current flow pattern. As a result, distortion at low current levels is improved, and signal-to-noise ratio is outstanding, assuring impressive dynamic range and sonic transparency. Ample current capability makes it possible for the amplifier to drive even extremely low loads with ease.

## M-2000 Guaranteed Specifications

※ Guaranteed specifications are measured according to EIA standard RS-490.

| | | |
|---|---|---|
| ● **Continuous Average Output Power (20 ~ 20,000Hz)** | 2,000W | into 1Ω ※ |
| | 1,000W | into 2Ω |
| | 500W | into 4Ω |
| | 250W | into 8Ω |
| | Note : ※Ratings marked are for music signals only. | |
| ● **Total Harmonic Distortion** | 0.1% | with 1Ω load |
| | 0.05% | with 2Ω load |
| | 0.03% | with 4 ~ 16Ω load |
| ● **Intermodulation Distortion** | 0.003% | |
| ● **Frequency Response** | At rated continuous average output: 20 ~ 20,000Hz +0 -0.2dB<br>At 1W output: 0.5 ~ 160,000Hz +0 -3.0dB | |
| ● **Gain** | 28.0dB | |
| ● **Output Load Impedance** | Continuous output: 2 ~ 16Ω<br>Music signal output: 1 ~ 16Ω | |
| ● **Damping Factor** | 400 | |
| ● **Input Sensitivity (8Ω load)** | 1.78V | for rated continuous average output |
| | 0.11V | for 1W output |
| ● **Input Impedance** | Balanced: 40kΩ<br>Unbalanced: 20kΩ | |
| ● **Signal-to-Noise Ratio (A-weighted)** | 120dB with input shorted, at rated continuous average output | |
| ● **Analog Output Level Meter** | Logarithmic compression scale -60dB to +3dB and direct watt-reading scale | |
| ● **Power Requirements** | 100V, 120V, 220V, 230V, 240V (Voltage as indicated on rear panel) AC, 50/60Hz | |
| ● **Power Consumption** | 180W at zero signal input<br>950W in accordance with IEC-65 | |
| ● **Maximum Outline Dimensions** | 475mm (18-11/16 inches) width,<br>252mm (9-15/16 inches) height,<br>545mm (21-7/16 inches) depth | |
| ● **Weight** | 50kg (110.2lbs.) net<br>60kg (132.3lbs.) in shipping carton | |

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

Accuphase
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