

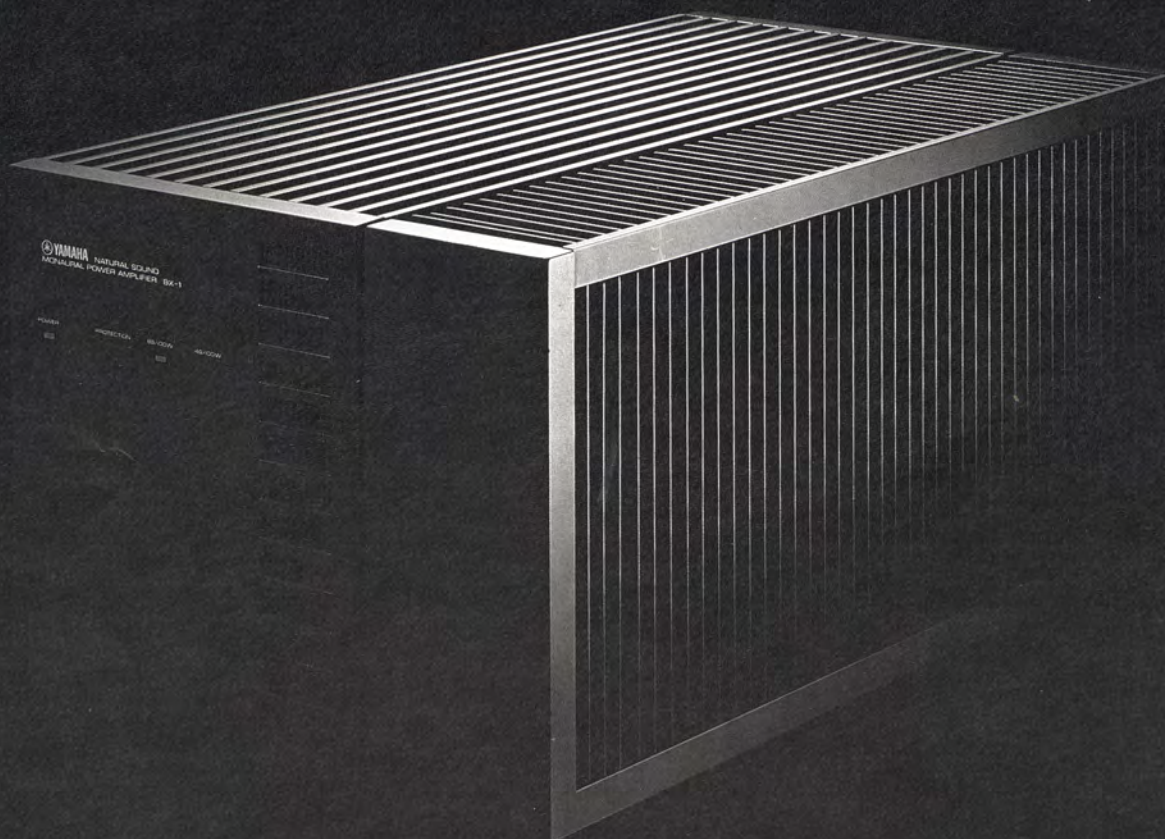
YAMAHA BX-1

*Natural Sound Monaural Power Amplifier
Pure Class-A, All DC Power Amplifier with Twin Output Stages
Pure Current Servo Power Amplifier
Yamaha Exclusive New Linear Transfer Circuit
Use Two Units for the Ultimate Audio System
100 W RMS Output Power (8 ohms, 4 ohms), 0.002% THD, 10 – 20,000 Hz*



Behind the Superior Yamaha Sound

Yamaha's foundation as a manufacturer spans more than a hundred years in a number of specialized fields. Since the company began as a producer of reed organs, it has expanded steadily until today, Yamaha music instruments, sound reinforcement gear, music education and popularization programs, motor products, sports equipment, and of course, audio products, are renowned worldwide for their highly refined performance. Naturally, the many years spent in intensive research and development in all these fields has resulted in a vast and varied store of technology. Moreover, the finely balanced interrelationship between the many Yamaha in-house technologies, production facilities and product groups creates a highly efficient network that makes it possible to achieve optimum quality and performance in every product. Yamaha audio know-how, however, does not stop at technology. Each and every new audio product must face the most demanding challenge imaginable: the critical ears of Yamaha music instrument designers. Unless the reproduced sound is exactly like the real thing, the product is not considered finished. Yamaha gives you vast technology tamed by musical sensitivity — a claim no other audio manufacturer can honestly make.



THE ULTIMATE IN PURE POWER AMPLIFICATION

YAMAHA POWER AMPLIFIER FIRSTS

Yamaha contributions to audio power amplification technology have had a considerable effect on the audio field. The legendary Yamaha B-1 power amplifier, for example, was the world's very first all-FET power amp — constructed with special Yamaha-developed power FETs of superlative quality. Even today, after several years of advancement in audio technology, the B-1 remains one of the finest power amplifiers available. The Yamaha M-2 power amplifier introduced the world to Linear Transfer Bias circuitry in the power output stage. This outstanding innovation essentially eliminated the long-standing power problem of crossover distortion. And in the same amplifier, Yamaha's top-quality high-ft power transistors reduced switching distortion to negligible levels. In terms of efficiency that resulted in superb audio performance, the incredible Yamaha B-6 power

amplifier demonstrated that true high-performance, high-power amplifiers don't have to be huge, power consuming or formidably expensive, and that it is possible to produce a power amplifier capable of supporting the exceptionally broad dynamic range and source accuracy available with today's direct cut and digitally recorded discs.

The new Yamaha BX-1 "luxury amplifier" outperforms even these illustrious forebears, attaining new, unprecedented heights in audio power amplification. Its design concept is quite simple: no compromises. Every step necessary to produce the ultimate music experience has been taken. We've spared no cost to use the highest quality parts, and the design incorporates Yamaha's most advanced technology. Certainly this amplifier is not for everyone, as absolute supremacy is not easily affordable. For the very serious audiophile, however, the BX-1 is the perfect base on which to build a "dream" audio system.

ALL CLASS-A OPERATION

Class-A amplifier operation has long been preferred for high-fidelity applications due to its intrinsically low distortion. Phono equalizers, preamplifiers, driver amplifiers for power amps and other low-level amplifiers always use class A. Up until now, however, high-power amplifiers have depended on class B operation for efficiency, forgoing the low-distortion benefits of class A. Certain of Yamaha's amplifiers in the past have included a unique "class-A" switch that allowed the amplifier to be operated in low-distortion class A mode at a fraction of its usual power. The BX-1 goes way beyond this — it is a pure class-A amplifier, and yet it provides a large 100 W output. This means you get pure low-distortion performance unprecedented at this power level. Only with a luxury amp like the BX-1 could the designers go this far to bring you the purest, cleanest music reproduction.

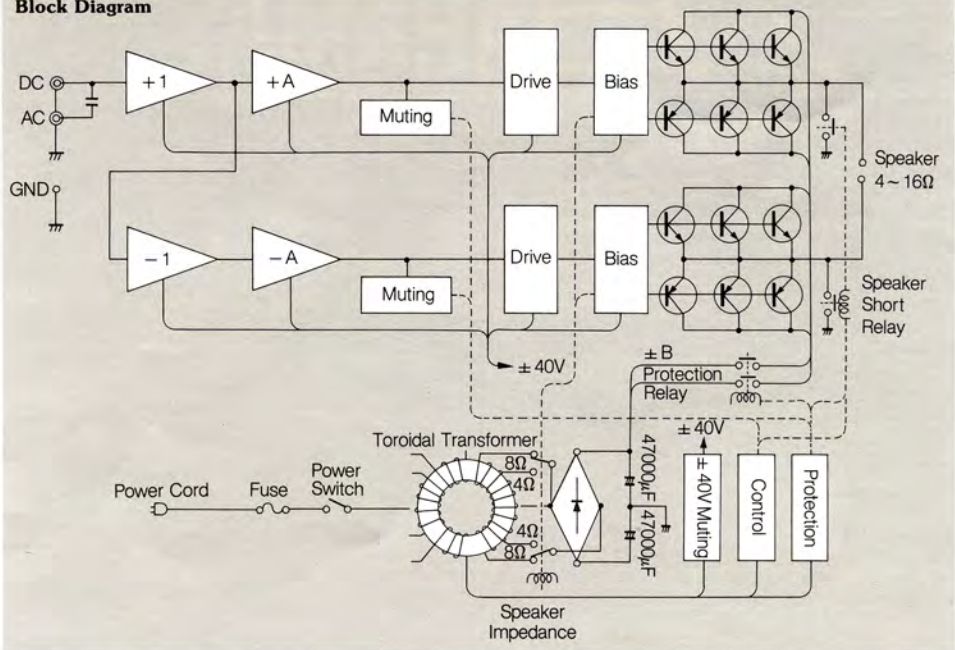
PURE CURRENT SERVO POWER AMPLIFIER

Yamaha's unique Pure Current Servo power amplifier guarantees the highest music reproduction quality with negligible distortion and spurious inter-stage coupling. In a conventional amp the amount of current drawn from the power supply is affected by the audio input signal. If, for example, a sine wave is input to the amplifier, then the current flowing through the power supply leads from the power supply to the amplifier and back to the supply via ground is also a sine wave. Due to the very slight, unavoidable impedance of the amplifier's ground path, this unwanted signal current can interfere with sound quality by causing increased distortion and spurious inter-stage coupling. The Pure Current Servo circuit eliminates this problem by continuously drawing just the right amount of current from the supply to keep the total supply current to the amplifier stage perfectly constant. The result is music reproduction that is pleasantly clean and natural sounding, with well-defined stereo imaging for maximum stereo impact.

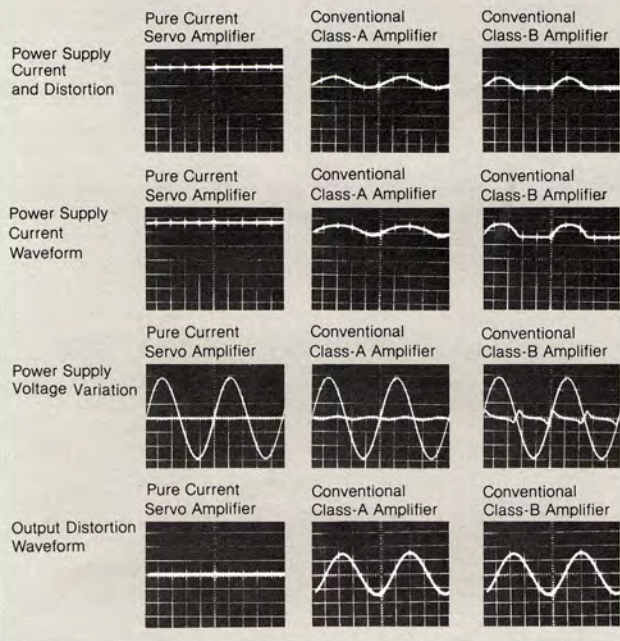
NEW LINEAR TRANSFER CIRCUIT

Although class-A amplification stages offer much greater linearity than class-B stages, they suffer from some non-linearity in waveform transmission due to the fact that the "gm" (mutual transconductance) curve of any semiconductor is distinctively non-linear outside its ideal flattest portion, so audio signals falling in this non-linear range will become distorted. With an ordinary constant-bias class-A amplifier, it is difficult to set the bias so that the signal always falls into the linear region. With a complementary class A amplifier, the transistors are operating in their non-linear regions near the zero crossover point. The emitter currents of

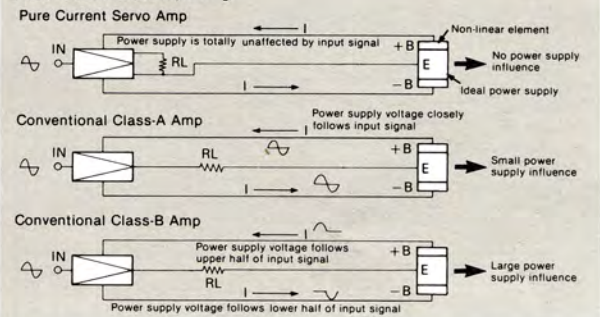
Block Diagram



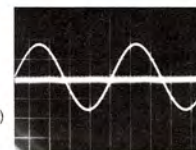
Power Supply Current Follows Lower Half of Input Signal



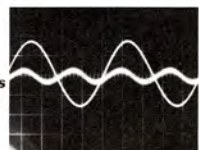
Pure Current Servo Amp



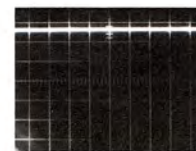
Distortion Waveform with New Linear Transfer Bias
(1 kHz, 50W)



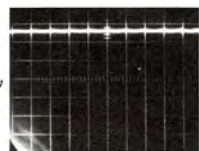
Distortion Waveform without New Linear Transfer Bias
(1 kHz, 50W)



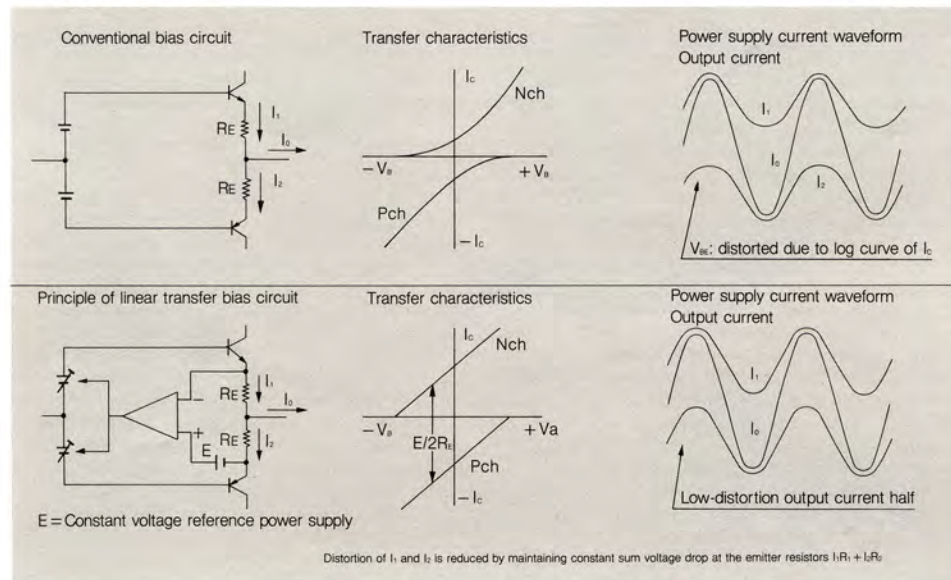
BX-1 Power Supply Current Waveform



Power Supply Current Waveform without New Linear Transfer



the upper and lower transistors are rather distorted, and even when these are added together to produce the final speaker current waveform there is distortion remaining. Much of this can be removed by applying a large amount of negative feedback, but in principle it is far better to design the amplifier for minimum distortion from the outset. (One problem with negative feedback is that it tends to convert amplitude distortion into phase distortion, thereby hiding the problem rather than eliminating it.) Yamaha engineers found a way to minimize this type of distortion in the New Linear Transfer circuit. A high-speed DC amplifier is used to detect any difference between the emitter currents of the upper and lower transistors and automatically vary the bias to force the two currents to match. This, in turn, ensures that the transistors are biased to operate in their linear gm ranges, because that is the only bias level where the emitter currents are the same. This creates two distortion-free emitter current waveforms which can be added together to produce a distortionless output to the speakers. The result is a new dimension in transparent music reproduction that cannot be matched by any ordinary amplifier.



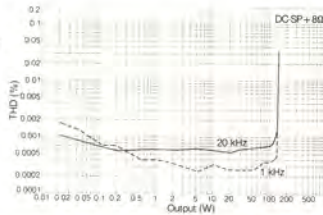
HIGHEST-QUALITY CONSTRUCTION

Critical Component Selection

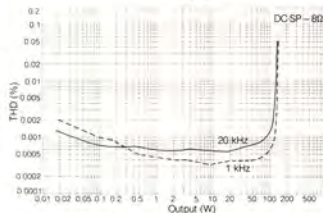
In addition to basic circuit design, the type and quality of individual components used in an audio amplifier can greatly influence reproduced sound quality. Absolutely no compromises were made in selecting components for the BX-1. Polypropylene film capacitors are used for all circuit time constants, mica capacitors are used for phase compensation, all signal-path resistors are low-noise metal film types, polypropylene polycarbonate composition capacitors are used at the output of the regulated power supply, and all input NF resistors are titanium tantalum types. In this respect, the BX-1 is a perfect example of traditional super-high-quality amplifier design, with the design engineer given full reign to use luxury-class parts and the most ideal layout to create a "dream" amplifier.

Conservative Layout – Specially Designed Hardware

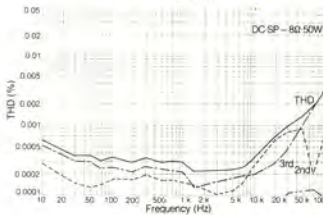
Output vs. THD* (8 ohms)



Output vs. THD* (4 ohms)



Frequency vs. THD* (8 ohms)



*THD: Total Harmonic Distortion

The BX-1 abounds with examples of design that the engineers have always known were desirable but were usually not implemented due to budget or space constraints. In addition, there are many examples of Yamaha innovations on the "ideal layout, high-quality chassis and mounting hardware" theme.

One example of this is the engineers' discovery that if 8-ohm dummy loads are connected to an amplifier in place of speakers and the volume is turned up, you can hear the music quite clearly (even the lyrics!) if you put your ear near the heat sinks. The high currents in the output stage are translated into mechanical vibration which is capable of interfering with accurate music reproduction. The BX-1 design stops these vibrations by using chrome-plated copper screws and steel washers to mount the transistors to the heat sinks. "Before" and "after" listening tests proved that this technique made a significant improvement in sound quality under actual listening conditions. Related research resulted in several other important improvements. Oxygen-free copper wiring is used throughout the BX-1, extra-heavy 175-micron copper is used for printed circuit traces, and metal portions of the amplifier's base plate are copper clad to arrest magnetic currents that might interfere with reproduction quality. All this attention to detail is one of the many reasons why the BX-1 is able to give you such a unique music listening experience.

LOW-NOISE, CONSTANT VOLTAGE POWER SUPPLY

The BX-1's power supply uses a massive toroidal power transformer with superior regulation and a pair of 47,000 μ F electrolytic capacitors. Together these provide a huge amount of energy storage to handle large transient loads with ease. Stability is ensured even at very low frequencies, very important for a DC amplifier such as the BX-1. Polypropylene polycarbonate capacitors are used

in parallel with the electrolytics to create a very low source impedance even at high frequencies. But the most unusual thing about the BX-1 power supply is that Yamaha lavished all this attention on a power supply for a single channel. If you're using one BX-1 amplifier for each channel of a stereo system, the total isolation between the left and right channel power supplies means that you'll hear absolutely no transient inter-channel crosstalk. Your music will have the kind of clarity of expression that will please even the most fastidious audiophile.

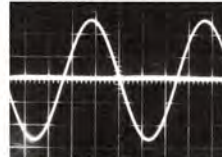
PROTECTION CIRCUITRY

The BX-1 is equipped with protection circuitry that prevents amplifier or speaker damage in such cases as shorted speaker leads, DC leakage from the preamplifier, or a dropped tonearm. As soon as any DC current is detected flowing in the speaker leads or if the transistor heat sinks get too hot, shielded relays in the plus and minus power supply lines cut the power to the output stage and another relay shorts the speakers. There are no relay contacts in the audio signal path, and thanks to the Pure Current Servo circuit there's only pure DC flowing through the power supply relays, so the protection circuit has absolutely no effect on music reproduction accuracy.

Other Features

- 8 ohm/4 ohm speaker impedance switch and indicators
- Speaker on/off switch
- DC/AC input jacks
- Power-on muting circuit

Distortion Waveform (20 kHz, 8 ohms)



Output Waveform (500 kHz sine wave)



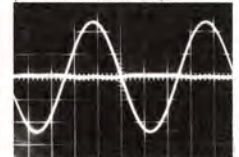
Distortion Waveform (50 kHz, 8 ohm)



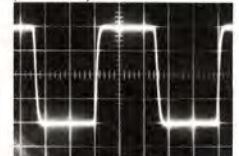
Clipping Waveform



Distortion Waveform (100 kHz, 8 ohms)



Square Wave Response (100 kHz)



BX-1 SPECIFICATIONS

Minimum RMS Output Power: 100 Watts (8 ohms, 4 ohms) From 10 to 20,000 kHz at 0.002% Total Harmonic Distortion

Total Harmonic Distortion	
10 to 20,000 Hz, 50 W	0.001% (8 ohms, 4 ohms)
IM Distortion Ratio (50 Hz: 7 kHz = 4 : 1)	
8 ohms/4 ohms, 50 W	Less than 0.001%
Power Bandwidth	
8 ohms/4 ohms, 50 W, 0.005% THD	10 Hz to 100 kHz
Damping Factor (8 ohms, 1 kHz)	
	160
Frequency Response (8 ohms, 1 W)	
DC Input	
10 Hz/1 kHz/100 kHz	0 dB/0 dB/-0.8 +0.5 dB
AC Input	
10 Hz/1 kHz/100 kHz	-1.5 +1 dB/0 dB/-0.8 +0.5 dB
Input Sensitivity/Impedance	

8 ohms, 100 W, 1 kHz	1 V/27 k-ohms
Signal-to-Noise Ratio (IHF A Network)	
8 ohms, input shorted	123 dB
Residual Noise (IHF-A-Network)	
	Less than 20 μ V
Rise Time	
	0.3 μ sec.
Slew Rate	
	600 V/ μ sec.
Power Supply	
	Matched to supply voltage and frequency of each area
Power Consumption	
	430 W, 570 VA (U.S. and Canada)
	470 W (Europe)
Dimensions (W x H x D)	
	271 x 230 x 488 mm
	10-5/8" x 9" x 19-1/4"
Weight	
	18.4 kg (40 lbs. 8 oz.)

Specifications subject to change without notice.

For details please contact:

SINCE 1887



YAMAHA

NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN