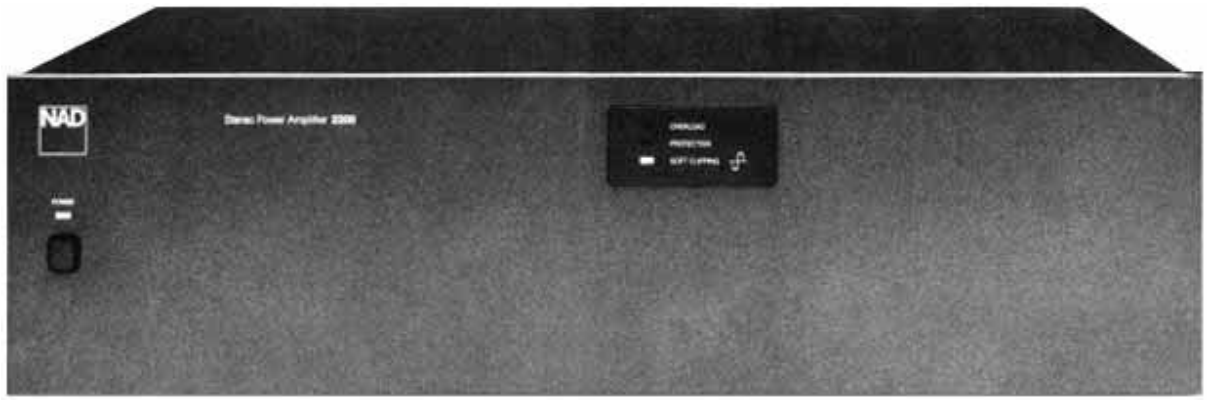
2200 Power Amplifier

Date of manufacture : Jan 87 - Feb 89

Please note that this document contains the text from the original product brochure, and some technical statements may now be out of date



Reproducing musical signals, the NAD 2200 routinely delivers over 500 watts per channel into typical loudspeaker impedances.

In actual measurement with speakers of complex impedance and lower-than-average sensitivity, the 2200 produces peak sound pressure levels exceeding 115 dB SPL(Sound Pressure Level) in a medium to large room, with no audible or measurable distortion.

But in size, heat dissipation, and cost, the NAD 2200 is similar to many other amplifiers rated at only 100 watts per channel. For audiophiles who can use and appreciate its capability, the 2200 is unquestionably the best-buy power amplifier ever manufactured.

The Key: Real-World Design

Examined from one perspective, the 2200 is a very conservatively rated 100 watts/channel power amplifier that has an extraordinary +6 dB of dynamic headroom, meaning that it can produce more than four times its rated power during musical transients.

Looked at another way, the 2200 is a super-amplifier that produces between 400 and 800 watts per channel for music (depending on speaker impedance), but contains an "intelligent" power supply that gives it the modest size, heat dissipation, and cost of a conventional 100 W/ch amplifier.

The key to the design of the 2200, as with all NAD amplifiers, is that its design goes beyond conventional specifications and laboratory tests to provide optimum performance under the conditions of everyday use, NAD amplifiers are designed, first and foremost, to reproduce the dynamically varying waveforms of music-not just sine-wave test tones. They are designed to deliver undistorted power to loudspeakers of any impedance-not just to an 8-ohm test resistor. NAD's engineers have always recognised the importance of supplying high levels of output current to drive the low and complex impedances of real loudspeakers. NAD premiered the use of Soft Clipping™ in solid-state amplifiers to prevent harsh distortion when the demands of the musical signal exceed the amplifier's limit. All NAD amplifiers feature high dynamic headroom for the transient sounds in music.

The NAD 2200 is a truly "dynamic" power amplifier. Its heart is the unique PowerTracker control circuit (patent pending), which automatically adjusts the amplifier's maximum power output according to the dynamic character of the signal that is being amplified. As befits a product designed for the reproduction of music, the NAD 2200 achieves its maximum power output of 400 to 800 watts per channel when amplifying wide-range musical signals that contain peaks IO to 20 dB above the average level. But when the amplifier is fed a high and constant signal (i.e. a sine-wave test tone instead of a musical waveform), its maximum output automatically declines to avoid overheating, and eventually levels out between 100 and 200 watts per channel.

The 2200 virtually redefines the concept of dynamic head-room.

Its high power reserves are available, not only for the short 20-millisecond bursts used in the standard IHF dynamic headroom test, but also for musical surges and climaxes lasting ten times longer. Even with compressed recordings of rock music in which the peaks may be only 8 dB higher than the average power, that may be enough variation to allow the 2200 to operate at high efficiency and maintain a clipping level above 500 watts per channel into the 4-ohm impedance that is typical of real speakers.

The appeal of the NAD 2200 may be based mainly on its combination of high dynamic power and low cost, but there are other noteworthy aspects of its design, too.

Transparent sound
The audio circuitry of the 2200 is based on the same principles that gained worldwide praise for other NAD amplifiers. In the 2200 the circuitry is scaled up substantially in speed and power, using the finest selected parts available today-individually tested filter capacitors and ultra high-speed transistors for wide bandwidth and extremely low distortion. The output stage is a fully complementary parallel circuit using high-gain 25MHz transistors with over 10 times the "safe operating area" of transistors used in typical 100 watts/channel designs.

High-voltage, high-current design
Current flowing through the voice-coil is what causes a speaker to produce sound, and NAD was the first manufacturer to emphasise the importance of high output current capacity-unrestricted by so-called protection circuits-to cope with the complex, reactive impatience that many speakers present. The NAD 2200 can produce peak output currents exceeding ±50 Amperes on demand, together with peak output voltages of ±95 volts to handle the most dynamic signals.

Inverted channels for powerful bass
The greatest power demands commonly occur at low frequencies. Bass signals are in phase (and virtually monophonic) in most recordings; thus when the bass waveform is strongly positive in the left channel, it usually is strongly positive in the right channel at the same time. As a result both channels draw current simultaneously from the positive half of the power supply, while the negative half sits idle. During the negative half of the waveform, both channels draw from the negative supply while the positive supply sits idle. In the NAD 2200 the right channel is internally inverted in polarity. When a bass waveform causes the left channel to draw current from the positive supply, the right channel draws its bass power from the negative supply, and vice-versa. This efficient usage halves the instantaneous drain on either supply, allowing much stronger bass to be reproduced without draining the supply.

Bridging
The NAD 2200 is so powerful in the normal stereo mode that few listeners will ever need more. For special situations the two channels of the 2200 can be bridged to form a mono amp of truly immense power. Its rated continuous sine-wave output is 400 watts, while its dynamic power output exceeds 1200 watts into 8 ohms and 1600 watts into 4 ohms.

Two 2200s in bridged mode (delivering over 3 kilowatts into a pair of 4-ohm speakers) would cost about the same as an ordinary 400-watt amplifier.

Quiet circuitry
The delicacy and purity of low-level musical information is as important for realism as the power to handle climaxes. The signal-to-noise ratio of the 2200 (relative to its rated 100 W/ch output level) is greater than Ill dB, No fan noise. In most power amps that are capable of the same 500 W/ch output on musical signals as the 2200, a noisy fan must be used to dissipate excess heat from the circuitry.

The efficient 2200 is totally, blissfully silent in operation.

Close-tracking Soft Clipping™ The newly improved Soft Clipping" circuit in the 2200 accurately tracks the available peak power, regardless of speaker impedance. Older Soft Clipping"" circuits tended to reduce the available dynamic power by 1.5 to 2 dB in order to ensure that continuous output would always be free from harsh distortion (even when the amplifier was over-driven).

With the new PowerTracker™ circuit, this limitation no longer applies. Now the amplifier's sound remains subjectively clean and transparent right up to the maximum output level. It continues to sound good even at levels 2 to 3 dB above the amplifier's rated maximum output, since the Soft Clipping circuit gently rounds off the waveform corners and prevents any distortion due to power-supply modulation as well as reducing high order harmonics which may damage tweeters.

"Audible Clipping" Indicator

To enable the user to make the fullest use of the dynamic power of the 2200, a front-panel "Overload" LED indicator illuminates whenever the amplifier is driven into clipping (or exhibits any other distortion) for a long enough time to be audible. Its calibration is based on psycho-acoustic studies showing that the audibility of clipping depends not only on the severity of the resulting distortion but also on its duration. (If an intense but brief transient overloads the amplifier for less than a thousandth of a second, you can't hear it.) The indicator works by comparing the output signal with the input, instant by instant. Ideally the amplifier's output signal should be an exact replica of its input, scaled up by a factor of 40 in voltage. The comparator circuit divides the output signal by 40, subtracts it from the input signal, and flashes the LED if there is any potentially audible deviation from perfect linearity.

The NAD 2200 is a "commutating" power amplifier, I.e., It has two power supplies, switching to the high-voltage supply when maximum power is needed, and switching to the lower-voltage supply for cooler operation at average power levels. (The switch is called a commutator; hence the name for this type of amplifier.) By itself, the basic idea is not new. What makes the NAD 2200 unique is how dramatically it overcomes the two problems that other commutating amplifiers suffer from: (1) poor efficiency, resulting in high heat dissipation in the power supply and consequently high cost; and (2) switching transients, which can become a form of audible distortion.

Basically, any power amplifier consists of two parts: a power supply and an audio circuit. The audio circuit functions as a valve, opening and closing to feed current from the power supply to the loudspeaker in accordance with the demands of the audio signal.

In the case of the 2200, the audio circuit is a fully complementary DC-coupled class A/B circuit designed for 500-watt output, operating in class A for distortionless sound at low levels and moving into class B for clean, efficient operation at higher levels. It has a fast, high-capacity output stage equipped for the high peak cur-rents (:' ?I 50 Amperes) and the large peak-to-peak voltage swing (190 volts) that are appropriate to a well designed 500-watt amplifier.

The high-voltage power supply in the 2200 provides the 190-volt swing needed for full-power operation, but it is deliberately designed to be self-limiting, able to supply high current for only a brief period. The lower-voltage supply provides a 125-volt swing and has ample capacity to run the amplifier comfortably at 150-watt levels all day long, If the amplifier were built for a continuous 500 watt output, it would require an enormous power transformer, special-order high-current filter capacitors, plus an elaborate system of heat sink fins and ventilating fan to dissipate the resulting waste heat.

The manufacturing cost of the amplifier would be doubled or tripled, for no purpose. Music rarely requires an average power much greater than about 50 watts (even for very high volume levels), and very few loudspeakers can absorb a continuous output of 500 watts for more than a few seconds. Music is dynamic, requiring high power only in bursts.

The NAD 2200 PowerTracker™ circuit is designed to reproduce music. Its high-voltage power supply contains a solid-state memory device that stores information on the recent history of the amplifier's output current and consequent heat dissipation. If the output has been fluctuating up and down (I.e. playing music), then the average current is modest; and the high-voltage supply continues to operate at full capacity, ready to supply high power when needed. But If the average goes up! reflecting a constant output of several hundred watts for more than a few seconds, then the high-voltage supply gradually shuts itself down, forcing the amplifier to derive its power mainly from the lower-voltage supply.

Thus while the NAD 2200 functions as a 500-watt amplifier with musical signals, it cannot be made to overheat. And when fed continuous sine-wave test tones it becomes, in effect, a 150.watt amp. Its operation is so efficient that the size, heat dissipation, and manufacturing cost of the 2200 are nearly the same as an ordinary 100 to 150.watt amplifier, If commutator switching occurs at low power levels, the switching transients can become a form of audible distortion.

This doesn't happen in the NAD 2200, for two reasons, (1) The changeover to the high-voltage supply occurs only at rather high power levels (around 140 watts). Relative to this level, even an ordinary switching transient would represent an inaudibly small percentage of distortion. In most music there is no switching at all; the high-voltage supply is used only during those brief transients and climaxes that demand the top 6 dB of the amplifier's dynamic range, when peak sound levels typically exceed 110 dB (6 ohm speaker, 88 dB sensitivity).

(2) The 2200 does not abruptly switch from one supply to the other. The output stage is permanently connected to the lower-voltage supply. The commutator is simply an electronic gate that opens when needed to allow current to flow from the high-voltage supply-quickly enough to supply the power needed for sudden full-power transients, but smoothly enough to guarantee that no switching transients are ever detectable in the output signal.

NAD is the world's leading manufacturer of affordable high-quality stereo equipment. Since 1978, NAD stereo components have won universal praise for their sophisticated engineering, excellent sound, ease of use and superior price performance value. NAD products are sold by a carefully selected network of dealers in twenty-nine countries around the world. If you haven't seen the name be-fore, it is because NAD invests most of its money in engineering rather than advertising-relying on enthusiastic word-of-mouth publicity and an unbroken string of rave reviews in magazines to spread the news of the superiority of NAD's designs. In keeping with its dedication to high value engineering and innovative product design, NAD is proud to introduce the Model 2200 Power Amplifier.

POWER AMP SECTION

Continuous output power into 8Ω *		100W (20dBW)
Rated distortion *(THD 20Hz - 20kHz)*		0.03%
Clipping power *(maximum continuous power per channel)*		140W
IHF Dynamic headroom at 8Ω		+6dB
IHF dynamic power *(maximum short term power per channel)*	8Ω	400W (26dBW)
	4Ω	600W (28dBW)
	2Ω	800W (29dBW)
Damping factor *(ref. 8Ω, 50Hz)*		>100
Input impedance		25kΩ / 1000pF
Input sensitivity *(for rated power into 8Ω)*		700mV
Frequency response		3Hz - 80kHz / +0, -3dBdB
Signal/noise ratio	ref. 1W	>91dB
	ref. rated power	>111dB
THD *(20Hz - 20kHz)*		<0.03%

Bridged Mode

Continuous output power into 8Ω *		400W (26dBW)
IHF Dynamic headroom at 8Ω		+5dB
IHF dynamic power *(maximum short term power per channel)*	8Ω	1.2kW (31dBW)
	4Ω	1.6kW (32dBW)

PHYSICAL SPECIFICATIONS

Dimensions *(W x H x D)*	420 x 123 x 370mm
Net weight	12.5kg
Shipping weight	14kg
Power consumption *(120 ~ 240V, 50/60Hz)*	770W

* Minimum power per chnnel, 20Hz - 20kHz, both channels driven with no more than rated distiortion.

Dimensions are of unit's cabinet without attached feet; add up to 18mm for total height.

Dimension depth excludes terminals, sockets, controls and buttons.

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