FISHER
BA 4500

Professional-Type Power Amplifier

All stages pure complementary symmetrical SEPP OCL circuitry delivers a full 300W RMS output power at 8 ohms, both channels driven from 20 to 20,000Hz with only 0.02% T.H.D. This advanced circuitry suppresses noise so completely that the S/N ratio of this unit is an amazing 105dB. The super-high 60V/μs slew rate also ensures superior handling of rapid signal changes, thereby suppressing transient intermodulation distortion.

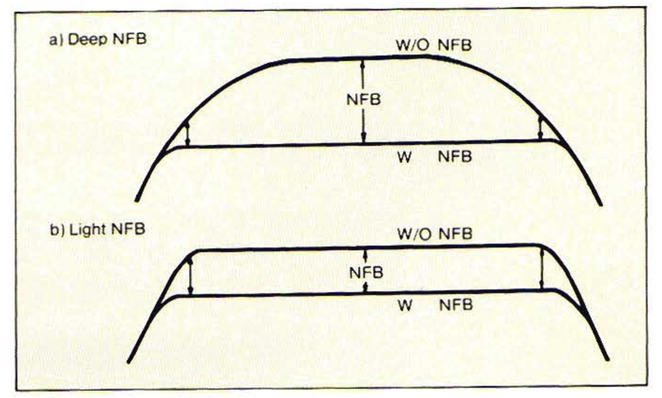
Our Goal: Dynamism but Virtually No Transient Intermodulation Distortion.

The "ideal" circuitry
Designed to eradicate transient intermodulation distortion, the BA 4500 employs state-of-the-art circuitry in all stages of its power amplifier circuitry. This all stages direct coupled SEPP OCL circuitry includes a first-stage differential amp, second-stage emitter follower, a two-stage direct coupled Darlington pre-drive circuit, a triple-push pull output stage, 21 transistors and 2 diodes per channel.

All Stages Pure Complementary Symmetrical Push-Pull Circuit
To eliminate shock noise during switching and ensure stable voltage at the output terminal, the PNP-NPN transistors of all stages are arranged in a purely symmetrical design. In this complementary structure, Class A Operation is employed in the stages up to the 2-stage direct coupled Darlington pre-drive circuit, while Class B Operation is used in the drive and triple push-pull output stage.

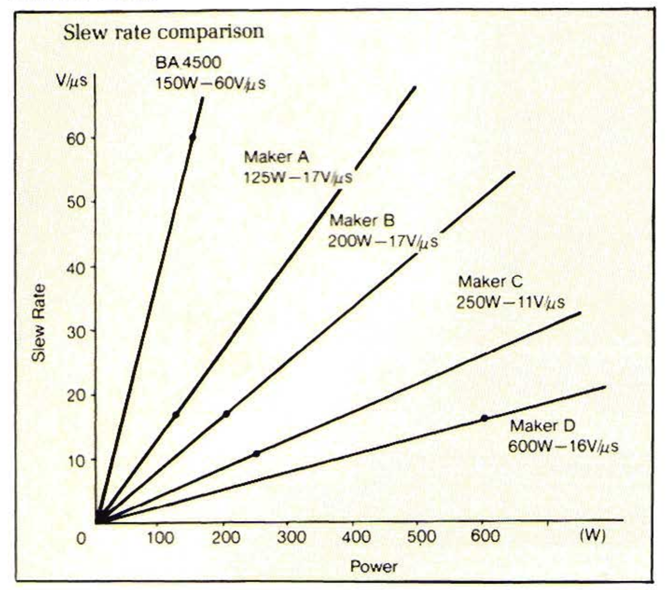
Extra First-Stage Dynamic Range
Most amps are planned in terms of output, with the result that the first-stage differential amp is designed for high gain, not large dynamic range. In the BA 4500, however, the complementary push-pull differential structure of the first stage guarantees more than enough gain, so that, even though they lower gain slightly, high-emitter resistor and local negative a feedback loops can be employed to extend the dynamic range. This design, coupled with 1mA operating current and the advance phase corrector incorporated in this stage, ensure a dynamic range that easily extends into the ultra-high frequency range.

Limiting Negative Feedback
In a first-stage differential amp with a negative feedback loop, the actual input voltage is equal to the difference between input from the program source and negative feedback. In areas of the frequency range where input signals are weak, however, feedback is proportionally lower. This, in turn, means that the actual input voltage increases in this range, generating a large amount of transient intermodulation distortion. For example, if the rated input voltage of an amp is 1V and gain is 30dB, when negative feedback is 50dB, a full 0.997V is returned and the actual first-stage input voltage is 3mV. However, in the ranges where bare performance drops to 40dB, negative feedback drops to 10dB, so only 700mV is returned and actual input voltage becomes a whopping 300mV—a hundred times what it should be. Even if this phenomenon occurs in the ultra-sonic range, superposed signals will be nullified, generating 100% transient intermodulation distortion. Thus the greater the negative feedback employed, the greater the difference in feedback volume in these ranges and the higher the transient intermodulation distortion. To improve overall performance, then, it is vital to both extend the dynamic range of the first stage and to reduce negative feedback.

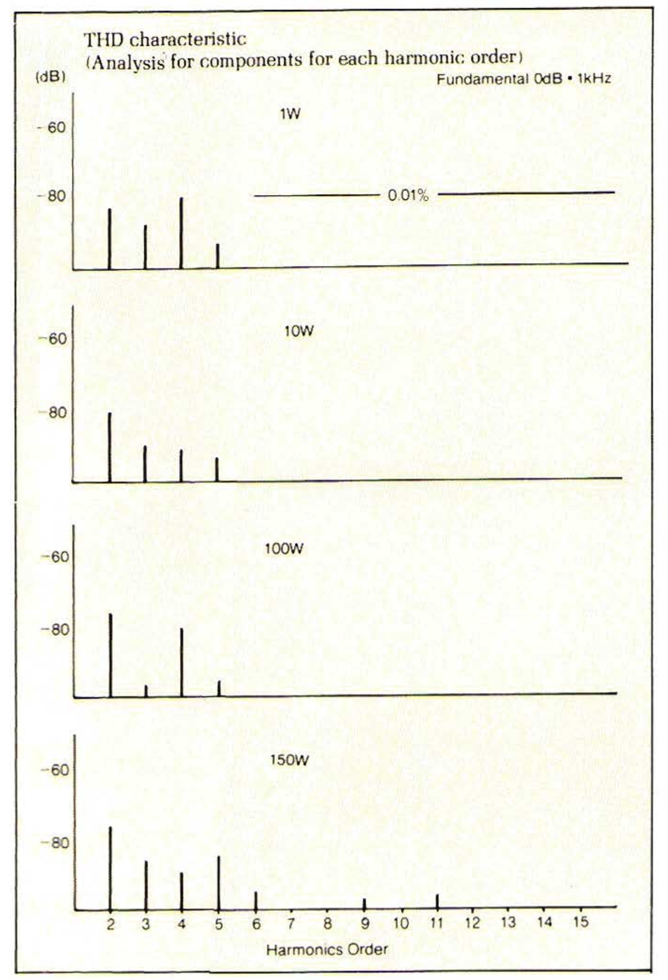


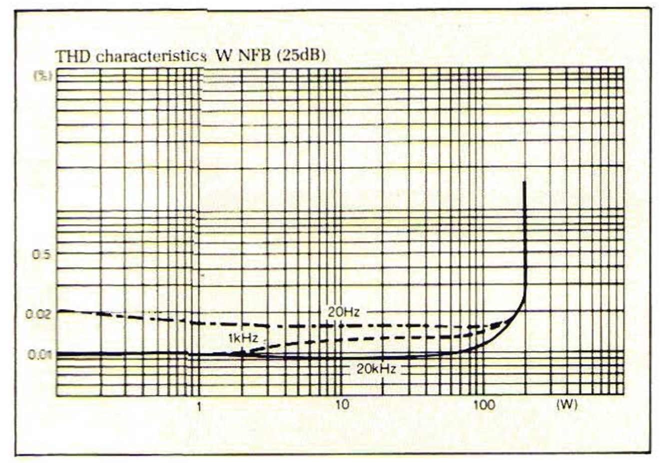
TID
Transient intermodulation distortion is a transient characteristic that cannot be detected in standard static characteristics, which are frequency responses and distortion measured by simple sine waves etc. It is clear, however, from the waveform of the collector output, that TID is not suppressed by negative feedback in the first stage. When the slew rate is small (that is, when response to the input signal is slow—in terms of microseconds), even though the first stage receives input, the stages beyond it do not operate until the input signal finally reaches them. Accordingly, the signal is not amplified, and no negative feedback returns to the first stage. This means that 100% TID is generated in the first stage, and the more negative feedbacks employed, the greater the loss of expected negative input, so therefore, the larger the enlarged input.

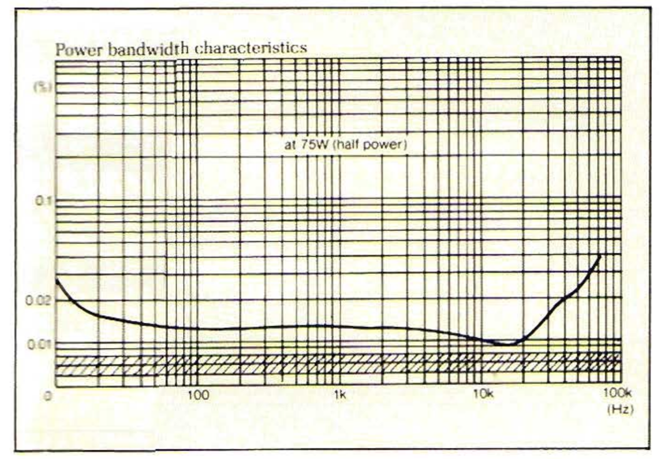
Super Slew Rate—60V/μs
The "slew rate" mentioned above is a measure of the time that energy-storing elements like condensers need to charge up or to release electricity. This rate is expressed in terms of "V/μs," which stands for the voltage that can be received or released in a microsecond. In more basic terms, this represents the slope of an amp's sound production and cut-off rates. An amp's required slew rate is proportional to its power output and the highest cut-off frequency of the frequency response. The higher the slew rate, the less chance of clipping distortion, even when output is large and signals are quick and ultra-high.
The slew rate for any amp stage is determined by the amount of current in the preceeding stage and the input capacity of the following stage. To raise the slew rate, then, the amount of current in the preceeding stage has to be increased and/or the input capacity of the following stage has to be decreased. By doing both for each stage of the BA 4500, the unprecended slew rate of 60V/μs was achieved.

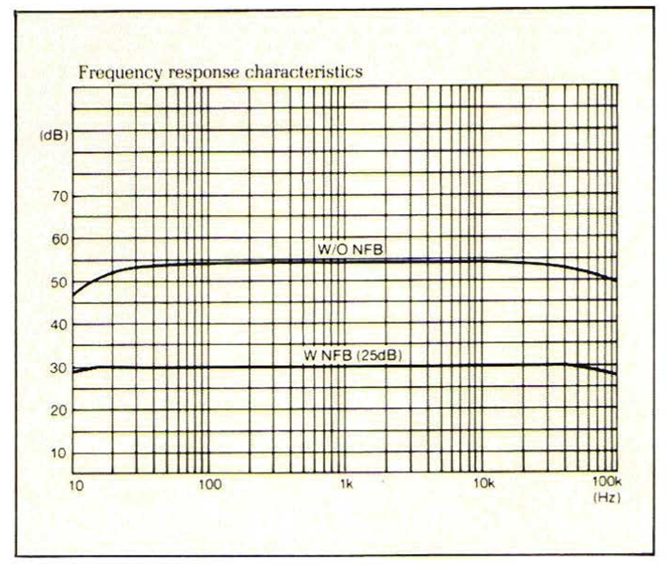


More on Negative Feedback
If an amp relies on negative feedback to improve performance, it has to employ a high-cut condenser called a phase corrector to prevent oscillation. This, however, lowers bare characteristics and slew rate and increases actual input power, so transient intermodulation distortion can occur even at small input levels. Moreover, most negative feedback loops are used on units with poor bare characteristics, and though feedback is ample in the mid-range, it becomes low at the ends of the frequency range. In this type of system, distortion may be low at 1kHz, but it tends to be amplified in the range over 10kHz. In the BA 4500, bare characteristics were improved as far as possible, then a weak negative feedback loop—only 25dB—was attached, to ensure that the 20kHz range would actually be better than the 1kHz range at output up to rated power. This means the power bandwidth is an impressive 10Hz to 50kHz. This low negative feedback and super-high slew rate also mean minimal TID, and almost no total harmonic distortion.







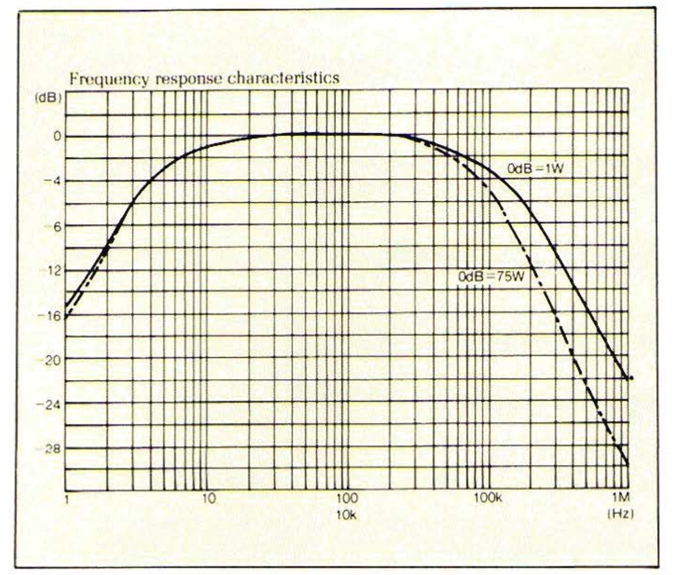


Second-Stage Emitter Follower
The second-stage emitter follower was designed with a low impedance level to decrease the load on the first-stage differential amp while ensuring ample drive for the 3rd stage. This design improves the first-stage S/N ratio and makes the second-stage ideal for impedance matching with the pre-drive stage. Its slew rate, though determined by the amount of current in the first-stage and the input capacity of the pre-drive stage, is ideal, since there is no mirror capacity, due to the emitter follower. The emitter follower can also relatively freely select the amount of current, and allows an ample flow of 3mA, which helps improve the slew rate of the third stage. This stage also employs a local negative feedback loop to improve bare characteristics.

High Speed Response Circuitry
The third stage, which corresponds to the drive stage, normally is common emitter complementary push-pull circuitry with ample gain and local negative feedback. A bias circuit stabilized by use of transistors is also employed. Because the circuitry is complementary, the two sides operate together as load and constant current circuit. This allows the elimination of the boot strap circuit, which reduces output in the lower ranges. Since it has to drive and to deliver gain, this stage is susceptible to distortion. However, by splitting high resistance to this emitter in half and using a 25dB local negative feedback loop on the 55dB basic gain distortion is suppressed. With 1kHz resistance, this stage also employs a "speed up" condenser that acts as a high speed response circuit.
This charge passes through the emitter and releases energy in the opposite direction to make the slew rate even higher.

All stages up to and including this stage employ Class A Operation. Following this stage, a drive stage with the ample idling current of 10mA is employed. Between these stages, an advance phase corrector is employed.

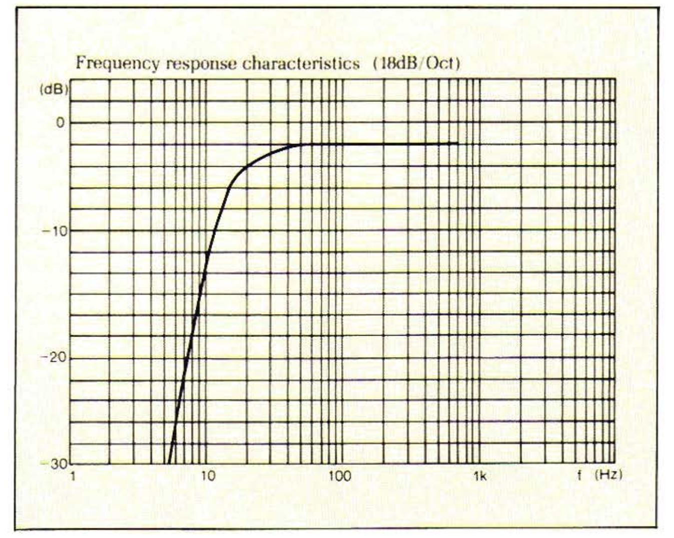
Advance Phase Corrector
If the phase of a signal is delayed, cut-off frequency will be lower, whereas if it is advanced, cut-off frequency will be higher. The advance phase corrector incorporated between the Darlington pre-drive stage and the drive stage of the BA 4500 operates like that employed in the first-stage differential amp, improving bare characteristics by emphasizing the ultra-high frequency range in proportion to the amount it is reduced in the drive stage. This circuit acts as a real phase corrector, unlike many other elements called by that name, which usually refers to nothing more than a condenser inserted between base correcters. Such a circuit does not correct phase, it delays phase and is a detrimental structure that just acts as a high filter. Moreover, its mirror capacity becomes a monstrous input capacity β times that of the transistors.

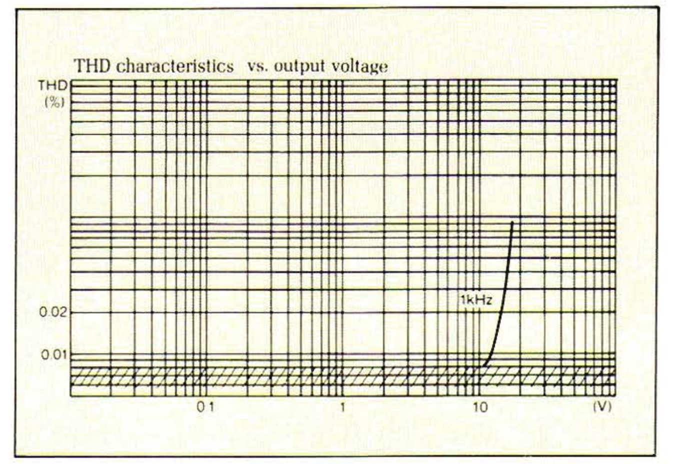


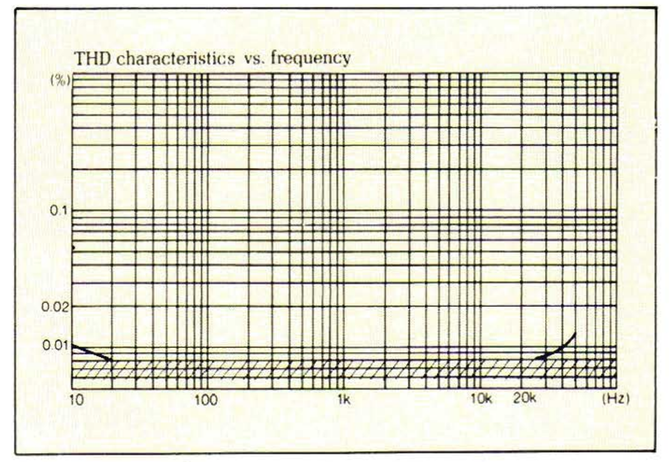
300W Output Stage With Class A Operation at Low Output Levels
The output stage of the BA 4500 is pure complementary push-pull circuitry employing a Darlington emitter follower with Pc100W power transistors. Output power flows through protective/muting circuitry, and reaches a massive 150W +150W, both channels driven at 8 ohms, 20—20,000Hz. With its large idling current of 200mA, this stage uses Class A Operation for levels up to 1W. This Class A push-pull circuitry allows no change in distortion when output level is low. Thus, low-level output is truly impressive.
The emitter resistor which, as in the first stage, also serves as a protector against overload, keeps the balance of the median electric potential neutral. The all stages push-pull structure means that output voltage remains stable within ±10mV at all temperatures and despite line voltage fluctuation of up to ±20%.

Three Power Supplies
Three types of power supply circuitry are used in the BA 4500. The ±55V power supply for the output stage sends enough energy from a 600VA large cut core transformer (exciting current of less than 100mA) to a high-capacity bridge rectifier diode, then smooths them out with two 40,000μF·70WV high-capacity condensers. The ±60V power supply for the pre-drive stage is a load voltage detector type constant voltage circuit that rectifies using 2 independent windings. The third type of power supply is the ±30V power supply for elements like the sub-sonic filter and protector circuit. 9 diodes and 6 transistors are incorporated in the power supplies of the BA 4500.
The continuous output power of 150W +150W at 8 ohms with both channels driven, which is ensured by the ultra-large power supply delivered by the 600VA large cut core transformer and 40,000μF·70WV condensers, gives a feeling of infinite scale. It also provides peak actual music power of an extra 200W. The BA 4500 is truly a power amp—totally free of restraint or clipping.

The "Inaudible" Sub-Sonic Filter
The sub-sonic filter of the BA 4500 has a cut-off frequency of 16Hz (18dB/oct). Instead of a conventional emitter follower, it incorporates a PNP-NPN 2-stage direct coupled design. 3 transistors per channel are used. It is an active filter using an amp with 0dB gain ensured by 100% negative feedback. This minimizes distortion increase during large-scale amplification. Its distortion-free output voltage is over 15V RMS. When turned on, the frequency range outside its control sounds virtually as if there were no filter. And when turned off, the circuit is completely bypassed.



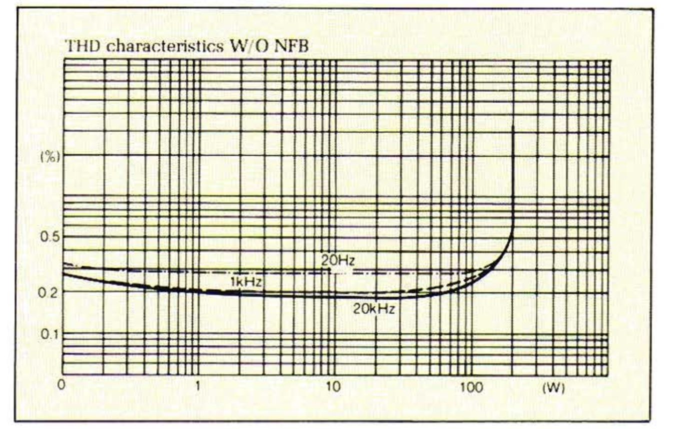


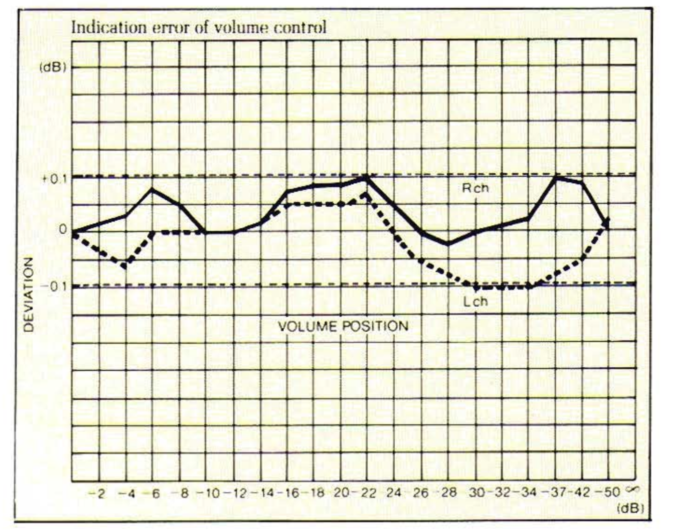


7 Types of Protective Circuitry
The BA 4500 provides 5 types of protective circuits for the amp itself and 2 types for the speaker system. To protect the amp, a relay effectively turns the amp off if the unit is turned on when the load is shorted out. If the load short circuits during use, the power line fuse will blow. Moreover, if the fuse doesn't blow, or during the time it takes to blow out, the current limiter makes sure that the transistor will not (S/B) breakdown, or the current overload detector switches the relay off. If speaker impedance is less than 2 ohms, a special detector circuit shuts the relay off.
To protect the speakers, a circuit turns the relay off if the DC voltage at the output terminal changes more than ±2V. The power supply muting circuit also keeps the relay off for 4 seconds after the amp has been turned on.

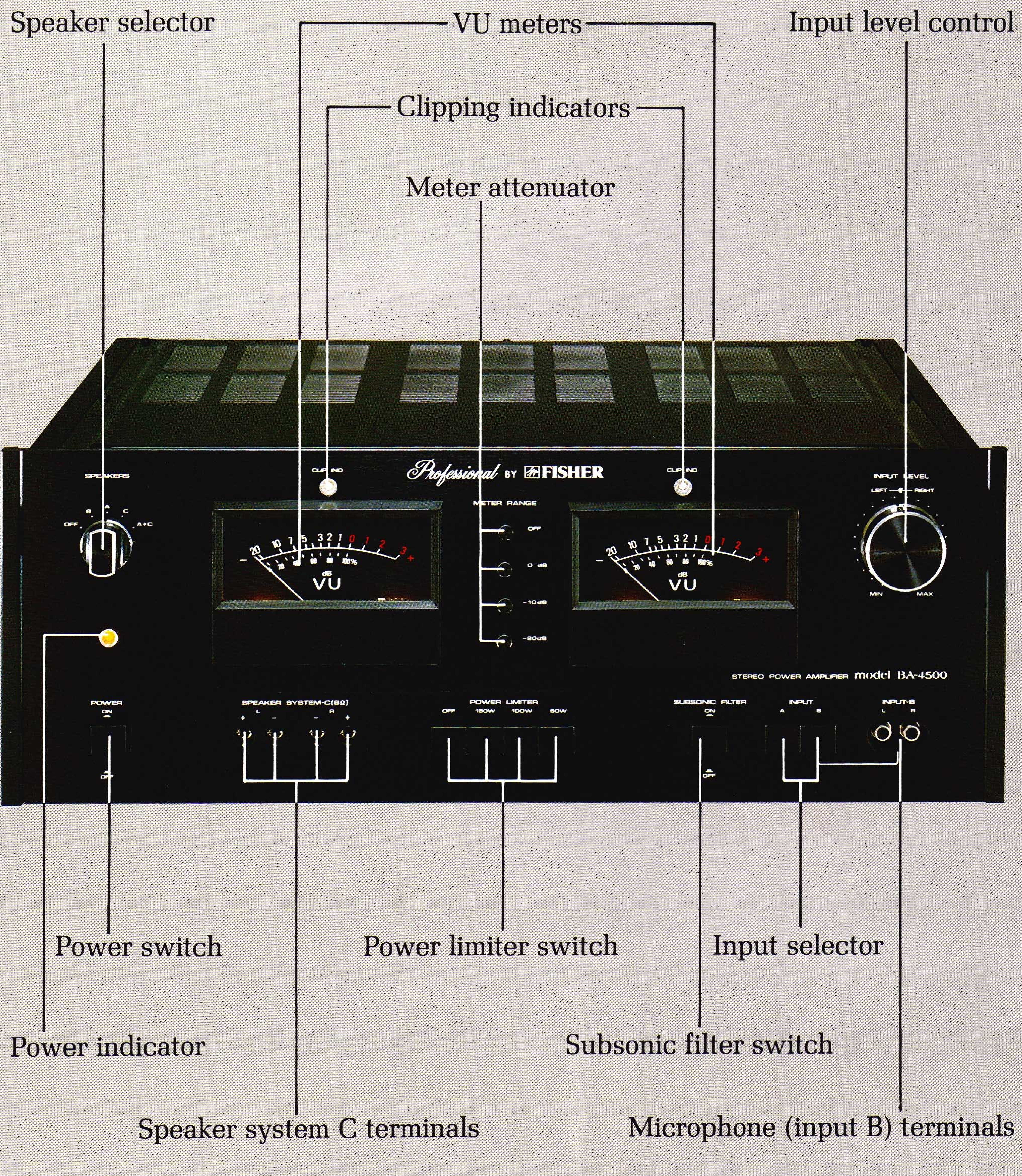
The power limiter can be switched between 4 settings: off, 50W, 100W and 150W. When the selected power is exceeded and clipping occurs, the clipping indicator lights up. The meter range can also be set at 4 levels: off, 0dB, −10dB and −20dB.

Superior Bare Characteristics
The BA 4500 uses the best materials, and each stage employs a local negative feedback loop to tremendously improve the bare frequency and distortion characteristics of each stage. This means bare characteristics that barely require overall negative feedback. The Class A Operation used in the stages up to and including the pre-drive stage means that these bare distortion characteristics reach the limits of measurement. The remaining Class B Operation stages mean just minimal distortion caused by a slight imbalance of the actual characteristics of PNP-NPN transistors in the push-pull circuitry. To suppress this, minimal overall negative feedback of 25dB is employed. This means surprisingly low distortion, in addition to high power without TID, thanks to the wide dynamic range of the first stage, the low overall negative feedback and the mammoth 60V/μs slew rate. The result is high fidelity in every sense of the word.





CONTROLS


Speaker selector
VU meters
Input level control
Clipping indicators
Meter attenuator
Professional BY FISHER
STEREO POWER AMPLIFIER model BA-4500
Power switch
Power limiter switch
Input selector
Power indicator
Subsonic filter switch
Speaker system C terminals
Microphone (input B) terminals

BA 4500 Professionalism reflected in the specs.

SPECIFICATIONS

Circuitry	Differential amp, all stages direct coupled SEPP circuitry
Actual output power **20—20,000Hz, 0.02% distortion**	
both channels driven, 8 ohms	150W+150W
both channels driven, 4 ohms	250W+250W
each channel driven, 8 ohms	180W+180W
each channel driven, 4 ohms	300W+300W
Total harmonic distortion	
both channels driven, at rated power	less than 0.02%
both channels driven, 1W	0.02%
Intermodulation distortion	
both channels driven, at rated power	0.05%
both channels driven, 1W	0.05%
Power bandwidth, 0.05% distortion	10—50,000Hz
Frequency response	15—100,000Hz (+0dB, −1dB)
Signal-to-noise ratio	105dB
Residual hum and noise	0.2mV
Input sensitivity/impedance	1.2V/30kohms
Slew rate	60V/μs
Damping factor	80
Sub-sonic filter	16Hz, 18dB/oct.
Semiconductors	87 transistors 76 diodes
Dimensions	187(H)×470(W)×400(D)mm
Weight	23kg.

*Specifications subject to change without notice.

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The first name in high fidelity

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