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YBA₁ DUAL MONO AMPLIFIER

Manufacturer's Specifications

Rated Output (From 115-V Line Power): Continuous power, 85 watts per channel into 8 ohms, 170 watts per channel into 4 ohms; pulse power, 1.8 kilowatts per channel into 0.7 ohm.

THD: Less than 0.09% from 20 Hz to 20 kHz, at 20 watts per channel.

Frequency Response: 5 Hz to 80 kHz, +0, −3 dB.

Rise-Time: 3 μS at 10 kHz.

S/N: Greater than 100 dB, unweighted.

Input Impedance: 27 kilohms.

Input Sensitivity: 1.1 V for full rated output.

Damping Factor: Greater than 800 at 100 Hz.

Power Consumption: Quiescent, 100 VA; 1,000 VA at full rated power, both channels driven.

Line Voltage: 115 or 230 V (factory set), 50 to 60 Hz.

Dimensions: 16 15/16 in. W × 5 3/16 in. H × 13 in. D (43 cm × 13.2 cm × 33 cm).

Weight: 46½ lbs. (21 kg).

Price: $6,000.

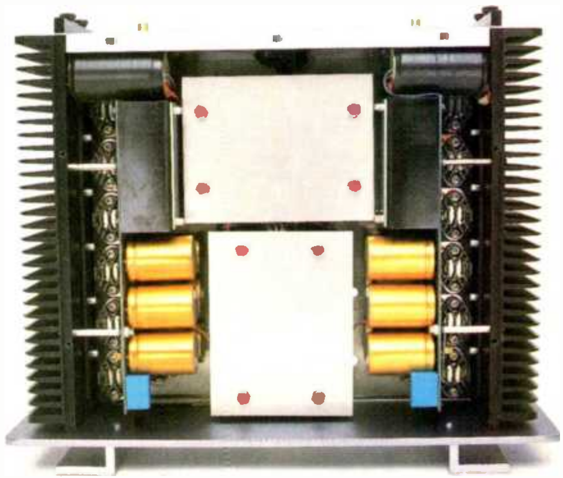
Company Address: c/o Sumiko, P.O. Box 5046, Berkeley, Cal. 94705.

For literature, circle No. 92

The YBA_1 is the larger of two solid-state power amplifiers manufactured by Phlox Electronique of France and imported and distributed in the U.S. by Sumiko; a pair of companion preamps are also available. YBA stands for the initials of Yves-Bernard André, the designer of these four electronic units. Also designed by André, under the Vecteur name, are a turntable and loudspeaker.

Physically, the YBA_1 is about normal in its dimensions for its power rating, but, weighing in at 46½ pounds, the system is definitely heavy for its size. This dual-mono unit is solid, very nice to look at, and built like the proverbial brick outhouse. A number of unusual ideas and great attention to detail are incorporated in the YBA_1's engineering, making it clear that the designer intended this amp to function properly for a long time. Some of the design features include: Topology and positioning of components to limit their interaction, orientation of each of the amp's two-terminal passive components in the best-sounding direction (i.e., in which direction a part should be aimed with regard to signal flow), common-ground star network, minimum internal cable and signal-path length from input to output, and the use of noble nonmagnetic materials with oriented crystal structure, internal wiring of long-crystal oxygen-free copper, power transformers with two C cores, and custom-made passive components. Still more design features will become apparent in subsequent discussions of this amplifier's circuit design and performance.

The amp is built with the two side heat-sinks as its main anchoring pieces. Separate front and rear panes and top and bottom covers bolt to the heat-sinks to form the complete unit. A power switch is hidden behind the front panel's left-side handle, and a single red LED below the logo in the panel's center indicates power on/off. On the rear panel are two pairs of female sockets for speaker cable connection via specially supplied gold mating plugs. Also found on the back of the unit are two special-design phono input connectors, two test-tip jacks for setting quiescent idling current, two circuit breakers, and a combined three-wire power connector/fuse-holder. Two separate C-core power transformers, mounted at right angles to each other and isolated by rubber bushings and grommets for minimum mechanical hum, take up about half of the interior space. Filter capacitors and rectifier diodes are on the unit's p.c. boards, which are mounted parallel to the heat-sinks with standoffs. Driver and output devices are on L-shaped ledges that bolt to the inside surfaces of the heat-sinks. The tops of the TO-3 devices (six per channel) have cast finned radiators attached for added cooling and mechanical damping. Small p.c. boards holding some of the bias-regulator components are mounted between the radiator fins, atop one TO-3 device in each channel. A rather sizable plastic box, taking up slightly less than half of each amp's p.c. board, houses each channel's front-end circuitry. These boxes are filled with carborundum granules to help ensure even temperature of all internal components and to assist with mechanical damping of the circuitry. Six 4,700-µF, 63-V filter capacitors take up most of the rest of the space on the p.c. boards. Some film bypass capacitors for the main electrolytics and a pair of 10-watt power resistors are at the front-panel end of the p.c. boards.



Circuit Description

A complete schematic wasn't supplied with the YBA_1 I received for testing, nor was one asked for. A generalized schematic, however, appears in the owner's manual. This unit's overall topology is very much like that of many other solid-state amplifiers—with a few, and perhaps sonically significant, twists. A complementary dual-differential amp serves as the input stage. Constant-current sources for the emitter pairs are indicated but not detailed. An input coupling capacitor and a shunt feedback capacitor of some 10 µF each are housed in what appears to be an aluminum can mounted on the heat-sink near the input and output connectors. Input impedance is about 30 kilohms and is set by a base-to-ground resistor after the input coupling capacitor. Cutoff frequency for this high-pass, first-order filter should be about 0.5 Hz. However, assuming a 30-kilohm series feedback resistor, a shunt value of about 1 kilohm would be appropriate for the closed-loop gain this amp has. A 1-kilohm resistor and 10-µF capacitor form a low-frequency cutoff of 16 Hz, which doesn't jibe with the excellent square-wave response this amp exhibits at low frequencies. The 10-µF film shunt feedback capacitor is probably paralleled with an electrolytic cap housed inside the enclosure for the front-end's circuit parts.

Inverting output collectors (the NPN and PNP devices whose bases are connected to the signal input) are direct-coupled to a complementary pair of devices. These devices' emitters are referenced to the appropriate supply rail, and their collectors are tied together through a bias-spreading regulator. These complementary devices appear to be mounted without heat-sinks to the printed side of the p.c. board and are not included among the enclosed front-end components. Resistive loading of each of these last-voltage-amplifier (LVA) collectors to ground limits the open-loop gain along with emitter degeneration in the input stage. Output of the LVA is direct-coupled to a pair of complementary TO-3 drivers that are connected as emitter followers

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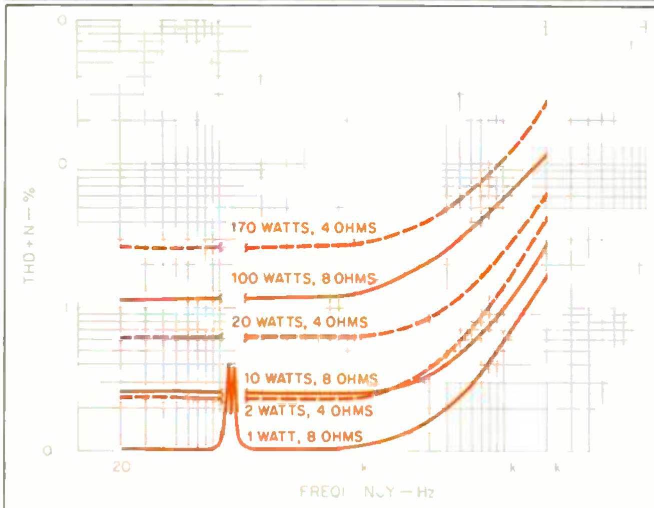

Fig. 1—THD + N vs. frequency for 8- and 4-ohm loads, each at three power levels.

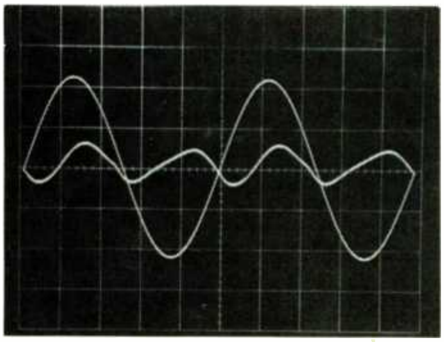

Fig. 2—Sine wave at 1 kHz, plus distortion products, for 10 watts into 8 ohms; here, THD + N is 0.029%. Note the slight kink in the distortion trace; see text. The polarity of the distortion waveform has been reversed by the analyzer.

and mounted on the main heat-sink ledge along with the output devices themselves. A resistor is tied between the emitters of the drivers to set their idling-current level. The drivers' emitters are direct-coupled to the bases of the output transistors, which consist of two NPN and two PNP TO-3 devices connected as emitter followers. The emitter resistors usually used for feedback and for increased thermal stability are not used here. Incidentally, all the devices in this circuit are bipolar transistors.

Instead of the usual insulating washers for the driver and output devices, which are usually thin pieces of mica or plastic, this unit has insulators made up of a sandwich of mica and copper sheet—i.e., mica/copper/mica. The copper pieces are bussed together and tied to the +50 V supply. The designer says this scheme's purpose is to bypass power-supply hash back to the center tap of the power transformers. (If I had been the designer, I would have connected the copper pieces directly back to the transformer center taps.) What the bussed-sandwich technique may alternatively be doing is preventing power-supply noise on the power-transistor cases from getting back to the power supply's center tap through chassis metal. Otherwise, this noise could be induced into the amplifier circuitry by capacitive and/or inductive coupling along the way. I don't really claim to understand this scheme.

No stabilizing series RC network from output to ground is used in this design, and no series RL buffer network, per se, exists. The two NPN output emitters are tied together and, along with the connection of the mating PNP output emitters, are led through two separate wires wound around the metal can surrounding the input and shunt feedback capacitors to form a coil with a small number of turns. These wires are then connected to the hot output terminal! This unusual connection is said to provide some "air feedback" and to stabilize the amp, obviating the need for the usual stabilizing network elements. André makes a point about having a minimum number of passive elements in the signal path from input to output. the devices in this path are predominantly active.

The power transformers' C-core construction may improve isolation from high-frequency noise in the power line. In such a transformer, primary and secondary coils are wound on opposite sides of a square-sided O core made up of the interleaved C pieces. Because the primary and secondary coils are not wound over or interleaved with each other, capacitive coupling between the windings is greatly reduced.

The six filter capacitors on each amp p.c. board add up to about 15,000 µF on both the positive and negative power rails of each channel—a medium to fairly high amount of capacitance in terms of energy storage for the amplifier's power rating.

The two 10-watt power resistors on the end of each amp p.c. board, mentioned earlier, are 1.5 kilohms in value. One is connected from +50 V to common; the other is connected from −50 V to common. The 30 or more mA of current flow and 3 to 4 watts per channel of power dissipation are said to pre-load the power supply and to provide some of the sonic advantages of Class-A operation without dissipating power in the output transistors themselves.

Measurements

I first ran the YBA$_1$ at one-third power (28.3 watts per channel) into 8-ohm loads for one hour. The heat-sinks got quite hot to the touch—I could only hold onto them for 2 to 3 S before having to let go. I did not run one-third power into 4-ohm loads, as I felt I might get the amp too hot and didn't

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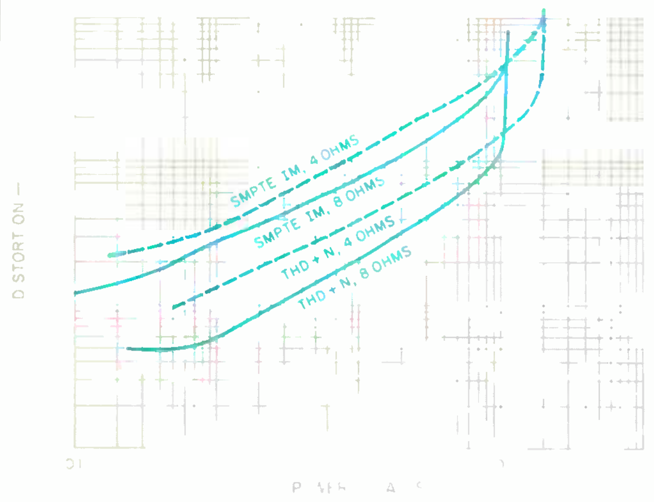

Fig. 3—SMPTE IM and THD + N vs. power for 8- and 4-ohm loads. THD + N is for a 1-kHz test signal, with distortion products measured from 400 Hz to 80 kHz.

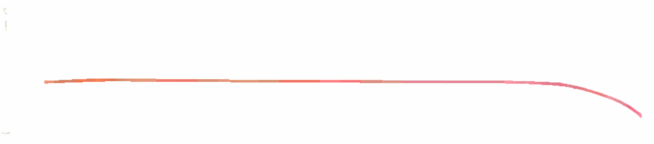

Fig. 4—Frequency response at 1 watt output into 8-ohm load.

want to risk damaging it. In all of my listening tests, this amp never got hotter than just warm.

Main power-supply voltage within the amp was ±50.5 V with 120-V a.c. line input. Voltage gain was 24.4× and 24.2× for left and right channels, or about 27.7 dB. IHF sensitivity for 1 watt into 8 ohms worked out to be 116 mV.

THD + N versus frequency, as a function of power and load, is shown in Fig. 1 for the right channel. This channel was slightly lower in distortion than the left. The lowest curve in this figure shows a nonlinearity caused by the beating of the test-signal frequency against the 120-Hz power-supply ripple. The percentage increase in distortion caused by this nonlinearity decreases as power output increases. For clarity, it has therefore been omitted from all but the 1-watt curve. I have seen this beat phenomenon in other amps in the past, and when it's present, I mention it and show it on the distortion curves. Harmonic distortion residue predominantly consists of even harmonics below 1 to 3 kHz. Above these frequencies, a distortion spike of increasing magnitude near the waveform's zero crossing causes the distortion to increase rapidly with increasing frequency. Typical harmonic distortion residue for the YBA_1 at low to medium frequencies is illustrated in Fig. 2 for 10 watts into 8 ohms at 1 kHz. Due to polarity reversal in the distortion meter's monitor output, the signal polarity of the output waveform is reversed from its actual polarity with respect to the distortion waveform. In other words, imagine the output waveform going negative in the first half-cycle displayed. The distortion glitch mentioned above is just noticeable here as a slight kink in the distortion waveform near its zero crossing in the negative-to-positive direction. Both THD + N at 1 kHz and the SMPTE-IM distortion, as functions of power and load, are plotted in Fig. 3.

Crosstalk versus frequency, with the undriven channel terminated in 1 kilohm, proved to be quite symmetrical in both directions. Results were better than −90 dB from 20 Hz to 6 kHz, decreasing to −82.5 dB at 10 kHz, 71.6 dB at 20 kHz, and 58.2 dB at 50 kHz.

Frequency response at 1 watt into 8-ohm loading appears in Fig. 4. With 4-ohm loading, the high-frequency response was within 0.1 dB of the 8-ohm response shown. Rise- and fall-times at 10 V peak to peak into 8 ohms were 3 μS. The waveform was exponential (normal) and essentially constant in rise- and fall-times from small signals up to voltage clipping. Figure 5 shows square-wave performance. The top trace is for 10 kHz into 8 ohms. The middle trace is also for 10 kHz, but into 8 ohms paralleled with a 2-μF capacitor. In the bottom trace, the test frequency is 40 Hz. Notable in these waveforms is the very low tilt at 40 Hz and the relatively low ringing, in the middle trace, for an amp without the usual output RL buffer network. All waveforms are at 10 V peak to peak.

Damping factor versus frequency is plotted in Fig. 6. Even though there is no RL output-buffer network per se, the turns of wire around the input capacitor's case form an inductor of some value and, along with a possible reduction in loop gain versus frequency, cause the output impedance to rise with frequency above 1 kHz. The reduction in damping factor (increase in output impedance) in the right channel below 100 Hz was really there in the measurement, and I have no idea what could have caused it.

IHF dynamic headroom was 1.74 and 1.53 dB for 8- and 4-ohm loading, respectively. Clipping headroom was 1.04 and 0.48 dB for 8- and 4-ohm loads, while clipping power for these conditions was 108 and 190 watts. Using the same tone-burst signal as in the other headroom tests, driving one channel into a 1-ohm load resulted in ±30 amperes of peak current—a respectable figure indeed.

IHF S/N ratio (A-weighted noise below 1 watt into 8 ohms at 1 kHz) was 99 and 98 dB for left and right channels, respectively.

A few final observations: 20-kHz clipping was clean, with no evidence of "sticking." Thermal stability, regarding quiescent current draw from the a.c. line, had some noticeable

The YBA_1 is the best solid-state amp I've heard so far. At $6,000, it's not a best buy but could well be worth it.

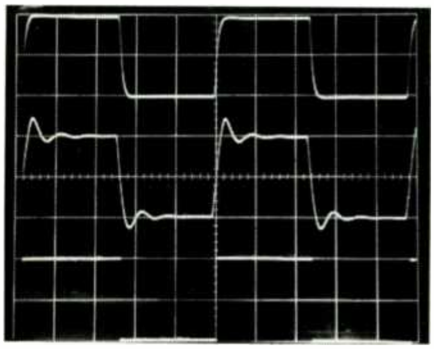

Fig. 5—Square-wave response. Top trace is 10 kHz, with 8-ohm load. With 2-μF capacitance across the 8-ohm load (middle trace), ringing is unusually low for an amplifier with no RL buffer. The tilt at 40 Hz (bottom trace) is notably low. Scales: Vertical, 5 V/div.; horizontal, 20 μS/div. for top two traces, 5 mS/div. for bottom trace.

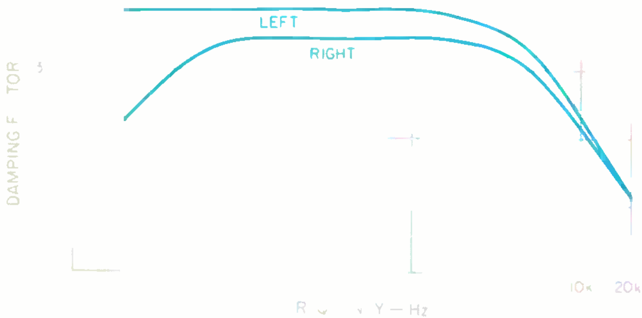

Fig. 6—Damping factor vs. frequency. Note the difference between channels; see text.

hysteresis. That is to say, if the amp was turned on and allowed to idle for a long time, current draw was about 0.4 ampere a.c. If the unit was heated up by making it produce one-third power for a while, line current could be as high as 1 ampere a.c. (or more) immediately upon cessation of the drive. Line current would then quickly drop, finally settling at about 0.6 ampere a.c. In my listening tests of the amp, I found it was predominantly cool in operation and was drawing the lower, 0.4-ampere current.

Use and Listening Tests

Equipment used to evaluate the YBA_1 included an Oracle turntable fitted with a Well Tempered arm and Koetsu Black Goldline cartridge, a California Audio Labs Tempest CD player, a Nakamichi 250 cassette deck, a Cook-King reference tube phono preamp, a Meitner PA-6i preamp, my 845 Class-A tube 100-watt mono amps, and Motif MS50 and MS100 power amps driving Siefert Research Magnum III speakers.

The YBA_1 is one of those amplifiers that sounded good to me right at the outset. I knew I had something special very quickly. André's distinctive and unusual ideas, and his attention to detail, really paid off in the sonic department.

One prong of the a.c. power plug is marked red by the factory; an interesting instruction in the owner's manual advises inserting this prong in the hot or live slot in the wall socket. With this particular amp, the marked prong was the one that would go to the longer slot, which is neutral by socket-wiring convention. Since the plug is a three-wire type, I used a three-wire to two-wire adaptor and reversed its orientation. The power-plug orientation which yielded the lowest chassis potential, when checked with a Namiki DF-100 a.c. plug-connection direction finder, agreed with the manufacturer's polarization. In use, especially when fed from the Cook-King tube phono preamp and playing records, it was easy to tell the difference between power-plug orientations. The sound was more open and natural with the plug used according to the instructions.

I would describe the sound of this amplifier—or its *lack* of sound—as very clear, transparent, and refined, with incredible definition and with very low irritation levels. Music sounded more simply "there" and real. One could unravel complex goings on with ease. Spatial replication was very good, and a wide, deep, and natural soundstage presented itself with appropriate source material. With the YBA_1 in residence, I quickly retired my 845 tube amps, as the YBA_1 sounded better. Now those 845 tubes are gathering lots of dust.

I tried the amp with IRS Beta speakers in Infinity's sound room. Although the sound with the YBA_1 wasn't quite as lush and big as it had been with the Audio Research M-300 and VTL 300W amplifiers, the YBA_1 sounded very refined, open, and spacious on the Infinity speakers.

I also tried the amp on a friend's system, one which has Apogee Acoustics Duetta Signature loudspeakers. These speakers like a lot of power, and the YBA_1 couldn't really drive them very loud. Nevertheless, within these power limitations the sound was outrageously good.

I believe that this is the best solid-state amplifier I've heard so far—certainly in my own setup. My associate, Geoff Cook, tends to agree. At $6,000 and 85 watts per channel, the YBA_1 is not everyone's best buy, but with loudspeakers of reasonable efficiency, this amp could well be worth the money. I know I am going to sorely miss the YBA_1 when I have to give it up. Thanks, Yves-Bernard André, for a very nice experience. *Bascom H. King*