BASCOM H. KING

KORA TRIODE 100 SB MONO AMP AND ECLIPSE PREAMP

Kora Electronic Concept is based in the Toulouse region of France, that country's answer to Silicon Valley. Maybe it's French styling, but the first time I saw Kora products, I was impressed with their looks as well as their sonic potential.

The Triode 100 SB mono amplifiers, in particular, look refreshingly different and attractive. A projecting front apron holds the main power shutoff and "Standby/Operate" rocker switches. Emerging from a polished, stainless-steel plate atop the unusually shaped chassis are two rugged Russian 6C33 triodes (which, operating in push-pull, are rated as delivering 80 watts) and three smaller tubes. On the rear of the chassis are balanced and unbalanced input jacks and three very nice metal binding posts for the 8-ohm, 4-ohm, and common speaker connections. A combination fuse holder and IEC AC line-cord socket is also on the rear.

The Eclipse preamplifier is a little more conventional-looking, but different and attractive nevertheless. Its polished stainless-steel front panel with angled lower corners gives the unit a distinctive appearance. The contents of this panel are equally distinctive: a headphone jack (uncommon on tube preamps), nine LEDs, and a shiny volume knob, the only operable front-panel control. Power on/off, muting, the tape monitor and external processor loops, and input selection are handled exclusively by the supplied remote, which also operates the motorized volume pot. The three LEDs nearest the volume control indicate muting and activation of the two loops; the six LEDs near the headphone jack show which input is selected. An eleven-position stepped balance control is on the rear panel, an odd place for it.

AMP

Rated Power: 80 watts into 8 or 4 ohms.

Rated THD: 0.3% at 70 watts out, 0.07% at 1 watt.

Rated S/N: 115 dB.

Dimensions: 8⅝ in. H x 15¾ in. W x 15¾ in. D (22 cm x 40 cm x 40 cm).

Weight: 39.6 lbs. (18 kg).

Price: $10,295 per pair.

PREAMP

Dimensions: Main chassis, 4¾ in. H x 17 in. W x 12¼ in. D (12 cm x 43.3 cm x 31 cm); power supply, 4⅜ in. H x 7¾ in. W x 11⅜ in. D (11 cm x 18.5 cm x 29 cm).

Weight: 26.4 lbs. (12 kg).

Price: $5,195.

Company Address: c/o OS Services, 4902 Placidia Ave., Toluca Lake, Cal. 91602; 818/760-0692; www.ossaudio.com.

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Also on the rear are inputs for four line-level sources and for MM and MC phono, a tape monitor, and an external processor loop, all unbalanced. Besides its tape and processor outputs, the Eclipse has one balanced and two unbalanced main outputs. One of the two unbalanced outputs, labeled "H," is connected directly to the tube output stage, via a coupling capacitor. The other, labeled "L," is buffered through a simple N-channel MOS-FET circuit. Similar circuits buffer both phases of the balanced output (which uses a male XLR connector). A DB-25 connector accepts a cord from the external power supply. A hybrid unit, the Eclipse uses tubes for its line stage and transistors for its phono preamp and line output buffers.

The construction of the Triode 100 SB amplifiers is unusual, to say the least. The audio circuit board is in the chassis' central section, beneath the polished-metal top cover. Each of the three projections from the central section holds a toroidal transformer: the main power and output transformers at the extreme left and right, the transformer for the tube heaters toward the front of the amp. The chassis is made up of two main pieces, a top and bottom. Rubber isolation between them reduces the possibility of vibration from the transformers, which are mounted to the bottom, reaching the tubes. The amplifier rests on two soft rubber feet near the rear of the chassis and a sharp, cone-shaped metal foot near the front.

THE TRIODE 100 SB'S UNUSUAL CHASSIS HOLDS SOME INNOVATIVE CIRCUITRY.

The Eclipse preamp's interior is practically filled by two circuit boards. The larger board holds all audio circuitry except the input and output jacks and the volume and balance controls. The tubes plug into individual socket pins soldered to the board instead of the usual tube sockets (the Triode 100 SB amp's smaller tubes are also mounted this way). The smaller circuit board, which rests on standoffs behind the front panel, holds the volume control and its motor-control circuit, the system-control microprocessor, and the headphone driver circuit. A smaller daughter board holds the front panel's indicator LEDs and remote-control sensor. The power-supply enclosure houses a generously sized toroidal power transformer and the supply's other components.

The Eclipse preamp and Triode 100 SB amp use many high-quality parts, and all their wiring is neat and workmanlike.

Measurements

Judging from the way the Triode 100 SB amp's frequency response changes with loading (Fig. 1), I'd have thought its output impedance was about 0.56 ohm. However, the damping factor I measured was lower than that impedance would suggest, ranging between 10 and 12 over most of the audio range and decreasing to about 7.7 at 20 kHz, indicating an impedance of 0.67 ohm to 1.04 ohms.

Rise and fall times for ±5-volt output into 8 ohms on the 8-ohm tap were about 4.4 microseconds. The Kora amp's square-wave response (Fig. 2) exhibits some ringing at 10 kHz even with a purely resistive load. When a 2-microfarad capacitance is connected across the load, this ringing becomes rather severe; therefore, electrostatic speakers might not be the best choice for use with this amp. The 40-Hz square wave has more tilt than I like to see; this relates to the rolled-off bass seen in Fig. 1. (Unless otherwise noted, all measurements are for the amp that I designated Amp 1 and were taken with unbalanced input.)

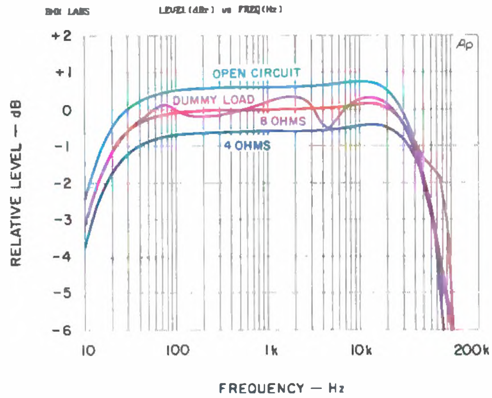

Fig. 1—Frequency response of Triode 100 SB amp as a function of loading on the 8-ohm tap.

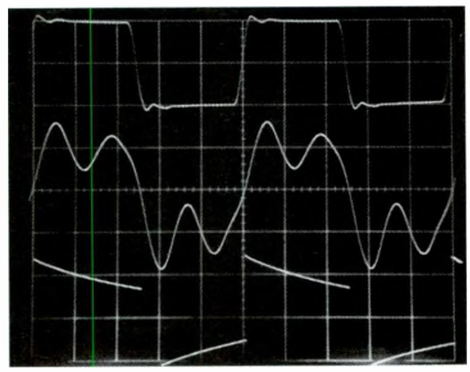

Fig. 2—Square-wave response of Triode 100 SB for 10 kHz into 8-ohm load (top), 10 kHz into 8 ohms paralleled by 2 µF (middle), and 40 Hz into 8 ohms (bottom); all tests made at 8-ohm tap.

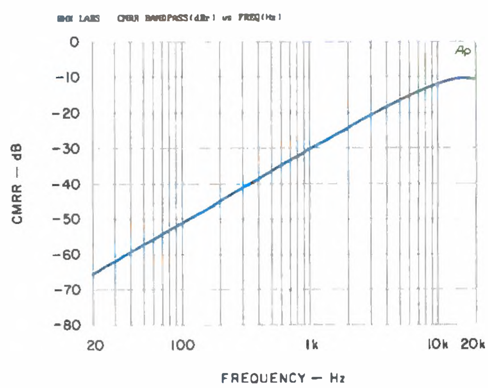

Fig. 3—Common-mode rejection ratio for amplifier's balanced input.

Figure 3 shows the Triode 100 SB's common-mode rejection ratio for the balanced input; results were nearly identical for both units. Over most of the audio range, CMRR decreases at 6 dB per octave as frequency rises and is a mere 10 dB at about 15 kHz, which is not too good. Signals fed through the unbalanced input were not inverted, but signals fed through the balanced input were, at least when pin 2 carried the positive input phase (the normal U.S. practice). Impedance at 1 kHz was 33.1 kilohms at the unbalanced input and 75.3 kilohms at the balanced input.

The amp's distortion (Fig. 4) is satisfactorily low, and the way distortion varies

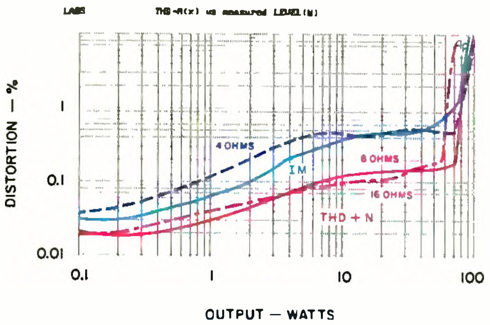

Fig. 4—Amplifier's THD + N at 1 kHz and SMPTE IM distortion vs. power output, at 8-ohm tap.

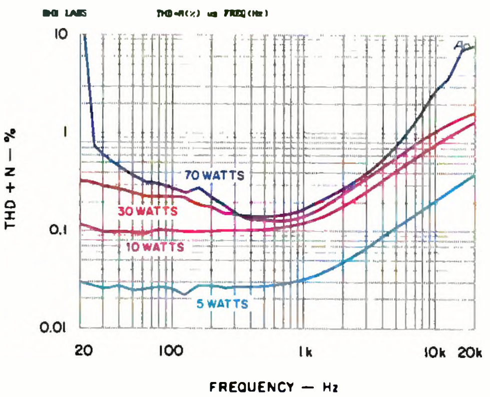

Fig. 5—Amplifier's THD + N vs. frequency, 8-ohm load on 8-ohm tap.

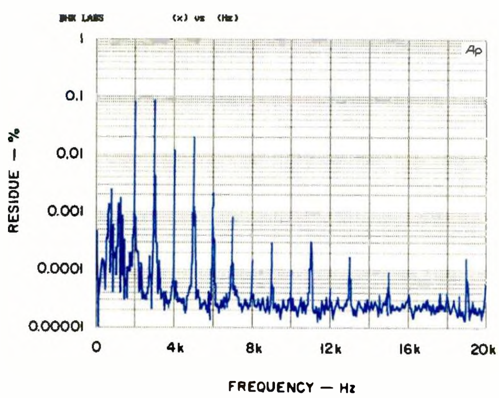

Fig. 6—Spectrum of amp's harmonic-distortion residue.

with loading is typical for tube amplifiers: When the load impedance is twice the tap's designated load (e.g., 16 ohms on the 8-ohm tap), maximum power at low distortion falls; when the impedance is half the tap's rating, power stays the same but distortion rises. The Triode 100 SB's total harmonic distortion plus noise (THD + N) rises with frequency above 1 kHz (Fig. 5), which is typical of most amps. The Kora amp's low-frequency distortion is very good at low to medium output levels; at 70 watts, however, it becomes excessive below 30 Hz. Figure 6 is a spectrum of the amp's harmonic-distortion residue for a 1-kHz signal at an output level of 10 watts into an 8-ohm load on the 8-ohm tap.

Dynamic power attainable at the 8-ohm tap was 63 watts with a 16-ohm load, 90 watts into 8 ohms, and 105 watts with 4-ohm loading. Based on Kora's 80-watt rating for the amp, the Triode 100 SB's dynamic headroom is about 0.5 dB. The output level at which clipping became visible on an oscilloscope (typically about 0.5% to 1% distortion) was about 80 watts, yielding a clipping headroom above rated power of 0 dB. Noise and sensitivity are listed in Table I.

The Triode 100 SBs drew 1.14 amperes from the AC line in standby mode and 1.6 amperes in operation. Overall feedback was about 16 dB.

The frequency response of the Eclipse preamplifier's line section is shown in Fig. 7. The direct ("H") output exhibits some peakiness with the IHF load, which is more capacitive than the instrument load. The buffered ("L") output, however, was virtually the same with either load, so only the response with instrument load is plotted. Response at the balanced outputs is pretty much like the response at the buffered outputs. Frequency response was essentially constant at all volume-control settings.

TABLE I—*Noise and input sensitivity, Triode 100 SB amplifiers.*

	AMP 1		AMP 2	
	BAL	UNBAL	BAL	UNBAL
IHF S/N, dB	86.7	84.5	88.4	92.1
IHF Sensitivity, mV	171.3	151.9	176.6	150.3
Output Noise, µV				
Wideband	406.2	408.1	234.8	214.8
22 Hz to 22 kHz	358.5	270.1	204	134.4
400 Hz to 22 kHz	156.3	228.7	125.5	81.5
A-Weighted	130.2	168.9	107.6	69.7

Rise and fall times at ±5-volt output ranged from 3.2 to 3.8 microseconds with instrument or IHF loading for all but the tape outputs. A 40-Hz square wave had about 12% tilt at the direct outputs with either the instrument or IHF load. At the buffered outputs, there was essentially no tilt with instrument loading and about 6% tilt with the IHF load. Signals were not inverted except when fed via the MC phono input. Output impedance at 1 kHz was 18 ohms for the buffered outputs, 284 ohms for the direct outputs, 30 ohms for the balanced outputs, and a very high 32.5 kilohms at the tape outputs. The high-level inputs' impedance was about 170 kilohms.

I CONSISTENTLY FELT THAT THE ECLIPSE PREAMP SOUNDED VERY GOOD WITH LINE-LEVEL SIGNALS.

The preamp's THD + N was pretty constant with load and frequency at the balanced outputs and, as you'd expect, was least constant at the direct unbalanced outputs; distortion at the buffered unbalanced outputs (Fig. 8) falls between these extremes. The curves shown are for IHF loading; with instrument loading, there was about as much distortion but it varied less with frequency. Although I've plotted distortion for output levels up to about 8 volts, the maximum level the preamp outputs have to deliver is perhaps 1 to 2 volts, at which levels distortion is quite negligible. In a circuit like the Eclipse's, with an amplifier stage before the volume control (see "Technical Highlights"), the input overload characteristics are of interest. With the line-stage gain set to 0.1, or −20 dB, the line input could accept about 15 volts before clipping—more than enough for any conceivable signal—and its distortion at 2 volts was about 0.09% from 20 Hz to 20 kHz.

As usual, interchannel crosstalk increased with frequency at 6 dB per octave. With the volume control set at −20 dB, left-

Associated Equipment Used

Equipment used in the listening tests for this review consisted of:

CD Equipment: PS Audio Lambda Two Special and modified Sonic Frontiers SFT-1 CD transports, Panasonic DVD-A310 DVD player used for CD play, Genesis Technologies Digital Lens anti-jitter device, and Classé Audio DAC-1 and Sonic Frontiers Processor 3 D/A converters

Phono Equipment: Kenwood KD-500 turntable, Infinity Black Widow arm, Win Research SMC-10 moving-coil cartridge, and Vendetta Research SCP2-C phono preamp

Additional Signal Sources: Nakamichi ST-7 FM tuner, Nakamichi 1000 cassette deck, and Technics 1500 open-reel recorder

Preamplifiers: Sonic Frontiers Line-3, Dynaco PAS-2, and First Sound Reference II passive

Amplifiers: Quicksilver Audio M135 mono tube amps and Bel Canto SET 40 and Audio Note Conqueror single-ended stereo tube amps

Loudspeakers: B&W 801 Matrix Series 3s, alone and as subwoofers with Dunlavy Audio Labs SC-III speakers, and Lowther PM5A drivers in modified Lowther Club Medallion II cabinets

Cables: Digital interconnects, Illuminati DX-50 (AES/EBU balanced); analog interconnects, Tara Labs Master, Audio Note AN-Vx, and Music and Sound (unbalanced); speaker cables, Transparent Cable MusicWave Reference, Jena Labs Speakeasy Twin Three, and Madrigal Audio Laboratories HF2.5C

to-right crosstalk was below –100 dB at 100 Hz, –83 dB at 1 kHz, and –57 dB at 20 kHz. With volume at –6 dB, crosstalk was about 10 dB lower (surprising, as many preamps' crosstalk is highest at that setting) and was also lower than at full volume. In the right-to-left direction, crosstalk was about 7 dB better. Volume control tracking was quite good, the two channels matching within 0.4 dB down to 60 dB of attenuation.

My review sample of the Eclipse preamp had some excessive but intermittent noise in the first stage of its line amplifier. As a result, noise measurements with the volume turned up fully were higher than they might have been, yielding worst-case A-weighted output noise figures of 245 microvolts from the left (worse) channel's buffered output, 311.8 microvolts from the unbuffered output, and 613.4 microvolts from the balanced output. (The right channel's noise readings were lower: 84.8, 98.7, and 195.7 microvolts, respectively.) This intermittent noise had little effect on the IHF signal-to-noise ratios, which are made at lower volume settings. Left-channel (worst-case) IHF S/N was 79.1 dB at the buffered output, 78.6 at the unbuffered output, and 74.6 dB at the balanced output; right-channel figures were all just over 8 dB better. Worst-case IHF S/N results for the MM and MC phono inputs were 76.4 dB and 68.4 dB, respectively, with no more than 1 dB variation between channels. The phono input readings were taken at the tape outputs. Input sensitivity data is listed in Table II.

The RIAA equalization error of the Eclipse's phono stage (Fig. 9) indicates a rather large drop in level with the IHF load, caused by the phono stage's fairly high output impedance, 6.5 kilohms. There is also, in my opinion, too much bass rolloff. Results shown are for the MM input; those for the MC input were essentially identical except for being about 1 dB further down at 20 Hz.

The overload resistance of phono preamps that use passive interstage RIAA equalization, as the Eclipse's does, is often compromised at high frequencies. Such was the case here. With instrument loading, the preamp could deliver 3 volts at only 3% harmonic distortion at all frequencies up to 3 kHz. But above that frequency, the phono section's input stage began

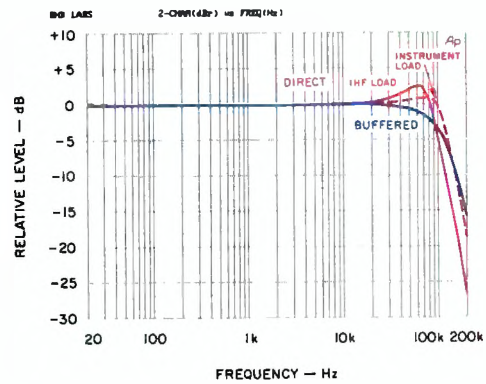

Fig. 7—Frequency response of Eclipse preamp at direct ("H") and buffered ("L") inputs; see text.

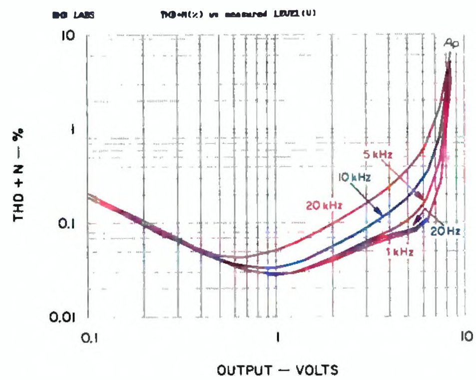

Fig. 8—THD + N vs. load and frequency for preamp's buffered output.

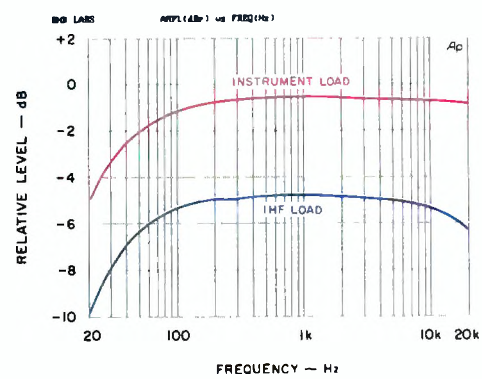

Fig. 9—RIAA equalization error.

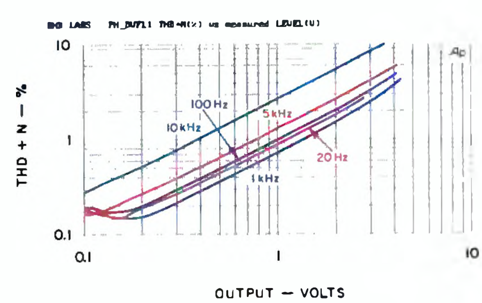

Fig. 10—MM phono section's THD + N.

The first of the Kora Triode 100 SB's three stages, its input stage, is cleverly configured as a four-resistor differential amplifier with gain. The input tube is a 6922 dual triode connected as a differential amplifier, one triode section acting as the noninverting input while the other acts as the inverting input. Voltage dividers made up of two equal-value resistors feed the grids of the noninverting and inverting sides from the positive and negative terminals of the balanced XLR input jack. Unbalanced signals from the phono input jack directly feed the noninverting triode's grid; because this is a differential amp, the two triodes then pass equal-amplitude signals of opposite phase to the second stage.

What's unusual about this circuit is that it develops gain, even though all four resistors of the two voltage dividers are the same value. Usually, in differential amps that produce gain, they aren't—the gain is proportional to the ratio between the input and shunt resistors in each divider. Designers who want reasonably high gain must then choose between using small input resistors that lower the input impedance or large shunt resistors that slow the circuit down.

In the usual topology, the shunt resistor of the voltage divider feeding the inverting tube's grid would connect to the stage's output, providing a feedback path. Kora's clever touch was to add a third voltage divider, at the stage's output, and connect the original feedback resistor to the junction of the new divider's two resistors. (The new divider now provides the feedback.) The stage's (and hence the amp's) gain is determined by the ratio between the resistance connected to the amplifier output and the smaller resistance that shunts to ground through a capacitor. This arrangement provides gain without lowering input impedance or slowing the circuit. It also serves as a new feedback path.

An N-channel J-FET (junction FET) is used as a constant-current source for the 6922's cathodes, which are tied together. The grids are ground-based, via their gridleak resistors (the shunt resistors of the first two voltage dividers). As a result, the tubes' grid bias will also be the cathode voltage. This voltage is high enough to properly polarize the J-FET, which is therefore connected to ground rather than to a negative supply. The plate resistor for the 6922's noninverting input side has a fixed value, but the plate resistor for the inverting input side is a rheostat (variable resistor), which can be adjusted to null out distortion or to equalize the voltages on both plates. These plates are capacitor-coupled to the grids of the second stage.

The second stage is another differential amplifier, using a pair of EL84 pentode power tubes. A balance potentiometer is connected between the cathodes of the two tubes; its wiper is connected through a rheostat to a regulated −166-volt supply, as are the EL84s' grid resistors. The screen grids of the tubes are connected to ground, and the cathode voltage is below ground, creating the right balance of voltages for pentode operation. The plate outputs of this second, or driver, stage are capacitor-coupled to the grids of the output tubes through resistors whose purpose is to prevent parasitic oscillation. The 6C33 output tubes have a low amplification factor (mu) and thus require high drive voltages; this drive circuit provides those voltages while keeping distortion low.

The −166-volt supply also provides adjustable negative grid bias for the output tubes. The two tubes' cathodes are linked through a nonpolarized electrolytic capacitor bypassed by a film cap. This being a push-pull stage, the plates of the output tubes are connected to the ends of the output transformer's primary winding. The center tap of this winding is connected to the +300-volt output supply, which is unregulated. Overall negative feedback is taken from the 8-ohm tap of the output transformer's secondary to the inverting side of the input stage.

The Triode 100 SB's main power transformer (another transformer handles the tube heaters) has two secondary windings, one for the positive supply and one for the negative. The unregulated positive supply's capacitor input filter uses six 470-microfarad, 400-volt capacitors in parallel, whereas the negative supply's filter uses but one of these capacitors. (The unregulated positive supply powers the output stage, so it needs its six capacitors for energy storage. But the load on the unregulated negative supply is constant and much lighter, so a single capacitor is enough.) Because the positive and negative supplies come from different secondary windings, the regulators that follow the positive and negative unregulated supplies can use same-sex (N-channel or P-channel) devices. Each regulator consists of a series resistor feeding a series string of Zener diodes, the output of which feeds the gate of a series pass device (an N-channel MOS-FET power transistor) through an RC low-pass filter.

The Eclipse preamp also has some very unusual circuitry. All signal switching is done with relays, as is common in high-end products. But the selected input signal, rather than going initially through the volume and balance controls (the usual case) passes directly into the first stage of the line amplifier. Like the amp, the preamp uses a 6922 dual triode in its first stage, but each half of the tube handles a different channel. Each of these halves acts as an inverting feedback amplifier, receiving its input signal via its grid. Output and stage feedback are taken from the tube plates. Feedback from the stage output back to the tube grid is through two resistors in series; there is a stepped variable resistor between the junction of these resistors and ground, part of the rear-panel balance control.

The left and right outputs of the first stage feed the two sections of the volume control, whose output then goes to the line amp's second stage. Operated as a common-cathode amplifier, the plate output of the second stage is directly coupled to the grid of the third. These stages each use one 6922 dual triode per channel.

This final stage of the line amp is configured as a split-load phase inverter, with matched cathode and plate resistors. Feedback is taken from the stage's cathode outputs to the second stage's input grids.

These outputs are also capacitor-coupled to the "H" (unbuffered) output. The cathode and plate outputs are fed to the solid-state buffers, one per signal phase, which feed each channel's balanced and buffered unbalanced jacks—a most unusual way to get balanced outputs in a preamp, though it's often used in power amps. (The buffers, incidentally, consist of small TO-92 MOS-FETs configured as source followers.)

The MM phono preamp is a two-stage circuit using an N-channel J109 J-FET for each stage, with RIAA equalization achieved by a passive network between the two stages. A third J-FET serves as the MC pre-preamp stage.

As far as I know, the way the Eclipse is turned on and off is unique. The preamp has three power supplies: one providing +6.3 volts DC for the heaters and +5 volts for the front panel's control circuitry and the volume control's motor-drive circuit, one to supply +200 volts to the tubes, and one to provide +30 volts for the solid-state circuitry. These supplies use Zener-follower regulators, in which the unregulated DC drives a Zener diode through a series resistor, providing a regulated voltage that drives the gate of a MOS-FET.

When the Eclipse's external power supply is plugged into the AC line and its power switch is on, +5 volts is always fed to the control circuitry so the preamp can respond to a turn-on command from the remote control. In this state, before turn-on, the resistors coupling the Zener diodes to the MOS-FETs' gates are shorted to ground through relay contacts. As a result, all supply outputs (except the 5-volt supply to the control circuitry) are at 0 volts. When the turn-on command is received from the remote, the relay is pulled in and all the regulated supplies rise gently to their final voltages. While the audio circuitry is stabilizing, all outputs are muted by relay contacts. The "CD" input light comes on when the circuits have had time to stabilize, but muting remains in effect until you press the "Mute" button on the remote control. *B.H.K.*

TABLE II—*Input sensitivity, Eclipse preamp.*

	IHF SENSITIVITY	
	LEFT	RIGHT
Line Input to Direct Output	70.8 mV	71.2 mV
Line Input to Buffered Output	83.8 mV	84.2 mV
Line Input to Balanced Output	40.3 mV	40.4 mV
Line Input to Tape Output	3.38 V	3.35 V
MM Input to Direct Output	240.3 µV	227.9 µV
MM Input to Buffered Output	284.4 µV	270.1 µV
MM Input to Balanced Output	136.9 µV	130 µV
MM Input to Tape Output	4.26 mV	3.98 mV
MC Input to Direct Output	34.8 µV	33 µV
MC Input to Buffered Output	41.7 µV	40 µV
MC Input to Balanced Output	19.9 µV	19 µV
MC Input to Tape Output	614 µV	573 µV

to clip, decreasing overload resistance to the point where the 3% distortion level was reached at only about 0.7 volt output at 20 kHz. For the MM inputs, the overload points at 1 kHz were 20 millivolts with instrument loading and 12.5 millivolts with the IHF load; for the MC inputs, the results were 5.5 millivolts and 3.4 millivolts. I find these overload points to be a bit low, and I'd recommend not using cartridges whose output exceeds about 2 millivolts at reference level (3.54-cm/second stylus velocity at 1 kHz) or using the MC inputs with those few MC cartridges whose output exceeds 500 millivolts at reference.

Distortion for the MM input with instrument loading (Fig. 10) is relatively high.

Use and Listening Tests

When I initially tried out the Kora Triode 100 SB amps, with B&W 801 speakers, I was struck by their fine sound. When I added the Eclipse preamp to my system, the sound remained very good.

After measuring the Triode 100 SBs, I hooked them up to Lowther speakers, which I had earlier tried with several other amps. With the Triode 100 SBs powering them, I immediately noticed how good the Lowthers sounded. Detail and resolution were of a high order, the presentation had great authority, and the sound was very natural, although a little more forward and aggressive than with some of the other amps I'd used. With these very sensitive (102-dB) speakers, I could hear some buzz from both Kora amps.

I then used the Triode 100 SBs with Dunlavy speakers. With a First Sound Reference II passive preamp feeding this combination, I was amazed at how good the sound was. Transparency and musical believability were right up there with the best I have heard with these speakers. Subsituting the Kora Eclipse preamplifier caused a slight loss of transparency and detail, but otherwise the sound was just about as good. Despite the low-bass rolloff in the Triode 100 SBs, bass quality, detail, and power were very good.

I WAS STRUCK BY THE KORA AMPS' SOUND WITH B&W SPEAKERS, AMAZED AT HOW THEY SOUNDED WITH DUNLAVYS.

While using the Eclipse preamp in my system over a period of time with many other components, I consistently felt that it sounded very good with line-level signals but that its phono reproduction, though still reasonably good, wasn't quite up to the line section's sound quality. I also felt that the preamp's turn-on delay, nearly 3½ minutes, was excessive, and I'd have liked to have the main control functions duplicated on the front panel.

I enjoyed having the opportunity to experience this Kora amp and preamp in my system. I would recommend auditioning them and that you check out some of the company's integrated amplifiers, which should also sound very good and are more affordable. A