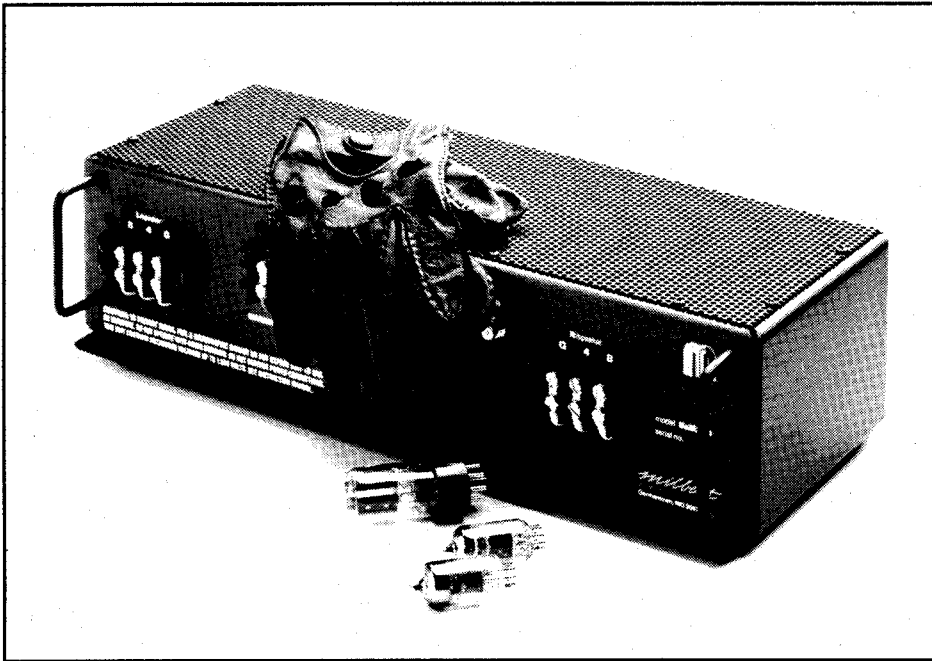


CAR STEREO REVIEW

September/October 1988

TEST REPORTS



MILBERT BaM-230

TUBE POWER AMPLIFIER

THE Milbert BaM-230 is unlike all other car power amplifiers that we know of. Its primary distinguishing feature is that there are no power transistors in the output stages, nor anywhere else in the audio chain. Clearly, it is not for your average driver, in his average car, with its average sound system. You see, the Milbert BaM-230 is a 30-watt-per-channel *vacuum-tube* amplifier.

In the old days, of course, vacuum tubes were common, being the only means of amplification available for the home and car. Incorporating a tube amp into a system was a problem for pioneering autosound installers, however. For starters, there was the "minor" problem of converting a car's 6- or 12-volt power supply up to the 400 or so volts needed to drive a tube amp. The transistor changed all that; it offered

There is no mistaking the classic tube sound of the BaM-230—it is indeed silky and luxurious. Although ambient noise levels can muddle that sound on the road, the tube difference should be discernible and unmistakable under many driving conditions.

smaller size, longer life, and lower power consumption. Tubes were largely banished from the car, and life became easier.

For some people, however, nothing can compare with the sound-reproduction qualities of tubes, and they cite the "smoothness" and "warmth" of tube-driven systems. (Other people listen to the same systems and find that their sound "lacks punch" or is "muddy.") The "tube sound" definitely *is* different, and it's up to the individual to decide whether he likes it better (and wants to pay for it).

Fortunately for tube aficionados, technology has come a long way since the early days of the car/tube relationship. The BaM-230 has a very contemporary design, combining the time-honored sonic qualities of tubes with more recent technology to extend their capabilities and to make their use much

more practical. For example, a fully regulated, transistorized switching power supply, using four 40-mHz, 20-amp transistors, enables the BaM-230 to store some 50 joules of energy, which recharge 54,000 times a second. The output to the tube audio circuit is regulated to within 2.5 percent of its optimum performance point; likewise, filament and bias voltages are regulated. A thermal-protection circuit is included.

The audio circuitry is completely tubed, of course. The complement includes a 12AX7, a 12AT7, a 6SN7, and a pair of 6JN6 output tubes per channel. The design and layout of the left and right channels are identical. The amp can be strapped (bridged) by paralleling the channels. Audiophiles might note that the amp does not invert absolute phase. And in case you're wondering, tube life is projected by Milbert to be ten years. Moreover, under normal circumstances bias need only be adjusted when the amp's tubes are replaced.

Because the BaM-230 draws considerably more current than most comparably powered car power amplifiers, it is designed to turn on and off via a power antenna or other remote lead; this insures that you won't leave it running by mistake—an error akin to leaving your headlights on. In fact, at idle (no signal) the BaM-230 draws about the same current as a headlight and much more when you're cranking the music. Specifically, the amp's power consumption at idle is rated at 5.5 amps, its full-power rating is 20 amps, and it is current-limited at 25 amps.

In other words, the BaM-230's current draw is not inconsequential. The point is this: Under heavy current demands (headlights, windshield wipers, brake lights, air conditioning, and audio system on) and low engine rpm, your battery could begin to discharge. In that event

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the owner's manual logically advises reducing current requirements by "taking your foot off the brake pedal, or putting the transmission into neutral and slightly accelerating." Of course, you could also turn off the amp.

As it is, most cars with a good battery should be able to handle the BaM-230 under most driving conditions. For example, an average Sears Die-Hard could power a BaM-230 at normal listening levels for 7 hours before risking a serious battery discharge. The first warning sign would be distortion as the amp becomes underpowered. Next, the amp's power supply would automatically turn itself off if the battery voltage dropped below 10.5 volts (and back on when adequate voltage was restored) to preserve the car's essential electrical functions. Despite this safeguard, a devoted user may want to explore a high-capacity battery, such as those used in many RV's.

The BaM-230 is a large unit, measuring approximately 18 x 7 x 4 inches. The interconnect points on the BaM-230 are typical of most car power amplifiers. You'll find a pair of Tiffany gold-plated phono jacks for audio input to the two channels, and a potentiometer to adjust line-level sensitivity. Left and

Installing the BaM-230 isn't difficult, but it is more involved than with some other amps. It's also vital to keep the amp away from moisture.

right speaker terminals, using barrier strips and number 8 binding posts, each employ a ground plus 4- and 8-ohm taps. Battery terminals, also using barrier strips and number 8 binding posts, power the unit. A front-panel fuse is included.

Construction is first-rate. A 1/8-inch-thick black-anodized aluminum chassis forms a solid foundation for the circuitry and acts as a heat sink for the power transistors. Inside, quality components are employed, including high-current capacitors and transformers. Circuit board work is neat and well laid out.

Installation

Using the beefiest interconnects and speaker cables I could lay my hands on, I installed the BaM-230 under the front hood of my Porsche 911. Eighteen feet of number 8 duplex battery cable is supplied with the amp, as are rubber fittings for mounting. Also provided is a Tron in-line fuse holder, socket bolts and well nuts, brass fittings for side-mount batteries, spare fuses, and crimp terminals.

The BaM-230 is positively fused by a Tron in-line fuse and negatively fused by a chassis-mounted fuse. The in-line fuse should be placed in the positive line and as close to the battery as possible; this will limit the damage done to the car's electrical system should the positive lead touch ground. As any experienced installer knows, don't put in the fuse until the install is completed; likewise, pull the fuse before disconnecting the power leads.

Because of its high current draw, the BaM-230's power leads must be connected directly to the battery binding posts—not to a fuse block or accessory outlet. The supplied battery cable and fittings are designed for this purpose. Do not place a switch in the power lead, as this would increase resistance. Finally, the owner's manual warns against those tow trucks

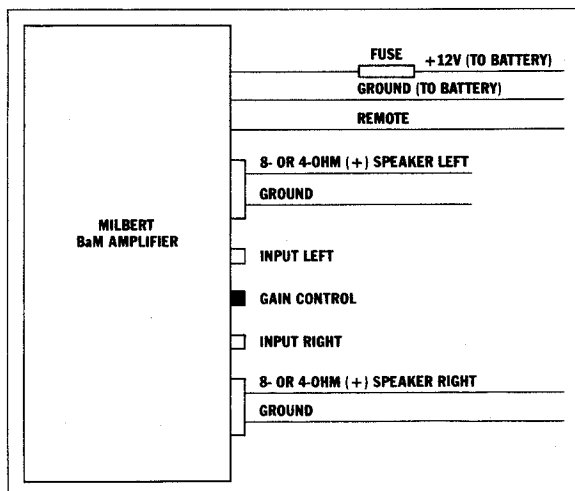
that use 24 volts or anyone who might reverse the battery leads when jump-starting your car. Should you need a jump, remove the in-line fuse and disconnect the remote power lead to be safe. (That's probably a good idea for a nontube amplifier as well.)

Installation proceeded without difficulty, although it was more involved than that of some other amps. The unit must be bolted down with socket bolts and neoprene well-nuts: Mark the center holes, drill 1/2-inch holes, and insert the well-nuts. Line up the chassis and screw in the stainless-steel bolts. The well-nuts are drawn up and expanded for a snug fit that insulates the BaM-230 from the car's chassis. This helps isolate the amplifier from vibration and prevents it from being grounded to the car's chassis.

The BaM-230 can be installed at any angle, but not upside-down. However, it's best to leave a space above the unit to allow for heat dissipation, and a relatively large space is recommended to insure proper air circulation. Also, the owner's manual warns against installing the amp in a trunk with any kind of leaking fuel vapors. (That is probably a no-no for any kind of electrical installation.) Installers should also note that the amp must be positioned away from moisture—including dew or other condensation—and heat. People who are tempted to stick screwdrivers into electronic components should note that the BaM-230 has voltages up to 1,500 at high current. In other words, leave servicing to a qualified technician.

Performance

On the road, there was no mistaking that classic tube sound. It is indeed silky and luxurious. By way of sonic comparison, the BaM-230 uses output circuitry that is very similar



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to the Berning EA-230 home power amplifier (this shouldn't be a surprise, since the BaM-230 was designed by David Berning). As high-end home audiophiles know, the dual 30-watt EA-230 is well known for its smooth sonics. The BaM-230 sounds every bit as good.

The BaM-230 is not current shy: at idle it consumes 5.5 amps, its full-power rating is 20 amps, and it has been current-limited at 25 amps.

On the open road, at high speed, you may not be able to hear the difference—although that will ultimately depend on ambient-noise levels. Suffice it to say that under many driving conditions, the tube sound of the BaM-230 is completely discernible and unmistakable.

For those wondering whether the BaM-230's 30 watts per channel is enough, remember that a tube amp can be driven beyond its rated power output because tubes overload much more smoothly than solid-state devices. In practice, I found that the BaM-230 was able to drive levels sufficient for any kind of music and for all but the most hardened of ears. And you need not worry about warm-up time. In normal temperatures, the amp's tubes take about 30 seconds to reach their operating temperature. In subfreezing temperature, allow 60 seconds. But the owner's manual does warn against cranking the amp up to high listening levels for the first 5 minutes.

You can also use the BaM-230 to amaze your friends: Even after you turn off its power, the BaM-230 continues to play for a minute or two because of the charge stored in its capacitors. I was also delighted to find that once this 15-pound baby was in place over my 911's front wheels, a slight but annoying understeer problem had been corrected.

In summary, the BaM-230 successfully brings vacuum-tube listening back to the automobile in style. By combining the best of old and new technology, this is a highly workable, practical package freed of many of the problems that plagued earlier tube-based designs. In particular, the contemporary-tube audio design is first-rate, delivering sound that is comparable to any home tube power amplifier.

The BaM-230 isn't for everybody, of course. It's big, it's heavy, it's expensive, it weighs heavily on your car's electrical system, its mounting requirements are tricky, and it is more susceptible to damage than solid-state amps. Still, if it's silky tube sound you want, all that may be a small price to pay.

—Ken Pohlmann

Circle 142 on reader service card

FEATURES

- Vacuum-tube stereo power amplifier
- Rated to deliver up to 30 watts per channel into 8- or 4-ohm loads from 30 to 20,000 Hz with less than 2% distortion
- Bridgeable
- Less than 8-dB negative feedback
- Does not invert phase
- High-voltage inverter power supply uses four high-speed, 20-ampere power transistors
- Power supply delivers regulated DC voltages and AC heater voltages to tubes
- Power supply is protected from overloads, insufficient DC input voltage, and overheating

Price: \$1,495. Milbert, Dept. CSR, 18 Warrior Brook Ct., Germantown, MD 20874.

LABORATORY MEASUREMENTS

Julian Hirsch, Hirsch-Houck Laboratories

Power output at clipping (1,000 Hz): 30 watts into 8 or 4 ohms, 15 watts into 2 ohms

Harmonic distortion (THD + noise) at 1,000 Hz: 2.4% at 30 watts

Clipping headroom and dynamic headroom: 0 dB

Maximum distortion (20 to 20,000 Hz): half power (15 watts), 8% at 20 Hz; will not deliver 30 watts over full frequency range

Input for 1-watt output: adjustable, minimum 48 millivolts

Frequency response (20 to 20,000 Hz): ± 0.1 dB

Noise (A-weighted, referred to 1 watt): -79.2 dB

THE Milbert BaM-230 tube amplifier is a unique product, and its uniqueness extends all the way from the road to the test bench. Power output at clipping measured as expected: At 1,000 Hz, the BaM-230 delivered 30 watts into both 8 and 4 ohms, and the output slipped to 15 watts into 2 ohms. The adjustable input for 1-watt output measured a minimum of 48 millivolts; this is a typical figure. The measurement for A-weighted noise referred to 1 watt was -79.2 dB, another fairly typical figure for an autosound amplifier. The BaM-230 performed extremely well in the area of frequency-response deviation: 20 to 20,000 Hz ± 0.1 dB.

Also as expected, the BaM-230's vacuum-tube design made its presence felt in the area of total harmonic distortion—THD was never a strong point of tube technology. Specifically, THD plus noise at 1,000 Hz measured 2.4 percent at 30 watts, and maximum distortion (from 20 to 20,000 Hz) measured 8 percent at 20 Hz with half power (15 watts). Both of these distortion measurements are much higher than you'd get from solid-state autosound amplifiers, but you must expect them from an amp using a tube design.

Along with the electrical limitations of the de-

vices used in the BaM-230, it is likely that an entirely different design approach was used: I'll hypothesize that the designer of the BaM-230 consciously relied on his ear rather than on an analyzer when he was perfecting his design, the argument being that most people spend more time listening to music than charting its performance on an analyzer.

The BaM-230 had no clipping or dynamic headroom when measured with our lab's standard burst test—that is, it delivered no extra power with a 20-ms burst. The clipping-headroom figure is the result of a measurement of the 1,000-Hz clipping-power level, which is made by observing the output waveform on an oscilloscope to establish the onset of clipping overload. The dynamic-headroom figure is established by measuring the amp's dynamic power, which is the clipping level with that 20-ms, 1,000-Hz tone burst repeated every half-second; the dynamic-headroom figure is the ratio (expressed in decibels) of the measured clipping power with the 20-ms tone bursts to the amp's rated continuous power at the rated impedance. In the BaM-230's case, these measurements indicate that the amp has a very well-regulated power supply.

—K.P.