

Crown M600 Mono Power Amp

MANUFACTURER'S SPECIFICATIONS

Power Output: 600 W rms in 8 Ohms with 0.05% THD from 1 Hz to 20 kHz; 1000 W rms into 4 Ohms with 0.05% THD from 1 Hz to 15 kHz.

I.M. Distortion: Less than 0.05% from 0.01 to 0.25 W and less than 0.01% from 0.25 to 600 W into 8 Ohms.

Slew Rate: 16 V/mS.

Damping Factor: Greater than 800, d.c. to 400 Hz into 8 ohms.

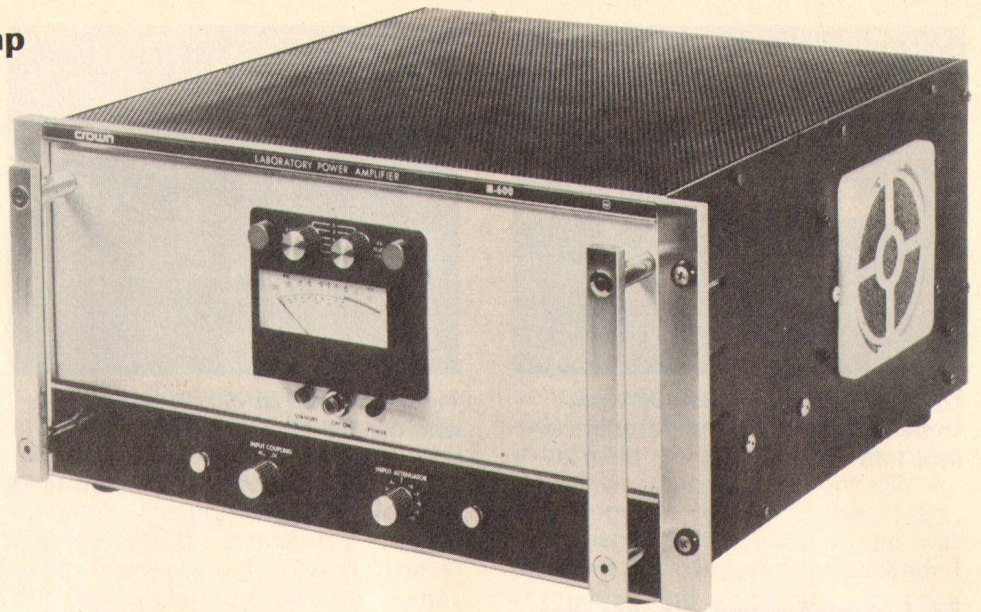
Input Sensitivity: 3.46 V rms \pm 1 per cent for 600 W rms into 8 ohms.

Signal-to-Noise Ratio: 120 dB.

Dimensions: 19 in. (48.3 cm) W x 8 3/4 in. (22.2 cm) H x 16 1/2 in. (42 cm) D.

Weight: 92 lbs. (41.7 kg).

Price: \$1795.00.



When I unpacked the M-600, it was clear this was no toy. The unit weighs 92 lbs. and has an industrial look I immediately liked.

Viewing the amp from the top through its perforated screen, one can see two large power transformers, each secured by four bolts to the chassis and by two additional bolts to the front plate. This arrangement is indicative of the care Crown has taken to make this amp suitable for commercial applications. I've seen the power transformers of less sturdy units literally fall out of their chassis from shocks and vibrations during transportation and set-up.

The M-600 utilizes a unique type of heat sink. Unlike the extrusions found on most units, they have a corrugated internal structure especially built for forced air cooling and which has much more surface area than extruded heat sinks of equivalent size. There are eight of these "refrigerator sinks" mounted four on the top and four on the bottom of a side-to-side oriented wind tunnel fed by a thermostatically controlled, two-speed cooling fan on the right side.

The front panel includes a peak-reading power meter, calibrated for 600 Watts at 0 dB, and two indicator lights, one red light which can be calibrated to come on at or a specified number of dB below maximum output, and a green one which lights at a calibrated number of dB below the red light setting. I've never seen an arrangement like this before but soon learned to appreciate its usefulness.

Directly below the meter is a plug-in compartment with an input attenuator control and an input coupling switch offering either capacitor or direct coupling. This compartment also houses a blank plug-in P.C. card

which allows user-designed circuitry to be interfaced to the input of the amplifier. More about this card and its possible uses later.

The front panel is finished off with a heavy-duty push button power switch and two massive rack handles secured by Allen bolts. The panel itself is made of thick aluminum stock and is reinforced with an extrusion along the bottom. This extra-strong panel is impressive, and its layout is logical and aesthetically pleasing.

The rear of the unit houses the input and output connectors, two switches—one for the protection circuit and one for a turn-on delay—and has a special socket for stacking two M-600s together in bridge.

Circuitry

The M-600 circuitry is very similar to that of the DC-300A, i.e. op-amp input, quasi-complimentary output. It is basically a bridge amp with one important difference, one side of the output is grounded. In a bridge configuration, there are two amps driven out of phase with a load bridged across their outputs, resulting in one amp with twice the voltage capability. The slave half of the bridge gets its drive from the output of the first amp. Its circuit is essentially the same except that the load is presented to the collectors of the output devices. This is because the output of the slave is tied to ground. Now, if the output is tied to ground, something has got to give and that something is the power transformer windings.

The power supply is floating and the windings swing up and down with the signal. In that the load is in the collector of the output transistors, this stage exhibits a voltage gain, rather than unity gain as in the more com-

mon emitter-follower configuration. Because of this, the driver stage has to swing only a small fraction of the total signal excursion and hence requires less supply voltage.

Certainly a novel circuit, but one wonders however about the effects of the winding reactance of the power transformer, as this presents a more complex load to the output of the slave. Also, it is reasonable to assume that since the signal passes through twice as much circuitry on the slave side, resolution will suffer, since two amps in series must, by definition, produce a greater change in terms of harmonic complexity. This circuit topology does, however, have some important advantages, namely that two M-600s may be bridged together for up to 2000 watts and there are industrial applications where a grounded output is required.

(Editor's Note: Crown designers believe that the filter capacitors should dominate any load.)

The protection circuit utilizes current limiting while producing no fly back transients. It also senses any d.c. component in the output and switches the amp to standby. This latter function may be defeated by use of a switch on the back panel.

On the P.C. card in the front compartment, \pm 15 Volts is available for user-designed circuits. Any number of nifty ideas could be implemented here, crossovers, limiters, isolation networks, etc.—a real convenience feature! The potential of this is only limited by one's imagination.

Measurements

We had to construct a special brine tank in order to measure the M-600s maximum power capabilities. Two electrodes were immersed in the

brine solution to specified depths, which determined the impedance between the electrodes. The impedance was periodically checked by monitoring the current as the brine solution evaporated. This gave us an accurate 3000-watt load resistor. With a 1 kHz-signal, we measured in excess of the rated 600 watts at 8 ohms, 1000 watts at 4 ohms, and 1300 watts at 2.7 ohms.

This amp measures well and exceeds its specifications for harmonic and I.M. distortion. I'm not going to show a harmonic or I.M. distortion graph because I've found that distortion measurements of this kind do not correlate with what an amp sounds like if the distortion magnitudes are below 0.25 per cent. There is, however, a probable correlation between sound and the nature of the distortion residual, i.e. its harmonic structure, and it seems logical that the higher order harmonics would be more offensive.

The Crown's distortion residual was primarily 2nd and 3rd order harmonics with crossover notches which were both steep and of fairly low magnitude. Examination of these notches with a spectrum analyzer reveals a splattering of higher order harmonics, mostly odds, to the upper ranges of the analyzer. The magnitude of these harmonics tapers off as the order increases. I don't know what all this truly means though I've always thought that odds sounded worse than evens, but at those magnitudes one wonders how the ear could detect it. Still, every amp has a sound of its own.

Applications & Conclusions

Back to reality! We took the M-600 out on the job to find out what it could do. The job was high-level sound reinforcement, the acid test for any piece of equipment.

This amp performed! Its tremendous power capability was immediately apparent, and it had an effortless about it regardless of how hard it was driven. Its very stiff power supply allowed the amp to be driven into clipping without folding up. It has the best overload characteristics I've ever encountered in a high-power amp.

The efficient heat-sinking system results in a cool-running unit. It was driven for extended lengths of time into 3-ohm loads with the meters pegged. It just won't shut down. The fan switches to high speed but the unit never gets hot.

I tried in the lab to find out just how

long it would run into a 3-Ohm load before the thermal breakers open. I had to give up as the circuit breakers in the building couldn't stand the load.

Another important consideration in evaluating an amp is stability. Some amps will work well in a home hi-fi installation, but when placed in parallel with other units or with long cables attached to their inputs, they turn into oscillators and self-destruct. This is not the case with the M-600. It demonstrates rock-hard stability, refusing to oscillate under any conditions. I've worked with many amps under wildly adverse conditions, and considering the M-600s overall performance, I feel this is the best amp for sound reinforcement I've so far encountered. It has fantastic bass. The midrange is very clear, slightly on the hard side, but no more so than any other high power transistor amp. It projects and articulates the individual sounds of vocals and instruments well. The high frequencies are slightly grainy, however, I doubt this unit would be used for driving tweeters as its extreme power capabilities would be wasted. Rather, I believe some mellow tube amp should be used for the highs. It is also worth mentioning that the amp will drive highly reactive loads without the limiter activating.

If you are going to use this amp for sound reinforcement, here are some suggestions. First, since it is susceptible to contamination through the cooling screen on the top, mounting this unit in a suitable cabinet is advisable. Second, if the amp is used for bass, the low-frequency protection circuit should be deactivated by use of the switch on the back. This circuit switches the amp to standby if more than 10 volts of d.c. is present in the output, and it is prone to activation by microphone popping and various other low-frequency transients.

Finally, some type of rear connector panel would be handy. The dress panel already there may be reworked for this purpose (speaker connectors, fuses, etc.). We removed the dress panels on our amps and replaced them with wood.

I've grown to respect this amp. It's fairly expensive (\$1795.00), but not when you consider the cost of purchasing a not-so-industrial amp and installing the cooling system necessary to make it reliable.

At a respectable \$1.79 a watt with a 4-ohm load, it is a cost effective tool for the professional. *Ed Goldman*

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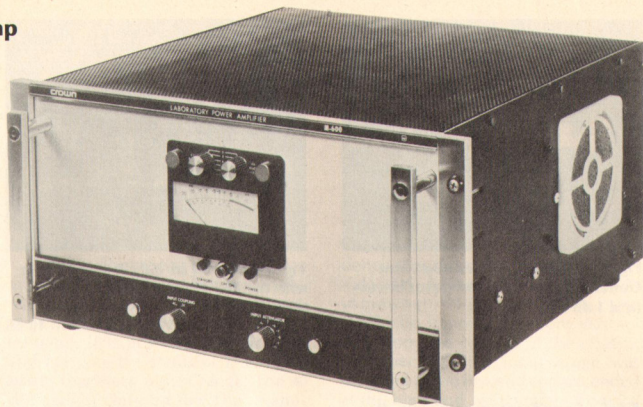
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