Equipment Profiles

Technics by Panasonic SA-8000X
4-Channel/2-Channel Receiver

MANUFACTURER'S SPECIFICATIONS
FM Tuner Section:
Sensitivity (IHF): 1.9 μV. **S/N:** 65 dB. **Selectivity:** 65 dB. **THD:** Mono, 0.3%; Stereo, 0.4%. **Capture Ratio:** 1.8 dB. **Frequency Response:** 20 Hz to 13 kHz ±1 dB. **Image Rejection:** 55 dB. **I.F. Rejection:** 60 dB. **Spurious Rejection:** 60 dB. **AM Suppression:** 50 dB. **Stereo FM Separation:** 1 kHz, 40 dB.
AM Tuner Section:
Sensitivity: 20μV (external antenna). **Selectivity:** 25 dB. **Image Rejection:** 40 dB. **I.F. Rejection:** 40 dB.
Amplifier Section:
Continuous Power Output: 13 W x 4 or 36 W x 2, 8 ohms, 20 Hz to 20 kHz, (16 W and 42 W respectively at 1 kHz). **Rated THD:** 0.5%. **Rated IM:** 0.7%. **Power Bandwidth:** 5 Hz to 40 kHz. **Frequency Response:** 10 Hz to 50 kHz, +0, -3 dB. **Input Sensitivity:** Phono, 1.5 mV; Aux, 150 mV; Mic, 2 mV. **Damping Factor:** 30@8 ohms. **Residual Hum and Noise:** Phono (IHF "A"), 70 dB; Aux, 90 dB. **Tone Control Range:** Bass, ±13 dB @59 Hz; Treble, ±10 dB @10 kHz.
General Specifications:
Maximum Power Consumption: 200 watts at 120 V, 60 Hz. **Dimensions:** 19½ in. W x 6⅜ in. H x 15¾ in. D. **Weight:** 29 lbs., 6 oz. **Price:** $549.95.

There are two ways of looking at a 4-channel/2-channel receiver such as the Technics SA-8000X. One can view it as a fairly powerful stereo receiver and judge it in the light of more conventional stereo all-in-ones in the same price class. Alternatively, one can judge it as a full-fledged quadraphonic receiver having relatively low power output per channel but equipped with just about every 4-channel control and decoding facility one might possibly want in this era of multiple system quad. Either way, this entry from Technics comes out ahead on nearly every count. Since Panasonic chose to support the CD-4 disc quite early in the short history of 4-channel sound, it is no surprise to find the receiver fully equipped with the demodulator circuitry necessary for playing these "discrete" discs. Matrix discs can be played through the system as well and, though there is none of the advanced "logic" circuitry now finding its way into some separate matrix decoders and a few all-in-one receivers.

The upper dial area of the receiver contains the usual AM and FM dial scales, a signal-strength meter, four illuminated VU level meters, and a variety of individually illuminated function and mode indicators, including the usual FM stereo light and a "Radar" light which illuminates when a CD-4 record is played. Along the black center-line of the panel are the power switch, a meter-sensitivity push button (which increases meter sensitivity by 10 dB, making them useful at any listening level), a pair of tape monitor push buttons, and four miniature knurled gold knobs used to adjust the CD-4 demodulator circuitry when first installing a new CD-4 cartridge. Since these adjustments need to be performed only during setup, we would have preferred to see them located on the rear panel which might discourage their unauthorized rotation by inquisitive small hands and fingers.

The lower, gold section of the panel contains headphone jacks for stereo or quadraphonic phones, bass and treble controls (operative for all channels at once), 4 individual-channel level controls flanking a master volume control, a pair of slide controls which alter matrix decode parameters, a mode switch (with positions for mono, stereo, a pair of matrix phase settings, and a discrete setting), the program selector knob, and a good sized tuning knob coupled to an effective and smooth flywheel and tuning dial assembly. A phone jack adjacent to the tuning knob accepts a low to medium impedance microphone. This last feature is virtually worthless, since the microphone cannot be used in a "mix" with any other program source nor are there provisions for a stereo pair of mics. Anyone desiring a mono P.A. system would not look to an elaborate 4-channel receiver such as the SA-8000X in the first place!

The rear panel layout shown in Fig. 1 includes the usual input, tape in and tape out phono tip jacks (provision is made for two 4-channel tape decks), 75-ohm, 300-ohm FM and external AM antenna terminals, switched and unswitched convenience a.c. receptacles, and a grounding terminal. Arrangements specifically related to the 4-channel functions of the unit include a three-position slide switch used to calibrate those front-panel separation and carrier adjust controls associated with CD-4 record playing, and a 3-position cartridge selector which permits the use of some of the new semi-conductor cartridges by supplying polarizing voltage for these devices right at the phono jacks. A third position on this switch is intended for use with conventional magnetic cartridges, whether they be stereo or CD-4 types. The speaker terminals are somewhat confusingly labelled (for that matter, the user would be well advised to read the entire instruction manual before starting to hook up this receiver, as with any new piece of gear, and to re-read the hook-up steps as they are performed), in that a stereo speaker arrangement must be hooked up differently from a 4-speaker quadra-

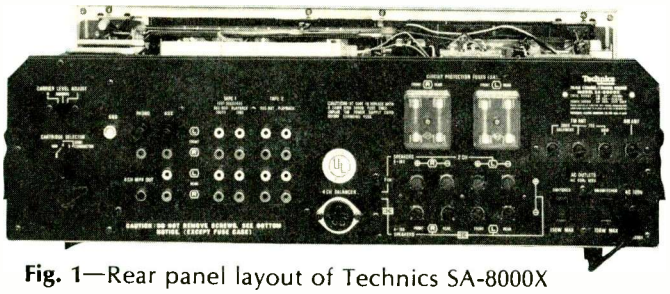

Fig. 1—Rear panel layout of Technics SA-8000X

phonic array. In one case, all the red terminals are used, while in the other case red and black pairs are used for each of the four speaker systems. Besides this reconnection requirement (when converting from 2-speaker to 4-speaker use), an adjacent switch must be thrown from 2-ch to 4-ch (or the other way) in order to alter internal circuitry to what Technics calls "BTL" (Balanced Transformerless) operation and what we, here, generally term "strapping" or "bridging."

A 4-channel FM detector output jack is also provided on the rear panel (for the discrete 4-channel FM broadcast system still to be selected by the FCC some day), and there is a multi-pin socket intended for a "joystick" remote control 4-channel balancing accessory which was not tested. Four speaker line fuses complete the rear panel layout. It should be noted that when using the receiver in the stereo mode, speaker impedance is restricted to 8- or 16-ohms, while in quadraphonic applications, speakers may have impedances of from 4 to 16 ohms.

An internal view of the chassis of the SA-8000X is pictured in Fig. 2. The FM front-end uses a 4-pole MOS-FET for an r.f. amplifier, and tuning is accomplished by means of a frequency-linear variable capacitor. The i.f. section has five stages, including three differential amplifier stages and band-pass characteristics are largely determined by three dual-element ceramic filters which require no alignment. Most of the functions of the stereo FM decoding circuit are performed by a single monolithic IC which incorporates two differential switching circuits.

The phono equalizer preamp section is a two-stage direct-coupled circuit which uses a combination of low-noise PNP and NPN transistors. Tone controls are of the negative feedback type. The power amplifier section features a differential amplifier input and direct-coupled circuitry right up to the speaker output connection points. In the two-channel mode, amplifier sections are paralleled using the now accepted "strapping" technique which places "chassis ground" effectively at the mid-points of the speaker loads. "Common ground" speaker connections are therefore not possible—a condition that is true with most 4-channel/2-channel receivers of recent vintage. The AM section of the receiver, unlike most, also utilizes a frequency-linear, variable capacitor which results in even spacing of the dial calibration from low end to high end and makes station selection somewhat easier. A ceramic filter is used in the AM i.f. section.

FM Measurements

Results of test measurements of the FM section of the SA-8000X are shown, in part, in Fig. 3. Although IHF sensitivity was higher than claimed (2.5 μV), 50 dB of quieting was reached with a signal input of only 4.9 microvolts. Ultimate quieting in mono reached a maximum of 70 dB at all signal levels above 100 μV—considerably better than

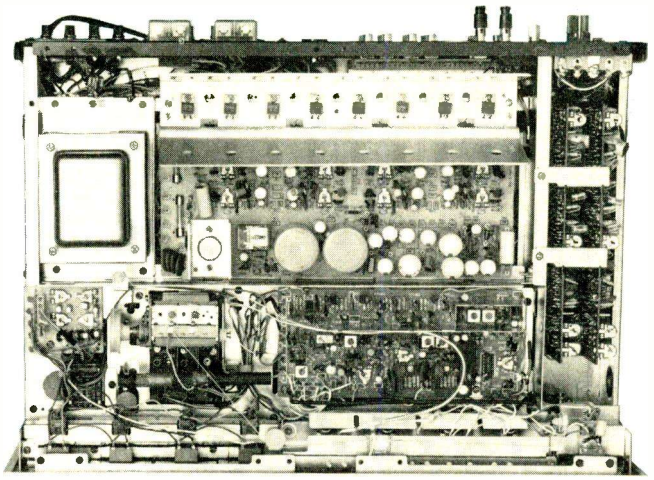

Fig. 2—Interior of SA-8000X

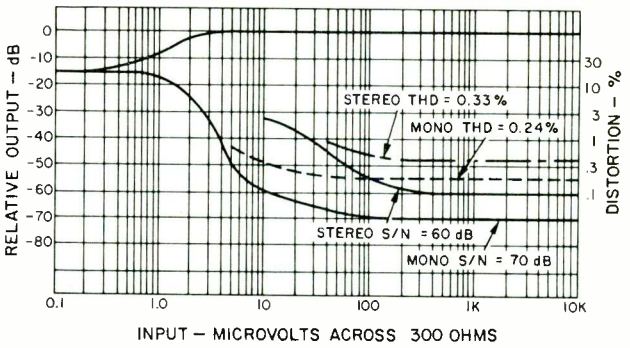

Fig. 3—FM quieting and distortion characteristics.

the 65 dB claimed by the manufacturer. Switchover to stereo occurred at about 8 microvolts, at which signal level noise was already down over 30 dB. Ultimate quieting in stereo reached 60 dB, a very respectable figure considering the fact that residual products then observed consisted of 38 kHz carrier leak-through rather than random noise. Technics claims carrier rejection of only 50 dB. THD in mono decreased to 0.24% for any signal level above 50 μV, at 1 kHz. In stereo, THD decreased to 0.33% with a 1 kHz signal for all input signal levels above 200 μV—again, considerably better than claimed. As shown in Fig. 4, THD tends to rise at the high frequency end of the audio spectrum, reaching just under 1.0% at 10 kHz in mono, and slightly more than 2.0% in stereo at the same extreme frequency. In the case of the stereo THD readings at high frequencies, the meter is responding, in part, to low-level "beats" caused by the interaction of the high audio frequency and the residual 19 kHz and 38 kHz carrier products. AM supression measured exactly 50 dB as claimed, and capture ratio exceeded claims with measured readings of 1.3 dB for 100 μV signal levels. Selectivity measured 67 dB, a bit better than claimed.

Stereo FM separation at mid frequencies, also plotted in Fig. 4, measured 42 dB, decreasing to 26 dB at 10 kHz. At the low end, separation remained at 40 dB or better for all frequencies down to 50 Hz.

Amplifier Measurements

THD versus power for a 1 kHz input signal is plotted for

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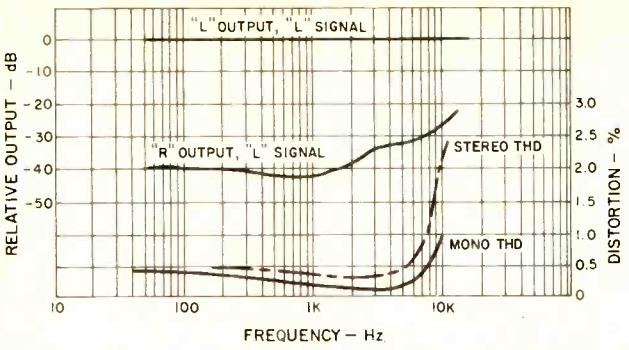

Fig. 4—Separation and distortion vs. frequency.

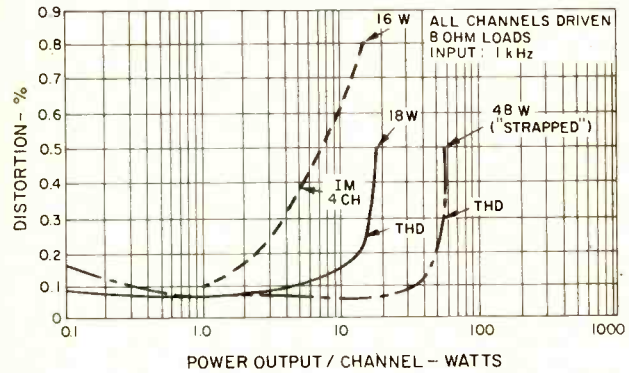

Fig. 5—THD and IM distortion characteristics.

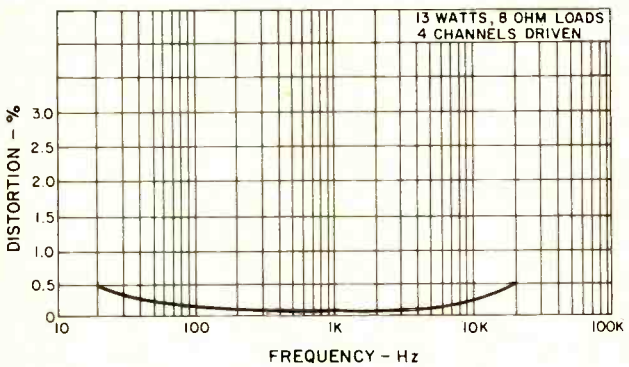

Fig. 6—Distortion vs. frequency.

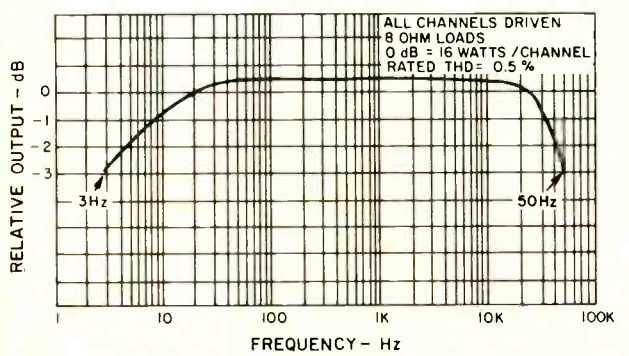

Fig. 7—Power bandwidth characteristics.

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both 4-channel and 2-channel strapped operation in Fig. 5. In both modes, mid-band power output capability was in excess of manufacturer's claims, reaching 18 watts per channel and 48 watts per channel respectively, for rated THD of 0.5%. IM distortion, shown for the 4-channel mode only, tended to rise almost linearly for power levels above 5 watts per channel, but remained below rated value of 0.7% right up to rated output which is 13 watts under these conditions. The 13 watt per channel nominal output was used to measure distortion versus frequency which is plotted in Fig. 6. Under these conditions, the receiver delivers full power from 20 Hz to 20 kHz at less than rated distortion (0.5%).

Power bandwidth, graphed in Fig. 7, extends from 3 Hz to 50 kHz, substantially better than claimed. The measurements were based upon a rated output of 16 watts per channel. If 13 watts were used as a 0 dB reference, the power bandwidth would have extended even higher and lower.

Tone control and loudness compensation for a -30 dB volume control setting are shown in Fig. 8. Both conform closely to manufacturers specifications. There are no high frequency or low frequency filters in the receiver.

Our tests of CD-4 demodulator performance are necessarily based upon measurements using test records and CD-4 cartridges since, to date, no one has come up with a suitable piece of test equipment which can provide the complex signals equivalent to those recorded in the groove of a CD-4 record. Of late, we have been using a new individually calibrated MMC-6000 cartridge manufactured by Bang & Olufsen of Denmark. It is the best CD-4 cartridge we have tested to date and one of the few that can properly track Quadradiscs at tracking forces of 1 gram or less. Using this cartridge, the CD-4 circuitry of the SA-8000X yielded separation of better than 22 dB from front to back, on both sides, and better than 28 dB from side to side, both front and back. Adjustment of the ideal demodulation parameters is accomplished in a matter of seconds, thanks to the four front panel meters on the unit, which are much easier to use in this procedure than simply listening to the test record and adjusting everything by ear, as the record's narration suggests. Carrier sensitivity of the demodulator circuitry was more than adequate for this, as well as for several other CD-4 cartridges that we tested in the course of our evaluations.

FM performance of the receiver was good, with muting threshold sensibly adjusted for about 5 microvolts. Using the muting feature indirectly guarantees that any station received will be heard with a quieting of at least 50 dB—just about enough for serious listening. Of course, the mute can be defeated if you want those few extra "noisy"

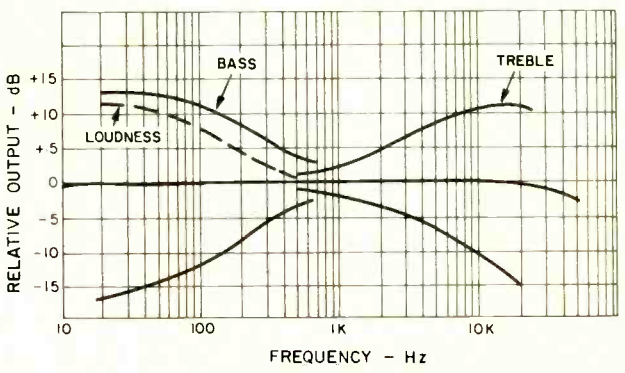

Fig. 8—Tone-control range and loudness characteristics. characteristics.

signals from distant stations. The somewhat lower values of image and spurious rejection (compared to high-priced stereo receivers) did not in any way interfere with our dial twirling and listening. The excellent capture ratio of the receiver did much to off-set the "average" AM suppression capability as far as multipath interference in stereo listening was concerned.

AM performance was adequate, but not outstanding—typical of most present day medium and even higher priced integrated stereo and 4-channel receivers. The major design priorities of this set are obviously in the 4-channel area.

The wide-band power response of the SA-8000X helps to offset the fairly low audio power output obtainable in the 4-channel mode. With four reasonably efficient speakers in a good sized room, we had no trouble raising volume levels to fairly loud sound pressures. In the two-channel "strapped" mode, there's enough power for even the low efficiency systems some listeners prefer, but if you plan to purchase this set with 4-channel as your ultimate objective (even if you start out in stereo) it might be a good idea to audition the set in the four-channel mode and choose a pair of speakers that provide enough sound so that they can be duplicated when you add the extra pair for full 4-channel sound.

Matrix performance was also judged by a series of listening tests. The dual slide control which Technics calls AFD does, indeed, vary the spatial sound field and a variety of 4-channel effects can be created from both stereo and intentionally encoded 4-channel matrix discs. The Phase Matrix 2 position on the AFD slide controls comes closest to properly decoding SQ encoded records and additional variation in sound placement and localization is achieved by selecting either the "0 phase" or "90° phase" positions on the mode switch, but all these variations did not provide the degree of apparent separation that either CD-4 records or matrix records played back through full-logic decoders can. In a musical context, however, this may not be all that important a consideration for the prospective listener who is not likely to walk around from speaker to speaker judging 4-channel crosstalk.

Technics by Panasonic introduced this model about a year ago and, based upon its features and overall performance, we would guess that the SA-8000X will continue to be a popular best-seller amongst that company's group of 4-channel audio products. *Leonard Feldman*

Check No. 60 on Reader Service Card

Sharp Stereo Cassette Deck, Model RT-48OU

MANUFACTURER'S SPECIFICATIONS

Type: A.c.-operated, solid-state, stereo cassette recorder, with Dolby "B"-type noise-reduction system and full automatic stop system. **Wow and Flutter:** 0.15% wrms. **Fast Forward and Rewind Times:** 75 sec. (C-60). **Frequency Response:** 45-15,000 Hz with CrO^2 tape; 45-11,000 Hz with normal tape. **Channel Separation:** 34 dB. **Dimensions:** 17-7/16 in W x 10-1/4 in. D x 4-11/16 in. H. **WEIGHT:** 13.2 lbs. **Price:** $249.95

The Sharp RT-480U cassette recorder is a neat and attractive unit which incorporates some interesting and useful features, one of the most helpful being the automatic program finder. This device works with the automatic-stop circuitry to permit the user to locate separate selections on the cassette by stopping tape motion at points where there is no modulation on the tape during rewind or fast-forward operations. The stopping circuitry for end of tape involves a magnetically-toothed wheel which rotates adjacent to a reed relay, and while the wheel (which turns with the takeup spindle) rotates, it provides a signal from the reed relay to the gate of the SCR (they call it thyristor) which inhibits current in its anode circuit so the stopping solenoid does not operate. When the "toothed" wheel stops, the gate of the SCR is no longer inhibited, and the SCR fires, tripping the solenoid and stopping the tape motion.

The automatic program finder involves another tape head which contacts the tape during fast spooling and feeds its output to a five-transistor amplifier which similarly inhibits the SCR as long as there is modulation on the tape. When a pause between selections comes along, the inhibiting voltage ceases and the solenoid trips the stop mechanism. Thus, if you are playing a tape with a number of selections on it and you wart to listen to the last one only, you simply wind forward in the fast-forward mode until you reach the pause just ahead of the desired selection. (Of course, it will stop at all the other pauses in the tape.) Or, in rewinding, you want to repeat a selection—play it through, press the STOP button, then rewind. When you reach the pause ahead of the selection, the machine stops automatically, and then you can repeat the desired selection by depressing the PLAY key.

Operation is controlled by six "piano keys"—the usual RECORD, REWIND, FAST FORWARD, PLAY, STOP, and, separated by a narrow divider, PAUSE. The cassette holder lid is actuated by sliding knob, which may not be moved if any of the keys are depressed.

To the right of the cassette compartment are two level meters, separated by a panel containing the DOLBY and RECORD indicator lights. Directly below are two pairs of slide controls for record and playback levels, and below them is a brushed aluminum panel containing the power switch at the extreme right, and two toggle-type switches for Dolby on/off and for tape type—the latter a three-position unit labeled CrO^2, LOW NOISE, and NORMAL. This switch affects only the equalization in the record mode, and does not vary the bias current. To the left of the piano keys are two miniature phone jacks for microphone input, cutting off the high-level inputs when jacks are inserted. To their left is a stereo headphone jack.

Above the jacks is a three-digit counter with the conventional reset button, and above that the nameplate, on which is mounted the on/off switch for the automatic program finder. In all, a neat and functional control panel, with a smoked plastic dust cover over the controls when the unit is not in use.

Circuit Description

Considering the playback circuit first, the output of the record/play head is fed to an IC with suitable tape-head

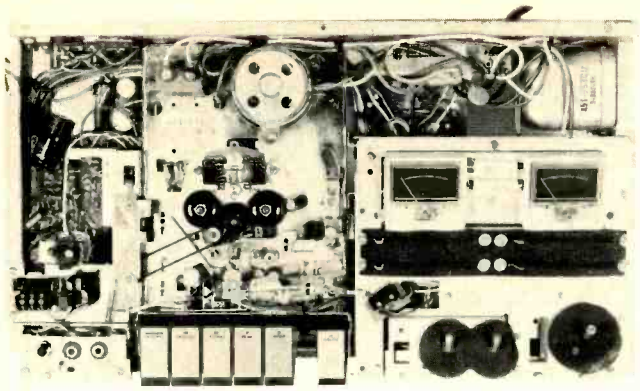

Fig. 1—Top view of the Sharp RT-480U. Note that the power transformer, located at upper right, is well removed from the heads to help ensure minimum hum.

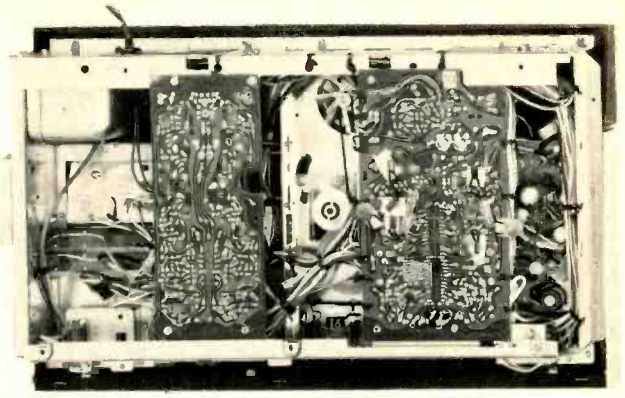

Fig. 2—Underside view of chassis. Larger circuit board incorporates switching between record and playback, with slide switches moving along contacts on opposite side of board. Smaller board contains two Dolby circuits, and is connected to main board by plug and cable assemblies. The automatic stop and automatic program-finder circuits are on smaller circuit board underneath and to the right of the main board.

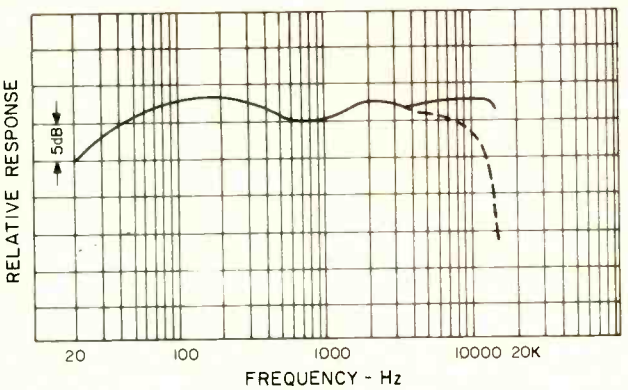

Fig. 3—Response curves of record/playback from line in to line out. Solid curve represents CrO_2 tape, with tape switch in CrO_2 position. Dashed line represents response with TDK SD tape, switch in CrO_2 position.

equalization, thence to the Dolby circuit board, returning to the playback volume control and amplified by a single transistor before being fed to the output jack.

In the record mode, the high-level input signal is fed to the record-level control, then to the Dolby circuit board, and back to the single transistor equalized for the various tape types, and thence to the recording head through a bias trap, with bias of 84 kHz being fed to the head simultaneously. The bias oscillator is a pair of transistors to provide a push-pull output, with variable resistors providing for bias adjustment separately for the two channels. The power supply provides full-wave rectification to the voltage-regulating transistor with an output of 23 volts. The automatic-stop and automatic-program-finder circuits were described previously.

Two more transistors in each channel provide sufficient gain to drive the level-indicating meters and furnish power for the headphones, using a transformer for impedance matching to the phones. Both meter and headphone circuits operate during playback as well as recording.

Performance

The RT-480U came up to its specifications in nearly every particular, if we assume that the bias was adjusted for CrO_2 tape, since frequency response extended out to 16,000 Hz with this type of tape, and with the tape selector switch in the CrO_2 position. With any other tape, the response fell off rapidly, being down 10 dB at 10,000 Hz with respect to the 1000-Hz level, and regardless of the position of the tape selector switch. Curves are reproduced for the response with CrO_2 tape, and the switch in the CrO^2 position, with dotted curves showing the response with TDK SD tape and the selector in the same position. Curves with the Dolby circuitry in use and not in use were identical (±1 dB) so it would appear that the Dolby circuit was working perfectly, regardless of the volume level at which the recording was made.

Fast forward and rewind times for a C-60 cassette were measured at 72 seconds, well within specification. Minimum input signal required for a "O" level indicated on the meters was 50 mV in the high-level inputs, 0.3 mV at the microphone jack, and both contributed an output level of 0.32 V at the playback jack. At the same time, a signal of 70 mV was available at the phone jack. Signal-to-noise ratio measured 53 dB with the Dolby circuit in operation, and 55 dB without, all very credible.

As received by us for testing, the machine would be considered quite satisfactory when used with CrO_2 tape. If other tapes were to be used, it would seem likely that bias should be decreased, an operation not readily performed by the user. Wow and flutter measured 0.14 percent, mostly contributed as flutter, since wow alone measured 0.1 percent—very good for cassette recorders.

The accompanying instruction book is remarkably complete, containing information concerning recording from stereo systems, from microphones (two of which are furnished), for recording with a microphone on one channel and music from radio or records on the other, and for recording of Dolbyized FM broadcasts, which because of the reference signals used with such broadcasting, must be done in a specified manner to obtain best results. And last, but not least (in our opinion), service information accompanied the unit we received. While it is not likely that the average user would use this information, it is also not terribly likely that the average hi-fi or recorder service facility would have the information on file. It is, of course, always desirable to be able to give the serviceman a schematic to aid in correcting any possible problems with the unit. If the machine were returned to an authorized service station, the information would naturally be at hand, but that is not always possible or convenient, so the nearest serviceman might be called, and then the information would be invaluable.

C. G. McProud

Check No. 61 on Reader Service Card

Crown DC-300A Power Amplifier

MANUFACTURER'S SPECIFICATIONS

Power Output:150 watts per channel, minimum rms at 8 ohms from d.c. to 20 kHz with no more than 0.05 percent total harmonic distortion and no more than 0.05 percent intermodulation distortion.

Damping Factor: Greater than 200 up to 1 kHz. **Hum and Noise:** 110 dB below 150 watts. **Input Sensitivity:** 1.75 volts for 150 watts into 8 ohms. **Input Impedance:** Nominal 100 kilohms, 10 kilohms at full gain. **Dimensions:** 19 in. W (standard rack) x 7 in. H x 9¾ in. D. **Weight:** 45 lbs. **Price:** $729.00.

The Crown DC-300 was not by any means the first low-distortion, high-power, solid state amplifier around, but it soon proved itself to be one of the most reliable. The latest version, Model DC-300A, was released several months ago, and in this instance, the "A" does not denote a minor modification or just a change in cosmetics but rather a nearly complete redesign. For instance, the older model used four power transistors per channel but the new model has no less than eight. And these are 150-watt homotaxial devices, so there is a dissipation of 2,400 watts available. The input stage now uses an op amp, and the protection circuits have been designed to allow full transient power without premature clipping. Because of the number of parallel output transistors, the maximum output is delivered at about 2.5 ohms, and even lower load values can be used without trouble. Distortion of the earlier DC-300 was extremely low—less than 0.05 percent up to 180 watts—but even this has been reduced, drastically reduced as we shall see later.

The black and silver anodized front panel measures 7 x 19 in., allowing the unit to be mounted on a standard rack if so desired. Total weight has been increased from 40 to 45 lbs., mostly due to the massive power transformer. Appearance of the new "A" model's front panel is virtually unchanged from the older unit, with the two large knobs controlling the input to each channel on each side and the illuminated heavy-duty **ON/OFF** switch right at the center. At the rear are the large terminals for the loudspeaker connections and a line fuse. Because of the efficiency of the protection circuits, no speaker fuses are provided.

Circuit Details

The input op amps are fed from a voltage-regulated power supply, and elaborate compensation circuits prevent any drift. There are two variable resistors used for the input and output offset controls, and these are of course adjusted at the factory. Output is taken straight to the base of the next transistor, and coupling is direct from input right through to the loudspeaker terminals. The output stage is a semi-complementary arrangement using an AB-B circuit with no bias current in the output transistors. The bias is applied to the driver transistors, and there is full thermal compensation. Protection against short circuits and very low impedance loads is provided by a complex circuit that Crown calls "SPACE" for Signal Programmed Automatic Current Executor—an acronym which must have given someone an awful lot of trouble! Briefly, SPACE works by functioning as a signal-controlled current limiter at audio frequencies and a power limiter at subsonics. The parameters of the variable current limiter are such that it does not generate "flyback pulses" with inductive loads, so the overload characteristic is smooth without those unpleasant rasping effects inherent in most circuits using fixed limiting. Further protection is provided by a thermal switch mounted on each heat sink. A bridge rectifier supplies d.c. voltage of ±60.

Measurements

Figure 3 shows the power output versus distortion, both THD and IM (SMPTE), at 4 ohms, while Fig. 4 shows the performance at 8 ohms. Both channels were driven in each case. It will be seen that distortion is down close to the limits of the test gear—even at rated outputs—and for some of the tests special equipment had to be made! Nearly 200 watts was obtained at 8 ohms, while 4 ohm output was 340 watts. Figure 5 shows the distortion versus frequency at 180 watts with 8 ohm loads. Power bandwidth extended from d.c. to about 50 kHz, and the -3 dB point for frequency response was 165 kHz. Square-wave response at 40 Hz and 1 kHz was virtually indistinguishable from the input signal, and the response at 10 kHz shows only a slight rounding with no sign of overshoot (see Figs. 6, 7, and 8). Figure 9 shows the symmetrical clipping at a power

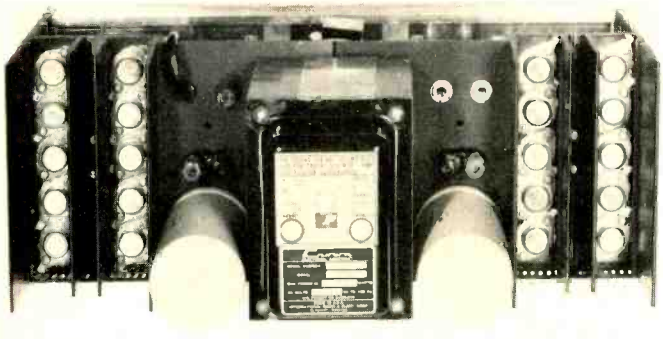

Fig. 1—Back panel, DC-300A.

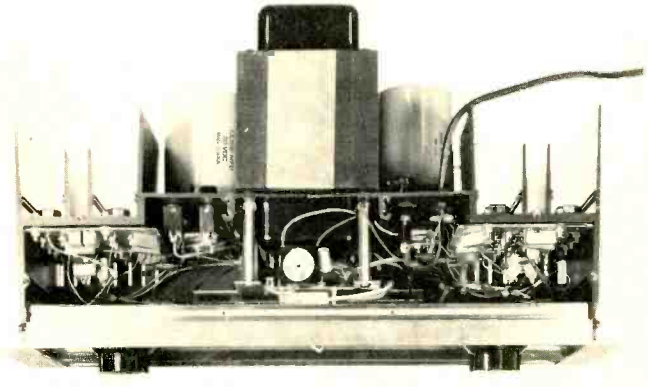

Fig. 2—Interior view.

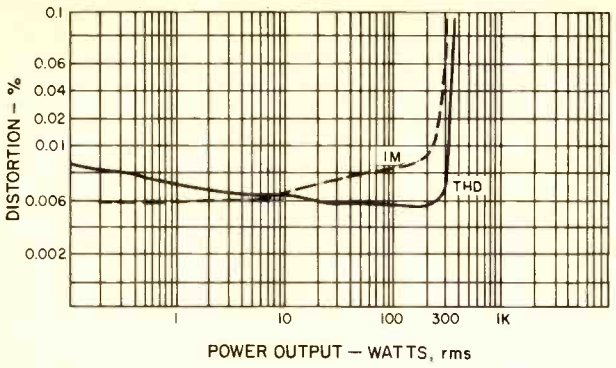

Fig. 3—Power output, into 4 ohm loads, both channels driven.

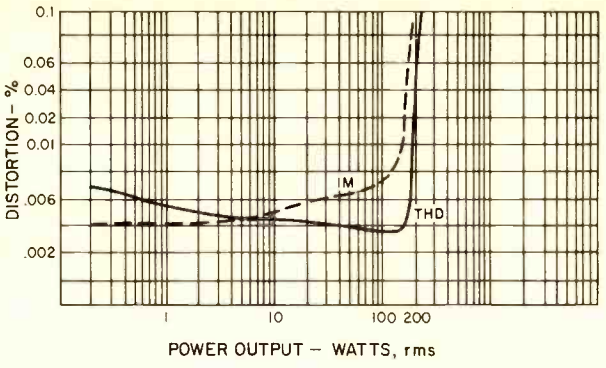

Fig. 4—Power output, into 8 ohm loads, both channels driven.

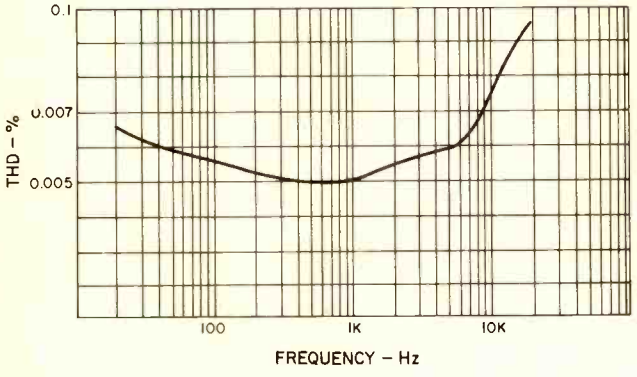

Fig. 5—Frequency versus THD, 180 watts into 8 ohm loads.

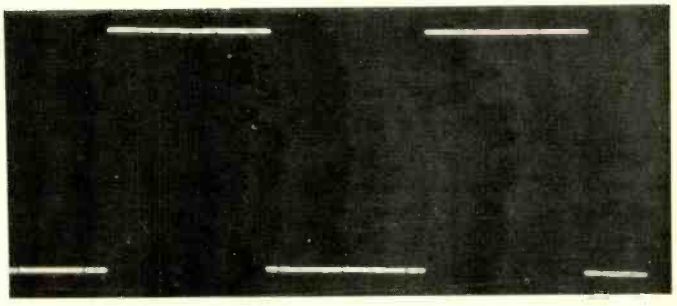

Fig. 6—Square-wave response at 40 Hz.

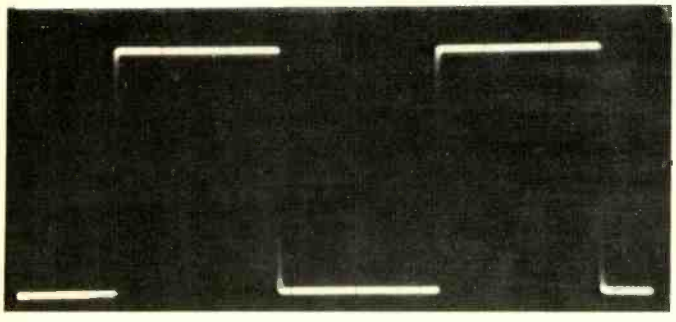

Fig. 7—Square-wave response at 1 kHz.

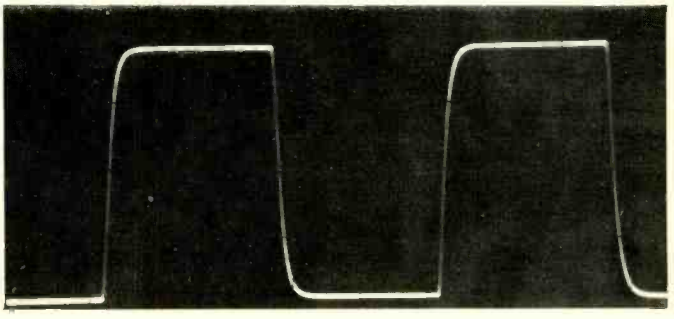

Fig. 8—Square-wave response at 10 kHz.

equivalent to 440 watts (4 ohm load, one channel driven), and Fig. 10 shows the residual hum and noise, which is -102 dB, 200 W., 8 ohms, full band. The input signal required for full output was 1.95 V. Crosstalk was checked but as the specified 90 to 100 dB figures seemed accurate, measurements seemed academic.

Use and Listening Tests

For most of the listening tests, the DC-300A was paired with a Crown IC-150 preamp, while the speakers were switched between AR LSTs and hybrid electrostatics. The phono cartridge used was a Shure V-15 III and the turntable was a Thorens TD-125. As you might expect, the overall sound quality was extremely good, and I am tempted to resurrect the old cliche about the piece of wire. . . . There was ample power to do justice to those organ pedal notes on my favorite Bach record of the *Toccata in D minor* (Everest 3156) or the magnificent *Organ Music from Westminster* disc made by that perfectionist, R. W. Fulton, which has excerpts from Widor, Mozart, Bach, and Sweelinck played on a Kimbell Organ (ARK 10251S, 8012 Cedar Ave. South, Bloomington, Minn. 55420). I was particularly impressed with the smooth overload characteristic; full marks to Crown for this and also for the foolproof protection circuits, as well as for the incredibly low distortion.

A word of praise is due for the instruction manual. This is not only crammed with all kinds of information about the amplifier, such as the graphs showing phase response, noise

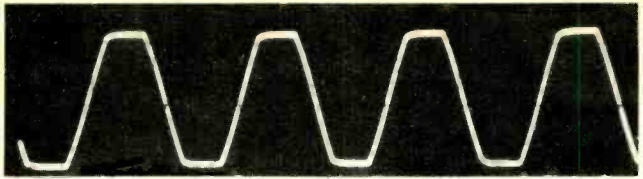

Fig. 9—Waveform at clipping, 440 watts, 8 ohm load.

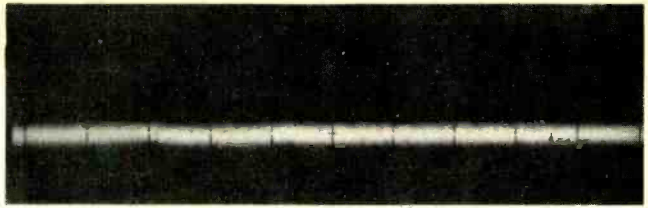

Fig. 10—Residual hum and noise, 102 dB below 200 watts, 8 ohm load.

spectrum, power efficiency, damping factor, output impedance, and so on, but it also gives nomographs for speaker lead resistances, circuits for loudspeaker protection, filters for r.f. interference, and much more. Instructions are also given for the connection of both channels in series to provide a mono 70 V output.

I am often asked, "Which is the best amplifier now available?" If the same question were put to a group of experts, you would get several different answers. Some would undoubtedly vote for the DC-300A, others might vote for a unit with more power or one with VU meters or illuminated power indicators, but I am certain that all would agree that the Crown DC-300A is in that group at the top against which any new pretender to the state-of-the-art title must be judged.

George W. Tillett