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MARANTZ CD-94 CD PLAYER AND CDA-94 D/A CONVERTER

Manufacturer's Specifications

Compact Disc Player

Frequency Response: 4 Hz to 20 kHz, ±0.5 dB.
Dynamic Range: Greater than 96 dB.
S/N Ratio: 96 dB.
THD + N: 0.003% at 1 kHz.
Wow and Flutter: Below measurable limits.
D/A Conversion: 16-bit, four-times oversampling.
Number of Programmable Selections: 20.
Output Level: 2.0 V rms.
Power Requirements: 120 V a.c., 60 Hz, 30 watts.
Dimensions: 18⅛ in. W × 3½ in. H × 13⅛ in. D (46 cm × 8.9 cm × 33.3 cm).
Weight: 27½ lbs. (12.5 kg).
Price: $1,700.

D/A Converter

Sampling Rates: 32, 44.1, and 48 kHz (automatic selection).
D/A Conversion: 16-bit, four-times oversampling.
S/N Ratio: 101 dB.
Frequency Response (with 44.1-kHz Input): Fixed-level output, 2 Hz to 20 kHz, ±0.1 dB; variable output, 2 Hz to 20 kHz, ±0.1 dB (output level at maximum); balanced outputs, 20 Hz to 20 kHz, ±0.3 dB.
THD: 0.003% at 1 kHz.
Dynamic Range: Greater than 96 dB.
Channel Separation: Greater than 90 dB.
Digital Input Levels: Systems 1 and 2, 0.5 V peak to peak; optical, −15 to −23 dBm; tape, 0.5 V peak to peak.
Digital Tape Output Level: 0.5 V peak to peak.
Analog Output Levels: Fixed, 2.0 V rms; variable, 4.0 V rms; balanced, 2.0 V rms; headphone, 75 mW at 600 ohms, 14 mW at 8 ohms.
Power Requirements: 120 V a.c., 60 Hz, 25 watts.
Dimensions: 18⅛ in. W × 3½ in. H × 13⅛ in. D (46 cm × 8.9 cm × 33.3 cm).
Weight: 25.3 lbs. (11.5 kg).
Price: $1,700.

Company Address: 20525 Nordhoff St., Chatsworth, Cal. 91311.
For literature, circle No. 91

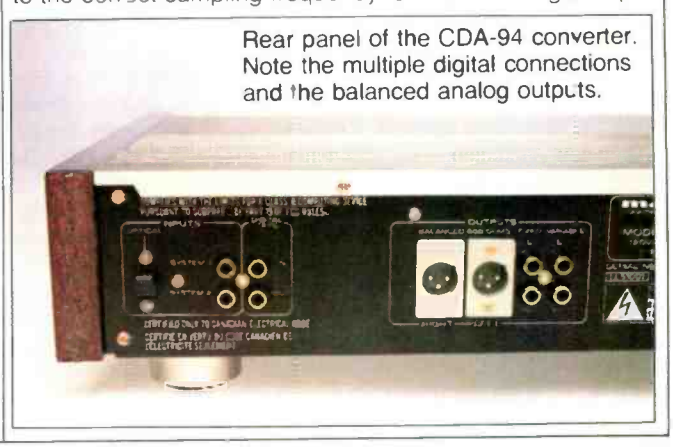
More and more audio equipment manufacturers who offer CD players are also beginning to manufacture and sell separate, stand-alone, digital-to-analog converters. What we are generally told is that, although the company's top CD players deliver excellent sound quality, the use of a separate D/A converter will provide an additional small measure of sonic perfection to a system. A stand-alone converter can be linked to any CD player that has a separate digital output. Most will also respond to digital inputs from DAT players or recorders (at 44.1 or 48 kHz) and from digital broadcast receivers (at 32 kHz) such as those available in Europe and Japan.

The Marantz CD-94 player and CDA-94 D/A converter not only are perfectly matched cosmetically, but are intended to work as a pair to provide the "ultimate" in CD playback performance. I did a comparison study between the CD-94 operated alone and the CD-94 and CDA-94 operated as a system. Essentially, this involved two complete lab testing sessions, using the various test discs available for this purpose. Before I get to the results of this head-to-head contest, let me describe the components themselves.

Both the CD-94 and the CDA-94 can be purchased either in a black-satin anodized finish with oak or rosewood side panels or in a rose-gold finish with rosewood side panels. Up to 20 "blocks" of programming can be memorized by the CD-94, using numeric keys on its front panel or on the supplied remote control. A "block" can be a track number, a track-plus-index number, or a time-into-track number. Shuffle (random) play of all tunes is possible, and Favorite Track Selection, first introduced in Magnavox and Philips CD players, is also featured in the Marantz CD-94. Favorite Track Selection, or FTS, enables you to store track information for a maximum of 226 discs. The number of discs decreases with the number of tracks selected for each disc. For example, if five tracks are memorized per disc, disc capacity of FTS will be 150. If 20 selections per disc are memorized, however, the number of discs that can be handled will drop to 70.

Both optical and coaxial (wired) digital outputs are provided on the CD-94, as well as unbalanced analog outputs.

The CDA-94 D/A converter is equipped with two sets of coaxial wired digital inputs, an optical digital input, digital tape monitoring facilities (for use when listening to a DAT recorder connected to the unit), and a headphone output jack and level control. The converter automatically switches to the correct sampling frequency to match the digital input



Rear panel of the CDA-94 converter. Note the multiple digital connections and the balanced analog outputs.

The promise of stand-alone D/A converters is better sound than one gets from the companion player alone.

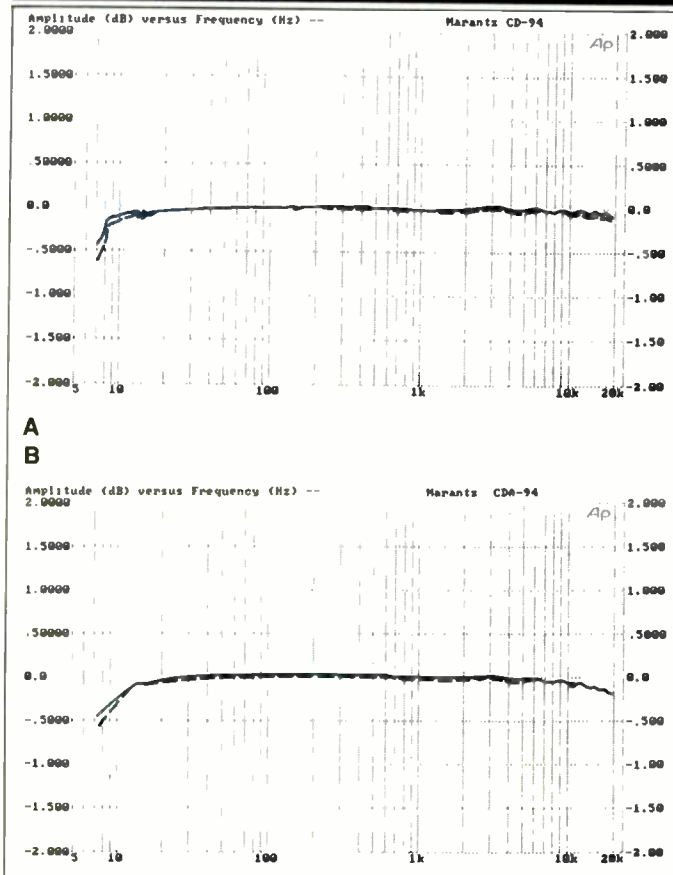


Fig. 1—Frequency response of left and right channels, from 5 Hz to 20 kHz, for the CD-94 player alone (A) and for the combination of the CD-94 player with the CDA-94 converter (B). For this and other figures, solid curve is for the left channel and dashed curve is for the right.

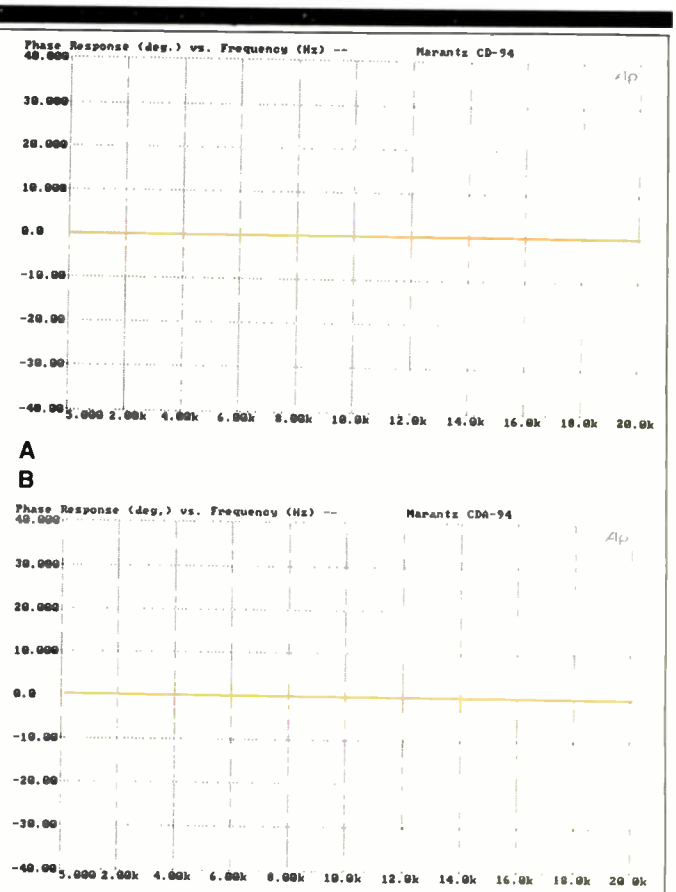


Fig. 2—Phase response for the player alone (A) and for the combination (B).

signal fed to it. The converter has balanced and unbalanced fixed-level output terminals as well as variable-level unbalanced output terminals. Both the CD-94 and the CDA-94 use D/A converters with four-times oversampling and digital filtration. According to Marantz, however, the CDA-94's design further protects signal integrity by using separate circuit boards, power supplies, and power transformers for the digital input-output section, the D/A converters, and the analog amplifiers. This extra care is said to provide a signal-to-noise ratio that is 5 dB better than the CD-94's. The CDA-94 also features an "Absolute Phase" switch that can compensate for phase inversion which took place anywhere in the recording chain.

CD-94 Control Layout

Secondary controls and pushbuttons of the CD-94 are hidden behind a nicely damped swing-down hinged panel along the bottom of the unit's front. The only features and controls visible with the hinged panel closed are the display, the CD drawer, the power switch, and buttons for drawer operation, FTS activation, forward and reverse track advance, play (and replay of the current track), plus a rocker for pause and stop. The display tells you just about everything you would want to know concerning the current status of the player. The time displays can be changed to show total remaining time on the disc as well as remaining time and time elapsed in the current track. Small numerals along

The CD-94's conveniences include shuffle play, Favorite Track Selection, and automatic music scan.

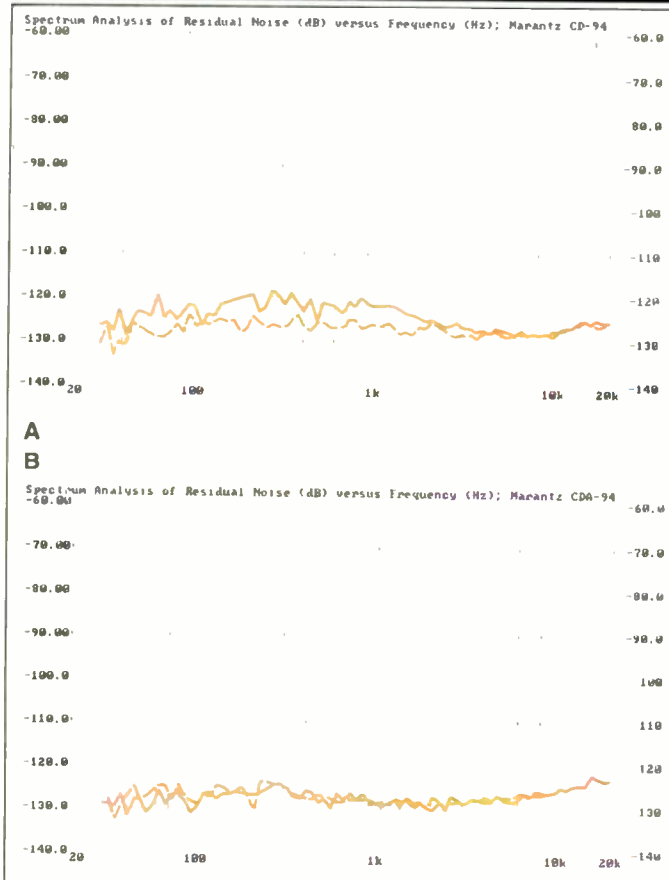


Fig. 3—Spectrum analysis of residual noise vs. frequency for "quiet" track of the CD-1 test disc, using the player alone (A) and the combination (B).

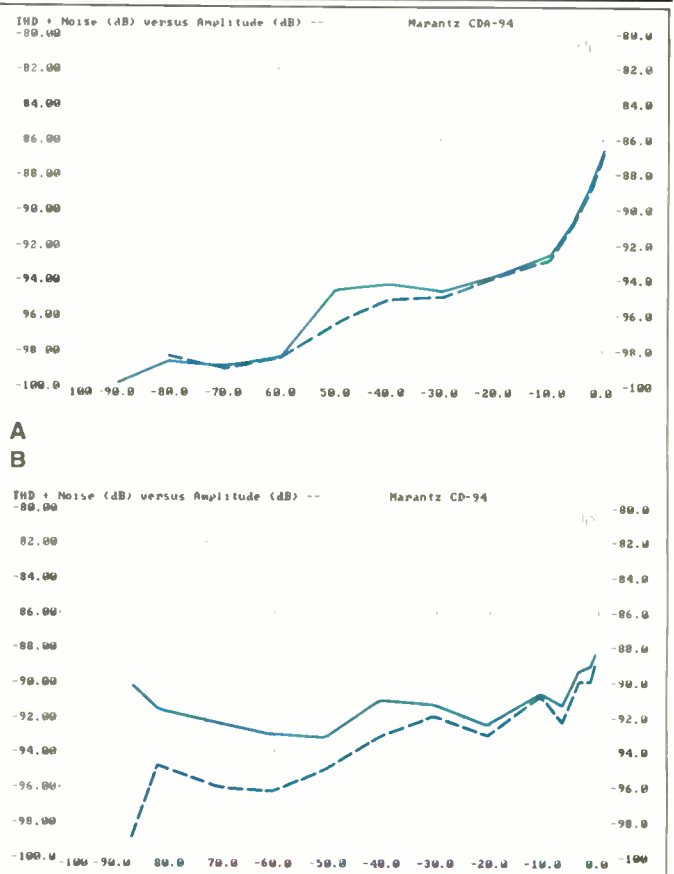


Fig. 4—THD + N vs. signal level for the player alone (A) and for the combination (B).

the lower edge of the display show the total number of tracks (up to 24) on the disc.

Ten small numbered buttons behind the hinged panel are used in programming by track, index, or time. Additional buttons determine the type of programming you want to do and the type of time display you want. You can select shuffle play, repeat mode, and automatic scan (to listen to the first 10 S of each track on a disc). Buttons for forward and reverse index, fast-forward, fast-reverse, and a timer on/off switch (for use with external timers) are also behind the hinged section. Most of the features on the front panel of the CD-94 are duplicated on its supplied remote control.

The CD-94's rear panel houses the optical and wired digital outputs in addition to the analog outputs. All signal output jacks, except the optical, are gold-plated. The panel also holds a switch and jack for use with a remote-control bus system used by several Marantz components.

CDA-94 Control Layout

At first glance, the CDA-94 D/A converter's front panel resembles that of the CD-94. It, too, has a display area and a hinged flip-down panel. The only controls visible when the hinged panel is shut are the power switch and a large rotary volume knob for the variable output terminals on the rear panel. The display area shows which input has been selected, whether the monitor switch is on or off, and which sampling frequency (32, 44.1, or 48 kHz) is currently being converted. A stereo headphone jack and level control are behind the hinged panel, as are switches for input selection, tape monitoring, and "Absolute Phase."

While the CDA-94 converter has both unbalanced and balanced analog outputs, the CD-94 player has only the unbalanced kind.

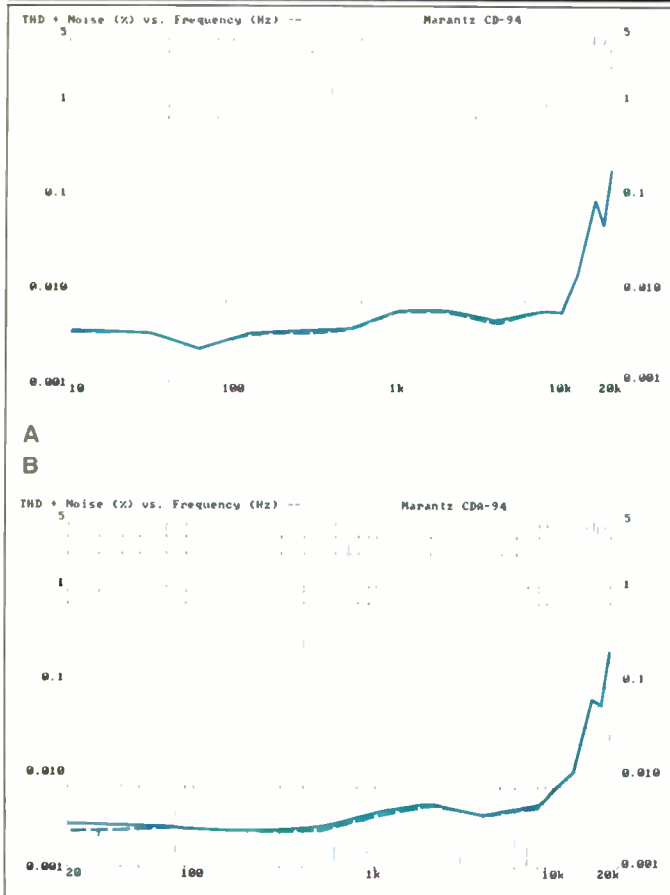


Fig. 5—THD + N vs. frequency, for signals at 0-dB (maximum) level, using the player alone (A) and the combination (B).

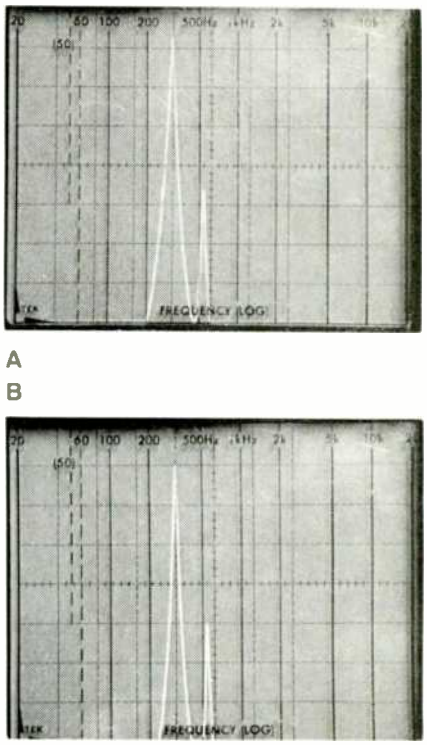


Fig. 6—Spectrum analysis of 20-kHz signal for the player alone (A) and for the combination (B). Note the 24.1-kHz "beat" tone. (Sweep is linear, from 0 Hz to 50 kHz, and vertical scale is 10 dB/div.)

The digital connections on the converter's rear panel include an optical input, two coaxial electronic inputs, and coaxial tape input and output jacks. The analog connections are all outputs, including fixed-level and variable unbalanced outputs and a pair of 600-ohm balanced outputs. A fuse-holder completes the rear-panel layout.

Measurements

Using mainly my EIA Standard test disc (the CD-1, produced by CBS Records) with my Audio Precision System One test setup, I measured most of the significant performance characteristics of the CD-94 and the CDA-94.

Frequency response of the CD player alone is plotted in Fig. 1A, while the results of combining the CD-94 and CDA-94 are shown in Fig. 1B. (In these and all subsequent graphs, figures labelled "A" apply to the CD-94 alone, and figures labelled "B" apply to the CD-94/CDA-94 combination. Where both solid and dashed curves are shown, the solid curve represents results for the left channel, and the dashed curve represents the right channel.) In order to detect any slight differences between the response of the CD player alone and that of the combination, I set the test system to plot all the way down to 5 Hz, instead of my usual 10- or 20-Hz cutoff. If you look very closely at Figs. 1A and 1B, you will notice that response of the CD-94 player alone was actually marginally flatter, down at the low end, than the combination. Both hookups yielded slight and almost identical degrees of ripple at the high frequencies, suggesting that the gentle analog filters following D/A conversion are identical in both components. Response was down only 0.1 dB at 20 kHz for the CD-94 alone and was down 0.2 dB for the tested combination.

Interchannel phase response was perfect when using just the CD player (Fig. 2A) and was equally perfect using the

The CDA-94 has both optical and coaxial inputs for two digital sources, plus one digital tape loop for DAT.

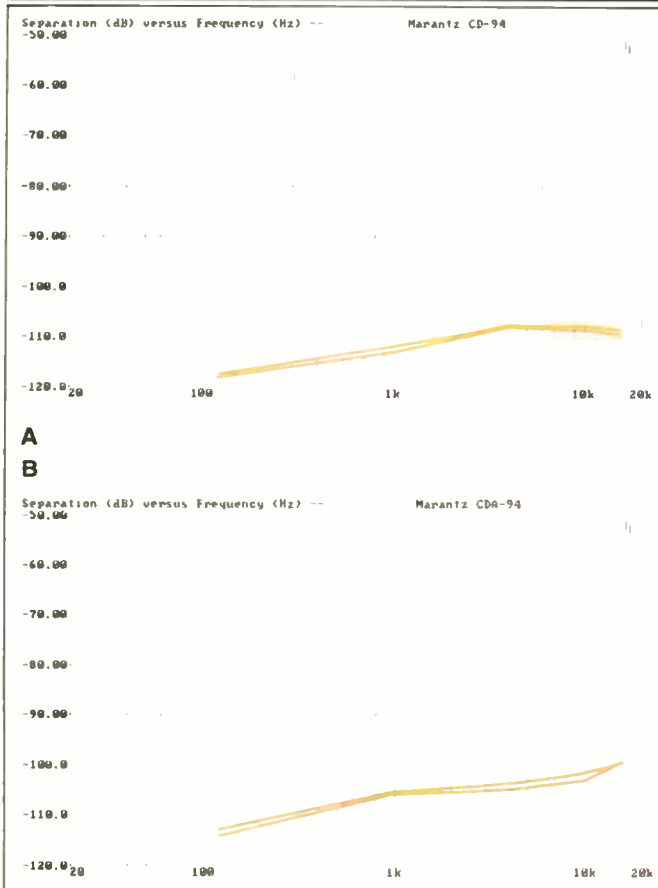


Fig. 7—Interchannel separation for the player alone (A) and for the combination (B). Leakage between channels was almost identical in both directions.

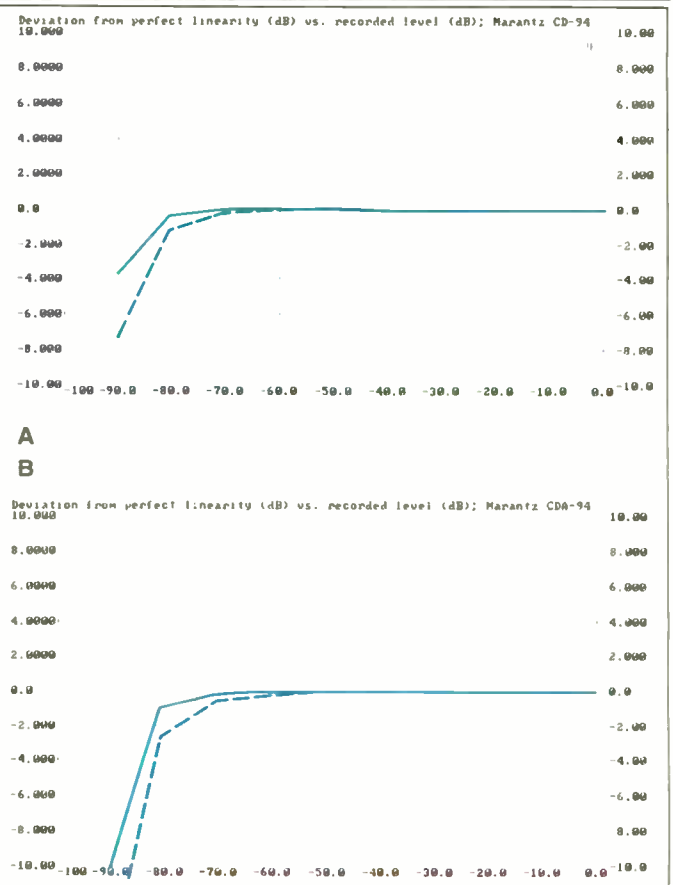
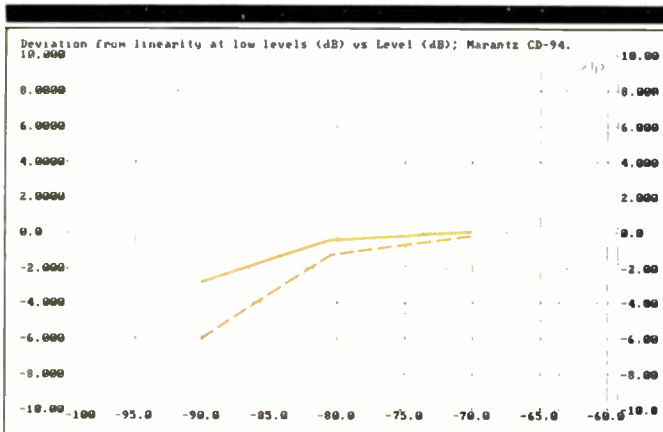


Fig. 8—Deviation from perfect linearity for undithered signal, using the player alone (A) and the combination (B).

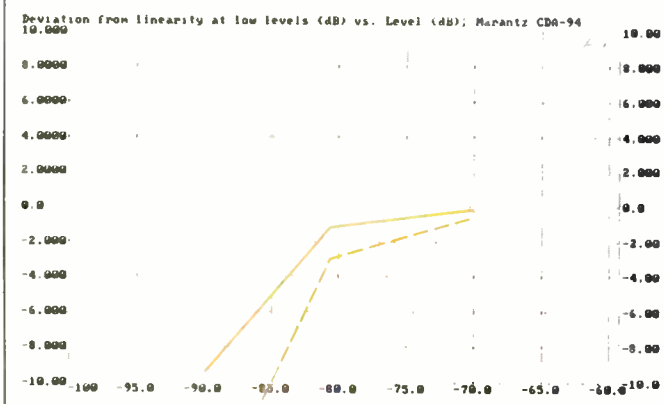
CD-94/CDA-94 combination (Fig. 2B). One advantage claimed for the CDA-94 did show up when I measured overall A-weighted S/N ratio for both hookups. The player alone yielded −112.23 dB for the left channel and −114.53 dB for the right. Measuring S/N via the outputs of the CDA-94 yielded marginally higher figures: −115.56 for the left channel and −115.89 dB for the right. As I have pointed out in previous reports, these S/N results are really a measure of the analog output stage's noise characteristics instead of an indication of the effectiveness of the D/A conversion process. Track 4 of the CD-1 test disc is an "infinity zero" track; it does not exercise the D/A converter circuitry of a CD player or of a stand-alone D/A converter. So, what's been shown by this test is that the CDA-94 has a quieter analog stage than the CD-94. If you will recall, that was one of the claims Marantz made for this separate D/A converter. Figures 3A and 3B seek to determine in which section of the audio spectrum the CDA-94's analog stage excels in its low-noise characteristics. Using the ⅓-octave spectrum-analysis function of the Audio Precision test system, I plotted residual noise versus frequency for both setups. In the region between about 100 Hz and 2 kHz, it is clear that the CD-94 operating alone exhibited more residual noise, especially in the left channel.

Figures 4A and 4B show how THD + N varied as a function of recorded level. In these graphs, THD + N is shown as dB below maximum recorded level. Ideally, these curves should be virtually horizontal. In fact, you can see that at recorded levels approaching maximum, the analog section of the CD-94 begins to contribute distortion. At 0 dB, the overall THD + N is only 86.7 dB below maximum recorded level. For the CD-94/CDA-94 combination, the

The D/A circuits on the CD-94 player and CDA-94 stand-alone converter are of the same type, but the CDA-94 is more elaborate.



A



B

Fig. 9—Deviation from perfect linearity for low-level, dithered signal, using the player alone (A) and the combination (B).

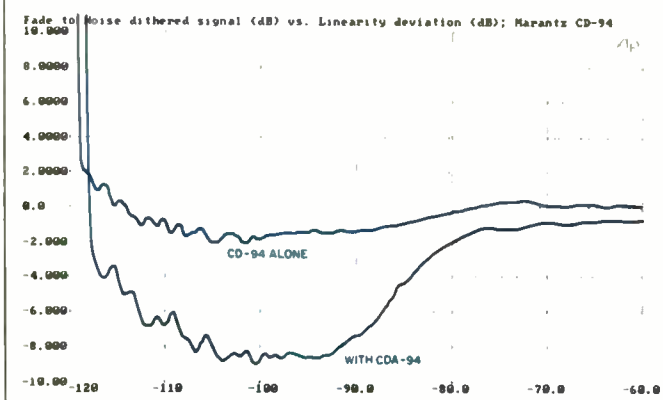


Fig. 10—Linearity deviation for EIA "fade-to-noise" test of dynamic range, using dithered signal.

results at maximum recorded level are −88.5 dB for the left channel and −89 dB for the right channel. These figures show that although the CDA-94 D/A converter has higher noise and distortion at all levels below about −18 dB, its analog output section has a bit more headroom than does the CD-94 Compact Disc player's.

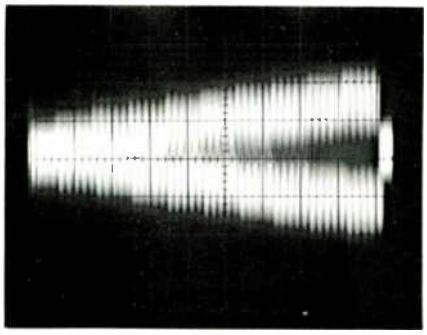
For a signal recorded at 0-dB (maximum) level, THD + N at 1 kHz measured 0.006% for the player alone (Fig. 5A). Using the combination, THD + N for the same test tone was slightly lower for the left channel, 0.004%, and even a bit lower for the right (Fig. 5B). I was disappointed, though, in the fact that at 20 kHz, the "beats" associated with most (but not all) CD players were present, regardless of whether I measured the CD-94 alone or with the D/A converter. In either case, apparent THD + N was 0.2% at 20 kHz. Of course, this higher figure does not represent actual harmonic distortion. It is a measure of the beat-frequency component that shows up when a 20-kHz test signal combines with the CD's sampling rate of 44.1 kHz to create a spurious out-of-band component at 24.1 kHz (Figs. 6A and 6B). For both hookups, the 24.1-kHz beat was exactly 40 dB below the desired 20-kHz signal. Using the CDA-94 offered no advantage here.

Figures 7A and 7B show how separation varied with frequency for both test setups. In these figures, both channels are represented by solid curves, and there is virtually no difference between left and right. For the CD-94 alone, separation at 1 kHz was 112 or 113 dB, depending on the channel measured. At 16 kHz, this player offered 108 or 109 dB. Surprisingly, separation for the combination was somewhat less than that of the CD-94 by itself, although the results were still more than adequate for excellent stereo, by anyone's criteria. Despite the extra care taken in the construction and layout of the CDA-94 as described by Marantz, it is nonetheless interesting to note that separation for the combined setup was around 105 dB at 1 kHz and just under 100 dB at 16 kHz.

Figures 8 through 11 are all concerned with the characteristics of the digital-to-analog converters used in the CD-94 and the CDA-94. In particular, these figures give us some idea about the linearity (or lack of it) of the D/A converter components in these two units.

For Figs. 8A and 8B, I first measured the linearity of the systems from 0 dB (maximum recorded level) to −90 dB, using a track of the CD-1 test disc that contains undithered signals at gradually decreasing discrete recorded levels. Then, rather than plot the results as input versus output, I let the Audio Precision test system translate the results into deviation from linearity, which is much easier to interpret. Using these undithered signals, linearity of the CD-94 was excellent down to −80 dB. However, as expected, the player departed from linearity for the −90 dB recorded level by a modest 3.8 dB in the left channel and 6.5 dB in the right. In the case of the CDA-94, deviation from perfect linearity was greater at −80 dB than it was for the CD-94, and was off the graph at −90 dB. I am forced to use the test disc's entire undithered sweep, from 0 to −90 dB, even though undithered signals do not give very meaningful results below −80 dB for this test. Therefore, I didn't draw any final conclusions about the CDA-94's performance. Yet con-

Extensive listening made it obvious that this CD player not only was packed with features, but sounded good.



A
B

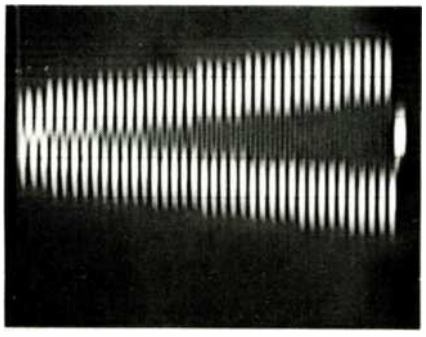
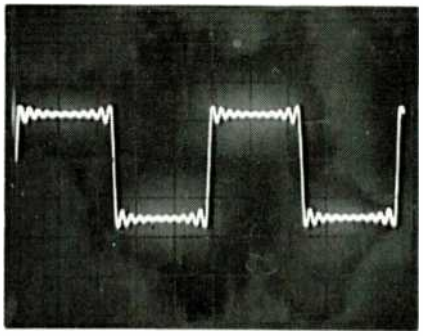


Fig. 11—Monotonicity test for the player alone (A) and for the combination (B).



A
B

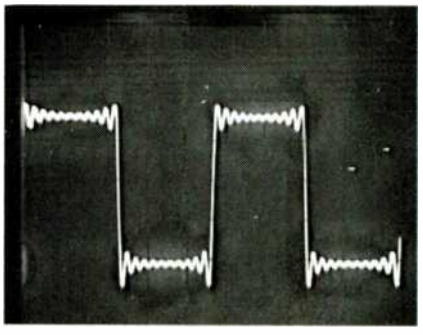


Fig. 12—Reproduction of 1-kHz square wave by the player alone (A) and by the combination (B).

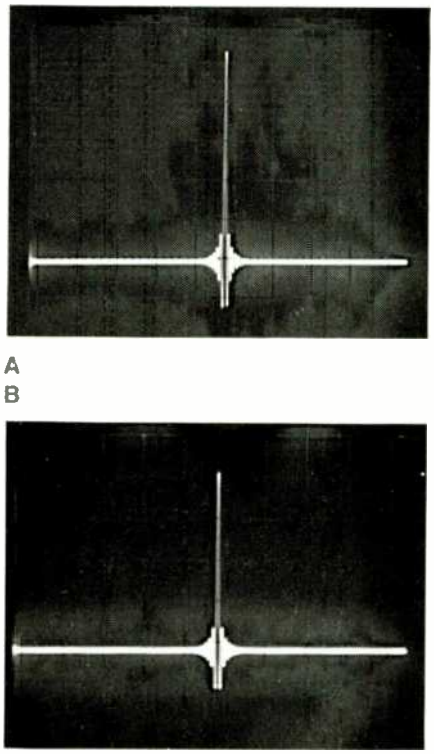
sider what happened when I used dithered signals to check low-level linearity. For the player, the deviation was less than 3 dB at the −90 dB level for the left channel and nearly 6 dB for the right (Fig. 9A). Now take a look at Fig. 9B. These results were obtained using the CDA-94 as the D/A converter and applying the same low-level, dithered signals from the test disc. Once again, the CDA-94 curves fall off the graph.

On the "fade-to-noise" signals of the test disc, the signal starts out at −60 dB and fades linearly into the noise level, or down to −120 dB, in less than 30 S. A special procedure of the Audio Precision test gear translates this changing signal into a plot of deviation from linearity, and, as you can see in Fig. 10, the CD-94 operating by itself is far and away the winner in this case, too!

The last test track of the CD-1 is called a monotonicity test. Ideally, in Figs. 11A and 11B, you should see the signals rising in equal steps, with the negative-going signals having the same amplitude steps as the positive-going signals. For the player alone, this was essentially true. In Fig. 11B, using the separate converter, you can see that the second, third, and fourth steps from the left exhibit an asymmetry between their top and bottom edges. This suggests less than perfectly linear operation of the CDA-94's D/A converter components.

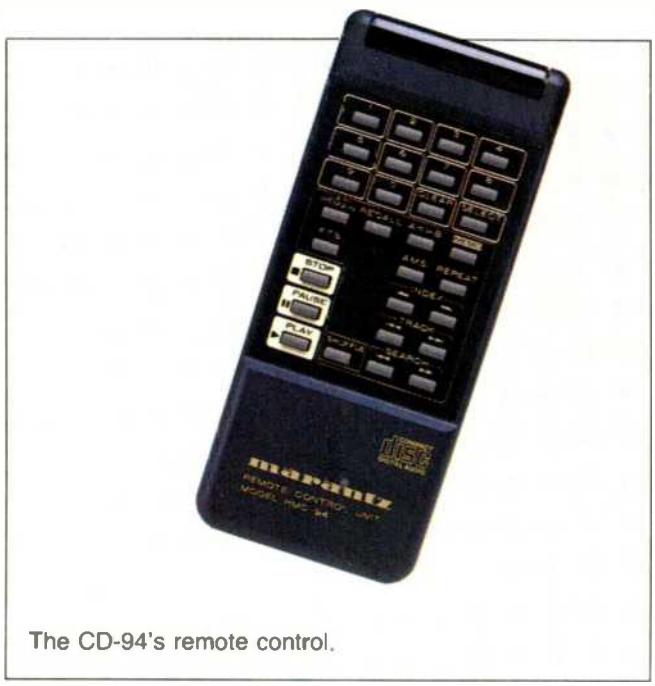
Theory tells us that the maximum dynamic range that one can obtain using the EIA's proposed method of measurement (assuming "perfect" D/A converter chips) is just over 98 dB. Readings of more than 98 dB actually indicate nonlinearities in the D/A chips. Based on the fade-to-noise test discussed earlier, I would have come up with a much higher dynamic range figure. This suggests again that the D/A chips in both the CD-94 and the CDA-94 are less than perfect, with the chips in the CD-94 the better of the two. Using the simpler EIAJ method of computing dynamic range, I came up with readings of 87.1 dB for the CD-94 and an even better figure of 92.7 dB for the left channel and 95.9 dB for the right with the CDA-94. The player, as might be expected, exhibited no measurable level of wow and flutter, and clock accuracy was within 0.0139% of being perfect.

The performance differences between the player and the player/converter combo are more visible in the graphs than they were audible.



A
B

Fig. 13—Single-pulse test for the player alone (A) and for the combination (B).



The CD-94's remote control.

Figures 12A and 12B show how a 1-kHz square-wave test signal was reproduced by the CD-94 alone and by the combination. The vertical scales on my oscilloscope were set a bit differently for the two photographs, but I could detect no significant difference between the two resulting waveforms. The same held true for Figs. 13A and 13B, which show how a unit pulse was reproduced in both test setups. In testing the CDA-94, it was gratifying to note that the polarity of the unit pulse was correct when the unit's phase-reverse switch was in its normal position.

Use and Listening Tests

I listened extensively to the CD-94, operating alone, and was very pleased with what I heard. I have recently acquired a new set of reference loudspeakers, the Infinity RS 9 Kappa units, and I must say that it has taken me awhile to get used to their awesome bass response and somewhat more brilliant high end. All of us tend to get used to our loudspeakers, and when we finally change (and we surely must from time to time, as the state of the art improves), it takes a period of adjustment to become familiar with their "new" sounds. Nevertheless, given some of the most recent CDs in my collection, such as a Telarc recording of Mozart's Symphonies Nos. 25, 28, and 29 (CD-80165) and a Delos recording of Rachmaninoff's Symphony No. 2 (DCD-3071), it was obvious that I was dealing with a good-sounding CD player. Moreover, its many conveniences—such as Favorite Track Selection, shuffle play, and extensive programming facilities—make it one of the more full-featured players that have passed through my lab and listening room recently.

The real evaluation started when I hooked up the CD-94/CDA-94 combination. All listening tests for this pairing were done using optical coupling between the two units. I selected this method because Marantz and others claim that it will provide audibly better results than a wired digital-to-digital connection. (The same hookup mode had been used for the bench measurements.)

During normal listening, I could not detect any difference in sound quality between the two setups. Oh, every once in awhile, I seemed to think that one or the other sounded better on certain passages of music, but with careful level matching, I found it almost impossible to favor one hookup over the other in an overall sense. There were moments, in the quieter passages of the Rachmaninoff recording, when I felt that the CD-94 alone provided a cleaner, more transparent sound. Switching to the combination, during those same quiet passages, seemed to add a bit of sheen to the string sounds. Though not unpleasant, the string sound did not seem totally lifelike to my ears.

The CD-94 does not boast the linearity of some other high-end players I have tested recently, yet it certainly has many compensating features that may justify its high price. I'm afraid the same cannot be said of the CDA-94 converter. If the sample I tested is representative of the full production run, I can see only one reason for spending as much money to own this component as for the player alone: The need for D/A conversion of sampling rates other than the CD's 44.1 kHz. Even so, there are other D/A converters that cost less and do a better overall job. Marantz seems to have batted .500 with this pair. *Leonard Feldman*