EQUIPMENT PROFILE

TECHNICS RS-DC10 DCC RECORDER

So far, I have tested and evaluated three Digital Compact Cassette (DCC) recorders. In case anyone tells you that all DCC machines are pretty much the same, let me assure you that they are not. I found the Technics RS-DC10 to be the easiest to use, requiring the fewest references to its owner's manual (which has 61 pages). Perhaps that's because I've already worked my way through two other DCC machines, but I think it's more a matter of better ergonomics and better labelling and positioning of controls.

Like all DCC recorders, the RS-DC10 automatically distinguishes between DCC and conventional analog tapes. Its two-motor drive system uses separate d.c. motors for the capstan and the reels. The chief difference between this transport and previous cassette drive systems lies in its servo control. A DCC deck records at constant speed but makes slight adjustments during playback. DCC decks also buffer recovered data to help minimize wow and flutter.

The RS-DC10's turnover head assembly uses a magnetoresistive thin-film head that includes nine tracks with 0.5-micron gaps for digital recording, nine tracks with 0.3-micron gaps for digital playback, and two analog playback tracks. No erase head is needed; digital recording is done by overwriting, and the RS-DC10 does not record analog tapes.

DCC TRANSPORTS MAKE SLIGHT, CONTROLLED SPEED ADJUSTMENTS DURING PLAYBACK.

To convert analog signals to digital format, the RS-DC10 uses a one-bit A/D converter and two delta-sigma modulators with 64-times oversampling. This A/D converter also has a built-in digital filter and sample-and-hold circuitry. The playback circuitry uses a one-bit D/A converter with third-order noise shaping. All of the PASC bit-rate reduction processing associated with the DCC format is accomplished by four chips.

One difference between DCC and analog cassette decks manifests itself as soon as you load a DCC tape: The deck winds the tape for a few seconds to read its Table of Contents. (Similar TOCs are found on CDs, MDs, and prerecorded DATs.)

Control Layout

The RS-DC10 provides just about every feature of the DCC format. The power switch is at the lower left of the front panel. Above it is a "timer" switch for use when an external timer has been connected to the unit. Further up is the section for marker controls. Its six buttons are used for writing track-start markers automatically or manually, renumbering tracks, writing "Next" and "Reverse" markers, and erasing markers. In playback, when a DCC machine finds a "Next" marker, it switches from side A to side B (or vice versa), rewinds to the beginning of that track, and then starts play. When the machine finds a "Reverse" marker, it switches tape sides and then starts play immediately.

Next to "Timer" is a noise-reduction switch, with settings for Dolby B and C NR (and an "Off" position) for use when playing back analog cassettes. Flanking the cassette drawer at the upper midsection of the panel are four tiny buttons for resetting the counter, selecting repeat play, changing mode of the counter display, and selecting text information. (The amount of text available on a prerecorded DCC tape is dependent on the software manufacturer and may include such things as overall album title, artist's name, and track title. Further to the right are the "Open/Close" button for the cassette tray and three controls used in recording: An input selector (with settings for unbalanced analog, fiber-optic digital, and

coaxial digital inputs), a large master level control, and a channel-balancing pot.

Along the lower edge of the front panel are buttons for "Side A/B" selection, forward and reverse track-skip, "Append" (to find the end of a partially recorded tape), and the usual tape-transport functions (recording, playback, rewind, "Stop," fast forward, and auto record mute for recording blank spaces between tracks). Farther to the right are the headphone jack and its level control.

Below the cassette drawer is the display. The display's alphanumeric section shows counter number or time (total remaining, total elapsed, or elapsed within the track), transport mode, and any text available on a DCC recording. It also shows track numbers for all prerecorded DCC tapes and for all home-recorded tapes whose makers have specifically included them. In addition, small flags light up to inform you about tape direction (side A or B), Dolby NR status, marker types and locations, sampling frequency, selected input, and, when applicable, digital copy-prohibition. (United States law now requires SCMS

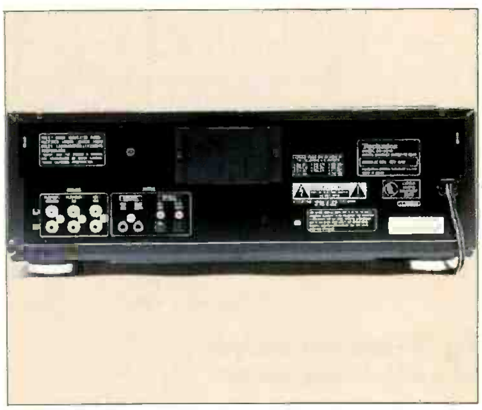
NONE OF US HEARD ANY DIFFERENCE IN MUSICAL INTEGRITY OR ACCURACY BETWEEN CDs AND DCCs MADE FROM THEM.

copy-limitation circuitry in all home digital recorders, and SCMS is therefore included in the specifications for both DCC and its rival MiniDisc format. All home DAT recorders now include SCMS, too.)

The supplied remote control duplicates just about all of the front-panel control functions and has numerical buttons for direct access to any track and a button for scanning and playing back the first 10 S of each track on a DCC tape. The remote also has buttons to control the variable-level output jacks on the rear of the RS-DC10. That rear panel carries jacks for fixed-level analog output, analog input, and both coaxial and optical digital inputs and outputs.

Measurements

In testing the performance of the RS-DC10, I first checked record/playback frequency response using the analog inputs and outputs to record a sweep of frequencies onto a blank DCC tape. Results are shown in Fig. 1A, with response perfectly flat from 20 Hz to 20 kHz and a minor channel imbalance of less than 0.3 dB.



SPECS

Digital Cassette (DCC)

Frequency Response: 44.1-kHz sampling, 10 Hz to 20 kHz, ±0.2 dB; 48-kHz sampling, 10 Hz to 22 kHz, ±0.2 dB; 32-kHz sampling, 10 Hz to 14.5 kHz, ±0.2 dB.

THD: Playback, less than 0.003%; record/playback, less than 0.005%.

S/N: Playback, greater than 98 dB; record/playback, greater than 92 dB.

Dynamic Range: Playback, greater than 95 dBA; record/playback, greater than 92 dBA.

Channel Separation at 1 kHz: Playback, greater than 95 dB; record/playback, greater than 80 dB.

Analog Cassette

Frequency Response: Type I tape, 30 Hz to 15 kHz, ±3 dB; Type II tape, 30 Hz to 16 kHz, ±3 dB; Type IV (metal) tape, 30 Hz to 17 kHz, ±3 dB.

S/N (re: 250 nWb/m with Type II Tape): Without noise reduction, 56 dB; with Dolby B NR, 66 dB; with Dolby C NR, 74 dB.

Wow and Flutter: 0.07% wtd. rms, ±0.12% wtd. peak.

Input & Output Levels

Minimum Analog Input Level: 60 mV.

Fixed Analog Output Level: 500 mV (maximum, 2 V).

Headphone Maximum Output: 30 mW/channel, 32 ohms.

Headphone Matching Load Impedance: 8 to 600 ohms.

General Specifications

Fast Forward/Rewind Time: Approximately 100 S with D-60 tape.

Power Requirements: 120 V a.c., 60 Hz, 42 watts.

Dimensions: 16$\frac{15}{16}$ in. W × 6 in. H × 13$\frac{7}{16}$ in. D (43 cm × 15.3 cm × 34.1 cm).

Weight: 18.3 lbs. (8.3 kg).

Price: $999.95

Company Address: One Panasonic Way, Secaucus, N.J. 07094.

For literature, circle No. 90

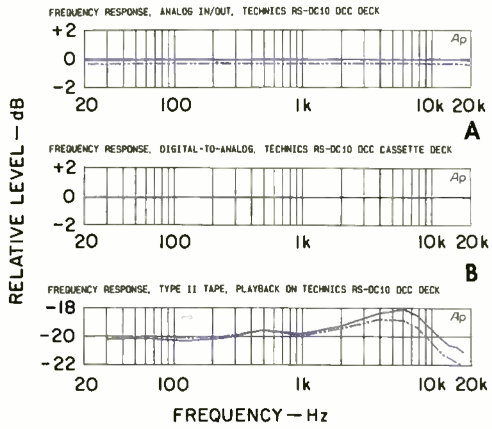


Fig. 1—Frequency response for record/play via analog (A) and digital inputs (B) and for playback of Type II analog cassette (C).

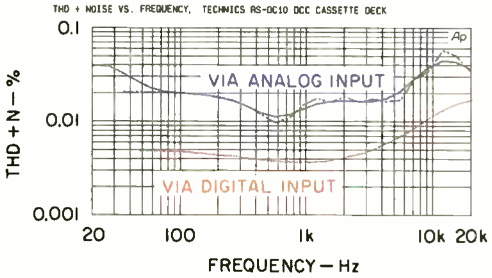


Fig. 2—THD + N vs. frequency for DCC record/play.

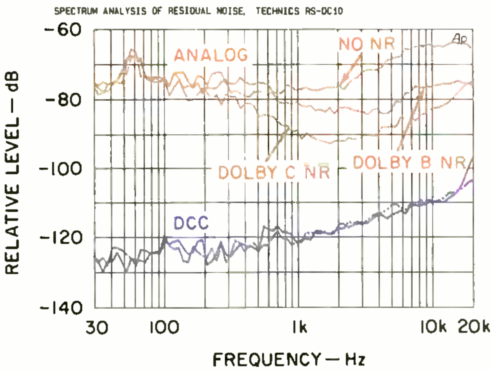


Fig. 3—Spectrum analysis of residual noise; see text.

For Fig. 1B, I fed a digital frequency sweep from my Audio Precision system to the RS-DC10's digital inputs. Response is even flatter than before, and this time there is no measurable amplitude difference between channels. Since one of the features of the DCC format is its backwards compatibility with analog cassettes, I next checked frequency response for playback of a Type II cassette, using a BASF test tape with spot frequencies from 31.5 Hz to 18 kHz (Fig. 1C). Response is actually much better than claimed by Technics; it extends out to the top test frequency of 18 kHz, with no more than about 1 to 1.5 dB of attenuation at that frequency and a slight rise from about 2 to 10 kHz. That's considerably better than many high-priced analog cassette recorders can do.

Returning to DCC mode, I measured THD + N versus frequency (Fig. 2). For analog input signals, the results range from about 0.01% to 0.02% over much of the audio spectrum, increasing to around 0.04% at 20 Hz and at 20 kHz. As expected, THD is even lower for digital signals fed via the coaxial input, just under 0.004% at 1 kHz and rising to 0.018% at 20 kHz.

To isolate the actual harmonic distortion components from the residual noise of the system, I conducted an FFT spectrum analysis of a 1-kHz digitally recorded signal at maximum level (not shown). The most significant actual harmonic was at 2 kHz and was 103 dB below maximum recorded level, which corresponds to a THD percentage of less than 0.001%!

Signal-to-noise ratio of the RS-DC10, for a "digital zero" signal recorded through the digital inputs, was 98 dBA for the left channel and 98.6 dBA for the right channel. It is worth noting that a spectrum analysis of the residual noise (Fig. 3) shows not the slightest trace of the 60-Hz a.c. line frequency or its harmonics.

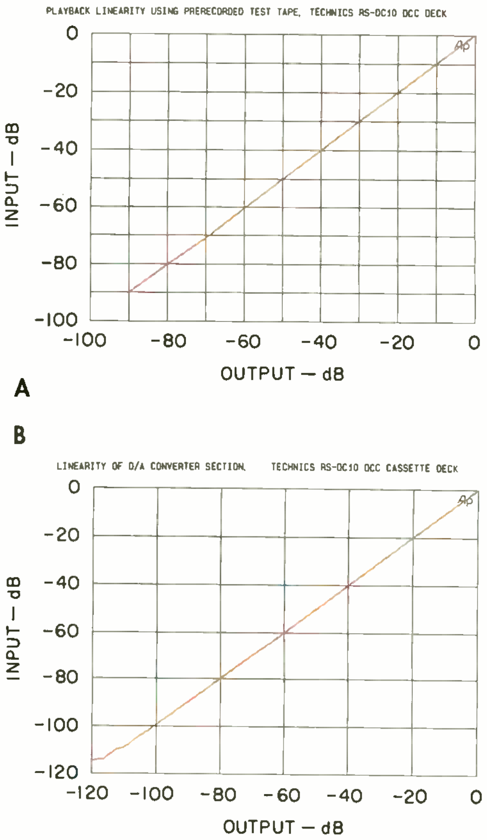


Fig. 4—Input vs. output linearity, for prerecorded DCC test tape (A) and for record/play via digital input (B).

Returning to analog tape, I played back a previously recorded "no-signal" Type I analog cassette and measured its signal-to-noise ratio without and with Dolby B and C noise reduction. The A-weighted readings were 57 dB without Dolby noise reduction, 66.2 dB using Dolby B NR, and 73.6 dB using Dolby C NR. Of course, these results would be different if I had used another tape formulation or brand. A spectrum analysis of residual noise for playback of the analog "no-signal" tape (Fig. 3) clearly illustrates the beneficial effects of Dolby B and C NR.

ON ANALOG TAPES, THE RS-DC10 IS FLATTER THAN MANY EXPENSIVE ANALOG DECKS, AND ON DCC IT'S FLATTER STILL.

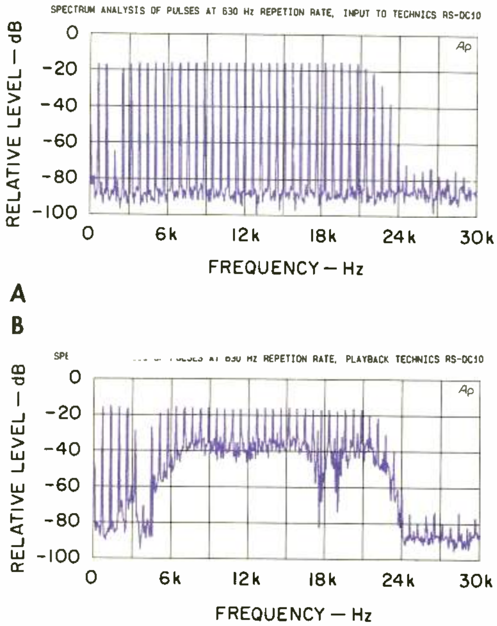


Fig. 5—Spectrum of digital pulse signal with 630-Hz repetition rate, as fed from CD through RS-DC10 (A) and after record/play (B).

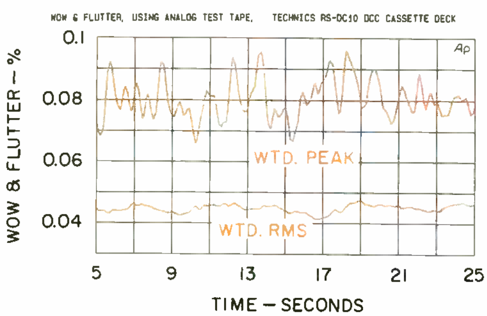


Fig. 6—Wow and flutter in analog playback.

Once again in the DCC mode, I measured the linearity of the system. Figure 4A shows the results for playback of a prerecorded test tape supplied by Philips; there is virtually no deviation from perfect linearity over the range from 0 dB (maximum digital recorded level) down to –90 dB. Using digital signals from my Audio Precision test set, I could measure down to –120 dB (Fig. 4B), finding nearly perfect linearity down to at least –100 dB.

As in previous tests of DCC recorders, I wanted to see if I could detect the action of the PASC bit-rate reduction system. Because ordinary single-tone test signals will not serve to illustrate this action, I had to use a special signal consisting of a unit pulse having a repetition rate of 630 Hz, which I fed from a Philips test CD via the RS-DC10's digital input. Figure 5A shows the harmonics in the complex input signal, prior to recording and playback. By contrast, Fig. 5B shows what happens to this signal when it is encoded and decoded for playback using the PASC bit-rate reduction system. As in a test of another DCC recorder, the noise floor over much of the audio spectrum increases by nearly 40 dB. Listening tests using music, however, revealed that this increase in measured noise has no audible effect. Neither I nor several guest listeners were able to detect any difference in musical integrity or accuracy when comparing DCC recordings with the CDs from which they were made. Interestingly, this was not the case when I first listened to such comparison tests more than a year ago. It seems obvious to me that the PASC encoding algorithm has been tweaked since then; the PASC system allows improvements in encoding to be heard even without improved decoders.

For my final bench test, I reverted to analog tape to measure the transport mechanism's wow and flutter. (There is no measurable wow and flutter when playing back DCC tapes.) The wtd. rms reading hovers between 0.04% and 0.05%, as can be seen in Fig. 6, while the wtd. peak (IEC) wow and flutter ranges from about 0.07% to about 0.095%. These are very respectable results for any analog cassette player.

Use and Listening Tests

As I indicated at the beginning of this report, the RS-DC10's layout is superb, as is its styling. Mechanically, the unit performed flawlessly. I was particularly impressed by its excellent text display facilities and by its truly full-function remote control. With the remote, you can control all recording or playback functions, including track marking and numbering, from the comfort of your listening position.

THE PASC ENCODING SYSTEM HAS OBVIOUSLY BEEN IMPROVED SINCE I FIRST HEARD IT.

The folks at Technics were kind enough to send along a prerecorded DCC sampler from GRP (GRX-9997). This tape has a wide variety of big-band music, including such favorites as "Fascinating Rhythm" interpreted by Dave Grusin and "In the Mood" by the Glenn Miller Orchestra. All 12 tracks were reproduced flawlessly. I particularly enjoyed the noise-free reproduction of this and other DCC prerecorded cassettes I have collected.

However, I am still somewhat bothered by the slow access times of the DCC decks I've reviewed so far. To play track 6 of the GRP sampler (the last track on side A of the cassette), I had to wait 90 S while the mechanism wound its way from the start of side A to the last track on that side. The actual playing time of tracks 1 through 5 that had to be traversed was only 23 minutes, 35 seconds. I guess I'm just too used to the instant access of CD players and the more rapid (though certainly not instant) access of DAT recorders. Of course, this will be of little concern to me when I play classical DCC tapes from start to finish, but I recognize that most DCC tapes (whether prerecorded or user-recorded) consist of several short tracks. Accessing a track that's deep into a tape side just seems to involve an endless wait.

As a home DCC deck, the Technics RS-DC10 is an outstanding example of superb mechanical and electronic engineering. Its suggested retail price of just under $1,000, however, suggests to me that it may be a fairly long time before DCC replaces analog cassette—especially since inexpensive personal portable players are now the chief hardware used for playing music from analog tapes. *Leonard Feldman*