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TECHNICS SV-P100 DIGITAL AUDIO CASSETTE RECORDER

Manufacturer's Specifications

Frequency Response: 2 Hz to 20 kHz, +0, −2.5 dB.

Total Harmonic Distortion: 0.01% or less.

PCM Standard: EIAJ.

Quantization: Linear, 14-bit.

Tape Type: VHS format videocassette.

Maximum Recording Time: Two hours.

Audio Channels: Two.

Input Levels: Line, 80 mV; mike, 1.5 mV.

Digital Input/Output Level: 1.0 V p-p.

Line Output Level: 400 mV.

Power Consumption: 80 watts.

Dimensions: 16.9 in. (42.92 cm) W x 10.94 in. (27.78 cm) H x 13.62 in. (34.59 cm) D.

Weight: 46.2 lbs. (20.79 kg).

Price: $3,000.00.

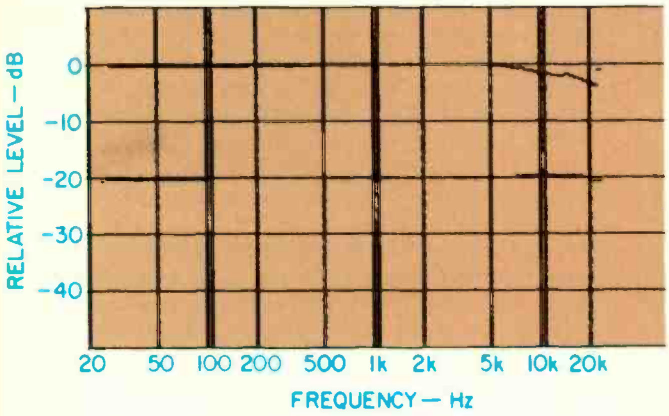
It appears there will be two distinct approaches to PCM (digital) tape recording for home use. For the March 1982 issue of *Audio*, I tested the Sony PCM-F1—a PCM audio processor which is intended to work in conjunction with a videocassette recorder. While Technics has experimented with this approach in producing the Model SH-P1 PCM processor, they presently seem to favor an all-in-one or "dedicated" digital audio recorder which would contain the required digital record/play electronics as well as a complete videocassette tape-transport mechanism. Since Matsushita Electric Company, the parent of Technics and Panasonic, subscribes to the VHS format of videocassette taping developed by its sister company, JVC (there is no end to the intercorporate relationships of Japanese industrial giants), it comes as no surprise that the SV-P100 utilizes VHS-style videocassettes as its digital program storage medium.

One of the chief differences between Beta and VHS video tape formats is the fact that VHS tapes are disengaged ("unthreaded") from the fast-rotating record/play head drum whenever the tape transport's stop button is depressed, whereas Beta tapes remain "threaded up" and ready to go. To compensate for this difference in tape-transport mechanisms, Technics has developed a wide variety of locating and editing features for the SV-P100 digital audio cassette recorder. The deck will, for example, shift into play mode automatically from fast-forward, rewind, or search if the play key is pressed while holding down the fast-forward, rewind, or search key. Holding down the play key while pressing the fast-forward key, on the other hand, causes the tape to progress at approximately eight times normal speed while maintaining head contact to allow headphone monitoring and cueing. Holding down the play key while pressing the rewind key makes the tape rewind at eight times normal speed while also allowing headphone monitoring and cueing.

Special circuits combined with use of the SV-P100's digital tape counter offer additional editing facilities and convenience features. For example, pressing the *Jump Mark* lever on the front panel during recording *or* playback causes a "jump mark" to be recorded on one of the auxiliary tape tracks that have been provided for in the EIAJ Digital Tape Standard. When such a jump mark code is encountered during playback, this section of the tape is skipped over at eight times normal speed. Normal speed playback is resumed when the end of the jump mark is reached. This proves to be a very convenient way of editing out unwanted material. Search marks may also be recorded onto a tape during recording or playback. Later, during playback, if the front-panel search key is pressed, the tape advances to the beginning of the nearest search mark and stops. If the play key is pressed at the same time as the search key, play begins automatically after the beginning of the search mark has been reached.

The tape counter reading can be placed into the "memory" of the recorder by pressing the memory button during recording or playback. The tape will then stop at the memorized setting or location during fast forward or rewind. After locating the desired setting, the tape will stop, but if the play key is also depressed while the fast-forward or rewind

The Technics SV-P100 contains digital record/play electronics as well as a complete videocassette tape-transport mechanism.



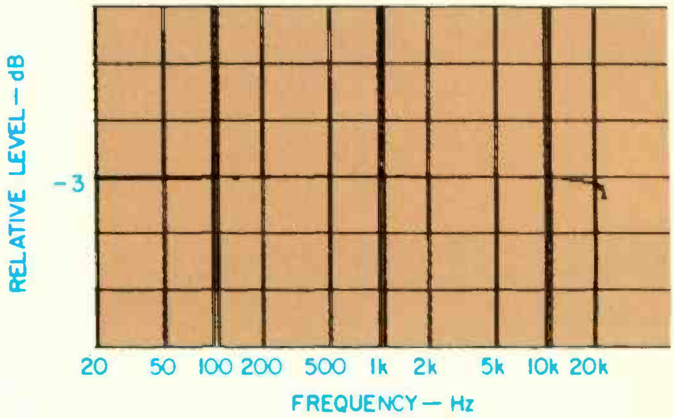


Fig. 1—Record/play response of Technics SV-P100 PCM recorder at 0 and −20 dB levels (A) and at −3 dB level (B).

key is held down, the tape will automatically shift to playback.

Physically, the SV-P100 is about the size of a very large stereo cassette deck or one of the late, lamented Elcaset recorders of yesteryear. When you consider the amount of circuitry (not to mention the precision VHS tape-transport mechanism) that had to be incorporated into this unit, its dimensions and weight have been kept within remarkably reasonable bounds. According to Technics, the recording digital-signal processor chip, an LSI known as MN-6601, has the equivalent of about 10,000 conventional components, yet the chip size is a mere 6.08 x 5.58 millimeters. The reproducer LSI, MN-6602, measures only 6.46 x 6.18 millimeters but has the equivalent of around 15,000 components! The MN-6601 LSI serves to add error detection code, correction code and data interleave processing to the A/D converted data, and it supplies a composite video-format video output signal. The MN-6602 decodes the digital signal, carries out error correction and data interleave processing, and provides a resulting signal to the D/A converter as serial data. The D/A converter developed for this unit is known as an MD-6192 and is a 14-bit linear converter.

Control Layout

Aside from the various specialized editing functions described, controls associated with timer-activated recording, and a few indicator lights specifically associated with the VHS type of video tape-transport mechanism, the other controls of the SV-P100 will be fairly familiar to most users of home cassette recorders. Major logic-type transport touch buttons include keys for search, pause, rewind, stop, play, fast forward, and record. The cassette compartment is opened and closed by a separate button, but the compartment will also close smoothly and automatically when a cassette is properly inserted into the holder. The forward edge of the recorder has headphone and microphone jacks, the main power switch, and a remote control jack for connection of a soon-to-be-available wired remote control unit which will duplicate the recorder's transport operating functions. The front sloping horizontal surface of the deck, in addition to housing the transport touch buttons, features a novel fader or master level control whose rotation span is only 150°—enabling you to accomplish a complete, smooth fade in one motion. Individual channel level controls are found on the main vertical surface of the deck, as are the meter level indicators which double as a metering system for checking tape playback quality and data and as a peak-hold indicator. Other indicators in this area include those for dew, digital input, rewind-reset, tape counting, and level selection. Controls associated with the editing and memory functions are also located in the vicinity of the display panel.

The rear panel, in addition to housing the line input and output jacks, contains digital input and output terminals (for direct digital-to-digital copying or dubbing), a tracking adjustment screw, a timer recording switch (which actually turns on an hour before you want recording to begin, so as to evaporate any moisture which may be present on the head assembly), and an edit switch which can be turned off if the editing features are not going to be used.

Measurements

Once again, my Sound Technology Model 1500 tape tester was taxed to, and beyond, its limits in attempting to measure all of the performance parameters of this digital tape recorder. While the test instrument's own residual noise and distortion are normally far lower than what one would expect to measure for *any* analog tape recorder, when the 1500 is called upon to measure a digital recording system such as the Technics SV-P100, it is not always good enough. Frequency response measurement was, of course, Technics developed a variety of locating and editing features to adapt the VHS tape-transport mechanism to audio requirements.

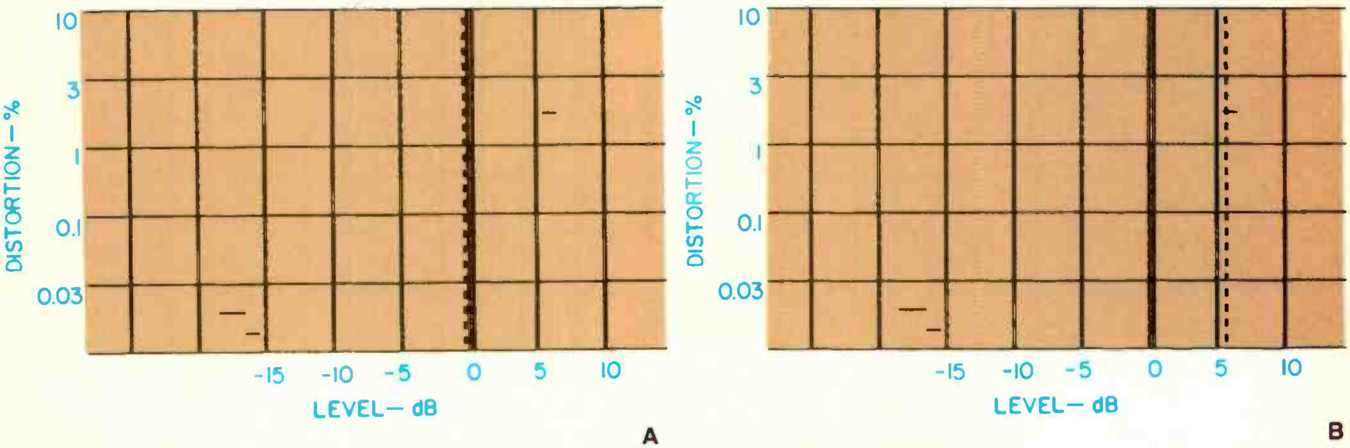


Fig. 2—At 0-dB record level, third-order distortion is less than residual harmonic distortion of test instrument (A). Meter calibration allowed recording up to +6 dB before rapid rise in distortion took place (B).

no problem. Unlike the case with analog tape decks, the concept of signal saturation does not exist for a digital PCM recorder, and the usual problem of high-frequency dynamic range limitation is also nonexistent. Still, I did note some small amount of high-frequency attenuation in the upper response curve of Fig. 1, measured at 0-dB record level. I suspect that the built-in pre-emphasis time constant may have had something to do with this slight roll-off at 20 kHz (−3.3 dB), in that the pre-emphasis may well have boosted actual recording amplitudes up to well beyond the 0-dB limits for recording on a PCM unit. Under music program conditions (where the amplitudes of highs never approach those of mid-frequencies), even this slight amount of high-frequency roll-off would not be likely to occur. Nevertheless, when I backed off to a −20 dB record level (lower plot of Fig. 1), response was now absolutely flat (well, within 0.1 dB, if you care to quibble) all the way out to 20 kHz. To further study this effect, I next made a response plot at a record level of −3.0 dB and, sure enough, attenuation at 20 kHz was now only 1.3 dB (Fig. 1B).

If you read the Sony PCM-F1 digital audio processor "Equipment Profile," you may recall that exceeding 0-dB record level even by a dB or two caused havoc as far as distortion was concerned. The designers of the Technics SV-P100 have wisely chosen to calibrate the level meters so that there is still some headroom at 0 dB before major "breakup" and distortion occurs. I suspect that this calibration was decided upon in deference to those recordists who are accustomed to letting the "needles" go above 0 dB on analog recorders for short peaks of program material without expecting to get ruined recording. In a digital recorder, the designer can, of course, arrange to have "0 dB" on the device's metering system wherever he thinks best. In Fig. 2, therefore, we see that for a recorded mid-frequency tone at the 0-dB level, third-order distortion measured 0.01%. It may, in fact, have been even a bit lower, since 0.01% third-order distortion is the lowest figure my test instrument can register (Fig. 2A). Note, however, that even at +6 dB (Fig. 2B), third-order distortion was still less than 3%, measuring 1.6%. When I attempted to increase level by just one more dB, however, third-order distortion ran off the scale of the display, which means that it was in excess of 10%! Such are the ways of digital recording—and we'd better all get used to them if our lot in life includes the setting of music recording levels.

More for my own amusement than for any practical purpose, I plotted channel separation between the two channels of the SV-P100 versus frequency. The 70.1 dB observed at 1 kHz is probably the result of a minute amount of capacitive leakage between channels at the input to the measuring instrument, rather than actual crosstalk between digitally encoded information channels. Results, however meaningful they may or may not be, are displayed in Fig. 3.

Signal-to-noise ratio was measured with respect to the previously determined maximum record level (+6 dB), using the CCIR/ARM weighting curve. The reading obtained was an astounding 90.9 dB (see Fig. 4). According to simplified digital information theory, a 14-bit digital system should provide a dynamic range of some 84 dB (14 x 6). That, however, does not take into account the pre-emphasis and de-emphasis which have been incorporated at the audio stages of this machine.

The brief message at the top of the display of Fig. 5 tells us all we need to know about the wow and flutter signal produced by the Technics SV-P100: "Signal too low." In other words, wow and flutter was unmeasurable!

For some reason I have not been able to determine, the line input sensitivity and line out levels did not correspond with published specifications. Perhaps the owner's manual, which was supplied in preliminary form, needs to be rechecked. In any event, I measured 140 mV as the required line input figure to reach a 0-dB record level, and

Considering the amount of circuitry incorporated in the SV-P100, its size and weight have been kept within remarkably reasonable bounds.

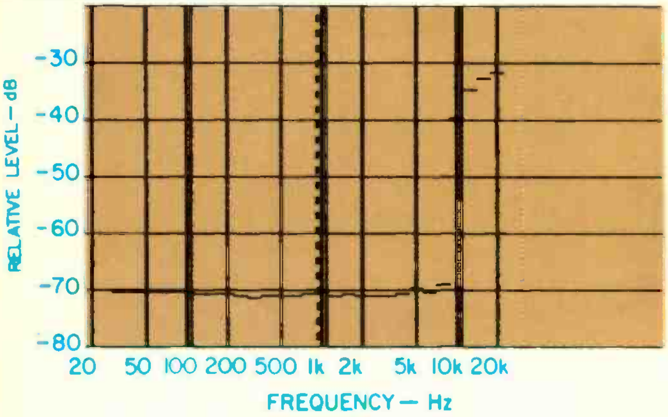


Fig. 3—Channel separation exceeded 70 dB at all frequencies up to around 10 kHz.

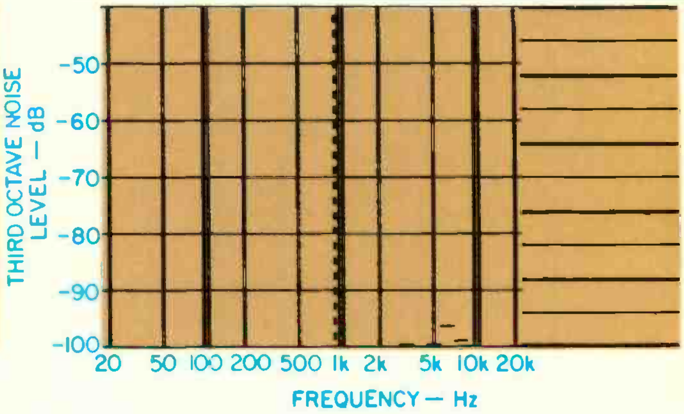


Fig. 4—CCIR/ARM weighted S/N exceeded 90 dB, referred to maximum (3% harmonic distortion) record level.

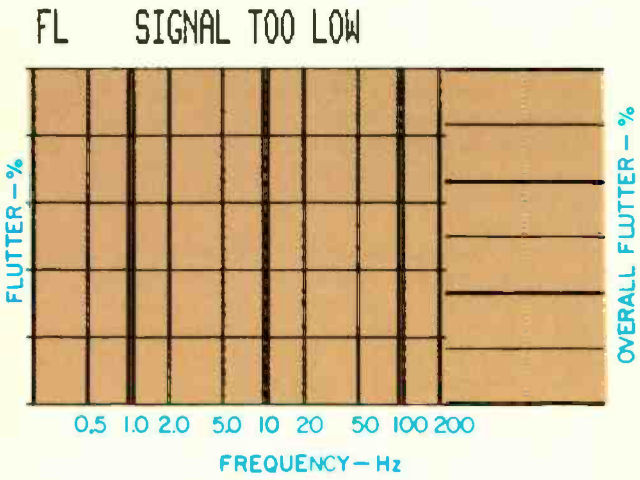


Fig. 5—The message at the top of this display tells all we need to know about wow and flutter on a PCM tape recorder such as the Technics SV-P100!

line output voltage corresponding to 0 dB on the metering system measured a full 2.0 volts! Output from the headphone monitoring jacks, with 8-ohm loads connected, measured 388 mV for 0 dB on the meters. The sample SV-P100 consumed a maximum power input of 83 watts. Fast winding modes (rewind or fast forward) each took 2 minutes and 40 seconds to completely wind or rewind a T-120 (two-hour) VHS video tape.

Use and Listening Tests

To date, sound quality of the PCM/digital processors or complete PCM recorders I have experimented with have all been superb, and the SV-P100 is no exception in this regard. In fact, it has been difficult to find program material good enough to truly challenge these systems. This being the case, all that remains is to access the SV-P100's ease of use as compared with other recording systems. Quite frankly, I found the unit a bit complicated to operate and understand at first. The deck requires the user to spend a reasonable amount of time in becoming familiar with its many features and controls. The memory and search functions involve a fair amount of "hunting" or overshoot as the microprocessor-controlled transport mechanism tries to zero in precisely to the required starting point or specified counter digit. In this respect, Technics has done a remarkable job getting the machine to cue exactly, despite the inherent cueing limitations of the VHS threading and tape-transport system. In doing so, however, they have had to incorporate tape-transport actions which slow down the cueing and editing process. To the home recordist this may be unimportant; to a semi-pro or professional recordist trying to enter the world of digital recording at what has to be a bargain price (compared with professional multitrack stationary-head digital recording systems), the "slow" transport action may be a bit disconcerting. But none of this detracts in the slightest from the fact that Technics has managed to come up with a compact all-in-one PCM cassette deck that costs considerably less than the best PCM audio processors of a year or two ago. It should be stressed that the $3,000 price tag is for a recording system complete in one unit. I would guess there are enough serious recordists to gobble up every SV-P100 that Technics will be able to bring into this country in the coming months.

Leonard Feldman