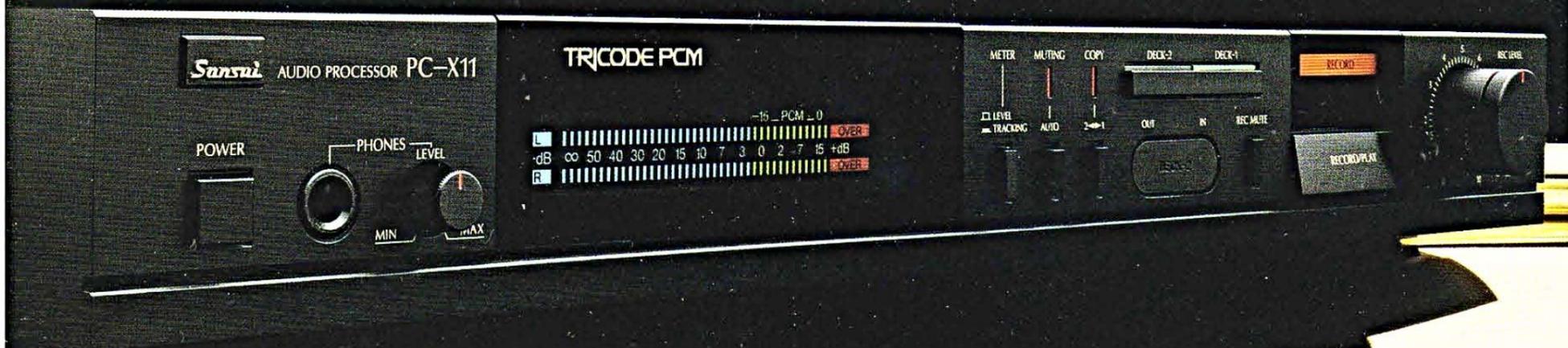


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Sansui

TRICODE PCM PROCESSOR PC-X11



TRICODE
PCM



The PC-X11 turns your VCR into a digital audio recorder

To make digital recordings, all you need is your VCR and a PCM digital audio processor like the PC-X11

If you own a VCR, you can be ready to make digital audio recordings by just connecting a PCM digital audio processor, such as Sansui's high-performance PC-X11. The processor hooks up between your present hi-fi system and your VCR—standard video functions of your VCR are not affected in any way.

Simple operation plus long recording time of open-reel

Because digital recordings are made on your VCR using standard videocassette tapes, operation is easy; indeed, it's just as easy as using a cassette deck—just pop a cassette into your VCR and adjust recording levels with the digital processor.

Recording time is much longer than cassette tapes—you can record up to 160 minutes (2 hours, 40 minutes) of music on a VHS VCR (recording times for Beta and other formats will be different). A professional-quality open-reel deck using huge 10-inch reels may be able to make recordings with playing time this long, but the fidelity of digital recording is far, far superior. And, minute for minute, digital recording on video tape is no more expensive.

With the PC-X11, you can record a Wagner or Verdi opera, a Mahler symphony, or half a dozen of your favorite albums on a single videocassette tape, and enjoy superior digital sound from one end of the tape to the other.

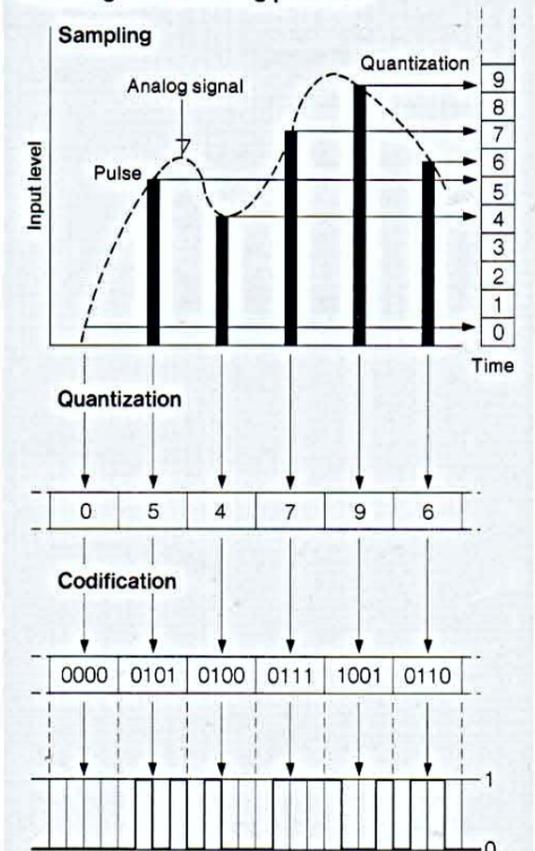
PCM digital recording—how it's done

PCM digital recording is very different from analog recording, which we are all familiar with. Under EIAJ standards applicable to digital audio recording using videocassette tapes, the sampling rate is 44,056Hz and quantization is 14 bits. This means music is sampled at a frequency of 44,056Hz, and each sampled unit is assigned a value among 2^{14} or 16,384 possibilities. After a musical signal undergoes sampling and quantization, it's codified in the binary system using the digits 1 (presence of a pulse) and 0 (absence of a pulse). After this, additional data for error detection and correction are added. Then the digital signal containing both music and this additional data is recorded onto the videocassette tape.

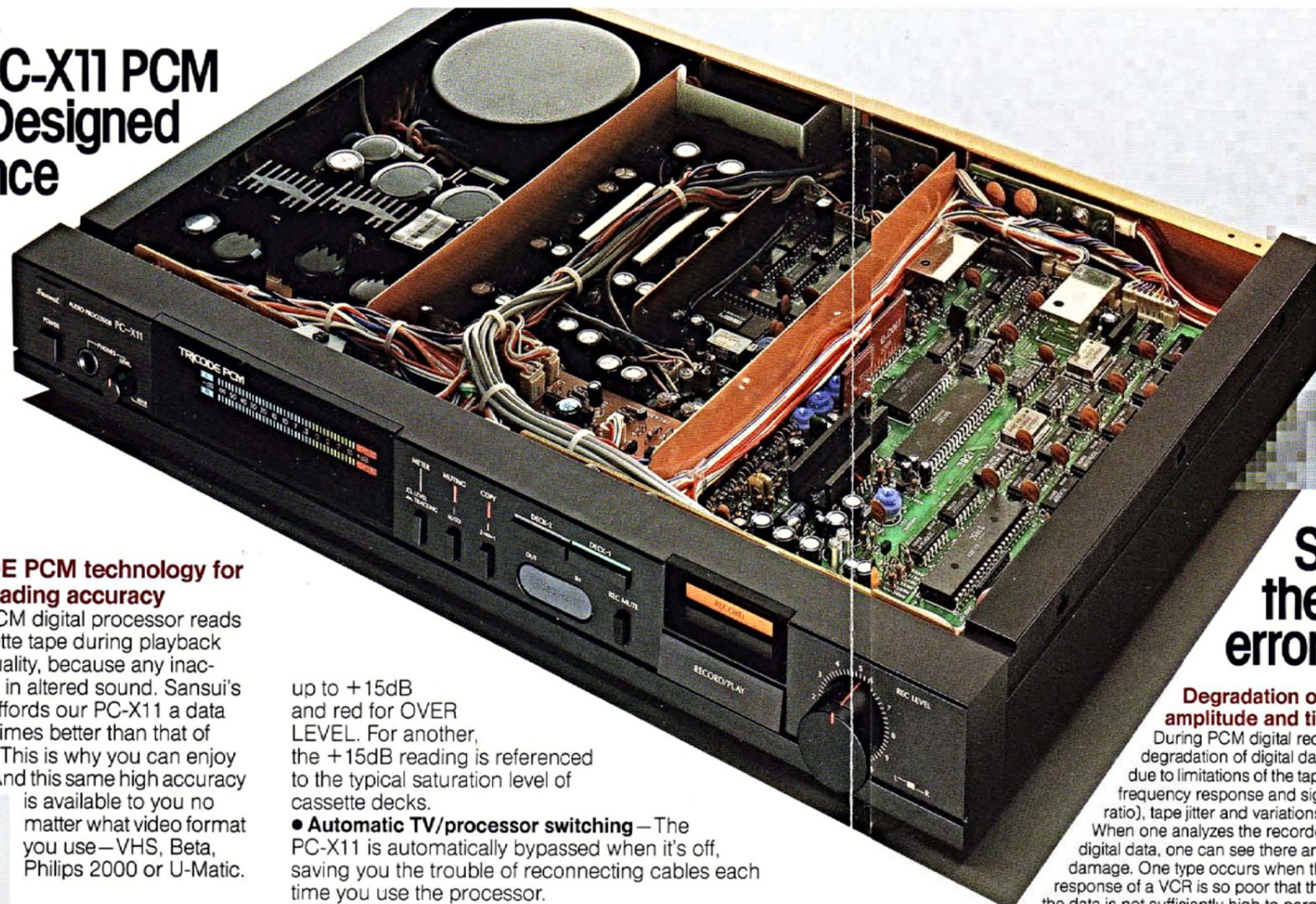
Since in PCM digital audio the process of recording (encoding) and playback (decoding) is reduced to a simple differentiation between 1's and 0's, waveform distortion (noise, distortion, wow and flutter, etc.), common to analog recording, is no longer of concern.

Therefore, even after many generations of copying, it is difficult, if not impossible, to tell which tape is the original and which is the n th generation copy. This advantage is unique to digital recording.

PCM digital recording process



The Sansui PC-X11 PCM Processor—Designed for convenience and super hi-fi sound



Sansui TRICODE PCM technology for superior data reading accuracy

The accuracy with which a PCM digital processor reads digital data from a videocassette tape during playback determines ultimate sound quality, because any inaccuracy in data reading results in altered sound. Sansui's TRICODE PCM technology affords our PC-X11 a data reading capability about 100 times better than that of most other PCM processors. This is why you can enjoy such good recording results. And this same high accuracy is available to you no matter what video format you use—VHS, Beta, Philips 2000 or U-Matic.



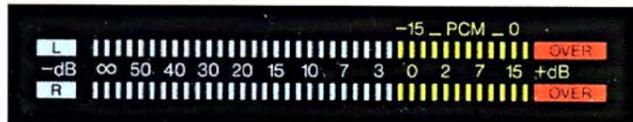
With the PC-X11, it's easy to record and play

Maybe you think using a PCM processor must be difficult; on the contrary, it's extremely simple to use.

● **Digital dubbing**—You can connect two VCRs to the PC-X11 and undertake digital dubbing between the two. Even if you're copying the copy of a copy of a copy, there will be no degradation in quality whatsoever. For connecting convenience, the set of terminals for the second VCR is up front.



● **Oversized fluorescent meters with peak hold**—Thirteen fluorescent dots per channel show peak levels over a wide 75dB range. Level settings are easy. For one, levels are color coded: white from -60dB to 0dB, yellow



up to +15dB and red for OVER LEVEL. For another, the +15dB reading is referenced to the typical saturation level of cassette decks.

- **Automatic TV/processor switching**—The PC-X11 is automatically bypassed when it's off, saving you the trouble of reconnecting cables each time you use the processor.
- **Headphone jack with level control**—Because the headphone output has its own level control, you can monitor recording and playback at any level you like.
- **Connections for 2 monitor TVs**—To help you integrate your audio and video systems, the PC-X11 connects two monitor TVs.



Top-flight circuit designs and top-quality parts mean top performance

You can't expect to enjoy the full advantages of digital recording unless your processor uses the most advanced analog and digital circuit designs and top-quality parts. That's why we use choice parts and circuits in the PC-X11.

Its rugged power supply features a highly capable, low-hum toroidal power transformer, outsized capacitors, large-capacity regulators, and other quality parts. Each of the analog, digital and display circuits has its own winding on the power transformer to prevent hum and other mutual interference.

Analog circuitry also enjoys the best of Sansui technology. For instance, the input/output line amp and AD/DA (Analog-to-Digital/Digital-to-Analog) converter are DC configured. And we use rugged two-sided glass-epoxy circuit boards, high-quality electrolytic capacitors, first-grade resistors, copper-film styrene capacitors, and a copper-plated chassis. All help contribute to the pure, clean sound of the PC-X11.

Sansui TRICODE PCM technology—the most accurate error correction system to date

Degradation of data in amplitude and time domains

During PCM digital recording, a slight degradation of digital data is inevitable due to limitations of the tape (in terms of the frequency response and signal-to-noise ratio), tape jitter and variations in amplitude. When one analyzes the recorded waveforms of digital data, one can see there are two types of damage. One type occurs when the frequency response of a VCR is so poor that the amplitude of the data is not sufficiently high to permit the PCM decoder to accurately assign a 0 or 1 value to each bit (Fig. 1a). The other type occurs when jitter and mutual interference between adjacent pulses shift the data forward or back in time (Fig. 2a). Less than perfect data leads to readout error. Sansui TRICODE PCM technology was specifically developed to effectively reduce both forms of data degradation.

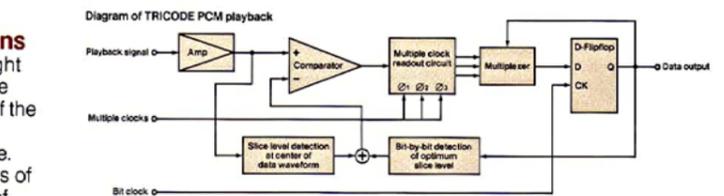
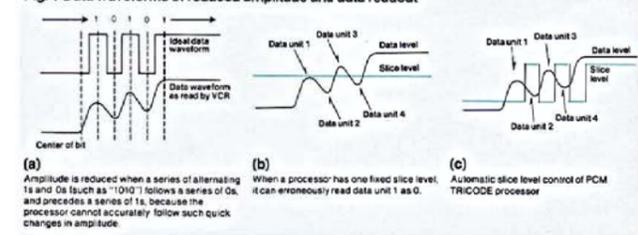
Sansui TRICODE PCM technology: superior data readout ability without waveshaping

At present there are two techniques for reading imperfect data. One involves "waveshaping," which attempts to improve the shape of the data waveform being read. The other is called "pulse detection," which reads the data to determine 0s and 1s without manipulating waveforms. The Sansui PCM TRICODE technology belongs to the latter category, yet it's radically different from other pulse detection decoders in that it copes with damaged data in both amplitude and time domains.

Reading data damaged in the amplitude domain

Units of data are assigned the values 0 (low level) and 1 (high level) by comparison with a reference level (slice level). Conventional PCM processors use one fixed slice level; therefore, in the example (Fig. 1b), though data units 2, 3 and 4 are read accurately, unit 1 is erroneously read as 0. The Sansui TRICODE PCM processor employs two slice levels (Fig. 1c). It detects the level at the center of each data wave-

Fig. 1 Data waveforms of reduced amplitude and data readout



form, and, by comparing preceding data, automatically chooses the optimum slice level for each unit of data. Assigning values 0 and 1 is accomplished with far more accuracy.

Reading data damaged in the time domain

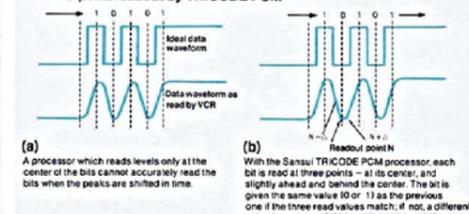
Since conventional PCM processors read data at the center of each "bit," they are prone to error when phase delay occurs (Fig. 2a). With the TRICODE PCM processor, however, data is read at three points—at the center of the bit, plus at points forward and back of it—and assigned the value 0 or 1. Current data is compared with preceding data: if the measurements at three points in the first unit match those in the second, then the current data is deemed to be the same as the previous one (0 for 0, or 1 for 1); if not, the current data is given a different value (1 for 0, or 0 for 1). This has resulted in dramatically improved tracking of phase variations in data waveforms. To date, TRICODE PCM is the only technology that accurately reads data even when there's a shift in time.

Thanks to an improved reading ability of data damaged in the amplitude and time domains, the Sansui TRICODE PCM technology makes it possible to read data, no matter how damaged it may be, with unflinching accuracy, even when the recordings have been made on poor-quality VCR tapes.

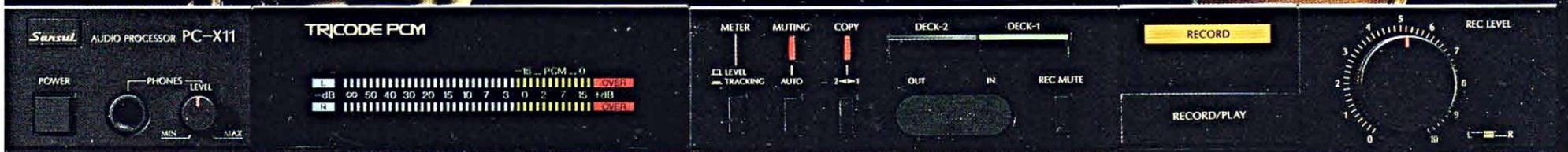
TRICODE PCM processor works completely automatically

With the Sansui PC-X11 TRICODE PCM processor, the slice level is automatically adjusted, as are time shifts. There's no need to adjust controls each time you use a different tape or record on a different VCR. Remember that with other PCM processors, manual adjustments are mandatory.

Fig. 2 Data waveforms affected by time shift and 3-point readout by TRICODE PCM



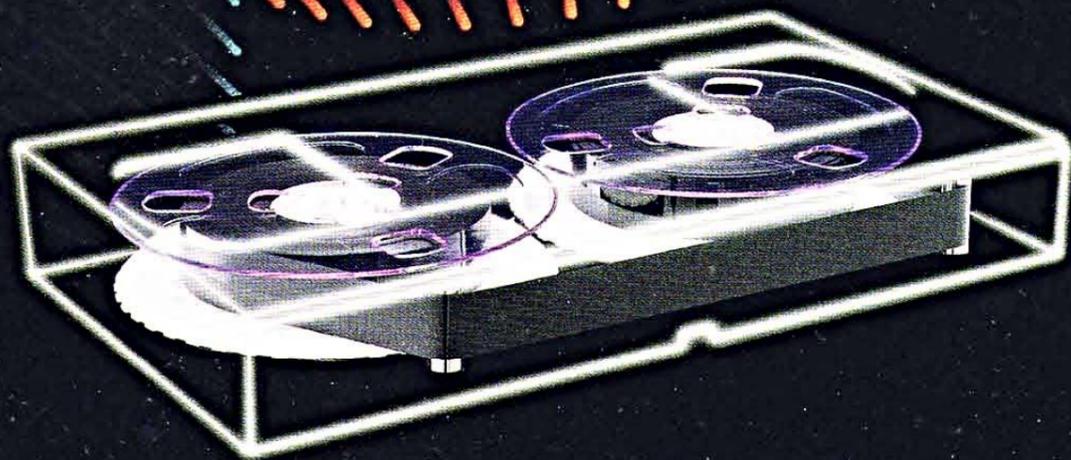
Make digital recordings at home today



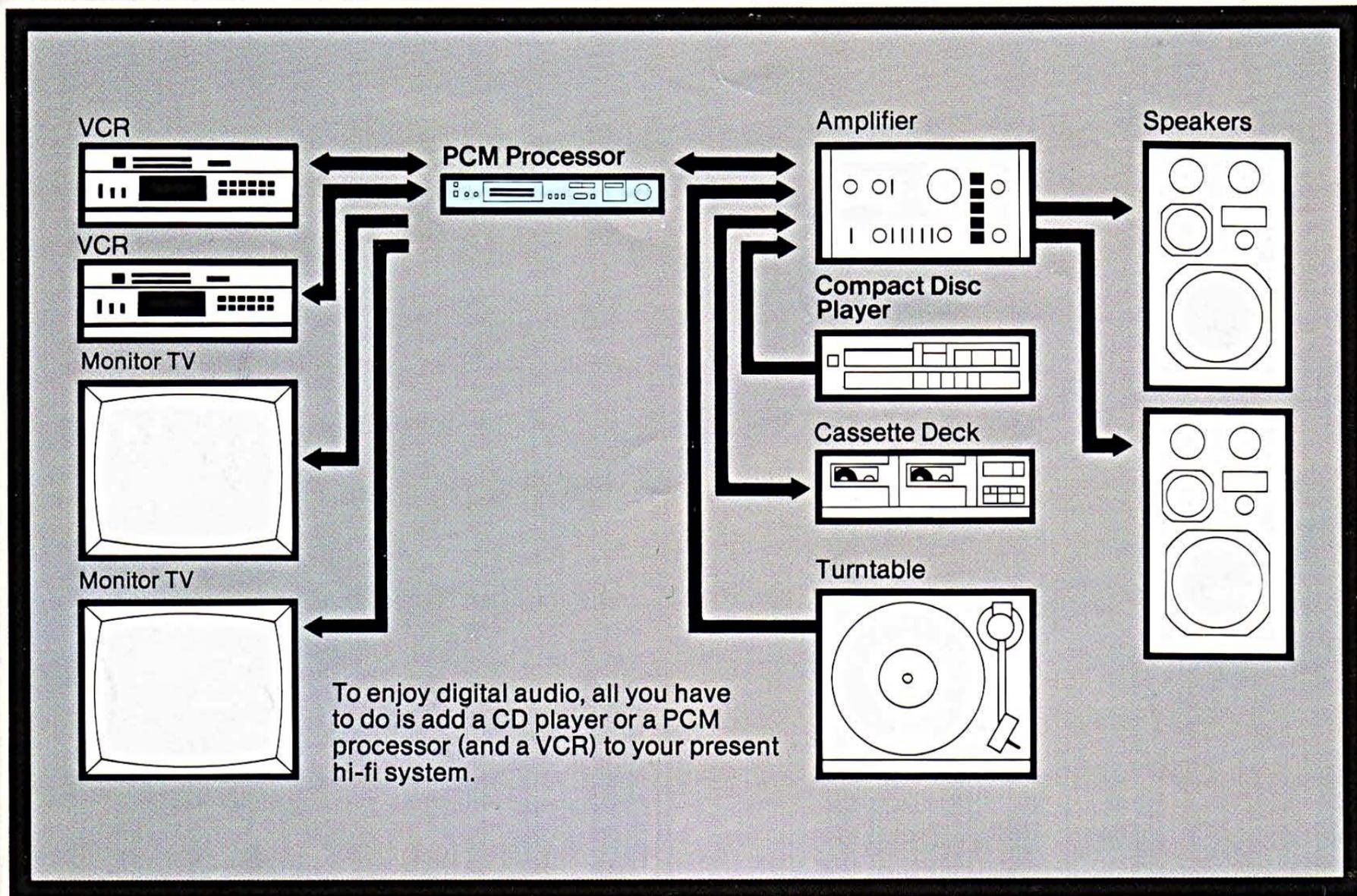
Audiophiles and music lovers continue to rave about the great sound of Compact Disc players, the new digital audio playback system. They find digital sound to be superior to conventional "analog" sound in every way. The awesome, true-to-life dynamic range of an original performance is brought into the home, note for note—there is no noise, no wow and flutter.

Sansui has developed a technology that now lets you make your own digital recordings, right at home. All you need is your VCR, a video cassette tape and Sansui's new PC-X11 TRICODE PCM digital audio processor.

Digital recording isn't a 21st century technology—it's here right now, thanks to Sansui.



Setup for Enjoying Digital Audio.



PC-X11 SPECIFICATIONS

Signal System	NTSC/PAL/SECAM television standard
Code Format	EIAJ (STC-007 Digital Audio Standard)
Number of Audio Channels	2 (stereo)
Sampling Frequency	44,056Hz
Quantization	14-bit linear quantizing
Error Correction	Error correction and concealment using CRCC and parity
Emphasis	Pre-emphasis (during recording): fixed at ON De-emphasis (during playback): automatically Switched to ON or OFF (by detecting pre-emphasis identification code) Time-constant: 50 μ sec., 15 μ sec.

Input Sensitivity and Impedance	
VIDEO	1Vp-p into 75 ohms
LINE	90mV, 47k ohms
Maximum Input Capability	
LINE	500mV
Output Voltage	
LINE OUT	250mV into 10k ohms
VIDEO OUT	1Vp-p into 75 ohms
MAX. LINE OUTPUT	1.4V into 10k ohms (at 1,000Hz)

Total Harmonic Distortion (at 1.4V)	
LINE OUT	0.007%
Frequency Response	5 to 20,000Hz +0dB, -0.5dB
Dynamic Range	86dB
Phones	200mV, 8 ohms
Power Requirements	
POWER VOLTAGE	120, 220, 240V, 50/60Hz
POWER CONSUMPTION	35 watts
Dimensions	430mm (16 ⁵ / ₁₆ ")W 57mm (2 ¹ / ₄ ")H 312mm (12 ³ / ₁₆ ")D
Weight	5.0kg (11.0 lbs.) Net 5.5kg (12.0 lbs.) Packed

- CAUTION: When a PCM tape recorded at the EP (Extended Play) mode is played back on a different VCR, reproduction may be intermittent due to special video signal processing.
- Design and specifications subject to change without notice for improvement.



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