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A Digital Audio Tape Primer

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DAT
Digital Audio Tape

Q ■ What is DAT?

DAT stands for Digital Audio Tape, the name for a new audio recording/reproduction system consisting of a specially formulated cassette tape and deck capable of digital sound recording/reproduction.

- Compared to existing analog recording systems, DAT is superior in sound quality, performance and operability, and is expected to become a core technology of the digital audio age, together with Compact Disk, see table marked Program Source Conversion [analog to digital].
- Just as CDs are taking the place of LPs, it is anticipated that DAT will become, in the long run, a mainstream substitute for existing audio cassettes.

Table 1: Program Source Conversion
(Analog to digital)

	Analog ⇒	Digital	Remark
Broad-casting	AM/FM Broad-casting		• High sound quality B-mode broadcasting via satellite (sampling frequency of 48 kHz, 16-bit) is now under experiment.
	TV Broadcasting		
		Sound of satellite broadcasting (A-mode) (image transmitted in analog signal)	
Disk	LP/EP records		• Audio signal of Laservision's laser digital disk (CDD) is digitally recorded in the same format as CD. • CDV is a 12 cmϕ disk like CD in which 20-min. digital sound and 5-min. animation are recorded.
		CD (compact disk)	
		Sound of Laservision disk (LDD) (image reproduced in analog signal)	
		CDV(CD w/video)	
Tape	Audio cassette		• DAT allows digital recording/reproduction using an exclusive audio tape. • Current DAT employs a rotary head system (R-DAT)
		Digital recording/reproduction system by a combination of VCR and PCM processor	
		Sound of 8mm video (PCM)	
		DAT (digital audio tape)	

Q ■ How does DAT record?

First, the analog audio signal to be recorded is "picked up," or sampled, at the speed of 48,000 times per second. (This figure is called a "sampling frequency", and is stated in kilohertz; hence, 48,000 times/sec or 48kHz.)

- Then, each sound volume of these 48,000 signals per second is digitized, dividing it by 65,536 steps (16 bit = 2^{16} = 65,536). In other words, if the smallest sound among the sound elements divided into 65,536 steps is assumed as "1", the greatest element becomes the numerical value of 65,536.
- The data thus digitized are recorded with "0" and "1" codes, just as for CDs.
- The method for converting analog sound into digital signals described thus far is called A/D (analog-to-digital) conversion, and the digital signal coded in "0"s and "1"s is recorded on a tape in a "pulse string", or series of signal pulses.

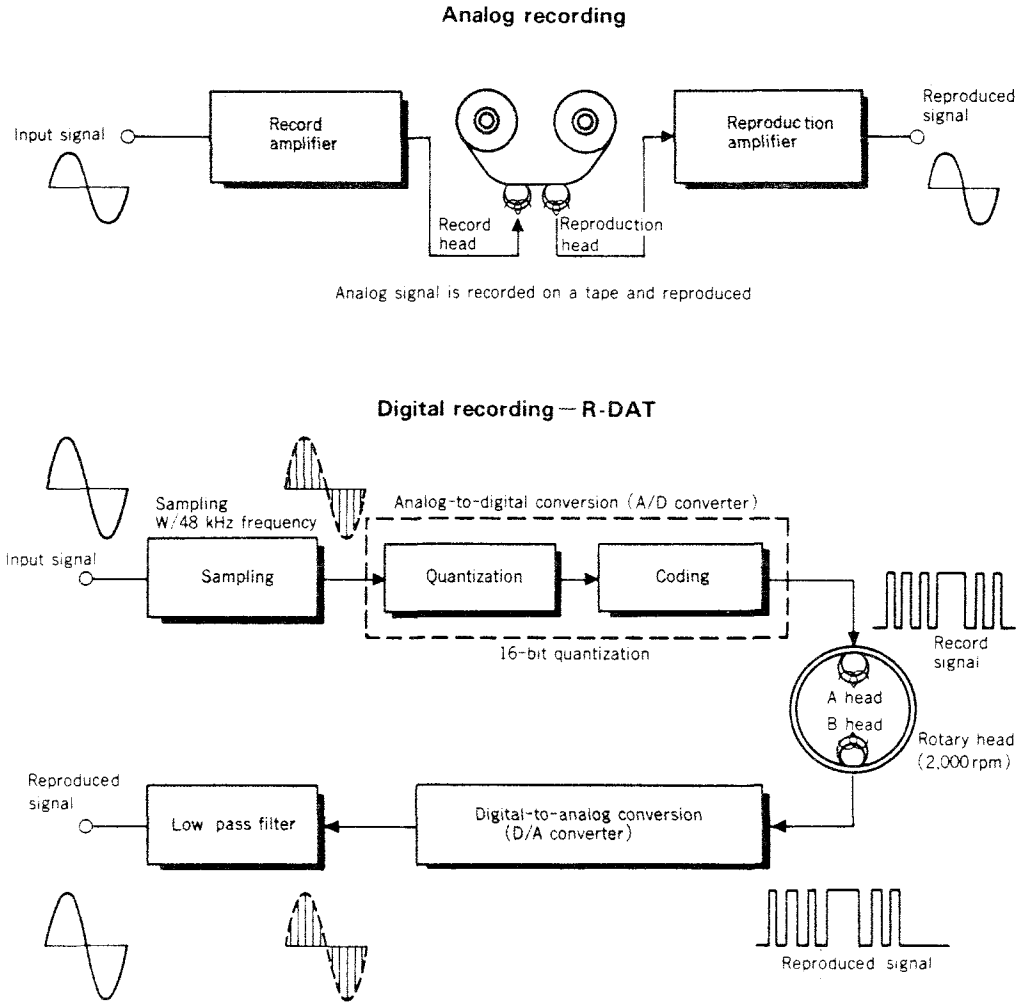


Fig. 1: Difference between Analog and Digital (R-DAT) Recording/Reproduction

Q ■ How is a recorded digital signal reproduced?

Reproduction is performed in a manner opposite that used for A/D conversion. In other words, first passing through a D/A (digital-to-analog) converter and then through a low-pass filter, the digital signal recorded on a tape is reproduced in its original, analog form.

Q ■ Why is analog recording inferior to DAT recording?

In the analog recording method, the audio signal is recorded on tape in the form of magnetic variation using a recording head. In reproduction, the recording is picked up as an audio signal through a reproduction head. Sound quality is influenced by the characteristics of the tape in use and the performances of the recording/reproduction head(s) and the tape deck's drive unit. In a nutshell, the analog system has the following drawbacks:

1) Dynamic range (difference between the strongest and the weakest sound) is narrow.
2) Noise inherent to analog tape recording increases each time tape copying, or dubbing, is repeated.
3) Frequency characteristics vary according to the recording level. (High-frequency characteristics become distorted if the recording level is high.)
4) The system is not suitable for recording of low frequencies.
5) Uneven drum rotation (wow & flutter) occurs due to irregularity of tape running
6) There is greater distortion.

Accordingly, the recorded signal gets worse each time it is dubbed, thus deteriorating sound quality.

- As far as analog recording is concerned, the attempt to improve performance enough to solve these problems has almost reached its limit.

Q ■ What are digital recording's characteristics?

Frequency characteristics are flat in the audible range of the human ear.

- Dynamic range is wide, and it expands almost up to the range of live music.
- There is no irregularity in drum rotation.
- There is no tape noise.
- There is no signal deterioration, regardless of how many times the process of recording to/from playback has been repeated. The original recorded sound quality is always retrievable and equal in quality to CDs.

Q ■ How does DAT recording differ from a VCR's PCM recording system?

There is no difference in terms of the result, but it differs in recording format, recording density, type of equipment, performance and operability.

- When a PCM (Pulse Code Modulation) processor and a VCR are used in combination, the audio signal is converted into a digital signal via a PCM processor, and the signal is further shaped into a video signal for recording and reproduction with a VCR.
- Accordingly, although the VCR PCM system is the same in terms of digital recording, DAT is superior in recording format, performance, functions and operability.

Q ■ How is DAT's recorded sound different from that of PCM in 8mm recording?

The 8mm VCR's PCM sound is specially devised to be digitally recorded. (The image signal is recorded in analog.)

- The portion of 8mm tape where digital sound is recorded is a separate part of the video track.
- Since this video track was originally devised to allow digital recording of TV sound or accompanying images, it is inferior in sound quality to DAT.

Table 2: Difference between DAT and Combined PCM Processor/VCR

	DAT (R-DAT)	PCM Processor
Available channels	2	2
Sampling frequency	48 kHz	44.056 kHz
Quantization	16-bit (linear quantization)	14-bit/16-bit
Coding	Binary numeral	Binary numeral
Frequency characteristic	2 ~ 22,000Hz	2 ~ 20,000Hz
Dynamic range	96dB or more	24dB, 96dB or more
Distortion factor	0.005% or less	0.01 ~ 0.005%
Recording time	120 min. (standard mode)	Max. 300 min. (Beta III L-830 VCR tape; Max. 480 min. (VHS 3 × mode T-160)
Tape speed	8.15mm/s (standard mode)	40mm/s (Beta I) ~ 13.3mm/s (Beta III); 33.35mm/s (VHS standard mode)
Relative speed	3.133m/s	6.973mm/s (Beta I) ~ 7m/s (Beta III); 5.8m/s (VHS standard mode)
Tape (width)	DAT exclusive tape (3.81mm)	12.65mm (Beta); 12.64mm (VHS)
Cassette size (W × D × H)	73 × 54 × 10.5mm	156 × 96 × 25 mm (Beta) 188 × 104 × 25mm (VHS)
Standard drum	30mm	74mm (Beta II); 33.35mm (VHS)
Drum rotation	2,000rpm	1,800rpm (same for Beta/VHS)
Tape winding angle	90°	180° (same for Beta/VHS)
Head azimuth angle	±20°	±7° (Beta II); ±6° (VHS)
Remarks	Digital recording/reproduction using DAT tape and deck	Digital recording and reproduction with a combination of PCM processor and VCR

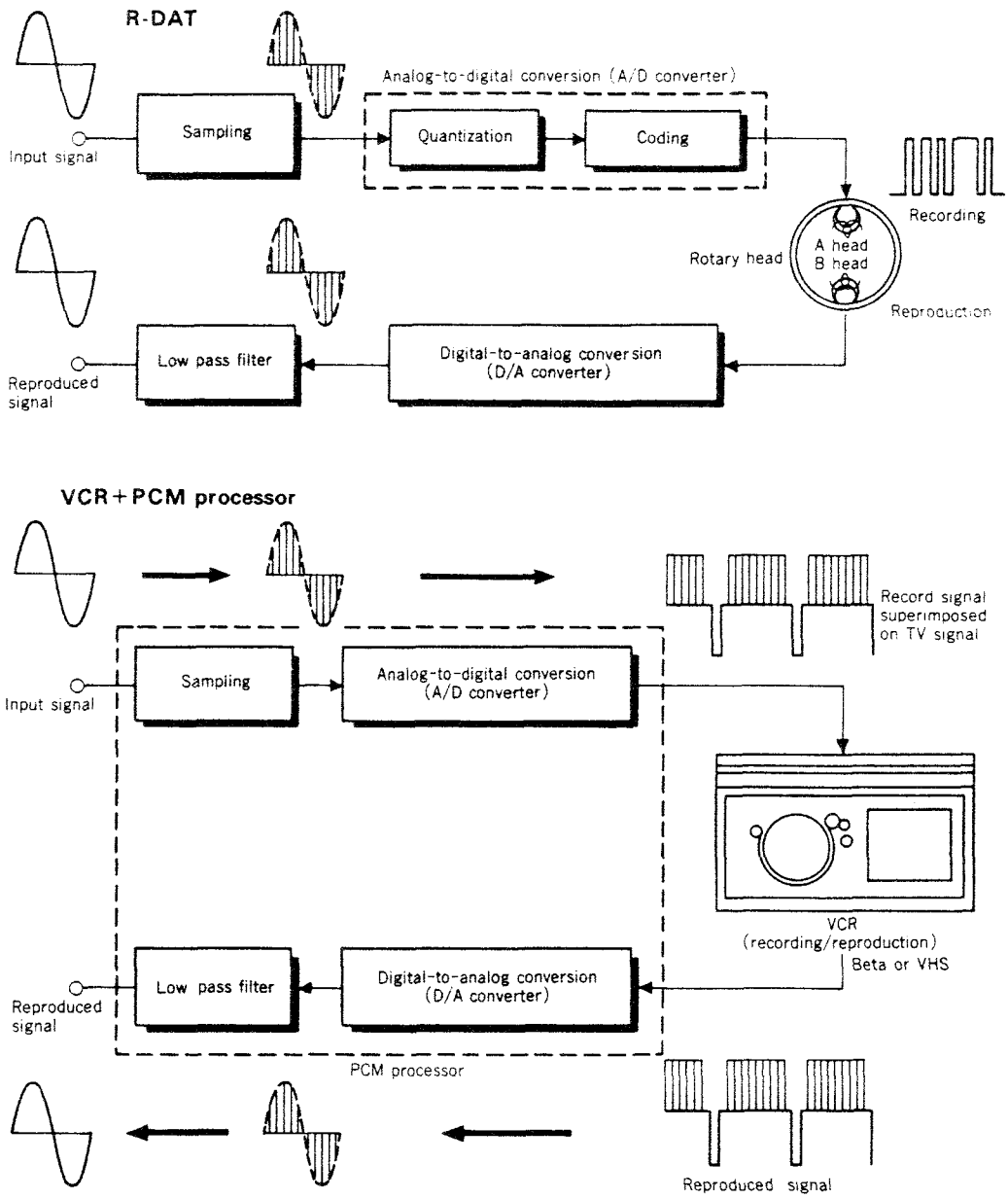


Fig. 2: Difference in PCM Recording/Reproduction
— DAT vs. PCM Processor + VCR

Table 3: Difference between DAT and 8mm Video

	DAT (R-DAT)	8mm Video PCM (sound)
Available channels	2	2
Sampling frequency	48kHz	31.5kHz
Quantization	16-bit (linear quantization)	8-bit (non-linear quantization)
Coding	Binary numeral	Binary numeral
Frequency characteristic	2~22,000Hz	20~15,000Hz
Dynamic range	96dB	S/N ratio 80dB (incl. noise reduction)
Distortion factor	0.005%	1% or less
Recording time	120 min.(standard mode)	120 min. (SP mode), 240 min. (LP mode)
Tape speed	8.15mm/s (standard mode)	14.345mm/s
Relative speed	3.133m/s	3.8m/s
Tape (width)	DAT exclusive tape (3.81mm)	8mm video tape
Cassettte size(W × D × H)	73 × 54 × 10.5mm	95 × 62.5 × 15mm
Standard drum(ϕ)	30mm	40mm
Drum rotation	2,000rpm	1,800rpm
Head azimuth angle	±20°	+10°
Tape winding angle	90°	221° (when used as PCM track)
Remarks	Digital recording/reproduction using DAT tape and deck	In case of Multi Digital Recording in which all the image tracks split into 6 portions is utilized for digital recording. An elongated period of digital recording/reproduction (6 tracks × 4hrs. = 24hrs.) is possible.

Q ■ What are DAT's main features?

DAT's main features are:

1. Sound quality equaling that of CD.
2. A cassette smaller than a conventional audio cassette, yet enabling continuous, two-hour recording/playback in standard mode. (It can also be used for a maximum of four hours of recording/reproduction.)
3. Faster (200 times faster than normal audio tape) and more accurate track searching capabilities.
4. No deterioration of sound quality through dubbing.
5. Standardized specifications devised in consideration of future possibilities, for instance, expansion of functions using subcodes.

Q ■ What other specs help to define DAT?

Dynamic range is very wide, 96dB or more. This range is roughly equivalent to the dynamic range of a live, orchestral performance.

- In digital recording, as the sampling frequency becomes higher and as the quantization number increases, sound quality also improves. DAT's sampling frequency is 48kHz, and the quantization number is 16 bits. Its flat reproduction frequency band ranges approximately from 5Hz through 22kHz, which indicates that DAT is superior to CD in high-frequency reproduction characteristics.
- No tape hissing, and better S/N ratio.
- No drum rotation irregularity (less than the limit of measured value).
- Excellent channel separation (equal to CD).
- Minimal distortion (less than 0.005%).
- Should tape dropouts occur, signal correction/compensation is available so that sound is neither interrupted nor distorted (identical to CD).
- There is no change in recording characteristics even if the recording level fluctuates and no tape modulation noise. This is a great strength of DAT over analog systems.

Sampling frequency

The analog signal's time axis is discrete, that is, analog signal is drawn out at a given interval of time, and the time of sampling per second is sampling frequency.
As this frequency becomes higher, finer sampling is available simultaneously with the signal's upper limit.

Bit numeral of quantization (Quantization numeral)

The analog signal's amplitude axis is discrete, that is, sound volume is divided by a given number of steps to enable digitization and this value is indicated in bit numeral. Quantization numeral means the number of dividing steps. As this bit numeral of quantization increases, the digital signal obtained becomes more error-free, widening dynamic range accordingly.

Q ■ What are some chief advantages of the DAT cassette over a conventional audio cassette?

Differences of characteristics and functions between a DAT and a conventional audio cassette are shown in the following.

	Audio cassette	DAT
Recording method:	Analog	Digital
Frequency resp.:	40Hz – 18kHz (metal)	5Hz – 22kHz
S/N ratio:	68dB (Dolby B)	96dB*or more
Distortion:	0.3%	0.005% or less
Tape size:	102.4 × 63 × 12mm	73 × 54 × 10.5mm
Recording time:	2 hrs (double track)	2 hrs (single track) or 4 hrs (max., single track)
Search speed:	20 times faster than playback speed	200 times faster than playback speed
Tape speed:	4.75cm/sec.	0.815mm/sec. (3.133mm/sec. in relative speed)

Table 4: Difference between DAT and Audio Cassette

	DAT (R-DAT)	Audio Cassette
Available channels	2	2
Sampling frequency	48kHz (standard mode)	—
Quantization Frequency characteristic	16-bit (linear quantization) Approx. 2 ~ 22,000Hz	— Approx. 25 ~ 20,000Hz (when using metal tape)
Dynamic range	96dB or more	50 ~ 60dB (noise reduction ON)
Distortion factor	0.005% or less	0.5%
Rotational irregularity	Less than measurable limit	Approx. 0.018%
Recording time	2hrs. (standard mode)	Max. 2hrs. (double track)
Tape width	3.81mm	3.81mm
Tape speed	8.15mm/s (standard mode)	Approx. 4.8cm/s
Track width	13.591μm	600μm
Tape in use	Metal tape	Evaporated tape, metal tape
Cassette size (W × D × H)	73 × 54 × 10.5mm	102.4 × 63 × 12mm

Q ■ What are DAT's standards?

DAT has six formats (as shown in the accompanying table).

- Two modes, recording/reproduction and reproduction only, are available in the DAT format.
- Any DAT deck will incorporate the following two modes among these six formats: a standard recording/reproduction mode of 48kHz sampling frequency, and a reproduction-only mode of 44.1kHz.
- With an eye toward the future, three modes were established as options for recording/reproduction for the following purposes:

1) To be used for direct digital recording of TV sound from satellite broadcasting BS-2 (A mode);
2) To be used for a longer period (maximum four hours) of recording/reproduction; and
3) To be used for four-channel recording/reproduction.

Q ■ Will the DAT format play prerecorded tape?

Prerecorded DAT offers sound quality equivalent to that of CD.

- Prerecorded DAT employs a sampling frequency of 44.1kHz, identical to that of CD. This will enable prerecorded tape makers to manufacture both CDs and prerecorded DAT at the same time.
- Prerecorded DAT will be available in two variations: normal-track and wide-track.
- In the case of wide-track tape, tape-speed is increased to 1-1/2 times the norm. A maximum of 80 minutes of playback is possible.

Q ■ What type of tape is DAT?

A special cassette tape is required for DAT recording/reproduction.

- Its specifications follow:

1) It measures 73 × 54 × 10.5mm and the tape width of 3.81mm is identical to ordinary audio cassette tape.
2) The construction of a DAT cassette is shown in the accompanying figure. The front lid covers the surface of tape's magnetic substance; further, hub holes (which are open in a VCR tape cassette) are stopped with sliders in order to protect the tape. These measures protect the tape from fingerprints, scratches and dust, so that the recorded digital signal is kept intact.
3) Metal powder, capable of high-density recording, is used as tape's magnetic substance.
4) The recording period is a maximum two hours with the current tape of 13μ depth, but in future, when a thinner tape is employed, the period will be lengthened.

Table 5: DAT Tape Specifications

Track mode / Item	Normal track		Wide track mode
	Normal speed	Half-speed	
Tape width	3.81mm		
Tape speed	8.15mm/sec.	4.075mm/sec.	12.225mm/sec.
Track pitch	13.591μm		20.41μm
Track angle	6°22'59.5"		6°23'29.4"
Head azimuth		±20°	
Effective width of recording		2.613mm	
Optional track width		0.4mm	
Magnetic substance	Metal		
Reel brake	Interlocked with the front lid		
Slider lock	2 positions available (open and closed state)		
Recording time	120min. using a tape of 13μm depth	240min. using a tape of 13μm depth	80min. using a tape of 13μm depth
Size	73mm × 54mm × 10.5mm		

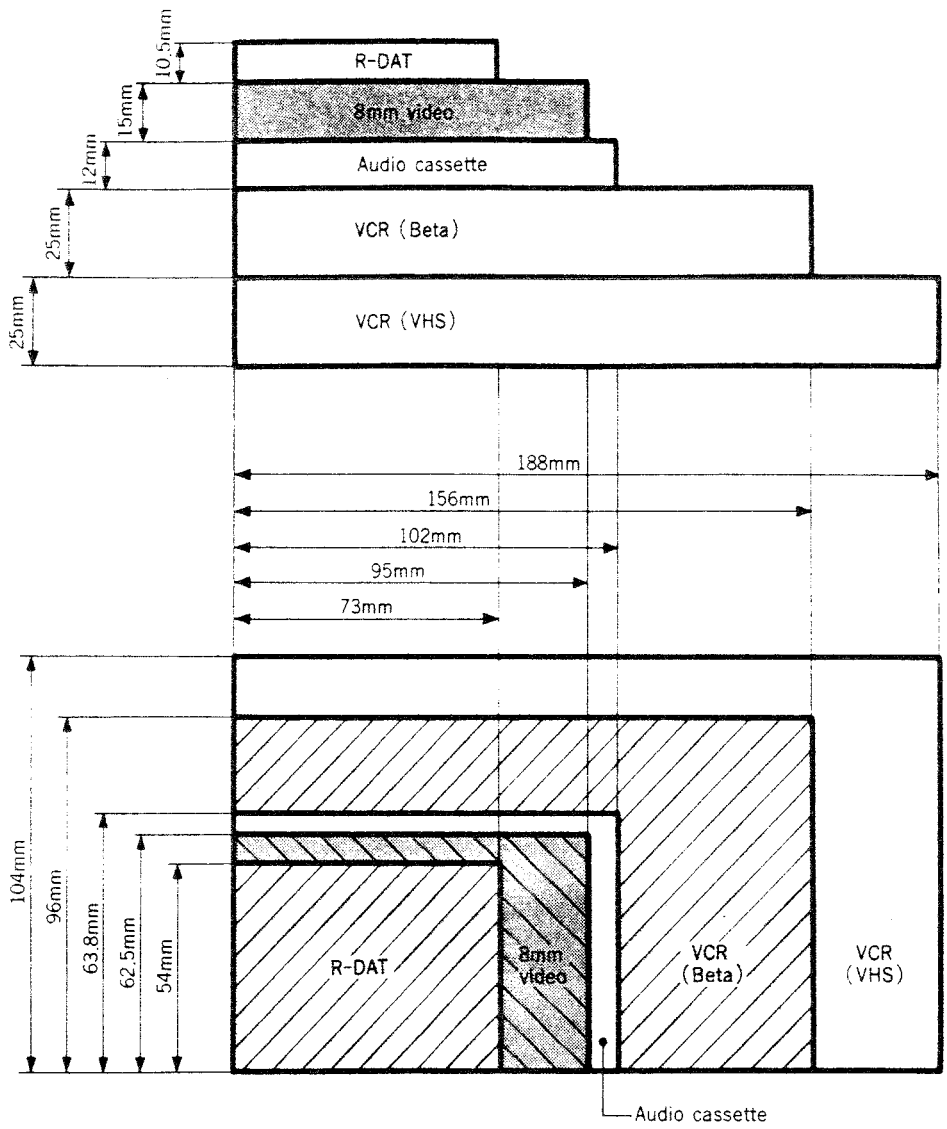


Fig. 3: Comparison of Various Types of Cassette Tape

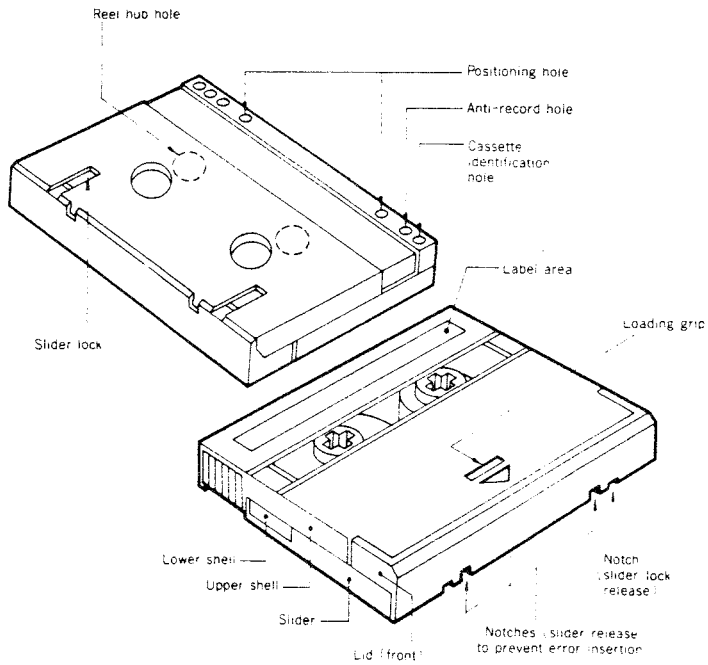


Fig. 4: Construction of DAT Tape

Q. Is DAT compatible with conventional audio cassette decks?

There is no compatibility because DAT is different in shape and recording method. A DAT deck accepts only the tape exclusively designed for it.

Q. Is DAT more cost-efficient than conventional audio tape?

The tape speed of 8.15mm is approximately 1/6 of that of a conventional audio cassette, so the tape length required is approximately 1/3 that of an audio cassette (double-track). The running-cost of DAT tape, therefore, is that much cheaper.

Q. What are the differences between R-DAT & S-DAT?

When the DAT system was first developed, two systems (S-DAT, using a stationary head, and R-DAT, using a rotary head) were studied.

- S-DAT is a system in which the digital signal is recorded/reproduced on or from a tape using a stationary head. This head has a configuration of thin-membrane head elements able to handle ten tracks. The tape's relative speed is determined so that the digital signal can be recorded while switching these head elements.
- R-DAT is a system enabling recording/playback of a digital signal using a rotary head similar to that of the VCR. Relative tape-to-head speed is increased by means of making the large, circular tape head rotate at a much higher speed than that of the tape being drawn across it.
- As S-DAT is inferior to R-DAT in terms of the tape's recording period, cost and size, the R-DAT system has been decided upon for general-purpose use.

Table 6: Major Specifications of R-DAT (Comparison of Available Modes)

Item \ Mode	Mode I	Mode II	Mode III	Mode IV
	Standard mode	Option 1	Option 2	Option 3
		Compatible with Satellite broadcasting A mode	Long-time mode	4-channel mode
Available channels	2	2	2	4
Sampling frequency	48kHz	32kHz	32kHz	32kHz
Bit numeral of quantization	16-bit (linear)	16-bit (linear)	12-bit (non-linear)	12-bit (non-linear)
Transmission speed	2.46Mbit/s	2.46Mbit/s	1.23Mbit/s	2.46Mbit/s
Sub-code capacity	273.1kbit/s	273.1kbit/s	136.5kbit/s	273.1kbit/s
Modulation system	8—10 conversion			
Error correction system	Dual Reed Solomon			
Tracking system	Area split ATF			
Tape width	3.81mm			
Tape depth	13 ± μm			
Tape in use	Metal powder			
Tape speed	8.15mm/s	8.15mm/s	4.075mm/s	8.15mm/s
Relative speed	3.133m/s	3.133m/s	1.567m/s	3.133m/s
Standard drum specs	φ 30, 90° lap			
Drum revolution	2,000 rpm	2,000 rpm	1,000 rpm	2,000 rpm
Track pitch	13.591μm			
Track angle	6°22'59.5"			
Head azimuth angle	±20°			
Recording time	120min. (tape depth of 13μm) 180min. (tape depth of 10μm)		240min. (tape depth of 13μ) 360min. (tape depth of 10μm)	120 min. (tape depth of 13μm) 180 min. (tape depth of 10μm)
Cassette size	73mm × 54mm × 10.5mm			
Remarks	•For general purpose, recording/reproduction and playback of pre-recorded tape. •For specific purposes, it is possible to select optional specifications. •In standard format, the sampling frequency is 48kHz, higher than that of CD. •It is possible to digitally record B-mode (sound) of satellite broadcasting BS-2.	•Option 1 is compatible with A-mode (TV sound) of satellite broadcasting BS-2.	•Option 2 is devised to meet the need for recording sound of W.German satellite broadcasting. Tape speed is reduced to half, thus enabling 4-hour recording.	•Option 3 is formatted to allow 4-channel recording.

Mode V	Mode VI
Pre-recorded tape	
Normal track	Wide track
2	2
44.1kHz	
16-bit (linear)	
2.4Mbit/s	
273.1kbit/s	
8—10 conversion	
Dual Reed Solomon	
Area split ATF	
3.81mm	
13 ± μm	
	Oxide tape
8.15mm/s	12.25mm/s
3.133m/s	3.129m/s
φ30, 90° lap	
2,000 rpm	
13.591μm	20.41μm
6°22'59.5"	
±20°	
120min (tape depth of 13μm) 180 min. (tape depth of 10μm)	80min (tape depth of 13μm) 120 min (tape depth of 10μm)
73mm × 54mm × 10.5mm	

•From the viewpoint of more efficient productivity of pre-recorded tape makers, the same sampling frequency (44.1kHz) to CD format is employed in pre-recorded tape mode (playback only).

Q ■ What does a DAT deck feature?

As in a VCR, a helical-scan rotary head is employed.

- As the head itself rotates at 2,000 rpm, although the tape speed is slow (8.15mm/sec.), relative speed during recording/playback becomes 3.133m/sec.
- The tape winding angle onto the rotary drum (rotary cylinder) is narrower or 90°, in comparison with that in a VCR. Accordingly, with the tape kept in contact with the drum, high-speed tape-running is possible while the signal on the tape is being read out.
- As a result, high-speed program search is possible—200 times faster than the normal tape speed of 3.133m/sec.

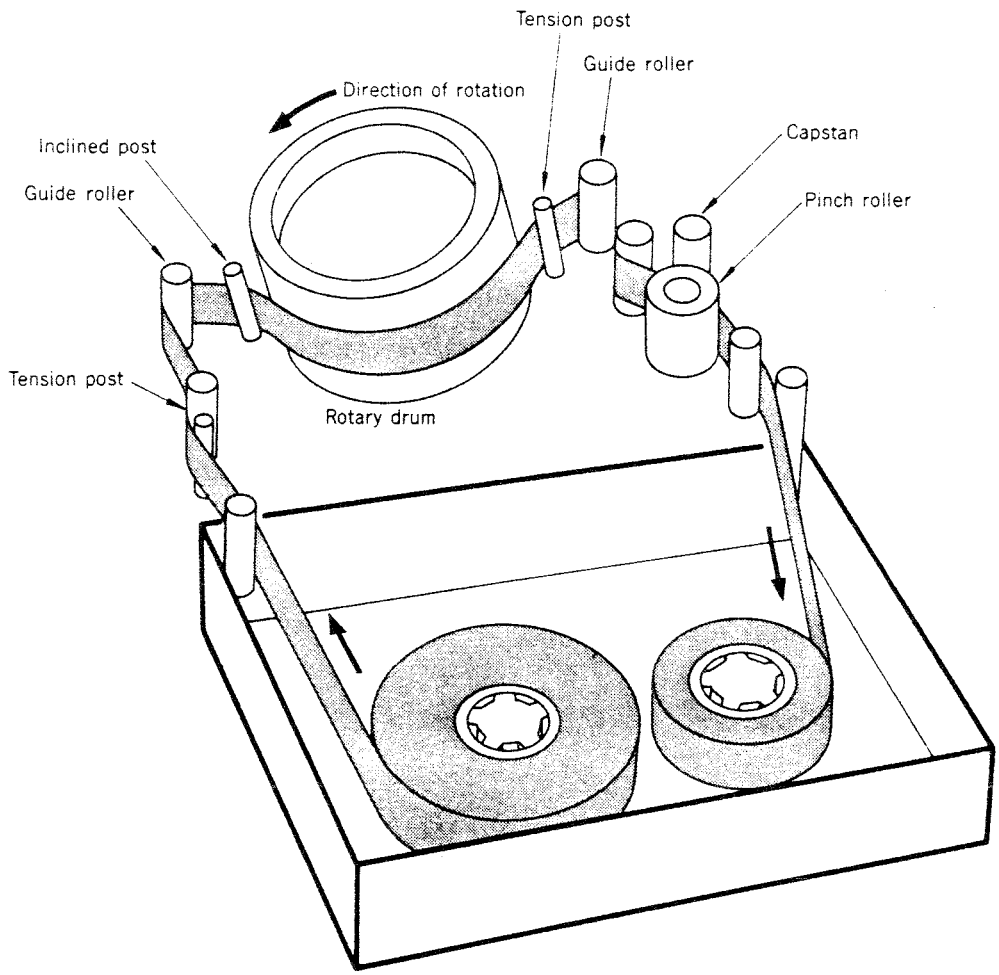
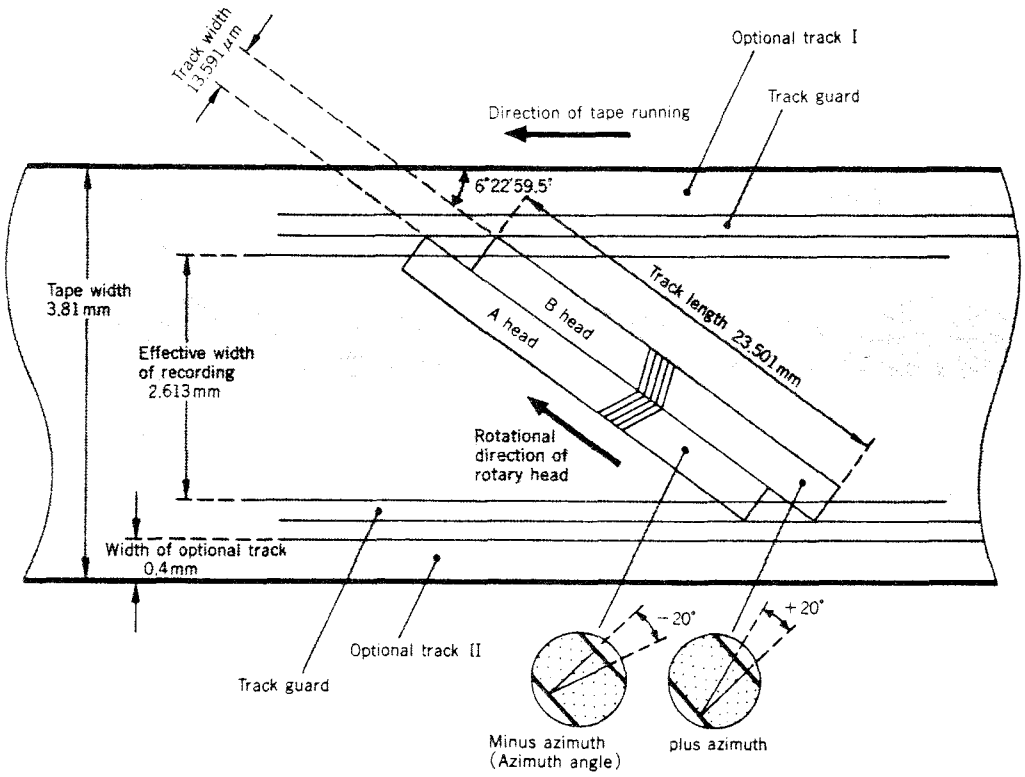


Fig. 5: DAT Mechanism (Tape loading)

Q ■ How is a DAT recording made?

As in a VCR, the signal is recorded helically.

- Two heads (A and B) mounted on the rotary drum record the signal in turn, and as an angle difference (azimuth) of ±20° is devised on each head, there is no possibility of recording error due to crosstalk from an adjacent track.
- The signal is recorded in a digitized pulse. The width of a track (corresponding to the sound groove on a record) on which the signal is recorded is 13.6μ (1/5 the diameter of a human hair). Each head accurately traces this thin track.



Item \ Mode	Normal track mode		Wide track mode
	Normal speed	Half-speed	
Tape width	3.81 mm	3.81 mm	3.81 mm
Tape speed	8.150 mm/sec	4.075 mm/sec	12.225 mm/sec
Track pitch	13.591 μm	13.591 μm	20.41 μm
Track angle	6°22'59.5"	6°22'59.5"	6°23'29.4"
Track length	23.501 mm	23.501 mm	23.471 mm
Head azimuth	± 20°		
Effective width of recording	2.613 mm		
Width of optional track	0.4 mm		

Fig. 6: Tape Recording Format

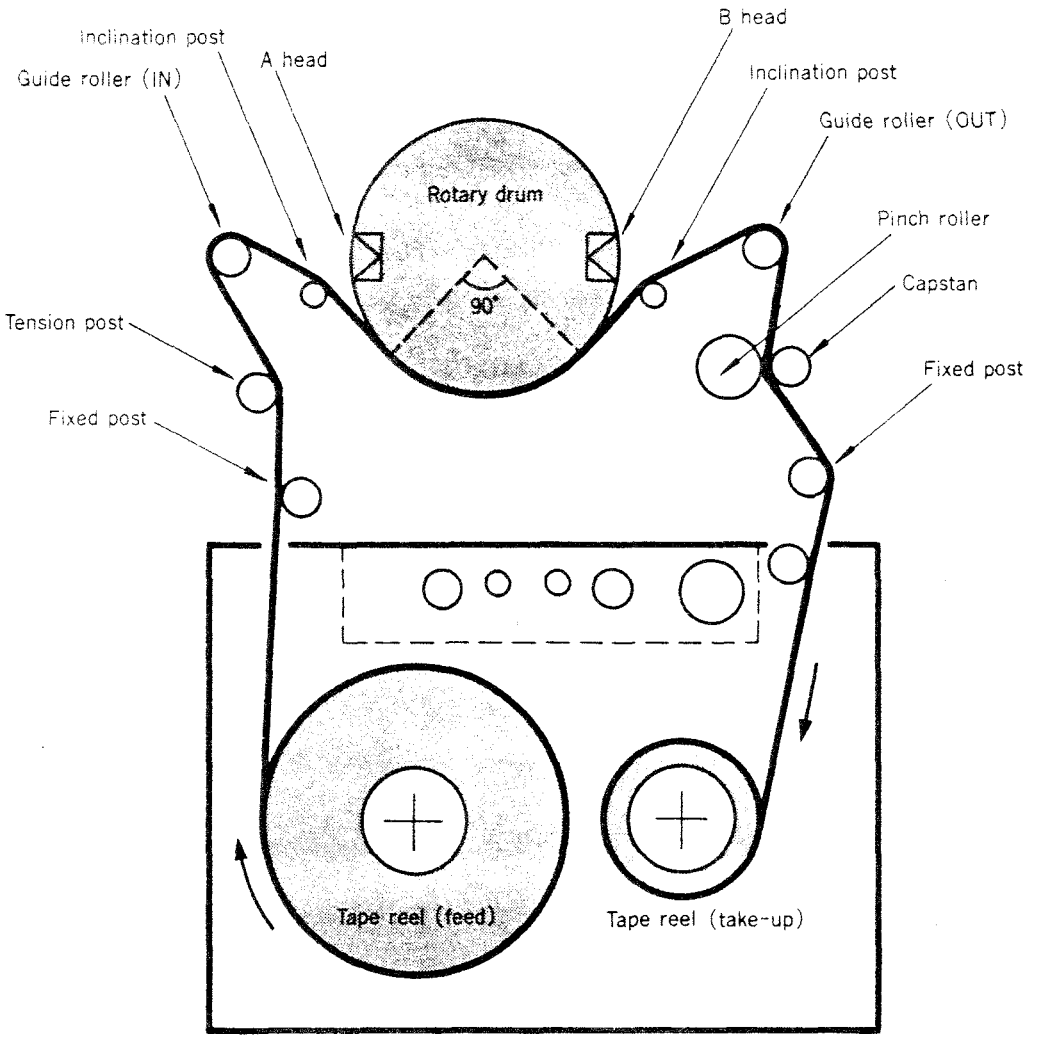


Fig. 7: Illustration of Tape Loading Principle

Q. What else, besides music, may be recorded on a DAT?

The following three kinds of signals may be recorded on a DAT:

1) A music signal digitally coded by the pulse code modulation (PCM) method is one.
2) A subcode (SUB) signal is another.
   Distinct from the music signal, this signal provides information about the DAT in playback mode. A variety of data, including the index number designated to a tune in playback and various control signals, can be recorded on a subcode.
3) An ATF (Automatic Track Finding) signal is the third.
   This is a signal which automatically follows tracks.

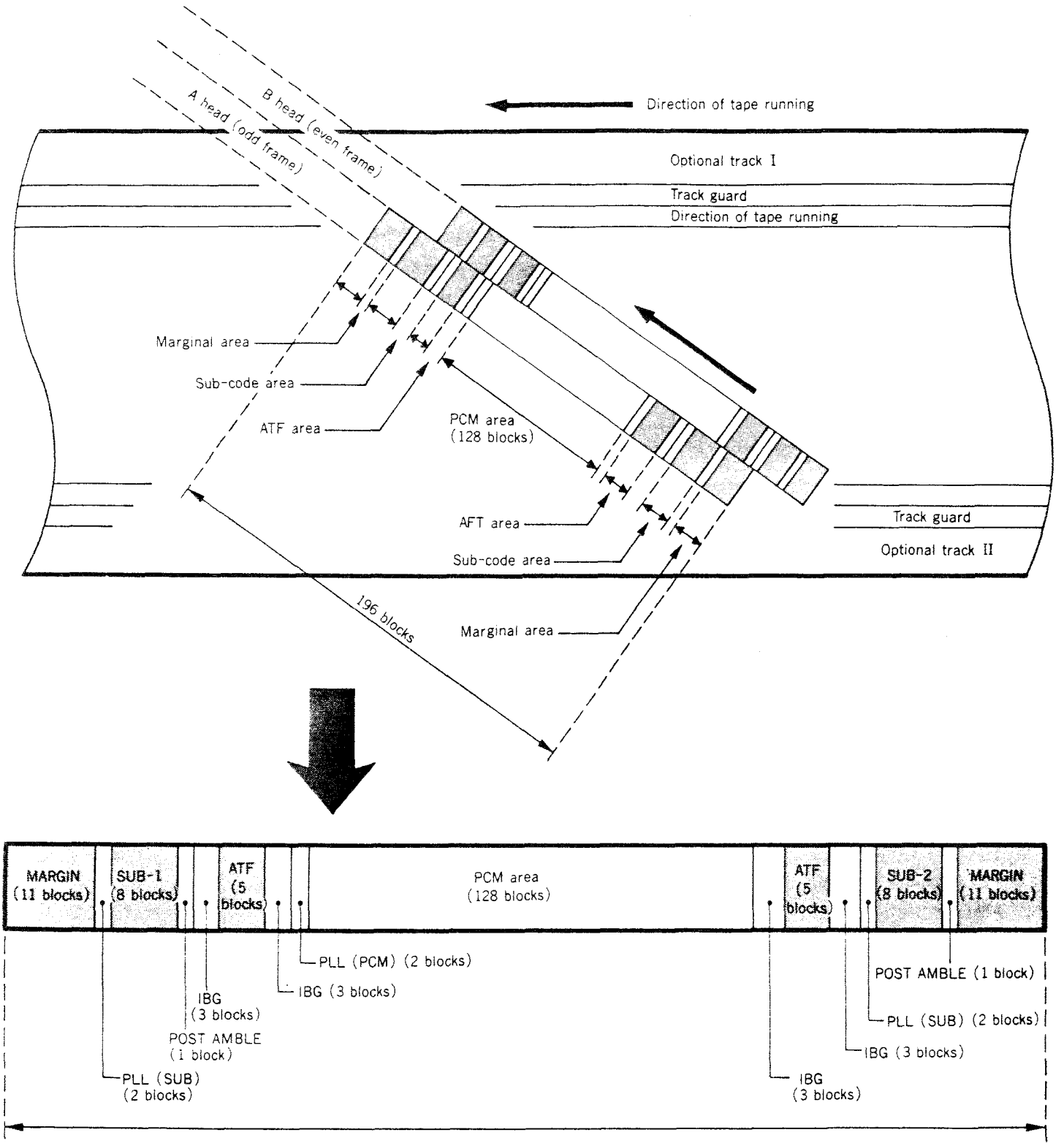
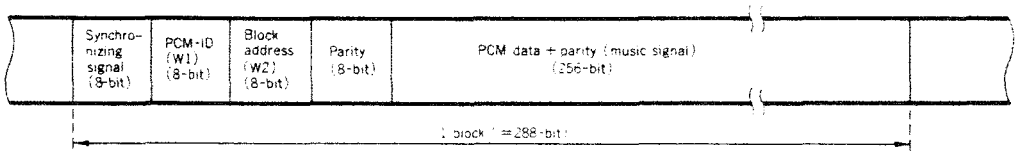


Fig. 8: Method of Data Recording

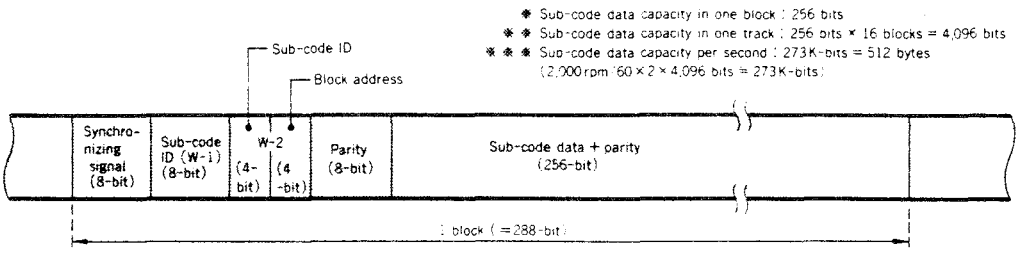
Q ■ What is a subcode?

Besides the music signal, this signal is provided for users' convenience. Its allows such signals as charting tune number, addressing and time control to be recorded.

- These control signals enable easy addressing of functions such as Skip ID, Start ID, TOC, direct-tune selection, and so on.
- Although CD has a similar control signal, the recording capacity of DAT is four times more than that of CD. This subcode, moreover, has been specially devised to allow further expansion of functions and operation in future DAT machines.



In-block structure in the PCM area



In-block structure in the Sub-code area

Fig. 9: PCM and Sub-code Areas

Q ■ What is ATF?

This stands for Automatic Track Finding and is a system which automatically follows tracks.

- When of a rotary-head machine like VCR or DAT is set in its reproduction mode, the head should accurately trace recorded tracks.
- When DAT equipment digitally records an audio signal, the ATF signal, which detects tracking discrepancies, is simultaneously recorded at the beginning and end of the audio signal.
- This ATF system eliminates the need for a control head such as exists on VCRs and a tracking adjustment knob.

Q ■ Why isn't an erasure head required for DAT?

In a conventional tape deck, when recording a new signal onto an audio cassette which has been used before for recording, the original signal should first be erased with a separate erasure head.

- DAT adopts the guard-bandless azimuth recording system, which uses a frequency of 1.568MHz, so that a previously recorded signal can be erased by an overwrite function.

Q ■ What is error correction?

There may be cases on a DAT where a part of the recorded signal has been lost (or, in other words, the signal has dropped out). Even in such a case, the error correction function compensates for the dropped-out portion by using either the remaining signal or data prerecorded for use with error correction.

- DAT is so devised that, should either head be damaged, the remaining head permits precise reproduction.
- This is why two heads "interleave or alternate signal data" to either of two tracks in turn. This method minimizes the sonic impact of data dropout by means of sharing data when recording.
- If the tape is scratched or dusty, noise or sound skip may occur. With DAT, however, almost all ill effects on sound quality are eliminated by this extremely effective error correction/interpolation function.

Q ■ What is Start ID ?

This is a signal to designate the beginning of a tune. DAT is so designed that Start ID can be recorded in the subcode area to enable accurate selection of musical pieces.

Q ■ What is Skip ID ?

This is a "skip identity" code which enables playback after automatically skipping such undesired sections as narration. Like Start ID, this code can be recorded in the subcode area.

Q ■ What is TOC ?

TOC stands for Table of Contents. This can contain general information including the number of tunes recorded on the tape, the length of a tune, and the start-time of each tune.

Q ■ How easy is a DAT machine to operate?

It operates in much the same way as a conventional audio cassette deck. But there are some operational features peculiar to DAT, including the following:

1) High-speed search, at 200 times (maximum) faster than normal tape running speed. This compares with the 10-times-faster search capability of a conventional audio cassette deck.
2) As with CD, provided that the tune number, time code, etc. are recorded in the subcode area, it is possible to accurately find the beginning of a tune utilizing this subcode.
3) Another operational feature peculiar to DAT is "Direct Program Selection", although this feature can differ from deck to deck depending on the manufacturer or the model. Following are some examples of this feature. (Names of makers are shown in parentheses):

- "Automatic Tune Number Recording Function", which enables recording of the tune number and the Start ID by means of detecting the blank portion between tunes at the time of recording. (Provided by all DAT manufacturers)
- "Re-Number Function", which automatically puts all the tune numbers in sequence if they have been disarranged while editing. (Aiwa, Sharp, Sony and Victor [JVC])
- "End-Search Function" (Aiwa, Matsushita Electric [Technics], Sony and Victor [JVC]), whereby the latest portion recorded on the tape

is automatically searched for and located.

- "Narration Cut Function", which allows automatic skipping of such undesired portions as narration when doing an air check. (Aiwa, Sony and Victor [JVC])
- "Forward/Reverse Skip Search Function." When the operation key is set to "play", "stop" or "pause", by depressing this "forward/reverse skip" key, fast-forwarding or rewinding starts from the tune currently in playback until the next tune is reached. Any desired tune can be searched for by depressing the key any number of times. (All DAT manufacturers; Aiwa calls it "Forward/Back Skip Function", while Sony has named it "Automatic Music Sensor.")

Q ■ What is Rehearsal Function?

This is a function to confirm the correctness of the tape position by means of repeatedly playing back the portion of the DAT deck's Start ID (as stated earlier, a subcode to indicate the beginning of a tune).

Q ■ What is Intro Scan?

In Intro Scan (sometimes known as Intro Play or Music Scan), only the first eight seconds of introductions of tunes in Sony's and Aiwa's machines or the first 10 seconds in Victor's machine are reproduced.

Q ■ How does End Search function?

This function allows the user to search the beginning of the tape's bland (not recorded) portion with one-touch operation.

Q ■ What are a DAT deck's display functions?

As on CD players, such information as tune number, time (all elapsed time, the tune's elapsed time), etc. is displayed.

Q ■ What recording is DAT best suited to?

Any type of sound can be recorded and/or reproduced with good quality. Its most effective use comes from recording a source with wide dynamic range, such as a CD or the B-mode PCM sound of satellite broadcasting.

- If valued records, CDs or private tapes are recorded with this DAT system, good sound may be preserved indefinitely.
- When a DAT deck is used in combination with a high-performance microphone or mixer, live recording of excellent quality is possible, corresponding in quality to a professional digital recording.

Q ■ Why have digital I/O terminals been included on DAT machines?

These terminals allow direct input/output of a digital signal. Accordingly, it is possible to digitally record satellite broadcasting (B-mode PCM sound or A-mode sound). An A-mode compatible deck is required in the latter case.

- It is also possible to dub DATs digitally by connecting one DAT deck with another.
- These I/O terminals are useful when digital recording/reproduction is made via an external converter, or when the DAT deck may be connected, in the future, to a totally digital audio system.

Q ■ Can digital copies be made of CDs?

Some CD players are equipped with a digital output terminal, but no digital dubbing is possible even if the player is connected to a DAT deck.

- This is why the DAT's sampling frequency differs from that of CD (44.1kHz). Even if you physically connect both, DAT is specially devised so that its recording ability won't function if such a connection is made with the intent to digitally copy.
- Analog recording is possible, however, through the ordinary line input. Even in the case of analog recording from CD, it is possible to record sound in excellent quality.

Q ■ Can prerecorded DATs be digital copies?

It is not possible to make a digital copy from a music tape which has a sampling frequency of 44.1kHz (identical to CD). (DAT prerecorded tapes are being produced using the sampling frequency of 44.1kHz.) As in the case of CD, such DAT cassettes must first be converted into analog and then be digitally recorded.

Q ■ What about the CBS Copycode system?

This is a filter system that incorporates a notch or signal into the software that, when recognized by a DAT recorder with an anti-copy chip, causes recording to stop. This is an alternative method and one which may cause distortion in the playback of music.

Q. What does the future hold for such technology?

Specific-purpose modes, compatible with satellite broadcasting or four-channel recording, are provided in the DAT standards in order to meet possible future demand.

- Further, the small, external configuration of the R-DAT cassette has given rise to consideration of other applications. DAT's cassette format, mechanism and so on are all specially devised so that a number of variations can be realized: For instance, car-mounted car stereo DAT players, portables, compact DAT (including headphone stereo type) and DAT equipment for use exclusively for live recording.
- DAT technology applications need not be confined to audio equipment. It is expected that, to make the best use of DAT's high-grade recording performance, the system may eventually be applied to the reproduction of still-images. DAT also has a large-capacity external memory, which can hold 1.2 gigabytes. For reference purposes, 1.2 gigabytes [or, 1,200 megabytes] of information may be filed on a 120-min. DAT tape. CD-ROM, on the other hand, has a memory capacity of 540 megabytes and a 3.5-inch floppy disk, a memory capacity of just one megabyte.

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