

Draft American National Standard  
**Basic System and Transport Geometry  
 Parameters for 1-in Type C  
 Helical-Scan Video Tape Recording**

C98.18

**1. Scope**

This standard specifies the general video record system, video pole tip locations, scanner parameters, scanner-guide locations, tape tension and test conditions for 1-in Type C helical-scan video tape recorders operating on the 525/60 monochrome or NTSC color systems.

**2. General Specifications**

**2.1** Dimensions in the metric system are primary. The English equivalents are derived and may deviate from established conversion practices.

**2.2** Tests and measurements made on the recorder to check the requirements of this standard shall be made under the following atmospheric conditions:

- Temperature for drum diameter  $23 \pm 0.5^\circ\text{C}$  ( $73 \pm 1^\circ\text{F}$ )
- Temperature for other tests  $23 \pm 1^\circ\text{C}$  ( $73 \pm 2^\circ\text{F}$ )
- Relative humidity 48 to 52 percent
- Barometric pressure 86 to 106 kPa (860 to 1060 mbar)
- Conditioning before testing 24 h

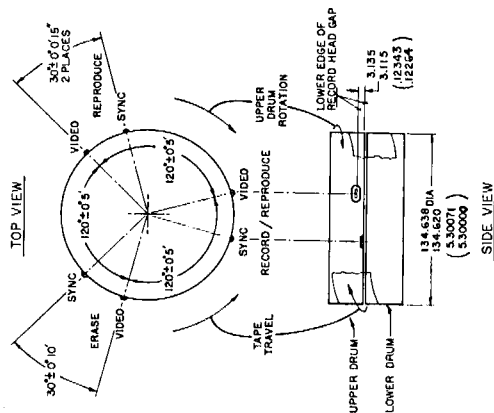
**3. Video and Sync Record System**

**3.1** Exactly one field of video shall be recorded during each scanner revolution. The record shall be divided into two parts, video and sync.

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**Fig. 1**  
**Pole Tip Locations and Drum Dimensions**

**3.2** The video record shall contain all active picture lines and sufficient vertical sync information for playback synchronization. Information not contained in the video record is defined as the vertical-interval dropout. (See American National Standard Dimensions and Location of Records for 1-in Type C Helical-Scan Video Tape Recording, C98.19.)

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**3.3** The sync record shall contain a number of horizontal TV lines during the vertical interval including those of the vertical-interval dropout and sufficient overlap of information for playback switching. (See ANSI C98.19.)

**3.4** Recording of the sync record shall be optional; however, no other information shall be recorded in the allotted tape area.

**4. Scanner Pole Tips**

**4.1** There shall be six circumferential pole tip locations as shown in Fig. 1, top-view. When an operational pole tip is not required, a suitable nonfunctional tip shall be placed in the same location.

**4.2** Each tip projection shall be  $0.06 \pm 0.03$  mm ( $0.0024 \pm 0.0012$  in), measured from the outer surface of the upper drum to the end of the pole tip.

**4.3** The axial distance between each video head pole tip and its associated sync head pole tip shall be as shown in Fig. 1, side view.

**5. Scanner Guides**

**5.1** Location of the tape entrance and exit guides shall provide a tape wrap angle such that the video record vertical-interval dropout is  $10.00 \pm 0.25$  horizontal lines due to loss of head-to-tape contact, with no electronic switching of the recording signal. Start and end of the vertical-interval dropout shall be measured at the half-amplitude points of the RF envelope.

**5.2** The helix angle formed by the scanner and all associated tape guides shall be  $2^\circ 35' 29'' \pm 2''$ .

**6. Drum Diameter and Tape Tension**

Effective drum diameter, tape tension, helix angle and tape speed completely determine the video record track angle. Different methods of design and/or minor variations in drum diameter and tape tension will produce equivalent recordings for interchange purposes. Values and operating conditions specified in this standard will produce the reference value of track angle. (See ANSI C98.19.)

**6.1** The actual drum diameter shall be  $134.620 \pm 0.018 - 0.000$  mm ( $5.30000 + 0.00071 - 0.00000$  in).

**6.2** The upper drum section shall rotate in synchronism with the video tips.

**6.3** The center span tape tension shall be  $1.5 \pm 0.2$  N ( $153 \pm 20$  gf).

**7. Definitions**

The following definitions of terms ensure correct understanding of this standard:

**Scanner:** A mechanical assembly containing a drum, rotating pole tips and tape-guiding elements used to record and reproduce video tape recordings.

**Drum:** A cylindrical column around which tape is at least partially wrapped in order to form the head-to-tape interface of a video tape recording system.

**Upper Drum:** That part of the drum in a helical-scan video tape recording system which does not contact the reference edge of the tape. (See ANSI C98.19.)

**Lower Drum:** That part of the drum in a helical-scan video recording system which contacts the reference edge of the tape and usually contains tape-guiding elements. (See ANSI C98.19.)

**Effective Drum Diameter:** A value of drum diameter which when used in theoretical calculations will correspond to the actual video record produced in a helical-scan video tape recording system. The effective value is equal to or greater than the actual drum diameter.

**Helix Angle:** The angle formed between the path of the rotating pole tips and the tape reference edge-guiding system on the scanner of a helical-scan video tape recording system.

**Track Angle:** The angle of the video record with respect to the reference edge of the tape in a helical-scan video tape recording. (See ANSI C98.19.)

**Center Span Tension:** A calculated value of tape tension at a point midway between tape entrance and exit guides of the scanner in a video tape recording system.

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NOTE: In addition to this standard, there are available the following documents relating to 1-in Type C helical-scan video tape recording:  
 C98.19, Draft American National Standard Dimensions and Location of Records for 1-in Type C Helical-Scan Video Tape Recording  
 C98.20, Draft American National Standard Frequency Response and Reference Level of Recorders and Repro-

ducers for Audio Records for 1-in Type C Helical-Scan Video Tape Recording  
 RP 85, Proposed SMPTE Recommended Practice on Tracking Control Record for 1-in Type C Helical-Scan Video Tape Recording  
 RP 86, Proposed SMPTE Recommended Practice on Video Record Parameters for 1-in Type C Helical-Scan Video Tape Recording

Draft American National Standard  
**Dimensions and Location of Records  
 for 1-in Type C  
 Helical-Scan Video Tape Recording**

C98.19

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**1. Scope**

This standard specifies the dimensions and location of recorded video, audio and tracking control records for 1-in Type C helical-scan video tape recorders operating on the 525/60 monochrome or NTSC color systems.

**2. General Specifications**

- 2.1 Dimensions in the metric system are primary. The English equivalents are derived and may deviate from established conversion practices.
- 2.2 Tests and measurements made on the tape record to check the requirements of this standard shall be made under the following conditions unless otherwise specified:

Temperature	23 ± 1° C (73 ± 2° F)
Relative humidity	48 to 52 percent
Barometric pressure	86 to 106 kPa (860 to 1060 mbar)
Tape tension	1.5 ± 0.2 N (153 ± 20 gf)

- 2.3 Conditioning before recording and testing shall be as follows:

Environmental conditions	Stabilized at measurement conditions
Tape tension	Wound on a reel at 0.5 to 3.0 N (51 to 306 gf)

- 2.4 The reference edge of the tape for dimensions in this standard shall be the lower edge as shown in Fig. 1. The magnetic coating is on the side facing the observer in all figures.

**3. Tape Speed**

The tape speed shall be 244.0 ± 0.5 mm/s (9.606 ± 0.010 in/s).

**4. Record Location and Dimensions**

- 4.1 Record location and dimensions shall be as specified in Fig. 1 and the table.
- 4.2 Dimensions P, Q, R and θ are for reference purposes only. The parameters given in Draft American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Recording, C98.18, and the tape speed completely determine these values and their tolerances. The nominal values given are based on tensioned tape; therefore, direct measurement without tension must take into account tape elasticity.

**5. Video Record Curvature**

The edge of the video record shall be contained within two parallel straight lines 0.030 mm (0.00118 in) apart.

**6. Relative Positions of Recorded Signals**

- 6.1 Video, sync, tracking control and audio signals with information intended to be time coincident shall be positioned as shown in Fig. 2. Dimensions Y and Z are for reference purposes only.
- 6.2 The start of the video record is that location on the video record which would be produced by scanner and guide locations with no electronic switching of the recording signal.
- 6.3 The vertical-interval dropout location with respect to a television frame is determined by the phase dimension, T, measured from the start of

Record Locations and Dimensions

Dimensions	Millimeters		Inches	
	Minimum	Maximum	Minimum	Maximum
A Audio 3 lower edge	0.000	0.200	0.00000	0.00787
B Audio 3 upper edge	0.775	1.025	0.03051	0.04035
C Sync track lower edge	1.385	1.445	0.05453	0.05689
D Sync track upper edge	2.680	2.740	0.10551	0.10787
E Control track lower edge	2.870	3.130	0.11299	0.12323
F Control track upper edge	3.430	3.770	0.13504	0.14843
G Video track lower edge	3.860	3.920	0.15197	0.15433
H Video track upper edge	22.355	22.475	0.88012	0.88484
J Audio 1 lower edge	22.700	22.900	0.89370	0.90157
K Audio 1 upper edge	23.475	23.725	0.92421	0.93406
L Audio 2 lower edge	24.275	24.525	0.95571	0.96555
M Audio 2 upper edge	25.100	25.300	0.98819	0.99606
N Video and sync track width	0.125	0.135	0.00492	0.00531
P Video offset	4.067 (2.5H) ref		0.16012 nom	
Q Video track pitch	0.1823 ref		0.007177 nom	
R Video track length	410.764 (252.5H) ref		16.17181 nom	
S Control track head distance	101.60	102.40	4.0000	4.0315
T Vertical phase odd field	1.220 (0.75H)	2.030 (1.25H)	0.04803	0.07992
U Vertical phase even field	2.030 (1.25H)	2.850 (1.75H)	0.07992	0.11220
V Sync track length	25.620 (15.75H)	26.420 (16.25H)	1.00866	1.04016
W Vertical phase odd sync field	22.360 (13.75H)	23.170 (14.25H)	0.88031	0.91220
X Vertical phase even sync field	23.170 (14.25H)	23.980 (14.75H)	0.91220	0.94409
Y* Vertical head offset	1.529 nom		0.06020 nom	
Z* Horizontal head offset	35.350 nom		1.39173 nom	
$\beta$ Track angle	2°34' ref			

\*For reference only

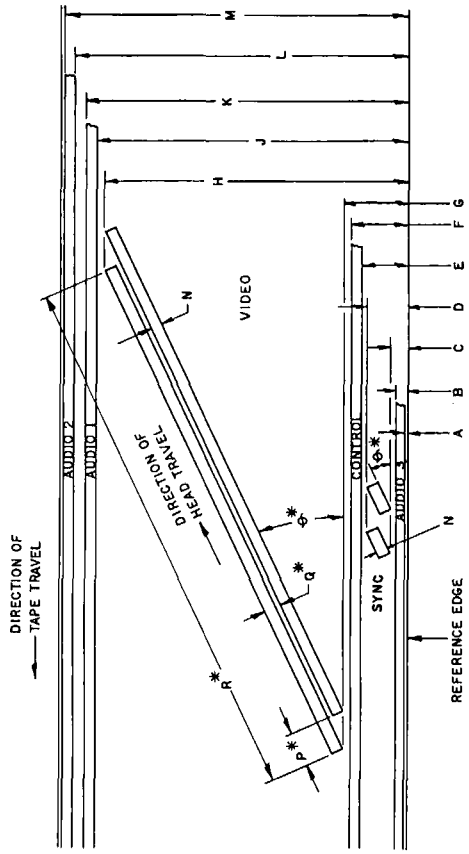


Fig. 1  
Record Locations and Dimensions

\* REFERENCE VALUE ONLY

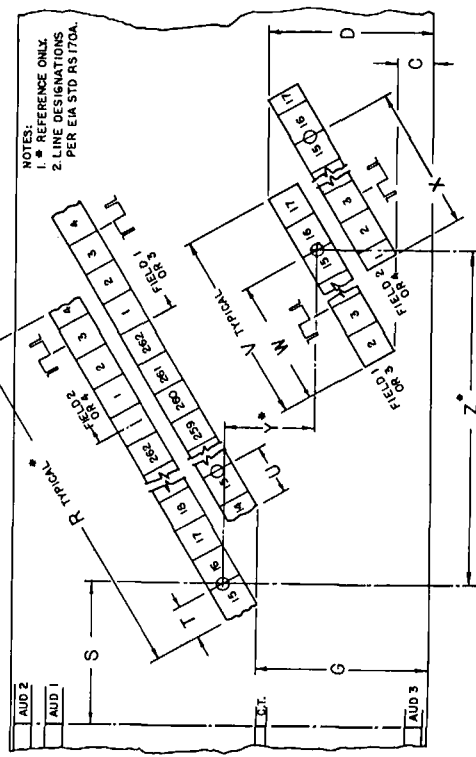


Fig. 2  
Video and Sync Record Locations

### 7. Gap Azimuth

**7.1** The azimuth of all head gaps used to produce longitudinal track records shall be perpendicular to the direction of relative head-to-tape motion.

**7.2** The azimuth of the video and sync head gaps shall be perpendicular to the direction of head motion.

NOTE: In addition to this standard, there is available Draft American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Recording, C98.18.

video to the negative-going edge of Line 16 H-sync in odd-numbered fields.

**6.4** The start and end of the sync record must be produced by electronic switching of the recording signal due to geometric constraints. (See ANSI C98.18.) Phasing of the sync record electronic switching shall be as per phase dimensions V and W in odd-numbered fields.

**6.5** Even-numbered fields have a different video and sync phasing (Dimensions U and X) due to the odd number of lines in a television frame.

# Draft American National Standard Frequency Response and Reference Level of Recorders and Reproducers for Audio Records for 1-in Type C Helical-Scan Video Tape Recording

C98.20

## 1. Scope

This standard specifies the frequency response and reference level of recorders and reproducers for audio records for 1-in Type C helical-scan video tape recording.

## 2. Reference Levels

**2.1** Recording Method. All recordings shall be made using the anhysteresis (bias) method.

**2.2** Recording and Reproducing Level Indicator. The audio recording and reproducing levels of a video tape recorder shall be adjusted with a standard volume indicator, as specified in American National Standard Volume Measurements of Electrical Speech and Program Waves, ANSI/IEEE Std 152-1953 (R1976).

**2.3** Recorder Reference Level. When a recording is made from a sinusoidal signal having a frequency of 1000 Hz such that the rms short circuit tape flux per unit track width on the record is  $100 \pm 3$  nWb/m of track width, the recording volume indicator shall be adjusted to deflect to its reference level (0 vu) scale mark. The reference level is intended to be nominally 8 dB below the recorded level that would produce 3% third-harmonic distortion.

**2.4** Reproducer Reference Level. When a tape record having an rms short circuit tape flux per unit track width of 100 nWb/m and a frequency of 1000 Hz is reproduced, the reproducing volume indicator shall deflect to its reference level (0 vu) scale mark.

## 3. Frequency Response

**3.1** Recorder Flux/Frequency Response. When a tape record is recorded from a constant voltage level applied to the input terminals of the recording system, the short circuit tape flux level on the record versus frequency,  $L_4(f)$ , shall be as given by the following equation:

$$L_4(f) = 10 \log_{10} \frac{1 + \left(\frac{F_1}{f}\right)^2}{1 + \left(\frac{f}{F_h}\right)^2} \quad [\text{dB}]$$

where  $L_4$  is the relative tape flux level;  $f$  is the frequency at which the response is being computed;  $F_1$  is the low-frequency transition frequency, 50 Hz; and  $F_h$  is the high-frequency transition frequency, 10610 Hz.

**3.2** Reproducer Flux/Frequency Response. When a tape record having a short-circuit tape flux level versus frequency given in Sec. 3.1 is reproduced, the output voltage level of the reproducer versus frequency shall be constant.

## 4. Track Usage

**4.1** Nonstereo Audio. The primary program audio channel shall be recorded on the Audio 1 track.

**4.2** Stereo Audio. When separate channels are used for stereo audio, the left channel shall be

recorded on the Audio 1 track and the right channel on the Audio 2 track. When sum and difference channels are used for stereo audio, the left plus right channel shall be recorded on the Audio 1 track and the left minus right channel on the Audio 2 track.

**4.3** Time and Control Code. When used, a time and control code shall be recorded on the Audio 3 track.

**5. Program Audio Head Phasing**  
When the same signal is recorded on the Audio 1 and Audio 2 tracks, the tracks shall be so phased that, when reproduced with a head wide enough to sense the recorded flux on both records, they will be additive.

NOTE: In addition to this standard, there is available Draft American National Standard Basic System and Transport Geometry Parameters for 1-in Type C Helical-Scan Video Tape Recording, C98.18.

## Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

The record flux level versus frequency method given in Sec. 3.1 is equivalent to the more familiar reproduce time-constant method. Transition frequencies may be calculated with the following equation:

$$F = \frac{1}{2\pi T}$$

Equivalent time constants would be:

$$T_1 = 3180 \mu\text{s}$$

$$T_h = 15 \mu\text{s}$$