SMPTE RECOMMENDED PRACTICE — RP 156-1990

Bar Code Labeling for Type D-1 Component and Type D-2 Composite Cassette Identification

1. Scope

This practice describes the requirements for the generation of bar code labels for the automatic identification of type D-1 component and type D-2 composite cassettes. Dimensions and tolerances of the printed bar code symbols are specified. The symbol encoding, data structure, and formatting of the label information is also specified. Lastly, the label characteristics, size, orientation, and placement are specified. This practice includes both rear and side labels.

2. Referenced American National Standards

This practice is intended for use in conjunction with the following American National Standards:

ANSI MH10.8M-1983, Specifications for Bar Code Symbols on Transport Packages and Unit Loads

ANSI X3.4-1986, Coded Character Set — 7-Bit American National Standard Code for Information Interchange

SMPTE 226M, Television Digital Recording — 19-mm Type D-1 Component and Type D-2 Composite Formats — Tape Cassettes

3. Bar Code Symbology

The interleaved 2 of 5 bar code shall be the symbology used for the identification of type D-1 and type D-2 cassettes.

3.1 General Description. The interleaved 2 of 5 bar code is a bidirectional, self checking, numerical bar code. Different start and stop characters are employed to permit bidirectional decoding. This bar code is a two-level code and employs a combination of wide and narrow elements to represent each symbol. The elements may be either bars or spaces. Wide elements are assigned a value of 1 and narrow elements a value of 0.

The characters are interleaved using bars to encode symbols in the odd-data positions and spaces to encode symbols in the even positions. The position numbering of the symbols begins with the first character after the start character (data 0). The interleaving process always requires an even number of characters. For example, if an odd number of characters must be encoded, a leading 0 shall be used to change the number of characters to an even number (as shown in Fig. 1).

3.2 Code Configuration. Each symbol is comprised of five elements, two of which are wide and three narrow. Table 1 shows the code symbology for characters 0 through 9.

The start and stop characters are encoded as follows (see Fig. 1):

Start character	0000
Stop character	100

The start character is constituted by two narrow bars and two narrow spaces. The stop character is constituted by one wide bar, one narrow space, and one narrow bar.

The start character is at the normal left-hand end adjacent to the most significant character. The stop character is at the normal right-hand end adjacent to the least significant character.

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Table 1
Interleaved 2 of 5 Bar Code Symbology

Character	Code
0	00110
1	10001
2	01001
3	11000
4	00101
5	10100
6	01100
7	00011
8	10010
9	01010

The interleaved 2 of 5 bar code is continuous because there are no inter-character gaps; all spaces contain information. Figs. 1 and 2 show examples of encoded data.

3.3 Alphanumeric Data. For rear labels, mixed use of alpha characters, numerics and symbols shall be permitted in fields defined as alphanumeric. These characters are encoded using a pair of numeric symbols. Symbol encoding is shown in Table 2. Encoding for alphanumeric characters may be calculated from the standard ASCII value according to the formula shown below.

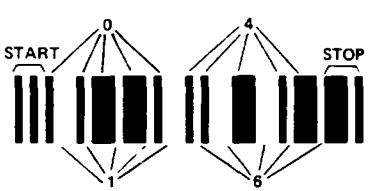

Fig. 1
Interleaved 2 of 5 Bar Code Symbol
Encoding 0146

Conversion from ASCII to the required format may be accomplished by subtracting 20_{hex} from the hexadecimal ASCII code and then converting the result to base 10.

$$\text{Required form} = \{ [\text{ASCII}]_{hex} - [20]_{hex} \}_{10}$$

Refer to ANSI X3.4-1986, for details concerning ASCII encoding. Table 2 defines alphanumeric characters that may be used for cassette bar code labels. An example of alpha encoding is as follows:

To encode the letter A

$$\begin{array}{r} \text{ASCII} \quad 41_{hex} \\ -\ 20_{hex} \\ \hline 21_{hex} = 33_{10} \end{array}$$

The position of alphanumeric data is defined by the label format.

Alphanumeric data shall be encoded, decoded, or both only in fields defined as alphanumeric.

3.4 Code Density and Dimensions. The significant parameters of the interleaved 2 of 5 code are the width of the narrow elements and the ratio of the width of wide to narrow elements. For optimum automatic scanning, the bar height (see Table 3), the code's position on the label, and the label's orientation on the cassette shall be specified (see 4.2 and 4.3, 5.1.1 and 5.1.2, 5.2.1 and 5.2.2).

The width of a narrow element shall be 0.26 mm for rear labels and 0.68 for side labels. The

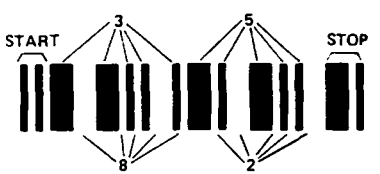

Fig. 2
Interleaved 2 of 5 Bar Code Symbol
Encoding 3852

Table 2
Bar Encoding of Alphanumeric Data

Upper / Lower	0	1	2	3	4	5	6	7	8	9	
0	SP	*	4	>	H	R	\	f	p	z	
1	!	+	5	?	I	S	]	g	q	{	
2	"	,	6	@	J	T		h	r	|	
3	#	-	7	A	K	U	_	i	s	}	
4	$	.	8	B	L	V	`	j	t	~	
5	%	/	9	C	M	W	a	k	u		
6	&	0	:	D	N	X	b	l	v		
7	'	1	;	E	O	Y	c	m	w		
8	(	2	<	F	P	Z	d	n	x		
9	)	3	=	G	Q	[	e	o	y		[Note 2]

Note 1: SP represents a space character.
Note 2: Data 99 is reserved and is invalid as an alphanumeric code. Refer to 4.4.

minimum and maximum width of an element is determined by the application and constraints imposed by the specific scanning equipment. This application requires the symbols to be printed in accordance with the ratios and tolerances specified in Table 3.

The ratio of the width of the wide elements to that of the narrow elements shall be 2.5:1.

The width of the various elements and the nominal ratio of the widths of the wide to narrow elements shall not change within a given bar code label.

3.5 Bar and Space Width Tolerances. The allowable printing width tolerance (T) is a function of the nominal width (W) of the narrow bars and spaces and the nominal ratio (N) of the wide to narrow elements. The tolerance is defined as follows:

$$T = \pm\left(\frac{18N - 21}{80}\right)W$$

Table 3
Bar Code Element Dimensions and Tolerances
(All dimensions in millimeters)

Label	Narrow Element Width (W) ± (T)	Wide Element Width	Wide/Narrow Ratio (N)	Bar Height
Rear	0.26 ± 0.078	0.65	2.5	5.0 ± 0.1
Side	0.68 ± 0.23	1.70	2.5	10.0 ± 0.5

The values of N for any interleaved 2 of 5 symbol must be in the range of 2 to 3. For the narrow element width and the specified ratio, the dimensions shall be as given in Table 3.

4. Bar Code Label Details

4.1 Rear Label. There shall be three areas of information on the rear bar code label. These are listed from the top of the label to the bottom and each occupies the full length of the label (see Fig. 3):

User information area
Bar code symbols
Human readable interpretation of the bar code

At each end of the bar code label, there shall be a quiet zone. The zone shall extend for a minimum of 3.5 mm beyond each end of the bar code extending toward the edges of the label. No markings of any kind are permitted in this area. For interchange of tape cassettes, any human readable information printed on this label shall be in the English language.

4.2 Rear Label Size and Placement. The rear bar code label shall be affixed to the cassette in the recessed area designated as the rear label area as described in SMPTE 226M.

The rear label dimensions shall be as follows (see Fig. 3):

Length 138.7 ± 0.2 mm
Width 17.5 + 3.0 – 0.1 mm

The label's thickness shall be in accordance with specifications of SMPTE 226M.

The label shall be oriented such that the label information can be read when the cassette is viewed from the rear edge with the top label area uppermost.

4.3 Label Format. Information areas, dimensions, and tolerances for the rear-label area are shown in Fig. 3.

4.4 Rear Label Bar Code Data Format. The data in Table 4 shall be encoded to identify the contents of a cassette.

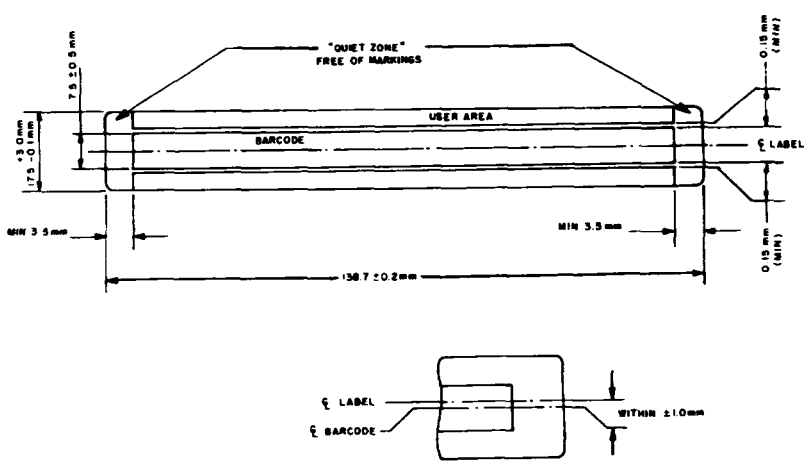

Fig. 3
Rear Label Information Areas, Dimensions and Tolerances

Table 4
Rear Label Bar Code Data Format

Symbol Position	Field	Type	Note
0	Type Number	numeric	1
1 → n	Identification No.	alphanumeric	2
n+1 → n+2	Separator		2
n+3 → 40	Title	alphanumeric	2
41 → 48	Start of Message (SOM)	numeric	3
49 → 56	Duration (DUR)	numeric	3
57	Checksum	numeric	4

Note 1: The type number shall be used to define the contents of the cassette as either a single-event (0) cassette or a multi-event (1) cassette. A single bar code symbol is used to specify the type number. Type numbers 2 to 9 are reserved.

Note 2: The identification number and title fields are alphanumeric and require 2 bar code symbols per character. A 20-character block is allocated to these fields. The identification number may be between 3 and 8 characters in length. A separator code is used to indicate the end of the identification number and the beginning of the title. The title data fills the remainder of the 20-character block. The separator code is always defined as 99 and is an unprinted character that is reserved in the alphanumeric table for this purpose.

Note 3: The SOM and DUR are numeric and are in the HHMMSSFF format.

Note 4: S3,S2,S1 is the three-digit resultant of the following expression:

(S3,S2,S1) = 3x (data0+data2+data4+ ... +data56) +(data1+data3+data5+ ... +data55)

S1 is the least significant digit of that resultant and is used to calculate the checksum.

Checksum = 10 - S1. If S1 = 0 then checksum = 0.

An example of data encoded in the correct format is shown in Fig. 4 and the resulting bar code label is shown in Fig. 5.

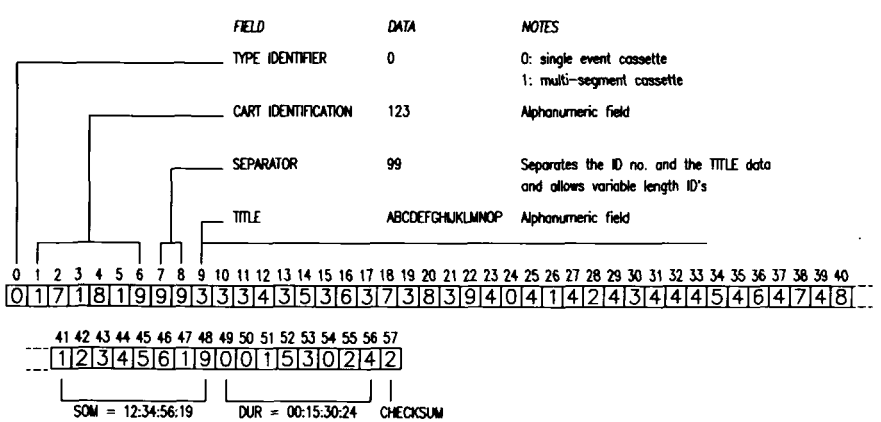

Fig. 4
Rear Label Bar Code Format

Fig. 5
Sample Rear Bar Code Label

4.5 Type Number. The type number defines the cassette as either a single-event cassette containing one identified event or as a multi-event cassette containing two or more identified events.

Type No. 0, Single-event cassette. The SOM and DUR fields on the label define the cue points for the identified event.

Type No. 1, Multiple-event cassette. The SOM defines the time code location of an on-tape directory containing the location of each identified segment on the tape. The DUR on the label is the sum of the individual segment durations that have been identified and are contained in the on-tape directory.

4.6 Identification Number and Title. The identification number and title fields are alphanumeric and variable in length. The total combined length is 20 alphanumeric characters (including the separator). This separator marks the end of the identification number data and the beginning of the title data.

The cassette identification number is the primary identifier for the cassette. The minimum length shall be 3 characters and the maximum 8 characters. Leading spaces in this field are not permitted. Unused space in the field shall be filled with spaces (ASCII = 20 $_{hex}$).

The title occupies the remaining portion of the field. The maximum size of the title field is 16 characters and the minimum 11 (corresponding to the minimum and maximum length of the identification number). Unused space in this field shall be filled with space characters.

4.7 SOM and DUR. Both fields are numeric and are formatted in the HHMMSSFF format. The start of message (SOM) defines a time code location to be interpreted as defined in 4.5.

The duration (DUR) for type 0 cassettes shall specify the desired duration of the material.

The duration (DUR) for type 1 cassettes shall be the sum of the segment durations identified on the tape.

4.8 Rear Label User Information Area. This area is reserved for user information and does not contain any essential machine readable data. Printed information in this area shall be separated vertically from the bar code by a space of not less than 0.15 mm. The last two characters at the right end of the user information area are reserved and shall indicate the type of cassette, using the letter S for a type 0 (single event) cassette and the letter M for a type 1 (multiple event) cassette (see 4.5).

4.9 Rear Label Bar Code Symbol Area. This area contains the machine readable information and is formatted as described in 4.4. The bar code shall be centered vertically on the label within 1 mm of the label's horizontal centerline.

4.10 Rear Label Human Readable Interpretation. This area is reserved for a translation of the bar code identification number, title, SOM and DUR data. Printed information in this area shall be separated vertically from the bar code by a space of not less than 0.15 mm.

5. Side Labels

5.1 Right-Side Label. The areas of information on the right-side label are identified and located as shown in Fig. 6.

Bar code symbols
Human readable interpretation of the bar code

At each end of the bar code label, there shall be a quiet zone. The zone shall extend for 9.0 ± 0.5 mm beyond each end of the bar code and is also shown in Fig. 6.

5.1.1 Right-Side Label Size and Placement. The right-side label shall be affixed to the side-label area of the cassette as shown in Fig. 7.

The right-side label dimensions shall be as follows:

Length: 58.5 ± 0.5 mm
Width: 20.5 ± 0.5 mm

The label's thickness shall be in accordance with specifications defined in SMPTE 226M.

The label shall be oriented such that the label information can be read when the cassette is viewed from the side with the top label area uppermost.

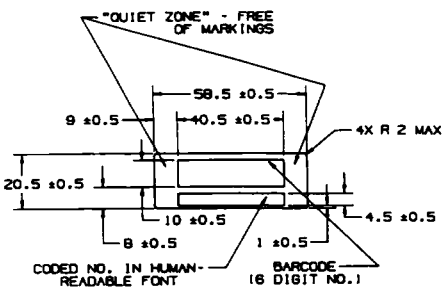

Fig. 6
Right-Side Label Information Areas, Dimensions and Tolerances

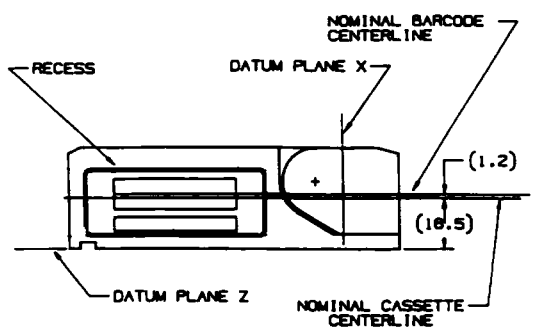

Fig. 7
Location of Right-Side Label

5.1.2 Right-Side Label Format. Information areas, dimensions, and tolerances for the right-side label are shown in Fig. 7.

5.1.3 Right-Side Label Bar Code Symbol Area. This area contains the machine readable information and is formatted as described in 3.2. The bar code shall be nominally offset 2 mm vertically above the centerline of the label.

5.1.4 Right-Side Label Bar Code Data Format. The right-side label contains a single field of 6 numeric digits for cassette identification purposes and the start and stop characters as described in 3.2. No other data is encoded in this area.

The checksum is excluded due to the low density of this data.

5.1.5 Right-Side Label Human Readable Interpretation. This area is a translation of the bar encoded data. The order of the translated information will correspond to the encoded data.

5.2 Left-Side Label. Optionally, another side label may be affixed to the left side of the cassette as shown in Fig. 8.

There shall be two areas of information on the optional left-side labels, located as shown in Fig. 9.

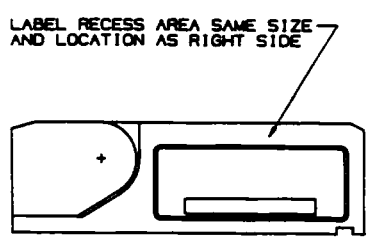

Fig. 8
Location on Left-Side Label

User information area
Human readable interpretation of the bar code on the left side of the cassette

5.2.1 Left-Side Label Size and Placement. The left-side label shall be affixed to the side-label area of the cassette as shown in Fig. 8.

The left-side label dimensions, thickness, and orientation shall be as specified in 5.1.1.

The dimensions and tolerancing of this optional label are shown in Fig. 9.

5.2.2 Left-Side Label User Information Area. The optional left-side label may be utilized for user information and shall, as a minimum requirement, contain the human readable interpretation of the bar code which is on the right side.

If a bar code is included in the user information area of the left-side label, it shall be located as shown (for the right-side label) in Fig. 6.

6. Printing and Scanning Requirements

Detailed information regarding printing of bar codes, paper type, ink election, and the requirements of the bar code scanner may be found in ANSI MH10.8M-1983.

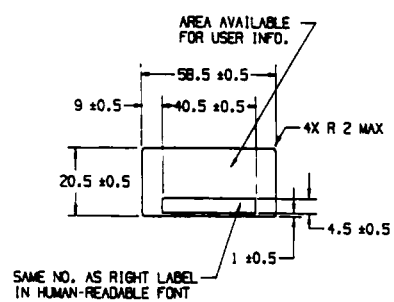

Fig. 9
Left-Side Information Areas, Dimensions and Tolerances

SMPTE RECOMMENDED PRACTICE

RP 157-1990

Key Signals

1. Scope

This practice describes the format of a key video signal which is used to control the contribution of an associated fill video signal into a composite of two or more signals. Such signals are commonly referred to simply as key signals. This description is given for composite and component analog and digital signals.

2. Referenced American National Standard

This practice is intended for use in conjunction with the following American National Standard:

ANSI/IEEE 511-1979, Video Signal Transmission Measurements of Linear Waveform Distortion

3. General Specifications

A key video signal represents the opacity or transparency of its associated fill video signal. When the fill signal is opaque, it will obscure all videos of lower priority in the composited image and will be visible unless it is itself obscured by videos of higher priority. When the fill video is transparent, it will not be visible. When the fill video is partially transparent, it will be mixed with the video(s) of lower priority.

Normally, the key signal shall have the same video format as the video signal with which it is associated. (See Note 1.)

The key information shall be treated as a video signal, with black representing complete transparency and white representing complete opacity. (See Note 2.) Values between black and white indicate partial transparency. Black-and-white levels shall conform to the specifications for the appropriate video format. (See Note 3.)

The chrominance of the signal shall be set to zero. (See Note 4.)

4. Synchronization and Timing (See Note 5.)

4.1 Synchronization. The key signal shall incorporate the same synchronizing elements as a video signal of the same format, including color burst for composite formats. (See Note 6.)

4.2 Picture Phase. Picture phase defines the timing relationship between picture information in the video, and the synchronizing information of the same video. The key signal shall have picture phase identical with that of its associated fill video signal, ± 0 lines vertically and ± T/25 horizontally. (See Note 7.) In digital component systems, key samples shall be co-sited with the corresponding luminance samples.

4.3 Timing. The key signal shall be timed coincident with its associated fill video signal, ± 0 lines vertically and ± T/25 horizontally. In composite systems, SC/H timing shall match that of the associated fill video signal.

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Notes:

1. In facilities employing multiple video formats, it is possible that the key signal and fill video signal will be of different formats. The intent of this practice is that the key signal shall be constituted according to the equipment through which it will pass. For example, a key signal which is to be handled by analog NTSC equipment should conform to specifications for analog NTSC video signals.

2. It should be noted that chroma keyers have traditionally used the opposite polarity to all other key signals. The method of implementation within equipment is at the discretion of the designer, but any key signal outputs from chroma keyers for external connection should conform to this practice.

3. When the fill video is required to be opaque at the horizontal edges of the picture, use of transmission blanking width on the key signal may give rise to undesirable edge effects. Facilities using narrow blanking for video should use the same blanking width for key signals. Edge artifacts will be removed when transmission blanking is applied. Facilities using transmission blanking width may wish to use narrower blanking for key signals to avoid edge artifacts.

4. In component systems, it is possible to use the color information channels for other purposes. Any such information does not form part of the key signal.

5. Much equipment now in use does not meet these specifications. Designers of new equipment should take this into account. The tolerances specified are those required to ensure no discernible error in the composited picture.

6. It should be noted that, for composite systems, burst is an essential part of the synchronization information. Many devices which operate in the composite domain do not operate properly when burst is not present. Consequently, burst is required on key signals in a composite environment.

7. T is the letter symbol for the duration of one half-period of the nominal upper cutoff frequency of a transmission system, thus $T = 1/(2f_c)$. It is commonly referred to as the Nyquist interval. For system M, T is approximately 125 ns. (See ANSI/IEEE 511-1979, p. 8.)