SMPTE ENGINEERING GUIDELINE

EG 23-1990

Transfer of Two-Channel Stereo Audio from Audio Magnetic Film or Tape to Video Tape

1 Scope

1.1 This guideline specifies the handling of volume range issues when transferring two-channel stereo audio from 35-mm or 16-mm magnetic film, or other audio tape formats utilizing time-code based methods of synchronization, to any video recording media.

1.2 Among the volume range issues are both objective and subjective ones, including:

Most end users will usually adjust loudness so that dialog is reproduced at a normalized level (despite how loud or soft other parts of the program may be) for best intelligibility.

Dubbing stages and monitor theaters are often operated at higher reference sound pressure levels than the end video consumer will use.

Commercials may well be intercut with program material, creating the potential for abrupt level changes among video sources.

Many of the video formats have reduced audio dynamic range capability when compared to magnetic audio-only masters.

Video transmission involves at least a 75 µs preemphasis network in the transmitter, and often much more nonstandardized audio signal processing, which has an impact on the volume range relationships within the program material.

1.3 The guideline also specifies certain labeling requirements for audio masters.

2 Definitions

Volume range: The range along an intensity scale occupied by program material; volume range is taken to be from the highest peaks of the program to the lowest signal intended to be audible.

Dynamic range: The range along an intensity scale of which a medium is capable; measured from a maximum point of stated distortion to a background noise level. Dynamic range varies frequency-by-frequency, but is often expressed as a single number from the mid-band defined distortion level to the psychoacoustically weighted noise level, e.g., "the dynamic range was 72 dB (3% THD to CCIR-ARM noise)."

3 Identification

3.1 The audio film or tape shall be clearly marked with the title and reel number of the program and identified as a two-channel stereo recording. If the medium is capable of more than two audio records, then the channels containing the left and right audio master information shall be indicated.

3.2 If proprietary noise-reduction companding is employed on the master, the type of noise reduction, and, if required, the reference fluxivity for setting the operating point of the noise reduction system, shall be indicated.

4 Use of noise reduction

4.1 If the program material has been encoded for a proprietary companding noise-reduction system, then corresponding noise reduction decoders must be engaged. If external to the video recorder, such decoders shall be included in the signal path immediately after the audio film or tape playback preamplifier, and before any other audio signal processing.

4.2 If the video master is to employ external noise reduction encoding, then the noise reduction encoder shall be included in the signal path after all other audio processing, immediately before the video recorder.

5 Reference levels and their usage

5.1 Reference fluxivity for film masters is given in SMPTE EG 9-1985 as 185 nWb/m. Reference fluxivity for 1-in C-format video tape is given in ANSI/SMPTE 20M-1985 as 100 nWb/m. Reference fluxivity on tape masters may range from 185 to 320 nWb/m, depending on the practice of the studio making the master and so must be indicated on the label. Even though reference fluxivity on tape masters may range from 185 to 320 nWb/m, the peak level used for program material is usually within a smaller range, since metering practice (vu vs. peak) dictates that vu meters are used with lower reference levels, and peak meters with higher ones.

5.2 Normal practice is to set the audio reproduction and recording chain gain structure such that the reference fluxivity used in the source medium is copied to the reference fluxivity of the recording medium. For media wherein reference fluxivity does not apply as a level-determining mechanism, such as 1/2-in "hi-fi" recording by way of audio on FM carriers on the video tracks, a combination of setting the level using meter readings on the recorder while playing the source material, and sample recordings, are the best way of determining the correct recording level.

5.3 If the video recorder has a compressor or limiter as a part of its circuitry, the compressor or limiter should be switched off, if possible.

6 Need for volume-range reduction

6.1 The combination of the subjective and objective factors given in the scope often leads to the need for reducing the volume range of source material, when copying from audio masters to video tape.

6.2 Measurements of contemporary magnetic film and 1-in video tape on recorders set to all the relevant standards show video tape to have 8 dB less headroom for equal distortion to magnetic film at 200 Hz, but equal headroom at 10 kHz. In addition, video tape is some 10 dB noisier in the psychoacoustically important 2-3 kHz region.

6.3 Differing conditions outlined in the scope lead to a range of solutions, so that no one set of rules can be developed. On the other hand, examples can be given for various transfer conditions, and are shown in the next section. General principles are:

It is important to monitor the program under conditions as like those as encountered by the final user as possible, so that volume range judgments are not obscured by other factors. These conditions include reference sound pressure level and frequency response of monitoring, background noise level of the listening room, choice of stereo vs. monaural monitoring, and the like.

It is important to monitor the output from the recording media, rather than simply its input, to check the generation loss due to the transfer process. If the recorder does not provide playback off the tape simultaneously while recording, then a sample recording should be synchronized to the audio master, and A/B compared.

Limiting may be preferred to compression as producing the better artistic representation of the program material on the recording medium (i.e., limiting can have fewer audible side effects than compression). The amount of limiting is usually kept to the range of about 6 dB on the peaks of program.

7 Examples

7.1 *Problem:* A 35-mm magnetic master intended for transfer to a stereo optical track of a theatrical motion picture is to be transferred to 1-in C-format video tape for playback on commercial television. The picture is action-oriented, containing loud sound effects and music.

Approved September 25, 1990

Discussion: There are a number of factors stated in the problem that influence the amount of volume range modification necessary:

The fact that the master has been prepared for transfer to optical film means that the volume range has probably already been limited, since conventional optical tracks have less dynamic range than do magnetic ones.

The statement that the picture contains loud sound effects and music implies that the dialog level is relatively low, compared to the maximum levels, for this example.

The reference sound pressure level in motion-picture theaters has been observed to be about 6 dB greater than that used by the majority of listeners in the home environment.

The statement that the program will be played over commercial television means that low dialog level will be much more noticeable than if there were no commercials, since listeners will adjust the volume for a normalized level of dialog during the program, and if the program dialog level is low, will find the commercials too loud.

The first factor implies little volume-range modification is necessary, but, on the other hand, the other three factors, especially taken together, call for a reduction of the volume range.

Solution: Use a limiter set so that the program peaks cause 6 dB of limiting.

7.2 *Problem:* The same master as in 7.1 is to be transferred to a wide dynamic range digital recording for use as a running master in duplicating 1/2-in "hi-fi" format video tapes.

Discussion: The emphasis in maintaining the full dynamics of the master are more important for the "hi-fi" part of the market than they are for commercial television, due to the rising popularity of home use of VCRs with attached stereo audio systems. The use of a wide dynamic range running master is essential since the dynamic range performance of the "hi-fi" recording is greater than that of 1-in C-format video tape, even if noise reducing companding is employed on the video tape.

Solution: Use no limiting or compression to make the running master. (Note: It may be necessary for the *duplicator* to employ compression or limiting of the signal sent to the conventional longitudinal track, if both the "hi-fi" and conventional tracks are to be optimized simultaneously.

7.3 *Problem:* A monaural DME (having dialog, music and effects on separate channels of a 3-track magnetic film) is to be transferred to 3/4-in video tape. The program material is a documentary in which narration is the loudest part of the program.

Discussion: Despite the probable low volume range of the original, some limiting may be necessary due to the low audio dynamic range of the 3/4-in video medium compared to the audio film source.

Solution: Use a limiter with a maximum gain reduction of about 6 dB.

Annex A (Informative)

References:

ANSI/SMPTE 20M-1985, Video Recording — 1-in Type C Recorders and Reproducers — Frequency Response and Reference Level

SMPTE RP 150-1988, Channel Assignments and Test Leader for Magnetic Film Masters Intended for Transfer to Video Media Having Stereo Audio

SMPTE EG 9-1985, Audio Recording Reference Level for Post-Production of Motion-Picture Related Materials

PROPOSED SMPTE STANDARD

Revision and Consolidation of
ANSI V98.2-1982
and
ANSI V98.9-1983

Television — Specifications for video tape leader

1 Scope

1.1 This standard specifies the minimum requirements for the content and duration of signals recorded prior to the start of the recorded program material to permit setup and adjustment of equipment for optimum performance during reproduction.

1.2 The standard also specifies a visual and aural countdown sequence to facilitate program cuing and specifies the duration of video tape that precedes and follows the recorded material to provide the minimum lengths of tape required to ensure proper threading in video tape systems which do not employ tape cassettes.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below:

EIA RS-189-A, Encoded Color Bar Signal

SMPTE EG 1-1990, Alignment Color Bar Test Signal for Television Picture Monitors

SMPTE RP 142-1986, Stereo Audio Track Allocations and Identification of Noise Reduction for Video Tape Recording

3 Runup section

In video tape systems which do not employ a tape cassette, there shall be a 10-second minimum duration runup section of blank tape (see figure 1(A)) prior to the recording of any signals on the tape.

4 Noise reduction

This segment of the video tape leader shall be used only if an external audio noise-reduction encoding system, not inherent to the video tape format being used, is applied to the program audio material and decoding is required during the playback. The use of external audio noise reduction is not covered by SMPTE specifications, and must be by mutual agreement. The tape shall be labelled with information about the form of external audio noise reduction used.

4.1 Video. A video signal as specified in 4.1 shall be recorded in this video segment (see figure 1(B)) for a duration equal to the total duration of the audio signals specified in 4.2.1 and 4.2.2.

4.2 Audio

4.2.1 Noise reduction identification. An interrupted tone of 5-second minimum duration shall be recorded in this audio segment (see figure 1(C)) at the level and frequency specified in 5.2.1. The interruptions may be of any duration and frequency that will be observed or heard by the operator during playback, nominally of 1-second duration at 1-second intervals.

4.2.2 Noise reduction alignment. If the external audio noise reduction system being used requires an alignment signal or signals, they shall be recorded in this audio segment (see figure 1(D)) for a minimum of 30 seconds. This signal must not be recorded unless the noise reduction identification specified in 4.2.1 is also recorded.

4.3 Leader noise reduction. If an external audio noise reduction encoding system is used for the program material, the audio signals specified in 5.2 should be recorded without external audio noise reduction encoding whenever practical.

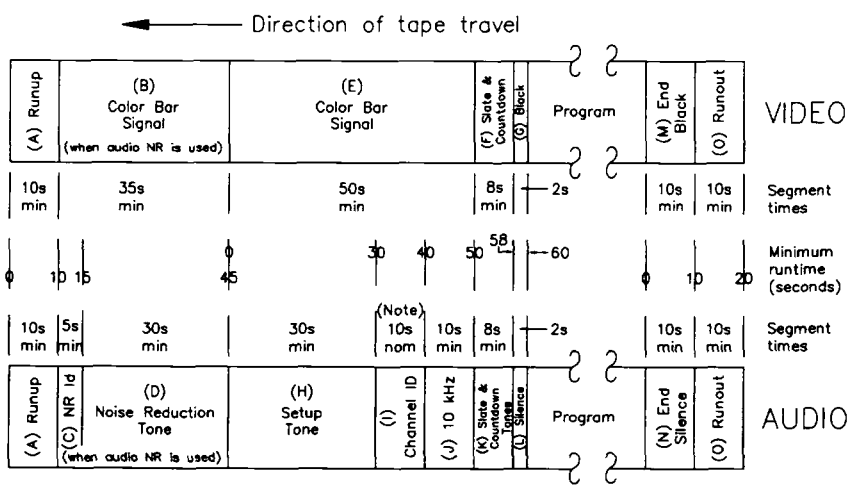
5 Basic leader

5.1 Video

5.1.1 Color bar signal. A color bar pattern as defined by EIA RS-189-A or SMPTE EG 1-1990 shall be recorded in this video segment (see figure 1(E)) for a duration equal to the total duration of the audio signals specified in 5.2.1, 5.2.2 and 5.2.3. Color bar signals shall be recorded with maximum luminance at 77 IRE units corresponding to a 75 percent chroma level, and shall include a reference white bar and a reference black bar. The recording of the color bar signal shall be made under the same conditions of equipment adjustment as used for recording the program video material. For original recording, the color bar signal shall originate in and be fed through the same studio and equipment used for the program. In the case of monochrome recordings, a stairstep signal may be substituted for the color bar signal.

5.1.2 Slate and countdown. Visual identification information shall be recorded in this video segment (see figure 1(F)) for a duration equal to the duration of the audio signals specified in 5.2.4. The identification shall contain the following information (if known):

(1) title
(2) subject
(3) production number



Note: See 5.2.2 for content of this audio segment.

Figure 1 — Video tape leader

(4) take number
(5) name of recording studio
(6) date of recording
(7) broadcast date

In addition, a visual seconds countdown shall be recorded in this video segment, beginning with the number representing the seconds remaining until the start of program, decreasing with each elapsed second, and ending with the number 2. Each visual countdown number shall appear coincident with the beginning of the corresponding tone burst specified in 5.2.4 and shall remain until the beginning of the next tone burst, with the exception of the number 2, which shall appear for a single video frame beginning 2 seconds before the program start.

5.1.3 Black. A video black signal (sync, color burst and setup) shall be recorded in this video segment (see figure 1(G)), beginning with the video frame following the countdown number 2 and ending with the video frame preceding the start of program.

5.2 Audio

5.2.1 Setup tone. An audio setup tone shall be recorded in this audio segment (see figure 1(H)) for a minimum of 30 seconds. The tone shall consist of a sine wave of a single frequency between 400 Hz (nominal) and 1000 Hz (nominal) at a level matching the operating level of the program material (normally reference level flux for the tape format being used). The tone recorded on all audio tracks shall originate from the same oscillator and be coherent in phase on all audio tracks.

5.2.2 Channel Identification

5.2.2.1 Monophonic Audio Recording. When the program audio is a monophonic recording, the audio setup tone specified in 5.2.1 shall continue on all audio tracks in this audio segment (see figure 1(I)) for a 10-second nominal duration.

5.2.2.2 Stereophonic Audio Recording. When the program audio is a stereophonic recording, a sequence of audio tones of frequency and level as specified in 5.2.1 shall be recorded in this audio segment (see figure 1(I)) for a 10-second nominal duration. The pattern of this sequence of audio tones shall be as given in table 1. The exact duration of these tones is not critical providing there is a single burst of audible tone on the left channel followed by two bursts of audible tone on the right channel. The left and right channels are defined in SMPTE RP 142-1986 and the individual recording format standards.

5.2.3 10 kHz. A 10-kHz sine wave with the same input level as the signal specified in 5.2.1 shall be recorded on all tracks in this audio

Table 1 — Sequence of audio tones for stereophonic audio channel identification

	Left channel	Right channel	Nominal duration
Segment 1	Silence	Silence	1.4 seconds
Segment 2	Tone burst	Silence	1.4 seconds
Segment 3	Silence	Silence	1.4 seconds
Segment 4	Silence	Tone burst	1.4 seconds
Segment 5	Silence	Silence	1.4 seconds
Segment 6	Silence	Tone burst	1.4 seconds
Segment 7	Silence	Silence	1.4 seconds

segment (see figure 1(J)) for a minimum of 10 seconds.

5.2.4 Slate and countdown tone bursts. A series of countdown tone bursts shall be recorded on all tracks in this audio segment (see figure 1(K)). The tone bursts shall be of a frequency and level as specified in 5.2.1, and shall each be of 1 video frame duration. The start of each tone burst shall be coincident with the corresponding seconds transition before the program start (see figure 2). The tone bursts shall begin 8 or more seconds preceding the program start and shall end with the tone burst 2 seconds before the program start. In addition, an aural recording of all or part of the information in 5.1.2 may be recorded in this audio segment, but it shall not interfere with the intelligibility of the countdown tone bursts.

5.2.5 Silence. Silence shall be recorded on all tracks in this audio segment (see figure 1(L)) from the end of the 2-second tone burst to the beginning of the program.

6 End

6.1 Video. A video black signal (sync, color burst, and setup) shall be recorded in this video segment (see figure 1(M)) for a minimum of 10 seconds.

6.2 Audio. Silence shall be recorded on all tracks in this audio segment (see figure 1(N)) for a minimum of 10 seconds.

7 Runout Section

In video tape systems which do not employ a tape cassette, there shall be a 10 second minimum duration runout section of blank tape (see figure 1(O)) following the recording of all signals on the tape.

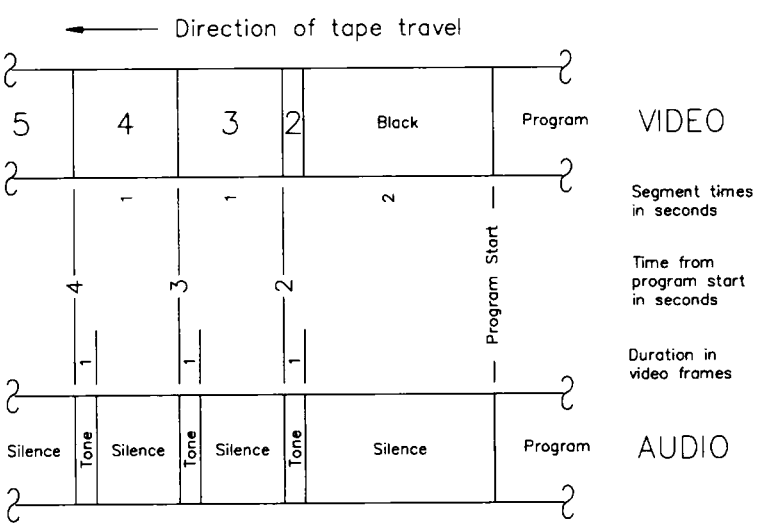


Figure 2 — Countdown signal alignment

PROPOSED SMPTE RECOMMENDED PRACTICE

RP 160

Three-channel parallel analog component high-definition video interface

1 Scope

1.1 This practice defines the physical characteristics of an interface using three parallel channels for the interconnection of equipment operating with analog component HDTV signals. For SMPTE 240M-1988, the signals carried across this interface have a scanning structure of 1125 lines, 60.00 fields per second, 16:9 aspect ratio, and 2:1 interlace. This interface is also appropriate for HDTV signals having other scanning structures.

1.2 The intended uses of this interface are:

To interconnect the elements of parallel analog HDTV video subsystems which use the same component sets within larger component islands or plants. Component HDTV editing and post-production suites are examples of such subsystems.

To interconnect equipment into complete, self-contained HDTV analog component systems of relatively small size.

1.3 This practice applies to signals carried on the connectors described in 7.1 and may not apply to component signals carried on other types of connectors. The practice also defines the preferred component video signals across the interface, including their waveform structure and levels.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this SMPTE Recommended Practice. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this practice are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

SMPTE 240M-1988, Television -- Signal Parameters -- 1125/60 High-Definition Production System

3 Video signals

The signals carried across this interface may be those of either of two signal sets: a color set comprising E_R', E_G', and E_B' signals, or a color-difference set comprising E_Y', E_{PB}', and E_{PR}' signals. Definitions of the signal sets may be found in SMPTE 240M-1988 and other relevant standards. Figures 1 and 2 illustrate the waveform structure, synchronizing signal, and video levels for these two component sets.

4 Impedance

Equipment using this interface shall have nominal 75-ohm input and output impedances.

5 Clamping and signal dc content

The clamp period shown in figures 1 and 2 may be used as a dc level clamp reference point. If an ac coupled system is employed, the average dc level of any signal specified herein shall not exceed ± 1 volt.

6 Component timing

The three component video signals (E_G', E_B', E_R') or (E_Y', E_{PB}', E_{PR}') should be simultaneous in real time.

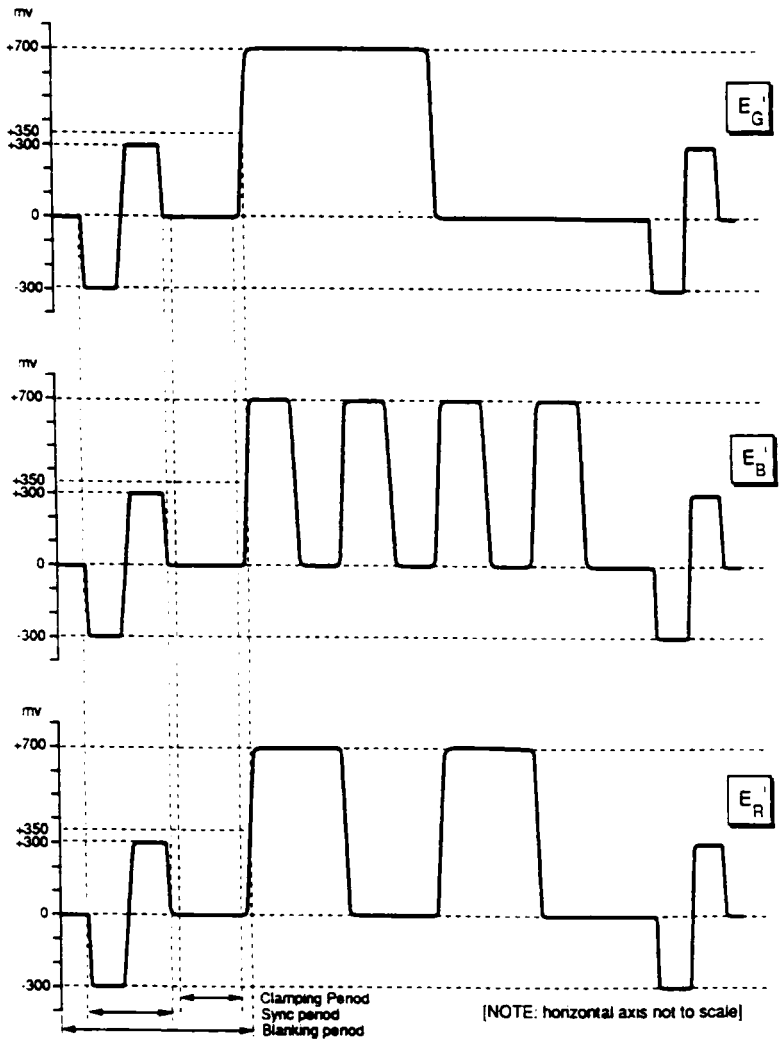


Figure 1 - Waveform structure and levels of (E_G', E_B', E_R') signals for 100% color bars

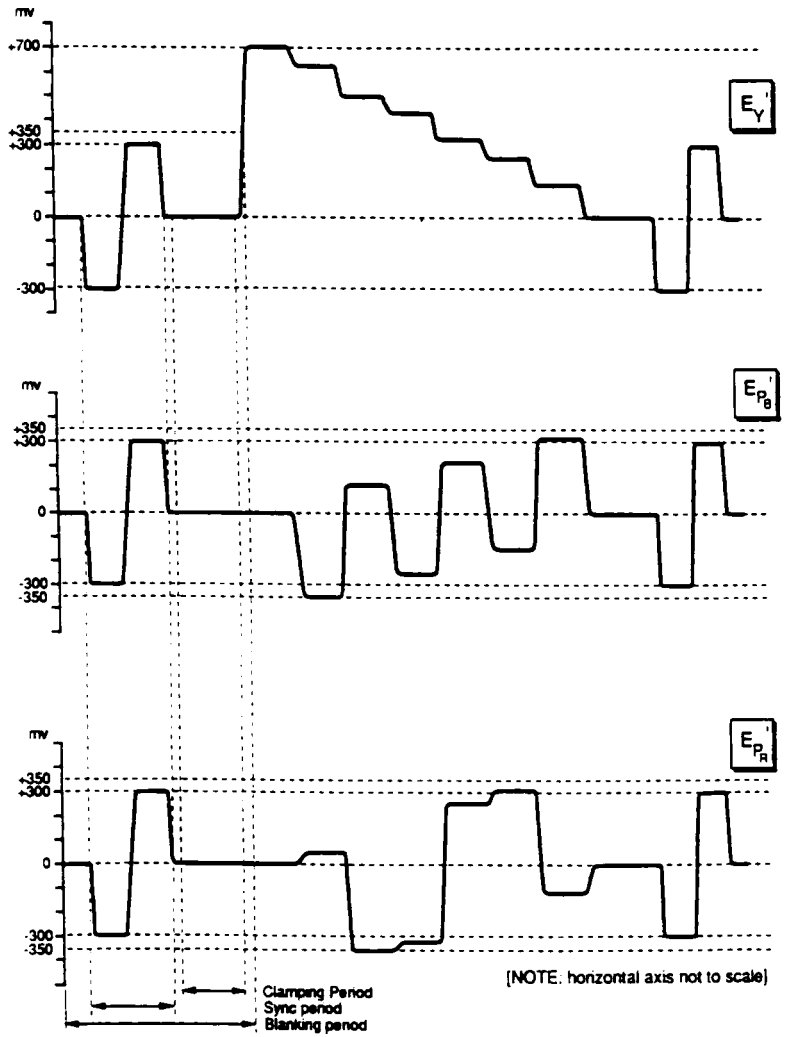
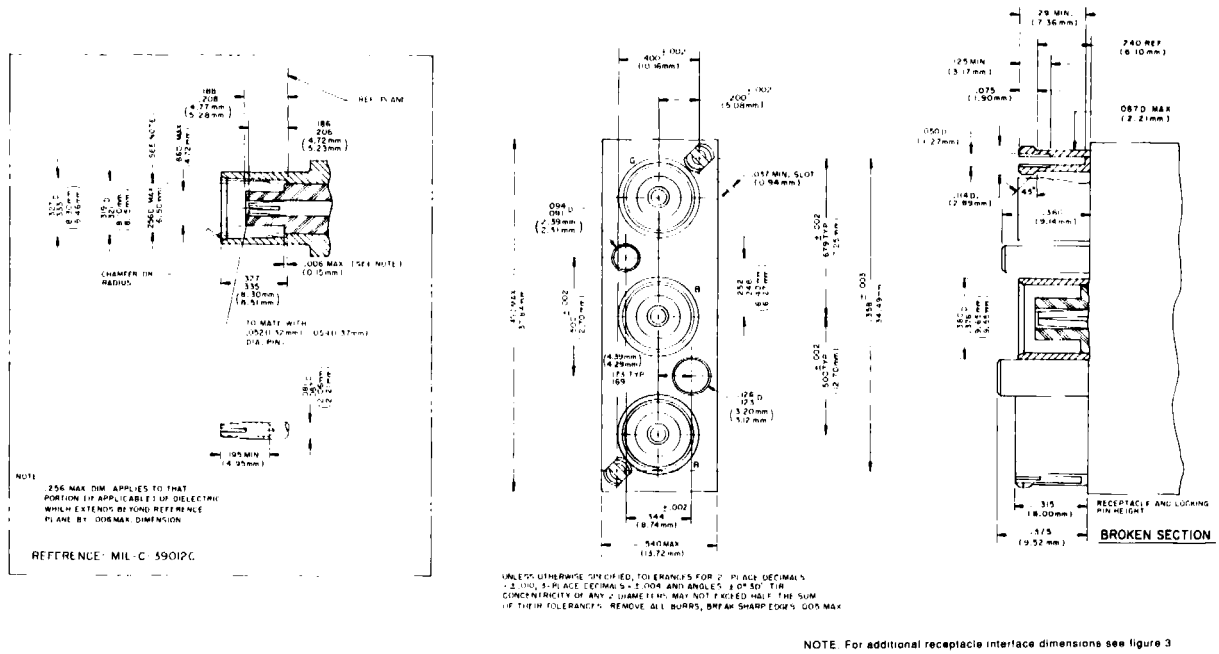
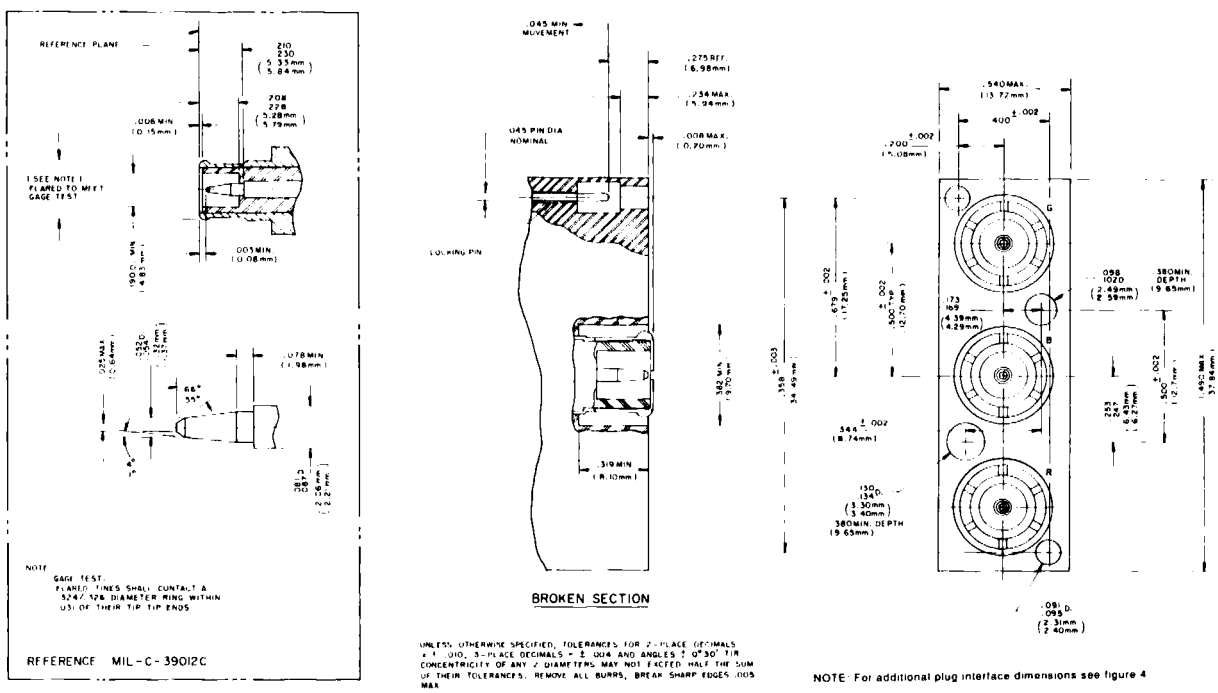


Figure 2 - Waveform structure and levels of (E_Y', E_{P_B}', and E_{P_R}') signals for 100% color bars



NOTE: For additional receptacle interface dimensions see figure 3

Figure 4 - Socket Interface



NOTE: For additional plug interface dimensions see figure 4

Figure 3 - Plug Interface

7 Connector and cable

Two different connector implementations are permissible under this practice. The preferred implementation incorporates a single multiconductor cable and keyed connector arrangement carrying all three parallel signals. The secondary implementation utilizes three separate cables with BNC connectors carrying the three parallel signals. This section describes the preferred implementation.

7.1 Connector The connector consists of three BNC inserts mounted in a rectangular housing. Latching is accomplished by two latch posts and receptacles, internal to the connector. Additional posts are utilized for polarizing and reinforcing purposes.

This practice defines the dimensions and tolerances necessary to permit the interchange of plug and socket connectors that contain the three BNC inserts.

The plug interface is described in figure 3, and the socket interface in figure 4. The BNC pin and socket are derived from Mil Spec. No. Mil-C-39012C and are described in figures 3 and 4.

Individual insert positions in each mating connector shall be marked with G, B, and R, respectively, as shown in figures 3 and 4. These position identifications correspond to the cable coding.

Annex A (informative)

Bibliography

SMPTE 253, Television – Three-Channel Parallel Component Analog Video Interface

7.2 Cable The recommended cable consists of three individual, insulated, coded, coaxial cables, all housed in a nonmetallic jacket.

7.2.1 Cable selection considerations HDTV component sets as specified, for example, in SMPTE 240M-1988, are wideband signals. In choosing the coaxial cable to implement this interface, the user should take account of the following:

30-MHz bandwidth for each video component signal

Differential timing between each of the three coaxial cables (this refers specifically to the tolerance in cable transit time)

Crosstalk among the three coaxial cables

A cable with nominal impedance of 75 ohms is recommended

Return loss of the cable.

7.2.2 Cable color coding Each individual coax within this cable shall be uniquely coded to *identify the signal to be carried upon it. The* coding shall be:

Coax coding	Signal carried
Color green or letter G	E_G' or E_Y'
Color blue or letter B	E_B' or E_{PB}'
Color red or letter R	E_R' or E_{PR}'

PROPOSED SMPTE ENGINEERING GUIDELINE

EG 25

Telecine scanning for film transfer to television

1 Scope

This guideline specifies the maximum film image area and minimum image size range that a telecine should be capable of scanning to transfer motion-picture images to television.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this SMPTE Engineering Guideline. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this guideline are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI/SMPTE 7-1988, Motion-Picture Film (16-mm) -- Camera Aperture Image and Usage

ANSI/SMPTE 59-1989, Motion-Picture Film (35-mm) -- Camera Aperture Images

ANSI/SMPTE 152-1989, Motion-Picture Film (70-mm) -- Projectable Image Area

ANSI/SMPTE 201M-1989, Motion-Picture Film (16-mm) -- Type W Camera Aperture Image

ANSI/SMPTE 215-1984, Motion-Picture Film (65-mm) -- Camera Aperture Image

3 Film image area and size

3.1 The film to video transfer device must be capable of reproducing the total camera aperture area. Film scanning requirements for five film formats are listed in table 1.

3.2 The film to video transfer device must be capable of variable x size, y size, and zoom. The x and y sizes must be independently and continuously variable over a minimum 2:1 range.

3.3 If the film image area selected for video transfer is less than the full intended scene captured by the camera, it should be possible to reposition the scanned area for video transfer anywhere within the available original intended scene image area.

Table 1 — Film scanning requirements

Film format	Maximum height		Maximum width	
	mm	in	mm	in
Super 16 mm	7.57	0.298	12.52	0.493
16 mm	7.59	0.299	10.26	0.404
35 mm	18.72	0.737	24.89	0.980
65 mm	23.52	0.926	52.48	2.066
70 mm*	23.52	0.926	52.48	2.066

*See annex A

Annex A (informative)

It is recognized that for artistic or technical reasons the variable x, y, and zoom may be independently variable over a greater than 2:1 range. The value given in 3.2 represents a minimum value only.

The maximum dimensions given in clause 3 represent the limiting areas within which the camera aperture may have been positioned. Each width dimension is the specified nominal value from the appropriate standard. Each height dimension is the sum of the specified image height plus the positive tolerance, from the appropriate standard.

For example, in the case of 35 mm
width = 24.89 mm
height = 18.67 + 0.05 = 18.72 mm

Note that certain 70 mm elements may have images printed perforation to perforation. Therefore, the maximum film image area for 70 mm is the same as for 65 mm.

PROPOSED

SMPTE ENGINEERING GUIDELINE

Audio channel assignments for digital television tape recorders with AES/EBU digital audio inputs

1 Scope

1.1 This guideline specifies the allocation of input audio signals to digital audio channels on digital television tape recorders (DTTRs) when the inputs are connected through AES/EBU digital interfaces.

1.2 This guideline also specifies preferred assignments of programs to audio recording channels, on the basis of program type, for purposes of program exchange.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this guideline. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this guideline are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI S4.40-1985, Digital Audio Engineering — Serial Transmission Format for Linearly Represented Digital Audio Data

SMPTE 227M, Television Digital Component Recording — 19-mm Type D-1 — Helical Data and Control Records

SMPTE 247M, Television Digital Recording — 19-mm Type D-2 Composite Format — Helical Data and Control Records

EBU Recommendation R48-1988, Allocation of Audio Channels in the D-1 Digital Television Tape Recording Format

3 Definitions

3.1 DTTR digital audio channel: The portion of the recorded data stream on a digital video recorder which contains sampled, quantized, and digitally represented audio information from a single audio channel. DTTRs may contain more than one of these channels, each of which is uniquely identified.

3.2 AES/EBU data stream: A stream of data corresponding to the recommendations of ANSI S4.40-1985 for the serial digital transmission of two channels of periodically sampled and linearly represented digital audio data. The following definitions are quoted from ANSI S4.40-1985:

3.2.1 audio sample data: An audio signal that has been periodically sampled, quantized, and digitally represented in twos complement form.

3.2.2 subframe: A set of audio sample data accompanied by other data containing auxiliary information. Two subframes, one for each channel, are transmitted in sequence in any one period of the source sampling frequency.

3.2.3 frame: A sequence of two subframes, each carrying audio sample data for a single channel, transmitted in one sample period. The first subframe in the frame is subframe A, the second is subframe B. (ANSI S4.40-1985 contains an error in this section, stating that each subframe carries "audio sample data for each of two channels." The document is under revision, and the next issue will conform to the content indicated here.)

4 Default channel assignments for DTTRs with four AES/EBU digital inputs

4.1 This section is applicable to DTTRs equipped with four input connectors and four output connectors conforming to ANSI S4.40-1985. The data streams arriving at these inputs each contain two audio channels, labelled A and B. Each of the channels has a status word identifying the relationship between the A and B channels, as follows:

Status	Meaning
0	Mode not indicated: receiver defaults to two channel mode
1	Two-channel mode
2	Single-channel mode (monophonic)
3	Primary/secondary mode (subframe A is primary)
4	Stereophonic mode (subframe A is left channel)
5-E	Undefined
F	Vector to byte 3 for future applications

4.2 The four digital audio recording channels in such a DTTR can only accept data from four of the eight incoming audio channels. As the DTTR is not transparent to all possible combinations of inputs, this document establishes a convention for the default relationship between audio channels on the input connectors and DTTR digital audio channels.

4.3 The assignment of input channels to DTTR channels in this convention is based upon the status word of the incoming data stream, and the input connector number as follows:

DTTR channel	Input channel carried	Conditions
1	1-A	Always
2	1-B	If input 1 status is 0,1,3,4
	2-A	If input 1 status is 2 or undefined
3	3-A	Always
4	3-B	If input 3 status is 0,1,3,4
	4-A	If input status is 2 or undefined

4.4 Output channels are data-filled, where possible, so as to be identical to the equivalent-numbered input.

4.5 Audio channels which arrive on an input connector, but which cannot be recorded due to the limited number of DTTR digital audio channels, are replaced with a null-filled channel at the identically-numbered output connector.

4.6 As a consequence of this convention, the DTTR is normally constrained to accept two-channel signals only if they appear on input connectors 1 and 3, and will not accept single-channel signals appearing on input connectors 2 and 4, respectively, when channel 1 or 3 is carrying a two-channel signal. Input channels 2-B and 4-B are never recorded.

4.7 The DTTR may, optionally, provide a means to reconfigure the input-to-DTTR and DTTR-to-output channel assignments.

5 Default channel assignments for DTTRs with two AES/EBU digital inputs

5.1 This section is applicable to DTTRs equipped with two input connectors and two output connectors conforming to ANSI S4.40-1985. In this case, the default allocation of incoming audio channels among the four DTTR digital audio channels is as follows:

DTTR channel	Input data carried
1	1-A
2	1-B
3	2-A
4	2-B

5.2 The DTTR may, optionally, provide a means to reconfigure the input-to-DTTR and DTTR-to-output channel assignments.

6 Channel allocations for program exchange

6.1 For the purpose of inter-company and international exchange of programs, it is advantageous to adhere to a consistent assignment of program types to specific audio channels. This simplifies the task of ensuring correct interface of program content to delivery channels at the playback location, and eases the requirements for labeling tapes.

6.2 Programs for exchange may include one or more of the following categories of audio information recorded in the DTTR digital audio channels:

Program (complete mix)
International sound
Commentary
Music
Effects
SAP (second audio program)

6.3 Any of these, except SAP, may be monophonic or stereophonic.

6.4 The following assignment of categories of audio information to DTTR digital audio channels is recommended, when the types of programs indicated are recorded for exchange purposes:

DTTR Channel	1 Monophonic program	2 Stereophonic program	3 Two complete stereophonic programs	4 Monophonic program with separate commentary	5 Stereophonic international sound with two separate commentaries	6 Stereophonic commentary and international sound	7 Non-mixed monophonic program	8 Stereophonic program and SAP
1	complete monophonic mix	complete mix, left	first program, complete mix, left	commentary	first commentary	commentary left	commentary	complete mix, left
2	blank	complete mix, right	first program, complete mix, right	blank	second commentary	commentary right	music	complete mix, right
3	international sound	international sound, left	second program, complete mix, left	international sound	international sound, left	international sound, left	effects 1	SAP
4	blank	international sound, right	second program, complete mix, right	blank	international sound, right	international sound, right	effects 2	blank