SMPTE RECOMMENDED PRACTICE — RP 113-1983

Supervisory Protocol for Digital Control Interface

1. *General*

1.1 Scope. This recommended practice defines the supervisory protocol used within a general purpose communication channel of an interface system which transports data and digital control signals between equipment utilized in the production, post-production, and/or transmission of visual and aural information. It is intended that the supervisory protocol described in this practice be part of an overall system, allowing interconnection of programmable and nonprogrammable equipment as required to configure an operational system with a defined function, and to allow rapid reconfiguration of a system to provide more than one defined function utilizing a given group of equipment.

1.1.1 The primary intent of this practice is to establish supervisory procedures of the communication channel for the purpose of transmitting control messages to equipment by external means. (The contents of the messages are not defined.) This practice, or sections thereof, may be applied to the interconnection of elements within an item of equipment.

1.2 Definitions. (See Fig. 1.) For the purposes of this practice, the following definitions apply:

Bus Controller: Each system contains one bus controller which supervises all tributaries in the system. Supervision is exercised through the use of this supervisory protocol.

Byte: A byte consists of eight bits of information. Bits used to effect transmission such as byte start, parity, or end are not part of the byte.

Tributary: A tributary transfers messages to and from an operational device via the interface system. The tributary is distinct from the function of the operational device and exists to transfer control messages between the communication channel and the device.

Word: A word consists of a byte and associated bits used to effect transmission such as start, parity, or end.

2. *Message Types*

Two types of messages shall be transmitted on the channel:

Supervisory Messages to supervise the channel and direct the flow of device messages.

Device Messages to control operation of equipment functions. This type of message shall be transmitted only within standard message blocks or during device defined communications modes. Details of device messages will be the subject of another document now in preparation.

3. *Tributary Addresses*

Tributary addresses shall consist of two bytes: the most significant byte, which is transmitted first, and the least significant byte. The most significant bit of both bytes shall be set to binary 1. This provides an address range starting at 8080_h. Each tributary shall be assigned two unique addresses, a SELECT address and a POLL address.

3.1 Select Address. An address in which the least significant bit of the least significant byte equals binary 0 is a SELECT address.

3.2 Poll Address. An address in which the least significant bit of the least significant byte equals binary 1 is a POLL address.

3.3 Group Addresses. Address pairs $8080\text{-}8081_h$ and $8082\text{-}8083_h$ through $81FE\text{-}81FF_h$ are reserved as GROUP SELECT addresses. The addresses in which the least significant bit of the least significant byte equals binary 1 (POLL address) shall not be used but are retained in the address numbering scheme for software considerations.

3.4 Discrete Addresses. Tributary addresses shall start at $8280\text{-}8281_h$. Precisely 8061 discrete tributary address pairs are available.

3.5 Address Allocation Table:

$8080\text{-}8081_h$	Group select—all call
$8082\text{-}80FF_h$	Group select—Groups 1-63
$8180\text{-}81FF_h$	Group select—Groups 64-127
$8280\text{-}82FF_h$	64 tributaries
$8380\text{-}83FF_h$	64 tributaries
⋮	⋮
$FF80\text{-}FFFF_h$	64 tributaries

Approved 3 February 1983

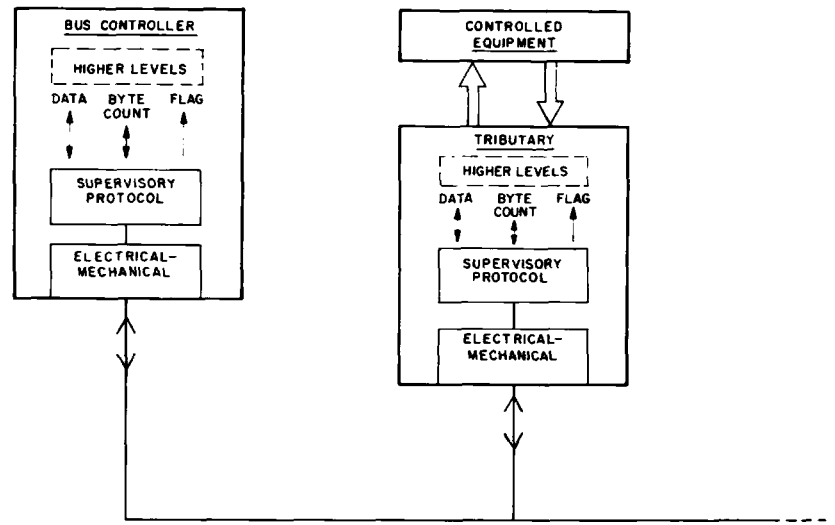


Fig. 1
System Elements

4. *Tributary Operational States*

A tributary shall be in one of five major operational states:

IDLE: The tributary shall not perform any communications. This state shall be exited only in response to BREAK.

ACTIVE: Prerequisite for transition to other operational states. The tributary shall enter this state whenever BREAK is received.

POLL: The tributary shall transmit a single status byte to the bus controller.

SELECT: A single tributary shall enter a communications mode with the bus controller.

GROUP SELECT: All tributaries or a selected group of tributaries shall enter a communications mode with the bus controller.

5. *Supervisory Messages*

Tributaries shall be directed to operational states through various communications sequences by supervisory messages as shown in Fig. 2. Supervisory messages consist of the following elements:

BREAK: Shall drive all tributaries to the ACTIVE state. (See American National Standard for Television—Digital Control Interface—Electrical and Mechanical Characteristics, ANSI/SMPTE 207M-1981, for code.)

(ADDR-POLL): A tributary poll address (ADDR-POLL) shall drive the addressed tributary to the POLL state.

(ADDR-SELECT): A tributary select address (ADDR-SEL) shall drive the addressed tributary to the SELECT state.

(GROUP ADDR-SEL): A group select address shall drive a group of tributaries to the GROUP SELECT state.

Supervisory Characters: Identify communications sequences and provide status information. Supervisory characters are single bytes within the range 00_h-$7F_h$. Supervisory characters shall consist of:

01_h	(GRP)	Group assign
02	(STX)	Start of message
03	(ESC)	Escape
04	(ACK)	Acknowledge
05	(NAK)	Not acknowledge
06	(BSY)	Busy
07	(RST)	Reset
08	(SVC)	Service request from controlled equipment
09	(TEN)	Transmit enable

All other supervisory characters are reserved. The use of other characters for tributary supervision is noncompliant with this specification.

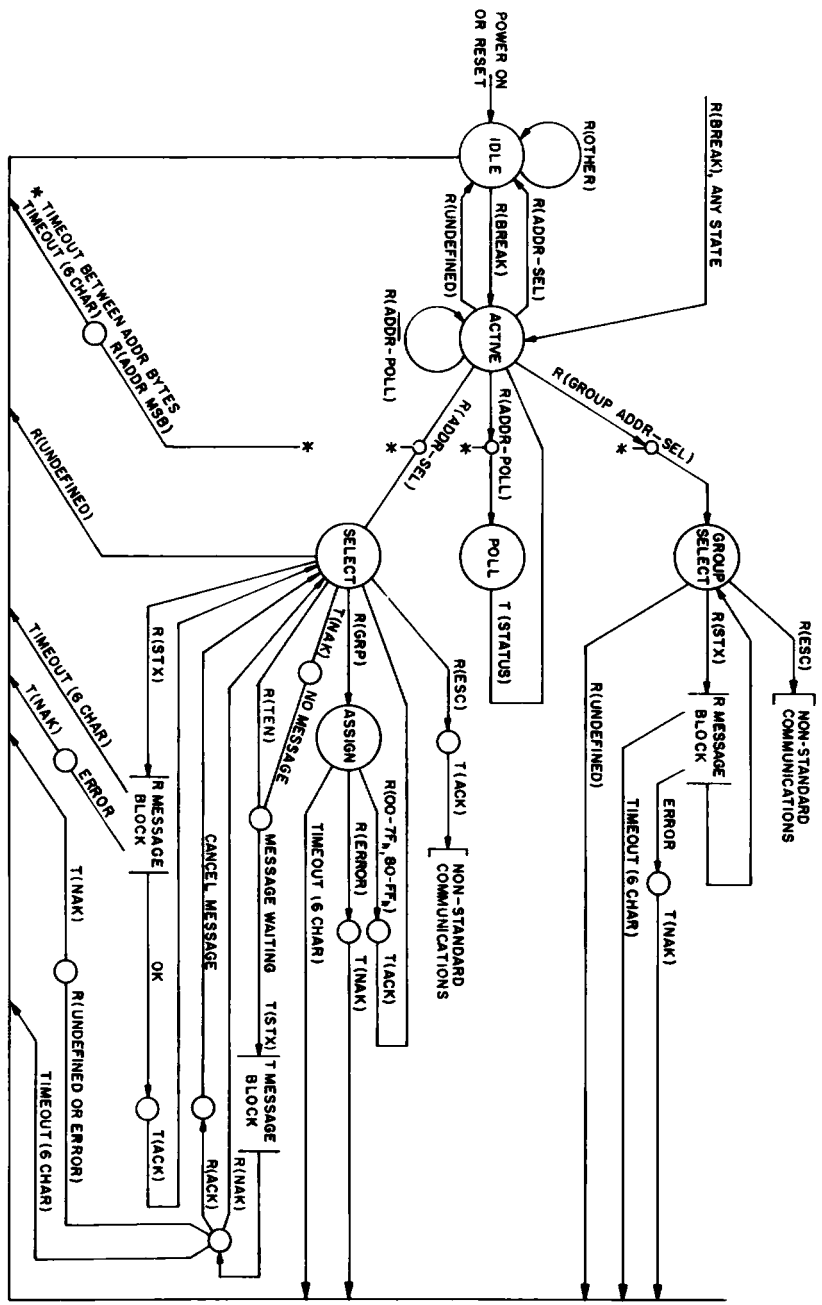


Fig. 2
Tributary Supervisory Protocol

6. *Operational Sequences* (See Fig. 2)

6.1 Idle. Tributaries in the idle state shall not perform any communications sequences.

6.1.1 Idle shall be entered under the following conditions:

Tributary power on or reset

Upon receipt of an (ADDR-SEL) not assigned to the tributary

Upon receipt of a GROUP (ADDR-SEL) not assigned to the tributary

When a specified time out of six words in duration occurs

On receipt of an undefined byte

On encountering a transmission error or ambiguous condition

6.1.2 A tributary shall exit the IDLE state only on receipt of BREAK.

6.2 Active. A tributary in the ACTIVE state shall perform communications sequences as directed by the bus controller.

6.2.1 All tributaries shall enter the ACTIVE state whenever BREAK is received and on completion of a poll sequence.

6.2.2 A tributary shall exit the ACTIVE state on receipt of an address which directs it to the POLL, SELECT, or GROUP SELECT states. A time out between the two address bytes shall cause the tributary to enter the IDLE state.

6.3 Poll. The POLL state shall be used to determine the presence and status of a tributary.

6.3.1 A tributary shall enter the POLL state on receipt of its poll address (ADDR-POLL). The tributary shall transmit one supervisory character to indicate its status, then return to the ACTIVE state. Tributaries not addressed shall remain in the ACTIVE state. Supervisory characters transmitted shall be of the following:

RESET (07_h): Tributary has powered up or been reset since last poll.

NAK (05_h): An exception (time out, undefined byte, etc.) condition has occurred since last poll or select.

BSY (06_h): Tributary not available to receive messages.

SVC (08_h): Service request from controlled equipment.

ACK (04_h): Tributary available to receive messages.

These characters rank in priority according to the order shown above.

6.4 Select

6.4.1 A single tributary shall enter the SELECT state on receipt of its select address (ADDR-SEL). All other tributaries shall transition to the IDLE state. A tributary in the SELECT state shall execute the communications sequences detailed in 6.4.1.1 through 6.4.1.4 as directed by the bus controller.

6.4.1.1 Receive Message. Supervisory character STX (02_h) shall be followed by a message block containing the following characters:

byte 1: byte count of bytes 2 thru n (0 = 256 bytes).

bytes 2 thru n: (256 bytes maximum)—device defined message.

byte n + 1: checksum = 2's complement of the least significant byte of the sum of bytes 1 through n.

The tributary shall indicate error-free reception by responding with ACK and shall return to the SELECT state.

On encountering an error during reception, the tributary shall respond with NAK, then transition to IDLE.

If transmission from the bus controller is interrupted for more than the time out period, the tributary shall transition to IDLE.

The tributary shall transfer a complete message, the byte count specified above, and a "block ready" indication to the entities using the system for control.

6.4.1.2 Transmit Message. A tributary shall notify the bus controller that a message is waiting by transmitting SVC (08_h) during POLL. Upon receipt of TEN (09_h) while in SELECT, the tributary shall transmit a standard message block as defined in 6.4.1.1.

6.4.1.3 Assign Tributary to Group. Supervisory character GRP (01_h) shall be followed by a single byte:

00_h deletes all previous group assignments of all tributaries

If the most significant bit of the byte following GRP (01_h) is a ZERO, the assignment of the tributary to the address represented by the following seven bits of that byte is deleted (1_h to 127_h).

80_h assigns the tributary to groups 1-127.

If the most significant bit of the byte following GRP (01_h) is a ONE, the tributary is assigned to the address represented by the following seven bits of that byte (1_h to 127_h).

A tributary may be removed from or assigned to more than one group by repeating the assignment sequence.

If transmission from the bus controller is interrupted for more than the time out period between receipt of GRP and the group assignment byte, the tributary shall transition to IDLE.

All group addresses except "all call" (8080_h) shall be deleted at tributary power-up or reset.

6.4.1.4 Nonstandard Communications. Supervisory character ESC (03_h) shall release a tributary to nonstandard communications sequences. The tributary shall respond with ACK; it shall exit ESC mode only in response to BREAK.

6.4.2 The tributary shall exit SELECT on receipt of BREAK or in response to the exceptional conditions noted in 6.1.1.1 through 6.1.1.3 above.

6.5 Group Select

6.5.1 Groups of tributaries shall enter the GROUP SELECT state on receipt of their group select address (GROUP ADDR-SEL). All tributaries not assigned to the group shall transition to IDLE. Tributaries in the GROUP SELECT state shall execute the communications sequences detailed in 6.5.1.1 and 6.5.1.2 as directed by the bus controller.

6.5.1.1 Receive Message. Supervisory character STX shall be followed by a message block as defined in 6.4.1.1.

Each tributary returns to GROUP SELECT state after error-free reception of the block; no response shall be transmitted.

On encountering an error during reception, a tributary shall respond with NAK, then transition to IDLE.

If transmission from the bus controller is interrupted for more than the time out period, tributaries shall transition to IDLE.

6.5.1.2 Nonstandard Communications. Supervisory character ESC shall release a group to nonstandard communications in accordance with 6.4.1.4. Tributaries shall exit this mode only in response to BREAK.

6.5.2 Tributaries shall exit GROUP SELECT on receipt of BREAK or in response to the exceptional conditions noted in 6.5.1.1.

7. *Bus Controller Operation*

7.1 System Synchronization. The bus controller shall transmit BREAK when power is turned on and after being reset.

7.2 Tributary Response Time Out. The bus controller shall transmit BREAK when a tributary fails to respond within the following time-out periods:

In response to ADDR-POLL, GRP (#), ESC, TEN, END OF MSG BLOCK	6 words

8. *Guidelines*

8.1 Function of This Practice. This practice specifies the supervisory protocol used within the communication channel. The protocol is the sequence of characters used to transfer messages between the bus controller and tributaries, provide recovery from error conditions, and generally supervise the usage of the communication channel. This practice is concerned only with channel supervision. Electrical/mechanical characteristics are specified in separate standards since many types of channels which can deliver eight-bit binary bytes and a unique BREAK condition can operate under supervision of the protocol. Message content is specified by standards which are independent of both electrical/mechanical and supervisory characteristics of the communication channel.

8.2 System Configurations. This supervisory protocol permits supervision of point-to-point and multipoint systems.

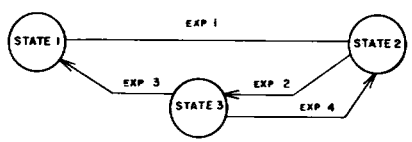
A point-to-point configuration is one in which a communication channel is connected to only one tributary. The bus controller may be connected to more than one channel, each having one tributary. This configuration has the advantage of speed since the dedicated channels provide access to all tributaries simultaneously.

The multipoint bus configuration is one in which more than one tributary is connected to a channel. This configuration has the advantage of reduced cabling costs and complexity. The main disadvantage of multipoint is that messages to different tributaries must queue up and be sent serially on the bus. This configuration is therefore slower in response time than point-to-point systems.

8.3 State Diagrams. The supervisory procedures are described by means of state diagrams that show how the interfacing hardware and software in a tributary follow sequences of bytes as they are received from the communication channel.

8.3.1 Each state (condition) that a tributary can assume is represented graphically as a circle; major states are identified by an upper case label or mnemonic within the circle:

8.3.2 All possible transitions between states are represented by arrows between the states; each transition is qualified by an expression which will produce the transition.



8.3.3 Expressions can be messages received from or transmitted to the communication channel, or local messages generated within the tributary.

8.3.3.1 Messages received from the channel are represented by R followed by the received message in parentheses:

indicates transition from state ONE to state TWO on receipt of the message GRP.

8.3.3.2 Messages transmitted to the bus are represented by T followed by the transmitted message in parentheses:

indicates transition from state THREE to state FOUR after transmitting the message ACK.

8.3.3.3 Local messages are represented by lower case labels:

indicates transition from state FIVE to state SIX when reset occurs.

8.4 Channel Synchronization. Data density is maximized by allowing the transmission of binary data in all device messages. This means that there must be no combination of transmitted bytes which can be interpreted as a channel synchronization command. The channel synchronization command is a unique transmission sequence called BREAK. This sequence cannot be accidentally generated by normal communications. Tributaries receiving BREAK are required to immediately transfer to the ACTIVE state regardless of what they are currently doing in relation to the communication channel. On power up, a tributary enters the IDLE state and ignores all bus transactions until it receives BREAK. Electrical specifications appropriate for use with this supervisory protocol assure that BREAK cannot be generated accidentally.

8.5 Supervisory Message Components. The protocol uses BREAK, tributary addresses, and a small number of predefined supervisory characters to manage the communication channel. Since the addresses and supervisory characters are eight-bit binary bytes, they must be recognized by being received immediately after BREAK. The only supervisory message that is unconditionally recognizable is the BREAK sequence.

8.5.1 Tributary Addresses. Tributary addresses consist of two bytes. Up to 8061 tributaries can be addressed uniquely. A one-byte addressing scheme would have served most small system applications with a saving in channel overhead, but complex reassignment strategies would have to be employed in order to accommodate larger users.

The address bytes are characterized by a 1 in the most significant bit. Each tributary is assigned two addresses, a SELECT address and a POLL address. The least significant bit of the least significant byte is set to 0 for SELECT and 1 for POLL.

A unique two-byte address serves as an all-call SELECT address. When this address is transmitted all tributaries in a multipoint system simultaneously receive and act on system messages.

Tributaries can be assigned to one or more of 127 group SELECT addresses. These addresses allow simultaneous operation with selected groups of tributaries in multipoint systems similar to all-call.

During all-call or group operation, transmission by the tributaries is allowed only when an error condition is encountered, since other transmission could cause channel errors as several tributaries attempted to transmit at the same time. When error conditions are encountered, tributaries transmit the supervisory character NAK; reception of the NAK, or an error indicating channel contention, alerts the bus controller to an error condition in one or more tributaries. The bus controller must assert BREAK and poll individual tributaries to determine which tributary (ies) has encountered an error and the nature of the error.

8.5.2 Supervisory Characters. The only supervisory characters used are those given in Sec. 5. Supervisory characters are single eight-bit bytes in which the most significant bit is 0. Implementations of this protocol must not use any other supervisory characters for nonspecified functions as such use would render a tributary incompatible with other systems and could occasion serious operational failures if other supervisory functions are added to this practice in the future.

8.6 Poll Sequence. The POLL sequence is used to verify tributary presence and status. In multipoint systems, the POLL sequence allows all tributaries to be scanned quickly to see if servicing or attention is required by any of them.

Status characters transmitted by a tributary inform the bus controller of the tributary's current condition. Characters associated with specific conditions are detailed in 6.3.1. The tributary is required to send the highest priority status character applicable to its condition if more than one applies. All status characters except service request (SVC) apply to conditions within the interface function. SVC is a pass-through condition which indicates a service need by the equipment controlled through the interface. Device messages are used to identify and provide the service required.

8.7 Message Receive or Transmit Sequences. Device messages are received or transmitted by a tributary by means of the message receive or transmit sequence from the SELECT state. This sequence offers message lengths of 1 to 256 bytes with checksum protection. Groups of tributaries can receive messages from the GROUP SELECT state.

On receipt of a message, the bus controller will transmit an ACK or NAK. It then waits for six characters for any exceptional condition. (See Fig. 2.)

All equipment control and status information is exchanged by means of device messages.

8.8 Escape Sequence. The escape sequence is provided for those users who wish to remain compatible with the electrical and supervisory protocol characteristics of the interface system but require nonstandard operational sequences or messages. Single tributaries or groups of tributaries may be placed outside the normal protocol limits using this sequence. The only protocol requirement which must be observed by devices while using this sequence is the requirement to enter the ACTIVE state whenever a BREAK is received from the communication channel.

8.9 System Design Considerations. This practice and associated standards specify characteristics for equipment compatible with the interface system. System function and configuration is left to the system designer. Certain cautions must be observed by the designer:

8.9.1 Device messages are specified by other standards. Only device messages which conform to those standards should be transmitted via the standard message receive/transmit facilities. Nonstandard messages should be transmitted via the escape sequence.

8.9.2 Switched Tributaries. This practice and associated standards consider operation of bus controllers and tributaries to be within one communication channel. If tributaries are transferred between channels, the system designer must provide means to place them in an appropriate state before connection to a new channel. It is recommended that the tributaries be forced to the IDLE state with all group address assignments cleared before connection. Procedures for notifying a bus controller of the attachment of a tributary will generally be required; these procedures are dependent on the nature of the system and are left to the designer's discretion.

SMPTE RECOMMENDED PRACTICE

RP 63–1983

Specifications for Sound-Focusing Test Film for 16-mm Audio Reproducers, Photographic Type

1. *Scope*

This practice specifies a test film for use in focusing the scanning beam of 16-mm motion-picture photographic audio reproducers operating at 36 ft (11 m) per minute.

2. *Test Film Signal*

2.1 Frequency. The audio record on the film shall reproduce at a frequency of 7000 ± 100 Hz (Type A) or 5000 ± 100 Hz (Type B) when the linear speed of the film is 24 perforations per second or approximately 36 ft per minute (7.2 in or 18.3 cm per second).

2.1.1 Type A. A film with a 7000-Hz record to be used by manufacturers and laboratories, for precise adjustment of the sound-focusing system.

2.1.2 Type B. A film with a 5000-Hz record to be used when simpler instruments are available or when lower quality is adequate, for quick adjustment of the sound-focusing system.

2.2 Audio Record. The location and dimensions of the recorded audio record shall be in accordance with American National Standard for Motion-Picture Film (16-mm) Prints—Photographic Sound Records, ANSI PH22.41-1983.

2.3 Recording. The film shall have an originally recorded, variable-density audio track. The track shall be heavily overmodulated and developed to high contrast so that it is essentially a square-wave track. The signal level shall not fluctuate more than ± 0.5 dB within the test film length.

2.4 Flutter. The weighted peak flutter of the audio record shall not exceed ± 0.1 percent when measured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, ANSI/IEEE 193-1982.

2.5 Azimuth. The azimuth of the audio record shall be 90° ± 3′ to the reference edge of the film.

3. *Film Stock*

3.1 The film stock, preferably polyester, shall be splice-free, of the low-shrinkage, safety type in compliance with American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31-1980, and cut and perforated in accordance with long-pitch dimensions specified in American National Standard Dimensions for 16-mm Motion-Picture Film Perforated 1R, ANSI PH22.109-1980.

3.2 In the event that triacetate film stock is used, it shall be splice-free and shall have a maximum lengthwise shrinkage of 0.50 percent when tested as follows: At least 20 strips of film approximately 31 inches in length shall be cut for measurement of shrinkage. After normal development and drying (not over 80°F [27°C]), the strips shall be placed at least ¼ in apart in racks and kept for seven days in an oven maintained at 120°F (49°C) and a relative humidity of 20 percent. The strips shall then be removed, reconditioned thoroughly to 50 percent relative humidity at 70°F (21°C), and the shrinkage measured by a suitable method. The percent shrinkage shall then be calculated on the basis of deviation from the nominal dimension for the length of 100 consecutive perforation intervals given in ANSI PH22.109-1980.

1. *Identification*

Each test film shall be identified by a suitable identification marking. This marking shall be printed lengthwise in the picture area and the spacing between consecutive titles shall be approximately 12 in (30 cm).

NOTE: Test films conforming to this practice are available from the Society of Motion Picture and Television Engineers.

Revision of RP 63-1976
Approved 7 October 1983

SMPTE RECOMMENDED PRACTICE — RP 69-1983

Specifications for Scanning-Beam Uniformity Test Film for 35-mm Motion-Picture Audio Reproducers

1. *Scope*

1.1 This practice describes a test film, the use of which is limited to the determination of the uniformity of scanning-beam illumination in 35-mm motion-picture audio reproducers.

1.2 This test film is not intended to be used for the determination of the correct position of the scanning beam with respect to the reference edge of the film.

2. *Test film*

2.1 The test film shall be a directly-recorded positive or a print from an original negative.

2.2 The test record on the film shall reproduce at a frequency of 1000 ± 20 Hz when the linear velocity of the film is 96 perforations per second or approximately 90 ft/min (18 in or 45.7 cm/s).

2.3 At full modulation, the test record shall have a width of 0.0050 ± 0.0005 in (0.127 ± 0.013 mm), as measured between opposite amplitude peaks. It shall be approximately sinusoidal.

2.4 The test record shall move laterally at a uniform rate from one edge of the scanned area to the other, as specified in the figure.

2.5 In any one test film, the combined effect of variation in modulation width and density of the exposed and unexposed areas shall result in a signal amplitude variation not exceeding ± 0.8 dB with respect to the average signal amplitude.

3. *Definitions*

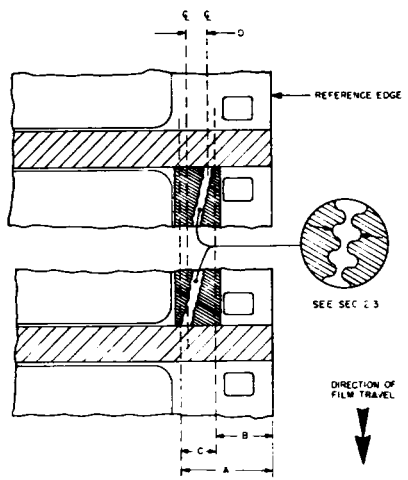
3.1 Edges. For the purpose of this practice, the edge of the test track nearest the reference edge of the film shall be called the outboard edge, and the opposite edge shall be called the inboard edge.

3.2 Centerline Sweep. The centerline sweep of the test track is defined as the lateral displacement of the centerline of the test track from its initial position to its final position. Dimension D is the nominal centerline sweep.

3.3 Total Test Track Sweep. The total test track sweep is defined as the sum of the centerline sweep and the overall width of the test track. Dimension C is the nominal total sweep.

4. *Dimensions*

The dimensions and position of the audio track shall be as specified in the figure and table. Dimension A extends to the inboard edge of the test track in its initial position. Dimension B extends to the outboard edge of the test track in its final position. Dimensions A and B shall be measured at points opposite the first image area frame-line next to the start and end splice of the test record negative. Dimension C, nominal total sweep, is 0.002 in (0.05 mm) less than the width of the scanning slit to avoid scanning of the edge of the slit.



Dimensions	Inches	Millimeters
A	0.285 $^{+\ 0.000}_{-\ 0.001}$	7.21 $^{+\ 0.00}_{-\ 0.03}$
B	0.203 $^{+\ 0.001}_{-\ 0.000}$	5.16 $^{+\ 0.03}_{-\ 0.00}$
C	0.082 nom	2.08 nom
D	0.077 nom	1.96 nom

Revision of RP 69-1977
Approved 7 October 1983

5. *Film Stock*

The film stock, preferably polyester, shall be splice-free, of the low-shrinkage, safety type in accordance with American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31M-1980, and cut and perforated in accordance with long-pitch dimensions specified in American National Standard Dimensions for 35-mm Motion-Picture Film Perforated KS, ANSI PH22.139-1980.

6. *Density*

The exposed track area shall have a minimum diffuse density of 2.0 above base density and the unexposed track area shall have a maximum density of 0.10 above base density. The longitudinal variations of these specified densities shall not result in a reproduced output variation exceeding ± 0.5 dB.

7. *Width of Exposed Area*

The overall width of the exposed track area shall exceed the maximum variation in the scanned area by no less than 0.010 in (0.25 mm) on each side of the slit. The maximum width of the scanning slit as specified in American National Standard for Motion-Picture Film (35-mm)—Photographic Audio Records—Release Prints, ANSI PH22.40-1984, is 0.085 in (2.16 mm). This requires a minimum printed width of 0.106 in (2.69 mm) to ensure a dense area adjacent to the scanned area.

8. *Test Film Length*

Each test film shall carry three identical prints of the total length of the test record. In each, the test record shall start near the edge of the film and travel toward the image area. The length of the test record shall be approximately 30 ft (9.14 m).

NOTE: A test film conforming to this practice is available from the Society of Motion Picture and Television Engineers.

Appendix

(The Appendix is not a part of this SMPTE Recommended Practice, but is included for information purposes only.)

Before the test film described in this document is used, it is recommended that correct placement of the scanning beam be determined by means of a buzz-track test film as specified in SMPTE Recommended Practice RP 68-1976, Specifications for Buzz-Track Test Film for 35-mm Motion-Picture Sound Reproducers, Photographic Type.

The uniformity of scanning-beam illumination should be measured by an rms voltmeter calibrated in decibels with an accuracy of ± 0.1 dB over the bandwidth 31.5 Hz to 16 kHz, connected to the output of the audio projector amplifier. The illumination of the scanning beam should be adjusted according to the instructions furnished by the equipment manufacturer.

Variations of the output of the meter should be observed while running the full length of one test track print, spliced into a loop, through the equipment.