RP 171-1993

SMPTE RECOMMENDED PRACTICE

Type-Specific Messages for Digital Control Interface of Analog Audio Tape Recorders

1 Scope

This practice details and defines the type-specific messages used for the control of analog audio tape recorder devices. These type-specific messages provide the means for the control and monitoring of a specific type of virtual machine and are implemented within an architecture of a greater control message language.

2 General

2.1 Virtual machine type

Analog audio tape recorders shall be identified as a virtual machine of a type which is uniquely coded as "03," expressed as an 8-bit word, in hexadecimal form.

2.2 Notation

This practice describes the keyword coding, naming conventions and its argument constructs in a form as shown below. The coding "NN" represents the assigned keyword code, expressed as an 8-bit word, in hexadecimal form.

NN	KEYWORD or I/F NAME	Keyword or I/F descriptive text	
	Format:	<COMMAND>	
		<PARAMETER NAME 0>	[Parameter description;
		...	Parameter value coding, scale or range;
		<PARAMETER NAME n>	Parameter definitions and explanations.]

In the practices listed in annex B, keywords are listed numerically, in hexadecimal notation. Keywords numbering 40_h – FF_h are reserved for the type-specific, virtual machine subsets. The type-specific messages for the ATR are contained within this subset.

2.2.1 Command classifications

All tape motion state commands are indicated by the command classification "TMS." Each TMS command causes a transition into a transport state. These states are mutually exclusive.

Tape motion process commands are indicated by the command classification "TMP." Tape motion processes are overriding control commands that cause the controlled device to automatically choose its own tape motion states to achieve the desired result. The tape motion state will be reflected in the TMS tally, as though that TMS command had been issued. TMPs are mutually exclusive.

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All audio record commands are indicated by the command classification “ARC.” ARC commands affect the manner in which tracks are selected and subsequently sequenced through record entries and exits.

All audio monitor commands are indicated by the command classification “AMC.” AMC commands affect the manner in which audio line output source selections are made.

2.2.2 Reserved keywords

All keyword codes listed as “reserved” are specifically retained for the expansion of the range of compatible message usage between ATR and VTR type-specific devices.

3 Index of keywords

3.1 Numerical index of keywords, mnemonics, and information field names

Commands which have a related information field for tally purposes are identified by a “>>” sign within the body of the index listing.

	Message keywords		Mnemonic	I/F field names		Mnemonic
	40	not used		40	not used	
TMS	41	STOP	STOP	41	INTERNAL LTC	INTC
TMS	42	VARIABLE PLAY	VAPL	42	not used	
TMS	43	PLAY	STPL	43	SELECTED TAPE CODE	SETC
TMS	44	STEP	STEP	44	INTERNAL LTC USERBIT	INUB
TMS	45	AUDIBLE FAST	AFST	45	not used	
TMS	46	SHUTTLE	SHUT	46	TAPE TIMER	TATI
	47	not used		47	not used	
	48	reserved		48	reserved	
	49	CAPSTAN REFERENCE SELECT	CAPS >>	49	CAPSTAN REFERENCE TALLY	CRET
ARC	4A	REHEARSE SELECT	REMS >>	4A	REHEARSE TALLY	REHT
ARC	4B	RECORD STROBE	RSTB	4B	CHANNEL RECORD STATUS	CRES
ARC	4C	RECORD EXIT	REEX	4C	not used	
	4D	TAPE CODE SELECT	TACS >>	4D	TAPE CODE SELECTION TALLY	TACT
TMP	4E	TARGET SEARCH	TASE	4E	SYNC VELOCITY	SVTY
TMP	4F	SYNC PREROLL SEARCH	SPRS	4F	PREROLL DURATION	PRDU
TMS	50	SYNC	SYNC	50	SYNC POINT	SPNT
TMS	51	LOCK	LOCK	51	LOCK TIME	LKTT
TMP	52	LOCK PREROLL SEARCH	LPRS	52	not used	
TMP	53	CHASE	CHAS	53	not used	
	54	reserved		54	reserved	
	55	reserved		55	reserved	
	56	reserved		56	reserved	
	57	reserved		57	reserved	
TMS	58	TAPE RELEASE	TARL	58	not used	
	59	FIXED SPEED SELECT	FISS	59	FIXED SPEED TALLY	FIST
	5A	not used		5A	TAPELENGTH	TLTH
	5B	not used		5B	not used	
	5C	not used		5C	SYNC LOCK ACCURACY	SLAC
	5D	not used		5D	LOCK DEVIATION	LKDE
	5E	not used		5E	not used	
	5F	not used		5F	not used	

	60	PRESET	PRST	60	TMP TALLY	TMPT
TMS	61	FAST FORWARD	FFOR	61	TMS TALLY	TMST
TMS	62	FAST REVERSE	FREV	62	VELOCITY TALLY	VELT
	63	not used		63	not used	
ARC	64	RECORD READY SELECT	RECS >>	64	RECORD READY TALLY	RECT
	65	not used		65	not used	
	66	AUTO ATTENUATE SELECT	AUAS >>	66	AUTO ATTENUATE TALLY	AUAT
	67	LIFTER DEFEAT SELECT	TLDS >>	67	LIFTER DEFEAT TALLY	TLDT
	68	not used		68	reserved	
	69	not used		69	reserved	
	6A	not used		6A	reserved	
	6B	not used		6B	reserved	
	6C	not used		6C	reserved	
	6D	not used		6D	reserved	
	6E	not used		6E	reserved	
	6F	not used		6F	reserved	
	70	LOCK MODE SELECT	LKMS >>	70	LOCK MODE TALLY	LKMT
AMC	71	GLOBAL MONITOR SELECT	MONS >>	71	GLOBAL MONITOR TALLY	MONT
AMC	72	EXCLUSIVE SYNC SELECT	ESYS >>	72	EXCLUSIVE SYNC TALLY	ESYT
AMC	73	SYNC INPUT SELECT	SYIS >>	73	SYNC INPUT TALLY	SYIT
	74	not used		74	EXTERNAL TIME CODE	EXTC
	75	not used		75	EXTERNAL USERBITS	EXUB
	76	not used		76	SLEW RATE	SLRT
	77	not used		77	REQUESTED OFFSET	ROFT
	78	not used		78	ACTUAL OFFSET	AOFT
	79	not used		79	STRIDE LENGTH	STLT
	7A	LOCAL LOCKOUT SELECT	LLOS	7A	LOCAL LOCKOUT TALLY	LLOT
	7B	not used		7B	TIME CODE ATTRIBUTES	TCAT
	7C	PLAY MODE SELECT	PLMS	7C	PLAY MODE TALLY	PLMT

3.2 Functional index of keywords, mnemonics, and information field names

Commands which have a related information field for tally purposes are identified by brackets within the body of the index listing.

Message keywords		Mnemonic	I/F field names		Mnemonic
System utility					
7A	LOCAL LOCKOUT SELECT	LLOS	7A	LOCAL LOCKOUT TALLY	LLOT
Tape motion procedures (TMP)					
4E	TARGET SEARCH	TASE \			
4F	SYNC PREROLL SEARCH	SPRS >	60	TMP TALLY	TMPT
52	LOCK PREROLL SEARCH	LPRS |			
53	CHASE	CHAS /			

Tape motion states (TMS)

41	STOP	STOP >	61	TMP TALLY	TMST
58	TAPE RELEASE	TARL \			
43	PLAY	STPL |			
61	FAST FORWARD	FFOR |			
62	FAST REVERSE	FREV >	62	VELOCITY TALLY	VELT
44	STEP	STEP |			
42	VARIABLE PLAY	VAPL |			
45	AUDIBLE FAST	AFST |			
46	SHUTTLE	SHUT |			
51	SYNC	SYNC |			
51	LOCK	LOCK /			

Tape motion references

59	FIXED SPEED SELECT	FISS >>	59	FIXED SPEED TALLY	FIST
49	CAPSTAN REFERENCE SELECT	CAPS >>	49	CAPSTAN REFERENCE TALLY	CRET
60	PRESET	PRST	79	STRIDE LENGTH	STLT

Synchronization parameters

70	LOCK MODE SELECT	LKMS >>	70	LOCK MODE TALLY	LKMT
7C	PLAY MODE SELECT	PLMS >>	7C	PLAY MODE TALLY	PLMT
		/	51	SYNC POINT	SPNT
		|	51	LOCK TIME	LKTT
		|	4E	SYNC VELOCITY	SVTY
60	PRESET	PRST <	4F	PREROLL DURATION	PRDU
		|	77	REQUESTED OFFSET	ROFT
		|	5C	SYNC/LOCK ACCURACY	SLAC
		\	76	SLEW RATE	SLRT
			78	ACTUAL OFFSET	AOFT
			5D	LOCK DEVIATION	LKDE

Position and synchronization references

4D	TAPE CODE SELECT	TACS >>	4D	TAPE CODE SELECT TALLY	TACT
60	PRESET	PRST >	46 *	TAPE TIMER	TATI
			41 *	INTERNAL LTC	INTC
			43 *	SELECTED TAPE CODE	SETC
			74 *	EXTERNAL TIME CODE	EXTC

* = Time I/Fs which may be used as event triggers.

Position and time code utilities

60	PRESET	PRST	5A	TAPE LENGTH	TLTH
			7B	TIME CODE ATTRIBUTES	TCAT
			44	INTERNAL LTC USERBITS	INUB
			75	EXTERNAL USERBITS	EXUB

Audio record control (ARC)

64	RECORD READY SELECT	RECS >>	64	RECORD READY TALLY	RECT
4A	REHEARSE SELECT	REMS >>	4A	REHEARSE TALLY	REHT
4B	RECORD STROBE	RSTB >	4B	CHANNEL RECORD STATUS	CRES
4C	RECORD EXIT	REEX /			

Audio monitor control (AMC)

71	GLOBAL MONITOR SELECT	MONS >>	71	GLOBAL MONITOR TALLY	MONT
72	EXCLUSIVE SYNC SELECT	ESYS >>	72	EXCLUSIVE SYNC TALLY	ESYT
73	SYNC INPUT SELECT	SYIS >>	73	SYNC INPUT TALLY	SYIT
66	AUTO ATTENUATE SELECT	AUAS >>	66	AUTO ATTENUATE TALLY	AUAT
67	LIFTER DEFEAT SELECT	TLDS >>	67	LIFTER DEFEAT TALLY	TLDT

4 Keywords, definitions, and syntax

40 not used

41 STOP

(TMS) Causes the controlled ATR to stop as soon as possible; all recording tracks are automatically exited from record operation prior to execution.

Format: <STOP>

42 VARIABLE PLAY

(TMS) Causes the controlled ATR to enter capstan-controlled variable forward playback mode with specified velocity relative to the FIXED SPEED. If the controlled ATR is recording, all recording tracks will exit record mode.

Format: <VARIABLE PLAY>
<SPEED>

3-byte signed binary number: twos complement scale:
000000_h = stationary
010000_h = fixed speed forward
$7F0000_h$ = approximately 127 times standard fixed speed forward
$FF0000_h$ = fixed speed reverse
800000_h = 128 times fixed speed reverse

NOTE – Argument does not imply resolution of a controlled device.

43 STD PLAY

(TMS) Causes the controlled ATR to enter playback at the speed determined by the value in the FIXED SPEED I/F. If the controlled ATR is recording, all recording tracks will exit record mode.

Format: <PLAY>

44 STEP

(TMC) Causes the controlled ATR to move the tape a specified number of STRIDE LENGTHS forward or backward, with respect to its current position, only while in STOP or STEP. Successive commands are cumulative until next TMS or TMP (other than STEP). The number argument refers to the quantity and direction of STRIDE PERIODS of tape movement requested. The longitudinal STRIDE LENGTH is defined in the STRIDE LENGTH I/F.

Format: <STEP>
<NUMBER> 1-byte signed number:
range: –127 ... +127

45 AUDIBLE FAST

(TMS) Causes the controlled ATR to enter fast tape motion with audible but not necessarily broadcastable audio at specified direction and velocity relative to the FIXED SPEED. All recording tracks are automatically exited from record operation prior to execution.

Format: <AUDIBLE FAST>
<SPEED> 3-byte signed binary number;
same format as in VARIABLE PLAY.

46 SHUTTLE

(TMS) Causes the controlled ATR to travel at specified direction and velocity relative to FIXED SPEED without necessarily reproducing audio. All recording tracks are automatically exited from record operation prior to execution.

Format: <SHUTTLE>
<SPEED> 3-byte signed binary number;
same format as in VARIABLE PLAY.

47 not used .

48 reserved

49 CAPSTAN REFERENCE SELECT

Causes the controlled ATR to select a capstan reference. This command is meaningful only when not in CHASE TMP, SYNC, or LOCK TMS. These operations will cause a return to the default selection.

Format: <CAPSTAN REFERENCE SELECT>
<MODE> 1-byte special binary code:
00_h = internal crystal (= default)
01_h = external capstan reference input
FF_h = as selected locally

4A REHEARSE SELECT

(ARC) During all subsequent record entries and exits, related line-out switching functions will mimic record operation as defined by the SYNC-INPUT SELECT I/F without actually erasing or applying bias and audio signal to tape.

Format: <REHEARSE SELECT>
<MODE>

1-byte special binary code:
00_h = rehearse true (default)
04_h = rehearse true
FF_h = as selected locally
else = record enabled

4B RECORD STROBE

(ARC) Causes record entry on the presently RECORD READY enabled track(s); causes record exit on any currently recording track(s) that are RECORD READY disabled.

Format: <RECORD STROBE>

4C RECORD EXIT

(ARC) Causes a record exit on all currently recording track(s).

Format: <RECORD EXIT>

4D TAPE CODE SELECT

Selects the source of code for all succeeding messages that refer to the SELECTED TAPE CODE.

Format: <TAPE CODE SELECT>
<CODE TYPE>

1-byte special binary code:
00_h = internal time code (= default)
01_h = reserved
02_h = tape timer
03_h = reserved
04_h = reserved
FF_h = as selected locally

4E TARGET SEARCH

(TMP) Causes the controlled ATR to move to a defined tape position in accordance with the TAPE CODE SELECT.

Format: <TARGET SEARCH>
<TAPE CODE>

(type TIME)

NOTE – The SELECTED TAPE CODE reference is selected by the command TAPE CODE SELECT.

4F SYNC PREROLL SEARCH

(TMP) Causes the controlled ATR to move to the SELECTED TAPE CODE tape position determined by the PREROLL DURATION I/F minus any device-specific acceleration allowance in advance of the SYNC POINT I/F. All recording tracks are automatically exited from record operation prior to execution.

Format: <SYNC PREROLL SEARCH>

50 SYNC

(TMS) This command is styled to follow the functional intent of the VTR dialect SYNC command. When issued, causes the controlled device to immediately establish synchronism with the selected TIMELINE SOURCE.

NOTES

1 The controlled device will synchronize with the above-selected reference at the prescribed SYNC POINT with the prescribed SYNC VELOCITY precisely at the prescribed PREROLL DURATION after either the “immediate” reception or “EVENT” reception of this keycode.

2 It is essential that the selected TIMELINE SOURCE is incrementing in a real time manner at the delivery time of the command during the PREROLL DURATION and throughout the remainder of the SYNC operation.

3 PREROLL DURATION and SYNC POINT I/Fs must be predefined before both SYNC PREROLL SEARCH and SYNC command execution. The controlled device must be cued to the correct preroll position before execution.

4 This command establishes synchronism independently of any previous preset REQUESTED OFFSET, as the offset at the instant of SYNC POINT is dependent upon the time of the command’s delivery and the prescribed SYNC VELOCITY. As a function of SYNC operation, REQUESTED OFFSET may continuously be changed in order to maintain SYNC VELOCITY conformance relative to the selected TIMELINE SOURCE.

Format: <SYNC>

51 LOCK

(TMS) When isssued, causes the controlled ATR to establish synchronism in a manner as defined by the LOCK MODE I/F. Causes a LOCK PREROLL SEARCH operation should the controlled device not be cued to the correct prerolled position.

Format: <LOCK>

NOTE – PREROLL DURATION, REQUIRED OFFSET, and LOCK TIME I/Fs must be predefined before LOCK execution.

52 LOCK PREROLL SEARCH

(TMP) Causes the controlled ATR to move to the SELECTED TAPE CODE tape position determined by the PREROLL DURATION I/F minus any device-specific acceleration allowance in advance of the REQUESTED OFFSET adjusted LOCK TIME I/F. All recording tracks are automatically exited from record operation prior to execution.

Format: <PREROLL SEARCH>

53 CHASE

(TMP) Causes the controlled device to attempt to follow, establish, and maintain synchronism with the EXTERNAL TIME CODE. Synchronism is established and maintained in a data-dependent manner. All recording tracks are automatically exited from record operation prior to any noncapstan servoed follow action.

Format: <CHASE>

54 reserved

55 reserved

56 reserved

57 reserved

58 TAPE RELEASE

(TMS) Releases the tape tension mechanism of the controlled ATR. All recording tracks are automatically exited from record operation prior to execution. This TMS is reset by STOP.

Format: <TAPE UNLOAD>

59 FIXED SPEED SELECT

Causes the controlled device to select the nominal tape speed.

Format: <FIXED SPEED SELECT>
<SPEED>

1-byte special binary code:

10_h =	1.875 ips	4.7625 cm/s
20_h =	3.750 ips	9.525 cm/s
30_h =	7.500 ips	19.05 cm/s
37_h =	9.606 ips	24.40 cm/s
40_h =	15.00 ips	38.10 cm/s
50_h =	30.00 ips	76.20 cm/s

FF_h = as selected locally

5A not used

5B not used

5C not used

5D not used

5E not used

5F not used

60 PRESET — Presets the named information field to the given value.

Format: <PRESET>
<PERMITTED INFORMATION FIELD NAME>
<VALUE> — Format and coding defined by the I/F NAME.

Permitted information field names for ATRs are:

TAPE TIMER	SYNC/LOCK ACCURACY
PREROLL DURATION	STRIDE LENGTH
SYNC POINT	SLEW RATE
LOCK TIME	REQUESTED OFFSET
TAPE LENGTH	

61 FAST FORWARD — (TMS) Causes the controlled ATR to go forward at its maximum speed without necessarily reproducing audio. All recording tracks are automatically exited from record operation prior to execution.

Format: <FAST FORWARD>

62 FAST REVERSE — (TMS) Causes the controlled ATR to rewind at its maximum speed without necessarily reproducing audio. All recording tracks are automatically exited from record operation prior to execution.

Format: <FAST REVERSE>

63 not used

64 RECORD READY SELECT — (ARC) Selects channels that will be record-enabled. These enabled tracks enter record upon receipt of a RECORD STROBE command. A track that is disabled from RECORD READY may be taken out of a recording condition through receipt of a RECORD STROBE or RECORD EXIT command.

Format: <RECORD READY SELECT>
<CHANNELS> — 8-byte bitmap:
Bits 0 – 63 = audio channels 1 – 64
Logic 1 = RECORD READY TRUE

Bits 0 – 7 form the least significant byte; this byte is transmitted last.

65 not used

66 AUTO ATTENUATE SELECT

Causes the audio outputs of the controlled ATR to be attenuated. Any locally-defined time code-designated tracks may be excluded from this function.

Format: <AUTO ATTENUATE>
<MODE>

1-byte special binary code:
00_h = OFF (= default)
01_h = ON
FF_h = as selected locally

67 LIFTER DEFEAT SELECT

Defeats the tape lifter mechanism of the controlled ATR, thus allowing full tape contact with the heads at all times.

Format: <LIFTER DEFEAT SELECT>
<MODE>

1-byte special binary code:
00_h = OFF (= default)
01_h = ON
FF_h = as selected locally

68 not used

69 not used

6A not used

6B not used

6C not used

6D not used

6E not used

6F not used

70 LOCK MODE SELECT

Selects the manner in which the controlled device achieves and maintains synchronization as commanded by the lock command.

Format: <LOCK MODE SELECT>
<MODE>

1-byte special binary code:

00_h Absolute standard mode: Achieve lock to EXTERNAL TIME CODE in data-dependent mode, maintain lock in data-dependent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

01_h Absolute resolve mode: Achieve lock to EXTERNAL TIME CODE in data-dependent mode, maintain lock in data-independent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

02_h Absolute video mode: Achieve lock to EXTERNAL TIME CODE in data-dependent mode, maintain lock to external video reference. External LTC is selected as the source of EXTERNAL TIME CODE.

03_h Absolute VITC mode: Achieve lock to external video with VITC in data-dependent mode, maintain lock to external video reference. External video VITC signal is selected as the source of EXTERNAL TIME CODE.

11_h Free resolve mode: Achieve lock to EXTERNAL TIME CODE in data-independent mode, maintain lock in data-independent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

12_h Free video mode: Achieve lock to external video signal, maintain lock to external video reference. The source of EXTERNAL TIME CODE is undefined.

FF_h = as selected locally.

NOTES

1 All LOCK commands issued in any absolute mode require predefined PREROLL DURATION, REQUIRED OFFSET, and LOCK TIME I/Fs and should be preceded by a LOCK PREROLL SEARCH command.

2 All LOCK commands issued in any free mode ignore any predefined PREROLL DURATION, REQUIRED OFFSET, and LOCK TIME I/Fs and need not be preceded by a LOCK PREROLL SEARCH command.

3 If a change in LOCK MODE from any mode to the absolute mode is performed during a successful LOCK TMS, then the ACTUAL OFFSET I/F data is automatically transferred to the REQUESTED OFFSET I/F. LOCK is maintained.

4 Smooth operation in any absolute mode is ensured only if correct framing of the EXTERNAL TIME CODE to the video reference signal is ensured; i.e., the leading edge of bit 0 must begin at the start of the appropriate line of the video.

71 GLOBAL MONITOR SELECT

(AMC) Selects all audio channels to present the signal identified below to the line output.

Format: <GLOBAL MONITOR SELECT>
<MODE>

1-byte special binary code:
01_h = playback (= default)
02_h = synchronous playback
03_h = input
FF_h = as selected locally

72 EXCLUSIVE SYNC SELECT

(AMC) Selects audio channels that will, to the exclusion of any GLOBAL MONITOR SELECTion, present synchronous playback on line output in accordance with the SYNC-INPUT I/F.

Format: <EXCLUSIVE SYNC>
<CHANNELS>

8-byte bit map:
Bits 0–63 = audio channels 1–64
Logic 1 = EXCLUSIVE SYNC TRUE

Bits 0–7 form the least significant byte; this byte is transmitted last.

73 SYNC INPUT SELECT

(AMC) Selects the conditions under which line input is presented to line output for those channels selected for synchronous playback. This function affects all audio channels exclusive of the designated time code channel.

Format: <SYNC INPUT SELECT>
<MODE>

1-byte special binary code:
00_h = record only (= default)
01_h = record or nonplay
02_h = record or record-ready
FF_h = as selected locally

Record only: All channels that are set to monitor synchronous playback will monitor input when recording. Upon the conclusion of a record operation, those channels will return to synchronous playback.

Record or nonplay: All channels that are set to monitor synchronous playback will monitor input when recording. Upon the conclusion of a record operation, those channels will revert to synchronous playback. In addition, all record-ready channels will monitor input when not in PLAY TMS.

Record or record-ready: All channels that are set to monitor synchronous playback, and are set to record-ready (or not but still recording), will monitor input.

74 not used

75 not used

76 not used

77 not used

78 not used

79 not used

7A LOCAL LOCKOUT SELECT

Causes the controlled device to disable all local control.

Format: <LOCAL LOCKOUT SELECT>
<MODE> 1-byte special binary code:
00_h = local control not disabled
01_h = local control disabled

7B not used

7C PLAY MODE SELECT

Selects the manner in which the controlled device establishes its nominal, fixed speed forward operation as commanded by the PLAY command.

Format: <LOCL MODE SELECT>
<MODE> 1-byte special binary code:

00_h Normal (default): Achieve PLAY as defined by the CAPSTAN REFERENCE SELECT. No relationship with any time code or video reference is implied.

11_h Free resolve mode: Achieve PLAY in a manner that resolves with EXTERNAL TIME CODE in a data-independent mode and maintains this resolve in a data-independent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

12_h Free video mode: Achieve PLAY in a manner that resolves to external video signal and maintains this resolve to external video reference. The source of EXTERNAL TIME CODE is undefined.

FF_h = as selected locally

5 Information fields, definitions, and syntax

40 not used

41 INTERNAL LTC

Contains the longitudinal time code value most recently read from tape.

Format: <INTERNAL LTC>
<CODE VALIDITY> 1-byte special binary code:
00_h = valid LTC
01_h = derived LTC
FF_h = not valid LTC

<TIME VALUE> standard “time” format

42 not used

43 SELECTED TAPE CODE

Contains the time value of that code (LTC, TAPE TIMER, etc.) which has been most recently selected by the TAPE CODE SELECT command.

Format: <SELECTED TAPE CODE>

<IDENTIFIER> — 1-byte special binary code:
- 00_h = INTERNAL LTC
- 01_h = reserved
- 02_h = TAPE TIMER
- 03_h = reserved
- FF_h = valid

<TIME VALUE> — standard “time” format

44 INTERNAL LTC USERBITS

Contains the LTC userbit contents most recently read from tape.

Format: <INTERNAL LTC USERBITS>

<UB SPECIFICATION> — 1-byte special code:

bits 0, 1:
- 0, 0 – content of userbits unspecified
- 1, 0 – content of userbits is 8-bit character set conforming to ISO/IEC 646 and ISO 2022 (ASCII)
- 0, 1 – unassigned
- 1, 1 – unassigned

bit 2:
- 0 – unassigned
- 1 – content of userbits is secondary time data in standard time format

bits 3–7:
- 0 – set to 0 until assigned

<UB GROUP 8/UB GROUP 7>
<UB GROUP 6/UB GROUP 5>
<UB GROUP 4/UB GROUP 3>
<UB GROUP 2/UB GROUP 1>

4 bytes, each consisting of two 4-bit nibbles, each containing one UB group

MSNibble LSNibble

NOTE – UB 1 is the UB group which comes first on the tape. It is transmitted last in this format.

45 not used

46 TAPE TIMER

Contains the instantaneous counting status of the tape timer.

Format: <TAPE TIMER>

Modified standard “time” format:
MSB (80-position of hours) = sign;
tape timer count through zero technique must be monotonic:

```
| – | – | – | – | – | – | – | – | – | – | – | – |
  –4  –3  –2  –1  –0 | +0  +1  +2  +3  +4
| – | – | – | – | – | – | – | – | – | – | – | – |
```

47 not used

48 reserved

49 CAPSTAN REFERENCE TALLY

Tallies the status set by the CAPSTAN REFERENCE SELECT command.

Format: <CAPSTAN REFERENCE TALLY>
<MODE>

1-byte special binary code:
00_h = internal crystal (= default)
01_h = external ref input

4A REHEARSE TALLY

Tallies the status set by the REHEARSE SELECT command.

Format: <REHEARSE TALLY>
<MODE>

1-byte special binary code
00_h = rehearse true (= default)
04_h = rehearse true
05_h = record enable

4B CHANNEL RECORD STATUS

Contains a 64-bit map of the channels that are currently recording.

Format: <CHANNEL RECORD STATUS>
<CHANNELS>

8-byte bit map:
bits 0–63 = audio channels 1–64

NOTE – Bits 0–7 form the least significant byte; this byte is transmitted last.

4C not used

4D TAPE CODE SELECTION TALLY

Tallies the code currently selected by the most recent TAPE CODE SELECT command.

Format: <TAPE CODE SELECTION TALLY>
<CODE TYPE>

1-byte special binary code:
00_h = longitudinal time code
01_h = reserved
02_h = tape timer
03_h = reserved
04_h = reserved

4E SYNC VELOCITY

Contains a velocity used as the synchronization velocity for the SYNC command.

Format: <SYNC VELOCITY>
<SPEED>

3-byte signed binary number; twos complement scale:
000000_h = stationary
010000_h = fixed speed forward
$7F0000_h$ = approximately 127 times fixed speed forward
$FF0000_h$ = fixed speed reverse
800000_h = 128 times fixed speed reverse direction

4F PREROLL DURATION

Prescribes the desired real-time preroll duration used in advance of the synchronizing processes.

For use with the LOCK command, the PREROLL DURATION specifies the exact real-time period between lock actuation time and the moment of encountering the LOCK POINT. It is assumed that EXTERNAL TIME CODE is presented to the device in a real-time manner during the PREROLL period. PREROLL DURATION may not be set to a value lower than the device-dependent lower limits.

For use with the SYNC command, the PREROLL DURATION specifies the exact real-time period between the receipt of the SYNC command and the moment of synchronization with the SYNC/LOCK POINT at the SYNC VELOCITY. It is assumed that the selected TIMELINE SOURCE is presented to the device in a real-time manner during this preroll period. PREROLL DURATION may not be set to a value lower than the device-dependent lower limits, which may change dependencies upon prescribed SYNC VELOCITY and other factors.

Format: <PREROLL DURATION>
<TIME VALUE>

Standard “time” format.

50 SYNC POINT

Contains the specified point on tape, as referenced to SELECTED TAPE CODE, at which synchronism with the selected TIMELINE SOURCE is ensured.

Format: <SYNC POINT>
<TIME VALUE> Standard “time” format.

51 LOCK TIME

Contains the last specified point in time, as referenced to EXTERNAL TIME CODE, at which synchronism with the INTERNAL LTC is ensured. The manner in which the device maintains synchronous operation from this point on is defined by the LOCK MODE SELECT I/F.

Format: <LOCK TIME>
<TIME VALUE> Standard “time” format.

52 not used

53 not used

54 not used

55 reserved

56 reserved

57 reserved

58 reserved

59 FIXED SPEED TALLY

Tallies the current nominal tape play speed.

Format: <FIXED SPEED TALLY>
<SPEED>

1-byte special binary code:

10_h =	1.875 ips	4.7625	cm/s
20_h =	3.750 ips	9.525	cm/s
30_h =	7.500 ips	19.05	cm/s
37_h =	9.606 ips	24.40	cm/s
40_h =	15.00 ips	38.10	cm/s
50_h =	30.00 ips	76.20	cm/s

5A TAPE LENGTH

Contains the length of the loaded tape.

Format: <TAPE LENGTH>
<TIME VALUE> Standard “time” format.

5B not used

5C LOCK ACCURACY

Contains a time value that determines the accuracy of synchronizing processes; i.e., it specifies the maximum allowed error before negation of the “LOCK successful tally” (see TMS TALLY I/F).

Format: <LOCK ACCURACY>
<LTC BIT PERIODS>

1-byte unsigned number;

parameter range:
0 less than 1/80th frame period;
255 less than 3-15/80ths frame periods.

5D LOCK DEVIATION

Contains the time difference between the position of the controlled ATR and the external time code adjusted by the REQUESTED OFFSET. This is computed as follows: INTERNAL LTC minus REQUESTED OFFSET minus EXTERNAL TIME CODE.

Format: <LOCK DEVIATION>
<TIME VALUE>

High-resolution time format.

5E not used

5F not used

60 TMP TALLY

Tallies the current transport motion process of the ATR and specifies its success at accomplishing that process.

Format: <TMP TALLY>
<KEYWORD>

1-byte value that contains the keyword of the last active commanded TMP.

<SUCCESS LEVEL>

1-byte special binary code:
00_h = trying; transition in process
01_h = successful
02_h = failure; this tally should be supplemented by an ERROR message as appropriate.

61 TMS TALLY

Tallies the current transport motion state of the ATR, and specifies its success at accomplishing that process.

Format: <TMS TALLY>
<KEYWORD>

1-byte value that contains the keyword of the last active commanded TMS command.

<SUCCESS LEVEL>

1-byte special binary code:
00_h = trying; transition in process
01_h = successful
02_h = failure; this tally should be supplemented by an ERROR message as appropriate.

62 VELOCITY TALLY

Tallies the current transport velocity. Note that this is the true velocity in all modes.

Format: <VELOCITY TALLY>
<SPEED>

3-byte signed binary number; twos complement

Scale:
000000_h = stationary
010000_h = FIXED SPEED forward
$7F0000_h$ = approximately 127 times FIXED SPEED forward
$FF0000_h$ = FIXED SPEED reverse
800000_h = 128 times FIXED SPEED reverse direction

63 not used

64 RECORD READY TALLY

Contains a 64-bit map of the channels that are ready to record.

Format: <RECORD READY TALLY>
<CHANNELS>

8-byte bit map:

Bits 0–63 = audio channels 1–64;

Bits 0–7 form the least significant byte; this byte is transmitted last.

65 not used

66 AUTO ATTENUATE TALLY

Tallies the status of the AUTO ATTENUATE function selected by the AUTO ATTENUATE SELECT command.

Format: <AUTO ATTENUATE TALLY>
<MODE>

1-byte special binary code:
00_h = OFF
01_h = ON

67 LIFTER DEFEAT TALLY

Tallies the status selected by the TAPE LIFTER DEFEAT command.

Format: <LIFTER DEFEAT TALLY>
<MODE>

1-byte special binary code:
00_h = OFF
01_h = ON

68 reserved

69 reserved

6A reserved

6B reserved

6C reserved

6D reserved

6E reserved

6F reserved

70 LOCK MODE TALLY

Tallies the mode in which synchronism is established and maintained.

Format: <LOCK MODE TALLY>
<MODE>

1-byte special binary code:
00_h = absolute standard mode
01_h = absolute resolve mode
02_h = absolute video mode
03_h = absolute VITC mode
11_h = free resolve mode
12_h = free video mode

71 GLOBAL MONITOR TALLY

Tallies the status of the monitor channels selected by the GLOBAL MONITOR SELECT command.

Format: <GLOBAL MONITOR SELECT>
<MODE> 1-byte special binary code:
01_h = playback
02_h = synchronous playback
03_h = input

72 EXCLUSIVE SYNC TALLY

Tallies the status of the audio channels defined by the EXCLUSIVE SYNC SELECT command.

Format: <EXCLUSIVE SYNC TALLY>
<CHANNELS> 8-byte bit map:
Bits 0–63 = audio channels 1–64

NOTE – Bits 0–7 form the least significant byte; this byte is transmitted last.

73 SYNC INPUT TALLY

Tallies the conditions selected by the SYNC INPUT SELECT command.

Format: <SYNC INPUT TALLY>
<MODE> 1-byte special binary code:
00_h = record (= default)
01_h = record or nonplay
02_h = record or record-ready

74 EXTERNAL TIME CODE

Contains the time code value most recently read from an external time code source.

Format: <INTERNAL LTC>
<CODE VALIDITY> 1-byte special binary code:
00_h = valid TC
FF_h = not valid TC

<TIME VALUE> Standard “time” format.

75 EXTERNAL USERBITS

Contains the userbit contents most recently read from an external time code source.

Format: <USERBITS>
<UB SPECIFICATION>
<UB GROUP 8/UB GROUP 7>
<UB GROUP 6/UB GROUP 5>
<UB GROUP 4/UB GROUP 3>
<UB GROUP 2/UB GROUP 1>

For format description, see INTERNAL LTC USERBITS.

76 SLEW RATE

Contains the maximum rate at which the position of the controlled machine may be changed during an attempt to reestablish synchronism following a loss of same.

Format: <SLEW RATE>
<RATE>

2-byte unsigned binary number

Scale:
0000_h = no slew
0001_h = 1/10 frame/second
$FFFF_h$ = maximum device dependent

77 REQUESTED OFFSET

Contains the desired time offset between the external time code and the internal tape time code for use with LOCK and CHASE commands.

Format: <REQUESTED OFFSET>
<OFFSET TIME>

High-resolution time code.

Definition: offset = internal minus external; e.g., if controlled device is to lead external reference by one minute, then: <OFFSET TIME> = <00 01 00 00.00 00>.

78 ACTUAL OFFSET

Contains the actual time offset between the external time code and the internal tape time code.

Format: <ACTUAL OFFSET>
<OFFSET TIME>

High-resolution time code.

Definition: offset = internal minus external; e.g., if controlled device is to lead external reference by one minute, then: <OFFSET TIME> = <00 01 00 00.00 00>.

79 STRIDE LENGTH

Contains the period of each unit in terms of LTC bits for the STEP TMS argument.

Format: <STRIDE PERIOD>
<NUMBER LTC BITS> 1-byte unsigned binary number

7A LOCAL LOCKOUT TALLY

Tallies the status of the local control capability of the controlled device.

Format: <LOCAL LOCKOUT TALLY>
<MODE> 1-byte special binary code:
00_h = local control not disabled
01_h = local control disabled

7B TIME CODE ATTRIBUTE

Contains the attributes of the time codes presented to the controlled device.

Format: <TIME CODE ATTRIBUTE>
<TAPE TIME CODE> Special binary code.
<EXTERNAL TIME CODE> Special binary code.

00_h = 24-frame count code
01_h = 25-frame count code
02_h = 30-frame count code
12_h = 30-frame count code compensated

7C PLAY MODE TALLY

Tallies the manner in which the controlled device is selected to establish its nominal, fixed speed forward operation, as commanded by the PLAY command.

Format: <LOCK MODE TALLY>
<MODE> 1-byte special binary code:
00_h = normal (default)
11_h = free resolve mode
12_h = free video mode

Annex A (informative)
General concepts

The following text contains a general explanation of some of the concepts used in the formulation of the ATR type-specific message set. It constitutes tutorial information and is intended to assist in the understanding of the specification in previous portions of this practice. A working knowledge of the following ESbus topics is assumed:

– ESbus system overview
– Control message architecture
– Supervisory protocol
– Tributary interconnection
– Electrical and mechanical characteristics
– System service and common messages

The ATR type-specific dialect shares many conceptual constructs with the VTR type-specific dialect. However, there are significant differences between the form and function of their command structures. The reader is cautioned not to assume that a transparency of control messages between the dialects has been provided.

Conventions: Acronyms and abbreviations are shown in uppercase characters; e.g, audio tape recorder -- ATR; tape motion state -- TMS; information field -- I/F.

Message keywords and names of information fields are shown in uppercase characters; e.g., RECORD STROBE; REQUESTED OFFSET.

These command keywords and information field names are used within the text of this document to imply requested action, information field identity, and, in turn, the information field contents of the virtual machine. To assist in readability of this document, these terms are used in the context of the presentation material; e.g.:

> "There are six modes available for LOCK MODE SELECTion" [LOCK MODE SELECT is a keyword].
>
> "This point in time is defined by the specification of the LOCK TIME I/F" [LOCK TIME I/F in this context implies the identity of an information field].
>
> "The ACTUAL OFFSET is maintained independent of the synchronization status [ACTUAL OFFSET in this context refers to the content of an information field].

Terms with special meaning to this or related documents are shown with leading uppercase characters; e.g., Tape Motion Process; Local Lock Point.

A.1 Command keywords and information fields

ATR-specific commands affect conditions or selection of characteristics particular to the Virtual ATR Machine.Commands which direct nonmutually exclusive conditions have corresponding Information Fields. When this Information Field is tallied, the response is in the same format as that of its respective command. Commands which direct mutually exclusive conditions may share a common Information Field.

A.2 Transport motion process and state control

The transport mechanism of an ATR is considered as a separate State Machine. The commands which control transport functions are subsets within the ATR-specific message set. These are called Tape Motion Process and State commands (TMPs and TMSs). Each TMS command causes a transition into a transport state and cancels the previous state. Tape Motion Processes (indicated below as "TMP") are overriding control commands that cause the controlled device to automatically choose its own Tape Motion States to achieve the desired result. The Tape Motion State will be reflected in the TMS tally, as though that TMS had been issued.

TMP commands include: TARGET SEARCH, PREROLL SEARCH, CHASE, etc. All Tape Motion Process commands are marked "TMP" in the index list and in the command description.

TMS commands include: STOP, PLAY, SHUTTLE, LOCK, etc. All Tape Motion State commands are marked "TMS" in the index list and in the command description.

A.2.1 TMP I/F tallies

This Information Field indicates the current Tape Motion Process. As these mutually exclusive Pocesses are commanded by TMP commands, the code of the corresponding TMP keyword is used to identify them individually. An additional byte tallies the level of success; i.e., whether the commanded Process is still in progress or has already accomplished its respective goal, successfully or not.

A.2.2 TMS I/F tallies

This Information Field indicates the current State of the transport. As these mutually exclusive States are commanded by TMS commands, the code of the corresponding TMS keyword is used to identify them individually. An additional byte tallies the level of success; i.e., whether the commanded State function is still in transition or has been achieved, successfully or not.

A.3 Audio record commands (ARCs) and tallies

The recording function of the tape machine is controlled and tallied by the following Keywords and I/Fs, respectively:

REHEARSE SELECT	REHEARSE TALLY
RECORD STROBE	RECORD TALLY
RECORD EXIT	----------
RECORD READY SELECT	RECORD READY TALLY

RECORD READY SELECT provides a means to identify tracks that when set will enter, and when cleared will exit a recording condition upon the receipt of a RECORD STROBE.

RECORD EXIT causes all recording tracks to exit from a recording condition.

REHEARSE SELECT provides a means of specifying that all tracks, when subsequently commanded to enter a recording condition, will mimic a record operation in regard to their respective pending Audio Monitor Commands (AMCs).

A.4 Audio monitor commands (AMCs) and tallies

The manner in which the Audio Line Output Source selections are made is controlled and tallied by the following Keywords and I/Fs, respectively:

GLOBAL MONITOR SELECT	GLOBAL MONITOR TALLY
EXCLUSIVE SYNC SELECT	EXCLUSIVE SYNC TALLY
SYNC INPUT SELECT	SYNC INPUT TALLY

GLOBAL MONITOR SELECT causes all audio channels to present either Playback, Synchronous Playback (sync), or Input signals to their respective Line Outputs of all audio channels.

EXCLUSIVE SYNC SELECT provides a means to select individual audio channels that will, to the exclusion of any GLOBAL MONITOR SELECTion, present synchronous playback on Line Output in accordance with the SYNC-INPUT I/F.

SYNC INPUT SELECT provides a means to choose the monitor switching methods used during record-related functions. These monitor switching functions are restricted to those channels selected for Synchronous Playback.

A.5 Velocity arguments

Some commands require a speed specification which is carried by a command in the form of a three-byte parameter. This parameter is intended to define direction and absolute value of the desired speed that should be achieved as closely as possible by the real machine. This speed is referenced in terms of the standard play speed as defined by the FIXED SPEED SELECT I/F.

All commands with a velocity parameter use the same format and coding. This is a three-byte, two's complement, signed number with a scale range defined such that:

000000_h represents a stopped condition;

010000_h represents the speed currently defined in I/F FIXED SPEED, forward direction;

$7F0000_h$ represents approximately 127 times FIXED SPEED forward;

$FF0000_h$ represents FIXED SPEED reverse;

800000_h represents 128 times FIXED SPEED reverse direction.

It allows theoretically for a resolution of 1/65,536th of standard speed. This represents an effective speed argument range from --128.00000 to +127.99998 times standard speed (rounded to five significant digits).

A.6 Track selection arguments

Some commands and Information Fields refer to one or more tracks (or channels) of the tape machine. The format used is the same in all cases and is defined as an 8-byte bit map. This allows for up to 64 tracks to be controlled. The command Keywords and I/Fs that utilize this track specific mapping are:

REHEARSE SELECT	REHEARSE TALLY
RECORD READY SELLECT	RECORD READY TALLY
EXCLUSIVE SYNC SELECT	EXCLUSIVE SYNC TALLY
	RECORD TALLY

A.7 Tape code identity

There are currently two means of referencing tape location:

-- INTERNAL LTC (longitudinal time code from tape)
-- TAPE TIMER

There are separate Information Fields for both the INTERNAL LTC and the TAPE TIMER. The contents of the selected TAPE CODE I/F, however, is chosen by the TAPE CODE SELECT command.

TARGET SEARCH, SYNC PREROLL SEARCH, and LOCK PREROLL SEARCH cause the Controlled Device to locate a position on the tape, referenced to the SELECTED TAPE CODE.

A.8 Achieving and maintaining synchronization

A.8.1 LOCK operations

Synchronization requires the Controlled Device to maintain a particular time relationship between its INTERNAL LTC and some External Reference. In ATRs, this relationship is usually restricted to a speed range around the nominal FIXED SPEED.

The External Reference to which synchronization is achieved and maintained may be selected from a number of alternative sources. This is done with the LOCK MODE SELECT command.

The LOCK command enables the process of synchronization. While there are facilities associated with the LOCK command that can provide for synchronization with no specification setup, the performance-critical methods of using the LOCK command require:

– a specified EXTERNAL TIME CODE ("when");
– a specified point on the tape ("where");
– a selected External Reference ("how").

When: This point in time is defined by the specification of the LOCK TIME I/F. This refers to a time, defined by the EXTERNAL TIME CODE, at which synchronism is assured between the EXTERNAL TIME CODE and the Controlled Device's INTERNAL LTC.

Where: This is a point on the tape called the "Local Lock Point." The Local Lock Point may be characterized by two independent specifications. These are the aforementioned LOCK TIME I/F and the REQUESTED OFFSET I/F.

The REQUESTED OFFSET I/F specifies the longitudinal time relationship between the EXTERNAL TIME CODE and the Controlled Device's INTERNAL LTC. This REQUESTED OFFSET is maintained during successful synchronous operation.

NOTE -- A related Information Field, the ACTUAL OFFSET I/F, is provided so that tallies of INTERNAL LTC minus the EXTERNAL TIME CODE may be facilitated.

The Local Lock Point may be calculated as the sum of the LOCK TIME I/F and the REQUESTED OFFSET I/F.

A.8.2 LOCK modes ("How")

The LOCK MODE SELECT command allows a choice in the manner in which synchronization is achieved and maintained. Two different classes of synchronization may be selected: "absolute" and "free." There are four Absolute modes and two Free modes available for LOCK MODE SELECTion.

A.8.2.1 Absolute modes of LOCK

Absolute standard mode: Achieve lock to EXTERNAL TIME CODE data in dependent mode, maintain lock in data-dependent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

Absolute resolve mode: Achieve lock to EXTERNAL TIME CODE in data dependent mode, maintain lock in data-independent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

Absolute video mode: Achieve lock to EXTERNAL TIME CODE in data-dependent mode, maintain lock to the External video reference. External LTC is selected as the source of EXTERNAL TIME CODE.

Absolute VITC mode: Achieve lock to External video with VITC, in data-dependent mode, maintain lock to the External video reference. The External video VITC signal is selected as the source of EXTERNAL TIME CODE.

A.8.2.2 Free modes of LOCK

Free resolve mode: Achieve lock to EXTERNAL TIME CODE in data-independent mode, maintain lock in data-dependent mode. External LTC is selected as the source of EXTERNAL TIME CODE.

Free video mode: Achieve lock to External video signal, maintain lock to the External video reference. The source of EXTERNAL TIME CODE is undefined.

A.8.3 LOCK operation in absolute modes

Three important concepts must be established before any of the Absolute modes of LOCK may be represented:

PREROLL DURATION: Contains the time used or needed in advance of achieving synchronization. The PREROLL DURATION I/F specifies the exact real-time period between the start of tape movement and the moment of encountering the specified LOCK TIME. It is assumed that EXTERNAL TIME CODE is presented to the device in a real-time manner during the Preroll Duration. The PREROLL DURATION I/F may not be set to a value lower than the device-dependent lower limits.

LOCK PREROLL SEARCH: This TMP causes the controlled ATR to move to a tape position specified by the Local Lock Point minus the predefined PREROLL DURATION plus any device specific "Acceleration Allowance" (see figure A.1). This position may be described as the PREROLL SEARCH Point.

"Lock Actuation": In all Absolute modes of the LOCK command, the condition which causes the start of tape movement to achieve and maintain synchronization is always the receipt of EXTERNAL TIME CODE of a value equal to the predefined LOCK TIME I/F minus the predefined PREROLL DURATION I/F. The time (referenced to EXTERNAL TIME CODE) at which this occurs may be termed the Lock Actuation Time.

The source of the EXTERNAL TIME CODE that triggers the Lock Actuation may be either LTC or VITC. This choice is specified by the LOCK MODE SELECT.

All LOCK commands issued in any Absolute mode require predefined PREROLL DURATION, REQUESTED OFFSET, and LOCK TIME I/Fs, and must be preceded with a LOCK PREROLL SEARCH command.

After establishing a PREROLL DURATION, DESIRED OFFSET, and commanding a LOCK PREROLL SEARCH, a LOCK command of the ABSOLUTE class may be issued. When the EXTERNAL TIME CODE equals the Lock Actuation Time, the Controlled Device will accelerate and synchronize its INTERNAL LTC with the EXTERNAL TIME CODE. For a LOCK to be successful, synchronism must be achieved prior to the LOCK TIME. Synchronous operation will be maintained from the LOCK TIME on, with the LOCK MODE SELECT I/F specified External Reference.

A.8.4 LOCK operation in FREE modes

All LOCK commands issued in any Free mode ignore any predefined PREROLL DURATION, REQUESTED OFFSET, and LOCK TIME I/Fs and need not be preceded with a PREROLL SEARCH command. These LOCK facilities provide the means to synchronize immediately without an absolute reference to EXTERNAL TIME CODE.

If a change in LOCK MODE from any mode to the Absolute Standard Mode is performed during a successful LOCK TMC, then the ACTUAL OFFSET I/F data is automatically transferred to the REQUESTED OFFSET I/F.

A.8.5 SYNC operations

The External Reference to which SYNC synchronization is achieved and maintained is prescribed by the TIMELINE SELECT common message. The SYNC command actuates the process of synchronization. To do this, the SYNC command requires:

– a specified instant in time ("when");
– a specified point on the tape ("where");
– a specified velocity ("how").

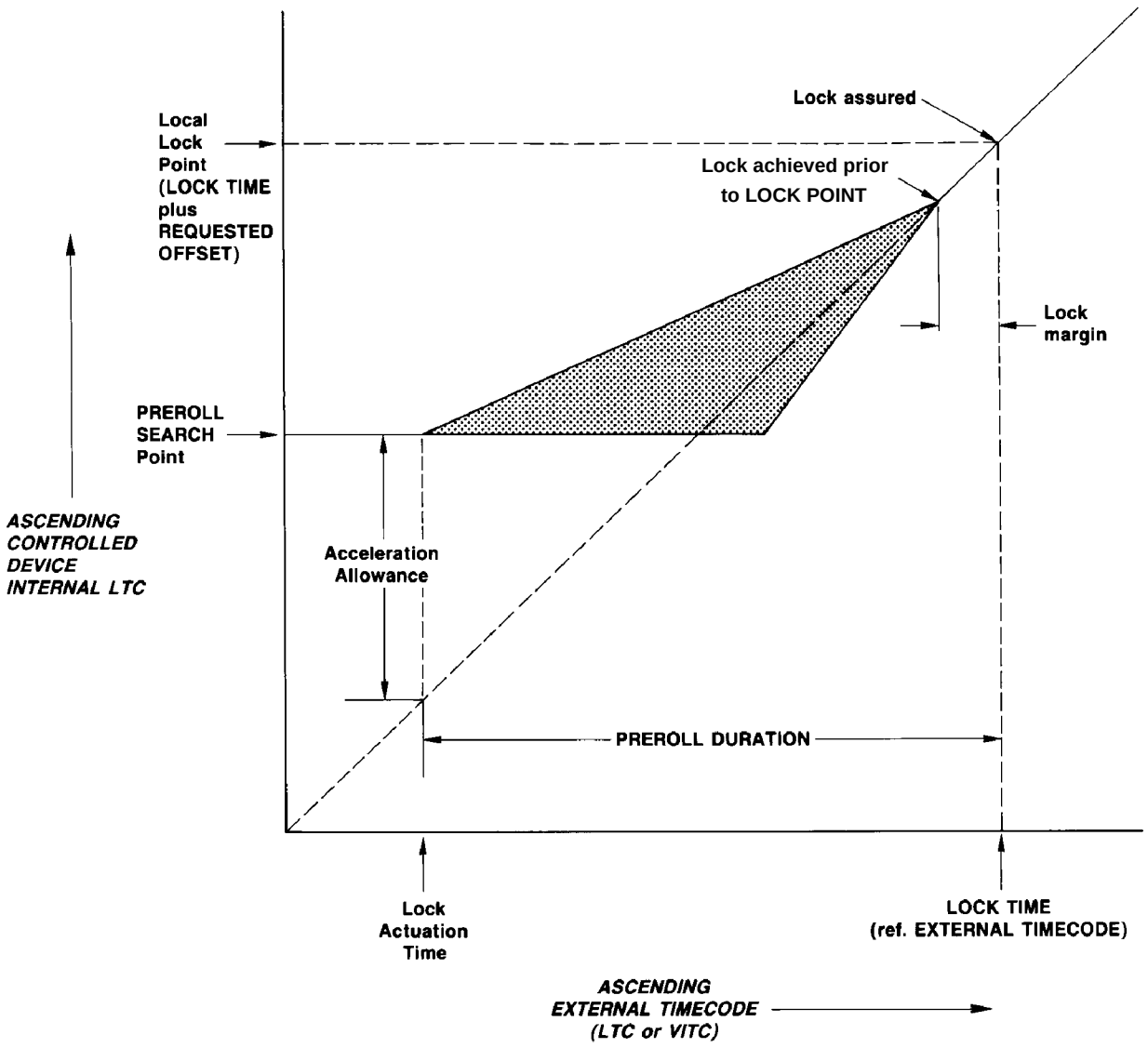


Figure A.1 – Lock operation diagram (absolute modes)

When: This is a specified instant in time defined as the PREROLL DURATION after the receipt of the SYNC command. As the ESbus by nature may not be deterministic in the delivery timing of commands, it is advisable to use the Common Message Event construct to define the actuation timing of this command.

Where: This point in time is defined by the specification of the SYNC POINT I/F. This refers to a tape position, relative to the SELECTED TAPE CODE, at which synchronism is ensured between the selected TIMELINE and the Controlled Device's SELECTED TAPE CODE.

How: The speed at the LOCK POINT is defined by the SYNC VELOCITY I/F. The SYNC command requires that the Controlled device be parked at a position such that the Controlled device will accelerate from its PREROLL SEARCH Point to the SYNC POINT at the prescribed SYNC VELOCITY during a precisely prescribed PREROLL DURATION.

If the Controlled device were to be "Ideal," it would have no latency in response to the SYNC command, and would have an infinite acceleration capability from its PREROLL SEARCH Point. Given an "Ideal" Controlled device, this PREROLL SEARCH Point would be characterized as follows:

"Ideal" PREROLL SEARCH Point =

$$\text{SYNC POINT} - \frac{\text{PREROLL DURATION} \times \text{SYNC VELOCITY}}{\text{STANDARD VELOCITY}}$$

As "Ideal" performance is unlikely in the real world, the Controlled Device would be required to park at a "Real" PREROLL SEARCH Point, which would be some distance in advance of the "Ideal" PREROLL SEARCH Point. The magnitude of this advance may be termed the "Acceleration Allowance." This "Aceleration Allowance" would most likely be proportional to the SYNC VELOCITY (see figure A.2).

After establishing a PREROLL DURATION and commanding a SYNC PREROLL SEARCH, a SYNC command may be issued. The Controlled Device will accelerate and synchronize its SELECTED TAPE CODE to the TIMELINE reference.

For a SYNC to be successful, SYNC VELOCITY must be achieved relative to the TIMELINE reference, at the SYNC POINT precisely the PREROLL DURATION after the receipt of the SYNC command.

A.8.6 CHASE command

An alternative means for maintaining synchronism. While the PREROLL SEARCH and LOCK commands may be used to run several machines in synchronism continuously (without changing their states and/or speed), the CHASE command is used to maintain synchronism during changes of the machine's state and/or velocity in a dynamic manner.

This operation, however, requires one of the synchronously running machines to be a "Master," while the others have to act as "slaves," which follow the movement of the Master, even in SHUTTLE.

For this purpose, the slaves must have information about the movement of the Master. This information is distributed as the Master Device's Time Code. This Time Code stream would be continuously distributed to all Slaves over a separate line. (The ESbus cannot be used for this purpose due to its nondeterministic delay characteristics.)

The CHASE command utilizes the REQUESTED OFFSET I/F to establish any required longitudinal position relationships between the Master and the Controlled Device. Synchronism is always established and maintained in a data dependent manner, independently of the current LOCK MODE TALLY I/F.

A.9 TIMELINE and other EVENT triggers

All ATR commands can be used in an "Immediate" manner in which their receipt causes their execution. As the timely transfer of traffic over the ESbus may not be deterministic, some of the more time-critical applications may not occur in an acceptable manner. In these cases, an Immediate command method would not be recommended.

Wherever possible, therefore, time-critical commands should be prepared using the EVENT command facilities provided by the Common Message Set. The DEFINE EVENT Common Message allows any Type-Specific Keyword or the Common Message READ to be executed by the Virtual Machine at a specified Trigger Time. This Trigger Time may be the Common TIMELINE I/F, or a Type-Specific Time I/F.

It should be noted that the temporal order of EVENTS should be preserved. Commands actuated by the EVENT construct that are placed on the EVENT cue at the same trigger point will execute as requested, preserving the temporal order of the delivery of the commands. The ATR Type-Specific Time I/Fs that may be used as EVENT Triggers are: INTERNAL LTC, SELECTED TAPE CODE, TAPE TIMER, and EXTERNAL TIME CODE. ATR Type-Specific Time I/Fs that are not permitted for use as EVENT Triggers are: TAPE LENGTH, LOCK DEVIATION, REQUESTED OFFSET, and ACTUAL OFFSET.

The Common Message TIMELINE SOURCE may be selected to be an internal clock or an External Reference Time. There is no restriction as to the source of this External Reference Time. Should the External Reference Time be chosen as the intended TIMELINE SOURCE, it might be conceivable to locally configure a Controlled Device to use an External LTC signal or an External video signal with the VITC signal as the TIMELINE TIME. Alternatively, when the Internal Clock is the intended TIMELINE SOURCE, the External "tick" which increments the Internal Clock, might be locally configured to be the sync-word of an External LTC signal or an External video signal.

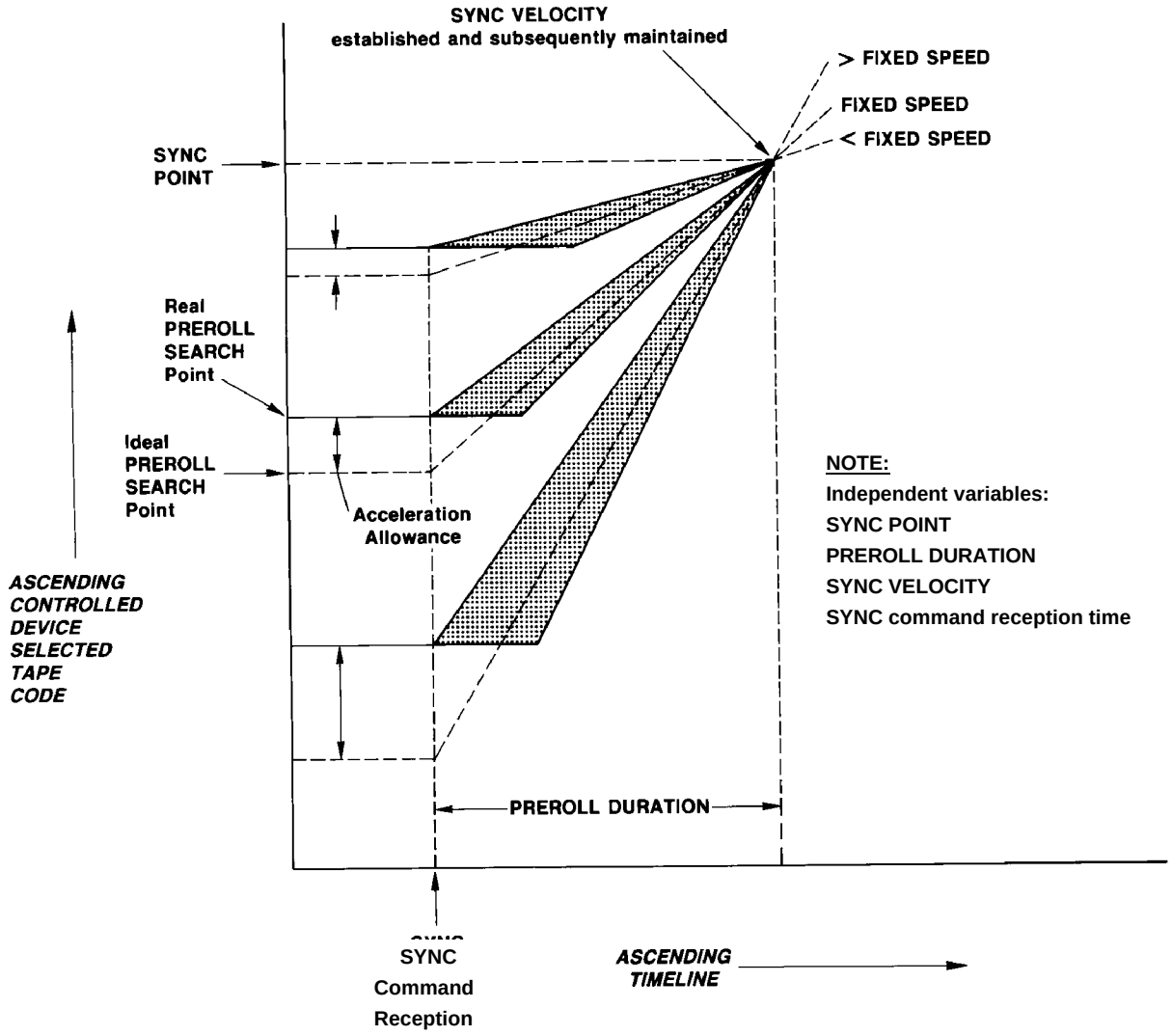


Figure A.2 – Sync operation diagram

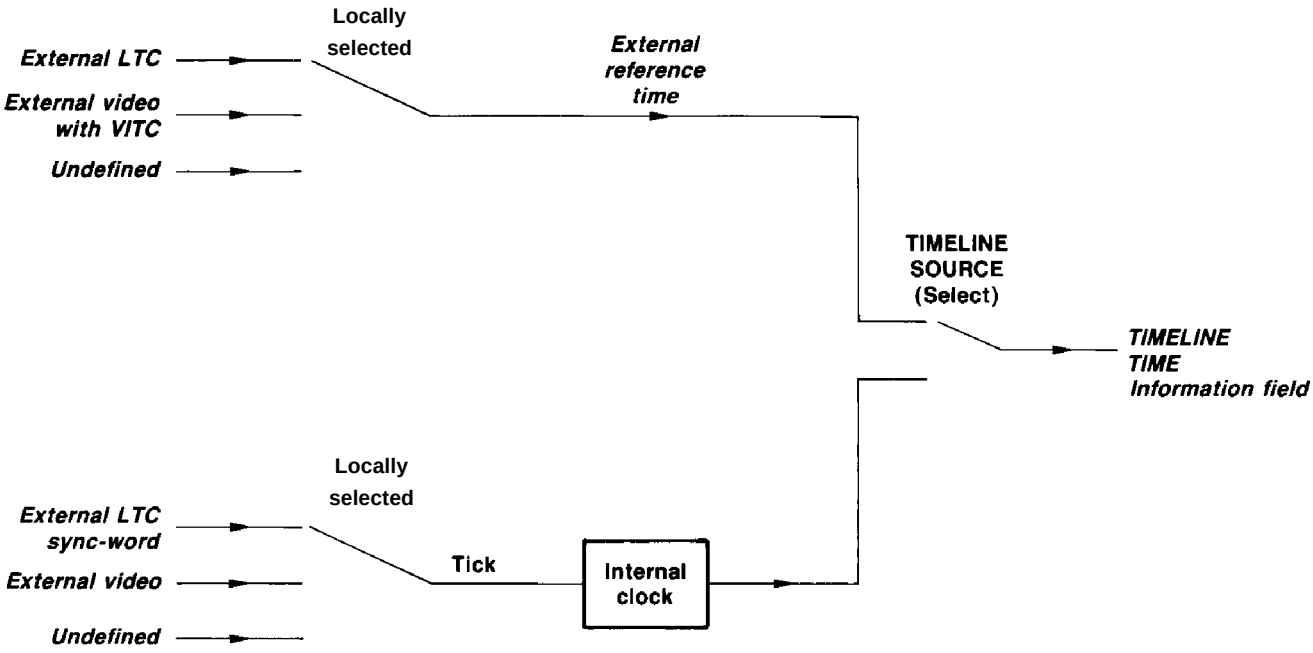


Figure A.3 – Selections of TIMELINE source

Activities requiring simultaneous operations between several Controlled Devices may be best suited to the EVENT mode of command delivery, which allows for the pre-programming of sequences of time-critical functions (e.g., RECORD STROBE).

EVENTS may refer to the TIMELINE of the individual virtual machines. These individual TIMELINE TIMEs are synchronized by a System Time transmission from the Bus Controller in response to the System Service REQUEST TIME TRANSMISSION command.

A.10 Sample command sequences

The following sections show samples of typical command sequences including time deferred EVENT constructs. These sequences describe only some of the applications of the command set. There is no obligation on the part of system designers to use precisely these sequences. READ commands of the related I/Fs for system confidence are not shown and should be an integral part of any reasonable Controlling Tributary's typical sequence.

A.10.1 Selective record entries and exits

Some time before initial record action:

<RECORD READY SELECT>
<00000000> (64-bit map)
<00000000>
<00000000>
<00000000>
<00000000>
<00000000>
<00000000>
<00000000>
<01010101>
(tracks 1,3,5,7 are record-enabled)
<PLAY>

Some time later:

<RECORD STROBE>
(above selected tracks enter recording condition)

Some time later:

<RECORD READY SELECT>
<00000000> (64-bit map)
|
|
<10101010>
(tracks 1,3,5,7 are record-disabled; tracks 2,4,6,8 are record-enabled; no change is made to the recording status of these tracks)

Some time later:

<RECORD STROBE>
(tracks 1,3,5,7 exit record; tracks 2,4,6,8 enter record)

Some time later:

<RECORD EXIT>
(the remaining record tracks 2,4,6,8 exit record)

A.10.2 EVENT-triggered record entries and exits

Exactly the same actions as above may be accomplished through the use of the EVENT construct, albeit with more precise control of the RECORD STROBE times:

<RECORD READY SELECT>
<00000000> (64-bit map)
|
<01010101>
(tracks 1,3,5,7 are record-enabled)
<PLAY>

Any time before the required record action sequence:

<DEFINE EVENT>
<event name #1> (user assigned)
<INTERNAL LTC> (I/F name of trigger)
<TRIGGER VALUE #1> (standard "time" value)
<RECORD STROBE>

<DEFINE EVENT>
<event name #2> (user assigned)
<INTERNAL LTC> (I/F name of trigger)
<TRIGGER VALUE #2> (standard "time" value)
<RECORD READY SELECT> <00000000>
|
<01010101>
(tracks 2,4,6,8 are record-enabled)

<DEFINE EVENT>
<event name #3> (user assigned)
<INTERNAL LTC> (I/F name of trigger)
<TRIGGER VALUE #3> (standard "time" value)
<RECORD STROBE>

<DEFINE EVENT>
<event name #4> (user assigned)
<INTERNAL LTC> (I/F name of trigger)
<TRIGGER VALUE #4> (standard "time" value)
<RECORD EXIT>

NOTES
1 The above TRIGGER VALUEs 1--4 are assigned with suitable ascending values respectively. These EVENTS are established with the assumption that the Controlled Device will encounter these INTERNAL LTC Triggers in ascending order.
2 The controlling virtual machine need not "know" the Device Specific record initiation delays of the ATRs. It is the job of the Virtual Machine to resolve any internal, time dependent idiosyncrasies.

Example: An IEC center-track format ATR is required to simultaneously enter record on track #1 and exit record on track #2 at an INTERNAL LTC of 12:26:00:02. The TIME CODE ATTRIBUTE I/F of the INTERNAL LTC indicates "30-frame count code compensated."

Given an INTERNAL LTC I/F Triggered RECORD STROBE EVENT, and working with an SMPTE Compensated (drop frame) Time Code, the machine must:

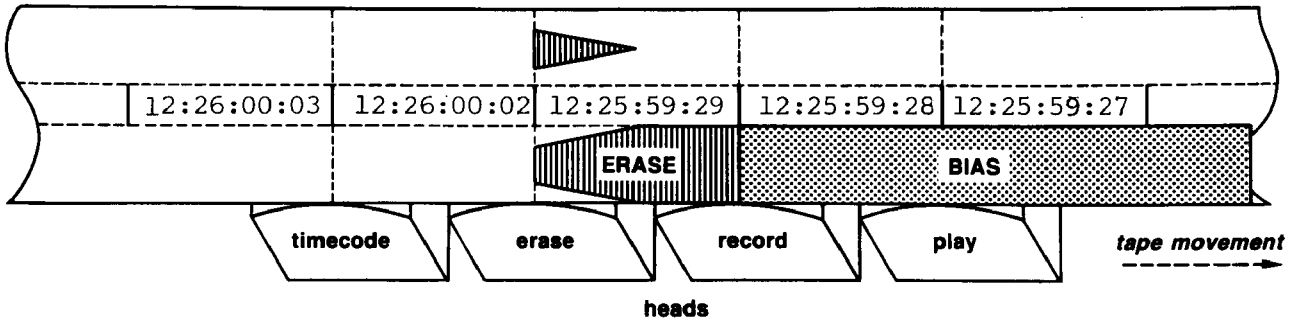
– anticipate the two missing frame codes in the INTERNAL LTC;

– compensate for any longitudinal offsets of the Controlled Device's Time Code Playback head;

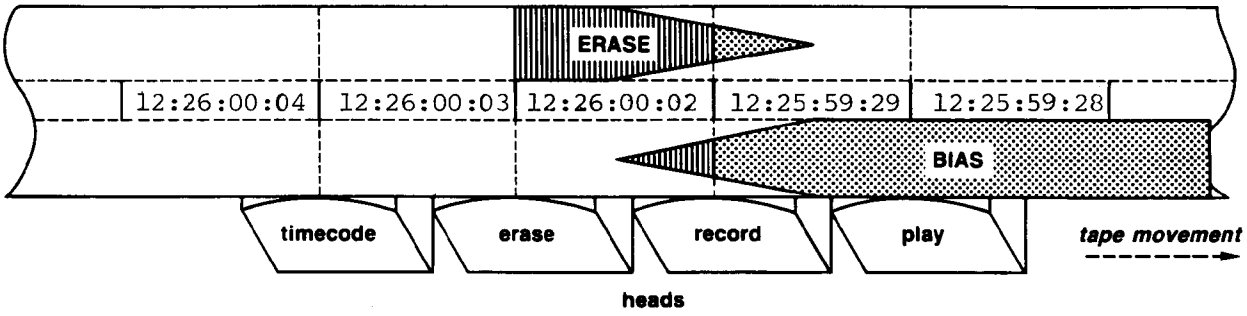
– transition the erase signal in advance of the Virtual Machine's INTERNAL LTC Trigger point to ensure that the erase signal starts and stops its process at the correct point on the tape.

Graphically represented:

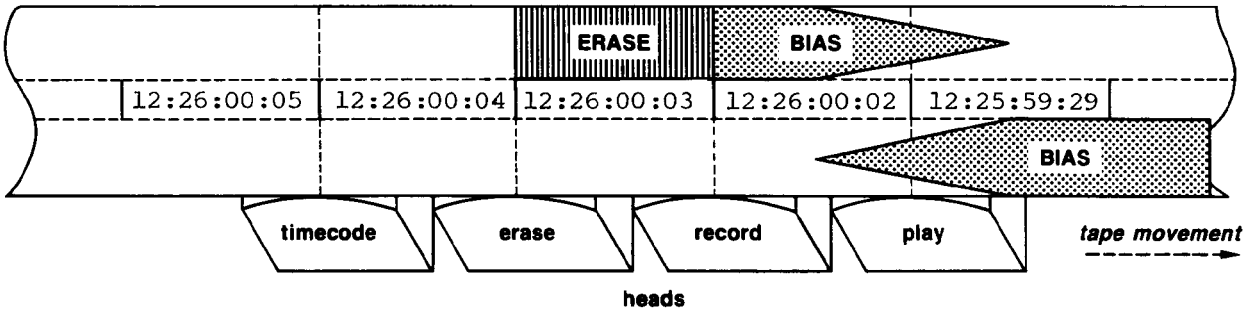
EVENT Time minus one frame	<VIRTUAL MACHINE INTERNAL LTC>
	< 12:25:59:29 >
	< the RECORD sequence begins >
	< tk #1 Erase begins ramp up >
	< tk #2 Erase begins ramp down >



EVENT Time <VIRTUAL MACHINE INTERNAL LTC>
< 12:26:00:02 >
< RECORD sequence in process >
< tk #1 Record begins ramp up >
< tk #2 Erase exit completed >



EVENT Time <VIRTUAL MACHINE INTERNAL LTC>
plus one < 12:26:00:03 >
frame < RECORD sequence completed >



If the above example were to consider a TIMELINE TIME I/F or EXTERNAL TIME CODE I/F triggered RECORD STROBE EVENT, the requirements of the Virtual Machine would be basically unchanged. The record EVENT must occur at the EVENT time, regardless of any Device-dependent precursive process.

Search and synchronize:

Some time before required synchronization action:

<PRESET> <PREROLL DURATION> (time value)
<PRESET> <LOCK POINT> (time value)
<PRESET> <REQUIRED OFFSET> (high resolution time value)
<LOCK MODE SELECT> <ABSOLUTE STANDARD MODE>

NOTE -- The PREROLL DURATION, LOCK POINT, REQUIRED OFFSET, and LOCK MODE SELECT, once chosen, need not be reloaded until a change is required.

<LOCK PREROLL SEARCH>

(Not earlier than when a TMP TALLY has indicated that the LOCK PREROLL SEARCH has been successfully accomplished.)

<LOCK>

On receipt of the LOCK command, the ATR will monitor the Longitudinal EXTERNAL TIME CODE. When the EXTERNAL TIME CODE equals the Controlled Device calculated “Lock Actuation Time,” the Controlled Device will accelerate and synchronize its INTERNAL LTC with the EXTERNAL TIME CODE. For a LOCK to be successful, synchronism must be achieved prior to the LOCK TIME.

Annex B (informative)
Bibliography

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SMPTE RP 170-1993, Video Tape Recorder Type-Specific Messages for Digital Control Interface

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ISO/IEC 646:1991, Information Technology — ISO 7-Bit Coded Character Set for Information Interchange

ISO 2022:1986, Information Processing — ISO 7-Bit and 8-Bit Coded Character Sets — Code Extension Techniques