REMOTE CONTROL SYSTEM
FOR BROADCASTING PRODUCTION EQUIPMENT
AUDIO TAPE-RECORDER TYPE-SPECIFIC MESSAGES

Tech 3245-E Supplement 3   3 February 1989

CONTENTS

Introduction

Document Tech. 3245 describes the specification of a digital remote-control system for broadcasting production equipment. It defines completely the electrical/mechanical level (level 1), and the supervisory level (level 2), of the interface. The two remaining levels - the system service level (level 3), and the virtual machine level (level 4) - are defined only in terms of function and control message syntax.

Supplement 1 to Tech. 3245 completes the definition of the system service level by detailing the system service messages and, in addition, defines the virtual machine messages which are common to all types of virtual machine - the common messages.

The present Supplement defines the type-specific virtual machine messages which are applicable to audio tape-recorders. Type-specific messages applicable to other categories of equipment are defined in other supplements to Tech. 3245.

In order to implement a complete network, the system designer therefore requires:

- Document Tech. 3245 - the general specification

- Supplement 1 - system service and common messages

and one or more other supplements appropriate to the category or categories of equipment to be used.

The specification described in this Supplement has been developed jointly with the SMPTE, and is functionally identical to that to be published as an SMPTE Recommended Practice.

Chapter 1

General concepts

This chapter 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 specifications in Chapter 2 of this document. A working knowledge of the following ESbus topics, which have been covered by earlier publications in this series, 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 in 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 upper-case 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 upper-case 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 the 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 identifies 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 having special meanings in this or related documents are shown with leading upper-case characters :

e.g.   Tape Motion Process
          Local Lock Point

1.   Command Keywords and Information Fields

ATR-specific commands affect conditions or selection of characteristics particular to the ATR virtual machine. Commands that produce non-mutually-exclusive conditions have individual information fields. In order to ascertain the existing state, a " Tally " message corresponding to a particular command may be sent; the response information field is in the same format as that of the corresponding command. Commands that produce mutually-exclusive conditions may have the same information field.

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 in a subset of the ATR-specific message set. These are called the 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 enter the appropriate Tape Motion State automatically so as to achieve the desired result. This Tape Motion State will be reported in the TMS tally as though that TMS had been issued.

2.1. TMP commands

TMP command include:

TARGET SEARCH, PREROLL SEARCH, CHASE

All Tape Motion Process commands are marked "TMP" in the index list and in the command description.

2.2. TMS commands

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.

2.3. TMP I/F tallies

These information fields indicate the current state of Tape Motion Process. As these processes are mutually-exclusive and commanded by TMP commands, the code of the corresponding TMP keyword is used to identify each information field individually. An additional byte indicates (tallies) the level of success, i.e. whether the commanded process is still in progress, has been completed, and whether successfully or not.

2.4. TMS I/F tallies

These information fields indicate the current state of the transport. As these states are mutually-exclusive commanded by TMS commands, the code of the corresponding TMS keyword is used to identify each information field individually. An additional byte tallies the level of success, i.e. whether the commanded state function is still in progress or has been completed, and whether successfully or not.

3.   Audio Record Corn and (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   CHANNEL RECORD STATUS

RECORD EXIT   -

RECORD READY SELECT   RECORD READY TALLY

RECORD READY SELECT provides a means to designate the channels that will enter (or exit) a recording condition upon the receipt of a RECORD STROBE.

RECORD EXIT terminates the recording condition on any channels where this condition exists.

REHEARSE SELECT provides a means to designate the channels that will, when subsequently commanded to enter a recording condition, simulate a recording operation, in accordance with the corresponding pending Audio Monitor Commands (AMCs).

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 controls whether Playback, Synchronous Playback (sync), or input signals are fed to the respective line outputs. of all audio channels.

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

SYNC INPUT SELECT provides a means to choose the monitor switching configuration used during record-related functions. These monitor switching configurations apply only to those channels selected for Synchronous Playback.

5.   Velocity Arguments

Some commands include a speed specification which is carried in the form of an accompanying three-byte parameter block. This parameter defines the direction and absolute value of the desired speed that should be achieved as closely as possible by the real machine. This speed is expressed in terms of the current nominal play speed as defined by the FIXED SPEED SELECT I/F.

Commands having a velocity parameter in the form of a three-byte 2's complement signed number have a scale-range defined such that:

000000 h represents a stationary condition*[*]
010000 h represents the speed currently defined in I/F FIXED SPEED, forward direction
7F0000 h represents approximately 127 times FIXED SPEED, forward direction
FF0000 h represents FIXED SPEED, reverse direction
800000 h represents 128 times FIXED SPEED, reverse direction.

This format thus has, theoretically, a resolution of 1/65,536th of nominal speed, i.e. an effective speed range of - 128.0000 to + 127.99998 times FIXED SPEED (rounded to five decimal places).

6.   Track Selection Arguments

Some commands and information fields refer to one or more channels (or tracks) of the tape machine. The format used is the same in all cases and it consists of an eight-byte bit map. This allows for up to 64 channels to be controlled. The command keywords and I/Fs that utilize this channel-specific mapping are:

REHEARSE SELECT	REHEARSE TALLY
RECORD READY SELECT	RECORD READY TALLY
EXCLUSIVE SYNC SELECT	EXCLUSIVE SYNC TALLY
	CHANNEL RECORD STATUS

---

[*] The letter h appended to a number indicates that it is expressed in hexadecimal notation.

7.   Tape Code Identity

At present, points on the tape can be identified by two means:

These are :

- INTERNAL LTC (longitudinal timecode from tape)

- TAPETIMER

The INTERNAL LTC and the TAPETIMER each have a separate information field. The content of the SELECTED TAPE CODE I/F, which designates which of these means is selected, is determined 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.

8.   Achieving and Maintaining Synchronisation

8.1.   LOCK Operations

Synchronisation requires the controlled device to achieve and maintain a particular time relationship between its INTERNAL LTC and some external reference. The maintenance of this relationship is usually restricted to within some speed range around the nominal FIXED SPEED.

The external reference signal to which synchronisation is achieved and maintained may be selected from a number of alternative sources; the LOCK MODE SELECT command is used to select this signal.

The LOCK command establishes synchronisation. The following additional information is normally required:

- A specified EXTERNAL TIMECODE ("when")

- A specified point on the tape ("where")

- A selected external reference signal ("how").

"When":   This point in time is dermed by the contents of the LOCK TIME I/F. This specifies the time, expressed in term of the EXTERNAL TIMECODE, at which synchronism is assured between the EXTERNAL TIMECODE 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 expressed 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 TIMECODE, and the controlled device's INTERNAL LTC. This REQUESTED OFFSET is maintained during successful synchronous operation.

Note: A related information field, the ACTUAL OFFSET I1F, is provided such that tallies of INTERNAL LTC minus the EXTERNAL TIMECODE 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.

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

8.1.1. Absolute Modes of LOCK

-Absolute Standard Mode

Achievement and maintenance of the lock to EXTERNAL TIMECODE is data-dependent. External LTC is selected as the source of EXTERNAL TIMECODE.

Absolute Resolve Mode

Achievement of the lock to EXTERNAL TIMECODE is data-dependent; maintenance of lock is data-independent. External LTC is selected as the source of EXTERNAL TIMECODE.

- Absolute video Mode

Achievement of the lock to EXTERNAL TIMECODE is data-dependent; maintenance of the lock is by reference to external video. External LTC is selected as the source of EXTERNAL TIMECODE.

- *Absolute VITC Mode*

Achievement of the lock is by reference to external video with VITC, data-dependent; maintenance of the lock is by reference to external video. The external video VITC signal is selected as the source of EXTERNAL TIMECODE.

8.1.2.   Free Modes of LOCK

- Free Resolve Mode

Achievement and maintenance of the lock is by reference to EXTERNAL TIMECODE dataindependent. External LTC is selected as the source of EXTERNAL TIMECODE.

- Free Video Mode

Achievement and maintenance of the lock is by reference to external video signal. The source of EXTERNAL TIMECODE is undefined.

8.1.3.   LOCK Operation in Absolute Modes

Three important concepts must be established before any of the absolute modes of LOCK may be represented.

a) PREROLL DURATION

This specifies the time used or needed in advance of achieving synchronisation. 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 TIMECODE is presented to the device in a real-time manner during the preroll period. The PREROLL DURATION I/F may not be set to a value lower than the device-dependent lower limits.

b) LOCK PREROLL SEARCH

This TMP causes the tape on the controlled ATR to move until the position on it specified by the Local Lock Point minus the pre-defined PREROLL DURATION plus any device-specific "Acceleration Allowance" (see diagram) is correctly located. This position may be described as the PREROLL SEARCH Point.

c) "Lock Actuation "

In all absolute modes of the LOCK command, the condition which causes the start of tape movement intended to achieve and maintain synchronisation is always the coincidence of the EXTERNAL TIMECODE value with that of the pre-defined LOCK TIME I/F minus the pre-defined PREROLL DURATION I/F. The time (with reference to EXTERNAL TIMECODE) at which this occurs may be termed the Lock Actuation Time.

The source of the EXTERNAL TIMECODE that triggers the Lock Actuation may be either LTC or VITC. This choice is specified by the LOCK MODE SELECT.
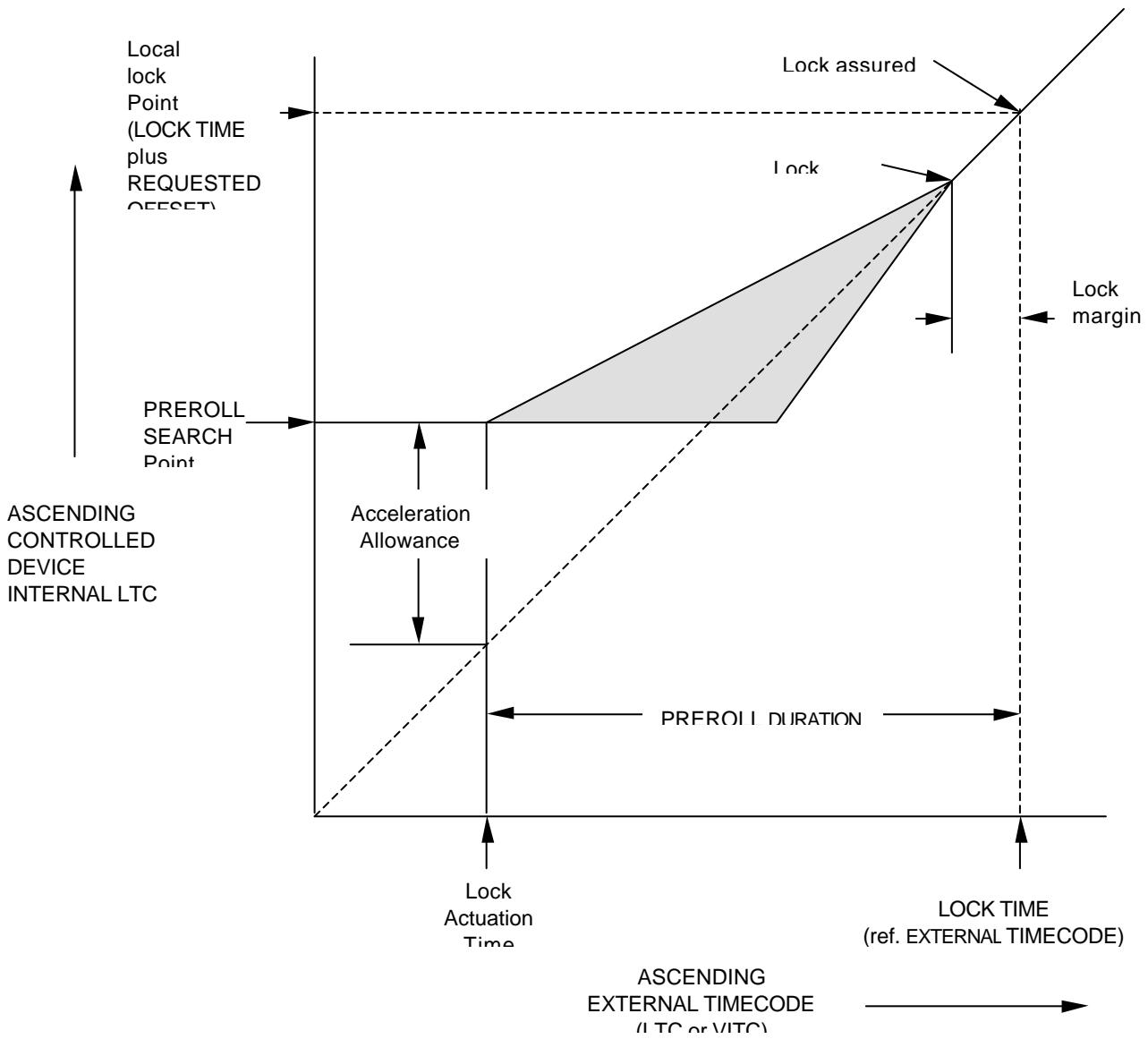
LOCK OPERATION (Absolute Modes)

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

After the PREROLL DURATION, REQUESTED OFFSET and LOCK PREROLL SEARCH have been specified, an absolute LOCK command may be issued. When the EXTERNAL TIMECODE coincides with the Lock Actuation Time, the controlled device will accelerate and adjust its speed until its INTERNAL LTC coincides with the EXTERNAL TIMECODE, thereafter maintaining synchronism. For a LOCK to be successful, synchronism must be achieved prior to the LOCK TIME. Synchronous operation with the external reference (as specified by LOCK MODE SELECT I/F) will be maintained from the LOCK TIME onwards.

8.1.4. 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 prededed with a PREROLL SEARCH command. These LOCK facilities provide the means for achieving synchronisation immediately, without reference to a particular EXTERNAL TIMECODE.

If a change in LOCK MODE from any m ode to the ABSOLUTE STANDARD during a successful LOCK TMC, then the ACTUAL OFFSET I/F data is automatically transferred to the REQUESTED OFFSET I/F. LOCK is thereby maintained.

8.2. SYNC Operations

The external reference to which SYNC synchronization is to be achieved and maintained is prescribed by the common message TIMELINE SELECT.

The SYNC command establishes synchronization. Synchronization means that the machine is programmed to pass:
- a specified point on the tape ("where")

- at a specified instant in time ("when"), and

-    at a specified velocity ("how").
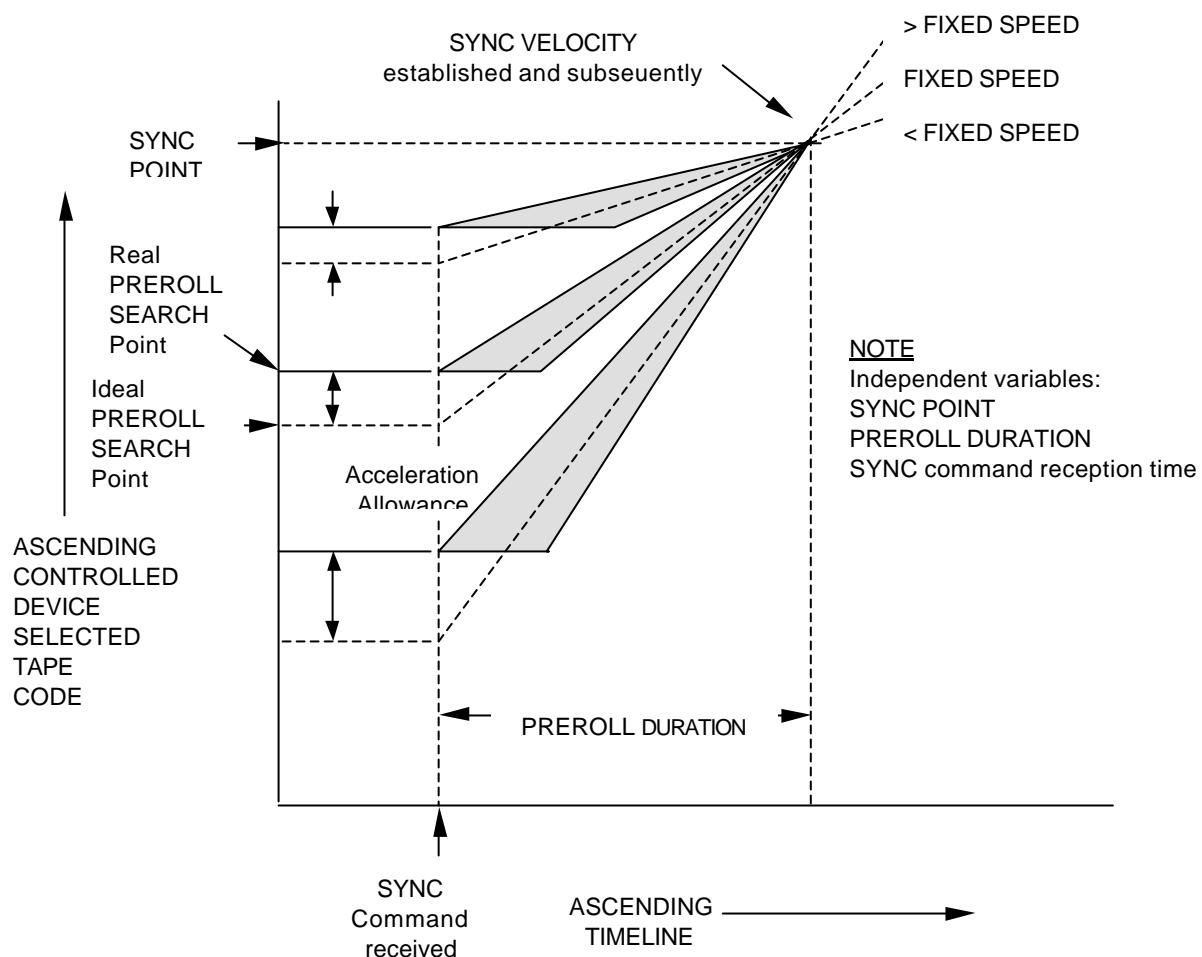
"Where": This is a point on the tape, defined by the SYNC POINT I/F, at which synchronization is assured between the selected TIMELINE and the controlled device's SELECTED TAPE CODE.

"When": This is defmed as the point in time at which the SYNC command is received plus the PREROLL DURATION time. (As the ESbus may not, by nature, be deterministic in the delivery timing of commands, it is advisable to use the common message " Event " construct to define the timing of this command.)

"How": The velocity at the SYNC POINT is defined by the SYNC VELOCITY I/F.

As a prerequisite for the use of the SYNC command, the tape must be placed at a park position which is calculated from the SYNC POINT and the SYNC VELOCITY as follows:

$$\text{PREROLL SEARCH POINT} = \text{SYNC POINT} - \frac{\text{PREROLL DURATION x SYNC VELOCITY}}{\text{FIXED SPEED}}$$

where FIXED SPEED is the speed defined in the FIXED SPEED I/F.

To achieve this park position the PREROLL SEARCH command is used and the ATR virtual machine must make the calculation automatically.

The SYNC Command in the Case of an "Ideal" Machine

A better understanding of the function of the SYNC command is possible if it is considered in the case of an "ideal" machine.

- On the arrival of a SYNC command an ideal ATR would start immediately with no delay, fully locked and at the specified speed. Under these ideal conditions the machine would, at the PREROLL DURATION time later, be precisely at the SYNC POINT.

- A real ATR cannot start and synchronize immediately; it is therefore the responsibility of the virtual machine, and hence of the virtual machine manufacturer, to control the real machine in such a manner that the result is the same.

Measures taken in order to correct synchronization following the PREROLL DURATION period may include:

- On the receipt of a PREROLL SEARCH command, parking at a PREROLL SEARCH point a few frames down the tape from the "ideal" PREROLL SEARCH point in order to match the average number of frames lost while coming up to play speed. This "Acceleration Allowance" is likely to be proportional to the SYNC VELOCITY.

- On the SYNC command, overriding the specified velocity using the tape speed override facility of the real machine to eliminate the remaining offset from the appropriate lock condition.

After establishing a PREROLL DURATION, and commanding a SYNC PREROLL SEARCH, a SYNC command may be issued. The controlled device will accelerate and synchronise to 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, at precisely the PREROLL DURATION after the receipt of the SYNC command.

8.3.   The CHASE Command

The CHASE command is an alternative means of maintaining synchronism.

While the PREROLL SEARCH and LOCK commands may be used to achieve and maintain synchronism among several machines continuously (without changing their states and/or speeds), the CHASE command is used to maintain synchronism in a dynamic manner as closely as possible, even during changes of the machine's state and/or velocity.

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

For this purpose the slaves must have information about the movement of the master; this information is distributed in the form of the master device's timecode. This timecode stream must be distributed continuously to all slaves over a separate line (the bus cannot be used for this purpose because of its indeterminate delay characteristics).

The CHASE command utilises 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, independent of the current LOCK MODE TALLY I/F.

9.   The TIMELINE and other Event Triggers

All ATR commands can be used in an " immediate " manner in which they are executed as soon as they are received. In the case of some of the more time-critical applications, unacceptable delays may occur because the time between initiating a command and its reception via the bus is indeterminate. In these cases an alternative command method is recommended.

Wherever possible, time-critical commands should be prepared using the " Event " command facilities provided by the common message set. The common message DEFINE EVENT allows any type-specific message or the common message READ to be executed by the virtual machine at a specified Trigger Time. This trigger time may be specified by the common TIMELINE I/F, or by some type-specific Time I/Fs.

The ATR type-specific Time I/Fs that may be used as Event triggers are:

INTERNAL LTC   TAPETIMER
SELECTED TAPE CODE   EXTERNAL TIMECODE

ATR type-specific Time I/Fs that are not permitted for use as Event triggers are:

TAPELENGTH   REQUESTED OFFSET
LOCK DEVIATION   ACTUAL OFFSET

This common message TIMELINE SOURCE may be selected to be an internal dock, 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 configure a controlled device locally to use an external LTC signal or an external video with 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 derived locally from the sync-word of an external LTC signal, or an external video signal. These are only examples of what might be selected as external references or ticks; there are no restrictions on external reference signals (see diagram below).

TIMELINE SOURCE Selection
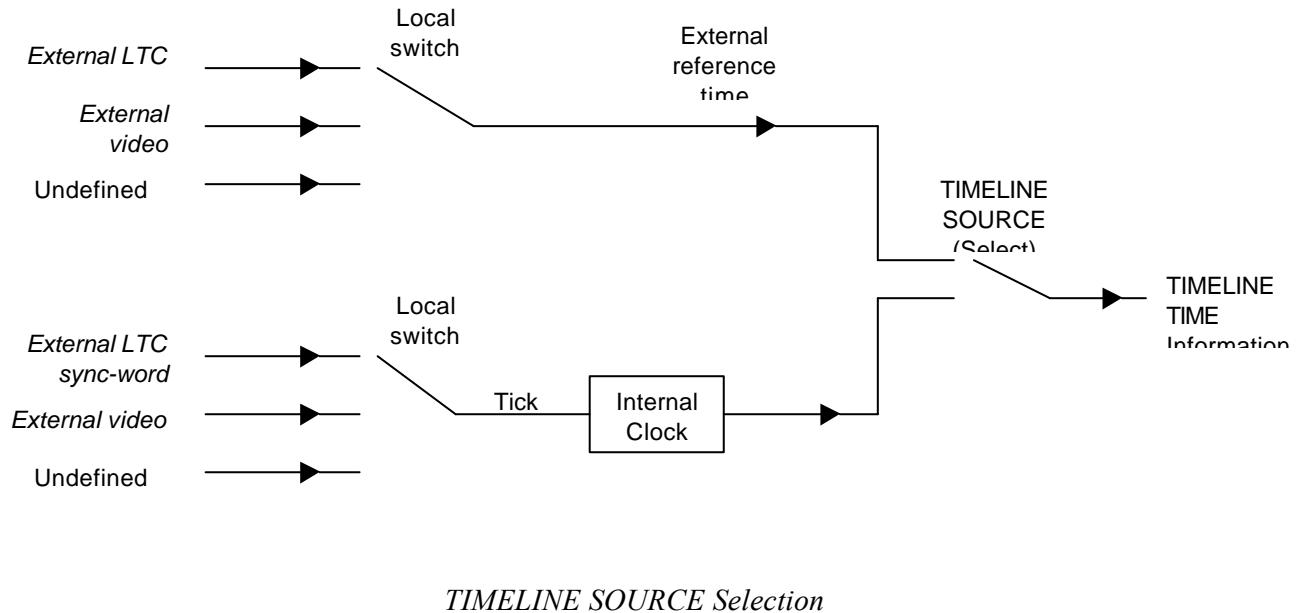
For activities requiring simultaneous operations by several controlled devices, the Event mode of command delivery, which allows sequences of time-critical functions (e.g. RECORD STROBE) to be pre-programmed, may be the most suitable.

Events may be referred to the TIMELINE of the individual virtual machines. These individual TIMELINE TIMEs are synchronised by a system the transmission from the bus controller in response to the system service REQUEST TIME TRANSMISSION command.

10.   Sample Command Sequences

The following sections shows examples 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 the system designer to use precisely these sequences. READ commands of the related I/Fs for system confidence are not shown; they should be an integral part of any reasonable controlling tributary's typical sequence.

10.1.   Selective Record Entries and Exits

Some time before initial record action...

< RECORD READY SELECT>   < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 00000000 >
                                < 01010101 >

         (channels 1, 3, 5, 7 are record-enabled)

<PLAY>

some time later...
    <RECORD STROBE >

       (the already-selected channels enter the recording condition)

some time later...
<RECORD READY SELECT>   < 00000000 >   (64-bit map)
                                 ,
                                 ,
                                 ,
                                 ,
                               < 10101010>

       (channels 1, 3, 5, 7 are record-disabled. Channels 2, 4, 6, 8 are record-enabled. No change is made to the recording status of these tracks)

some time later...
    <RECORD STROBE>

       (channels 1, 3, 5, 7 stop recording. Channels 2, 4, 6, 8 start recording)

some time later...
    <RECORD EXIT

       (the channels still recording, 2, 4, 6, 8 cease recording)

10.2.   Event-Triggered Record Entries and Exits

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

```
<RECORD READY SELECT>    <00000000>    (64-bit map)
                                  ,
                                  ,
                                  ,
                         <01010101>
             (channels; 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 l>        (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>
                                                         ,
                                                         ,
                                                         ,
                                                <10101010>
       (channels 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: 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

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 centre-track format ATR is required simultaneously to enter record on track (channel) 1, and exit record on track 2 at an INTERNAL LTC of 12:26:00:02. The TIMECODE ATTRIBUTE I/F of the INTERNAL LTC indicates " 25 frame count code ".

Given an INTERNAL LTC I/F triggered ' RECORD STROBE Event, and working with an EBU/SMPTE timecode, the machine must:

- compensate for any longitudinal offsets of the controlled device's timecode playback head;

- control the transitions of the erase signal in advance of the virtual machine's INTERNAL LTC trigger point, to ensure that the erase signal starts and stops at the correct points on the tape.

Graphically represented:

Event time minus one frame   <VIRTUAL MACHINE INTERNATAL LTC >
   <   12:26:00:01   >
                                              <RECORD sequence begins   >
                                              < track 1 erase begins ramp up   >
                                              < track 2 erase begins ramp down   >
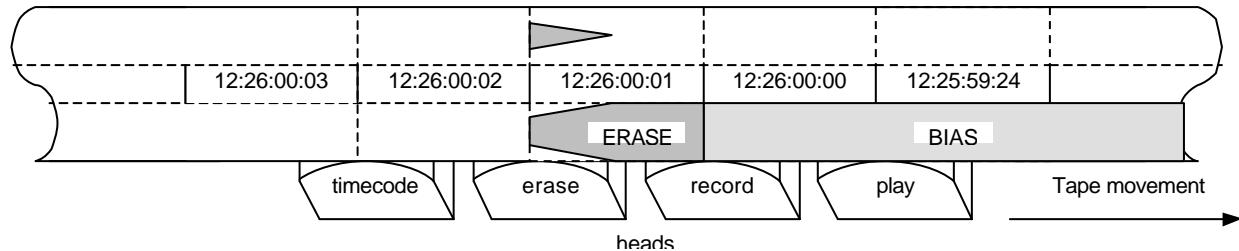
Event time   <VIRTUAL MACHINE INTERNAL LTC >
                                              <   12:26:00:02   >
                                              <RECORD sequence in progress   >
                                              <track 1 record begins ramp up   >
                                              <track 2 erase exit completed   >
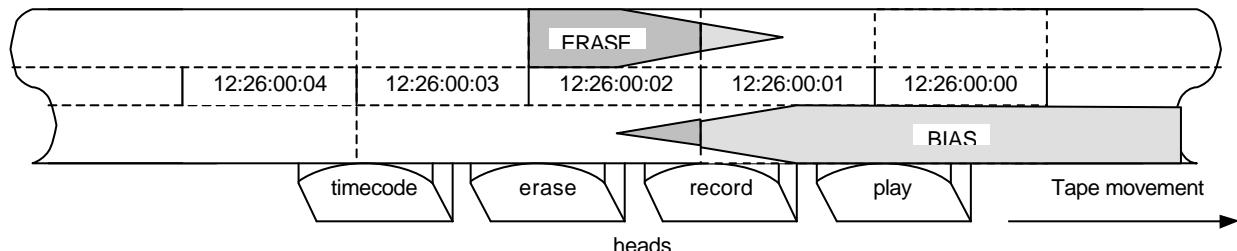
Event time   <VIRTUAL MACHINE INTERNAL LTC >
                                              <   12:26:00:03   >
                                              <RECORD sequence completed   >
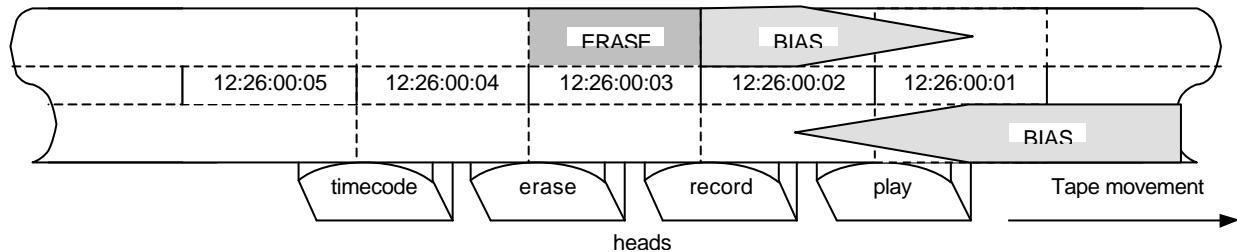
   If the above example were to include a RECORD STROBE Event triggered by the TIMELINE TIME I/F or EXTERNAL TIMECODE I/F, the requirements of the virtual machine would be basically unchanged. The record Event must occur at the Event time, regardless of any device-dependent preliminary process.

10.3.   Search and Synchronise

Some time before the required synchronisation action:

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

Note: After the PREROLL DURATION, LOCK POINT, REQUESTED OFFSET and LOCK MODE SELECT have been specified, they need not be retransmitted until a change is required.

<LOCK PREROLL SEARCH>

(not before a TMP TALLY has indicated that the LOCK PREROLL SEARCH has been successfully accomplished):

<LOCK>

On the receipt of the LOCK command, the ATR will monitor the longitudinal EXTERNAL TIMECODE. When the EXTERNAL TIMECODE coincides with "lock actuation time" calculated by the controlled device, the controlled device will accelerate and synchronise its INTERNAL LTC with the EXTERNAL TIMECODE. For a LOCK to be successful, synchronism must be achieved prior to the LOCK TIME.

Chapter 2

ATR type-specific messages
(Virtual Machine type is 03h)

General notes

1. Commands which have a related information field for tally purposes ("... SELECT" -"...　　TALLY" pairs) are identified by a " >> " sign in the list below.

2. All Tape Motion State commands (indicated below as " TMS ") are mutually exclusive.

3. Tape Motion Process commands (indicated below as " TMP are overriding control commands that cause the controlled device to enter automatically the appropriate Tape Motion States to achieve the desired result. The Tape Motion State will be reported in the TMS tally, as though that TMS command had been issued. TMPs are also mutually exclusive.

4. All Audio Record Commands (indicated below as " ARC ") affect the manner in which tracks are selected and subsequently sequenced through record Entries and Exits.

5. All Audio Monitor Commands (indicated below as " AMC ") affect the manner in which audio line output source selections are made.

6. In all cases, the temporal order of Events must be preserved. Commands actuated by the Event construct, if placed on the Event cue at the same trigger point, will execute preserving the temporal order of the delivery of the commands.

7. All hex codes listed as " reserved " are specifically retained for possible future expansion of the range of common use between YTR and ATR dialects. In particular, it should be noted that this includes a number of commands concerned with presetting and operating a timecode generator which are already defined in the VTR dialect.

1.   Index of keywords, mnemonics and information field names

1.1.   Numerical index

Function	hex	/Message Keyword	(mnemonic)	hex	Information field name	(mnemonic)
	40h	not used		40h	not used	
TMS	41h	STOP	STOP	41h	INTERNAL LTC	INTC
TMS	42h	VARIABLE PLAY	VAPI,	42h	not used	
TMS	43h	PLAY	STPL	43h	SELECTED TAPE CODE	SETC
TMS	44h	STEP	STEP	44h	INTERNAL LTC USERBITS	INUB
TMS	45h	AUDIBLE FAST	AFST	45h	not used	
TMS	46h	SHUTTLE	SHUT	46h	TAPETIMER	TATI
	47h	not used		47h	not used	
	48h	reserved		48h	reserved	
	49h	CAPSTAN REF SELECT	CAPS	49h	CAPSTAN REF TALLY	CRET
ARC	4Ah	REHEARSE SELECT	REHS >>	4Ah	REHEARSE TALLY	REHT
ARC	4Bh	RECORD STROBE	RSTB	4Bh	CHANNEL RECORD STATUS	CRES
ARC	4Ch	RECORD EXIT	REEX	4Ch	not used	
	4Dh	TAPE CODE SELECT	TACS >>	4Dh	TAPE CODE SEL TALLY	TACT
TMP	4Eh	TARGET SEARCH	TASE	413h	SYNC VELOCITY	SYTY
TMP	4FH	SYNC PREROLL SEARCH	SPRS	417h	PREROLL DURATION	PRDU
TMS	50h	SYNC	SYNC	50h	SYNC POINT	SPNT
TMS	51h	LOCK	LOCK	51h	LOCK TIME	LKIT
TMP	52h	LOCK PREROLL SEARCH	LPRS	52h	not used	
TMP	53h	CHASE	CHAS	53h	not used	
	54h	reserved		54h	reserved	
	55h	reserved		55h	reserved	
	56h	reserved		56h	reserved	
	57h	reserved		57h	reserved	
TMS	58h	TAPE RELEASE	TARL	58h	not used	
	59h	FIXED SPEET SELECT	FISS >>	59h	FIXED SPEED TALLY	FIST

	5Ah	not used		5Ah	TAPELENGTH		TLTH
	5Bh	not used		5Bh	not used		
	5Ch	not used		5Ch	SYNC/LOCK ACCURACY		SLAC
	5Dh	not used		5Dh	LOCK DEVIATION		UDE
	5Eh	not used		5Eh	not used		
	5Fh	not used		5Fh	not used		
	60h	PRESET	PRST	60h	TMP TALLY		TMPT
TMS	61h	FAST FORWARD	FFOR	61h	TMS TALLY		TMST
TMS	62h	FAST REVERSE	FREV	62h	VELOCITY TALLY		VELT
	63h	not used		63h	not used		
ARC	64h	RECORD READY SELECT	RECS >>	64h	RECORD READY TALLY		RECT
	65h	not used		65h	not used		
	66h	AUTO ATTENUATE SEL	AUAS >>	66h	AUTO ATTENUATE TALLY		AUAT
	67h	LIFTER DEFEAT SELECT	TLDS >>	67h	LIFTER DEFEAT TALLY		TLDT
	68h	not used		68h	reserved		
	69h	not used		69h	reserved		
	6Ah	not used		6Ah	reserved		
	6Bh	not used		6Bh	reserved		
	6Ch	not used		6Ch	reserved		
	6Dh	not used		6Dh	reserved		
	6Eh	not used		6Eh	reserved		
	6Fh	not used		6Fh	reserved		
	70h	LOCK MODE SELECT	LKMS >>	70h	LOCK MODE TALLY		LKMT
AMC	71h	GLOBAL MONITOR SEL	MONS >>	71h	GLOBAL MONITOR TALLY		MONT
AMC	72h	EXCLUSIVE SYNC SEL	ESYS >>	72h	EXCLUSIVE SYNC TALLY		ESYT
AMC	73h	SYNC INPUT SELECT	SYIS >>	73h	SYNC INPUT TALLY		SYIT
	74h	not used		74h	EXTERNAL TIMECODE		EXTC
	75h	not used		75h	EXTERNAL USERBITS		EXUB
	76h	not used		76h	SLEW RATE		SLRT
	77h	not used		77h	REQUESTED OFFSET		ROFT
	78h	not used		78h	ACTUAL OFFSET		AOFT
	79h	not used		79h	STRIDE LENGTH		STLT
	7Ah	LOCAL LOCKOUT SEL	LLOS	7Ah	LOCAL LOCKOUT TALLY		LLOT
	7Bh	not used		7Bh	TIMECODE ATTRIBUTE		TCAT
	7Ch	PLAY MODE SELECT	PLMS >>	7Ch	PLAY MODE TALLY		PLMT

1.2.   Functional Index

Hex	Message Keyword	(mnemonic)	**information field name**	(mnemonic)

System Utility

7Ah	LOCAL LOCKOUT SEL	LLOS	7Ah LOCAL LOCKOUT TALLY	LLOT

Tape Motion Processes (TMP)

413h	TARGET SEARCH	TASE ~		
4Fh	SYNC PREROLL SEARCH	SPRS	60h TMP TALLY	TMPT
52h	LOCK PREROLL SEARCH	LPRS		
53h	CHASE	CHAS		

Tape Motion States (TMS)

41h	STOP	STOP	61h TMS TALLY	TMST
58h	TAPE RELEASE	TARL		
43h	PLAY	STPL		
61h	FAST FORWARD	FFOR		
62h	FAST REVERSE	FREV		
44h	STEP	STEP		
62h	VELOCITY TALLY	VELT		
42h	VARIABLE PLAY	VAPI		
45h	AUDIBLE FAST	AFST		
46h	SHUTTLE	SHUT		
50h	SYNC	SYNC		
51h	LOCK	LOCK		

Tape Motion References

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

Synchronization Parameters

70h	LOCK MODE SELECT	LKMS >>	70h LOCK MODE TALLY	LKMT
7Ch	PLAY MODE SELECT	PLMS >>	7Ch PLAY MODE TALLY	PLMT

				50h	SYNC POINT	SPNT
				51h	LOCK TIME	LKTT
				4Eh	SYNC VELOCITY	SVTY
				4Fh	PREROLL DURATION	PRDU
60h	PRESET	PRST		77h	REQUESTED OFFSET	ROFT
				5Ch	SYNC/LOCK ACCURACY	SLAC
				76h	SLEW RATE	SLRT
				78h	ACTUAL OFFSET	AOFT
				5Dh	LOCK DEVIATION	LKDE

Position and Synchronization References

4Dh	TAPE CODE SELECT	TACS >>	4Dh	TAPE CODE SELECT TALLY	TACT
60h	PRESET	PRST	46h*	TAPETIMER	TATI
			41h*	INTERNAL LTC	INTC
			43h*	SELECTED TAPE CODE	SETC
			74h*	EXTERNAL TIMECODE	EXTC

Position and Timecode Utilities

60h	PRESET	PRST	5Ah	TAPELENOTH	TLTH
			7Bh	TIMECODE ATTRIBUTES	TCAT
			44h	INTERNAL LTC USERBITS	INUB
			75h	EXTERNAL USERBITS	EXUB

Audio Record Control (ARC)

64h	RECORD READY SELECT	RECS >>	64h	RECORD READY TALLY	RECT
4Ah	REHEARSE SELECT	REHS >>	4Ah	REHEARSE TALLY	REHT
4Bh	RECORD STROBE	RSTB	4Bh	CHANNEL REC STATUS	CRES
4Ch	RECORD EXIT	REEX			

Audio Monitor Control (AMC)

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

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* - Time I/Fs which may be used as Event triggers.

2.   Keywords

40h   not used

41h   STOP (TMS command)
Causes the controlled ATR to stop as soon as possible; all recording channels automatically exit from
record operation prior to execution.
Format: <STOP>

42h   VARIABLE PLAY (TMS command)
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 channels will
exit record mode.
Format: <VARIABLE PLAY>
                 <SPEED>   3-byte signed binary number; 2's complement
                 scale: 000000h stationary
                           010000h   FIXED SPEED, forward direction
                           7F0000h   approximately 127 times FIXED SPEED, forward direction
                           FF0000h   FIXED SPEED, reverse direction
                           800000h   128 times FIXED SPEED, reverse direction

Note: The argument does not imply that the controlled device has equivalent resolution.

43h   PLAY (TMS command)
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 channels will exit record mode.
Format: <PLAY>

44h   STEP (TMS command)
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 LENGTHs of tape movement requested. The longitudinal STRIDE
LENGTH is defined in the STRIDE LENGTH I/F
Format: <STEP>
                 <NUMBER>   3-byte signed binary number;
                              range: 127 to + 127

45h   AUDIBLE FAST (TMS command)
Causes the controlled ATR to enter fast tape motion giving an output of audible but not necessarily
broadcastable audio, at specified direction and velocity relative to the FIXED SPEED. All recording
channels automatically exit from record operation prior to execution.
Format: <AUDIBLE FAST>
                 <SPEED>   3-byte signed binary number;
                                 same format as in VARIABLE PLAY command

46h   SHUTTLE (TMS command)
Causes the controlled ATR to move the tape at the specified direction and velocity relative to FIXED
SPEED, without necessarily giving audio playback. All recording channels automatically exit from
record operation prior to execution.
Format: <SHUTTLE>
                 <SPEED>   3-byte signed binary number;
                                 same format as in VARIABLE PLAY command.

47h   not used

48h   reserved

49h   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 condition.
      Format: <CAPSTAN REFERENCE SELECT>
                         <MODE>   1-byte special binary code:
                                         00h = internal crystal
                                         01h = external capstan reference
                                         FFh = as selected locdk

4Ah   REHEARSE SELECT (ARC COMMAND)
      During all subsequent record Entries and Exits, related output 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
                                         00h = rehearse true
                                         04h = rehearse true
                                         FFh = as selected locally
                         all other codes   record enabled

      Note: Two hex codes are designated corresponding to Rehearse True in order to achieve
            conformity with the VTR type specific message RECORD MODE SELECT

4Bh   RECORD STROBE
       Causes record entry on the currently RECORD READY-enabled channel(s), causes record exit on
       any currently recording channels that have had RECORD READY enablement withdrawn.
      Format: <RECORD STROBE>

4Ch   RECORD EXIT
      Causes a record exit on all currently recording channels.
      Format: <RECORD EXIT>

4Dh   TAPE CODE SELECT
      Selects the source of timecode for all succeeding messages that refer to the selected tape code.
      Format: <TAPE CODE SELECT>
                         <CODE TYPE> 1-byte special binary code:
                                         00h = INTERNAL LTC (longitudinal timecode)
                                         01h = reserved
                                         02h = TAPETIMER
                                         03h = reserved
                                         04h = reserved
                                         FFh = as selected locally

4Eh   TARGET SEARCH (TMP command)
      Causes the controlled ATR to move the tape to a defined position in accordance with the selected tape
      code (selected by the command TAPE CODE SELECT).
      Format: <TARGET SEARCH>
                         <TAPE CODE> (type TIME)

4Fh   SYNC PREROLL SEARCH   command)
      Cause the controlled ATR to move the tape to a position (reference the selected tapecode) determined
      by the PREROLL DURATION I/F minus any device-specific acceleration allowance in advance of
      the LOCK POINT I/F. All recording channels automatically exit from record operation prior to
      execution.
      Format: <SYNC PREROLL SEARCH>

50h   SYNC (TMS command)
      Causes the controlled device immediately to establish synchronism with the selected timeline source at
      the prescribed SYNC POINT with the prescribed SYNC VELOCITY, and after the prescribed
      PREROLL DURATION period.

      Notes: 1. This command is styled to conform functionally to the VTR dialect SYNC command.
      *   2. PREROLL DURATION I/F and SYNC POINT I/F 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 of the SYNC command.*
      *   3. This command establishes synchronism independently of any previously preset*
      *   REQUESTED OFFSET, because 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 be changed in order to*
      *   maintain SYNC VELOCITY relative to the selected timeline source.*
      Format: < SYNC >

51h   LOCK (TMS command)
      Causes the controlled ATR to establish synchronism in the manner defined by the LOCK MODE I/F
      and causes a LOCK PREROLL SEARCH operation should the controlled device not be cued to the
      correct preroll position.
      Format: <LOCK>

      Note: PREROLL, DURATION, REQUESTED OFFSET and LOCK TIME IIF must be predefined be_fore LOCK tion.

52h   LOCK PREROLL SEARCH (TMP command)
      Causes the controlled ATR to move the tape to a position (reference the selected tapecode)
      determined by the PREROLL DURATION I/F minus any device-specific acceleration allowance in
      advance of the LOCK TIME I/F as adjusted by the REQUESTED OFFSET. All recording channels
      automatically exit from record operation prior to execution.
      Format: <LOCK PREROLL SEARCH>

53h   CHASE (TMP command)
      Causes the controlled device to attempt to follow, establish and maintain synchronism with the external
      timecode in a data-dependent manner. All recording channels automatically exit from record operation
      prior to any " follow " action which is independent of the capstan servo.
      Format: <CHASE>

54h   reserved

55h   reserved

56h   reserved

57h   reserved

58h   TAPE RELEASE (TMS command)
       Releases the tape tension mechanism of the controlled ATR. All recording Channels exit from record
       operation prior to exectition. 71m TMS is reset by STOP.

       Format: <TAPE RELEASE>

59h   FIXED SPEED SELECT
        Causes the controlled device to select the nominal tape speed.

       Format: <FIXED SPEED SELECT>
                        <SPEED>   1-byte special binary code:

                                             10h = 1.875 inch/s =   4.7625 cm/s
                                             20h = 3.750 inch/s =   9.525 cm/s
                                             30h = 7.500 inch/s =   19.05 cm/5
                                             37h = 9.606 inch/s =   24.40 cm/s
                                             40h = 15.00 inch/s =   38.10 *CM/8*
                                             50h = 30.00 inch/s =   76.20 cm/s
                                             FFh = as selected locally

5Bh   not used

5Ch   not used

5Dh   not used

5Eh   not used

5Fli   not used

        The following command is used to preset items whose contents are represented in an information
field:

60h   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
                                          (see section 3: Information Fields)

       Permitted information field names for ATRs are:

            TAPETIMER
            SYNC VELOCITY
            PREROLL DURATION
            SYNC POINT
            LOCK TD4E
            TAPELENGTH
            SYNC/LOCK ACCURACY
            STRIDE LENGTH
            SLEW RATE
            REQUESTED OFFSET

61h   FAST FORWARD (TMS command)
     Causes the controlled ATR to run forward at its maximum speed without necessarily giving audio playback . All recording channels automatically exit from record operation prior to execution.
     Format: <FAST FORWARD>

62h   FAST REVERSE (TMS command)
     Causes the controlled ATR to rewind at its maximum speed without necessarily giving audio playback. All recording channels automatically exit from record operation prior to execution.
     Format: <FAST REVERSE>

63h   not used

64h   RECORD READY SELECT (ARC command)
     Controls which channels are to be record-enabled. These enabled channels enter record upon receipt of a RECORD STROBE command. A channel that has had its enablement withdrawn by RECORD READY will exit the recording condition upon 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

     Note: Bits 0-7 form the least significant byte; this byte is transmitted last.

65h   not used

66h   AUTO ATTENUATE SELECT (AMC command)
     Causes the audio outPuts of the controlled ATR to be attenuated.

     Note: Any channels locally-defined for carrying timecode may be excluded from. this function.

     Format: <AUTO ATTENUATE>
                      <MODE>   1-byte special binary code:
                                      00h =   OFF
                                      01h =   ON
                                      FFh =   as selected locally

67h   LIFTER DEFEAT SELECT (AMC command)
     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:
                                      00h =   OFF
                                      01h =   ON
                                      FFh =   as selected locally

68h   not used

69h   not used

6Ah   not used,

6Bh   not used

6Ch   not used

6Dh   not used

6Eh   not used

6Fb,   not used

70h   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 codi

00h Absolute Standard Mode:
Achievement of lock to EXTERNAL TIMECODE is data-dependent; maintenance of lock is data-dependent. External LTC is selected as the source of EXTERNAL TIMECODE.

0.1h Absolute Resolve Mode:
Achievement of lock to EXTERNAL TIMECODE is data-dependent; maintenance of lock is data-independent. External LTC is selected as the source of EXTERNAL TIMECODE.

02h Absolute Video Mode:
Achievement of lock to EXTERNAL TIMECODE is data-dependent; maintenance of lock is by reference to external video. External LTC is selected as the source of EXTERNAL TIMECODE.

03h Absolute VITC Mode:
Achievement of lock to external video with VITC is data-dependent; maintenance of lock is by reference to external video. The external video VITC signal is selected as the source of EXTERNAL TIMECODE.

11h Free Resolve Mode:
Achievement of lock to EXTERNAL TIMECODE is data-independent; maintenance of lock is data-independent. External LTC is selected as the source of EXTERNAL TIMECODE.

12h Free Video Mode:
Achievement of lock is by reference to external video signal; maintenance of lock is by reference to external video. The source of EXTERNAL TIMECODE is undefined.
FFh As selected locally

Notes: 1. All LOCK commands ~ in any Absolute Mode require predefined PREROLL DURATION, REQUESTED OFFSET, and LOCK TIME I/Fs, and must be preceded by a LOCK PREROLL SEARCH command.
        2. 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 by a LOCK PREROLL SEARCH command.
        3. If a change in lock mode from any Free Mode to the Absolute Mode is performed following a successful LOCK operation, then the ACTUAL OFFSET I/F data is automatically transferred to the REQUESTED OFFSET I/F. LOCK is maintained.
        4. Smooth operation in Absolute Video Mode is assured only if the EXTERNAL TIMECODE is framed correctly with respect to the video reference signal, i.e. the leading edge of bit zero must begin at the start of the appropriate line of the video.

71h   GLOBAL MONITOR SELECT (AMC command)
        Controls which of the listed signals is selected for the output of all audio channels.
        Format.   <GLOBAL MONITOR SELECT>
                                   <MODE>   1-byte special binary code:

                                              01h =   Playback
                                              02h =   Synchronous Playback
                                              03h =   Input
                                              FFh =   As selected locally

72h   EXCLUSIVE SYNC SELECT (AMC command)
        Controls which, if any, audio channels will, notwithstanding any GLOBAL MONITOR SELECTion,
        provide synchronous playback on Line Output, in accordance with the SYNC INPUT I/F.

         Format: <EXCLUSIVE SYNC SELECT>
                                   <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.

73h   SYNC INPUT SELibf~(iAMC- command)
         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, except for the designated
         timecode channel.

         Format: <SYNC INPUT SELECT>
                                   <MODE>   1-byte special binary code:
                                              00h = Record Only
                                              01h = Record or Non-Play
                                              02h = Record or Record-Ready
                                              FFh = As selected locally
     Notes: 1. "Record Only
             All channels that are set to monitor Synchronous Playback will monitor input only when
             recording. Upon the conclusion of a record operation, those channels will revert back of
             Synchronous Play.
          2. "Record or Non-play l.:
             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 back to Synchronous
             Playback. In addition, all Record Ready channels will monitor Input when not in PLAY mode.
          3. -Record or Record-Ready ":
             All channels that are set to monitor Synchronous Playback, and are set to Record Ready (or are
             still recording), will monitor Input.

74h   not used

75h   not used

76h   not used

77h   not used

78h   not used

79h   not used

7Ah   LOCAL LOCKOUT SELECT
       Causes the controlled device to disable all local controls.

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

                    logic: 00h = local control not disabled
                                              01h = local control disabled

7Bh   not used

7Ch   PLAY MODE SELECT'
       Selects the manner in which the controlled device establishes its nominal, FIXED SPEED forward
       operation, as directed by the PLAY command.
        Format: <PLAY MODE SELECT>
                             <MODE>   1-byte special binary code:
                    00h Normal:
                    Achieve PLAY as defined by the CAPSTAN REFERENCE SELECT. No relationship is
                    implied to any timecode or video reference.

                    11h Free Resolve Mode:
                    Achieve PLAY in a manner that resolves to EXTERNAL TIMIECODE data-independent;
                    maintain resolve data-independent. External LTC is selected as the source of
                    EXTERNAL TIMECODE.

                    12h Free Video Mode:

                    Achieve PLAY in a manner that resolves to external video signal; maintain resolve to
                    external video reference. The source of EXTERNAL TIMECODE is undefined.

                    FFh As selected locally

3.   Information Fields

Note: The items of the INFORMATION FIELD are accessed by the common messages:
       READ, UPDATE, CYCLE or SIMULTANEOUS READ,
       which are tallied by the common messages:

       I/F ITEM RESPONSE or SIMULTANEOUS READ RESPONSE
       These commands use the format
            <KEYWORD> <PARAMETER NAME>
       and
            <KEYWORD> <PARAMETER NAME> <PARAMETER VALVE>
       where
       PARAMETER NAME uses the information field name specified below,
       and
       PARAMETER VALUE carries the information contents specified below.

40h   not used

41h   INTERNAL LTC
This contains the longitudinal timecode value most recently read from tape.
Format: <INTERNAL LTC >
                <CODE VALIDITY>   1-byte special binary code:

                        00h = valid LTC
                        01h = derived LTC
                        02h = non valid LTC

        <TIME VALUE> standard "time" format

43h   SELECTED TAPE CODE
Contains the time value of the timecode (INTERNAL LTC, TAPETIMER, etc.) that has been
selected most recently by the TAPE CODE SELECT command.
Format: <SELECTED TAPE CODE>
                <IDENTIFIER>   1-byte special binary code:

                        00h = INTERNAL LTC
                        01h = reserved
                        02h = TAPETIMER
                        03h = reserved
                        FFh = invalid
        <TIME VALUE>   standard " time " format

44h   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 eight-bit character set
                                        conforming to ISO 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
                        bit   3-7:
                                0   Set to 0 until assigned

        <UB GROUP 8/IUB GROUP 7>
        <UB GROUP 6/UB GROUP 5>   4 bytes, each consisting of two 4-bit
        <UB GROUP 4/UB GROUP 3>   nibbles, each containing one UB group
        <UB GROUP 2/UB GROUP 1 >
        (MSnibble)

   Note: UB 1 is the UB group which occurs first on tape (transmitted last in this format).

45h   not used

46h   TAPETIMER
       Contains the instantaneous counting status of tapetimer.
       Format: <TAPETIMER>

                                  modified standard "time" format:
                                  MSB (i.e. 80h position of "hours" byte) = sign

       Note: tapetimer count through zero technique must be as follows: -4 -3- 2 -1 -0 + 0 + 1 + 2 + 3 + 4 ....

47h   not used

48h   reserved

49h   CAPSTAN REFERENCE TALLY
       Tallies the status set by the CAPSTAN REFERENCE SELECT command.
       Format: <CAPSTAN REFERENCE TALLY>
                                  <MODE>   1-byte special binary code

                                              00h = internal crystal (= default)
                                              01h = external ref input

4Ah   REHEARSE TALLY
       Tallies the status set by the REHEARSE SELECT command.
       Format: <REHEARSE TALLY>
                                  <MODE>   1-byte special binary code:
                                              01h = rehearse true (= default)
                                              04h = rehearse true
                                              05h = record enabled

4Bh   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.

4Ch   not used

4Dh   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:

                                              00h = INTERNAL LTC (= default)
                                              01h = reserved
                                              02h = TAPETIMER
                                              03h = reserved
                                              04h = reserved

4Eh   SYNC VELOCITY
       Contains a velocity used as the synchronization velocity for the SYNC command.
       Format: <SYNC VELOCITY>

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           < SPEED >   3-byte signed binary number; same format as in
VARIABLE PLAY command.
Default is FIXED SPEED forward.

4Fh   PREROLL DURATION
Contains the desired real-time preroll duration used in advance of the synchronising process.

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 (see Chapter 1 for concept). It is assumed that EXTERNAL TIMECODE 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 limit.

For use with the SYNC command, the PREROLL DURATION specifies the exact real-time period between the receipt of the SYNC <u>command,</u> and the moment of synchronizing 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 limit, which may change dependent upon prescribed SYNC VELOCITY and other factors.

    Format: <PREROLL DURATION>
                                  <TIME VALUE>   standard "time" format

50h   SYNC POINT
Contains the specified point on tape, by reference to SELECTED TAPECODE, at which synchronism to the selected TIMELINE SOURCE is assured.
    Format: <SYNC POINT>
                                  <TIME VALUE> standard " time " format.

51h   LOCK TIME
Contains the last specified point in time, by reference to EXTERNAL TIMECODE, at which synchronism to the INTERNAL LTC is assured. 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

52h   not used

53h   not used

54h   reserved

55h   reserved

56h   reserved

57h   reserved

58h   not used

59h   FIXED SPEED TALLY
        Tallies the current play speed.

        Format: <FIXED SPEED TALLY>
                                <SPEED>   1-byte special binary code:

                                        10h =   1.875 inch/s =   4.7625 cm/5
                                        20h =   3.750 inch/s =   9.525   cm/s
                                        30h =   7.500 inch/s =   19.05   cm/s
                                        37h =   9.606 inch/s =   24.40   cm/s
                                        40h =   15.00 inch/s =   38.10   cm/s
                                        50h =   30.00 inch/s =   76.20   cm/s

5Ah   TAPELENGTH
        Contains the length of the loaded tape.

        Format: <TAPELENGTH>
                                <TIME VALUE>   standard time format

5Bh   not used

5Ch   SYNC/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 or SYNC successful tallies (see TMS TALLY
        I/F).

        Format: <SYNC/LOCK ACCURACY>
                                <LTC BIT PERIODS>   1-byte unsigned number

        Argument range

                        0   less than 1/80 frame period
                      255   less than 255/80 frame periods

5Dh   LOCK DEVIATION
        Contains the time difference between the position of the tape on the controlled ATR and the external
        timecode adjusted by the REQUESTED OFFSET.

        This is computed as follows:

                        INTERNAL LTC
                  minus REQUESTED OFFSET
                  minus EXTERNAL TIMECODE

        Format: <LOCK DEVIATION>
                                <TIME VALUE> high resolution time format

5Eh   not used

5Fh,   not used

60h   TMP TALLY
        Tallies the current Transport Motion Process of the ATR, and reports how successfully that process
        has been accomplished.

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Format   \<TMP TALLY\>

                                     \<KEYWORD\>   1 value that contains the keyword of the last active TMP command.

                                     \<SUCCESS LEVEL\>   1-byte special binary code:

                     00h =   trying; transition in progress
                     01h =   successful
                     02h =   failure; this tally should be supplemented by an ERROR message as appropriate

61h   TMS TALLY

Tallies the current Transport Motion State of the ATR, and reports how successfully this state has been reached.

Format: \<TMS TALLY\>

                                     \<KEYWORD\>   1 -byte value that contains the keyword of the last active TMS command.

                                     SUCCESS LEVEL\>   1-byte special binary code:

                     00h =   trying; transition in progress
                     01h =   successful
                     02h =   failure; this tally should be supplemented by an ERROR message as appropriate

62h   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; same format as in VARIABLE PLAY command.

63h   not used

64h   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

Note: Bits 0-7 form the least significant byte; this byte is transmitted last.

65h   not used

66h   AUTO ATTENUATE TALLY (AMC 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:
                                         00h =   OFF (= default)
                                         01h =   ON

67h   LIFTER DEFEAT TALLY (AMC tally)

Tallies the status selected by the LIFTER DEFEAT SELECT command.

Format: \<LIFTER DEFEAT TALLY\>

                                     \<MODE\>   1-byte special binary code:
                                         00h =   OFF (= default)
                                         01h =   ON

68h   reserved

69h   reserved

6Ah   reserved

6Bh   reserved

6Ch   reserved

6Dh   res~

6Eh   reserved

6Flh   reserved

70h   LOCK MODE TALLY
        Tallies the mode in which synchronism is established and maintained.
        Format: <LOCK MODE TALLY>
                             <MODE>   1-byte special b~ code:

                                               00h   Absolute Standard Mode
                                               01h   Absolute Resolve Mode
                                               02h   Absolute Video Mode
                                               03h   Absolute VITC Mode
                                               11h   Free Resolve Mode
                                               12h   Free Video Mode

71h   GLOBAL MONITOR TALLY (AMC tally))
        Tallies the status of the monitor channels selected by the GLOBAL MONITOR SELECT
        command.
        Format: <GLOBAL MONITOR TALLY>
                             <MODE>   1-byte special binary code:
                                               01h = Playback (= default)
                                               02h = Synchronous Playback
                                               03h = Input.

72h   EXCLUSIVE SYNC TALLY (AMC 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.

73h   SYNC INPUT TALLY (AMC tally)
        Tallies the conditions selected by the SYNC INPUT SELECT command.
        Format: <SYNC INPUT TALLY>
                             <MODE>   1-byte special binary code:
                                               00h   Record (= default)
                                               01h   Record or Non-Play
                                               02h = Record or Rec-Ready

74h   EXTERNAL TIMECODE
       Contains the timecode value most recently received from an external timecode source.
       Format: <EXTERNAL TIMECODE>
                              <CODE VALIDITY>   1-byte special binary code:

                                                     00h - valid timecode
                                                     01h - not valid timecode

                              <TIME VALUE>   standard "time" format

75h   EXTERNAL USERBITS
       Contains the userbit contents most recently received from an external timecode source.
       Format: <USERBITS>
                              <UB SPECIFICATION>   (format as
                              <UB GROUP 8/UB GROUP 7>   INTERNAL LTC USERBITS)
                              <UB GROUP 6/UB GROUP 5>
                              <UB GROUP 4/UB GROUP 3>
                              <UB GROUP 2/UB GROUP 1>

76h   SLEW RATE
       Contains the maximum rate at which the position of the tape on the controlled machine may be
       changed during an attempt to re-establish synchronism following a loss of synchronism.
       Format: <SLEW RATE>
                              <RATE>   2-byte unsigned binary number
                                     scale: 0000h =   no slew
                                              0001h =   1/10 frame/sec
                                              FFFFh =   maximum machine-dependent slew rate

77h   REQUESTED OFFSET
       Contains the desired time offset between the external timecode and the internal tape timecode for use
       with LOCK and CHASE commands.
       Format: <REQUESTED OFFSET>
                              <OFFSET TIME>   high-resolution timecode

                              definition: offset = internal timecode minus external timecode

                              e.g.: If the controlled device is to lead the external reference by 1 minute, then
                              <OFFSET TIME> = <00 01 00 00.00 00>

78h   ACTUAL OFFSET
       Contains the actual time offset between the external timecode and the internal tape timecode.
       Format: <ACTUAL OFFSET>
                              <OFFSET TIME>   high-resolution timecode

                              definition: offset = internal timecode minus external tim~e
                              e.g.: If the controlled device leads the external reference by 1 minute, then
                              <OFFSET TIME> = <00 01 00 00.00 00>

79h   STRIDE LENGTH
       Contains the period of each unit, in terms of LTC bits, for the STEP TMS argument.

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

7Ah   LOCAL LOCKOUT TALLY
      Tallies the status of the local control capability of the controlled device.

     Format: <LOCAL LOCKOUT TALLY>
                       <MODE>   1-byte q~ binary code:
                       logic: 00h = local control not disabled
                                           01h = local control disabled

7Bh   TIMECODE ATTRIBUTE
       Contains the attributes of the timecodes presented to the controlled device.

     Format: <TIMECODE ATTRIBUTE>
                       <ATTRIBUTE OF TAPE TIMECODE>   1-byte special binary code
                       <ATTRIBUTE OF EXTERNAL TIMECODE> 1-byte special binary code
                       coding (both cases):   00h = 24-frame-count code
                                               01h = 25-frame-count code
                                               02h = 30-frame-count code
                                               12h = 30-frame-count code, compensated

7Ch   PLAY MODE TALLY
       Tallies the manner in which the controlled device is selected to establish its nominal, FIXED SPEED
       forward operation, as directed by the PLAY command.

     Format: <PLAY MODE TALLY>
                       <MODE>   1-byte special binary code:

                                           00h = normal (= default)
                                           11h = Free Resolve Mode
                                           12h = Free Video Mode