Video Disk Recorder

Command and Control Specification

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Revision History

Revision	Date	Versions	Notes
NC	01/14/94	All Products	First release for review and discussion.
A	4/29/94	All Products	Updated based on initial implementations.
B	8/23/94	All Products	Updated for initial product release.
C	1/9/96	All Products	Changed meaning of Storage Request command to Longest contiguous storage request. Updated Scenarios to reflect Odetics usage.
D	2/20/97	All Products	Added Tape Archive Commands CX.40 - CX.49
E	3/5/97	All Products	Added multi tape drive capability to Archive Commands CX40 - CX49
F	6/16/98	All Products	Added response 81.18 for A8.18 command.

Change Bars

All changes since the last revision are marked with a vertical change bar on the outside edge of the changed section. An example of a vertical change bar is shown next to this note.

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1. Introduction

1.1. Scope

This document presents the requirements for a command set and control method for video disk recorders. This document is intended to define a minimum level of command and control support for a video disk recorder that is intended to be interfaced to Odetics cart machines and control systems.

The command and control method presented is based on the requirements for program and commercial spot playback in a broadcast environment. Although the command and control methods presented should not preclude their use in a video editing environment, no special considerations were given for a video editing environment. It is expected that additional command and control methods will need to be specified and/or modified for a video editing environment, and those additional methods could be added to this specification in the future.

1.2. Background

The introduction of digital video disk recorders to the broadcast market has brought new possibilities for the storage and control of video information. Companies that manufacture video disk recorders are proficient in the technology of digital video, but are often not experienced in the control and automation of video systems. Companies, such as Odetics, that are experienced in the control and automation of video systems have requirements for video disk recorders that need to be communicated to the manufacturers. This document was created with the intent of assisting both types of companies by presenting control requirements for video disk recorders that can be used as a basis for product development until a command and control standard is developed.

1.3. References

The following documents contain information that applies to this specification:

+ **Sony Betacam/Betacam SP Protocol of Remote-1 (9 Pin) Connector** (Sony part number 9-967-137-02)

+ **Sony DVR-10/DVR-C10 Protocol** (Sony part number unknown)

2. Device Interface

This section describes methods for interfacing to a video disk recorder. The methods are based on those currently used to interface to video cassette recorders, and consequently the terminology used will generally parallel that for video cassette recorders.

2.1. Communication Model

The communications model presented to a controlling device by the video disk recorder is based on the communications model for video cassette recorders. A controlling device is any system or equipment that issues control commands to the video disk recorder.

A video cassette recorder can be configured as a playback only device or as a record and playback device. Typically, one video input and/or output channel is provided. Usually one control port is provided for the video cassette recorder, and the device will only be able to service one video function, such as record or playback, at a time.

The communications model for a video disk recorder parallels that of a video cassette recorder. One control port will be provided for each channel that can record or playback video material, so that each channel will appear as a distinct video disk recorder that shares the video storage with all other channels.

2.2. Communication Format

The communication format for a video disk recorder control port will correspond to the communication format for video cassette recorders specified in the Sony Betacam/Betacam SP Protocol. The communications signal will be asynchronous, bit serial, conforming to EIA RS-422A standards. The communications channel will be full duplex running at 38.4 kb/sec. The bit configuration will be 1 start bit, 8 data bits, 1 parity bit, and 1 stop bit, with the parity being odd. The control port connector should be a standard 9 pin D-subminiature connector using standard pin assignments.

2.3. Command Format

The command format for a video disk recorder control port will correspond to the command format for video cassette recorders specified in the Sony Betacam/Betacam SP Protocol. Each command will consist of a function category and data count byte (with the most significant nibble being the function category, and the least significant nibble being the data count), followed by a command byte, followed by 0 to 15 data bytes, and concluded with a checksum byte. The checksum is calculated as the least significant 8 bits of the sum of the values of the function category and data count byte through the last data byte.

Although the Sony Betacam/Betacam SP Protocol does not specify commands with data that varies in size and content, it also does not prohibit commands with varying data. This specification will specify commands whose data format will be determined by the contents of the data count nibble of the function category and data count byte. For example a command may specify a data count of 4 bytes corresponding to a time code, or a data count of 8 bytes corresponding to an ID. The data count will not, how-

ever, specify a change in the overall functionality of the command, just in the format of the data provided. This method is preferred over using a separate command code for each version of the command in order to avoid adding a large number of new commands to the existing protocol.

2.4. Communications Protocol

The communications protocol for a video disk recorder control port will correspond to the communications protocol for video cassette recorders specified in the Sony Betacam / Betacam SP Protocol. The controlling device will initiate and supervise all communications with the video disk recorder using a master / slave relationship.

The controlling device will not interrupt transmission of command bytes for more than 10 ms. The controlling device will not issue further commands before receiving a response from the video disk recorder. If the controlling device receives a “NAK” response from the video disk recorder during transmission of a command, the controlling device will immediately stop transmission and will not begin transmission of subsequent commands for at least 10 ms. However, if the controlling device receives a “NAK” response with the contents of the error data indicating an undefined command, the controlling device may begin to immediately transmit the next command without waiting for 10 ms.

The video disk recorder will complete transmission of the response to a received command from the controlling device within 9 ms. If the video disk recorder received a valid command requiring no data, an “ACK” response will be issued. If the video disk recorder received a valid command requiring data, a response code plus the data will be issued as a response. If the video disk recorder received an invalid command or if any communications error occurred during transmission of a command, a “NAK” response plus any error data will be immediately issued. The video disk recorder will provide a sufficient command buffer so that a lengthy command that is executing will not prevent receipt or execution of the next command.

Each command must have a fixed latency in number of fields from the field in which the command is received to the field in which the command actually takes effect. For example, a controlling device must know how many fields in advance to transmit a play command in order to output the first field of video at a particular point in time.

2.5. Device ID

In some cases it is useful to uniquely identify the video disk recorder. For example, if cables are swapped between two video disk recorders, the controlling device could check the video disk recorder’s device ID and match it up to saved information about that particular video disk recorder.

The video disk recorder will save and maintain an overall device ID for that particular video disk recorder. A device ID consists of eight bytes of binary data whose format is determined by the controlling device. The controlling device may set the device ID, and request the current device ID to be returned. If the device ID has not been set, it will default to eight null bytes with a value of 0.

2.6. Front Panel Controls

A video disk recorder may provide a user interface similar to the front panel controls of video tape recorders. A capability may also be provided to enable and disable front panel access to the video disk recorder, or to enable or disable remote access while the front panel is enabled. In all cases, commands which are initiated from the front panel interface must be reflected in any status obtained through the remote interface.

2.7. Power On State

When powered up, the video disk recorder will initialize and be ready for operation without user intervention.

3. Video Storage and Access

This section describes methods for creating and accessing video material stored in a video disk recorder. These methods are based on those currently used to control video cassette recorders, and consequently the terminology used will generally parallel that for video cassette recorders.

3.1. Video Storage Model

The storage model presented to a controlling device by the video disk recorder is based on the storage model for video cassette tapes and video cassette recorders.

With a video cassette recorder, the medium is a video cassette tape. Each cassette normally has a fixed capacity for the storage of video material of from 15 to 90 minutes. Cassettes are generally removable, and under automated control are typically loaded and unloaded from the video cassette recorders by the system robotics. Typically, only one cassette can be loaded into a video cassette recorder at a time.

With a video disk recorder, the medium is usually a digital mass storage medium such as a hard disk drive or an optical laser disk. In a video disk recorder, the capacity for the storage of video material is often variable, depending on such factors as video compression rates and the size of hard disk storage, but could be the equivalent of many video cassette tapes comprising hundreds of minutes of storage. The video disk recorder's medium is usually not removed and therefore requires no physical loading or unloading. In order to specify a reference for video input and output operations, however, a logical loading or unloading operation will likely be required, paralleling the physical loading or unloading applied to video cassette recorders and video cassette tapes. In a video disk recorder that provides multiple input/output channels one ID can be loaded *per channel* at a time.

The storage model for video disk recorders parallels that of the video cassette recorder and video cassette tape combination. The storage of a video disk recorder consists of uniquely addressable IDs, each containing time code referenced video material.

3.2. IDs

An ID is a single, uniquely addressable portion of storage on the video disk recorder containing video material. Each ID has a virtual capacity up to the largest valid time code position (24 hours). The maximum number of IDs contained within a video disk recorder will vary based on the available storage and the amount of video material recorded in each ID.

Each ID is uniquely addressed by an ID code. An ID code consists of eight bytes of binary data whose format is determined by the controlling device. The terms ID and ID code are for most purposes synonymous, and this document will use the term ID to refer to both the ID as a unique portion of storage and as a code to refer to that unique portion of storage.

The video disk recorder will maintain a sorted list of all IDs currently existing in the video disk recorder's storage. The preferred sorting sequence is by binary byte values,

with the first byte of the ID being the most significant byte and the last byte of ID being the least significant byte.

The video disk recorder will always contain one default ID. The primary purpose of the default ID is to allow operation without using IDs, thereby maintaining compatibility with existing video cassette recorders. The ID code of this default ID will consist of eight null bytes with a value of 0. The default ID will not be included in the list of available IDs maintained by the video disk recorder, and will not be returned when a list of available IDs is requested. The default ID may be specified and used for all other purposes. If no other valid ID has been specified and loaded, such as on initialization and errors, the video disk recorder will load the default ID.

If a video disk recorder is unable to support the concept of IDs, the entire video disk recorder's storage may be viewed as a single, time code addressable ID. Under this model, the controlling device must assume responsibility for assigning and managing segments of time code associated with individual IDs. Note that this model will not allow for a video disk recorder with more than 24 total hours of storage.

3.3. Time Code and User Bits

Each ID is considered to have available a "pre-striped" time code range with continuous ascending time code beginning at 00:00:00:00 through the largest valid time code position. Video material may be recorded at any time code position within the ID. Time code positions that have never been recorded over are considered to be black. The video disk recorder is not required to allocate storage for unrecorded time code positions, but must output black if those positions are played.

A video disk recorder should be capable of supporting both NTSC and PAL time code formats. Since the time code format will usually remain consistent throughout the video disk recorder's use, the selection of the current format may be a static set up parameter or switch setting. Although not officially specified, some video cassette recorder implementations use the least significant bit of the category byte of the device type to indicate if the device is configured for NTSC (bit low) or PAL (bit high). (See 12.11 Device Type response for description)

A video disk recorder should be capable of supporting both drop frame and non-drop frame time code. Since the drop frame setting will usually remain consistent throughout the video disk recorder's use, the selection of the current drop frame setting may be a static set up parameter or switch setting.

Wherever a time code range is specified, such as with in and out presets or when erasing a time code range from an ID, the range will be specified as a starting and ending time code position. The range is defined to include the starting time code position, and end one field prior to the ending time code position. In other words, the starting time code position is inclusive, while the ending time code position is exclusive.

Each time code position will have an associated 4 bytes of user bits. Time code positions that have never been recorded over are considered to have user bit values of 0. The video disk recorder is not required to allocate storage for user bit values of unrecorded time code positions, but must return 0 for the user bit values for those positions

when requested. The video disk recorder will maintain user bit preset values that will be stored at time code positions during subsequent recordings. When the video disk recorder is initialized, the user bit preset values will be 0. The user bit preset values may be changed by the controlling device at any time to apply to subsequent recordings.

Time code positions and user bits within an ID are considered to be stored in the linear time code track. If a video disk recorder implements a vertical interval time code, it will be considered a separate time code track from the linear time code track. If a video disk recorder does not implement a vertical interval time code, the vertical interval time code will always be identical to the linear time code for all time code and user bits requests.

3.4. Loading and Creating IDs

Each channel of the video disk recorder will have associated with it a currently active, or loaded, ID. By default (on initialization or errors), the default ID will be loaded (see section 3.2, IDs, page 12). This currently active ID is loaded by attempting to record or play cue using an ID, or through the auto mode mechanism by specifying an ID for an in preset or preview in preset.

IDs can be created and loaded by attempting to record cue using an ID that did not previously exist in the video disk recorder. If an attempt is made to record cue using an ID that exists in the video disk recorder, the existing ID will be loaded and subsequent material will be recorded within the context of that ID and any existing video material and time code. Normally a record cue is issued to a specified time code position. If a record cue is issued without specifying a time code position, the current time code position will default to 00:00:00:00.

IDs can be loaded by attempting to play cue using an ID that currently exists in the video disk recorder. If an attempt is made to play cue using an ID that does not exist in the video disk recorder, the cue command will not successfully complete. Normally a play cue is issued to a specified time code position. If a play cue is issued without specifying a time code position, the current time code position will default to 00:00:00:00.

IDs can be loaded through the auto play mechanism by specifying an in preset or preview in preset using an ID that currently exists in the video disk recorder. If an attempt is made to specify an in preset or preview in preset using an ID that does not exist in the video disk recorder, the preset will not be set and will be considered invalid. Normally an in preset or preview in preset is set with a specified time code position. If an in preset or preview in preset is set without specifying a time code position, the preset time code position will default to 00:00:00:00.

3.5. Recording Video Material

Video material is recorded based on a time code position within the currently loaded ID. The starting time code position will usually be specified when cueing prior to recording. If a record cue is issued without specifying a time code position, the time code position will default to 00:00:00:00.

Before recording begins, it is often useful to know if there is sufficient storage in the video disk recorder for the new material. Because of the nature of video compression,

the video disk recorder may not be able to determine the exact amount of storage a segment of video material will require until after it is recorded and compressed, but the video disk recorder should be able to compute the worst case storage requirement for a given duration of video material. The longest contiguous available block of storage in the video disk recorder can be queried by requesting it. (see 84.1C Available Storage.

If the controlling device requests the longest contiguous available block of storage in the video disk recorder, the video disk recorder will determine the amount of storage based on worst case compression requirements. The reason for requesting the longest contiguous block is for disk systems that can get fragmented and therefore might have holes in their disk allocation. Disk systems that don't have fragmentation problems could return their total available storage which would be equivalent to their longest contiguous block.

A recording will start with a record cue command followed by the out preset. This would determine the duration of the recording. If there is insufficient space to hold the worst case compression requirements for the given duration, the recording would stop and an end of tape condition will result, since no other error can be sent. Video material can also be recorded without specifying a duration prior to recording. While it is understood that such an open ended recording could impose difficult storage allocation requirements on a video disk recorder implementation, it would be necessary in order to maintain compatibility with existing video cassette recorder implementations.

When recording begins, the time code position will increase and new video material and user bits will be recorded until the recording is stopped. Video material and user bits recorded to a previously unused time code position will be stored by the video disk recorder, thereby "replacing" the default black. Video material and user bits recorded to an already used time code position will replace the previously recorded material with the same time code position. If the video disk recorder runs out of available storage during the recording, the recording will stop and an end of tape condition will result.

The video disk recorder will store the highest time code position, plus one frame, that was recorded on each ID. This highest recorded position will be used when the controlling device is utilizing an access method which only uses IDs. Under such a method, recording can be specified using only a duration and an ID, with the time code position defaulting to 00:00:00:00. Then, for playback, the in preset can be set to the desired ID with the time code position defaulting to 00:00:00:00, and the out preset can be defaulted to the highest recorded time code position. Using this method, video material can be recorded and played without the need for the controlling device to specify and manage time code.

3.6. Playing Video Material

Video material is output based on a time code position within the currently loaded ID. The starting time code position for playback will usually be specified when cueing prior to playback. If a play cue is issued without specifying a time code position, the time code position will default to 00:00:00:00. The video disk recorder will set the cur-

rent time code position as specified, and output the video material corresponding to the current time code position.

The video disk recorder will always output the video material corresponding to the currently loaded ID and time code position, regardless of whether the time code position is changing (playing, rewinding, etc.) or not (cued, stopped, etc.). If video material has been recorded to the current time code position, the recorded video material will be output. If no video material was recorded to the current time code position, black will be output.

When playback begins, the time code position will increase and new video material will be output until playback is stopped. When playback is stopped, video material corresponding to the time code position where playback was stopped will be output.

Continuous playback of video material to time code ranges on the same or different IDs will be supported through the use of the auto mode extensions (see section 3.7, Auto Mode Extensions, page 16).

3.7. Auto Mode Extensions

A video disk recorder will be required to playback non-adjacent segments of video material from the same or different IDs back to back, that is without a break in the video output. Although the cueing time for video disk recorders will likely be very short, it will generally not be possible to stop the current playback, cue up to the new playback position, and begin the next playback without disrupting the continuous video stream. It is therefore necessary to provide advanced cueing information to allow the video disk recorder to cue up to the next video segment prior to its playback time.

The capability for advanced cueing will be provided through an extension of existing “auto mode” capabilities. When auto mode is enabled, the video disk recorder will allow the controlling device to preset an ID and a starting and ending time code position for the next video segment to be loaded and played or recorded. The video disk recorder will then be able to load the next ID and cue up the next video segment prior to its required time. When auto mode is enabled and playback or recording is started, the video disk recorder will use the preset starting and ending time code positions to control the current playback. Once the current playback is started, the controlling device can then preset the information for the next video segment to play.

3.8. Deleting IDs and Video Material

A video cassette recorder provides a fixed, static amount of storage on a video cassette tape. There is no need to allocate storage for video material since the tape already physically exists, and likewise there is no need to deallocate the storage if a segment of tape is no longer needed.

A video disk recorder, however, will provide a dynamic, virtual storage space presented to the controlling device as many large virtual IDs, with large virtual time code ranges. It will consequently be necessary to allocate actual physical storage for video material when it is to be recorded to previously unused virtual storage space. This allocation is performed when an ID is loaded and cued for recording. When video material is no longer required, it will be advantageous to release the physical storage allocated

for the video material so that it can be mapped to a new portion of the virtual storage for future recordings.

An ID and all of the video material associated with its time code may be deleted by deleting the ID. The controlling device will specify the ID to be deleted, and the video disk recorder will then remove the ID from its database and reclaim any physical storage associated with the video material stored on that ID.

3.9. Multiple Channel Considerations

If the video disk recorder implements multiple input and/or output channels that share the video storage, it is possible for more than one channel to access the same segment of time code on the same ID.

Where multiple channels are accessing the same video segment, there should be no conflict, even if the channels are not synchronized. In other words, the same segment of video material can be accessed either simultaneously or offset in time by any number of channels. It is the responsibility of the controlling device to ensure that simultaneous access to a video segment produces rational video input and/or output.

4. Commands and Responses

If more than one channel is attempting to record to the same time code position simultaneously, the video disk recorder must determine which channel's video material will actually be recorded. In general, the access control should be on a "first in" basis, so that the last channel granted access will be the last to record over the identical position, thereby being the only channel to actually leave its video material at that position. A video disk recorder implementation may use alternate conflict resolution methods as required, and in general it is not required that simultaneous recording using multiple channels over the same time code position produce rational results. Commands and Responses

This section describes each command and response that is required of a video disk recorder implementation. Each command and response will be identified by its command code and name, and will be accompanied by a description of the command's purpose, effects, and any data that accompanies the command.

Most of the required commands and responses are identical to those specified in the Sony Betacam / Betacam SP Protocol. Information listed for existing commands is intended to specify the minimum requirements for each command. Unless otherwise noted, a video disk recorder may implement all the capabilities for each command as specified in the Sony Betacam / Betacam SP Protocol and still be compatible with these requirements.

Some of the required commands have been modified from the specifications in the Sony Betacam / Betacam SP Protocol. These modifications were developed to address capabilities required of a video disk recorder, but not existing in current video cassette recorder implementations. These modifications have been designed to follow the original command format and function as closely as possible. Unless otherwise noted, a video disk recorder should implement the modifications as described, and may implement additional capabilities as specified in the Sony Betacam / Betacam SP Protocol provided they do not conflict with the specified modifications.

Some of the required commands have been added to the command set specified in the Sony Betacam / Betacam SP Protocol. These commands have been developed to address capabilities required of a video disk recorder, but not existing in current video cassette recorder implementations. These commands were only added where the required functionality could not be reasonably offered by modifying existing commands. Unless otherwise noted, a video disk recorder should implement the modifications as described. The command codes for additional commands, where specified, are the suggested command code values and should be used by video disk recorder implementations. Although a video disk recorder may implement these commands using different command codes, consideration should be given for establishing standard command codes that could be used by all video disk recorder implementations.

00.11 Device Type Request

This command requests the model identifier of the video disk recorder. The video disk recorder will respond with a Device Type response (12.11).

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

10.01 ACK

This response is returned to acknowledge a command that requires no data to be returned.

11.12 NAK

This response is returned in response to an immediate communications error resulting from a command. One byte of data will be returned with this response indicating the error or errors that occurred. This byte of data is a bit field with the following format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Time Out	Framing Error	Overrun Error	Parity Error		Checksum Error		Undefined Command

bit 7: Time Out .....This bit is high when a communications time out error has occurred, otherwise it is low.

bit 6: Framing Error .....This bit is high when a communications framing error has occurred, otherwise it is low.

bit 5: Overrun Error .....This bit is high when a communications overrun error has occurred, otherwise it is low.

bit 4: Parity Error..... This bit is high when a communications parity error has occurred, otherwise it is low.

bit 2: Checksum Error .....This bit is high when a communications checksum error has occurred, otherwise it is low.

bit 0: Undefined Command..This bit is high when an undefined command error has occurred, otherwise it is low.

12.11 Device Type

This response is returned for a Device Type Request (00.11) command. Two bytes of data will be returned with this response. The first byte is generally used as a category of device, and the second byte is generally used as a model number for the device. Although not officially specified, some video cassette recorder implementations use the least significant bit of the category byte of the device type to indicate if the device is configured for NTSC (bit low) or PAL (bit high). Video disk recorder manufacturers must assign a unique number for their category and models, and should be careful to avoid conflicting with existing device types. Manufacturers are encouraged to contact Odetics Broadcast for assistance. A partial listing of commonly used categories follows.

Category	Devices Assigned	Notes
00	BVH series machines	
10	BVU series machines	
20	BVW series machines	
40	D2 series machines	
80	EVO (8 mm) machines	
A0	MII series machines, SVHS machines, laser disc machines, other	This seems to be a “catch all” category and should be avoided.
AA	some existing video disk recorders	
B0	Digital Betacam	
D8	video disk recorders	This is the suggested category for video disk recorders.
F0	D3 series machines	

20.00 Stop

This command places the video disk recorder in the stop mode, and any “motion” command such as play, fast forward, record, etc., will stop. This command will immediately abort any current auto play or record process, but will not reset the auto mode presets and preview presets.

When a stop command is issued, the stop status (status byte 1, bit 5) will be set high, and the rewind status (status byte 1, bit 3), fast forward status (status byte 1, bit 2), record status (status byte 1, bit 1), play status (status byte 1, bit 0), shuttle status (status byte 2, bit 5), jog status (status byte 2, bit 4), and variable play status (status byte 2, bit 3) will all be set low.

20.01 Play

This command places the video disk recorder in the play mode, and playback will begin. Playback begins from the current time code position on the currently loaded ID, and the time code position will increase and new video material will be output until playback is stopped.

If auto mode is enabled, the play command will initiate the auto play processing described under the auto mode on command (40.41).

There should be a fixed latency in number of frames from the time this command is issued, after a play cue or in preset is issued, until the video disk recorder actually starts

playback, so that the controlling device can frame accurately synchronize the source material.

When a play command is issued, the stop status (status byte 1, bit 5) will be set low, and the play status (status byte 1, bit 0) and servo lock status (status byte 2, bit 7) will be set high.

20.02 Record

This command places the video disk recorder in the record mode, and recording will begin. Recording begins from the current time code position on the currently loaded ID, and the time code position will increase and new video material will be recorded until recording is stopped.

If auto mode is enabled, the record command will initiate the auto record processing described under the auto mode on command (40.41).

There should be a fixed latency in number of frames from the time this command is issued, after a record cue is issued, until the video disk recorder actually starts recording, so that the controlling device can frame accurately synchronize the source material.

When a record command is issued, the stop status (status byte 1, bit 5) will be set low, and the record status (status byte 1, bit 1), play status (status byte 1, bit 0) and servo lock status (status byte 2, bit 7) will be set high.

20.04 Standby Off

This command has no effect in a video disk recorder, and the video disk recorder will always respond with an ACK response (10.01).

20.05 Standby On

This command has no effect in a video disk recorder, and the video disk recorder will always respond with an ACK response (10.01).

20.0F Eject

This command has no effect in a video disk recorder, and the video disk recorder will always respond with an ACK response (10.01).

20.10 Fast Forward

This command will cause the current time code position to increase at the maximum speed. The video output will be updated as frequently as possible.

When a fast forward command is issued, the stop status (status byte 1, bit 5) and direction status (status byte 2, bit 2) will be set low, and the fast forward status (status byte 1, bit 2) will be set high.

2X.11 Jog Forward

2X.12 Variable Forward

2X.13 Shuttle Forward

These commands will cause the current time code position to increase at the specified speed. The data provided for these commands is variable.

When one of these commands is issued, the stop status (status byte 1, bit 5) and direction status (status byte 2, bit 2) will be set low, and either the jog status (status byte 2, bit 4), variable play status (status byte 2, bit 3), or shuttle status (status byte 2, bit 5), as appropriate for the command, will be set high.

21.11, 21.12, 21.13

If one byte of data is specified as the rate parameter, N, the speed is defined as $10^{(N/32-2)}$ times the normal play speed.

22.11, 22.12, 22.13

If two bytes of data are specified as the rate parameter, N_1 and N_2, the speed is defined as $10^{(N_1/32-2)} + N_2 / 256\{10^{(N_1+1/32-2)} - 10^{(N_1/32-2)}\}$ times the normal play speed. The video output will be updated as frequently as possible.

20.20 Rewind

This command will cause the current time code position to decrease at the maximum speed. The data provided for this command is variable.

When a rewind command is issued, the stop status (status byte 1, bit 5) will be set low, and the rewind status (status byte 1, bit 3) and direction status (status byte 2, bit 2) will be set high.

2X.21 Jog Reverse

2X.22 Variable Reverse

2X.23 Shuttle Reverse

These commands will cause the current time code position to decrease at the specified speed. This command can be issued with either one or two parameters.

When one of these commands is issued, the stop status (status byte 1, bit 5) will be set low, and either the jog status (status byte 2, bit 4), variable play status (status byte 2, bit 3), or shuttle status (status byte 2, bit 5), as appropriate for the command, and direction status (status byte 2, bit 2) will be set high.

21.21, 21.22, 21.23

If one byte of data is specified as the rate parameter, N, the speed is defined as $10^{(N/32-2)}$ times the normal play speed.

22.21, 22.22, 22.23

If two bytes of data are specified as the rate parameter, N_1 and N_2, the speed is defined as $10^{(N_1/32-2)} + N_2 / 256\{10^{(N_1+1/32-2)} - 10^{(N_1/32-2)}\}$ times the normal play speed. The video output will be updated as frequently as possible.

2X.31 Cue Up With Data

Note:	*This command has been extended to address video disk recorder specific requirements.*
Obsolete:	*This command is no longer used. Use In Preset command in auto mode instead*

This command can be used prior to playback to load the currently active ID for the channel and / or set the current time code position within the currently loaded ID. This command will also set the ID and / or the time code position for the auto mode in preset as described by the in preset command (4X.14). The data provided for this command is variable.

When a cue up with data command is accepted and an ACK response is received by the controlling device, the preroll status (status byte 4, bit 0) will be set high, and the cue complete status (status byte 2, bit 0) will be set low. When the cue command has successfully completed, the preroll status (status byte 4, bit 0) will be set low, and the cue complete status (status byte 2, bit 0) will be set high. If the cue command does not successfully complete, the preroll status (status byte 4, bit 0) and cue complete status (status byte 2, bit 0) will be set low.

20.31

This command can be issued with no parameters. If zero bytes of data are specified, the current time code position will be set to 00:00:00:00, and the currently loaded ID will be used.

24.31

This command can be issued with a single time code position parameter. If four bytes of data are specified, the current time code position will be set to the specified time code position within the currently loaded ID.

28.31

This command can be issued with a single ID parameter. If eight bytes of data are specified, the ID corresponding to the specified ID will be loaded, and the current time code position will be set to 00:00:00:00. If the ID specified does not currently exist in the video disk recorder, the cue command will not successfully complete.

2C.31

This command can be issued with two parameters indicating the time code position and ID. If twelve bytes of data are specified, the first four bytes correspond to the time code position and the next eight bytes correspond to the ID. When this command is issued, the ID corresponding to the specified ID will be loaded, and the current time code

position will be set to the specified time code position. If the ID specified does not currently exist in the video disk recorder, the cue command will not successfully complete.

20.52 Tension Release

This command has no effect in a video disk recorder, and the video disk recorder will always respond with an ACK response (10.01).

44.05 User Bits Preset

This command will set the current user bit preset values to the values of the specified 4 bytes.

4X.14 In Preset

Note:	*This command has been extended to address video disk recorder specific requirements.*

This command will set the ID and / or the time code position for the auto mode in preset. The data provided for this command is variable.

When an In Preset command is issued the VDR should cue to this position. While this cue operation is in progress, the Preroll status bit should be set. (see status byte 4 description) When cueing is finished, and the spot is found, the Preroll bit should be cleared and the Cue Complete bit should be set as well as Preset In. If the spot is not found, the VDR should clear the Preroll bit, Cue Complete, and In Preset status bits. It should also set the Stop status bit. This will indicate that the position was not found. Also the Out Preset value will be cleared.

Note:	*There is an implied order for Preset and Preview In and Out point, It is Preset In followed by Preset out then Preview In followed by Preview Out.*

40.14

This command can be issued with no parameters. If zero bytes of data are specified, the time code position for the auto mode in preset will be set to 00:00:00:00 within the currently loaded ID.

44.14

This command can be issued with a single time code position parameter. If four bytes of data are specified, the time code position for the auto mode in preset will be set to the specified time code position within the currently loaded ID.

48.14

This command can be issued with a single ID parameter. If eight bytes of data are specified, the ID for the auto mode in preset will be set to the specified ID, and the time code position for the auto mode in preset will be set to 00:00:00:00 If the ID specified does not currently exist in the video disk recorder, the auto mode in preset will become invalid for subsequent auto play operations.

4C.14

This command can be issued with two parameters indicating the time code position and ID. If twelve bytes of data are specified, the first four bytes correspond to the time code position and the next eight bytes correspond to the ID. When this command is issued, the ID for the auto mode in preset will be set to the specified ID, and the time code position for the auto mode in preset will be set to the specified time code position. If the ID specified does not currently exist in the video disk recorder, the auto mode in preset will become invalid for subsequent auto play.

4X.15 Out Preset

Note:	*This command has been extended to address video disk recorder specific requirements.*

This command will set the time code position for the auto mode out preset. If the auto mode in preset is not valid, the out preset will be lost when a valid preset in is sent, because it will clear the out preset. But auto play will not be able to function until a valid in preset has been set. The ID associated with the auto mode presets can only be set by an in preset command (4X.14)The out preset may be set at any time during auto play processing to dynamically change the out preset. The data provided for this command is variable.

This command is also used to set the length of a recording. If a Record Cue With Data has been sent, then this command will determine the out point of the recording. Once recording has started, the out preset cannot be changed.

When an out preset command is issued and the out preset is set and valid, the out preset status (status byte 3, bit 1) will be set high.

Note:	*There is an implied order for Preset and Preview In and Out point. I t is Preset In followed by Preset out then Preview In followed by Preview Out.*

40.15

This command can be issued with no parameters. If zero bytes of data are specified, the time code position for the auto mode out preset will be set to the highest recorded time code position of the ID currently specified for the auto mode in preset.

44.15

This command can be issued with a single time code position parameter. If four bytes of data are specified, the time code position for the auto mode out preset will be set to the specified time code position within the ID specified for the auto mode in preset.

40.20 In Reset

This command will clear the ID for the auto mode in preset to an undefined ID, and will clear the time code position for the auto mode in preset to 00:00:00:00, thereby making the in preset invalid.

When an in reset command is issued and the in preset becomes invalid, the in preset status (status byte 3, bit 0) will be set low.

40.21 Out Reset

This command will clear the time code position for the auto mode out preset to 00:00:00:00.

When an out reset command is issued and the out preset is cleared, the out preset status (status byte 3, bit 1) will be set low.

40.40 Auto Mode Off

This command will disable auto play of video segments that was enabled with the auto mode on command (40.41).

When this command is issued and auto mode is disabled, the auto mode status (status byte 3, bit 7) will be set low.

40.41 Auto Mode On

Note:	*This command has been extended to address video disk recorder specific requirements.*

This command will enable auto play of video segments as defined by the auto mode ID and in and out preset values. Auto mode is the mechanism by which advanced cueing information can be provided to the video disk recorder, thereby allowing continuous playback of video material.

When this command is issued and auto mode becomes enabled, the auto mode status (status byte 3, bit 7) will be set high. The in and out preset values, as well as the preview in and out preset values will be cleared, and the in preset status (status byte 3, bit 0), out preset status (status byte 3, bit 1), preview in preset status (status byte 9, bit 0), and preview out preset status (status byte 9, bit 1) will be set low.

When auto mode is enabled and a play command (20.01) is issued, the video disk recorder will begin playing the ID specified by the in preset command and will play to the auto mode out preset position.

After an In Preset command has completed processing, there should be a fixed latency in the number of frames from the time the play command is issued until the video disk recorder actually starts playback, so that the controlling device can frame accurately synchronize the source material.

When the out preset has been reached, and if auto mode is still enabled, the video disk recorder will examine the auto mode preview in preset (set by the preview in preset command, AX.04). If it is valid, the ID and the in and out preset values will be shifted from the auto mode preview preset to the auto mode preset, and the video disk recorder will once again load the ID specified by the ID for the auto mode preset, and output video material from the auto mode in preset to the auto mode out preset. At this point a new set of Preview In Preset, Preview Out Preset commands can be sent. When the ending time code position has been reached, and if auto mode is still enabled, the

video disk recorder will repeat the process until either no more Preview In / Out commands are sent, or any other command that would cause video output to stop is issued (such as a stop command, 20.00, etc.), or any error occurs that would prevent auto play from continuing.

The auto mode out preset and the auto mode preview in and preview out presets may be changed at any time up to their use during the auto play process.

A stop command (20.00) will immediately abort a current auto play process, but will not reset the auto mode presets or preview presets. An auto skip command (A0.01) will abort the current auto play or record segment only, and will cause processing to proceed as if the out preset had been reached, as described above.

61.0C Current Time Sense

This command requests the current time code position and / or user bit values for the current time code position. One byte of data is provided that specifies the desired information. This byte of data is a bit field with the following format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		VITC User Bits	LTC User Bits		Time	VITC Time Code	LTC Time Code

A current time sense command may be issued that requests either time code only, user bits only, or both time code and user bits. The source for the requested data may be specified as either linear time code (LTC), vertical interval time code (VITC), or both, which indicates that the information will be derived from the source with the “most confidence.”

It is assumed that LTC data will always be available for video disk recorders, and will be returned if the source is specified as LTC only. If VITC data is implemented, it will be returned if the source is specified as VITC only. If VITC data is not implemented, an error will be returned if the source is specified as VITC only. If the source for data is specified as both, the video disk recorder will select the source that it has the “most confidence” in, which for most situations will be the LTC data.

The following table maps the possible values for the current time sense data byte to the expected responses. Refer to each response’s individual description for further information on each response.

Data Byte Value	Expected Response
01	74.04 LTC Time Data with the LTC time code.
02	If VITC is implemented, 74.06 VITC Time Data with the VITC time code. If VITC is not implemented, 70.0D Request Time Data Missing.
03	74.04 LTC Time Data with the LTC time code.
10	74.05 LTC User Bits Data with the LTC user bits.
20	If VITC is implemented, 74.07 VITC User Bits Data with the VITC user bits. If VITC is not implemented, 70.0D Request Time Data Missing.
30	74.05 LTC User Bits Data with the LTC user bits.
11	78.04 LTC Time and User Bits Data with the LTC time code and user bits, respectively.
22	If VITC is implemented, 78.06 VITC Time and User Bits Data with the VITC time code and user bits, respectively. If VITC is not implemented, 70.0D Request Time Data Missing.
33	78.04 LTC Time and User Bits Data with the LTC time code and user bits, respectively.

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

61.20 Status Sense

This command requests current status from the video disk recorder. One byte of data is provided, with the most significant nibble specifying the first data byte to be returned, and the least significant nibble specifying the number of data bytes to return. Refer to Status Data command (7X.20) for a description of the contents of each status byte.

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

74.04 LTC Time Data

This response is returned for the current time sense command (61.0C). Four bytes of data will be returned, corresponding to the current LTC time code.

74.05 LTC User Bits Data

This response is returned for the current time sense command (61.0C). Four bytes of data will be returned, corresponding to the current LTC user bits.

74.06 VITC Time Data

This response is returned for the current time sense command (61.0C). Four bytes of data will be returned, corresponding to the current VITC time code.

74.07 VITC User Bits Data

This response is returned for the current time sense command (61.0C). Four bytes of data will be returned, corresponding to the current VITC user bits.

78.04 LTC Time and User Bits Data

This response is returned for the current time sense command (61.0C). Eight bytes of data will be returned, with the first four bytes corresponding to the current LTC time code, and the second four bytes corresponding to the current LTC user bits.

78.06 VITC Time and User Bits Data

This response is returned for the current time sense command (61.0C). Eight bytes of data will be returned, with the first four bytes corresponding to the current VITC time code, and the second four bytes corresponding to the current VITC user bits.

70.0D Request Time Data Missing

This response is returned for the current time sense command (61.0C) when the requested data is not available. The most common cause of this error response is that VITC data was requested but VITC has not been implemented.

7X.20 Status Data

This response is returned for the Status Sense command (61.20). The number and sequence of data bytes returned will depend on the value of the data byte sent with the request. Applicable status bytes are shown below, with each field required of a video disk recorder implementation listed and described. These status bytes have the following format:

Status Byte 0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Busy		Cassette Out			Hard Error		Local

bit 7: Busy ..... This bit is high if the video disk recorder can not accept motion commands or other commands requiring time consuming processing, low if those commands can be accepted. Note that status commands and other sensing commands must always be processed, even if this bit is set high.

bit 5: Cassette Out ..... This bit is always low.

bit 2: Hard Error ..... This bit is high if a hardware error or other unrecoverable error is encountered, low if no such error has occurred.

bit 0: Local ..... This bit is high if the video disk recorder is under local control, low if remote control is enabled. Status sense is always available to the controlling device, even under local control.

Status Byte 1

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Standby On	Tension Release	Stop	Eject	Rewind	Fast Forward	Record	Play

bit 7: Standby On ..... This bit is always high.

bit 6: Tension Release .....This bit is always low.

bit 5: Stop.....This bit is high when in stop mode, low for other modes.

bit 4: Eject.....This bit is always low.

bit 3: Rewind.....This bit is high when in rewind mode, low for other modes.

bit 2: Fast Forward.....This bit is high when in fast forward mode, low for other modes.

bit 1: Record.....This bit is high when in record mode, low for other modes.

bit 0: Play.....This bit is high when in play or record mode, low for other modes.

Status Byte 2

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Servo Lock		Shuttle	Jog	Variable Play	Direction	Still	Cue Complete

bit 7: Servo Lock.....This bit is high when a play or record mode is active, low for other modes such as when the output is not genlocked to the reference. While servo lock probably has no meaning for a video disk recorder, this status bit is provided in order to maintain compatibility with existing video cassette recorder implementations.

bit 5: Shuttle .....This bit is high when in shuttle mode, low for other modes.

bit 4: Jog.....This bit is high when in jog mode, low for other modes.

bit 3: Variable Play.....This bit is high when in variable play mode, low for other modes.

bit 2: Direction .....This bit is low when time code is increasing ("moving" forward), high when time code is decreasing ("moving" in reverse).

bit 1: Still.....This bit is high when time code is not changing (stopped, still, zero speed shuttle, jog, or variable play, etc.).

bit 0: Cue Complete.....This bit is set high at the completion of a play / record cue command or Preset In command. It is set low on initialization, and any time the current time code position changes due to a motion command, etc.

Status Byte 3

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Auto Mode						Out Preset	In Preset

bit 7: Auto Mode ..... This bit is set high when auto mode is enable, low when auto mode is disabled.

bit 1: Out Preset..... This bit is set high if the auto mode out preset contains a valid time code position. Otherwise, it is set low.

bit 0: In Preset..... This bit is set high if the auto mode in preset references a valid ID and contains a valid time code position. Otherwise, it is set low.

Status Byte 4

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
							Preroll

bit 0: Preroll..... This bit is set high while cueing (following the issuing of a record / play cue command or Preset In command), and is set low high at completion.

Status Byte 9

Note: This status byte has been extended to address video disk recorder specific requirements.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						Preview Out Preset	Preview In Preset

bit 1: Preview Out Preset..... This bit is set high if the auto mode preview out preset contains a valid time code position. Otherwise, it is set low. The auto mode preview presets will become invalid, and this bit will be set low, when the auto mode preview presets are shifted to the auto mode presets as part of the auto play processing. This will be the means by which a controlling device can determine when it can set new values for the auto mode preview presets.

bit 0: Preview In Preset..... This bit is set high if the auto mode preview in preset references a valid ID and contains a valid time code position. Otherwise, it is set low. The auto mode preview presets will become invalid, and this bit will be set low, when the auto mode preview presets are shifted to the auto mode presets as part of the auto play processing. This will be the means by which a controlling device can determine when it can set new values for the auto mode preview presets.

Status Byte D

Note:	*Although the status bits described for this status byte are not defined in the Sony Betacam/Betacam SP Protocol, they are defined in subsequent documents such as the Sony DVR-10/DVR-C10 Protocol.*

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Tape Top	Tape End						

bit 7: **Tape Top** .....This bit is set high when the current time code position has reached its minimum value and can not decrease ("move" in reverse). Once set, this bit will be cleared (set low) by any movement command (play, rewind, etc.), and will continue to be set low as long as the current time code position can decrease ("move" in reverse).

bit 6: **Tape End** .....This bit is set high when the current time code position has reached its maximum value and can not increase ("move" forward). Once set, this bit will be cleared (set low) by any movement command (play, rewind, etc.), and will continue to be set low as long as the current time code position can increase ("move" forward). This bit is also used during recording to indicate to the controlling device that there is no more available storage in the video disk recorder.

8X.14 ID Listing

Note:	*This response has been added to address video disk recorder specific requirements*

This response is returned for the list first ID (A0.14) and list next ID (A0.15) commands.

80.14

This response is returned for the list first ID (A0.14) command if no IDs exist on the video disk recorder, and for the list next ID (A0.15) command if there are no further IDs in sorted order available to satisfy the request.

88.14

This response is returned for the list first ID (A0.14) and list next ID (A0.15) commands if there is an ID to satisfy the request. Eight bytes of data will be returned, filled with the requested first or next ID.

81.18 ID Status

Note:	*This response has been added to address video disk recorder specific requirements.*

This response is returned for the ID status request command (A8.18). A single byte of data will be returned, indicating the status of the specified ID. Additional ID status fields may be defined as required by the video disk recorder implementation. This byte of data is a bit field with the following format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						ID Loaded	ID In Storage

bit 1: **ID Loaded**.....This bit is set high if the ID is loaded for the channel which issued the ID status command, otherwise it is set low.

bit 0: **ID In Storage** .....This bit is set high if the ID currently exists in the video disk recorder's storage, otherwise it is set low.

84.1C Longest Contiguous Available Storage

Note:	*This response has been added to address video disk recorder specific requirements.*

This response is returned for the Longest Available storage request command (A0.1C). Four bytes of data will be returned, representing the amount of the longest contiguous available storage in the video disk recorder expressed in hours, minutes, seconds, and frames. The available storage time will be calculated based on worst case compression requirements. The longest available storage time is formatted similar to the 4 byte BCD format for time code positions, but the hours digits will be permitted to reach 99 hours. If the available storage time exceeds 99:59:59:00, the video disk recorder should return 99:59:59:00.

88.21 Device ID

Note:	*This response has been added to address video disk recorder specific requirements.*

This response is returned for the device ID request command (A0.21). Eight bytes of data will be returned, corresponding to the device ID previously set using the set device ID command (A8.20). If no device ID had been previously set, the video disk recorder will return eight null bytes with a value of 0 for the device ID.

A0.01 Auto Skip

Note:	*This command has been added to address video disk recorder specific requirements.*

This command immediately aborts auto play of the current video segment specified by the current auto mode preset, and performs the processing associated with the end of the current auto mode preset (see 40.41, Auto Mode On).

AX.02 Record Cue Up With Data

Note:	*This command has been added to address video disk recorder specific requirements.*

This command must be used prior to recording to load or create the ID for the channel, and set the current time code position within that ID. The data provided for this command is variable.

When a record cue up with data command is accepted and an ACK response is received by the controlling device, the preroll status (status byte 4, bit 0) will be set high, and the cue complete status (status byte 2, bit 0) will be set low. When the record cue command has successfully completed, the preroll status (status byte 4, bit 0) will be set low, and the cue complete status (status byte 2, bit 0) will be set high. If the record cue command does not successfully complete, the preroll status (status byte 4, bit 0) and cue complete status (status byte 2, bit 0) will be set low and stop status(status byte 1, bit 5) will be set high.

The duration for a recording can be defined by either using the out preset or the stop command. After a record cue with data command is issued, a record command could follow which would start an “open ended” recording which would be completed by the reception of a Stop command. Or, an out preset could be set followed by a record command. Using the Out Preset mechanism, the video disk recorder can calculate the duration based on the Record Cue and out preset values. When doing open ended recordings, it is important to remember to send an out point reset command to clear any previously set out points.

A0.02

This command can be issued with no parameters. If zero bytes of data are specified, the current time code position will be set to 00:00:00:00, and the currently loaded ID will be used.

A4.02

This command can be issued with a single time code position parameter. If four bytes of data are specified, the current time code position will be set to the specified time code position within the currently loaded ID.

A8.02

This command can be issued with a single ID parameter. If eight bytes of data are specified, the ID corresponding to the specified ID will be loaded, and the current time code position will be set to 00:00:00:00. If the ID specified does not currently exist in the video disk recorder, an ID with the specified ID will be created and loaded.

AC.02

This command can be issued with two parameters indicating the time code position and ID. If twelve bytes of data are specified, the first four bytes correspond to the time code position and the next eight bytes correspond to the ID. When this command is issued, the ID corresponding to the specified ID will be loaded, and the current time code position will be set to the specified time code position If the ID specified does not currently exist in the video disk recorder an ID with the specified ID will be created and loaded.

AX.04 Preview In Preset

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will set the ID and / or the time code position for the auto mode preview in preset. The data provided for this command is variable.

When a preview in preset command is issued and the preview in preset is set and valid, the preview in preset status (status byte 9, bit 0) will be set high.

A0.04

This command can be issued with no parameters. If zero bytes of data are specified, the time code position for the auto mode preview in preset will be set to 00:00:00:00 within the ID loaded at the time the preview in preset is examined prior to being shifted to the in preset.

A4.04

This command can be issued with a single time code position parameter. If four bytes of data are specified, the time code position for the auto mode preview in preset will be set to the specified time code position within the ID loaded at the time the preview in preset is examined prior to being shifted to the in preset.

A8.04

This command can be issued with a single ID parameter. If eight bytes of data are specified, the ID for the auto mode preview in preset will be set to the specified ID, and the time code position for the auto mode preview in preset will be set to 00:00:00:00. If the ID specified does not exist in the video disk recorder at the time the preview in pre-

set is examined prior to being shifted to the in preset, the auto mode preview in preset will become invalid for subsequent auto play operations.

AC.04

This command can be issued with two parameters indicating the time code position and ID. If twelve bytes of data are specified, the first four bytes correspond to the time code position and the next eight bytes correspond to the ID. When this command is issued, the ID for the auto mode preview in preset will be set to the specified ID, and the time code position for the auto mode preview in preset will be set to the specified time code position. If the ID specified does not exist in the video disk recorder at the time the preview in preset is examined prior to being shifted to the in preset, the auto mode preview in preset will become invalid for subsequent auto play operations.

AX.05 Preview Out Preset

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will set the time code position for the auto mode preview out preset. If the auto mode preview in preset is not valid, the preview out preset will still be set, but auto play will not be able to function until a valid preview in preset has been set. The ID associated with the auto mode preview presets can only be set by a preview in preset command (AX.04). The data provided for this command is variable.

When an preview out preset command is issued and the preview out preset is set and valid, the preview out preset status (status byte 9, bit 1) will be set high.

A0.05

This command can be issued with no parameters. If zero bytes of data are specified, the time code position for the auto mode preview out preset will be set highest recorded time code position of the ID currently specified for the auto mode preview in preset. If no valid ID is currently specified for the auto mode preview in preset, the auto mode preview out preset will still be set, but auto play will not be able to function until a valid preview in preset has been set.

A4.05

This command can be issued with a single time code position parameter. If four bytes of data are specified, the time code position for the auto mode preview out preset will be set to the specified time code position within the ID specified for the auto mode preview in preset. If no valid ID is currently specified for the auto mode preview in preset, the auto mode preview out preset will still be set, but auto play will not be able to function until a valid preview in preset has been set.

A0.06 Preview In Reset

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will clear the ID for the auto mode preview in preset to an undefined ID, and will clear the time code position for the auto mode preview in preset to 00:00:00:00, thereby making the preview in preset invalid.

When a preview in reset command is issued and the preview in preset becomes invalid, the preview in preset status (status byte 9, bit 0) will be set low.

A0.07 Preview Out Reset

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will clear the time code position for the auto mode preview out preset to 00:00:00:00.

When a preview out reset command is issued and the preview out preset is cleared, the preview out preset status (status byte 9, bit 1) will be set low.

AX.10 Erase ID

Note:	*This command has been added to address video disk recorder specific requirements.*

This command is used to erase and delete either a specified ID, or all existing IDs from the video disk recorder's storage. All time code positions for a deleted ID will be erased and deallocated. Note that the default ID (see section 3.2, IDs, page 12) can not be deleted. An attempt to delete the default ID will have no effect. The data provided for this command is variable.

A0.10

This command can be issued with no parameters. If zero bytes of data are specified, all existing IDs (with the exception of the default ID) will be erased and deleted from the video disk recorder's storage.

Deleting many IDs may prevent the video disk recorder from processing further commands for some period of time. If this is the case, the busy status (status byte 0, bit 7) will be set high until the video disk recorder can once again process commands.

A8.10

This command can be issued with a single ID parameter. If eight bytes of data are specified, the specified ID will be erased and deleted from the video disk recorder's storage. If the specified ID does not currently exist in the video disk recorder's storage, or if the default ID is specified, the erase ID command will have no effect.

A8.11 Erase Segment

Note:	*This command has been added to address video disk recorder specific requirements.*

This command is used to erase the specified time code positions from the currently loaded ID. Eight data bytes are specified, with the first four bytes corresponding to the starting time code position and the second four bytes corresponding to the ending time code position. All time code positions between the specified starting and ending time code positions, inclusive, will be erased and deallocated.

A0.14 List First ID

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will request the first ID in sorted order that currently exists in the video disk recorder's storage, returned using the ID listing response (88.14). This command will then advance the current listing position to the second ID in sorted order, so that a subsequent list next ID command will return the second ID.

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

A0.15 List Next ID

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will request the next ID in sorted order that currently exists in the video disk recorder's storage, returned using the ID listing response (88.14). This command will then advance the current listing position to the next ID in sorted order, so that a subsequent list next ID command will return the next ID.

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

A8.18 ID Status Request

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will request the status of the specified ID, returned using the ID status response (81.18). Eight bytes will be specified as the parameter, indicating the ID corresponding to the ID whose status is requested.

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

A0.1C Longest Contiguous Storage Request

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will request the longest contiguous amount of available storage in the video disk recorder expressed in hours, minutes, seconds, and frames, returned using the longest contiguous available storage response (84.1C).

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

A8.20 Set Device ID

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will set the device ID to the device ID specified.

A0.21 Device ID Request

Note:	*This command has been added to address video disk recorder specific requirements.*

This command will request the device ID of the video disk recorder, returned using the device ID response (88.21).

Note that this command must complete and return its response within the time constraints detailed in section 2.4, Communications Protocol, page 10.

CX.40 Tape Subsystem Status Request

Note:	*This command has been added to address video disk recorder specific requirements.*

Status bits set: None

RETURNS: DX.40.DATA

Queries the status of the tape subsystem. The VDR shall reply with the amount of <X> bytes requested, each representing a bitmap of status information associated with each drive. Drive 0 being byte 1. See command **TAPE SUBSYSTEM STATUS REQUEST DX.40** for a full description. A normal response, indicating that a tape is loaded and ready would be < 07 >.

C1.41.<drive> Load Tape

Note:	*This command has been added to address video disk recorder specific requirements.*

DRIVE: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte > Bit 1 (loaded), Bit 2 (if formatted) of DX.40

RETURNS: 10.01

This command will cause a load tape command to the tape in <drive>. The VDR should initialize the tape and read any associated directory information. Controllers should first check the **TAPE SUBSYSTEM STATUS REQUEST (DX.40)** to verify drive present (bit 0 set) and loaded (bit 1 not set).

C1.42.<Drive> Format Tape

Note:	*This command has been added to address video disk recorder specific requirements.*

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set: <drive byte > Bit 4 (busy), Bit 2 (formatted) of DX.40

RETURNS: 10.01

This command will cause a format of tape in <drive>. Controllers should first check the **TAPE SUBSYSTEM STATUS REQUEST (DX.40)** to verify drive present (bit 0 set), loaded (bit 1 set) and formatted (bit 2 not set). Upon completion of this command the VDR will set format (bit 2), unless an error has occurred in which case the VDR will set the error (bit 7).

C1.43.<Drive> Unload Tape

Note:	*This command has been added to address video disk recorder specific requirements.*

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set: <drive byte > Bit 4 (busy) of DX.40

RETURNS: 10.01

This command will issue an unload, eject command to the drive. Controllers should first check tape subsystem status to verify drive present, loaded, not busy status < 03 > or < 07 >. Upon completion of this command the VDR will clear all bits except Drive Present(bit 0), unless an error has occurred in which case the VDR will set the error (bit 7).

C1.47.<Drive> List First Archive Id

Note:	*This command has been added to address video disk recorder specific requirements.*

DRIVE: 0h - 3h 1 byte value indicating drive to query.

Status bits set:: NONE

RETURNS: DX.47.DATA0-7

This command will return a DX.47.DATA0-7 the first existing ID <DATA0-7>, sorted by location. Or a D0.47 indicating no ID's exist on tape. **It is recommended that enough storage be allocated at the beginning of the tape for this ID and directory information. Otherwise it could be a very long process to search the tape for ID's.**

C1.48.<Drive> List Next Archive Id

Note:	*This command has been added to address video disk recorder specific requirements.*

Drive: 0h - 3h 1 byte value indicating drive to query.

Status bits set:: NONE

RETURNS: DX.47.DATA0-7

This command will return a DX.47.DATA0-7 next ID <DATA0-7>, sorted by location. Issuing this command in succession will result in stepping through all ID's until the D0.48 is returned. Indicating no more ID's to return. **It is recommended that enough storage be allocated at the beginning of the tape for this ID and directory information. Otherwise it could be a very long process to search the tape for ID's.**

C1.49<Drive> Abort Tape Activity

	Note: This command has been added to address video disk recorder specific requirements.

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte> bit 4 (busy)

RETURNS: 10.01

This command will stop tape access and return to last non-busy state after cleaning up any affected processing. i.e.. in the middle of coping to archive or retrieving from archive.

C9.44.<Data0-7>.<Drive> Copy Id To Archive

Note:	*This command has been added to address video disk recorder specific requirements.*

Data0-7: ID to copy.

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte> bit 4 (busy), bit 7

RETURNS: 10.01

This command is used to copy the video / audio data associated with the specified ID <DATA0-7> from disk storage to tape <DRIVE>. Controllers should first issue **IS TRANSFER OK C9.48** then **TAPE SUBSYSTEM STATUS REQUEST (CX.40)** and check for drive present (bit 0 set), loaded (bit 1 set), format (bit 2 set), busy (bit 4 not set), tape full (bit 3 not set). This command does nothing if the ID already exist. If there is an error during the copy the VDR must set the error(bit 7).
EXAMPLE: C9.44.S.E.G.M.E.N.T.1.3 This command will archive ID SEGMENT1 to tape in drive 3.

C9.45.<Data0-7>.<Drive> Retrieve From Archive

Note:	*This command has been added to address video disk recorder specific requirements.*

Data0-7: ID to retrieve.

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte> bit 4 (busy)

RETURNS: 10.01

This command is used to copy the video / audio data associated with the specified ID <DATA0-7> from tape in <DRIVE> to disk storage. Controllers should first issue a **TAPE SUBSYSTEM STATUS REQUEST (CX.40)** and check for drive present (bit 0 set), loaded (bit 1 set), format (bit 2 set), busy (bit 4 not set). This command does nothing

if the ID already exists. If there is an error during the copy the VDR must set the error(bit 7).

C9.46.<Data0-7>.<Drive> Delete Id From Archive

Note:	*This command has been added to address video disk recorder specific requirements.*

Data0-7: ID to delete.

Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte> bit 4 (busy)

RETURNS: 10.01

This command is used to erase the video/audio data associated with the specified ID <DATA0-7> from tape in <DRIVE>. Controllers should first issue a **TAPE SUBSYSTEM STATUS REQUEST (CX.40)** and check for drive present (bit 0 set), loaded (bit 1 set), format (bit 2 set), busy (bit 4 not set). If there is an error during the copy the VDR must set the error(bit 7).
EXAMPLE: C9.45.S.E.G.M.E.N.T.1.3 This will delete SEGMENT1 from tape in drive 3.

C9.48.<Data0-7>.<Drive> Is Transfer OK?

Note:	*This command has been added to address video disk recorder specific requirements.*

Data0-7: ID to check.

Drive: 0h - 3h 1 byte value indicating transfer drive.

Status bits set:: <drive byte> bit 3 (tape full)

RETURNS: 10.01

This command checks to see if there is enough storage on the tape in <DRIVE> for ID <DATA0-7> to be copied. If there is not enough storage the VDR needs to set the tape full (bit 3) status bit. The controller should then request a **TAPE SUBSYSTEM STATUS REQUEST (CX.40)** and check for drive present (bit 0 set), loaded (bit 1 set), format (bit 2 set), busy (bit 4 not set), tape full (bit 3 not set) before trying to copy the ID <DATA0-7>.

CA.47.<Data0-7>.<Source Drive>.<Destination Drive> Copy Id From Tape To Tape

Note:	*This command has been added to address video disk recorder specific requirements.*

Data0-7: ID to copy.

Source Drive: 0h - 3h 1 byte value indicating source drive.

Destination Drive: 0h - 3h 1 byte value indicating destination drive.

Status bits set:: <drive byte> bit 4 (busy)

RETURNS: 10.01

This command is used to copy the video / audio data associated with the specified ID <DATA0-7> from tape in <SOURCE DRIVE> to tape in <DESTINATION DRIVE>. Controllers should first issue a **TAPE SUBSYSTEM STATUS REQUEST (CX.40)** and check for drive present (bit 0 set), loaded (bit 1 set), format (bit 2 set), busy (bit 4 not set). This command does nothing if the ID already exists. If there is an error during the copy the VDR must set the error(bit 7).

Dx.40 Tape Subsystem Status Response

Note: This command has been added to address video disk recorder specific requirements.

This status is sent in response to a CX.40. The X indicates the amount of status information bytes requested in the CX.40 command. Each byte returned is a bit image of status information associated with a drive. The status information is defined below.

TAPE SUBSYSTEM STATUS RETURN BYTE

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1 Drive 0	ERROR	0	CLOSING ***	BUSY*	TAPE FULL	FORMAT OK	LOADED	DRIVE PRESENT
Byte 2 Drive 1	ERROR	0	CLOSING ***	BUSY*	TAPE FULL	FORMAT OK	LOADED	DRIVE PRESENT
Byte 3 Drive 2	ERROR	0	CLOSING ***	BUSY*	TAPE FULL	FORMAT OK	LOADED	DRIVE PRESENT
Byte 4 Drive 3	ERROR	0	CLOSING ***	BUSY*	TAPE FULL	FORMAT OK	LOADED	DRIVE PRESENT

While the tape subsystem is busy, **it is reasonable for the VDR not to except transport control commands. I.e.. disk storage specific commands.*

*** **Always set in conjunction with busy (bit 4)**.*

DX.48 Archive Id

Note: This command has been added to address video disk recorder specific requirements.

This is the response to the “List First / Next Archive ID command. Will return the next existing ID (an eight byte string), sorted by location. A response with 0 in the data count field indicates the end of the list.

RETURN SAMPLES: IF an ID exists: D8.48.*SEGMENT2*

Past the Last ID: D0.48

5. Control Scenarios

This section describes control scenarios for several important functions that will be performed using a video disk recorder. Each scenario will describe the command sequence and expected responses and status changes.

For better readability, commands are expressed by listing the command code (function category and data count byte, and command byte) in hexadecimal, and listing some command parameters in a text format. Note that these listings do not correspond to the actual hexadecimal byte stream that would be sent by a controlling device. Refer to section 0, and Responses, page 18, for detailed descriptions of the commands and responses.

A controlling device will likely be issuing status sense and current time sense (both time and user bits) commands continually throughout these scenarios. These status sense commands will not be listed in the scenarios, and it should be considered that they could be issued at any time.

5.1. Control Using IDs and Time Code

This section presents scenarios based around a control method that uses a combination of IDs and time code. A control method based solely around time code would be similar, except that IDs would not be specified and the default ID would be used.

5.1.1. Open Ended Recording to a New ID

This scenario describes a command sequence for creating a new ID and recording video material of an unspecified duration.

1. **AC.02 00:01:00:00 “SPOT 1”**
   The controlling device issues a record cue up with data command, specifying the starting time code position and the ID. The starting time code position is specified as 00:01:00:00, and the controlling device has chosen to use the ID as a text string (left justified, null filled to eight bytes), and specified it as “SPOT 1”. Since “SPOT 1” does not exist in the video disk recorder storage, the ID will be created and loaded. The current time code position will be set to 00:01:00:00. When the command is accepted and an ACK response is received by the controlling device, the preroll status will be set high, and the cue complete status will be set low. When the command has successfully completed, the preroll status will be set low, and the cue complete status will be set high.
   2. 40.21The controlling device issues a Out Reset command to clear any previously set out points.
3. **20.02**
   The controlling device issues a record command to start the recording process. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts recording, so that the controlling device can frame accurately synchronize the source material. When recording begins, the video disk recorder will go into record mode, the record status, play status, and servo lock status will be set high, and the stop status will be set low.
4. **20.00**
   When recording has finished, the controlling device issues a stop command to stop the recording process. When recording stops, the video disk recorder will go into stop mode, the record status, play status, and servo lock status will be set low, and the stop status will be set high. The new recording is now complete.

5.1.2. Open Ended Recording to an Existing ID

This scenario describes a command sequence for recording video material of an unspecified duration to an existing ID. In this case, a second video segment will be added to an existing ID at a different time code position.

1. **AC.02 00:02:00:00 "SPOT 1"**
   The controlling device issues a record cue up with data command, specifying the starting time code position and the ID. The starting time code position is specified as 00:02:00:00, and the ID is specified as "SPOT 1". Since "SPOT 1" exists in the video disk recorder storage, the ID will be loaded. The current time code position will be set to 00:02:00:00. When the command is accepted and an ACK response is received by the controlling device, the preroll status will be set high, and the cue complete status will be set low. When the command has successfully completed, the preroll status will be set low, and the cue complete status will be set high.
2. **40.21**
   The controlling device issues a Out Reset command to clear any previously set out points.
3. **20.02**
   The controlling device issues a record command to start the recording process. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts recording, so that the controlling device can frame accurately synchronize the source material. When recording begins, the video disk recorder will go into record mode, the record status, play status, and servo lock status will be set high, and the stop status will be set low.
4. **20.00**
   When recording has finished, the controlling device issues a stop command to stop the recording process. When recording stops, the video disk recorder will go into stop mode, the record status, play status, and servo lock status will be set low, and the stop status will be set high. The new recording is now complete.

5.1.3. Recording with a Specified Duration

This scenario describes a command sequence for recording video material of a specified duration to an existing ID using the auto mode features.

1. **AC.02 00:03:00:00 "SPOT 1"**
   The controlling device issues a record cue up with data command, specifying the starting time code position and the ID. The starting time code position is specified as 00:03:00:00, and the ID is specified as "SPOT 1". Since "SPOT 1" exists in the video disk recorder storage, the ID will be loaded. The current time code position will be set to 00:03:00:00. When the command is accepted and an ACK response is received by the controlling device, the preroll status will be set high, and the cue complete status will be set low. When the command has successfully completed, the preroll status will be set low, and the cue complete status will be set high.
2. **44.15 00:03:30:00**
   The controlling device issues an out preset command specifying the ending time code position. The out preset status will be set high to indicate a valid out preset has been set. The video disk recorder can calculate the duration of the recording by subtracting the starting time code position from the ending time code position.
3. **20.02**
   The controlling device issues a record command to start the auto record process. There should be a fixed latency in number of frames from the time the command is issued until

the video disk recorder actually starts recording, so that the controlling device can frame accurately synchronize the source material. When recording begins, the video disk recorder will go into record mode, the record status, play status, and servo lock status will be set high, and the stop status will be set low.

4. **(no command)**
   The video disk recorder will record material from the in preset position until the out preset position is reached. At that point the recording will end and the stop status will be asserted.

5.1.4. Playing a Single Video Segment

This scenario describes a command sequence for playing a single video segment of an unspecified duration.

1. **40.41**
   The controlling device issues an auto mode on command to enable auto play using the auto mode in and out preset values. Issuing this command will clear all auto mode preset values, the auto mode status will be set high, and the in preset status, out preset status, preview in preset status, and preview out preset status will be set low.

2. **4C.14 00:01:00:00 “SPOT 1”**
   The controlling device issues a preset in command, specifying the starting time code position and the ID. The starting time code position is specified as 00:01:00:00 and the ID is specified as “SPOT 1”. Since “SPOT 1” already exists in the video disk recorder storage, the ID will be loaded. The current time code position will be set to 00:01:00:00. When the command is accepted and an ACK response is received by the controlling device the preroll status will be set high, and the cue complete will be set low. When the command has successfully completed, the preroll status will be set low, and the cue complete status will be set high. Since the preset in command clears the preset out point, there is no need to clear the preset out.

3. **20.01**
   The controlling device issues a play command to start playback. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts playback, so that the controlling device can frame accurately synchronize with other devices, etc. When playback begins, the video disk recorder will go into play mode, the play status and servo lock status will be set high, and the stop status will be set low.

4. **20.00**
   When playback is finished, the controlling device issues a stop command to stop the playback process. When playback stops, the video disk recorder will go into stop mode, the play status and servo lock status will be set low, and the stop status will be set high. Playback is now complete.

5.1.5. Playing Continuous Video Segments

This scenario describes a command sequence for playing several video segments of specified durations continuously using the auto mode features.

1. **40.41**
   The controlling device issues an auto mode on command to enable auto play using the auto mode in and out preset values and preview in and out preset values. Issuing this command will clear all auto mode preset values, the auto mode status will be set high,

and the in preset status, out preset status, preview in preset status, and preview out preset status will be set low.

2. **4C.14 00:01:00:00 "SPOT 1"**
   The controlling device issues an in preset command specifying the starting time code position and the ID. The in preset status will be set high to indicate a valid in preset has been set.
3. **44.15 00:01:30:00**
   The controlling device issues an out preset command specifying the ending time code position. The out preset status will be set high to indicate a valid out preset has been set.
4. **AC.04 00:02:30:00 "SPOT 2"**
   The controlling device issues a preview in preset command specifying the starting time code position and ID of the next video segment to play. The preview in preset status will be set high to indicate a valid preview in preset has been set.
5. **A4.05 00:03:00:00**
   The controlling device issues a preview out preset command specifying the ending time code position of the next video segment to play. The preview out preset status will be set high to indicate a valid preview out preset has been set.
6. **(no command)**
   The Video disk will indicate that is ready to play by setting the cue complete status bit.(Status byte 2, bit 0)
7. **20.01**
   The controlling device issues a play command to start the auto play process. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts playback, so that the controlling device can frame accurately synchronize with other devices, etc. When playback begins, the video disk recorder will go into play mode, the play status and servo lock status will be set high, and the stop status will be set low.
8. **(no command)**
   The video disk recorder will play material from the in preset position to the out preset position. When the out preset position has been reached, the preview in preset will be checked. If it is valid, the preview presets will be shifted to the presets, and the video disk recorder will load the specified ID and begin playback from the in preset position to the out preset position. When the preview presets have been shifted to the presets and the video disk recorder is ready to accept new preview presets, the preview in status and preview out status will be set low indicating to the controlling device that new preview presets may be set.
9. **AC.04 00:02:30:00 "SPOT X"**
   The controlling device issues a preview in preset command specifying the starting time code position and ID of the next video segment to play. The preview in preset status will be set high to indicate a valid preview in preset has been set.
10. **A4.05 00:03:00:00**
    The controlling device issues a preview out preset command specifying the ending time code position of the next video segment to play. The preview out preset status will be set high to indicate a valid preview out preset has been set.
11. **(wait for transition)**
    If the controlling device has more video segments to be played, then it should wait until the preview in and out status bytes are 0. Then steps 9 through 11 will be repeated until there are no more segments to be played. If there are no more video segments to be played, playback will automatically stop.

5.2. Control Using IDs Only

This section presents scenarios based around a control method that uses IDs only.

5.2.1. Recording with a Specified Duration to a New ID

This scenario describes a command sequence for recording video material of a specified duration to an existing ID using the auto mode features.

1. **AC.14 “SPOT 3”**
   The controlling device issues a record cue up with data command specifying the new ID. The starting time code position will default to 00:00:00:00. The in preset status will be set high to indicate a valid in preset has been set.
2. **44.15 00:00:30:00**
   The controlling device issues an out preset command specifying the duration as the ending time code position. The out preset status will be set high to indicate a valid out preset has been set. The video disk recorder can calculate the duration of the recording by subtracting the starting time code position from the ending time code position.
3. **20.02**
   The controlling device issues a record command to start the auto record process. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts recording, so that the controlling device can frame accurately synchronize the source material. When recording begins, the video disk recorder will go into record mode, the record status, play status, and servo lock status will be set high, and the stop status will be set low.
4. **(no command)**
   The video disk recorder will create the specified ID and record material from the in preset position to the out preset position.

5.2.2. Playing A Single Video Segment

This scenario describes a command sequence for playing a single video segment using the auto mode features. The durations are not specified, but rather are defaulted to the duration of the recorded material.

1. **40.41**
   The controlling device issues an auto mode on command to enable auto play using the auto mode in and out preset values and preview in and out preset values. Issuing this command will clear all auto mode preset values, the auto mode status will be set high, and the in preset status, out preset status, preview in preset status, and preview out preset status will be set low.
2. **48.14 “SPOT 1”**
   The controlling device issues an in preset command specifying the ID. The starting time code position will be default to 00:00:00:00. The in preset status will be set high to indicate a valid in preset has been set.
3. **40.15**
   The controlling device issues an out preset with no parameters. The ending time code position will default to the highest recorded time code position, plus one frame. In this case, that position is 00:00:30:00, and was set when the ID was recorded as described in section 5.2.1, Recording with a Specified Duration to a New ID, above. The out preset status will be set high to indicate a valid out preset has been set.
4. **A8.04 “SPOT 2”**

The controlling device issues a preview in preset command specifying the ID of the next video segment to play. The preview in preset status will be set high to indicate a valid preview in preset has been set.

5. **A0.05**
   The controlling device issues an preview out preset with no parameters. The ending time code position will default to the highest recorded time code position, plus one frame.
6. **20.01**
   The controlling device issues a play command to start the auto play process. There should be a fixed latency in number of frames from the time the command is issued until the video disk recorder actually starts playback, so that the controlling device can frame accurately synchronize with other devices, etc. When playback begins, the video disk recorder will go into play mode, the play status and servo lock status will be set high, and the stop status will be set low.
7. **(no command)**
   The video disk recorder will play material from the in preset position to the out preset position. When the out preset position has been reached, the preview in preset will be checked. If it is valid, the preview presets will be shifted to the presets, and the video disk recorder will load the specified ID and begin playback from the in preset position to the out preset position. When the preview presets have been shifted to the presets and the video disk recorder is ready to accept new preview presets, the preview in status and preview out status will be set low indicating to the controlling device that new preview presets may be set
8. **A8.04 “SPOT X”**
   The controlling device issues a preview in preset command specifying the ID of the next video segment to play. The preview in preset status will be set high to indicate a valid preview in preset has been set.
9. **A0.05**
   The controlling device issues an preview out preset with no parameters. The ending time code position will default to the highest recorded time code position, plus one frame.
10. **(wait for transition)**
    If the controlling device has more video segments to be played, then it should wait until the preview in and out status bytes are 0. Then steps 8 through 10 will be repeated until there are no more segments to be played. If there are no more video segments to be played, playback will automatically stop.

6. Additional Topics

Because of the nature of video disk recorders, especially the use of digital mass storage, they may have special requirements and can potentially provide capabilities beyond those available with video cassette recorders. This section discusses topics relating to those special requirements and advanced capabilities. This section is not intended to present requirements, but rather to present ideas that can form the basis for discussion and the development of future requirements to address special requirements and advanced capabilities.

6.1. Storage Management

When video disk recorders are implemented using computer technology such as disk drives and file systems, issues of storage management may arise.

The video disk recorder may allocate storage in units of disk storage rather than units of time. A controlling device will want to specify allocation in units of time, since these are the meaningful units in the application domain. This specification was written assuming that allocation can be performed using units of time.

The video disk recorder's storage may become fragmented after a period of time where material has been recorded and erased from the video disk recorder. This specification was written assuming that internal storage management, including defragmentation, will be handled transparently by the video disk recorder.

A video disk recorder implementation may require the controlling device to provide additional information or perform additional functions to assist with internal storage management, and subsequently commands may need to be modified or added to address those requirements.

6.2. Alternate Communication Methods

Since video disk recorders are often implemented using standard computer systems, other methods of communications may be possible. In particular, a video disk recorder may be connected via a network to other computer systems, including the controlling device. In a networked environment, commands could be issued through the network using protocols such as TCP/IP, IPX, RPC, etc. It would be expected that a command set and control method offered through a network interface be similar to the command and control method for the RS-422 port presented in this document, but other capabilities may be possible and other special requirements may exist for a network based communications method.

6.3. Direct Digital Video Transfers

Because most video disk recorders utilize compressed digital video storage, it is possible to transfer video material in a compressed digital format at a much higher speeds than would be possible in a real time analog format. A video disk recorder could transfer compressed digital video between its primary storage and secondary storage or other video disk recorders using the same video storage format. While it is highly desirable to be able to transfer digital compressed video between video disk recorders of dif-

ferent manufacturers as well as other equipment, this may not be possible until true industry wide standards for digital formats and compression methods are in place.

6.4. Archival Storage

A video disk recorder may provide some type of archival storage, such as additional disk drives or tape drives, as part of its hardware implementation. This archival storage could be used to either back up the video disk recorder's primary storage, or to provide a secondary storage for video material that is not required to be immediately accessible. Additional commands have been added to allow the transfer of video material between the video disk recorder's primary and secondary storage.

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