AV/C Camera Subunit Specification

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Abstract: This document defines models and common command sets for an AV/C video and still camera subunit. The AV/C protocol defines models and command sets for a variety of professional and consumer electronics devices operated over IEEE 1394 - 1995. The AV/C command sets make use of the Function Control Protocol (FCP) defined by IEC - 61883 - FDIS, Digital Interface for Consumer Electric Audio/Video Equipment standard, for the transport of audio/video command and response. The audio/video devices are implemented as a common unit architecture within 1394 - 1995.

Keyword: Audio, Video, 1394, Digital, Interface

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Part I. Introduction

1. References

AV/C Master Index: Guide to AV/C Specification Documents - this document is available on the 1394 Trade Association web site noted above, and is kept up to date with the latest released versions of AV/C specifications. The reader is encouraged to always consult this document for information on the latest versions of specifications mentioned here, as well as specifications which may be developed in the future.

AV/C Digital Interface Command Set for VCR Subunit Specification, version 2.0.1, January 5, 1998

AV/C Tuner Model Working Specification Version 1.0W

IEEE Std 1394 - 1995, Standard for a High Performance Serial Bus

IEC - 61883, proposed standard for Digital Interface for Consumer Electronic Audio/Video Equipment

ISO/IEC 13123:1994, Control and Status Register (CSR) Architecture for Microcomputer Buses

HD Digital VCR Conference, Specifications of Consumer - Use Digital VCR's using 6.3 mm magnetic tape (December 1995)

2. Definitions and Abbreviations

2.1 Conformance

Several keywords are used to differentiate between different levels of requirements and optionality, as follows:

expected: A keyword used to describe the behavior of the hardware or software in the design models assumed by this specification. Other hardware and software design models may also be implemented.

may: A keyword that indicates flexibility of choice with no implied preference.

shall: A keyword indicating a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other products conforming to this specification.

should: A keyword indicating flexibility of choice with a strongly preferred alternative. Equivalent to the phrase "is recommended."

2.2 Technical Glossary

AV unit: The physical instantiation of a consumer electronic device, *e.g.*, a camcorder or a VCR, within a Serial Bus node. This document describes a command set that is par of the software unit architecture for AV units.

AV subunit: An instantiation of a virtual entity that can be identified uniquely within an AV unit and offers a set of coherent functions.

AV/C: Audio/video control, as in the AV/C Digital Interface Command Set specified by this document.

byte: Eight bits of data.

CSR: A node or unit Control and Status Register, as defined by IEEE Std 1394 - 1995

DVCR: Digital video cassette recorder as defined by the HD Digital VCR Conference, Specifications of Consumer - Use Digital VCR's using 6.3 mm magnetic tape.

EUI - 64: Extended Unique Identifier, 64 - bits, as defined by the IEEE. The EUI - 64 is a concatenation of the 24 - bit company_ID obtained from the IEEE Registration Authority Committee (RAC) and a 40 - bit number (typically a silicon serial number) that the vendor identified by company_ID guarantees to be unique for all of its products. The EUI - 64 is also known as the node unique ID and is redundantly present in a node's configuration ROM in both the Bus_Info_Block and the Node_Unique_Id leaf.

FCP: Function Control Protocol, as defined by IEC - 1883, proposed standard for Digital Interface for Consumer Electronic Audio/Video Equipment.

IEEE: The Institute of Electrical and Electronics Engineers, Inc.

isochronous: A term that indicates the essential characteristic of a time - scale or signal, such that the time intervals between consecutive instances either have the same duration or durations that are integral multiples of the shortest duration. In the context of Serial Bus, "isochronous" is taken to mean a bounded worst - case latency for the transmission of data; physical and logical constraints that introduce jitter preclude the exact definition of "isochronous".

module: The smallest component of physical management, *i.e.*, a replaceable device.

nibble: Four bits of data. A byte is composed of two nibbles.

node: An addressable device attached to Serial Bus with at least the minimum set of control registers defined by IEEE Std 1394 - 1995.

node ID: A 16 - bit number, unique within the context of an interconnected group of Serial Buses. The node ID is used to identify both the source and destination of Serial Bus asynchronous data packets. It can identify one single device within the addressable group of Serial Buses (unicast), or it can identify all devices (broadcast).

plug: A physical or virtual end - point of connection implemented by an AV unit or subunit that may receive or transmit isochronous or other data. Plugs may be Serial Bus plugs, accessible through the PCR's; they may be external, physical plugs on the AV unit; or they may be internal virtual plugs implemented by the AV subunits.

quadlet: Four bytes of data.

Serial Bus: The physical interconnects and higher level protocols for the peer - to - peer transport of serial data, as defined by IEEE Std 1394 - 1995.

SMPTE/EBU time code: Time code format for professional use.

stream: A time - ordered set of digital data originating from one source and terminating at zero or more sinks. A stream is characterized by bounded bandwidth requirements and by synchronization points, or time stamps, within the stream data.

unit architecture: The formal specification of the format and function of the software - visible resources and behaviors of a class of units. This document, in conjunction with the references above, defines a unit architecture for the class of AV devices.

Part II. Camera Subunit

3. Camera Subunit Model

3.1 Camera Logical Model

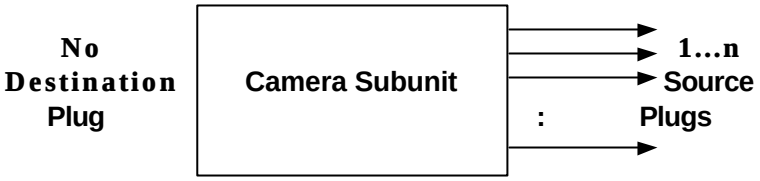

Figure 3.1 - 1 Camera Subunit Logical Model

The Camera Subunit may support multiple streams and asynchronous outputs depend on the implementation. It may have no destination Plug and may have one to n source Plugs.

4. Camera Subunit Commands

The camera subunit commands are identified by a *subunit_type* value of seven and a *subunit_ID* value between zero and seven, inclusive. Table 4 - 1 below summarizes the camera subunit commands.

Table 4 - 1 Camera subunit commands

Opcode	Value	Support level (by ctype) C	S	N	Comments
AE MODE	40_{16}	*	M	-	Control automatic exposure mode
AE SHIFT	42_{16}	O	O	-	Control the amount of light
AF MODE	$C8_{16}$	M	M	-	Control automatic focussing mode
AGC GAIN	45_{16}	M	M	-	Control AGC gain
AGC MAXIMUM GAIN	74_{16}	-	*	-	Report maximum value of AGC gain
CCD SCAN MODE	$7A_{16}$	R	R	-	Control scan mode of imaging de - vices
CONTRAST	55_{16}	O	O	-	Control contrast
DIGITAL ZOOM	60_{16}	M	M	-	Control digital zoom
DIGITAL ZOOM MAX LIMIT	61_{16}	O	O	-	Control to limit of maximum magnification of digital zoom
FLASH	48_{16}	O	O	-	Report status of electronic flash
FOCAL LENGTH	$C3_{16}$	O	O	-	Control or report focal length of the optical system
FOCUS	$C1_{16}$	*	M	-	Control motion of focussing lens group of the optical system
FOCUSSING POSITION	$C2_{16}$	O	O	-	Control position of focussing lens group of the optical system
FREEZE	62_{16}	R	R	-	Control to still the picture
GAMMA	52_{16}	O	O	-	Control gamma correction
HUE	$5C_{16}$	O	O	-	Control hue
IMAGE STABILIZER	DC_{16}	O	O	-	Control image stabilizer
IRIS	43_{16}	*	M	-	Control diaphragm of the optical system

continued on next page

Continued from previous page

Opcode	Value	Support level (by ctype) C	S	N	Comments
IRIS RANGE	75_{16}	-	*	-	Report maximum/minimum F.No of diaphragm
ND FILTER	CB_{16}	O	O	-	Control neutral density filter
RANGE	70_{16}	-	*	-	Report maximum/minimum value
REVERSE	64_{16}	O	O	-	Control to reverse picture state between positive and negative
PAN	DA_{16}	O	O	-	Control panhead in a panning direction
SATURATION	$5B_{16}$	O	O	-	Control saturation of color
SETUP LEVEL	54_{16}	O	O	-	Control setup level
SHARPNESS	56_{16}	O	O	-	Control sharpness
SHUTTER SPEED	44_{16}	R	R	-	Control shutter speed
SUPPORT LEVEL PROFILE	72_{16}	-	M	-	Report support level of camera subunit
TILT	DB_{16}	O	O	-	Control panhead in a tilting direction
VIDEO LIGHT	49_{16}	O	O	-	Control video light
WHITE BALANCE	$5D_{16}$	R	R	-	Control white balance
ZOOM	$C4_{16}$	*	M	-	Control motion of zoom lens group of the optical system

In the preceding tables, a dash in the support level column indicates that a command is not defined for the indicated *ctype* value, CONTROL, STATUS, or NOTIFY. An asterisk in the support level column indicates that the command operands or type of subunit determine whether the command is mandatory (M), recommended (R) or optional (O). The specific command formats and corresponding response frame formats are described for each of the commands in the clauses that follow.

Note) If a camera subunit does not have the capabilities specified by any command whose support level is mandatory, except for the SUPPORT LEVEL PROFILE command, this command may not be implemented in the camera subunit.

4.1 AE MODE command

The AE MODE control command is used to control the automatic exposure mode.
The structure of the AE MODE control command is illustrated in Figure 4.1 - 1 below.

	msb							lsb
opcode	AE MODE							
operand[0]	mode							

Figure 4.1 - 1 AE MODE control command format

The mode field specifies the mode of automatic exposure, as defined in Table 4.1 - 1 below.

Table 4.1 - 1 AE modes

Mode	Value	Support level	Description
FULL AUTOMATIC	00_{16}	M	A camera subunit controls all parameters of exposure
GAIN PRIORITY MODE	01_{16}	R	A camera subunit controls pa - rameters of exposure except gain
SHUTTER PRIORITY MODE	02_{16}	R	A camera subunit controls pa - rameters of exposure except shutter speed
IRIS PRIORITY MODE	04_{16}	R	A camera subunit controls pa - rameters of exposure except di - aphragm
MANUAL	$0F_{16}$	M	A camera subunit do not control exposure

Note) If a camera subunit has the capabilities specified by the *mode* field in the AE MODE control command, but cannot realize these functions because of the mechanical switch used to select the automatic exposure mode, then the camera subunit may return a REJECTED response to the AE MODE control command, if the *mode* indicated by the switch is different from the *mode* of the AE MODE control command, e.g. the *mode* field indicates MANUAL mode, while the mechanical switch indicates FULL AUTOMATIC mode.

The AE MODE status command is used to obtain information about the automatic exposure mode. The format of the AE MODE status command is illustrated in Figure 4.1 - 2 below.

	msb							lsb
opcode	AE MODE							
operand[0]	FF_{16}							

Figure 4.1 - 2 AE MODE status command format

In the response frame returned by the camera subunit, *operands* are replaced with the current mode, as defined in Table 4.1 - 1 above.

4.2 AE SHIFT command

The AE SHIFT control command is used to change the target value in the automatic exposure mode. The format of the AE SHIFT control command is illustrated in Figure 4.2 - 1 below.

	msb							lsb
opcode	AE MODE							
operand[0]	subfunction							

Figure 4.2 - 1 AE SHIFT control command format

The value of the *subfunction* field controls the value in the automatic exposure mode, as defined in Table 4.2 - 1 below.

Table 4. 2 - 1 AE shift subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	Increase the exposure value one step further
DECREMENT	02_{16}	Reduce the exposure value one step further
reserved	03_{16} - FF_{16}	Reserved for future specification

Note) The results of the AE SHIFT control command with *operand* of which value is INCREMENT or DECREMENT depend on each vendor.

The AE SHIFT status command is used to obtain information about a change in the value of the automatic exposure mode. The format of the AE SHIFT status command is illustrated in Figure 4.2 - 2 below.

	msb							lsb
opcode	AE SHIFT							
operand[0]	FF_{16}							

Figure 4.2 - 2 AE SHIFT status command format

If the camera subunit is able to return a STABLE response to the AE SHIFT status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.3 AF MODE command

The AF MODE control command is used to change the automatic focussing mode. The format of the AF MODE control command is illustrated in Figure 4.3 - 1 below.

	msb							lsb
opcode	AE MODE							
operand[0]	focussing_mode							

Figure 4.3 - 1 AF MODE control command format

The *focussing_mode* field specifies the automatic focussing mode, as defined in Table 4.3 - 1 below.

Table 4.3 - 1 Focussing modes

Focussing Mode	Value	Description
FOCUSSING AUTO	00_{16}	Automatic focussing mode
FOUCUSSING MANUAL	01_{16}	Manual focussing mode
reserved	02_{16} - FF_{16}	reserved for future specification

The AF MODE status command is used to obtain information about the automatic focussing mode that is currently set. The format of the AF MODE status command is illustrated in Figure 4.3 - 2 below.

	msb							lsb
opcode	AE MODE							
operand[0]	FF_{16}							

Figure 4.3 - 2 AF MODE status command format

In the response frame returned by camera subunit, *operands* are replaced with the current mode, as defined in Table 4.3 - 1 above.

4.4 AGC GAIN command

The AGC GAIN control command is used to change the value of the master gain in the automatic gain control (AGC) in the camera subunit. The format of the AGC GAIN control command is illustrated in Figure 4.4 - 1 below.

	msb							lsb
opcode	AGC GAIN							
operand[0]	subfunction							

Figure 4.4 - 1 AGC GAIN control command format

Note) If the camera subunit is able to return an ACCEPTED response to the AGC GAIN control command, the automatic exposure mode described in the “AE MODE command” clause above, shall be GAIN PRIORITY MODE or MANUAL MODE.

The *subfunction* field value controls changes in the gain used by the target, as defined in Table 4.4 - 1 below.

Table 4.4 - 1 Gain subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The AGC master gain is increased one step further.
DECREMENT	02_{16}	The AGC master gain is reduced one step further.
reserved	03_{16} - FF_{16}	Reserved for future specification

Note) Changes in the AGC master gain as a result of the AGC GAIN control command with *operand* of which value is INCREMENT or DECREMENT depend on each vendor.

The AGC GAIN status command may also be used to obtain information about the AGC master gain that is currently set in a camera subunit. The format of the AGC GAIN command with *a ctype* value for STATUS is illustrated in Figure 4.4 - 2 below.

	msb							lsb
opcode	AGC GAIN							
operand[0]	FF_{16}							

Figure 4.4 - 2 AGC GAIN response format

The information returned is formatted in a response frame, as shown in Figure 4.4 - 3 below.

	msb							lsb
opcode	AGC GAIN							
operand[0]	gain							

Figure 4.4 - 3 AGC GAIN status command format

In the response frame returned following an AGC GAIN status command, the *gain* indicates the gain value of AGC, as defined by the HD Digital VCR Conference, Specification of Consumer - Use Digital VCR's using 6.3 mm magnetic tape.
The gain value is obtained as follows:

$20_{16} = 0$ [db]
$\Delta 1$ [LSB] = 0.5 [db]

4.5 AGC MAXIMUM GAIN command

The AGC MAXIMUM GAIN status command is used to ascertain the maximum value of the AGC gain. The format of the AGC MAXIMUM GAIN status command is illustrated in Figure 4.5 - 1 below.

	msb							lsb
opcode	AGC MAXIMUM GAIN							
operand[0]	FF_{16}							

Figure 4.5 - 1 AGC MAXIMUM GAIN status command format

The AGC MAXIMUM GAIN command shall be used only with a *ctype* value for STATUS. If the camera subunit is able to return a STABLE response to the AGC MAXIMUM GAIN status command, the AV/C response frame has the format shown in Figure 4.5 - 2 below.

	msb							lsb
opcode	AGC MAXIMUM GAIN							
operand[0]	max_gain							

Figure 4.5 - 2 AGC MAXIMUM GAIN response format

In the response frame following an AGC MAXIMUM GAIN status command, the *max_gain* field is the maximum value of the AGC gain. The format of the *max_gain* field is represented by a previously defined field, the *gain* field in the AGC GAIN command.

> Note) If the camera subunit implement the AGC GAIN command, the AGC MAXIMUM GAIN command shall also be supported by the camera subunit.

4.6 CCD SCAN MODE command

The CCD SCAN MODE control command is used to control the scanning mode of the imaging devices in a camera subunit. The format of the CCD SCAN MODE control command is illustrated in Figure 4.6 - 1 below.

	msb							lsb
opcode	SCAN MODE							
operand[0]	subfunction							

Figure 4.6 - 1 SCAN MODE control command format

The *subfunction* field controls the scanning mode, as defined in Table 4.6 - 1 below.

Table 4.6 - 1 Scan modes

Subfunction	Value	Description
INTERLACE MODE	00_{16}	Set to the interlace mode
EX - INTERLACE MODE	01_{16}	Set to the progressive mode
reserved	02_{16} - FF_{16}	Reserved for future specification

The CCD SCAN MODE status command is used to ascertain the scanning mode of the imaging devices in a camera subunit. The format of the CCD SCAN MODE status command is illustrated in Figure 4.6 - 2 below.

	msb							lsb
opcode	SCAN MODE							
operand[0]	FF_{16}							

Figure 4.6 - 2 SCAN MODE status command format

In the response frame returned by a camera subunit, *operands* are replaced with the current mode and subfunction, as defined in Table 4.6 - 1 above.

4.7 CONTRAST command

The CONTRAST control command is used to change the contrast value in the camera subunit. The format of the CONTRAST control command is illustrated in Figure 4.7 - 1 below.

	msb							lsb
opcode	CONTRAST							
operand[0]	subfunction							

Figure 4.7 - 1 CONTRAST control command format

The *subfunction* field value determines the contrast used by the target, as defined in Table 4.7 - 1 below.

Table 4.7 - 1 Contrast subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The contrast is increased one step further.
DECREMENT	02_{16}	The contrast is reduced one step further.
reserved	03_{16} - FF_{16}	Reserved for future specification

Note) The alteration of contrast as a result of the CONTRAST control command with *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The CONTRAST status command may also be used to obtain information about the contrast that is currently set in a camera subunit. The format of the contrast command with a *ctype* value for STATUS is illustrated in Figure 4.7 - 2 below.

	msb							lsb
opcode	CONTRAST							
operand[0]	FF_{16}							

Figure 4.7 - 2 CONTRAST status command format

If the camera subunit is able to return a STABLE response to the CONTRAST status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.8 DIGITAL ZOOM command

The DIGITAL ZOOM control command is used to change the digital zoom status of a camera subunit. The format of the DIGITAL ZOOM control command is illustrated in Figure 4.8 - 1 below.

	msb							lsb
Opcode	DIGITAL ZOOM							
Operand[0]	digital_zoom_state							

Figure 4.8 - 1 DIGITAL ZOOM control command format

Note) The DIGITAL ZOOM control command shall only change the digital zoom status, whether the camera subunit is digital zoom enabled or not. The digital zoom magnification may change according to the ZOOM control command.

When the DIGITAL ZOOM command is issued with a *ctype* value for CONTROL, the *digital_zoom_state* field specifies the desired digital zoom state of the camera subunit. The *digital_zoom_state* is encoded according to Table 4.8 - 1 below.

Table 4.8 - 1 Digital zoom state

Digital Zoom State	Value	Description
DIGITAL ZOOM DISABLE	60_{16}	Disable the digital zoom
DIGITAL ZOOM ENABLE	70_{16}	Enable the digital zoom
reserved	Other values	Reserved for future specification

The DIGITAL ZOOM command with a *ctype* value for STATUS may be used to determine the current digital zoom state of the camera subunit. The format of the DIGITAL ZOOM status command is illustrated in Figure 4.8 - 2 below.

	msb							lsb
opcode	DIGITAL ZOOM							
operand[0]	FF_{16}							

Figure 4.8 - 2 DIGITAL ZOOM status command format

In the response frame returned by camera subunit, *operands* are replaced with the current digital zoom status as defined in Table 4.8 - 1 above.

4.9 DIGITAL ZOOM MAX LIMIT command

The DIGITAL ZOOM MAX LIMIT control command is used to limit the maximum digital zoom magnification. The format of the DIGITAL ZOOM MAX LIMIT control command is illustrated in Figure 4.9 - 1 below.

	msb							lsb
opcode	DIGITAL ZOOM MAX LIMIT							
operand[0]	Subfunction							

Figure 4.9 - 1 DIGITAL ZOOM MAX LIMIT control command format

The value of the *subfunction* field determines the maximum limit of the digital zoom used by the target, as defined in Table 4.9 - 1 below.

Table 4.9 - 1 Digital zoom maximum limit subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The maximum limit of digital zoom is increased one step further.
DECREMENT	02_{16}	The maximum limit of digital zoom is reduced one step further.
Reserved	03_{16} - FF_{16}	reserved for future specification

Note) The alteration of maximum limit of digital zoom as a result of the DIGITAL ZOOM MAX LIMIT control command with *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The DIGITAL ZOOM MAX LIMIT status command is used to ascertain the value of magnification that is limited by the DIGITAL ZOOM MAX LIMIT control command described above. The format of the DIGITAL ZOOM MAX LIMIT status command is illustrated in Figure 4.9 - 2 below.

	msb							lsb
opcode	DIGITAL ZOOM MAX LIMIT							
operand[0]	FF_{16}							

Figure 4.9 - 2 DIGITAL ZOOM MAX LIMIT status command format

If the camera subunit is able to return a STABLE response to the DIGITAL ZOOM MAX LIMIT status command, the AV/C response frame has the format illustrated in Figure 4.9 - 3 below.

	msb							lsb
opcode	DIGITAL ZOOM MAX LIMIT							
operand[0]	magnification							

Figure 4.9 - 3 DIGITAL ZOOM MAX LIMIT response format

The *magnification* field indicates the maximum magnification value that is limited by the DIGITAL ZOOM MAX LIMIT control command described above. The maximum magnification value is determined as follows:

$$\text{Maximum magnification} = \textit{magnification} \times 10^{-1}$$

magnification: unsigned integer

4.10 FLASH command

The FLASH status command is used to ascertain the status of the electronic flash in the camera subunit. The format of the FLASH status command is illustrated in Figure 4.10 - 1 below.

	msb							lsb
opcode	FLASH							
operand[0]	FF_{16}							
operand[1]								

Figure 4.10 - 1 FLASH status command format

The FLASH command shall be used only with a *ctype* for STATUS. If the camera subunit is able to return a STABLE response to the FLASH status command, the AV/C response frame has the format illustrated in Figure 4.10 - 2 below.

	msb							lsb
opcode	FLASH							
operand[0]	flash_state							
operand[1]	charge							

Figure 4.10 - 2 FLASH status command format

In the response frame after a FLASH status command, the *flash_state* field indicates electronic flash state. The *flash_state* field is encoded as shown in Table 4.10 - 1 below.

Table 4.10 - 1 Flash states

Name	Value	Description
OFF	60_{16}	Power off of electronic flash
CHARGING	71_{16}	Under charging
COMPLETE	72_{16}	Completed charging
reserved	other values	Reserved for future specification

In the response frame after a FLASH status command, the *charge* field indicates the degree of charging in terms of a percentage of the electronic flash. If the *flash_state* field indicates a CHARGING value, the *charge* field value shall be within a range of 00_{16} to 64_{16}. If the *flash_state* field indicates an OFF or COMPLETE value, the *charge* field value shall be FF_{16}.

4.11 FOCAL LENGTH command

The FOCAL LENGTH control command is used to change the focal length of the optical system in a camera subunit. The format of the FOCAL LENGTH control command is illustrated in Figure 4.11 - 1 below.

	msb							lsb
opcode	FOCAL LENGTH							
operand[0]	type							
operand[1]	type_dependent_field							
operand[2]								

Figure 4.11 - 1 FOCAL LENGTH control command format

The *type* field is used to distinguish a means to specify the focal length of the optical system in a camera subunit directly or relatively, as defined in Table 4.11 - 1 below.

Table 4.11 - 1 Focal length types

Focal Length Type	Value	Description
ABSOLUTE FOCAL LENGTH	00_2	Specify directly by using real value
NORMALIZED FOCAL LENGTH	01_2	Specify directly by using normalized value of 35mm film camera lens with same horizontal angle of view.
RELATIVE FOCAL LENGTH	10_2	Specify relatively
reserved	11_2	Reserved for future specification

If the *type* field has a value that indicates ABSOLUTE FOCAL LENGTH, the *type_dependent_field* shall specify the focal length of the optical system in the camera subunit by using a real value.

If the *type* field has a value that indicates NORMALIZED FOCAL LENGTH, the *type_dependent_field* shall specify the focal length of the optical system in the camera subunit by using the normalized value of a 35mm film camera lens with the same horizontal angle of view.

When the FOCAL LENGTH control command is issued with a *type* value for ABSOLUTE FOCAL LENGTH or NORMALIZED FOCAL LENGTH, the format of the FOCAL LENGTH control command is as shown in Figure 4.11 - 2 below.

	msb							lsb
opcode	FOCAL LENGTH							
operand[0]	type=00_2 or 01_2			$3F_{16}$				
operand[1]	focal_length_power							
operand[2]	focal_length_base							

Figure 4.11 - 2 FOCAL LENGTH control command format at *type*=00_2 or 01_2

The *focal_length_power* and the *focal_length_base* fields specify a focal length. The value of the focal length is determined as follows:

focal length = *focal_length_base* $\times 10^{\text{focal\_length\_power}}$ [mm]
focal_length_base: unsigned integer
focal_length_power: signed integer (2's complement)

If the *type* field has a value that indicates RELATIVE FOCAL LENGTH, the *type_dependent_field* shall specify the position of the lens groups over the full movable range of the optical system to change the focal length. When the FOCAL LENGTH control command is issued with a *type* value for RELATIVE FOCAL LENGTH, the format of the FOCAL LENGTH control command is as shown in Figure 4.11 - 3 below.

	msb							lsb
opcode	FOCAL LENGTH							
operand[0]	type=10_2			$3F_{16}$				
operand[1]	1	percentage						
operand[2]	FF_{16}							

Figure 4.11 - 3 FOCAL LENGTH control command format at type=10_2

The *percentage* field shall specify a position as a percentage of the entire movable range. The minimum value of the focal length is 0% and the maximum value is 100%. The *percentage* field value shall be in a range of 00_{16} to 64_{16}.

The FOCAL LENGTH status command is used to ascertain the current focal length of the optical system in a camera subunit. The format of the FOCAL LENGTH status command is illustrated in Figure 4.11 - 4 below.

	msb							lsb
opcode	FOCAL LENGTH							
operand[0]	type			$3F_{16}$				
operand[1]	FF_{16}							
operand[2]								
operand[3]								

Figure 4.11 - 4 FOCAL LENGTH status command format

The *type* field shall be specified as Table 4.11 - 1 above.

If the camera subunit is able to return a STABLE response to the FOCAL LENGTH status command, the AV/C response frame has the format illustrated in Figure 4.11 - 5 below.

	msb							lsb
opcode	FOCAL LENGTH							
operand[0]	type			type_dependent_field				
operand[1]								
operand[2]								
operand[3]	extend	extender_ratio						

Figure 4.11 - 5 FOCAL LENGTH response format

The *type_dependent_field* indicates the current focal length of the optical system in a camera subunit. The *type_dependent_field* format depends on the *type* field in the FOCAL LENGTH status command. In the response frame returned by the camera subunit, the *type_dependent_field* format is the same as the FOCAL LENGTH control command, as defined in Table 4.11 - 2 and Table 4.11 - 3 above.

NOTE) If the camera subunit implements the FOCAL LENGTH command but the camera subunit does not provide the FOCAL LENGTH command format specified by the *type* field, the camera subunit shall return a response frame indicating NOT IMPLEMENTED value.

The *extend* and the *extender_ration* fields indicate the status of the extender. The relationship among the extender status, the *extend* values and the *extender_ration* field is shown in Table 4.11 - 2 below.

Table 4.11 - 2 Extend and extender_ratio field

extend	extender_ratio	Description
0	00_{16} - $7E_{16}$	The camera subunit shall not return this value.
	$7F_{16}$	The camera subunit has a means to detect installation of the extender, but the extender is removed.
1	00_{16}	The camera subunit has a means to detect installation of the extender, but the camera subunit does not have a means to detect extender magnification.
	01_{16} - $7E_{16}$	The camera subunit has a means to detect installation and extender magnification, and the *extender_ratio* field indicates extender magnification
	$7F_{16}$	The camera subunit does not have a means to detect installation of the extender.

4.12 FOCUS command

The FOCUS control command is used to control the movement of the focus lens group. The format of the FOCUS control command is illustrated in Figure 4.12 - 1 below.

	msb							lsb
opcode	FOCUS							
operand[0]	focus_mode							

Figure 4.12 - 1 FOCUS control command format

The *focus_mode* field value controls the movement of the focus lens group in the manner defined in Table 4.12 - 1 below.

Table 4.12 - 1 Focus modes

Focus Mode	Value	Support level	Description
FOCUS FASTEST	31_{16}	O	Move the focus lens group to infinity direction
FOCUS ∞ 6	33_{16}	O	
FOCUS ∞ 5	35_{16}	O	
FOCUS ∞ 4	37_{16}	O	
FOCUS ∞ 3	39_{16}	O	
FOCUS ∞ 2	$3B_{16}$	O	
FOCUS ∞ 1	$3D_{16}$	O	
FOCUS ∞ SLOWEST	$3F_{16}$	M	
FOCUS STOP	60_{16}	M	Stop the focus lens group
FOCUS NEAR SLOWEST	41_{16}	M	Move the focus lens group to near direction
FOCUS NEAR 1	43_{16}	O	
FOCUS NEAR 2	45_{16}	O	
FOCUS NEAR 3	47_{16}	O	
FOCUS NEAR 4	49_{16}	O	
FOCUS NEAR 5	$4B_{16}$	O	
FOCUS NEAR 6	$4D_{16}$	O	
FOCUS NEAR FASTEST	$4F_{16}$	O	

The subunit support level for FOCUS, mandatory (M), and optional (O), varies according to the focus mode requested.

A camera subunit need not provide all eight possible focus speeds; rather it is required only to map all possible focus modes for the speeds that it does support. The actual speeds encoded by the focus modes shall be subject to one of the following restrictions, as appropriate:

$$\infty \text{ SLOWEST} \leq \infty 1 \leq \infty 2 \leq \infty 3 \leq \infty 4 \leq \infty 5 \leq \infty 6 \leq \infty \text{ FASTEST}$$

or

$$\text{NEAR SLOWEST} \leq \text{NEAR 1} \leq \text{NEAR 2} \leq \text{NEAR 3} \leq \text{NEAR 4} \leq \text{NEAR 5} \leq \text{NEAR 6} \leq \text{NEAR FASTEST}$$

The FOCUS status command is used to ascertain the current focus state of the focussing mechanism. The format of the FOCUS status command is illustrated in Figure 4.12 - 2 below.

	msb							lsb
opcode	FOCUS							
operand[0]	FF_{16}							

Figure 4.12 - 2 FOCUS status command format

The FOCUS command shall be used only with a *ctype* for STATUS. The information returned is formatted in a response frame, as shown in Figure 4.12 - 3 below.

	msb							lsb
opcode	FOCUS							
operand[0]	focus_state							

Figure 4.12 - 3 FOCUS response format

In the response frame following a FOCUS status command, the *focus_state* indicates the state of focus, as defined in Table 4.12 - 2 below.

Table 4.12 - 2 Focus state values

Focus state	Value	Comment
As defined by Table 4.12 - 1		Any of the values defined for the FOCUS command may be returned to indicate the corresponding focus state.
UNSPECIFIED ∞	31_{16}	One of the ∞ focus state, 31_{16} - $3F_{16}$
UNSPECIFIED NEAR	41_{16}	One of the NEAR focus state, 41_{16} - $4F_{16}$

If a camera subunit is unable to precisely determine its focus state, it may return a response that indicates one of UNSPECIFIED states described in Table 4.12 - 2 above.

A camera subunit that supports only one speed for any of the focus groups, FOCUS ∞ or FOCUS NEAR, shall return the corresponding UNSPECIFIED code when in one of these focus states.

A camera subunit that supports two or more speeds for any of the focus groups shall return a code that corresponds to the actual speed of the focus lens group, as defined in the mapping described in Table 4.12-1; however, it may not be equal to the *focus_mode* operand of the FOCUS control command that indicates the operation.

4.13 FOCUSSING POSITION command

The FOCUSSING POSITION control command is used to move the focussing lens group. The format of the FOCUSSING POSITION control command is shown in Figure 4.13 - 1 below.

	msb							lsb
opcode	FOCUSING POSITION							
operand[0]	type	type_dependent_field						
operand[1]								
operand[2]								

Figure 4.13 - 1 FOCUSSING POSITION control command format

The *type* field is used to distinguish a means to specify the position of the focussing lens group directly or relatively, as defined in Table 4.13 - 1 below.

Table 4.13 - 1 Focussing position types

Focussing Position Type	Value	Description
ABSOLUTE FOCUSSING POSITION	0	Specify the focussing position directly by using a distance of a subject
RELATIVE FOCUSSING POSITION	1	Specify the focussing position relatively

If the *type* field has a value which indicates ABSOLUTE FOCUSSING POSITION, the format of the FOCUSSING POSITION control command is illustrated in Figure 4.13 - 2 below.

	msb							lsb
opcode	FOCUSING POSITION							
operand[0]	*type*=0	$7F_{16}$						
operand[1]	inf	position_power						
operand[2]	position_base							

Figure 4.13 - 2 FOCUSSING POSITION control command format at *type*=0

The *inf* field indicates movement of the focussing lens group into a position that assumes the subject distance to be infinity. A value of one indicates that the camera subunit shall move the focussing lens group into the infinity position. If the *inf* field is set to one, the *position_power* field shall be set to value of $7F_{16}$ as described below.

The *position_power* and the *position_base* fields specify the position of the focussing lens group. The position of the focussing lens group is indicated by using the distance of a subject as follows:

$$\text{focus position} = \textit{position\_base} \times 10^{\text{position\_power}} \text{ [cm]}$$

position_base: unsigned integer
position_power: signed integer (2's complement)

When the FOCUSSING POSITION control command is issued with a *type* value for RELATIVE FOCUSSING POSITION, the format of the FOCUSSING POSITION control command is as shown in Figure 4.13 - 3 below.

	msb							lsb
opcode	FOCUSING POSITION							
operand[0]	*type*=1	percentage						
operand[1]	FF_{16}							
operand[2]								

Figure 4.13 - 3 FOCUSSING POSITION control command format at *type*=1

The *percentage* field shall specify a position as a percentage of the entire movable range. When the distance of a subject is infinity, the position of the focussing lens group is 0%.

The FOCUSSING POSITION status command is used to ascertain the current position of the focussing lens group. The format of the FOCUSSING POSITION status command is illustrated in Figure 4.13 - 4 below.

	msb							lsb
opcode	FOCUSING POSITION							
operand[0]	type	$7F_{16}$						
operand[1]	FF_{16}							
operand[2]								

Figure 4.13 - 4 FOCUSSING POSITION status command format

The *type* field shall be specified as Table 4.13 - 1 above.

When the FOCUSSING POSITION status command is issued with a *type* value for ABSOLUTE FOCUSSING POSITION, the format of the response frame is the same as the FOCUSSING POSITION control command with a *type* value for ABSOLUTE FOCUSSING POSITION as defined in Figure 4.13 - 2 above.

When the FOCUSSING POSITION status command is issued with a *type* value for RELATIVE FOCUSSING POSITION, the format of the response frame is as shown in Figure 4.13 - 5 below.

	msb							lsb
opcode	FOCUSING POSITION							
operand[0]	*type*=1	percentage						
operand[1]	o_i	o_n	$3F_{16}$					
operand[2]	FF_{16}							

Figure 4.13 - 5 FOCUSSING POSITION response format at type=1

The *o_i* bit indicates whether or not the position of the focussing lens group has exceeded the end of infinity. If the position of the focussing lens group has exceeded the end of infinity, the *o_i* bit shall be set to one. If the position of the focussing lens group has not exceeded the end of infinity, the *o_i* bit shall be set to zero.

The *o_n* bit indicates whether or not the position of the focussing lens group has exceeded end of near. If the position of the focussing lens group has exceeded the end of near, the *o_n* bit shall be set to one. If the position of the focussing lens group has not exceeded the end of near, the *o_n* bit shall be set to zero.

4.14 FREEZE command

The FREEZE control command is used to take still pictures.
The format of the FREEZE control command is illustrated in Figure 4.14 - 1 below.

	msb							lsb
opcode	FREEZE							
operand[0]	mode							

Figure 4.14 - 1 FREEZE control command format

The *mode* field controls the status of the image, as defined in Table 4.14 - 1 below.

Table 4.14 - 1 Freeze mode values

Mode	Value	Comment
FREEZE OFF	00_{16}	Set the status of the image to motion
FREEZE ON	01_{16}	Set the status of the image to still

Note) If the camera subunit is not able to return the response frame to the FREEZE control command, because the camera subunit is determining the parameters of a specific action, e.g. focussing or automatic exposure, it shall return a response frame issued with a *response* value of INTERIM.

The FREEZE status command is used to ascertain the current status of the picture being taken. The format of the FREEZE status command is illustrated in Figure 4.14 - 2 below.

	msb							lsb
opcode	FREEZE							
operand[0]	FF_{16}							

Figure 4.14 - 2 FREEZE status command format

In the response frame returned by camera subunit, *operands* are replaced with the current mode as defined in Table 4.14 - 1 above.

Note) If a response frame that has a *mode* value for FREEZE OFF is returned by the camera subunit and the camera subunit receives a FREEZE control command that has a *mode* value of FREEZE OFF, the ACCEPTED response frame shall be returned by the camera subunit and the camera subunit shall remain in this state. If a response frame that has a *mode* value for FREEZE ON is returned by the camera subunit and the camera subunit receives a FREEZE control command that has a *mode* value for FREEZE ON, the ACCEPTED response frame shall be returned by the camera subunit and the camera subunit shall remain in this state.

4.15 GAMMA command

The GAMMA control command is used to change the gamma value in the camera subunit. The format of the GAMMA control command is shown in Figure 4.15 - 1 below.

	msb							lsb
opcode	GAMMA							
operand[0]	subfunction							

Figure 4.15 - 1 GAMMA control command format

The *subfunction* field value is used to change the target gamma, as defined in Table 4.15 - 1 below.

Table 4.15 - 1 Gamma subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The gamma is increased one step further.
DECREMENT	02_{16}	The gamma is reduced one step further.
reserved	03_{16} - FF_{16}	reserved for future specification

Note) Changes in the gamma obtained by using the GAMMA control command with an *operand* of which value is INCREMENT or DECREMENT depend on each vendor.

The GAMMA status command may also be used to request information about the gamma currently set in a camera subunit. The format of the gamma command with a *ctype* value for STATUS is illustrated in Figure 4.15 - 2 below.

	msb							lsb
opcode	GAMMA							
operand[0]	FF_{16}							

Figure 4.15 - 2 GAMMA status command format

If the camera subunit is able to return a STABLE response to the GAMMA status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.16 HUE command

The HUE control command is used to change the hue value in the camera subunit. The format of the HUE control command is illustrated in Figure 4.16 - 1 below.

	msb							lsb
opcode	HUE							
operand[0]	subfunction							

Figure 4.16 - 1 HUE control command format

The value of *subfunction* field controls the hue used by the target, as defined in Table 4.16 - 1 below.

Table 4.16 - 1 Hue subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The hue is increased one step further.
DECREMENT	02_{16}	The hue is reduced one step further.
reserved	03_{16} - FE_{16}	reserved for future specification

Note) Changes in the hue obtained by using the HUE control command with an *operand* of which value is INCREMENT or DECREMENT depend on each vendor.

The HUE status command may also be used to request information about the hue that is currently set in a camera subunit. The format of the hue command with a *ctype* value for STATUS is illustrated in Figure 4.16 - 2 below.

	msb							lsb
opcode	HUE							
operand[0]	FF_{16}							

Figure 4.16 - 2 HUE status command format

If the camera subunit is able to return a STABLE response to the HUE status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.17 IMAGE STABILIZER command

The IMAGE STABILIZER control command is used to change the state of the image stabilizer. The format of the IMAGE STABILIZER control command is illustrated in Figure 4.17 - 1 below.

	msb							lsb
opcode	IMAGE STABILIZER							
operand[0]	image_stabilizer_state							

Figure 4.17 - 1 IMAGE STABILIZER control command format

The *image_stabilizer_state* field specifies whether or not the image stabilizer is enabled, as defined in Table 4.17 - 1 below.

Table 4.17 - 1 Image stabilizer state

Image Stabilizer Mode	Value	Description
IMAGE STABILIZER OFF	60_{16}	Disable the image stabilizer
IMAGE STABILIZER ON	70_{16}	Enable the image stabilizer
reserved	other values	reserved for future specification

The IMAGE STABILIZER command with a *ctype* value for STATUS may be used to determine the current image stabilizer state of the camera subunit. The format of the IMAGE STABILIZER status command is illustrated in Figure 4.17 - 2 below.

	msb							lsb
opcode	IMAGE STABILIZER							
operand[0]	FF_{16}							

Figure 4.17 - 2 IMAGE STABILIZER status command format

In the response frame returned by the camera subunit, *operands* are replaced by the current image stabilizer status, as defined in Table 4.17 - 1 above.

4.18 IRIS command

The IRIS control command is used to control the diaphragm of the optical system in a camera subunit. The format of the IRIS control command is illustrated in Figure 4.18 - 1 below.

	msb							lsb
opcode	IRIS							
operand[0]	type							
operand[1]	type_dependent_field							

Figure 4.18 - 1 IRIS control command format

Note) If the camera subunit is able to return an ACCEPTED response to the IRIS control command, the automatic exposure mode described in clause the “AE MODE command” above, shall be IRIS PRIORITY MODE or MANUAL MODE.

The *type* field is used to distinguish a means for specifying the diaphragm of the optical system in a camera subunit directly or relatively, as defined in Table 4.18 - 1 below.

Table 4.18 - 1 Iris types

Name	Value	Support level	Description
ABSOLUTE SETTING	00_{16}	R	Specify the diaphragm by using F.No.
RELATIVE SETTING	01_{16}	M	Specify the diaphragm relatively
Reserved	02_{16} - FF_{16}		reserved for future specification

If the *type* field has a value that indicates ABSOLUTE SETTING, the *type_dependent_field* field shall be the specified F.No of the optical system, as defined in the HD Digital VCR Conference, Specification of Consumer - Use Digital VCR's using 6.3 mm magnetic tape.

The F.No values indicate the following:

$$\textit{iris position}\ (\text{F.No.}) = \sqrt{2}^{(\text{type\_dependent\_field}/16)}$$

type_dependent_field: unsigned integer

If the *type* field has a value that indicates RELATIVE SETTING, the *type_dependent_field* field controls changes in the F.No of the optical system, as defined in Table 4.18 - 2 below.

Table 4.18 - 2 Type dependent field of relative setting

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	F.No is increased one step further.
DECREMENT	02_{16}	F.No is reduced one step further.
reserved	03_{16} - FF_{16}	reserved for future specification

Note) Changes in the F.No of the optical system obtained by using the IRIS control command with an *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The IRIS status command is used to obtain the current F.No of the diaphragm of the optical system in a camera subunit. The IRIS status command shall be set by the type field. The format of the IRIS status command is illustrated in Figure 4.18 - 2 below.

	msb							lsb
opcode	IRIS							
operand[0]	FF_{16}							

Figure 4.18 - 2 IRIS status command format

The format of the response frame returned by the camera subunit is the same as the format for an IRIS control command issued with a *type* value for ABSOLUTE SETTING.

4 - 19 IRIS RANGE command

The IRIS RANGE status command is used to ascertain the range of the F.No. of a diaphragm. The format of the IRIS RANGE status command is illustrated in Figure 4.19 - 1 below.

	msb							lsb
opcode	IRIS RANGE							
operand[0]	FF_{16}							
operand[1]								

Figure 4.19 - 1 IRIS RANGE status command format

The IRIS RANGE command shall be used only with a *ctype* for STATUS. If the camera subunit is able to return a STABLE response to the IRIS RANGE status command, the AV/C response frame has the format illustrated in Figure 4.19 - 2 below.

	msb							lsb
opcode	IRIS RANGE							
operand[0]	open_f_number							
operand[1]	maximum_f_number							

Figure 4.19 - 2 IRIS RANGE response format

In the response frame after an IRIS RANGE status command is issued, the *open_f_number* field is the minimum value of the F.No. when the diaphragm is opened.

The *maximum_f_number* field is the maximum value of the F.No., when the diaphragm is closed.

The formats of the *open_f_number* and the *maximum_f_number* fields are represented by a previously defined field, the *type_dependent_field* in the IRIS control command when the type field indicates ABSOLUTE SETTING.

> Note) If the camera subunit implement the IRIS command, the IRIS RANGE command shall also be supported by the camera subunit.

4.20 ND FILTER command

The ND FILTER control command is used to change that the neutral density (ND) filter is installed. The format of the ND FILTER control command is illustrated in Figure 4.20 - 1 below.

	msb							lsb
opcode	ND FILTER							
operand[0]	mode							
operand[1]	permeation							

Figure 4.20 - 1 ND FILTER control command format

The *mode* field determines whether or not an ND filter is installed, as defined in Table 4.20 - 1 below.

Table 4.20 - 1 ND Filter Modes

Name	Value	Description
REMOVE	00_{16}	Remove the ND filter
INSTALL	01_{16}	Install the ND filter
reserved	02_{16} - FF_{16}	reserved for future specification

The *permeation* field specifies the degrees of permeation of the ND filter. The degree of permeation of the ND filter is indicated as follows:

$$permeation = 2^{-permeation}$$

permeation: unsigned integer

The ND FILTER status command is used to obtain information about the ND filter. The format of the ND FILTER status command is illustrated in Figure 4.20 - 2 below.

	msb							lsb
opcode	ND FILTER							
operand[0]	FF_{16}							
operand[1]								

Figure 4.20 - 2 ND FILTER status command format

In the response frame returned by camera subunit, *operands* are replaced with the current mode, as defined in Table 4.20 - 1 above.

4.21 PAN command

The PAN control command is used to control the pan motions of the panhead. The format of the PAN control command is illustrated in Figure 4.21 - 1 below.

	msb							lsb
opcode	PAN							
operand[0]	pan_mode							

Figure 4.21 - 1 PAN control command format

The value of *pan_mode* field controls pan movement, as defined in Table 4.21 - 1 below.

Table 4.21 - 1 Pan modes

Pan Mode	Value	Description
PAN LEFTWARD FASTEST	31_{16}	Move the panhead to leftward direction at various spend described in detail below
PAN LEFTWARD 6	33_{16}	
PAN LEFTWARD 5	35_{16}	
PAN LEFTWARD 4	37_{16}	
PAN LEFTWARD 3	39_{16}	
PAN LEFTWARD 2	$3B_{16}$	
PAN LEFTWARD 1	$3D_{16}$	
PAN LEFTWARD SLOWEST	$3F_{16}$	
PAN STOP	60_{16}	Stop the panhead
PAN RIGHTWARD SLOWEST	41_{16}	Move the panhead to rightward direction at various speed described in detail below
PAN RIGHTWARD 1	43_{16}	
PAN RIGHTWARD 2	45_{16}	
PAN RIGHTWARD 3	47_{16}	
PAN RIGHTWARD 4	49_{16}	
PAN RIGHTWARD 5	$4B_{16}$	
PAN RIGHTWARD 6	$4D_{16}$	
PAN RIGHTWARD FASTEST	$4F_{16}$	

A camera subunit need not have all eight possible pan speeds; rather it is required only to map all possible pan modes for the speeds that it does support. The actual speeds encoded by the pan modes shall be subject to one of the following restrictions, as appropriate:

LEFTWARD SLOWEST ≤ LEFTWARD 1 ≤ LEFTWARD 2 ≤ LEFTWARD 3 ≤ LEFTWARD 4 ≤ LEFTWARD 5 ≤ LEFTWARD 6 ≤ LEFTWARD FASTEST

or

RIGHTWARD SLOWEST ≤ RIGHTWARD 1≤ RIGHTWARD 2≤ RIGHTWARD 3 ≤ RIGHTWARD 4 ≤ RIGHTWARD 5 ≤ RIGHTWARD 6 ≤ RIGHTWARD FASTEST

The PAN status command is used to ascertain the current pan state of the panhead mechanism. The format of the PAN status command is illustrated in Figure 4.21 - 2 below.

	msb							lsb
opcode	PAN							
operand[0]	FF_{16}							

Figure 4.21 - 2 PAN status command format

The PAN command shall be used only with a *ctype* for STATUS. The information is returned formatted in a response frame, as shown in Figure 4.21 - 3 below.

	msb							lsb
opcode	PAN							
operand[0]	pan_state							

Figure 4.21 - 3 PAN response format

In the response frame after a PAN status command, the *pan_state* indicates the pan state, as defined in Table 4.21 - 2 below.

Table 4.21 - 2 Pan state values

Pan Mode	Value	Description
As defined by Table 4.21 - 1		Any of the values defined for PAN command may be returned to indicate the corresponding pan state
UNSPECIFIED LEFTWARD	31_{16}	One of the LEFTWARD pan state, 31_{16} - 41_{16}
UNSPECIFIED RIGHTWARD	41_{16}	One of the RIGHTWARD pan state, 31_{16} - $4F_{16}$

If a camera subunit is unable to precisely determine its pan state, it may return a response that indicates one of UNSPECIFIED states described in Table 4.21 - 2 above.

A camera subunit that supports only one speed for any of the pan groups, PAN LEFTWARD or PAN RIGHTWARD, shall return the corresponding UNSPECIFIED code when in one of these pan states.

A camera subunit that supports two or more speeds for any of the pan groups shall return a code that corresponds to the actual speed of the panhead, as defined by the mapping described in Table 4.21 - 1; however, it may not be equal to the *pan_mode* operand of the PAN control command that indicates the operation.

4.22 RANGE command

The RANGE status command is used to ascertain the control parameter range. The format of the RANGE status command is illustrated in Figure 4.22 - 1 below.

	msb							lsb
opcode	RANGE							
operand[0]	range_mode							
operand[1]	FF_{16}							
operand[2]								

Figure 4.22 - 1 RANGE status command format

In the RANGE status command frame, the *range_mode* field indicates the parameter to inquire. The *range_mode* field is represented by previously defined opcodes, GAMMA, SETUP LEVEL, HUE, SHARPNESS and SATURATION.

> Note) If the camera subunit implements the command represented the opcodes, GAMMA, SETUP LEVEL, HUE, SHARPNESS and SATURATION, the camera subunit shall also support a RANGE command with the same *range_mode* field.

The RANGE command shall be used only with a *ctype* for STATUS. If the camera subunit is able to return a STABLE response to the RANGE status command, the AV/C response frame has the format illustrated in Figure 4.22 - 2 below.

	msb							lsb
opcode	RANGE							
operand[0]	range_mode							
operand[1]	minimum_value							
operand[2]	maximum_value							

Figure 4.22 - 2 RANGE response format

In the response frame following a RANGE status command, the *range_mode* field has a value in accordance with the *range_mode* value in the RANGE status command frame.

The *minimum_value* field is the minimum value of the control parameters.

The *maximum_value* field is the maximum value of the control parameters.

4.23 REVERSE command

The REVERSE control command is used to turn a picture from positive to negative. The format of the REVERSE control command is illustrated in Figure 4.23 - 1 below.

	msb							lsb
opcode	REVERSE							
operand[0]	picture_state							

Figure 4.23 - 1 REVERSE control command format

When the REVERSE command is issued with a *ctype* value for CONTROL, the *picture_state* field specifies the desired picture state (negative or positive), of the camera subunit. The *mode* is encoded as shown in Table 4.23 - 1 below.

Table 4.23 - 1 Picture state

Picture State	Value	Description
POSITIVE	60_{16}	Change to positive mode
NEGATIVE	70_{16}	Change to negative mode
reserved	other values	reserved for future specification

A REVERSE command with a *ctype* value for STATUS may be used to determine the current picture state of the camera subunit. The format of the REVERSE status command is illustrated in Figure 4.23 - 2 below.

	msb							lsb
opcode	REVERSE							
operand[0]	FF_{16}							

Figure 4.23 - 2 REVERSE status command format

In the response frame returned by the camera subunit, *operands* are replaced with the current picture status, as defined in Table 4.23 - 1 above.

4.24 SATURATION command

The SATURATION control command is used to change the saturation value in the camera subunit. The format of the SATURATION control command is illustrated in Figure 4.24 - 1 below.

	msb							lsb
opcode	SATURATION							
operand[0]	subfunction							

Figure 4.24 - 1 SATURATION control command format

The value of *subfunction* field controls to change the saturation used by the target, as defined in Table 4.24 - 1 below.

Table 4.24 - 1 Saturation subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The saturation is increased one step further.
DECREMENT	02_{16}	The saturation is reduced one step further.
reserved	other values	reserved for future specification

Note) The alteration of saturation as a result of the SATURATION control command with *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The SATURATION status command may also be used to ascertain information about the saturation currently set in a camera subunit. The format of the saturation command with a *ctype* value of STATUS is illustrated in Figure 4.24 - 2 below.

	msb							lsb
opcode	SATURATION							
operand[0]	FF_{16}							

Figure 4.24 - 2 SATURATION status command format

If the camera subunit is able to return a STABLE response to the SATURATION status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.25 SETUP LEVEL command

The SETUP LEVEL control command is used to change the setup level value in the camera subunit. The format of the SETUP LEVEL control command is illustrated in Figure 4.25 - 1 below.

	msb							lsb
opcode	SETUP LEVEL							
operand[0]	subfunction							

Figure 4.25 - 1 SETUP LEVEL control command format

The value of *subfunction* field changes the setup level used by the target, as defined in Table 4.25 - 1 below.

Table 4.25 - 1 Setup subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The setup level is increased one step further.
DECREMENT	02_{16}	The setup level is reduced one step further.
reserved	03_{16} - FF_{16}	reserved for future specification

Note) The alteration of setup level as a result of the SETUP LEVEL control command with *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The SETUP LEVEL status command may also be used to request information about the setup level currently set in a camera subunit. The format of the setup level command with a *ctype* value for STATUS is illustrated in Figure 4.25 - 2 below.

	msb							lsb
opcode	SETUP LEVEL							
operand[0]	FF_{16}							

Figure 4.25 - 2 SETUP LEVEL status command format

If the camera subunit is able to return a STABLE response to the SETUP LEVEL status command, the response frame includes an *operand* that has the number of steps from the default value defined by vendor.

4.26 SHARPNESS command

The SHARPNESS control command is used to change the sharpness value in the camera subunit. The format of the SHARPNESS control command is illustrated in Figure 4.26 - 1 below.

	msb							lsb
opcode	SHARPNESS							
operand[0]	subfunction							

Figure 4.26 - 1 SHARPNESS control command format

The value of *subfunction* field changes the sharpness used by the target, as defined in Table 4.26 - 1 below.

Table 4.26 - 1 Sharpness subfunction

Name	Value	Description
DEFAULT	00_{16}	Set to default value defined by vendor
INCREMENT	01_{16}	The sharpness is increased one step further.
DECREMENT	02_{16}	The sharpness is reduced one step further.
reserved	02_{16} - FF_{16}	reserved for future specification

Note) The alteration of sharpness as a result of the SHARPNESS control command with *operand* of which value is INCREMENT or DECREMENT depends on each vendor.

The SHARPNESS status command may also be used to request information about the sharpness currently set in a camera subunit. The format of the sharpness command with a *ctype* value for STATUS is illustrated in Figure 4.26 - 2 below.

	msb							lsb
opcode	SHARPNESS							
operand[0]	FF_{16}							

Figure 4.26 - 2 SHARPNESS status command format

If the camera subunit is able to return a STABLE response to the SHARPNESS status command, the response frame includes an *operand* that has the number of steps from the default value defined by the vendor.

4.27 SHUTTER SPEED command

The SHUTTER SPEED control command is used to control the shutter speed. The format of the SHUTTER SPEED control command is illustrated in Figure 4.27 - 1 below.

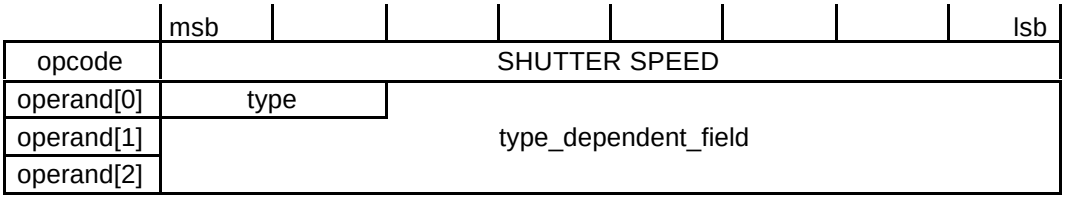

Figure 4.27 - 1 SHUTTER SPEED control command format

Note) If the camera subunit is able to return an ACCEPTED response to the SHUTTER SPEED control command, the automatic exposure mode described in the “AE MODE command” clause above, shall be SHUTTER PRIORITY MODE or MANUAL MODE.

The *type* field is used to distinguish a means to specify the shutter speed directly or relatively, as shown in Table 4.27 - 1 below.

Table 4.27 - 1 Shutter speed type encoding

Name	Value	Description
ABSOLUTE SETTING	00_2	
RELATIVE SETTING	01_2	
reserved	10_2 - 11_2	reserved for future specification

If the *type* field has a value that indicates ABSOLUTE SETTING, the *type_dependent_field* shall specify shutter speed with a real value.

When the SHUTTER SPEED control command is issued with a *type* value for ABSOLUTE SETTING, the format of the SHUTTER SPEED control command is illustrated in Figure 4.27 - 2 below.

	msb							lsb
opcode	SHUTTER SPEED							
operand[0]	00_2	(most significant bit)						
operand[1]	speed							
operand[2]								(least significant bit)

Figure 4.27 - 2 ABSOLUTE SHUTTER SPEED control command format

The *speed* field specifies the shutter speed, as defined by the HD Digital VCR Conference, Specification of Consumer - Use Digital VCR's using 6.3 mm magnetic tape.

The value of the shutter speed is determined as follows:

$$\text{SHUTTER SPEED} = T_H \times \textit{speed}\ [\textit{sec}]$$

T_H : Horizontal Scanning Period [*sec*]

If the *type* field has a value that indicates RELATIVE SETTING, the *type_dependent_field* controls to change shutter speed. When the SHUTTER SPEED control command is issued with a *type* value for RELATIVE SETTING, the format of the SHUTTER SPEED control command is illustrated in Figure 4.27 - 3 below.

	msb							lsb
opcode	SHUTTER SPEED							
operand[0]	01_2	speed						
operand[1]	FF_{16}							
operand[2]								

Figure 4.27 - 3 RELATIVE SHUTTER SPEED control command format

The *speed* field controls the shutter speed, as defined in Table 4.27 - 2 below.

Table 4.27 - 2 Speed field encoding

Name	Value	Description
DEFAULT	00_{16}	Set the default value defined by vendor
INCREMENT	01_{16}	Shutter speed is increased one step further. e.g.)1/1000 → 1/500
DECREMENT	02_{16}	Shutter speed is increased one step further. e.g.)1/500 → 1/1000
Reserved	03_{16} - FF_{16}	reserved for future specification

Note) Changes in the shutter speed as a result of the SHUTTER SPEED control command with an *operand* of which value is INCREMENT or DECREMENT depend on each vendor.

The SHUTTER SPEED status command is used to determine the current shutter speed. The format of the SHUTTER SPEED status command is illustrated in Figure 4.27 - 4 below.

	msb							lsb
Opcode	SHUTTER SPEED							
Operand[0]	FF_{16}							
operand[1]								

Figure 4.27 - 4 SHUTTER SPEED status command format

The format of the response frame returned by the camera subunit is the same as the format for a SHUTTER SPEED control command issued with a *type* value for ABSOLUTE SETTING.

4.28 SUPPORT LEVEL PROFILE command

The SUPPORT LEVEL PROFILE status command is used to ascertain the situation regarding the implementation of a control command whose support level is mandatory. The format of the SUPPORT LEVEL PROFILE status command is illustrated in Figure 4.28 - 1 below.

	msb							lsb
Opcode	SUPPORT LEVEL PROFILE							
operand[0]	FF_{16}							
operand[1]								
operand[2]								

Figure 4.28 - 1 SUPPORT LEVEL PROFILE status command format

Note) If the camera subunit supports one or more camera subunit commands, the camera subunit shall also support a SUPPORT LEVEL PROFILE command. If the camera subunit command does not support any command, the camera subunit may return a NOT IMPLEMENTED response to the SUPPORT LEVEL PROFILE command.

The SUPPORT LEVEL PROFILE command shall be used only with a *ctype* for STATUS. If the camera subunit is able to return a STABLE response to the SUPPORT LEVEL PROFILE status command, the AV/C response frame has the format illustrated in Figure 4.28 - 2 below.

	msb							lsb
opcode	SUPPORT LEVEL PROFILE							
operand[0]	profile							
operand[1]								
operand[2]								

Figure4.28 - 2 SUPPORT LEVEL PROFILE response format

In the response frame following a SUPPORT LEVEL PROFILE status command, the *profile* indicates the situation regarding implementation of the commands. The situation regarding implementation is returned by using *profile* bits, as defined in Table 4.28 - 1 below.

Table 4.28 - 1 Bit assignment of profile

Operand	Bit	Description
operand[0]	bit 7 (msb)	AE MODE (FULL AUTOMATIC)
	bit 6	AE MODE (MANUAL) and AGC GAIN
	bit 5	AE MODE (MANUAL) and IRIS (RELATIVE)
	bit 4	reserved for future specification
	bit 3	AF MODE and FOCUS
	bit 2	reserved for future specification
	bit 1	
	bit 0 (lsb)	
operand[1]	bit 7 (msb)	DIGITAL ZOOM
	bit 6	ZOOM
	bit 5	reserved for future specification
	bit 4	
	bit 3	
	bit 2	
	bit 1	
	bit 0 (lsb)	
operand[2]		reserved for future specification

In Table 4.28 - 1, if the bit of operand is set, it is indicated that the command described in *Description* of Table 4.28 - 1 is supported by the camera subunit, e.g., if the most significant bit (msb) of *operand[0]* is set to one, the AE MODE command is supported by the camera subunit.

The value of the *reserved* field shall be zero.

> Note) If the camera subunit supports no mandatory (M) command because the camera subunit does not have the capabilities of that command, but the camera subunit supports a command whose support level is recommended (R) or optional (O), the camera subunit may return a response frame with a *profile* value of zero to the SUPPORT LEVEL PROFILE status command.

4.29 TILT command

The TILT control command is used to control the tilt motion of the panhead. The format of the TILT control command is illustrated in Figure 4.29 - 1 below.

	msb							lsb
opcode	TILT							
operand[0]	tilt_mode							

Figure 4.29 - 1 TILT control command format

The value of *tilt_mode* field controls tilt movement, as defined in Table 4.29 - 1 below.

Table 4.29 - 1 Tilt modes

Tilt Mode	Value	Description
TILT UPWARD FASTEST	31_{16}	Move the panhead to upward direction at various speed described in detail below
TILT UPWARD 6	33_{16}	
TILT UPWARD 5	35_{16}	
TILT UPWARD 4	37_{16}	
TILT UPWARD 3	39_{16}	
TILT UPWARD 2	$3B_{16}$	
TILT UPWARD 1	$3D_{16}$	
TILT UPWARD SLOWEST	$3F_{16}$	
TILT STOP	60_{16}	Stop the panhead
TILT DOWNWARD SLOWEST	41_{16}	Move the panhead to downward direction at various speed described in detail below
TILT DOWNWARD 1	43_{16}	
TILT DOWNWARD 2	45_{16}	
TILT DOWNWARD 3	47_{16}	
TILT DOWNWARD 4	49_{16}	
TILT DOWNWARD 5	$4B_{16}$	
TILT DOWNWARD 6	$4D_{16}$	
TILT DOWNWARD FASTEST	$4F_{16}$	

A camera subunit need not have all eight possible tilt speeds; rather it is required only to map all possible tilt modes to the speeds that it does support. The actual speeds encoded by the tilt modes shall be subject to one of the following restrictions, as appropriate:

UPWARD SLOWEST ≤ UPWARD 1 ≤ UPWARD 2 ≤ UPWARD 3
≤ UPWARD 4 ≤ UPWARD 5 ≤ UPWARD 6 ≤ UPWARD FASTEST

or

DOWNWARD SLOWEST ≤ DOWNWARD 1 ≤ DOWNWARD 2 ≤ DOWNWARD 3
≤ DOWNWARD 4 ≤ DOWNWARD 5 ≤ DOWNWARD 6 ≤ DOWNWARD FASTEST

The TILT status command is used to ascertain the current tilt state of the panhead mechanism. The format of the TILT status command is illustrated in Figure 4.29 - 2 below.

	msb							lsb
opcode	TILT							
operand[0]	FF_{16}							

Figure 4.29 - 2 TILT status command format

The TILT command shall be used only with a *ctype* for STATUS. The information is returned formatted in a response frame, as shown in Figure 4.29 - 3 below.

	msb							lsb
opcode	TILT							
operand[0]	tilt_state							

Figure 4.29 - 3 TILT response format

In the response frame following a TILT status command, the *tilt_state* indicates the degree of tilt, as defined in Table 4.29 - 2 below.

Table 4.29 - 1 Tilt state values

Name	Value	Description
As defined by Table 4.29 - 2		Any of the values defined for TILT command may be returned to indicate the corresponding tilt state
UNSPECIFIED UPWARD	31_{16}	One of the UPWARD tilt state, 31_{16} - $3F_{16}$
UNSPECIFIED DOUWNWARD	41_{16}	One of the DOWNWARD tilt state, 31_{16} - $4F_{16}$

If a camera subunit is unable to precisely determine its tilt state, it may return a response that indicates one of UNSPECIFIED states described in Table 4.29 - 2 above.

A camera subunit that supports only one speed for any of the tilt groups, TILT UPWARD or TILT DOWNWARD, shall return the corresponding UNSPECIFIED code when in one of these tilt states.

A camera subunit that supports two or more speeds for any of the tilt groups shall return a code that corresponds to the actual speed of the panhead, as defined by the mapping described in Table 4.29 - 1; however, it may not be equal to the *tilt_mode* operand of the TILT control command that indicates the operation.

4.30 VIDEO LIGHT command

The VIDEO LIGHT control command is used to control the video light. The format of the VIDEO LIGHT control command is illustrated in Figure 4.30 - 1 below.

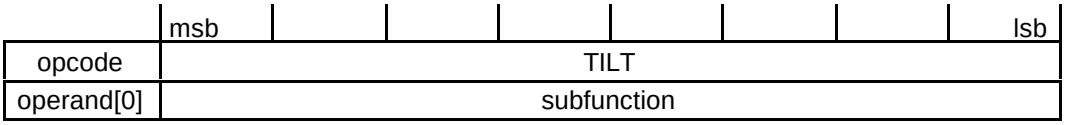

Figure 4.30 - 1 VIDEO LIGHT control command format

The *subfunction* field controls whether or not video light is turned on, as defined in Table 4.30 - 1 below.

Table 4.30 - 1 Video light subfunction encoding

Name	Value	Description
TURN OFF	00_{16}	Turn off the video light
TURN ON	01_{16}	Turn on the video light

The VIDEO LIGHT status command is used to obtain information about the video light. The format of the VIDEO LIGHT status command is illustrated in Figure 4.30 - 2 below.

	msb							lsb
opcode	VIDEO LIGHT							
operand[0]	FF_{16}							

Figure 4.30 - 2 VIDEO LIGHT status command format

In the response frame returned by camera subunit, *operands* is replaced with the current mode as defined in Table 4.30 - 1 above.

4.31 WHITE BALANCE command

The WHITE BALANCE control command is used to control the white balance of the camera subunit. The format of the WHITE BALANCE control command is illustrated in Figure 4.31 - 1 below.

	msb							lsb
opcode	WHITE BALANCE							
operand[0]	mode				white_balance			

Figure 4.31 - 1 WHITE BALANCE control command format

The *mode* field set the mode of white balance, as defined in Table 4.31 - 1 below.

Table 4.31 - 1 White Balance modes

Name	Value	Description
AUTOMATIC	00_{16}	
HOLD	01_{16}	
ONE - PUSH SET	02_{16}	
PRESET	03_{16}	

The *white_balance* field sets a type of white balance, as defined in Table 4.31 - 2 below.

Table 4.31 - 2 White Balance

Name	Value	Description
CANDLE	00_{16}	
INCANDESCENT LAMP	01_{16}	
FLUORESCENT LAMP(LOW)	02_{16}	Fluorescent lamp of low color temperature
FLUORESCENT LAMP(HIGH)	03_{16}	Fluorescent lamp of high color temperature
SUNLIGHT	04_{16}	
CLOUDINESS	05_{16}	
VENDOR DEPEND	06_{16} - $1E_{16}$	
NO INFORMATION	$1F_{16}$	

The WHITE BALANCE control command shall have a *white_balance* field value of NO INFORMATION, with a *mode* field value of AUTOMATIC, HOLD or ONE - PUSH SET.

The WHITE BALANCE status command is used to obtain information about the current white balance status. The format of the WHITE BALANCE status command is illustrated in Figure 4.31 - 2 below.

	msb							lsb
opcode	WHITE BALANCE							
operand[0]	FF_{16}							

Figure 4.31 - 2 WHITE BALANCE status command format

In the response frame returned by the camera subunit, *operands* are replaced with the current mode and type, as defined in Table 4.31 - 1 and Table 4.31 - 2 above.

4.32 ZOOM command

The ZOOM control command is used to control the zoom motion of the optical system of a camera subunit. The format of the ZOOM control command is illustrated in Figure 4.32 - 1 below.

	msb							lsb
opcode	ZOOM							
operand[0]	zoom_mode							

Figure 4.32 - 1 ZOOM control command format

The value of *zoom_mode* field controls the movement of the zoom lens group, as defined in Table 4.32 - 1 below.

Table 4.32 - 1 Zoom modes

Zoom Mode	Value	Support level	Description
ZOOM TELE FASTEST	31_{16}	O	Move the zoom lens group to telephoto direction
ZOOM TELE 6	33_{16}	O	
ZOOM TELE 5	35_{16}	O	
ZOOM TELE 4	37_{16}	O	
ZOOM TELE 3	39_{16}	O	
ZOOM TELE 2	$3B_{16}$	O	
ZOOM TELE 1	$3D_{16}$	O	
ZOOM TELE SLOWEST	$3F_{16}$	M	
ZOOM STOP	60_{16}	M	Stop the zoom lens group
ZOOM WIDE SLOWEST	41_{16}	M	Move the zoom lens group to wide-angle direction
ZOOM WIDE 1	43_{16}	O	
ZOOM WIDE 2	45_{16}	O	
ZOOM WIDE 3	47_{16}	O	
ZOOM WIDE 4	49_{16}	O	
ZOOM WIDE 5	$4B_{16}$	O	
ZOOM WIDE 6	$4D_{16}$	O	
ZOOM WIDE FASTEST	$4F_{16}$	O	

The subunit support level for ZOOM, mandatory (M) and optional (O) varies according to the zoom mode requested.

A camera subunit need not have all eight possible zoom speeds; rather it is required only to map all possible zoom modes for the speeds that it does support. The actual speeds encoded by the zoom modes shall be subject to one of the following restrictions, as appropriate:

TELE SLOWEST ≤ TELE 1 ≤ TELE 2 ≤ TELE 3
≤ TELE 4 ≤ TELE 5 ≤ TELE 6 ≤ TELE FASTEST

or

WIDE SLOWEST ≤ WIDE 1 ≤ WIDE 2 ≤ WIDE 3
≤ WIDE 4 ≤ WIDE 5 ≤ WIDE 6 ≤ WIDE FASTEST

The ZOOM status command is used to ascertain the current zoom state of the zooming mechanism. The format of the ZOOM status command is illustrated in Figure 4.32 - 2 below.

	msb							lsb
opcode	ZOOM							
operand[0]	FF_{16}							

Figure 4.32 - 2 ZOOM status command format

The information returned is formatted in a response frame, as shown in Figure 4.32 - 3 below.

	msb							lsb
opcode	ZOOM							
operand[0]	zoom_state							

Figure 4.32 - 3 ZOOM response format

In the response frame following a ZOOM status command, the *zoom_state* indicates the state of zoom, as defined in Table 4.32 - 2 below.

Table 4.32 - 2 Zoom state values

Name	Value	Description
As defined by Table 4.32 - 1		Any of the values defined for ZOOM command may be returned to indicate the corresponding zoom state
UNSPECIFIED TELE	31_{16}	One of the TELE zoom state, 31_{16} - $3F_{16}$
UNSPECIFIED WIDE	41_{16}	One of the WIDE zoom state, 41_{16} - $4F_{16}$

If a camera subunit is unable to precisely determine its zoom state, it may return a response that indicates one of UNSPECIFIED states described in Table 4.32 - 2 above.

A camera subunit that supports only one speeds for any of the zoom groups, ZOOM TELE or ZOOM WIDE, shall return the corresponding UNSPECIFIED code when in one of these zoom states.

A camera subunit that supports two or more speeds for any of the zoom groups shall return a code that corresponds to the actual speed of the zoom lens group, as defined by the mapping described in Table 4.32 - 1; however, it may not be equal to the *zoom_mode* operand of the ZOOM control command that indicates the operation.

A. AV/C commands in numerical order (normative)

The table below lists all the AV/C camera subunit commands, in numerical order by *ctype*. Commands that pertain to subunits, *e.g.*, Camera's, columns are head by a single letter that encodes the type of subunit. The legend for the subunit types follows the table.

Table A - 1 command in numerical order

Value	Opcode	Unit command	Subunit commands V	Subunit commands C	Support level (by ctype) C	Support level (by ctype) S	Support level (by ctype) N
40_{16}	AE MODE			X	*	M	-
42_{16}	AE SHIFT			X	O	O	-
43_{16}	IRIS			X	*	M	-
44_{16}	SHUTTER SPEED			X	R	R	-
45_{16}	AGC GAIN			X	M	M	-
48_{16}	FLASH			X	O	O	-
49_{16}	VIDEO LIGHGT			X	O	O	-
52_{16}	GAMMA			X	O	O	-
54_{16}	SETUP LEVEL			X	O	O	-
55_{16}	CONTRAST			X	O	O	-
56_{16}	SHARPNESS			X	O	O	-
$5B_{16}$	SATURATION			X	O	O	-
$5C_{16}$	HUE			X	O	O	-
$5D_{16}$	WHITE BALANCE			X	R	R	-
60_{16}	DIGITAL ZOOM			X	M	M	-
61_{16}	DIGITAL ZOOM MAX LIMIT			X	O	O	-
62_{16}	FREEZE			X	R	R	-
64_{16}	REVERSE			X	O	O	-
70_{16}	RANGE			X	-	*	-
72_{16}	SUPPORT LEVEL PROFILE			X	-	M	-
74_{16}	AGC MAXIMUM GAIN			X	-	*	-
75_{16}	IRIS RANGE			X	-	*	-
$7A_{16}$	CCD SCAN MODE			X	R	R	-
$C1_{16}$	FOCUS			X	*	M	-
$C2_{16}$	FOCUSSING POSITION			X	O	O	-
$C3_{16}$	FOCAL LENGTH			X	O	O	-
$C4_{16}$	ZOOM			X	*	M	-
$C8_{16}$	AF MODE			X	M	M	-
CB_{16}	ND FILTER			X	O	O	-

continued on next page

continued from previous page

Value	Opcode	Unit command	Subunit commands V	Subunit commands C	Support level (by ctype) C	S	N
DA_{16}	PAN			X	O	O	-
DB_{16}	TILT			X	O	O	-
DC_{16}	IMAGE STABILIZER			X	O	O	-

In the preceding table, an asterisk in the support level column indicates that the command operands or the types of subunit determine whether the commands is mandatory (M), recommended (R) or optional (O).

The legend which defines the subunit type codes is as follows:

Table A - 2 Legend of subunit type

Subunit Type Code	Definition
V	Video cassette recorder(VCR)
C	Camera