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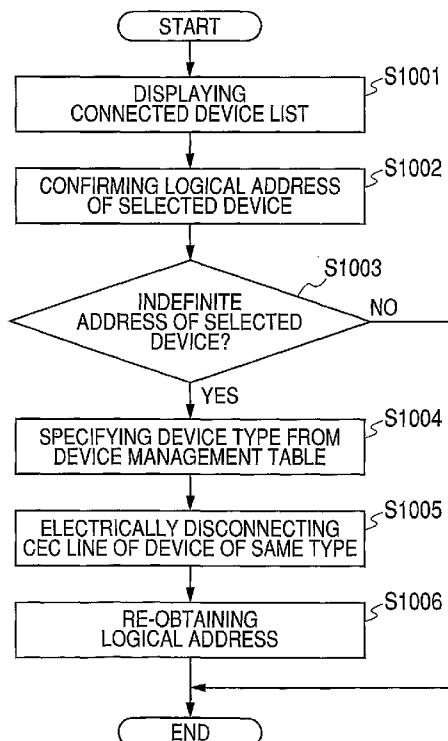
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(54) Title: DEVICE CONTROL APPARATUS AND DEVICE CONTROL METHOD IN VIDEO IMAGE DISPLAY SYSTEM INCLUDING A PLURALITY OF CONNECTED DEVICES

**FIG. 10**



(57) Abstract: A device control apparatus in a video image display system including a plurality of connected devices. The apparatus includes an obtaining unit which obtains a logical address of a first device connected to the device control apparatus as a control object, a specifying unit which specifies the device type of the first device if the obtained logical address of the first device is not a logical address according to the device type, a selection unit which selects a second device which is connected to the device control apparatus and is of the same device type as the first device, and a control unit which controls a logical address assigned to the selected second device according to the device type thereof so that the first device obtains a logical address.



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## DESCRIPTION

DEVICE CONTROL APPARATUS AND DEVICE CONTROL METHOD IN VIDEO  
IMAGE DISPLAY SYSTEM INCLUDING A PLURALITY OF CONNECTED  
5 DEVICES

## TECHNICAL FIELD

The present invention relates to a device control apparatus and a device control method in a video image display system including a plurality of connected devices.

## BACKGROUND ART

In recent years, the High-Definition Multimedia Interface (HDMI) is available that connects a video signal output apparatus, such as a camcorder, a video recorder or a tuner, and a video image display apparatus, such as a television, through one cable, and that can effect collaboration control between the apparatuses.

The HDMI is a standard extended from the preceding Digital Visual Interface (DVI) standard by arranging a function to transmit audio data as well as video data, a copyright protecting function and a color difference transmitting function for home-use AV appliances.

The video signal output apparatus is capable of obtaining information on the display performance of the connected video image display apparatus through Digital Data Channel (DDC) communication specified in the HDMI and

is also capable of obtaining the address of the HDMI terminal of the connected video image display apparatus.

Also, the video image display apparatus can make, by high/low control in Hot Plug Detect (HPD) specified in the 5 HDMI, the video signal output apparatus execute processing for DDC communication. According to Japanese Patent Application Laid-Open No. 2007-078980, the video signal output apparatus is reset by HPD control to re-obtain Extended Display Identification Data (EDID) when the video 10 signal output apparatus transmits data other than EDID descriptions to the video image display apparatus.

Further, HDMI Ver. 1.2 and the subsequent versions have an additional function, called Consumer Electronics Control (CEC), which is capable of collaboration control 15 between the video image display apparatus and the video signal output apparatus.

Not only the video signal output apparatus that outputs a video signal but also a video recording apparatus or the like can be CEC-controlled. According to the HDMI 20 standard, such an audiovisual device obtains one of logical addresses 0 to 15. The video image display apparatus can control, by using the logical address, the audiovisual device to be controlled (High-Definition Multimedia Interface Specification Ver. 1.3, November 10, 2006, 25 Supplement 1).

In the HDMI standard, however, there is a limit to the number of addresses obtainable by audiovisual devices

(hereinafter referred to simply as "device") connected to the video image display apparatus, and the upper limit of the number of addresses is determined according to a kind of device (device type). For example, only three devices 5 corresponding to Playback Device (reproducing apparatus) can obtain logical addresses. If a fourth Playback Device is connected, it obtains a logical address non-compatible with CEC control (indefinite address). The video image display apparatus cannot CEC-control the device that has 10 obtained the indefinite address.

The technique described in Japanese Patent Application Laid-Open No. 2007-078980 relates to processing by which the video signal output apparatus is reset to re-obtain EDID, but it is a technique devised without 15 considering CEC control on a device having an indefinite address obtained. Therefore the technique is incapable of solving the above-described problem.

While the problem has been described with respect to the HDMI standard by way of example, the problem is not 20 limited to the one with the HDMI standard. The above-described problem also exists with whole video image display system that is capable of the collaboration control among devices and has the determined number of assignable logical numbers.

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#### DISCLOSURE OF THE INVENTION

An aspect of the present invention is to enable

control on a device even if any logical address usable for device control is not assigned to the device.

In order to solve the above-described problem, according to an aspect of the present invention, a device control apparatus in a video image display system which includes a plurality of connected devices and is arranged to control each of the connected devices by assigning a logical address according to the device type of the device, an upper limit of the number of assignable logical addresses being determined with respect to each device type, comprises an obtaining unit which obtains a logical address of a first device connected to the device control apparatus as a control object, a specifying unit which specifies the device type of the first device if the first logical address obtained is not a logical address according to the device type, a selection unit which selects a second device which is connected to the device control apparatus and is of the same device type as the first device, and a control unit which controls a logical address assigned to the selected second device according to the device type thereof so that the first device obtains a logical address.

According to another aspect of the present invention, a device control method in a video image display system including a device control apparatus and a plurality of devices connected to the device control apparatus and being arranged to control each of the devices connected to the device control apparatus by assigning a logical address

according to the device type of the device, an upper limit of the number of assignable logical addresses being determined with respect to each device type, comprises the steps of obtaining a logical address of a first device 5 connected to the device control apparatus as a control object, specifying the device type of the first device if the first logical address obtained is not a logical address according to the device type, selecting a second device which is connected to the device control apparatus and is 10 of the same device type as the first device, and controlling a logical address assigned to the selected second device according to the device type thereof so that the first device obtains a logical address.

According to the present invention, even if there 15 exist a device to which any logical address usable for device control is not assigned, the device can be controlled.

Further features of the present invention will become apparent from the following description of exemplary 20 embodiments with reference to the attached drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a video image display system according to a first embodiment.

25 FIG. 2 is a block diagram of a video signal output apparatus according to the first embodiment.

FIG. 3 is a diagram illustrating the configuration of

HDMI.

FIG. 4 is a diagram illustrating a CEC command frame.

FIG. 5 is a diagram illustrating a header block of a CEC command.

5 FIG. 6 is a diagram illustrating a data block of a CEC command.

FIG. 7 is a diagram illustrating the flow of operation before address determination in the video signal output apparatus according to the first embodiment.

10 FIG. 8 is a diagram illustrating the flow of operation preparing a device management table in the video image display apparatus according to the first embodiment.

FIG. 9 is a diagram illustrating an example of the device management table according to the first embodiment.

15 FIG. 10 is a diagram illustrating the flow of operation when the video image display apparatus according to the first embodiment makes an indefinite address device re-obtain an address.

FIG. 11 is a diagram illustrating a display screen 20 for a connected device list according to the first embodiment.

FIG. 12 is a block diagram of a video image display system according to a second embodiment.

25 FIG. 13 is a diagram illustrating an example of a device management table according to the second embodiment.

FIG. 14 is a diagram illustrating the flow of operation when the video image display apparatus according

to the second embodiment makes an indefinite address device re-obtain an address.

FIG. 15 is a diagram illustrating logical addresses and device types in the HDMI standard.

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#### BEST MODES FOR CARRYING OUT THE INVENTION

Exemplary embodiments of the present invention will be illustratively described in detail with reference to the drawings.

##### 10 First Embodiment

Modes for carrying out the present invention will be illustratively described with reference to the drawings. However, it is not to be construed that the scope of the present invention is limited to the functions, shapes and 15 relative placements of components described in exemplary embodiments, unless otherwise specifically described. Also, the functions, shapes, etc., of components described once in the following description are assumed to be the same as originally described, unless otherwise specified.

20 FIG. 1 is a block diagram illustrating a video image display system to which the present invention can be applied.

Referring to FIG. 1, a video image display apparatus 100 and video signal output apparatuses 131 to 135 are 25 connected to each other via connection lines (hereinafter referred to as HDMI cables) 126 to 130 conforming to the High Definition Multimedia Interface (HDMI) standard.

### Configuration of vide image apparatus

The video image display apparatus 100 includes a remote control receiving unit 102, a tuner unit 104, a demultiplexer unit 105, a decoder unit 106, selector units 5 108 and 109, an HDMI receiving unit 110, an input source selection unit 107, a video image processing unit 111, a GUI generation unit 114, a synthesization unit 112, a video image display unit 113, an audio processing unit 115, an audio output unit 116, and bus switches 121 to 125.

10 The video image display apparatus 100 is a television which displays a video image input in digital form and outputs audio, and which is, for example, a cathode ray tube (CRT), a liquid crystal television or a plasma television.

15 The remote control receiving unit 102 receives a remote control signal from a remote controller 101.

20 The tuner unit 104 performs processing including demodulation and error correction on a television broadcast signal input through an antenna 103 to generate a transport stream (TS), descrambles the generated TS and outputs the descrambled TS to the demultiplexer unit 105.

25 The demultiplexer unit 105 extracts video data and audio data from TSs in a plurality of channels input from the tuner unit 104, and outputs the extracted data to the decoder unit 106. The video data and audio data processed in the decoder unit 106 are output to the input source selection unit 107.

The selector units 108 and 109 select video data and audio data from the plurality of video signal output apparatuses connected to the video image display apparatus 100.

5 The HDMI receiving unit 110 converts, by an HDMI signal receiving interface, video data and audio data input from the selector units 108 and 109 into a desired format and outputs the data in the desired format to the input source selection unit 107.

10 The input source selection unit 107 selects video data and audio data to be displayed and output between the input from the tuner unit 104 receiving broadcast waves and the input from the HDMI receiving unit 110, and outputs the selected video and audio data to the video image processing 15 unit 111 and the audio processing unit 115.

The video image processing unit 111 performs image quality processing or the like on the input video data and outputs the processed data to the synthesization unit 112.

20 The GUI generation unit 114 generates a menu screen and a connection device list described below and outputs the menu screen and the connection device list to the synthesization unit 112.

25 The synthesization unit 112 synthesizes image data input from the video processing unit 111 and image data input from the GUI generation unit 114 and outputs the synthesized image data to the video image display unit 113. This image data is displayed by the video image display

unit 113.

The audio processing unit 115 performs desired audio processing on the input audio data and outputs the processed data to the audio output unit 116. This audio data is output as sound by the audio output unit 116.

A control unit 117 controls the entire display apparatus. The control unit 117 is, for example, a central processing unit (CPU).

In the present invention, the bus switches 121 to 125 are provided in connection lines (CEC lines) from HDMI terminals, and the control unit 117 can electrically switch over connection/disconnection between two ends of each switch.

#### Configuration of video signal output apparatus

FIG. 2 is a block diagram showing the configuration of video signal output apparatuses 131 to 135. The video signal output apparatuses are apparatuses capable of outputting video data, including, for example, a camcorder, a DVD player, a video player and a game machine. A camcorder will be described by way of example. A camcorder includes an image pickup unit 201, a signal processing unit 202, a storage unit 203, an HDMI transmission unit 204 and a control unit 205.

The image pickup unit 201 has an image pickup lens and an image pickup device. An output signal from the image pickup device is A/D converted and input to the signal processing unit 202.

The signal processing unit 202 includes a level correction unit, a white balance correction unit, a  $\gamma$  correction unit, a color processing unit, a color difference conversion unit and an encoding/decoding unit.

5 The signal processing unit 202 performs encoding processing on a signal input from the image pickup unit 201, and stores processed contents in the storage unit 203. Also, when the stored contents are to be output to the outside, the signal processing unit 202 reads out the contents from 10 the storage unit 203, performs decoding processing on the contents and inputs the decoded contents to the HDMI transmission unit 204.

15 The storage unit 203 manages directory information and format information on stored contents and image sizes as a contents profile.

The HDMI transmission unit 204 sends out video data and audio data by a method described below.

The control unit 205 controls the entire video signal output apparatus 131.

20 Configuration of HDMI

FIG. 3 is a diagram illustrating the configuration of the HDMI.

A transmission unit 300 is provided in devices such as a camcorder and a DVD player existing as video/audio 25 sources (video signal output apparatuses 131 to 135), while a receiving unit 301 is provided in a device such as a display which outputs video/audio (video image display

apparatus 100). More specifically, the transmission unit 300 includes an HDMI transmission unit 204 and a control unit 205, and the receiving unit 301 includes an HDMI receiving unit 110, a control unit 117 and an EDID-ROM 312.

5 Connections are made between the transmission unit 300 and the receiving unit 301 through an HDMI cable 302.

The transmission unit 300 supplies a 5 V power signal to a 5 V line 304 when using a TMDS line 303 or a DDC line 307.

10 The receiving unit 301 detects the connection of the transmission unit 300 from the supply of the 5 V power signal and initializes the EDID (Extended Display Identification Data)-ROM 312. In the EDID-ROM 312, information on the display performance of the receiving unit 301 and physical address information for recognition of connection ports is stored. The HDMI receiving unit 110 supplies an HPD signal to a Hot Plug Detect (HPD) line 306 after the completion of initialization.

15 By being supplied with the HPD signal, the transmission unit 300 obtains through a Display Data Channel (DDC) line 307 the information written in the EDID-ROM 312.

20 The HDMI transmission unit 204 performs Transition Minimized Differential Signaling (TMDS) encoding of video data and audio data and outputs the encoded date in a form suitable for high-speed transmission to the TMDS line 303. For example, the HDMI transmission unit 204 converts video

data of parallel 8 bits  $\times$  3 channels into serial 10 bits  $\times$  3 channels and converts audio data of parallel 4 bits into serial 10 bits.

The HDMI receiving unit 110 performs TMDS decoding of 5 received video data and audio data and outputs baseband video data and baseband audio data. With respect to the above-described example, the HDMI receiving unit 110 converts video data of serial 10 bits  $\times$  3 channels into parallel 8 bits  $\times$  3 channels and converts audio data of 10 serial 10 bits into parallel 8 bits. The control units 205 and 117 integratively control the transmission unit 300 and the receiving unit 301, respectively.

A Consumer Electronics Control (CEC) line 306 is a device control line through which commands capable of 15 controlling the device (hereinafter referred to as CEC commands) can be transmitted and received between the transmission unit 300 and the receiving unit 301.

#### CEC command frame

FIG. 4 illustrates a CEC command frame, FIG. 5 a 20 header portion, and FIG. 6 the format of a data block portion. The CEC command has a maximum length of 16  $\times$  10 bits. The header portion includes logical addresses indicating a source and a destination. The data portion includes an opcode indicating details of control and an 25 operand indicating control parameters.

#### System operation

The operation of the video image display system

having the above-described configuration will be described.

1. Logical address determination processing

The operation from connecting the video signal output apparatuses 131 to 135 to the video image display apparatus 100 up to determination of logical addresses for device control will first be described with reference to FIGS. 7 and 8. FIG. 7 is a flowchart of processing performed by the video signal output apparatuses 131 to 135. FIG. 8 is a flowchart of processing performed by the video image display apparatus 100.

When the video signal output apparatus 131 is connected to the video image display apparatus 100, the video signal output apparatus 131 supplies the 5 V power signal (step S701).

Upon detecting supply of the 5 V power signal (step S801), the video image display apparatus 100 initializes the EDID and sets the HPD signal high (steps S802 and S803).

When the HPD signal becomes high (step S702), the video signal output apparatus 131 reads the EDID and obtains the display performance of the display apparatus and a physical address indicating the HDMI connection terminal position (step S703).

After the determination of the physical address, the video signal output apparatus 131 transmits a polling message onto the CEC line by using the logical address corresponding to the device type (step S704). If the video signal output apparatus is a camcorder, the video signal

output apparatus transmits a CEC command by setting Playback Device 1 with Logical Address "4" as a source and as a destination according to FIG. 15.

In the case of no acknowledgement (Nack) (S705: NO), 5 the video signal output apparatus holds the logical address as an address indicating itself (step S706).

If an acknowledgement (Ack) signal is returned, it can be understood that the address has already been in use by another apparatus. At this time, if the next address 10 exists (S707: YES), the video signal output apparatus transmits the polling message to the address (step S708). More specifically, the video signal output apparatus transmits a CEC command by changing Playback device 1 to Playback Device 2 and setting Logical Address "6" as a 15 source and as a destination. Thus, an available (unused) logical address can be searched for by executing polling one by one with respect to logical addresses according to the device type.

In a case where no address is obtained even after 20 transmitting the polling message to all the logical addresses indicating the same device type (S708: NO), it can be understood that there is no unused logical address. In this case, the video signal output apparatus obtains an indefinite address.

25 The above-described polling message can be grasped as a logical address obtaining request from the device side. Also, Nack can be grasped as a permission reply to the

obtaining request, and Ack as a negative reply to the obtaining request.

Thus, the video signal output apparatus 131 obtains a logical address uniquely assigned on the device control line.

In a case where no logical address is determined even after transmission with respect to Playback Device 3, the video signal output apparatus 131 obtains a logical address (14 or 15) by setting its own address as an indefinite address.

On the other hand, the video image display apparatus 100 monitors the polling message on the CEC line (step S804). The video image display apparatus 100 stores, as a device management table, in a memory unit 118, a history before a terminal position and a logical address for of the connected apparatus are determined (step S805).

As a result of the above-described monitoring, the video image display apparatus 100 can specify the device type to be originally obtained by the device that has obtained an indefinite address.

Further, the video image display apparatus 100 can obtain a maker code and a name to be menu-displayed of the connected device via the CEC line. The video image display apparatus 100 can inquire the video signal output apparatus 131 of the method of obtaining the maker code and the name to be menu-displayed. A notice can also be sent from the video signal output apparatus 131 to the video image

display apparatus 100. FIG. 9 shows an example of the device management table.

In the example shown in FIG. 9, names to be displayed, physical addresses, logical addresses, polling message histories and device types of devices are stored as the device management table. In this example, "DVD player", "Game machine" and "Camera" have succeeded in obtaining logical addresses (4, 8 and 11, respectively) corresponding to Playback Device. On the other hand, "Camcorder" has obtained an indefinite address (logical address "15").

While the device types of the former three devices can also be determined from the obtained logical addresses, the device type of "Camcorder" cannot be specified from the obtained logical address. Since by referring to the polling message history, it is found that the address corresponding to Playback Device has been obtained, thus enabling the device type of this device can be specified.

## 2. Logical address re-obtaining processing

The operation from user's depressing a remote control button to making the indefinite address device (the device that has obtained the logical address "15") re-obtain an address will be described with reference to FIGS. 10 and 11.

A user first depresses a device list display button of the remote controller 1101.

The video image display apparatus 100 displays a connected device list 1102 by referring to the device management table (step S1001). The video image display

apparatus 100 displays in the list not only the devices that have obtained usable logical addresses but also the device that has obtained an indefinite address unusable for device control. That is, the video image display apparatus 5 100 produces a list display regardless of the assigned logical addresses.

In the connected device list 1102, each device name is displayed if obtained, and the device type is displayed according to the logical address with respect to the device 10 for which no device name has been obtained. Also, with respect to the device that has obtained an indefinite address unusable for device control, the polling message history is referred to and the device type specified from the history is displayed in the list.

15 The user then moves a focus 1103 on the connected device list 1102 by operating the remote controller 101 to select the device on which operation control is to be performed (corresponding to the first device of the present invention).

20 The video image display apparatus 100 refers to the device management table to check the logical address of the selected device (step S1002). If the selected device has an indefinite address (step S1003), the video image display apparatus 100 specifies the device type to be originally obtained by the device (step S1004).

25 The video image display apparatus 100 then electrically disconnects the device having the same device

type and having already obtained logical addresses usable for control (corresponding to the second device of the present invention) (step S1005). This disconnection processing can be performed by the control unit 117 controlling the bus switches 121 to 125 provided in the CEC lines. In the present embodiment, if there exist a plurality of devices of the same device type as the control object device, arbitrary ones of them are disconnected.

It is also possible to disconnect the devices by setting the HPD to low. In such a case, the HPDs of the devices are temporarily set in the low state and the devices on which operation control is to be performed have the HPDs successively changed into the high state. This processing enables the device on which operation control is to be performed to obtain a usable logical address and enables the device that has already obtained a usable logical address to obtain an indefinite address.

However, there exist some of the devices which are not disconnected by only setting the HPD to low. In the present embodiment, therefore, a configuration for completely disconnecting the CEC lines by using the bus switches is adopted to enable disconnection with improved reliability.

Subsequently, the video image display apparatus 100 sets to low the HPD of the terminal to which the device selected by the user is connected and again sets the HPD to high to execute address re-obtaining processing (step

S1006).

Thereafter, the device disconnected in step S1005 is connected by the bus switch, thereby being enabled to obtain an indefinite address.

5 Thus, even in a case where an indefinite address has been assigned to the device (first device) designated as a control object by the user, it can be attained to enable the device to re-obtain a logical address according to the device type and undergo device control.

10 3. Post processing

After the completion of control on the device designated as a control object by the user, postprocessing for restoring the original logical addresses may be performed or may not be performed. The user may be enabled 15 to determine whether or not the original logical addresses are restored.

If the original logical addresses are restored, the device that has been a control object is disconnected by the bus switch in the CEC line or by the HPD after the 20 completion of control, and the device that has been disconnected (second device) is connected. The device that has been disconnected is thereby made to have the original logical address. The device that has been a control object is then connected to again obtain an indefinite address.

25 It is desirable to perform such post processing and to thereby restore the original logical addresses in a case where the device designated as a control object by the user

is to be temporarily controlled.

In a case where the original logical addresses are not restored, the device management table is updated. The logical address of the control object device is written 5 from the indefinite address into the obtained address. On the other hand, the device disconnected in step S1005 (second device) has an indefinite address and the device management table is updated so as to reflect this state. Subsequent device operation processing is executed on the 10 basis of the updated device management table.

#### Operation and advantages of the embodiment

With the above-described arrangement, a device type with an indefinite address can be specified and a device of the same device type is temporarily set aside 15 (disconnected) to provide an unused logical address, thus enabling control of the indefinite address device. Even in a case where a number of devices larger than a predetermined upper limit number are connected, the indefinite address device can be controlled without 20 requiring any of users of the other devices to disconnect the device, thus improving the users' convenience.

The indefinite address device is thus made CEC controllable and can therefore be displayed in a list of controllable devices no matter what the kind of logical 25 address obtained by the device. That is, it is not necessary for the user to perform disconnection of the device, and even the need for considering whether or not

the device has obtained an indefinite address is eliminated.

The description has been made by assuming that when there is no unused logical address corresponding to the device type, an indefinite address is assigned to the newly connected device. However, the present invention is not limited to this. That is, the arrangement may be such that no address is assigned to the newly connected device. In such a case, if the user attempts to control the device to which no address is assigned, the device may be made to obtain a logical address according to the device type. The same effect can also be obtained in this way.

#### Second Embodiment

A video image display apparatus according to a second embodiment will be described below.

In the first embodiment, the CEC bus is disconnected with respect to an arbitrarily selected device holding the same device type as a device selected by a user. In the second embodiment, a device to be disconnected is selected on the basis of the frequency of control by a user.

FIG. 12 is a block diagram illustrating a video image display system in the second embodiment. The same reference numerals are used for components identical or corresponding to those in FIG. 1 and the description for such component will not be repeated.

#### 25 Operation management unit

Referring to FIG. 12, an operation management unit 1201 manages devices provided as control objects and

control frequency with respect to each device. The control frequency includes use frequency and operation frequency. Use frequency is computed on the basis of a cumulative sum of use time periods. It is preferable to compute the 5 cumulative time period by putting a heavier weight with respect to a point in time closer to the present time. Operation frequency is obtained, after selecting a device, from the number of times the device is operated by a user under CEC control before the completion of the operation of 10 the device. Simpler computation through the number of times the CEC command is transmitted is also possible.

FIG. 13 illustrates an example of a device management table including control frequency. In this example, the states of operation of the devices are also included as 15 well as use frequency and operation frequency.

#### Logical address re-obtaining processing

The operation from user's depressing a remote control button to making an indefinite address device re-obtain an address will be described with reference to FIG. 14.

20 A user first depresses the device list display button of the remote controller 101.

The video image display apparatus 1200 displays the connected device list 1102 by referring to the device management table (step S1401). The video image display apparatus displays in the list not only devices that have 25 obtained controllable logical addresses but also a device that has obtained an indefinite address unusable for device

control.

The user then moves the focus 1103 on the connected device list by operating the remote controller to select the device on which operation control is to be performed.

5 The video image display apparatus 1200 refers to the device management table to check the logical address of the selected device (step S1402). If the selected device has an indefinite address, the video image display apparatus 1200 specifies the device type of the device (steps S1403  
10 and S1004).

In the second embodiment, a device to be disconnected is selected from devices of the same device type as the control object device (step S1405).

More specifically, the operation state of each device  
15 is first referred to (FIG. 13). For example, in a case where the device is a playback device in reproduction operation, there is still a possibility of being operation-controlled in two-view display or the like and the device is not selected as an object to be disconnected. Also in a  
20 case where the device is a recording device in recording operation such that the possibility of continuing the operation of the device is high, the device is not selected as an object to be disconnected. If the device is in a standby state, it is selected as a disconnection candidate  
25 device.

In a case where a plurality of disconnection candidate devices exist, the use frequency and the

operation frequency are referred to. One of the devices having a lower use frequency and a lower operation frequency is selected to be disconnected. In the present embodiment, the operation frequency and the use frequency 5 are referred to in this order. This is because leaving one having a higher CEC operation frequency is more advantageous in avoiding impairing user operability.

In a case where the use frequency and the operation frequency are equal to each other, the highest priority is 10 given to control of the device selected by the user in selecting one of the devices to be disconnected similarly to the first embodiment.

The device selected to be disconnected by the above-described determination is electrically disconnected (step 15 S1406).

Subsequently, the video image display apparatus sets to low the HPD of the terminal to which the device selected by the user is connected and again sets the HPD to high to execute address re-obtaining processing (step S1407).

20 In a case where the 5 V power supply is stopped by stoppage of video signal input from the video signal output apparatus, insert/pulling-out a plug into/from an outlet, or power on/off, the video image display apparatus cancels the electrical disconnection of the CEC bus and executes 25 address re-obtaining processing on the device that has been disconnected.

With the above-described arrangement, a device type

with an indefinite address can be specified and a device of the same device type is temporarily set aside (disconnected) to provide an unused logical address, thus enabling control of the indefinite address device. Even in  
5 a case where a number of devices larger than a predetermined upper limit number are connected, the indefinite address device can be controlled without requiring any of users of the other devices to disconnect the device, thus improving the users' convenience.

10 Further, a device to be disconnected is determined on the basis of the use frequency and the operation frequency and, therefore, a device with a low probability of being used by a user is disconnected, thus avoiding impairing users' convenience.

15 Also, with respect to the electrically disconnected device, the desirable convenience in the case of using the device next time is ensured by performing address re-obtaining processing when use of the indefinite address device is terminated. While the description has been made  
20 with respect to a case where only one indefinite address device is connected, a case where a plurality of indefinite address devices are connected is conceivable. In such a case, when a user attempts to control one of the indefinite address devices, the indefinite address devices in a  
25 plurality of devices of the same device type as the control object device are excluded from objects to be disconnected. That is, a selection of a disconnection object device is

made only from the devices to which logical addresses according to the device type are assigned, naturally because when one of the indefinite address devices is disconnected, a logical address according to the device 5 type cannot be newly assigned to the control object device.

#### Other embodiments

While the description has been made by way of example with respect to a camcorder which is a playback device (reproduction device) in the above-described embodiments, 10 device control can be performed on other types of devices such as a recording apparatus and a tuner by performing address assignment in the same manner.

The embodiments have been described with respect to an HDMI system by way of example. However, it can be 15 easily understood that the present invention can also be applied to other similar system without limiting the application of the above-described technique to the HDMI system.

While the present invention has been described with 20 reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures 25 and functions.

This application claims the benefit of Japanese Patent Application No. 2008-138344, filed May 27, 2008, which is hereby incorporated by reference in its entirety.

## CLAIMS

1. A device control apparatus in a video image display system including a plurality of connected devices, and being arranged to control each of the connected devices by assigning a logical address according to the device type of the device, an upper limit of the number of assignable logical addresses being determined with respect to each device type, the device control apparatus comprising:

10 an obtaining unit which obtains a logical address of a first device connected to the device control apparatus as a control object;

15 a specifying unit which specifies the device type of the first device if the obtained logical address of the first device is not a logical address according to the device type;

20 a selection unit which selects a second device which is connected to the device control apparatus and is of the same device type as the first device; and

25 a control unit which controls a logical address assigned to the selected second device according to the device type thereof so that the first device obtains a logical address.

2. The device control apparatus according to claim 1, wherein each of the devices connected to the device control apparatus performs address determination processing for determining a logical address assigned to the device, by

requesting a logical address to be obtained by the device, of the device control apparatus and requesting another logical address if the first requested address has already been assigned to other device; and

5       wherein the specifying unit monitors a history of requesting in the address determination processing and determines the device type of the first device on the basis of the history.

3. The device control apparatus according to claim 1,  
10    wherein the selection unit selects as the second device one having the lowest frequency of control from the device control apparatus from among of the devices of the same type as the first device connected to the device control apparatus.

15    4. The device control apparatus according to claim 1,  
      wherein the selection unit selects as the second device one to which a logical address according to the device type is assigned, from among of the devices of the same type as the first device connected to the device control apparatus.

20    5. The device control apparatus according to claim 1,  
      wherein switch units are provided in connection lines between the devices and the device control apparatus, each switch unit being capable of electrical connection and disconnection of the line; and

25    the control unit effects disconnection with the switch unit in the connection line of the second device to enable the first device to obtain a logical address

according to the device type.

6. The device control apparatus according to claim 1, wherein the control unit effects control so that after the completion of control of the first device, the second device re-obtains the logical address according to the device type assigned to the first device.

5 7. The device control apparatus according to claim 1, further comprising:

10 a display control unit which effects control so as to display a list of the plurality of devices connected to the device control apparatus; and

an operation unit which selects the first device as a control object from the displayed list of the plurality of devices according to an instruction from a user.

15 8. A device control method in a video image display system including a device control apparatus and a plurality of devices connected to the device control apparatus and being arranged to control each of the connected devices by assigning a logical address according to the device type of 20 the device, an upper limit of the number of assignable logical addresses being determined with respect to each device type, the device control method comprising the steps of:

25 obtaining a logical address of a first device connected to the device control apparatus as a control object;

specifying the device type of the first device if the

obtained logical address of the first device is not a logical address according to the device type;

selecting a second device which is connected to the device control apparatus and is of the same device type as  
5 the first device; and

controlling a logical address assigned to the selected second device according to the device type thereof so that the first device obtains a logical address.

9. The device control method according to claim 8,  
10 wherein each of the devices connected to the device control apparatus performs address determination processing for determining a logical address assigned to the device, by requesting a logical address to be obtained by the device, of the device control apparatus and requesting another logical address if the first requested address has already  
15 been assigned to other device; and

wherein the specifying step includes monitoring a history of requesting in the address determination processing and determining the device type of the first  
20 device on the basis of the history.

10. The device control method according to claim 8,  
wherein the second device is selected as one having the lowest frequency of control from the device control apparatus from among of the devices of the same type as the  
25 first device connected to the device control apparatus.

11. The device control method according to claim 8,  
wherein the second device is selected as one to which a

logical address according to the device type is assigned, from among of the devices of the same type as the first device connected to the device control apparatus.

12. The device control method according to claim 8,  
5 wherein switch units are provided in connection lines between the devices and the device control apparatus, each switch unit being capable of electrical connection and disconnection of the line; and

wherein the controlling step effects the control so  
10 that disconnection is effected by the switch unit in the connection line of the second device to enable the first device to obtain a logical address according to the device type.

13. The device control method according to claim 8,  
15 wherein the controlling step effects the control so that after the completion of control of the first device, the second device re-obtains the logical address according to the device type assigned to the first device.

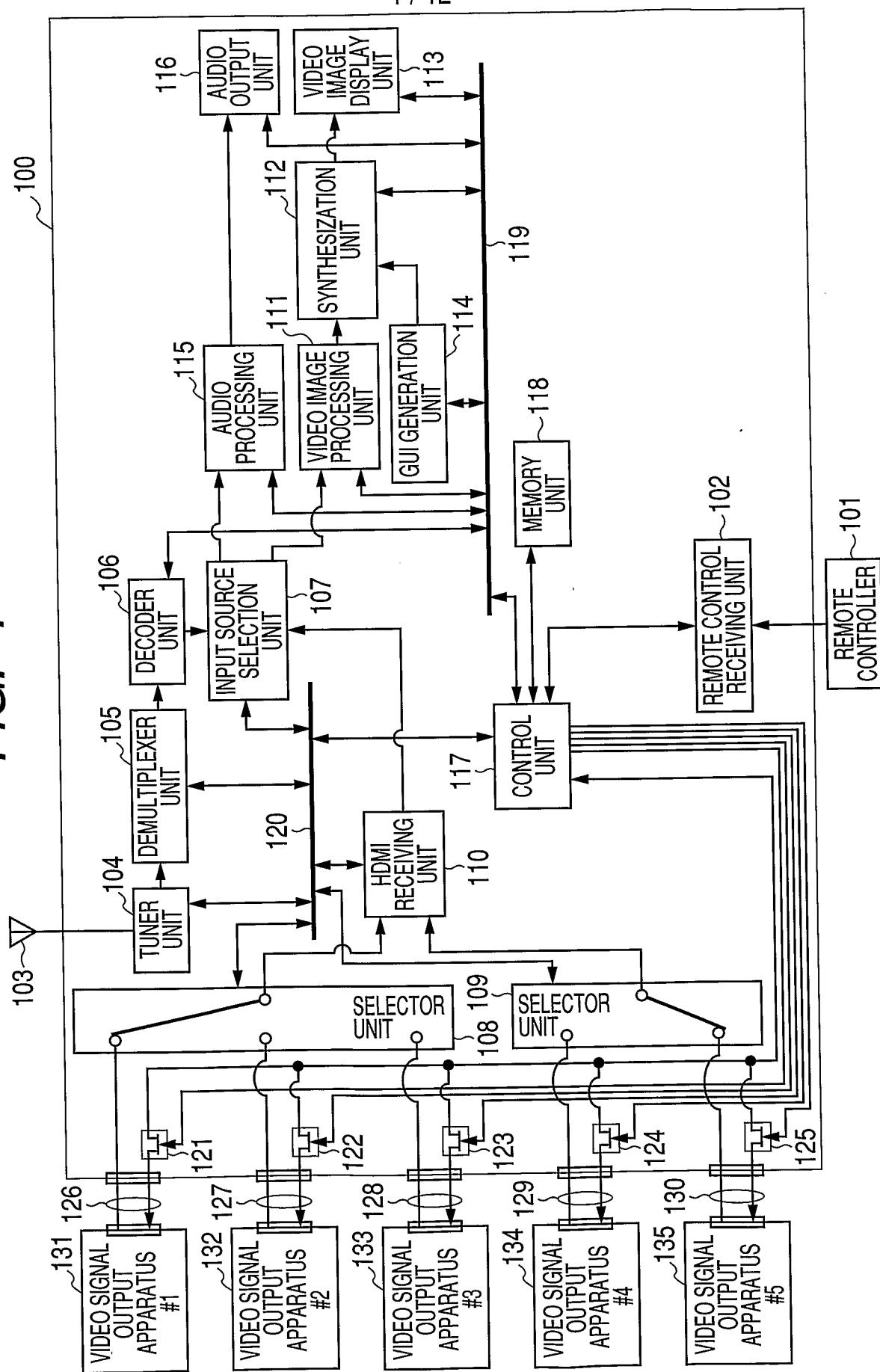
14. The device control method according to claim 8,  
20 further comprising:

a display control step of effecting control so that a list of the plurality of devices connected to the device control apparatus is displayed; and

an operation step of selecting the first device as a  
25 control object from the displayed list of the plurality of devices according to an instruction from a user.

FIG. 1

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FIG. 2

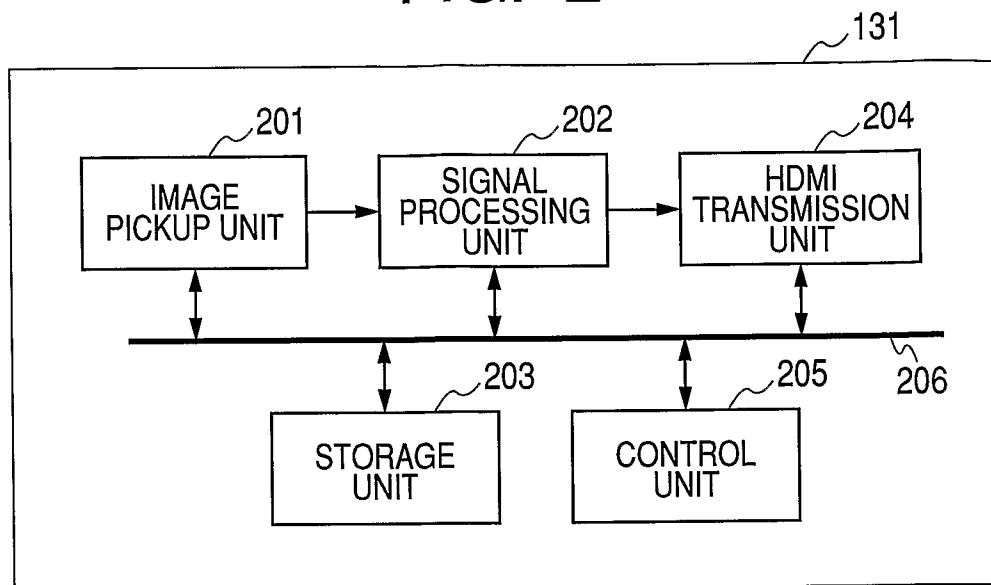
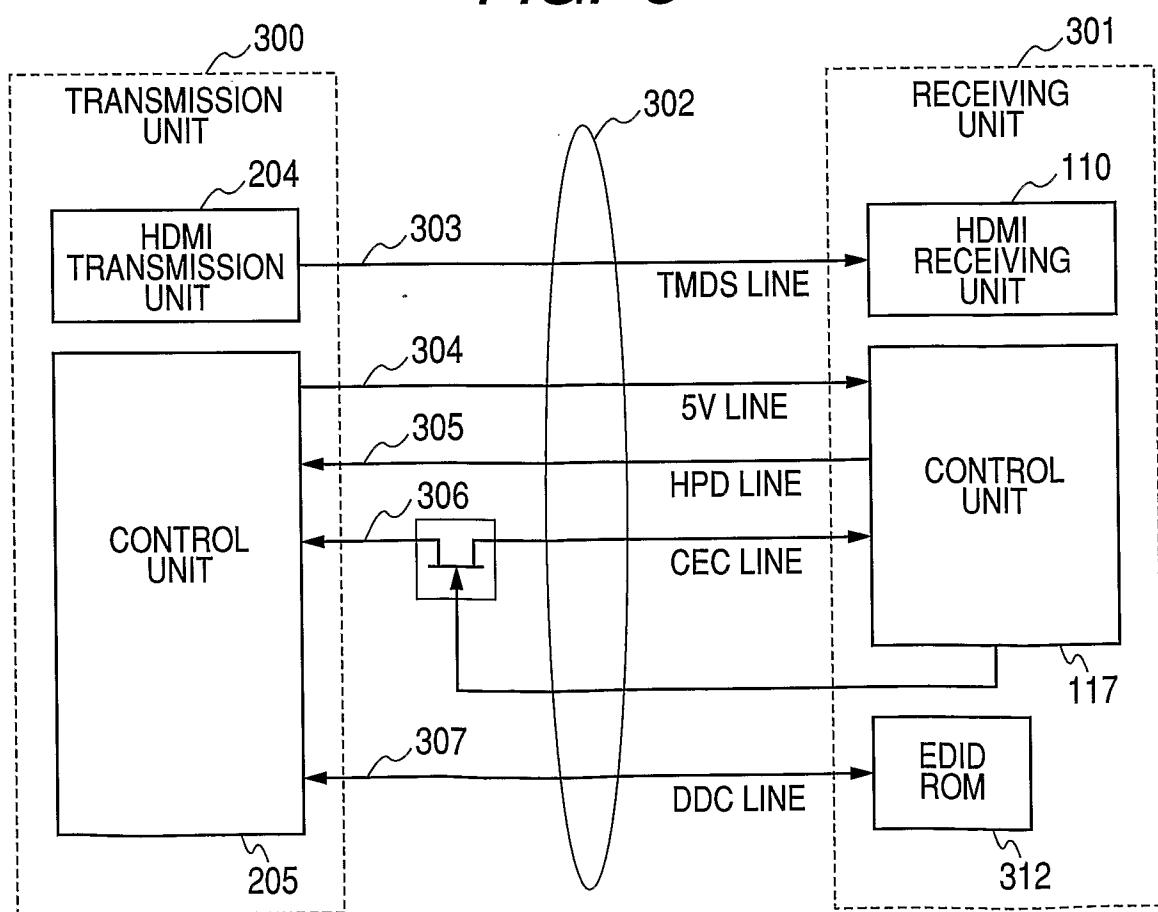
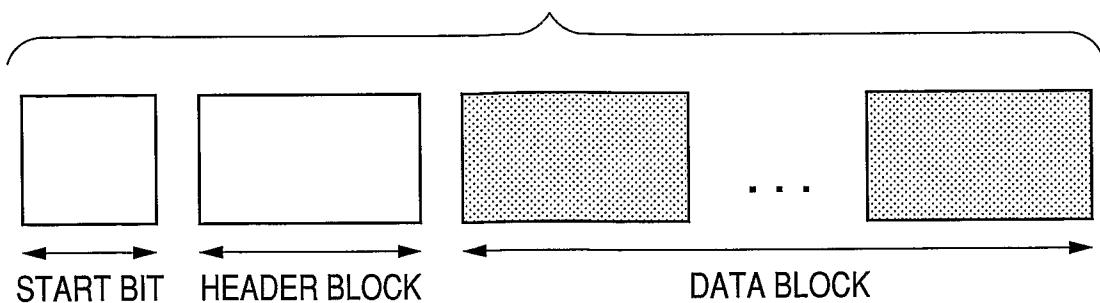


FIG. 3



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**FIG. 4****FIG. 5**

HEADER BLOCK (10 BITS)									
1	2	3	4	5	6	7	8	-	-
INITIATOR			DESTINATION			EOM		ACK	

**FIG. 6**

DATA BLOCK (10 BITS)									
1	2	3	4	5	6	7	8	-	-
INFORMATION BIT (OPCODE/OPERAND)						EOM		ACK	

FIG. 7

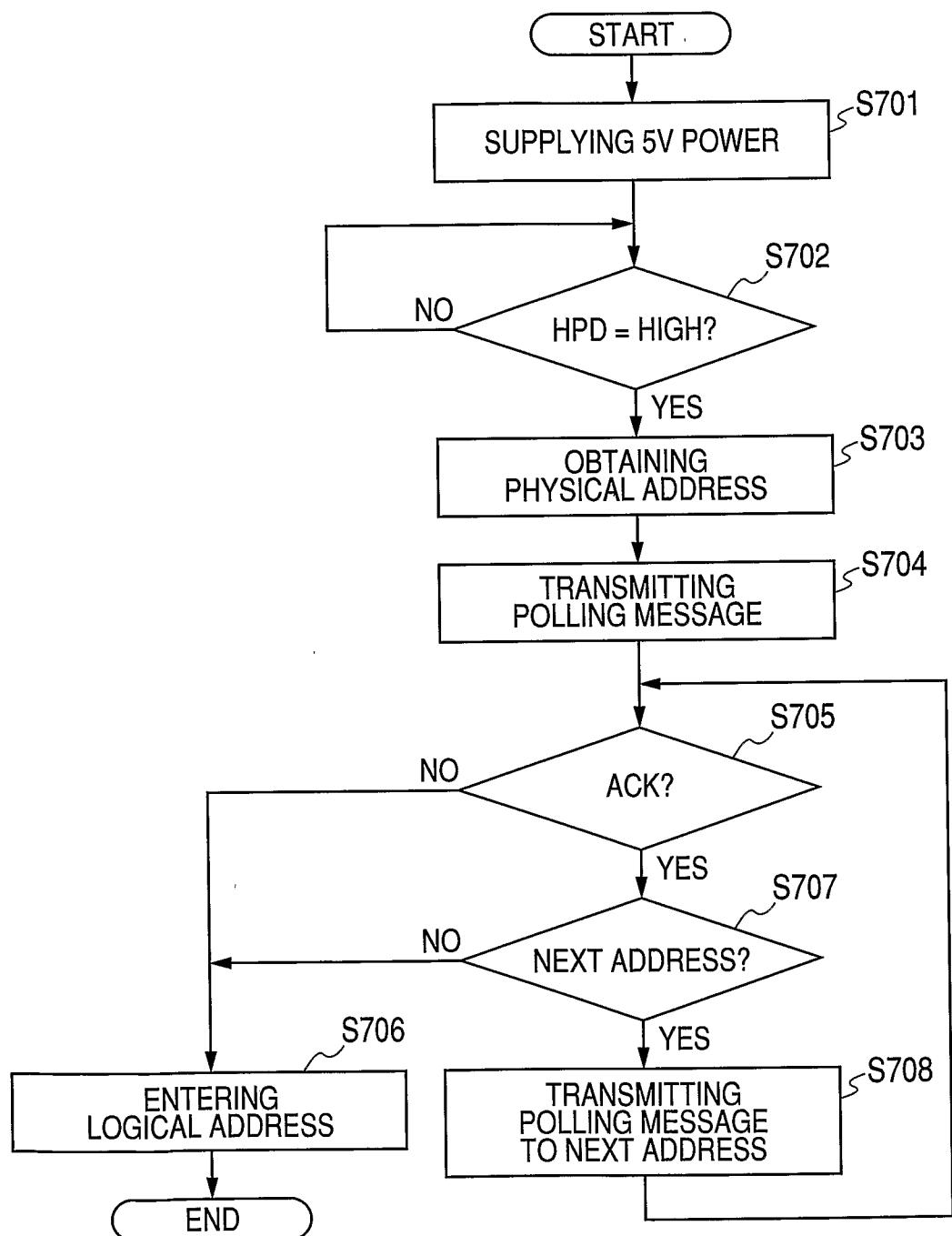


FIG. 8

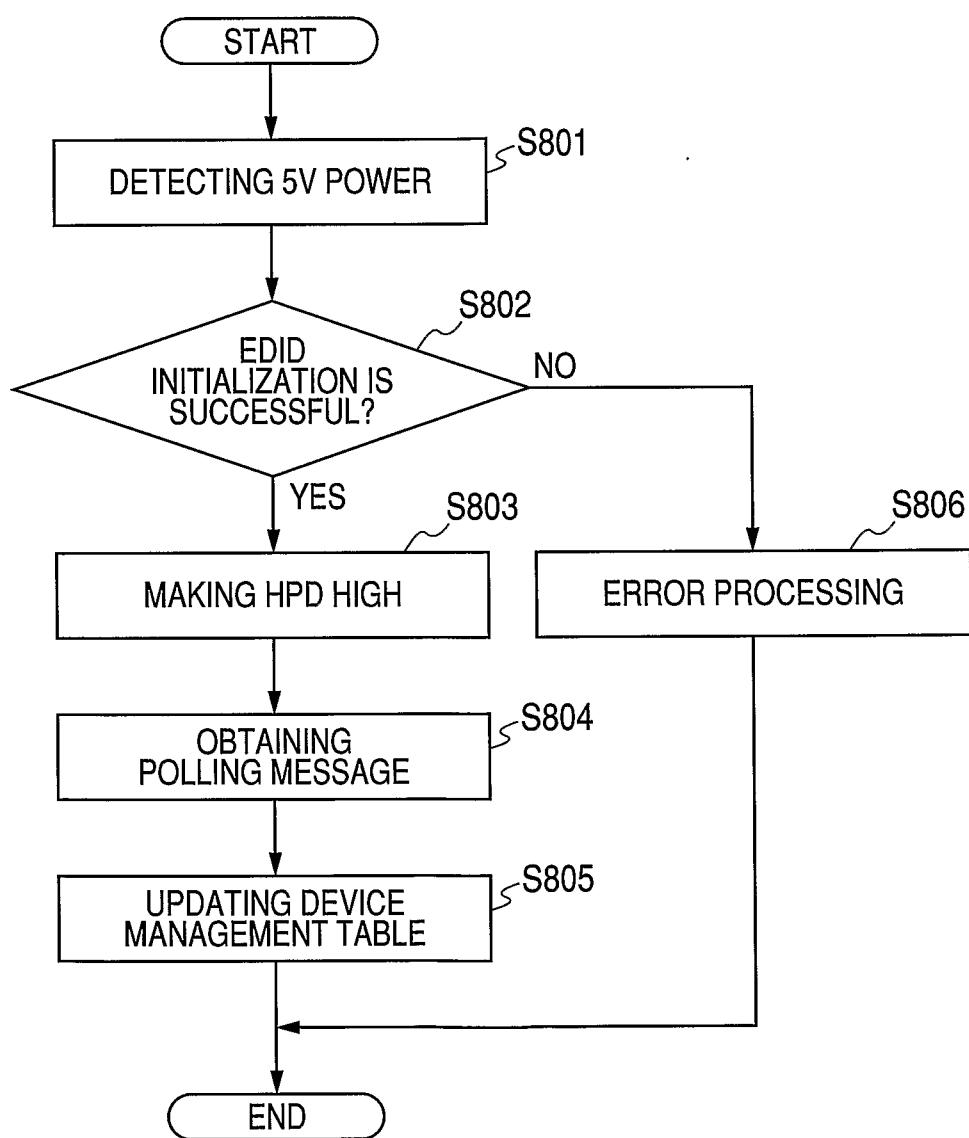
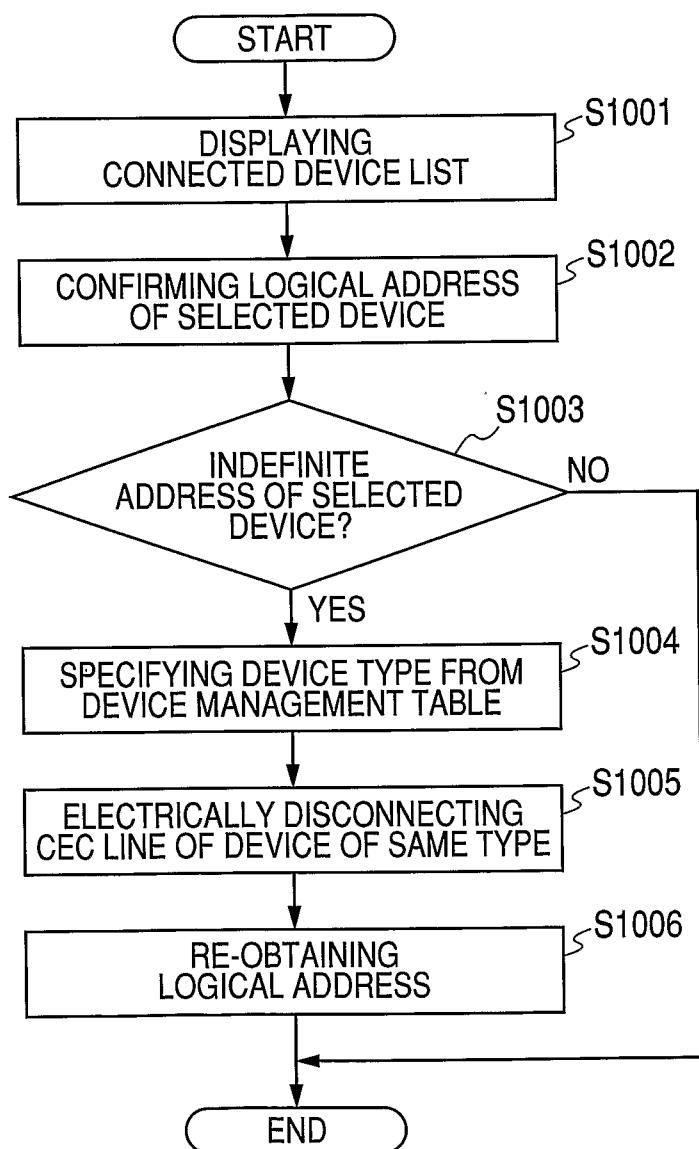


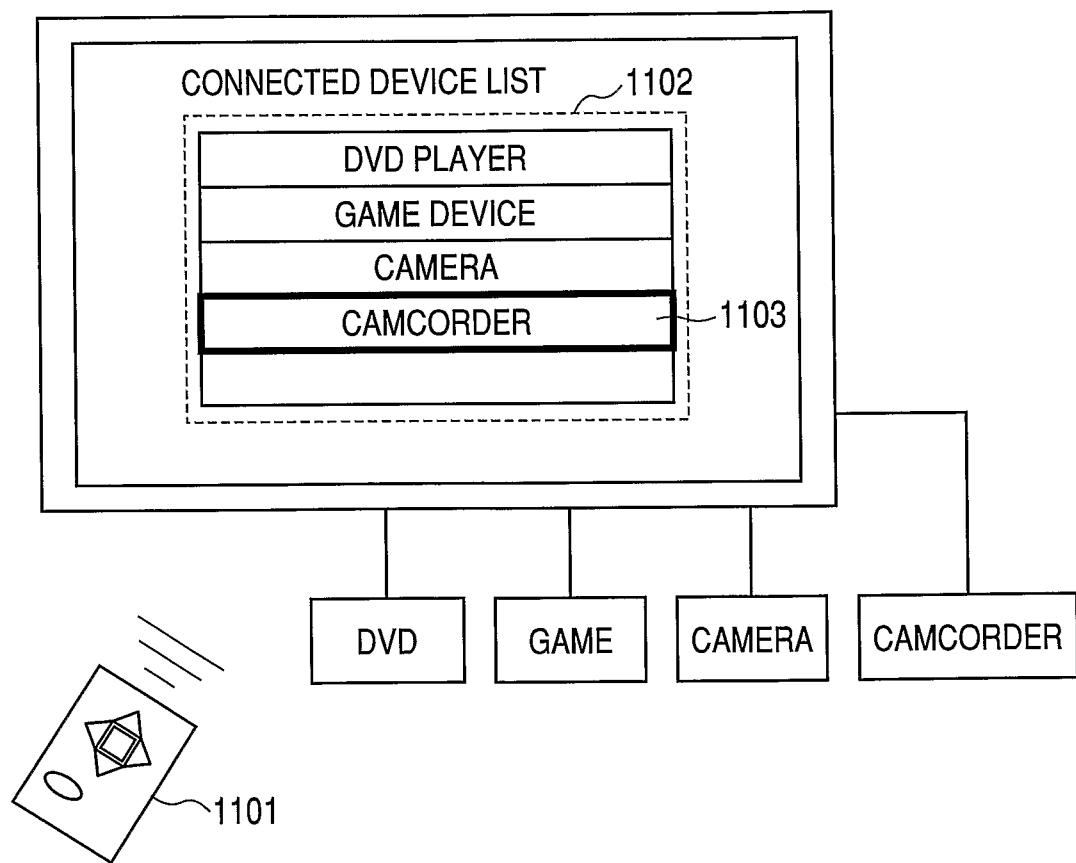
FIG. 9

DISPLAY NAME	PHYSICAL ADDRESS	LOGICAL ADDRESS	POLLING MESSAGE	DEVICE TYPE
DVD PLAYER	1.0.0.0	4	4	PLAYBACK DEVICE
GAME DEVICE	2.0.0.0	8	4→8	PLAYBACK DEVICE
CAMERA	3.0.0.0	11	4→8→11	PLAYBACK DEVICE
CAMCORDER	4.0.0.0	15	4→8→11→15	PLAYBACK DEVICE

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FIG. 10



**FIG. 11**

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FIG. 12

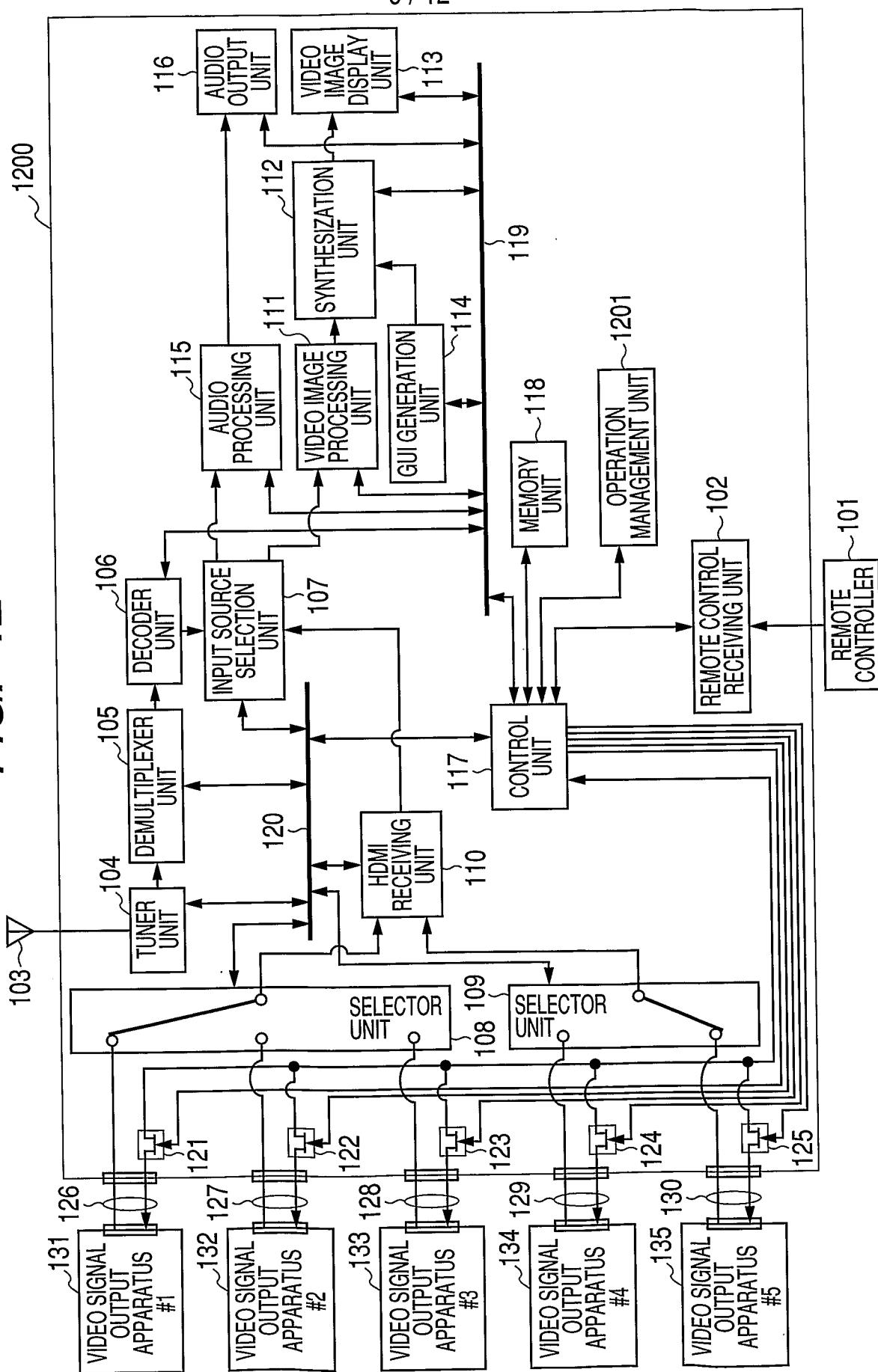
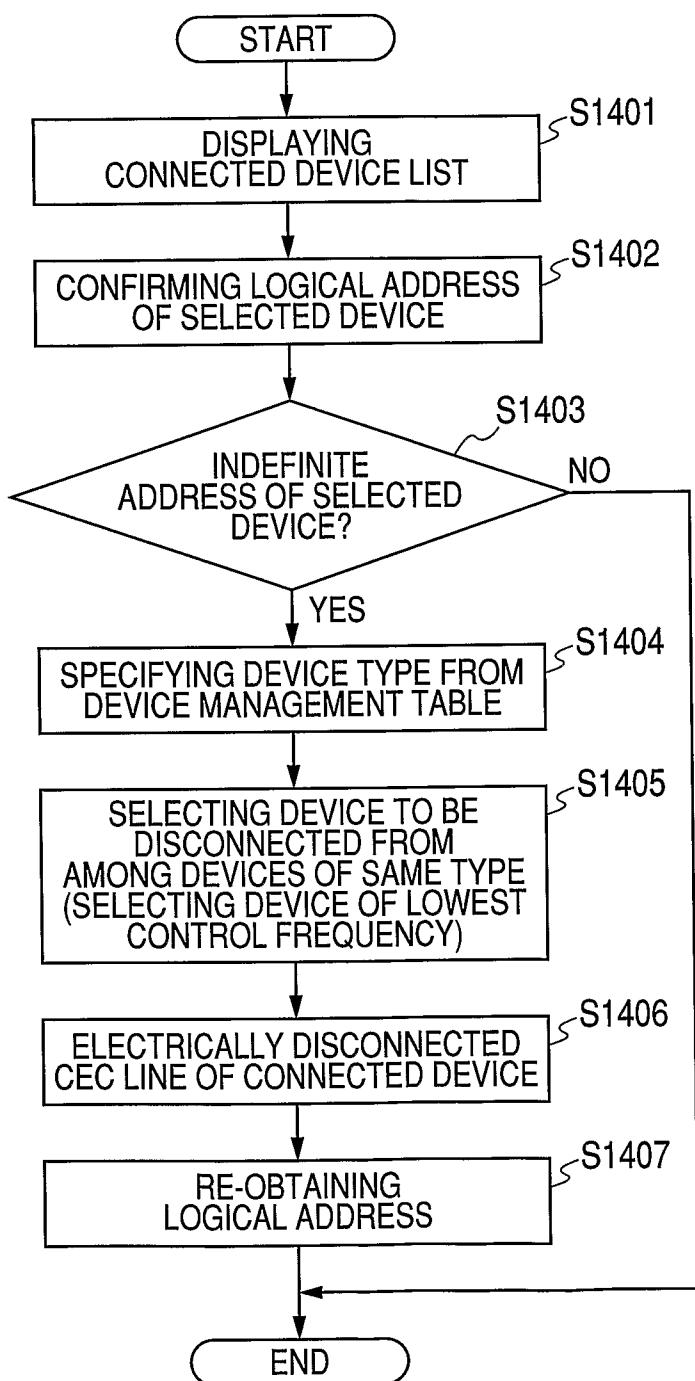


FIG. 13

DISPLAY NAME	PHYSICAL ADDRESS	LOGICAL ADDRESS	POLLING MESSAGE	DEVICE TYPE	STATE	USE FREQUENCY	OPERATION FREQUENCY
DVD PLAYER	1.0.0.0	4	4	PLAYBACK DEVICE	STANDBY	LOW	LOW
GAME DEVICE	2.0.0.0	8	4→8	PLAYBACK DEVICE	STANDBY	HIGH	HIGH
CAMERA	3.0.0.0	11	4→8→11	PLAYBACK DEVICE	ON	HIGH	HIGH
CAMCORDER	4.0.0.0	15	4→8→11→15	PLAYBACK DEVICE	ON	—	UNDEFINED

**FIG. 14**

***FIG. 15***

ADDRESS	DEVICE
0	TV
1	RECORDING DEVICE 1
2	RECORDING DEVICE 2
3	TUNER 1
4	PLAYBACK DEVICE 1
5	AUDIO SYSTEM
6	TUNER 2
7	TUNER 3
8	PLAYBACK DEVICE 2
9	RECORDING DEVICE 3
10	TUNER 4
11	PLAYBACK DEVICE 3
12	RESERVED
13	RESERVED
14	FREE USE
15	UNREGISTERED (AS INITIATOR ADDRESS) BROADCAST (AS DESTINATION ADDRESS)

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2009/059468

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H04L12/28 H04N5/775 H04N7/16 G09G5/00			
According to International Patent Classification (IPC) or to both national classification and IPC			
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) <b>H04L H04N G09G</b>			
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched			
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) <b>EPO-Internal, WPI Data</b>			
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>			
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	
<b>X</b>	HITACHI; ET AL: "High-Definition Multimedia Interface - Specification Version 1.3a" HIGH-DEFINITION MULTIMEDIA INTERFACE, [Online] XP002491706 Retrieved from the Internet: URL: <a href="http://www.hDMI.org/download/HDMISpecification13a.pdf">http://www.hDMI.org/download/HDMISpecification13a.pdf</a> > [retrieved on 2006-11-10] paragraph [CEC 10.2] page CEC 83 -----	1-14	
<b>A</b>	WO 2008/020401 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; VERGOOSSEN THEODORUS A P G [NL]) 21 February 2008 (2008-02-21) page 1, line 26 - page 2, line 2 page 5, line 12 - line 17 page 9, line 7 - line 17 -----	1-14 -/-	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.	
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed			
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family			
Date of the actual completion of the international search <b>22 September 2009</b>		Date of mailing of the international search report <b>29/09/2009</b>	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer <b>Mikulastik, Patrick</b>	

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2009/059468

## C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A, P		2-7,9-14

**INTERNATIONAL SEARCH REPORT**

## Information on patent family members

International application No  
PCT/JP2009/059468

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 2008020401	A2 21-02-2008	CN EP	101507183 A 2055048 A2	12-08-2009 06-05-2009
US 2008320539	A1 25-12-2008	JP	2009004877 A	08-01-2009