Title: SYSTEM AND METHOD FOR INTEGRATING MULTIPLE VIDEO SWITCHES INTO A VIDEO MATRIX

Abstract: A system and method for integrating multiple video switches into a video matrix may be provided including an expandable video switching matrix having a first number of inputs and a first number of outputs. The matrix may include a first crosspoint matrix switch having a second number of inputs and a second number of outputs, and a second crosspoint matrix switch having a third number of inputs and a third number of outputs. The first and second crosspoint matrix switches may be interconnected such that the first number of inputs is equal to the sum of the second number of inputs and the third number of outputs, and the first number of outputs may be equal to or less than the second number of outputs. In one embodiment, a plurality of the second number of outputs may be dedicated for interconnection with inputs associated with at least a second video switching matrix.
SYSTEM AND METHOD FOR INTEGRATING MULTIPLE VIDEO SWITCHES INTO A VIDEO MATRIX

RELATED APPLICATIONS
This application is related to U.S. application entitled SYSTEM AND METHOD FOR MONITORING VIDEO INPUTS, Serial No. 09/328,922, filed June 9, 1999.

TECHNICAL FIELD OF THE INVENTION
The present invention relates generally to audio-visual systems and, more particularly, to a system and method for integrating multiple video switches into a video matrix.

BACKGROUND OF THE INVENTION
In a fully automated environment, appliances that change various parameters of the environment can be linked to a control area network (CAN) and a computer-based controller. Appliances may include heating, ventilation and air conditioning (HVAC), lighting, audio-visual, telecommunications, security, surveillance and fire protection systems, for example. A user interface, such as a touch panel, may be electronically linked to the control area network to accept user input and display current system status.

Audio-visual equipment may include centralized video switches with multiple inputs and multiple outputs. Various components may be coupled with the inputs to provide video signals for distribution to the outputs. The number of inputs and outputs associated with each switch is limited. In order to increase capacity beyond certain limits, equipment must be replaced with larger, more expensive units.

SUMMARY OF THE INVENTION
Accordingly, a need has arisen for an improved system and method for integrating multiple video switches into a video matrix. The present invention provides a system and method for integrating multiple video switches into a video matrix that substantially eliminates or reduces problems associated with the prior video switching apparatus.

In accordance with the teachings of the present invention, an expandable video switching matrix having a first number of inputs and a first number of outputs may be provided. The matrix may include a first crosspoint matrix switch having a second number of inputs and a second number of outputs, and a second crosspoint matrix switch having a third number of inputs and a third number of outputs. The first
and second crosspoint matrix switches may be interconnected such that the first number of inputs is equal to the sum of second number of inputs and the third number of inputs, and the first number of outputs may be equal to or less than the second number of outputs. In one embodiment, a plurality of the second number of outputs may be dedicated for interconnection with inputs associated with at least a second video switching matrix. In another embodiment, a plurality of the second number of inputs may be dedicated for interconnection with outputs associated with the second video switching matrix.

In yet another embodiment, the expandable video switching matrix may be embodied in a video switching tray having a plurality of video output devices. The video switching tray may also include one or more data busses for communicating with an audio visual system network.

In still another embodiment, the video switching tray may be removably coupled with an expandable video switch. The video switch may include one or more expansion ports for coupling with additional video switching trays.

Technical advantages of the present invention include an expandable video switch which may be upgraded for increased capacity, without replacement of the entire switch. The interconnection and configuration of crosspoint matrix switches allow for a plurality of inputs dedicated to future expansion.

Another technical advantage includes the modularity and versatility of the resultant multi input/multi output video switch. After expansion with one or more additional video switching trays, the video switch retains the ability to distribute any input to any combination of output signals.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following brief descriptions, taken in conjunction with the accompanying drawings and detailed description, wherein like reference numerals represent like parts, in which:

FIGURE 1 is a simplified top-level block diagram of a system and method of coupling one or more control systems to the Internet, constructed according to an embodiment of the present invention;

FIGURE 2 is a more detailed block diagram of a system and method of coupling one or more control systems to the Internet, constructed according to an embodiment of the present invention;

FIGURE 3 is a perspective view illustrating a video switch according to teachings of the present invention;

FIGURE 4 is an elevational view of the rear of the video switch;

FIGURE 5A is a perspective view of the top of a video tray suitable for use with the video switch of FIGURE 3;
FIGURE 5B is an elevational view of the bottom of the video tray of FIGURE 5A.

FIGURE 6A is a schematic diagram of a crosspoint matrix switch according to the teachings of the present invention;

FIGURE 6B is a schematic diagram of four crosspoint matrix switches configured to form a 16 input-16 output video switching matrix according to the teachings of the present invention;

FIGURE 6C is a schematic diagram of nine crosspoint matrix switches configured to form a 24 input-24 output video switching matrix according to the teachings of the present invention; and

FIGURE 7 is a schematic diagram of one embodiment of a instrumentation and wiring configuration according to the teachings of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments of the present invention and its advantages are best understood by referring now in more detail to FIGURES 1-7 of the drawings, in which like numerals refer to like parts.

FIGURE 1 is a simplified top-level block diagram of a system and method 10 of Internet control system which couples one or more control systems to the Internet, constructed according to the teachings of the present invention. The implications of employing system and method 10 of the present invention are the ability to communicate with, control, and be controlled by one or more Internet nodes or Internet applications that act as one or more devices in a control system connected by a control area network (CAN). These Internet applications may include web browsers, web server applications of information content providers, and e-mail applications. In other words, the geographical and communication protocol boundaries are transparent between a local control area network and the Internet, so that the Internet, web information content providers and web browser applications become devices in the control system. By definition, a device in the control system can send control commands to and/or receive control messages from a master controller on the control area network. Hereinafter, the word Internet may be also used to refer to an Intranet or the World Wide Web and vice versa.

System 10 includes a control network portal 12 coupled between the Internet 22 and one or more control area networks 30 and 31. Control area networks 30 and 31 are local area networks operating under transport protocols such as Ethernet, and AXLink and PhastLink of AMX Corporation (Dallas, Texas) that interconnect a variety of devices, appliances and/or equipment. The underlying network connectivity 34 may be wired, wireless, power line carriers, or any suitable transmission medium.

Coupled to control area networks 30 and 31 are a plurality of devices, appliances and/or equipment, including control area network user interfaces (CAN UI/F) 35, master controllers 36, and Internet
appliances 37-39. Some devices may be coupled to control area networks 30 and 31 via additional intermediate communications devices, such as an RS 232 controller.

Control area network user interface device 35 is any device that is capable of receiving user input and displaying or indicating control network status. For example, a touch panel, a computer terminal with a monitor, keyboard and pointing device, and any device with similar functionalities may serve as control area network user interface 35. As described in detail below, with the use of control area network portal 12 of the present invention, Internet applications are also capable of functioning as control area network user interface devices without the use of custom and dedicated applications on the user's end.

Master controller 36 is generally a CPU-based controller that controls the communications among user interface 35 and Internet appliances 37-39. It is operable to receive user inputs received by user interface devices, such as commands, and instruct the appropriate Internet appliance to act according to the command. Master controller 36 may also poll each device in control area network 30 periodically to monitor its status. The system status and/or the status of each device may be sent to control area network user interface devices for display.

Internet appliances 37-39 are devices that can receive commands from master controller 36 and operate or act according to the command. Internet appliances 37-39 may include equipment that affects or monitors the various parameters of the premises. For example, Internet appliances 37-39 may include heating and air conditioning, lighting, video equipment, audio equipment, sprinklers, security cameras, infrared sensors, smoke detectors, etc. in a residential or commercial control area network. Household appliances, such as a hot tub, fireplace, microwave oven, coffee maker, etc. may also be Internet appliances coupled to the network. Internet appliances 37-39 may also be capable of providing a current status of its operational state to master controller 36, such as ON/OFF, temperature settings, current ambient temperature, light intensity settings, volume settings, threshold settings, and predetermined alphanumeric strings reflective of operational states.

Master controller 36 is also operable to receive user input from nodes of the Internet 22 via control network portal 12. Connected to Internet 22 are content providers 25 and 26, which may also function as control area network user interface devices. Content providers 25 and 26 are typically web servers that generate and provide static and/or dynamic information and content in the form of web pages. Content provider applications executing on the web server are able to mine data stored in databases.
Also connected to the Internet 22 are web browsers 23 and 24 that may also serve as control area network user interfaces. Web browsers 23 and 24 are application programs that can be used to request web pages from content providers 25 and 25 and decode the web pages.

Using control network portal 12, users may access control area networks 30 and 31 via web browsers 23 and 24 accessing web pages provided by control network portal 12 or value-added web pages provided by content providers 25 and 26. For example, a user who has a control area network deployed in her luxury residence to control various aspects of the home environment may use a web browser application to remotely monitor her home. She may change the temperature setting to decrease energy use, for example, because she will be leaving on a business trip straight from work. She may also use the surveillance cameras to visually ensure security has not been breached. She may even be able to remotely program her VCR to record certain favorite programs that will be broadcast while she is away.

An example of value-added web pages provided by content providers is the provision of an interactive version of the television programming web page, www.tvguide.com. A user may request this web page, determine available program choices, and click on a certain program. Options may be provided to enable the user to turn on the television and tune to a particular channel scheduled to broadcast the selected program or to program the VCR to record the selected program.

Another example of value-added web pages provided by content providers is the provision of a secured web page that an electric company may access to slightly raise the temperature settings of the air conditioning systems of its participating customers in anticipation of high demand brown out conditions.

Yet another example is a web page that a security company may use to access, monitor and control the security, surveillance and fire protection systems of its customers.

FIGURE 2 is a more detailed block diagram of a system and method 10 of coupling one or more control system to the Internet constructed according to an embodiment of the present invention. Control area network portal 12 may include a web server 13 coupled to the Internet 22. Web server 13 is also coupled to an Internet appliance (IA) server 14, which may also be coupled to a control network server 40. Control network server 40 is coupled to control area network 30 that links several appliances and systems, such as fire protection systems 50, heating, ventilation and air conditioning (HVAC) systems 51, lighting systems 52, audio and visual systems 53, and security systems 54. Control area network 30 is also coupled to user interface devices 55 and master controller 36.

It may be noted that control network portal 12 may be implemented by a single stand-alone system that has sufficient memory and processing power or several separate systems with distinct functions as shown in FIGURE 2. Web server 13 is operable to receive requests of web pages from web
browser 23 and to respond by generating and providing the requested web pages. The information content of the web pages may be dynamically obtained by communicating with IA server 14, which is operable to communicate with master controller 36 via control network server 40 to obtain status and other information. Control network server 40 is used only if there is protocol conversion or other control issues needed to operate the control area network. It may be thought of, logically, that IA server 14 is directly coupled to the network and functions as a device on the network. Commands entered at a web browser are sent to web server 13, which relays the commands to master controller 36 via IA server 14 and control network server 40. Master controller 36 then instructs appropriate appliances and/or systems in the control network to act according to the received command.

Referring now to FIGURE 2, in one embodiment of the present invention, audio-visual systems may include a video switch 60. Video switch 60 may be incorporated into a multi-room home automation system including a plurality of video input devices 64 and video output devices 66. Video input devices 64 suitable for use within the teachings of the present invention include, but are not limited to, security cameras, and television, VCR, cable, and satellite signals. Video output devices 66 may include television and computer monitors, and many other video signal processing systems. Video switch 60 may be configured to switch and distribute video signals, for example, standard 75 ohm base band video signals. Video switch 60 may also detect sync signals on each video input in order to determine the power state of video input devices 64 connected by the sync signal. The video switch senses the presence of a video signal at each input, allowing a video signal to act as a trigger event for system programming events. Furthermore, video switch 60 can distribute any input signal to any combination of output signals, with full signal strength level for all destinations.

As shown in FIGURES 3-5, video switch 60 may be a generally rectangular box-shaped structure defined by a hub box 62. AC power may be supplied to video switch 60 through a 120 volt power adaptor 68. A plurality of video trays 100, 200 and 300 may be coupled with hub box 62 using mechanical fasteners 104. Hub box 62 can house a combination of multiple video trays, for example 100, 200 and 300 allowing each video switch to function as a multiple input, multiple output matrix video router. Hub box 62 may be rack-mounted or may be used as a free-standing unit.

Video trays 100, 200 and 300 of the illustrated embodiment are essentially equivalent both structurally and functionally. For descriptive purposes, video tray 100 will be described in detail below.

Relevant components of video trays 200 and 300 will be described as necessary to establish the interaction between video trays 100, 200 and 300, and hub box 62.
Communication between video switch 60, various other components of audio-visual systems 53 and control area network 34 is established through a data bus 102. In the illustrated embodiment, data bus 102 is an RJ-45 PhastLink port. PhastLink cables may be used to connect video switch 60 with other PhastLink compatible devices including keypads, dimmers, amplifiers, audio switches, etc. PhastLink connections employ a standard 10 Base-T connection (i.e., category 5 wire and RJ-45 connectors). Phastlink products are available from AMX Corporation of Dallas, Texas. Other suitable substitutes are available and may be incorporated within the teachings of the present invention.

An auxiliary data bus 103 is provided adjacent to data bus 102. Auxiliary data bus 103 is identical to data bus 102 and the two can be used interchangeably to establish communication connections with components of control area network 30. By providing at least one auxiliary data bus 103, system components may be "daisy-chained" for intercommunication purposes. For optimum performance of the system, a double 120 ohm terminator may be inserted into either data bus 102 or auxiliary data bus 103 of the last, or in some cases the only video tray 100, 102 or 103 of the "daisy-chain," to complete the circuit established therebetween.

Link light 106 is provided upon video tray 100 and includes a green LED indicator light which indicates communication between video tray 100 and other components of audio-visual systems 53. Indicator lights 110 are also provided, to indicate the software object allocation of respective video trays 100, 200, and 300. Identify (ID) button 108 provides a hardware identification mechanism which allows software objects to be properly associated with various hardware objects. When configuring audio visual systems 53, ID button 108 may be depressed to send device ID information to audio visual system 53. This allows the system software to make the correct software connection and assign the proper address to the physical device, or video switch 60. Accordingly, each component of video switch 60, has a "soft address" which is assigned by configuration software during installation, or when additional components are added to the audio visual systems 53. This is a distinct contrast from prior automation networks which require each component to have a "hard," or permanent dip switch address.

Video tray 100 includes eight video input ports 111-118, and eight video output ports 121 - 128. In the illustrated embodiment, video input and output ports 111-118, and 121-128, respectively, comprise RCA female video ports. Video input ports 111-118 allow a total of eight video input devices 64 to be coupled with video tray 100. Similarly, video output ports 121 - 128 allow a total of eight video output devices 66 to be coupled with video tray 100. Each video input device 64 coupled with video tray 100 can be distributed to any combination of video output devices 66 with full signal strength level provided for all destinations.
Video switch 60 may function with a single video tray 100 disposed therein. An edge connector 138 associated with video tray 100 may be inserted into and fully seated within a female edge connector located on the interior of hub box 62. In this configuration, video switch 60 will operate as an eight input, eight output video switching matrix. Blank plates (not explicitly shown) may be installed in lieu of video trays 200 and 300 and the eight input/eight output functionality will be maintained. Alternatively, at least one additional video tray 200 and/or 300 may be coupled with hub box 62 to increase capacity and enhance the functionality of video switch 60. As will be described later in more detail, the addition of video tray 200 allows video switch 60 to function as a 16 input/16 output video switching matrix. Similarly, providing a third video tray 300 allows video switch 60 to function as a 24 input/24 output video switching matrix.

Additional components associated with video tray 100 are illustrated in more detail in FIGURES 5A and 5B. Video signals are introduced into video tray 100 through any one of video input ports 111-118. A plurality of crosspoint matrix switches 130, 131 and 132 provide video signal switching capability to video tray 100. Video signals from any one of video input ports 111-118 may be distributed to any one of video output ports 121-128. Alternatively, ribbon cable 150 may be coupled with video switch 60 to provide up to sixteen additional inputs, for distribution among video output ports 121-128. Similarly, video signals from any one or more of input ports 111-118 may be output through ribbon cable 150 for distribution amongst any one or more of sixteen additional output ports associated with video switch 60.

In the illustrated embodiment, a total of twenty-four inputs and twenty-four outputs are provided for video switch 60. The present invention allows video switch 60 to distribute any input signal to any combination of output signals, with full signal strength level for all destinations. It will be recognized by those skilled in the art that fewer, or more additional video input ports and video output ports may be provided within the teachings of the present invention. Any number of video input and output ports may be provided upon each video tray, and any number of video trays may be incorporated into a given video switch. Additional details regarding the signal processing capabilities of video tray 100 will be described in more detail with respect to FIGURES 6A-6C and 7.

FIGURES 6A-6C are schematic diagrams of cross point matrix switches according to the teachings of the present invention. Referring to FIGURE 6A, an eight input/eight output cross point matrix switch 130 is shown. An example of a commercially available crosspoint matrix switch is HA456 manufactured by Harris Corporation of Melbourne, Florida. Crosspoint matrix switch 130 may be incorporated into video switch 60 to allow for a total of eight video input devices to be coupled to and
distributed amongst eight video output devices. By incorporating a second cross point matrix switch 131, the functionality of an eight input/eight output or alternatively, a sixteen input/eight output crosspoint matrix switch may be established. FIGURE 6B illustrates a configuration of four crosspoint matrix switches 130, 131, 132, and 230 configured to function as a sixteen input/sixteen output video switching matrix. Similarly, FIGURE 6C illustrates a configuration of nine cross point matrix switches 130-132, 230-2 and 330-2 having twenty-four input/twenty-four output video switching matrix functionality. Accordingly, in additional embodiments, sixteen crosspoint matrix switches may provide thirty two input/thirty two output video switching matrix functionality and twenty-five cross point matrix switches may provide forty input/forty output video switching matrix functionality.

In the illustrated embodiment, video tray 100 includes cross point matrix switches 130-132. In the absence of additional trays within video switch 60, video tray 100 allows video switch 60 to function as a 24 input/8 output video switching matrix. Eight of the twenty-four inputs initiate from video input ports 111-118. Sixteen additional input nodes associated with video tray 100 may be coupled with up to two additional video trays 200, 300. Video output ports 121-128 associated with video tray 100 may be configured to accept signals input from video input ports 111-118, and/or up to 16 additional video input ports associated with video trays 200 and 300.

Referring now to FIGURE 7, an exemplary point-to-point wiring diagram illustrating one configuration for video tray 100 is shown. Video tray 100 includes an input section 134 which comprises video input ports 111-118 and a buffer 136 associated with each video input port 111-118. In one embodiment, input signals through video input ports 111-118 are 75 ohm terminated, for example. Input signals are buffered in order to maintain sufficient strength during distribution.

Input signals next encounter a bus selector 140 which ultimately determines how video signal routing is distributed. As mentioned previously, a "soft" address is assigned to each video tray 100, 200 or 300 in order to properly assign and track input signals through the matrix. Bus selector 140 assigns input signals through video input ports 111-118 to one of three input busses A, B, or C. The input signals through video input ports 111-118 also route to a signal sensor 142, which monitors the presence of a signal from each input port, to determine whether or not a video signal and/or video device is coupled with any one of video input ports 111-118. Bus selector 140 is monitored and controlled by a microprocessor, which allows configuration and control of video tray 100 remotely, through control area network 30.

Each video tray 100, 200 and 300 includes three crosspoint matrix switches 130-132. Alone, crosspoint matrix switches 130, 131 and 132 form an expandable video switching matrix 144, which
functions as a twenty-four input/eight output video switching matrix. Video switching matrix 144 is also controlled by a microprocessor. In one embodiment of the present invention, a single microprocessor associated with control area network 30 may accomplish the tasks of selecting the appropriate video bus A, B or C to assign signals through video input ports 111-118, monitor the signal sensors to determine the presence or absence of video signals through each video input port 111-118, and control the crosspoint video switching matrix. In this configuration, the microprocessor associated with video switching matrix 144 controls bus selector 140 and monitors the signals on video input ports 111-118 and video output ports 121-128. The output section 146 of video tray 100 includes video output ports 121-128, each having a buffer 148 associated therewith to enhance the signal strength and allow long video cables to be driven by video switch 60.

Any of video output ports 121-128 associated with video tray 100 can access any one of the twenty-four video input ports associated with video switch 60. In the illustrated embodiment, video input ports 111-118 comprise eight of the twenty-four input ports. Similarly, video trays 200 and 300 each include eight video input ports for a total of twenty-four video input ports. Each video tray 100, 200 and 300 include a ribbon cable which connects to a common video bus. Ribbon cable 150 associated with video tray 100 is illustrated in FIGURES 5A, 5B and 7. Video signals through any of the twenty-four video inputs associated with video switch 60 may travel through ribbon cable 150 for distribution to any one of the twenty-four video output ports. Ribbon cable 150 may be essentially broken up into twenty-four video signals, or three groups of eight.

Each video input signal is associated with a respective video input port. Bus selector 140 assigns and determines the configuration of the video input port signal distribution within ribbon cable 150. In the illustrated embodiment, ribbon cable 150 connects three video trays together to maintain a twenty-four input/twenty-four output video switch 60. In another embodiment as few as one video tray 100, or many more than three video trays, may be coupled with a ribbon cable to expand the capacity of a given video switch.

The twenty-four input/twenty-four output video switch 60 of the present invention allows the user to begin with an eight input/eight output switch at a minimum investment. As user needs increase, the capacity of video switch 60 may be increased to sixteen input/sixteen output and ultimately twenty-four input/twenty-four output with minimal costs associated with each upgrade, rather than the wholesale system replacement. Expansion is also user friendly, in that enhancements can be performed by the user, with simple plug in devices.
Audio visual system 53 is configured to operate with software. Upon startup, control area network 30 will recognize video switch 60 as three devices, which correspond to video trays 100, 200 and 300. ID button 108 may be depressed to allow control area network 30 to recognize the location of each respective video tray. When each of the video trays 100, 200 and 300 have been identified, the software will assign an address to each of the trays 100, 200 and 300. For example, the software may assign tray 100 the reference letter "A," tray 200 the reference letter "B," and tray 300 the reference letter "C." Commands may be entered through one of various terminal devices associated with audio visual system 53, or remotely through other components of control area network 30. In particular, video switch 60 is configured to respond to various commands operable to, for example, switch an individual output channel to an input channel, or switch the entire matrix such that all of the inputs become outputs and all of the outputs become inputs.

Although the present invention has been described by several embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present invention encompasses such changes and modifications as fall within the scope of the present appended claims.
WHAT IS CLAIMED IS:

1. An expandable video switching matrix, having a first number of inputs and a first number of outputs, comprising:
   a first crosspoint matrix switch having a second number of inputs and a second number of outputs;
   a second crosspoint matrix switch having a third number of inputs and a third number of outputs;
   the first and second crosspoint matrix switches interconnected such that the first number of inputs is equal to the sum of the second number of inputs and the third number of inputs, and the first number of outputs is equal to or less than the second number of outputs; and
   a plurality of the second number of outputs coupled with a plurality of the third number of inputs.

2. The expandable video switching matrix of Claim 1, wherein a plurality of the first number of inputs are dedicated for interconnection with outputs associated with a second video switching matrix.

3. The expandable video switching matrix of Claim 1, further comprising at least a third crosspoint matrix switch.

4. The expandable video switching matrix of Claim 1, wherein the second number of inputs and the second number of outputs are each equal to eight.

5. The expandable video switching matrix of Claim 1, wherein the first number of inputs is equal to sixteen and the first number of outputs is equal to eight.

6. A video switching tray, comprising:
   a first number of video input ports;
   a first number of video output ports;
   an expandable video switching matrix having a first number of inputs and a first number of outputs, comprising:
   a first crosspoint matrix switch having a second number of inputs and a second number of outputs;
a second crosspoint matrix switch having a third number of inputs and a third number of outputs;

the first and second crosspoint matrix switches interconnected such that the first number of inputs is equal to the sum of the second number of inputs and the third number of inputs, and

the first number of outputs is equal to or less than the second number of outputs; and

a plurality of the second number of outputs coupled with a plurality of the third number of inputs; and

the video input ports and the video output ports coupled with the video switching matrix.

7. The video switching tray of Claim 6, further comprising a ribbon cable coupled with the video switching matrix for interconnection with a second video switching matrix.

8. The video switching tray of Claim 6, further comprising at least a first data bus for communication with an audio visual system network.

9. The video switching tray of Claim 7, further comprising an auxiliary data bus.

10. The video switching tray of Claim 6, further comprising a link light for indicating communication with an audio visual system network.

11. The video switching tray of Claim 6, further comprising an identify button for identification of the video switching tray to an audio visual system network.

12. The video switching tray of Claim 6, further comprising a bus selector for routing signals associated with the first number of inputs to one of a plurality of input busses.

13. The video switching tray of Claim 6, further comprising a signal sensor for monitoring the presence of a video signal at any one of the video input devices.

14. The video switching tray of Claim 6, further comprising a plurality of buffers, each buffer associated with a respective video input device.
15. An expandable video switch, comprising:
a hub box;
at least a first video switching tray having a first number of video input ports and a first number of video output ports, and including a video switching matrix having a first number of inputs and a first number of outputs, the video switching matrix comprising:
a first crosspoint matrix switch having a second number of inputs and a second number of outputs;
a second crosspoint matrix switch having a third number of inputs and a third number of outputs;
the first and second crosspoint matrix switches interconnected such that the first number of inputs is equal to the sum of the second number of inputs and the third number of inputs, and the first number of outputs is equal to or less than the second number of outputs; and
a plurality of the second number of outputs coupled with a plurality of the third number of inputs; and
the video input ports and the video output ports coupled with the video switching matrix;
and
at least a first expansion port for coupling at least a second video switching tray to the first video switching tray.

16. The expandable video switch of Claim 15, further comprising a power adapter coupled with the hub box for supplying electrical power to the video switch.

17. The expandable video switch of Claim 15, wherein the first number of video input ports and the first number of video output ports are each equal to eight.

18. The expandable video switch of Claim 15, further comprising at least a second video switching tray.

19. A method for expanding a video switch having a first number of video input ports and a first number of video output ports, the method comprising:
providing a first video switching matrix having a first number of inputs and a first number of outputs, the first video switching matrix further comprising:
a first crosspoint matrix switch having a second number of inputs and a second number of outputs;

a second crosspoint matrix switch having a third number of inputs and a third number of outputs; and

the first and second crosspoint matrix switches interconnected such that the first number of inputs is equal to the sum of the second number of inputs and the third number of inputs, and the first number of outputs is equal to or less than the second number of outputs; and coupling a plurality of the second number of outputs with a plurality of the third number of inputs.

20. The method of Claim 19, wherein the first number of video input ports and the first number of video output ports are each equal to eight.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04N5/268

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04N

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)

EPO-Internal, WPI Data, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>EP 0 449 632 A (SONY CORP) 2 October 1991 (1991-10-02) column 3, line 22 -column 10, line 53</td>
<td>1-3, 6, 7, 19</td>
</tr>
<tr>
<td>A</td>
<td>US 4 700 230 A (PSTISSKYY YACOV A ET AL) 13 October 1987 (1987-10-13) column 3, line 6 -column 6, line 51</td>
<td>1, 6, 15</td>
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<tr>
<td>A</td>
<td>US 5 144 548 A (SALANDRO JERRY R) 1 September 1992 (1992-09-01)</td>
<td></td>
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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  *A* document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search

13 September 2000

Date of mailing of the international search report

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Name and mailing address of the ISA

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Wentzel, J
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<th>Patent document cited in search report</th>
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