Description

The present invention relates to an interconnection apparatus for transferring electric signals between various signal providing or receiving components of a system such for example as a home entertainment system. It concerns for example a switch arrangement for selectively distributing video signal among a plurality of video components, at least one of which includes a bi-directional video signal bus.

With the increased popularity of various home entertainment video components, such as video disc and tape players, teletext, home computers and satellite TV receivers, etc., the interconnection of these components has become more complex.

One multiple component system is described for example in GB—A—1267878 in which a plurality of components such as a TV camera, video tape recorder, and another video source are selectively connected to a TV receiver over a switch which has a like plurality of input terminals connected one to each of these components, and a common output terminal which is coupled to a TV receiver which displays the output from whichever component is selected according to the position of the switch. FKTG Tagungsband, 9th meeting, September 1981, pages 351 to 363, in chapter 4.1 and Figure 8, also discloses a plural component system in which several TV cameras are selectively connected by a multiplexing switch (MUX) to a single TV channel leading via a demultiplexer (DEMUX) to respective monitors.

EP—A—0130036 filed on the same day as the present application and having the same priority date (being based inter alia on US Patent Application No. 508605) describes an audio/video component interconnection system including a bi-directional video signal bus for transferring video signal in a serial manner among the video components. The video components are connected at distributed locations along the video bus and are responsive to remote control signals transmitted along a control bus for selectively transmitting and/or receiving a video signal to or from the video bus. This distributed switched type of interconnection system is relatively easy for the user to set-up and control and flexible enough to easily allow for future system expansion by simple connection for subsequently added components.

It is herein recognized, however, that the user of such a distributed switched system may also possess video components which are not compatible with the bi-directional video bus system, i.e., they may not be of the type described in the aforenoted European application which are capable of selectively transmitting or receiving video signal in response to the systems control signals. It is desirable to provide a relatively simple interconnection arrangement for interconnecting video components which are compatible with a bi-directional bus system (distributed components) with individual components (non-distributed).

In an embodiment of the present invention, a first switch unit having a plurality of inputs and a common output has one input coupled to receive video signals from the distributed components connected to the bi-directional video signal bus and at least one other input coupled to receive video signal from at least one non-distributed component. A second switch unit having at least one input and a common output has an input coupled to receive a video signal from the non-distributed video component. A video signal driver is coupled between the common output of the second switch and the bi-directional video signal bus and has an output impedance, even when not supplying video signal to the bus, corresponding substantially to the characteristic impedance of the bi-directional video signal bus, so as to terminate the bus in its characteristic impedance.

In the drawing:

Figure 1 illustrates partially in block diagram form and partially in schematic diagram form an illustrative, video component, interconnection arrangement in accordance with the invention; and

Figure 2 illustrates in schematic diagram form details of a portion of Figure 1.

Referring to Figure 1, a plurality of video components are shown. Components 10 and 12 are distributed since they are directly coupled to a bi-directional video signal bus 8 at distributed locations along bus 8. Bus 8 is coupled to an input 9 of a television (TV) monitor 26 (shown in dashed line). Video signal bus 8 may comprise, for example, a 75 ohm coaxial cable. Components 14, 16 and 18 are not distributed since they are not directly coupled to bus 8 but rather are directly coupled to respective input terminals 15, 17 and 19 of monitor 26. By way of example, components 10—18 correspond to a teletext decoder, video tape recorder (VTR), TV tuner, video disc player (VDP) and a video camera, respectively, each supplying a baseband video signal at its respective video signal output.

The distributed components 10 and 12 include video signal switches 20 and 22, respectively, for selectively transferring video signals from their outputs to bus 8. These switches can be manually controlled or remotely controlled as described in the aforenoted EP—A—0130036. Additionally, a high input impedance video signal buffer 24 supplies video signal from bus 8 to a record input of VTR 12. Television monitor 26 includes a signal processing circuit 28 of conventional design for applying the video signal from one of components 10—18 for a kinescope 30 for display.

In accordance with the present invention an illustrative interconnection arrangement includes a first switch unit 32 for selectively applying video signals from distributed components 10 or 12 via bi-directional bus 8 or from one of the non-distributed components 14—18, to the signal processing circuit 28. A second switch unit 34 selectively coupled video signals from one of the non-distributed components to bus 8 via a video

signal driver 36. Driver 36 has an output impedance corresponding substantially to the characteristic impedance of the bi-directional bus 8 for terminating bus 8 in its characteristic impedance when bi-directional bus 8 is supplying video signal to the TV monitor 26.

More specifically, switch unit 32 includes four independently operable switches A, B, C and D, having inputs coupled to input terminals 9, 15, 17 and 19 of TV monitor 26 to receive respective video signals from bi-directional bus 8. TV tuner 14, VDP 16 and video camera 18. The output of switches A-D of switch unit 32 are coupled in common for supplying the video signal received through one of switches A-D to signal processing circuit 28.

The switch unit 34 includes four independently operable switches A, B, C and D. Switches A-C have inputs coupled to input terminals 15, 17 and 19 of TV monitor 26 to receive respective video signal from TV tuner 14. VDP 16 and video camera 18. Switch D has an input coupled to signal ground reference voltage. The outputs of switches A-D of switch unit 34 are coupled in common to the input of video signal driver 36 for supplying a selected one of the video signals to bi-directional bus 8 in order that a video signal from one of the non-distributed components 14, 16 or 18 can be recorded using the VTR 12.

Since the frequency range of baseband video signals is substantial, i.e., extending approximately 4 MHz, the ends of bi-directional bus 8 should be terminated in its characteristic impedance (e.g., 75 ohms) in order to minimize video signal reflections which would otherwise manifest themselves as ghosts in the reproduced image. One end of bus 8 includes a 75 ohm resistor 38 coupled between the center conductor of bus 8 and its outer shield, which is grounded. The other end of bus 8 is terminated in its characteristic impedance by video signal driver 36. Driver 36 has a 75 ohm output impedance (represented by a resistor 40). When video signal is to be received by monitor 26 from bus 8, switch D of unit 34 is closed so as to couple signal ground to the input of driver 36.

In this condition, driver 36 maintains it 75 ohm output impedance and advantageously serves as the characteristic impedance termination for the end of bus 8 connected to monitor 26. Since its input is grounded, driver 36 is prevented from introducing spurious signal onto bus 8. Additionally, 75 ohm resistors 42, 44 and 46 are included in TV monitor 26 for providing proper impedance termination for video components 14, 16 and 18 at respective input terminals 15, 17 and 19 of TV monitor 26.

Furthermore, an audio signal bus (not shown) could be used to supply audio signals from distributed video components 10 and 12 (or other audio components, not shown) and non-distributed components 14, 16 and 18 may also supply audio signals. An interconnection arrangement similar to switches 32 and 34 could be used to couple the audio signals from the audio bus or the non-distributed components 14—18 to TV monitor 26 for reproducing a sound program in conjunction with the reproduced image. The reader is referred to the aforenoted U.S. Patent Application No. 508,605 for further details of a distributed switched component audio system.

Switches A-D of switch units 32 and 34 may be physically located on one side of TV monitor 26, in which case the user can manually operate the switches for controlling the routing of the video signals. The described switching arrangement advantageously allows several of the video components to operate and be interconnected simultaneously. For example, although a user may view a video disc on kinescope 30 by closing switch C of switch unit 32, he does not have to miss a TV program presently being broadcast. In this case, the user may also close switch A of switch unit 34, in order to couple video signal from TV tuner 14 to bus 8 where it can be recorded by VTR 12 for subsequent viewing. Appropriate ones of audio switches (not shown) would also be closed for proper routing of the corresponding audio signals.

The circuitry of Figure 2 is suitable for constructing driver 36 or buffer 24. Video signal from either bus 8 or the output of switch 34 is applied by emitter follower transistor 210 to the junction of equal valued resistors 212 and 214. An opposite conductivity type transistor 216 clamps the voltage at the collector of transistor 210 to approximately 1 V_{be} below 15 volts for stabilizing its operation with respect to temperature variations. The video signal level at the junction of resistors 212 and 214 is substantially equal to the video signal level at the base of transistor 210 due to its emitter follower operation. Since resistors 212 and 214 are of equal value, the signal level at the junction of resistor 214 and the base of an output transistor 218 is twice the input video signal level. Output transistor 218 includes a 75 ohm resistor 220 having one end connected at its emitter for supplying the video signal. When the circuitry of Figure 2 is used for providing video signal driver 36 of Figure 1, 75 ohm resistor 220 corresponds to 75 ohm resistor 40. Since the 75 ohm output impedance of the driver reduces the amplitude of the video signal by 50% when driving a 75 ohm load, the amplifier arrangement of Figure 2 has a gain of 2, due to resistors 212 and 214.

While the invention has been illustrated in terms of a particular switching arrangement, it is to be understood that other switching arrangements could be used for interconnecting the video components in accordance with the principles of the invention. For example, driver 36 will maintain its 75 ohm output impedance regardless of the closing of switch D of switch unit 34 and thus, switch D is not essential. However, in the present example, switch D is desirable since it prevents spurious signals from being coupled to bus 8 by driver 36 when driver 36 is terminating bus 8 in its characteristic impedance. Additionally, it is also to be understood that the

impedance required for effectively reducing a signal reflection from the monitor end of video bus 8 is not required to be exactly equal to the characteristic impedance, such as shown in Figure 1.

Claims

1. Interconnection apparatus which, for transferring electric signals between various signal providing or receiving components (10; 12; 14; 16; 18) of a system, includes first switch means (32) having a plurality of selectively conductive signal paths (A; B; C; D) between a plurality of inputs (9; 15; 17; 19) coupled to respective interconnection paths from said components, and a common output, characterized in that

one of said inputs (9) is adapted to be coupled to a bi-directional signal bus (8) connected to at least one of said components (10; 12), with each other (15; 17; 19) of said inputs adapted to be coupled to another of said components (14; 16;

that there is provided a second switch means (34) having a plurality of selectively conductive signal paths (A; B; C; D) between individual inputs and a common output, with a connection from each said other component to one of the inputs of said second switch means;

and that a signal driver (36), having an input coupled to said output of said second switch means (34), has an output coupled to said input (9) of said first switch means adapted to be coupled to said signal bus, said output of the driver (36) having an impedance (40) corresponding substantially to the characteristic impedance of said signal bus when supplying signal and substantially maintaining said characteristic output impedance when not supplying signal.

2. Apparatus as recited in Claim 1 wherein said signals correspond to video signals and said driver (36) maintains said output impedance (40) when said bi-directional signal bus (8) transfers no signal to said first switch means, so as to terminate said signal bus in its characteristic impedance.

3. Apparatus as recited in Claim 1 or 2 wherein said second switch means (34) has a second input adapted to be coupled to a reference potential (GND).

4. Apparatus as recited in claim 3 wherein said second switch means (34) couples said reference potential (GND) to the input of said driver so as to cause said driver to not supply video signal to said bus (8) while maintaining said characteristic output impedance (40).

5. Apparatus as recited in Claim 2 wherein said output of said first switch means (32) is coupled to a video signal processing circuit (28).

6. Apparatus as recited in Claim 5 wherein said first and second switch means, signal driver and video signal processing circuit are all in a television monitor (26).

Patentansprüche

1. Verbindungseinrichtung, die zur Übertragung elektrischer Signale zwischen verschiedenen signalliefernden oder -empfangenden Bausteinen (10; 12; 14; 16; 18) einer Anlage eine erste Schalteinrichtung (32) enthält, welche eine Vielzahl wahlweise leitender Signalwege (A; B; C; D) zwischen einer Vielzahl von Eingängen (9; 15; 17; 19) die mit zugeordneten Verbindungswegen von den besagten Bausteinen gekoppelt sind, und einem gemeinsamen Ausgang hat, dadurch gekennzeichnet, daß

einer der besagten Eingänge (9) zur Kopplung an eine Zweirichtungs-Signalschiene (8) ausgelegt ist, die mit mindestens einem der besagten Bausteine (10; 12) verbunden ist, wobei jeder andere (15; 17; 19) der besagten Eingänge zur Kopplung an einen anderen der Bausteine (14; 16; 18) ausgelegt ist;

daß eine zweite Schalteinrichtung (34) vorgesehen ist, die eine Vielzahl wahlweise leitender Signalwege (A; B; C; D) zwischen einzelnen Eingängen und einem gemeinsamen Ausgang hat, mit einer Verbindung von jedem der besagten anderen Bausteine zu einem der Eingänge der zweiten Schalteinrichtung;

und daß ein Signaltreiber (36), der einen mit dem besagten Ausgang der besagten zweiten Schalteinrichtung (34) gekoppelten Eingang hat, einen mit dem besagten Eingang (9) der besagten ersten Schalteinrichtung gekoppelten Ausgang aufweist, welcher zur Kopplung an die Signalschiene ausgelegt ist, wobei der besagte Ausgang des Treibers (36) eine Impedanz (40) hat, die bei Lieferung eines Signals im wesentlichen dem Wellenwiderstand der Signalschiene entspricht und die im wesentlichen den besagten Wellenwiderstand am Ausgang aufrechterhält, wenn kein Signal geliefert wird.

2. Einrichtung nach Anspruch 1, worin die besagten Signale Videosignalen entsprechen und der besagte Treiber (36) die besagte Ausgangsimpedanz (40) aufrechterhält, wenn die besagte Zweirichtungs-Signalschiene (8) Videosignale an die erste Schalteinrichtung überträgt, um so die besagte Signalschiene mit ihrem Wellenwiderstand abzuschliessen.

3. Einrichtung nach Anspruch 1 oder 2, worin die besagte zweite Schalteinrichtung (34) einen zweiten Eingang hat, der zum Koppeln an ein Bezugspotential (Masse) ausgelegt ist.

4. Einrichtung nach Anspruch 3, worin die besagte zweite Schalteinrichtung (34) das Bezugspotential (Masse) mit dem Eingang des besagten Treibers koppelt, um zu bewirken, daß der besagte Treiber kein Videosignal an die besagte Schiene (8) liefert, während er die besagte Wellenwiderstands-Ausgangsimpedanz (40) aufrechterhält.

5. Einrichtung nach Anspruch 2, worin der besagte Ausgang der besagten ersten Schalteinrichtung (32) mit einer Videosignalverarbeitungsschaltung (28) gekoppelt ist.

6. Einrichtung nach Anspruch 5, worin die

impedance required for effectively reducing a signal reflection from the monitor end of video bus 8 is not required to be exactly equal to the characteristic impedance, such as shown in Figure 1.

Claims

1. Interconnection apparatus which, for transferring electric signals between various signal providing or receiving components (10; 12; 14; 16; 18) of a system, includes first switch means (32) having a plurality of selectively conductive signal paths (A; B; C; D) between a plurality of inputs (9; 15; 17; 19) coupled to respective interconnection paths from said components, and a common output, characterized in that

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...at there is provided a second switch means (34) having a plurality of selectively conductive signal paths (A; B; C; D) between individual inputs and a common output, with a connection from each said other component to one of the inputs of said second switch means;

and that a signal driver (36), having an input coupled to said output of said second switch means (34), has an output coupled to said input (9) of said first switch means adapted to be coupled to said signal bus, said output of the driver (36) having an impedance (40) corresponding substantially to the characteristic impedance of said signal bus when supplying signal and substantially maintaining said characteristic output impedance when not supplying signal.

2. Apparatus as recited in Claim 1 wherein said signals correspond to video signals and said driver (36) maintains said output impedance (40) when said bi-directional signal bus (8) transfers o signal to said first switch means, so as to terminate said signal bus in its characteristic impedance.

3. Apparatus as recited in Claim 1 or 2 wherein said second switch means (34) has a second input adapted to be coupled to a reference potential (GND).

4. Apparatus as recited in claim 3 wherein said second switch means (34) couples said reference potential (GND) to the input of said driver so as to cause said driver to not supply video signal to said bus (8) while maintaining said characteristic output impedance (40).

5. Apparatus as recited in Claim 2 wherein said output of said first switch means (32) is coupled to a video signal processing circuit (28).

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einer der besagten Eingänge (9) zur Kopplung an eine Zweirichtungs-Signalschiene (8) ausgelegt ist, die mit mindestens einem der besagten Bausteine (10; 12) verbunden ist, wobei jeder andere (15; 17; 19) der besagten Eingänge zur Kopplung an einen anderen der Bausteine (14; 16; 18) ausgelegt ist;

daß eine zweite Schalteinrichtung (34) vorgesehen ist, die eine Vielzahl wahlweise leitender Signalwege (A; B; C; D) zwischen einzelnen Eingängen und einem gemeinsamen Ausgang hat, mit einer Verbindung von jedem der besagten anderen Bausteine zu einem der Eingänge der zweiten Schalteinrichtung;

und daß ein Signaltreiber (36), der einen mit dem besagten Ausgang der besagten zweiten Schalteinrichtung (34) gekoppelten Eingang hat, einen mit dem besagten Eingang (9) der besagten ersten Schalteinrichtung gekoppelten Ausgang aufweist, welcher zur Kopplung an die Signalschiene ausgelegt ist, wobei der besagte Ausgang des Treibers (36) eine Impedanz (40) hat, die bei Lieferung eines Signals im wesentlichen dem Wellenwiderstand der Signalschiene entspricht und die im wesentlichen den besagten Wellenwiderstand am Ausgang aufrechterhält, wenn kein Signal geliefert wird.

2. Einrichtung nach Anspruch 1, worin die besagten Signale Videosignalen entsprechen und der besagte Treiber (36) die besagte Ausgangsimpedanz (40) aufrechterhält, wenn die besagte Zweirichtungs-Signalschiene (8) Videosignale an die erste Schalteinrichtung überträgt, um so die besagte Signalschiene mit ihrem Wellenwiderstand abzuschliessen.

3. Einrichtung nach Anspruch 1 oder 2, worin die besagte zweite Schalteinrichtung (34) einen zweiten Eingang hat, der zum Koppeln an ein Bezugspotential (Masse) ausgelegt ist.

4. Einrichtung nach Anspruch 3, worin die besagte zweite Schalteinrichtung (34) das Bezugspotential (Masse) mit dem Eingang des besagten Treibers koppelt, um zu bewirken, daß der besagte Treiber kein Videosignal an die besagte Schiene (8) liefert, während er die besagte Wellenwiderstands-Ausgangsimpedanz (40) aufrechterhält.

5. Einrichtung nach Anspruch 2, worin der besagte Ausgang der besagten ersten Schalteinrichtung (32) mit einer Videosignalverarbeitungsschaltung (28) gekoppelt ist.

6. Einrichtung nach Anspruch 5, worin die

* C L M S *

...agte erste und zweite Schalteinrichtung, der besagte Signaltreiber und die Videosignalverarbeitungsschaltung alle in einem Fernsehmonitor (26) sind.

Revendications

1. Dispositif d'interconnexion qui, pour transférer des signaux électriques entre différents composants délivrant ou recevant des signaux (10; 12; 14; 16; 18) d'un système, comprend un premier moyen de commutateur (32) ayant une pluralité de passages de signaux sélectivement conducteurs (A; B; C; D) entre une pluralité d'entrées (9; 15; 17; 19) couplée à des passages d'interconnexion respectifs provenant desdits composants, et une sortie commune, caractérisé en ce que l'une desdites entrées (9) est adaptée pour être couplée à un bus (8) de signal bidirectionnel connecté à au moins l'un desdits composants (10; 12), chaque autre (15; 17; 19) desdites entrées étant adaptée pour être couplée à un autre desdits composants (14; 16; 18)

en ce qu'il est prévu un second moyen de commutateur (34) ayant une pluralité de passages de signaux sélectivement conducteurs (A; B; C; D) entre des entrées individuelles et une sortie commune, avec une connexion depuis chacun desdits autres composants avec l'une des entrées dudit second moyen de commutateur;

et en ce qu'un circuit de commande de signal (36), ayant une entrée couplée à ladite sortie dudit second moyen de commutateur (34), a une sortie couplée à ladite entrée (9) dudit premier moyen de commutateur adaptée pour être couplée audit bus de signal, ladite sortie du circuit de commande (36) ayant une impédance (40) correspondant sensiblement à l'impédance caractéristique dudit bus de signal lorsqu'il fournit un signal et maintenant sensiblement ladite impédance de sortie caractéristique lorsqu'il ne fournit pas de signal.

2. Dispositif selon la revendication 1, dans lequel lesdits signaux correspondant à des signaux vidéo et ledit circuit de commande (36) maintient ladite impédance de sortie (40) lorsque ledit bus (8) de signal bidirectionnel transfère un signal vidéo audit premier moyen de commutateur, de façon à terminer ledit bus de signal dans son impédance caractéristique.

3. Dispositif selon la revendication 1 ou 2, dans lequel ledit second moyen de commutateur (34) a une seconde entrée adaptée pour être couplée à un potentiel de référence (GND).

4. Dispositif selon la revendication 3, dans lequel ledit second moyen de commutateur (34) couple ledit potentiel de référence (GND) à l'entrée dudit circuit de commande de façon à amener ledit circuit de commande à ne pas fournir de signal vidéo audit bus (8) tout en maintenant ladite impédance de sortie caractéristique (40).

5. Dispositif selon la revendication 2, dans lequel ladite sortie dudit premier moyen de commutateur (32) est couplée à un circuit (28) de traitement de signal vidéo.

6. Dispositif selon la revendication 5, dans lequel lesdits premier et second moyens de commutateur, ledit circuit de commande et ledit circuit de traitement de signal vidéo sont tous dans un moniteur de télévision (26).