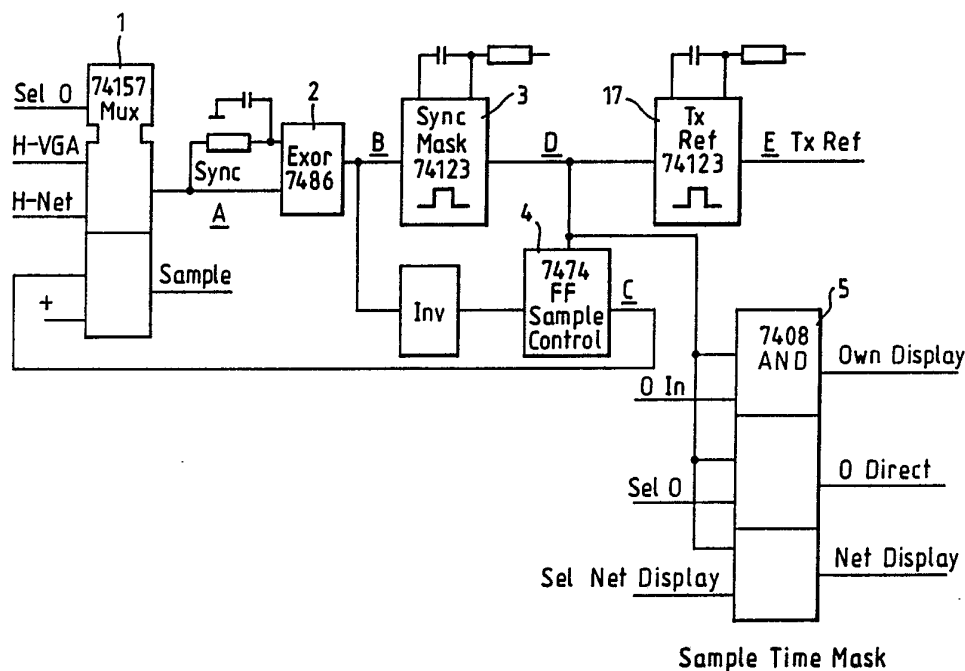




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/AU91/00034 (22) International Filing Date: 1 February 1991 (01.02.91) (30) Priority data: PJ 8422                      2 February 1990 (02.02.90)      AU (71) Applicant (for all designated States except US): KETEX PTY. LTD. [AU/AU]; 18 Dome Street, Eight Mile Plains, QLD 4113 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only) : ASTROM, Harri, Evert [FI/FI]; 18 Dome Street, Eight Mile Plains, QLD 4113 (AU). (74) Agent: CULLEN & CO.; G P O Box 1074, Brisbane, QLD 4001 (AU).		(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.  <b>Published</b> <i>With international search report.</i>

## (54) Title: IMPROVED VIDEO DISPLAY TRANSFER



## (57) Abstract

Video signals are transmitted between computers in a multicomputer network, with automatic level control. A reference voltage is transmitted, by the transmitting computer station, during either the horizontal or vertical synchronising pulses of the video signals. The reference voltage is detected by the receiving computer stations, and is used by each receiving computer station to provide the correct level of amplification to the received video colour signals, thereby permitting a constant display level to be achieved at the monitor of receiving station irrespective of cable and equipment loadings and other factors influencing the level of the received video signals.

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# "IMPROVED VIDEO DISPLAY TRANSFER"

THIS INVENTION relates to improvements in video display for a multicomputer network. In particular, the invention is directed to apparatus and method for transferring video signals between computers in a multi-computer network, with automatic level control.

## BACKGROUND ART

With the increasing demand and usage of computers, and their decreasing cost, multi-computer networks have become quite popular. Such networks typically comprise a number of microcomputers, such as personal computers ("PCs"), which are connected in a network, for example by LAN (local area network) cables. Each computer station typically comprises a microcomputer with associated keyboard, and a video display monitor.

Microcomputer networks are now becoming popular in classrooms for teaching purposes. A typical multi-computer teaching system comprises a number of student computer stations connected in a network which includes a teacher computer station. An interface circuit is provided between each computer station and the network bus, and a control unit is normally associated with the teacher computer station. The interface circuit may be housed on an adaptor card in each micro-computer. An example of a known multi-computer teaching system can be found in U.S. patent no. 4,759,717.

In one known multi-computer teaching system, the video display monitor of each student computer station can display either an output from its own computer or an output

transmitted through the network from either the teacher computer station or another selected student computer station. Each computer station is provided with an adaptor card containing a video logic circuit to enable video display signals to be transferred to and from that computer station.

The teacher can communicate with the whole class of students without moving away from the teacher's computer station. The teacher may transfer displays, information and data files, use the computer screen as a blackboard, correct the student's work, use a "mouse" as a pointer, and give different degrees of assistance to students with different abilities. The teacher can also obtain a full picture of the students' progress by scanning their displays. This can be done automatically, or by manual control so that the teacher may observe the individual students' displays for different periods. The multi-computer network therefore provides an efficient teaching tool.

However, a disadvantage of known multi-computer networks is that the brightness and quality of the monitor displays vary considerably, depending on the extent of the network, the number of computer stations connected to it, the length of LAN cables, the distance between each receiving monitor and the computer station from which the video signals are being sent, and other factors. Such unwanted variation in display brightness and quality can have a disturbing effect on the student and detract significantly from the otherwise advantageous teaching qualities of the multi-computer system.

It is an object of the present invention to overcome

or at least substantially ameliorate the abovedescribed disadvantage by providing an apparatus and method for transferring video signals within a computer network such that the brightness and quality of the video display at the receiving monitors are maintained at a substantially constant level.

#### STATEMENT OF THE INVENTION

In one broad form, the present invention provides a method of transferring video signals between computer stations in a multi-computer network, wherein said video signals include synchronising signals and colour signals, characterised in that a reference voltage is transmitted during at least some of the synchronising signals and said reference voltage is used by the receiving computer station(s) to control the amplification of the received colour signals so as to provide a substantially constant video display level at the monitor of the receiving computer station(s).

In the preferred embodiment, a reference voltage is derived at the transmitting station and transmitted during the horizontal synchronising pulses of the video display signals. The reference voltage is sampled and held by each receiving station, and is used to provide a reference level for amplification of the received colour signals. (The reference voltage is removed before the received video display signal is sent to the monitor).

In another form, the present invention provides apparatus for transferring video signals between computer stations in a multi-computer network, wherein the video

signals comprise synchronising signals and colour signals, said apparatus comprising means for detecting the occurrence of a synchronising signal; means for deriving and transmitting a reference voltage during the detected synchronising signal; means for receiving and retaining the transmitted reference voltage; and means for amplifying the received colour signals in accordance with the retained reference voltage in order to provide a substantially constant video display level.

Typically, the apparatus is embodied as a logic circuit on an adaptor card fitted to each computer to enable the computer to both transmit and receive a video display.

The means for retaining the reference voltage may suitably comprise a sample and hold circuit, but any other equivalent circuit will suffice.

The present invention overcomes the abovedescribed problem of known video display transfer systems since a reference voltage is transmitted with the displays, and this reference voltage is used to enable a constant display level to be achieved at the receiving station irrespective of cable and equipment loadings and other factors influencing the level of the received video signals.

In order that the invention may be more fully understood and put into practice, a preferred embodiment thereof will now be described with reference to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1, 2 and 3 collectively form a schematic circuit diagram of the video signal transfer control apparatus

of an embodiment of the present invention;

Fig. 4 illustrates the timing signals at the station receiving a transmitted video display; and

Fig. 5 illustrates the timing signals at the station transmitting the video display.

#### DESCRIPTION OF PREFERRED EMBODIMENT

The video display signals transmitted between computer stations in a network consist of analog colour video signals (R, G, B) representing the red, green and blue primary colours together with horizontal (Hsync) and vertical (Vsync) synchronising signals. In general terms, the method of automatically maintaining constant brightness and quality of the video display according to this invention involves the transmission of a reference voltage to the receiving monitor during a synchronising signal. This reference voltage is retained by the receiving station and is used to provide the correct level of amplification to the received video colour signals. This is achieved by an improved video display transfer circuit, an embodiment of which is shown in Figs. 1 to 3.

The transfer circuit of Figs. 1 to 3 is typically provided on the adaptor card at each computer station which transmits or receives video signals. As illustrated in Fig. 1, each circuit comprises a multiplexer 1 which, in use, receives a select signal ("sel o") from the control unit (not shown) to cause the multiplexer 1 to select either the Hsync signal transmitted by its own display adaptor card (H-VGA) or the Hsync signal transmitted through the network bus (H-Net).

The waveform of the Hsync signal selected by the multiplexer 1 is shown as signal Sync A in the timing diagrams of Figs. 4 and 5.

5 The output signal sync A of the multiplexer 1 is fed to an exclusive-or gate 2 which provides an output pulse on each positive or negative level change in the sync A signal. The waveform of the output signal of gate 2 (Exor B) is also shown in Figs. 4 and 5.

10 The Exor B signal pulses output from the exclusive-or gate circuit 2 are fed to a one-shot circuit 3 which acts as a masking circuit. The one-shot circuit 3 provides an output pulse on detecting a pulse from the exclusive-or gate 2, and the length of the output pulse from the one-shot circuit 3 is long enough to mask out the next received pulse from the exclusive-or circuit 2, thereby securing the front edge of the sync A pulse independent of polarity. The output of the one-shot circuit 3 is shown as the wave form "Sync Mask D" in figures 4 and 5.

20 The output signal of the one-shot circuit 3 is fed to a flip-flop 4 which acts as a sample control circuit. The flip-flop 4 provides an output timing pulse C which is fed to the multiplexer circuit 1 and is used to form a Sample signal provided by the multiplexer 1 to a sample and hold circuit 11 via a level translator 10 (Fig. 2). The Sample signal is used to indicate to the sample and hold circuit 11 when the signal from the network is to be sampled, namely, during the synchronising pulse. The wave form of the output signal from the flip-flop 4 is shown as "Sample control FF C" in Fig. 4.



The output of the one-shot circuit 3 is also fed to a reference one-shot circuit 17 which outputs a reference signal pulse "Tx Ref E" whose waveform is shown in Figures 4 and 5. The Tx Ref signal has a pulse length of preferably about 20% more than sync pulse sync A so as to ensure that the reference signal is transmitted for sufficient time to be sampled by all receiving circuits.

The output of the one-shot circuit 3 is also fed to AND gate 5 the output of which controls switches for the analog video signals R, G, B (as described later) to prevent the reception of the video colour signals during the transmission of a reference voltage as well as preventing the transmission of the reference voltage from one station to its own monitor. The AND gate also receives "select own display" or "select network display" signals from the control unit.

During transfer of video display signals, the blue, red and green colour signals are fed from the VGA controller of the transmitting computer station to the network. A switch 6 disconnects the transfer circuit from the blue colour signal B from the VGA controller card of the micro-computer during the Hsync signal, thereby allowing a reference voltage to be sent on the Blue line to the LAN network. That is, the reference voltage is not affected by the blue signal.

The reference voltage is derived from a voltage reference circuit 7 which is switched into the network by a transistor switch 7A controlled by the output signal Tx Ref E of one-shot circuit 17. Thus the reference voltage is transmitted on the blue line during the duration of the pulses

on the Tx Ref E waveform.

The reference voltage signal is passed through video buffer circuit 8A and a transmit switch 8B. The transmit switch 8B is controlled by a transmit display signal from the control unit to connect only the transmitting computer station to the network, i.e. the transmit display signal disconnects transmitting portions of all other computer stations from the network so that only one station may transmit at a time.

An analog switch 9 controlled by the "own direct" output signal from AND gate circuit 5 also ensures that the transmitted reference voltage is not fed to the monitor of the transmitting computer station while the reference signal is transmitted to the network during the sync pulse.

When a computer station is receiving a video display from the network bus, the "sample" signal from the multiplexer 1 indicates when the received signal is to be sampled and held so as to capture the reference voltage being transmitted during the sync pulse of the received video signal. As described above, the sample signal from multiplexer 1 is fed to a level translator circuit 10, the output of which is connected to sample and hold circuit 11. During this sample pulse F, as shown in Fig. 4, the sample and hold circuit 11 will sample the received reference voltage by charging a capacitor through FET switches throughout the sample signal, and hold the charged voltage at the negative going edge of the sample signal.

An amplifier 12 is used to amplify the voltage level held by the sample and hold circuit 11, and the amplifier

output is then buffered to provide a reference level to the individual video amplifiers for the R, G, and B colour signals. Preferably, the amplifier 12 has gain adjustment and reference adjustment to allow the proper voltage levels for the video amplifiers of the R, G and B colour signals to be pre-set.

The colour video signal received from the network on the blue line (after the sync pulse) is then amplified by amplifier 13. The previously sampled and buffered reference voltage is now used to control a gain control FET switch which acts as a voltage controlled resistance and varies the amplification provided to the blue colour video signal by the amplifier 13 so as to produce a substantially constant level signal.

The blue colour signal output from amplifier 13 is then transmitted to the monitor of the computer station via video buffer 15.

Thus, irrespective of the level of the received blue colour signal, the output of the amplifier 13 will be of substantially consistent level as determined by the reference voltage transmitted during the sync pulse. The variable degree of amplification thereby compensates for variations to the video signal, for example, as a result of the network cable loading.

A network analog switch 14, controlled by the "net display" signal from the AND gate circuit 5, is interposed between amplifier 13 and the monitor to prevent the reference voltage transmitted during the sync signals from being

transmitted to the monitor.

The video logic circuits 16 for the red and green colour signals are shown in Fig. 3. These logic circuits are similar to the logic circuit for the blue colour signal, except that there is no need to include circuitry for transmitting, or receiving and capturing, the reference voltage as the output of the gain amplifier 12 in the blue signal logic circuit is used to control the individual colour signal amplifiers in the red and green signal circuits as well.

In use, when video display signals are transmitted from a particular computer station, a reference voltage is transmitted by that computer station during the synchronising pulses of the video signal. The receiving computer stations use that reference voltage to maintain a substantially constant output display level, irrespective of factors such as cable and equipment loading on the transmitted video signals. As a result, the displays at all of the computer stations are of substantially constant level and quality.

The foregoing describes only one embodiment of the invention, and modifications which are obvious to those skilled in the art may be made thereto without departing from the scope of the invention as defined in the following claims. For example, the reference voltage may be transmitted during the vertical synchronising signals rather than the horizontal synchronising signals. Furthermore, the reference voltage may be transmitted on the red or green colour signals rather than the blue colour signal.

The invention may also be used for monochrome video displays, and the term "colour" as used in this specification is to be interpreted accordingly when used in reference to monochrome video signals.

## CLAIMS

1. A method of transferring video signals between computer stations in a multi-computer network, wherein the video signals include at least one synchronising signal and at least one colour signal, characterised in that a reference voltage is transmitted during at least part of a synchronising signal and the reference voltage is used by the receiving computer station(s) to control the amplification of the received colour signal(s) so as to provide a substantially constant video display level at the monitor of the receiving computer station(s).
2. A method as claimed in claim 1, wherein the reference voltage is transmitted during either the horizontal or vertical synchronising pulses for a particular colour signal.
3. A method as claimed in claim 1, wherein the timing of the transmission of the reference voltage is controlled by a controller station of the network.
4. Apparatus for transferring video signals between computer stations in a multicomputer network, wherein the video signals comprise at least one synchronising signal and at least one colour signal, said apparatus comprising means for transmitting from a computer station, a reference voltage during at least part of a synchronising signal, and means at each receiving computer station for receiving the reference voltage and using same to control the amplification of the received colour signal(s) so as to provide a substantially constant video display level at the monitor of the receiving

computer station(s).

5. Apparatus as claimed in claim 4, wherein the transmitting means includes means for detecting the occurrence of one of either a horizontal or vertical synchronising signal, and means for deriving and transmitting a reference voltage during the detected synchronising signal.

6. Apparatus as claimed in claim 4, further comprising means for inhibiting the transmission of video signals to the network from other computer stations while a particular computer station is transmitting video signals to the network.

7. Apparatus as claimed in claim 4, further comprising means for inhibiting the transmission of the reference voltage from a computer station to its own display monitor.

8. Apparatus as claimed in claim 4, wherein the receiving means comprises means for retaining the received reference voltage, and means for amplifying received colour signals in accordance with the retained reference voltage.

9. Apparatus as claimed in claim 8, wherein the retaining means comprises a sample and hold circuit.

10. Apparatus as claimed in claim 8, wherein the amplifying means comprises an amplifier, a voltage control resistance connected to the amplifier for varying the gain thereof, the voltage control resistance being connected to the received reference voltage.

11. Apparatus as claimed in claim 4, wherein the apparatus is mounted on an adaptor card fitted to each computer station.

12. Apparatus as claimed in claim 4, further comprising

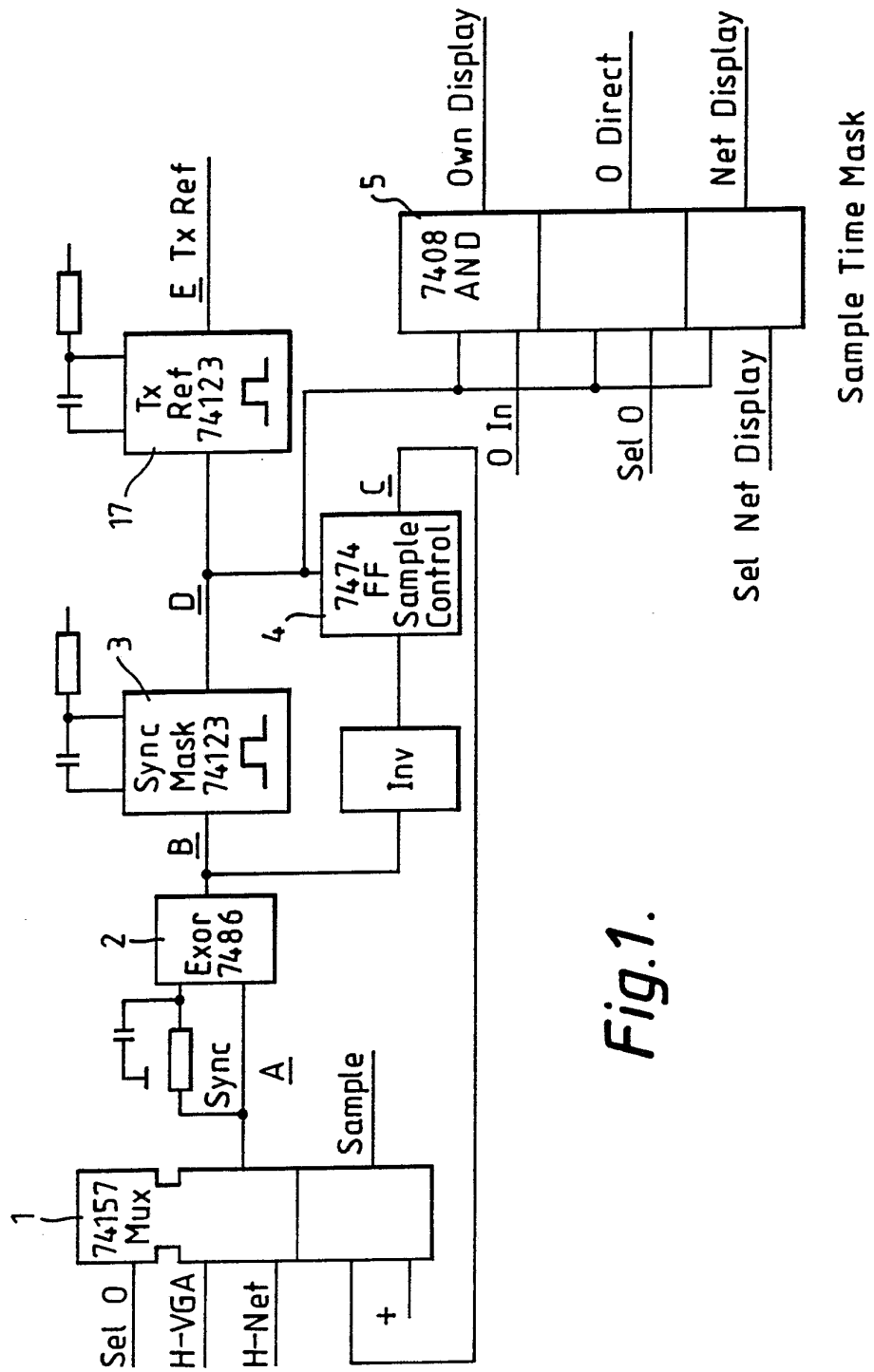
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a control unit for controlling the timing of the transmitting and receiving means, the control unit being connected to one of the computer stations.

13. A multicomputer network comprising the apparatus of claim 4.



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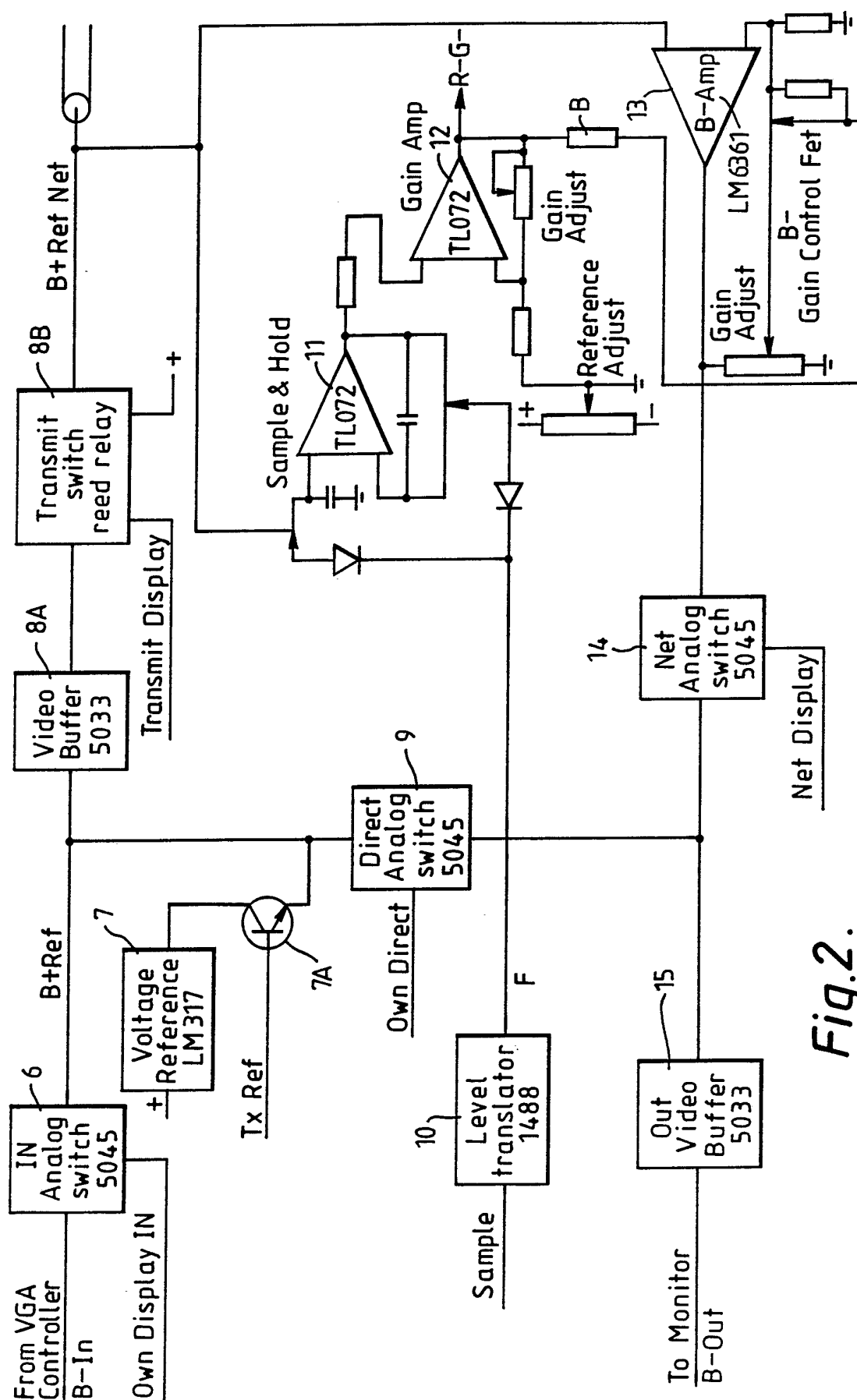


Fig.2.

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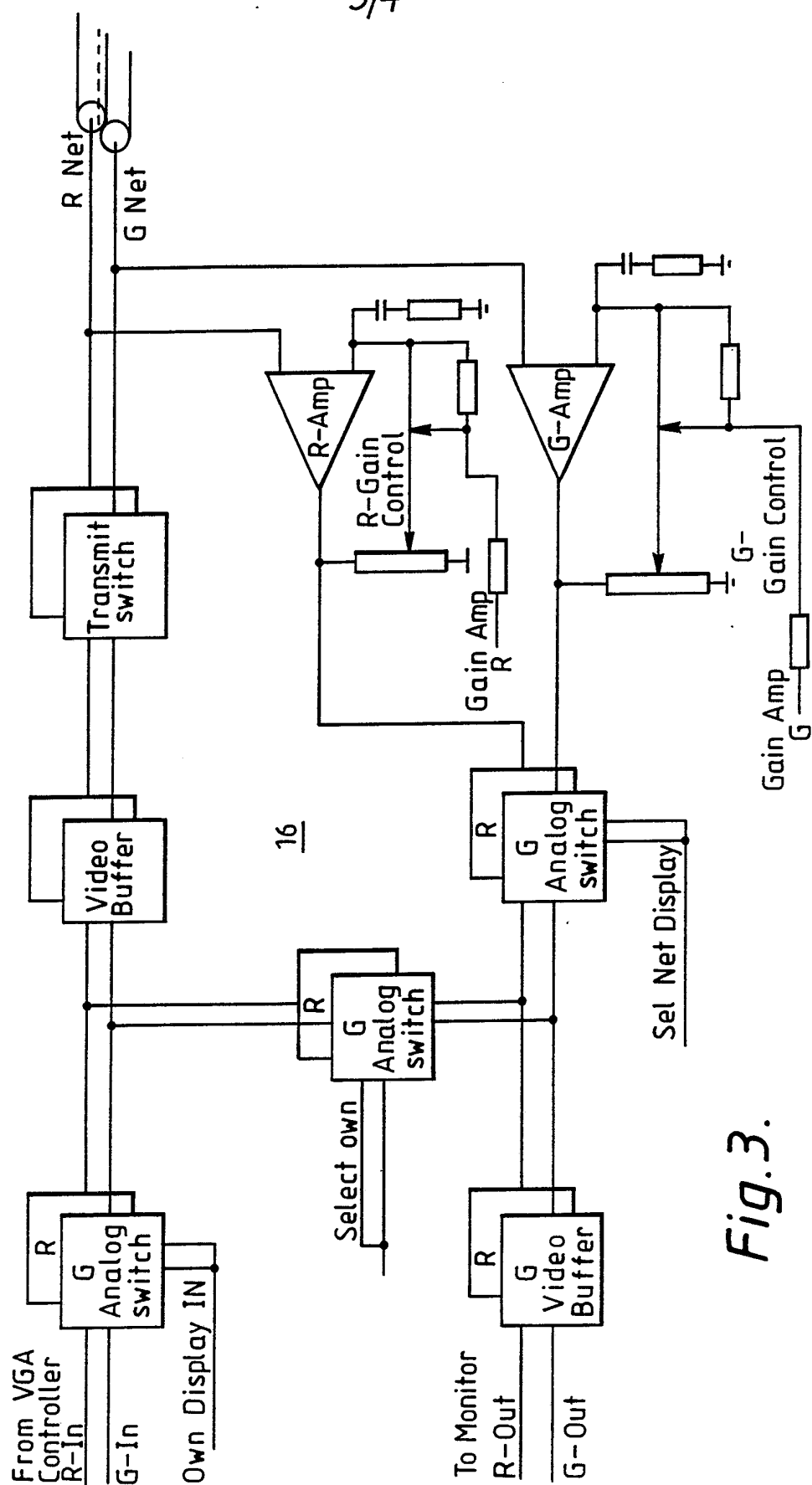
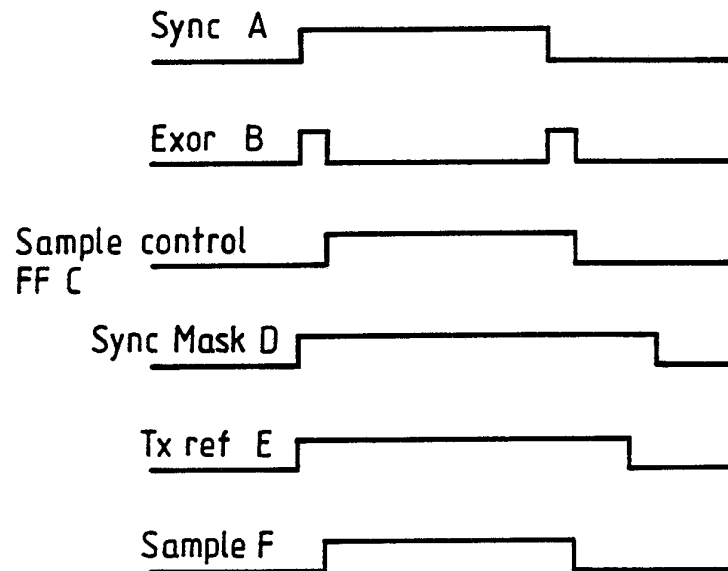
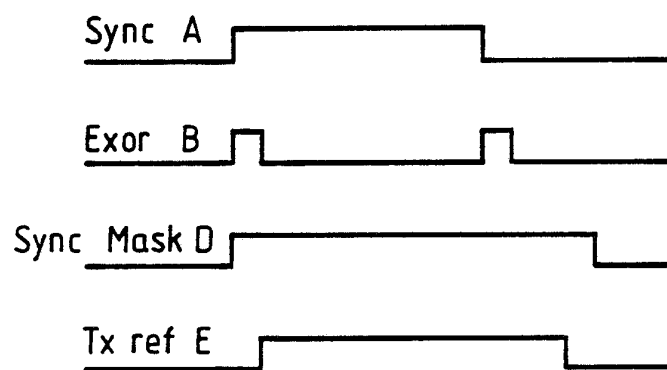


Fig. 3.

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*Fig. 4.**Fig. 5.***SUBSTITUTE SHEET**

# INTERNATIONAL SEARCH REPORT

International Application No. **PCT/AU 91/00034**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) 6				
According to International Patent Classification (IPC) or to both National Classification and IPC				
Int. Cl. <sup>5</sup> H04N 9/68				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched 7				
Classification System	Classification Symbols			
IPC	H04N 9/68			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8				
AU : IPC as above, Australian classification 05.42				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> 9				
Category*	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13		
A	WO,A1, 87/07810 (SCIENTIFIC ATLANTA INC.) 17 December 1987 (17.12.87) Figs. 2 to 4, pages 4 to 6			
A	US,A, 4303986 (LANS) 1 December 1981 (01.12.81) Fig. 3, column 2 lines 6 to 22, column 3 lines 6 to 44			
A	US,A, 3780218 (RENNICK) 18 December 1973 (18.12.73) Fig. 2, column 4 lines 49 to 62			
A	GB,A, 1018715 (FERNSEH GmbH) 2 February 1966 (02.02.66) Figs. 1 to 4, page 2 line 32 to page 3 line 47			
A	US,A, 2908748 (MACOVSKI) 13 October 1959 (13.10.59) Fig. 1, column 3 lines 4 to 68			
<p>* Special categories of cited documents: 10</p> <table style="width: 100%;"> <tr> <td style="width: 50%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%;"> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p>
<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p>			
<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search ( )	Date of Mailing of this International Search Report <b>13 MAY 1990</b>			
International Searching Authority  <b>Australian Patent Office</b>	Signature of Authorized Officer  <b>A.W DUKE</b> <i>a. w. Duke</i>			

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
  
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
  
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 91/00034

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document  
Cited in Search  
Report

Patent Family Members

WO 8767810	AU 75815/87 EP 271540 NO 880454	CN 87104065 FI 880474 ZA 8703823	DK 528/88 JP 1500394
US 4303986	DE 3063711 EP 23217 JP 56500106	DK 3817/80 FI 800056 JP 62056533	DK 157465 IT 1150977 WO 8001422
US 3780218	CA 944475		

END OF ANNEX