

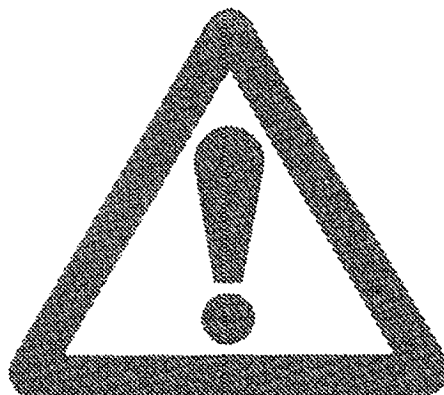
# CVI

COMPUTER VIDEO INSTRUMENT

SERVICE MANUAL

FAIRLIGHT JUNE 1985



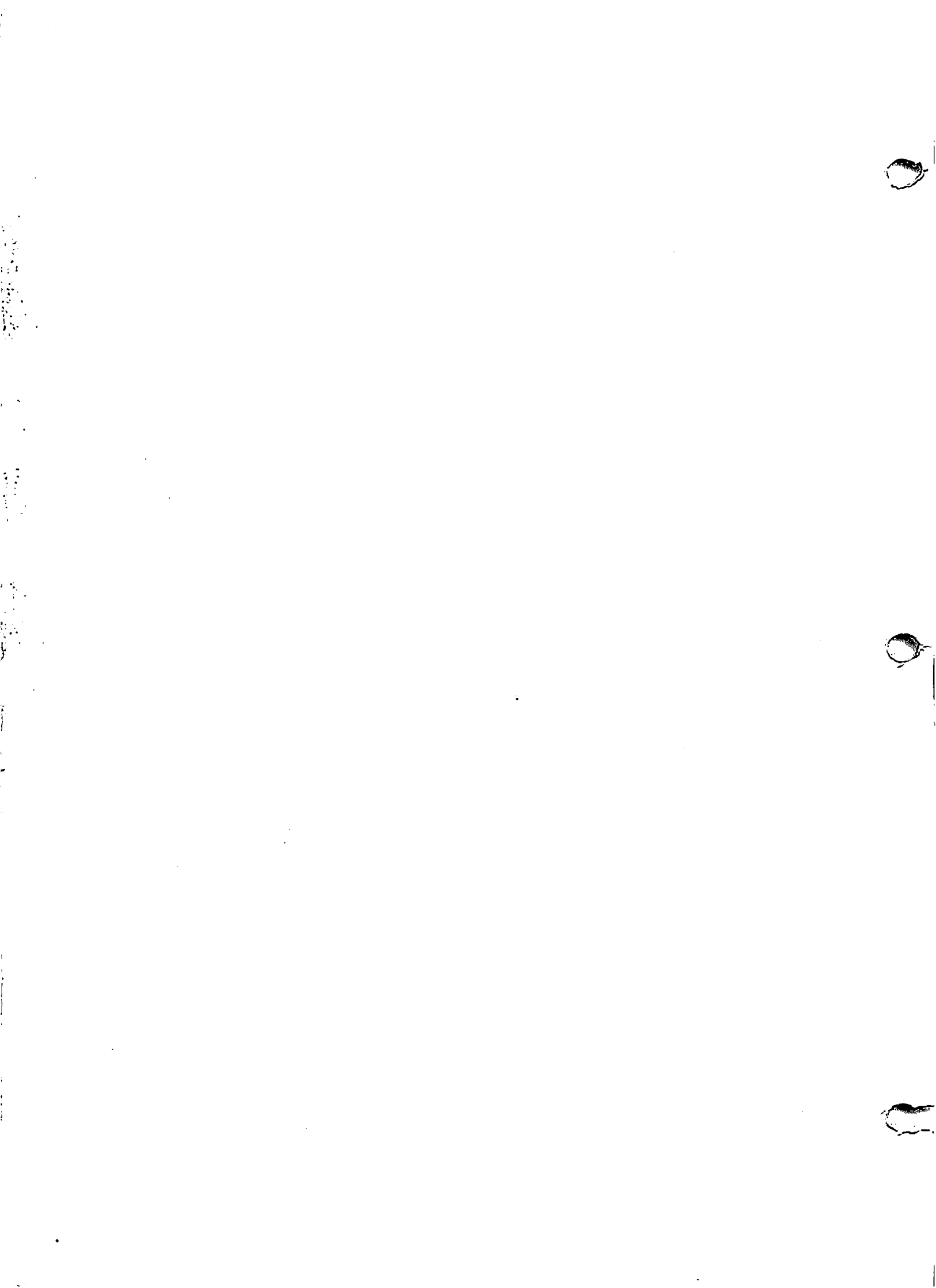


**These service instructions are for use by qualified personnel.  
If nontechnical CVI owners suspect that the unit has degraded,  
or that some functions are not working,  
perform the self diagnostic tests (Video menu 9) first  
then report error messages to your distributor.**

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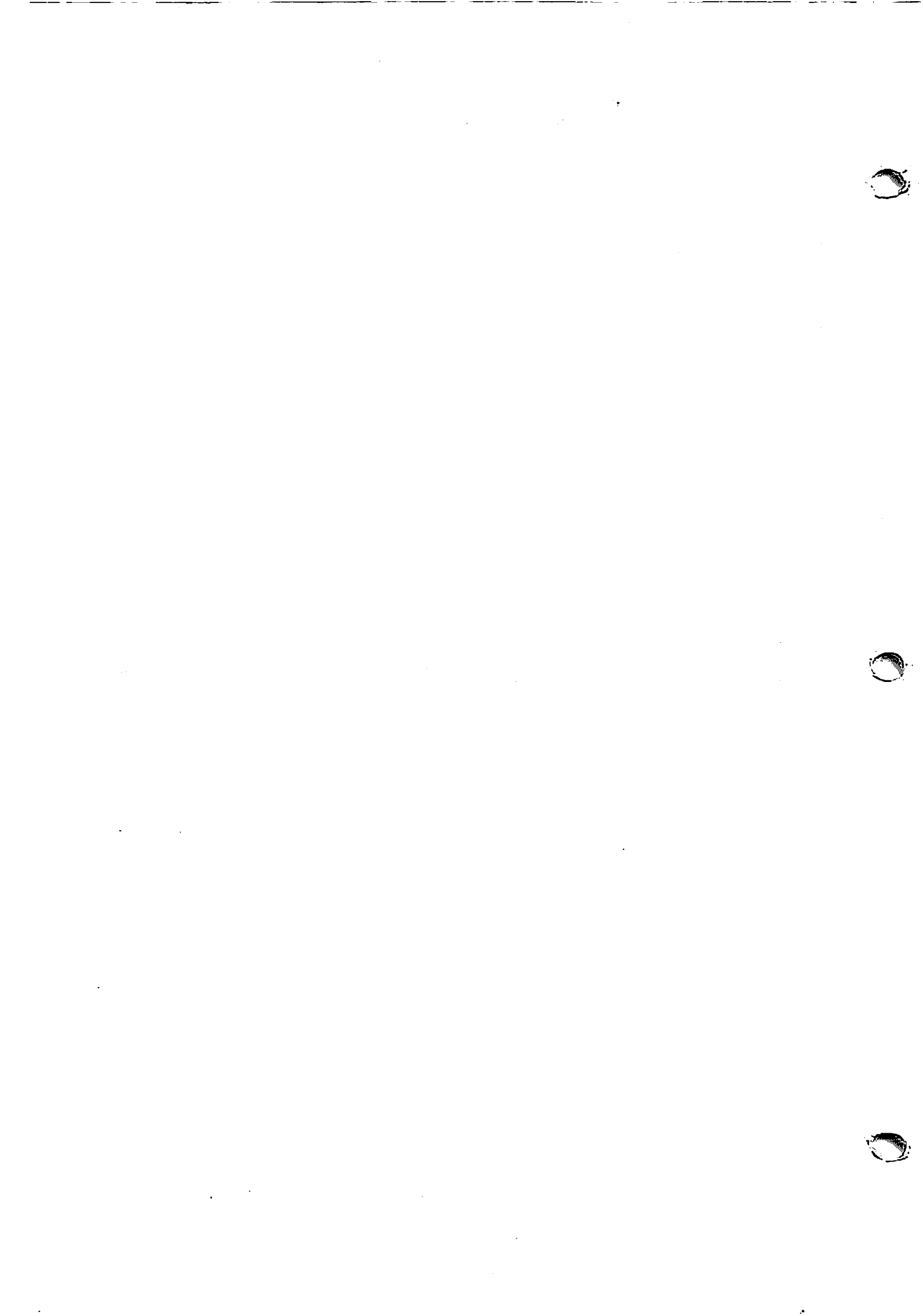
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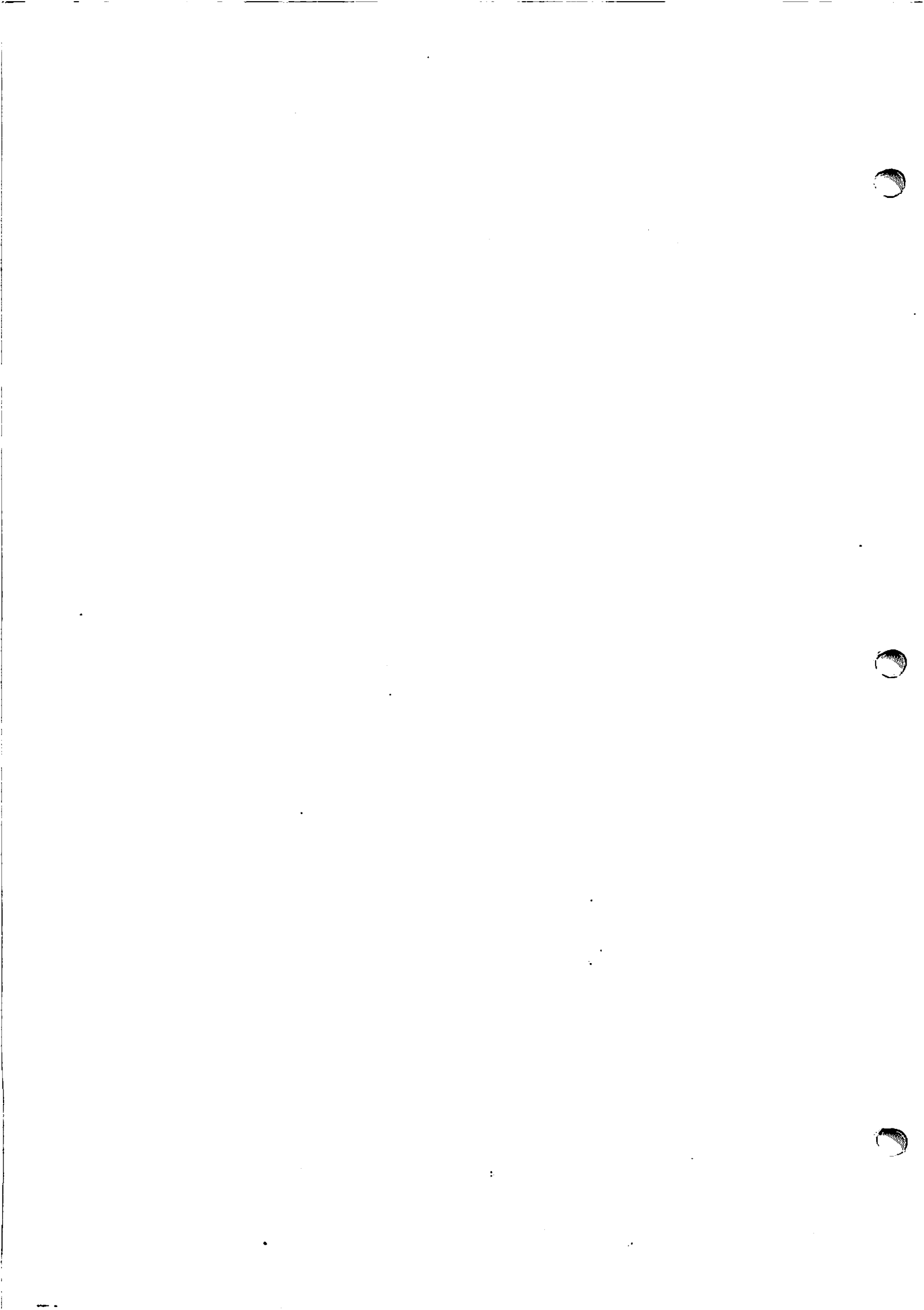


# System Overview

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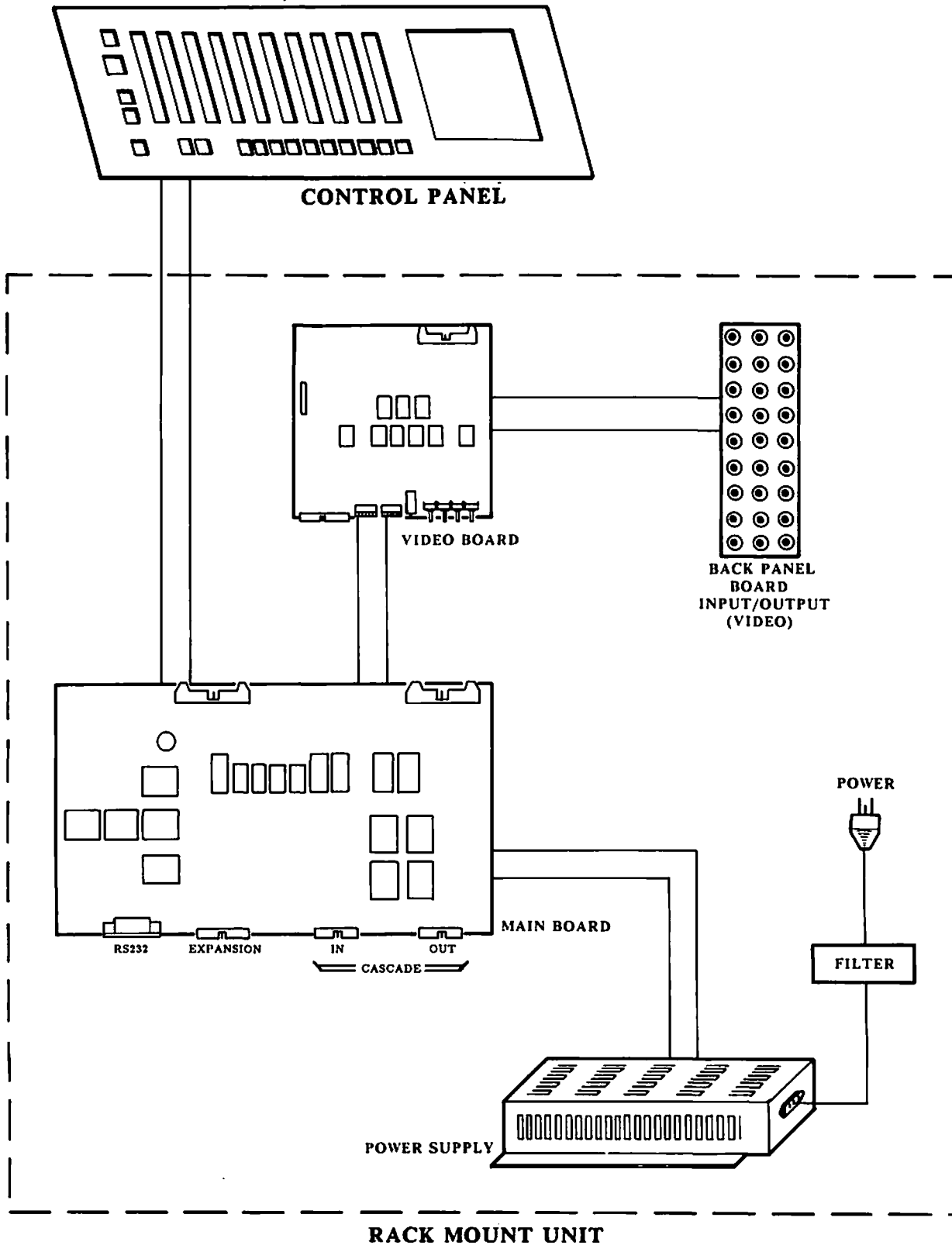
<b>Video standard:</b>	NTSC or PAL compatible (note 1).
<b>Field store:</b>	256 x 256 pixels, 14 bit planes, 4096 colours (note 2).
<b>Memory:</b>	128 Kbytes RAM, 32 Kbytes ROM.
<b>Processor:</b>	2MHz 6809.
<b>Communications:</b>	RS232C port (300 - 19200 baud). Internal functions can be accessed and controlled by ASCII codes.
<b>Expansion:</b>	Processor expansion bus, Digital video cascade in and out.
<b>Composite video inputs:</b>	x2, 1Vp-p, loop through
<b>RGB inputs:</b>	x2, 0.7Vp-p, loop through
<b>Composite video output:</b>	1Vp-p, 75 ohms (note 3).
<b>RGB output:</b>	0.7Vp-p, 75 ohms.
<b>Stencil (key/matte) in:</b>	0.7V dc slicing level.
<b>Stencil out:</b>	2Vp-p, 75 ohms.
<b>Resolution:</b>	> 300 lines (composite in - composite out). 256 pixels per line (field store).
<b>Delay:</b>	1300 ns (composite in - composite out).
<b>Subcarrier:</b>	Internally generated or external input (loop through) 1V to 4V p-p. 0 - 360 degree phase control.
<b>Synchronization:</b>	Internally generated for stand-alone use. Auto external sync to composite video 1 input.
<b>Termination:</b>	Switchable 75 ohm termination inbuilt on all video inputs.
<b>Video connections:</b>	Full complement of BNC connectors (26).
<b>Audio input:</b>	Internal mic, external mic or line.
<b>Power:</b>	40W (100 - 120 or 200 - 240 volts).
<b>Dimensions and Weight:</b>	Control panel: 428(W)x178(H)x25(D) mm. Multicore cable between control panel and electronics unit. Standard length: 2m optional: 5, 10 or 20m. Standard EIA rack size, 4 units. 1Kg. Remote electronics unit: 482(W)x133(H)x270(D) mm. Standard EIA rack size, 3 units. 6kg.

**Please note:**

- (1) In PAL systems field store displays only 256 lines. This will normally be visible as 3 to 5 black lines at the top and bottom of the digitally stored picture, depending on the monitor vertical scanning adjustments.
- (2) CVI will not squeeze or zoom LIVE images.
- (3) If used in a studio installation where the CVI output is to be mixed with other sources, or where broadcast style output is required, an external PAL/NTSC coder and SPG should be used.

\* These specifications are subject to change and are presented as a guide only.

# CVI OVERVIEW BLOCK DIAGRAM



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## INTRODUCTION AND SYSTEM OVERVIEW

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The Computer Video Instrument is a computer controlled field store. It is compatible with either PAL or NTSC systems and can be used with most video sources including cameras, VTR's and VCR's. Two genlocked RGB or composite video inputs can be used. Composite and RGB outputs are provided.

The video signal is processed initially on the Video Board before being sent to the Main Board for switching/mixing or digital processing. The signal is then returned to the Video Board for further processing before being output.

The system uses separated red, green and blue colour components for processing by the computer instead of luminance and colour difference components used in other digital video systems. This reduces the amount of computation necessary. RGB component signals are therefore used throughout the system in both analog and digital form.

The system comprises five main sections: Video Board, Main Board, BNC Connector Board, Control Panel and Power Supply.

The CVI is housed in a standard 19" rack-mounting case. The Video Board and Power Supply Assembly are mounted on the top of the central tray which slides out for servicing and adjustment. The Main Board is mounted on the underside of this tray. The BNC Connector Board is mounted on the back panel. The Control Panel is housed in a separate rack-mounting assembly.

Separate PAL and NTSC versions of the Video Board are available. The Main Board, Control Panel, BNC Connector Board and Power Supply are used for both TV standards.

The functions of each are now described. Refer to the block diagram.

### Video Board

This card contains the composite video decoders, sync separator, colour subcarrier oscillator, encoder, delay lines, buffers, RGB multiplexers and audio filters. It connects to the Main Board via a forty way ribbon cable. The main functions performed on this card are:

- decoding the input composite video signals to red, green and blue analog signals.
- switching these signals to the selected analog and digital paths.
- generating the subcarrier signal to be used by the Main Board as a reference frequency.
- generating horizontal and vertical sync signals from the incoming video signals.
- generating the audio control signals from

the internal microphone or external audio input.

- encoding the final analog RGB signals from the Main Board into a composite video signal.

### Main Board

This card contains the microcomputer, field store, analog-to-digital and digital-to-analog converters, chroma-key circuitry, control, timing and interface circuitry.

The main functions performed on this card are:

- conversion of analog RGB signals to digital signals.
- generating the internal and chroma-key stencils.
- generating the timing and control signals for the whole system.
- communicating with external devices via the RS232 port.
- monitoring the status of the control panel.
- displaying and updating the menu displays.
- storing a field of digitised video information.
- processing the digital signals for such effects as colorisation, freeze, zoom, pan, stretch, mirror, etc.
- generating the final analog RGB signals from the digital and analog RGB signals.

### Control Panel

This unit contains the switches, control sliders, graphics pad and preset display. It connects to the Main Board via a forty way ribbon cable upto twenty metres in length.

The main functions performed by the Control Panel are:

- generating the control signals from the switches and sliders.
- deriving position information from the graphics pad.
- displaying the preset number.
- indicating the status of various functions on the switch LEDs and buzzer.

### BNC Connector Board

This board contains all the input and output connectors. It connects to the Video Board via a forty way ribbon cable.

### Power Supply

This unit consists of a switch mode power supply unit, on/off switch and mains socket and filter. It provides the +12v, +5v, -12v and 0V supply rails required by the CVI. It connects to the Main Board via a fourteen way ribbon cable.



# Main Board Control Board

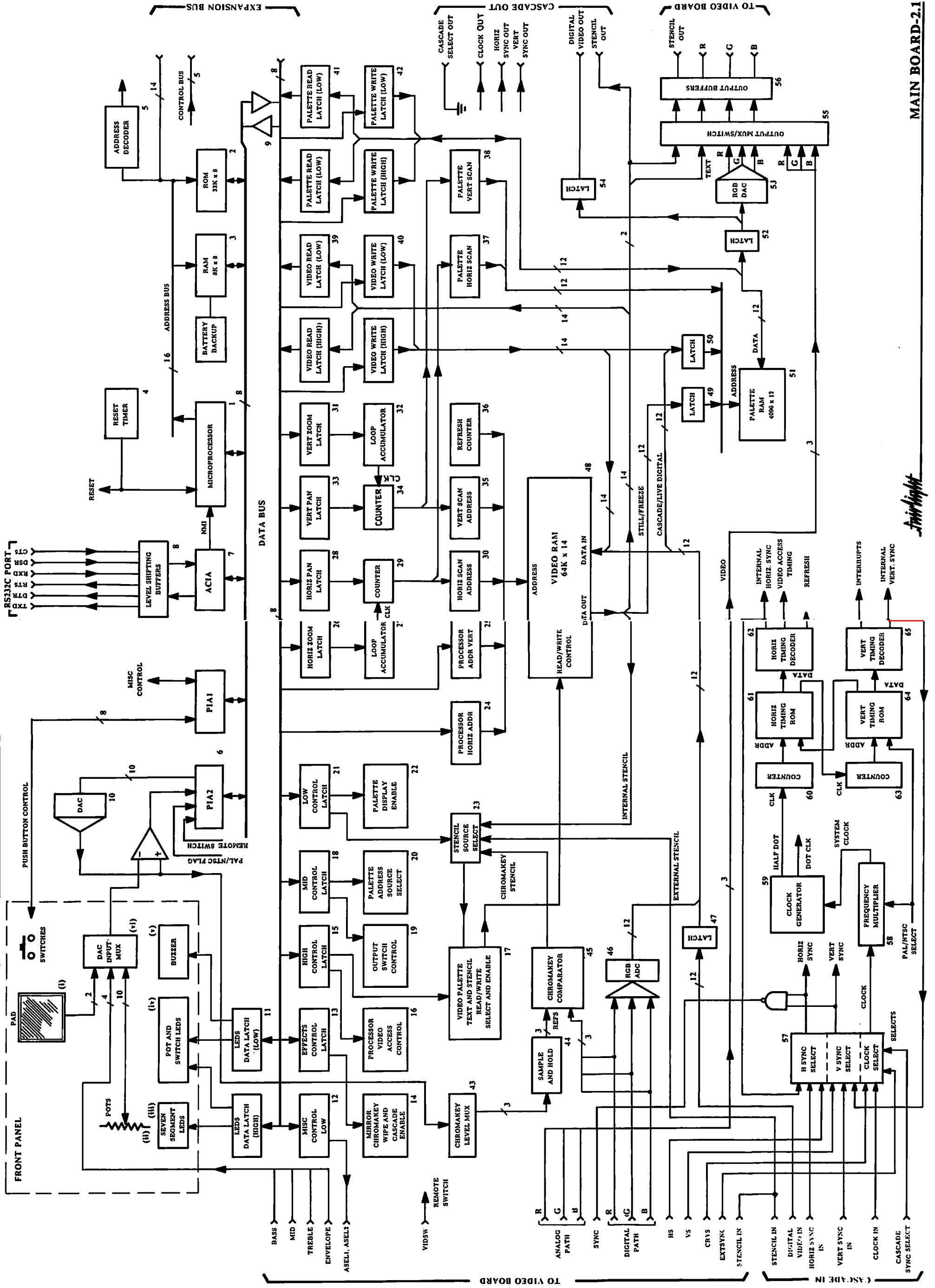
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# BLOCK DIAGRAM



## BLOCK DIAGRAM DESCRIPTIONS

**NOTE:** For easy reference, the numbers preceding each paragraph coincide with the block under description on Main Board Block Diagram - Page 2.1.

The numbers in brackets [ ] refer to the ICs under description. See overlay Page 2.4.

The numbers in parenthesis ( ) refer to Circuit Diagrams No CVI 01, Sheets 1-10, Page 2.5-2.5.9

1. **6809 microprocessor** runs at 2MHz, asynchronously to the video timing. The processor controls 32K of ROM, 8K of static RAM, two PIA's and one ACIA, as well as four read-only and seventeen write-only latches on a buffered data bus. Processor RAM or ROM may be expanded by up to 16K by using the expansion port.

IRQ interrupts are generated once per frame to initiate hardware configuration activity. All the control latches are set during the IRQ interrupt. FIRQ interrupts are generated four times per frame to update the control-panel LEDs without flicker. NMI interrupts are generated when a character is received or transmitted from the serial port (7). Further synchronisation to the video timing is achieved by polling PIA inputs as required. [A7 (CVI01 Sheet 1)]

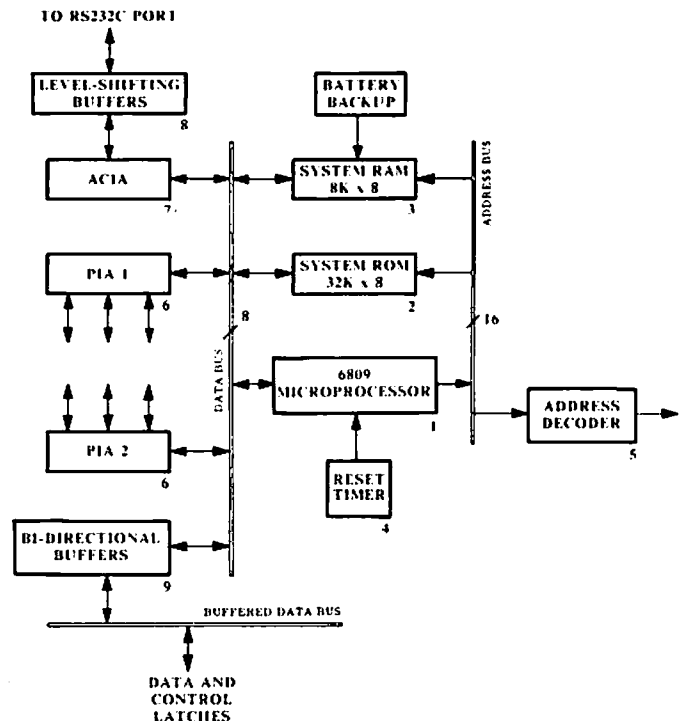
2. **System ROM** is 32Kx8. The two 16K chips are removable to accommodate software upgrades. [B7,C7 (CVI01 Sheet 1)]

3. **System RAM** is 8Kx8 of static RAM. Battery backup retains the preset and sequencer data on power-down. [D7 (CVI01 Sheet 1)]

4. **Reset timer** provides the power-up reset pulse to the processor and to much of the digital circuitry. [F19 (CVI01 Sheet 1)]

5. **Address decoder** decodes the address bus into enable signals for each of the processor peripherals, for the expansion bus, and for each of the twentyone processor-accessible 8-bit latches. [E17,E18,E19,E20,E21 (CVI01 Sheet 6)]

6. **Parallel interfaces** control the analog input multiplexer on the control-panel, the chromakey level multiplexer and control-panel switch decoding. The PIA's also provide software access to hardware timing signals and control the IRQ and FIRQ interrupts to the processor. [F12,F16 (CVI01 Sheet 1)]



7. **Asynchronous communications interface** has programmable baud-rate with timing generated from an external crystal. It is programmed for RS232C communications. The ACIA causes NMI interrupts to the processor on data transfer. [A4 (CVI01 Sheet 1)]

8. **Data buffers** convert the TTL ACIA signals to +/-12V line signals and vice versa. [A1,A2 (CVI01 Sheet 1)]

9. **Bi-directional buffers** isolate the processor data bus from the hardware latches, and provide current-drive capability. [A12 (CVI01 Sheet 1)]

10. **Analog-to-digital converter** is implemented with a 10-bit DAC, a comparator and a successive-approximation algorithm. An analog-to-digital conversion is performed only when an input has changed since the previous reading. The DAC also sets the chromakey levels. [F21,G22 (CVI01 Sheet 9)]



## BLOCK DIAGRAM DESCRIPTIONS

11. LEDs data latch (16-bit) controls the data and multiplexing sequence for the control-panel LEDs and the buzzer. Four transistor drivers provide current drive. [F8,F9 (CVI01 Sheet 5)]

12. Miscellaneous control latch (8-bit) controls the multiplexer that selects the video source for each of the analog and digital paths. The multiplexer is located on the video board. The latch also enables extended vertical blanking. [C29 (CVI01 Sheet 7)]

13. Effects control latch (8-bit) enables mirror, wipe, chromakey and cascade effects. The bits of the latch each enable or control dedicated hardware logic. [C15 (CVI01 Sheet 7)]

14. Effects control is performed by the effects control latch (13).

Horizontal and vertical mirrors are created by enabling counting-direction reversal in the video-address counters (29,34).

Horizontal and vertical wipes are created by enabling carry-out from the video-address counters to swap between the still and live digital image sources.

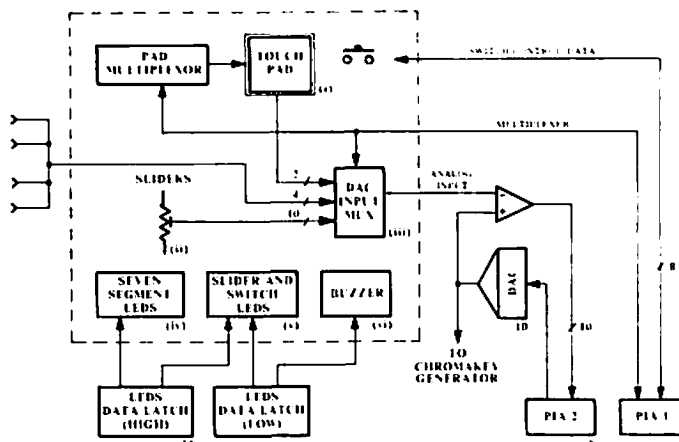
Cascade of a digital image from another CVI is enabled by selecting data from the cascade input latch (47) instead of from the ADC (46).

Chromakey-type selection (blue or luminance) is made by altering the logical combinations of the chromakey comparator outputs (45). [(CVI01 Sheets 3 & 7)]

15. High control latch (8-bit) stores the processor read/write control signals for the video, stencil, text and palette memories (48,51). [C14 (CVI01 Sheet 7)]

16. Processor video access control: Processor access to the video and palette memories is restricted by the horizontal timing generator (62) to once in each video line. A hardware status flag is set when a control word is written to the high control latch (15). The flag is subsequently cleared after the data transfer is completed in the next processor access cycle. The processor reads the flag through PIA1, and hence avoids overwriting unwritten data or reading old data. [E12 (CVI01 Sheet 7)]

17. Video and palette RAM read/write control: The latched signals from the high control latch are used during the processor access cycle to enable the processor data latches (39,40,41,42) and to generate read or write pulses to the



appropriate sections of memory. [D14 (CVI01 Sheet 7)]

18. Mid control latch (8-bit) stores control signals which operate the output switch (55), determine whether stored or direct image data addresses the palette, and determine whether incoming image data is written to the video RAM. [C13 (CVI01 Sheet 7)]

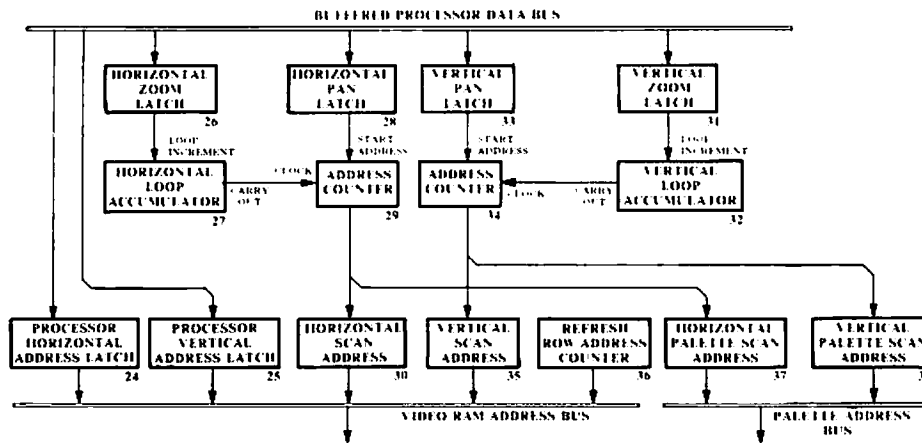
19. Output switch control: Four latched bits from the mid control latch are used to select RGB outputs from either the digital or analog path or both for when the stencil is on and for when it is off. The four bits are combined with the stencil to form two control signals to the output switch (55). [B13 (CVI01 Sheet 7)]

20. Palette address source select hardware determines whether the palette address data (and hence the output of the digital path) is taken from the video RAM (still or freeze) or directly from the digital input (live digital or cascade). [D9 (CVI01 Sheet 7)]

21. Low control latch (8-bit) stores data that determines which stencil is to be used and whether the stencil, text page or the palette is displayed. [C16 (CVI01 Sheet 7)]

22. Palette display enable logic allows the video address counters (29,34) to address the palette via the palette scan latches (37,38). This causes the output of the digital path to be an ordered display of the palette RAM that can respond to pan and zoom. [(CVI01 Sheet 7)]

23. Stencil source select uses three bits from the low control latch to select the active stencil from the internal, external and chromakey stencils. [E14 (CVI01 Sheet 7)]



**24. Processor horizontal address latch (8-bit)** contains the high-order address during a video RAM access by the processor. Data is transferred through the video read or write latches (39 or 40) under the control of the processor video access control logic (16). [C19 (CVI01 Sheet 3)]

**25. Processor vertical address latch (8-bit)** contains the low-order address during a video RAM access by the processor. [C20 (CVI01 Sheet 3)]

**26. Horizontal zoom latch (8-bit)** holds the input data for the loop accumulator (27) that controls horizontal pixel zooming. [B12 (CVI01 Sheet 5)]

**27. Horizontal loop accumulator (8-bit)** increments once each pixel period by the value stored in the horizontal zoom latch. The carry-out from the accumulator enables clocking of the horizontal video address counter. Hence a small value in the zoom latch causes one pixel to be displayed many times, resulting in stretch. [B9,B10,B11 (CVI01 Sheet 5)]

**28. Horizontal pan latch (8-bit)** holds the start address for the horizontal video address counter (29). In slide mode the start address is increased each frame. [C17 (CVI01 Sheet 3)]

**29. Horizontal address counter** increments through horizontal video addresses at a rate determined by the horizontal zoom logic (26,27). Counting begins at the address stored in the horizontal pan latch and continues to the end of the video line. The carry-out is used to determine the position of horizontal mirrors and wipes when they are activated. [A15,A16,A17,A18 (CVI01 Sheet 3)]

**30. Horizontal scan address latch (8-bit)** holds

the address from the horizontal address counter. [A19 (CVI01 Sheet 3)]

**31. Vertical zoom latch (8-bit)** holds the input data for the loop accumulator (32) that controls vertical pixel zooming. [C12 (CVI01 Sheet 5)]

**32. Vertical loop accumulator (8-bit)** increments once each line period by the value stored in the vertical zoom latch. The carry-out from the accumulator enables clocking of the vertical video address counter. [C9,C10,C11 (CVI01 Sheet 5)]

**33. Vertical pan latch (8-bit)** holds the start address for the vertical video address counter (34). In slide mode the start address is increased each frame. [C18 (CVI01 Sheet 3)]

**34. Vertical address counter** increments through vertical video addresses at a rate determined by the vertical zoom logic (31,32). Counting begins at the address stored in the vertical pan latch and continues to the end of the video field. The carry-out is used to determine the position of vertical mirrors and wipes when they are activated. [A13,A14,B17,B18 (CVI01 Sheet 3)]

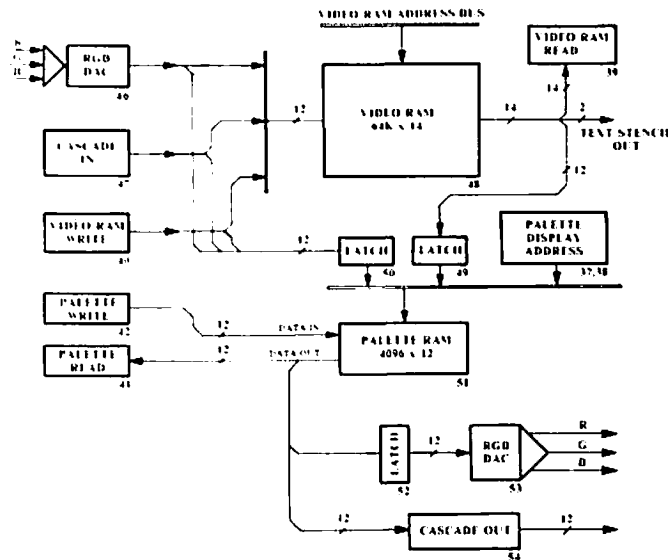
**35. Vertical scan address latch (8-bit)** holds the address from the vertical address counter. [A20 (CVI01 Sheet 3)]

**36. Refresh counter** continually refreshes the dynamic video RAM during the horizontal blanking periods by cycling through the row addresses. [B19,B20 (CVI01 Sheet 3)]

**37. Palette horizontal scan latch (6-bit)** takes addresses from the horizontal pan/zoom counter (29). If the palette display logic (22) enables the latch then the addresses are applied to the palette RAM to give an ordered palette display. [A21 (CVI01 Sheet 3)]

# BLOCK DIAGRAM DESCRIPTIONS

38. Palette vertical scan latch (6-bit) takes addresses from the vertical pan/zoom counter (34). If the palette display logic (22) enables the latch then the addresses are applied to the palette RAM. [A22 (CVI01 Sheet 3)]



39. Video read latch (16-bit) contains the 14 bits of data after a processor read from the video RAM. [C21,C22 (CVI01 Sheet 2)]

40. Video write latch (16-bit) is the write-data latch for the video RAM and the address latch for the palette RAM. The control word written to the high control latch determines which function is required. [C23,C24 (CVI01 Sheet 2)]

41. Palette read latch (16-bit) contains the 12 bits of data after a processor read from the palette RAM. [C27,C28 (CVI01 Sheet 4)]

42. Palette write latch (16-bit) contains the 12-bits of data for a processor write to the palette RAM. [C25,C26 (CVI01 Sheet 4)]

43. Chromakey level multiplexer updates the red, green and blue analog chromakey levels to the three sample-and-hold circuits every field under processor control. The analog levels are supplied from the DAC (10) and the multiplexer is controlled from PIA1. [F23 (CVI01 Sheet 9)]

44. Sample and holds hold the chromakey reference levels set by the processor. [(CVI01 Sheet 9)]

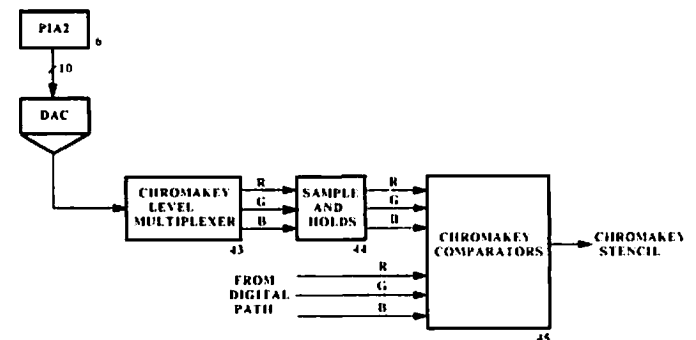
45. Chromakey comparator compares the incoming red, green and blue levels with the chromakey references. The comparator outputs are combined logically with the chromakey-type controls from the effects latch (13) to generate the chromakey stencil. [G24,G25,G26 (CVI01 Sheet 9)]

46. RGB digital-to-analog flash converter digitises each of the red, green and blue signals to four bits. The 12-bit output may be stored in the video RAM (still/freeze) or used to address the palette (live digital). [E24,E25,E26 (CVI01 Sheet 9)]

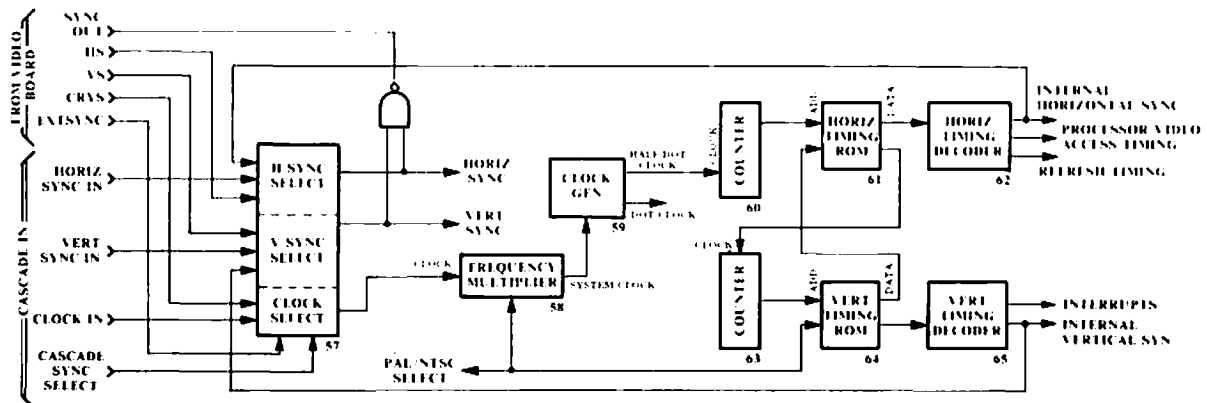
47. Cascade input latch (16-bit) enables image data to be cascaded from another CVI. The latch is enabled via the effects control latch (13). [A23,A24 (CVI01 Sheet 4)]

48. Video RAM is 64Kx14 bits of dynamic RAM. The 64K locations correspond to the 256x256 pixel locations. Each pixel location has 12 bits of colour information, one bit for the stencil information and one bit for the menu page. [D17,D18 ... D29,D30 (CVI01 Sheet 2)]

49. Palette address latch (12-bit) allows direct digital image data or processor data to address the palette RAM. This latch is enabled from the palette-address selection logic (20). [B23,B24 (CVI01 Sheet 4)]



## BLOCK DIAGRAM DESCRIPTIONS



**50. Palette address latch (12-bit)** allows stored image data from the video RAM (48) to address the palette RAM. This latch is enabled from the palette-address selection logic (20). [B21,B22 (CVI01 Sheet 2)]

**51. Palette RAM** is 4Kx16 bits of static RAM of which 4Kx12 bits are used. It performs a colour transformation, allowing each colour to be mapped to any other colour. The 12-bit address is pixel colour data from the video RAM or from the direct video inputs. The 12-bit data output is the transformed or colourised value of the addressing colour. Data is written to the palette RAM only by the processor, through the video and palette write latches (40,42). [A25,A27,B25,B27 (CVI01 Sheet 4)]

**52. Palette output latch (16-bit)** clocks the transformed colour data from the palette RAM to the RGB digital-to-analog converter and to the cascade output. [A28,B28 (CVI01 Sheet 4)]

**53. RGB digital-to-analog converter** converts the twelve bits of colour information from the digital path back into three analog signals (red, green and blue). [E27,E28,E30 (CVI01 Sheet 10)]

**54. Cascade output buffer (16 bit)** buffers the digital video outputs to a second CVI. [A29,B29 (CVI01 Sheet 4)]

**55. Video output switch** combines the digital and analog paths, the stencil and the menu page into the final image format. Each of the red, green and blue outputs is formed by the selective analog addition of the digital path, analog path, stencil and text signals. This enables such functions as menus, show-stencil, video-mix, live digital, still, video, etc. The adder is controlled by the output-switch control logic (19) and by the low control latch (21). [E27,E28,E30 (CVI01 Sheet 10)]

**56. Output buffers** buffer the output of the video switches. [G27,G28,G30 (CVI01 Sheet 10)]

**57. Sync source select circuit** selects the source of the system sync signals according to the status of EXTERNAL SYNC and CASCADE SYNC lines. EXTERNAL SYNC is enabled if an input is connected to the CVI Video 1 input. CASCADE SYNC is enabled if an input is connected to the Cascade In port. System sync signals are selected, as appropriate, from the internal syncs (62,65), from the sync derived from the external video signal, or from the cascade syncs. The twice-subcarrier signal is selected either from the clock on the video board or from the cascade input clock. [B3,B4,B5 (CVI01 Sheet 8)]

**58. Frequency multiplier** uses a phase-locked loop to multiply the twice-subcarrier clock by four for PAL or five for NTSC to give the 35MHz system clock. [F1,F4 (CVI01 Sheet 8)]

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## BLOCK DIAGRAM DESCRIPTIONS

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59. **Clock generator** uses the 35MHz system clock from the frequency multiplier to generate a number of hardware clocks. The pixel (dot) clock is the system clock divided by 8. [F5 (CVI01 Sheet 8)]

60. **Horizontal timing counter** addresses the horizontal timing ROM sequentially. It is clocked at twice the pixel rate, and is cleared by the system horizontal sync pulse from the sync selector (57). [D1 (CVI01 Sheet 8)]

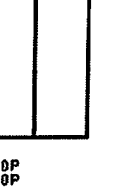
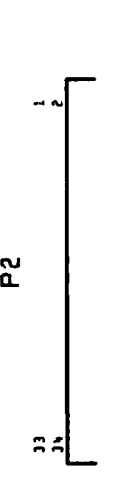
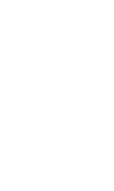
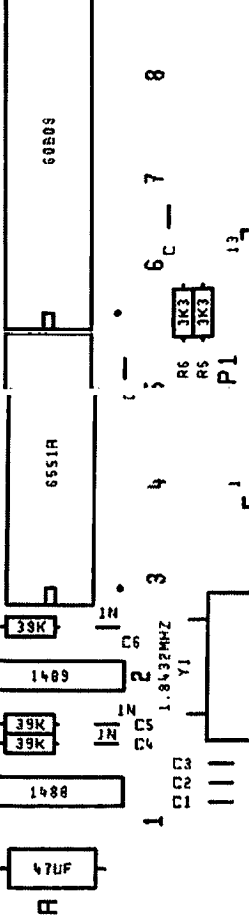
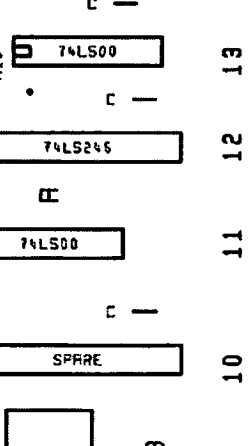
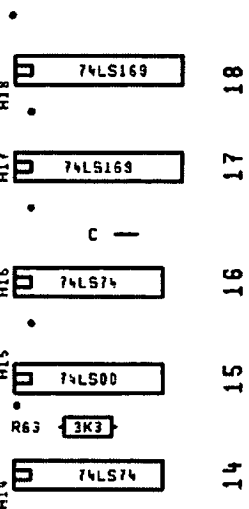
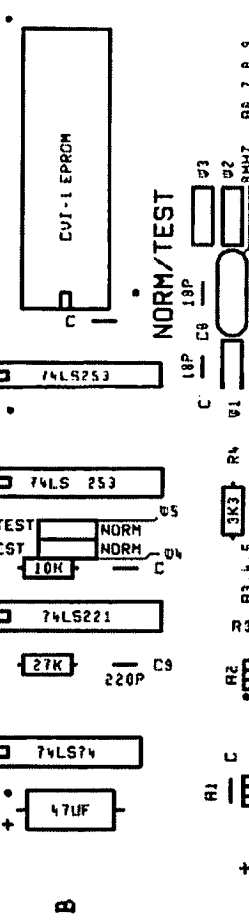
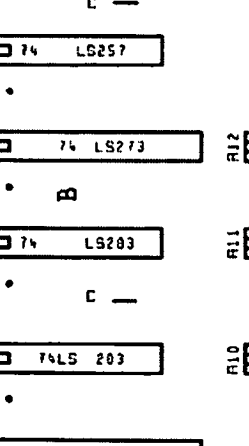
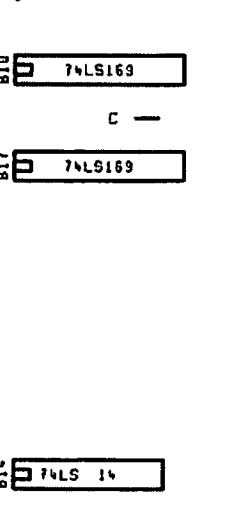
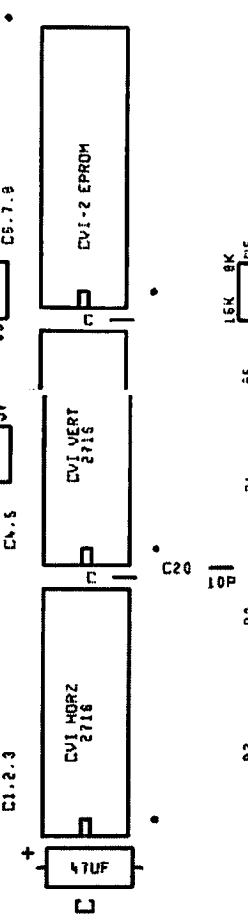
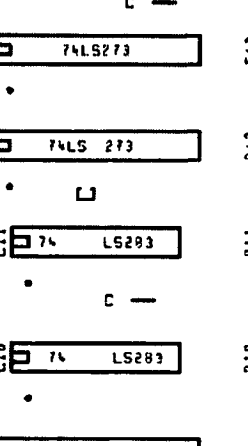
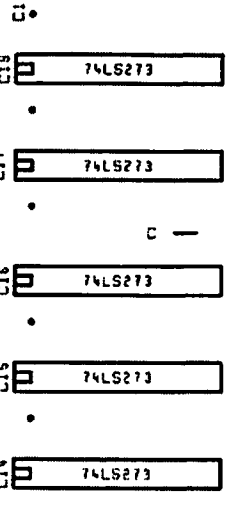
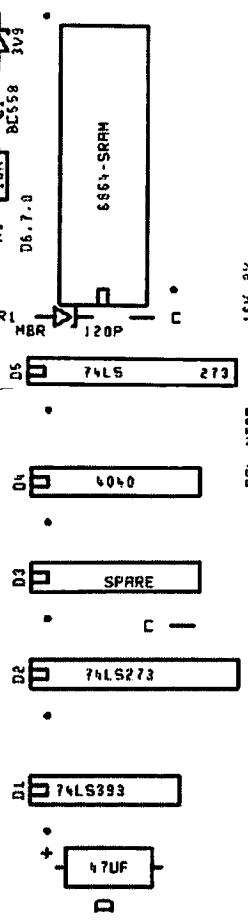
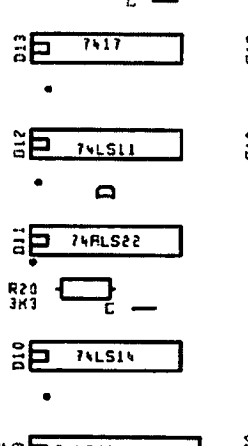
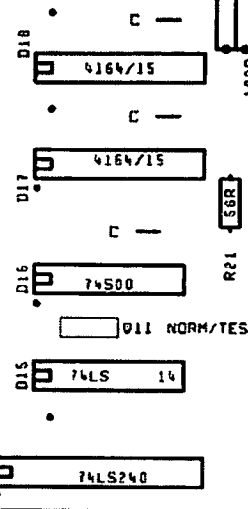
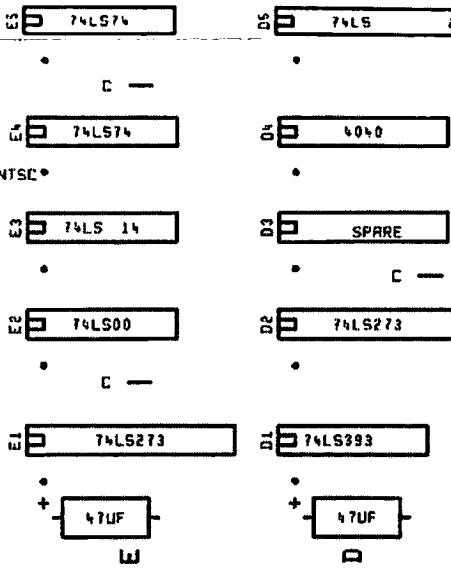
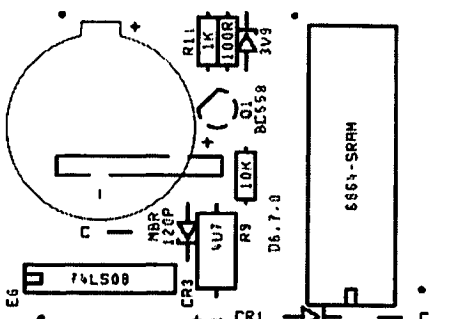
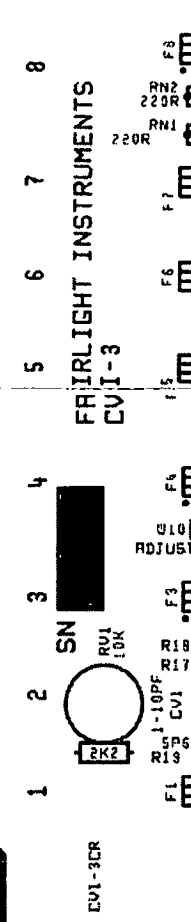
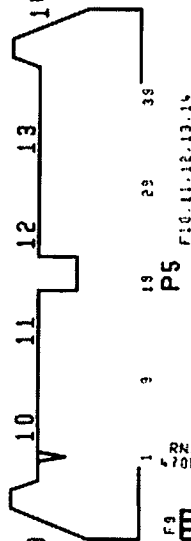
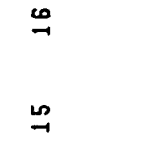
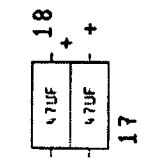
61. **Horizontal timing ROM** is 2Kx8 bits. It contains the data to generate eight horizontal control signals for one video line in both PAL and NTSC formats. The highest address bit of the ROM, which selects between PAL and NTSC timing data, is controlled by the vertical timing ROM. [C1 (CVI01 Sheet 8)]

62. **Horizontal timing decoder** combines the eight timing signals from the horizontal timing ROM to generate all the horizontal video and digital timing signals for the system, including the refresh timing and processor video access timing. [D2,E1,E4,E5 (CVI01 Sheet 8)]

63. **Vertical timing counter** addresses the vertical timing ROM sequentially. It is clocked by the line pulse from the horizontal timing ROM, and is cleared by the system vertical sync pulse from the sync selector (57). [D4 (CVI01 Sheet 8)]

64. **Vertical timing ROM** is 2Kx8 bits. It contains the data to generate eight vertical control signals for one video field in both PAL and NTSC formats. The highest address bit of the ROM selects between PAL and NTSC timing data. [C4 (CVI01 Sheet 8)]

65. **Vertical timing decoder** combines the eight timing signals from the vertical timing ROM to generate all the vertical video and digital timing signals for the system, including processor interrupts. [D5 (CVI01 Sheet 8)]



**PAL****Equipment Required**

- Frequency meter, 100 MHz
- CVI-03 PAL aligned video board.
- Component overlay page 2.4.

**Setup**

- Remove the video board connector from P10.
- Set link W10 to ADJUST.
- Set link W7 to the position closest to link W8.
- Set link W9 to the position farthest from link W10.
- Set the link at board matrix F11 to the position closest to E10.
- Set RV1 to mid-range.
- Set RV2 fully clockwise.

**Procedure**

- Measure the frequency at the NORM pin of W10.
- Adjust CV1 so that the frequency is 8.867MHz.
- Set link W10 to NORM.
- Reconnect the video board connector to P10.
- Measure the frequency at the NORM pin of W10. It should be 8.86723 MHz (+/- 10 Hz).

**NTSC****Equipment required**

- Frequency meter, 100MHz.
- CVI-03 NTSC aligned video board.
- Component overlay page 2.4.

**Setup**

- Remove the video board connector from P10.
- Set link W10 to ADJUST.
- Set link W7 to the position farthest from link W8.
- Set link W9 to the position closest to link W10.
- Set the link at board matrix F11 to the position closest to E12.
- Set RV1 to mid-range.
- Set RV2 fully clockwise.

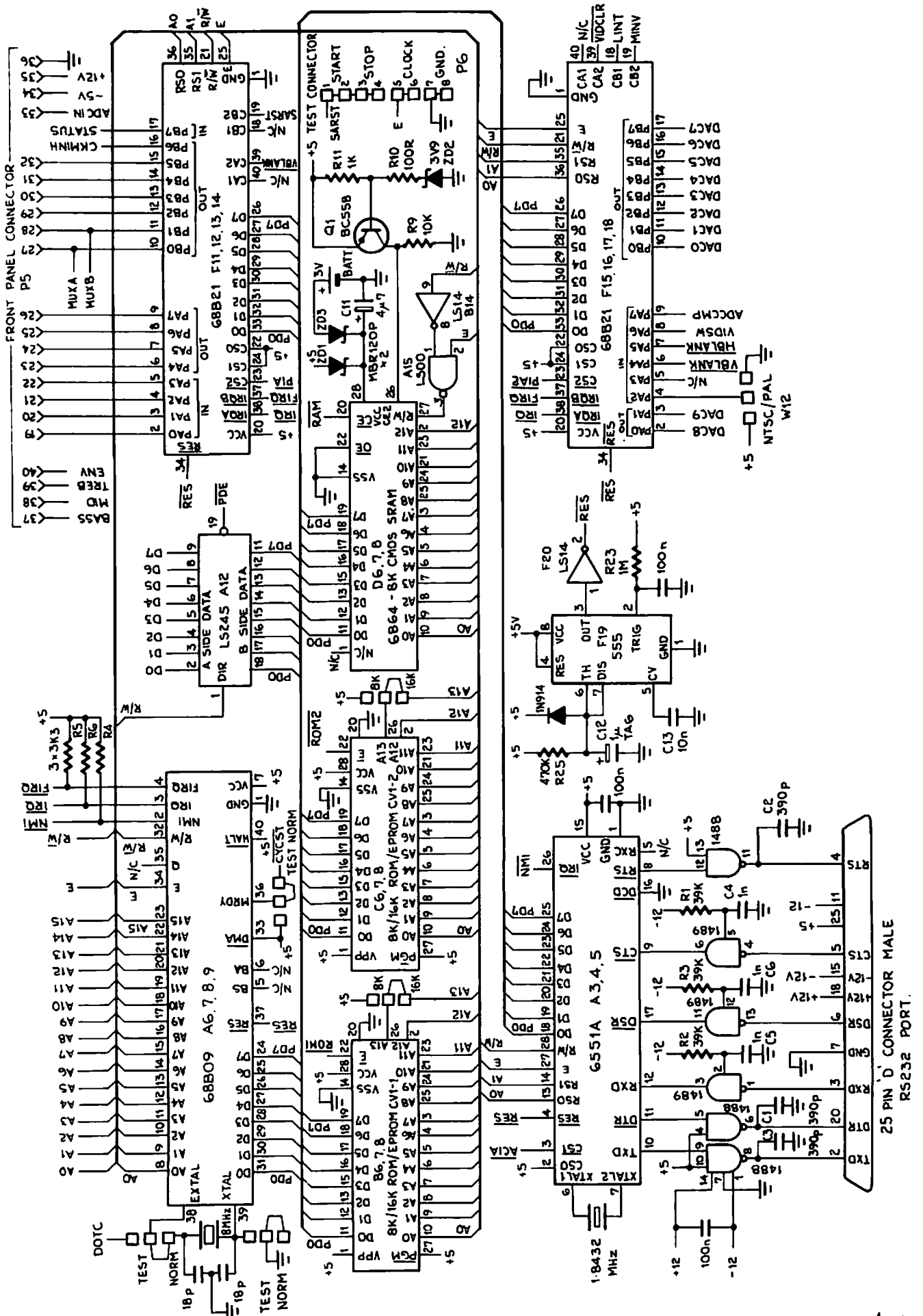
**Procedure**

- Measure the frequency at the NORM pin of W10.
- Adjust CV1 so that the frequency is 7.159MHz.
- Set link W10 to NORM.
- Reconnect the video board connector to P10.
- Measure the frequency at the NORM pin of W10. It should be 7.15909 MHz (+/- 10 Hz).





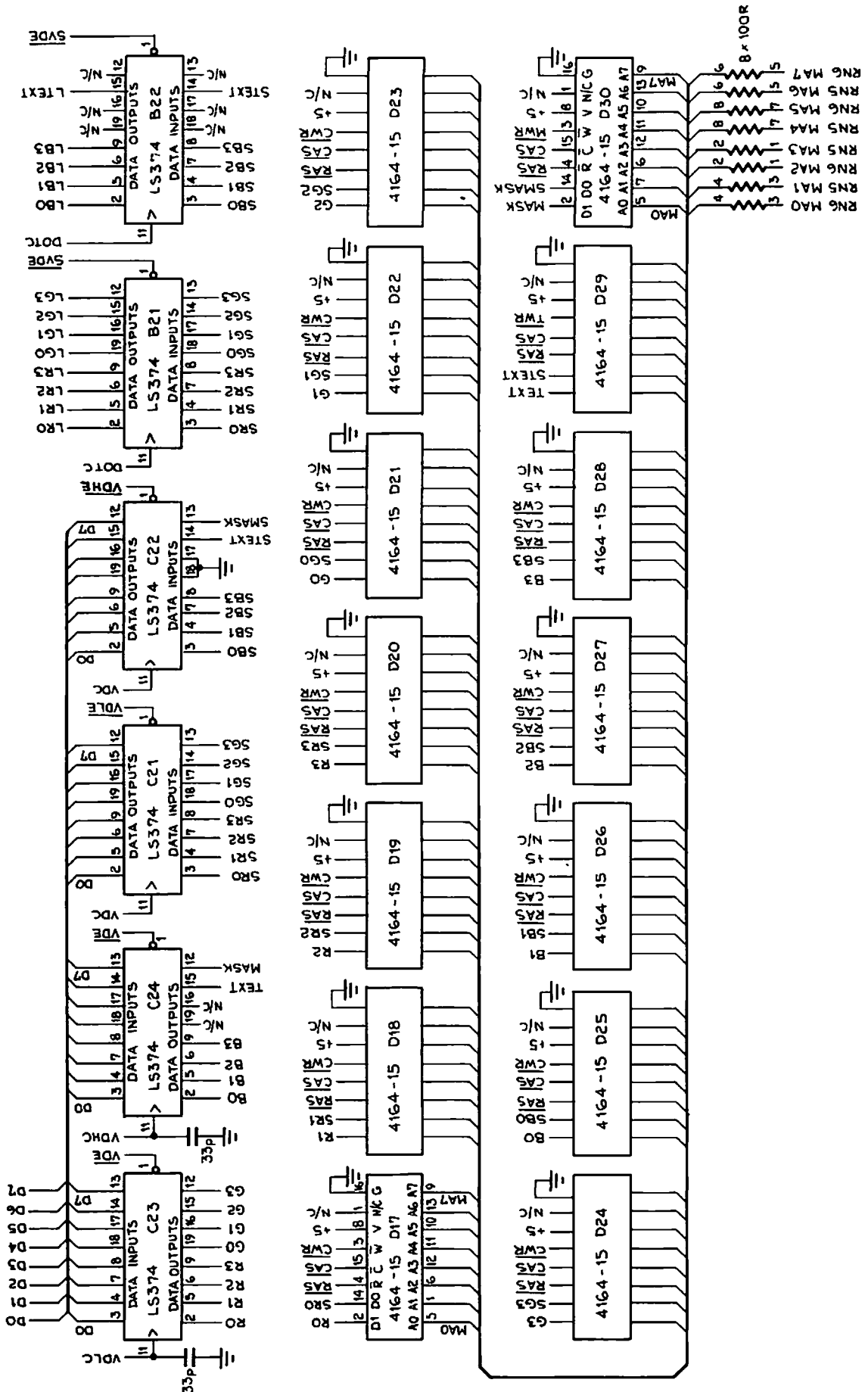
# PROCESSOR MEMORY & COMMUNICATIONS



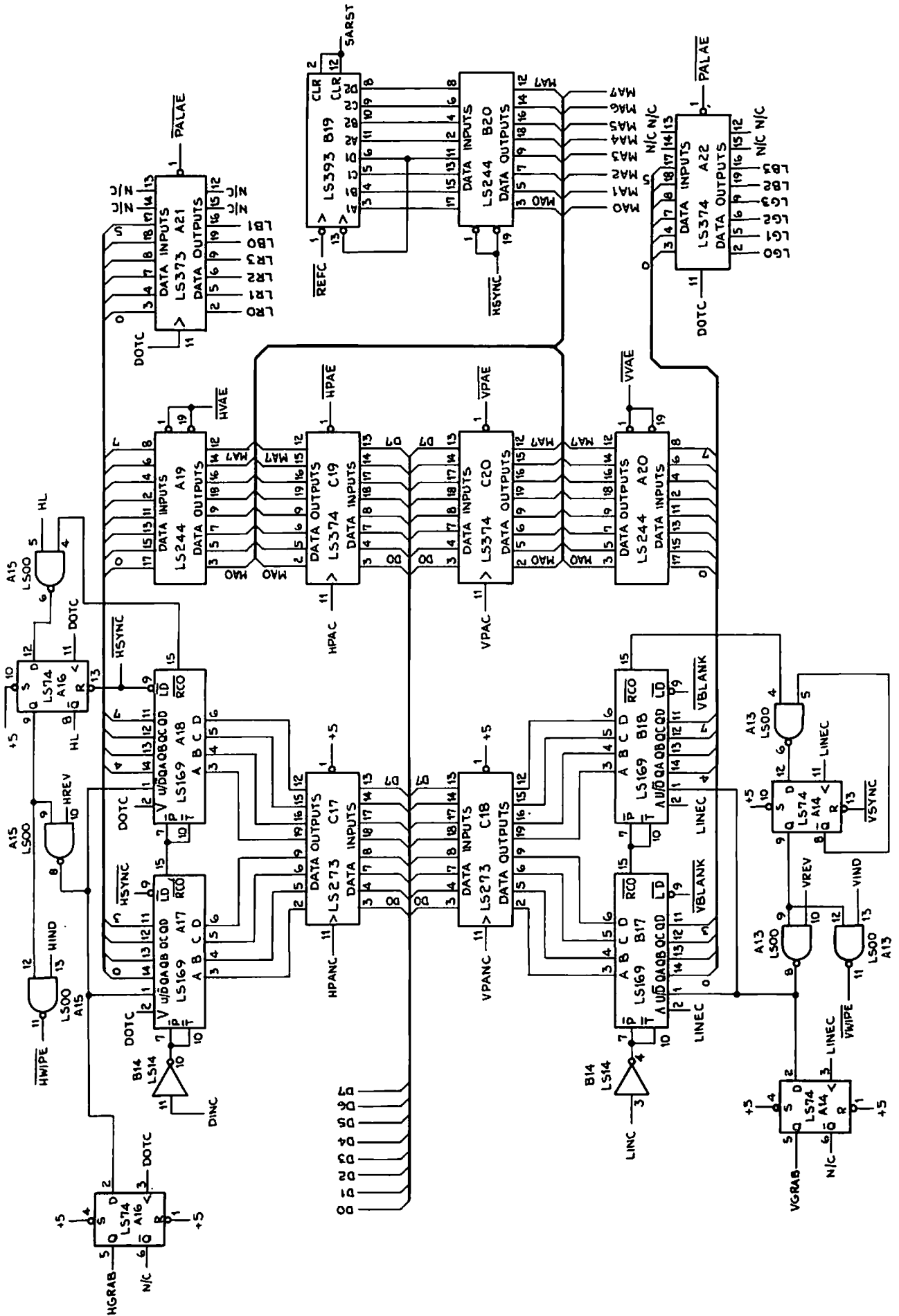
2.5-MAIN BOARD

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# MEMORY ARRAY



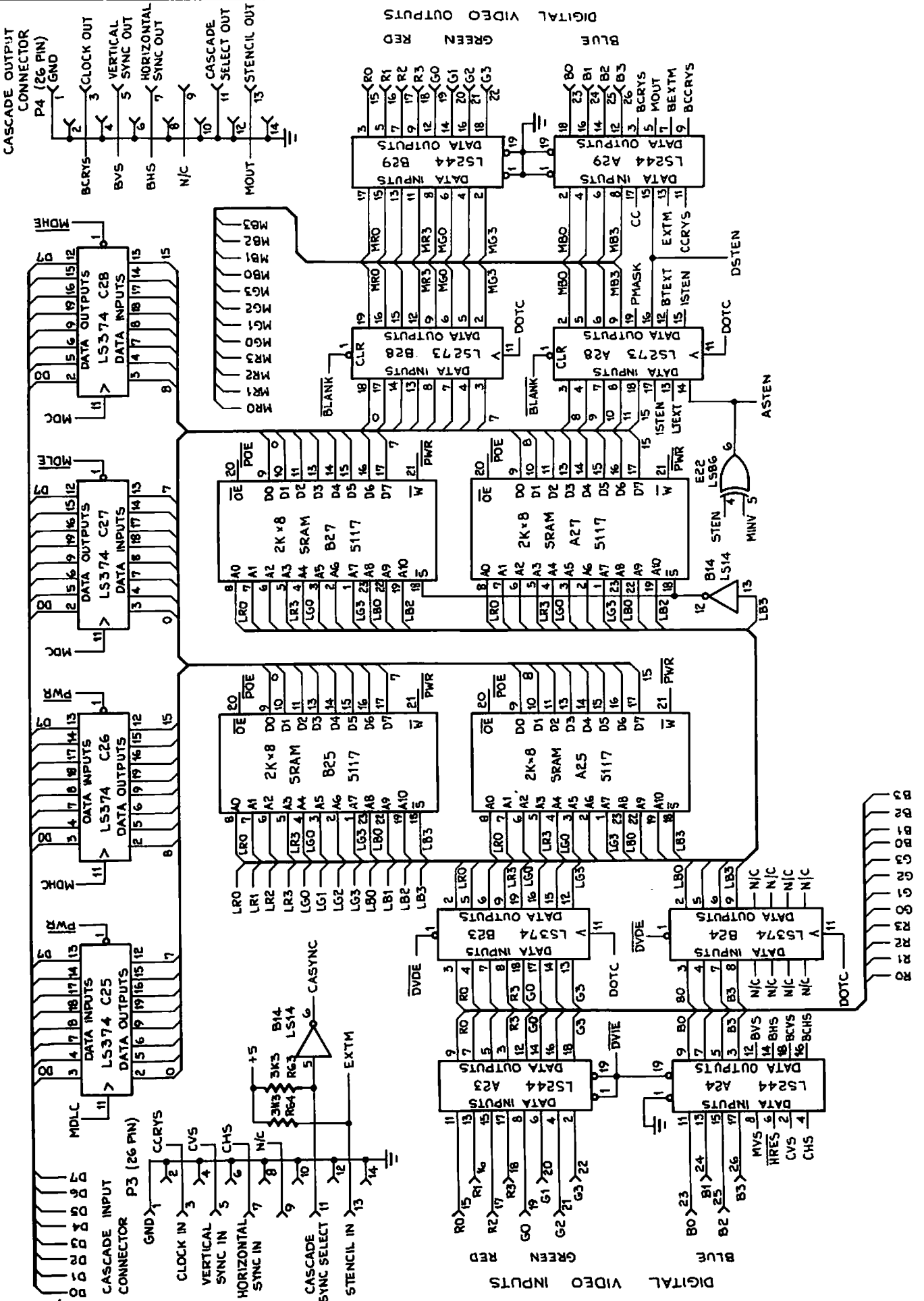
# VIDEO ADDRESSING



2.5.2-MAIN BOARD

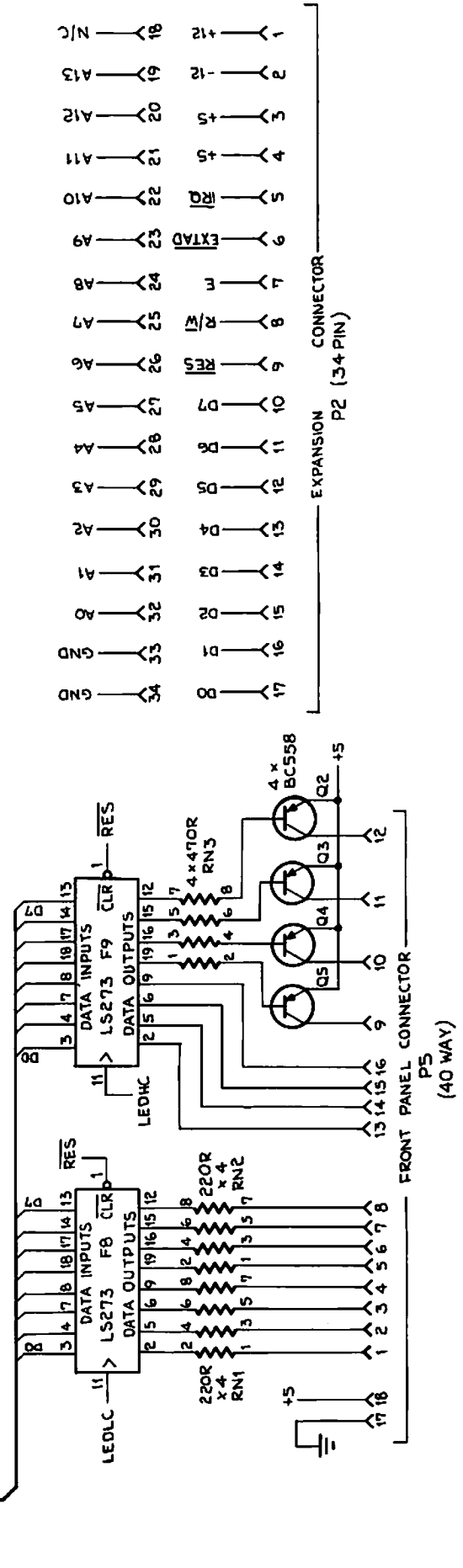
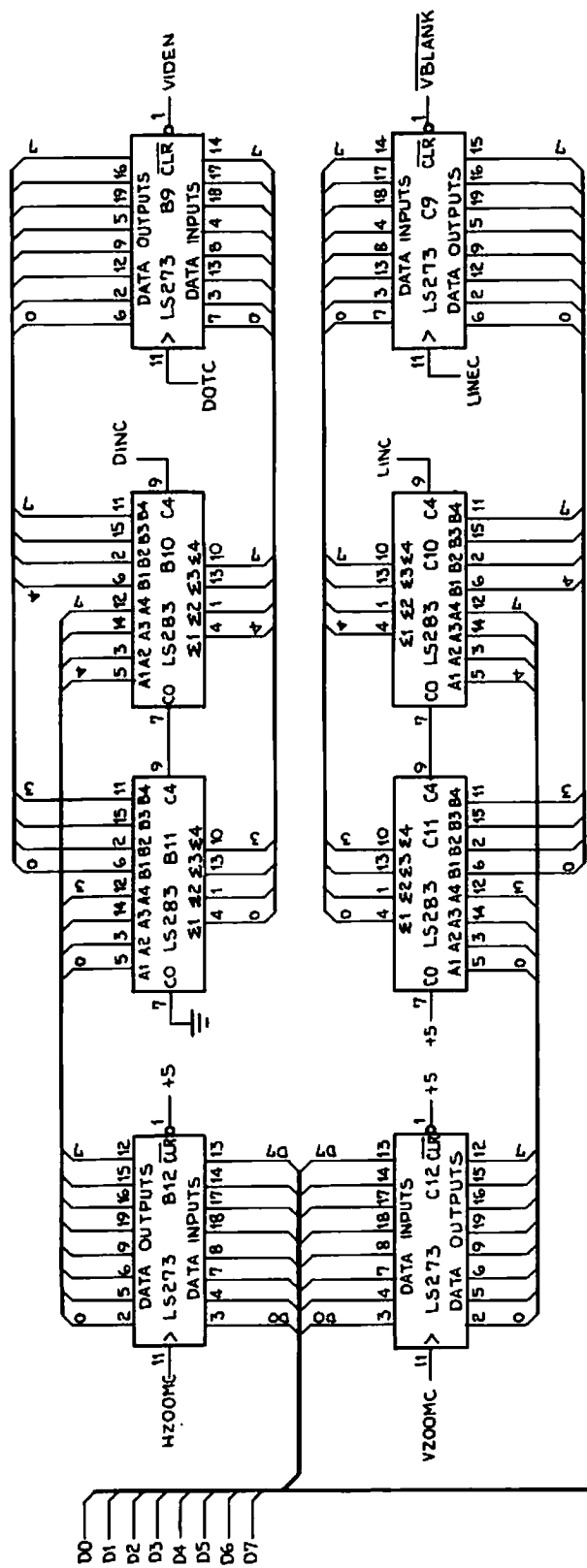
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# VIDEO I/O AND PALETTE



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# ZOOM LOGIC AND LED DRIVERS



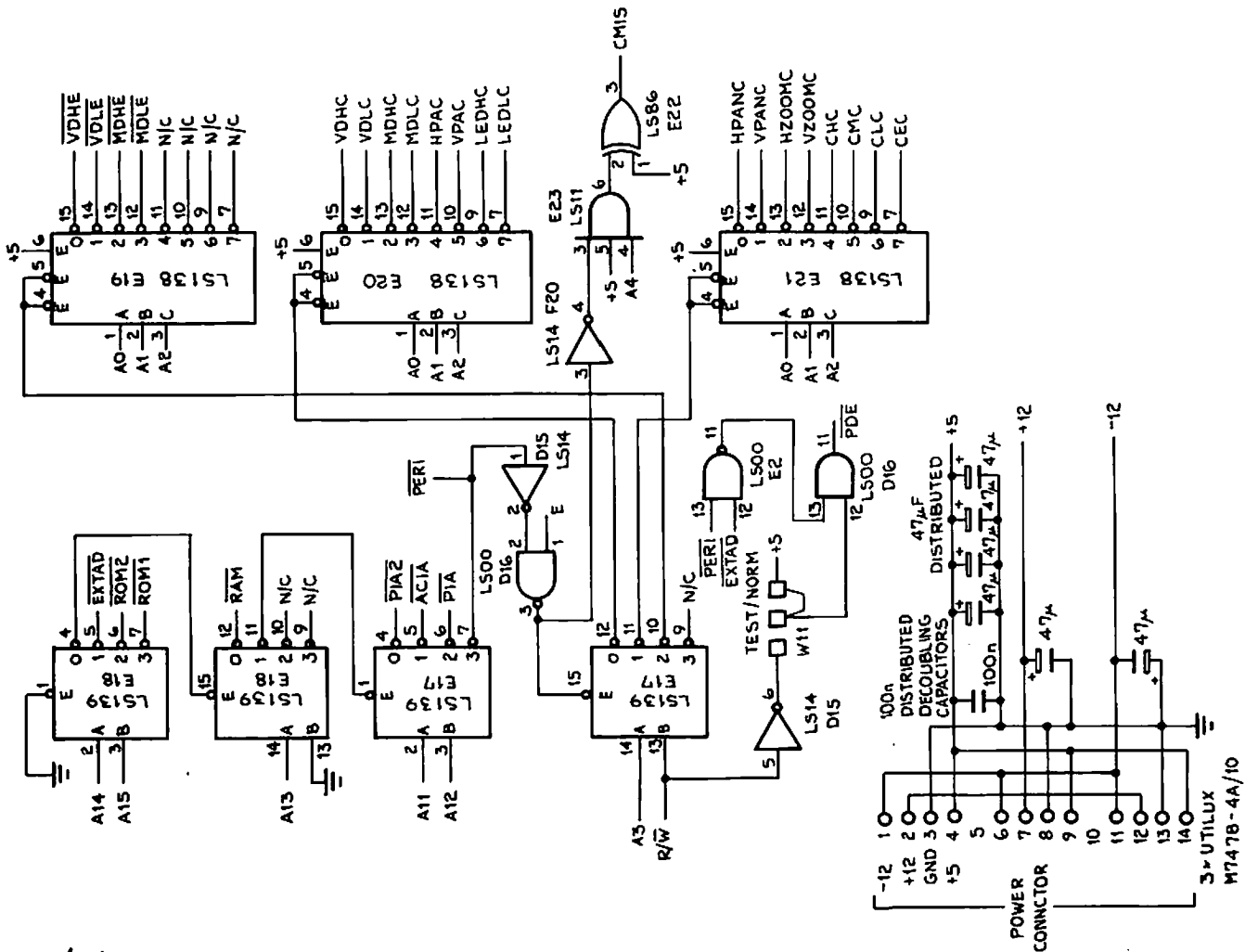
2.5.4-MAIN BOARD



# ADDRESS DECODING

ADDRESS	WRITE FUNCTION	READ FUNCTION
3800	VRAM DATA HIGH	VRAM DATA HIGH
3801	VRAM DATA LOW	VRAM DATA LOW
3802	PALETTE DATA HIGH	PALETTE DATA HIGH
3803	PALETTE DATA LOW	PALETTE DATA LOW
3804	HORIZONTAL ADDRESS	---
3805	VERTICAL ADDRESS	---
3806	LEDS HIGH	---
3807	LED LOW	---
3808	HORIZONTAL PAN	---
3809	VERTICAL PAN	---
380A	HORIZONTAL ZOOM	---
380B	VERTICAL ZOOM	---
380C	CONTROL HIGH	---
380D	CONTROL MID	---
380E	CONTROL LOW	---
380F	CONTROL EFFECTS	---
3810	CONTROL MISC.	---

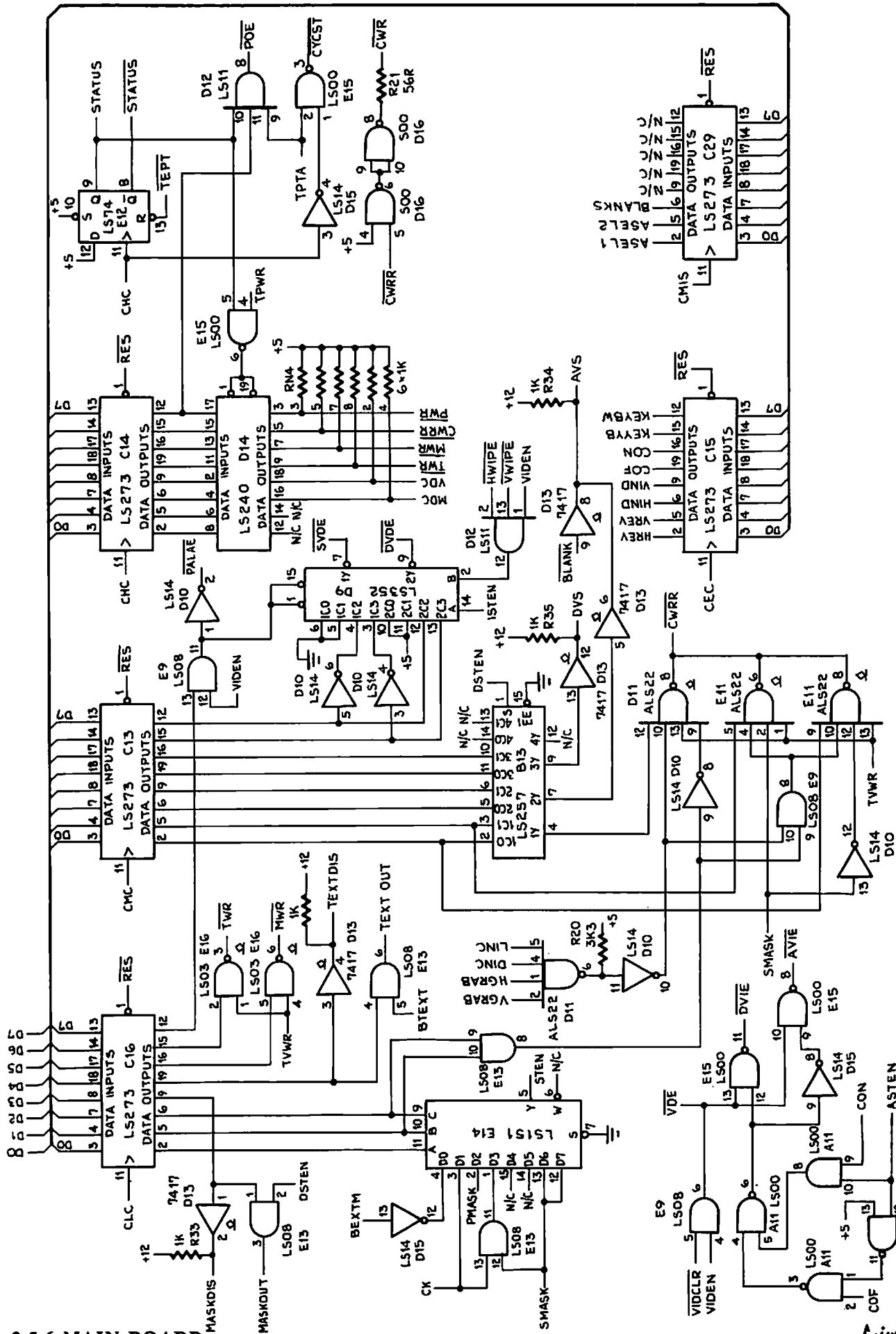
ADDRESS MAP	I/O ADDRESS MAP	
0000 - 1FFF	RAM	
2000 - 3FFF	I/O	
4000 - 7FFF	EXTERNAL	
8000 - BFFF	ROM 2	
C000 - FFFF	ROM 1	
	2000 - 27FF	PIA2
	2800 - 2FFF	ACIA
	3000 - 37FF	PIA1
	3800 - 3FFF	VIDEO I/O



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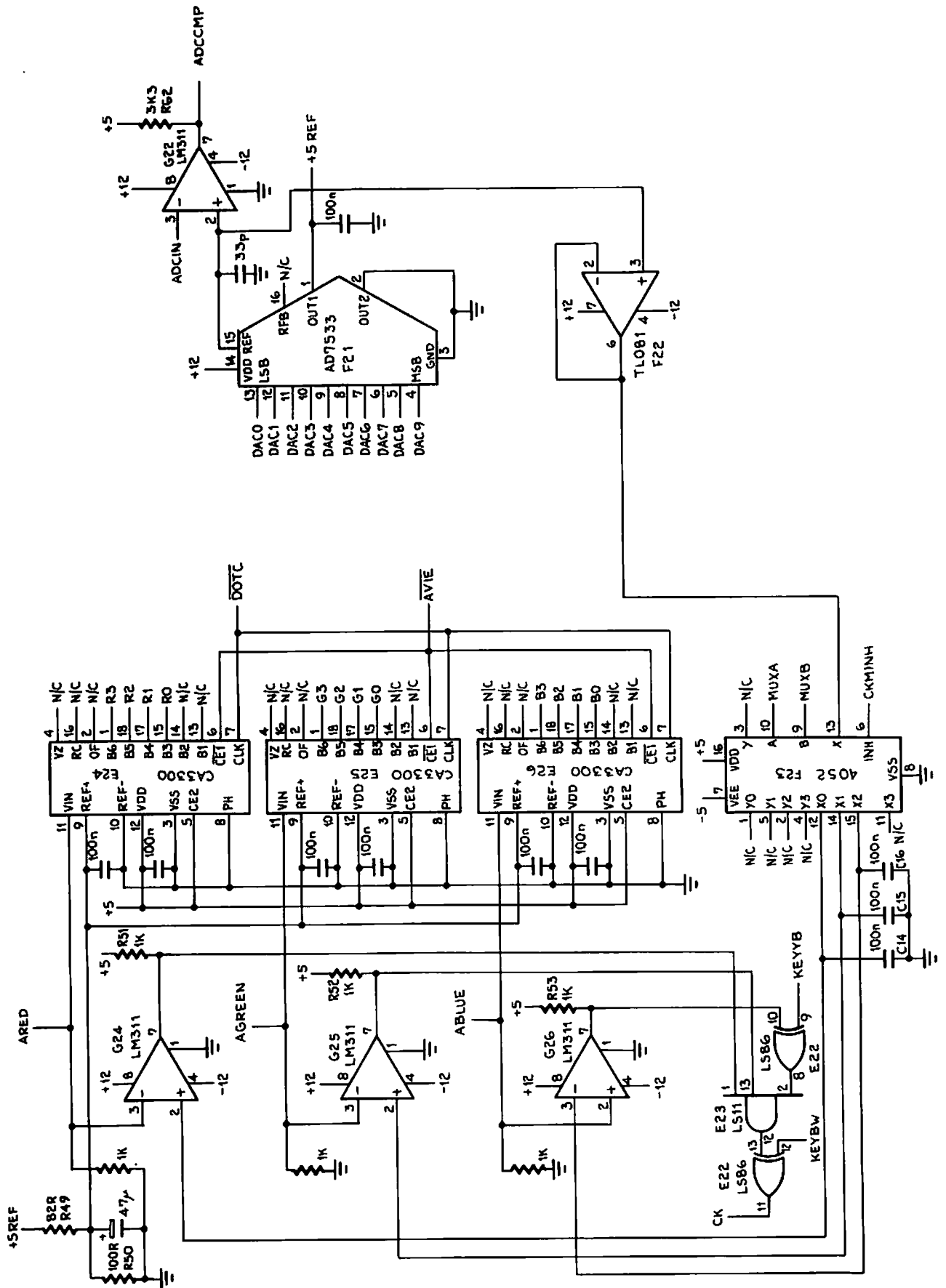
MAIN BOARD-2.5.5

# MISCELLANEOUS CONTROL



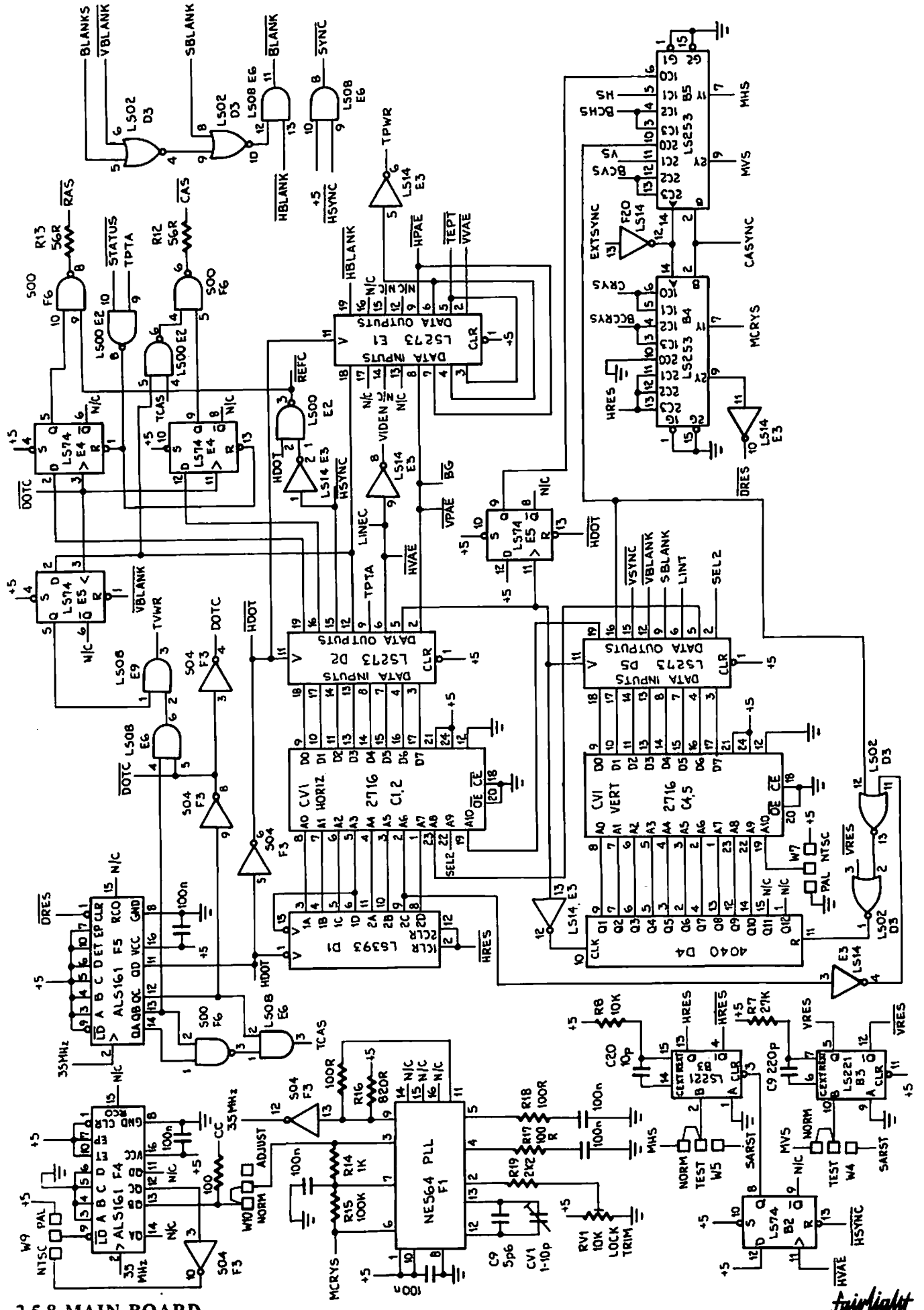
2.5.6-MAIN BOARD

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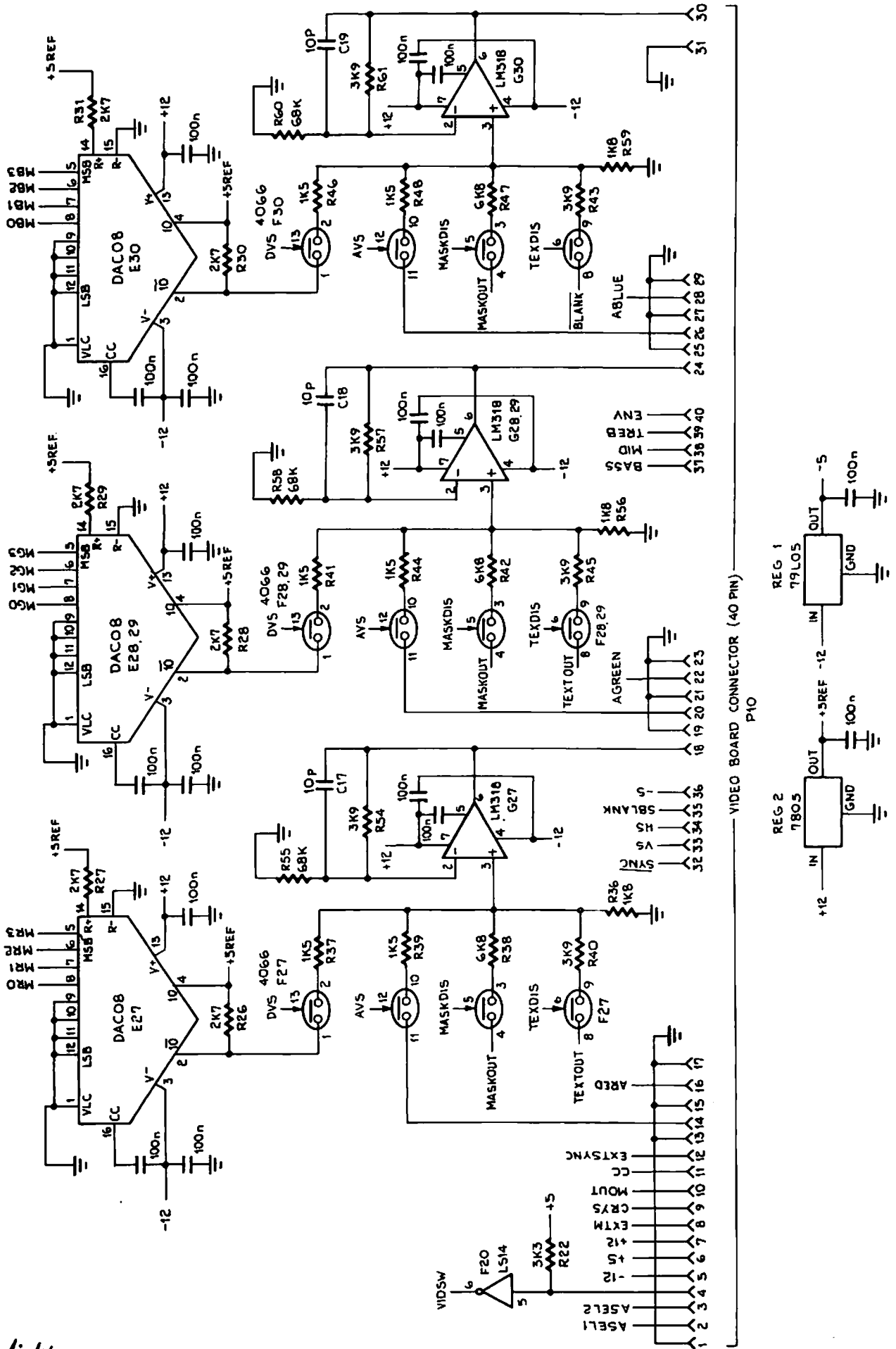
# TIMING GENERATION AND SYNC



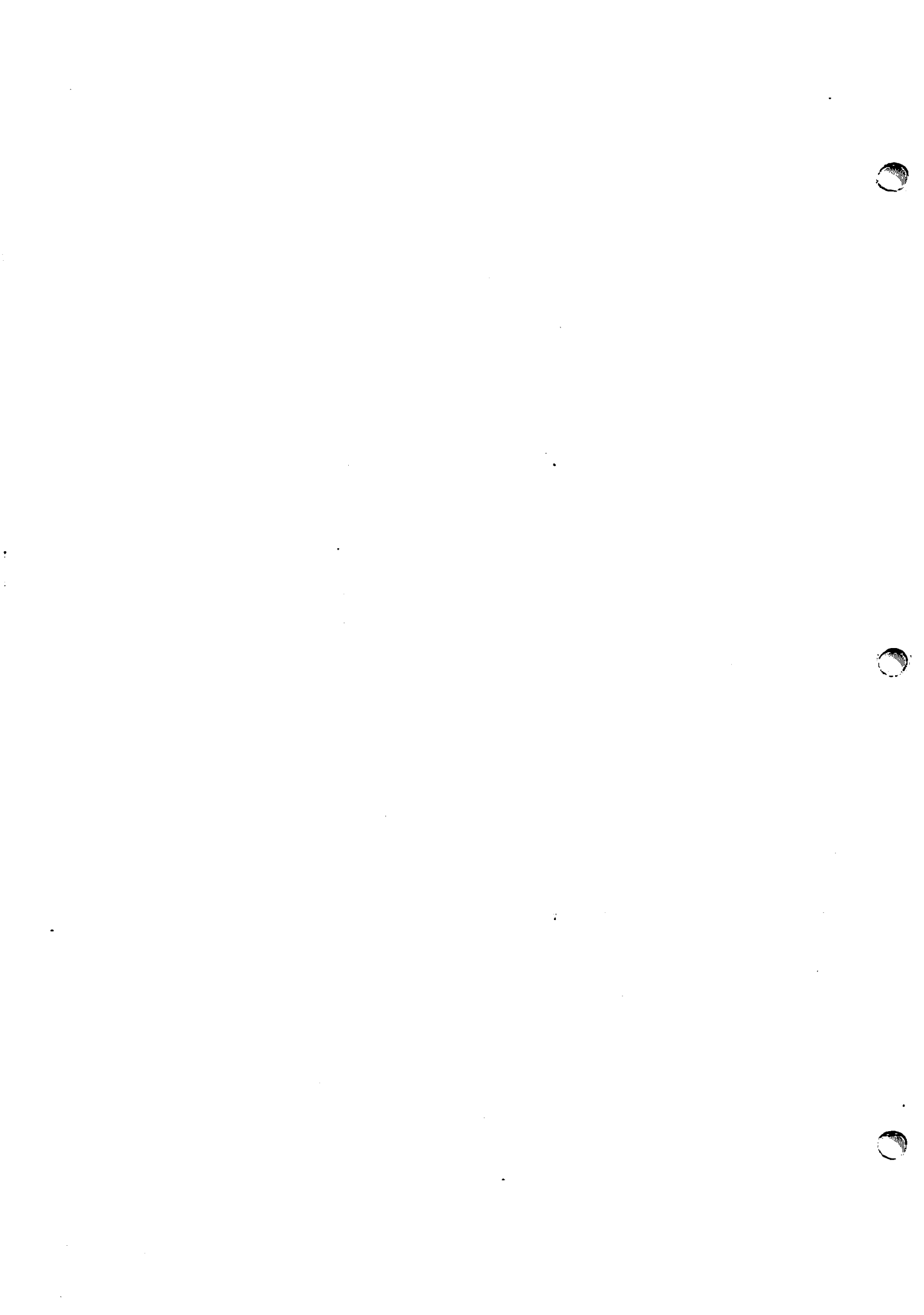
2.5.8-MAIN BOARD

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# VIDEO OUTPUT DACS AND SWITCHES

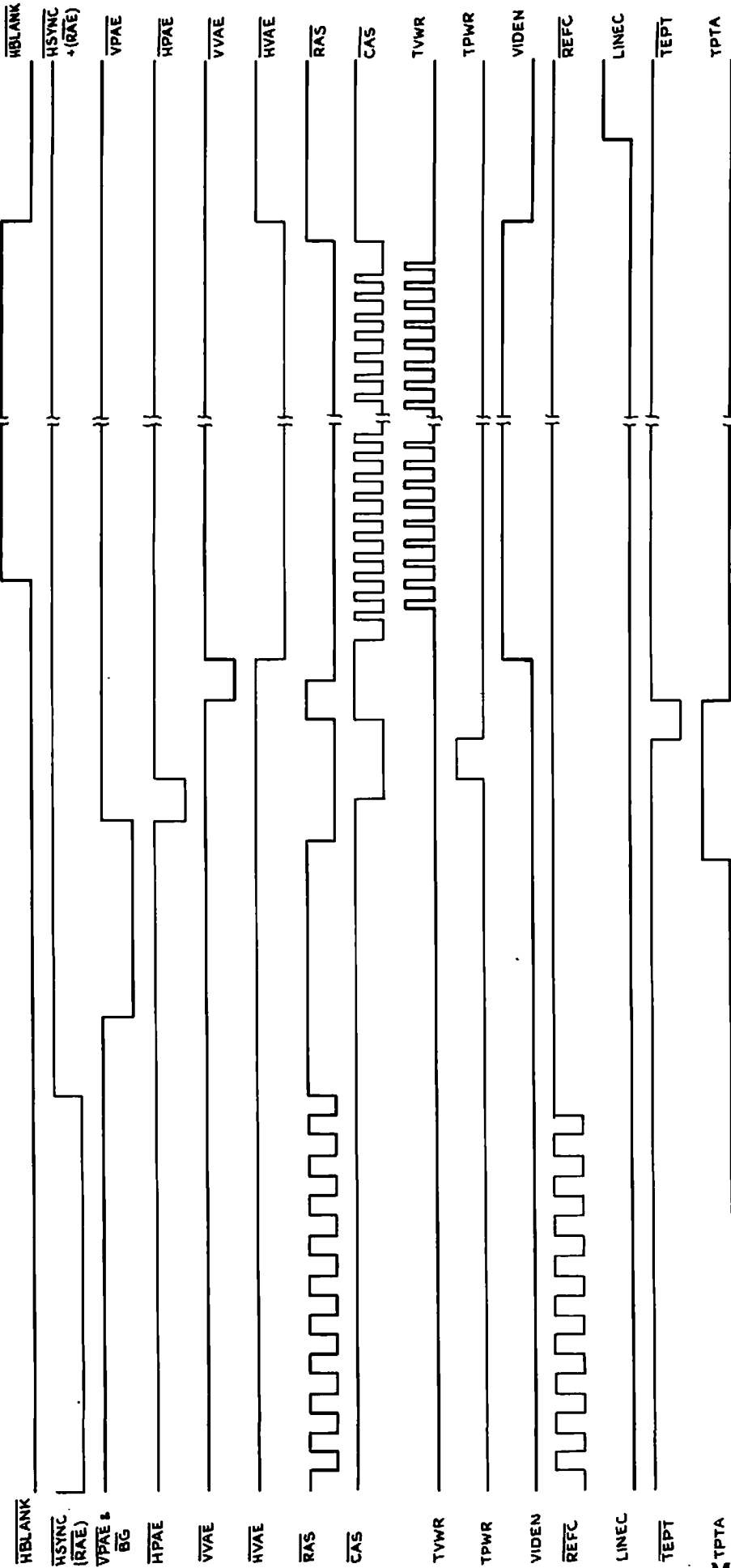


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# HORIZONTAL PAL MODE

<sup>16</sup>MS ROM ADDRESS | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | ≈ | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142

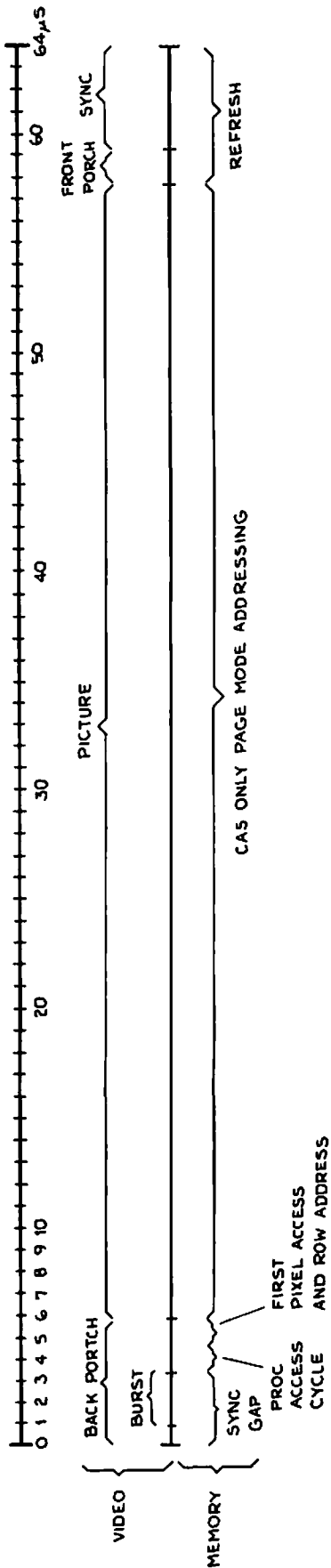


HORIZONTAL SYNC & REFRESH | UNUSED | PROCESSOR ACCESS INITIAL VIDEO CYCLE | FRONT PORCH

≈ | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 |

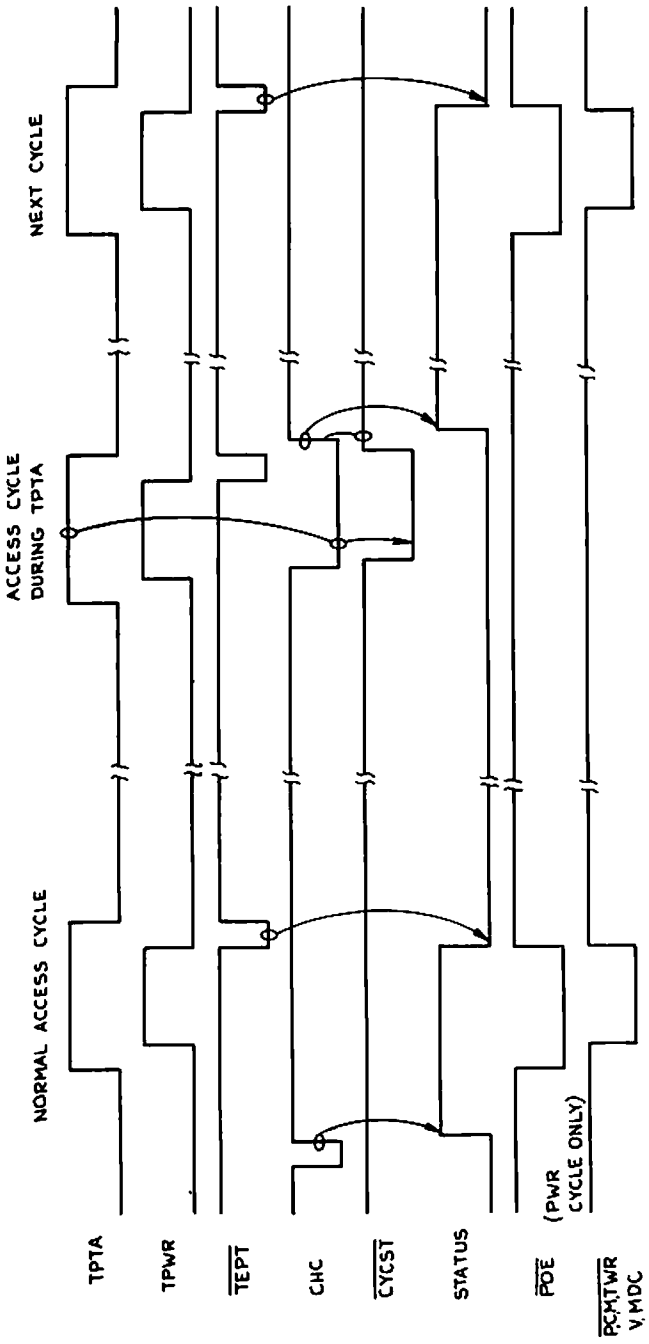
*twilight*

# PAL TIMING



PARAMETER	PAL	NTSC	UNITS
No OF CC CYCLES/LINE	283.7516	227.301	
FRAME FREQUENCY	25	30	H <sub>z</sub>
LINE FREQUENCY	15625	15750	H <sub>z</sub>
LINE PERIOD	64	63.492	μS
No LINES/FRAME	625	525	MHz
COLOUR CARRIER	4.7		μS
BLANKING	12.05		μS
FRONT PORCH	1.55		μS
BACK PORCH	5.8		μS
BURST DURATION	5.25		μS
BURST START	5.6		μS
ACTIVE VIDEO	51.95		μS
BURST AMPLITUDE	300		mV
SIGNAL VOLTAGE	700		mV
SYNC VOLTAGE	300		mV

# PROCESSOR TRANSFER CYCLE



PALETTE READ SEQUENCE

1	[CHECK STATUS = LOW]
2	WRITE COLOUR TO BE READ TO VRAM WRITE (H,L)
3	WRITE CONTROL LATCH HIGH WITH 000001002
4	WAIT FOR STATUS=LOW
5	READ PALETTE DATA FROM MAP READ (H,L)

PALETTE WRITE SEQUENCE

1	[CHECK STATUS = LOW]
2	WRITE COLOUR TO BE CHANGED TO VRAM WRITE (H,L)
3	WRITE PALETTE DATA TO MAP WRITE (H,L)
4	WRITE CONTROL LATCH HIGH WITH 100000002
	[ONLY NECESSARY <64µS AFTER WRITE

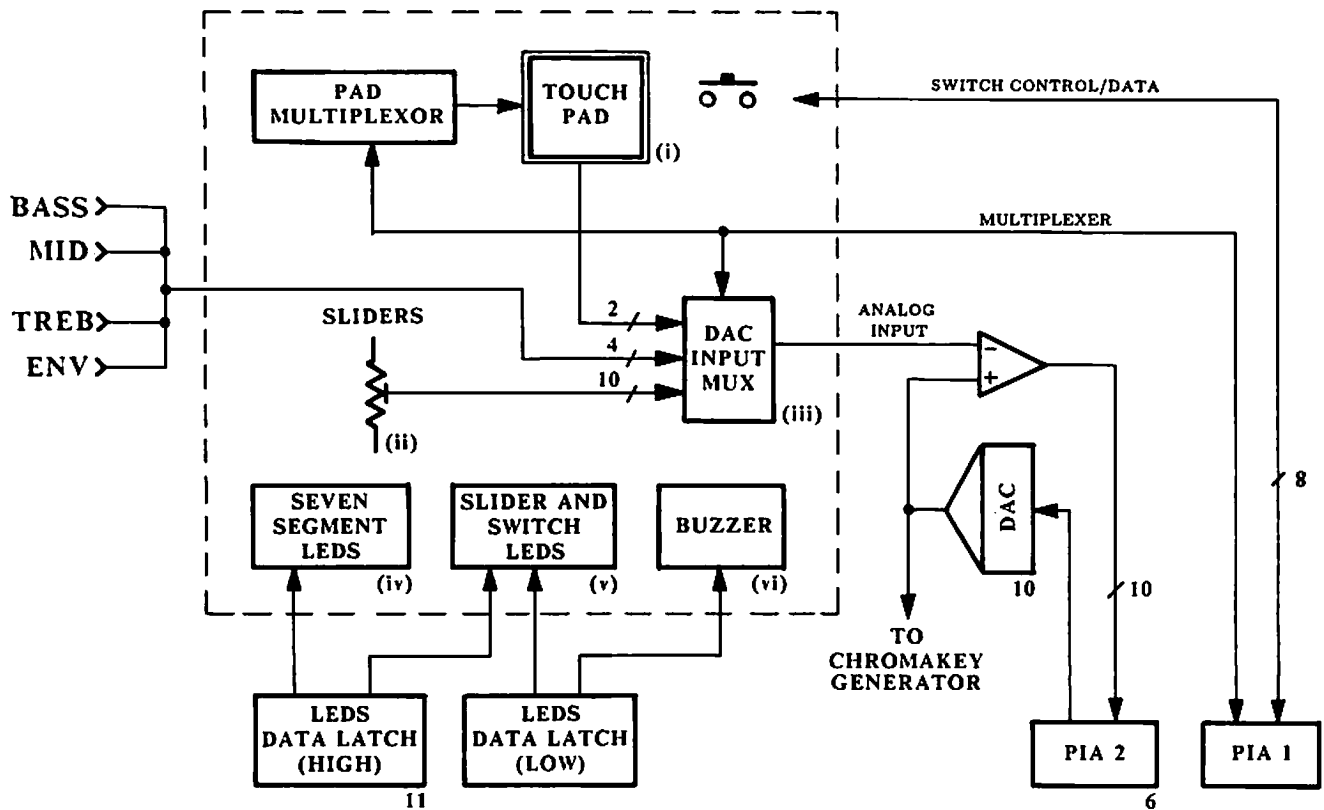
VRAM READ SEQUENCER

1	[CHECK STATUS = LOW]
2	WRITE PIXEL ADDRESS
3	WRITE CONTROL LATCH HIGH WITH 000010002
4	WAIT FOR STATUS=LOW
5	READ DATA FROM VRAM READ (H,L)

VRAM WRITE SEQUENCE

1	[CHECK STATUS = LOW]
2	WRITE PIXEL ADDRESS
3	WRITE DATA TO VRAM WRITE (H,L)
4	WRITE CONTROL LATCH HIGH WITH 000010002
	WHERE C = COLOUR
	M = MASK WRITE
	T = TEXT WRITE

## CONTROL PANEL



1. Touch-sensitive pad, under the control of two multiplexers, produces four voltages which are decoded to determine the pad touch position. The multiplexers are controlled from PIA1. [U3,U4]

2. Front panel pots each generate a voltage according to the slider position, which may be digitised by the ADC under software control.

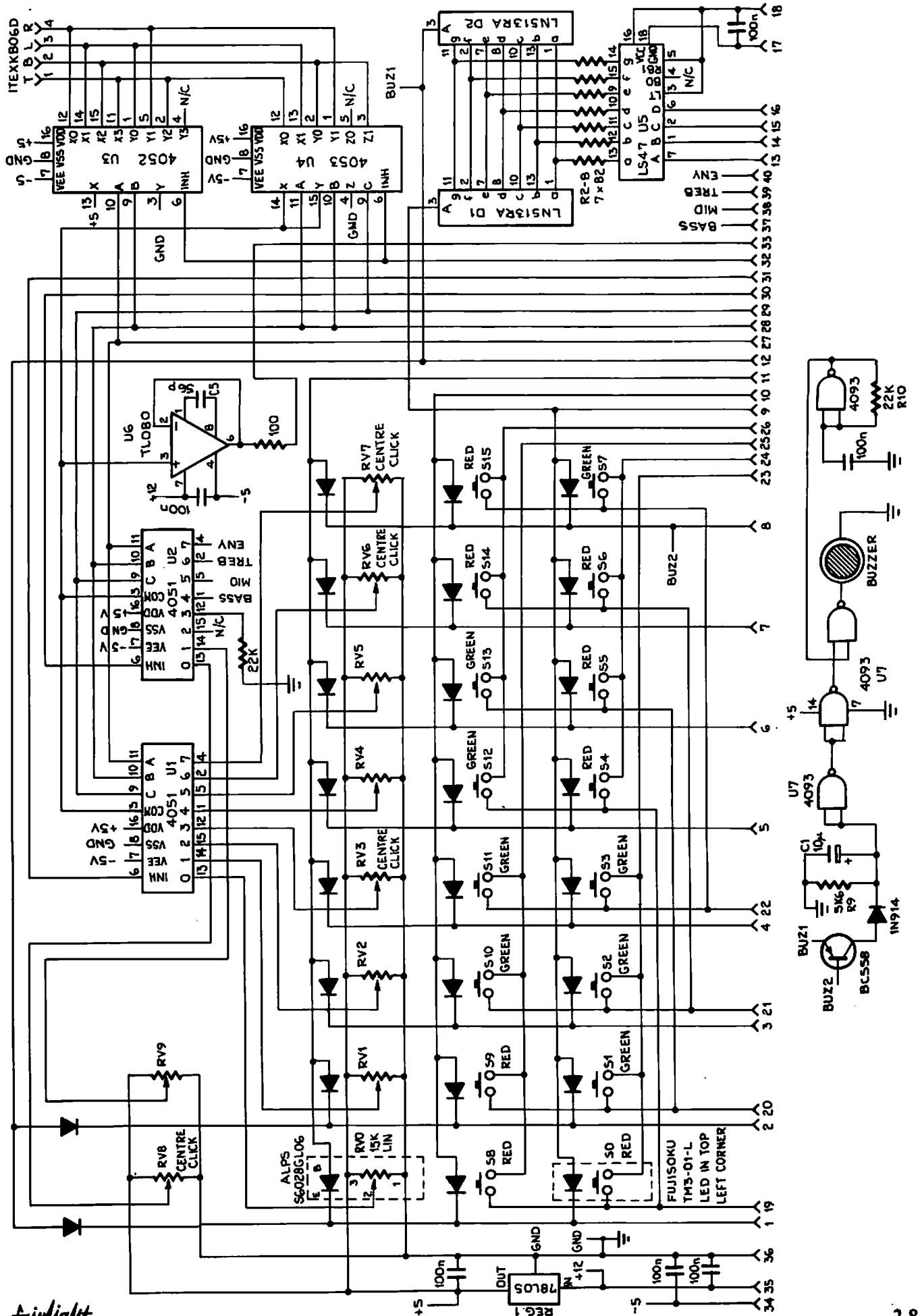
3. Seven-segment leds are controlled by a seven-segment decoder/driver using four bits from the LEDs control latch. [U5,D1,D2]

4. Front-panel leds on the pots and switches are arranged in a 4x8 multiplexing matrix controlled by 12 bits from the LEDs control latch. Each LED is updated 50-60 times per second.

5. Buzzer oscillator is enabled using a position in the front-panel multiplexing matrix (4). [U7]

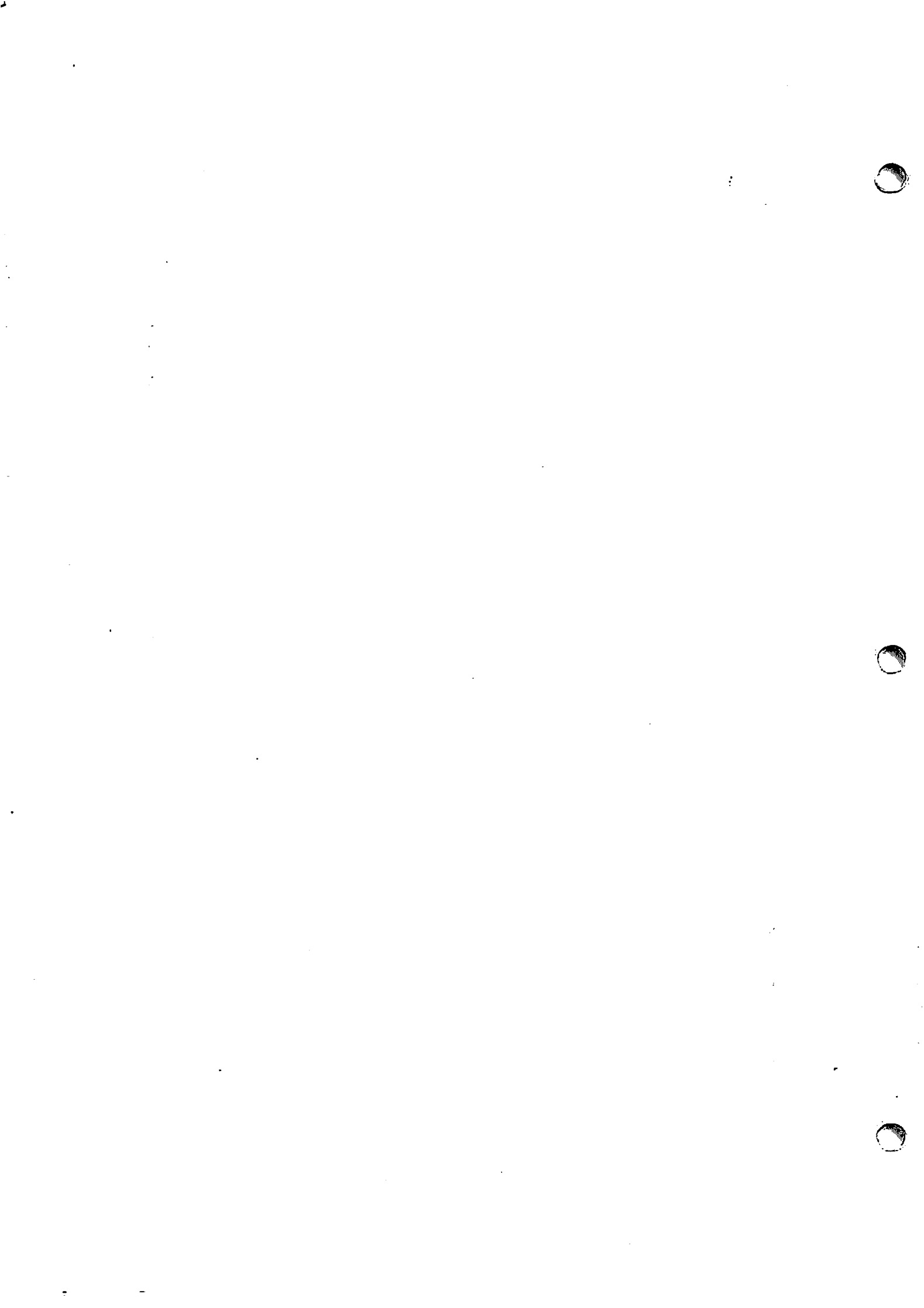
6. Analog-input multiplexer selects the input to the analog-to-digital converter from the front-panel slider voltages, the touch-pad voltages and the audio-analyser levels (bass, mid-range, treble and envelope). The multiplexer is controlled from PIA1. [U1,U2,U6]

# CIRCUIT DIAGRAM

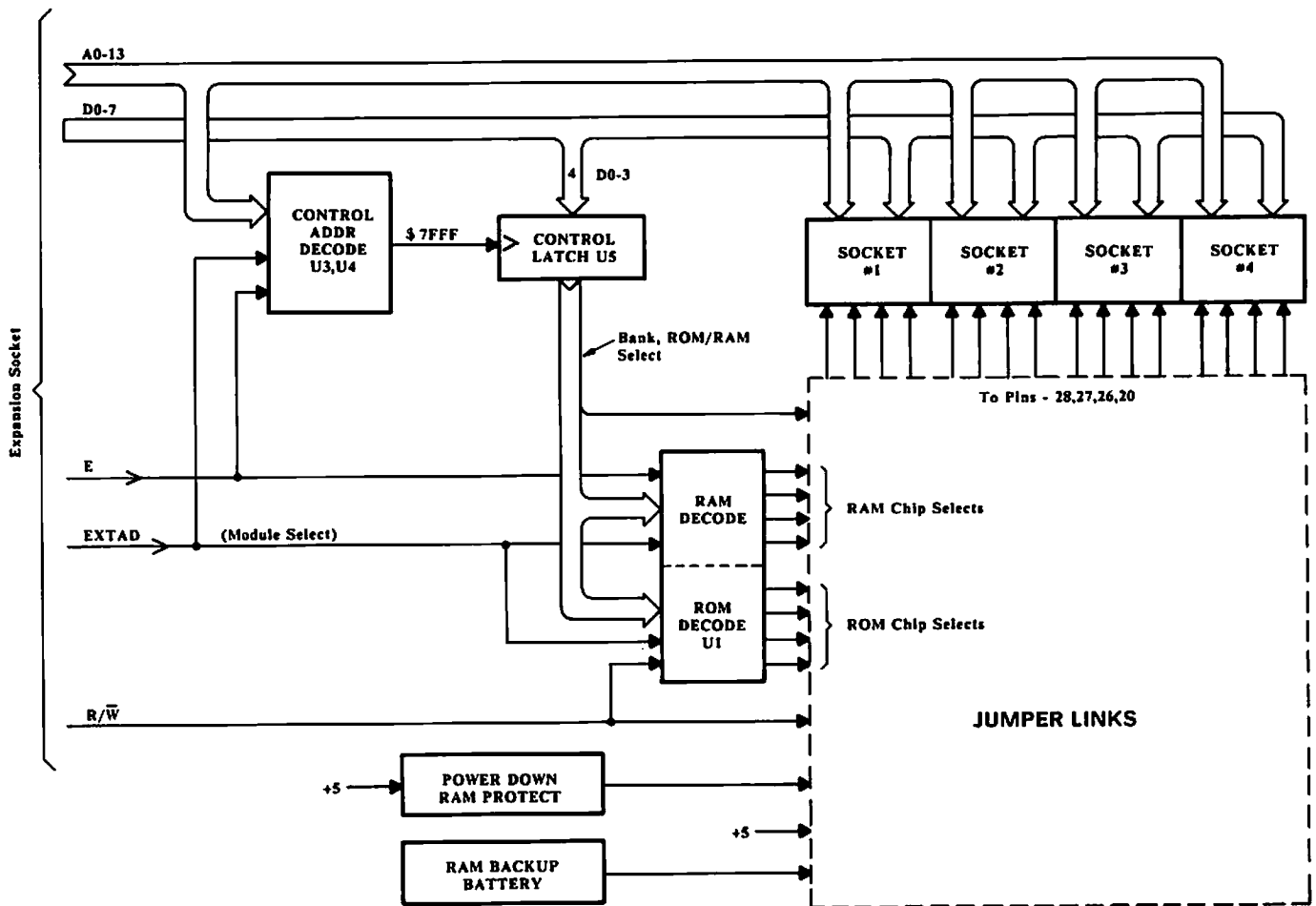


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BLOCK DIAGRAM



General

The memory expansion module plugs into the "expansion bus" socket on the back of the CVI. It allows up to 128K bytes of EPROM or 64K bytes of static battery RAM (or various mixes of EPROM and RAM) to be added to the CVI system memory. The memory on the module exists as a number of 16K byte banks which are selected under software control to appear in the 16K expansion bus address space, at 4000 to 7FFF.

Functional description

- 1) Control address decode. The 16 input AND gate formed of U3 and U4 decodes the top address within the 16K byte expansion module address space. This is used to select the mode control register.
- 2) The mode control register. U5, is a 4 bit, write only latch. By writing to this register, the processor selects which of the "socket(s)" appears in the 16K byte address space, and whether they are ROM or RAM.

# FUNCTIONAL DESCRIPTION

Table 1. The functions of the control register are:

B1	B0	JUMPER 8K/16K RAM	SOCKETS SELECTED	
0	x	8K	#1 - Lower 8K RAM, #2 - Upper 8K RAM	
1	x		#3 - Lower 8K RAM, #4 - Upper 8K RAM	
0	0	16K	#1	ROM or RAM
0	1		#2	
1	0		#3	
1	1		#4	

B2 - Only used by 32K byte ROMS, for which it is used as A14, selecting the upper or lower half of the ROM.

B3 - A1 selects the RAM decoder, A0 selects the ROM decoder.

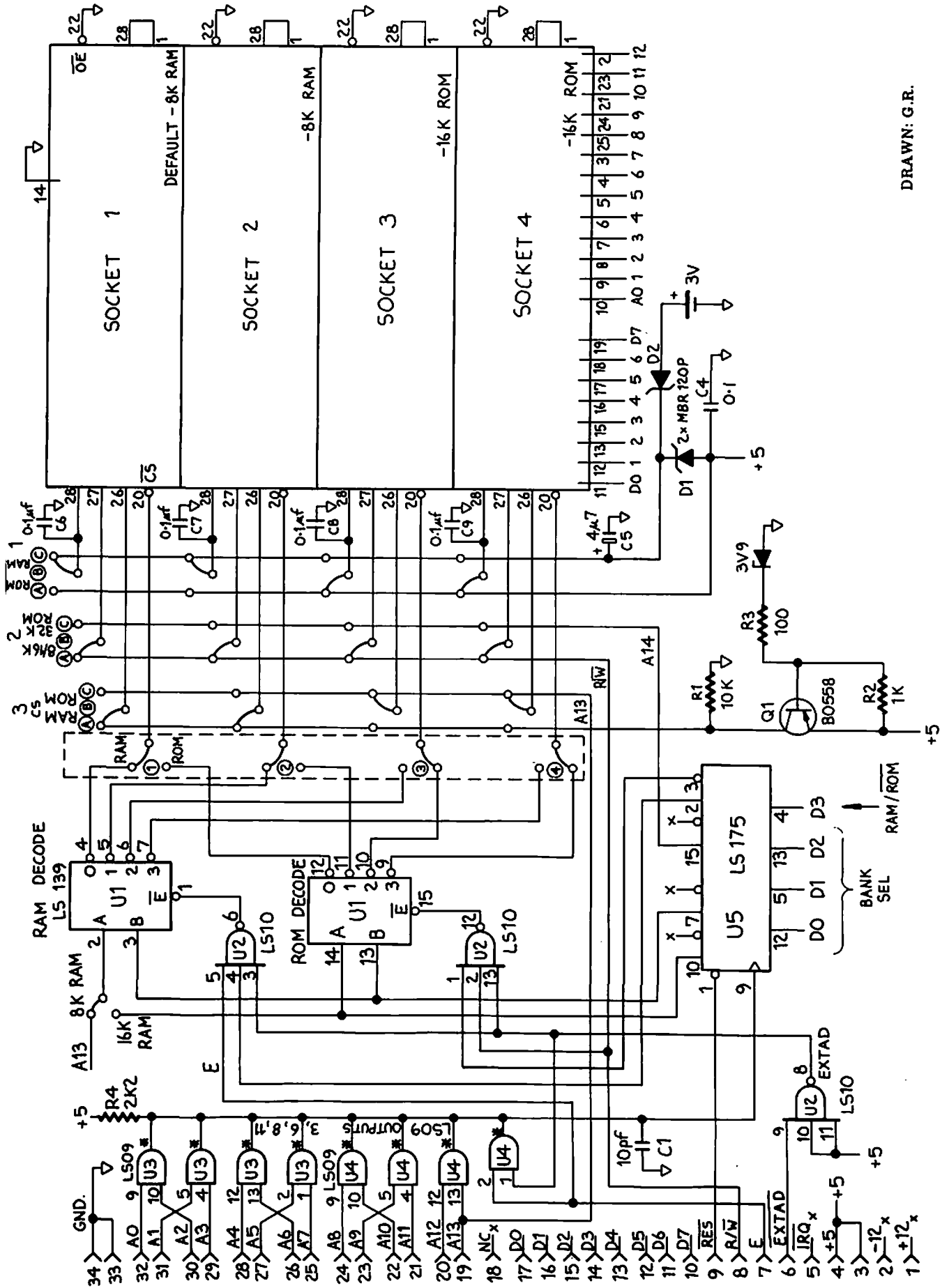
Table 2

SOCKET PIN#	6264 8K BYTE RAM	27128 16K BYTE ROM	27256 32K BYTE ROM
28	Vcc (Battery backed)	Vcc (+5)	Vcc (+5)
27	$\overline{WE}$ (R/W)	$\overline{PGM}$ (R/W or A14 = 1)	A14
26	$\overline{CS}$ (Disable)	A13	A13
20	$\overline{CS}$ (RAM Decoder)	$\overline{CE}$ (ROM Decoder)	$\overline{CE}$ (ROM Decoder)

- 3) Power down RAM protect. Q1 and the 3.9V zener provide a DISABLE signal for any RAM IC's on the module, which are also supported by a 3V lithium battery.
- 4) The RAM/ROM decoder U1 provides the four RAM select and four ROM select signals which are connected by jumper links to the appropriate sockets.
- 5) Memory sockets. The four 28 pin IC sockets are each individually configurable to hold 8K byte RAMS, 16K ROMS or 32K ROMS. Normally, the devices used and the connections on the 4 jumper selectable pins are as per Table 2 above.
- 6) The Jumper Links. Each socket has 4 "double throw" links, i.e the centre pad must be linked to one of the two pads to either side of it. Refer to the circuit diagram for their names and functions.

# MEMORY EXPANSION MODULE

DRAWN: G.R.



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**NOTES**

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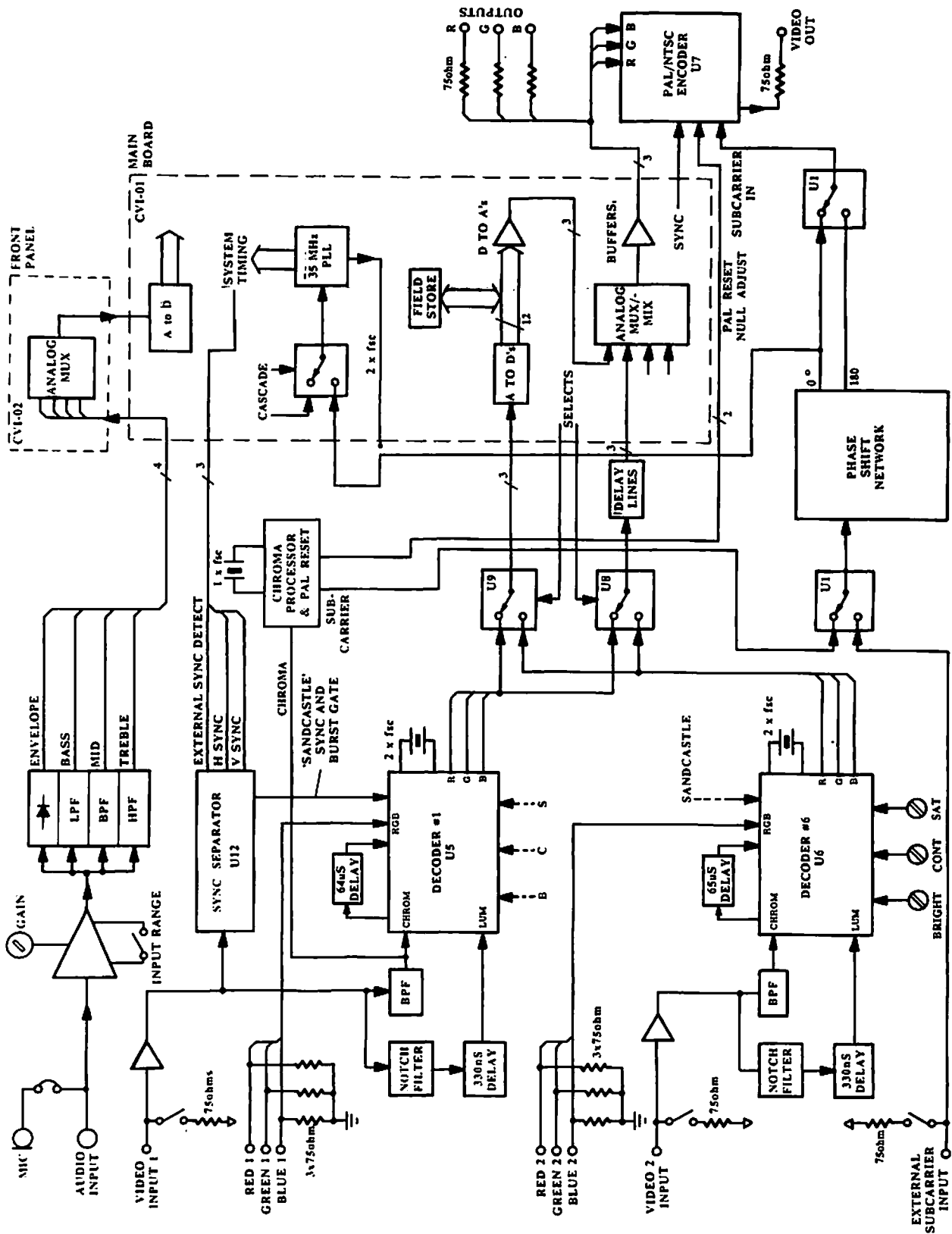
# Video Board – PAL

3

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<b>Block diagram descriptions .....</b>	<b>3.2</b>
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<b>Subcarrier nulling adjustment.....</b>	<b>3.15.4</b>

# BLOCK DIAGRAM



## BLOCK DIAGRAM DESCRIPTIONS

### Audio input

The audio input is selected from either the internal microphone or an external source. The external source is selected when a plug is inserted into the audio input jack on the back panel. [CVI03-1]

### Audio amplifier

The audio amplifier amplifies the selected input signal to levels required by the following filter and detector stages. The gain of the amplifier may be set to low or high using Switch 1 No.1 (SW1/1), and adjusted using the Audio Sensitivity control. [U2,U4, CVI03-5]

### Audio analyser

The audio analyser consists of three filters: lowpass (200Hz) for bass, bandpass (400-800Hz) for midrange, highpass (800Hz) for treble. The output of each filter drives an envelope detector, the output voltages of which represent the energy in that particular audio bandwidth. A fourth detector is used to detect the overall envelope. These four signals (0-3.2V) are passed to the analog multiplexer on the front panel and on to the ADC. [U4, CVI03-5]

### Sync separator

U12 and associated circuitry derives various video timing signals from the video signal on the Video 1 input. When U12 determines that the external video is absent or poor quality then pin U12/9 sources current into its load resistor R163, causing the output of U11/7 to go high. With acceptable external video present U12/9 goes open circuit, resulting in a low output from U11/7. This signal is used on the main board to select the appropriate internal or external timing signals. When acceptable external video is present U12/1 outputs positive going vertical sync pulses which are buffered by U13/3,4. When no external video is present these pulses are inhibited. U12/15 produces a positive going, multilevel synchronising pulse that is used by the decoders. The lower level provides Hsync timing and the higher level provides burst gating. Comparator U10 detects H.sync from the sandcastle for the main board timing. A vertical blanking signal (SBLANK) from the main board is added to the sandcastle signal by R150 and CR5. The resultant signal

is used by the decoders U5 and U6. IC U15 buffers the signal to the decoders.

Internally the 3571 consists of a sync separator, oscillator, phase-locked loop, a vertical sync integrator and a 625 line divider. The sync separator samples the input video black level on U12/4, R162, C113 and generates a sync slicing level proportional to the input sync amplitude via R161, U12/3. The oscillator runs at 2H frequency which is set by C108, R154, RV10 and the voltage on pin 17 and is phase locked to the external video H via the RC networks on U12/7,17,11 and 6. The response time of the phase lock loop is made slow or fast depending on whether the oscillator is locked or not by clamping or open circuiting U12/11. The vertical sync integrator and detector is formed by U12/5, R159 and C112. The 625 line divider, coincidence detection and signal switch is used to generate the vertical sync output in two different ways depending on the quality of the external video. The Vsync can be generated internally by the divider or taken from the external sync integrator.

### Video input buffers

These consist of emitter followers Q9 and Q11 buffer the video 1 and 2 inputs. Their outputs drive the bandpass and notch filters for the two decoder ICs. Q9 (input 1) also provides the video signal to the sync separator U12. [CVI03-2 and 3]

### Notch filters

These are formed by L4, C40 and L9, C68 removes the colour subcarrier (4.4MHz in PAL) from the composite video signal. The remaining luminance information at the output is passed to the decoders via the 330nS delay lines. [CVI03-2 and 3]

### Bandpass filters

These are formed by L3, C37 and L8, C65 passes only the colour subcarrier component of the incoming video signal to the chrominance input of decoders. Chroma from VIDEO 1 is also used by the chroma processor. [CVI03-2 and 3]



## BLOCK DIAGRAM DESCRIPTIONS

### 330nS Delay line

This delay line in the luminance signal path compensates for the delay of the chrominance signal through the bandpass filters and the decoders. This ensures that the two signals remain synchronised. [CVI03-2 and 3]

### Chroma Processor

The chroma processor generates subcarrier and PAL signals that are locked to the incoming video signal. The subcarrier and PAL signals are used as references by the encoder and main board. The filtered chroma signal derived from the Video 1 input is coupled into pin 1 of the chroma processor chip CA3128 U16. A burst gate signal is derived from the sandcastle pulse by comparator U17 and fed to the CA3128. This burst gate pulse is used internally to lock the subcarrier filter formed by crystal Y6, C147 and associated components to the frequency of the burst from pin 1 of CA3128. Components connected to pins 2, 3, 4, 10, and 11 determine the time constants of the phase-locked loop. A continuous subcarrier signal is available at pin 8 which is converted to TTL levels by Q20. Q22 amplifies the negative-going portion of the PAL signal available at pin 13. This is used to turn on Q21 and thus reset the encoder PAL flip-flop when Q24 is off. Q23 buffers the PAL signal from the encoder U7 and drives Q24 off when the encoder PAL signal is low. Thus the reset pulses from Q22 can only reset the encoder when the encoder PAL pulse is low: this is the out-of-phase condition. The reset pulses are inhibited by Q24 when the encoder PAL pulse is high: the in-phase condition. The reset pulses must be inhibited when in phase since the reset pulse occurs during the burst period and interferes with normal burst phase operation. Q19 generates an adjustable PAL pulse signal level from the encoder PAL pulse to allow subcarrier feedthrough nulling via the R-Y clamp capacitor of the encoder. When no input is connected the crystal oscillator free runs and the PAL reset is disabled. The free running frequency is set by C147. CR20 generates +11.3v from +12v for the chroma processor CA3128.

### Decoder 1

Decoder 1 generates red, green and blue (RGB) signals from the composite video 1 input. Synchronisation is taken from the sync separator (4). The decoder output is either the direct RGB signals from RGB input 1 or the RGB signals decoded from composite input 1, depending on the position of SW1/8. In PAL systems a 64uS delay line is required for the decoding operation.

The crystal on U5/26 runs at twice the colour subcarrier frequency. It locks to the external video subcarrier if present or free runs if no video is present.

The RGB outputs from the TDA 3562 are intended to drive the RGB gun drive transistors of a TV set and so have an automatic "black level" control input pin U5/18. Resistors R114,115,116 and 117 are used to maintain the RGB outputs at the correct DC level. The colour saturation control pin U5/5 is bidirectional. When colour video is present it is an input controlled by the SAT. pot RV3, and can be forced low to kill colour by jumper W1. When there is insufficient colour burst on the external video the TDA 3562's colour killer circuit pulls pin 5 low, but it may be forced high by jumper W1 to "unkill" colour.

The output (U5/28) to the 64uS delay line contains chrominance information only. The burst is at a constant level and the level of the picture chrominance is variable, controlled by the saturation input pin U5/5, and the kill/unkill jumper W1.

The inductors L6 and L7 compensate for the capacitance of the input and output piezoelectric transducers on the glass 64uS delay line L5. The balanced output of the delay line is combined with some of the signal from pin U5/28 to produce U and V signals which are fed to pins U5/22 and 23.

Trimpot RV7 together with L6 and L7 adjust the amplitude and phase of the chroma delay circuit. They are adjusted so that correct chroma cancellation occurs on both odd and even lines and does not result in visible "Hanover" bars which are seen as alternate red/green lines on decoded video.

**Decoder 2**

Decoder 2 generates red, green and blue (RGB) signals from the composite video 2 input. Synchronisation is taken from the sync separator (4). The decoder output is either the direct RGB signals from RGB input 2 or the RGB signals decoded from composite input 2, depending on the position of SW1/7. In PAL systems a 64µs delay line is required for the decoding operation. [U6, TDA 3562, CVI03-3]

**Picture controls**

The picture controls provide control voltages to the decoders that control the brightness, contrast and saturation of the decoded outputs. If direct RGB inputs are selected to the decoders only the brightness and contrast controls will affect the decoder outputs. [CVI03-4]

**Video source multiplexers**

These select the inputs to the digital and analog paths through the CVI. Each path may take its input from the RGB outputs of either Decoder 1 or Decoder 2. The selection is made using two control lines from the digital card, ASEL1 and ASEL2. These TTL signals are buffered to 12V levels by open collector gates U13/11 and 10. When ASEL1 and 2 are low decoder #1 RGB outputs are selected, and when high Decoder #2 outputs are selected. [U8,U9, CVI03-4]

**660ns delay lines**

These delay lines at the start of the analog path compensate for the delays caused by digitising and processing on the digital path. The delay ensures that picture information sent through the two paths retains horizontal registration. [L14,15,16], (CVI03-4)

**Subcarrier phase shifter**

The subcarrier phase shifter takes its input from either the external input or the chroma processor, depending on the position of SW1/6, which provides the SUBSEL signal to U1. SW1/5 provides a coarse phase shift of 0 or 180 degrees by selecting the Q or NOT Q outputs of U16/5,12. The subcarrier trimmer RV5 allows fine adjustment by varying the

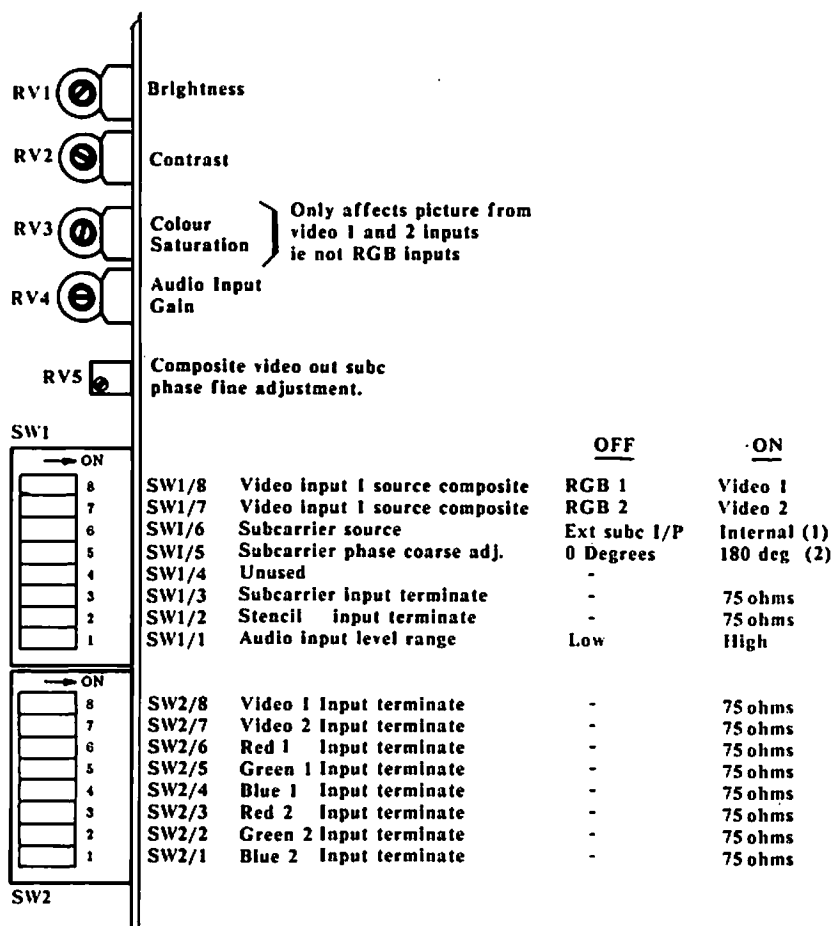
pulse width from the other half of U16. Together these give a full 360 degree range. Transistors Q3A, Q4A and filter L1, C28 and C30 convert the rectangular output of the phase shifter to a constant level sine wave. This is passed to the encoder subcarrier input via RV12 which sets the correct level required by the encoder IC. [U1,U16, CVI03-5]

**Encoder**

The encoder generates a full composite PAL colour signal from RGB, composite sync and subcarrier inputs. The output (pin 9) can directly drive a 75-ohm cable. The RGB inputs are capacitively coupled. Clamping is done on various signals in the MC1377 using external capacitors C90, C99, C100 and C119. Trimpots RV14 and RV15 vary the DC bias current to the R-Y and B-Y clamp pins and are used to null the amount of residual colour carrier in black. RV13 varies the bias to pin 19 which alters the phase of the R-Y modulator. A PAL null adjustment from the chroma processor via RV20 allows fine nulling of the R-Y modulator on alternate lines. These adjustments require the use of a PAL vectorscope. The MC1377 contains a ramp generator running at horizontal line rate, which is used to set the burst position in the output video and also to trigger the internal PAL flip-flop. The slope of the ramp (and the burst position) is determined by RV11, R130 and C118 connected to U7/1. The PAL flip-flop is reset by the Chroma Processor by pulling pin 20 to ground. U7/16 is an 8.2V reference output voltage used as a stable source for the ramp generator. The PAL phase of the output signal is controlled by the chroma processor and PAL reset circuitry. The bandwidth of the chroma signal generated by the MC1377 is limited by the bandpass circuit (C93, L19, C98) between U7 pins 13 and 10. This delays the chroma by about 350ns and so the luminance must also be delayed by the same amount. This delay is provided by L18 between pins 6 and 8 of U7.

The composite sync signal to U7/2 is derived from the digital board. The subcarrier input U7/17 comes via the phase shifter from either external or internal sources.

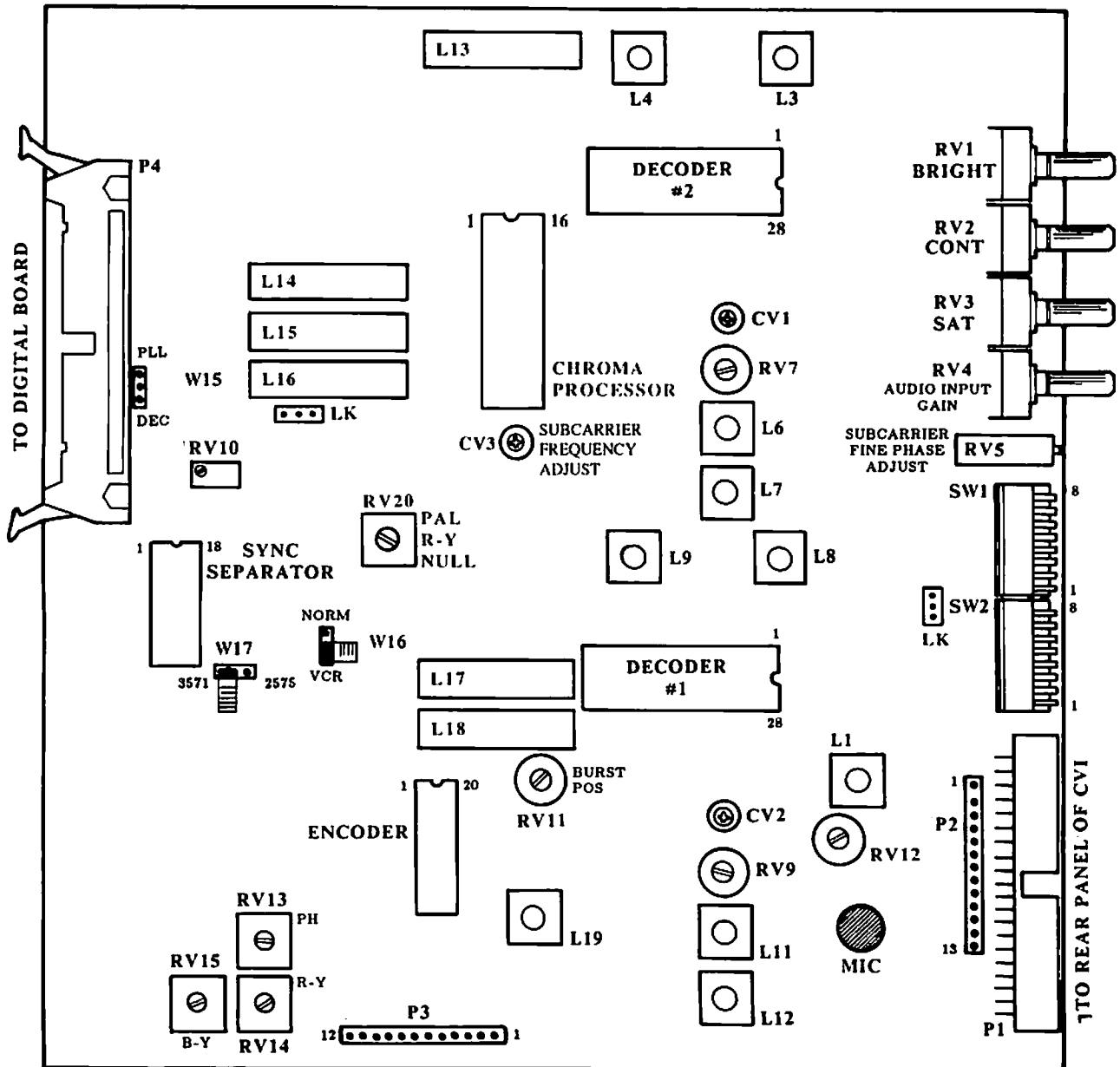
# OPERATING CONTROLS



## Notes

- (1) The internal subcarrier is both frequency and phase locked to the VIDEO 1 input if a video signal is present on it.
- (2) SW1/5 selects a phase shift of zero or 180 degrees. Using it and the phase fine adjustment trimpot, the video output subcarrier phase may be adjusted from 0 degrees to 360 degrees relative to the reference subcarrier.

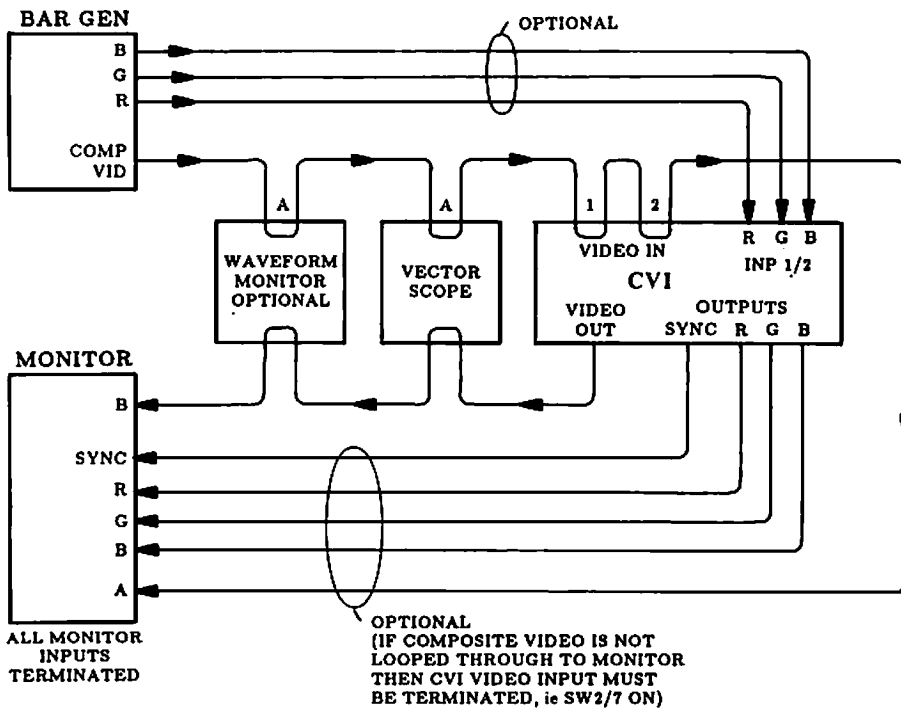
# LOCATION OF SERVICE ADJUSTMENTS



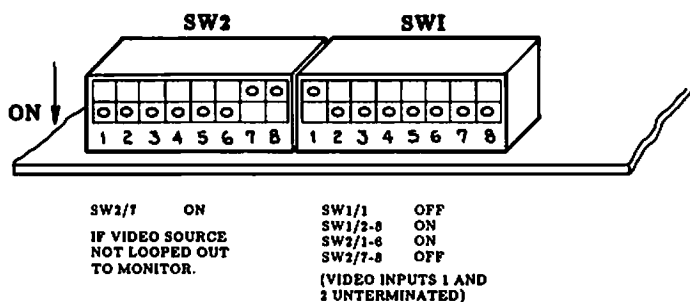
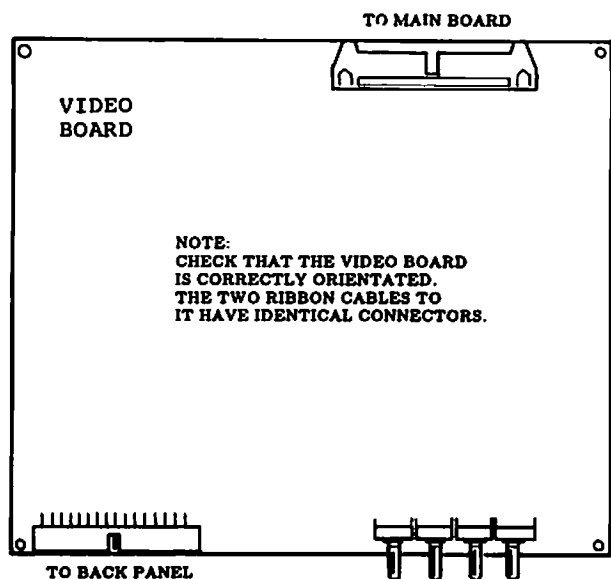
## EQUIPMENT REQUIRED

- a) 100MHz dual channel C.R.O. (cathode ray oscilloscope).
- b) 6 to 7 digit 100MHz frequency meter.
- c) PAL Vectorscope (2 inputs).
- d) PAL 100% colour bar generator.
- e) PAL Composite video monitor with RGB inputs.
- f) PAL Waveform monitor (optional).
- g) CVI system (main board, front panel, cables, power supply etc.)

## GENERAL TEST SETUP & PROCEDURE



# GENERAL TEST SETUP AND PROCEDURE



The diagram above shows original settings of SW1 and SW2

## Initial test switch settings on video card Jumper link settings

W1 - unused  
W2 - unused  
P2 - unused  
P3 - unused  
W15 - unused  
W16 - VCR  
W17 - 3571

## General procedure

Due to the interactions between adjustments on the board, the following sequence of operations is recommended:

- 1) check and adjust sync separator
- 2) chroma processor
- 3) set free run frequency of subcarrier crystal
- 4) check and adjust subcarrier phase shift chain
- 5) check that main board PLL locks to subcarrier
- 6) check and adjust video encoder
- 7) check and adjust decoder #1
- 8) check and adjust decoder #2
- 9) check RGB inputs and outputs
- 10) check audio input

---

## PRESETS USED IN SERVICING

---

The CVI PRESETS allow the internal state of the CVI to be quickly restored to a predefined condition. For a full description refer to the operation manual.

Only a few of the 100 presets available need to be used while servicing the videoboard. They are:

- 00 Selected at power on, displays the Fairlight logo
- 95 Video 2 through
- 96 Video 1 through
- 97 Internal colour bars

The preset number currently selected is displayed on the front panel LED display. To change the preset number, press the PRESET key followed by two number keys.

For example, PRESET 9 5 for preset 95.

If the CVI has been in use it is possible that these presets have been changed by the user. In this case reset the above presets. Refer to the "RESET PRESETS" section of the user manual.

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## DETAILED DESCRIPTION OF PRESETS

---

The effects and uses of these presets are as follows:

00 At power on, the Fairlight logo is drawn (in colour) in the CVI video RAM and stencil. If video is present on the Video 1 input the CVI locks to it. The Video 1 image is converted to analog RGB by decoder 1, then passed via mux U9 to the analog path on the main board. Simultaneously, the image in the RAM is read out and converted to analog RGB. The RAM image (the logo) and the incoming video are combined by the analog video MUX/MIX and then passed through buffers to the CVI RGB outputs and composite video encoder.

This preset is used while testing the sync separator, main subcarrier oscillator, MUX U9 and the phase shifter circuit.

95 Video input 2 through. The CVI locks to Video 1 input, and passes the Video 2 input through the analog path, i.e. decoder #2, MUX U8, delay lines, main MUX/MIX/buffers, RGB outputs and encoder.

This preset is used to test decoder #2.

96 Video input 1 through. The same as 95, but uses decoder #1.

This preset is used to test decoder #1.

97 Internal colour bars. The CVI locks to Video 1 input if present, but uses the RAM as the sole colour source. The processor writes a "colour bars" image to the RAM. The video route is - RAM, D to A's, MUX/MIX, buffers, encoder.

This preset is used to test and align the encoder.



# ALIGNMENT PROCEDURE

## CONTENTS

Sync separator .....	3.8
Chroma processor .....	3.8.1
Subcarrier phase shifter .....	3.8.2
Subcarrier locking .....	3.8.2
RGB Sync and stencil outputs .....	3.8.2
Video encoder .....	3.8.3
Decoder #1 and #2 .....	3.8.4
RGB inputs .....	3.8.5
Audio inputs .....	3.8.6
Operating adjustments .....	3.8.6

### NOTE:

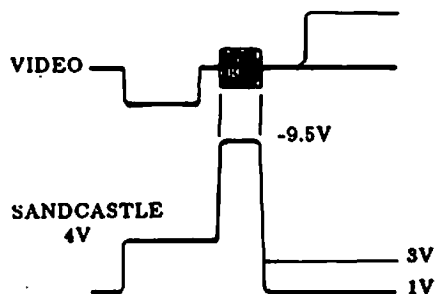
TTL levels implies a high (or 1) to be above 2.5V and a low (or 0) to be below 0.8V.

### Sync separator

IC U12 - TDA 3571B 18 pins

### Setup

- Colour bars to Video input #1.
- Ignore CVI controls and video output.
- CRO - sweep 2uS/div.
- CRO - Channel 1 200mV/div. On external video input 1 (P2/5) i.e. Pin 5 of P2.
- CRO - Channel 2 2V/div. On "sandcastle" pulse on U6/7. This comes from U12/15.
- CRO - Trigger on CH1, negative edge of video H sync.



Adjust RV10 so that the sandcastle (CH2) is locked to the video (CH1), with the peak of the sandcastle encompassing the video burst.

Change CRO sweep to 500uS/div. Trigger on vertical sync. Check that the sandcastle signal does not go below 2V during the vertical blanking period.

Check that U11/7 is a TTL low (EXTERNAL SYNC) with video applied to video 1 input. Check that it goes high (INTERNAL SYNC) if video is removed from Video 1 input.

With video applied, check for TTL Horizontal sync pulses on U10/7 and TTL Vertical sync pulses on U13/4.

See page 3.14.1 for block diagram of 3571B.

# ALIGNMENT PROCEDURE

## Chroma Processor

### Setup

- Disconnect input to VIDEO 1.
- CRO - sweep 100ns div.
  - CH1 2V div on DEC pin of W15.
  - trigger AC on CH1.
- Frequency meter - DEC pin of W15.
- Vectorscope - reference and sync CHA, NTSC display, input CHB.

### Procedure

#### Subcarrier Frequency

- The CH1 signal should be a TTL square wave.
- Adjust CV3 (near the chroma processor IC CA3128) so that the subcarrier frequency is 4.433619 MHz  $\pm$  5Hz.
- Reconnect the video input to VIDEO 1 and check that the frequency at DEC pin of W15 has not changed.
- Disconnect the signal to VIDEO 1 again and check that the frequency is as before. This sets the free-running frequency of the internal subcarrier reference oscillator.

#### PAL and Subcarrier Phase

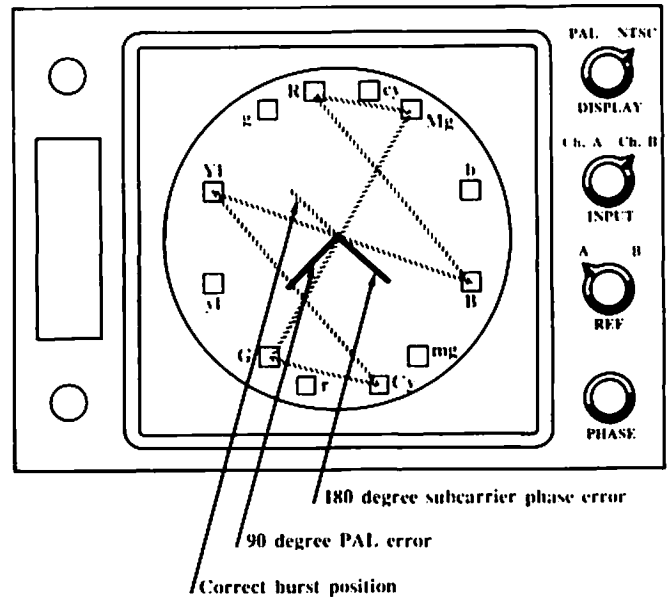
##### (Oscilloscope Method)

- Connect a video signal to VIDEO 1 input.
- Check the signal on pin 20 of the encoder IC U7. This should be a 2Vp-p square wave at half line rate. When the signal to VIDEO 1 is disconnected and reconnected this PAL square wave should be pulled to ground for one or two lines during the burst period after which it should be inhibited.

#### PAL and Subcarrier Phase

##### (Vectorscope Method)

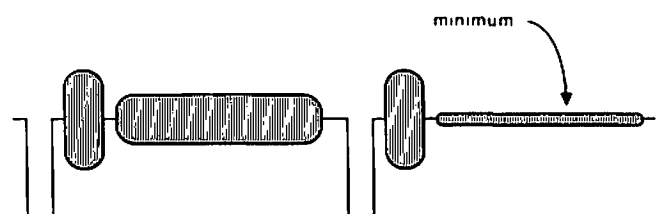
- Assuming that the encoder section is working then the chroma processor can also be checked using the vectorscope.
- Connect a PAL colour bar signal to VIDEO 1 input.
- Select CHB and NTSC display on the vectorscope. See following diagram.



- Align the vectorscope and CVI subcarrier phase so that the burst vectors overlap and are positioned over the top burst mark.
- Disconnect and reconnect the signal to VIDEO 1 several times. The vectorscope display should always revert back to the original display when the signal is reconnected indicating that subcarrier and PAL phase are being recovered correctly from the incoming video.
- With an input to VIDEO 1 turn the CVI off and on several times and again check that the vectorscope display aligns correctly. A 90 degree error could indicate a PAL phase error while a 180 degree error usually indicates a subcarrier phase error.

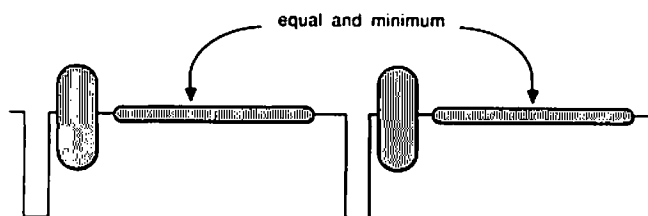
#### PAL Null Adjustment

- Clear the screen to black using factory PRESET 3 with the VALUE control set to zero.
- While observing the VIDEO OUT signal on the waveform monitor or CRO adjust RV14 and RV15 to obtain minimum chroma in the picture area on a particular line. See diagram below.



## ALIGNMENT PROCEDURE

- Adjust RV20 so that any chroma feedthrough on consecutive lines is equal. See diagram below.



- Re-adjust RV14, RV15 and RV20 to obtain minimum chroma feedthrough in the picture area on consecutive lines.
- Select PRESET 97 and check that the colour bar waveforms are the same.

### Subcarrier phase shifter

This circuit is used to adjust the phase of the output video subcarrier relative to the input video subcarrier. A full 360 degrees range is possible using the coarse adjust switches and fine adjust trimmer.

The subcarrier source is selected (via U1) from either the external subcarrier input, or the chroma processor. Dual monostables U16 and trimpot RV5 provide the fine phase adjustment. One of the two outputs from U16 (0 or 180 degrees) is selected by U1 and SW1/5 and passed via the subcarrier filter L1 and level control RV12 to the encoder.

### Setup

- CRO - Sweep 100ns/div
- / - Trigger on CH1
- / - CH1 1V/div, on U1/14 (4053, selected subcarrier)
- / - CH2 1V/div, on U7/17 (subcarrier input to encoder)

### Procedure

To test the external subcarrier input amplifier, connect subcarrier to the input and check that the signal appears on CH1 when SW1/6 is off.

With SW1/6 on, set RV12 to midrange and adjust L1 for maximum amplitude and cleanest waveform at U7/17 (CH2). Next adjust the level pot RV12 for 0.75Vp-p at U7/17. Allowed range is 0.5Vp-p to 1Vp-p.

Check that SW1/5 moves the phase of U7/17 (CH2) by 180 degrees relative to U1/14 (CH1), and that RV5 also varies the phase.

Alternatively, if the rest of the board is working, supply colour bars to input 1, synchronise the vectorscope to the bar generator, select Preset 97 and view the CVI output on the vectorscope. Check that the CVI output burst can be rotated through 360 degrees using the coarse and fine phase controls.

### Subcarrier locking

#### Setup

- CRO - sweep 100ns/div.
- CRO - CH1 2V/div. on DEC pin of W15.
- CRO - CH2 2V/div. on PLL pin of W15.
- CRO - trigger on CH1.
- Colour bars to Video 1 input.

The signal on CH2 should be a TTL square wave at the same frequency of CH1, and in steady phase lock.

### RGB, sync and stencil outputs

The RGB lines come directly from the main board, while the SYNC and STENCIL signals are generated on the main board and buffered by U13 on the video board.

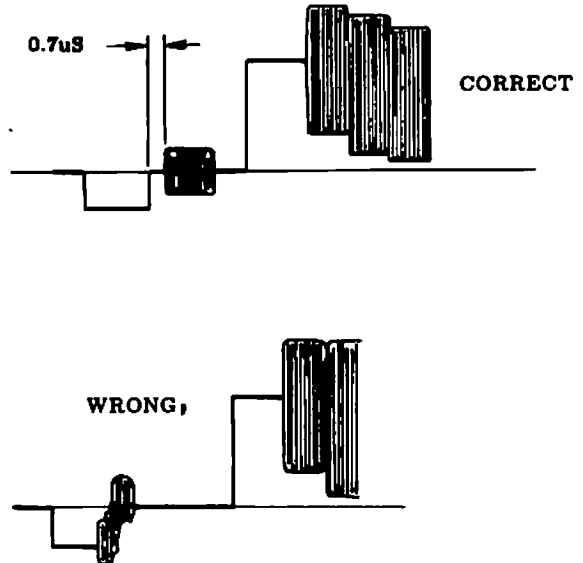
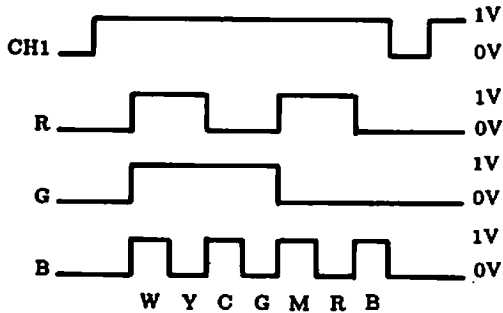
Check these before proceeding to the encoder.

#### Setup

- Select preset 97 (internal colour bars)
- If your monitor has RGB inputs, connect the CVI's RGB and SYNC outputs to the monitor. Check for a clean and correct colour bars image.

# ALIGNMENT PROCEDURE

Check for signals as indicated below:



Otherwise -

- CRO - Sweep 10uS/division.
- CRO - CH1 0.5V/division. On SYNC OUT signal (with 75 ohm termination).
- CRO - CH2 0.5V/division. On R/G/B signal out (with 75 ohm terminations).
- CRO - Trigger on CH1, TV H sync.

Check for signals as indicated below:

Turn the CVI OFF. Wait for 5 or more seconds and turn ON, to obtain the startup logo. Check that the STENCIL output is 1V p-p into 75 ohms. The signal will not be regular or coherent except during sync and blanking.

## Video encoder

The PAL encoder IC U7 takes RGB, subcarrier and sync inputs and generates composite colour video.

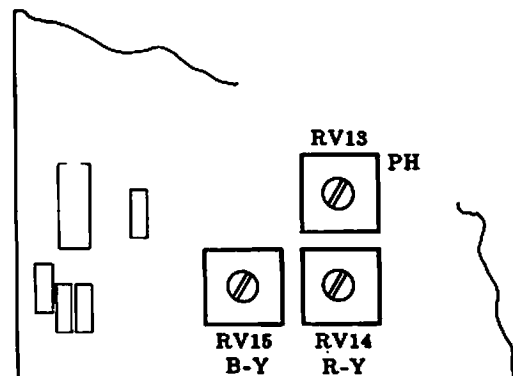
## Setup

- Preset 97 (internal colour bars).
- Select the CVI composite video output on the monitor, vectorscope and waveform monitor or CRO.

Adjust RV11 for correct colour burst position on the front porch as indicated below.

Adjust "PH" pot for symmetrical vector display (U7/19).

Adjust "R-Y" (U7/12) and "B-Y" (U7/11) pots for minimum chroma on sync and front and back porches. Alternatively adjust these pots so that the central point of the vector display is centred on the grid.



Check the colour bars on the monitor for correct colour and hue.

# ALIGNMENT PROCEDURE

## Decoder #1 and #2 - TDA 3562

The PAL decoder IC's U5 and U6 convert composite colour video to analog RGB signals. They require a multilevel "sandcastle" sync input signal for burst sampling, H syncs, etc. The external RGB inputs are processed and switched by the decoders also.

Refer to the TDA 3562A block diagram on page 3.14

### General Decoder Setup

View CVI RGB outputs on monitor. Alternatively, view CVI composite video out.

- 100% Colour bars to input 1 and 2.
- Brightness to minimum, saturation to mid range, contrast to maximum.
- CRO - Sweep 10uS/division.
- CRO - CH1 0.5V/division on Video 1 input.
- CRO - Trigger on CH1, TV horizontal.

### Decoder #1 setup

- Preset 96 (video 1 through).
- Set RV7 (amplitude adjust) fully anticlockwise.
- CRO - CH2 0.5V/division

Short pins 24 and 25 of U5 together. This disables the voltage control of the crystal oscillator and allows the free run frequency to be adjusted.

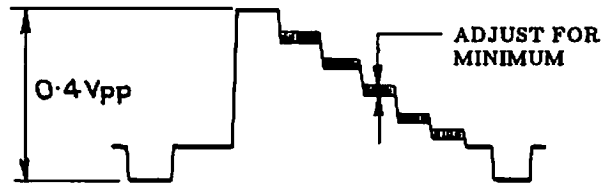
Adjust CV1 to the middle of the range in which colour appears on the screen. Remove the input to video 1 then put it back, checking that colour reappears when it is replaced. If not, readjust CV1.

Connect CH2 to U5/4. Adjust L3 for maximum chroma amplitude.

Connect CH2 to U5/8. Adjust L4 for minimum chroma on the luminance signal.



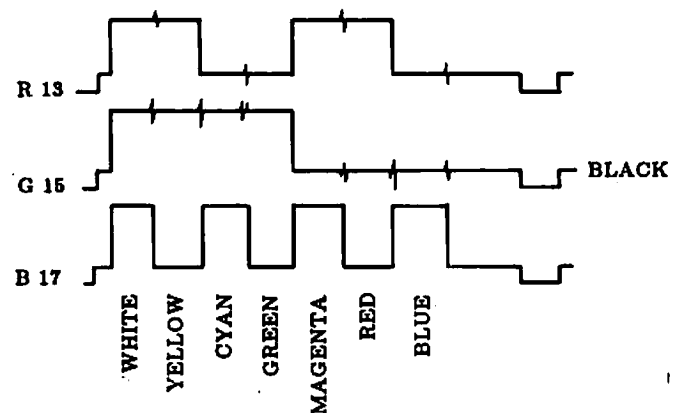
Connect CH2 to U5/8. Adjust L4 for minimum chroma on the luminance signal.



CRO - CH2 2V/division. On U5 pins 13,15,17 alternatively.

Adjust L6, L7 and RV7 for the best "RGB bars" waveforms on U5 pins 13, 15 and 17.

i.e., U5 pin



The aim is to get the tops and black levels of each waveform all lined up (equal levels). Pin 17 (blue) is the most critically affected by RV7. "Twitter" or alternate line flickering of each of the traces should be minimised since this causes Hanover bars on the screen (alternate red and green lines). Several iterations may be required to get the best results.

Brightness and saturation controls also affect these waveforms.

# ALIGNMENT PROCEDURE

## Decoder #2 setup

- Preset 95 (video 2 through).
- Set RV9 (amplitude adjust) fully anticlockwise.
- CRO - CH2 0.5V/division.

Short pins 24 and 25 of U6 together. This disables the voltage control of the crystal oscillator and allows the free run frequency to be adjusted.

Adjust CV2 to the middle of the range in which colour appears on the screen. Remove the input to video 2 then put it back, checking that colour reappears when it is replaced. If not, readjust CV2.

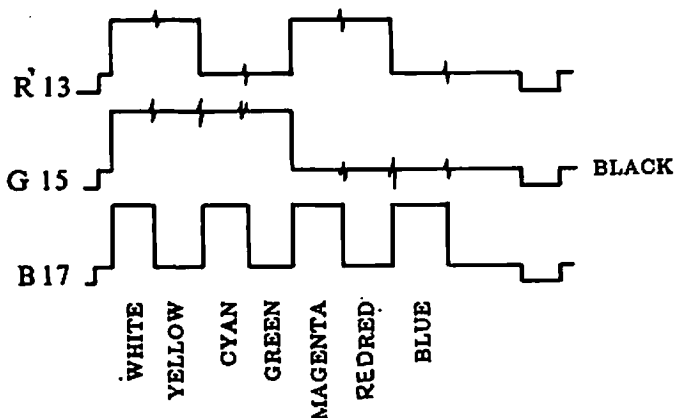
Connect CH2 to U6/4. Adjust L8 for maximum chroma amplitude.

Connect CH2 to U6/8. Adjust L9 for minimum chroma on the luminance signal.

CRO - CH2 2V/division. On U6 pins 13,15,17 alternatively.

Adjust L11, L12 and RV9 for the best RGB bars waveforms on U6 pins 13, 15 and 17.

i.e., U6 pin



The aim is to get the tops and black levels of each waveform all lined up (equal levels). Pin 17 (blue) is the most critically affected by RV9. "Twitter" or alternate line flickering of each of the traces should be minimised since this causes Hanover bars on the screen (alternate red and green lines).

Several iterations may be required to get the best results.

## RGB inputs

These are analog RGB inputs to the decoder chips U5 and U6. SW1/8 and SW1/7 select either RGB or composite on decoder #1 (U5) and decoder #2 (U6) respectively. See VIDEO BOARD OPERATING CONTROLS page 3.3.

## To check RGB 1 inputs -

View CVI composite or RGB video output on monitor.

Select preset 96 (Video 1 through).

Apply colour bars to video 1 input.

Turn SW1/8 OFF. The colour bar output from the CVI should disappear (become black).

If the bar generator has RGB outputs, connect them to the CVI RGB 1 inputs and check for correct bars output from the CVI.

Otherwise, loop the composite video bars signal through to the RGB 1 inputs one at a time and check for R,G and B images out of the CVI. Note that there should be only one termination on the video input, so the video input should be unterminated and the RGB inputs terminated.

## To check RGB 2 inputs -

Select preset 95. (Video 2 through)

Apply colour bars to Video 1 and loop through to Video 2.

(Only terminate Video 2.)

Turn video board switch 1/7 OFF. The colour bar output from the CVI should disappear (become black).

Apply RGB bars or composite video to the RGB 2 inputs while observing the CVI output as for the decoder #1 procedure above.

# ALIGNMENT PROCEDURE

## Audio input

The audio input circuit consists of op amp U2 with a high or low gain selected by SW1/1, followed by the sensitivity pot RV4. The internal microphone or an external line level input are selected automatically by the external input socket. The signal is passed to a peak detector, a low pass filter, a band pass filter and a high pass filter, giving Envelope, Bass, Mid and Treble signals. These are sent to the multiplexer on the front panel to be digitised.

The audio analyser can be tested either by observation on a CRO, or by use of the CVI Testing ROM software (see your distributor).

## Setup

- Set the audio sensitivity pot RV4 to 3/4 (clockwise).
- Set SW1/1 ON.

## Quick check

Using either an external microphone plugged into the AUDIO INPUT jack on the back of the CVI, or the internal microphone MIC1 on the video board, check that sounds picked up by the microphone affect the voltage levels at the test points on the video board.

Connect a line level (200mV pp or greater) music source to the external input jack. Adjust the audio sensitivity pot RV4 for optimum response.

## Detailed check

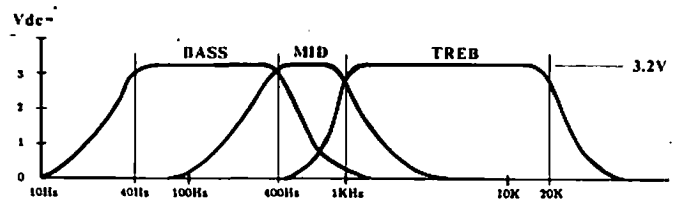
### Equipment required

- Audio oscillator
- DC voltmeter
- Oscilloscope

## Setup

- Disconnect the back plane to video board ribbon cable from P1 on the video board.
- Connect the audio oscillator sine wave output to the video card AUD input at P2/7 and adjust the level to 1V pp (keep constant for all measurements).
- Set SW/1 on.
- Adjust the SENS pot RV4 for 7V pp at U4/14 (just less than the level at which the signal clips on the positive peaks) with a 1kHz input signal.

- While varying the input frequency and observing the DC voltages at the BASS, MID and TREB test points, check that the filter characteristics are approximately as follows.



## Operating adjustments

These consist of the five pots and sixteen switches on the edge of the video board.

### To adjust the video control pots -

Select Preset 96

Connect colour bars to Video input 1

View the output of the CVI on the monitor Flip between Presets 96 (external video) and Preset 97 (internal bars).

Adjust the Brightness, Contrast and Colour Saturation controls so that the CVI internal colour values (Preset 97) match the external video range (Preset 96). For example, the two white values should be equally bright, etc. This may have to be adjusted for various source material.

The video/RGB/stencil and subcarrier termination switches should be set ON for the signal cables that terminate at the CVI, and OFF for those that are looped through the CVI.

The fine phase adjust and audio sensitivity pots are set depending on the installation.

# TEST CHECKLIST

Notes 1. The tests for each section should be carried out in the CVI Preset indicated.

2. The components to be adjusted in each test are indicated in square brackets.

TEST	TEST POINT	EQUIPMENT
<b>SETUP</b> Set DIP switches. Set jumper links.		
<b>SYNC (Preset 00)</b> Check against video input: <ul style="list-style-type: none"> <li>- sandcastle position and levels [RV10]</li> <li>- EXTSYNC signal</li> <li>- horizontal sync signal</li> <li>- vertical sync signal</li> </ul>	U6/7 U11/7 U10/7 U13/4	
<b>SUBCARRIER (Preset 00)</b> Check: <ul style="list-style-type: none"> <li>- Subcarrier amplifier output &gt; 2.5V</li> <li>- Subcar. oscillator free run frequency                PAL 8.867238 MHz [CVI]</li> <li>- PLL lock</li> <li>- External subcarrier input amp. [SW1/6]</li> <li>- Subcarrier filter [RV12,L1]</li> <li>- Subcarrier level [RV12]</li> <li>- Subcarrier phase shift [SW1/5,RV5]</li> </ul>	W15 (DEC) W15 (DEC)  (W15) DEC vs U14/9 U1/14 U7/17 U7/17	Vectorscope
<b>RGB OUTPUTS AND STENCIL (Preset 00)</b> Check.		CRO or RGB Monitor
<b>ENCODER (Preset 97)</b> Adjust: <ul style="list-style-type: none"> <li>- Burst position [RV11]</li> <li>- Chroma filter [L19]</li> <li>- Chroma balance [RV13,RV14,RV15]</li> </ul>		CRO Vectorscope Vectorscope
<b>DECODER 1 (Preset 96)</b> Adjust: <ul style="list-style-type: none"> <li>- Maximum chroma [L3]</li> <li>- Minimum chroma [L4]</li> <li>- PAL : RGB bars [L6,L7,RV7]</li> </ul>	U4/4 U4/8 U4/13,15,17	Monitor
<b>DECODER 2 (Preset 95)</b> Adjust: <ul style="list-style-type: none"> <li>- Maximum chroma [L8]</li> <li>- Minimum chroma [L9]</li> <li>- PAL : RGB bars [L11,L12,RV9]</li> </ul>	U5/4 U5/8 U6/13,15,17	Monitor
<b>RGB INPUTS 1 &amp; 2 (Presets 96 &amp; 95)</b> Check.		Monitor
<b>AUDIO INPUT</b> Check. [SW2/1,RV4]		Monitor
<b>COLOUR LEVELS (Presets 96 and 97)</b> Adjust: [RV1,RV2,RV3]		Monitor



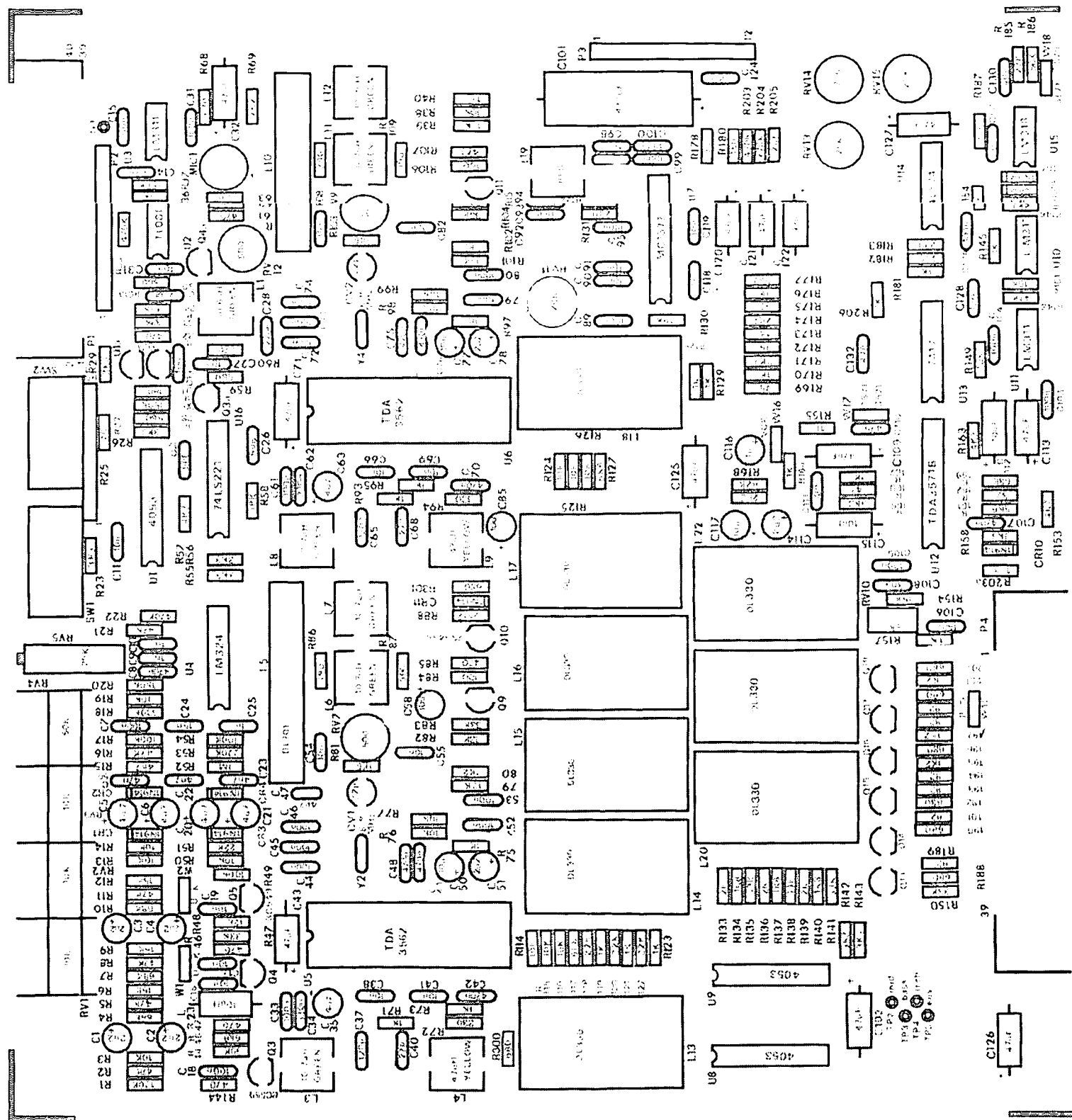
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## **FAULTS AND POSSIBLE CAUSES**

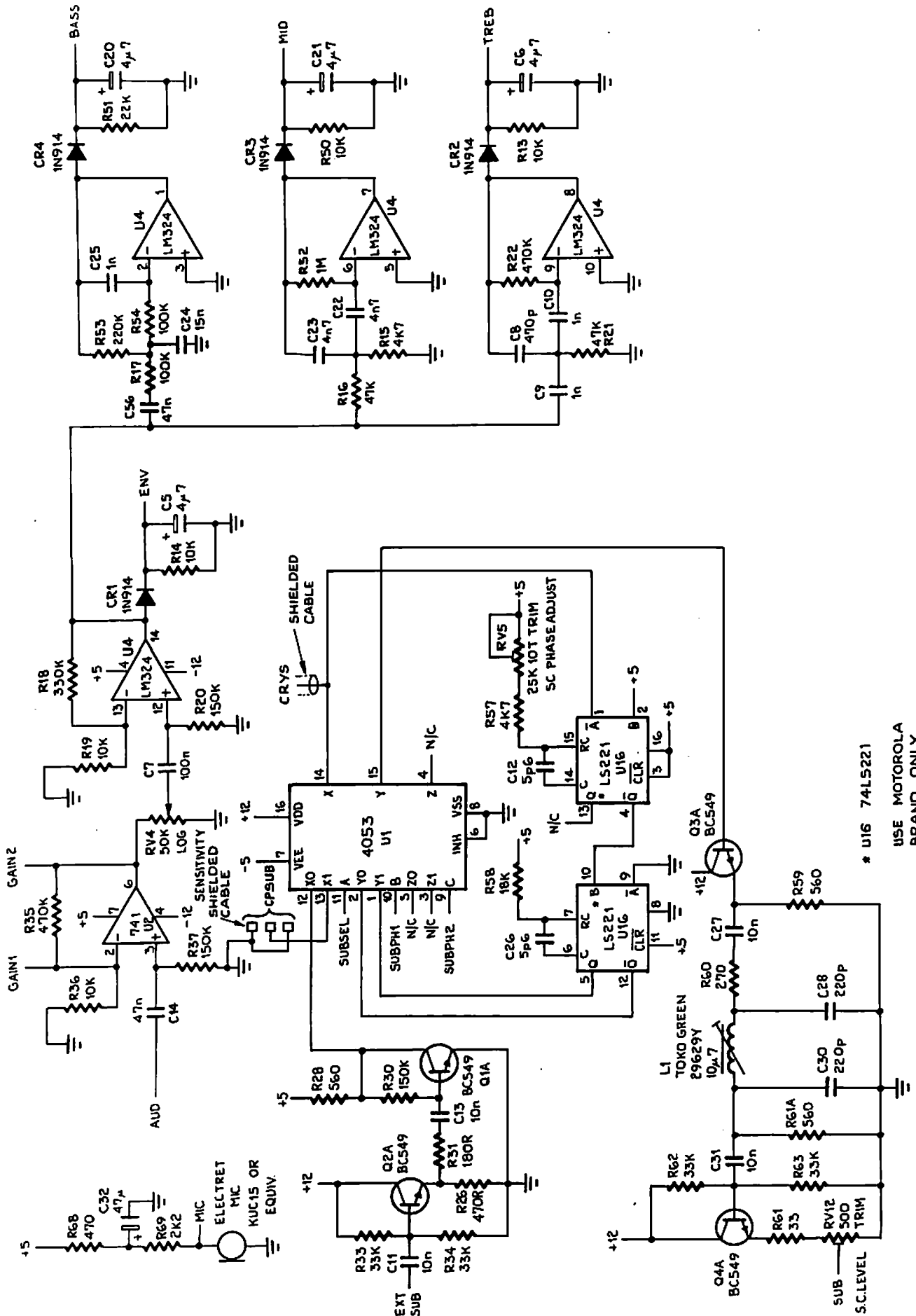
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- 1) Loss of colour on output in internal sync mode (no external video).
  - Decoder #1 XTAL OSC free run frequency wrong (not 2 x Fsc)
  - Move W15 to DEC position. If colour returns then main board PLL is not locking to video subcarrier.
  - Divider U14 or phase shift chain faulty. Check that the encoder is getting subcarrier.
  - Burst is in the wrong position.
- 2) Loss of colour on composite input.
  - Decoder XTAL OSC free run frequency wrong.
  - link W1 or W2 set in U position.
  - saturation control RV3 set too low.
- 3) Screen tears and rolls.
  - EXTSYNC signal is low when no input video to VIDEO 1.
  - Vs or Hs signals are missing when in external sync.

COMPONENT OVERLAY

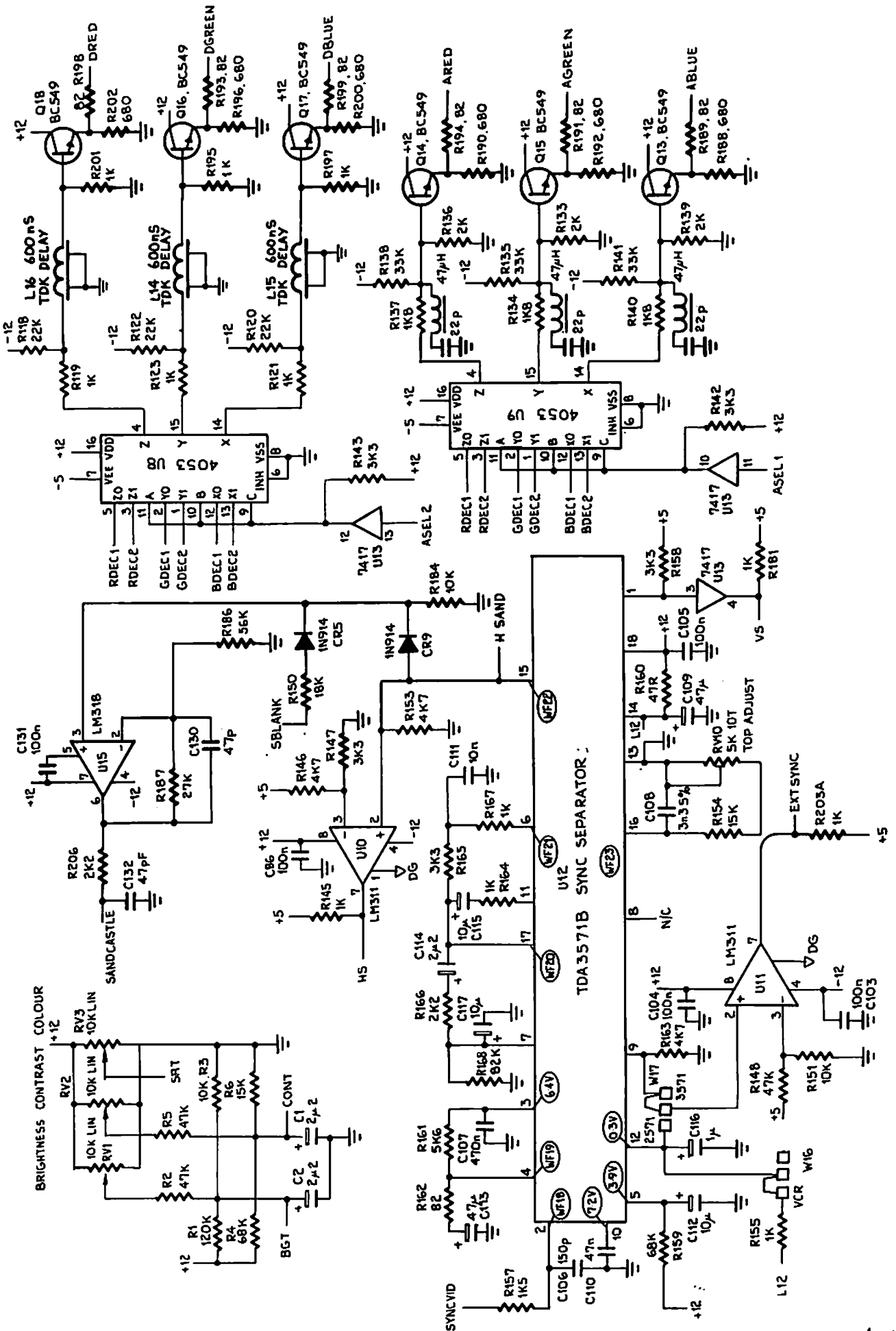


# AUDIO INPUT & FILTERS & SUBCARRIER ADJUSTMENTS

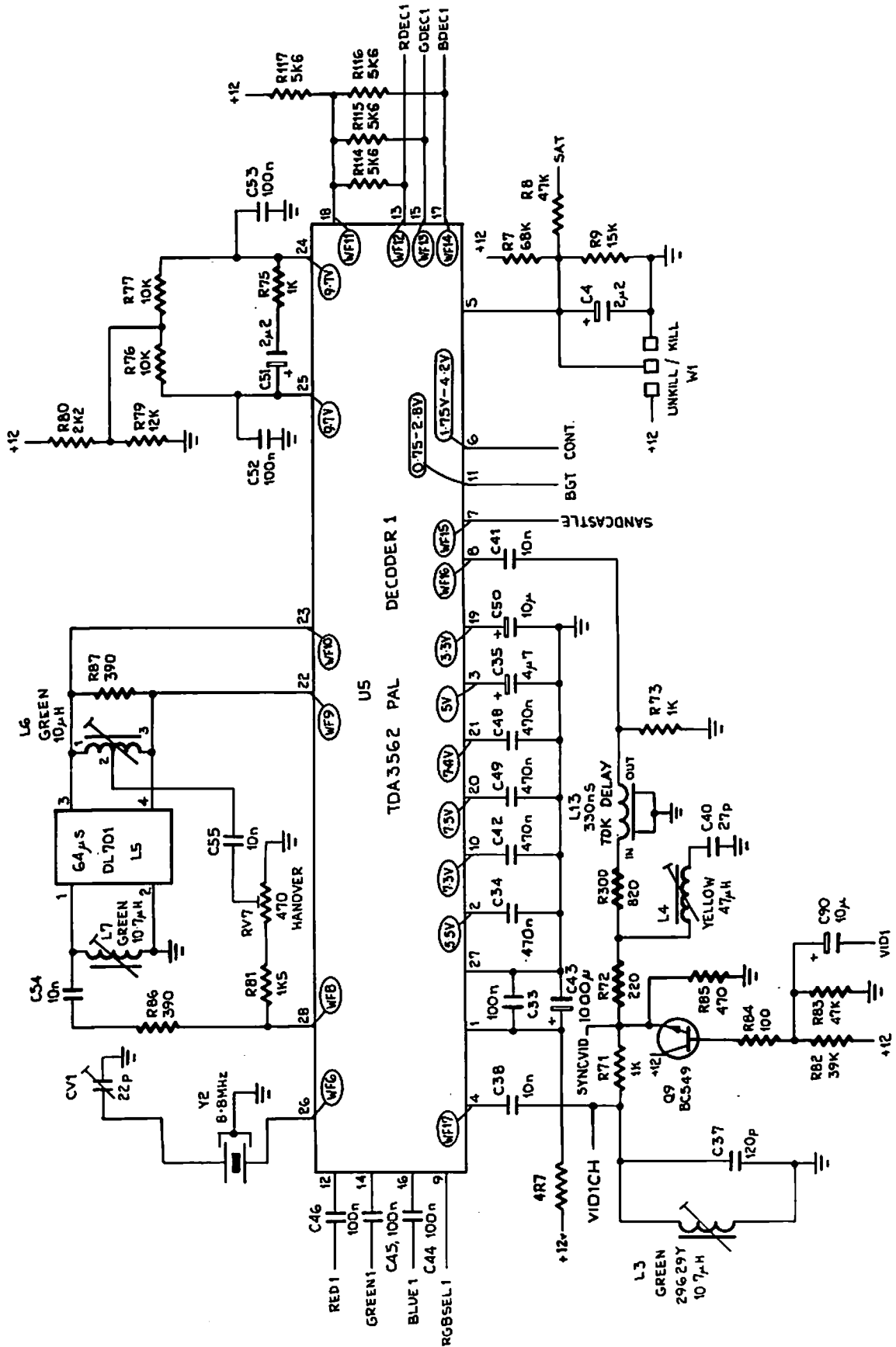


\* U16 74LS221  
USE MOTOROLA  
BRAND ONLY

# PAL SYNC SEPARATOR VIDEO MULTIPLEXER

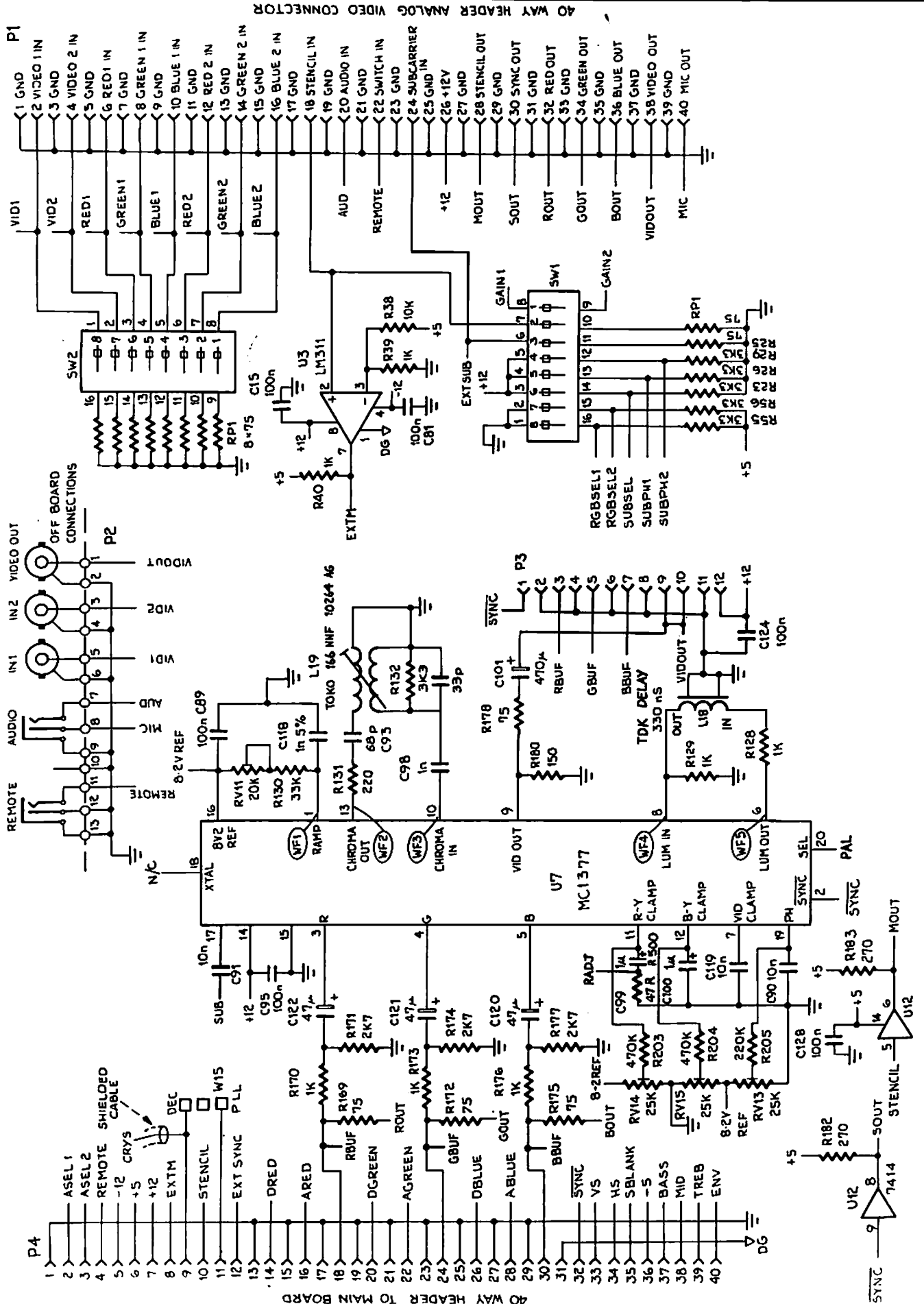


3.12.1-VIDEO BOARD PAL

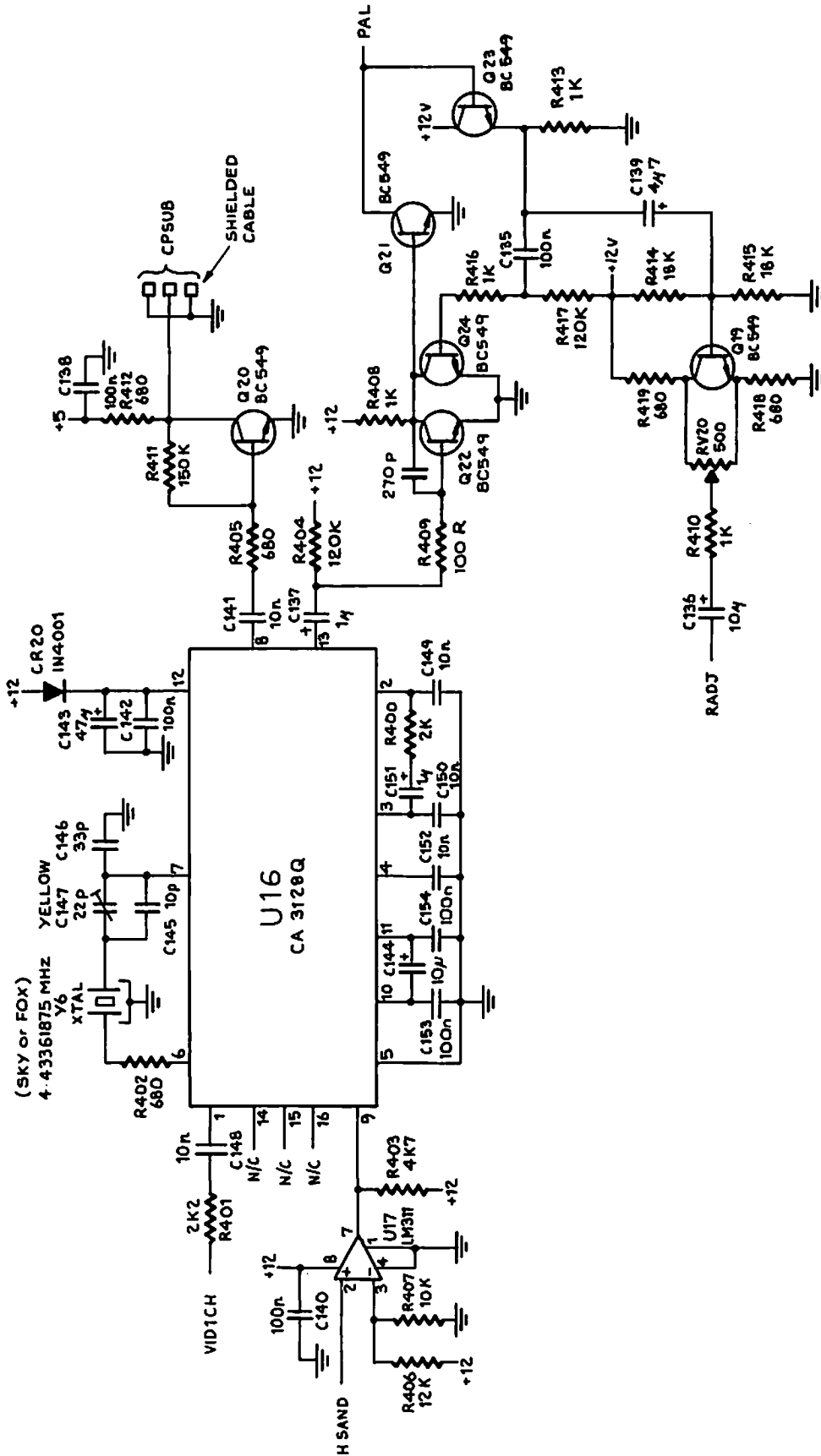




# PAL ENCODER CONNECTORS



# PAL / CHROMA

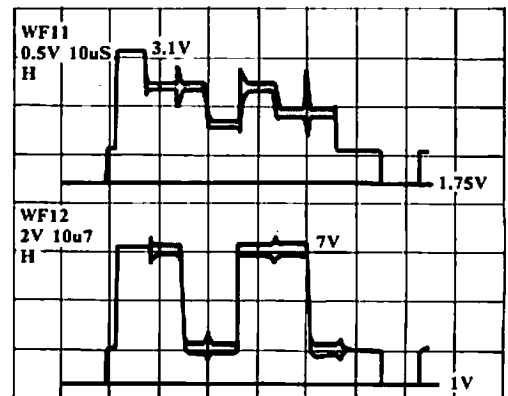
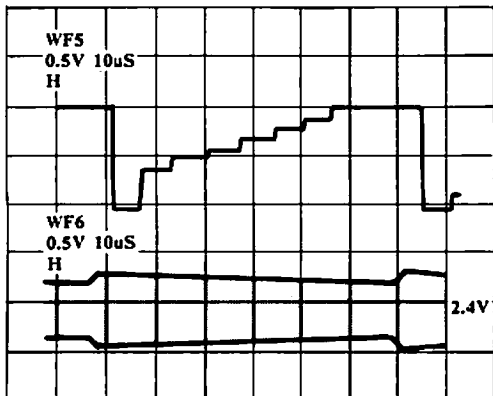
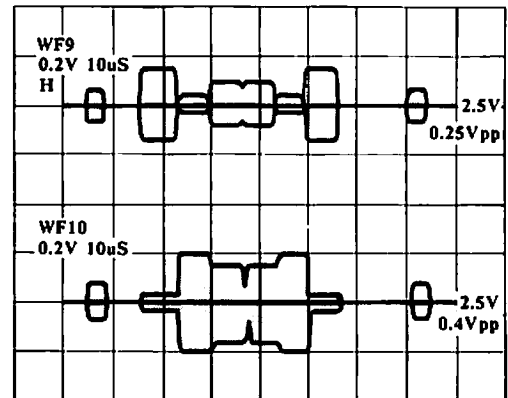
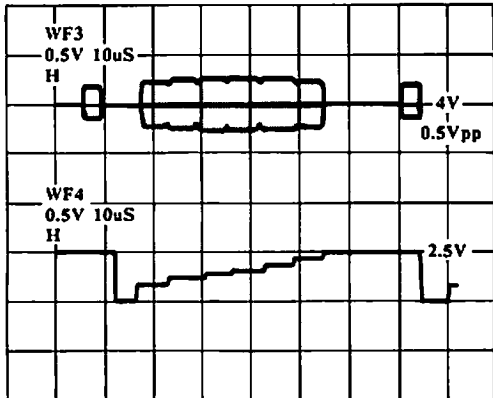
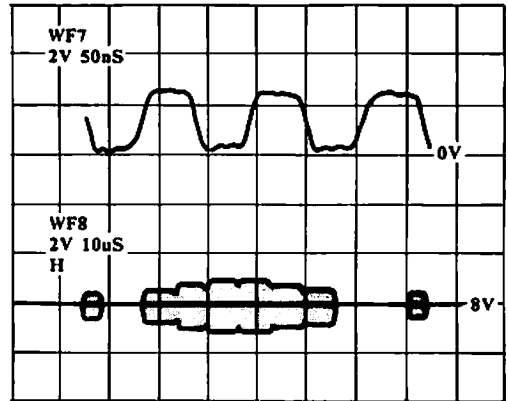
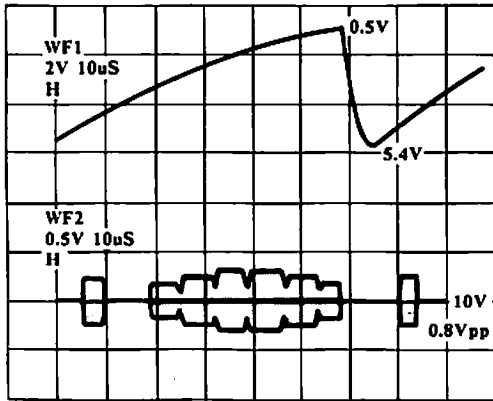


3.12.5-VIDEO BOARD PAL

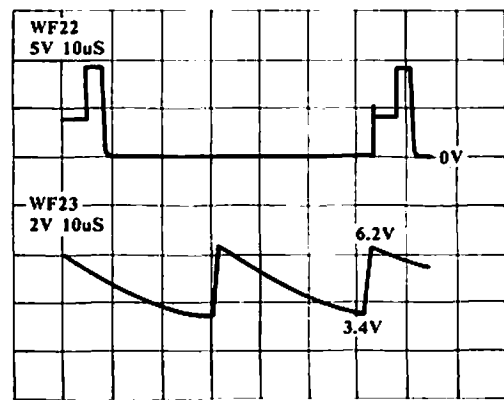
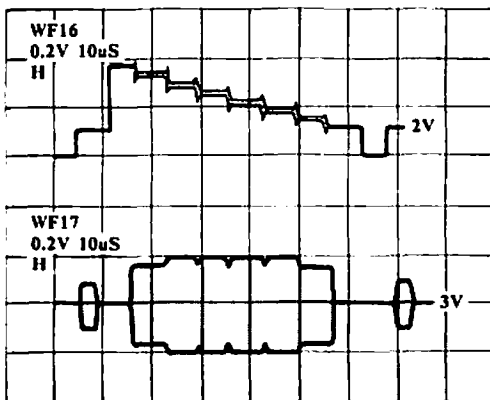
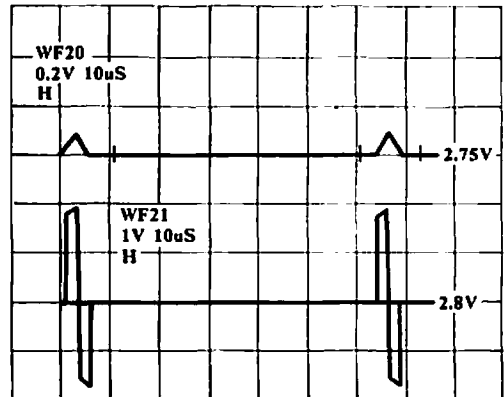
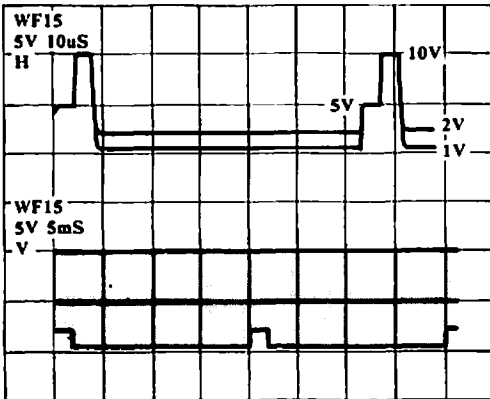
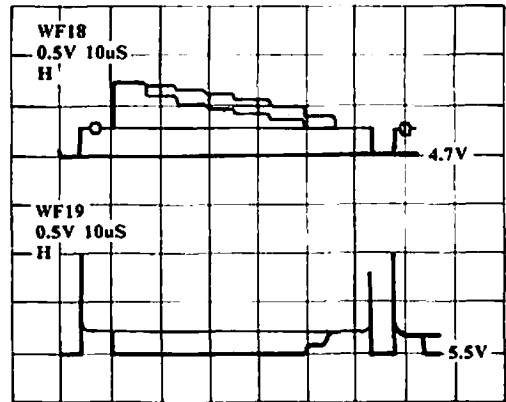
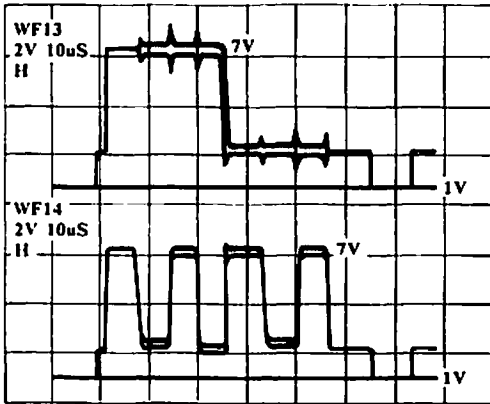




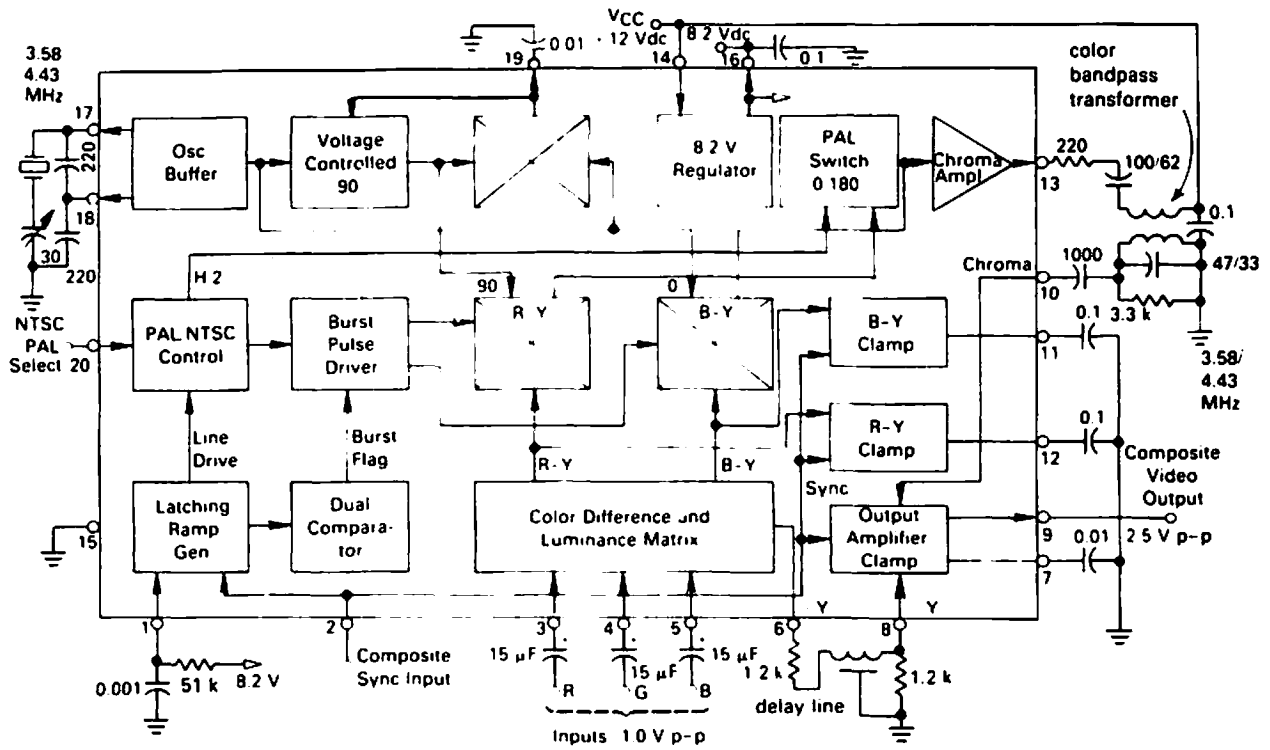
# WAVEFORM DIAGRAMS



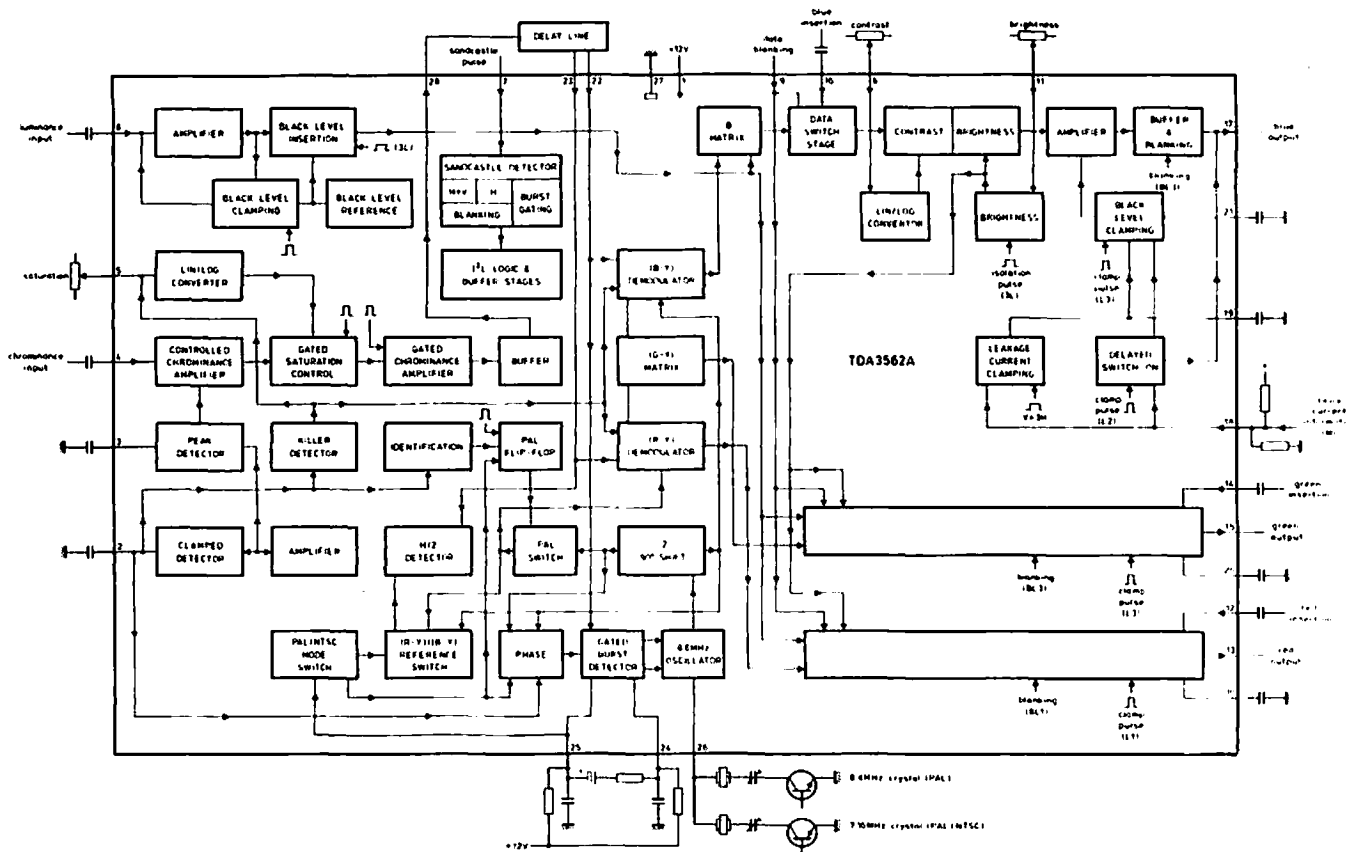
# WAVEFORM DIAGRAMS



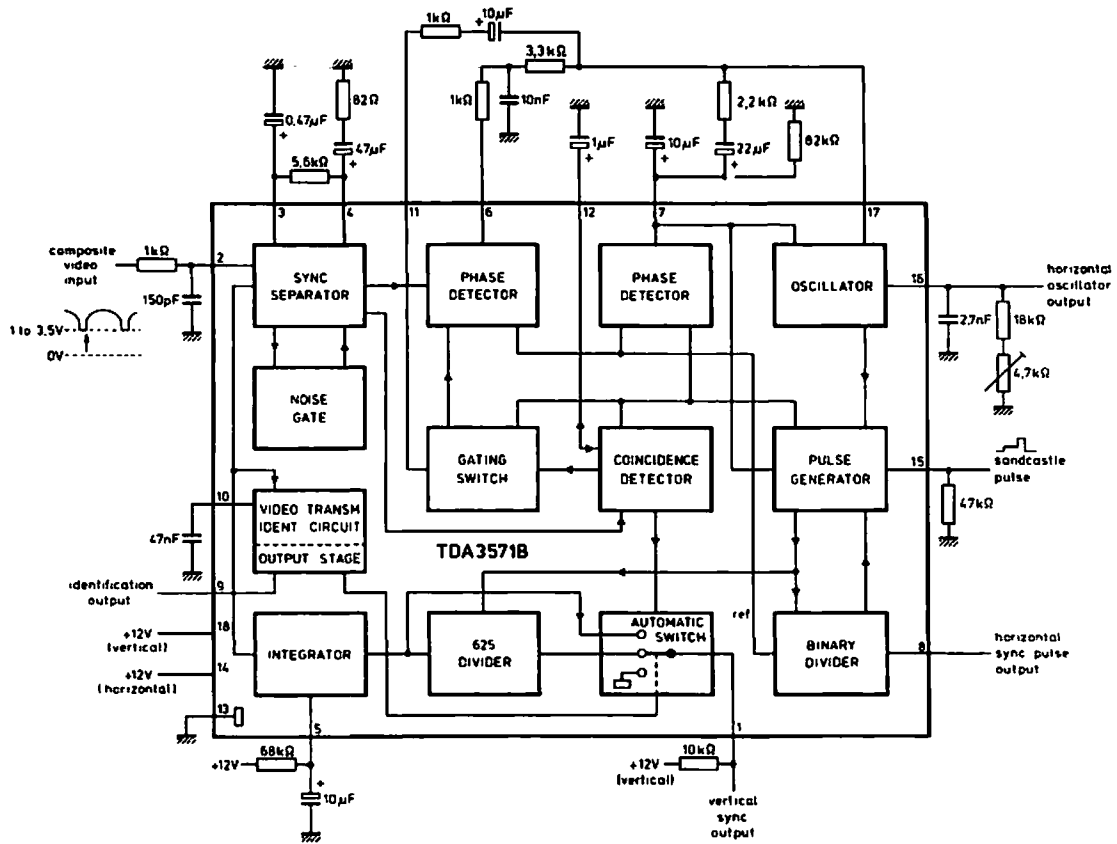
# MC 1377P ENCODER

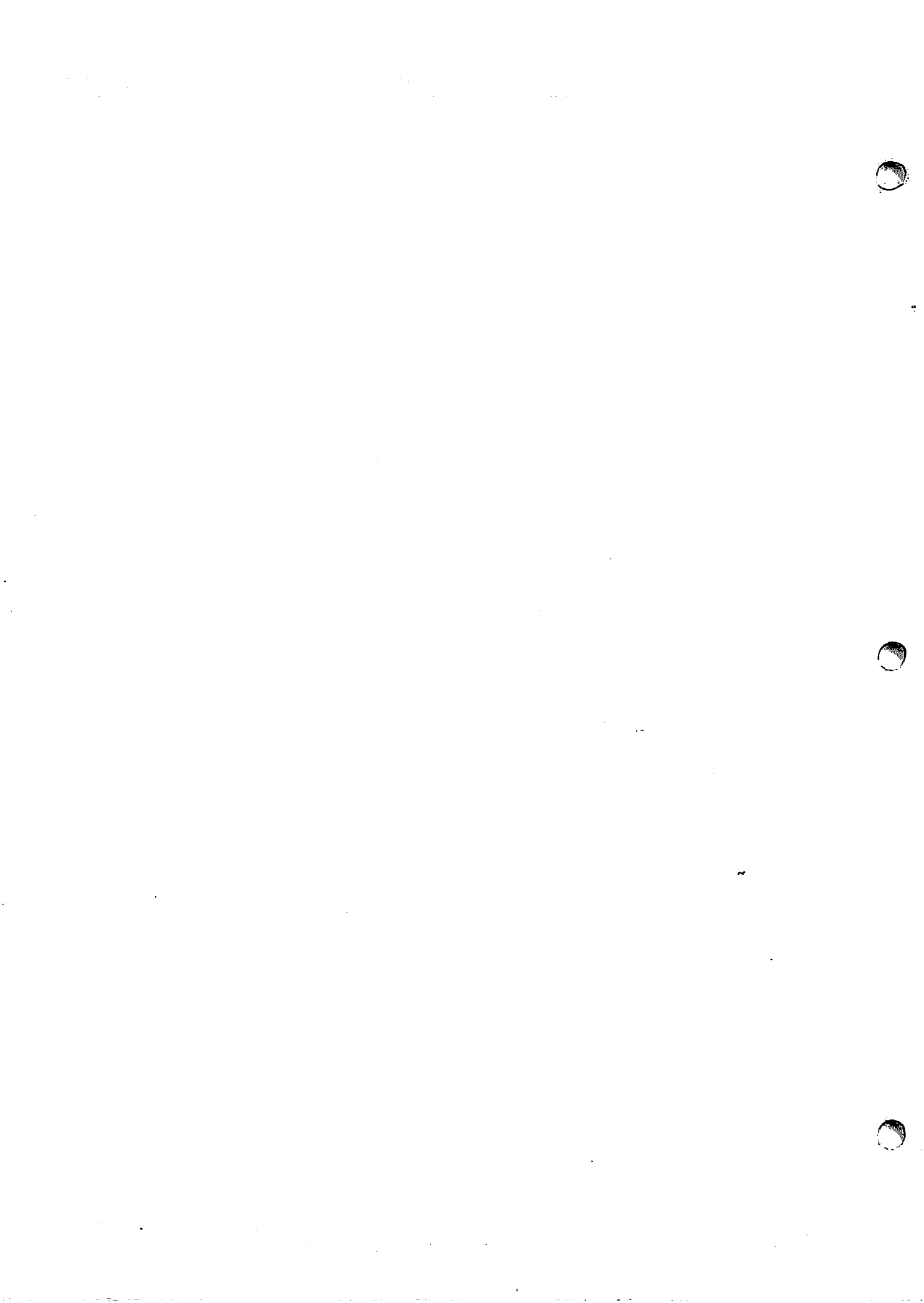


# TDA 3562A DECODER



# SYNC SEPARATOR TDA 3571B





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## CVI-07 CHROMA BOARD DESCRIPTION

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### Introduction

The CVI-07P Chroma Board is designed to provide correct subcarrier and PAL phase locking for CVI-03 rev 4 and rev 4A PAL video boards. It bolts to the side of the video board and attaches to various points by way of six connectors and associated leads.

When the CVI is used in conjunction with a video mixer the chroma and PAL phase on the mixer video input is required to be stable. In this situation the installation of CVI-07P is recommended. In situations where chroma phase and PAL phase are not as important (e.g. a two VCR machine edit suite without mixing effects) there may be no obvious benefit gained from installing CVI-07P.

### Circuit Description

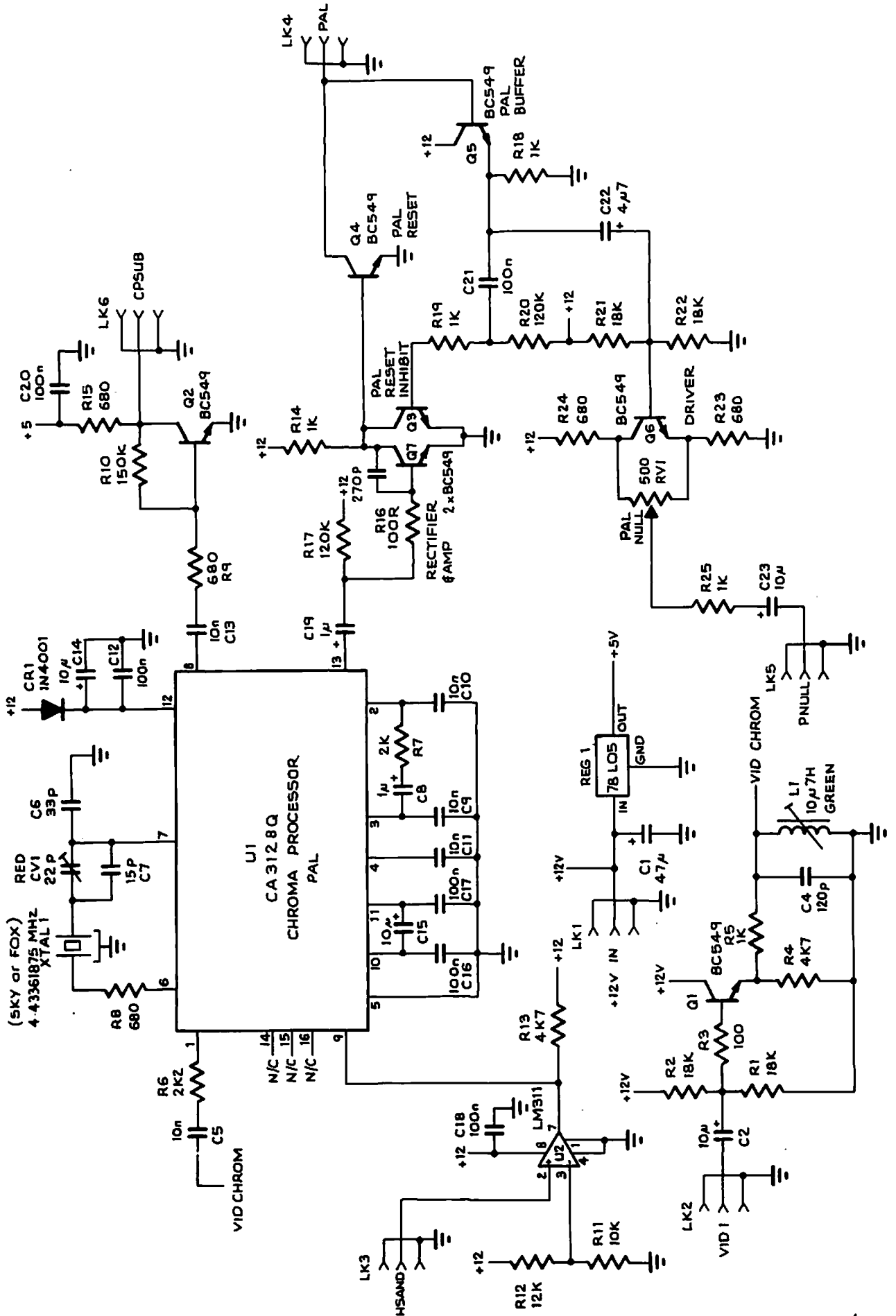
The video signal via connector LK2 from the VIDEO 1 input is buffered by Q1 and filtered by L1 and C4 to provide a chrominance only signal to pin 1 of the chroma-processor U1. A burst gate signal is derived from the sandcastle signal via LK3 by comparator U2 and passed to U1. Using the burst gate and chroma signals the chroma-processor U1 locks a crystal oscillator formed by crystal XTAL1, CV1, C7, C6 to the subcarrier burst frequency. The free-running oscillator frequency is set by CV1. A 1vp-p continuous sinusoidal subcarrier signal is available at pin 8 of U1 and is squared up to TTL levels by Q2 and sent to the Video Board via LK6.

A PAL phase signal is available at pin 13 of U1. The negative going peaks of this signal are amplified by Q7 which provides a reset signal to Q4 if not inhibited by Q3. Q5 buffers the PAL phase signal via LK4 from the encoder IC on the video board. This is amplified by Q3 which inhibits the reset pulse from Q7 whenever the PAL phase from the encoder is high. This is the in-phase condition. If a reset pulse is generated by Q7 when the encoder PAL phase is low (the out-of-phase condition) then Q3 is off and the reset pulse turns on Q4 which pulls the encoder PAL signal via LK4 to 0v, causing the encoder to change the PAL phase. The reset pulse needs to be inhibited during the in-phase condition because the pulse occurs during the burst period and interferes with the normal functioning of the encoder burst generation. Thus resets only occur when the internal and external PAL phases do not match.

Buffer Q6 provides a bipolar PAL phase signal to the encoder R-Y clamp via LK5. The level of this signal can be adjusted accurately through zero by RV1 to allow subcarrier feedthrough nulling within the encoder.

The +12v supply via LK1 from the video board is smoothed by C1. The +11.3v for U1 is supplied by CR1 and smoothed by C12 and C14. The +5v rail is generated by REG1 from the +12v rail.

# CVI-07 CHROMA/PAL GENLOCK



3.15.1 - CVI-07 CHROMA BOARD

*twilight*



## Equipment Required

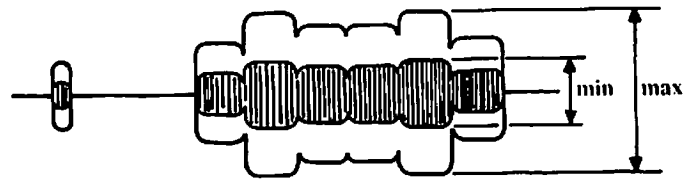
- CVI with calibrated CVI-03P rev 4 or rev 4A and modifications and connections for CVI-07P
- Oscilloscope, dual channel, 100MHz
- Vectorscope (PAL)
- Monitor (PAL composite or RGB)
- Test Signal (Colour Bar) Generator (PAL)
- Frequency Meter (upto 10MHz with 6 digit accuracy)

## Setup

- Refer to the "General Test Setup" section in the CVI Service Manual for connecting test equipment.
- Connect CVI-07 to modified CVI-03.
- Connect PAL Colour Bars signal to VIDEO 1.
- CRO - sweep 100ns div.
  - CH-1 0.5V div, AC, on pin 1 of U1 (CA3128).
  - trigger AC on CH-1.
- Frequency meter - middle pin of LK6.
- Vectorscope - reference and sync CH-A, NTSC display, input CH-B.

## Procedure

With colour bars input and observing CH-1 on the CRO, adjust the inductor L1 so that the chroma signal on pin 1 of U1 is set to a maximum. See following diagram. This sets the centre frequency of the chroma bandpass filter around the subcarrier frequency.



Chroma adjusted to be maximum

## Subcarrier Frequency Adjustment

- Connect CH-1 to the middle pin of LK6.
- Disconnect the signal to VIDEO 1.
- The CH-1 signal should be a TTL square wave (low: <math><0.8\text{v}</math>, high: <math>>2.4\text{v}</math>).
- Adjust CV1 so that the subcarrier frequency is 4.433619 MHz  $\pm$  5Hz.
- Reconnect the video input to VIDEO 1 and check that the frequency is within the above limits.
- Disconnect the signal to VIDEO 1 again and check that the frequency is still within limits. This sets the free-running frequency of the internal subcarrier reference oscillator.

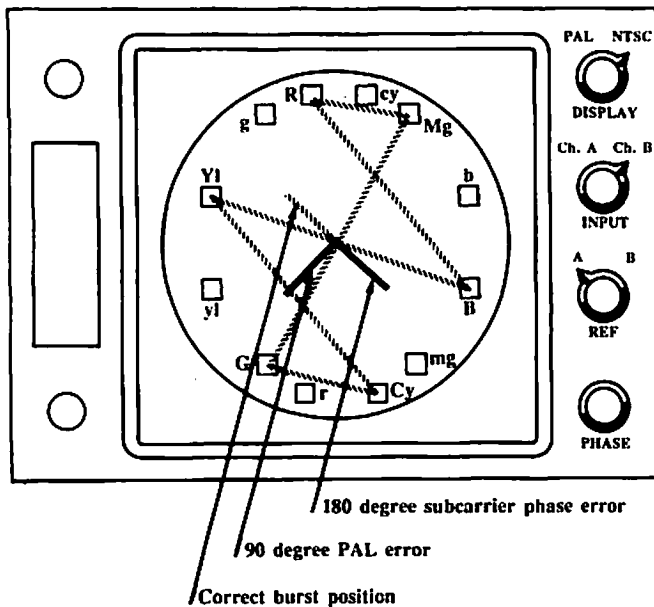
## PAL and Subcarrier Phase (Oscilloscope Method)

- Connect a video signal to VIDEO 1 input.
- Check that the CVI-07 locks to the incoming subcarrier on the vectorscope.
- Check the signal on the middle pin of LK4. This should be a 2Vp-p square wave at half line rate. When the signal to VIDEO 1 is disconnected and reconnected this PAL square wave should be pulled to ground for one or two lines during the burst period (reset pulses). These reset pulses should only occur when there is an interruption to the normal PAL pulse sequence (i.e. at the point when the input is connected or disconnected, glitch off tape signal etc.). No reset pulses should occur when there is no input to VIDEO 1.

# TEST PROCEDURE

## PAL and Subcarrier Phase (Vectorscope Method)

- Connect a PAL colour bar signal to VIDEO 1 input.
- Select CH-B and NTSC display on the vectorscope.
- Check that the CVI-07 locks to the incoming subcarrier on the vectorscope.
- Align the vectorscope and the CVI subcarrier phase so that the burst vectors overlap and are positioned over the top burst mark (see diagram below).

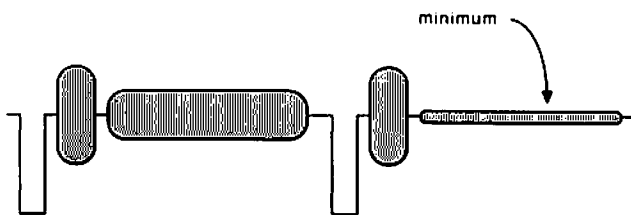


- Disconnect and reconnect the signal to VIDEO 1 several times. The vectorscope display should always revert back to the original display when the signal is reconnected indicating that subcarrier and PAL phase are being detected correctly from the incoming video.
- With an input to VIDEO 1 turn the CVI off and on several times and again check that the vectorscope display aligns correctly.

## SUBCARRIER NULLING ADJUSTMENT

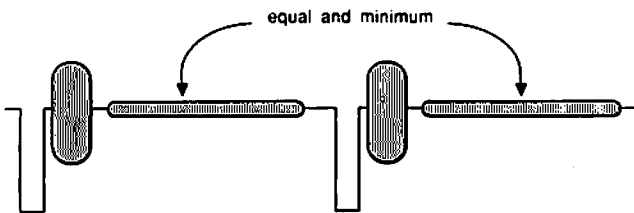
### Procedure

- a) Clear the screen to black using preset 3 with the value control set to zero.
- b) Adjust RV14 and RV15 on CVI-03P to obtain minimum chroma in the picture area on a particular line. See diagram below.



This test procedure checks that the CVI output PAL phase and subcarrier phase are locked to the incoming video signal on VIDEO 1 input. Several PAL reset pulses will be visible on pin 20 of encoder U7 for a short period after the signal to VIDEO 1 input is connected but should not appear at any other time unless there is a disturbance to the PAL sequence on the input signal.

- c) Adjust RV1 on CVI-07P so that any chroma feedthrough on consecutive lines is equal. See diagram below.



- d) Re-adjust RV14, RV15 on CVI-03P and RV1 on CVI-07P to obtain minimum chroma feedthrough in the picture area on consecutive lines.
- e) Select preset 97 and check that the colour bar waveforms on consecutive lines are the same.

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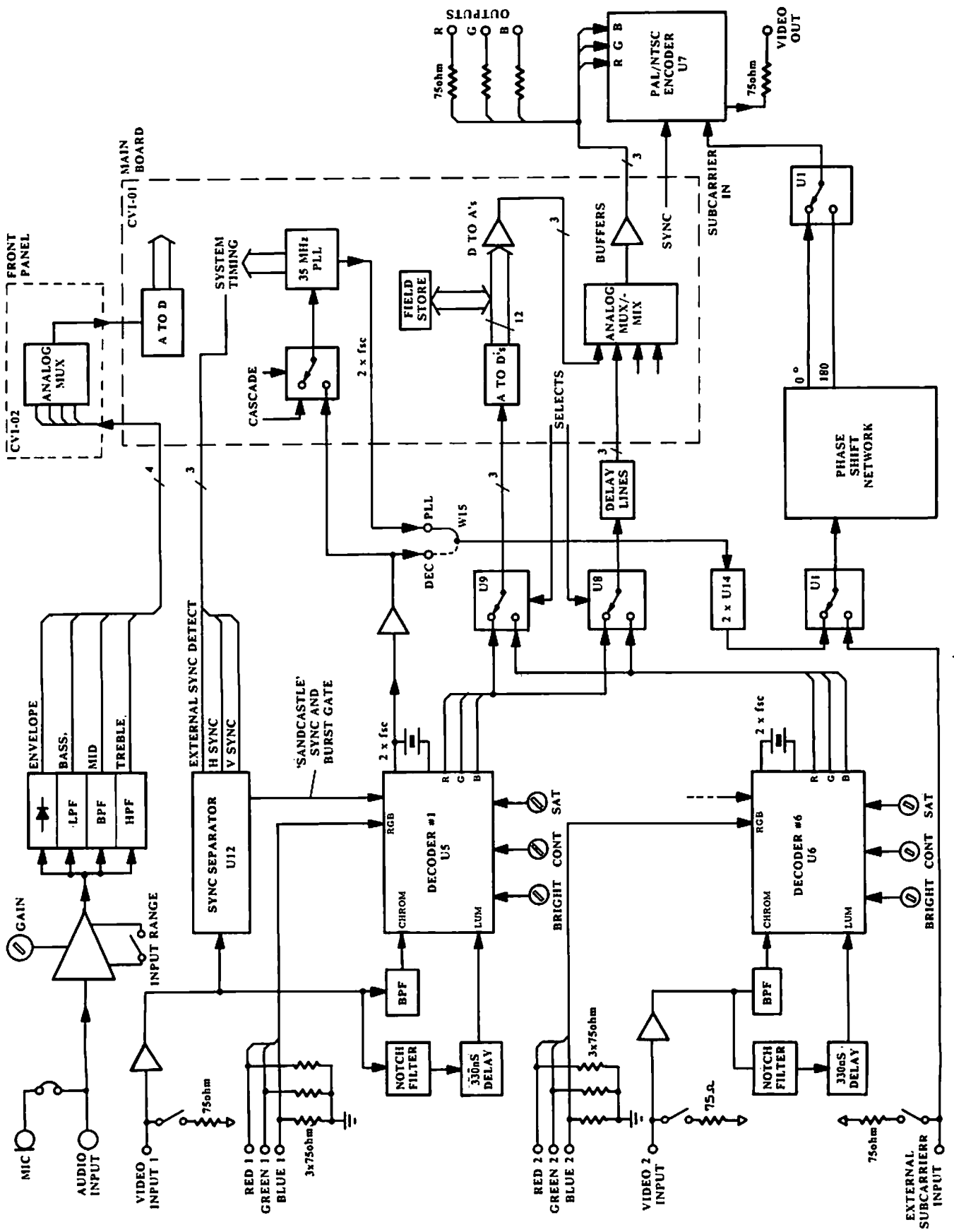
# Video Board – NTSC

4

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# BLOCK DIAGRAM



1. **Audio input** is selected from either the internal microphone or an external source. The external source is selected when a plug is inserted into the audio input jack on the back panel. [CVI03-1]

2. **Audio amplifier** amplifies the selected input signal to levels required by the following filter and detector stages. The gain of the amplifier may be set to low or high using Switch 1 No.1 (SW1/1), and adjusted using the Audio Sensitivity control. [U13,U14, CVI03-5]

3. **Audio analyser** consists of three filters: lowpass (200Hz) for bass, bandpass (400-800Hz) for midrange, highpass (800Hz) for treble. The output of each filter drives an envelope detector, the output voltages of which represent the energy in that particular audio bandwidth. A fourth detector is used to detect the overall envelope. These four signals (0-3.2V) are passed to the analog multiplexer on the front panel and on to the ADC. [U14, CVI03-5]

4. **Sync separator** derives video timing signals from Video 1 input. The signals that U6 generates are:

**External sync detect.** When U12 determines that the external video is absent or poor quality then pin U6/10 goes high, causing the output of U7/7 to go high. With acceptable external video present U6/10 goes low, resulting in a low output from U7/7. This signal is used on the main board to select the appropriate timing signals. It is also used to turn on the FET Q12 when external video is absent. This prevents the PAL decoder U4 from trying to lock its crystal oscillator to any noise on the video input and stabilises the crystal running frequency.

**Vertical sync.** When acceptable external video is present U6/1 outputs positive going vertical

sync pulses which are buffered by U12/5,6. When no external video is present these pulses are inhibited.

**Sandcastle. (Horizontal Sync and Burst Gate)** U12/15 produces a positive going, multilevel pulse. The lower level provides Hsync timing and the higher level provides burst gating. Comparator U8 detects H.sync from the sandcastle for the main board timing. A vertical blanking signal (SBLANK) from the main board is added to the sandcastle signal by R142 and D2. The resultant signal is used by the decoders U4 and U5.

IC U9 buffers the sandcastle signal to the decoders.

Internally the 2575 consists of:

a. A sync separator that samples the input video black level on U6/4, R120, C94 and generates a sync slicing level proportional to the input sync amplitude via R121, U6/3. A two times H frequency oscillator whose frequency is set by C125, R134, VR5 and the voltage on pin 15 and which is phase locked to the external video H via the RC networks on U6/7,9 and 6. The response time of the phase lock loop is made slow or fast (depending on whether the oscillator is locked or not) by clamping or open circuiting U6/9.

b. A vertical sync integrator and detector, U6/5, R127, C91.

c. A 625 line divider, coincidence detection and signal switch which is used to generate the vertical sync output in two different ways depending on the quality of the external video. The Vsync can be generated internally by the divider or taken from the external sync integrator.

For more detailed information refer to the Philips publication "Bipolar ICs for video equipment, 1983." [U6, TDA 2575], (CVI03-4)

## BLOCK DIAGRAM DESCRIPTIONS

5. Video input buffers consist of emitter followers Q13 and Q16 buffer the video 1 and 2 inputs. Their outputs drive the bandpass and notch filters for the two decoder ICs. Q13 (input 1) also provides the video signal to the sync separator U6. [CVI03-2 and 3]

6. Notch filter removes the colour subcarrier (3.58MHz) from the composite video signal. The remaining luminance information at the output is passed to the decoder via the 330nS delay lines. [L6,C51,L15,C79,C68], (CVI03-2 and 3)

7. Bandpass filter passes only the colour subcarrier component of the incoming video signal to the chrominance input of decoder. [L4,C49,L5,C77], (CVI03-2 and 3)

8. 330nS delay line in the luminance signal path compensates for the delay of the chrominance signal through the bandpass filter and the decoder. This ensures that the two signals remain synchronised. [CVI03-2 and 3]

9. Decoder 1 generates red, green and blue (RGB) signals from the composite video 1 input. Synchronisation is taken from the sync separator (4). The decoder output is either the direct RGB signals from RGB input 1 or the RGB signals decoded from composite input 1, depending on the position of SW1/8.

The crystal on U4/26 runs at twice the colour subcarrier frequency. It locks to the external video subcarrier if present or free runs if no video is present. The signal from the crystal is also passed to the subcarrier amplifier for use by the digital board and the encoder. To prevent noise on video 1 input line affecting the operation of the crystal oscillator when no external video is present, the FET Q12 is used to short U4 pins 24 and 25 together. This disables the gated burst phase detector that controls the crystal oscillator.

The 'Hue' trimpot VR8 controls the phase of the reference drive to the burst phase detector in the TDA 3562 by varying the voltage at pins 24 and 25 between 7.5V and 8.5V. The RGB outputs from the TDA 3562 are intended to drive the RGB gun drive transistors of a TV set and so have an automatic "black level" control input pin U4/18.

Resistors R68,R69,R70 and R71 are used to maintain the RGB outputs at the correct DC level. The colour saturation control pin U4/5 is bidirectional. When colour video is present it is an input controlled by the SAT. pot VR11, and can be forced low to kill colour by jumper LK4. When there is insufficient colour burst on the external video the TDA 3562's colour killer circuit pulls pin 5 low, but it may be forced high by jumper W1 to "unkill" colour.

The output (U4/28) to the phase splitter Q10 contains chrominance information only. The complementary signals from Q10 are passed via pins 22 and 23 to the chrominance demodulators in the TDA 3562. Q11 provides a constant current sink on the Q10's emitter. In the signal on pin 28, the burst is at a constant level and the level of the picture chrominance is variable, controlled by the saturation input pin U5/5, and the kill/unkill jumper LK4.

10. Decoder 2 generates red, green and blue (RGB) signals from the composite video 2 input. Synchronisation is taken from the sync separator (4). The decoder output is either the direct RGB signals from RGB input 2 or the RGB signals decoded from composite input 2, depending on the position of SW1/7. [U5, TDA 3562], (CVI03-3)

11. Picture controls Decoders 1 and 2 have separate brightness, contrast and saturation control pots, which vary the control voltages to pins 11,6 and 5 of the decoders. If direct RGB inputs are selected to the decoders only the



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## BLOCK DIAGRAM DESCRIPTIONS

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brightness and contrast controls will affect the decoder outputs. [CVI03-2 and 3]

12. Video source multiplexers select the inputs to the digital and analog paths through the CVI. Each path may take its input from the RGB outputs of either Decoder 1 or Decoder 2. The selection is made using two control lines from the digital card, ASEL1 and ASEL2. These TTL signals are buffered to 12V levels by open collector gates U12/1 and 3. When ASEL1 and 2 are low decoder #1 RGB outputs are selected, and when high Decoder #2 outputs are selected. [U10,U11, CVI03-4]

13. 660nS delay lines at the start of the analog path compensate for the delays caused by digitising and processing on the digital path. The delay ensures that picture information sent through the two paths retains horizontal registration. [L7,8,9,10,11,12], (CVI03-4)

14. Frequency divider halves the frequency of the twice-subcarrier signal from the phase-locked loop or Decoder 1. Its output provides the internal subcarrier reference to the phase shifter for use by the encoder. [U1, CVI03-1]

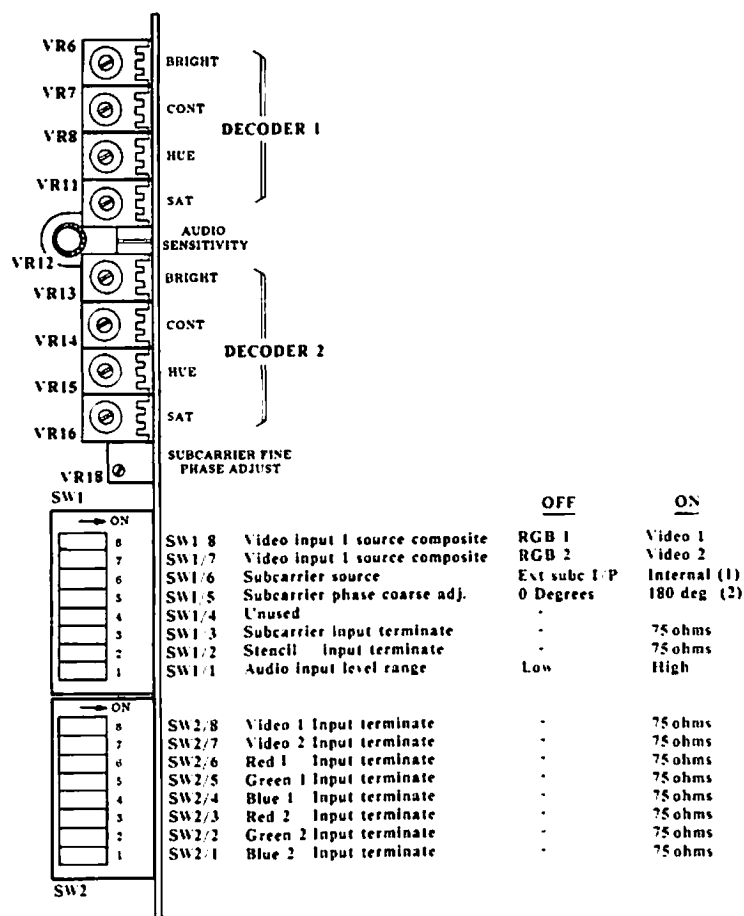
15. Subcarrier phase shifter takes its input from either the External input or the frequency divider, depending on the position of SW1/6, which provides the SUBSEL signal to U15. SW1/5 provides a coarse phase shift of 0 or 180 degrees by selecting the Q or NOT Q outputs of U16/5,12. The subcarrier trimmer VR5 allows fine adjustment by varying the pulse width from the other half of U16. Together these give a full 360 degree range. Transistors Q4, Q25 and filter L2, C122 and C120 convert the rectangular output of the phase shifter to a constant level sine wave. This is passed to the encoder subcarrier input via VR17 which sets the correct level required by the encoder IC. [U15,U16], (CVI03-5)

16. Encoder generates a full composite PAL colour signal from RGB, composite sync and subcarrier inputs. The output (pin 9) can directly drive a 75-ohm cable. The RGB inputs are capacitively coupled. Clamping is done on various signals in the MC1377 using external capacitors C7, C8, C9 and C10. Trimpots VR2 and VR3 vary the bias current to the R-Y and B-Y clamp pins and are used to null the amount of residual colour carrier in black. VR4 varies the bias to pin 19 which alters the phase of the R-Y modulator. These adjustments require the use of a vectorscope. The MC1377 contains a ramp generator running at horizontal line rate, which is used to set the burst position in the output video. The slope of the ramp (and the burst position) is determined by VR1, R20 and C12 connected to U2/1. U2/16 is an 8.2V reference output voltage used as a stable source for the ramp generator. The bandwidth of the chroma signal generated by the MC1377 is limited by the bandpass circuit (C13, L1, C130) between U2 pins 13 and 10. This delays the chroma by about 350ns and so the luminance must also be delayed by the same amount. This delay is provided by L2 between pins 6 and 8 of U2.

The composite sync signal to U7/2 is derived from the digital board. The subcarrier input U7/17 comes via the phase shifter from either external or internal sources.

For more information, refer to Motorola's "Application of the MC1377 Colour Encoder". [U2 MC1377], (CVI03-1)

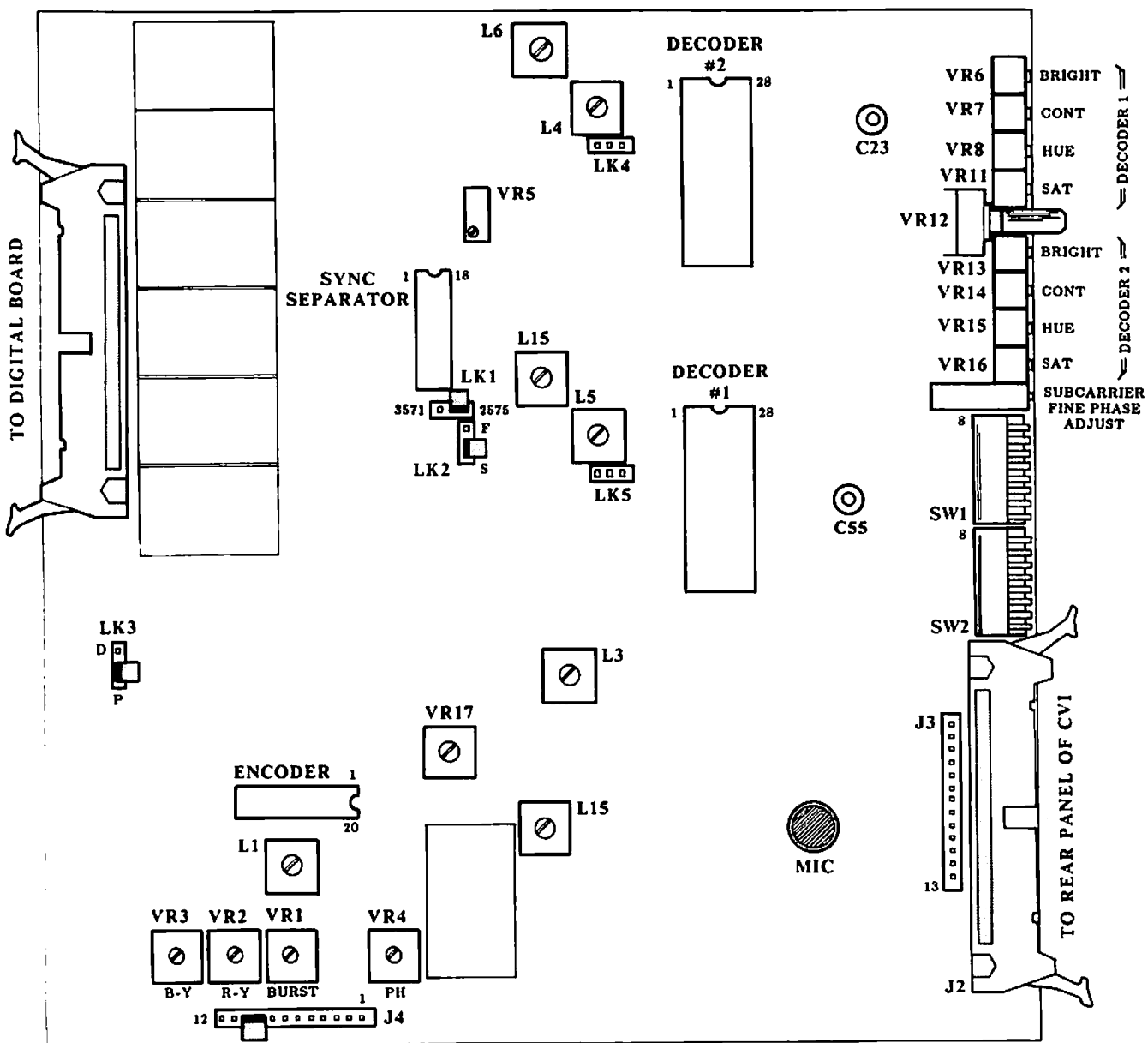
# OPERATING CONTROLS



## Notes

- (1) The internal subcarrier is frequency (but not phase) locked to the VIDEO 1 input if video is present on it.
- (2) SW1/5 selects a phase shift of zero or 180 degrees. Using it and the phase fine adjustment trimpot, the video output subcarrier phase may be adjusted from 0 degrees to 360 degrees relative to the reference subcarrier.

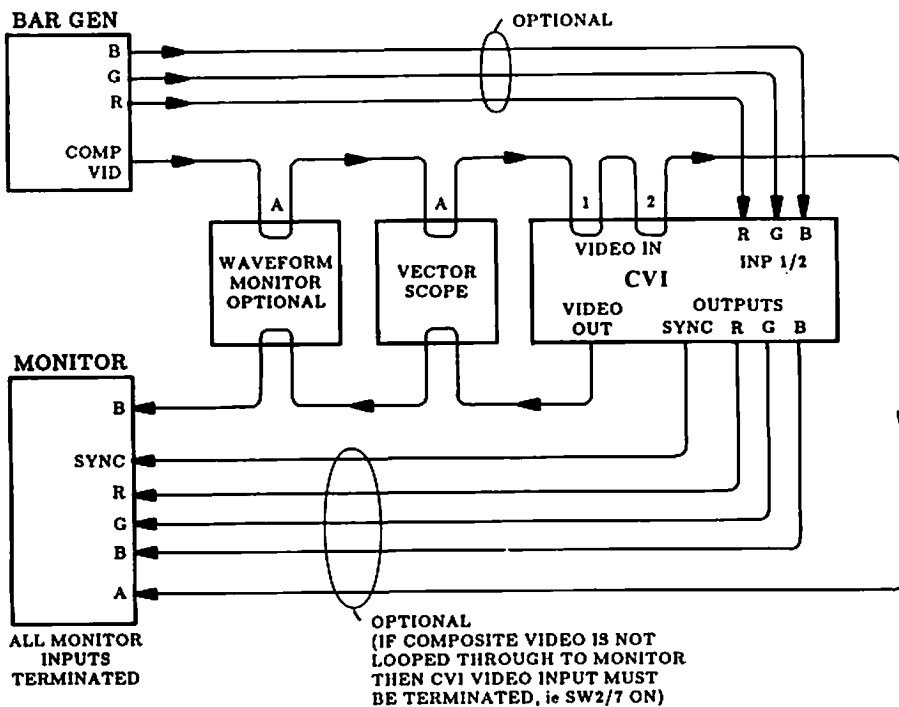
# LOCATION OF SERVICE ADJUSTMENTS



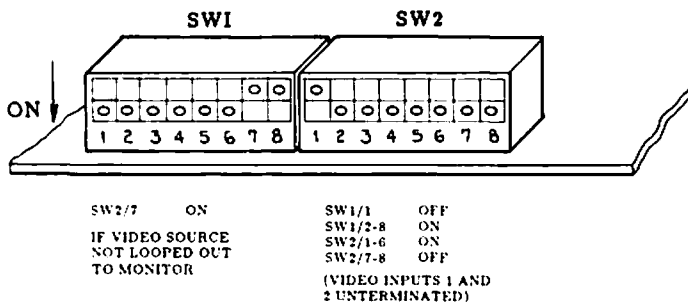
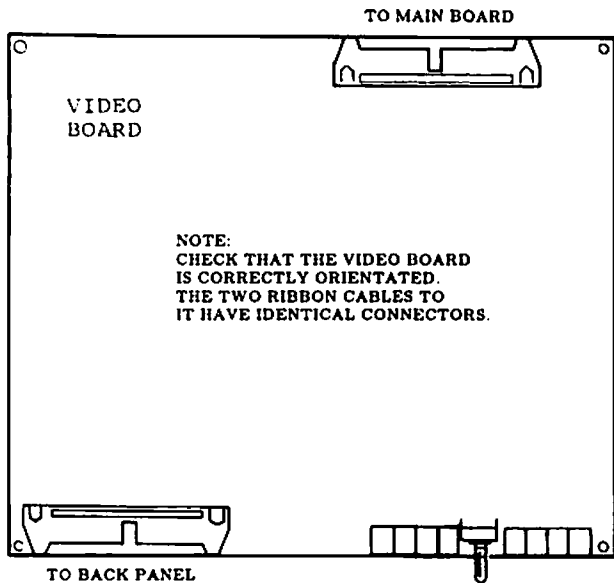
## EQUIPMENT REQUIRED

- a) 100MHz dual channel oscilloscope.
- b) 6 to 7 digit 100MHz frequency meter.
- c) NTSC Vectorscope.
- d) NTSC 100% colour bar generator.
- e) NTSC composite video monitor with RGB inputs.
- f) NTSC waveform monitor (optional).
- g) CVI system (main board, front panel, cables, etc.)

## GENERAL TEST SETUP AND PROCEDURE



# GENERAL TEST SETUP AND PROCEDURE



The diagram above shows original settings of SW1 and SW2

## Jumper link settings (NTSC)

LK1 - 2575  
LK2 - S  
LK3 - D  
Link J4 - Pins 9 and 10

## General procedure

Due to the interactions between adjustments on the board, the following sequence of operations is recommended:

- 1) check and adjust sync separator
- 2) check operation of subcarrier amplifier
- 3) set free run frequency of subcarrier crystal
- 4) check that main board PLL locks to subcarrier
- 5) check and adjust subcarrier phase shift chain
- 6) check and adjust video encoder
- 7) check and adjust decoder #1
- 8) check and adjust decoder #2
- 9) check RGB inputs and outputs
- 10) check audio input

---

## PRESETS USED IN SEVICING

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The CVI PRESETS allow the internal state of the CVI to be quickly restored to a predefined condition. For a full description refer to the operation manual.

Only a few of the 100 presets available need to be used while servicing the videoboard. They are:

- 00 Selected at power on, displays the Fairlight logo
- 95 Video 2 through
- 96 Video 1 through
- 97 Internal colour bars

The preset number currently selected is displayed on the front panel LED display. To change the preset number, press the PRESET key followed by two number keys.

For example, PRESET 9 5 for preset 95.

If the CVI has been in use it is possible that these presets have been changed by the user. In this case reset the above presets. Refer to the "RESET PRESETS" section of the user manual.

---

## DETAILED DESCRIPTION OF PRESETS

---

The effects and uses of these presets are as follows:

00 At power on, the Fairlight logo is drawn (in colour) in the CVI video RAM and stencil. If video is present on the Video 1 input the CVI locks to it. The Video 1 image is converted to analog RGB by decoder 1, then passed via mux U9 to the analog path on the main board. Simultaneously, the image in the RAM is read out and converted to analog RGB. The RAM image (the logo) and the incoming video are combined by the analog video MUX/MIX and then passed through buffers to the CVI RGB outputs and composite video encoder.

This preset is used while testing the sync separator, main subcarrier oscillator, subcarrier amplifier, MUX U9 and the phase shifter circuit.

95 Video input 2 through. The CVI locks to Video 1 input, and passes the Video 2 input through the analog path, i.e. decoder #2, MUX U8, delay lines, main MUX/MIX/buffers, RGB outputs and encoder.

This preset is used to test decoder #2.

96 Video input 1 through. The same as 95, but uses decoder #1.

This preset is used to test decoder #1.

97 Internal colour bars. The CVI locks to Video 1 input if present, but uses the RAM as the sole colour source. The processor writes a "colour bars" image to the RAM. The video route is - RAM, D to A's, MUX/MIX, buffers, encoder.

This preset is used to test and align the encoder.

---

# ALIGNMENT PROCEDURE

---

## CONTENTS

Subcarrier amplifier .....	4.8.1
Subcarrier crystal frequency .....	4.8.1
Subcarrier locking .....	4.8.1
Subcarrier phase shifter .....	4.8.2
RGB Sync and stencil outputs .....	4.8.2
Video encoder .....	4.8.3
Decoder #1 and #2 .....	4.8.4
RGB inputs .....	4.8.5
Audio inputs .....	4.8.6
Operating adjustments .....	4.8.6



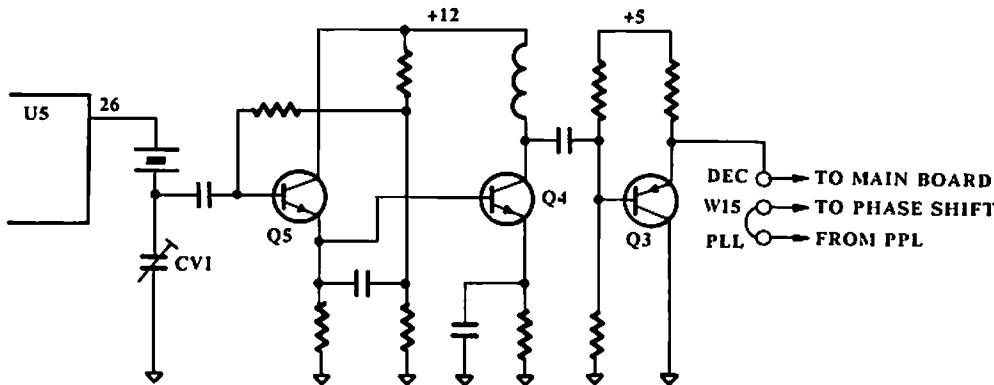
# ALIGNMENT PROCEDURE

NOTE: TTL levels implies a high (or 1) to be above 2.5V and a low (or 0) to be below 0.8V

## Subcarrier amplifier

The crystal oscillator of the video 1 input decoder is used as the master frequency reference  $2F_{sc}$  and locks to the video input subcarrier if video is present, or free runs if video is absent.

Transistors Q7, Q8 and Q9 amplify the low level signal from the crystal to TTL compatible levels.



Check the waveform at the D pin of LK3 for correct TTL levels, both with video applied to Video 1 input and with Video 1 disconnected.



## Subcarrier crystal free run frequency Setup

Connect the frequency meter to the D pin of LK3. Disconnect Video 1 and Video 2 inputs. Terminate Video 1 and Video 2 inputs (SW2/7, SW2/8). Adjust trimcap C23 for a frequency of 7.159090 MHz.

## Subcarrier locking Setup

- Link LK3 to "P".
- CRO - sweep 100nS/div.
- CRO - CH1 2V/div. on D pin of LK3.
- CRO - CH2 2V/div. on U1/9 ( $2F_{sc}$  divided by 2)
- CRO - trigger on CH1.
- Colour bars to Video 1 input.

The signal on CH2 should be a TTL square wave at 1/2 the frequency of CH1, and in steady phase lock.

# ALIGNMENT PROCEDURE

## Subcarrier phase shifter

This circuit is used to adjust the phase of the output video subcarrier relative to the input video subcarrier. A full 360 degrees range is possible using the coarse adjust switch and fine adjust trimmer.

The subcarrier source is selected (via U15) from either the external subcarrier input, or the Video 1 input decoder divided by two. Dual monostables U16 and trimpot VR18 provide the fine phase adjustment. One of the two outputs from U16 (0 or 180 degrees) is selected by U15 and SW1/5 and passed via the subcarrier filter L2 and level control VR17 to the encoder.

## Setup

### CRO

- Sweep 100ns/div
- Trigger on CH1
- CH1 1V/div, on U15/14 (4053, selected subcarrier)
- CH2 1v/div, on U2/17 (subcarrier input to encoder)

## Procedure

To test the external subcarrier input amplifier, connect subcarrier to the input and check that the signal appears on CH1 when SW1/6 is off.

With SW1/6 on, set VR17 to midrange and adjust L2 for maximum amplitude and cleanest waveform at U7/17 (CH2). Next adjust the level pot VR12 for 0.75Vp-p at U2/17. The allowed range is 0.5Vp-p to 1Vp-p.

Check that SW1/5 moves the phase of U2/17 (CH2) by 180 degrees relative to U5/14 (CH1), and that VR18 also varies the phase.

Alternatively, if the rest of the board is working, supply colour bars to input 1, synchronise the vectorscope to the bar generator, select Preset 97 and view the CVI output on the vectorscope. Check that the CVI output burst can be rotated through 360 degrees using the coarse and fine phase controls.

**Note:** The division by two of the 2 x Fsc crystal oscillator on decoder 1 introduces a 0/180 degree ambiguity to the output subcarrier relative to the input subcarrier. Hence full colour lock cannot be guaranteed.

## RGB, sync and stencil outputs

The RGB lines come directly from the main board, while the SYNC and STENCIL signals are generated on the main board and buffered by Q1 and Q2 on the video board.

Check these before proceeding to the encoder.

## Setup

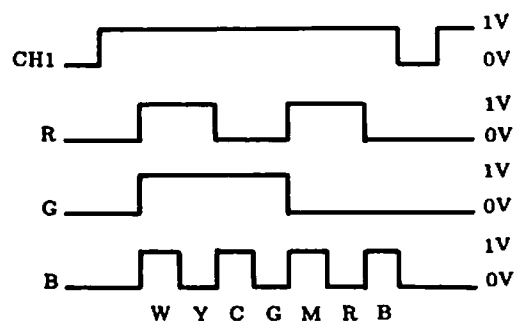
- Select preset 97 (internal colour bars)
- If your monitor has RGB inputs, connect the CVI's RGB and SYNC outputs to the monitor.

Check for a clean and correct colour bars image.

## Otherwise -

- CRO - Sweep 10uS/division.
- CRO - CH1 0.5V/division. On SYNC OUT signal (with 75 ohm termination).
- CRO - CH2 0.5V/division. On R/G/B signal out (with 75 ohm terminations).
- CRO - Trigger on CH1, TV H sync.

Check for signals as indicated below:



Turn the CVI OFF. Wait for 5 or more seconds and turn ON, to obtain the startup logo.

Check that the STENCIL output is 1V p-p into 75 ohms. The signal will not be regular or coherent.

# ALIGNMENT PROCEDURE

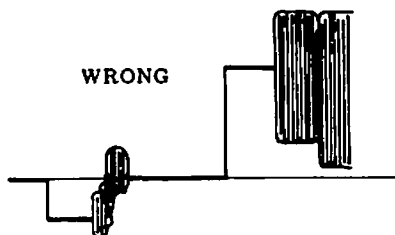
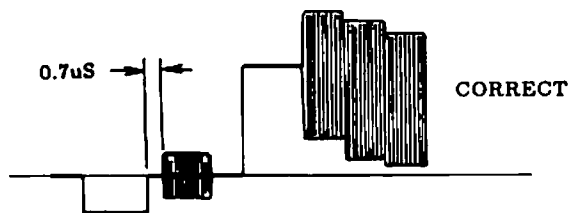
## Video encoder

The NTSC encoder IC U2 takes RGB, subcarrier and sync inputs and generates composite colour video. Refer to page 4.14 for MC1377 block diagram.

## Setup

- Preset 97 (internal colour bars).
- Select the CVI composite video output on the monitor, vectorscope and waveform monitor or CRO.

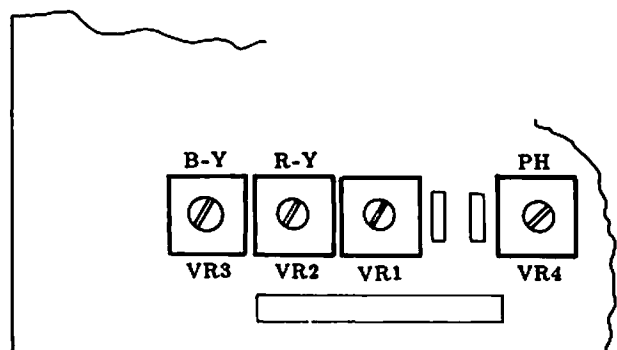
Adjust VR1 for correct colour burst position on the front porch as indicated below.



Adjust L1 for the straightest possible lines between colour points on the vectorscope.

Adjust VR4 pot for symmetrical vector display (U2/19).

Adjust VR2 (U2/12) and VR3 (U2/11) pots for minimum chroma on sync and front and back porches. Alternatively adjust these pots so that the central point of the vector display is centred on the grid.



Check the colour bars on the monitor for correct colour and hue.

# ALIGNMENT PROCEDURE

## Decoder #1 and #2 - TDA 3562

The NTSC decoder IC's U4 and U5 convert composite colour video to analog RGB signals. They require a multilevel "sandcastle" sync input signal for burst sampling, H syncs, etc. The external RGB inputs are processed and switched by the decoders also. Refer to the TDA 3562A block diagram on page 4.14

### General Decoder Setup

- View CVI RGB outputs on monitor. Alternatively, view CVI composite video out.
- 100% Colour bars to input 1 and 2.
- Brightness to minimum, saturation to mid range, contrast to maximum on both decoders.
- CRO - Sweep 10uS/division.
- CRO - CH1 0.5V/division on Video 1 input.
- CRO - Trigger on CH1, TV horizontal.

### Decoder #1 setup

- Preset 96 (video 1 through).
- Set VR8 (HUE) to midrange.
- CRO - CH2 0.5V/division

The crystal oscillator free run frequency should have been set previously. See SUBCARRIER FREQUENCY section if frequency needs to be reset.

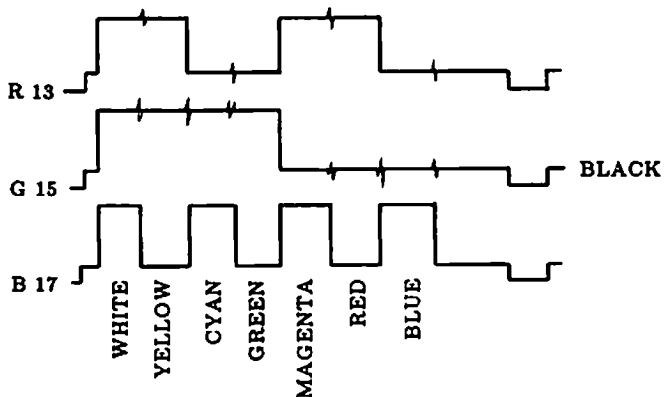
Connect CH2 to U5/4. Adjust L4 for maximum chroma amplitude.

### Setup

CRO - CH2 2V/division. On U4 pins 13,15,17 alternatively.

Adjust VR6 for correct hue, waveforms similar to below.

i.e., U4 pin

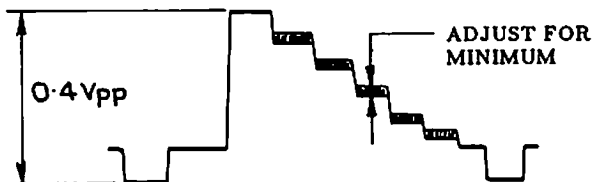


The aim is to get the tops and black levels of each waveform all lined up (equal levels).

Brightness and saturation controls also affect these waveforms.



Connect CH2 to U5/8. Adjust L4 for minimum chroma on the luminance signal.



# ALIGNMENT PROCEDURE

## Decoder #2 setup

- Preset 95 (video 2 through).
- Set VR15 (HUE) to mid range.
- CRO - CH2 0.5V/division.

Adjust CV55 to the middle of the range in which colour appears on the screen. Remove video input 2, then put it back, checking that colour reappears when it is replaced. If not, readjust CV55.

Connect CH2 to U5/4. Adjust L5 for maximum chroma amplitude.

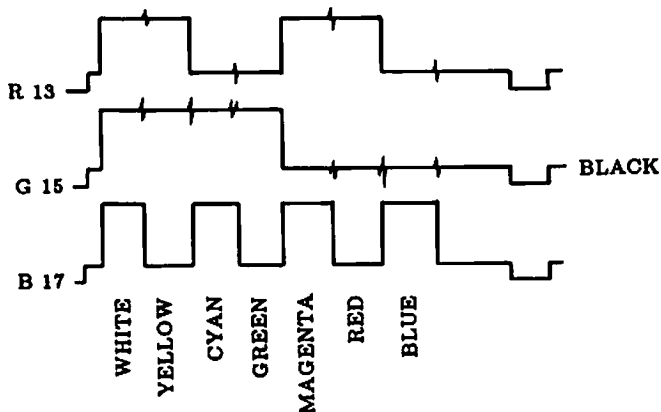
Connect CH2 to U5/8. Adjust L15 for minimum chroma on the luminance signal.

## Setup

CRO - CH2 2V/division. On U6 pins 13,15,17 alternatively.

Adjust VR8 for correct hue.

i.e., U5 pin



The aim is to get the tops and black levels of each waveform all lined up (equal levels).

Several iterations may be required to get the best results.

## RGB inputs

These are analog RGB inputs to the decoder chips U4 and U5. SW1/8 and SW1/7 select either RGB or composite on decoder #1 (U4) and decoder #2 (U5) respectively. See VIDEO CARD OPERATING CONTROLS.

### To check RGB 1 inputs -

View CVI composite or RGB video output on monitor.

Select preset 96 (Video 1 through).

Apply colour bars to video 1 input.

Turn SW1/8 OFF. The colour bar output from the CVI should disappear (become black).

If the bar generator has RGB outputs, connect them to the CVI RGB 1 inputs and check for correct bars output from the CVI. Otherwise, loop the composite video bars signal through to the RGB 1 inputs one at a time and check for R,G and B images out of the CVI. Note that there should be only one termination on the video input, so either the RGB inputs or the video input should be unterminated.

### To check RGB 2 inputs -

Select preset 95. (Video 2 through)

Apply colour bars to Video 1 and loop through to Video 2.

(Only terminate Video 2.)

Turn video board switch 1/7 OFF. The colour bar output from the CVI should disappear (become black).

Apply RGB bars or composite video to the RGB 2 inputs while observing the CVI output as for the decoder #1 procedure above.

# ALIGNMENT PROCEDURE

## Audio input

The audio input circuit consists of op amp U13 with a high or low gain selected by SW1/1, followed by the sensitivity pot VR12. The internal microphone or an external line level input are selected automatically by the external input socket. The signal is passed to a peak detector, a low pass filter, a band pass filter and a high pass filter, giving Envelope, Bass, Mid and Treble signals. These are sent to the multiplexer on the front panel to be digitised.

The audio analyser can be tested either by observation on a CRO, or by use of the CVI Testing ROM software (see your distributor).

### Setup

- Set the audio sensitivity pot VR12 to 3/4 (clockwise).
- Set SW1/1 ON.

### Quick check

Using either an external microphone plugged into the AUDIO INPUT jack on the back of the CVI, or the internal microphone MIC1 on the video board, check that sounds picked up by the microphone affect the voltage levels at the test points on the video board.

Connect a line level (200mV pp or greater) music source to the external input jack. Adjust the audio sensitivity pot VR12 for optimum response.

### Detailed check

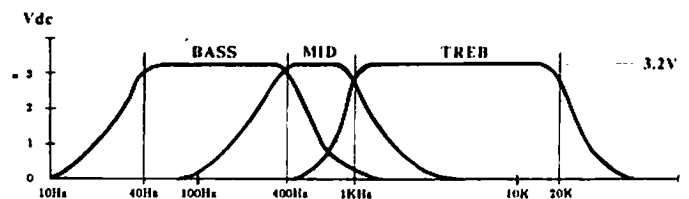
#### Equipment required

- Audio oscillator
- DC voltmeter
- Oscilloscope

### Setup

- Disconnect the back plane to video board ribbon cable from P1 on the video board.
- Connect the audio oscillator sine wave output to the video card AUD input at P2/7 and adjust the level to 1V pp (keep constant for all measurements).
- Set SW/1 on.
- Adjust the SENS pot VR12 for 7V pp at U14/1 (just less than the level at which the signal clips on the positive peaks) with a 1kHz input signal.

- While varying the input frequency and observing the DC voltages at the BASS, MID and TREB test points, check that the filter characteristics are approximately as follows.



### Operating adjustments

These consist of the ten pots and sixteen switches on the edge of the video board.

To adjust the video control pots -

Select Presets 96 and 95 alternately.

Connect colour bars to Video inputs 1 and 2.

View the output of the CVI on the monitor Flip between Presets 96/95 (external video) and Preset 97 (internal bars).

Adjust the Brightness, Contrast, Hue and Saturation controls so that the CVI internal colour values (Preset 97) match the external video range (Preset 96/95). For example, the two white values should be equally bright, etc. This may have to be adjusted for various source material.

The video/RGB/stencil and subcarrier termination switches should be set ON for the signal cables that terminate at the CVI, and OFF for those that are looped through the CVI.

The fine phase adjust and audio sensitivity pots are set depending on the installation.

# TEST CHECKLIST

Notes 1. The tests for each section should be carried out in the CVI Preset indicated.

2. The components to be adjusted in each test are indicated in square brackets.

TEST	TEST POINT	EQUIPMENT
<b>SETUP</b> Set DIP switches. Set jumper links.		
<b>SYNC (Preset 00)</b> Check against video input: - sandcastle position and levels [VR10] - EXTSYNC signal - horizontal sync signal - vertical sync signal	U4/7 U7/7 U8/7 U12/6	
<b>SUBCARRIER (Preset 00)</b> Check: - Subcarrier amplifier output > 2.5V - Subcar. oscillator free run frequency NTSC 7.159090 MHz [C23] - PLL lock - External subcarrier input amp. [SW1/6] - Subcarrier filter [VR17,L2] - Subcarrier level [VR17] - Subcarrier phase shift [SW1/5,VR18]	LK3 (D) LK3 (D) LK3 (D) Vs U1/9 U15/4 U2/17 U2/17	Vectorscope
<b>RGB OUTPUTS AND STENCIL (Preset 00)</b> Check.		CRO or RGB Monitor
<b>ENCODER (Preset 97)</b> Adjust: - Burst position [VR1] - Chroma filter [L1] - Chroma balance [VR2,VR3,VR4]		CRO Vectorscope Vectorscope
<b>DECODER 1 (Preset 96)</b> Adjust: - Maximum chroma [L4] - Minimum chroma [L6] - NTSC Hue [VR8]	U4/4 U4/8 U4/13,15,17	Monitor
<b>DECODER 2 (Preset 95)</b> Adjust: - Maximum chroma [L5] - Minimum chroma [L15] - NTSC Hue [VR8]	U5/4 U5/8 U6/13,15,17	Monitor
<b>RGB INPUTS 1 &amp; 2 (Presets 96 &amp; 95)</b> Check.		Monitor
<b>AUDIO INPUT</b> Check. [SW2/1,VR12]		Monitor
<b>COLOUR LEVELS (Presets 95,96 and 97)</b> Adjust: [VR6,VR7,VR11,VR13,VR14,VR16]		Monitor

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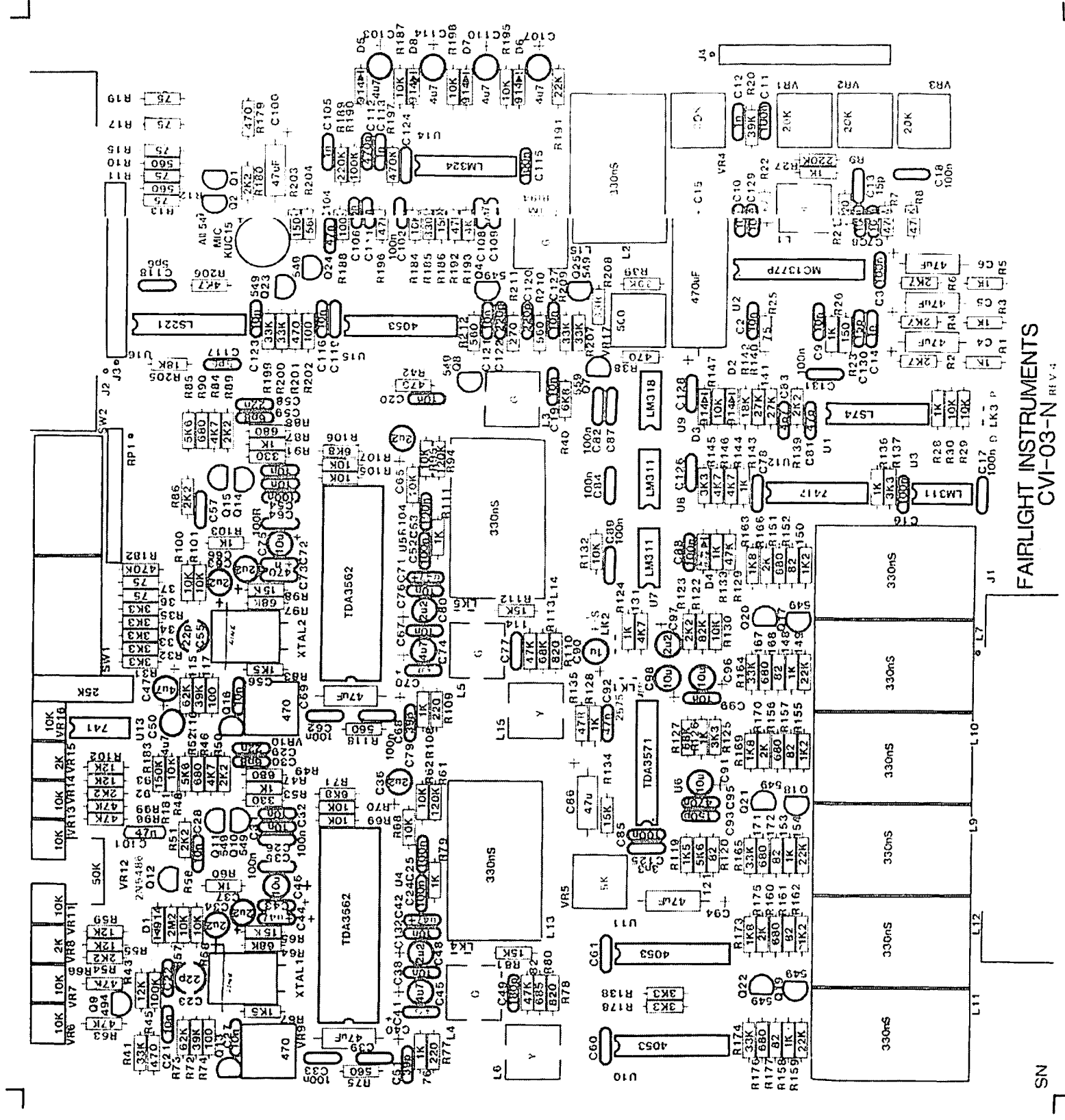
## FAULTS & POSSIBLE CAUSES

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- 1) Loss of colour on output in internal sync mode (no external video).
  - Decoder #1 XTAL OSC free run frequency wrong (not  $2 \times F_{sc}$ )
  - Move LK3 to D position. If colour returns then main board PLL is not locking to video subcarrier.
  - Divider U1 or phase shift chain faulty. Check that the modulator is getting subcarrier.
  - Burst is in the wrong position.
  
- 2) Loss of colour on composite input.
  - Decoder XTAL OSC free run frequency wrong.
  - Link LK4 or LK5 set in U position.
  - Saturation controls set too low.
  
- 3) Screen tears and rolls.
  - EXTSYNC signal is low when no input video to VIDEO 1.
  - Vs or Hs signals are missing when in external sync.

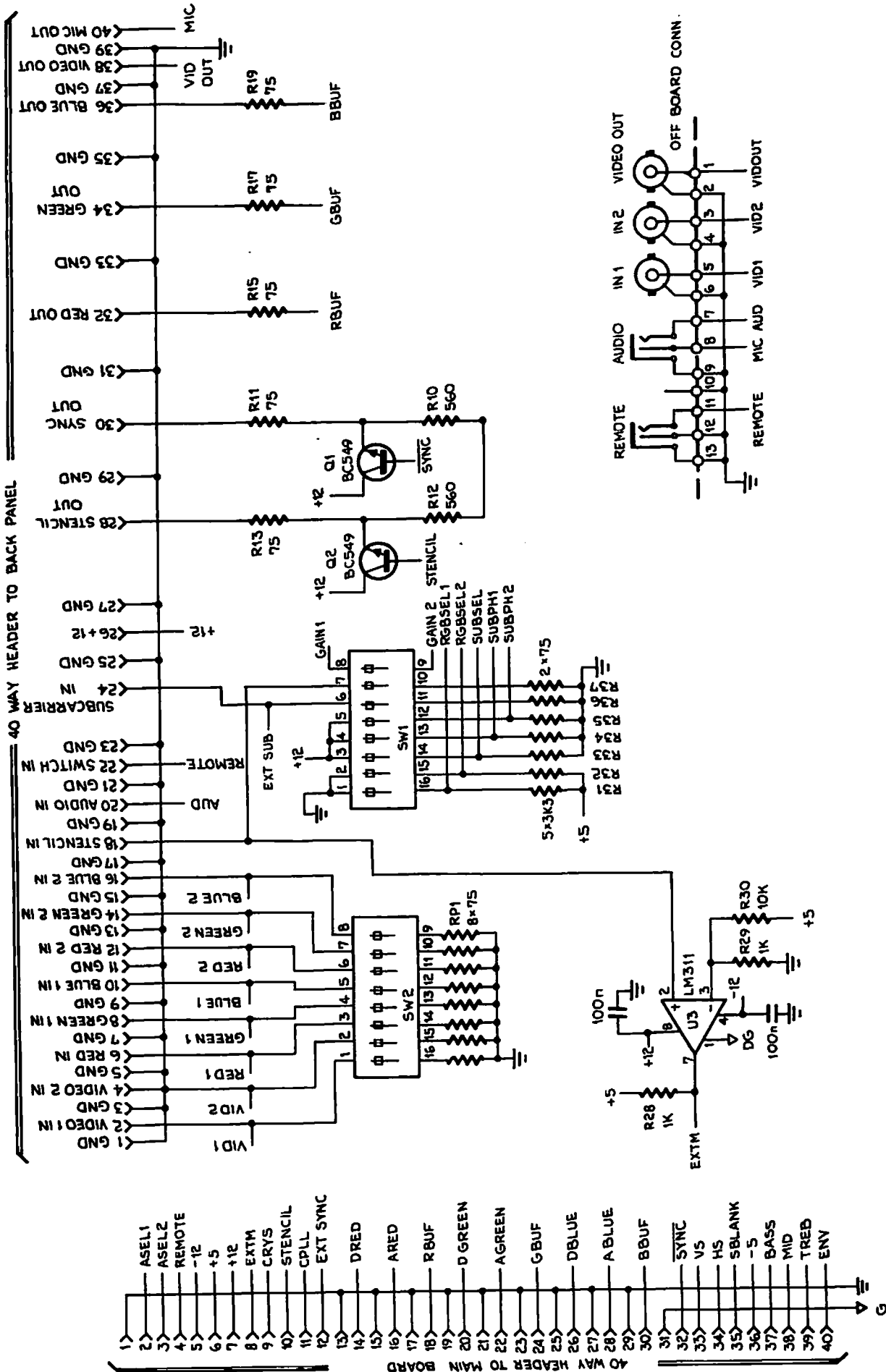


COMPONENT OVERLAY



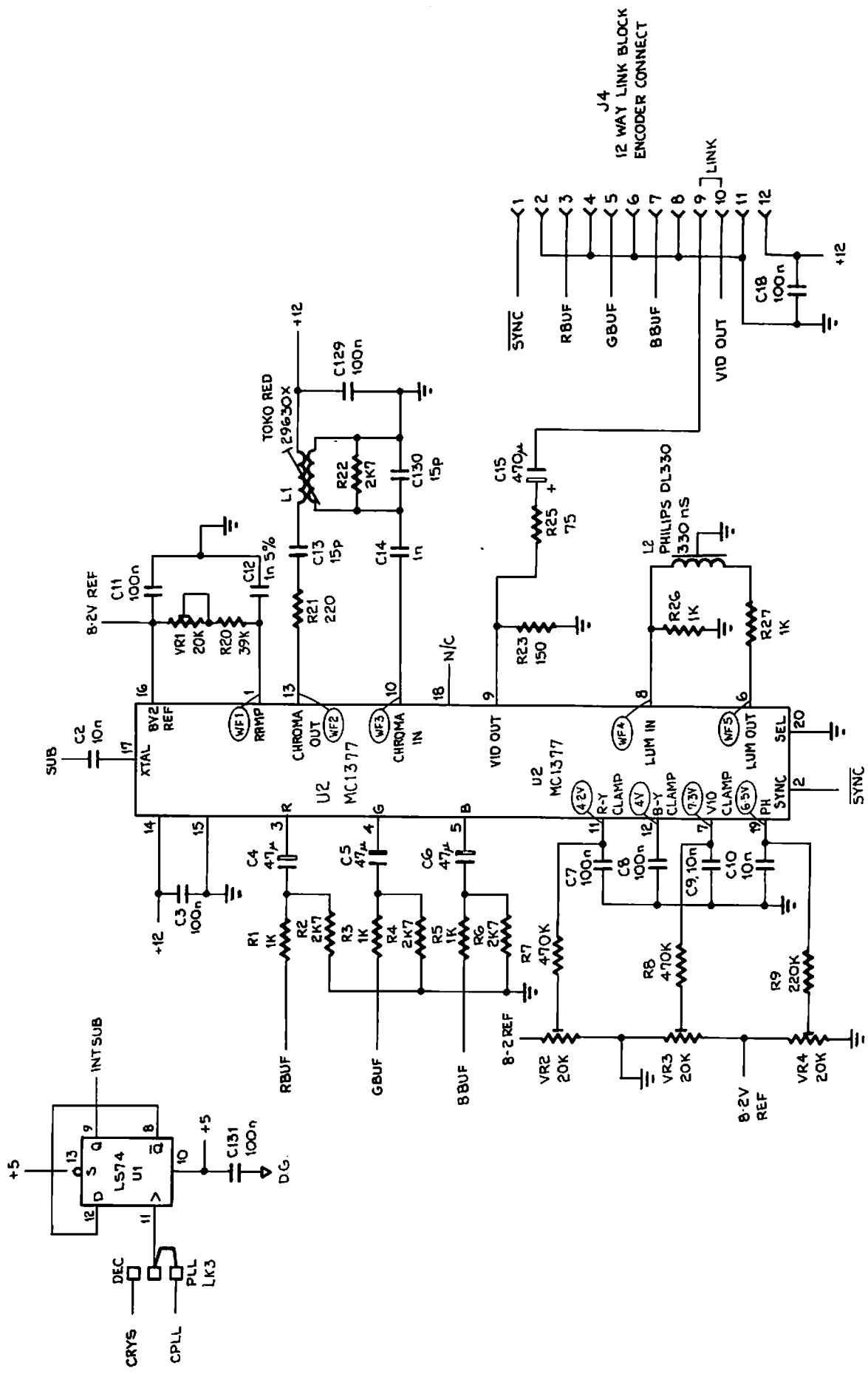
FAIRLIGHT INSTRUMENTS  
CVI-03-N REV. 4

# CONNECTORS AND SWITCHES



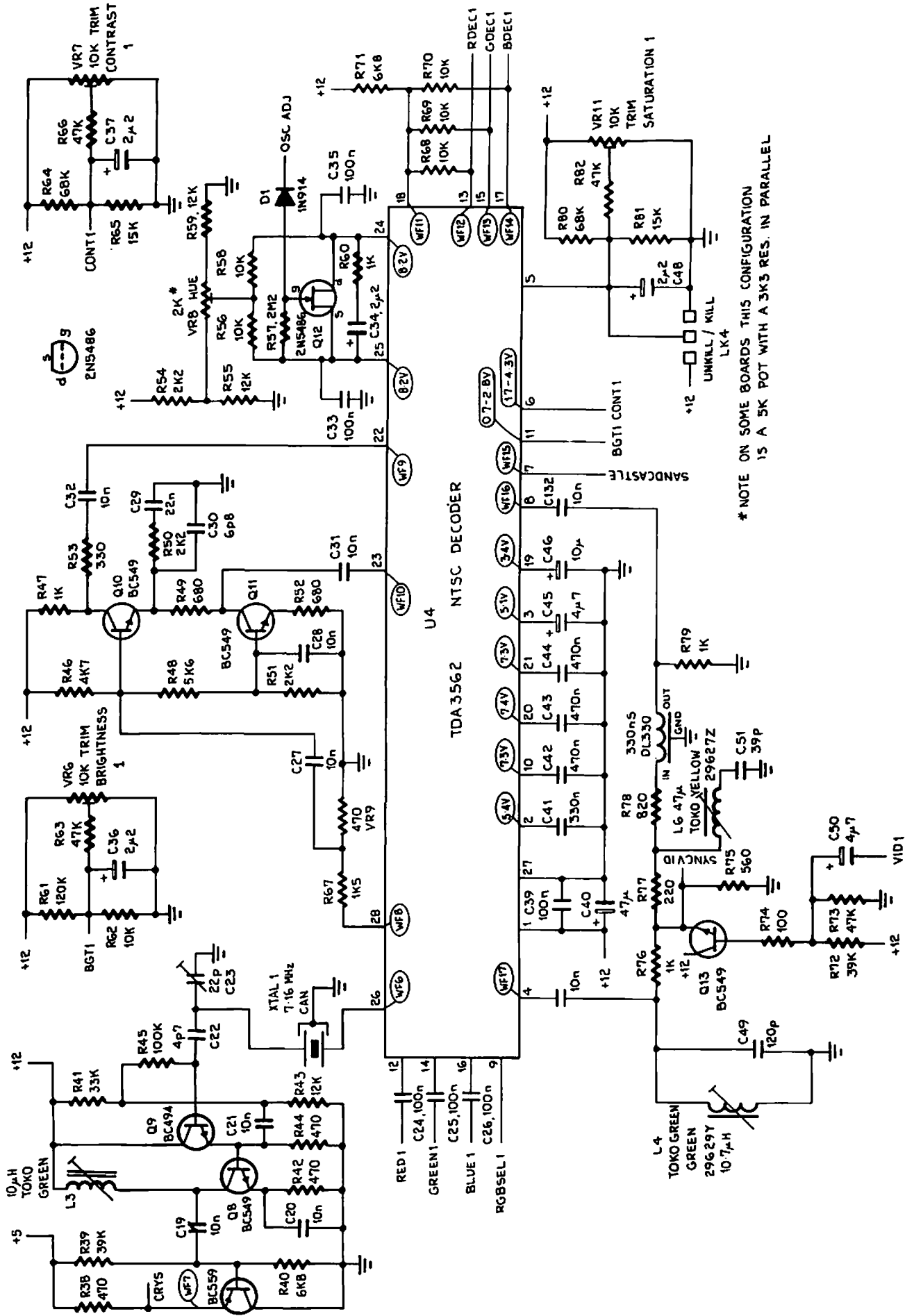
4.12-VIDEO BOARD NTSC

*twilight*



J4  
12 WAY LINK BLOCK  
ENCODER CONNECT

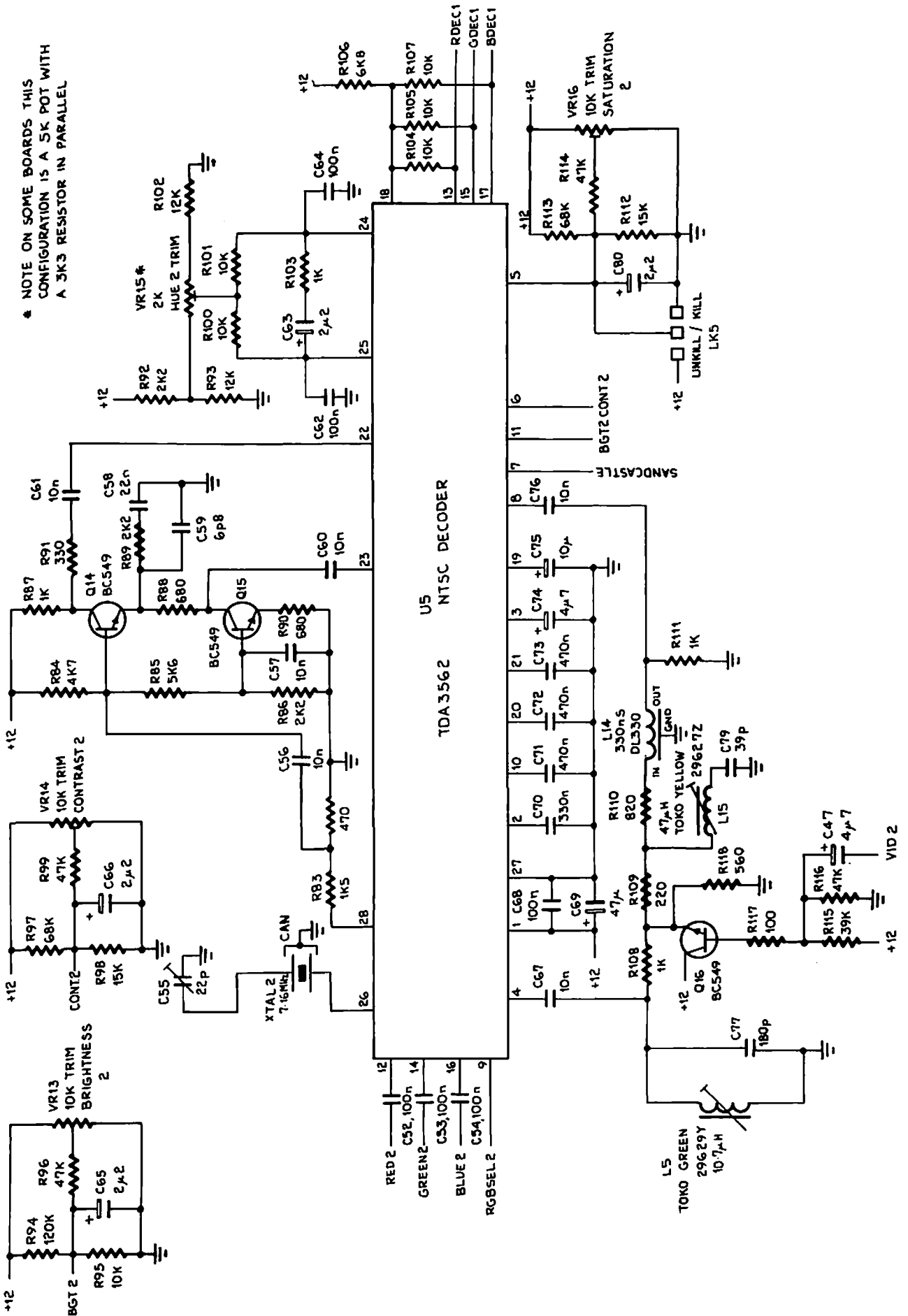
# DECODER FOR VIDEO 1 INPUT



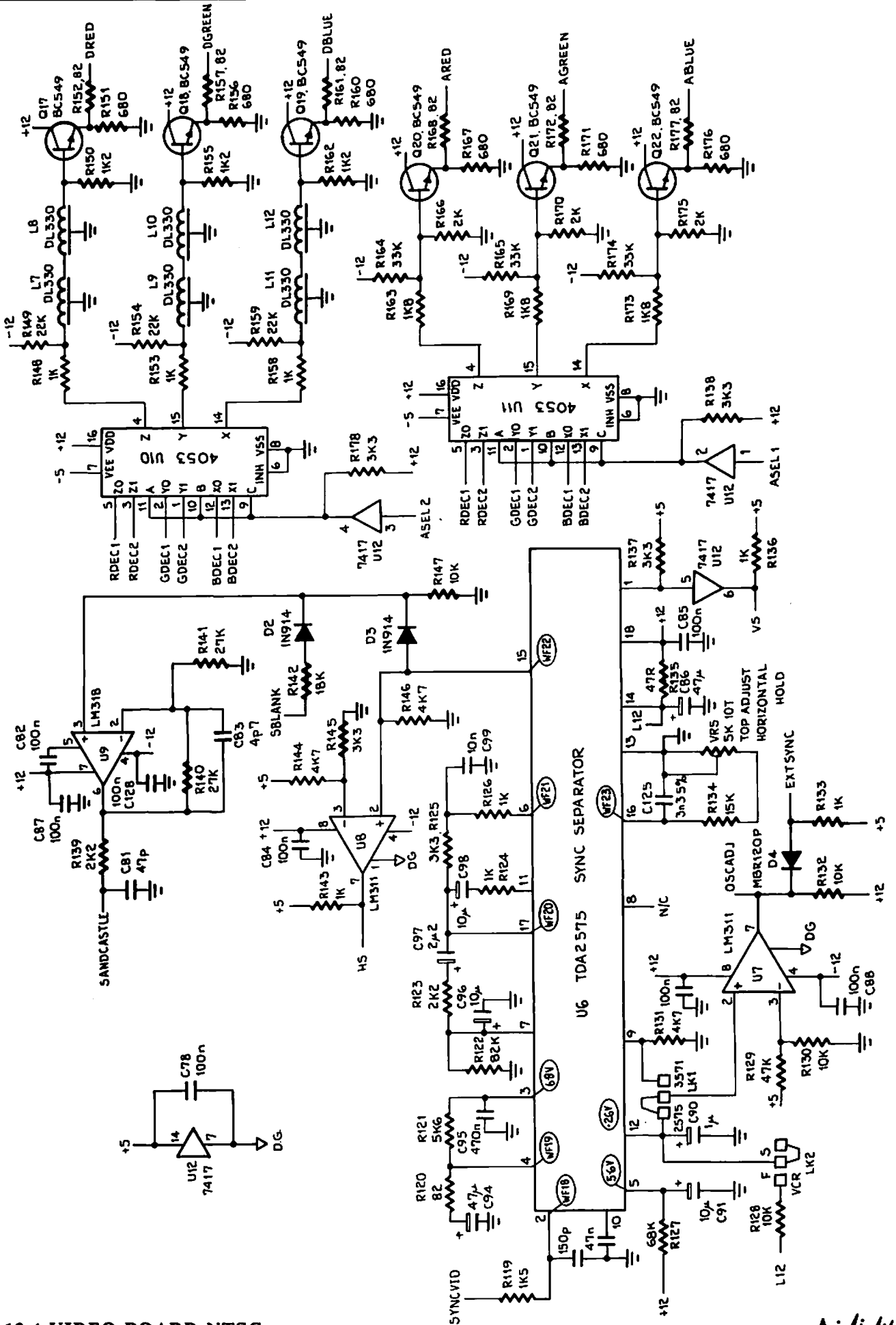
\* NOTE ON SOME BOARDS THIS CONFIGURATION IS A 5K POT WITH A 3K5 RES. IN PARALLEL

4.12.2-VIDEO BOARD NTSC

# DECODER FOR VIDEO 2 INPUT

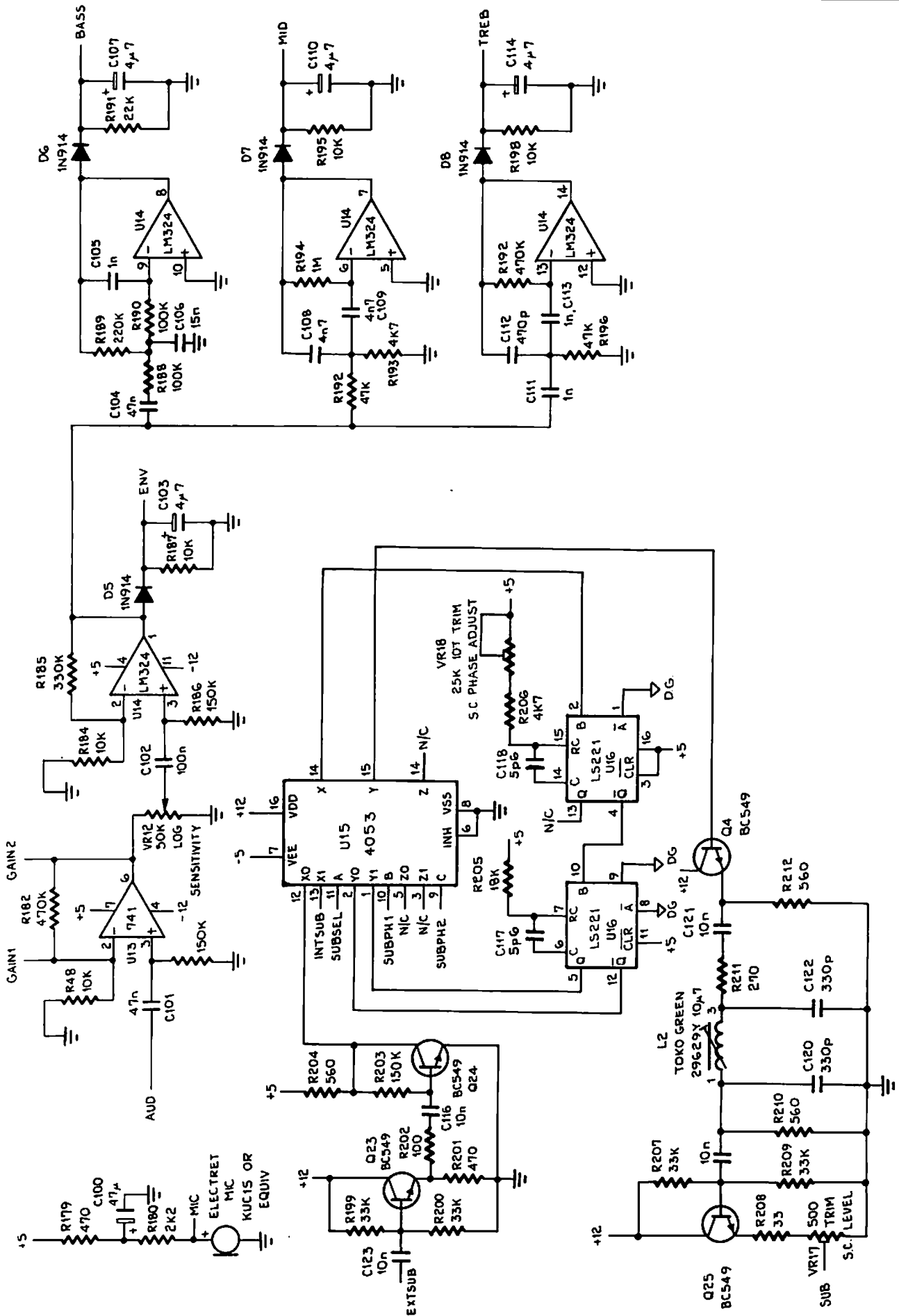


# SYNC SEPARATOR FOR VIDEO MULTIPLEXER

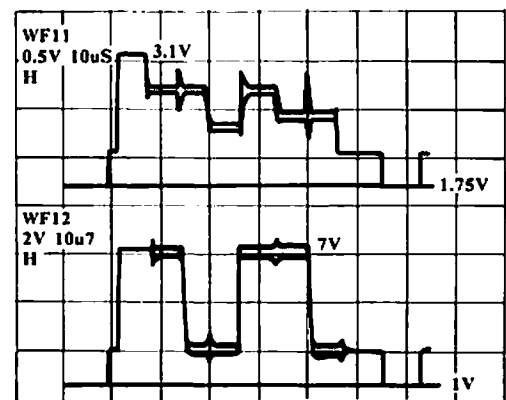
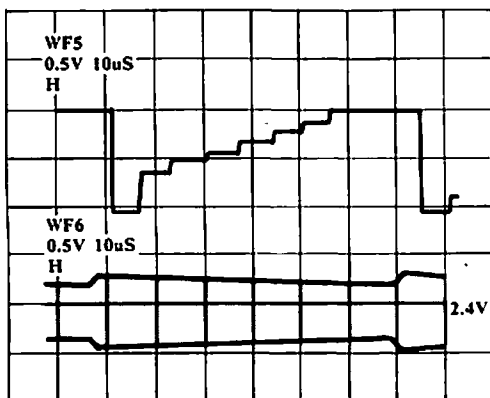
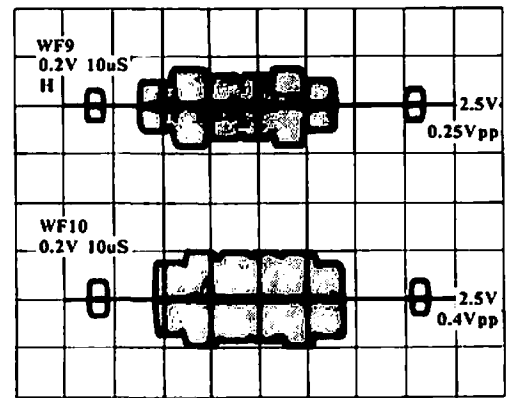
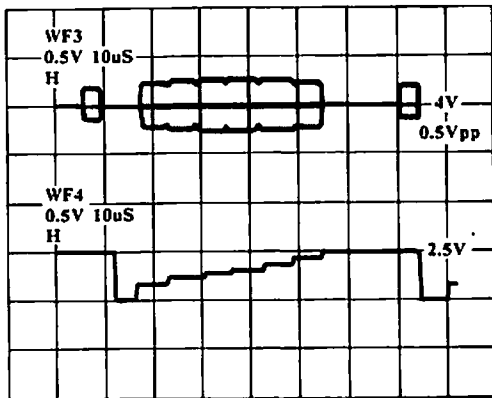
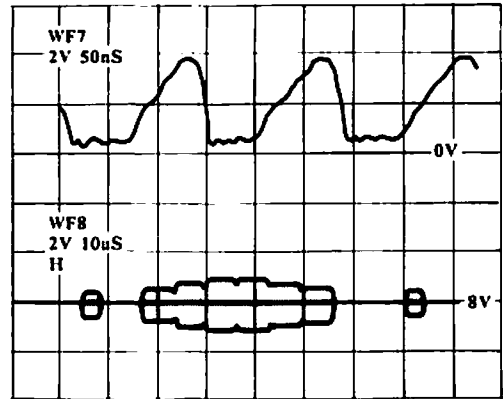
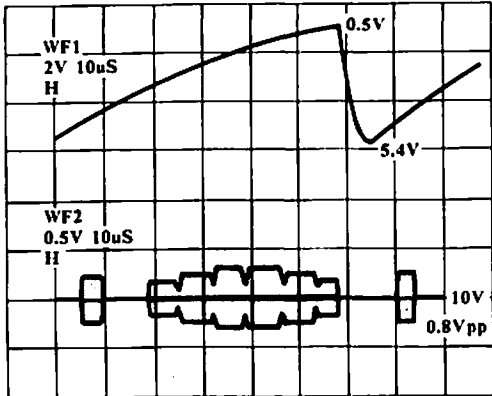


4.12.4-VIDEO BOARD-NTSC

# AUDIO INPUT AND FILTERS + SUBCARRIER PHASE ADJUST

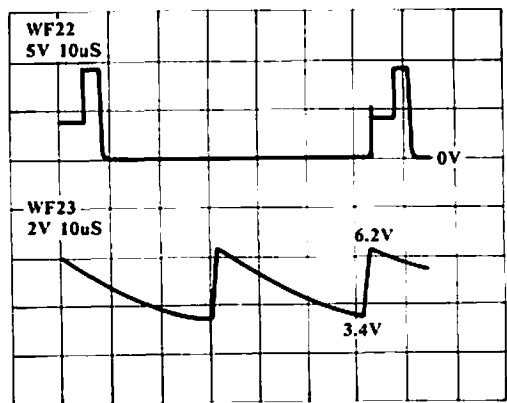
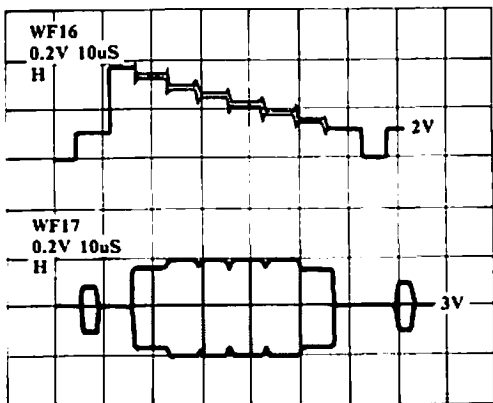
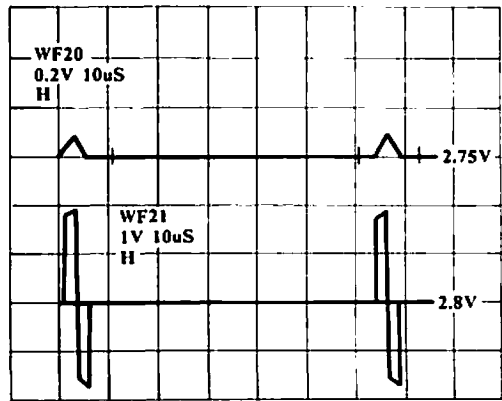
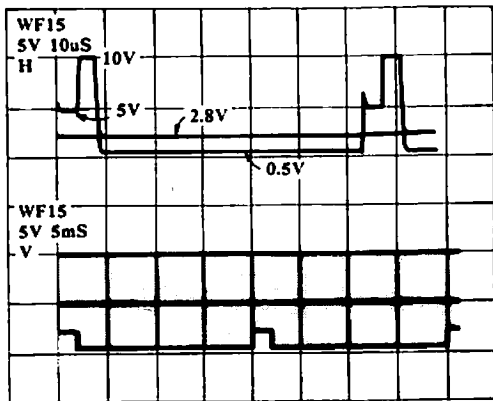
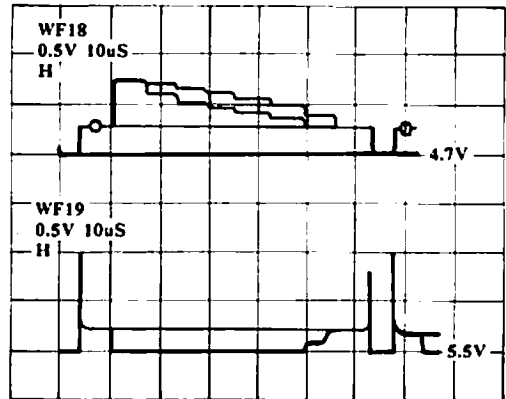
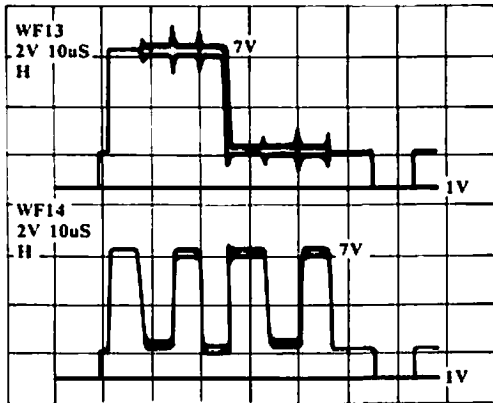


# WAVEFORM DIAGRAMS

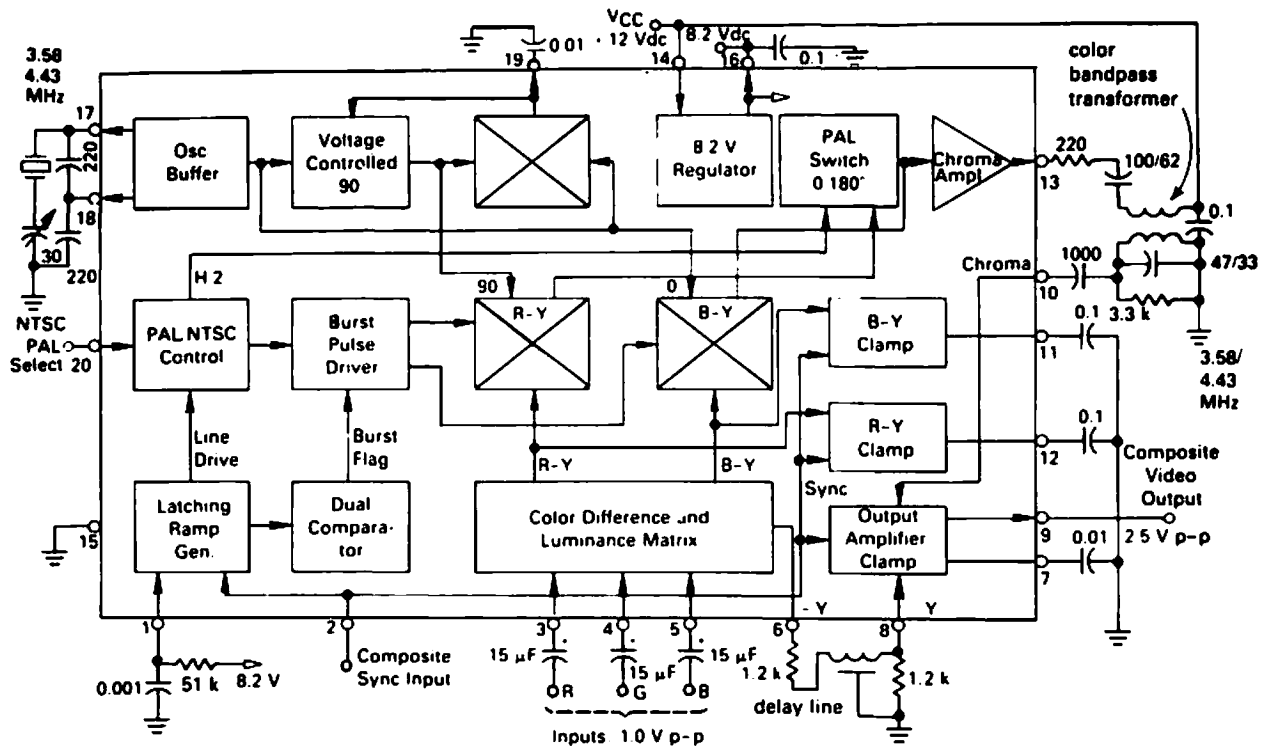




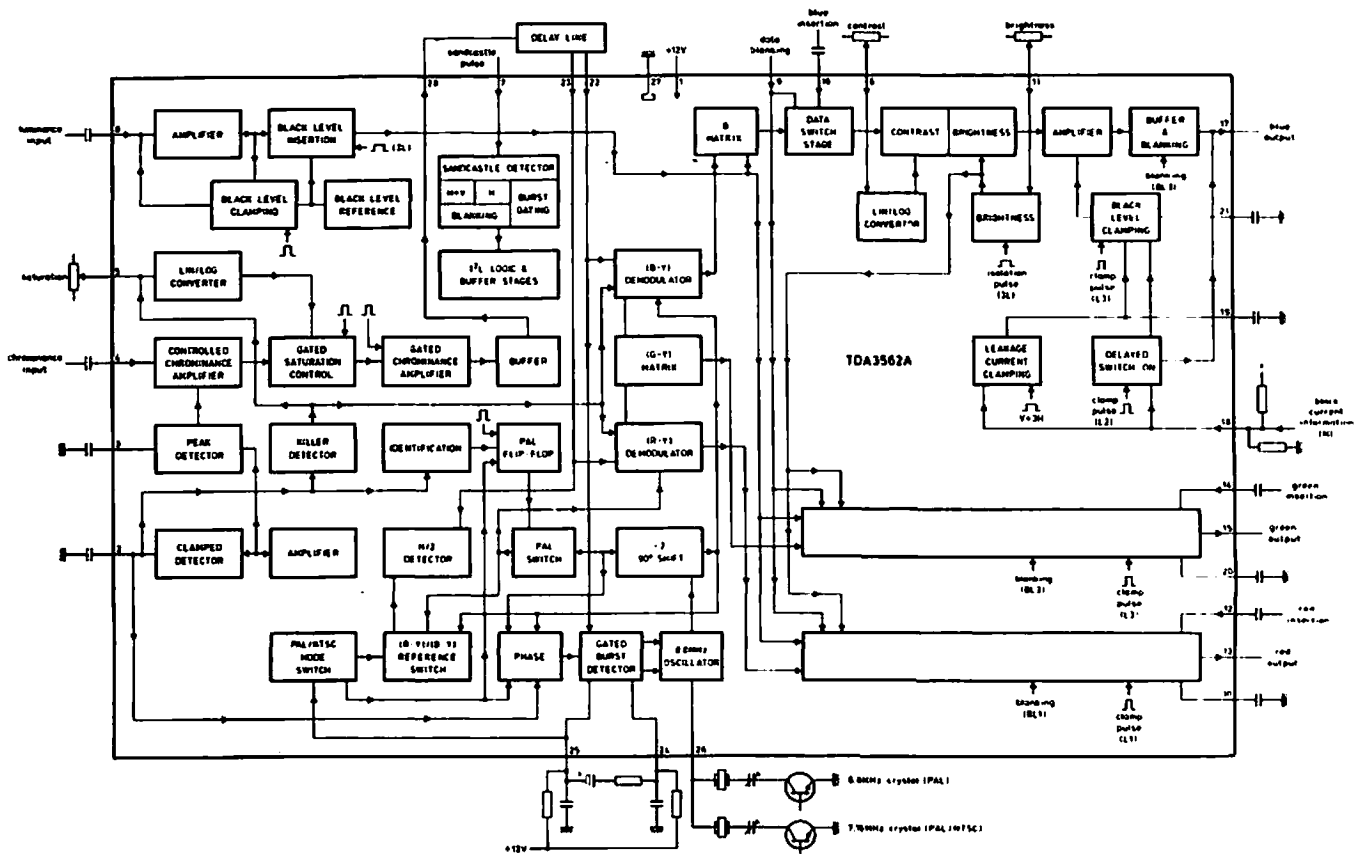
# WAVEFORM DIAGRAMS



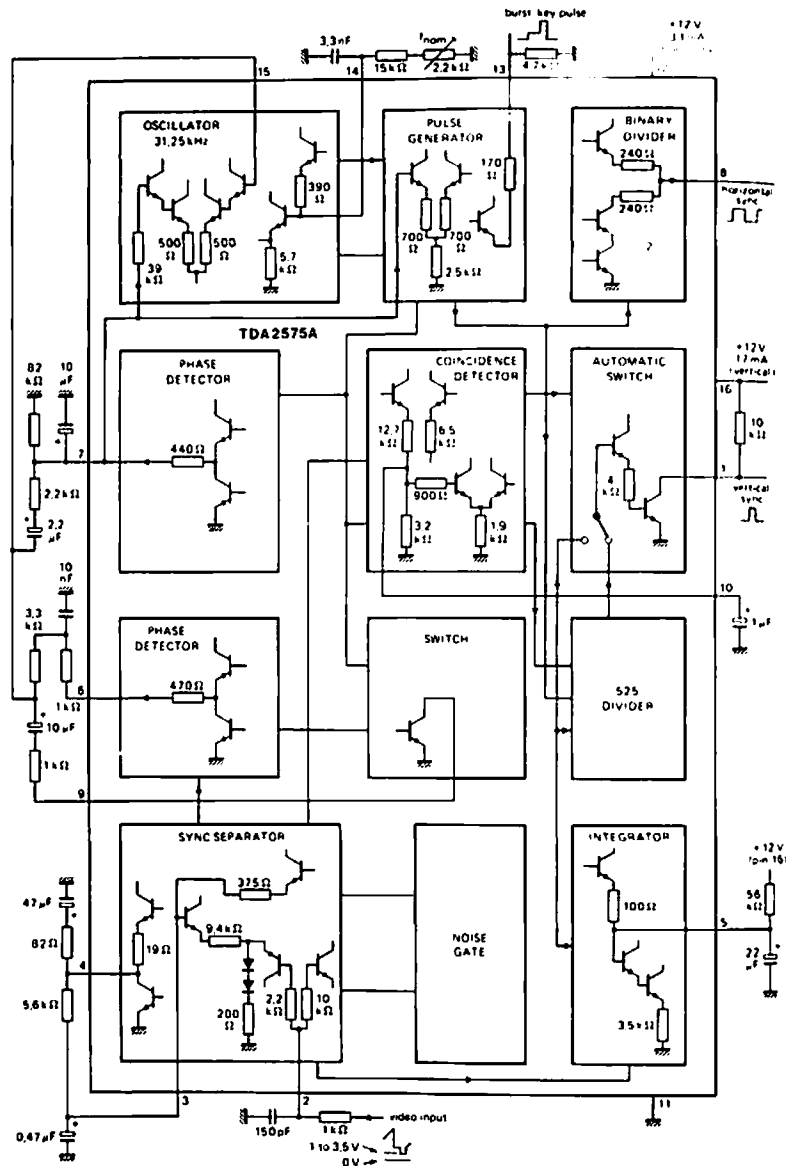
# MC 1377P ENCODER

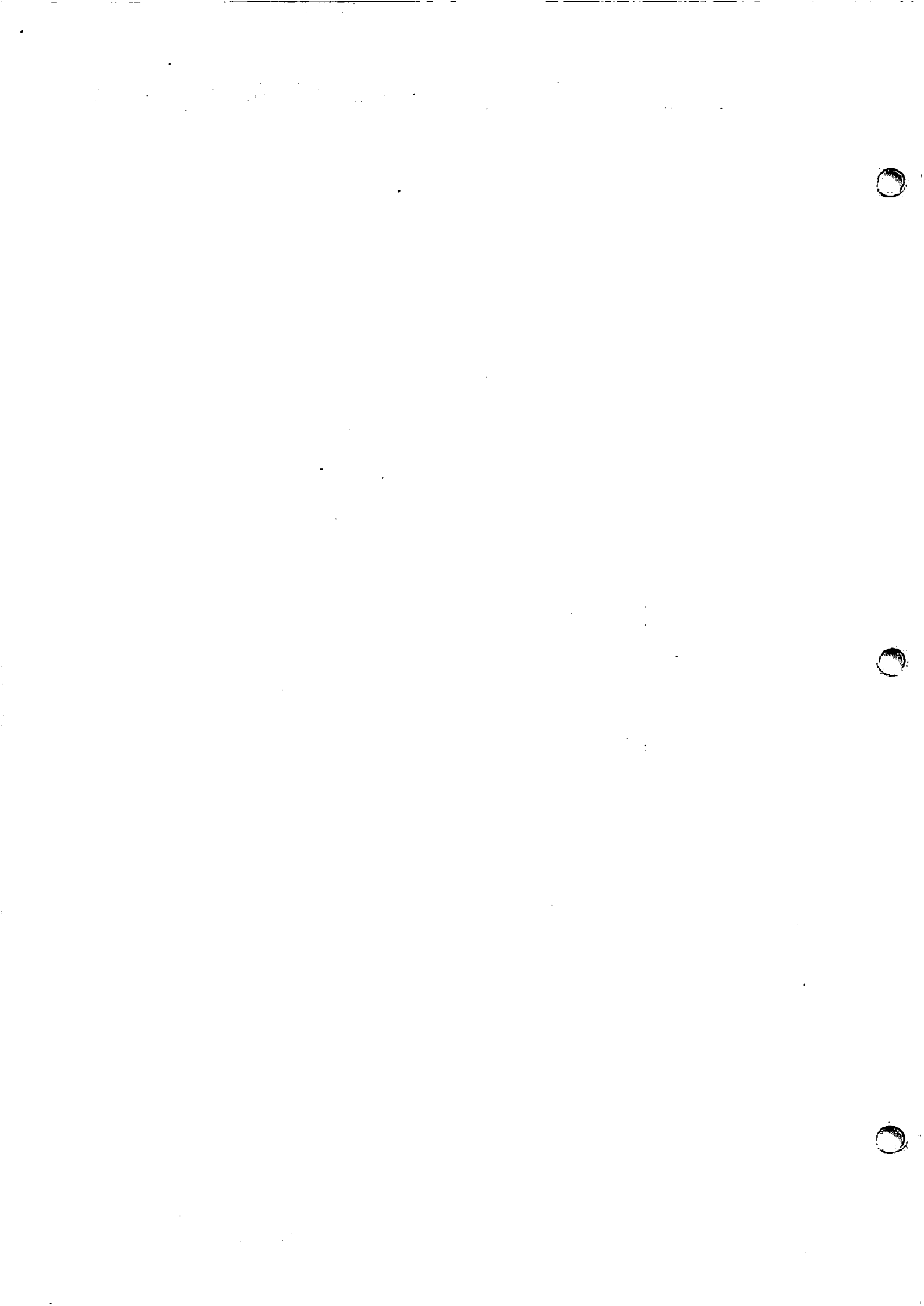


# TDA 3562A DECODER



# TDA 2575A SYNC SEPARATOR





## General

The CVI-08N sync board when installed in place of the TDA2575 chip on CVI-03N rev4 and rev4x NTSC video boards provides improved syncing especially to video tape signals. It provides faster lockup to unstable video input signals due to a shorter time constant.

## Circuit Description

The lowpass filtered video signal from U6 pin 2 on CVI-03N is buffered by Q1 and sync tip clamped by comparator U3B to a level determined by zener diode D2. Composite sync is separated by comparator U1. Half line information is deleted by monostable U2B and the resultant line rate signal is buffered by Q2 and fed to the sync processor U4 pin 1. The separated sync from U1 pin 7 is integrated at the input to monostable U2A to derive a vertical sync signal at U2A pin 13 which is also fed to the sync processor U4 pin 24.

The sync processor U4 regenerates the horizontal signal from a phase locked loop. The time constant for this loop is controlled by components connected to pins 2 and 3. The oscillator frequency is controlled by components connected to pins 4 and 5. The regenerated vertical signal is derived from an internal counter when a standard video signal (525 lines) is connected. When non-standard signals are connected the vertical signal is derived directly from the separated signal to U4 pin 24.

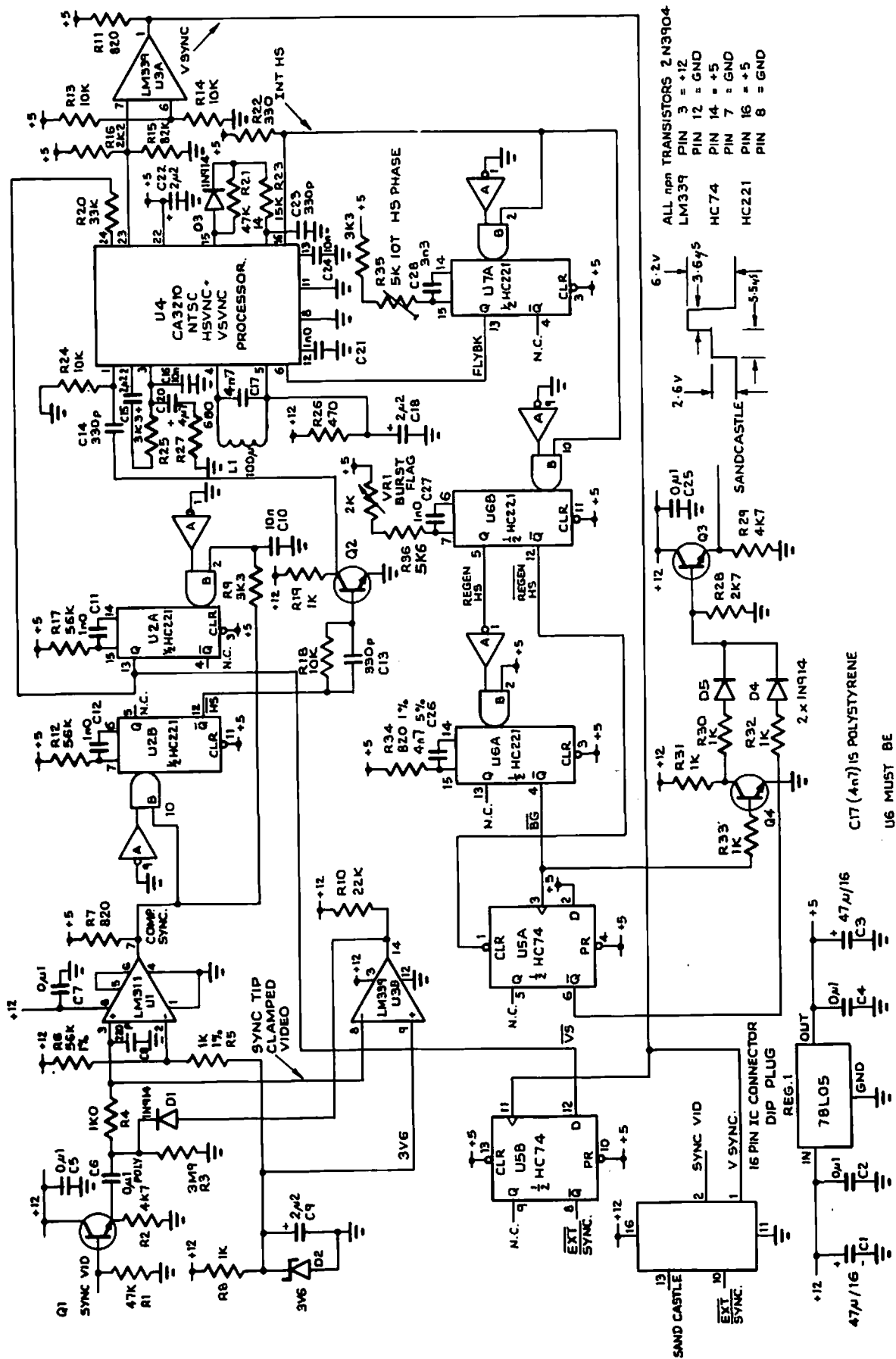
Processed vertical sync at U4 pin 23 is detected by comparator U3A. This signal is used as vertical reset on the CVI-01 board when in external sync mode. Flip-flop U5B samples the separated vertical sync signal from U2A pin 13 on the rising edge of the processed vertical sync signal from U3A pin 1 and provides a low signal at U5B pin 8 if there is coincidence indicating external lock. This signal is used on the CVI-01 board to select external sync mode.

The horizontal drive output from U4 pin 16 is delayed by monostable U7a to provide a flyback signal required by U4 for correct phasing of the incoming and processed horizontal sync signals. The start of the burst gate signal is determined by VR1 and U6B which is triggered on the rising edge of the horizontal drive from U4. The burst gate length is set by monostable U6A, R34 and C26.

The multilevel "sandcastle" signal required by the decoders is generated by U5A, Q3 and Q4. The highest level occurs during the burst period and is generated by Q4. The middle level indicates the horizontal sync period and is generated by U5A pin 6, R32 and D4. The resulting signal is buffered by Q3.

The +12v supply is smoothed by capacitor C1. The +5v supply is derived from +12v by REG1 and smoothed by C3 and C4.

# CVI-08 NTSC SYNC SEPARATOR



DRAWN: G.D.

C17 (4n7) IS POLYSTYRENE  
U6 MUST BE  
CDT4HC221E (RCA)



## Equipment

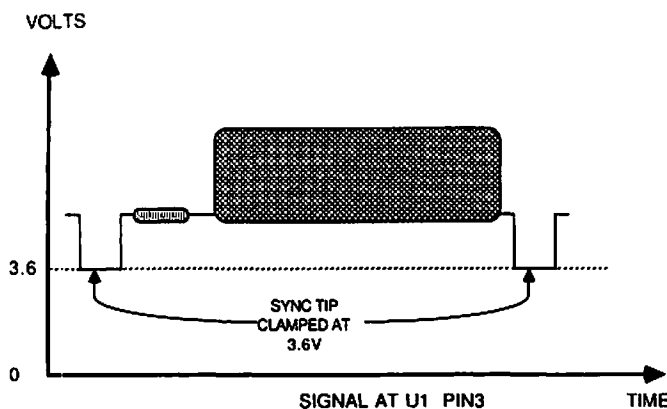
- oscilloscope 100MHz, dual channel
- video test signal generator (NTSC)
- video cassette recorder (NTSC)
- CVI (NTSC), tested and calibrated

## Setup

- Connect video signal generator to VIDEO 1 input.
- CRO CH1 connected to input video signal trigger on CH1

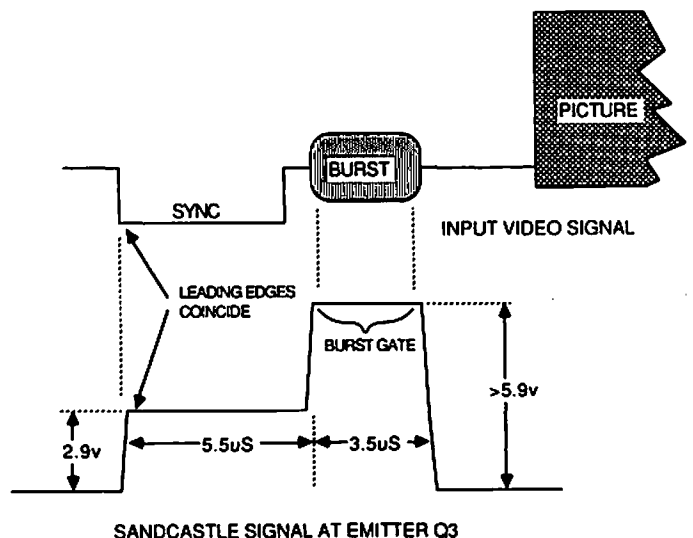
## Procedure

- 1) Connect an NTSC video signal to the VIDEO 1 input.
- 2) Check that the input video sync tip at U1 pin3 is clamped to about 3v6 as set by D2. See figure below.



- 3) Check for separated sync on U1 pin 7 at TTL levels.
- 4) Check that the leading edge of the signal on U2 pin 13 occurs during the first line of the vertical sync period of the input video.
- 5) Check that the EXTSYNC signal (U5 pin 8) is at zero volts when an external video signal is connected to VIDEO 1 input and is greater than 3 volts when the input to VIDEO 1 is disconnected.

- 6) Adjust VR2/R35 (5k trimpot) so that the leading edge of the sandcastle signal at emitter of Q3 is in phase with the horizontal sync of the input video. See figure below.
- 7) Adjust VR 1 so that the sandcastle burst gate coincides with the input burst. See figure below.
- 8) Check that the sandcastle signal has approximately correct durations and levels. See figure below.
- 9) Check that the CVI-08N board locks to the VCR off-tape signal without tearing at the top of the screen or excessive instability.



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**NOTES**

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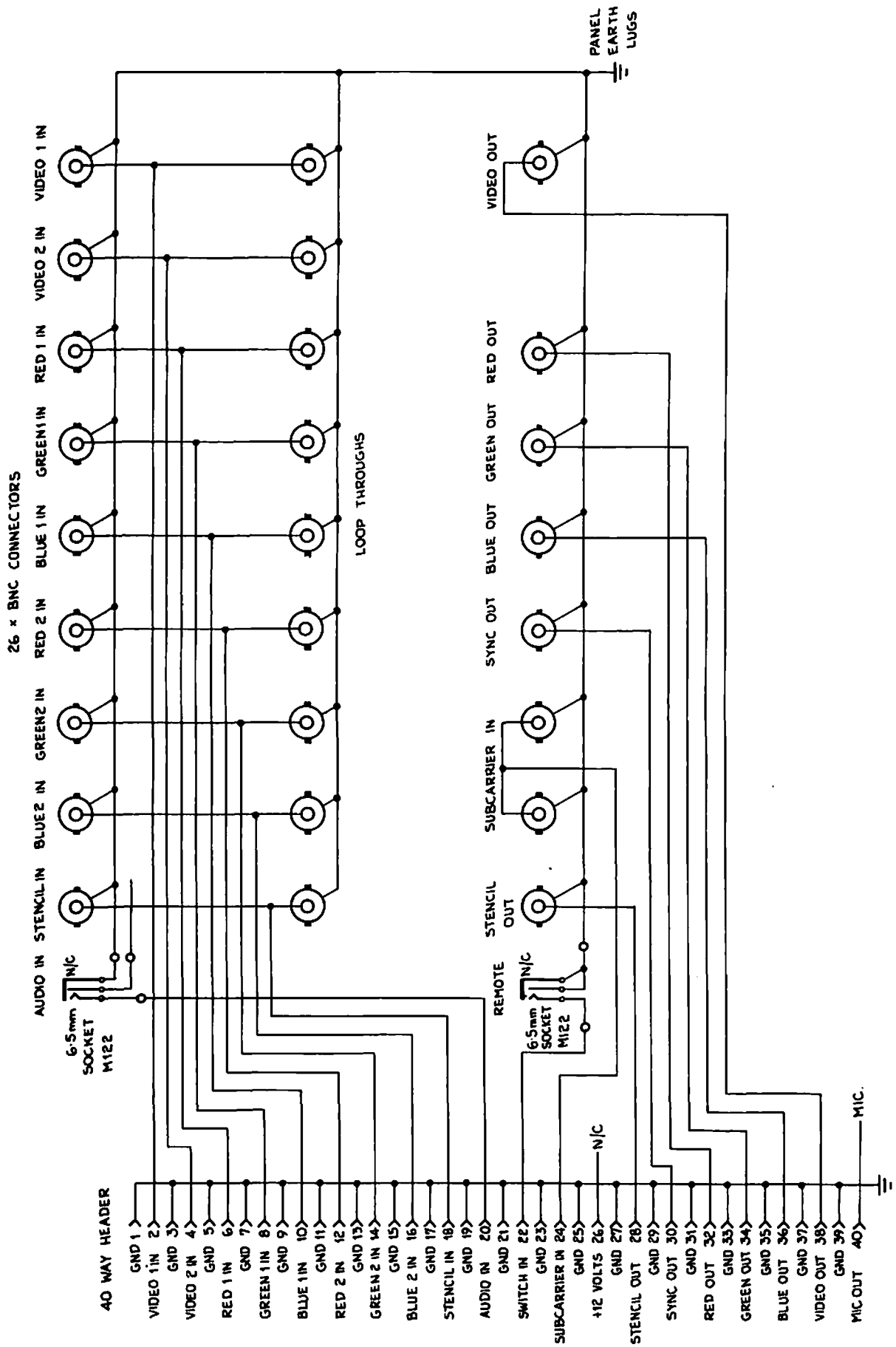


# BNC Connector Board 5

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# BNC CONNECTOR DIAGRAM



5.1-BNC CONNECTOR DIAGRAM

# Power Supply

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# FUSE REPLACEMENT

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## WARNING

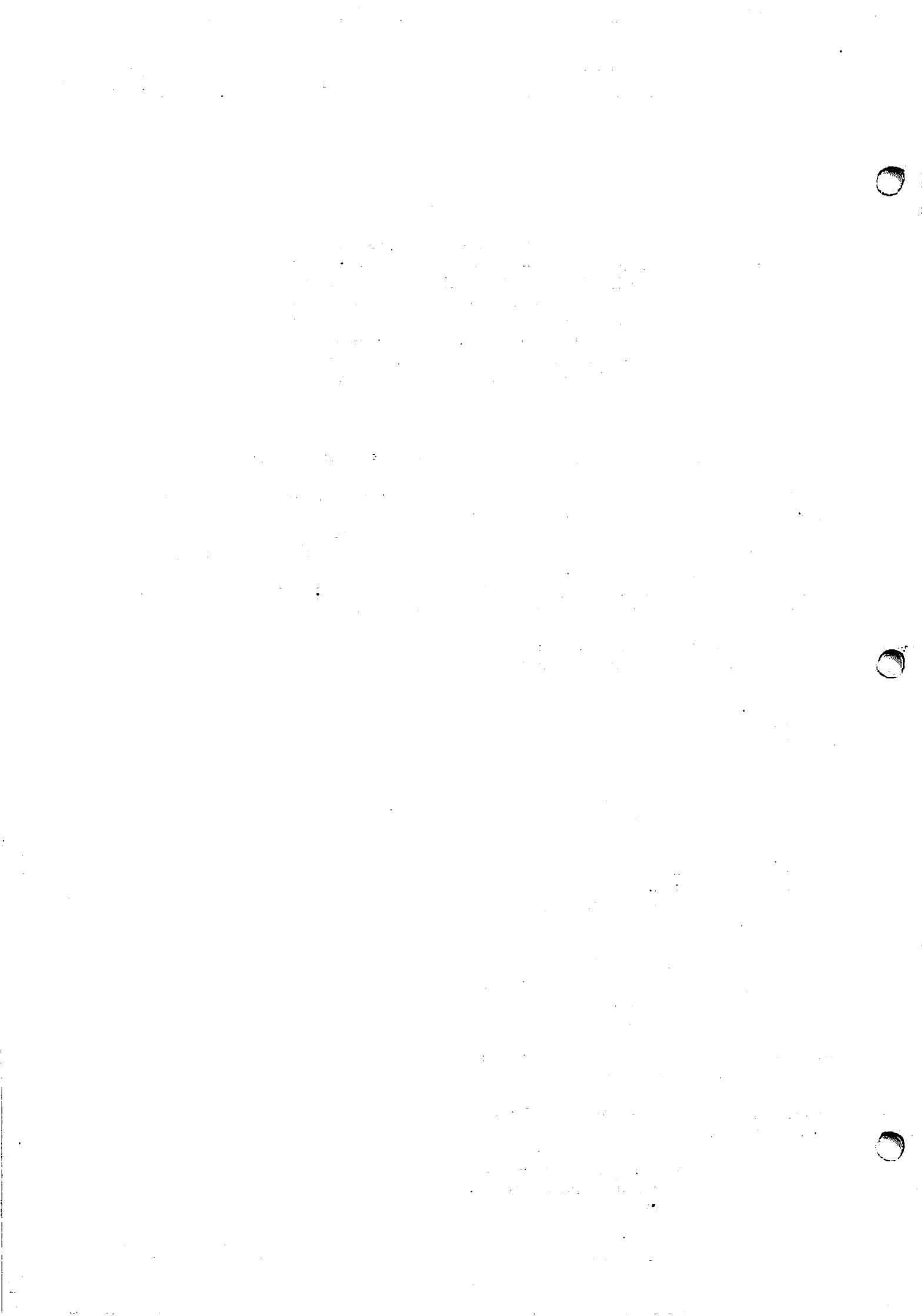
Fuse replacement should be undertaken only by experienced personnel. FAIRLIGHT INSTRUMENTS is not liable for any damage due to improper installation. Should you be unsure of the installation procedure we recommend that you consult Fairlight Instruments, your distributor or qualified service personnel.

1. Turn the unit off and unplug the mains cable.
  2. Remove the facia panel from the unit and slide out the tray.
  3. Undo the four screws that secure the cover of the power supply. Remove and retain the four screws and their locking washers
  4. Lift the power supply away from the main tray, avoiding strain on the flat connector cable.
  5. Remove the fuse from its socket in the power supply.
  6. If the fuse is blown, replace it with a new fuse of the same size and rating (2A, 250V).
  7. Place the power supply unit on the main tray. Avoid twisting or straining the flat connector cable. The orange button should face the front of the tray.
  8. Replace the four screws, each with a locking washer. Do not over-tighten.
  9. Slide the tray back into the case and replace the facia panel.
  10. Plug in the mains cable and turn the unit on. The normal start-up sequence should follow.
- If the CVI fails to start up correctly:
1. Check that the power cable is plugged in.
  2. Unplug the power cable and follow steps 1-10 again, checking all connections.
  3. If the unit still does not start, contact your distributor.

## WARNING

Change of the supply voltage should be undertaken only by experienced personnel. FAIRLIGHT INSTRUMENTS is not liable for any damage due to improper voltage settings. Should you be unsure of the procedure or of the local supply voltage we recommend that you consult Fairlight Instruments, your distributor or qualified service personnel.

1. Turn the unit off and unplug the mains cable.
  2. Remove the facia panel from the unit and slide out the tray.
  3. Undo the four screws that secure the cover of the power supply. Remove and retain the four screws and their locking washers
  4. Lift the power supply away from the main tray, avoiding strain on the flat connector cable.
  5. Remove the black link marked "SEL" from its lug.
  6. Place the "SEL" link firmly on the lug marked with the local supply voltage (i.e. either on "230" for 200-240V AC or on "115" for 100-120V AC).
  7. Change the voltage indication on the back of the rack unit to the new setting. This marking is immediately below the power socket on the back of the CVI.
  8. Place the power supply unit on the main tray. Avoid twisting or straining the flat connector cable. The orange button should face the front of the tray.
  9. Replace the four screws, each with a locking washer. Do not over-tighten.
  10. Slide the tray back into the case. Replace the facia panel
  11. Plug in the mains cable and turn the unit on. The normal start-up sequence should follow.
- If the CVI fails to start up correctly:
1. Check that the power cable is plugged in.
  2. Unplug the power cable and follow steps 1-11 again, checking all connections.
  3. If the unit still does not start, contact your distributor.

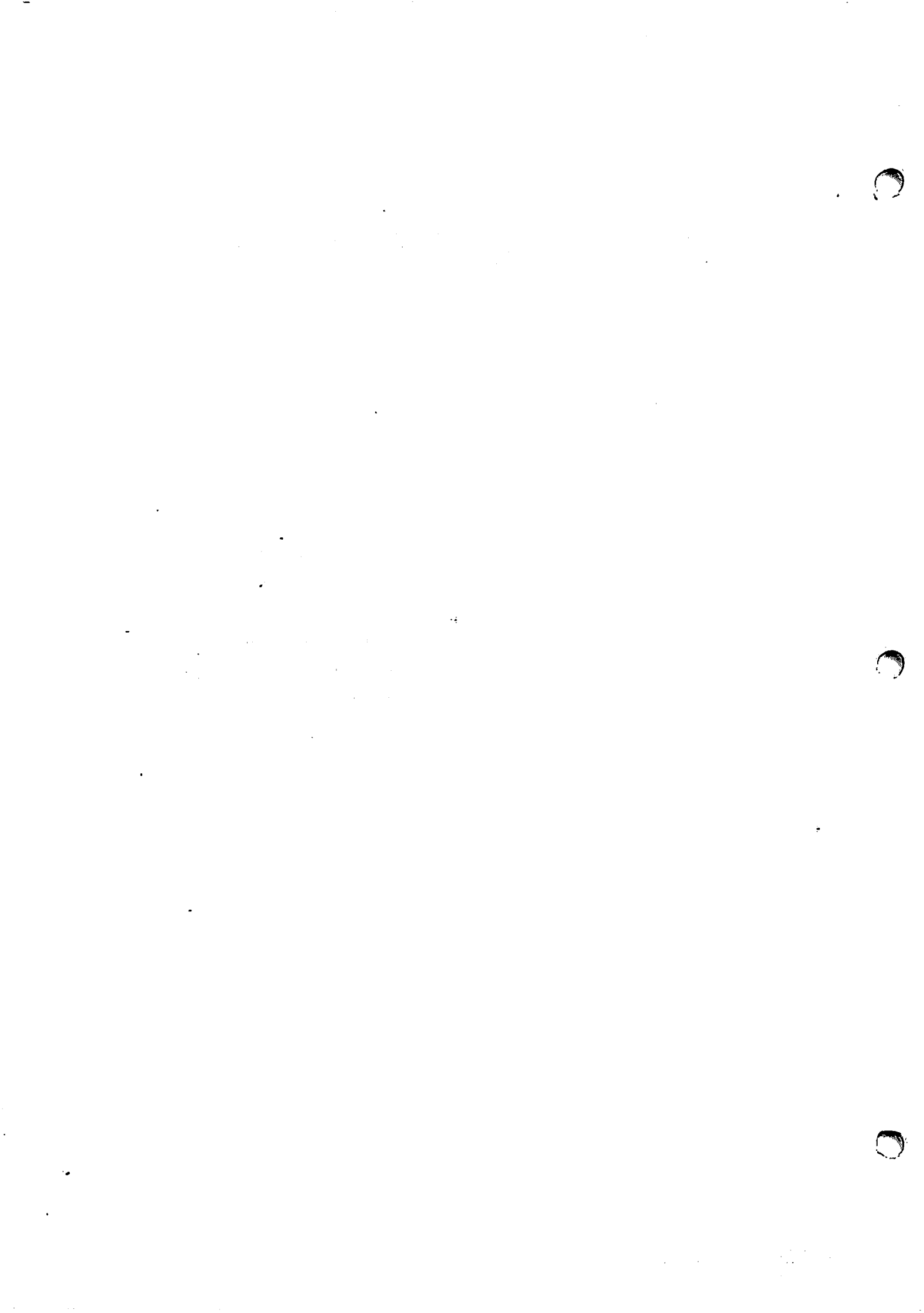


# Exploded Diagrams

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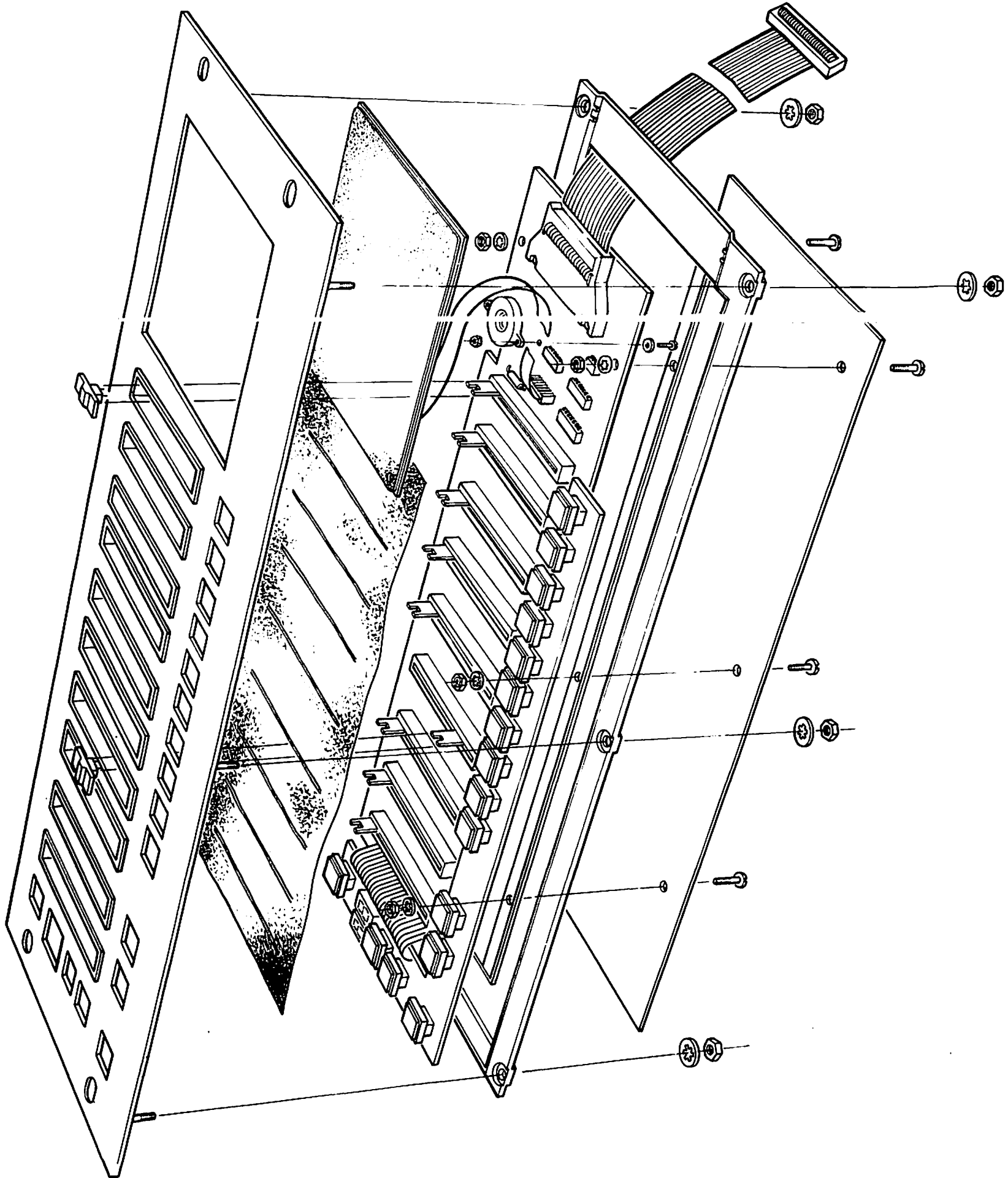
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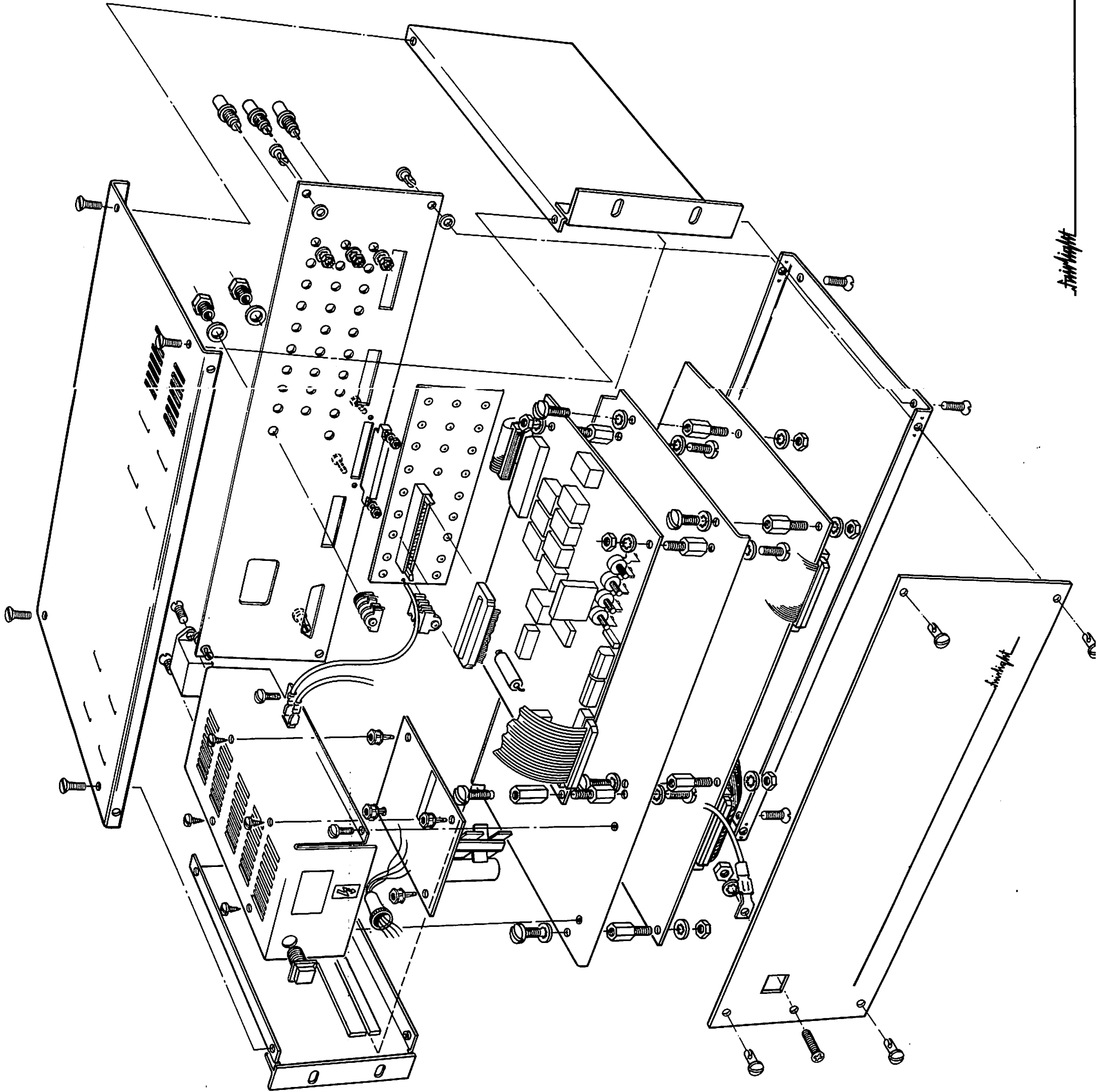




CONTROL PANEL



RACK MOUNT UNIT



*Airlight*

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