

SERVICE MANUAL

Color Video Monitor

ZVM-1380



NOTE: This preliminary manual is based upon preliminary engineering information. Your monitor may be slightly different than the one represented in this manual.

PRELIMINARY COPY

The purpose of this page is to make sure that all service bulletins are entered in this manual. When a service bulletin is received, mark the manual and list the information in the record below.

Record of Field Service Bulletins

SERVICE BULLETIN NUMBER	DATE OF ISSUE	CHANGED PAGE(S)	PURPOSE OF SERVICE BULLETIN	INITIALS

LIMITED RIGHTS LEGEND

Contractor is Zenith Data Systems Corporation of St. Joseph, Michigan 49085. The entire document is subject to Limited Rights data provisions.

Copyright © 1986 by Zenith Data Systems Corporation
Printed in the United States of America

Zenith Data Systems Corporation
St. Joseph, Michigan 49085

PRELIMINARY COPY

WARNINGS and CAUTIONS

IMPORTANT SAFETY NOTICE: Under no circumstances should the original design be modified or altered without permission from Zenith Electronics Corporation. All components should be replaced only with types identical to those in the original circuit, and their physical location, wiring, and lead dress must conform to the original layout upon completion of repairs.

In some instances, redundant circuitry is used for additional circuit protection and X-radiation protection. Special circuits are also used to prevent shock and fire hazard. **These special circuit components contain an X in their reference designator (CX501 is an example). They are to be replaced with identical components only.**

WARNING: No work should be attempted on any part of the chassis by anyone not familiar with Zenith service procedures and precautions. Otherwise, personal injury may result.

WARNING: External isolation transformers should always be used when test equipment is connected to the monitor. This is to reduce a lethal shock hazard, monitor damage, and test equipment damage that could result from the monitor and/or test equipment chassis being connected to different sides of the AC line.

WARNING: Do not operate a monitor with excessive high voltage because the monitor will produce X-rays from the CRT when the high voltage is excessive. Always verify that the high voltage is at the normal level when servicing the unit.

WARNING: Discharge the high voltage at the anode lead of the CRT before attempting service on the high voltage supply or associated circuits. Refer to the servicing section of this manual for detailed instructions.

WARNING: The CRT and the attached CRT board loses support once the back cover is removed. Use extra care when repositioning the monitor. Turn the power off and disconnect the power cord before attempting to reposition the monitor.

WARNING: Handle the cathode-ray tube carefully when you hold, remove, or install it; otherwise implosion and/or personal injury may result.

WARNING: To prevent electrical shock after reassembly, perform an AC leakage test on all exposed metal parts of the monitor. Do not use a line isolation transformer to perform this test.

Any leakage voltage measurement that exceeds 0.75 volts rms (0.5 milliamperes AC) constitutes a potential shock hazard and must be corrected. These voltage and current values are based upon the following test meter circuit (Figure 1) and the following test instructions.

1. Connect the test circuit as shown in Figure 1.
2. With monitor power turned on, measure the leakage voltage between earth ground and an exposed monitor metal part.
3. Repeat the measurement with the meter leads reversed.
4. Repeat steps 2 and 3 until all exposed monitor metal parts are verified to have satisfactory AC leakage levels.

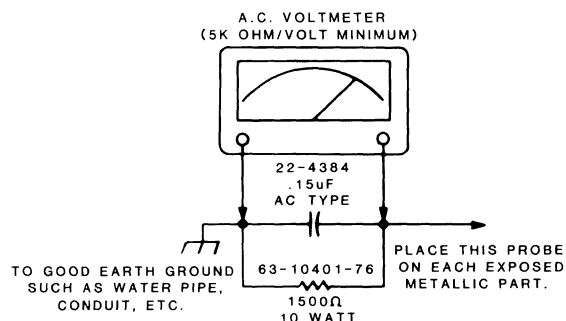


Figure 1
AC Leakage Voltmeter Circuit

WARNING: Unplug the monitor's power cable before cleaning; otherwise, electrical shock and/or personal injury may result.

WARNING: Removing or lifting the ground from the AC power source may present a lethal shock hazard.

CAUTION: The monitor must be located in an area that will provide proper ventilation. Inform the user that the air vents at the bottom, back, and top of the monitor must not be blocked.

CAUTION: Be sure the signal and power cables are unplugged from the computer or other signal and power sources before disassembling the monitor.

CAUTION: Some of the ICs (integrated circuits) used in this unit are electrostatic-sensitive devices. These devices can be damaged by static electricity. When handling any IC, be sure to equalize the static charge before touching the IC, by using a grounding strap.

Contents

Chapter 1: Characteristics

Specifications	1-1
Controls, Indicators and Cables	1-3
Front Panel	1-3
Rear Panel	1-4

Chapter 2: Installation

Color Bar Test	2-1
Fill Screen Test	2-2
Video Cable Interface	2-2

Chapter 3: Circuit Description

Video Signal Processing	3-1
-------------------------------	-----

Chapter 4: Servicing

Safety Guidelines	4-1
AC Leakage Test	4-2
Suggested Supplies and Equipment	4-2
Tools and Supplies	4-2
Test Equipment	4-2
Inspection and Troubleshooting	4-3
Cleaning Procedure	4-4
Servicing Diagrams	4-4

Chapter 5: Parts Lists

Figures

1-1: Front Panel Controls and Indicators	1-3
1-2: Rear Panel Controls and Cables	1-4
2-1: Video Cable Connector	2-2
4-1: AC Leakage Voltmeter Circuit	4-2
4-2: Block Diagram	4-4
5-1: Monitor Schematic	5-9

Tables

2-1: Video Connector Signals	2-2
3-1: Input Signals	3-1
3-2: Displayed Colors	3-1
4-1: Fault Isolation	4-3
5-1: Electronic parts	5-1

Listings

2-1: BASIC Color Bar Program	2-1
2-2: BASIC Program to Fill the Screen	2-2

PRELIMINARY COPY

PRELIMINARY COPY

Characteristics

The Zenith Data Systems ZVM-1380 monitor is a 13 inch, non-glare color display that provides two modes of operation. Mode 1 will provide 16 colors and is used with computers that supply an RGBI video output, such as the Z-150 and Z-200 computer series. Mode 2 will

provide 64 colors and is used with computers that supply an enhanced RGB video output, such as the Z-158 and Z-241 that support an enhanced graphics card. The monitor determines the mode of operation from the vertical sync polarity.

Specifications

The following specifications represent optimum video input signal operation. Other display presentations may be used with some change in display position or appearance.

Power Input	98-132/208-262 VAC, 48-62Hz, 90 watts.
Video Input	16 color, RGBI positive TTL. 64 color, RGBrgb positive TTL.
Horizontal Sync	Positive TTL, switching by TTL. 15.75 kHz \pm 300 Hz, mode 1. 21.85 kHz \pm 300 Hz, mode 2.
Vertical Sync	Positive TTL 47 to 63 Hz, mode 1. Negative TTL 47 to 63 Hz, mode 2.
Video Cable Connector	9-pin D connector
CRT	13 inch, 0.31 mm pitch, dark tint nonglare.
Display Area	250 mm wide by 170 mm high.
Display Colors	16 colors @ 15.75 kHz (Mode 1), 64 colors @ 21.85 kHz (Mode 2).
Display Characters	2000 characters, 80 \times 25 @ 15.75 kHz (Mode 1, 8 \times 8 dot matrix). 80 \times 25 @ 21.85 kHz (Mode 2, 8 \times 14 dot matrix).
Horizontal Display Time	44.5 **S @ 15.75 kHz (Mode 1), 39.37 **S @ 21.85 kHz (Mode 2),

PRELIMINARY COPY

Horizontal Retrace Time	6.0 **S @ 15.75 kHz (Mode 1), 6.0 **S @ 21.85 kHz (Mode 2).
Vertical Display Time	12.58 mS @ 15.75 kHz (Mode 1), 16.01 mS @ 21.85 kHz (Mode 2).
Vertical Retrace Time	1.2 mS @ 15.75 kHz (Mode 1), 0.6 mS @ 21.85 kHz (Mode 2).
Horizontal Resolution	640 dots (Mode 1 and Mode 2).
Vertical Resolution	200 lines, noninterlaced (Mode 1), 400 lines, interlaced (Mode 1), 350 lines, noninterlaced (Mode 2), 700 lines, interlaced (Mode 2).
Misconvergence	0.5 mm maximum within data area.

Zenith Data Systems reserves the right to discontinue products and to change specifications at any time without incorporating these changes into products previously sold.

PRELIMINARY COPY

Controls Indicators and Cables

The following is a description of the controls, indicators and cables for the video monitor. Refer to Figure 1-1 for their location.

Front Panel

Power indicator — Lights when monitor power is on.

Power switch — Switches monitor power on or off.

Contrast — Adjusts the intensity of the intensified data on the screen.

Brightness — Adjusts the intensity of the entire display.

G N A switch — Selects green, normal, or amber display.

CAUTION: Avoid setting the contrast and brightness controls for an excessively bright display. A bright, fixed pattern, if displayed for long periods of time, may permanently imprint the pattern on the CRT.

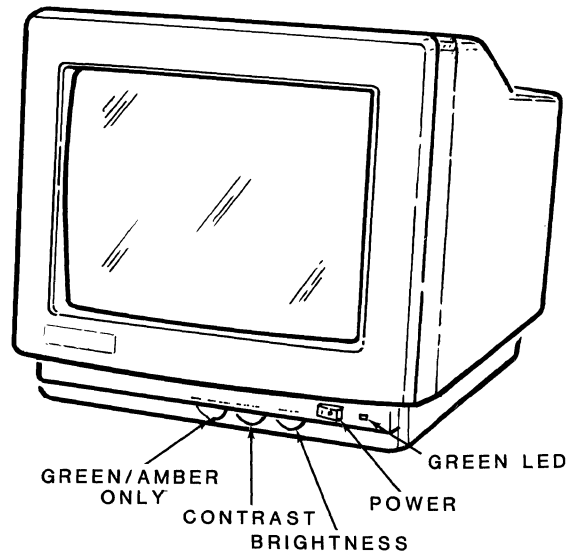


Figure 1-1
Front Panel Controls and Indicators

Rear Panel

Video input cable — Transmits the video signal from the computer to the monitor.

Power connector — Supplies AC power to the computer. The ZVM-1380 uses a switchable power supply that permits use of a 120 VAC or a 240 VAC cable.

Voltage Select switch — Selects 115 VAC or 230 VAC operation.

V Size 1 control — Control vertical size for mode 1.

V Size 2 control — Controls vertical size for mode 2.

H Center 1 control — Controls horizontal center for mode 1.

H Center 2 control — Controls horizontal center for mode 2.

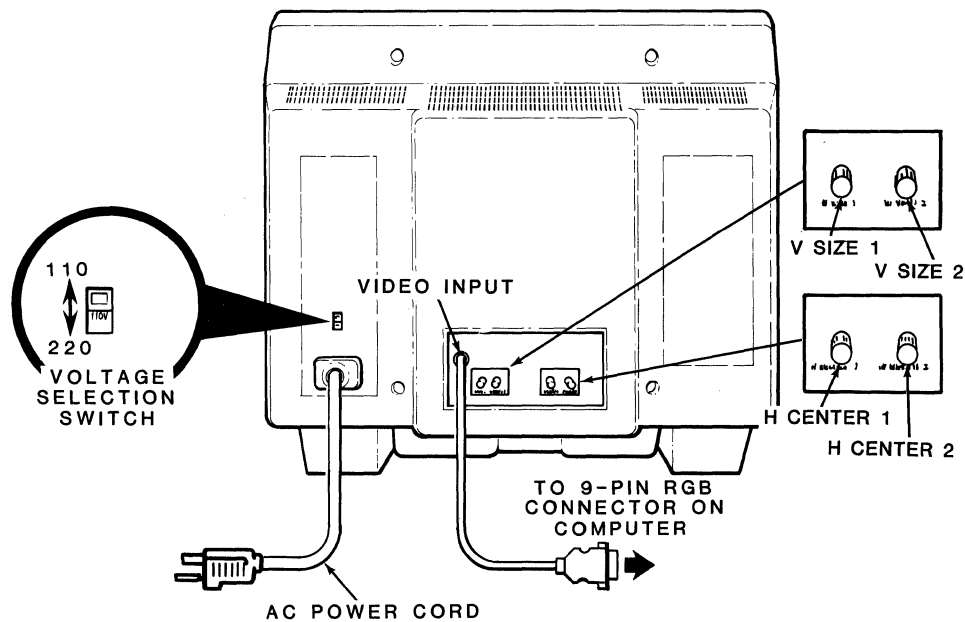


Figure 1-2
Rear Panel Controls and Cables

Chapter 2

Installation

This chapter discusses basic installation of the monitor. It includes the set-up procedure and performance test for the monitor.

1. Place the monitor on a horizontal surface that is near the computer and near AC power. The monitor must be located in an area that will provide proper ventilation and allow airflow through the unit. Verify that the vents on the top and bottom of the monitor are free from obstruction.
2. Connect the video monitor signal cable to the computer.
3. Connect the power cable to the monitor and then to the correct AC power source. Verify that the power source corresponds to the monitor's power requirements.

WARNING: Removing or lifting the ground from the AC power source may present a lethal shock hazard.

4. Turn on the computer and the monitor. The power indicator on the front of the monitor should light.
5. Perform the color bar test or the fill screen test to adjust the brightness and contrast to the desired levels. If further adjustments are required, refer to Chapter 4, "Servicing."

NOTE: Changes in room lighting or repositioning the monitor screen may require resetting the brightness and contrast controls.

Color Bar Test

The color bar test displays 16 different colors in the form of a bar graph. A gray scale (shades of a single color) is displayed if the monitor is used with a computer that does not have color capabilities. If the moni-

tor is to be used with a PC-compatible computer, display the PC color bar from the ROM. Display the color bar with a Z-100 PC series computer as follows:

1. Press the **CTRL**, **ALT**, and **INS** keys simultaneously to display the monitor prompt.
2. Enter **C** and press **RETURN** to call up the color bar display.
3. Proceed to the fill screen test.

NOTE: Not all video cards are capable of providing the RGBI video signals to the monitor. If the intensity bit is not used, only eight colors will be displayed.

The BASIC program in Listing 2-1 may also be used to generate a color bar pattern when used with a computer that has RGB color capabilities.

Listing 2-1
BASIC Color Bar Program

```
10 REM clear screen
20 CLS
30 REM produce color bar
40 LINE (0,0)-(79,106),0,BF
50 LINE (80,0)-(159,106),1,BF
60 LINE (160,0)-(239,106),4,BF
70 LINE (240,0)-(319,106),5,BF
80 LINE (320,0)-(399,106),2,BF
90 LINE (400,0)-(479,106),3,BF
100 LINE (480,0)-(559,106),6,BF
110 LINE (560,0)-(639,106),7,BF
120 REM label bars
130 LOCATE 13,5
140 PRINT TAB (5); "BLACK"; TAB (15); "BLUE"; TAB (25); "RED";
150 PRINT TAB (35); "MAGENTA"; TAB (45); "GREEN"; TAB (55); "CYAN";
160 PRINT TAB (65); "YELLOW"; TAB (75); "WHITE"
170 REM end of program
180 END
```

Fill Screen Test

The fill screen test will fill the screen with any character entered from the keyboard. If a Z-100 PC computer is being used, fill the screen as follows:

1. Press the **CTRL**, **ALT**, and **INS** keys simultaneously to display the monitor prompt.
2. Type **TEST** and press **RETURN** to enter the TEST menu.
3. Select the Keyboard Test by pressing the **2** key.
4. Choose any character to fill the screen by pressing the corresponding key. The capital Z is recommended.
5. Check to see if the screen is filled with the character and if the width and height of the display are correct. Refer to the specifications for dimensions.
6. After setting the desired controls, press the **DELETE** key to return to the test menu.
7. Press the **5** key to return to the monitor prompt.

The BASIC program shown in Listing 2-2 may also be used to fill the screen with any character as follows:

1. Prepare the computer for the BASIC program operation.
2. Enter the program shown in Listing 2-2.
3. Run the program by typing **RUN** and pressing the **RETURN** key. The screen will be filled with the letter Z or any other character inserted in line 20.
4. To end the program, press the **CTRL** and **BREAK** keys at the same time.

Listing 2-2
BASIC Program to Fill the Screen

```

10 FOR I=1 TO 2000
20 PRINT "Z";
30 NEXT I
40 GO TO 40
50 END
    
```

Video Cable Interface

The video cable is fixed to the monitor on one end and supplied with a D-type 9-pin connector on the other. Figure 2-1 illustrates the connector, and Table 2-1 lists the connector signals.

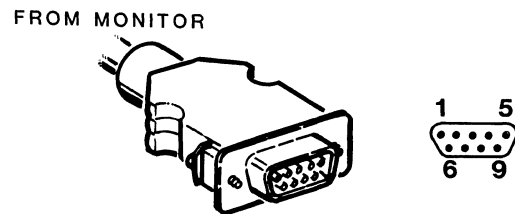


Figure 2-1
Video Cable Connector

Table 2-1
Video Connector Signals

PIN NO.	MODE 1	MODE 2
1	Ground.	Ground.
2	Ground.	R'.
3	R.	R.
4	G.	G.
5	B.	B.
6	Intensity.	G'.
7	Monochrome Video*	B'.
8	Horizontal Sync.	Horizontal Sync.
9	Vertical Sync.	Vertical Sync.

NOTE: Secondary red (R'), green (G'), and blue (B') signals are indicated by the lower case r, g, and b throughout this manual.

* Present, but not used by this monitor.

Circuit Descriptions

Refer to the block diagram and the schematics in Chapter 4, while reading the following material.

Video Signal Processing

The RGBI inputs are all TTL level, digital signals supplied by the computer. These signals are listed in Table 3-1.

Table 3-1
Input Signals

PIN NO.	MODE 1	MODE 2
1	Ground.	Ground.
2	Ground.	R'.
3	R.	R.
4	G.	G.
5	B.	B.
6	Intensity.	G'.
7	Monochrome Video*	B'.
8	Horizontal Sync.	Horizontal Sync.
9	Vertical Sync.	Vertical Sync.

NOTE: Secondary red (R'), green (G'), and blue (B') signals are indicated by the lower case r, g, and b throughout this manual.

*Present, but not used by this monitor.

The monitor determines the mode of operation by decoding the vertical sync signal. A positive polarity directs the monitor into mode 1 and a negative polarity directs the monitor into mode 2. The RGB (red, green, and blue) signals contain the primary color information. In mode 1, the intensity bit is used to enhance the hue of a particular color by providing additional drive to the displayed color. In this manner, as many as 16 different colors can be displayed.

In mode 2, additional color information is contained in the secondary colors r,g,and b. These bits of data are used in a similar manner as the intensity bit in mode 1. They are used to enhance the hue of a primary color by providing additional drive to the color signal. 64 color combinations are available using 6 input bits. The 16 colors and the input signal combinations required to generate those colors for both modes are listed in Table 3-2.

Table 3-2
Displayed Colors

Color	MODE 1	MODE 2
	R G B I	Rr Gg Bb
Black	0 0 0 0	00 00 00
Gray	0 0 0 1	00 00 10
Blue	0 0 1 0	00 10 00
Light blue	0 0 1 1	00 10 10
Green	0 1 0 0	10 00 00
Light green	0 1 0 1	10 00 10
Cyan	0 1 1 0	10 01 00
Light cyan	0 1 1 1	10 10 10
Red	1 0 0 0	01 01 01
Light red	1 0 0 1	01 01 11
Magenta	1 0 1 0	01 11 01
Light magenta	1 0 1 1	01 11 11
Yellow	1 1 0 0	11 01 01
Light yellow	1 1 0 1	11 01 11
White	1 1 1 0	11 11 01
Intensified white	1 1 1 1	11 11 11

0 = No signal.
1 = Signal active.

PRELIMINARY COPY

Chapter 4

Servicing

The following service procedures provide information on how to adjust, align and troubleshoot the monitor. These procedures are intended to be used with the schematics, component views, and waveforms found at the end of this chapter. Review the following safety guidelines before beginning service and perform the final checks at the end of this chapter after repairing the unit.

Safety Guidelines

WARNING: No work should be attempted on any part of the chassis by anyone not familiar with Zenith service procedures and precautions; otherwise personal injury may result.

WARNING: With monitor power turned off and disconnected, discharge the high voltage anode lead at the CRT using a jumper lead connected between the chassis and screwdriver as illustrated in Figure 6-1.

WARNING: Operation of the CRT at voltages higher than 28 KV may produce X-rays. Always verify that the voltage is at normal levels when servicing the monitor. Do not operate the monitor with excessive high voltage any longer than necessary to locate the cause of the excessive voltage.

WARNING: Carefully handle the CRT when holding, removing, or installing it; otherwise, implosion and/or personal injury may result.

CAUTION: Many integrated circuits are electrostatic-sensitive and can be damaged by static electricity if they are handled improperly. Once an IC or board is removed from its protective foam packing, envelope, or computer **do not** lay the IC or board down or let go of it until it is installed in the unit. When bending the leads of an IC, hold the IC in one hand and place the other hand on the work surface before touching the IC to the work surface. This will equalize the static electricity between the work surface, you, and the IC.

WARNING: Under no circumstances should the original design be modified or altered without permission from Zenith Electronics Corporation. All components should be replaced only with types identical to those in the original circuit, and their physical location, wiring, and lead dress must conform to the original layout upon completion of repairs.

PRELIMINARY COPY

AC leakage Test

To prevent electrical shock after reassembly, perform an AC leakage test on all exposed metal parts of the monitor. Do not use an isolation transformer to perform this test.

1. Connect the test circuit as shown in Figure 4-1.
2. With the monitor turned on, measure the leakage voltage between earth ground and an exposed monitor metal part.
3. Repeat the measurement with the meter leads reversed.
4. Repeat steps 2 and 3 until all exposed metal parts are verified to have satisfactory AC leakage levels.

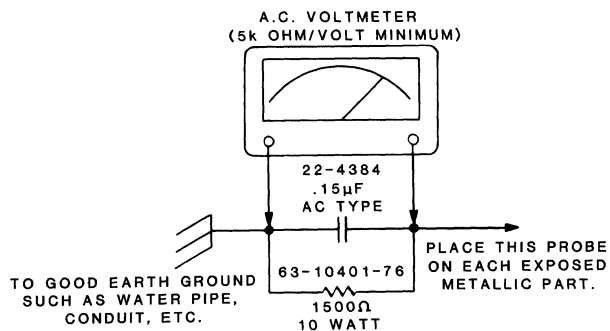


Figure 4-1
AC Leakage Voltmeter Circuit

WARNING: An isolation transformer must be used during troubleshooting to prevent personal injury and/or damage to the monitor or test equipment.

Suggested Supplies and Equipment

TOOLS AND SUPPLIES

The following items are recommended to be at hand when servicing the monitor.

- 1/4-inch nut driver.
- Flat-blade screwdriver, 1/4-inch blade.
- Phillips screwdriver, No. 1 tip.
- Phillips screwdriver, No. 2 tip.
- Diagonal cutters.
- Wire strippers.
- Long-nose pliers.
- Desoldering tool.
- Soldering iron, 25 to 40 watts.
- Solder, 60/40, HE-490-185.
- Desoldering braid, HE-354-59.
- Lint-free cloths.
- Z-100 PC or equivalent.
- Diagnostic disk, CB-5063-28

TEST EQUIPMENT

The following items are recommended to troubleshoot the monitor to the board level. The test equipment specification should meet or exceed those listed after each item.

- Oscilloscope — DC to 100 MHz, dual-trace triggered sweep. Tektronix Model 2235, or equivalent.
- Digital voltmeter — High impedance input, zero to 1000 volts, zero to 1 megohm. Heath Model SM-2215, or equivalent.

- Low capacitance oscilloscope probe — Input capacitance adjustable from 15 pF to 50 pF, 4 ns rise time. Heath Model PKW-105, or equivalent.
- High voltage probe — Zero to 40 kV. Heath Model IM-5215, or equivalent.
- Isolation transformer.

Inspection and Troubleshooting

Use the following procedures to determine possible external causes of monitor failure.

- Verify proper computer operation and compatibility.
- Check monitor controls for proper response and settings.
- Check the signal and power cables for proper connection. Inspect these cables for burnt insulation, broken wires, or loose prongs on the plugs.
- Check the AC power source for proper operating voltage.

If the previous inspection did not reveal the cause of monitor failure, refer to Table 4-1. This table will help to identify the problem area and suggest the most likely cause. A board or module will be recommended for further investigation. The checkout procedure for each board or module follows after Table 4-1.

Table 4-1
Fault Isolation

PROBLEM	POSSIBLE CAUSE	ITEM TO CHECK
Dead monitor, power LED is not lit.	No power.	Power source. Power cord. Power switch. Power supply. Fuse.
No raster, power LED is lit.	High-voltage or horizontal circuits.	G2 adjustment. High-voltage to anode. Main board Power supply.
No display.	No video.	Brightness, contrast, RGB gain, drive, or cutoff adjustments. Video cable. Main board. CRT socket board.
No vertical deflection.	Vertical circuit.	Main board. Deflection yoke.
Poor vertical linearity.	Vertical circuit.	Vertical linearity or pincushion adjustment. Main board.
Poor horizontal linearity.	Horizontal circuit.	Horizontal linearity adjustment. Main board.
Narrow picture.	Horizontal circuit.	Width adjustment. Main board
Poor color.	Video circuit.	RGB gain, drive or cutoff adjustments. Main board. CRT socket board.
Out of focus.	High-voltage circuit.	Focus adjustment. Main board
Insufficient brightness.	Video circuit.	Brightness, contrast, RGB gain, drive, cutoff or G2 adjustments. Main board. CRT socket board.

Cleaning Procedure

WARNING: Be sure that the monitor's power cable is unplugged before cleaning.

- Clean the cabinet with a lint-free cloth, lightly dampened with a mild cleaning solution. **Do not** spray liquids directly on the monitor or use a wet, saturated cloth.
- Clean the screen with a good quality glass cleaner.
- Be sure that the monitor is completely dry before applying electric power.

Servicing Diagrams

Schematic and component location drawings are provided in this section. The source location of waveforms referenced in the text are shown on both schematic and component location drawings.

A Z-150 PC computer was used to supply the RGB signals for generating the waveforms.

NOTE: Some input and output waveforms for some boards are taken from the adjacent boards because test points having the same signal are more accessible there.

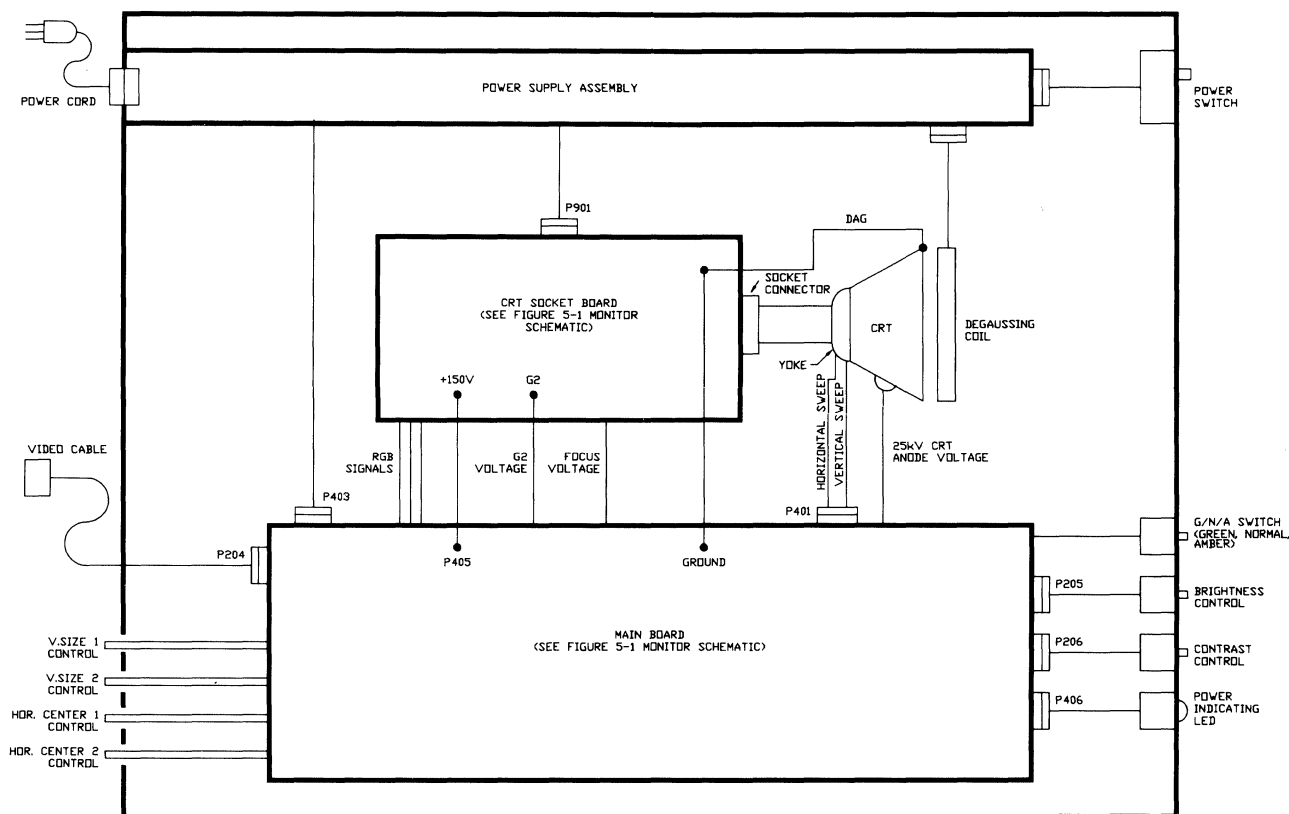


Figure 4-2
Block Diagram

Chapter 5

Parts Lists

This section contains the replacement parts list for the monitor.

CAUTION: Many integrated circuits are electrostatic-sensitive and can be damaged by static electricity if they are handled improperly. Once an IC or board is removed from its protective foam packing, envelope, or computer **do not** lay the IC or board down or let go of it until it is installed in the monitor. When bending the leads of an IC, hold the IC in one hand and place the other hand on the work surface before touching the IC to the work surface. This will equalize the static electricity between the work surface, you, and the IC.

WARNING: Under no circumstances should the original design be modified or altered without permission from Zenith Electronics Corporation. All components should be replaced only with types identical to those in the original circuit, and their physical location, wiring, and lead dress must conform to the original layout upon completion of repairs.

In some instances redundant circuitry is incorporated for additional circuit protection and X-radiation protection. Special circuits are also used to prevent shock and fire hazard. The letter X in the schematic, parts list, and the component views designate special critical safety components. These components should be replaced only with components identical to the original component.

Table 5-1
Electronic Parts

CIRCUIT
REFERENCE
DESIGNATOR DESCRIPTION

Capacitors

C201	Capacitor, 22 μ F, 35 volts, electrolytic
C202	Capacitor, .01 μ F, ceramic disc
C203	Capacitor, 100 μ F, 16 volts, electrolytic
C204	Capacitor, 47 μ F, 25 volts, electrolytic
C205	Capacitor, 47 μ F, 25 volts, electrolytic

C206	Capacitor, 10 μ F, 35 volts, electrolytic
C207	Capacitor, 22 μ F, 35 volts, electrolytic
C208	Capacitor, 22 μ F, 35 volts, electrolytic
C209	Capacitor, 100 μ F, 16 volts, electrolytic
C210	Capacitor, 100 μ F, 16 volts, electrolytic
C211	Capacitor, 2.2 μ F, 250 volts, electrolytic
C301	Capacitor, .033 μ F
C301	Capacitor, .033 μ F, 50 volts
C302	Capacitor, 1 μ F, 50 volts, electrolytic
C303	Capacitor, 100 pF, ceramic disc
C304	Capacitor, 680 pF, ceramic disc
C305	Capacitor, 150 pF, ceramic disc
C306	Capacitor, 1.5 μ F, 35 volts, tantalum
C307	Capacitor, 4700 pF, ceramic disc
C308	Capacitor, 330 μ F, 16 volts
C309	Capacitor, 180 pF, ceramic disc
C310	Capacitor, 100 μ F, 50 volts, electrolytic
C311	Capacitor, 10 μ F, 35 volts, electrolytic
C312	Capacitor, 10 μ F, 16 volts, electrolytic
C313	Capacitor, .027 μ F, 250 volts
C314	Capacitor, 4.7 μ F, 160 volts, electrolytic
C315	Capacitor, 220 μ F, 50 volts, electrolytic
C316	Capacitor, 3.3 μ F, 160 volts, electrolytic
C317	Capacitor, 4.7 μ F, 50 volts, electrolytic
C318	Capacitor, 10 μ F, 35 volts, electrolytic, identified as C308, next to J30
C319	Capacitor, 4700 pF, ceramic disc
C320	Capacitor, .047 μ F, 100 volts
C321	Capacitor, 4.7 μ F, 50 volts, electrolytic
C322	Capacitor, 47 μ F, 50 volts, electrolytic
C323	Not used
C324	Capacitor, 10 μ F, 35 volts, electrolytic
C325	Capacitor, 100 μ F, 16 volts, electrolytic
C326	Capacitor, 2.2 μ F, 50 volts, electrolytic
C401	Not used
C402	Capacitor, 1 μ F, 50 volts, electrolytic

PRELIMINARY COPY

C403	Capacitor, 22 μ F, 16 volts, electrolytic	C482	Capacitor, 82 pF
C404	Capacitor, .015 μ F	C483	Capacitor, 1 μ F, 50 volts, electrolytic
C405	Capacitor, .015 μ F	C484	Capacitor, 1 μ F, 50 volts, electrolytic
C406	Capacitor, .001 μ F	C501	Capacitor, .01 μ F, ceramic disc
C407	Capacitor, .0047 μ F	C502	Capacitor, .01 μ F, ceramic disc
C408	Capacitor, .027 μ F	C503	Capacitor, 10 μ F, 35 volts, electrolytic
C409	Capacitor, 47 μ F, 16 volts, electrolytic	C504	Capacitor, .022 μ F
C410	Capacitor, .0068 μ F	C505	Capacitor, 22 μ F, 35 volts, electrolytic
C411	Capacitor, 100 pF, ceramic disc	C506	Capacitor, .033 μ F, 250 volts
C412	Capacitor, 1 μ F, 50 volts, electrolytic	C541	Capacitor, .01 μ F, ceramic disc
C413	Capacitor, 4700 pF, ceramic disc	C542	Capacitor, .01 μ F, ceramic disc
C414	Capacitor, .0095 μ F, 1600 volts	C543	Capacitor, 10 μ F, 35 volts, electrolytic
C415	Capacitor, .1 μ F, 250 volts	C544	Capacitor, .022 μ F
C416	Capacitor, 22 μ F, 100 volts, electrolytic	C544	Capacitor, .022 μ F, 50 volts
C417	Capacitor, 1 μ F, 100 volts	C545	Capacitor, 22 μ F, 35 volts, electrolytic
C418	Capacitor, 2.7 μ F, 250 volts	C546	Capacitor, .033 μ F
C419	Capacitor, 22 μ F, 160 volts, electrolytic	C571	Capacitor, .01 μ F, ceramic disc
C420	Capacitor, 100 pF, ceramic disc	C572	Capacitor, .01 μ F, ceramic disc
C421	Capacitor, 1 μ F, 50 volts, electrolytic	C573	Capacitor, 10 μ F, 35 volts, electrolytic
C422	Capacitor, .022 μ F, 250 volts	C574	Capacitor, .022 μ F
C423	Capacitor, 4700 pF, ceramic disc	C575	Capacitor, 22 μ F, 35 volts, electrolytic
C424	Capacitor, 47 μ F, 200 volts, electrolytic	C576	Capacitor, .033 μ F
C425	Capacitor, 2.2 μ F, 250 volts	C901	Capacitor, .022 μ F
C426	Capacitor, .0022 μ F, 1600 volts	C902	Capacitor, 330 pF
C427	Capacitor, .47 μ F, 100 volts		
C428	Capacitor, .01 μ F, ceramic disc		
C430	Capacitor, 2200 pF	Diodes	
C431	Capacitor, .1 μ F, 100 volts	D201	Diode, 1N4148 or 1S2076
C432	Capacitor, 22 μ F, 50 volts, electrolytic	D202	Diode, 1S2076
C433	Not used	D302	Diode, 1N4148 or 1S2076
C434	Not used	D303	Diode, 1N4148 or 1S2076
C435	Capacitor, 47 μ F, 35 volts, electrolytic	D304	Diode, V09C
C436	Capacitor, .22 μ F, 50 volts	D305	Diode, V09C
C443	Capacitor, .0033 μ F, 600 volts	D307	Diode, Zener, HZ-11A2
C481	Capacitor, 330 pF, ceramic disc	D308	Diode, 1S2076
		D309	Diode, Zener, HZ-6C2
		D401	Diode, 1N4148 or 1S2076

D402	Diode, 1N4148 or 1S2076	Q206	Transistor, BC237B
D402	Diode, 1N4148 or 1S2076	Q207	Transistor, BC237B
D403	Diode, 1N4148 or 1S2076	Q208	Transistor, BC237B
D404	Diode, 1N4148 or 1S2076	Q209	Transistor, BC237B
D405	Diode, Zener, HZ-12A1	Q210	Transistor, BC237B
D406	Diode, RGP10G	Q211	IC, regulator, 7805
D406	Diode, V06E	Q212	IC, 74LS05
D407	Diode, RGP15M	Q301	Transistor, 2SC1921
D408	Diode, RGP10G	Q302	Transistor, 2SC1138
D409	Diode, RGP10G	Q303	Transistor, 2SB861C
D410	Diode, RGP10G	Q304	IC, LM324 or HA17324
D411	Diode, RGP10G	Q305	IC, HD14053BP or TC4053BP
D412	Diode, RGP10G	Q401	IC, HA11235
D413	Diode, RGP15M	Q402	Transistor, 2SD667C
D414	Diode, RGP10G	Q403	Transistor, 2SD1094
D415	Diode, Zener, HZ-5C2 or 05Z5-1X	Q404	Transistor, 2SD667C
D416	Diode, 1N4148 or 1S2076	Q405	Transistor, 2SB856
D417	Diode, 1N4148 or 1S2076	Q406	Transistor, 2SD667C
D501	Diode, 1N4148 or 1S2076	Q407	Transistor, BU208
D502	Diode, 1N4148 or 1S2076	Q408	Transistor, 2SC2898
D541	Diode, 1N4148 or 1S2076	Q409	IC, LM324 or HA17324
D542	Diode, 1N4148 or 1S2076	Q410	Transistor, 2SC458
D571	Diode, 1N4148 or 1S2076	Q411	Transistor, 2SA844E
D572	Diode, 1N4148 or 1S2076	Q412	IC, HD14053BP or TC4053BP
		Q413	Transistor, 2SC458
Inductors		Q501	Transistor, 2N2396 or 2SC641K
L301	Coil, air core	Q502	Transistor, 2N2396 or 2SC641K
L401	Transformer, TCH-141	Q503	Transistor, BC237B
L402	Choke, horizontal linearity, TLH-140	Q504	Transistor, 2SC1507 or 2SC1514
L403	Coil, iron core, TCH-139	Q505	Transistor, 2N2396 or 2SC1906
L404	Choke, iron core, TSH-138		
ICs and Transistors		Q506	Transistor, 2SC1507 or 2SC1514
Q201	IC, 74S472	Q541	Transistor, 2N2396 or 2SC641K
Q202	IC, 74LS86	Q542	Transistor, 2N2396 or 2SC641K
Q203	IC, LM324 or HA17324	Q543	Transistor, BC237B
Q204	Transistor, BC237B	Q544	Transistor, 2SC1507 or 2SC1514
Q205	Transistor, BC307B		

Q545	Transistor, 2N2396 or 2SC1906	R228	Resistor, 33 Ω , 1/2 watt
Q546	Transistor, 2SC1507 or 2SC1514	R229	Resistor, 1.2 k Ω , 1/4 watt, 5%
Q571	Transistor, 2N2396 or 2SC641K	R302	Resistor, 470 Ω
Q572	Transistor, 2N2396 or 2SC641K	R304	Resistor, 2 k Ω
Q573	Transistor, BC237B	R305	Resistor, 15 k Ω
Q574	Transistor, 2SC1507 or 2SC1514	R306	Control, dual, 1 k Ω – 1 k Ω
Q575	Transistor, 2N2396 or 2SC1906	R307	Resistor, 10 k Ω , 1/4 watt, 5%
Q576	Transistor, 2SC1507 or 2SC1514	R309	Control, 5 k Ω
		R310	Resistor, 27 k Ω
		R312	Resistor, 120 Ω
		R313	Resistor, 11 k Ω
		R314	Resistor, 9.1 k Ω
		R315	Resistor, 1.2 k Ω , 1/4 watt, 5%
		R316	Resistor, 1.2 k Ω , 1/4 watt, 5%
		R317	Resistor, 75 Ω
		R318	Resistor, 1.5 Ω , 1/2 watt, 5%
		R319	Resistor, 10 Ω , 1 watt, 5%
		R320	Thermistor, 2.2 Ω , 1 watt
		R321	Resistor, 2.0 Ω
		R322	Resistor, 4.7 Ω
		R323	Resistor, 33 k Ω
		R324	Resistor, 10 k Ω , 1/4 watt, 5%
		R325	Resistor, 120 Ω , 2 watts
		R326	Control, 10 k Ω , 1/2 watt
		R327	Resistor, 1 k Ω , 1/2 watt
		R328	Resistor, 6.8 k Ω
		R329	Resistor, 1.2 k Ω , 1/4 watt, 5%
		R330	Resistor, 100 k Ω , 1/4 watt, 5%
		R331	Resistor, 1 M Ω
		R332	Resistor, 10 k Ω , 1/4 watt, 5%
		R333	Control, 10 k Ω , E-W APL
		R334	Resistor, 10 k Ω , 1/4 watt, 5%
		R335	Resistor, 100 k Ω , 1/4 watt, 5%
		R336	Resistor, 100 k Ω , 1/4 watt, 5%
		R337	Resistor, 1 M Ω
Resistors			
R202	Resistor, 10 k Ω , 1/4 watt, 5%		
R203	Resistor, 10 k Ω , 1/4 watt, 5%		
R204	Resistor, 22 k Ω		
R205	Resistor, 1.2 k Ω , 1/4 watt, 5%		
R206	Resistor, 3.3 k Ω		
R207	Resistor, 5.6 k Ω		
R208	Control, 10 k Ω , brightness		
R209	Control, 10 k Ω , contrast		
R210	Resistor, 56 k Ω		
R211	Resistor, 33 Ω		
R212	Resistor, 10 k Ω , 1/4 watt, 5%		
R213	Resistor, 5.6 k Ω		
R214	Resistor, 33 Ω		
R215	Resistor, 2.2 k Ω		
R216	Resistor, 2.2 k Ω		
R217	Resistor, 2.2 k Ω		
R218	Resistor, 2.2 k Ω		
R219	Resistor, 2.2 k Ω		
R220	Resistor, 2.2 k Ω		
R221	Resistor, 33 Ω		
R223	Resistor, 820 Ω		
R224	Resistor, 1.5 k Ω , 1/4 watt, 5%		
R225	Resistor, 1 k Ω		
R226	Resistor, 1.5 k Ω , 1/4 watt, 5%		
R227	Resistor, 33 Ω , 1/2 watt		

R338	Resistor, 820 Ω	R433	Control, 5 k Ω
R339	Resistor, 10 k Ω , 1/4 watt, 5%	R434	Resistor, 1 k Ω
R340	Resistor, 82 k Ω	R435	Control, 68 Ω , 3 watts, horizontal centering
R341	Resistor, 1 k Ω , 1/2 watt, 5%	R436	Resistor, 56 Ω , 2 watts
R401	Resistor, 2.4 k Ω , 3 watts	R437	Resistor, 270 Ω
R402	Resistor, 6.8 k Ω	R438	Resistor, 1 k Ω
R403	Resistor, 68 k Ω	R439	Resistor, 180 Ω
R404	Resistor, 6.8 k Ω	R440	Resistor, 180 Ω , 1/4 watt, 5%
R405	Resistor, 5.6 k Ω	R441	Resistor, 21 Ω
R406	Resistor, 5.6 k Ω	R442	Resistor, 1.8 k Ω , 5 watts
R407	Resistor, 5.6 k Ω	R443	Resistor, 1.8 k Ω , 5 watts
R408	Resistor, 2.4 k Ω	R444	Resistor, 10 Ω , 1/4 watt, 5%
R409	Control, 5 k Ω , Frequency 1	R445	Resistor, 470 Ω
R410	Resistor, 470 Ω	R446	Resistor, 56 k Ω
R411	Resistor, 22 k Ω	R447	Resistor, 1 k Ω
R412	Resistor, 1 k Ω , 1/4 watt, 5%	R448	Resistor, 1 k Ω
R413	Control, 10 k Ω , Horizontal phase 1	R449	Resistor, 10 k Ω , 1/4 watt, 5%
R415	Resistor, 1.5 k Ω , 1/4 watt, 5%	R450	Resistor, 39 k Ω
R416	Resistor, 4.7 k Ω	R451	Control, 22 k Ω , 20 kV adjust
R417	Resistor, 1 k Ω	R452	Resistor, 2 k Ω , 1/4 watt, 5%
R418	Resistor, 620 Ω	R453	Resistor, 2 k Ω , 1/4 watt, 5%
R419	Resistor, 1.5 k Ω , 1/4 watt, 5%	R454	Thermistor, 2.2 Ω
R420	Resistor, 270 Ω , 1/2 watt, 5%	R455	Resistor, 470 k Ω
R421	Resistor, 100 Ω , 1/4 watt, 5%	R456	Resistor, 100 Ω , 1/4 watt, 5%
R422	Resistor, 2.2 k Ω , 1/4 watt, 5%	R457	Resistor, 10 k Ω , 1/4 watt, 5%
R423	Resistor, 2.2 k Ω , 1/4 watt, 5%	R458	Resistor, 220 Ω
R424	Resistor, 330 Ω , 1/4 watt, 5%	R459	Resistor, 2.2 k Ω , 1 watt
R425	Resistor, 220 Ω , 1/2 watt, 5%	R463	Resistor, 56 k Ω
R426	Resistor, 100 Ω , 1/4 watt, 5%	R466	Resistor, 4.3 k Ω
R427	Resistor, 56 k Ω	R467	Resistor, 3 k Ω
R428	Resistor, 510 Ω , 1 watt	R468	Resistor, 2.4 k Ω
R429	Resistor, 100 k Ω , 1/4 watt, 5%	R469	Control, 5 k Ω , Frequency 2
R430	Resistor, 3.3 k Ω , 1/4 watt, 5%	R473	Control, 10 k Ω , Horizontal phase 2
R431	Resistor, 100 k Ω , 1/4 watt, 5%	R481	Resistor, 1 k Ω
R432	Resistor, 1 k Ω , 1/4 watt, 5%	R482	Resistor, 100 Ω , 1/4 watt, 5%

R483	Resistor, 3.9 k Ω	R543	Resistor, 1.2 k Ω , 1/4 watt, 5%
R484	Resistor, 15 k Ω	R544	Resistor, 1.2 k Ω , 1/4 watt, 5%
R485	Resistor, 1 k Ω	R545	Resistor, 100 Ω , 1/4 watt, 5%
R486	Resistor, 5.6 k Ω	R546	Resistor, 100 Ω , 1/4 watt, 5%
R486	Resistor, 680 k Ω	R547	Resistor, 470 Ω
R493	Control, 5 k Ω	R548	Resistor, 470 Ω
R501	Resistor, 680 Ω	R549	Resistor, 1.5 k Ω , 1/4 watt, 5%
R502	Resistor, 680 Ω	R550	Resistor, 1.5 k Ω , 1/4 watt, 5%
R503	Resistor, 1.2 k Ω , 1/4 watt, 5%	R551	Resistor, 470 Ω
R504	Resistor, 1.2 k Ω , 1/4 watt, 5%	R552	Resistor, 470 Ω
R505	Resistor, 100 Ω , 1/4 watt, 5%	R553	Resistor, 1 k Ω
R506	Resistor, 100 Ω , 1/4 watt, 5%	R554	Resistor, 1 k Ω
R507	Resistor, 470 Ω	R555	Resistor, 560 Ω
R508	Resistor, 470 Ω	R556	Resistor, 3.3 k Ω
R509	Resistor, 1.5 k Ω , 1/4 watt, 5%	R557	Resistor, 820 Ω
R510	Resistor, 1.5 k Ω , 1/4 watt, 5%	R558	Resistor, 2.7 k Ω , 2 watts
R511	Resistor, 470 Ω	R559	Resistor, 2.7 k Ω , 2 watts
R512	Resistor, 470 Ω	R560	Resistor, 6.8 k Ω , 2 watts
R513	Resistor, 1 k Ω	R561	Resistor, 6.8 k Ω , 2 watts
R514	Resistor, 1 k Ω	R562	Resistor, 300 Ω , 1/4 watt, 5%
R515	Resistor, 560 Ω	R563	Control, 500 Ω , green cutoff
R516	Resistor, 3.3 k Ω	R564	Resistor, 100 Ω , 1/4 watt, 5%
R517	Resistor, 820 Ω	R565	Resistor, 68 Ω
R518	Resistor, 2.7 k Ω , 2 watts	R556	Control, 2.2 k Ω
R519	Resistor, 2.7 k Ω , 2 watts	R567	Control, 2.2 k Ω
R520	Resistor, 6.8 k Ω , 2 watts	R571	Resistor, 680 Ω
R521	Resistor, 6.8 k Ω , 2 watts	R572	Resistor, 680 Ω
R522	Resistor, 330 Ω , 1/4 watt, 5%	R573	Resistor, 1.2 k Ω , 1/4 watt, 5%
R523	Control, 500 Ω , red cutoff	R574	Resistor, 1.2 k Ω , 1/4 watt, 5%
R524	Resistor, 100 Ω , 1/4 watt, 5%	R575	Resistor, 100 Ω , 1/4 watt, 5%
R525	Resistor, 68 Ω , 1/4 watt, 5%	R576	Resistor, 100 Ω , 1/4 watt, 5%
R526	Control, 2.2 k Ω	R577	Resistor, 470 Ω
R527	Control, 2.2 k Ω	R578	Resistor, 470 Ω
R541	Resistor, 680 Ω	R579	Resistor, 1.5 k Ω , 1/4 watt, 5%
R542	Resistor, 680 Ω	R580	Resistor, 1.5 k Ω , 1/4 watt, 5%

R581 Resistor, 475 Ω
R582 Resistor, 475 Ω
R583 Resistor, 178 k Ω
R584 Resistor, 178 Ω
R585 Resistor, 560 Ω

R586 Resistor, 3.3 k Ω
R587 Resistor, 820 Ω
R588 Resistor, 27 k Ω , 2 watts
R589 Resistor, 27 k Ω , 2 watts
R590 Resistor, 6.8 k Ω , 2 watts

R591 Resistor, 6.8 k Ω , 2 watts
R592 Resistor, 330 Ω , 1/4 watt, 5%
R593 Control, 500 Ω , blue cutoff
R594 Resistor, 100 Ω , 1/4 watt, 5%
R595 Resistor, 68 Ω , 1/4 watt, 5%

R901 Resistor, 330 Ω , 1/2 watt, 5%
R902 Resistor, 330 Ω , 1/2 watt, 5%
R903 Resistor, 330 Ω , 1/2 watt, 5%
R904 Resistor, 1 k Ω , 1/2 watt, 5%
R905 Resistor, 150 k Ω , 1/4 watt, 2%

R906 Resistor, 330 k Ω , 1/2 watt, 5%
R907 Control, 10 k Ω

Transformers

T402 Transformer, TLN-125A
T403 Transformer, TFB-176, flyback
T408 Transformer, TLN-125A

Miscellaneous

CRT Cathode-Ray Tube, 30 x 66, M34JDU
S201 Switch, green-normal, amber selection

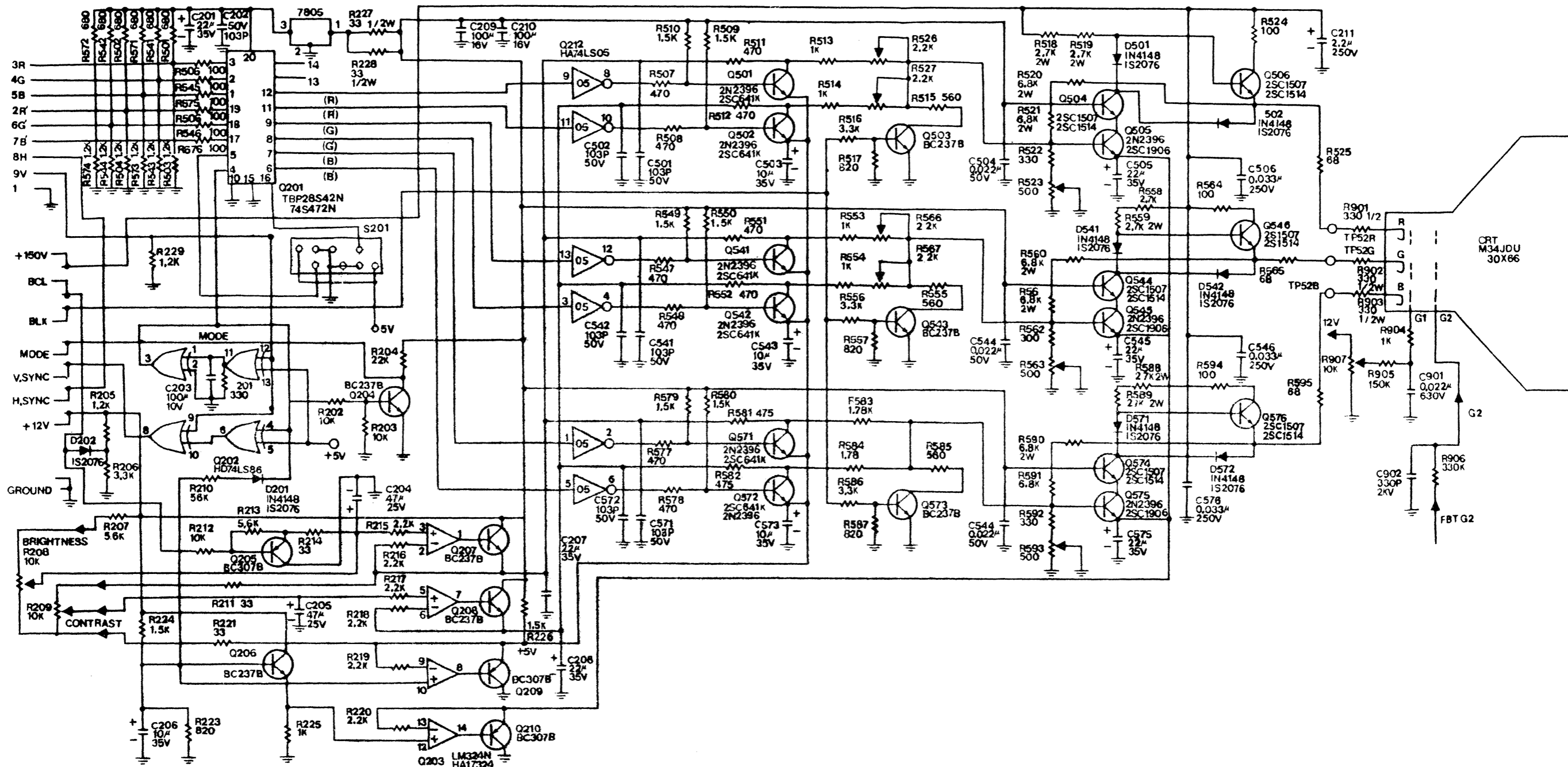


Figure 5-1 Part 1
Monitor Schematic

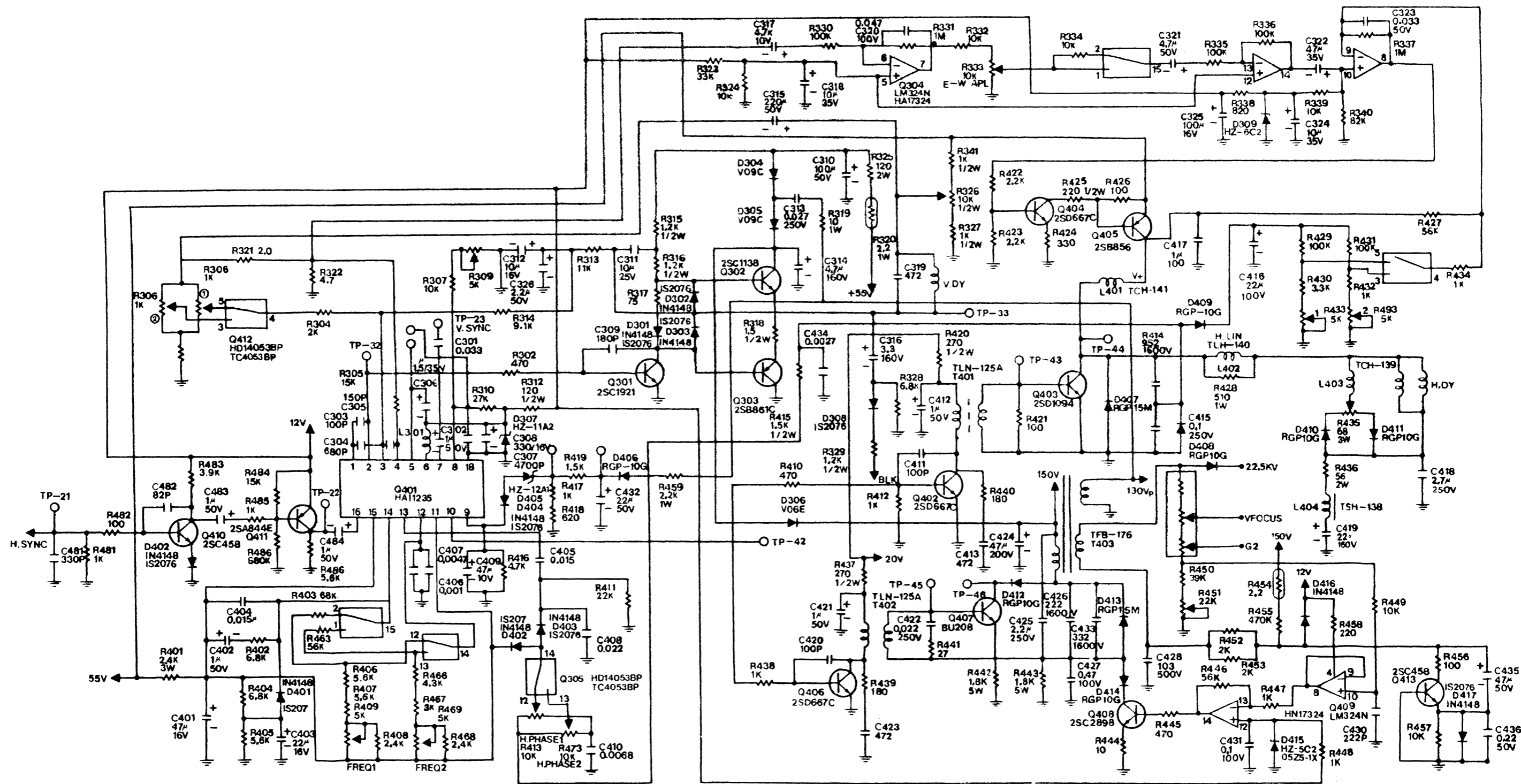


Figure 5-1 Part 2
Monitor Schematic