SERVICE MANUAL

Monochrome Video Monitors
ZVM-1220/1230

ZENITH | data systems

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

Zenith Data Systems Corporation
St. Joseph, Michigan 49085

Contents

Characteristics

Zenith Data Systems ZVM-1220 and ZVM-1230 video monitors each provide a monochrome display from NTSC composite video signals. These video monitors are for use with Zenith Z-100, Z-100 PC, and most other small computers.

All models are the same except for CRT phosphor color and components necessary to accommodate applicable AC voltage:

ZVM-1220-A	Amber phosphor CRT	120 VAC
ZVM-1230-A	Green phosphor CRT	120 VAC
ZVM-1220-EA	Amber phosphor CRT	240 VAC
ZVM-1230-EA	Green phosphor CRT	240 VAC

Controls and Indicators

(Shown in Figure 1)

Side Panel Controls	Contrast (top control) Brightness (bottom control)
Rear Panel Controls	Power Switch, Vertical Size, Horizontal Hold, Width
Front Panel	LED Power Indicator

Specifications

Electrical Power Requirements (35 watts all models)	
ZVM-1220-A	100-130 VAC, 60 Hz, 0.4A
ZVM-1230-A	100-130 VAC, 60 Hz, 0.4A
ZVM-1220-EA	200-260 VAC, 50 Hz, 0.2A
ZVM-1230-EA	200-260 VAC, 50 Hz, 0.2A
Cathode-Ray Tube	
Size	12 inch (305 mm) diagonal
Phosphor	
ZVM-1220-A	Amber (H-10)
ZVM-1220-EA	Amber (H-10)
ZVM-1230-A	Green (P-31)
ZVM-1230-EA	Green (P-31)
Anode Voltage	13 kV

Installation

1. Place the video monitor on a horizontal surface that is near the computer and near AC voltage.
2. Connect the video monitor signal cable between the computer and the video monitor.
3. Connect the video monitor power cable to the correct AC voltage.
4. Turn on the computer and the video monitor power switches. The power indicator on the front of the video monitor should light.

Listing 1
BASIC program used to fill the screen with a character

```
10 FOR I = 1 TO 2000
20 PRINT "Z";              'replace the "Z" with the
30 NEXT I                  'character of your choice
40 GO TO 40
```

5. Use the BASIC program shown in Listing 1 to fill the screen with any character as follows:
   a. Enter the program shown in Listing 1 into the computer. You may want to save this program on a disk for later use.
   b. 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.
   c. To end the program, press **CTRL** and **BREAK** keys at the same time.
6. Set the contrast and brightness controls for maximum, full clockwise.
7. As the CRT warms up, a raster should fill the screen.
8. Adjust the contrast and brightness controls as desired. The suggested sequence is:
   a. Set the brightness for a slight raster.
   b. Set the contrast to a level that is pleasant.
   c. Reset the brightness for a slight raster.

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

9. Adjust the vertical size and width controls to fill the screen with raster.
10. Adjust the horizontal hold control to lock in the characters.

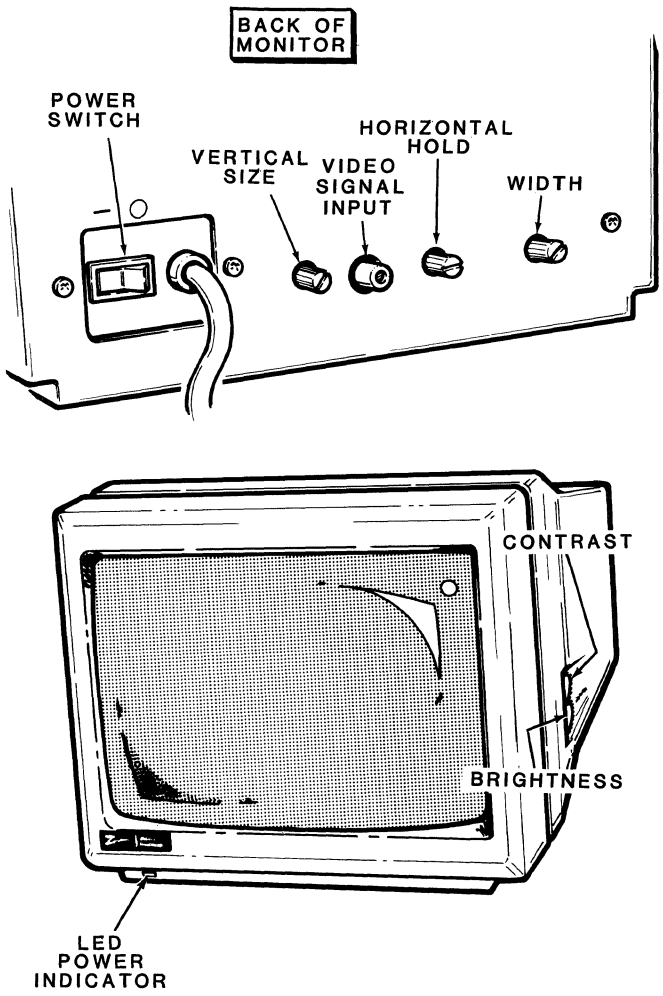


Figure 1
ZVM-1220 and ZVM-1230 Monitors

Block Diagram

Refer to Figure 2 as you read the following description.

Signal Paths — The composite video signal is split into two components at the first stage inside the monitor. One component is used to supply the video information to the CRT. The other component of the signal is used to supply vertical and horizontal synchronization (sync) information. This component goes to both vertical and horizontal oscillators after it is split at the sync amplifier/separator stage.

Deflection — Deflection of the electron beam is controlled by the current flow in the horizontal and vertical windings of the CRT yoke. Vertical current is supplied by the vertical processor output which is controlled by the vertical size control. The horizontal output, which is driven by a horizontal driver, supplies the horizontal current through the width control.

In addition to supplying the current for horizontal deflection, transformer TX102 windings also supply the +13 kV high voltage, +500 VDC, and +60 VDC supplies.

Refer to the following circuit descriptions for more information.

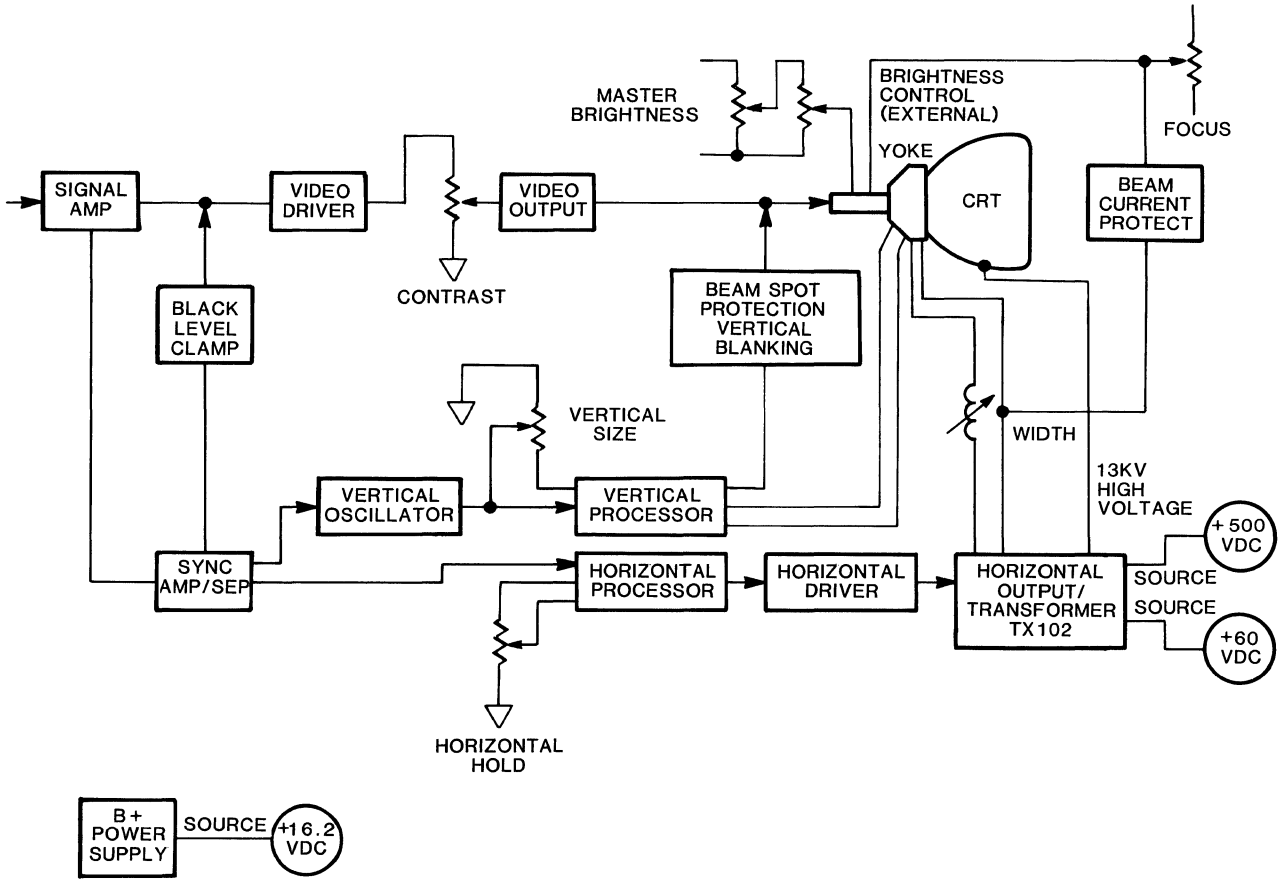


Figure 2
ZVM-1220 and ZVM-1230 Monitor Block Diagram

Power Supply

The full wave bridge rectifier circuit comprised of diodes CRX501 through CRX504 rectify the AC voltage when power switch SX501 is closed. Capacitor CX507 develops approximately +170 VDC with 1.7 Vpp typical ripple. CX508 and CX509 provide additional filtering. The DC potential of +170 volts is applied to pin 12 of transformer TX502. Resistor RX505 and capacitor CX513 provide a self-starting bias circuit for transistor QX501. When voltage develops at the output of the bridge, the base of QX501 is driven positive, forcing the transistor into conduction. As a current path is achieved through QX501, pin 10 of TX502 approaches chassis ground potential. As current flows through the primary of TX502, pins 10 to 12, a magnetic field develops around the winding, inducing EMF into each secondary winding, pins 1 to 2 and 7 to 8. The voltage induced into the winding tied to the emitter of QX501 gradually goes positive until conduction through the transistor stops. When conduction stops, the field collapses and the collector tuned circuit rings at a frequency determined by CX512 and the primary of TX502. This keeps QX501 reverse biased. When the sinewave at the collector of QX501 tries to go negative, it induces a negative voltage at pin 7 of TX502 and the transistor begins to conduct to saturation again. The voltage induced into the winding, pin 1 to pin 2 of TX502 is rectified by CRX506 and filtered by CX511 to provide a +23 VDC input to the emitter of QX502. This transistor, along with QX503, QX504, and associated circuitry, form the power supply regulator. RX503 is the B+ adjustment and should be set for +15.8 VDC output. CRX505 is the power indicator.

Video Processing

The composite video signal is fed to 75 ohm resistor, R401, and then goes through CX401 to the base of Q401. Signals appear at both collector and emitter of Q401.

The inverted and amplified signal at Q401 collector goes to the base of Q404 (sync separator). Q404 is on (in saturation) during sync time and off (cutoff) during scan time. The resulting sync pulses go to pin 3 of IC101, horizontal processor, through R123 and C109. Also, the sync pulses go to vertical oscillator Q301/Q302 after filtering by R323, C313, R322, and C312.

The video signal at the emitter of Q401 goes to the base of Q402, which in turn drives Q403. The amplified video signal at the collector of Q403 is coupled through CX407 to the base of Q406, video driver. Q406 emitter ties directly to R402, contrast control, which controls the drive to the cascode video output stage, Q201 and Q202. The video signal is then coupled from Q202 collector through R206 to the cathode at pin 2 of the CRT.

Sync Tip Clamp

The sync tip clamp circuit is located at the base of transistor Q406. This circuit consists of capacitor CX407, 180 Ω resistor CR401[1], 100 Ω resistor CR402[1], and a diode. The purpose of this circuit is to minimize black level variations. This is accomplished by maintaining a constant level (position) of the sync tips despite variations in the video input signal level. The clamp level is determined by the bias at the anode of the diode.

Horizontal Sweep

The operation of the horizontal processor IC101 (221-141-01) is the same as the 221-86-01 and they are interchangeable in the ZVM-1220 and ZVM-1230 monitors. The integrated circuit has four distinct circuit configurations; phase detector, oscillator, regulator, and predriver.

Phase Detector — The phase detector is comprised of a differential amplifier and a gated current source. The current source is strobed by a negative sync signal that is AC coupled to pin 3.

The current division of the two transistors of the differential amplifier is determined by the phase relationship between the sync and the sawtooth waveform on pin 4 of IC101. This sawtooth is derived from positive horizontal flyback pulses. When the sync and sawtooth are in phase, the current division between the two transistors in the differential amplifier will be equal. When there is a phase difference, current will flow into or out of pin 5, which is connected by way of a low-pass filter to pin 7 of the oscillator. This current controls the oscillator.

Oscillator — The oscillator is an R-C type with pin 7 being the control point. The timing capacitor, C101, is charged by the external resistor, R104, to a trip voltage set in the integrated circuit. When this trip voltage is reached, the capacitor discharges to a new trip value. This process is repeated, producing a sawtooth waveform at pin 7.

The output of the phase detector controls the oscillator through resistive coupling from pin 5 to pin 7. The horizontal hold control, R101, is also connected to pin 7. The two 100K ohm resistors, R123 and R124, in the horizontal hold circuit are used to center the hold control range.

Regulator — The input to the regulator is at pin 6 of IC101. The regulator is temperature compensated and consists of two high current diodes in series with a zener diode. The zener current is determined by an external resistor, RX108, connected to the +15.8 volt power supply. C102, CX103, and RX108 also provide filtering.

1. Temporary designation until rescreening the board.

Predriver — The predriver is a 4 transistor circuit which takes the sawtooth formed at pin 7 and produces a variable duty cycle waveform at pin 1. This output goes to the base of Q101 after it is reduced by resistors, R117 and R118. The "on time" of the output waveform is determined by the bias voltage on pin 8. This voltage is determined by a series of clip resistors, R106, R107, R109, R127, and R132, that match the integrated circuit to the monitor.

Horizontal Output

The signal from the horizontal output driver, Q101, is coupled to the base of Q102 through transformer TX101. Q102 controls the current in the primary winding of horizontal output transformer TX102 to switch scan current in yoke TX202B for right side scan. C118 and the yoke inductance provide a resonant retrace pulse that resets the beam to the left side of the screen. Diode CR102 then provides scan for the left side of the screen. The current through the yoke establishes the magnetic field necessary to deflect the electron beam along a horizontal plane. The retrace pulse is also fed to TX102 where it is stepped up to provide high voltage for the CRT.

Vertical Sweep

The vertical circuit consists of a two-transistor, free-running oscillator and an IC power amplifier with retrace pulse generator.

Transistor Q301 and Q302 form an SCR type free-running oscillator. Sync pulses injected into the junction of R302 and R303 lock the oscillator to the proper scan frequency. C303 is the sawtooth charging capacitor, charged by the two transistor oscillator. The DC bias point of the sawtooth is controlled by the voltage at CX301. The amplitude of the sawtooth and vertical size are set by resistors R309, R311, and R312. This sawtooth is fed into the non-inverting input of power amplifier IC301 at pin 7. The output is amplified by IC301 and drives yoke TX202A. The DC parabola on CX306, the yoke coupling capacitor, is s-shaped by network R317, R316, CX309, and CX307. This signal is summed with the yoke current sample from R319 and fed back into the inverting input of IC301, pin 1, providing linearity correction.

IC301 also contains a flyback generator which retraces the vertical scan current quickly without excessive power penalty. It also provides vertical retrace blanking from pin 3.

Spot Burn Protection

When the monitor is turned off, the filament of the CRT is still hot and capable of emitting electrons. With a high potential still on the face of the CRT, it is possible that a beam of electrons could be attracted to one particular area of the screen. If this occurs, the phosphor on the screen may be burned leaving a permanently damaged spot.

To prevent spot burn, capacitor CX124 charges to approximately 60 volts while the monitor is in use. When power is switched off, CX124 does not have a discharge path because the collector of Q202 represents a high impedance. The cathode of the CRT, pin 2, is therefore held positive, attracting the electrons from the hot filament and preventing them from striking the CRT. Diode CR108 is reverse biased, preventing CX124 from discharging through it.

Brightness

Adjustment of master brightness R142, changes the amount of voltage across the external brightness control, R143. R143 is used to vary the bias on the grid of the CRT, pins 1 and 5. This bias controls the acceleration of the electron beam and therefore controls the intensity of illumination.

Focus

Potentiometer, R141, is used to adjust the bias on the final grid of the CRT, pin 7. Changing this voltage will change the focus (clarity) of the raster displayed on the CRT. The +500 volt power supply provides voltage to pin 6 of the CRT and to the focus control, R141.

Dynamic Focus

A horizontal rate parabolic voltage is taken across the yoke s-shaping capacitor, C113, and amplified by Q103. The amplified parabolic voltage is then inserted at the arm of potentiometer, R141, which modulates the DC focus with respect to time. This provides a higher voltage at the raster edges and a lower voltage at the center of the screen.

Servicing

This section provides servicing information to assist in servicing and troubleshooting the monitor. Included are safety servicing guidelines, cleaning instructions, adjustments, inspection, testing, and troubleshooting.

Safety and Service 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 the monitor power turned off and disconnected, discharge the high voltage anode lead at the CRT using a jumper lead connected between the chassis and a screwdriver (See Figure 7). Failure to comply could result in severe shock and/or personal injury.

WARNING: Do not operate a monitor with excessive high voltage any longer than necessary or the monitor may produce X-rays from the CRT.

Excessive high voltage will produce X-rays from the cathode-ray tube; always check that the voltage is at normal levels when servicing the unit.

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

NOTE: Under no circumstances should the original design be modified or altered without permission of Zenith Electronics Corporation.

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 a line isolation transformer to perform this test.

1. Connect the test circuit as shown in Figure 3.
2. With the 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.

WARNING: Any leakage voltage measurement that exceeds 0.75 volts rms (0.5 milliamperes AC) constitutes a potential shock hazard and must be corrected.

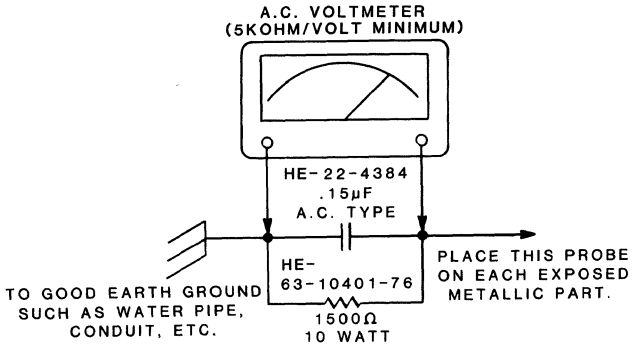


Figure 3
AC Leakage Voltmeter Circuit

CAUTION: Some of the Integrated Circuits (ICs) used in the monitor are Electrostatic-Sensitive Devices (ESD). These units can be damaged by static electricity. When handling any IC, use a wrist grounding strap or be sure to equalize the static charge before touching the IC.

OTHER PRECAUTIONS

- Be sure that all components are positioned in such a manner as to avoid the possibility of short circuits.
- Inspect and correct all soldered connections for cold solder joints, frayed leads, damaged insulation, splashed solder, or sharp points.
- Never release a repaired product to a customer unless all protective devices, such as insulators, barriers, cover shields, strain reliefs, etc., have been reinstalled.
- Remove all loose material from the inside of the monitor after servicing.
- Follow the original lead layout, dress, lengths, and tension.
- Replace all components with exact Zenith replacement types.

Suggested Tools and Supplies

- 1/4" nut driver
- Standard screwdriver, 1/4" 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-331-13
- Desoldering braid, HE-490-185
- Cable ties, HE-354-59
- Lint-free cloths

Test Equipment

- Oscilloscope — DC to 35 MHz, triggered sweep, with low capacitance (3 pF) probe
- Digital voltmeter — High impedance input, zero to 1000 volts, zero to 1 megohm, Heath model SM-2215, or equivalent

Troubleshooting

Use the following inspection to determine possible causes of monitor failures.

- Check for proper computer operation.
- Check monitor controls for proper response and settings.
- Unplug the signal and power cables from the monitor and check for burnt insulation, broken wires, or loose prongs on plugs.
- Check the AC receptacle (wall outlet) for the proper supply voltage.
- Check all cabling and internal circuit board plugs in the monitor for proper electrical connections.
- Check monitor adjustments as explained at the end of this section.
- Check all circuit boards in the monitor for broken or burnt components or for darkened areas or other signs of component overheating.

Table 1
General Troubleshooting

PROBLEM	POSSIBLE CAUSE
Monitor completely dead	1. Power cord not connected 2. Power switch not on 3. Fuse is missing or blown 4. Power supply failure 5. Shorted horizontal output
No video (Power indicator is lit — high and low voltages are okay)	1. Signal cable not connected to computer 2. Contrast control set too low 3. CRT socket board defective 4. Main circuit board defective 5. Wiring between boards defective 6. No signal from the computer
Insufficient brightness	1. Brightness control set too low 2. CRT socket board defective 3. Main circuit board defective
No raster	1. Brightness control defective 2. Horizontal circuit/high voltage not working 3. CRT socket board defective 4. CRT defective
Characters on screen out of focus	1. Focus control defective 2. CRT socket board defective 3. Main circuit board defective
No horizontal sync	1. Horizontal hold control defective 2. Horizontal processor IC101 defective
No vertical sync	1. Vertical size control defective 2. Vertical processor IC301 defective
Vertical sweep scans bottom to top	1. Red and blue wires reversed on deflection yoke
Horizontal sweep scan right to left	1. Yellow and black wires reversed on deflection yoke

Table 2
Circuit Board Troubleshooting

PROBLEM	POSSIBLE CAUSE
No raster	1. Q106, TX102 (check high voltage at CRT anode) 2. CR102, RX133, RX136 3. Q101, Q102, TX101 4. IC101 5. VX201 CRT
No video (Raster okay)	1. Q201, Q202, CR108 2. VX201, R402 contrast control 3. CR103 4. CRT socket
No vertical deflection	1. Q301, Q302 2. IC301 3. TX202A 4. CR301
No vertical sync	1. Q404, Q301, Q302
Vertical sweep off frequency	1. IC301
No horizontal sync	1. Q404 2. IC101 3. R101 horizontal hold control, CX104
Horizontal sync off frequency	1. IC101
Poor horizontal linearity or foldover	1. TX102, LX101, LX102, CR106 2. TX202B 3. Q106, Q101, Q102
Narrow horizontal raster	1. Q102, TX101 2. LX102, CR106
Characters out of focus	1. CR107, RX136, C122 2. R141 focus control 3. Q103
Only top or bottom of vertical deflection	1. IC301 2. Vertical deflection yoke TX202A open
No high voltage on CRT	1. Q106, Q101, Q102 2. Yoke TX202B winding open 3. Flyback transformer TX102 4. CR102
No video	1. Q201, Q201, L201 open 2. Q401, Q402, Q403, Q406, Q407 3. Signal cable defective

Table 3
Power Supply Troubleshooting

PROBLEM		POSSIBLE CAUSE
No +15.8V output	1.	FX501 fuse, SX501 switch
	2.	RX501, C506, CX507, CX508
	3.	Q501, TX502, CRX506
+15.8V output not regulating	1.	RX501, QX502, QX503, QX504

Adjustments

Use a computer to provide signals for the following adjustments.

B+ (+15.8V) VOLTAGE

NOTE: This adjustment may interact with the focus adjustment.

1. Turn the monitor power off and disconnect it from the AC voltage source.
2. Remove the back cover and reconnect cables.
3. Locate the B+ adjustment, RX503 (See Figure 4).
4. Connect a Heath SM-2215 or equivalent DVM between any B+ point and chassis ground.
5. Adjust the B+ adjustment for +15.8 volts.

FOCUS

NOTE: CRT yoke adjustment may interact with the focus adjustment.

1. Turn the monitor power off and disconnect it from the AC voltage source.
2. Remove the back cover and reconnect cables.
3. Locate the focus adjustment, R141 (See Figure 4).
4. Set the contrast and brightness controls to normal levels with characters displayed.
5. Adjust the focus adjustment for the clearest, sharpest display.

CRT YOKE

NOTE: These adjustments may interact with the focus adjustment.

Do not over-tighten the yoke clamp.

Make sure the yoke is positioned as far forward on the CRT as possible. If necessary unclamp the yoke, slide it forward, and reclamp.

Positioning

1. Loosen the clamp screw and rotate the deflection yoke until the edges of the display are parallel with the the edges of the screen; then tighten the clamp screw.
2. Adjust the centering rings so that the display is centered on the screen.

Linearity

1. Remove the ferrite foam magnets that may be installed on the yoke.
2. Select the most nonlinear of the four displayed edges and install a ferrite magnet on the yoke post nearest the greatest distortion.
3. Repeat step 2 as necessary, around the yoke, until a uniform rectangular shape is displayed.

NOTE: If only a small effect is desired, reduce the size of the ferrite magnets by cutting off a small portion with diagonal cutters.

Cleaning Procedures

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

- Clean the cabinet with a lint-free cloth, mildly dampened with a nondetergent cleaning solution; do not spray liquids directly on the monitor or use a wet, saturated cloth.
- Clean the monitor's screen with a good quality glass cleaner.
- Be sure the monitor is completely dry before applying electrical power.

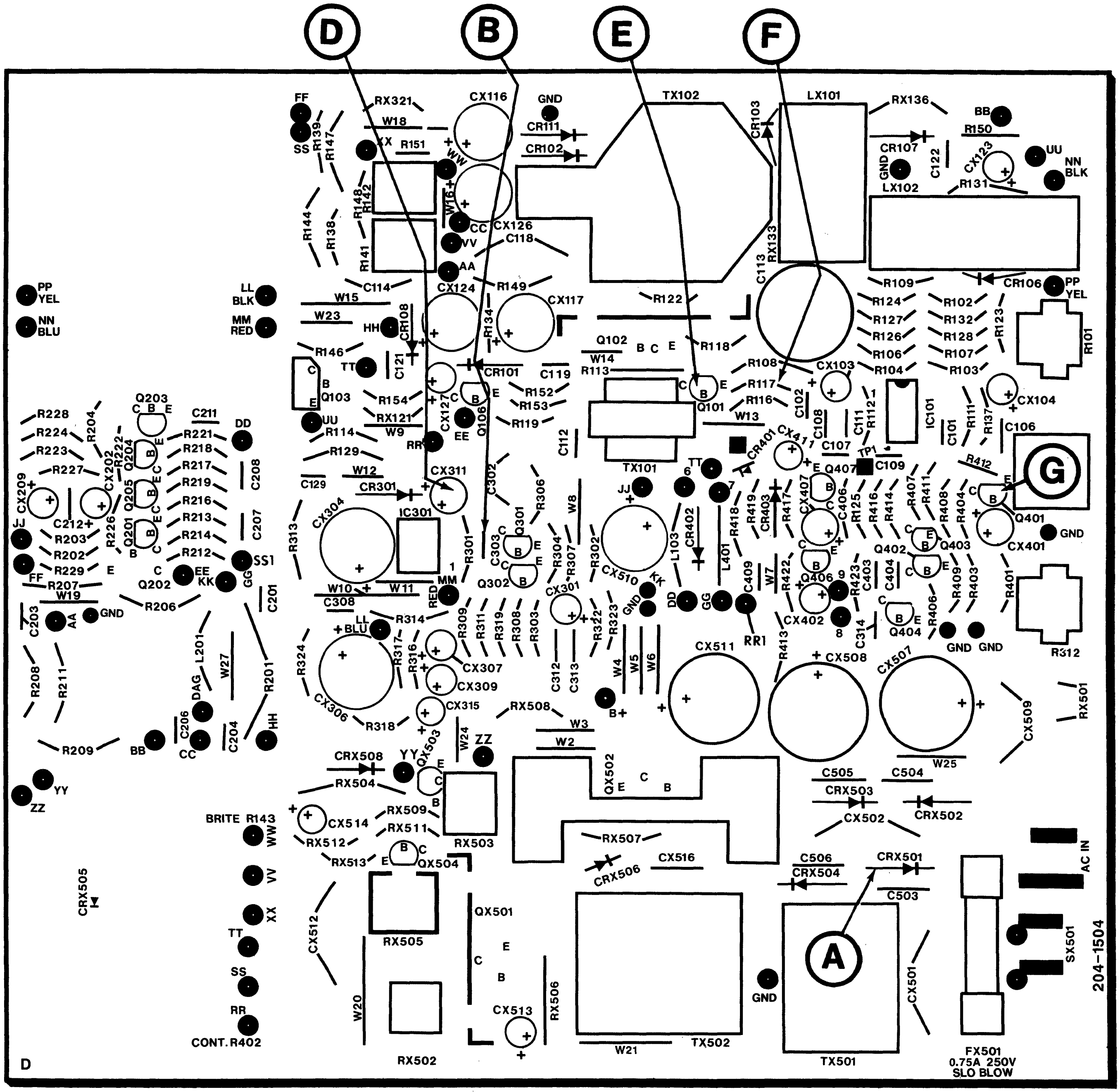


Figure 4
Circuit Board Component Location

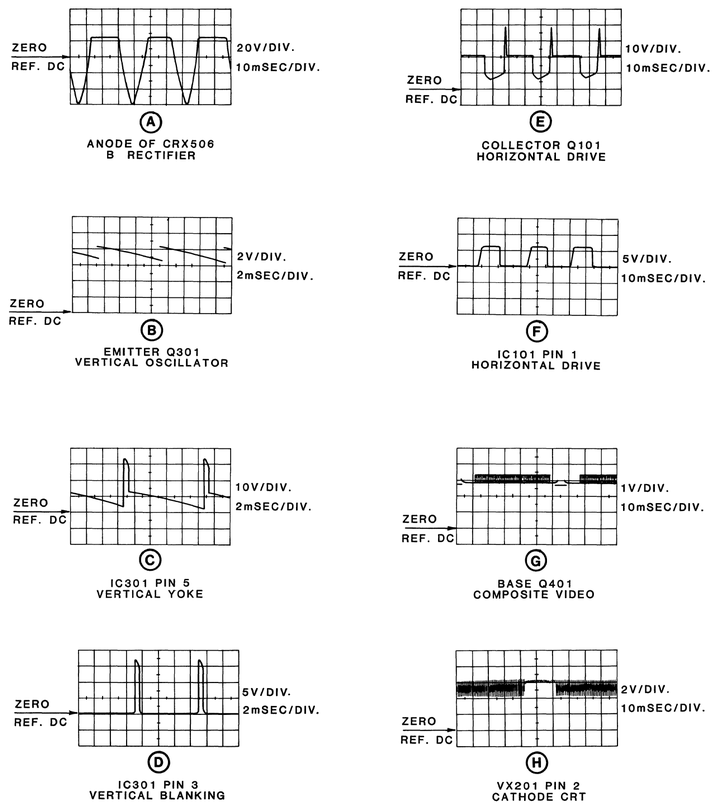
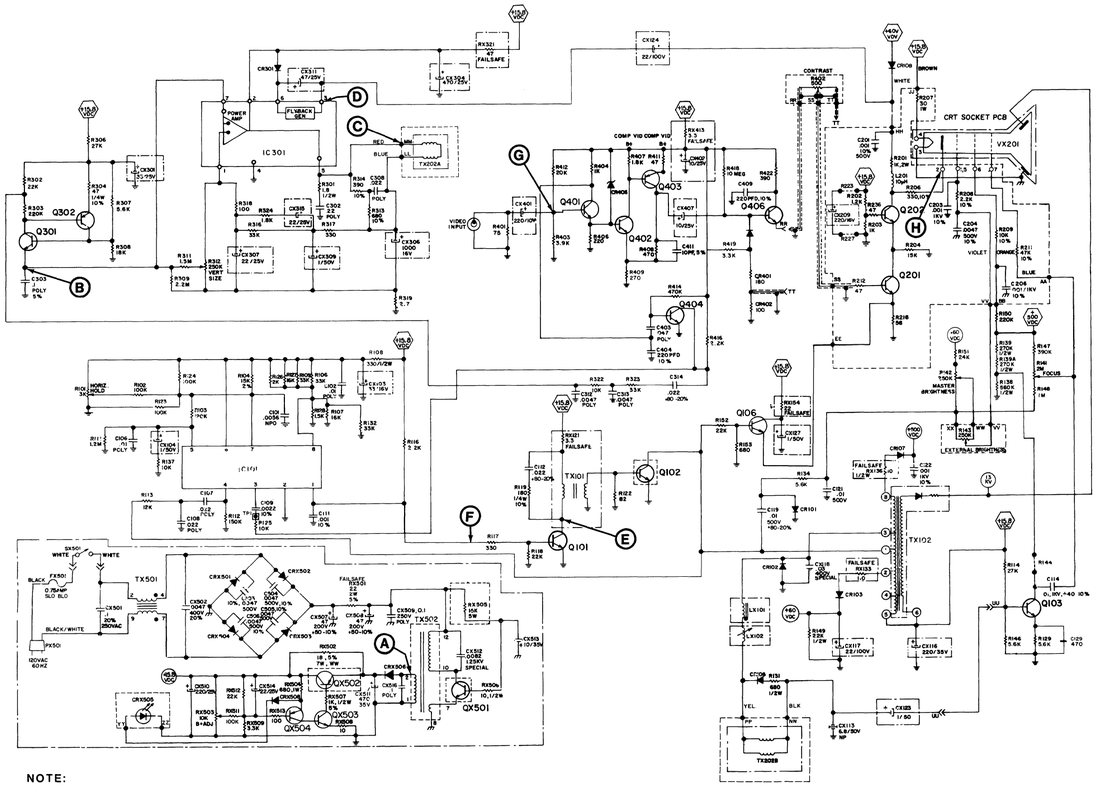


Figure 5
Oscilloscope Waveforms

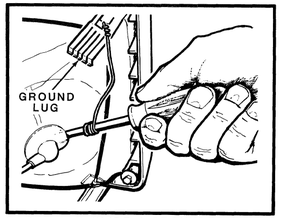
ZVM-1220 AND ZVM-1230 SCHEMATIC



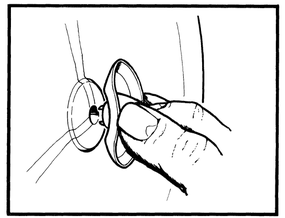
NOTE:

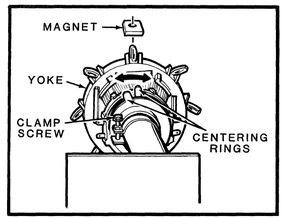
1. CRITICAL LETTER "X" IN THE ELECTRICAL SCHEMATIC AND PARTS LIST DESIGNATES SPECIAL SAFETY CRITICAL COMPONENTS. THESE SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ZENITH PARTS LIST AND SCHEMATIC.
2. THIS SCHEMATIC MAY DIFFER FROM ACTUAL CIRCUITS BECAUSE CIRCUITS ARE CHANGED AND UPDATED FOR SAFETY AND IMPROVED PERFORMANCE.

Figure 6
ZVM 1220/1230 Schematic



CAREFULLY SLIDE A GROUNDED FLAT SCREWDRIVER TIP UNDER THE LIP OF THE ANODE LED LEAD. GROUND LUG CRT SOCKET BOARD.





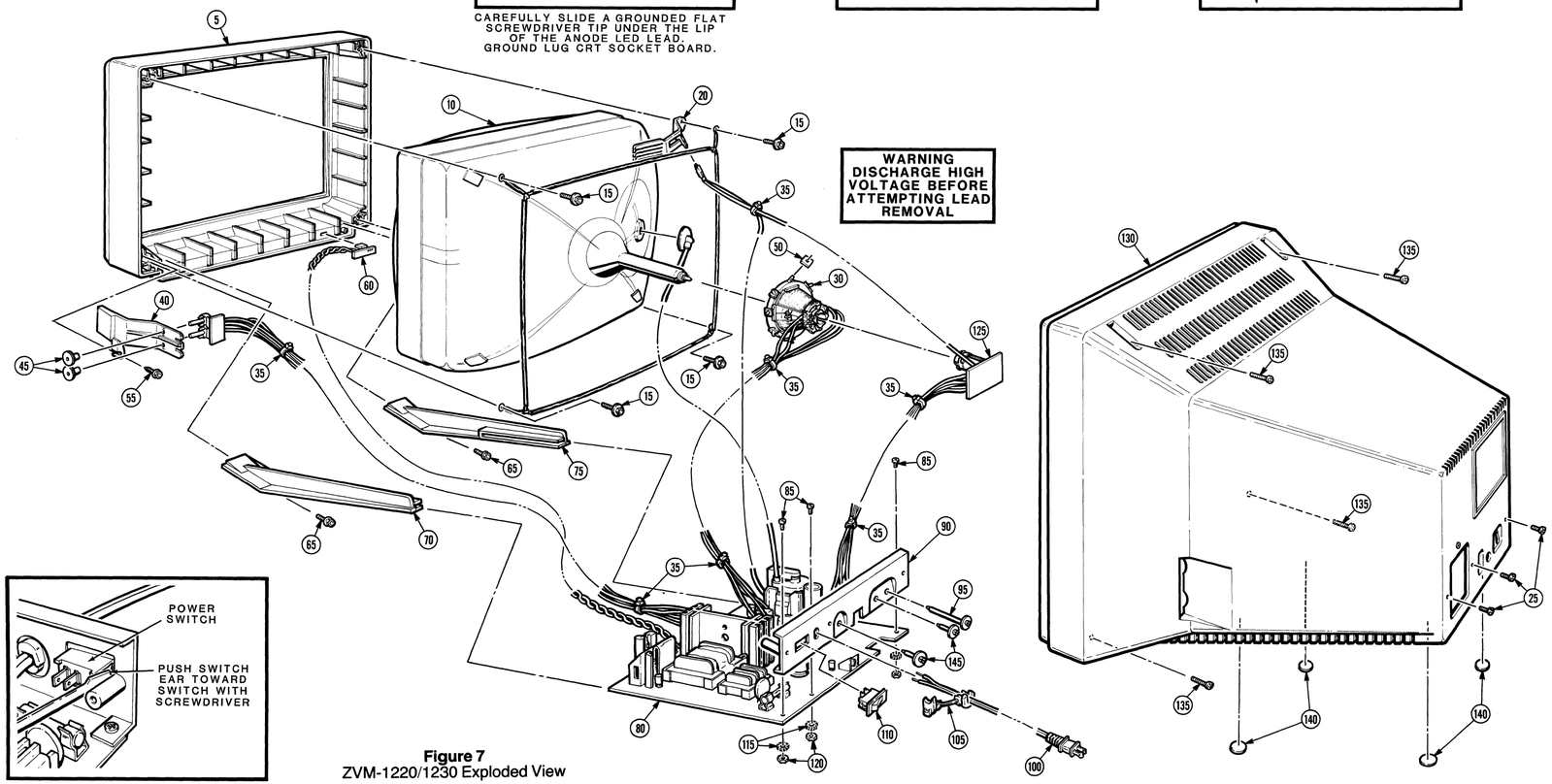


Figure 7
ZVM-1220/1230 Exploded View

Disassembly/ Reassembly

This section, along with Figure 7 provides instructions to both disassemble and reassemble the ZVM-1220/1230 monitors. The step-by-step instructions are written for disassembly. For reassembly, perform steps in the reverse order except when instructed otherwise.

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

Normally, the disassembly sequence is as follows:

1. Remove the back cover.
2. Remove the side panel control board.
3. Remove the CRT socket board.
4. Remove the main circuit board.
5. Remove the cathode-ray tube.

NOTE: Some of the assemblies can be removed independently of the others, see each procedure.

BACK COVER

1. Switch off computer power and disconnect the power cable from the AC voltage source.
2. Disconnect the video cable from the rear of the monitor.
3. Remove the seven screws shown in Figure 7.
4. Carefully slide the back cover from the computer.

CRT SOCKET BOARD

1. Remove the back cover.
2. Loosen the clamp which secures the CRT socket board to the neck of the CRT.
3. Carefully slide the CRT socket board to the rear until the CRT pins are disengaged and the CRT socket board clamp is free from the neck of the CRT.

MAIN CIRCUIT BOARD

1. Remove the back cover.
2. Carefully slide the main board toward the rear and out of the guide rails.

SIDE CONTROL BOARD

1. Remove the back cover.
2. Remove the nut which secures the bracket to the front panel.
3. Carefully slide the bracket assembly to the rear and out of the guide in the front panel.

POWER SWITCH

1. Switch the computer power off and disconnect the power cable from the AC voltage source.

2. Use a flat-bladed screwdriver to carefully pry the ON/OFF switch out of the rear control panel. Alternately pry from side to side until the switch is loose. Refer to the inset in Figure 7.

CATHODE–RAY TUBE (CRT)

1. Remove the rear cover.
2. Place the monitor face down on a flat, horizontal surface.

WARNING: Discharge the high voltage at the anode lead of the CRT using a jumper lead connected between the chassis and a screwdriver. Otherwise, shock or injury may result. Refer to the inset of Figure 7.

3. Remove the anode lead from the CRT.
4. Remove the main board.
5. Disconnect the ground clip from the grounding strip at the corner of the CRT. Refer to Figure 7.
6. Remove the side control board.
7. Loosen the clamp which secures the CRT socket board to the neck of the CRT and remove the CRT socket board.
8. Loosen the clamp which secures the yoke to the neck of the CRT and remove the yoke.
9. Remove the four screws which secure the CRT to the front panel and lift out the CRT.

Parts List

CAUTION: Some of the Integrated Circuits (ICs) used in this unit are Electrostatic-Sensitive Devices (ESD). These devices can be damaged by static electricity. When handling any IC, use a wrist grounding strap or be sure to equalize the static charge before touching the IC.

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 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 location chart designate special critical safety components. These components should be replaced only with components identical to the original component.

NOTE: Unless otherwise specified all resistors are 1/4 watt, 5% tolerance.

In the following parts lists, N/A refers to "not assigned," parts for which there is no replacement part number assigned.

Table 4
Major Assemblies (Refer to Figure 7)

REFERENCE NUMBER	ZDS PART NUMBER	DESCRIPTION
5	014-11683	Cabinet front
10	100-00761-23	CRT, vacuum tube (Green)
	100-00761-28	CRT, vacuum tube (Amber)
15	114-01150-03	Screw, 8-18 × 1.00, 0.250 hex head
20	127-00277	Ground contact
25	112-02143-01	Screw, 8-18 × 0.500 Phillips
30	095-03397-06	Deflection yoke
35	019-00733-01	Cable retainer, wire tie
40	012-08939	Bracket, control switch mounting
45	046-10296-03	Knob, push button
50	149-464	Foam magnet
55	114-01431-03	Screw, 8-18 × 0.750 hex HWH
60	N/A	Power indicator LED
65	114-00803-09	6-20 × 0.312, 0.250 hex head
70	012-08940	Bracket, pc board guide left
75	012-08940-01	Bracket, pc board guide right
80	F-22776	PC board assembly with components
85	112-01717-01	Screw, 6-32 × 0.375 Phillips
90	F-22768	Bracket, switch and cord assembly
95	076-02172-01	Shaft, tuning
100	011-00357-02	Power cord
105	125-00198-19	Strain relief
110	085-01708	Power switch
115	N/A	Washer, lock
120	054-00347	Nut, 6-32 × 0.312
125	N/A	CRT card with components
	078-03233	CRT socket
130	014-11684	Cabinet rear
135	112-02247-01	Screw, 8-18 × 0.625 Phillips
140	166-00234	Bumper foot
145	093-02024-02	Washer, flat
	078-03279	Signal connector
	019-00840-01	Fuse holder clip

Table 5
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
CAPACITORS		
C101	022-07759-26	5600 pF ceramic
C102	022-07774-12	0.01 μF polyester
CX103	022-07859-07	33 μF electrolytic
CX104	022-07862-01	1 μF electrolytic
C106	022-07774-12	0.01 μF polyester
C107	022-07774-16	0.022 μF polyester
C108	022-07774-16	0.022 μF polyester
C109	022-07613-16	2200 pF ceramic
C111	022-07613-12	1000 pF ceramic
C112	022-07615-08	22000 pF ceramic
CX113	022-07892-04	6.8 μF electrolytic
C114	022-03512	0.01 μF ceramic
CX116	022-07861-10	220 μF electrolytic
CX117	022-07864-06	22 μF electrolytic
CX118	022-07798-11	0.030 μF polypropylene
C119	022-04905-01	0.01 μF ceramic
C121	022-04905-01	0.01 uF ceramic
C122	022-07811	1000 pF ceramic
CX123	022-07862-01	1 μF electrolytic
CX124	022-07864-06	22 μF electrolytic
CX127	022-07862-01	1 μF electrolytic
C129	022-07613-08	470 pF ceramic
C201	022-07241	0.001 μF ceramic
C203	022-07811	1000 pF ceramic
C204	022-07440	0.0047 μF
C206	022-07811	1000 pF ceramic
CX209	022-07859-10	220 μF electrolytic
CX301	022-07860-07	33 μF electrolytic
C302	022-7563-28	0.22 μF polyester
C303	022-08004-02	.1 μF polyester
CX304	022-07860-12	470 μF electrolytic
CX306	022-07859-13	1000 μF electrolytic
CX307	022-07860-06	22 μF electrolytic
C308	022-07774-16	0.022 μF polyester
CX309	022-07862-01	1 μF electrolytic
CX311	022-07860-08	47 μF electrolytic
C312	022-07774-08	0.0047 μF polyester
C313	022-07774-08	0.0047 μF polyester
C314	022-07615-08	22000 pF ceramic
CX315	022-07860-06	22 μF electrolytic

Table 5 (Continued)
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
CX401	022-07858-10	220 μF electrolytic
CX402	022-07869-05	10 μF electrolytic
C403	022-07774-20	0.047 μF polyester
C404	022-07613-04	220 pF ceramic
CX407	022-07860-05	10 μF electrolytic
C409	022-07613-04	220 pF ceramic
CX501	022-07867 or 22-7866	0.1 μF polyester
CX502	022-07889	0.0047 μF ceramic
CX503	022-07440	0.0047 μF ceramic
CX504	022-07440	0.0047 μF ceramic
C505	022-07440	0.0047 μF ceramic
C506	022-07440	0.0047 μF ceramic
CX507	022-07909	47 μF electrolytic
CX508	022-07909	47 μF electrolytic
CX509	022-07566-24	0.1 μF polyester
CX510	022-07860-10	220 μF electrolytic
CX511	022-07861-12	470 μF electrolytic
CX512	022-08008-11	.0082 μF polypropylene
CX513	022-07861-05	10 μF electrolytic
CX514	022-07860-06	22 μF electrolytic
CX516	022-07874-12 or 22-7873-12	0.1 μF polyester
	022-07743-12	10 pF ceramic
DIODES		
CR101	103-00295-03	
CR102	103-00298-03	
CR103	103-00323-03	
CR106	103-00323-03	
CR107	103-00323-04	
CR108	103-00254-01	
CR301	103-00254-01	
CR406	103-103-00279	
CRX501	103-00254-01	
CRX502	103-00254-01	
CRX503	103-00254-01	
CRX504	103-00254-01	
CRX505	103-00385-04	
CRX506	103-00339-04	
CR508	103-00142-01	

Table 5 (Continued)
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
FUSE		
FX501	136-00116-17	0.75 amp, SLO BLO, 250 volts (ZVM-1220/1230)
INTEGRATED CIRCUITS		
IC101	221-00141-01	Horizontal processor
IC301	221-00347	Vertical output
INDUCTORS		
LX101	020-03945-05	RCF coil, tunable, linearity
LX102	020-04148	RCF coil, tunable, width control
L201	020-03907-12	RCF coil, 10 μH
TRANSISTORS		
Q101	121-00819	NPN, Horizontal driver 1
Q102	F-14656	Transistor and heat sink assembly, Horizontal driver 2
Q103	121-01058	NPN, Dynamic focus
Q106	121-00975	NPN, Horizontal output
Q201	121-00895	NPN, Video output
Q202	121-01058	NPN, Video output
Q301	121-00975	NPN, Vertical oscillator
Q302	121-00699	PNP, Vertical oscillator
Q401	121-00895	NPN, Signal amplifier/ separator
Q402	121-00895	NPN, Video amplifier
Q403	121-00699	PNP, Video amplifier
Q404	121-00895	NPN, Sync amplifier/separator
Q406	121-00895	NPN, Video driver
QX501	F-24259	Transistor (121-01142) and heat sink assembly (126-02108), Power oscillator
QX502	F-14199	Transistor (121-00994) and heat sink assembly (126-02108). Power supply regulator
QX503	121-01035	NPN, Power supply regulator
QX504	121-00699	PNP, Power supply regulator
	121-00994	PNP
	F-14656	Transistor (121-01070) and heat sink assembly (126-0296)

Table 5 (Continued)
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
RESISTORS		
CR401[2]	063-10235-54	180 Ω, 1/4 watt, 5%
CR402[2]	063-10235-48	100 Ω, 1/4 watt, 5%
R101	063-09228-05	3 KΩ, control, horizontal hold
R102	063-10236-20	100 KΩ, 1/4 watt, 5%
R103	063-10236-22	120 KΩ, 1/4 watt, 5%
R104	063-10234	15 KΩ, 1/4 watt, 2%
R106	061-10236-08	33 KΩ, 1/4 watt, 5%
R107	063-10236-01	16 KΩ, 1/4 watt, 5%
RX108	063-10243-60	330 Ω, 1/2 watt, 5%
R109	063-10236-08	33 KΩ, 1/4 watt, 5%
R111	063-10236-46	1.2 MΩ, 1/4 watt, 5%
R112	063-10236-24	150 KΩ, 1/4 watt, 5%
R113	063-10235-98	12 KΩ, 1/4 watt, 5%
R114	063-10236-06	27 KΩ, 1/4 watt, 5%
R116	063-10235-80	2.2 KΩ, 1/4 watt, 5%
R117	063-10235-60	330 Ω, 1/4 watt, 5%
R118	063-10236-04	22 KΩ, 1/4 watt 5%
R119	063-10183-54	180 Ω, 1/4 watt, 10%
RX121	063-10559-12	3.3 Ω, 1/4 watt, 5%
R122	063-10235-46	82 Ω, 1/4 watt, 5%
R123	063-10236-20	100 KΩ, 1/4 watt, 5%
R124	063-10236-20	100 KΩ, 1/4 watt, 5%
R125	063-10235-96	10 KΩ, 1/4 watt, 5%
R126	063-10235-79	2 KΩ, 1/4 watt, 5%
R127	063-10236-01	16 KΩ, 1/4 watt, 5%
R128	063-10235-76	1.5 KΩ, 1/4 watt, 5%
R129	063-10235-90	5.6 KΩ, 1/4 watt, 5%
R131	063-10243-68	680 Ω, 1/2 watt, 5%
RX132	063-10236-08	33 KΩ, 1/4 watt, 5%
RX133	063-10559	1 Ω, 1/4 watt, 5%
R134	063-10235-90	5.6 KΩ, 1/4 watt, 5%
RX136	063-10565-24	10 Ω, 1/2 watt, 5%
R137	063-10235-96	10 KΩ, 1/4 watt, 5%
R138	063-10244-38	560 KΩ, 1/4 watt, 5%
R139	063-10244-30	270 KΩ, 1/4 watt, 5%
R139A	063-10244-30	270 KΩ, 1/4 watt, 5%
R141	063-10857-24	2 MΩ, control, focus
R142	063-10857-20	250 KΩ, control, master brightness
R143	063-11028-01	250 KΩ, control, external brightness

2. Temporary designation until rescreening the boards.

Table 5 (Continued)
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
R144	063-10244-18	82 KΩ, 1/2 watt, 5%
R146	063-10235-90	5.6 KΩ, 1/4 watt, 5%
R147	063-10236-34	390 MΩ, 1/4 watt, 5%
R148	063-10236-44	1 MΩ, 1/4 watt, 5%
R149	063-10244-04	22 KΩ, 1/2 watt, 5%
R150	063-10236-28	220 KΩ, 1/4 watt, 5%
R151	063-10236-05	24 KΩ, 1/4 watt, 5%
R152	063-10236-04	22 KΩ, 1/4 watt, 5%
R153	063-10235-68	680 Ω, 1/4 watt, 5%
RX154	063-10559-32	22 Ω, 1/4 watt, 5%
R201	063-10836-72	1 KΩ, 2 watt, 5%
R202	063-10235-74	1.2 KΩ, 1/4 watt, 5%
R203	063-10235-72	1 KΩ, 1/4 watt, 5%
R204	063-10236	15 KΩ, 1/4 watt, 5%
R206	063-07763	330 Ω, 1/2 watt, 5%
R207	063-10832-35	35% Ω, 1 watt,
R208	063-107799	2.2 KΩ, 1/2 watt, 10%
R209	063-07827	10 KΩ, 1/2 watt, 10%
R211	063-07855	47 KΩ, 1/2 watt, 10%
R212	063-0235-40	47 Ω, 1/4 watt, 5%
R216	063-10235-42	56 Ω, 1/4 watt, 5%
R236	063-10235-40	47 Ω, 1/4 watt, 5%
R301	063-10243-06	1.8 Ω, 1/2 watt, 5%
R302	063-10236-04	22 KΩ, 1/4 watt, 5%
R303	063-10236-28	220 KΩ, 1/4 watt, 5%
R304	063-10183-40	47 Ω, 1/4 watt, 10%
R306	063-10236-06	27 KΩ, 1/4 watt, 5%
R307	063-10235-90	5.6 KΩ, 1/4 watt, 5%
R308	063-10236-02	18 KΩ, 1/4 watt, 5%
R309	063-10236-52	2.2 MΩ, 1/4 watt, 5%
R311	063-10236-48	1.5 MΩ, 1/4 watt, 5%
R312	063-09228-16	250 KΩ, control, vertical, size
R313	063-07778	680 Ω, 1/2 watt, 10%
R314	063-07768	390 Ω, 1/2 watt, 10%
R316	063-10236-08	33 KΩ, 1/4 watt, 5%
R317	063-10235-60	330 Ω, 1/4 watt, 5%
R318	063-10235-48	100 Ω, 1/4 watt, 5%
R319	063-10235-10	2.7 Ω, 1/4 watt, 5%
RX321	063-10559-40	47 Ω, 1/4 watt, 5%
R322	063-10235-96	10 KΩ, 1/4 watt, 5%
R323	063-10236-08	33 KΩ, 1/4 watt, 5%
R324	063-10235-78	1.8 KΩ, 1/4 watt, 5%

Table 5 (Continued)
Electronic Components
(Refer to Figures 4 and 6)

CIRCUIT COMP. NO.	ZDS PART NUMBER	DESCRIPTION
R401	063-10235-45	75 Ω, 1/4 watt, 5%
R402	063-11028-03	500 Ω, control, contrast
R403	063-10235-84	3.3 KΩ, 1/4 watt, 5%
R404	063-10235-72	1 KΩ, 1/4 watt, 5%
R406	063-10235-56	220 Ω, 1/4 watt, 5%
R407	063-10235-78	1.8 KΩ, 1/4 watt, 5%
R408	F-19601	Capacitor and resistor assembly
R409	063-10235-58	270 Ω, 1/4 watt, 5%
R411	063 10235-40	47 Ω, 1/4 watt, 5%
R412	063-10236-03	20 KΩ, 1/4 watt, 5%
RX413	063-10559-12	3.3 Ω, 1/4 watt, 5%
R414	063-10236-44	1 MΩ, 1/4 watt, 5%
R416	063-10235-80	2.2 KΩ, 1/4 watt, 5%
R418	063-10236-68	10 MΩ, 1/4 watt, 5%
R419	063-10235-84	3.3 KΩ, 1/4 watt, 5%
R422	063-10235-62	390 Ω, 1/4 watt, 5%
RX501	063-10836-32	22 Ω, 2 watt, 5%
RX502	063-10449-54	18 Ω, 7 watt, 5%
RX503	063-10857-12	10 KΩ, control, B + adjust
RX504	063-10832-68	680 Ω, 1 watt, 5%
RX505	F-24260	Resistor (063-10845) and heat sink assembly
RX506	063-10243-24	10 Ω, 1/2 watt, 5%
RX507	063-07784	1 KΩ, 1/2 watt, 5%
RX508	063-10235-24	10 Ω, 1/4 watt, 5%
RX511	063-10236-08	33 KΩ, 1/4 watt, 5%
RX512	063-10236-04	22 KΩ, 1/4 watt, 5%
RX518	063-10235-48	100 Ω, 1/4 watt, 5%
RX519	063-10235-84	3.3 KΩ, 1/4 watt, 5%
	063-10235-64	470 Ω, 1/4 watt, 5%
	063-10844-96	10 KΩ, 5 watt, 5%

TRANSFORMERS

TX101	095-03136-03	Transformer, horizontal driver
TX102	095-03828	Transformer, sweep
TX501	095-03559-01	Coil, line filter
TX502	095-03854	Transformer, power oscillator

Video Input (RCA phone jack)	NTSC Composite Monochrome
Maximum Characters/Line	80 Characters per Line
Maximum Rows of Characters	25 Rows of Characters
Video Bandwidth	15 MHz
Rise Time	23 Nanoseconds
Horizontal Frequency	15.697 KHz
Vertical Frequency	60 Hz
Dimensions	
Height	10 inches (255 mm)
Width	12.7 inches (325 mm)
Depth	11.8 inches (300 mm)
Weight	12.9 lb. (5.85 kg)

Zenith Data Systems reserves the right to discontinue products and to change specifications at any time.