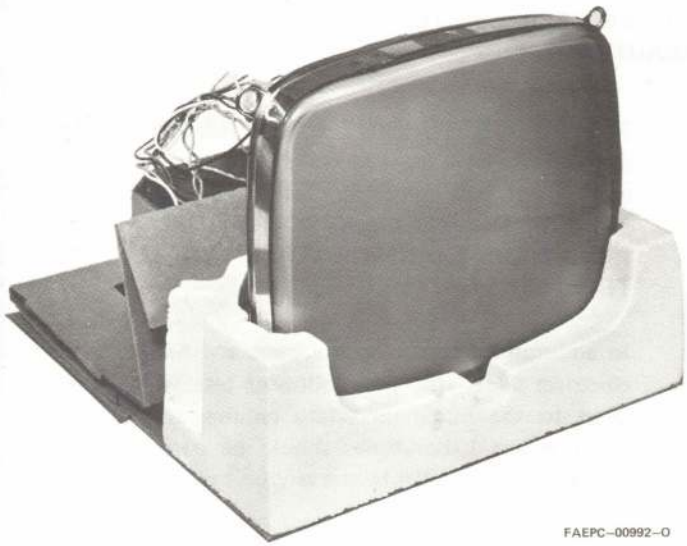
MOTOROLA

Service Manual

M3970–191
M3970–192
M3970–193



FAEPC–00992–O

Model M3970 – Series Kits

GENERAL INFORMATION

The specific model numbers identify the type of packaging used (bulk or individual). It also identifies the factory adjusted units. Therefore, all models in this manual are electrically identical, fully transistorized (except CRT), and are designed to display alphanumeric characters. All models are direct drive, requiring separate TTL vertical/horizontal drive and video inputs.

All use 12" CRT's of the magnetic deflection type with integral implosion protection, and require a power input of +12 volts @ 1.2 amps.

Input and output connections for the monitors are made through a 10-pin circuit card edge connector. The inputs are video, horizontal drive, vertical drive, system ground, and +12 volts. Connections are provided for an optional remote brightness control and a remote contrast control, both of which are customer supplied.

A single circuit card with components mounted on one side is used in each model. Schematic reference numbers are printed on both sides of the circuit card to aid in the location and identification of components for servicing.

Circuitry consists of one stage of video amplification, two stages of horizontal deflection processing, and three stages of vertical deflection processing.

(Included in this service manual are installation instructions for the Model M3970 Series of CRT Monitor Kits. Refer to the last section of this manual.)

CAUTION

NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

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* NOTE: All schematics, circuit board details and general service information are applicable to M3970 Service Kits.

MOTOROLA INC.
Display Systems

VP 34
8/79

68P25253A70

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SAFETY WARNING

CAUTION: NO WORK SHOULD BE ATTEMPTED ON AN EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

1. SAFETY PROCEDURES should be developed by habit so that when the technician is rushed with repair work, he automatically takes precautions.

2. A GOOD PRACTICE, when working on any unit, is to first ground the chassis and to use only one hand when testing circuitry. This will avoid the possibility of carelessly putting one hand on chassis or ground and the other on an electrical connection which could cause a severe electrical shock.

3. Extreme care should be used in HANDLING THE PICTURE TUBE as rough handling may cause it to implode due to atmospheric pressure (14.7 lbs. per sq. in.). Do not nick or scratch glass or subject it to any undue pressure in removal or installation. When handling, safety goggles and heavy gloves should be worn for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from ground to anode or use a well insulated piece of wire. When servicing or repairing the monitor, if the cathode ray tube is replaced by a type of tube other than that specified under the Motorola Part Number as original equipment in this Service Manual, then avoid prolonged exposure at close range to unshielded areas of the cathode ray tube. Possible danger of personal injury from unnecessary exposure to X-ray radiation may result.

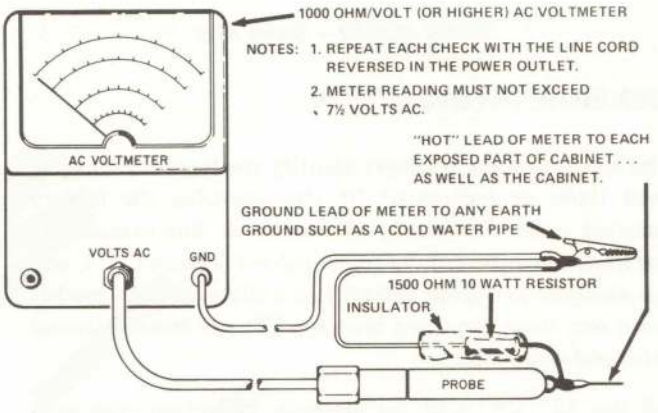
4. An ISOLATION TRANSFORMER should always be used during the servicing of a unit whose chassis is connected to one side of the power line. Use a transformer of adequate power rating as this protects the serviceman from accidents resulting in personal injury from electrical shocks. It will also protect the chassis and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

5. Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the unit.

6. If the HIGH VOLTAGE is adjustable, it should always be ADJUSTED to the level recommended by the manufacturer. If the voltage is increased above the normal setting, exposure to unnecessary X-ray radiation could result. High voltage can accurately be measured with a high voltage meter connected from the anode lead to chassis.

7. BEFORE RETURNING A SERVICED UNIT, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

In addition to practicing the basic and fundamental electrical safety rules, the following test, which is related to the minimum safety requirements of the Underwriters Laboratories should be performed by the service technician before any unit which has been serviced is returned.



Voltmeter Hook-up for Safety Check

A 1000 ohm per volt AC voltmeter is prepared by shunting it with a 1500 ohm, 10 watt resistor. The safety test is made by contacting one meter probe to any portion of the unit exposed to the operator such as the cabinet trim, hardware, controls, knobs, etc., while the other probe is held in contact with a good "earth" ground such as a cold water pipe.

The AC voltage indicated by the meter may not exceed 7½ volts. A reading exceeding 7½ volts indicates that a potentially dangerous leakage path exists between the exposed portion of the unit and "earth" ground. Such a unit represents a potentially serious shock hazard to the operator.

The above test should be repeated with the power plug reversed, when applicable.

NEVER RETURN A MONITOR which does not pass the safety test until the fault has been located and corrected.

NAEPC–00798–O
+ BEPC–00149

M3970 SERIES
12" CRT DISPLAY MODULES

ITEM	SPECIFICATION
Cathode Ray Tube:	12" measured diagonally (305 mm); 74.86 square inches (483 sq. cm); 90° deflection angle; integral implosion protection, P4 phosphor standard
Power Input:	+12 VDC at 1.2 amps typical, 1.5 amps maximum
TTL Level Direct Drive Input Signals:	1.5 to 5V P-P Horizontal: 10 to 30 microseconds positive-going drive, Vertical: negative-going sync, Video: positive white
Video Response:	Bandwidth within 3 dB, 10 Hz to 15 MHz typical
Pulse Rise Time:	30V rise in less than 30 nanoseconds
Horizontal Blanking Interval:	11 microseconds minimum (includes retrace and delay)
High Voltage:	12 kV typical
Scanning Frequency:	Horizontal: 15, 750 Hz $\pm$ 500 Hz; Vertical 50/60 Hz
Resolution:	800 lines center, typical
Geometric Distortion:	within 2% measured with standard EIA ball chart and dot pattern
Linearity:	within 10% measured with standard EIA ball chart and dot pattern
Controls:	Internal – horizontal size, vertical size, vertical linearity, internal brightness. Provisions for an additional remote (operator) brightness control, customer supplied. Video level (contrast) customer supplied.
Unit Weights:	M3970 (all models) 8½ lbs. (3.86 k ·)
Shipping Weights: (Skid not included)	M3970–193 (individual pack) 13½ . ·s. (6.12 kg) M3970–191, 192 (tray pack of 6 units) 63 lbs. (28.6 kg)
Dimensions:	See outline drawings
Environment:	Operating temperature: 0°C to +55°C Storage temperature: –40°C to +65°C Note: Models with bonded anti-reflective faceplate should not be subjected to storage or operating temperatures above 50°C. Operating altitude: 10,000 ft. maximum (3048 meters) Designed to comply with applicable DHEW rules on X-Radiation Designed to enable listing under UL Specification 478
	Specifications subject to change without notice.

SERVICE NOTES

CIRCUIT TRACING

Component reference numbers are printed on the top and bottom of the three circuit cards to facilitate circuit tracing. In addition, control names are also shown and referenced on the schematic diagram in this manual.

Transistor elements are identified as follows:

E – emitter, B – base, and C – collector

COMPONENT REMOVAL

Removing components from an etched circuit card is facilitated by the fact that the circuitry (copper foil) appears on one side of the circuit card only and the component leads are inserted straight through the holes and are not bent or crimped.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature controlled heating element would be desirable since it would reduce the possibility of damaging the circuit card foil due to over-heating.

The nozzle of the solder extracting gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away leaving the lead free from the copper foil. This method is particularly suitable in removing multi-terminal components.

CRT REPLACEMENT

Replace CRT as described in customer's manual, supplied under separate cover. Additional precautions to be observed follow.

Use extreme card in handling the CRT as rough handling may cause it to implode due to high vacuum pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection. In addition, be sure to disconnect the monitor from all external voltage sources.

– NOTE –

Discharge CRT by shorting 2nd anode to ground; then remove the CRT socket, deflection yoke and 2nd anode lead.

ADJUSTMENTS

A non-metallic tool is recommended when performing the following adjustments.

BRIGHTNESS/CONTRAST ADJUSTMENT

1a. Remove Video Drive signal, input at pin 8 of edge connector P1.

– or –

1b. If unit is equipped with a customer supplied Contrast control, rotate to minimum.

2. Rotate Internal Brightness control, R11, to minimum, full CW.

3. If unit is equipped with a customer supplied Remote Brightness control, rotate to full maximum position.

4. Rotate R11 to the threshold of the raster.

5a. Reconnect Video Drive signal .

– or –

5b. Adjust customer supplied Contrast control for the desired video level.

6. Adjust the Remote Brightness for the desired brightness level.

VERTICAL SIZE/LINEARITY ADJUSTMENT

1. Connect a test generator whose output is similar to the signal normally used.

2. (Refer to Figure 1.) Adjust the Vert. Linearity control, R25, until the extreme top and bottom characters (designated "A" and "B") are equal in height.

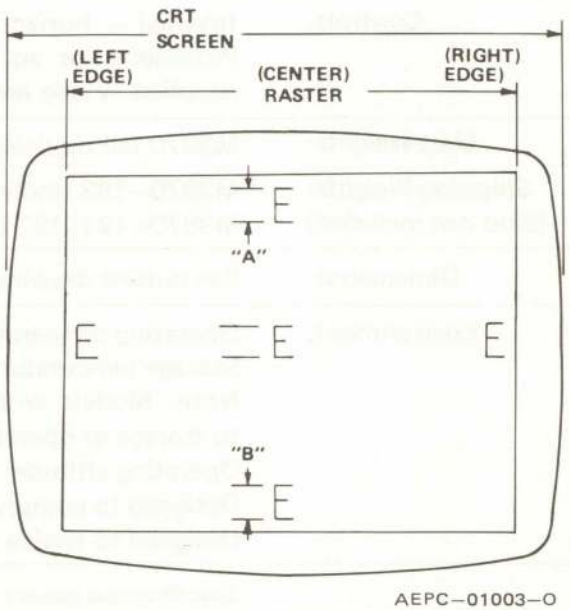


Figure 1. Partial CRT Raster Display of Characters for Adjustment

FOCUS ADJUSTMENT

The optimum focus of the display is obtained by adjusting the focus control, R30, for best focus at a point which is near the center and approximately 1/3 down from the top of the display.

HORIZONTAL SIZE ADJUSTMENT

– NOTE –

Turn slug of Horizontal Size Coil, L3, clockwise (to the circuit card) for maximum width and counterclockwise for minimum width (away from the circuit card).

Adjust Horizontal Size Coil, L3, for specified width or for a proportionate display (approximately 6" high by 8½" wide).

VIDEO CENTERING

– NOTE –

The direct drive monitor does not include a horizontal oscillator circuit, hence to center the video within the active phosphor area of the CRT, use the video centering magnets on the yoke. (See Figure 2.) See adjustments below.

1. Adjust Vert. Size, R17, so that all edges of the raster are visible.
2. Position the video centering magnets for best centering of display video.
3. Readjust size to specified dimensions.

RASTER YOKE ADJUSTMENTS

– NOTE –

This adjustment is normally required only if the yoke and/or CRT have been replaced. Upon completion of the Geometry Adjustment, you may not have a magnet installed on every yoke mounting pin. Normal installation ranges from one to four magnets.

– WARNING –

High voltages are present at the deflection yoke and are a potential shock hazard. Exercise caution when performing the following adjustment procedure.

Pincushion/Barrel Correction (top, bottom and sides).

Perform this adjustment if the raster has the abnormal effects as shown in Figure 3.

1. Push a magnet onto the yoke mounting pin as shown in Figure 3. A magnet should be placed only on the pin that corresponds to the affected area.
2. Rotate the magnet to obtain the desired raster, labeled "NORMAL" on Figure 3.

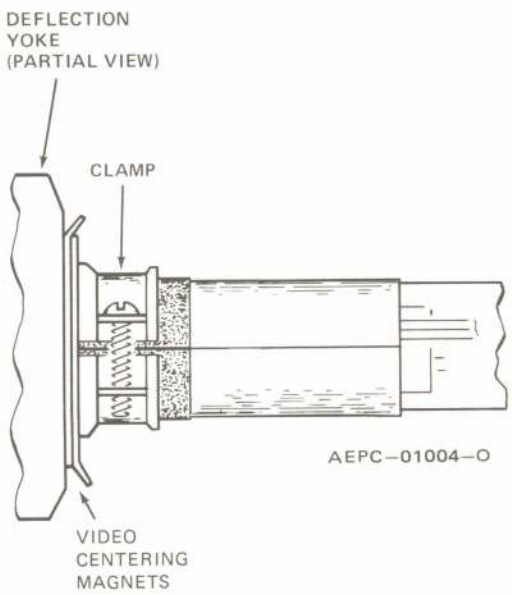


Figure 2. Partial View of CRT Neck/Deflection Yoke

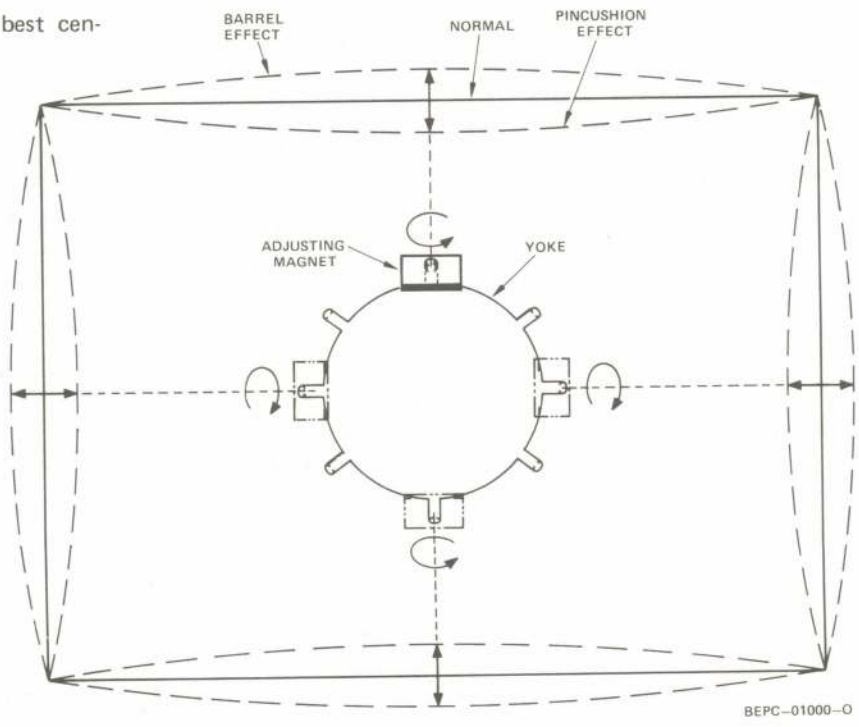


Figure 3. Pincushion/Barrel Adjustments

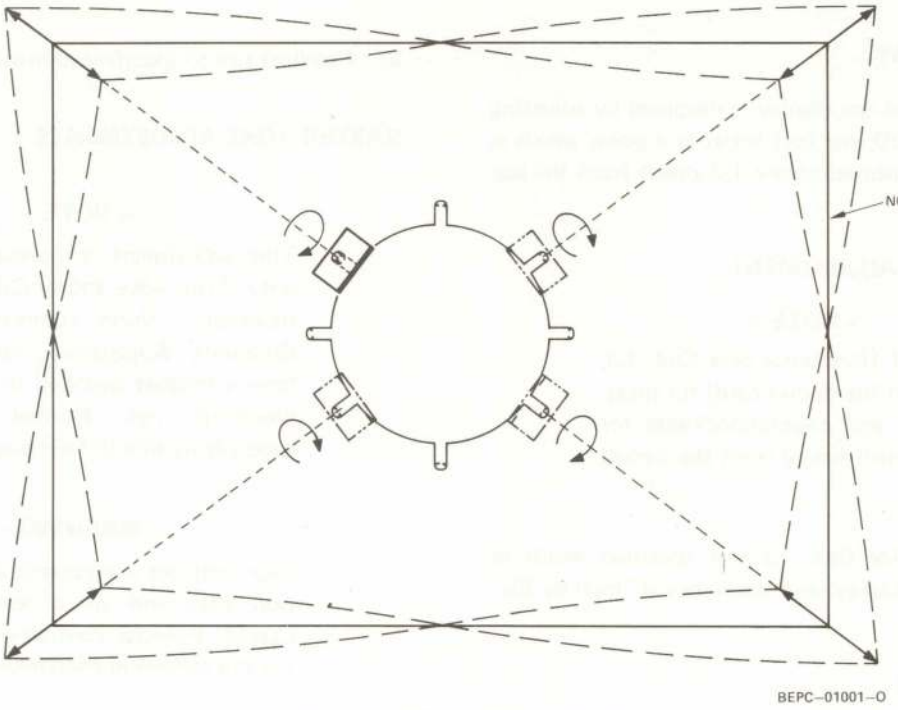


Figure 4. Trapazoidal Adjustments

3. If the desired raster cannot be obtained, add a second magnet to the yoke mounting pin. Both magnets must be rotated simultaneously.

– NOTE –

The magnets should be aligned as shown in Figure 5. Failure to observe polarity will result in negation of the magnetic field, and the desired raster will not be obtainable.

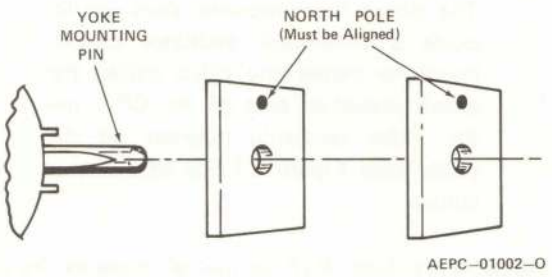


Figure 5. Yoke Adjusting Magnets

Trapazoidal Correction (corners).

Perform this adjustment if the raster has the abnormal effects as shown in Figure 4.

1. Push a magnet onto the yoke mounting pin as shown in Figure 4. Magnet should be placed only on the pin that corresponds to the affected area.
2. Rotate the magnet to obtain the desired raster, labeled "NORMAL" on Figure 4.
3. If the desired raster cannot be obtained, add a second magnet to the yoke mounting pin. Both magnets must be rotated simultaneously.

– NOTE –

The magnet should be aligned as shown in Figure 5. Failure to observe polarity will result in negation of the magnetic field, and the desired raster will not be obtainable.

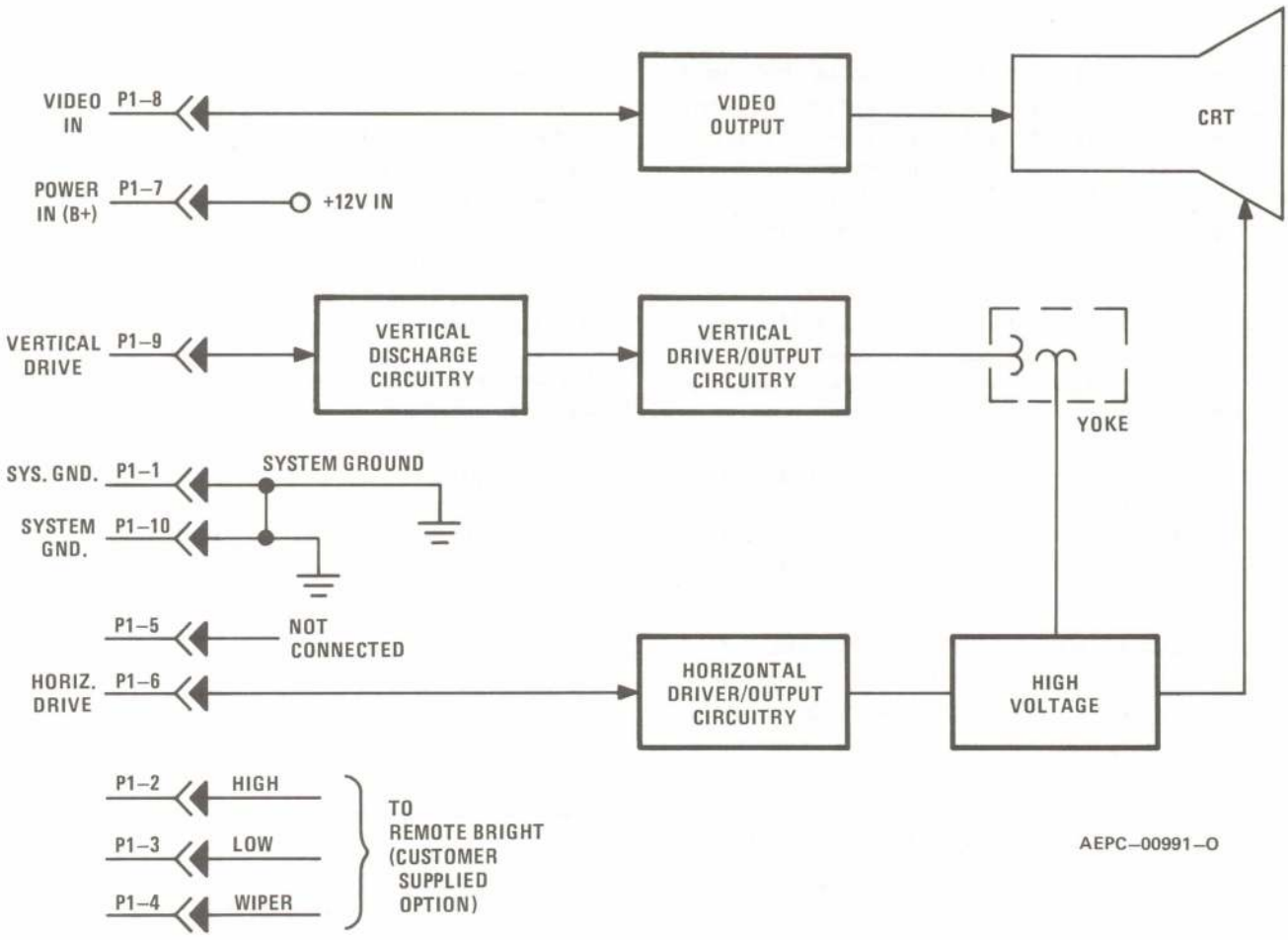
THEORY OF OPERATION

The Model M3970 Series monitors are direct drive units requiring separate video, horizontal sync and vertical sync inputs. All are TTL compatible. Power supplied to the monitor is +12V.

The monitor consists of a Video Amplifier, a Horizontal Driver, a Horizontal Output stage, and two stages of Vertical Deflection (see Block Diagram).

VIDEO AMPLIFIER

The TTL compatible video signal, input at pin 8 of edge connector P1, is direct coupled via R2 to the base of the Video Amplifier Q1. R1 is used as the load resistor for the video signal source. The RC network (R4, R5 and C1) provides Q1 with increased gain at high frequencies by altering the collector-emitter load resistance ratio. At low frequencies, C1 appears as an "open" and only R4 is in the circuit. At higher frequencies, C1 "shorts" shunting



Block Diagram – Direct Drive Model

R4 with R5, lowering the emitter load resistance and increasing the emitter-collector resistance ratio. Therefore, the gain of Q1 increases. Approximate voltage gain of this stage is 25.

Resistor R3 provides the collector load for the video output signal. The amplified video is fed forward and direct coupled via R34 to the cathode of the CRT.

HORIZONTAL DRIVER (See Figure 6)

The horizontal drive signal, input at pin 6 of P1, must be TTL compatible and a series of positive-going pulses of approximately 27.5 uSec duration (see Figure 6). In addition, the leading edge of the pulse may be coincident with the end of the video. If desired, the user may decide to delay the horizontal pulses (approximately 1.3 μSec) to attain centering of the video within the raster.

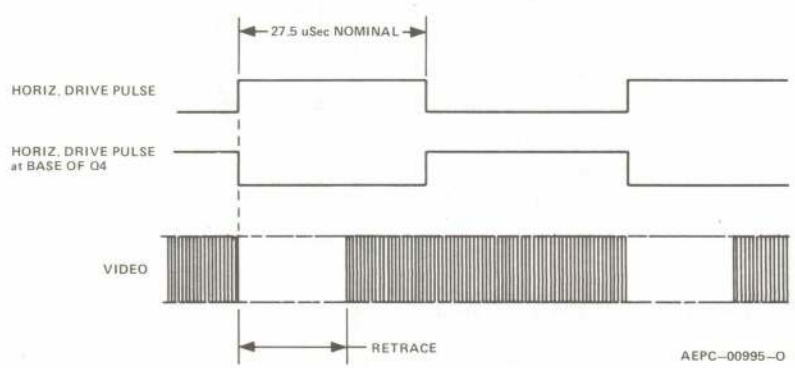


Figure 6. Horizontal Drive Signal

At the end of the video period, the horizontal drive signal goes positive and is coupled through C2 and R6 to the base of Q3, Horizontal Driver No. 2. Q3 "turns on" drawing current through D1, R10 and C3. This action pulls the base of Q4, the Horizontal Output stage, low, forcing Q4 into "cut-off." Approximately 27 μSec later, the negative-going trailing edge of the horizontal drive pulse switches Q3 off which in turn, allows Q2 to conduct. Base current is now provided to Q4 via the network R9, R10 and C3. The RC network R10 and C3 is a speed-up network in the base circuit of Q4. It is used to increase the collector switching time of Q4.

At the end of the video period (horizontal drive going positive) the drive pulse at the base of Q4 goes low, forcing Q4 to cut-off. This produces a retrace pulse occurring at the end of each line or sweep period that quickly drives the electron beam from the right to left side of the screen.

Coincident with the retrace pulse, is the dissipation of the yoke current as determined by the LR time constant of the yoke, the primary windings of T1 and the action of D9. When the electron beam travels to about the center of the screen, Q4 turns on forming a current path from the +12V supply through the yoke (L2B), the Horizontal Size (L3) and the Horizontal Linearity (L4) coils, to complete the raster line.

The retrace tuning capacitor, C4, forms a tuned circuit with the inductive components of the yoke, L2B. The linearity coil, L4, provides optimum horizontal linearity, by shaping the deflection current per the amount of magnetic biasing as determined by the position of its core. The two RC networks C17 and R39, and C16 and R38 provide damping for the coils L4 and L3 respectively, which eliminates any ringing effects in the circuits.

HORIZONTAL OUTPUT TRANSFORMER

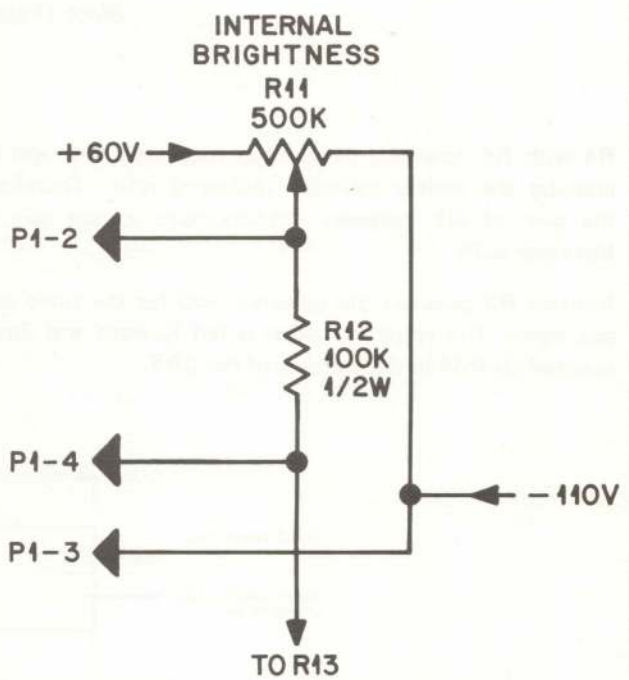
Transformer T1 produces secondary voltages via the auto transformer action of the primary winding. The transformer produces +60V, −110V, +300V, and +12 kV. The +60V supply is used as B+ for transistor Q1. At Q7, this voltage limits the peak voltage that appears at the collector utilizing the electrical path through D5 and R27. The +60V and the −110V are applied across the brightness pot R11. In addition, these voltages provide enough range to allow the blanking pulses to turn off the CRT beam during retrace. The +300V source supplies the second grid, G2, of the CRT, in addition to the variable focus bleeder resistor. The +12 kV supplies the second anode of the CRT with B+.

VERTICAL DEFLECTION

The vertical drive signal, a negative-going short duration spike, is supplied to the unit via pin 9 of edge connector P1. This drive signal is direct coupled to the base of Q5 via R15. When the vertical drive signal is false or high, Q5 is cut off allowing C8 and C9 to charge toward +12V through the network of R17, R18 and D4. This charging action generates a linear positive-going ramp (sawtooth waveform) applied to the base of Q6, the Vertical Driver stage. When the vertical drive signal goes true or negative, Q5 conducts discharging C8 and C9 to nearly zero volts. This action forms the retrace portion of the sawtooth waveform. Q6, an emitter follower configuration, transforms the high impedance of the sawtooth waveform into a low impedance drive for Q7, the vertical output stage.

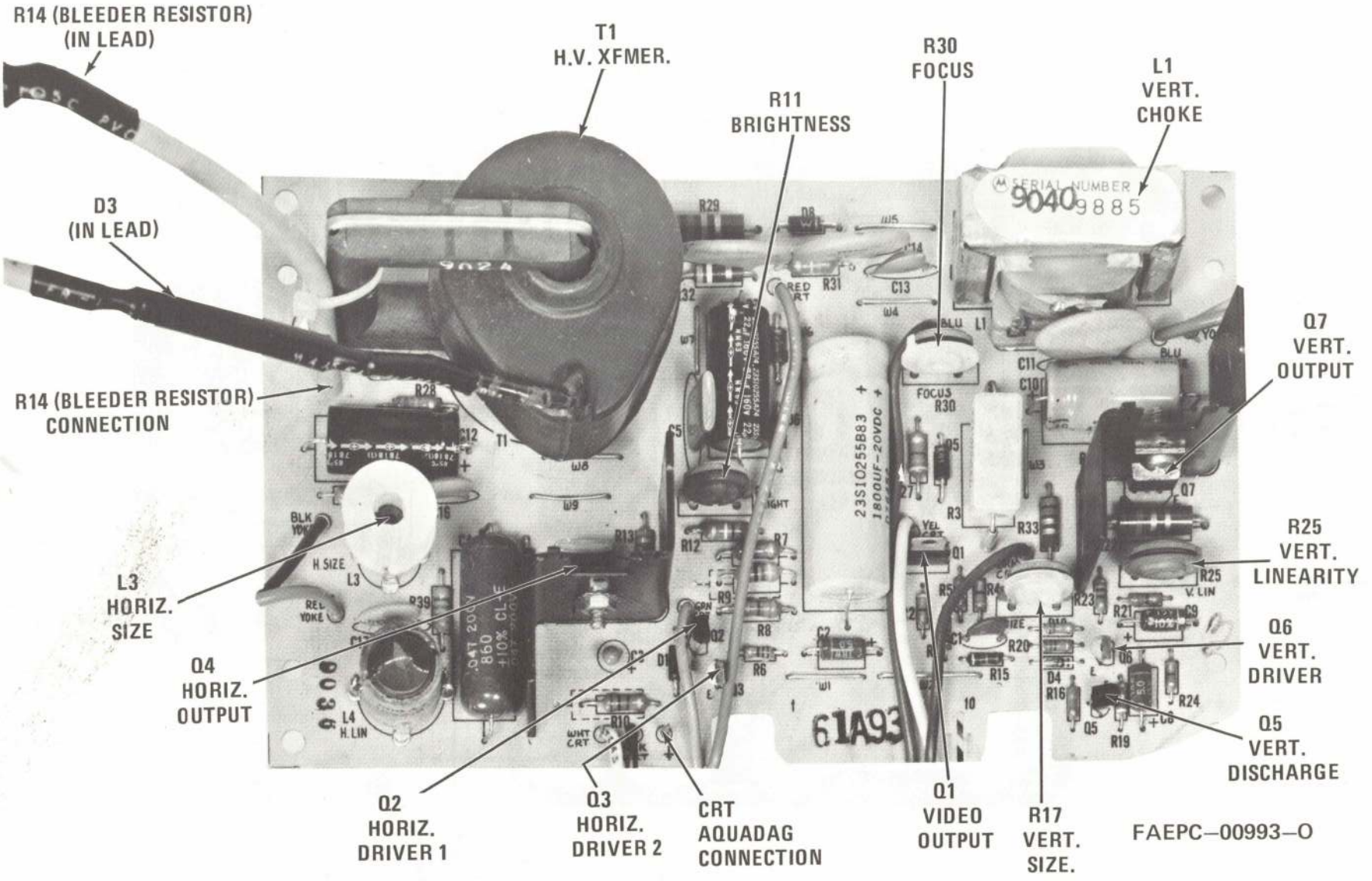
The vertical output transistor, Q7, provides the required sawtooth waveform of current through vertical choke L1 and vertical yoke L2A. When Q7 is at minimum current flow during retrace, a large pulse voltage is developed as the yoke field collapses. The high voltage pulse is limited by D5 and R27 connected to the +60V source. The yoke coupling capacitor C10 blocks any DC voltage to the yoke which can cause de-centering of the raster. The resistors R25 and R21 couple the emitter voltage of Q7 to the junction of C8 and C9. Because this path is resistive, the waveform coupled back will be integrated into a parabola by C8. This action pre-distorts the drive sawtooth and allows optimization of the vertical linearity adjustment.

Internal Brightness Circuit Alternate Wiring Detail

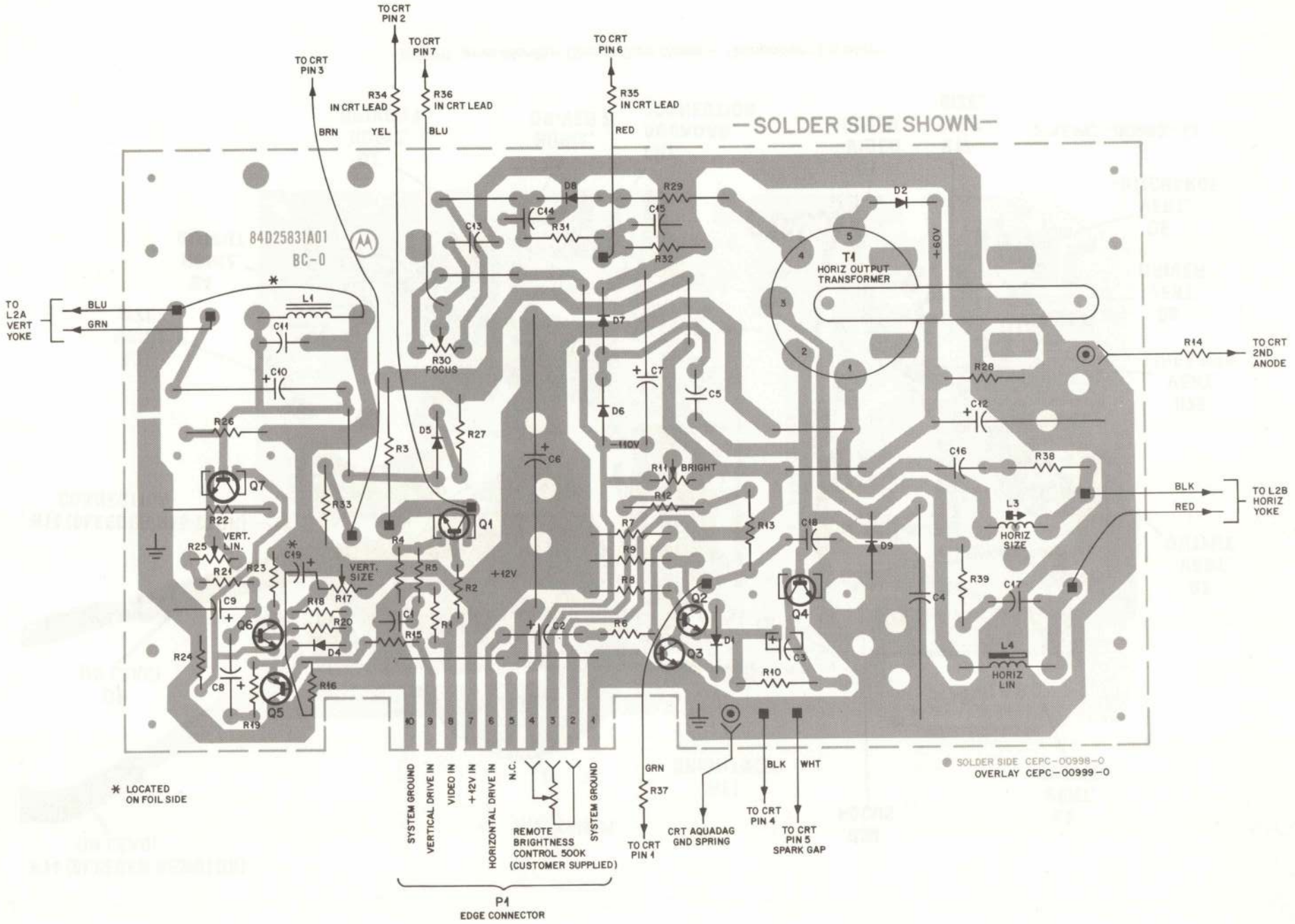


Circuit cards with the Part No. 84D25831B01, C01, etc. are wired as indicated above.

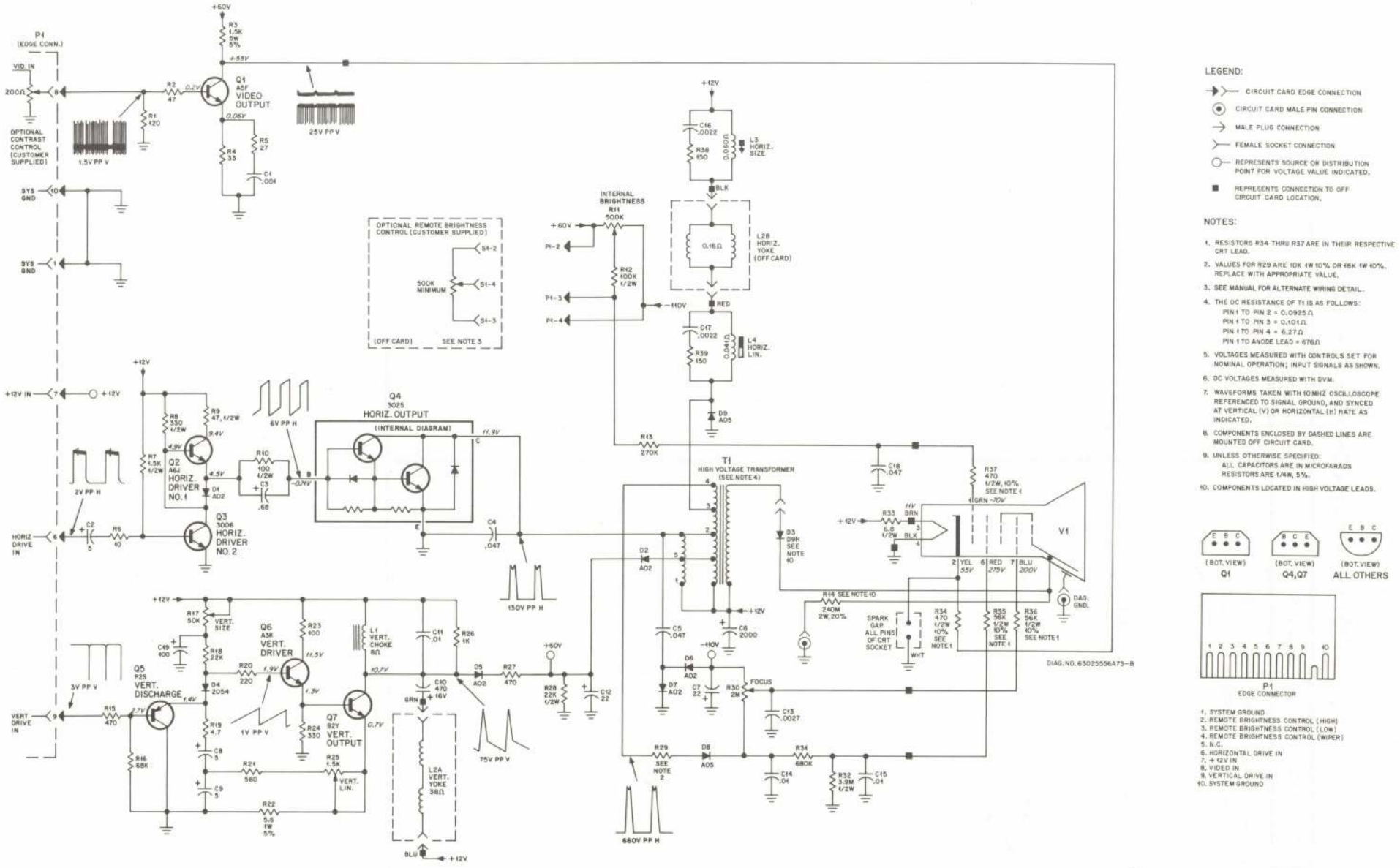
For earlier version, refer to schematic diagram on Page11in this manual.



M3970 Series Monitor Circuit Card Detail — Component Location



M3970–XXX (Direct Drive) Monitor Circuit Card Detail – Solder View



LEGEND:

- CIRCUIT CARD EDGE CONNECTION
- CIRCUIT CARD MALE PIN CONNECTION
- MALE PLUG CONNECTION
- FEMALE SOCKET CONNECTION
- REPRESENTS SOURCE OR DISTRIBUTION POINT FOR VOLTAGE VALUE INDICATED.
- REPRESENTS CONNECTION TO OFF CIRCUIT CARD LOCATION.

NOTES:

1. RESISTORS R34 THRU R37 ARE IN THEIR RESPECTIVE CRT LEAD.
2. VALUES FOR R29 ARE 10K 1W 10% OR 18K 1W 10%. REPLACE WITH APPROPRIATE VALUE.
3. SEE MANUAL FOR ALTERNATE WIRING DETAIL.
4. THE DC RESISTANCE OF T1 IS AS FOLLOWS:
   PIN 1 TO PIN 2 = 0.092Ω
   PIN 1 TO PIN 3 = 0.401Ω
   PIN 1 TO PIN 4 = 6.27Ω
   PIN 1 TO ANODE LEAD = 676Ω
5. VOLTAGES MEASURED WITH CONTROLS SET FOR NOMINAL OPERATION; INPUT SIGNALS AS SHOWN.
6. DC VOLTAGES MEASURED WITH DVM.
7. WAVEFORMS TAKEN WITH 10 MHZ OSCILLOSCOPE REFERENCED TO SIGNAL GROUND, AND SYNCED AT VERTICAL (V) OR HORIZONTAL (H) RATE AS INDICATED.
8. COMPONENTS ENCLOSED BY DASHED LINES ARE MOUNTED OFF CIRCUIT CARD.
9. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN MICROFARADS
   RESISTORS ARE 1/4W, 5%.
10. COMPONENTS LOCATED IN HIGH VOLTAGE LEADS.

1. SYSTEM GROUND
2. REMOTE BRIGHTNESS CONTROL (HIGH)
3. REMOTE BRIGHTNESS CONTROL (LOW)
4. REMOTE BRIGHTNESS CONTROL (WIPER)
5. N.C.
6. HORIZONTAL DRIVE IN
7. +12V IN
8. VIDEO IN
9. VERTICAL DRIVE IN
10. SYSTEM GROUND

M3970–191, 2, 3 – Diagram Schematic

M3970 – SERIES MONITOR PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
CAPACITORS: (ALL VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.)		
C1	21S180B07	0.001 10%, Z5F, 100V; Disc
C2	23S10218A31	5, 15V; Tant.
C3	23R29976A01	0.68, 35V; Tant.
C4	8S10072A44	0.047 10%, 200V; Poly
C5	8R29959A02	0.047 10%, 400V; Film
C6	23S10255A11	2000, 35V; Lytic
C7	23S10255A74	22, 160V; Lytic
C8, C9	See C2	
C10	23S10255A29	470, 16V; Lytic
C11	8R29959A01	0.01 10%, 400V; Film
C12	See C7	
C13	21S180C41	0.0027 20%, Z5F, 500V; Disc
C14,C15	See C11	
C16,C17	21S180C39	0.0022 10%, Z5F, 500V; Disc.
C18	See C5	
C19	23S10255A06	100, 16V; Lytic
DIODES/RECTIFIERS:		
D1, D2	48R191A02	Rect., Silicon 91A02
D3	48S137608	Rect., H.V. D9H
D4	48R02054A00	Diode, Silicon 2054
D5–D7	See D1	
D8, D9	48R191A05	Rect., Silicon 91A05
COILS/CHOKES:		
L1	25D25221A01	Coil, Vert. Choke
L2 A/B	24D25830A01	Yoke, Deflection
L3	24D25603A16	Coil, Width
L4	24D25600A15	Coil, Lin.
TRANSISTORS:		
Q1	48R137093	Transistor, A5F
Q2	48R137172	Transistor, A6J
Q3	48R03006A00	Transistor, MPS-A05
Q4	48R03025A00	Transistor, BU-807
Q5	48R137127	Transistor, P2S
Q6	48R134997	Transistor, A3K
Q7	48R137598	Transistor, B2Y

REF. NO.	PART NO.	DESCRIPTION
RESISTORS:		
Note: Only power or special resistors are listed. Use the description when ordering standard values of fixed carbon resistors up to 2 watts.		
R3	17–136062	1.5k 5%, 5W, Wire Wound
R7	6–10164B32	1.5k 5%, ½W, Film
R8	6–10164B19	330 5%, ½W, Film
R9	6–10164B01	47 5%, ½W, Film
R10	6–10164A78	100 5%, ½W, Film
R11	18D25245A07	500k, Pot.
R12	6–10164A80	100k 5%, ½W, Film
R14	6R29978A01	240M 20%, 2W, Cer.
R17	18D25245A20	50k, Pot.
R22	6–126B63	5.6 5%, 1W, Comp.
R25	18D25245A10	1.5k, Pot.
R28	6–10164B54	22k 5%, ½W, Film
R29	6–00126A79	18k 5%, 1W
R30	18D25245A12	2M, Pot.
R32	6–125B36	3.9M 5%, ½W, Comp.
R33	6–10164L13	6.8 5%, ½W, Film
R34	6–125C41	470 10%, ½W, Comp.
R35,R36	6–125C91	56k 10%, ½W, Comp.
R37	See R34	
TRANSFORMERS:		
T1	24D25240A27	Transformer, Horiz. Output
MISCELLANEOUS:		
V1	96R2500A15	CRT 12" 90° P4
- -	42D25298A13	Anode Connector
- -	9D25241A08	CRT Socket
- -	59B25840A01	Yoke Magnet
- -	41B25685B01	Aquadag Spring
- -	43S10865A01	1 Inch Spacer
	29S10134A71	Yoke Lead Term. Lugs
- -	29S10134A55	Aquadag & Bleeder Wire Lugs
- -	84–25561C93	P.C. Panel
- -	26–25834B01	Heat Sink for Q4
- -	9–25241A08	Pix Tube Socket

Installation Instruction Section for M3970–xxx Monitor Kits

GENERAL

The Model M3970–XXX CRT Display Monitor kit may be installed into many different types of cabinets, housings, consoles, etc. As a result, it is not the intention of these brief installation instructions to describe the many installation possibilities. Instead, only installation limitations will be described. To ensure a proper installation, read the following paragraphs completely (before starting) to fully understand the various limitations.

For complete operation and maintenance information, which includes schematics, circuit card layout details, parts lists, photographs with parts identification/location, etc., use the front half of this manual.

– CAUTION –

NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR KIT COMPONENTS BY ANYONE NOT FAMILIAR WITH PROPER SERVICING PROCEDURES AND PRECAUTIONS.

PRELIMINARY CHECKOUT

The 12-inch CRT and associated components, which make up the basic M3970–XXX kit, are mounted and shipped as shown in Figure 1. All components are properly interconnected for operation. Simply fabricate the mating plug for the edge connector on the rear of the monitor circuit card (see Figure 2).

To pretest the kit before final installation, remove the kit from the shipping carton, or remove the kit from the pallet and open the cardboard shipping housing. (See Figure 1.)

– CAUTION –

A fire hazard exists if the monitor is operated in the shipping carton or on the cardboard shipping board for any length of time. Be sure adequate ventilation is available to keep the ambient temperature, in the monitor housing, below +55°C (+131°F).

12–INCH CRT

As with any glass envelope vacuum tube, the danger of implosion is always present if dropped or mishandled. Even though the CRT used in this kit has integral implosion protection, handle the CRT with extreme care, and wear safety glasses. In addition, do not carry the CRT by its neck or apply excessive pressure to it.

The CRT may be positioned with its high voltage cap (2nd anode connection) either left or right; however, be sure that the cap has a minimum of 1-inch clearance from any metal shield, bracket, etc.

To mount the CRT in its final operating location, use No. 8 type hardware and the holes in each corner of the CRT. After final installation, check to be sure that the CRT aquadag spring is positioned properly and grounded via a black wire to the monitor circuit card. Check to be sure that the bleeder resistor, R14, is connected to the ground lug. (See the circuit board detail photograph.)

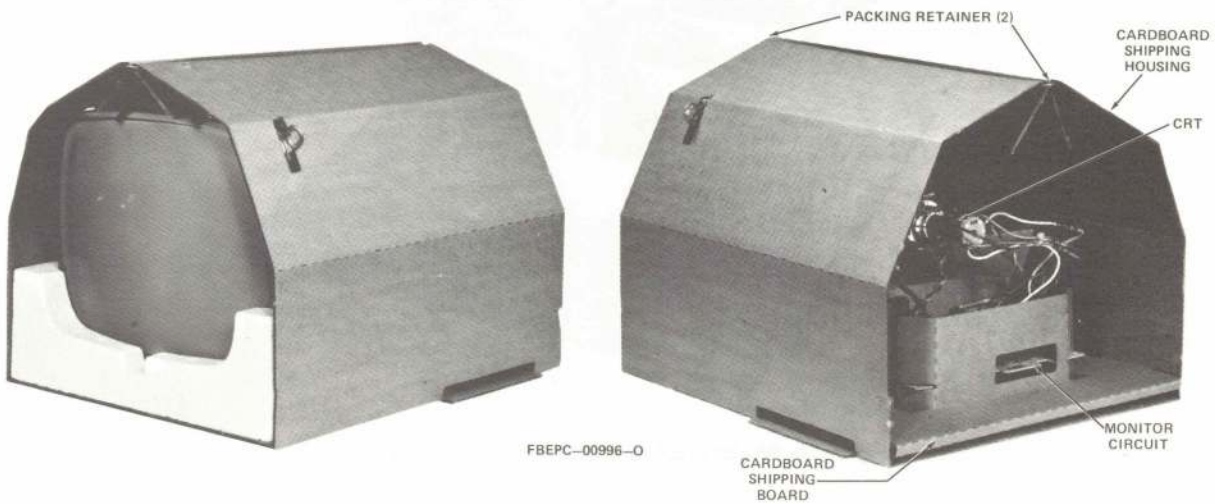


Figure 1. M3970 Shipping Package, Front and Rear View

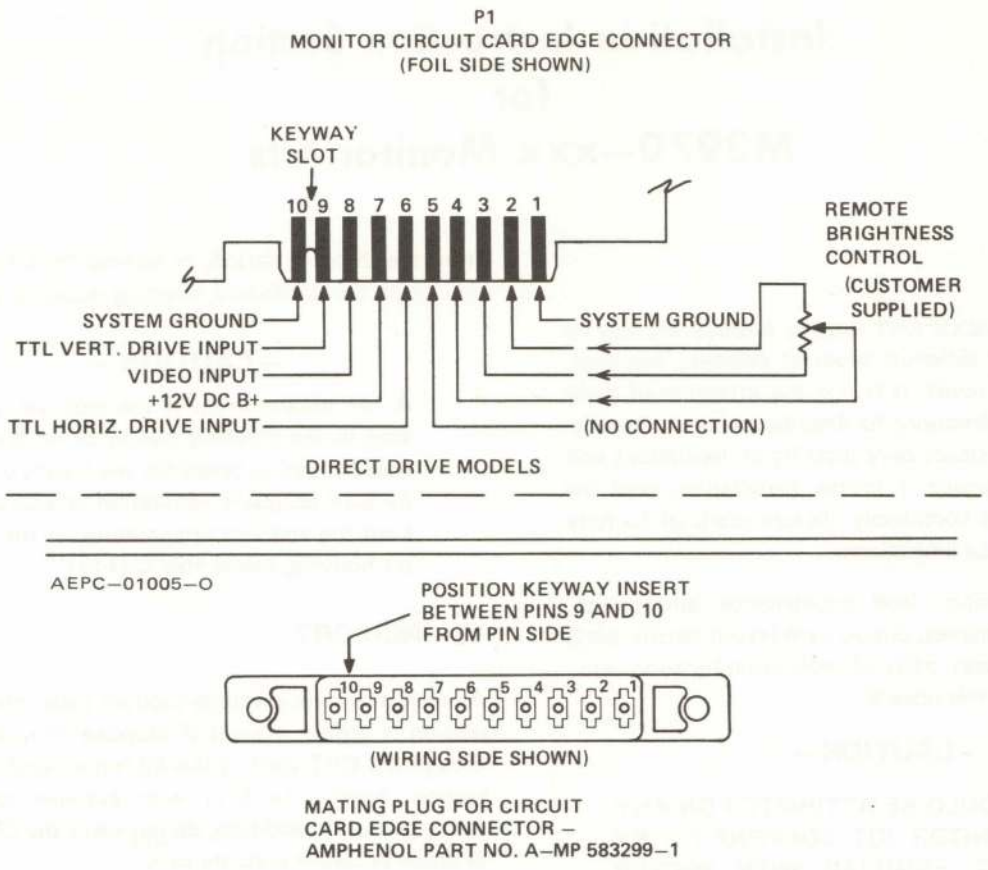


Figure 2. Monitor Circuit Card – Edge Connector

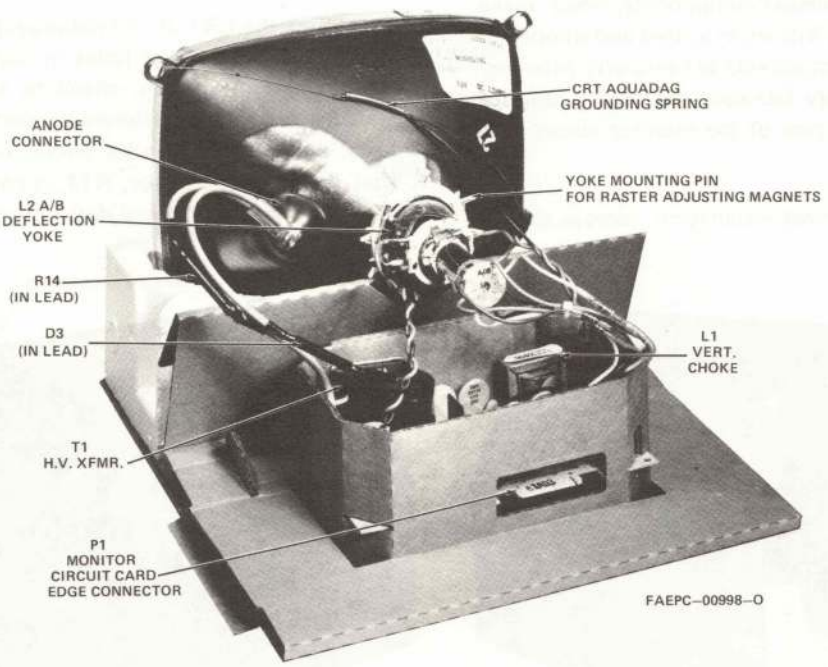


Figure 3. Model M3970 – Series Kits, Rear View

MONITOR CIRCUIT CARD

The monitor circuit card may be mounted horizontally or vertically. Whichever position is selected, however, a minimum of 5/16-inch clearance is required between the copper foil side of the circuit card and the mounting surface. In addition, a minimum of 2 inches is required above the circuit card for component clearance and access to all adjustable controls. Furthermore, it is desirable to place the Vertical Choke and the High Voltage Transformer a minimum of three inches away from the Deflection Yoke. For convenience in troubleshooting, there should be a large opening below the circuit card for access to its copper foil.

Do not allow any wires to lay on top of, or alongside any power transistor heat sinks on the circuit card. High heat dissipation could melt the wire insulation. In addition, be sure the yellow wire (CRT cathode connection) from the circuit card to pin 2 of the CRT socket does not lay near any metal or horizontal circuitry.

Use four (4) No. 6 type screws and hardware, plus insulated standoffs, to secure the circuit card in its desired location.

After final installation, be sure the CRT aquadag spring is connected via a black wire to the circuit card (reference Page 9). Additional grounding of the monitor circuit card to an external metal chassis ground connection, however, depends on the overall system grounding into which the monitor will be installed.

Refer to the ADJUSTMENTS outlined in front half of this manual and perform as necessary.

– NOTE –

At the time of the initial installation procedure, it will be necessary to perform the Raster (Yoke) Adjustment Procedure.

GENERAL SERVICING PRECAUTIONS

– CAUTION –

Before attempting to service the monitor, disconnect (or turn off) the external power supply; then, as an added precaution, discharge the CRT 2nd anode before handling any high voltage components. In addition, be sure to observe all safety warnings and service notes in the front of this manual.

When it is necessary to disconnect the deflection yoke, and/or CRT socket leads, pull their small female pins straight out without any back and forth rocking motion. This action will prevent, or at least minimize deforming male pins on the components and/or breaking their solder connections.

When disconnecting the H.V. rectifier, D3, pull it out of the high voltage lead holder slowly and carefully to prevent breaking or deforming the short rectifier lead.

Use caution around the heat sinks of the horizontal and vertical output transistors. The heat sinks are at the same potential as the transistor collectors. During normal operation with signal input present, the horizontal heat sink has 130 volt P-P pulses and the vertical heat sink has 75 volt P-P pulses (with respect to system ground).