

FLIM-FLAM MANUAL

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INTRODUCTION AND WARRANTY INFORMATION

Flim Flam is a coin operated video amusement device which accurately simulates the experience of a doubles tennis match.

The game may be operated by two, three, or four players simultaneously and accommodates groups of players who have differing degrees of skill.

The electronics of this game incorporates the latest advances in semiconductor technology resulting in long life and low maintenance.

However - as with all devices mechanical or electrical - there will inevitably be minor problems. This manual describes all adjustments, repairs, and troubleshooting procedures which you will need to know to operate the game.

If the printed circuit board (PCB) fails within the one-year warranty
period, immediately contact for repair
and replacement instructions. NOTE: Any PCB repair attempted by
anyone other than factory authorized service personnel will void
PCB warranties. If your computer PCB fails after the warranty expires,
it will be repaired for a nominal parts and labor charge.
The TV monitor is under warranty for a period of thirty days and if the
monitor should fail within this period, immediately contact
for repair and replacement instructions NOTE:

Any TV monitor repairs attempted by anyone other than factory authorized service personnel during warranty period will void TV monitor warranty. If the TV monitor fails after the warranty period has expired, we recommend having service performed by any reputable TV repair shop.

NEW MACHINE SET-UP AND CHECK-OUT PROCEDURES

After uncrating, save all packing materials in the event machine needs to be returned.

As each new Flim Flam leaves the factory, every component and subassembly is carefully checked for proper operation. However, since parts may have been damaged or factory adjustments changed due to shaking and jarring during shipping, the following check-out procedure must be performed prior to placing the machine on location.

- a. With the machine unplugged, open coin acceptor door and raise the top by removing wing nut hold down. Carefully inspect both the exterior and interior for any obvious damage to the cabinet or internal components which may have occurred during shipping. If any such damage is discovered, immediately contact the freight carrier. Then contact _______ for repair or replacement instructions.
- b. Inspect the interior of the machine more carefully, looking for

broken or disconnected wires, sub-assemblies not securely mounted, and any foreign objects shorting or interfering with electrical connections. Pay particular attention to the connections to the TV monitor, the players' controls, and the coin switch. Check the security of the computer PCB and flasher PCB edge connectors.

- c. Plug the machine in and check the CRT (Cathode Ray Tube) image which should be steady, centered, sharp, and exhibit the proper levels of brightness and contrast. With the machine plugged in, but not started, the CRT will display the Attract Mode (see next section for Attract Mode explanation).
- d. Insert several old and new coins into the coin acceptor. No genuine coin should be rejected. Operate the coin return button while checking for signs of stickiness or binding. Lightly spray the coin acceptor, return button and the inside of both lock cylinder with WD-40, a silicone lubricant.
- e. Check the computer for proper operation by playing several games and compare the results with the game sequence analysis in the next section.

THE GAME SEQUENCE

With the game plugged in but not started, the CRT will display the Attract Mode. Durring Attract, the general illumination lamps are

lighted, the attract lamps flash, and the ball rebounds off the playfield walls.

Coin insertion produces game credit and the players may select either the Two Player Mode or the Four Player Mode by depositing one (25¢) or two (50¢) coins. The game is started by pressing one of the paddle size buttons.

THE TWO PLAYER MODE

If only one coin is inserted, the Two Player Mode will automatically be selected by the computer and the two player configuration will appear on the CRT after one of the paddle size selector buttons is pressed. These buttons control the relative difficulty of the game by changing the paddle size.

The two player CRT configuration consists of a playfield bounded by walls on all four sides, a dotted net line separating the players' courts, two paddles (one for each side) and the score remaining from the last game. The attract lamps do not flash during the play mode. The score is reset to zero at the beginning of each game and will count to a maximum of 11 or 15, depending on the position of the score switch. The ball is automatically served from the middle of the CRT and is manipulated by placing the paddle directly in the path of the ball. The direction the ball is bounced is controlled only by where the ball strikes the paddle. For instance, if the ball encounters

the uppermost portion or "segment" of the paddle, it will be bounced upward at the maximum angle. "Striking" the ball with a moving paddle will not produce a greater or different effect than simply placing the paddle in the path of the ball. There are two ball speeds: the normal or "slow" speed, and the "fast" speed produced by pressing the speed buttons. The speed button will produce this effect only after the ball has been hit, and pressing this button causes the ball to drastically shift horizontally.

THE FOUR PLAYER MODE

Two coins (50¢) must be deposited to produce the four player configuration which will appear on the CRT when the desired size button is pressed. In this configuration, an additional horizontal net line divides the playfield into two sections. Four paddles appear and each paddle is permitted movement only within its own quadrant. Other than these differences in the CRT display, the four player game sequence is identical to the two player sequence.

SCORE ADJUSTMENT

A maximum score of 11 or 15, may be operator selected by changing the position of the slide switch found in the bottom right hand corner of the computer PBC (Figure 1). If the switch is in the right hand position, the game will end at 11 points. Sliding the switch to the left endsgame at 15, which is the recommended setting.

TV MONITOR ADJUSTMENT

The TV monitor adjustments function like those of the home TV Set.

Refer to monitor manual for the locations of the following adjustments.

- a. VOLUME: Adjust the volume to the preference of the location.

 Meep in mind that the machine will sound louder with the control panel raised.
- b. BRIGHTNESS: Brightness is adjusted before contrast. Adjust so the CRT background is as dark as possible without diminishing the brightness of the playfield walls.
- c. CONTRAST: Adjust so that the CRT images are as bright as possible against the pre-adjusted dark background without blurring.
- d. VERTICAL HOLD: Adjust only if the picture appears to be rolling up or down the screen. Adjust for a stable, centered picture.
- e. HORIZONTAL HOLD: Adjust if the picture appears to be shifted off center horizontally, the images are warped, or if the whole picture is broken into diagnol lines.

PADDLE ADJUSTMENT

For reference the lower side of court is nearest coin operator. The upper side of court is nearest the game's scores. The left and right sides of court are as you face the coin operator.

Paddle should be checked every service call. Paddle will need adjusting when a pot or logic board has been replaced. If a pot has been replaced refer to section on <u>preliminary adjustment</u>. Each paddle has three adjustments:

- 1. Right Horizontal Position
- 2. Upper Vertical Position
- 3. Lower Vertical Position

When adjusting, set four play mode using "pro" size paddles.

To adjust horizontal position, move joystick to extreme right position.

Rotate horizontal pot on joystick assembly (Figure 2) until the paddle is just inside its right hand boundary.

To adjust top vertical position, move joystick to its extreme upper position. Turn pot on joystick (Figure 2) until the paddle is at its upper boundary.

To adjust lower vertical, move joystick to its extreme lower position.

Turn pot on logic board (Figure 1) so that the paddle is at its

lower boundary. This adjustment may disturb upper vertical position.

Further adjustment may be necessary. Repeat procedure for each of the four paddles.

PRELIMINARY ADJUSTMENT

The joystick pots need preliminary adjustment if the pots have been replaced. Preliminary adjustments should be done before the joystick is remounted.

a. ADJUSTING 2 PLAYER JCYSTICKS: Rotate pots of joystick <u>Counter-</u>
Clockwise until the stick is forced to move and the pot will not rotate

any further. Now apply slight pressure to the stick and move it in a circular motion. The joystick is ready for mounting in the unit. Wires must be connected to terminals #1 and #2 on the pots.

b. ADJUSTING 4 PLAYER JOYSTICKS: Rotate pots of the joystick Clockwise until the stick is forced to move and the pot will not rotate any further. Now apply slight pressure to the stick and move it in a circular motion. The joystick is ready for mounting in the unit. Wire must be connected to terminals #2 and #3 on the pots.

COIN ACCEPTOR OPERATION, ADJUSTMENT AND MAINTENANCE

The detection and rejection of undesired or counterfeit coins are determined by size (both thickness and diameter), weight, and metallic composition.

The transfer cradle (#9 in Figure 4) is used to test both the size and weight of the coin. The quarter must first pivot an "undersize" lever (10) to unlock the transfer cradle and can be returned by actuating the wiper operating lever (17). Oversize diameter coins will fail to pass between the transfer cradle and the wiper and can be returned by operating the wiper lever. Coins that are oversize in thickness will fail to pass between the magnet gate (11) and the main channel (5) and will have to be dislodged by actuating the wiper operating lever. Underweight coins will fail to overcome the transfer cradle counterweight and can be returned by operating the wiper lever.

A magnet is used to test the metallic composition of the coin.

Highly magnetic coins, such as steel or iron, will be retained by
the magnet and can be returned by actuating the wiper operating lever.

Coins having comparatively high magnetic properties will be slowed
down by the magnet and will drop off the rail short of the Accept
entrance and will be returned. Coins having little or no magnetic
properties, such as brass or zinc, will pass through the magnetic field
so fast they will overshoot the accept entrance and will be returned.

ADJUSTMENT

All coin acceptors leave the factory adjusted for maximum performance. If, however, more critical adjustment is desired, or if the unit has been disassembled for cleaning, the following adjustment procedure is suggested.

KICKER AND SEPARATOR

- a. Set the acceptor on a level surface with the back of the unit facing you (the kicker and separator are on the back).
- b. Loosen the screws holding the kicker (1) and the separator (3) and move both the kicker (2) and the separator (4) as far to the right as they will go. Tighten the screws lightly.
- c. Insert several test coins (both old and new) and note that some are returned by striking the separator.
- d. Loosen the separator screw and move the separator a slight amount to the left. Retighten the screw.

- e. Insert the test coins again, and if some are still returned, repeat Step D until all the coins are accepted.
- f. Loosen the kicker screw and move the kicker a slight amount to the right. Retighten the screw.
- g. Insert the test coins again and, if some of them are returned, repeat Step F until all coins are accepted.
- h. Be sure that both screws are tight after the adjustments have been made.

THE MAGNETIC GATE

- a. Set the acceptor with the front of the unit facing you in the test position.
- b. Turn the magnet gate adjustor (12) out (counter-clockwise) until none of the coins will fit through.
- c. With a coin resting in the transfer cradle, turn the adjustor in (clockwise) until the coin barely passes through the magnet gate.
- d. Test this adjustment using several coins, and if any fail to pass through the magnet gate, repeat Step C until all coins are accepted.
- e. Fix the magnet gate adjustor in this position with a drop of glue or Loctite, if necessary.

ACCEPTOR MAINTENANCE

Depending on the enviornment in which the acceptor is used, periodic preventative maintenance should be performed.

The mainplate (5) may be cleaned with any household cleaner. Thorough rinsing and drying are necessary to remove deposits and/or film. Remove all metal particles from the magnet by guiding a screwdriver along the edges of the magnet. Remove the transfer cradle and undersize lever and clean the bushings and pivot pins and bushings and re-assemble. Spray the entire unit lightly with WD-40, a silicone lubricant.

TROUBLE SHOOTING HINTS

TESTING COMPONENTS OF GAME

Buttons & Coin Switch are normally open. When pushed they are closed.

The buttons can be by-passed by touching the wires together.

Harness can be tested by an ohm-meter or continuity checker.

Fuses are checked by a visual inspection or continuity checker.

Flasher Board assembly can be checked by first measuring proper voltages on wires from flasher board. See figure diagram, Dwg 25-0001.

Logic Board & T.V. Monitor can be checked by substitution of a good replacement. Repair of Logic Board & Monitor should only be serviced by experienced technicians.

NO PICTURE: Check if back of picture tube is lit. If not, inspect fuses, power cord, and power outlet. If these are good and tube is not lit repair of monitor is necessary.

If the tube is lit, check adjustments of brightness and contrast.

Test continuity of logic board pins #1 and #3 (5th volt dc power supply),

and pin #5 (Video output). If all check out, problem is either the

logic board or monitor.

NO SOUND: Check adjustment of volume control on T.V. monitor. Test continuity of logic board pin #17 (audio signal), and monitor pins #5 and #8. Check speaker, logic board, and T.V. monitor.

NO BALL: Coin acceptor switch may be shorted or jammed. Wires from logic board pin #16 and #22 may be shorted. Replace logic board.

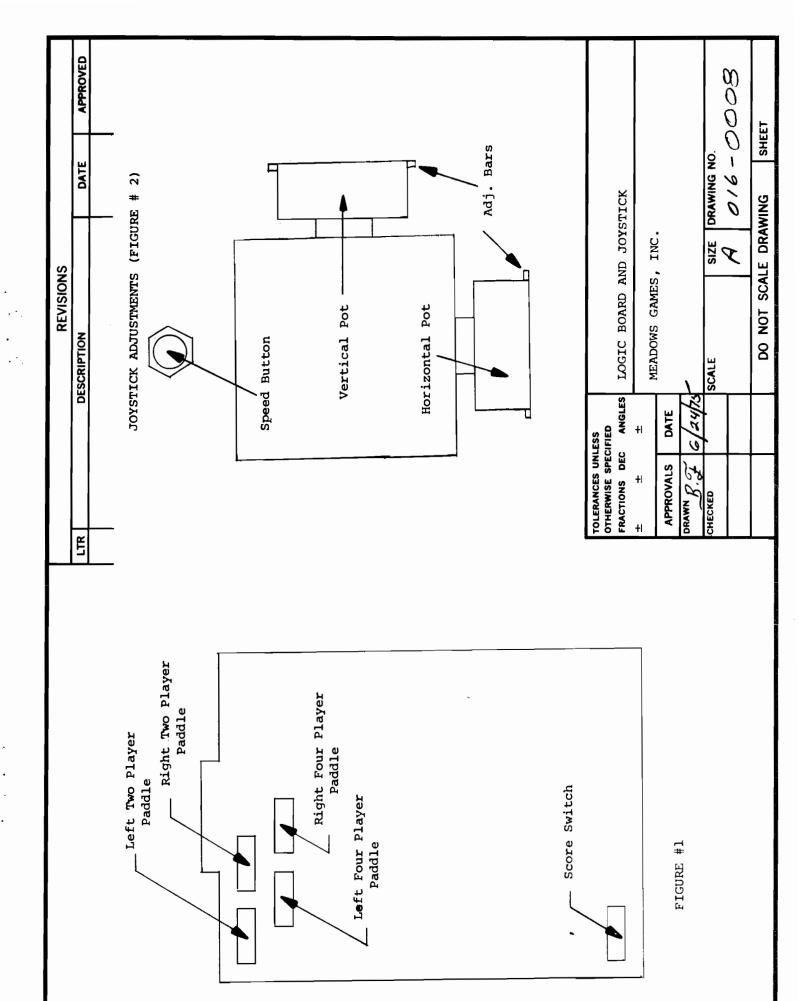
NO PADDLES: Check paddle adjustment. Test continuity of wires, from pots to logic board. The game may not be resetting properly. Check coin switch and wires. Check pots and logic board.

PADDLE DEFECTS: If paddles appear and are jumpy, oscillating, flick-ering, or will not stay within its boundaries, pots may need adjustment or replacement.

SCORE: If game shuts off at scores other than 11 or 15, the selection switch may be dirty. Use a contact or switch cleaner on switch.

GAME DEFECTS: If game is not operating properly, for example: incorrect scoring segments missing, erratic ball movement, the likely cause is the logic board.

FLIM FLAM SPEED BALL: Check speed buttons & wires. Check logic board.



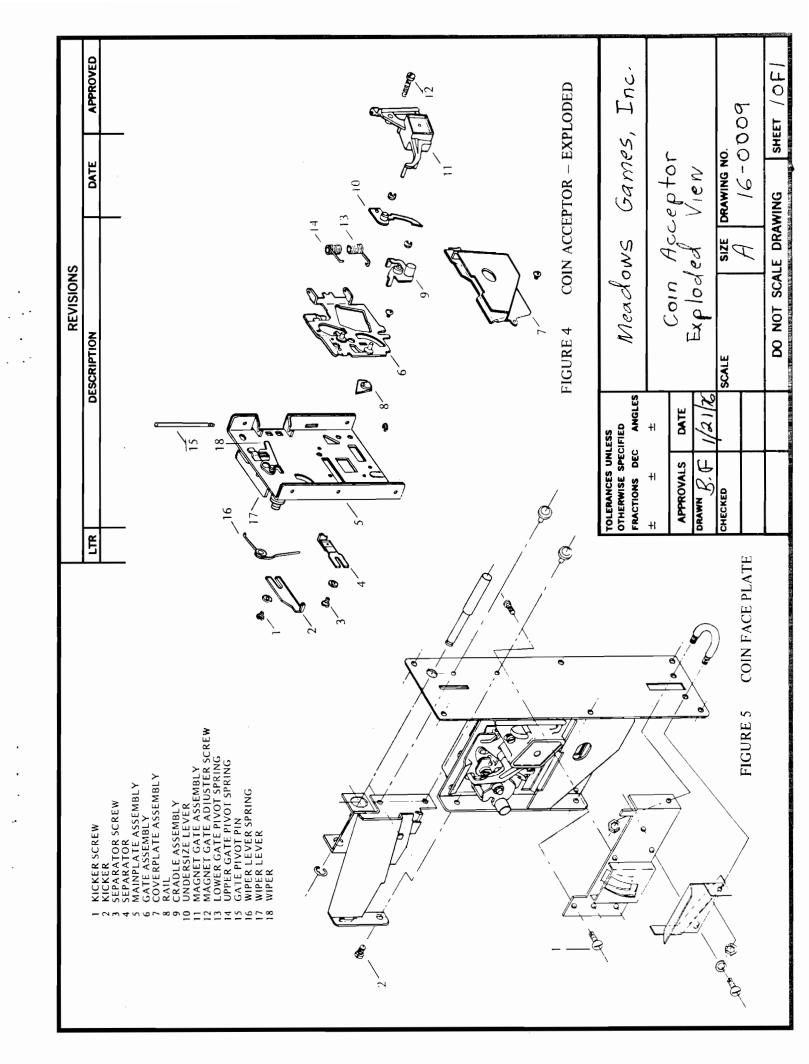
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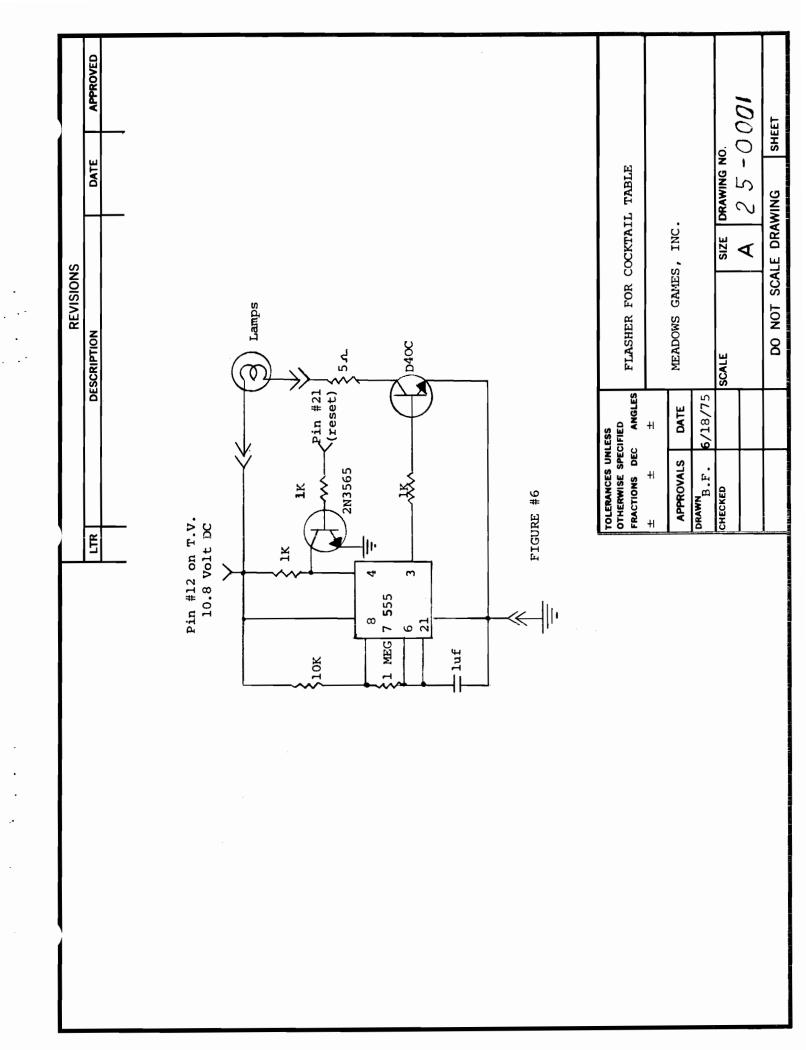
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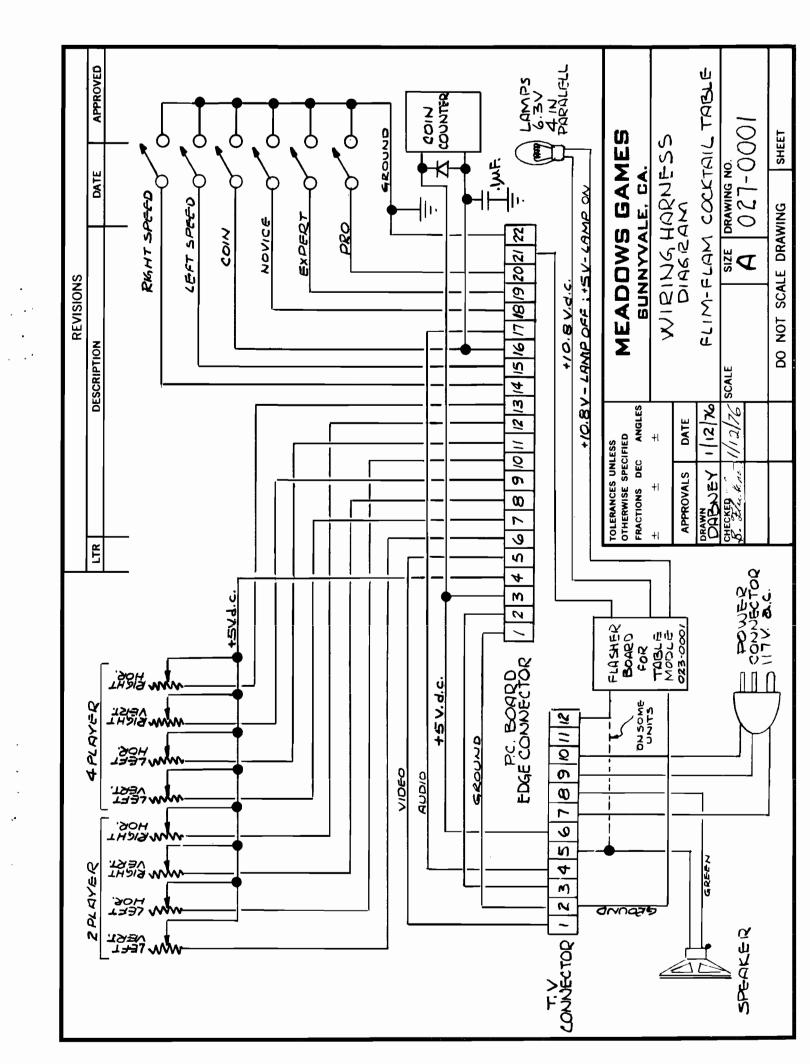
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service manual

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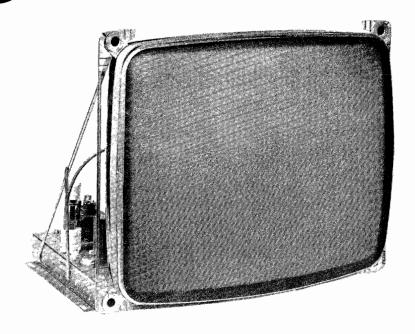
DISPLAY PRODUCTS



19VP111 23VP111

MODELS

XM501-10 XM701-10



GENERAL INFORMATION

These models are transistorized monitors designed for the video game market. They are identical except for the CRT size. See V1 in Replacement Parts List.

Circuitry includes four stages of video amplification, a two stage audio amplifier, sync and deflection circuits and a regulated power supply. An additional 5 volt 3 amp supply is included to power external logic systems. The picture tube is a 114 degree deflection CRT with implosion protection. Composite video is fed to the monitor through a connector mounted on the rear of the chassis.

Rear panel controls include Horizontal Hold, Vertical Hold, Contrast, Brightness, Volume and width controls. Additional service controls are mounted on the plated circuit panel, and are accessible from the rear of the chassis.

The chassis utilizes plug-in etched panel construction with components mounted on the top side and plated wiring on the bottom. Component reference numbers and circuit legend are printed on the board to aid in servicing. Horizontal, vertical output and regulator transistors are mounted on the chassis base which also serves as a heat sink and CRT support.

CAUTION

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

ELECTRICAL SPECIFICATIONS

Power Rating: 110 watts nominal. 50 watts without 5 volt

supply.

Source: 120/240V AC at 50/60Hz Switch selected.

JWILLII SCIECTED.

Video Input: 0.5 to 2.5 volts composite

PP (sync negative).

Audio Output: 5 watts peak

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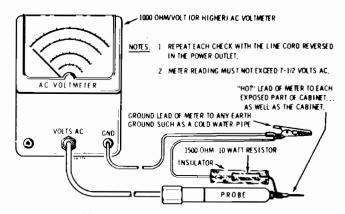
SAFETY WARNING

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.



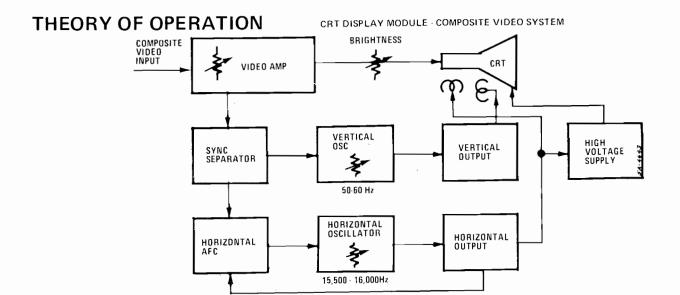
Voltmeter Hook-up for Safety Check-

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.

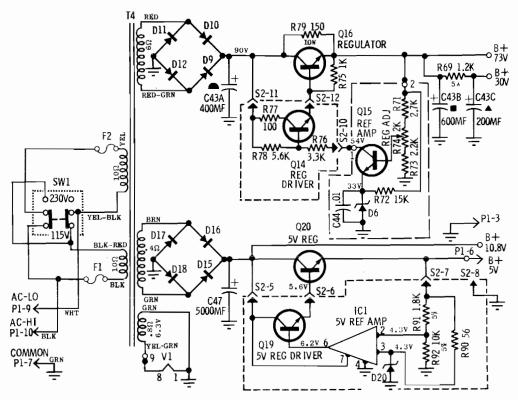
The AC voltage indicated by the meter may not exceed 7½ volts. A reading exceeding 7½ volts indicates that a potentially dangerous leakage path exists between the exposed portion of the unit and "earth" ground. Such a unit represents a potentially serious shock hazard to the operator.

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.



Block Diagram



POWER SUPPLY

The power supply is a transformer operated, full wave, regulated supply which maintains constant output voltage with input variations of $\pm 15\%$. A switch (SW1) is provided to allow operation from 115/230 volts, 50/60Hz. The regulator is a series pass circuit. Q16 is the series pass transistor, Q15 the reference amplifier and Q14 the output driver.

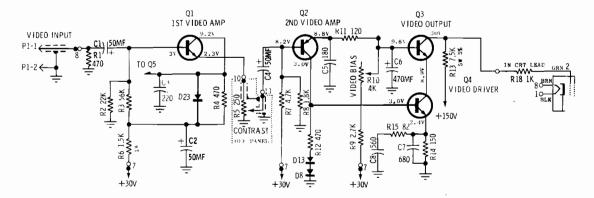
The output voltage of the regulator appears at the emitter of Q16. This voltage is divided between R71, R74 and R73. The voltage appearing on the arm of potentiometer R74 is a reference input to the base of Q15.

A temperature conpensated zener diode (D6) is used to establish a fixed reference voltage at the emitter of Q15. R72 provides a bias current for D6, establishing its operating point.

An increase in output voltage will result in an increase of voltage at the base of Q15. Since the emitter of Q15 is held at a fixed reference voltage, the change in base voltage will turn Q15 on harder, reducing its collector voltage. This reduces forward bias for Q14 resulting in less emitter current and less base current for Q16. Q16 will conduct less, lowering the output voltage.

R79 provides a shunt current path for Q16 allowing it to run cooler, improving reliability. C44 is an RF noise filter.

A fixed, regulated 5V DC supply is used to power circuits external from the monitor. Its operation is similar to the 73V regulator except for the reference amplifier which is contained in the IC package.



VIDEO AMPLIFIER

The video amplifier has four stages incorporating devices Q1, Q2, Q3 and Q4. The first stage, Q1, functions as an emitter follower. The low output impedance of the first stage permits use of a low resistance contrast control which furnishes flat video response over its entire range without the need for compensation. The collector output of Q1 is used to drive the sync separator. C3 provides high frequency roll off to limit the collector output to the bandwidth required to pass synchronization signals. Q2 is a common emitter stage and is directly coupled to Q4. Q3 and Q4 are connected in a cascode configuration. This common emitter-common base connection greatly reduces the effect of Miller capacity compared with a conventional single transistor video output stage. C6 provides a ground for video at the base of Q3, the grounded base transistor of the video output cascode pair. Diodes D13 and D8 provide temperature compensation for the video output stages, and diode D23 protects Q1 from transients.

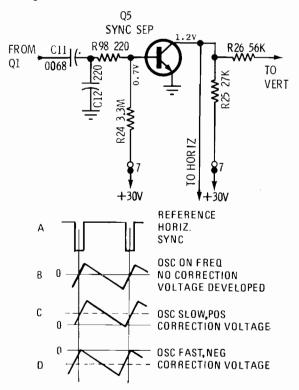
The video bias control R10, is used to set the quiescent collector voltage of Q3. C5, C7, C8 and R15 are used for high frequency compensation. The video amplifier output is direct coupled to the control grid of the CRT through R18 which is used to isolate Q3 from transients that may occur as a result of CRT arcing.

SYNC SEPARATOR

The sync separator employs a single stage, Q5, to recover sync from the composite video signal. A single stage sync separator is adequate due to the high impedance of the following stages. The video input to the sync separator is black positive. C11 is charged by the peak base current that flows when the positive peak of the input takes Q5 to saturation. This charge depends on the peak to peak input to Q5 and thus makes the bias for Q5 track the amplitude of the input signal. As a result Q5 amplifies only the positive peaks of the input signal. The initial bias current through R24 sets the clipping level. R98 is used for transient protection.

PHASE DETECTOR

The Phase Detector consists of two diodes in a keyed clamp circuit. Two inputs are required to generate the required output, one from the sync separator and one from the horizontal deflection system. The required output must be of the correct polarity and amplitude to correct phase differences between the input sync and the horizontal time base. The horizontal collector pulse is integrated into a sawtooth by R45 and C15. During sync time both diodes in D7 conduct, shorting C15 to ground.

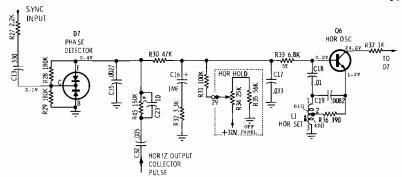


The sawtooth on C15 is thus clamped to ground at sync time. If the horizontal time base is in phase with the sync, the sync pulse will occur when the sawtooth is passing through its AC axis and the net charge on C15 will be zero. (Figure B). If the horizontal time base is lagging the sync, the sawtooth on C15 will be clamped to ground at a point negative from the AC axis. This will result in a positive DC charge on C15. (Figure C). This is the correct polarity to cause the horizontal oscillator to speed up to correct the phase lag.

Likewise, if the horizontal time base is leading the sync, the sawtooth on C15 will be clamped at a point positive from its AC axis, resulting in a net negative charge on C15 which is the required polarity to slow the horizontal oscillator (Figure D). R30, C17, C16 and R32 comprise the phase detector filter. The bandpass of this filter is chosen to provide correction of horizontal oscillator phase without ringing or hunting. Capacitor C23 times the phase detector for correct centering of the picture on the raster.

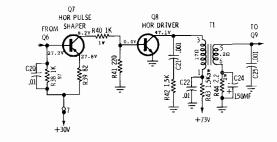
HORIZONTAL OSCILLATOR

Q6 is employed in a modified type of Hartley oscillator. The operating frequency of this oscillator is sensitive to its base input voltage. This permits control by the output of the phase detector and also by the setting of the horizontal hold control, R34. The horizontal hold range is set by adjustment of the core of L1.



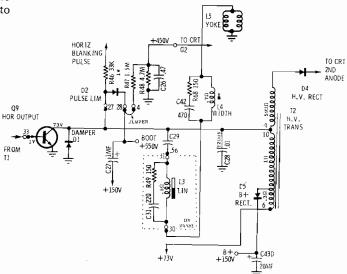
PULSE SHAPER & HORIZONTAL DRIVER

Q7 is used as a buffer stage between the horizontal oscillator and horizontal driver. It provides isolation for the horizontal oscillator as well as a low impedance drive for the horizontal driver. R38 and C20 form a time constant which shapes the oscillator output to the required duty cycle (approximately 50%), to drive the horizontal output circuitry. The horizontal driver stage, Q8 operates as a switch to drive the horizontal output transistor through T1. Because of the low impedance drive and fast switching times furnished by Q7, very little power is dissipated in Q8. C21 and R42 provide damping to suppress ringing of the primary of T2 when Q8 goes into cutoff.

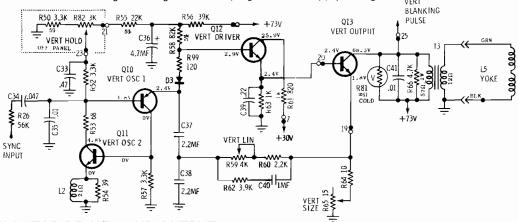


HORIZONTAL OUTPUT

The secondary of T1 provides the required low drive impedance for Q9. R44 and C24 form a time constant for fast turn-off of the base of Q9. Q9 operates as a switch which, once each horizontal period, connects the supply voltage across the parallel combination of the horizontal deflection yoke and the primary of T2. The required sawtooth of deflection current through the horizontal yoke is formed by the L-R time constant of the yoke and output transformer primary. The horizontal retrace pulse charges C27 through D2 to provide operating voltage for G2 of the CRT. Momentary transients at the collector of Q9, should they occur, are limited to the voltage on C27 since D2 will conduct if the collector voltage exceeds this value.



The damper diode, D1, conducts during the period between retrace and turn on of Q9. C28 is the retrace tuning capacitor. C29 blocks DC from the deflection yoke. L3 is a magnetically biased linearity coil which shapes deflection current for optimum trace linearity. L4 is a series width control. C31 and R49, C42 and R68 are damping network components for the linearity and width controls. C43D is charged through D5 developing the video supply voltage.



VERTICAL OSCILLATOR DRIVER AND OUTPUT

Sync from the collector of Q5 is integrated by R26 and C35. Q10 and Q11 are connected as a regenerative switch. The series combination of C37 and C38 charges through R58, R56 and D3 until Q10 turns on. This occurs when the emitter of Q10 exceeds its base voltage and causes current to flow into the base of Q11, turning that device on. When Q10 and Q11 conduct,

C37 and C38 are discharged to nearly zero. Q10 and Q11 then shut off and the cycle repeats. The setting of R82 determines the repetition rate of the charge and discharge of C37 and C38. The waveform generated is a positive going ramp or sawtooth with a fast retrace to zero. D3 provides a small incremental voltage above ground to overcome the forward sawtooth to a low impedance drive for Q13.

T3 matches the collector of Q13 to the vertical yoke. When Q13 is cut off during vertical retrace, a high voltage pulse is developed across the primary of T3. To limit this pulse to a safe value a varistor, R81, is connected across the primary. R66 and C41 provide damping to shape the collector pulse so it may be used for retrace blanking. Since the primary impedance of T3 decreases with current, the degree to which the primary shunts the reflected load impedance varies with collector current. This would result in severe vertical non-linearity unless some compensation is employed.

Resistors R59 and R60 couple the emitter voltage of Q13 to the junction of C37 and C38. Since this path is resistive, the waveform coupled back will be integrated into a parabola by C38. This results in a pre-distortion of the drive sawtooth as shown in Figure C. This is done to compensate for the non linear charging of C37 and C38 and the changing impedance of the primary of T3. An additional feedback path through R62 and C40 serves to optimize the drive waveshape for best linearity.

RETRACE BLANKING

Both vertical and horizontal retrace blanking are provided by positive pulses applied to the CRT cathode. The collector pulse from the horizontal output transistor is placed across R23 through R46. The vertical collector voltage is differentiated by C30 to remove the sawtooth portion of the waveform. The remaining pulse appears across R23. The mixed vertical and horizontal pulses on R23 are coupled to the CRT cathode by C10.

AUDIO AMPLIFIER

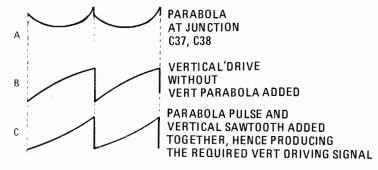
Q17 and Q18 form a DC coupled "switching tone burst amplifier". An input signal biases Q17 on, in turn driving Q18 into conduction. When the signal is removed both stages return to a quiescent mode. Coupling capacitor C50, diode D19 and resistor R88 establish a bias voltage which is signal dependent. Volume control R85 sets the peak to peak level for the output stage.

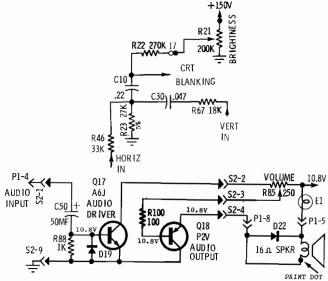
Lamp E1 serves to protect the speaker if the audio output transistor fails, it also protects the transistor should the speaker leads be shorted.

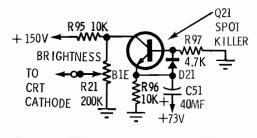
Diode D22 (on early models) polarizes the speaker insuring proper installation. If it is installed wrong, little or no audio will be developed.

SPOT KILLER

Normally Q21 is not conducting and capacitor C51 is charged to the supply voltage. When the monitor is turned off, C51 discharges through R96 turning the transistor on. It in turn removes the positive potential from the brightness control connecting the CRT cathode to ground, causing the tube to conduct hard, discharging the high voltage.

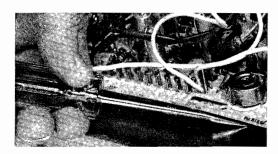






PANEL REMOVAL/INSTALLATION

SERVICE NOTES



To prevent damage to the board or foil when removing the circuit panel it may be necessary to pry up slowly, IN STAGES around the edges as shown. Start at one corner and move all around the board keeping the screw driver tip against the chassis. When installing, apply pressure at the edges near the pins. Do not force down on the components.

CIRCUIT TRACING

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

Transistor elements are identified as follows:

E — emitter, B — base, and C — collector.

COMPONENT REMOVAL

Removing components from the etched board is facilitated by the fact that the circuitry (plating) appears on one side of the board 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 board due to over-heating.

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

REGULATOR ADJUSTMENT

NOTE: Misadjustment of the low voltage regulator, or the horizontal oscillator may result in damage to the Horizontal Output Transistor or pulse limiter diode. The following procedures are recommended to insure reliable operation.

- 1. Connect monitor to AC line supply. Adjust supply to 120 volts (240 on some models).
- 2. Apply test signal to proper input. Signal should be of same amplitude and sync rate as when monitor is in service.
- 3. Adjust vertical and horizontal oscillator controls until display is synced.
- 4. Connect a DC digital voltmeter or other precision accuracy voltmeter to the emitter of the regulator output transistor, (or any 73 volt test point).
- 5. Adjust the regulator control R74, on circuit board for an output of 73 volts. Do not "run" the regulator control through its range or damage to the monitor may result.
- 6. When adjustment is complete, the AC line supply can be varied between 105 and 130 volts to check for proper regulator operation. With regulator operating properly, changes in display size should be negligible.

HORIZONTAL OSCILLATOR ADJUSTMENT

- 1. Set the horizontal hold potentiometer to mid-range (R34).
- 2. Adjust core of horizontal hold coil L1 until the horizontal blanking lines are vertical.
- 3. Rotate potentiometer R34 through its full range. Display should go out of sync in each direction and hold in sync at the center of its range. Retouch L1 as necessary to center the hold range.

VIDEO AMPLIFIER BIAS ADJUSTMENT

Adjust video bias control R10 for 30 volts DC on collector of video output transistor Q3 with no signal input.

Disconnect cable from video input jack if necessary to eliminate noise.

POWER TRANSISTOR REPLACEMENT

When replacing any "plug-in" transistor, i.e., the horizontal or vertical output, please observe the following precautions:

- 1. The transistor sockets are not "Captive", that is, the transistor mounting screws also secure the socket. When installing the transistor, the socket must be held in its proper location. This location is indicated by flanges on the socket which fit into the heat sink.
- 2. When replacing the output transistors, silicone grease (Motorola Part No. 11M490487) should be

applied evenly to both sides of the mica insulator.

3. All transistor mounting screws must be tight before applying power to the receiver. This insures proper cooling and electrical connections.

NON-COMPLIANCE WITH THESE INSTRUCTIONS CAN RESULT IN FAILURE OF THE TRANSISTOR AND/OR ITS RELATED COMPONENTS.

NOTE: Use caution when tightening transistor mounting screws. If the screw threads are stripped by excessive pressure, a poor electrical and mechanical connection will result.

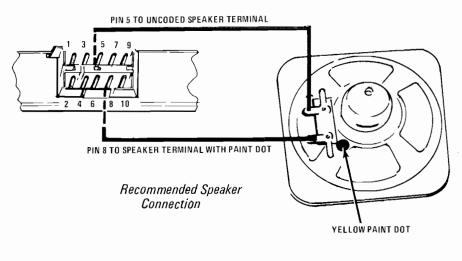
CRT REPLACEMENT

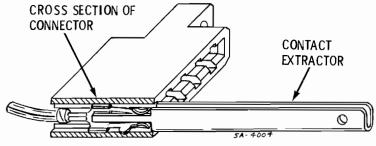
Use extreme care in handling the CRT as rough handling may cause it to implode due to atmospheric pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection.

- 1. Discharge CRT by shorting 2nd anode to ground. Remove CRT socket, yoke and 2nd anode lead.
- 2. Remove CRT from chassis by removing four screws at corners.

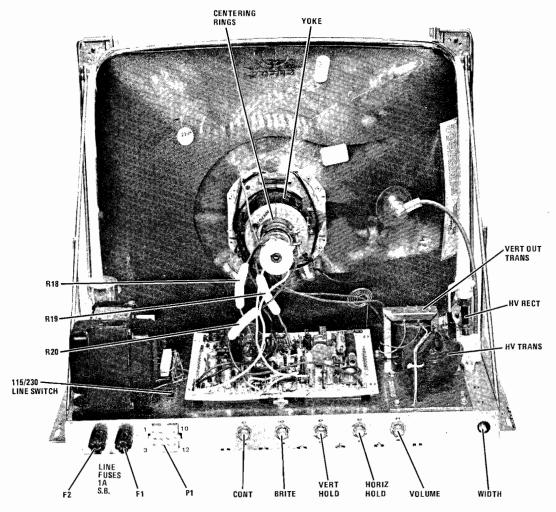
PANEL CONNECTOR CONTACT REMOVAL

Contacts can be removed from the mulitpin panel connector by using extractor tool, Part No. 66P65173A47. Insert the tool over contact and seat fully. Tool will release contact. Pull contact out from wired side

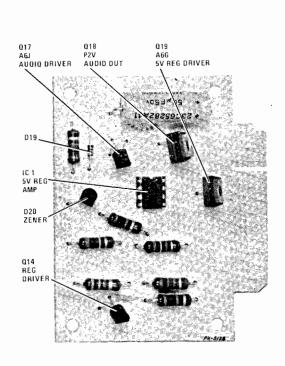


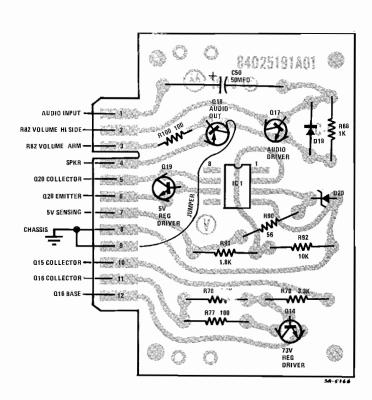


Edge Connector Contact Removal

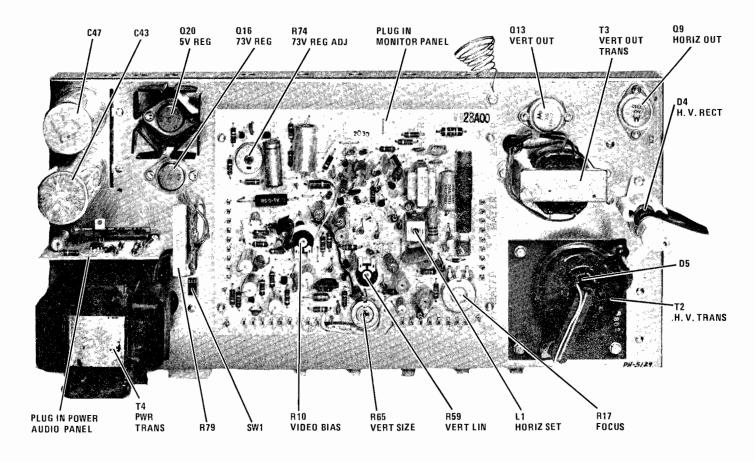


Chassis Component Location Rear View

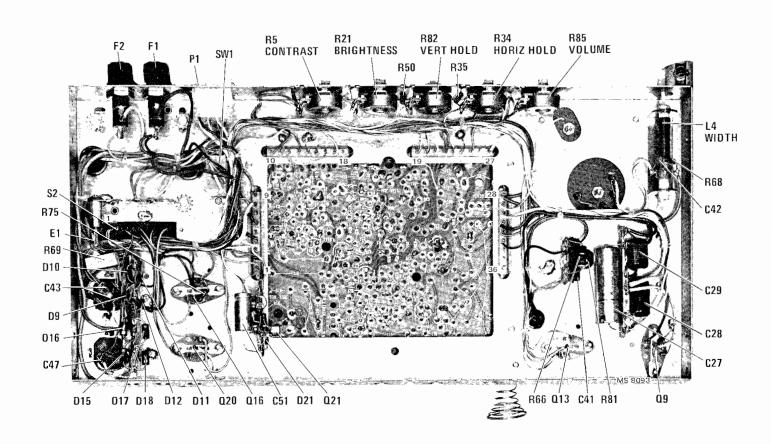




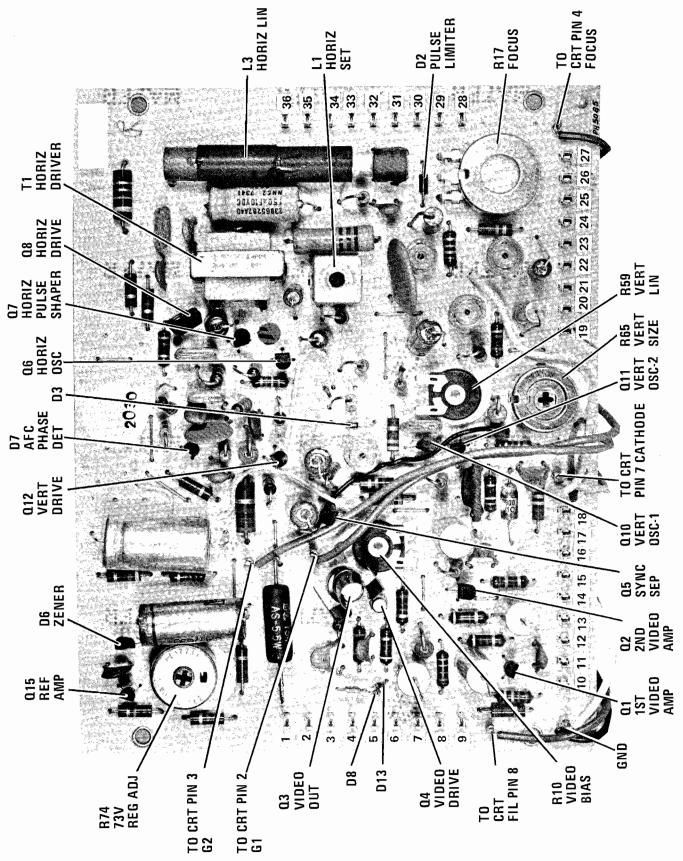
Top View Circuit Side



Chassis Component Location Top View



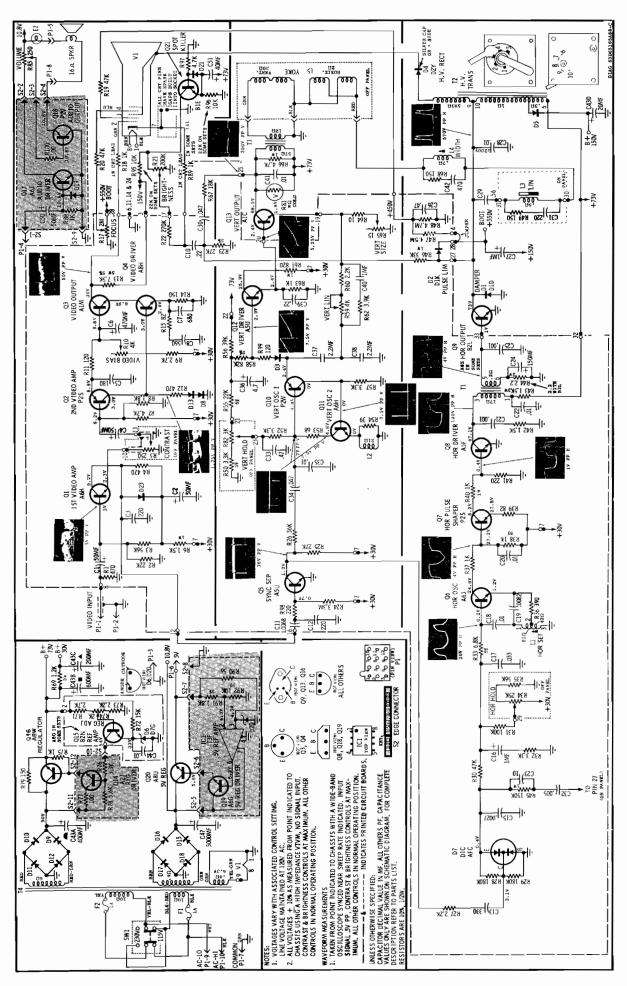
Chassis Component Location Bottom View



Monitor Panel — Component Side

Monitor Panel — Circuit Side

11



REPLACEMENT PARTS LIST

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
'			COILS &	CHOKES	
ELECT	RICAL PART	rs	L-1 L-2 L-3	24D68822A08 24D68801A67 24D69163A18	HORIZ SET COMPENSATING: 2000 uh HORIZ LINEARITY
	1Y25017A01	MONITOR PANEL: complete; KT364LM	L-4 L-5	24V25000A74 24D68523A15	HORIZ WIDTH: incls C42 & R68 DEFLECTION YOKE
	1Y25017A02	POWER, Audio Panel: complete: KT365LM	C-1 Q-2	48S137171 48S137127	1st VIDEO: A6H 2nd VIDEO: P2S
			Q-3 Q-4	48\$134919 48\$137317	VIDEO OUTPUT: A1M VIDEO DRIVER: A8H
CAPACIT			Q-5 Q-6	48\$137115 48\$137172	SYNC SEPERATOR: A5U HORIZ OSCILLATOR: A6J
C-1 C-2 C-3 C-4 C-5 C-6 C-7 C-8 C-10 C-11 C-12 C-13 C-15	23C65282A41 23C65282A41 21S180D10 23C65282A41 21S180B98 23S10255A78 21S180C01 21S180B5 8S10191B67 8S10191B67 8S10191B454 21S180D10 21S131625 21S180C41	50 mf 50V Lytic 50 mf 50V Lytic 220 pf 20% 100V X5F (Use 21R132503) 50 mf 50V Lytic 180 pf 10% 500V X5F 470 mf 16V Lytic 680 pf 10% 500V X5F 560 pf 10% 500V X5F .22 mf 10% 250V Polyester .0068 mf 10% 160V Polyester 220 pf 20% 100V X5F (Use 21R132503) 330 pf 10% X5F .0027 mf 10% 500V Z5F. (Use 21K121699) 1.0 mf +40—20% 15V Lytic	Q-7 Q-8 Q-9 Q-10 Q-11 Q-12 Q-13 Q-14 Q-15 Q-16 Q-17 Q-18 Q-19 Q-20 Q-21	48S137127 48S137093 48S137570 48S137173 48S137115 48S137115 48S1374952 48S137574 48S137574 48S137168 48S137168 48S137169 48S137169 48S137344	HORIZ PULSE SHAPER: P2S HORIZ DRIVER: A5F HORIZ OUTPUT: B2L VERT OSCILLATOR (1): P2W VERT OSCILLATOR (2): A6H VERT DRIVER: A5U VERT OUTPUT: A1C REGULATOR DRIVER; A2J REFERENCE AMP: B2N REGULATOR: A8W AUDIO DRIVER: A6J AUDIO OUTPUT: P2V 5V REGULATOR, Driver: A6G SV REGULATOR: A8U SPOT KILLER: B1E
C-17	8S10191B90	(Use 23C43280A17) .033 mf 10% 160V Polyester	CONTRO	LS	
C-18 C-19 C-20 C-21 C-22 C-23 C-24 C-25 C-26 C-27 C-28 C-29	8S10299A73 8S10299A74 8S10191B98 21S180B51 8S10191B98 21S180C02 23D65282A40 21S180B51 8S10212B53 8S10212A11 8S10571A06 8S10571A23	01 mf 10% 100V Poly carb 0082 mf 10% 160V Poly carb .01 mf 10% 250V Polyester .001 mf 10% 500V X5F .01 mf 10% 160V Polyester 10 pf 10% N150 150 mf 10V Lytic .001 mf 10% 500V X5F .47 mf 10% 630V Mtlz Poly 1.0 mf 10% 630V Mtlz Poly .01 mf 5% 1200V Poly Prop Foil .56 mf 10% 250V Prop Foil	R-5 R-10 R-17 R-21 R-34 R-59 R-65 R-74 R-82 R-85	18D68222A34 18D66401A44 18D67858A12 18D68222A35 18D68222A37 18D66401A44 18D67671A18 17D65820A37 18D68222A36 18D68222A34	CONTRAST: 250 Ohm VIDEO BIAS: 4K FOCUS: 2 meg BRIGHTNESS: 200K HORIZ HOLD: 25K VERT LINEARITY: 4K VERT SIZE: 15 Ohm REGULATOR ADJUST: 2K VERT HOLD: 3K VOLUME: 250 Ohm
C-30 C-31 C-32 C-33 C-34 C-35 C-36 C-37 C-37 C-38 C-39 C-40	8S10191A32 21S180B87 21S180D34 8S10212A69 8S10191A32 8S10191B98 23S10255A69 8S10212A20 8S10212A20 8S10191B67 8S10212A10	.047 mf 10% 250V Polyester. 220 pf 10% 500V X5F .005 mf 20% 1KV Z5F (Use 21S180D31) .47 mf 10% 100V Mtlz Poly .047 10% 250V Polyester .01 mf 10% 250V Polyester 4.7 mf 100V Lytic 2.2 mf 10% 100V Mtlz Poly .22 mf 10% 100V Mtlz Poly .22 mf 10% 250V Polyester 1.0 mf 10% 100V Mtlz Poly (Use	R-1 R-2 R-3 R-4 R-6 R-7 R-8 R-9 R-11 R-12	6S127633 6S125568 6S127541 6S127633 6S128955 6S121847 6S122445 6S119926 6S128226 6S127633	470 10% 1/2W 22K 10% 1/2W 56K 10% 1/2W 470 10% 1/2W 1500 10% 1/2W 1800 10% 1/2W 1800 10% 1/2W 2700 10% 1/2W 470 10% 1/2W 470 10% 1/2W
C-41 C-42 C43	8S10064A06 21S180A71 23C65807A47	8S10191A46 .01 mf 10% 600V Mylar 470 pf 10% 500V X5F 400 mf/125V; 600 mf/50V; 20 mf/200V Lytic	R-13 R-14 R-15 R-18 R-19	17S10731A02 6S124797 6S127516 	7500 5% 5W WW 150 10% 1/2W 82 10% 1/2W Part of CRT socket assembly Part of CRT socket assembly
C-44 C-47 C-50 C-51	21S180E60 *23C65807A52 23D65282A41 23S10255B43	01 mf +80—20% 50V Z5V 5000 mf 20V Lytic 50 mf 50V Lytic 40 mf 100V Lytic	R-20 R-22 R-23 R-24 R-25	6S129296 6S10053C67 6S127538 6S121300	Part of CRT socket assembly 270K 10% 1/2W 27K 5% 1/2W 3.3 meg 10% 1/2W 27K 10% 1/2W
	& RECTIFIERS		R-26 R-27 R-28	6S127541 6S129875 6S125531	56K 10% 1/2W 2200 10% 1/2W 180K 10% 1/2W
D-1 D-2 D-3 D-4 D-5	48S134921 48S134978 48D67120A11 48S137114 48S191A05	DIODE, Silicon: D1D; Damper DIODE, Silicon: D1K; Pulse Limiter DIODE, Low Power RECTIFIER, H. V.: Silicon; D2Y RECTIFIER, Silicon: 91A05 (Use 485191A07)	R-29 R-30 R-31 R-32 R-33	6\$125531 6\$125892 6\$125534 6\$124506 6\$10053C53	180K 10% 1/2W 47K 10% 1/2W 100K 10% 1/2W 3300 10% 1/2W 6800 5% 1/2W
D-6 D-7 D-9 D-10 D-11 D-12 D-13 D-15 D-16 D-17 D-18 D-19 D-20 D-23	48S137469 48S134917 48S67120A11 *48S191A07 48S191A07 48S191A07 48S191A10 48S191A10 48S191A10 48S191A10 48S191A10 48S191A10 48D67120A11 *48S10641D43 48D67120A11 48S191A05	DIODE, Silicon: zener; D7G DIODE, Dual: D1C; Detector DIODE, Low Power RECTIFIER, Silicon: 91A07 RECTIFIER, Silicon: 91A07 RECTIFIER, Silicon: 91A07 RECTIFIER, Silicon: 91A07 DIODE, Low Power RECTIFIER, Silicon: 91A10 DIODE, Low Power DIODE, Low Power DIODE, Silicon, D4.3 DIODE, Low Power RECTIFIER, Silicon: (Use 48S191A07)	R-35 R-37 R-37 R-38 R-40 R-41 R-42 R-44 R-44 R-45 R-48 R-45 R-45 R-53	6S127541 6S125545 6S1215301 6S10053C33 6S127516 6S127547 6S127599 6S127513 17S10130B07 17S744356 6S120141 6S127634 6S129417 6S10053D21 6S124797 6S10053C45 6S129874	56K 10% 1/2W 390 10% 1/2W 1000 10% 1/2W 1000 5% 1/2W 82 10% 1/2W 1000 10% 1W 220 10% 1/2W 1500 10% 1/2W 1500 10% 3W fxd mtl film 2.2 10% 2W WW 150K 10% 1W 33K 10% 1W 1.5 MEG 10% 1/2W 4.7 meg 10% 1/2W 150 10% 1/2W 3300 5% 1/2W 3300 10% 1/2W 68 10% 1/2W
FUSES	GE0120404	ELICE, 1A 2EAV	R-54 R-55	6S131972 6S10053C65	39 10% 1/2W 22K 5% 1/2W 39K 10% 1/2W
F-1 F-2	65S139424 65S139424	FUSE: 1A-250V FUSE: 1A-250V	R-56 R-57 R-58 R-60	6S125535 6S124506 6S129793 6S129875	39K 10% 1/2W 3300 10% 1/2W 82K 5% 1/2W 2200 10% 1/2W
	TED CIRCUITS *51S10732A01	INTEGRATED CIRCUIT: T3F	R-60 R-61 R-62	6S129675 6S10053F29 6S127515	820 10% 1/2W 820 10% 1W 3900 10% 1/2W
		L			

REPLACEMENT PARTS LIST

		DEGODISTICAL	DEC NO	DADT NUMBER	DECCRIPTION
REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
R-63 R-64 R-66 R-67	6S121301 17S10130C91 6S129064 6S122848	1000 10% 1/2W 10 10% 1/2W (special) 4700 10% 1W 18K 10% 1/2W	E-1	50D68164A27 65\$139451	SPEAKER: 4" PM LAMP: No. 1436
R-68 R-69	6S124797 17S647132	150 10% 1/2W 1200 10% 5W WW	МЕСН	IANICAL PAR	TS
R-71	6S119926	(Use 17S136197) 2700 10% 1/2W			
R-72 R-73	6S124551 6S129875	15K 10% 1/2W 2200 10% 1/2W		9D66133A28	CAP, SS Rect (HV Transformer — PRI/SEC lead)
R-75 R-76	6S121301 6S124506	1000 10% 1/2W 3300 10% 1/2W		42B25158A01 31D70080B04	CLAMP, Metal: Defl Yoke Mtg CONNECTOR, PC panel: 9 contact;
R-77 R-78	6S129221 6S127 00 5	100 10% 1/2W 5600 10% 1/2W	S-2	*15S10390A06	on chassis CONNECTOR, PC panel: 12 contact; less key and contacts (power-audio panel)
R-79 R-81 R-88	17S135589 6C66263A08 6S121301	150 10% 10W WW VARISTOR (Use 6S66263A16) 1000 10% 1/2W	P-1	*15S10183A69	CONNECTOR', Plug: 12 contact; less contacts (power)
R-89 R-90	6S131412	Part of CRT Socket 56 10% 1/2W		*39S10184A63	CONTACT, Plug: for power connector 15S10183A69
R-91 R-92	6S10053C39 6S10053C57	1800 5% 1/2W 10K 5% 1/2W		39S10184A22 15S10630A01	CONTACT: for S2 connector COVER, nylon: slide switch; SW1
R-95 R-96	6S119932 6S119932	10K 10% 1/2W 10K 10% 1/2W	l	*7S10609A03 26C66745A05	GROMMET, Plastic: PC panel mtg HEAT SINK: Q3
R-97 R-98	6S121847 6S127099	4700 10% 1/2W 220 10% 1/2W		*26C25198A01 9C66238A02	HEAT SINK: Q20 HOLDER, Fuse: F1 & F2
R-99 R-100	6S128226 6S129221	120 10% 1/2W 100 10% 1/4W		14A562353	INSULATOR, Mica: Transistor socket; Q9, Q13, Q16 & Q20 (Use 14A543810)
SWITCHE	:S			28S10733A01 2S7051	KEY, Plug: for S2 connector NUT, hex: 3/8-32; control mtg
SW-1	40 S10624A01	SWITCH, Slide: DPDT (115V-230V)		5S10281A03 47C66082A03	RIVET, drive pin: nylon; HV transf mtg ROD, Adjustment: width coil; L4
TRANSFO				3S136050	SCREW, tpg: 6-20 x 1/2 clu pan hd; Q9, Q13, Q16 & Q20
T-1 T-2	25D67440A03 24D25240A04	HORIZ DRIVER H.V. TRANSFORMER: complete		9S10143A41 9D67555V27	SOCKET, lamp: E1 SOCKET, CRT: incls leads & resistors
T-3 T- 4	25D25221A07 *25D68164A31	VERT OUTPUT POWER		*9D25201A01	SOCKET, CHT: Incis leads & resistors SOCKET, HV Rectifier (4): complete; incls 2nd anode lead & cup
MISCELL	ANEOUS ELECTR	ICAL PARTS		9C63825A01 9C63825A02	SOCKET, transistor: Q9, Q13, Q16 SOCKET, transistor: Q20
V-1	20WP4 23JEP4	CRT (XM501-10 19VP111) CRT (XM701-10 23VP111)		41D65987A01 66P65173A47	SPRING, special: CRT aquadag grnd TOOL, contact removel (S2 connector)



MOTOROLA service manual

FILE VP12-S1

SUPPLEMENT TO PART NO. 68P65130A70
DISPLAY PRODUCTS

CHASSIS

19VP111 23VP111

MODELS

XM501-10 XM701-10

AUDIO INPUT TO R82- VOLUME (HI SIDE) TO R82- VOLUME ARM SPEAKER TO Q20 COLLECTOR TO Q20 EMITTER SV SENSING CHASSIS TO Q16 COLLECTOR TO Q16 COLLECTOR TO Q16 COLLECTOR TO Q16 COLLECTOR TO Q16 BASE *Mounted on foil side of circuit card

Power Supply/Audio Circuit Card (Circuit Foil Side)

GENERAL INFORMATION

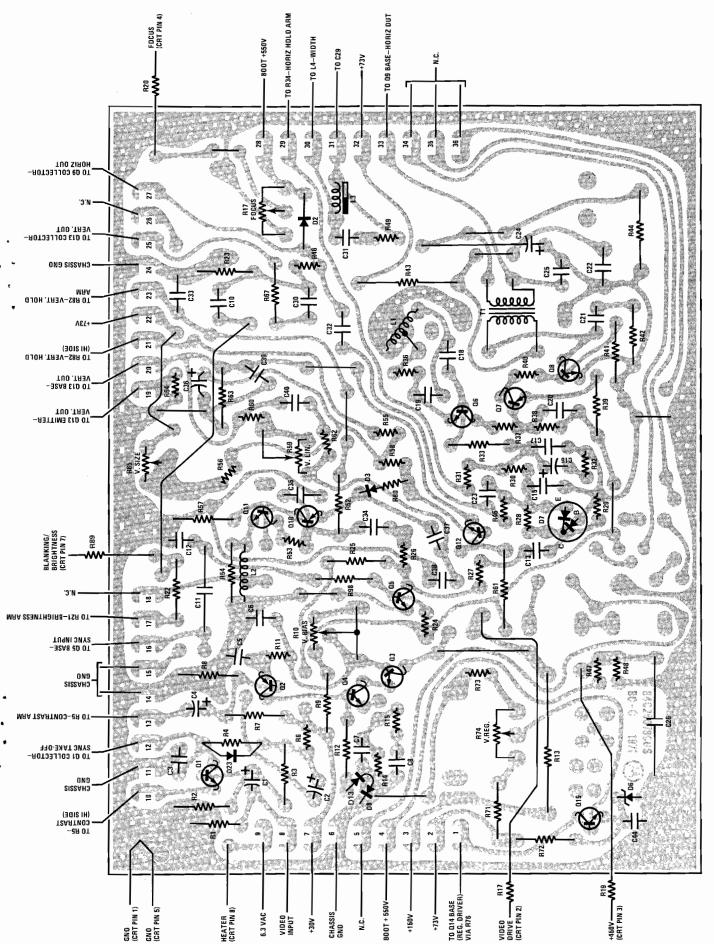
This supplement updates service information for chassis 19 & 23VP111 (Models XM501-10/XM701-10). Changes are applicable to the 84C25078<u>B06</u> circuit card, which are reflected in the revised diagrams and parts list. The "A" suffix models include a 6A fuse (F3).

For all other service information on these models, refer to the original VP12 manual, part number 68P65130A70.

REPLACEMENT PARTS LIST

REF.NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
EL ECT	RICAL PARTS		C-20	8S10191B98	.01 mf 10% 250V Polyester
LLECIT	NICAL FANTS		C-21	21S180B51	.001 mf 10% 500V X5F
			C-22	8S10191B98	.01 mf 10% 160V Polyester
M	ONITOR CIRCUIT CARD;	complete;	C-23	21S180C02	10 pf 10% N150
	RDER BY MODEL NUMBE		C-24	23S10255B50	150 mf 10V Lytic
PO	OWER SUPPLY/AUDIO CII	RCUIT CARD complete;	C-25	21S180B51	.001 mf 10% 500V X5F
0	RDER BY MODEL NUMBE	R	C-26	8S10212B53	.47 mf 10% 630V Mtlz Poly
			C-27	8\$10212A11	1.0 mf 10% 630V Mtlz Poly
			C-28	8S10571A06	.01 mf 5% 1200V Paly Prop Foil
CAPACIT	TORS		C-29	8S10571A23	.56 mf 10% 400V Poly Prop Fail
			C-30	8S10191A32	.047 mf 10% 250V Polyester
C-1	23S10255B51	50 mf 50V Lytic	C-31	21S180B87	220 pf 10% 500V X5F
C-2	23S10255B51	50 mf 50V Lytic	C-32	21S180D34	.005 mf 20% 1KV Z5F (Use 21S180D31)
C-3	21S180D10	220 pf 20% 100V X5F (Use 21R132503)	C-33	8S10212A69	.47 mf 10% 100V Mtlz Poly
C-4	23S10255B51	50 mf 50V Lytic	C-34	8S10191A32	.047 10% 250V Polyester
C -5	21S180B89	180pf 10% 500V X5F	C-35	8S10191B98	.01 mf 10% 250V Polyester
C-6	23S10255A78	470 mf 16V Lytic	C-36	23S10255A69	4.7 mf 100V Lytic
C-7	21S180C01	680 pf 10% 500V X5F	C-37	8S10212A20	2.2 mf 10% 100V Mtzl Poly
C-8	21S180B85	560 pf 10% 500V X5F	C-38	8\$10212A20	2.2 mf 10% 100V Mtlz Poly
C-10	8S10191B67	.22 mf 10% 25QV Polyester	C-39	8S10191B67	.22 mf 10% 250V Polyester
C-11	8S10191A54	.006B mf 10% 160V Polyester	C-40	8S10212A10	1.0 mf 10% 100V Mtlz Poly (Use
C-12	21S180D10	220 pf 20% 100V X5F (Use 21R132503)	1		8S10191A46)
C-13	21S131625	330 pf 10% X5F	C-41	8S10064A06	.01 mf 10% 600V Mylar
C-15	21S180C41	.0027 mf 10% 500V Z5F (Use	C-42	21S180A71	470 pf 10% 500V X5F
		21K 121699)	C-43	23C65807A47	400 mf/125V; 600 mf/50V;
C-16	23S10229A07	1.0 mf +40-20% 15V Lytic			20 mf/200V Lytic
		(Use 23C43280A17)	C-44	21S180E60	.01 mf +80-20% 50V Z5V
C-17	8S10191B90	.033 mf 10% 160V Polyester	C-47	23S10255B46	5000 mf 20V Lytic
C-18	8S10299A73	.01 mf 10% 100V Poly carb	C-50	23S10255B51	50 mf 50V Lytic
C-19	8S10299A74	.0082 mf 10% 160V Poly carb	C-51	23S10255B43	40 mf 100V Lytic

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Monitor Circuit Card (Circuit Foil Side)

Schematic Diagram

REPLACEMENT PARTS LIST

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
DIODES 8	k RECTIFIERS		RESISTO	ORS	
D-1 D-2 D-3 D-4 D-5	48S134921 48S134978 48D67120A11 48S137114 48S191A05	DIODE, Silicon: D1D; Damper DIODE, Silicon: D1K; Pulse Limiter DIODE, Low Power RECTIFIER, H.V.: Silicon; D2Y RECTIFIER, Silicon: 91A05	th		I resisters are listed. Use ordering standard values ers up to 2 watts.
D-6 D-7 D-8 D-9 D-10 D-11 D-12 D-13 D-15 D-16 D-17 D-18 D-19 D-20 D-21	48S137469 48S134917 48S67120A11 48S191A10 48S191A10 48S191A10 48S191A10 48S191A10 48S191A05 48S191A05 48S191A05 48S191A05 48S191A05 48S191A05 48S191A05	DIODE, Silicon: zener; D7G DIODE, Dual: D1C; Detector DIODE, Low Power RECTIFIER, Silicon: 91A10 RECTIFIER, Silicon: 91A10 RECTIFIER, Silicon: 91A10 RECTIFIER, Silicon: 91A10 DIODE, Low Power RECTIFIER, Silicon: 91A05 RECTIFIER, Silicon: 91A05 RECTIFIER, Silicon: 91A05 RECTIFIER, Silicon: 91A05 DIODE, Low Power DIODE, Silicon: 91A05 DIODE, Silicon: 91A05 DIODE, Silicon: 91A05 RECTIFIER, Silicon: 91A05 RECTIFIER, Silicon: 91A05 RECTIFIER, Silicon: 91A05	R-18 R-19 R-20 R-43 R-44 R-64 R-69 R-79 R-81 R-89	17S10130807 17S744356 17S10130C91 17S647132 17S135589 6S10201A04	Part of CRT socket assembly Part of CRT socket assembly Part of CRT socket assembly 1500 10% 3W fxd mtl film 2.2 10% 2W WW 10 10% 1/2W (special) 1200 10% 5W WW (Use 17S136197) 150 10% 10W WW VARISTOR Part of CRT Socket
			SW-1	40S10624A07	SWITCH, Stide: DPDT (115V – 230V)
F-1 F-2 F-3	65S139424 65S139424 65S139551	FUSE: 1A-250V FUSE: 1A-250V FUSE: 6A-250V		ORMERS	
INTEGRA	ATED CIRCUITS 51S10732A01	INTEGRATED CIRCUIT: T3F	T-1 T-2 T-3 T-4	25D25221A05 24D25240A07 25D25221A07 25D25239A07	HORIZ DRIVER H.V. TRANSFORMER: complete VERT OUTPUT POWER
COILS &	CHOKES		MISCELI	LANEOUS ELECTRI	CAL PARTS
L-1 L-2 L-3 L-4 L-5	24D68822A08 24D68801A67 24D69163A18 24V25000A74 24D25261A03 24D25261A04	HORIZ SET COMPENSATING: 2000 uh HORIZ LINEARITY HORIZ WIDTH: incls C42 & R68 DEFLECTION YOKE XM701-10 DEFLECTION YOKE XM501-10	V-1 E-1	19VARP4 22VATP4 50D68384A02 65S139451	CRT (XM501-10 19VP111) CRT (XM701-10 23VP111) SPEAKER: 4" PM LAMP: No. 1436
TRANSIS	TORS		MECHA	NICAL PARTS	
Q-1 Q-2 Q-3 Q-4 Q-5 Q-6 Q-7 Q-8 Q-9 Q-10 Q-11 Q-12 Q-13 Q-14 Q-15 Q-16 Q-17 Q-18 Q-19 Q-20 Q-21	48S137171 48S137127 48S137317 48S137317 48S137115 48S137172 48S137172 48S137173 48S137570 48S137173 48S137171 48S137115 48S137156 48S137566 48S137574 48S137368 48S137168 48S137168 48S137168 48S137169 48S137168	1st VIDEO: A6H 2nd VIDEO: P2S VIDEO OUTPUT: A1M VIDEO DRIVER: A8H SYNC SEPARATOR: A5U HORIZ OSCILLATOR: A6J HORIZ PULSE SHAPER: P2S HORIZ DRIVER: A5F HORIZ OUTPUT: B2L VERT OSCILLATOR (1): P2W VERT OSCILLATOR (2): A6H VERT DRIVER: A5U VERT OUTPUT: B2V REGULATOR DRIVER; A2J REFERENCE AMP: B2N REGULATOR: A8W AUDIO DRIVER: A6J AUDIO OUTPUT: P2V 5V REGULATOR, Driver: A6G 5V REGULATOR, Driver: A6G 5V REGULATOR: A8U SPOT KILLER: B1E	S-2 P-1	9D66133A28 42B25158B01 31D70080B04 15S10390A06 15S10183A69 39S10184A63 39S10184A63 39S10184A22 15S10630A02 7S10609A03 26C66745A05 26C25198A01 9S10783A01 14A562353 28S10733A01 257051 5S10281A03 47C66082A03 3S136050	CAP, SS Rect (HV Transformer — PRI/SEC lead) CLAMP, Metal: Defl Yoke Mtg CONNECTOR, PC panel: 9 contact; on chassis CONNECTOR, PC panel: 12 contact; less key and contacts (power-audio panel) CONNECTOR, Plug: 12 contact; less contacts (power) CONTACT, Plug: for power connector 15510183A69 CONTACT: for S2 connector COVER, nylon: slide switch; SW1 GROMMET, Plastic: PC panel mtg HEAT SINK: Q3 HEAT SINK: Q20 HOLDER, Fuse: F1 & F2 INSULATOR, Mica: Transistor socket; Q9, Q13, Q16 & Q20 (Use 14A543810) KEY, Plug: For S2 connector NUT, hex: 3/8-3/2; control mtg RIVET, drive pin: nylon; HV transf mtg ROD, Adjustment: width coil; L4 SCREW, tpg: 6-20 x 1/2 clu pan hd; Q9, Q13, Q16 & Q20
CONTRO		CONTRACT: 350 Ob		9S10143A41 9D25282A08	SOCKET, lamp: E1 SOCKET, CRT: incls leads & resistors
R-5 R-10 R-17 R-21 R-34 R-59 R-65 R-74 R-82 R-85	18D25212A09 18D25245A04 18C25218A10 18D25212A10 18D25212A12 18D25245A04 18D25245A19 18C25218A13 18D25212A11 18D25212A11	CONTRAST: 250 Ohm VIDEO BIAS: 4K FOCUS: 2 meg BRIGHTNESS: 200K HORIZ HOLD: 25K VERT LINEARITY: 4K VERT SIZE: 100K Ohm REGULATOR ADJUST: 2K VERT HOLD: 3K VOLUME: 250 Ohm	ı	9D25201A01 9C63825A03 9C63825A02 41D65987A01 66P65173A47	SOCKET, HV Rectifier: complete; incls 2nd anode lead & cup SOCKET, transistor: Q9, Q13, Q16 SOCKET, transistor: Q20 SPRING, special: CRT aquadag grnd TOOL, contact removal (S2 connector)