

**SERVICE  
MANUAL**

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F.C.C. USER INFORMATION

WARNING:

THIS EQUIPMENT GENERATES, USES AND CAN RADIATE RADIO FREQUENCY ENERGY. IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTIONS MANUAL, THIS EQUIPMENT MAY CAUSE INTERFERENCE WITH RADIO COMMUNICATIONS. AS TEMPORARILY PERMITTED BY REGULATION, IT HAS NOT BEEN TESTED FOR COMPLIANCE PURSUANT TO SUBPART J OF PART 15 OF F.C.C. RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER AT HIS OWN EXPENSE WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

KNOCK-OUT  
PLAYING INSTRUCTIONS

- \* You are the Painter. Paint the road by moving the painter with the control lever.
- \* When you paint one complete square, square changes its color and you get score.
- \* Broom moves to erase your painting.
- \* Gorilla and Ghost move randomly to capture you.
- \* Fire turns down at every corner.
- \* Hit one, two, three punches timely to knock out Gorilla, Broom, and Ghost. Then a rescue car appears to help them to recover. If you knock out the other one while the rescue car is working, you get higher score.
- \* 20,000 points gives you another Painter.

## INSTALLATION

Your game was shipped from the factory in ready-to-play condition. A brief inspection is suggested before the machine is removed from the carton. If there is damage to the shipping carton, contact the freight carrier for claim purposes. External damage could indicate possible damage to the cabinet and/or electronic components.

After the carton has been satisfactorily inspected, remove the machine from the shipping carton.

Examine the interior of the game for disconnected wires, cables, or harnesses. Make sure the electronic (CPU, EPROM, etc.) devices are securely mounted in their sockets, etc. Record the game serial number since it will be required for reference and servicing.

## ELECTRICAL REQUIREMENTS

Unless otherwise specified, this game is set to operate at 110 volts AC.

Power supply chassis schematic information and parts list are included in this manual.

## POWER SUPPLY

For most efficient operation of this game, the power supply should be set so that the voltage on the board is +5.0 volts,  $\pm 0.1$  volts. To check this, place a meter across +5.0 volts and ground at the edge connector. If necessary, adjust the screwdriver control on the power supply so the meter reads between 4.9 and 5.1 volts.

## ROUTINE MAINTENANCE & SERVICE

Because of the solid state electronic circuitry, this equipment should require very little maintenance and only occasional adjustments. However, it is necessary to take measures to insure this.

### TROUBLESHOOTING:

If the game is not functioning properly, check the following items:

1. Is the fuse intact? (Always use fuse of the designated rating). If the replaced fuse opens again, this indicates another component is defective.
2. Are there any poor connections (connectors) or open circuits? Special care must be taken to ensure connectors are firmly inserted. Problems due to faulty contacts can exhibit various symptoms.  
NOTE: Always turn off the power when inserting or removing the connectors.
3. If a normal picture does not appear when the power switch is on, reset of the control circuit may be necessary. Check this by turning the power supply switch on and off several times.
4. When checking counters, switches, etc. with a tester, always disconnect the I.C. board edge connector first.

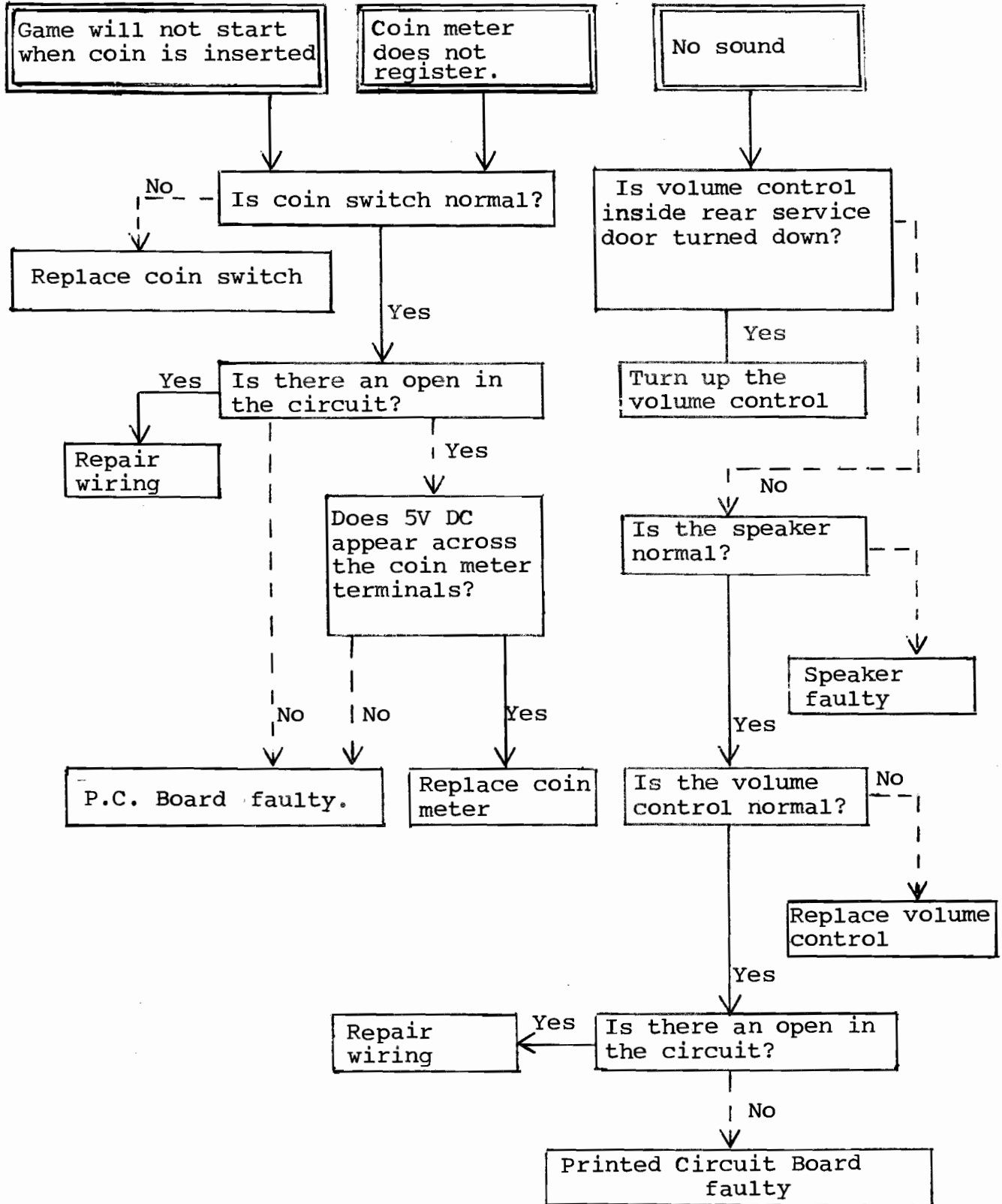
The video monitor has been properly adjusted before shipping.

Occasionally minor adjustments are necessary. See monitor specifications and schematics for technical information. Adjustment controls for the monitor are located at the rear of the monitor.

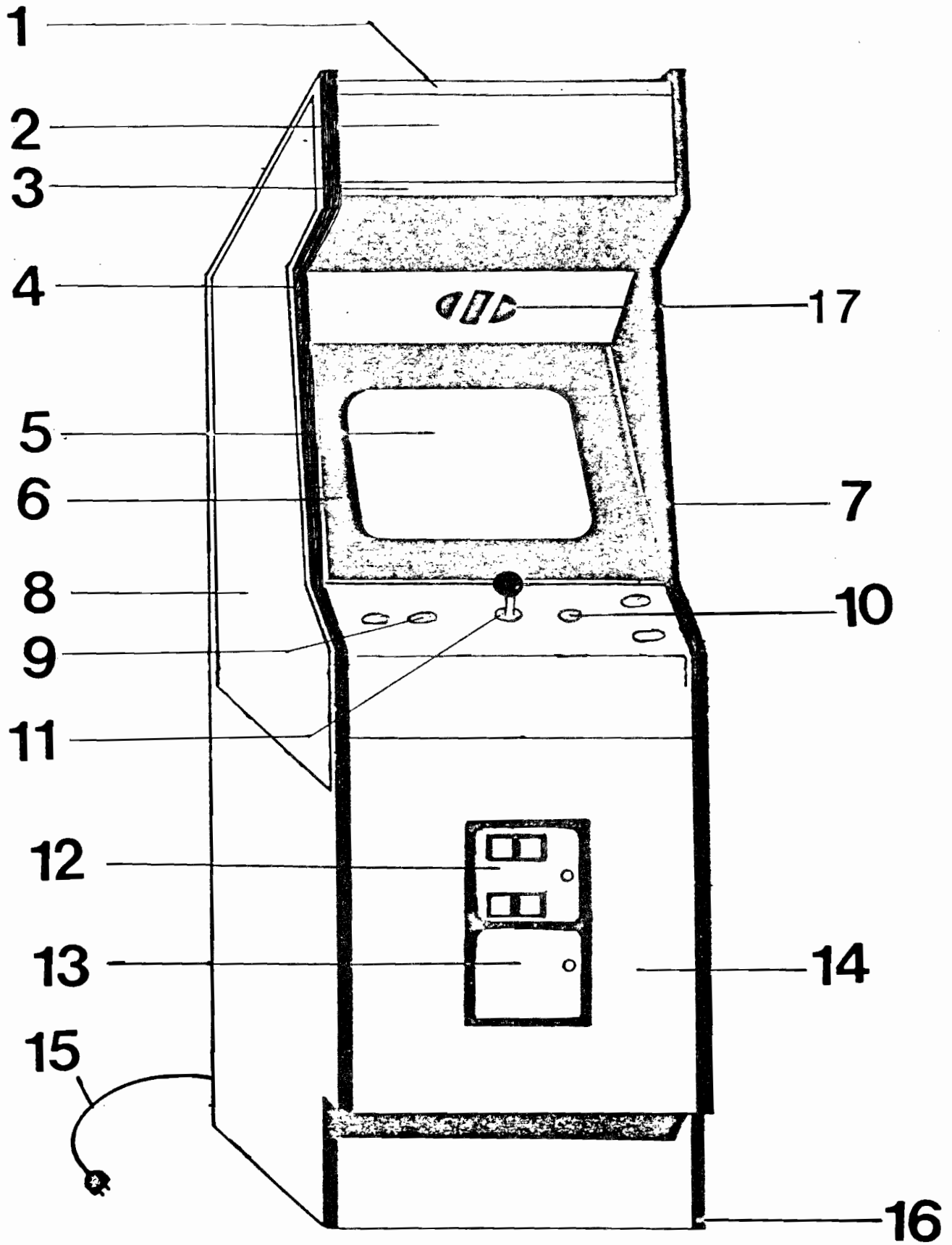
This machine should be serviced only by a qualified technician.

Do not make any adjustments on this machine while the power is on.

TROUBLE SHOOTING



(FIGURE 4)

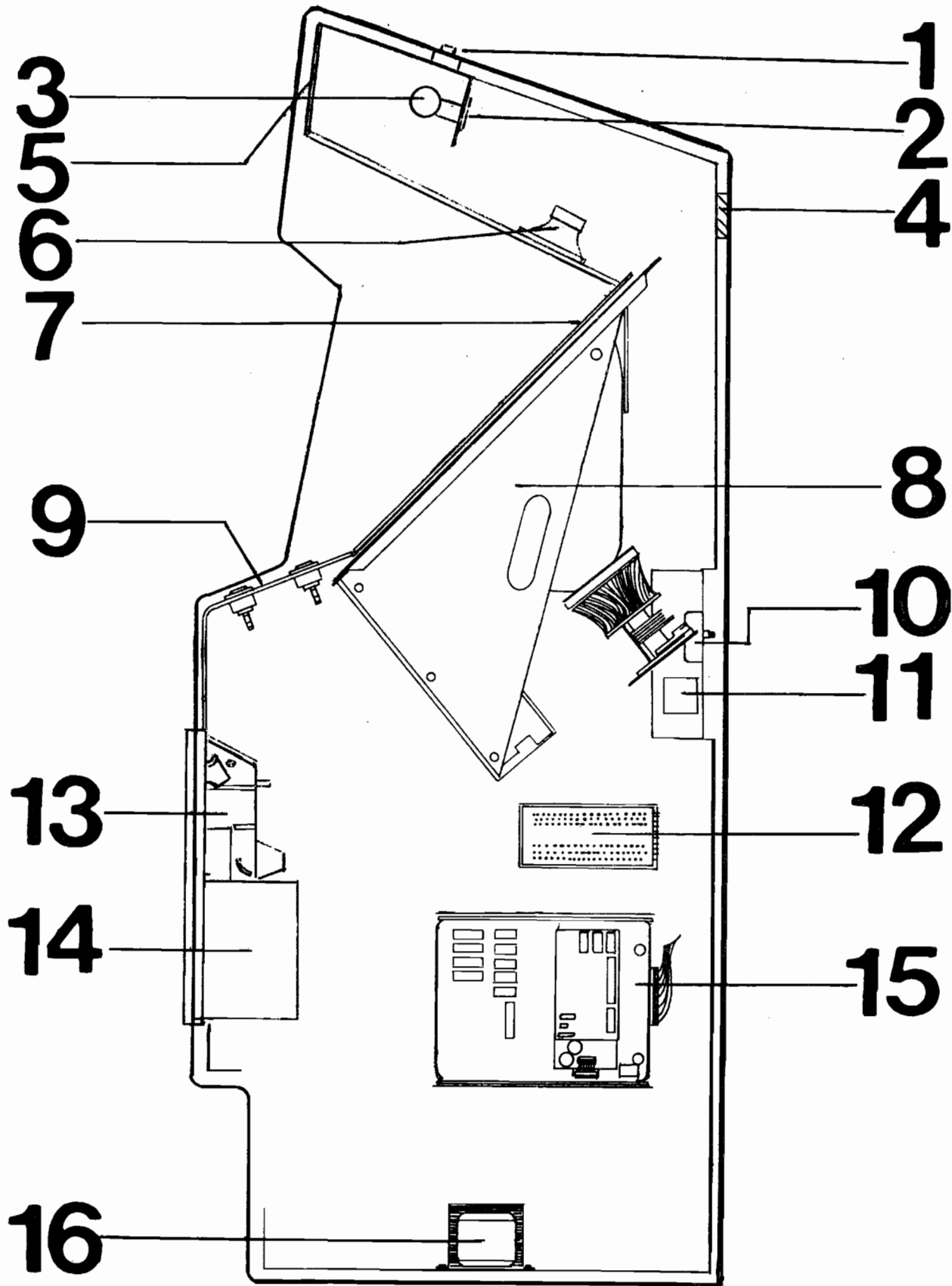


(FIG. 1) CABINET



PARTS LIST FOR CABINET (Fig. 1)

<u>NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	93-006	Header top mounting bracket
2	92-004	Silk screened header
3	93-005	Header bottom mounting bracket
4	92-005	Vinyl trim
5	92-001	Viewing glass
6	92-001	Silk screened monitor overlay
7	92-002	Right hand side decal
8	92-002-A	Left hand side decal
9	91-050	White Button
10	91-051	Red Button
11	93-057	4-Way joystick with 8-Way option
12	91-002	Coin door assembly
13	91-003	Cash box
14	05-500	Wood cabinet assembly
15	91-058	A.C. line cord harness
16	93-001	Leg leveler (4)
17	93-007	Speaker screen



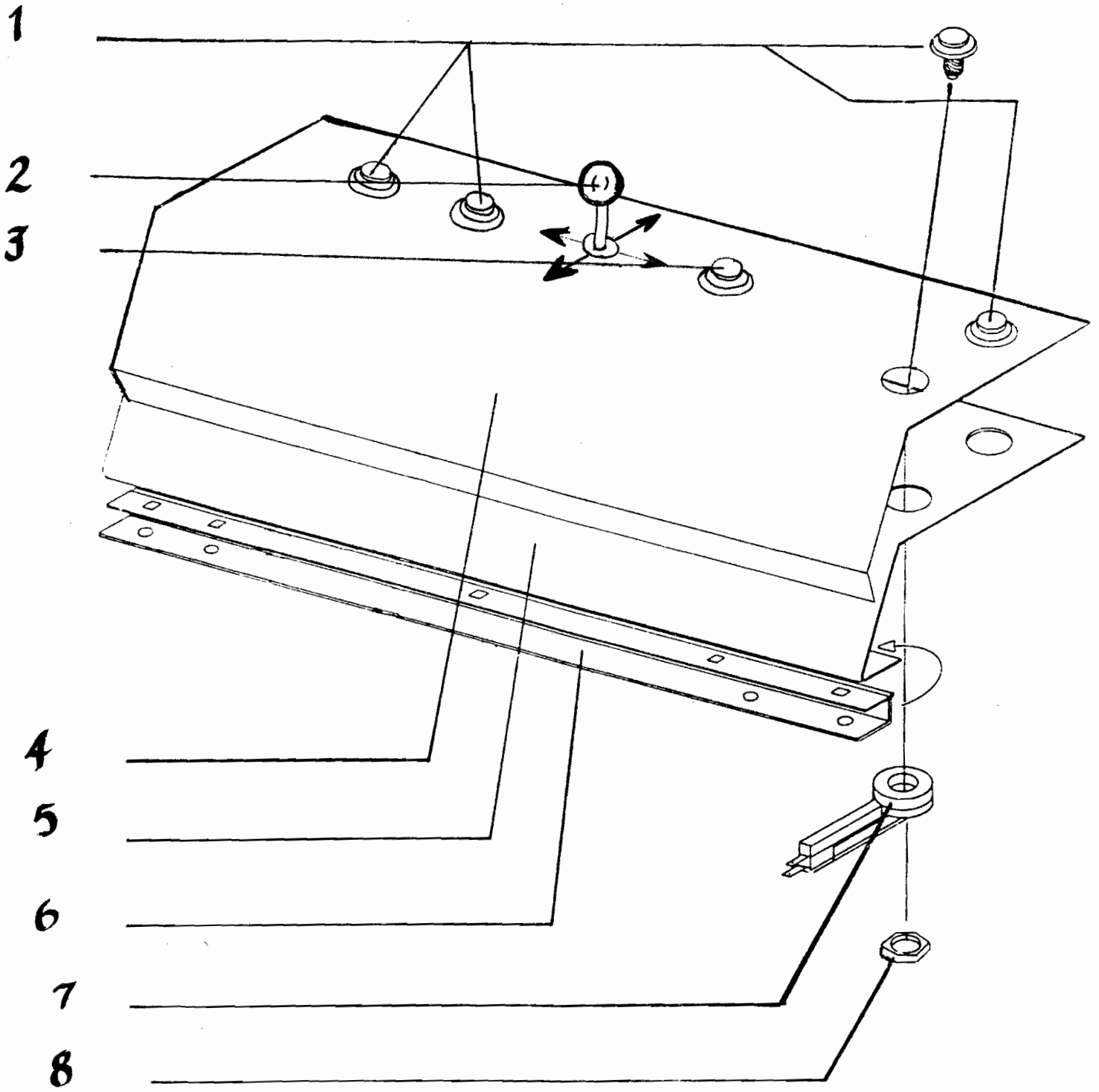
(FIG.2) CABINET CROSSECTION.

PARTS LIST FOR CABINET CROSS-SECTION (Fig. 2)

<u>NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	91-062	Power switch assembly
2	93-014	Incandescent lamp assembly
3	91-061	Incandescent lamp - 25 watts
4	93-008	Vent
5	92-004	Header - plexiglass
6	91-006	Speaker, 5" round, 8 watt, 8 ohm
7	92-001 A or B	Viewing glass
8	91-001 A or B	19" color monitor assembly
9	93-003	Control panel assembly
10	91-057	Interlock switch
11	91-056	Line filter
12	91-004	Power supply, switching regulator
13	91-002	Coin door assembly
14	91-003	Cash box assembly
15	91-008	Printed circuit board assembly
16	91-005	Isolation transformer

A - vertical

B - horizontal



(FIG.3) EXPLODED VIEW OF CONTROL PANEL.

PARTS LIST FOR CONTROL PANEL (Fig. 3)

<u>NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	91-050	White Button
2	93-057	4-Way Joystick with 8-Way option
3	91-051	Red Button
4	92-003	Control panel overlay
5	93-003	Control panel (sheet metal)
6	93-011	Control panel hinge
7	91-052	Button switch assembly
8	91-053	Pal nut

PARTS LIST FOR SHINDENGEN POWER SUPPLY

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>USAGE</u>
T1	Transformer, single phase, 2A VA	1
L1	Choking coil, 1.6 mH, 1.5A	1
L2, L4	Choking coil, SF-T8-50S-03	2
L3	Choking coil, SF-HP-2A-03	1
D1	Diode, V19G	1
D2	Diode, V06C	1
D3, D6	Diode, 1S1588	2
D4	Diode, S15S3	1
D5, D7	Diode, 5SH1M	2
D12, D13	Diode, F113B	2
D14	Diode, F113B	1
RF1	Diode, S4Vb40 (bridge type)	1
Q1	Transistor, 2SC2504	1
Q2	Transistor, 2SD467 (B)	1
Q3	Transistor, 2SC460 (B)	1
Q4	Transistor, 2SA673 (B)	1
1C1	Integrated Circuit, RM723DC or HA17723G-02	1
PC1	Photo coupler, PS2001	1
R1	Resistor, 2 watt, 18 Ohm.	1
R8, R9	Resistor, 2 watt, 47K Ohm.	2
R3, 1-4	Resistor, 2 watt, 15 Ohm.	4
R4	Resistor, 1 watt, 56 Ohm.	1
R12	Resistor, 1 watt, 100 Ohm.	1
R28	Resistor, 1 watt, 470 Ohm.	1
R7	Resistor, 1 watt, 0.56 Ohm.	1
R26	Resistor, 1 watt, 0.82 Ohm.	1
R23	Resistor, 1/4 watt, 22 Ohm.	1
R10	Resistor, 1/4 watt, 33 Ohm.	1
R27	Resistor, 1/4 watt, 68 Ohm.	1
R2	Resistor, 1/4 watt, 330-470 Ohm.	1
R22	Resistor, 1/4 watt, 220 Ohm.	1
R21	Resistor, 1/4 watt, 270 Ohm.	1
R6	Resistor, 1/4 watt, 330 Ohm.	1
R11	Resistor, 1/4 watt, 68 Ohm.	1

Parts List (Cont.)  
Shindengen Power Supply

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>USAGE</u>
R20	Resistor, 1/4 watt, 470 Ohm.	1
R17	Resistor, 1/4 watt, 680 Ohm.	1
R19	Resistor, 1/4 watt, 800 Ohm.	1
R18	Resistor, 1/4 watt, 1.2K Ohm.	1
R5	Resistor, 1/4 watt, 10K Ohm.	1
R16	Resistor, 1/4 watt, 220K Ohm.	1
R29	Resistor, 3 watt, 27 Ohm.	1
R39	Resistor, 1/4 watt, 4.7K Ohm.	1
R38	Resistor, 1/4 watt, 5.6 K Ohm.	1
R24	Resistor, 1/4 watt, 330 Ohm.	1
R25	Resistor, 1/4 watt, 150 Ohm.	1
RV1	Variable Resistor, RJ-6P501	1
C1, C2	Capacitor, ECK-DA1102E	2
C3-1,-2	Capacitor, 160VSN100	2
C9,C10	Capacitor, SM10VB-2200	2
C11, C23	Capacitor, SM10VB-2200	2
C12,C13,C15	Capacitor, SL25VB-10	3
C27	Capacitor, SL25VB-10	1
C18,C19,C20	Capacitor, SM35VB-1000	3
C26	Capacitor, SM35VB-1000	1
C21,C22,C25	Capacitor, SM16VB-1000	3
C5	Capacitor, DMY21H472K	1
C6	Capacitor, DMY21H	1
C14, C16	Capacitor, DMY21H222K	2
C4	Capacitor, CM20XC511K5	1
C8	Capacitor, MDD22G473K	1
C5-2	Capacitor, DMY21H222K	1
F1, F2	Enclosed type fuse, 3A	2

## MONITOR SERVICE INFORMATION

### **K4600 IMPORTANT SERVICE SAFETY INFORMATION**

**WARNING:** An Isolation transformer must be used between the AC supply and the AC plug of the monitor before servicing or testing is performed since the chassis and the heat-sink are directly connected to one side of the AC line which could present a shock hazard.

The chassis of the monitor should never be connected to the ground. Before servicing is performed, read all the precautions labelled on the CRT and chassis.

#### **X-RAY RADIATION WARNING NOTICE**

**WARNING:** PARTS WHICH INFLUENCE X-RAY RADIATION IN HORIZONTAL DEFLECTION, HIGH VOLTAGE CIRCUITS AND PICTURE TUBE ETC. ARE INDICATED BY (★) IN THE PARTS LIST FOR REPLACEMENT PURPOSES. USE ONLY THE TYPE SHOWN IN THE PARTS LIST.

#### **PRODUCT SAFETY NOTICE**

**WARNING:** FOR CONTINUED SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER RECOMMENDED PARTS. THESE PARTS ARE IDENTIFIED BY SHADING AND BY ( Δ ) ON THE SCHEMATIC DIAGRAM.

**AVERTISSEMENT:** POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

For replacement purposes, use the same type or specified type of wire and cable, ensuring that the positioning of the wires is followed (especially for H.V. and power supply circuits). Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

The picture tube used, employs integral implosion protection and should be replaced with a tube of the same type number for continued safety.

When handling the CRT, shatter-proof goggles must be worn after completely discharging the high voltage circuit. Do not lift the picture tube by the neck.

### **PERFORMANCE AND OPERATING DATA**

1. Apply a suitable power source to the monitor through an isolation transformer.
2. Apply a suitable signal source to the monitor PCB by means of P205.
3. Set up Controls.  
All controls are preset at the factory, but may be adjusted to suit program material.

#### **1.0 Supply**

Voltage	108 VAC - 132 VAC
Frequency	50 Hz - 60 Hz

Note: Apply supply voltage through an isolation transformer with 1 Amp. capability.

#### **2.0 High Voltage (EHT)**

For 19"V models	25.5 ± 0.8 K.V. at 0 Beam
-----------------	---------------------------

Note: Condition for above  
1 (beam) = 0  
A.C. = 120V



### 3. Service Set-Up Controls

- A. V. Adjustment VR501 set for 127V DC
- B. Vertical Size Cont = VR302
- C. Vertical Hold Cont = VR301
- D. Horizontal Hold Cont = VR351
- E. Horizontal Width Cont = L702
- F. Focus Control = VR702

- G. Screen Control = VR406
- H. Video Drive Controls - Red Drive = VR401  
Green Drive = VR402
- I. CRT Cut Off Controls - Red Cutoff = VR403  
Green Cutoff = VR404  
Blue Cutoff = VR405

## SERVICE INSTRUCTIONS

### FOCUS

Adjust the Focus control (VR702), located on the HV unit (T701), for maximum over-all definition and fine picture detail.

#### + 127V ADJUSTMENT (See Fig. 1)

The + 127V adj. control (VR501) is adjusted at the factory. However, if readjustment should be required, proceed as follows.

1. Operate monitor for at least 15 minutes at 120V AC line.
2. Connect Positive lead of V.T.V.M. to blue lead of TR502 negative lead to chassis ground.
3. Adjust VR501 to obtain + 127V reading.
4. After adjustment VR501 must be locked with a sealing varnish.

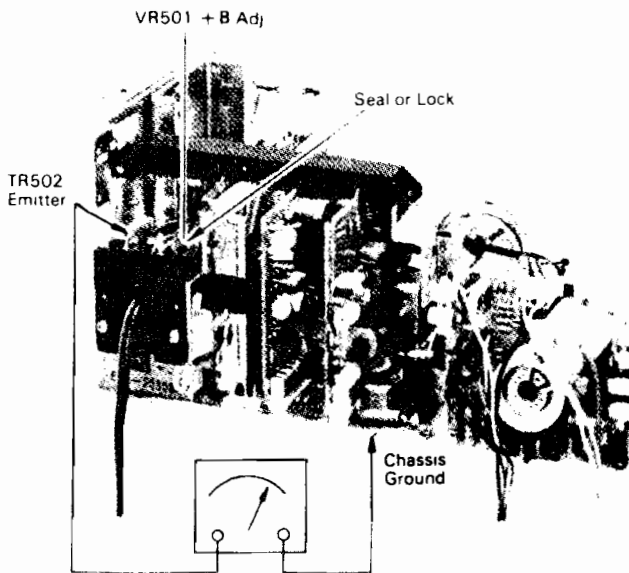


FIGURE 1

### BLACK LEVEL CONTROL ADJUSTMENT

This control has been set at the factory and should not need further attention. If however when the game is connected a slight adjustment of VR201 may be necessary to obtain the proper black level (the black portion of the picture just extinguished).

### VERTICAL SIZE (HEIGHT)

The vertical height control is a screw-driver adjustment. Location of this control is shown in Fig. 3. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct vertical proportions

### CIRCUIT PROTECTION

A 3.0A pigtail fuse, mounted on the Main Board has been provided to protect the Power Output Circuit.

### HORIZONTAL OSC. ALIGNMENT

(See Fig. 2)

A warm-up period of at least five minutes should be allowed before alignment is carried out. Set VR351 to center position.

Adjust L351 after grounding R328 plug. (TP32 of Vert/ Horiz. P.C. Board) through a 1uF/50V capacitor. Adjust L351 to obtain normal picture.

After adjustment, remove 1uF/50V capacitor.

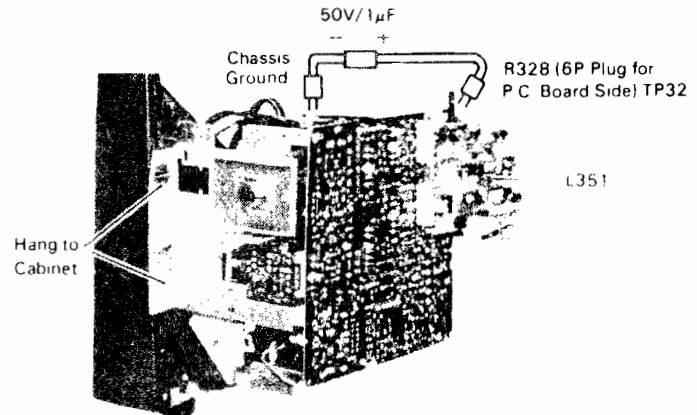


FIGURE 2

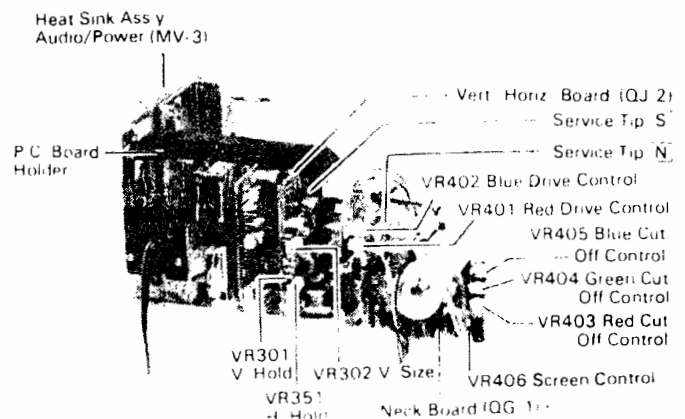


FIGURE 3

## INSTALLATION AND SERVICE INSTRUCTIONS

### COLOR PURITY AND VERTICAL CENTERING ADJUSTMENT

For best results, it is recommended that the purity adjustment be made in the final monitor location. If the monitor will be moved, perform this adjustment with it facing west or east. The monitor must have been operating 15 minutes prior to this procedure and the faceplate of the CRT must be at room temperature.

The monitor is equipped with an automatic degaussing circuit. However, if the CRT shadow mask has become excessively magnetized, it may be necessary to degauss it with manual coil. Do not switch the coil OFF while the raster shows any effect from the coil.

Purity Magnets are used for Color Purity and V Centering Adjustment.

Purity Adjustment procedure is as follows.

1. Remove R-G-B signal from monitor.
2. Turn Green Cut off Control (VR404) on the Neck Board fully CCW.  
Turn Red and Blue Cut off Control (VR405) fully CW.
3. Pull the Deflection Yoke backward so that the Magenta belt will appear. (See Fig. 4)
4. Move the two Purity Magnets and bring the Magenta belt to the mechanical center of the screen (See Fig. 5) The vertical center position should be set VRS to  $-5/64$ " ( $-2$  mm) as shown in Fig. 6.  
Insert service tip "N" on Neck circuit board to "S" on Vert./Horiz. circuit board (See Fig. 13). To check, use the Green raster at low intensity. Be sure to return the service tips to their original positions for the next check.
5. Push the Deflection Yoke forward gradually and fix it at the place where the Magenta screen becomes uniform throughout.
6. Turn Cut off Control, and Drive Control and confirm that each color is uniform.
7. If the color is not uniform, re-adjust it moving Purity Magnets slightly.
8. Move a pair of Purity Magnets at the same time (do not change the angle of the pair), and adjust the vert. center to center of screen.
9. Obtain the three colors and confirm whether white uniformity is balanced.
10. Insert the temporary wedge as shown in Fig. 5 and adjust the angle of Deflection Yoke.

### STATIC CONVERGENCE ADJUSTMENT

A recently developed Deflection Yoke and Electron Guns construction has been used on this equipment in combination with In-Line Guns and Black Stripe Screen to make a barrel-type magnetic-field distribution for vertical deflection and a pin-cushion-type magnetic field for horizontal deflection with which a self-converging system can be obtained. This type is different from conventional unity-magnetic field distribution type deflection yoke. 4-Pole Magnets and 6-Pole Magnets are

employed for static convergence instead of a Convergence Yoke.

1. A cross hatch signal should be connected to the monitor.
2. A pair of 4-Pole Convergence Magnets are provided and adjusted to converge the blue and red beams. When the Pole opens to the left and right  $45^\circ$  symmetrically, the magnetic field maximizes. Red and blue beams move to the left and right oppositely (See Fig. 7-a and 7-b). Variation of the angle between the tabs adjusts the convergence of red and blue vertical lines.  
When the both 4-Pole Convergence Magnet Tabs are rotated as a pair, the convergence of the red and blue horizontal lines is adjusted.
3. A pair of 6-Pole Convergence Magnets are also provided and adjusted to converge the magenta (red + blue) to green beams.

When the Pole opens to the left and right  $30^\circ$  symmetrically, the magnetic field is maximized. Red and blue beams both move to the left and right (See Fig. 8-c and 8-d).

Variation of the opening angle adjusts the convergence of magenta to green vertical lines. When both 6-Pole Convergence Magnet Tabs are rotated as a pair the convergence of magenta to green horizontal lines is adjusted.

### PRECISE ADJUSTMENT OF DYNAMIC CONVERGENCE (See Fig. 10 and 11)

1. Feed a cross hatch signal to the monitor.
2. Insert the temporary wedge and fix Deflection Yoke so as to obtain the best circumference convergence (See Fig. 10 and 11).

NOTE:

The temporary wedges may need to be moved during adjustments.

4. Insert three rubber wedges to the position as shown in Fig. 9 to obtain the best circumference convergence.

NOTE:

- 1) Tilting the angle of the yoke up and down adjusts the crossover of both vertical and horizontal red and blue lines. See Fig. 10 (a) and (b).
- 2) Tilting the angle of the yoke sideways adjusts the parallel convergence of both horizontal and vertical lines at the edges of the screen. See Fig. 11-a and b.
- 3) Use three rubber wedges (thick and thin rubber wedges are used for a purpose).
- 4) The angle of each rubber wedges are shown in Fig. 9.
- 5) After three rubber wedges have been inserted, pull out the temporary wedge.
- 6) Fix the rubber wedges with chloroprene rubber adhesive.

## INSTALLATION AND SERVICE INSTRUCTIONS

### BLACK AND WHITE TRACKING (With R/G.B. inputs grounded)

1. Set Black Level Control (VR201) to mid point.
2. Set Red and Blue Drive Controls (VR401 & VR402) to their mechanical center.
3. Set the G2 Screen Control (VR406) and the 3 Cut-off Controls (VR403, VR404, & VR405) to minimum (CCW).
4. Slowly turn up G2 screen control until the first faint color appears.
5. Slowly turn up the other two color cut-off controls in turn to match the first.
6. Remove ground from R/G/B/ inputs. Adjust Red and Blue Drive Controls (VR401 & VR402) for white screen.

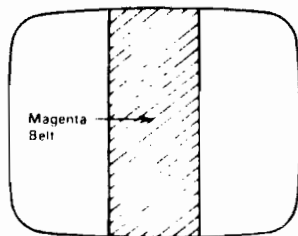


FIGURE 4

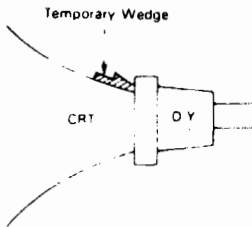


FIGURE 5

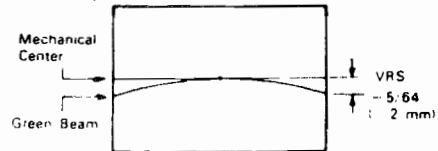
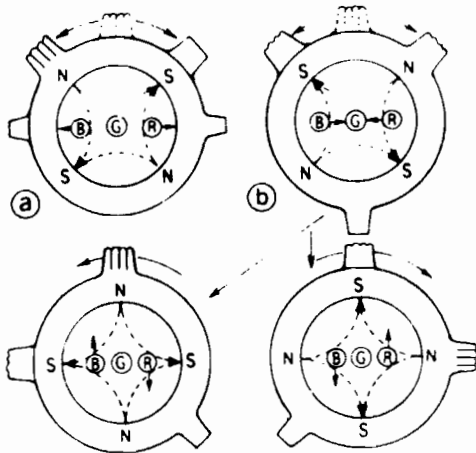
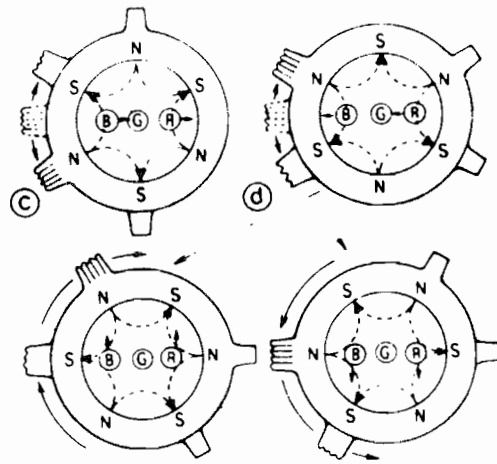


FIGURE 6



4-Pole Magnets and the Movement of Beams

FIGURE 7



6-Pole Magnets and the Movement of Beams

FIGURE 8

# INSTALLATION AND SERVICE INSTRUCTIONS

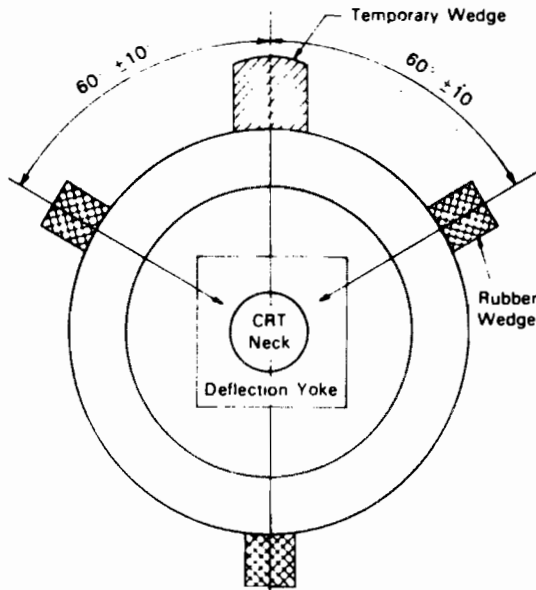
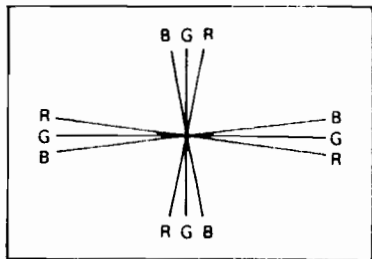
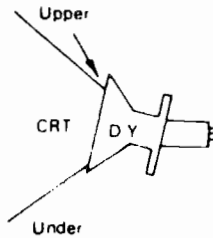


FIGURE 9

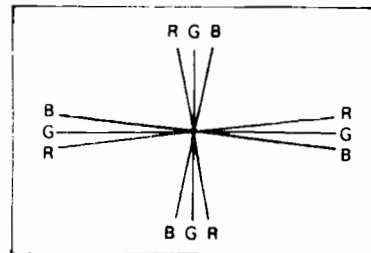


CRT Screen

(a)

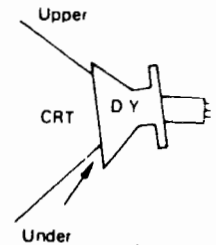


Insert Rubber Wedge from Upper Side



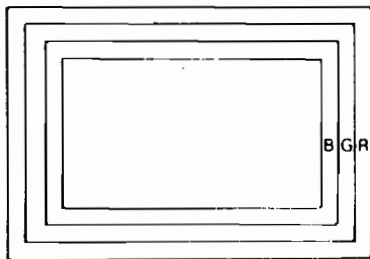
CRT Screen

(b)



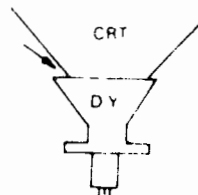
Insert Rubber Wedge from Lower Side

FIGURE 10

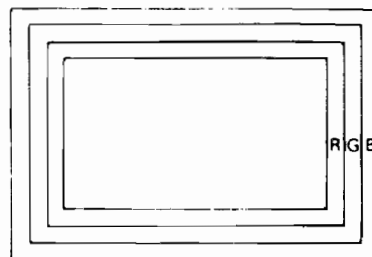


CRT Screen

(a)

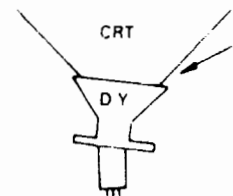


Insert Rubber Wedge from Left Side



CRT Screen

(b)



Insert Rubber Wedge from Lower Side

FIGURE 11

# INSTALLATION AND SERVICE INSTRUCTIONS

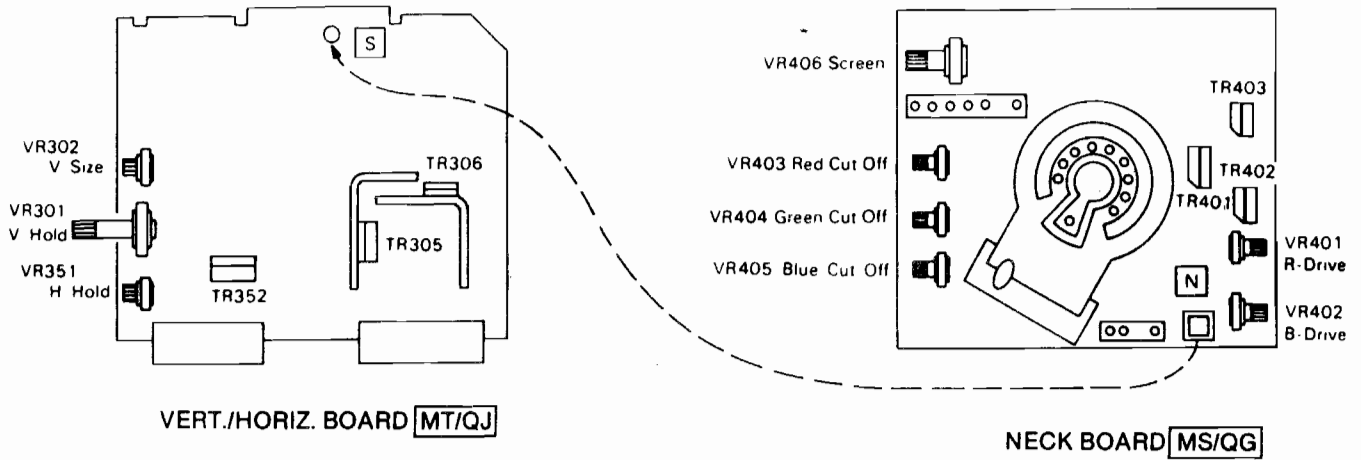


FIGURE 12

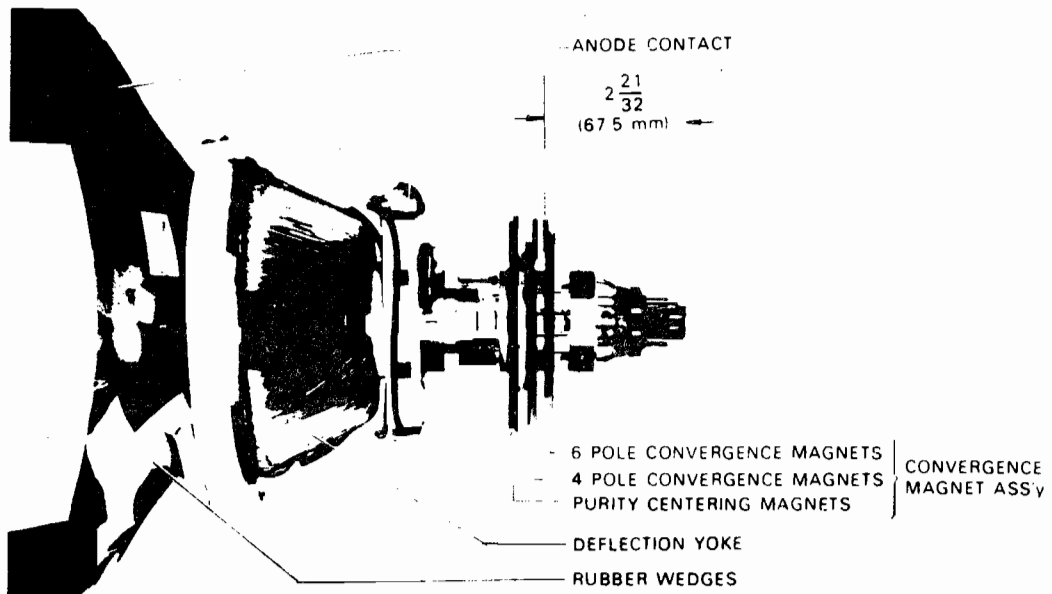


FIGURE 13. PICTURE TUBE NECK COMPONENTS LOCATION



## UNIVERSAL HARNESS

<u>Assigned Pin #</u>	<u>Color Coded Wire</u>	<u>Function</u>	<u>Connector</u>
<b>Power Supply:</b>			
1			
2			
3			
4			
<b>Monitor:</b>			
5	Red	TV Red	J3-10Pin 1
6	Green	TV Green	2
7	Blue	TV Blue	3
8	White	Sync V	10
9	Wht/Gry	Sync H	9
10	Black	Ground for Mon	4
<b>Speaker:</b>			
11	Gray	Audio	J4-2Pin 1
12	Gray	Audio Ground	2
<b>Coin Assembly:</b>			
13	Black	Ground	J1-9Pin 1
14	Black	Ground	2 - To SPS
15	Wht/Org	Coin Switch	3
16	Violet	+ 12 Volts	4 - To SPS
17	Wht/Red	+ 5 Volts	5 - To SPS
18	Wht/Grn	- 5 Volts	6 - To SPS
19	Yellow	Test	7
20	Wht/Blk	Coin Counter	8
<b>Control Panel:</b>			
21	Black	Ground	J2-12Pin 1
22	Orange	1P Start	2
23	White/Yellow	2P Start	3
24	White/Violet	Left	4
25	White/Blue	Right	5
26	Yellow	Up	6
27	Brown	Down	7
28	White/Brown	Fire(1)	8
29	White/Black	Bomb(2)	9
30,31	White/Blk/Brn	(Function 3,4)	10,11

