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Service Manual

HX-12
MONITOR

PRINCETON®
GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

Table of Contents

PRINCETON®
GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

601 Ewing Street, Building A, Princeton, NJ 08540 800-221-1490, 609-683-1660 (NJ only) Telex: 821402 PGS PRIN

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ecifications

• **Receivable Frequency Range:**	Video signal frequency
• **CRT:**	12", 76°, .31 mm dot pitch, black matrix, non-glare
• **CRT Size:**	28.1 cm wide, 22.2 cm high and 32.2 cm diagonal
• **Power Consumption:**	67W
• **High Voltage Output:**	24.0 kV
• **Semiconductors:**	6 ICs 18 transistors 25 diodes
• **Power Supply:**	120V, 60Hz (220/240V, 50Hz available)
• **Cabinet:**	Plastic
• **Dimensions:**	37.7(W) x 28.0(H) x 41.8(D) cm
• **Weight:**	12.0 kg
• **AC Cord:**	1.9 m
• **Input Connector:**	9-pin "D" subminiature connector
• **Input Signal:**	R.G.B. direct drive system
• **Video Signal Input:**	TTL level, positive
• **Ver./Hor. Sync:**	TTL level, positive
• **Intensity:**	TTL level, positive
• **Scanning Frequency:**	Horizontal—15.7 kHz Vertical—60 Hz
• **Active Video Period:**	Horizontal—48.0 μS max Vertical—14.61ms max
• **Resolution:**	Horizontal—640 pixels Vertical—200 lines (non-interlaced), (690 x 240 max in 216mm x 160mm area at 15.7 kHz
• **Active Display Area:**	215(W) x 160(H) mm
• **Display Characters:**	80 characters with 25 lines—8 x 8 dots
• **Display Colors:**	16 colors, red, green, blue, cyan, yellow, magenta, black, white & 2 intensity levels
• **Accessory:**	Owner's Manual Signal cable Power cord

NOTE: SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Important Servicing Safety Precautions

Please be thoroughly familiar with all of the following safety checks and servicing guidelines before any service work is performed.

WARNING

1. For continued safety and service, do not attempt to modify any circuits.
2. Disconnect the AC plug from the AC outlet before servicing unit.
3. The semiconductor heat sinks are potential shock hazards when the chassis is in operation.

SERVICING OF HIGH VOLTAGE SYSTEM AND PICTURE TUBE

When attempting to service the high voltage system, remove the static charge by placing a 10K ohm resistor in series with an insulated wire, such as a test probe, between the chassis and the anode lead.

1. The picture tube in this monitor uses integral implosion protection.
2. Always replace the tube with the same type and number.
3. Be careful not to lift the picture tube by the neck.
4. Only handle the picture tube after discharging the high voltage completely and when wearing shatter-proof goggles.

X RADIATION AND HIGH VOLTAGE LIMITS

1. X radiation can be potentially hazardous and should be approached with extreme caution.
2. The only potential sources of X-ray are in the picture tube. If the high voltage is kept at factory set levels, there are no measurable X-ray emissions from the picture tube. However, only if the high voltage exceeds factory set levels is the X-radiation capable of penetrating the shield of the lead filled picture tube. Therefore, it is vital to maintain the high voltage at the preset levels.
3. Operation at higher voltages could also cause failures in the picture tube or high voltage circuitry, aside from excess radiation.
4. When servicing a monitor with excessive high voltage, avoid being unnecessarily close to the monitor when making measurements. Also, do not operate the monitor longer than is necessary to locate the cause of the excessive voltage.
5. Everytime a color chasis is serviced, the brightness should be tested while the high voltage is being monitored with a meter. This is necessary to be certain that the high voltage is not excessive and that the high voltage regulators are operating properly.
6. An accurate high voltage meter, which has been checked periodically should be available at all times.
7. Replace a picture tube only with the model specified and do not make unrecommended circuit modifications in the high voltage circuitry.

FIRE AND SHOCK HAZARD

Please perform the following checks before returning unit to customer:

1. Check to see that there is no hardware lodged between the chassis and any metal parts in the monitor. Also make certain that no leads are pinched.
2. Check all the non-metallic protective devices such as control knobs, cabinet backs, insulating fishpapers, compartment covers, isolation resistor, capacitor networks, mechanical insulators, etc.
3. To insure against shock hazards, check for leakage of current in the following manner:
   - Plug the AC cord directly into a 120 volt AC outlet. Do not use an isolation transformer for this test.
   - While using two clip leads, connect a 1.5K ohm, 10 watt resistor paralleled by a 0.15μf capacitor in series with all exposed metal cabinet parts with a known ground, such as a water pipe.
   - While using a VTVM or VOM with 1000 ohm per volt (or higher) sensitivity, measure the AC voltage drop across the resistor (see Figure 1 overleaf).
   - Move the resistor connection to the earth exposed metal part while having a return path to the chassis (metal cabinet, screw leads, knobs, etc.) and measure the AC drop across the resistor.
   - Repeat the checks with the AC cord plug connector reversed. It may be necessary to use a non-polarized adaptor plug to perform these checks.
   - Any reading of 0.3 volt RMS (equal to 0.2 milliamps AC) or more is dangerous and indicates a potential shock hazard to the customer and must be corrected.

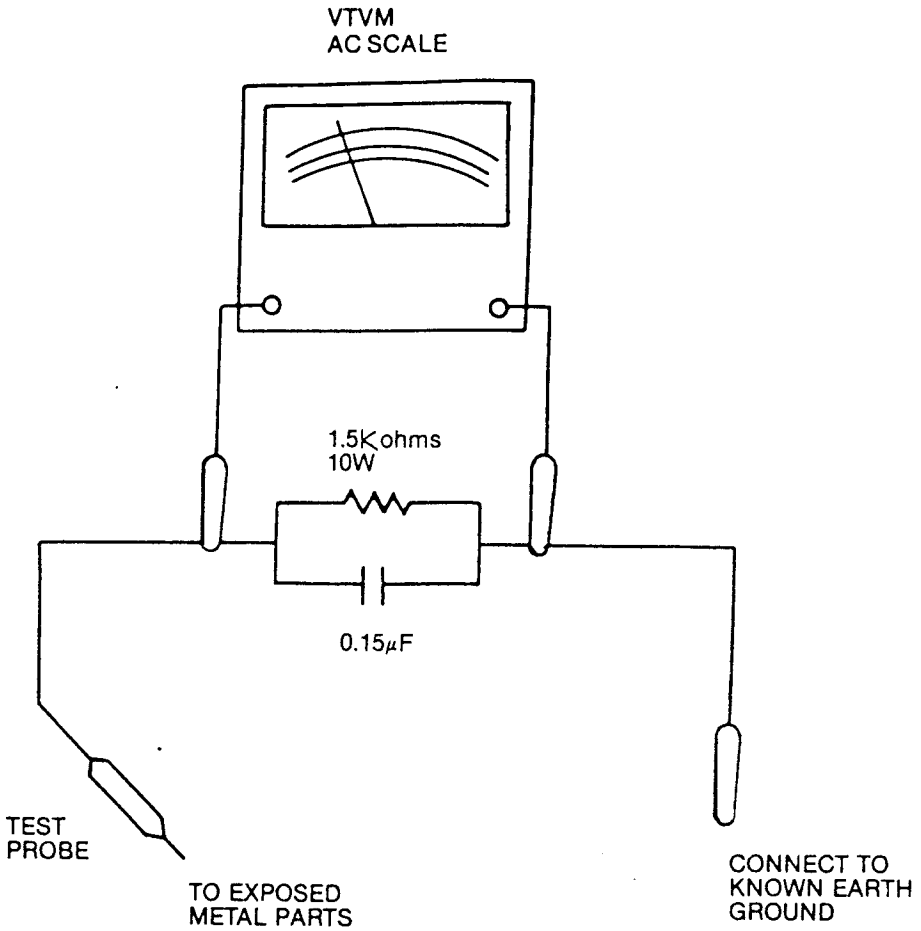


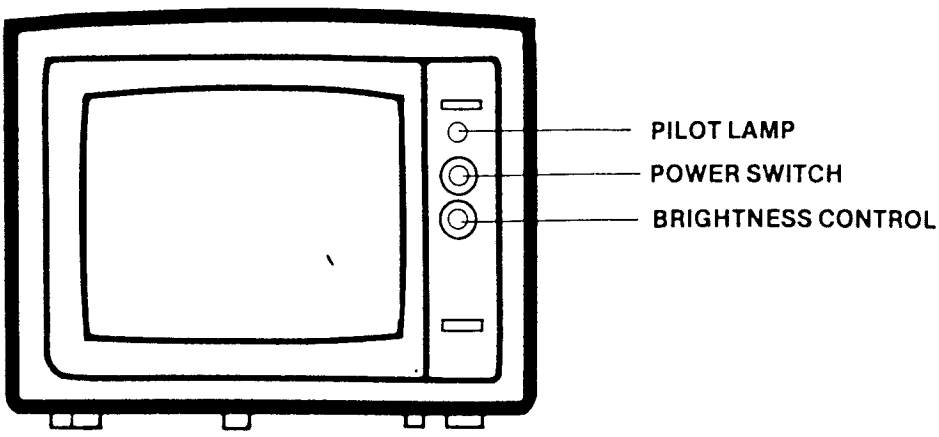
FIGURE 1.

SAFETY NOTICE

Many electrical and mechanical parts in display monitors have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them be necessarily increased by using replacement components rated for higher voltage, wattage, etc.

For continued protection, replacement parts must be identical to those used in the original circuit. The use of a substitute replacement part which does not have the same safety characteristics as the factory recommended replacement parts shown in this service manual, may create shock, fire, X-radiation or other hazards.

Location of Controls



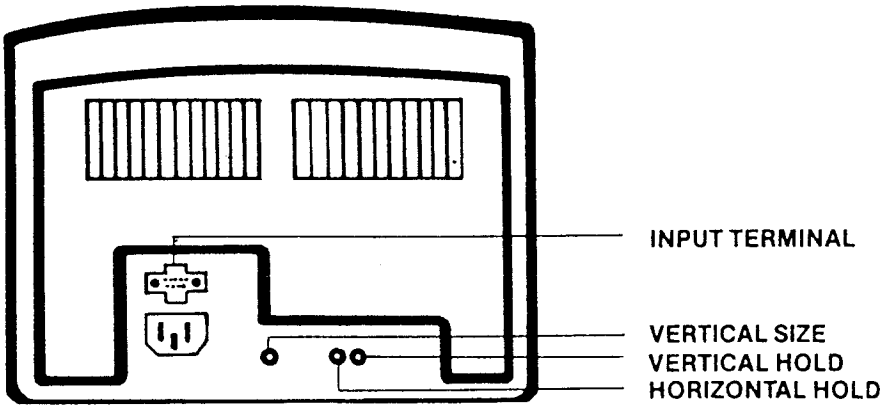


FIGURE 2.

Adjustment of Semi-Fixed Controls

1. **B + VOLTAGE ADJUSTMENT: VR801.**
   Attach the DC voltmeter (with a range of 150 volts) between TP91 of the printed wiring board (PWB) and each ground. Then adjust the VR801 until the voltage reads 115V.

2. **HORIZONTAL HOLD ADJUSTMENT: VR 401**
   Connect TP31 of the PWB to the ground. Next, adjust the Horizontal Hold until the display slowly sweeps horizontally across the screen. Once this is done, remove the jumper and turn the power switch off and on, to test the sychronization.

3. **VERTICAL HOLD ADJUSTMENT: VR302**
   Adjust the Vertical Hold until synchronization is obtained.

4. **VERTICAL HEIGHT ADJUSTMENT: VR301**
   Display any characters filling the screen and adjust the Vertical Height until the maximum height is obtained.

5. **HORIZONTAL POSITIONING CONTROL: VR502.**
   This controls the left-right movement of the picture. Adjust it so that the picture is centered.

The following 4 adjustments should be made when the focus or white balance is greatly out of tune, due to replacement of the picture tube.

6. **FOCUS ADJUSTMENT: VR491-1**
   Adjust the focus until the picture is sharpest.

7. WHITE BALANCE ADJUSTMENT:

Red bias (VR504)
Green bias (VR505)
Blue bias (VR506)
Red Drive (VR502)
Blue Drive (BR503)
Screen (VR491-2)
Service Switch (SW201)

a) Remove 9 pin (DB9) input signal plug and check that the screen emits light.
b) Set VR504, VR505, VR506, and VR491-2 all to the counterclockwise direction.
c) Set VR502 & VR503 to the mechanical center.
d) Set SW201 to "service" side and turn VR491-2 slowly in a clockwise direction in order to obtain a slight horizontal line.
e) Turn the bias control for the color which does not emit light (blue, green or red) in order to obtain a white balance horizontal line.
f) In a clockwise direction, turn VR491-2 slightly so that the horizontal line of the color most difficult to see, emits light slightly.
g) Set service switch at "normal" and adjust the Red and Blue Drive controls to get a white color.
h) Lastly, check to see that the white color is present in both bright and dark intensities by turning the brightness control.
i) If not, repeat Step g).

8. PURITY ADJUSTMENT:

a) Check to see that the spacing between the static magnet and stem top conforms to the illustration in Fig. 3.
b) Remove the G-Y tip from the main printed wiring board, thus attaining a magenta color.
c) Adjust the picture so it is a magenta color, by turning the two overlapping pawls on the purity magnet in opposite directions. Move them until they are at the same angle, 9 o'clock and 3 o'clock position respectively.

9. STATIC CONVERGENCE ADJUSTMENT:

a) Receive cross hatch signal and then adjust brightness to desired intensity.
b) Allow only the red and blue to emit light by pulling out the G-Y tip from the main printed wiring board.
c) Open the two pawls of the 4-pole magnets to allow the red and blue vertical lines to unite.
d) Open and rotate the two pawls at a constant angle so that the red and blue horizontal lines unite.
e) If the vertical line deviates, open the pawl at the deviation position and make a minor adjustment by changing its angle.
f) Allow the three colors to light up by restoring the G-Y tip to its original position.
g) Make the magenta and green vertical lines at the center unite by opening the two hexode pawls.
h) Rotate the two pawls at a constant angle in order to unite the red and blue horizontal lines with the green.
i) If the vertical lines deviate, change the angle of the pawls from the deviation position.

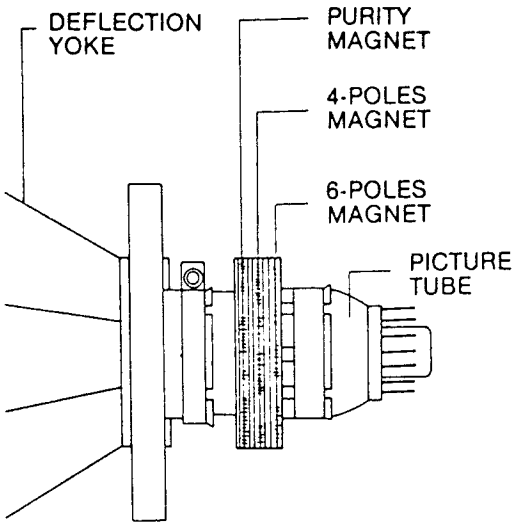


FIGURE 3.

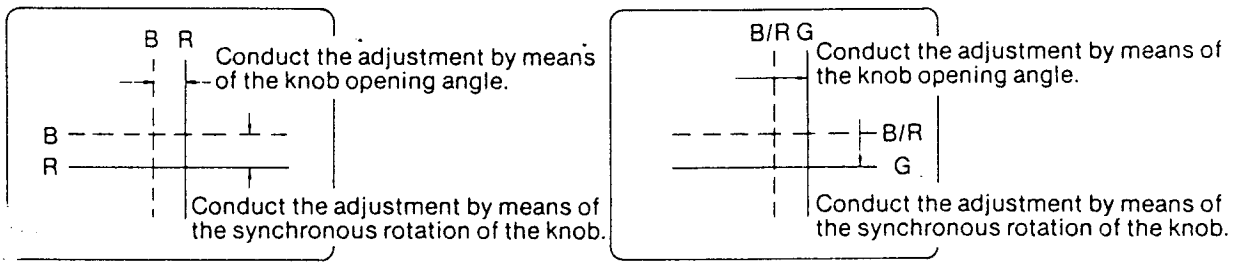
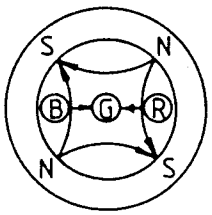
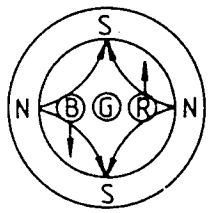


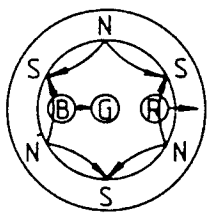
FIGURE 4.



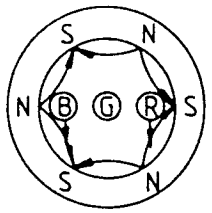
Beam migration in application of 4-pole magnets.



Beam migration in application of 4-pole magnets rotated.



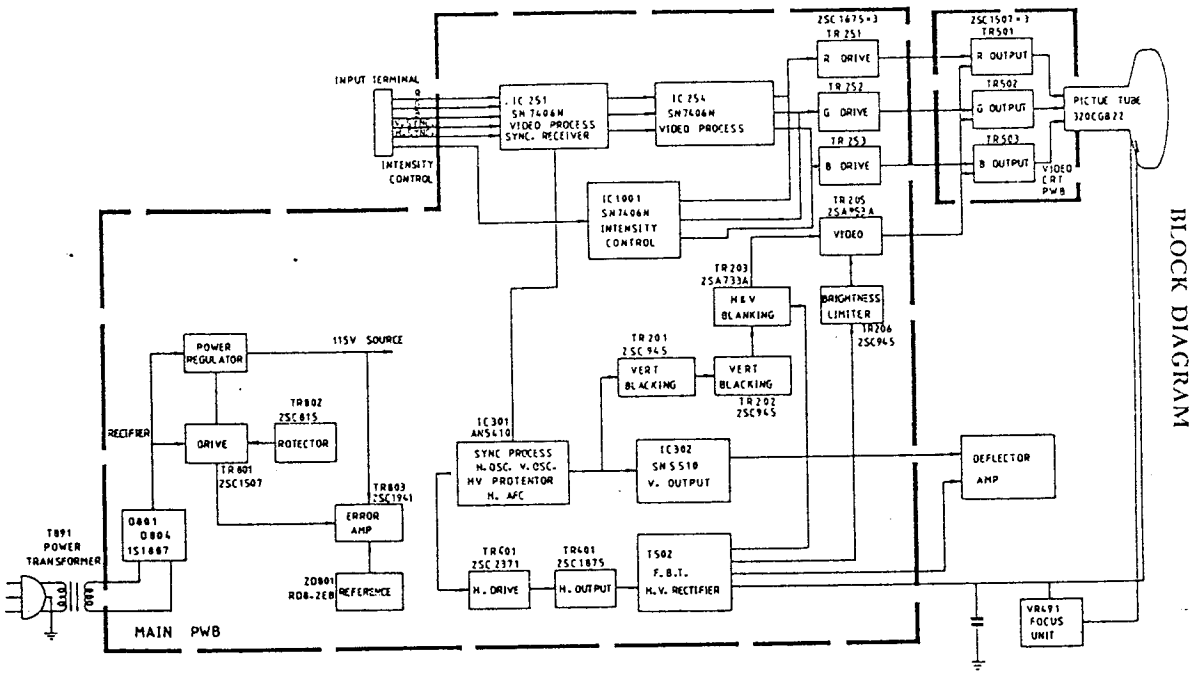
Beam migration in application of 6-pole magnets.



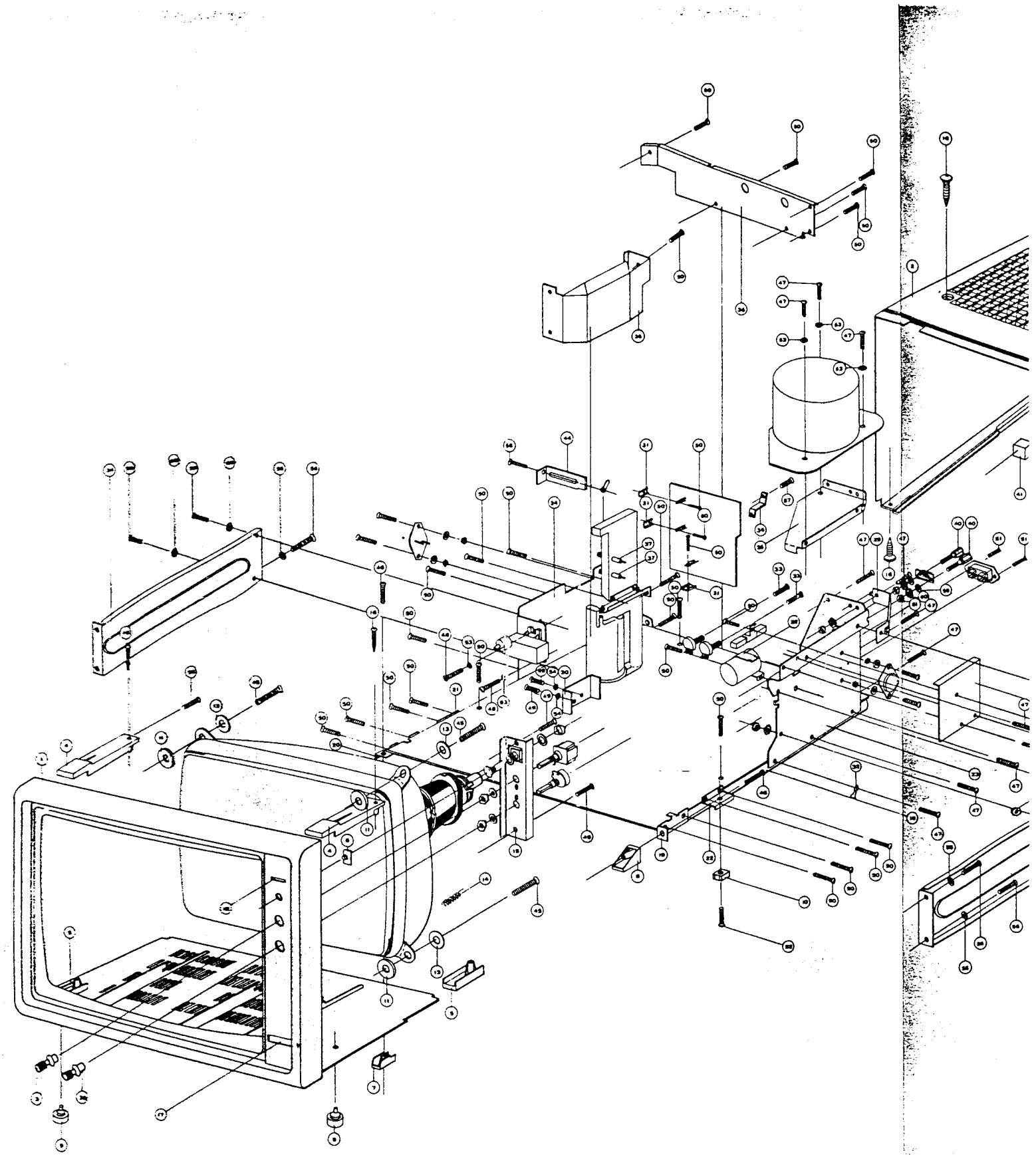
Beam migration in application of 6-pole magnets rotated.

FIGURE 5.

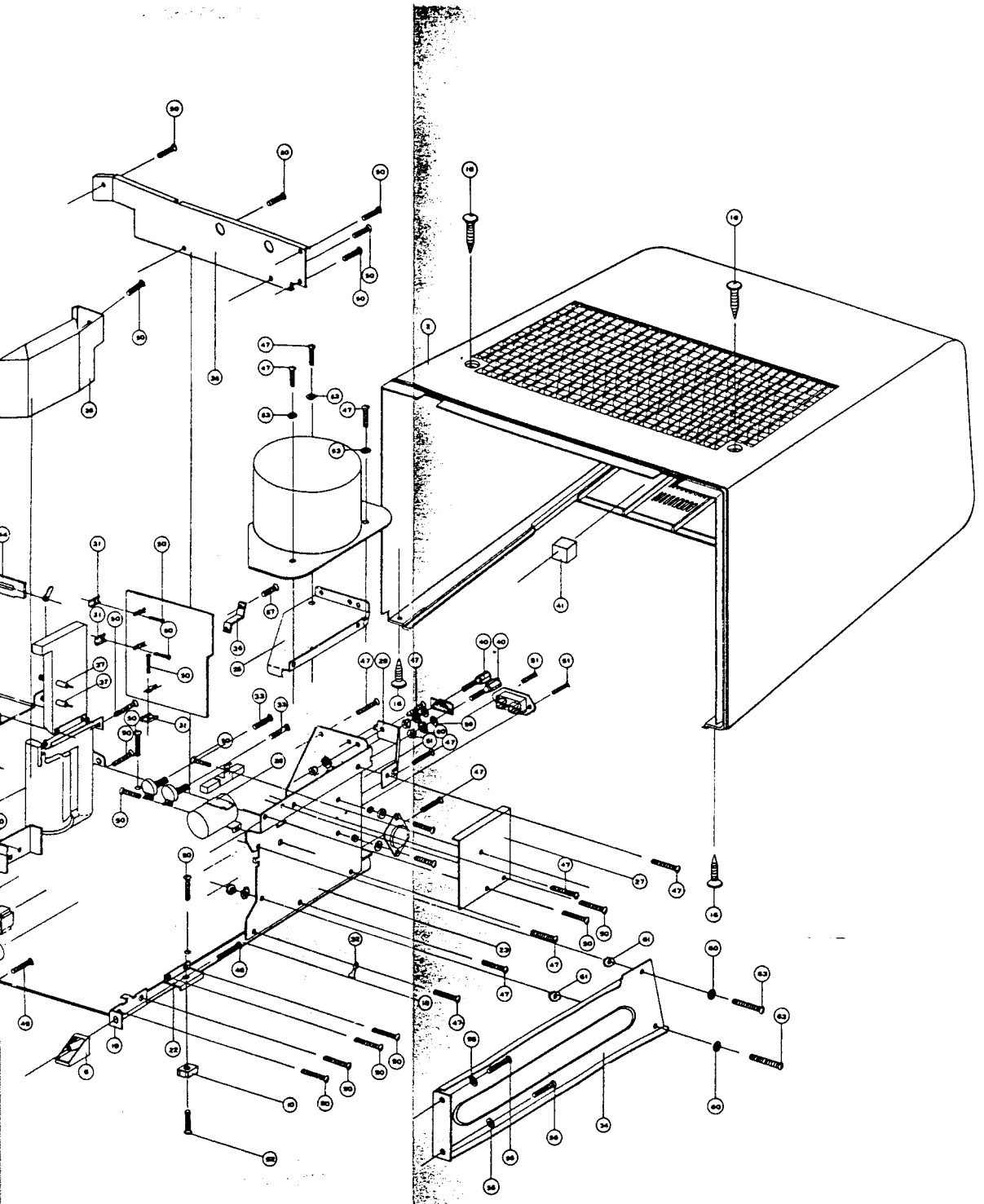
Block Diagram



BLOCK DIAGRAM



Exploded View



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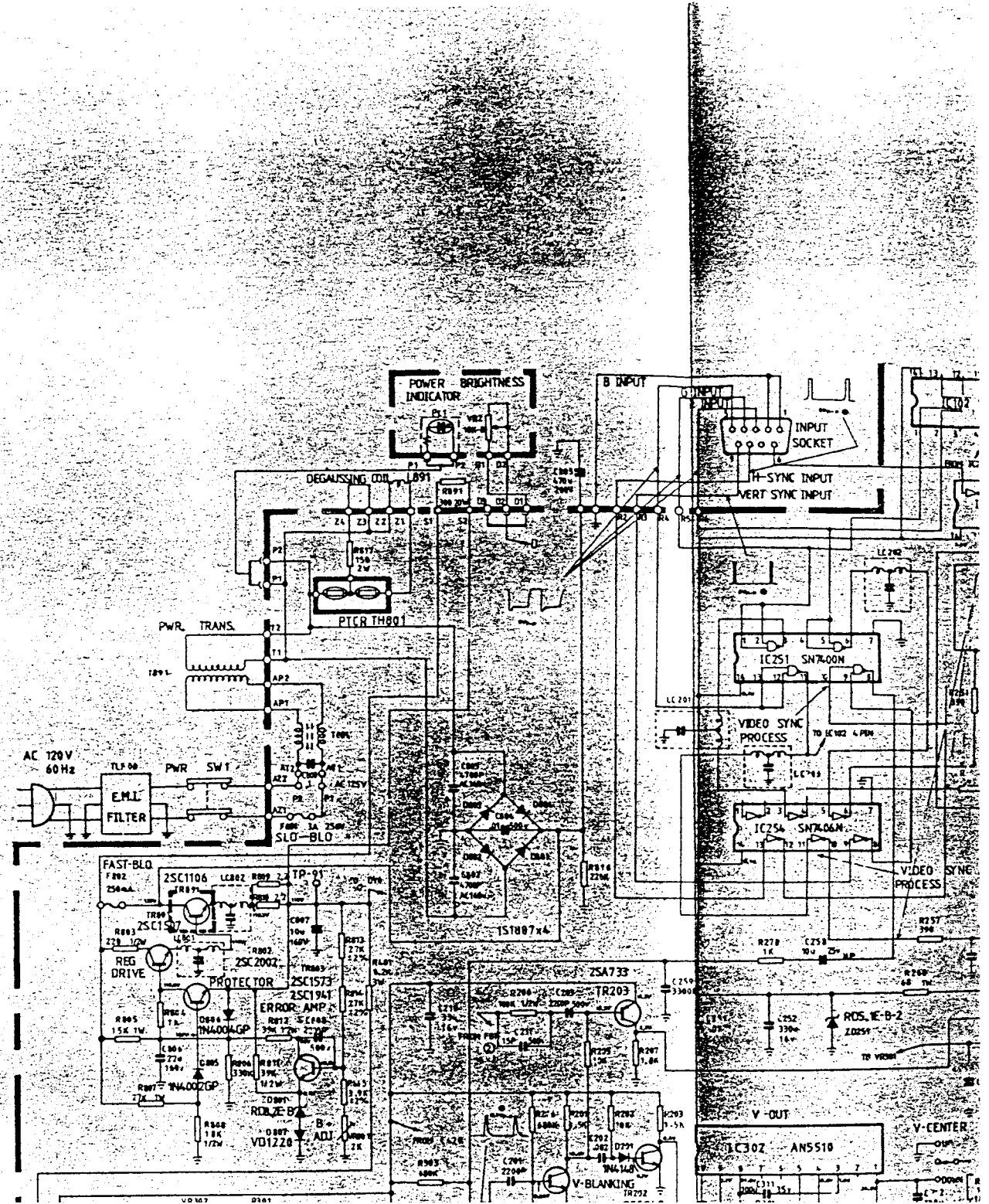
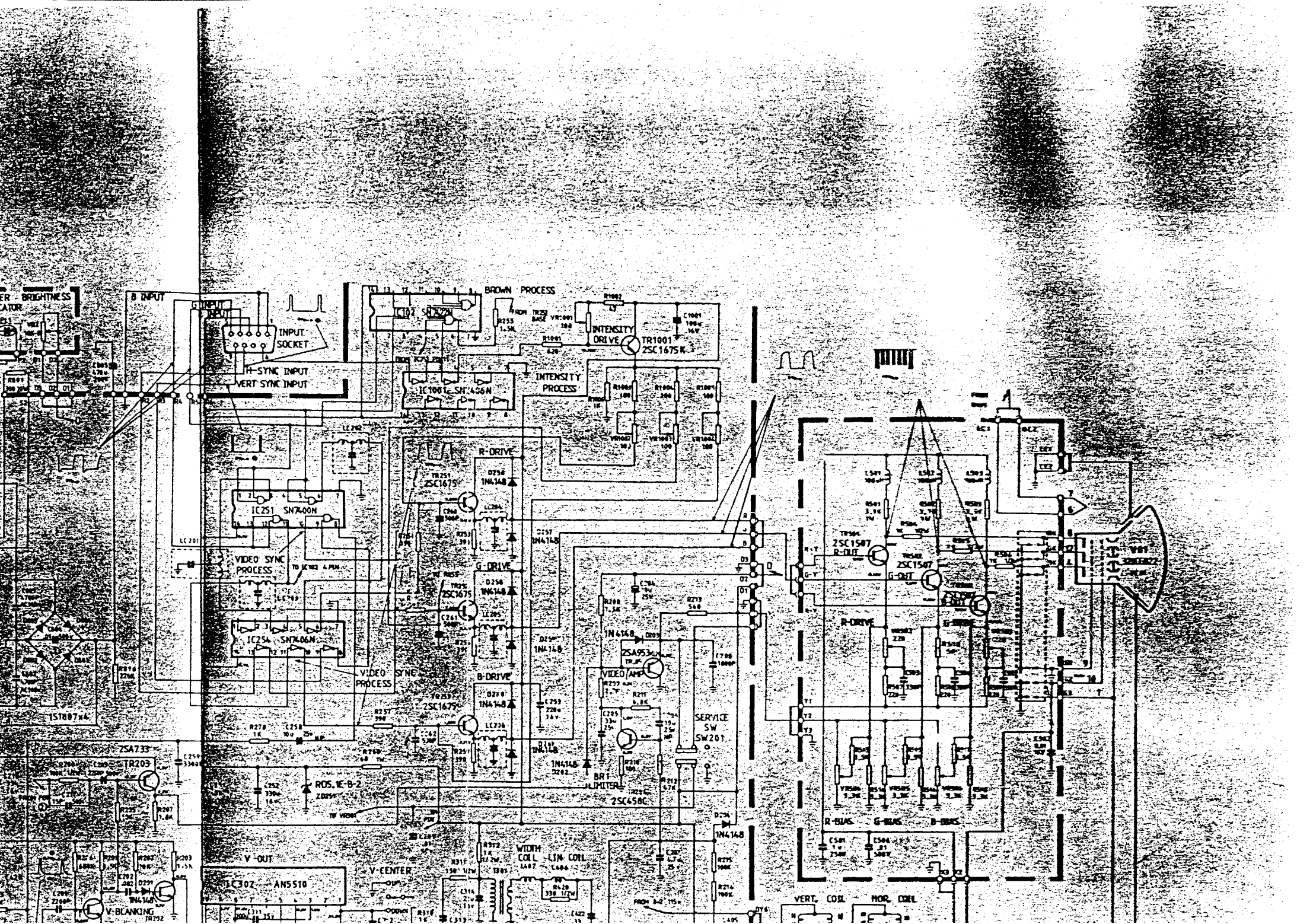
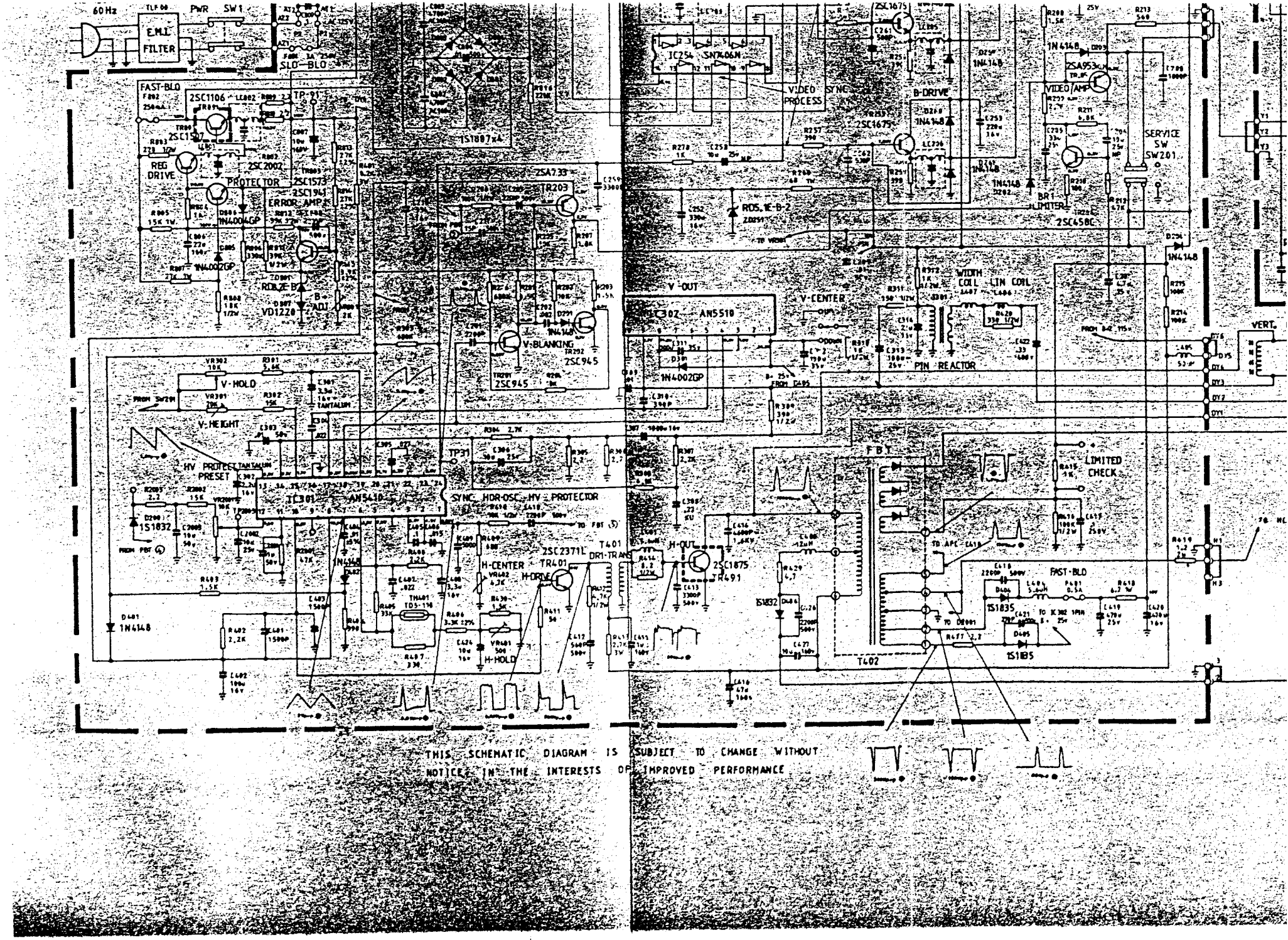
Schematic Diagram




B INPUT
G INPUT
INPUT SOCKET
H-SYNC INPUT
VERT SYNC INPUT
IC102 SN7420N
BROWN PROCESS
INTENSITY DRIVE
TR1001 2SC1675K
IC1001 SN7406N
INTENSITY PROCESS
R-DRIVE
G-DRIVE
B-DRIVE
IC251 SN7400N
IC254 SN7406N
VIDEO SYNC PROCESS
TR251 2SC1675
TR252 2SC1675
TR253 2SC1675
1N4148
2SA953
VIDEO AMP
SERVICE SW SW201
BR1 LIMITER
2SC458C
2SA733
TR203
RD5.1E-B2
V-BLANKING
V OUT
IC302 AN5510
V-CENTER
WIDTH COIL
LIN. COIL
2SC1507 R-OUT
G-OUT
R-BUS
G-BUS
B-BUS
VERT. COIL
HOR. COIL


60Hz
TLF09
PWR SW1
E.M.I. FILTER
SLO-BLO
FAST-BLO
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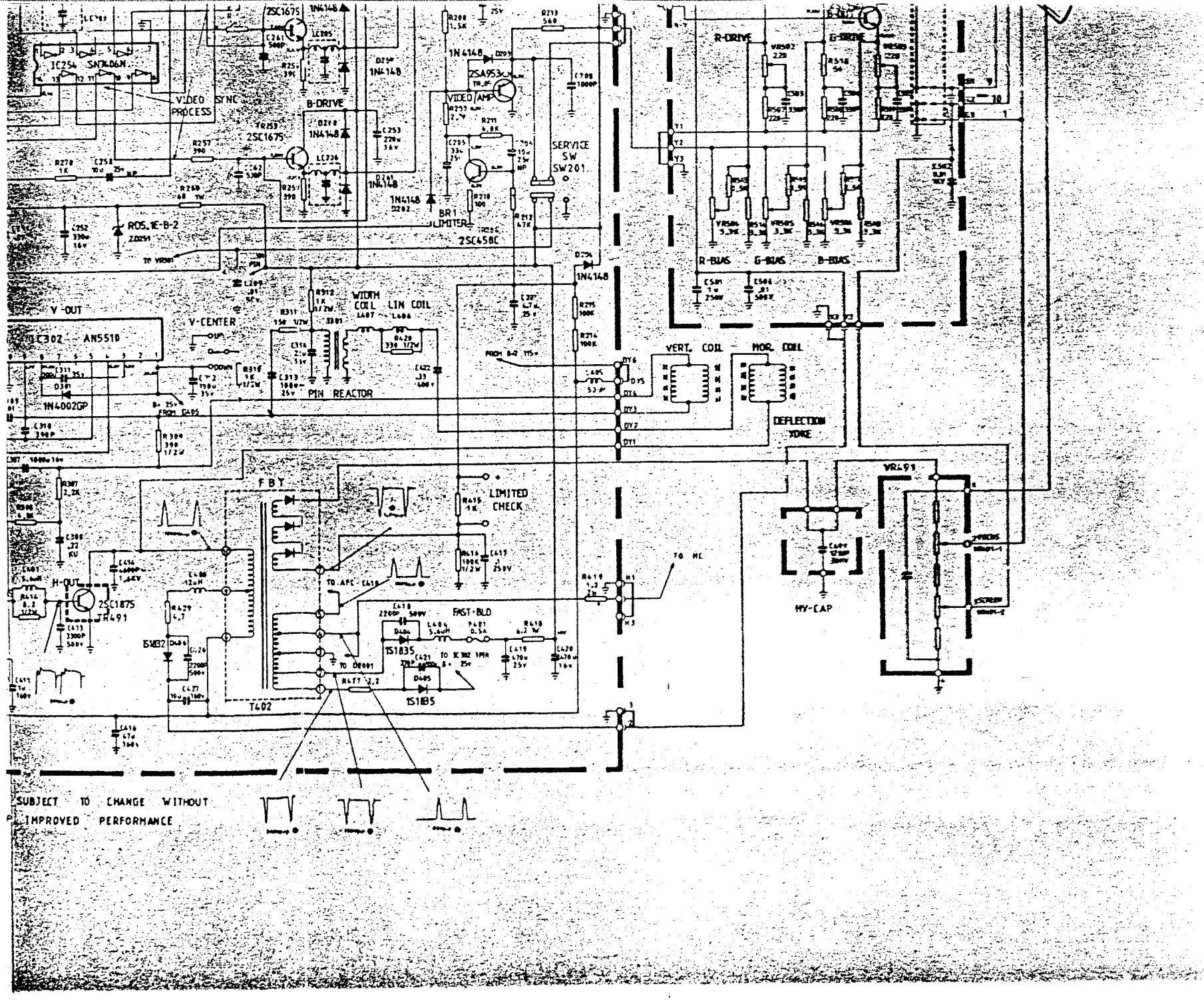
TP-91
2SC1573
2SC1941
2SC2002
REG DRIVE
PROTECTOR
ERROR AMP
1N4002GP
RDRIVE B
B-ADJ
VD1220
TS1887A
2SA733
TR203
V-BLANKING
2SC945
V-OUT
V-CENTER
IC302 AN5510
V-HOLD
V-HEIGHT
HV PROTECT PRESET
TANTALUM
IC301 AN5430
SYNC HDR-OSC HV PROTECTOR
1S1832
TP31
H-CENTER
H-DRIVE
TR401
2SC2371L
DR1-TRANS
TDS-116
H-HOLD
1N4148
H-OUT
2SC1875
TR491
FBT
PIN REACTOR
WIDTH COIL
LIN COIL
T402
T401
LIMITED CHECK
FAST-BLD
1S1835
1S1885
IC254 SN7406N
VIDEO PROCESS
B-DRIVE
2SC1675
VIDEO AMP
SERVICE SW SW201
BR1 LIMITER
2SC458C
RDS.1E-B-2
VERT.
THIS SCHEMATIC DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE IN THE INTERESTS OF IMPROVED PERFORMANCE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VIDEO AMP
SERVICE SW SW201
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2SC458C
RD5.1E-B-2
R-DRIVE
G-DRIVE
R-BIAS
G-BIAS
B-BIAS
V-OUT
IC302 AN5510
V-CENTER
WIDTH COIL
LIN COIL
PIN REACTOR
1N4002GP
VERT. COIL
HOR. COIL
DEFLECTION YOKE
FBT
LIMITED CHECK
H-OUT
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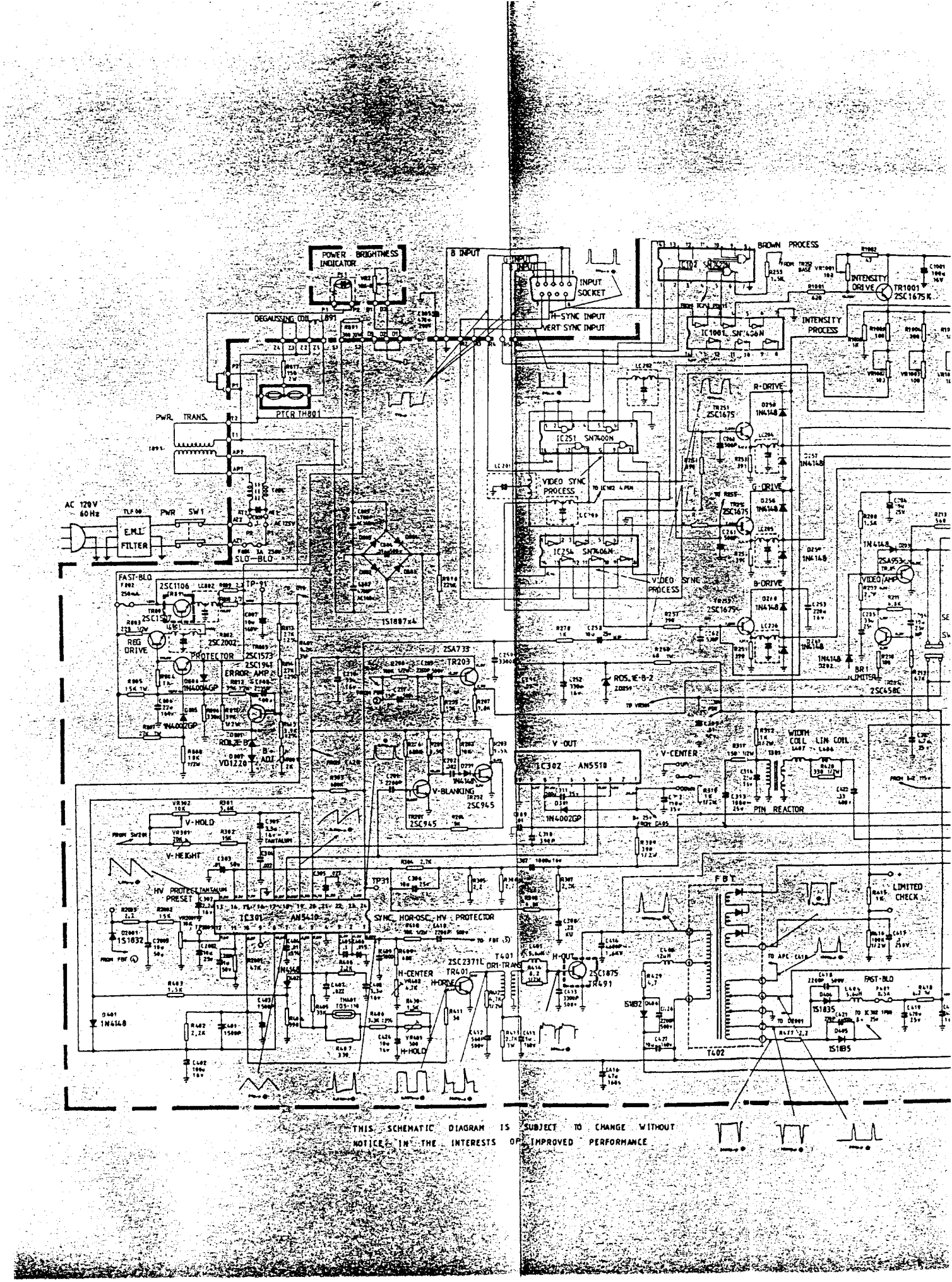
T402
VR491
HV-CAP
SUBJECT TO CHANGE WITHOUT
IMPROVED PERFORMANCE


POWER BRIGHTNESS INDICATOR
B INPUT
INPUT SOCKET
H-SYNC INPUT
VERT SYNC INPUT
DEGAUSSING COIL
PTCR TH801
PWR. TRANS.
AC 120V 60Hz
E.M.I. FILTER
PWR SW1
SLO—BLO
FAST-BLO
REG DRIVE
PROTECTOR
ERROR AMP
V-HOLD
V-HEIGHT
HV PROTECT PRESET
SYNC. HOR-OSC., HV PROTECTOR
H-CENTER
H-DRIVE
H-HOLD
V-BLANKING
V-OUT
V-CENTER
H-OUT
FBT
PIN REACTOR
WIDTH COIL
LIN COIL
LIMITED CHECK
BROWN PROCESS
INTENSITY DRIVE
INTENSITY PROCESS
R-DRIVE
G-DRIVE
B-DRIVE
VIDEO SYNC PROCESS
VIDEO AMP
BRT LIMITER
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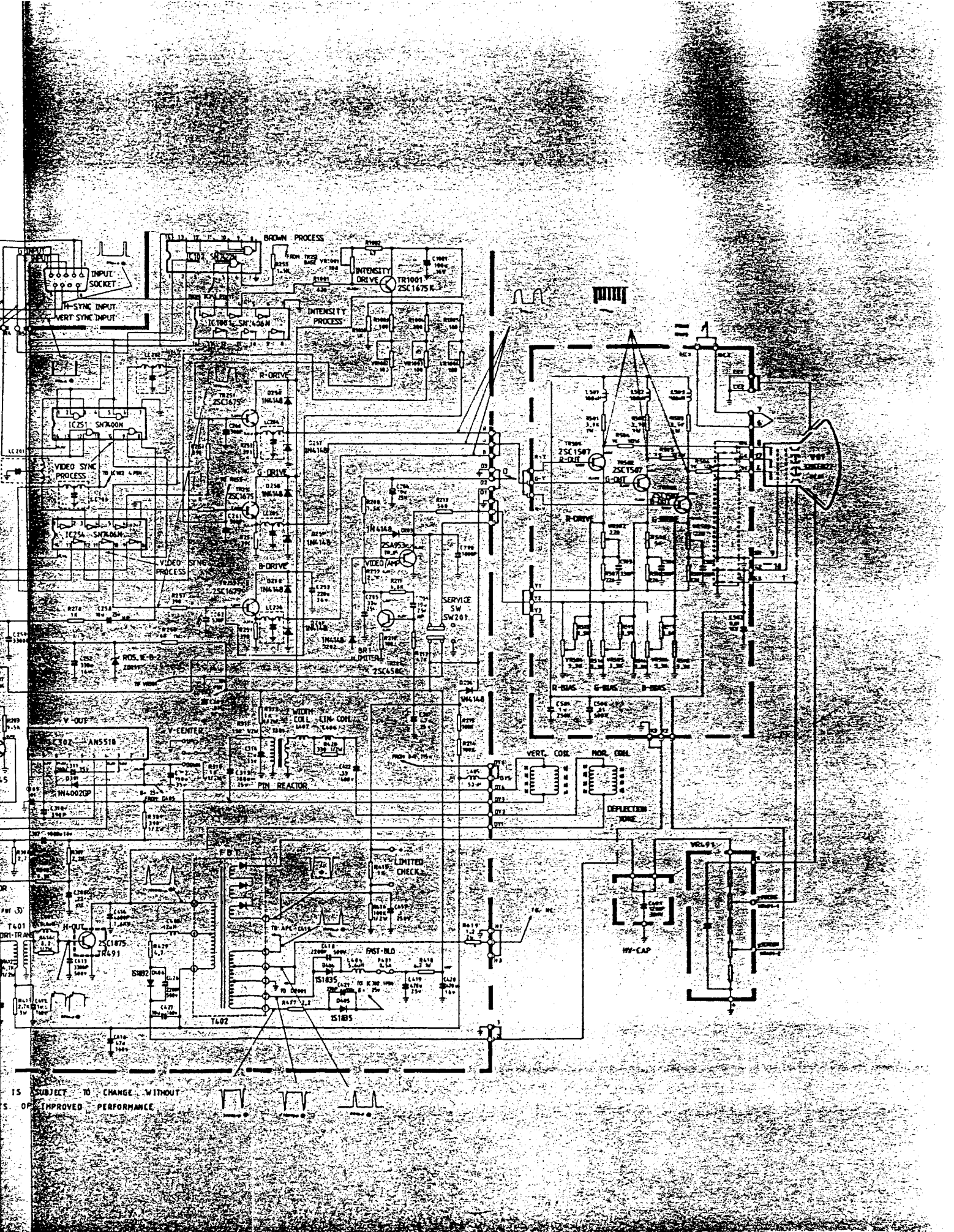
INPUT SOCKET
H-SYNC INPUT
VERT SYNC INPUT
BROWN PROCESS
IC102 SN7406N
INTENSITY DRIVE
TR1001 2SC1675K
INTENSITY PROCESS
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R-DRIVE
2SC1475
1N4148
IC251 SN7400N
G-DRIVE
2SC1675
VIDEO SYNC PROCESS
IC254 SN7406N
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SERVICE SW SW201
BRT LIMITER
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R05.1E-B-2
V-OUT
V-CENTER
IC202 AN5518
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LIN. COIL
PIN REACTOR
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P.B.U.
LIMITED CHECK
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T402
FAST-BLD
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1S1892
TO APC
TO DY001
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2SC1507 G-OUT
R-DRIVE
R-BIAS
G-BIAS
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HOR. COIL
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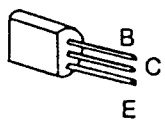
HV-CAP
VR491
IS SUBJECT TO CHANGE WITHOUT
S OF IMPROVED PERFORMANCE



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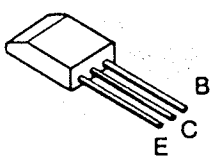

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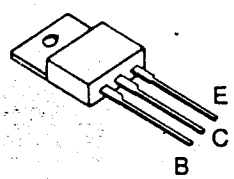

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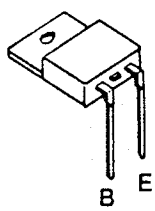

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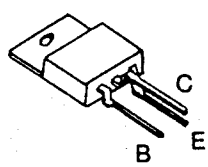

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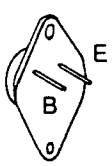

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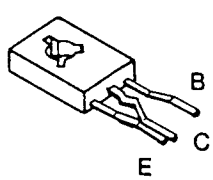


NO RASTER APPEARS

DOES 120V AC APPEAR BETWEEN THE CROSS POINT OF D803 & D804 AND THE CROSS POINT OF D802 & D801?

NO

POWER CORD LOOSE
FAILURE OF SW1
F801 OPEN
FAILURE OF DEGAUSSING CIRCUIT
C809 IS SHORTED
FAILURE OF T891
FAILURE OF PL1

YES

F801 BROKEN

D801, D802 D803, D804 PL1 ARE SHORTED

DOES 145V DC APPEAR BETWEEN THE C805 POSITIVE SIDE AND GROUND?

NO

FAILURE OF C802 C803 C804
FAILURE OF D801 D802 D803 D804
FAILURE OF C805

YES

DOES 115V REGULATOR VOLTAGE APPEAR BETWEEN THE TP-91 AND GROUND?

ABNORMAL 115V

FAILURE OF IC301
FAILURE OF H. OSC. CIRCUIT C404
FAILURE OF H. DRIVE CIRCUIT
FAILURE OF H.V. PROTECTOR CIRCUIT
FAILURE OF 115V POWER REGULATOR CIRCUIT

NO

POWER REGULATOR OPEN

YES

CHECK 12V B+

ABNORMAL

FAILURE OF 12V CIRCUIT LOOP
FUSE F401 OPEN
FAILURE OF AMBIENT F.B.T. CIRCUIT

OK

OK CHECK F802 OK OR NOT

SHORTED

FAILURE OF H. O/P TRANSISTOR

OPEN OR BROKEN

CHECK H. OUTPUT TRANSISTOR

NORMAL

115V LINE IS SHORTED
FAILURE OF H. DRIVE CIRCUIT
FAILURE OF F.B.T.
FAILURE OF C414

NO VERTICAL SWEEP

CHECK B + 25V VOLTAGE ON RECTIFIER CIRCUIT

LOW OR 0 VOLT — FAILURE OF 25V RECTIFIER CIRCUIT

NORMAL

APPLY 22ND PIN SYNC SIGNAL TO 17TH PIN OF IC301 THROUGH CAPACITOR

VERTICAL GETS HEIGHT — FAILURE OF IC301

WITHOUT EFFECT — FAILURE OF IC301
FAILURE OF D.Y. (WHEN AC SIGNAL OBTAINED ON 9TH PIN OF IC302)

FAILURE OF WHITE BALANCE

READJUST WHITE BALANCE

OK

NO — CHECK CRT CATHODE VOLTAGE

NORMAL — FAILURE OF CRT

ABNORMAL — FAILURE OF VIDEO O/P TRANSISTOR TR501, TR502, TR503
FAILURE OF VIDEO O/P TRANSISTOR AMBIENT CIRCUIT
FAILURE OF VIDEO CIRCUIT

ABNORMAL BRIGHTNESS OF SCREEN

CHECK 180V VOLTAGE LINE

LOW — DOES R429 OPEN?
FAILURE OF 180V POWER CIRCUIT

NORMAL

CHECK EMITTER VOLTAGE OF TR251, TR252, TR253

LOW — FAILURE OF TR205, TR204

NORMAL

FAILURE OF TR205 and TR204
FAILURE OF AMBIENT CIRCUIT

PICTURE ABNORMAL

CHECK PINS 3, 6, 11, OF IC251

HIGH — FAILURE OF IC251
FAILURE OF AMBIENT

LOW

LOW — FAILURE OF IC254
FAILURE OF AMBIENT

CHECK PINS 4, 6, 10 OF IC254

HIGH — FAILURE OF TR251, TR252
TR253, TR1001
FAILURE OF AMBIENT CIRCUIT

IF ABOVE STEPS ARE NORMAL

CHECK CRT HEATER — **NO** — CRT HEATER DISCONNECTED
FAILURE OF HEATER CIRCUIT
FAILURE OF F.B.T.

OK

CHECK CRT CATHODE VOLTAGE — **HIGH** — CHECK EMITTER VOLTAGE OF TR251, TR252, TR253 — **NORMAL**

NORMAL — **LOW**

CHECK SCREEN VOLTAGE — **NORMAL 400V** — FAILURE OF TR251, TR252, TR253 AND AMBIENT CIRCUIT (ON MAIN PCB)
FAILURE OF IC251 IC254 AND AMBIENT CIRCUIT
FAILURE OF IC1001 INTENSITY CIRCUIT — FAILURE OF TR205, TR204 AND AMBIENT CIRCUIT

TOO LOW OR 0 VOLT — FAILURE OF CRT

FAILURE OF VR 491-2

DARK RASTER

CHECK SYNCHRONIZATION — **UNSTABLE SYNC** — FAILURE OF IC251, IC254
FAILURE OF AMBIENT CIRCUIT

STABILIZED

CHECK SUPPLY VOLTAGE OF CRT — **OK** — CHECK EMITTER VOLTAGE OF TR251, TR252, TR253

LOW HIGH VOLTAGE — **LOW EG2** — FAILURE OF VR491-2 — **LOW** — **NORMAL**

FAILURE OF H. DRIVE CIRCUIT
FAILURE OF H. O/P CIRCUIT
FAILURE OF F.B.T.

FAILURE OF VIDEO CIRCUIT — FAILURE OF TR205 AND TR204
FAILURE AMBIENT CIRCUIT

UNSTABLE VERTICAL

CHECK FREQUENCY VARIATION BY ROTATING V-HOLD

60HZ APPEARS BUT UNSTABLE

FAILURE OF C305

OSCILLATION FREQUENCY SHIFTS

FAILURE OF IC301
FAILURE OF C301

UNSTABLE HORIZONTAL

CHECK FREQUENCY VARATION WITH ROTATING H-HOLD

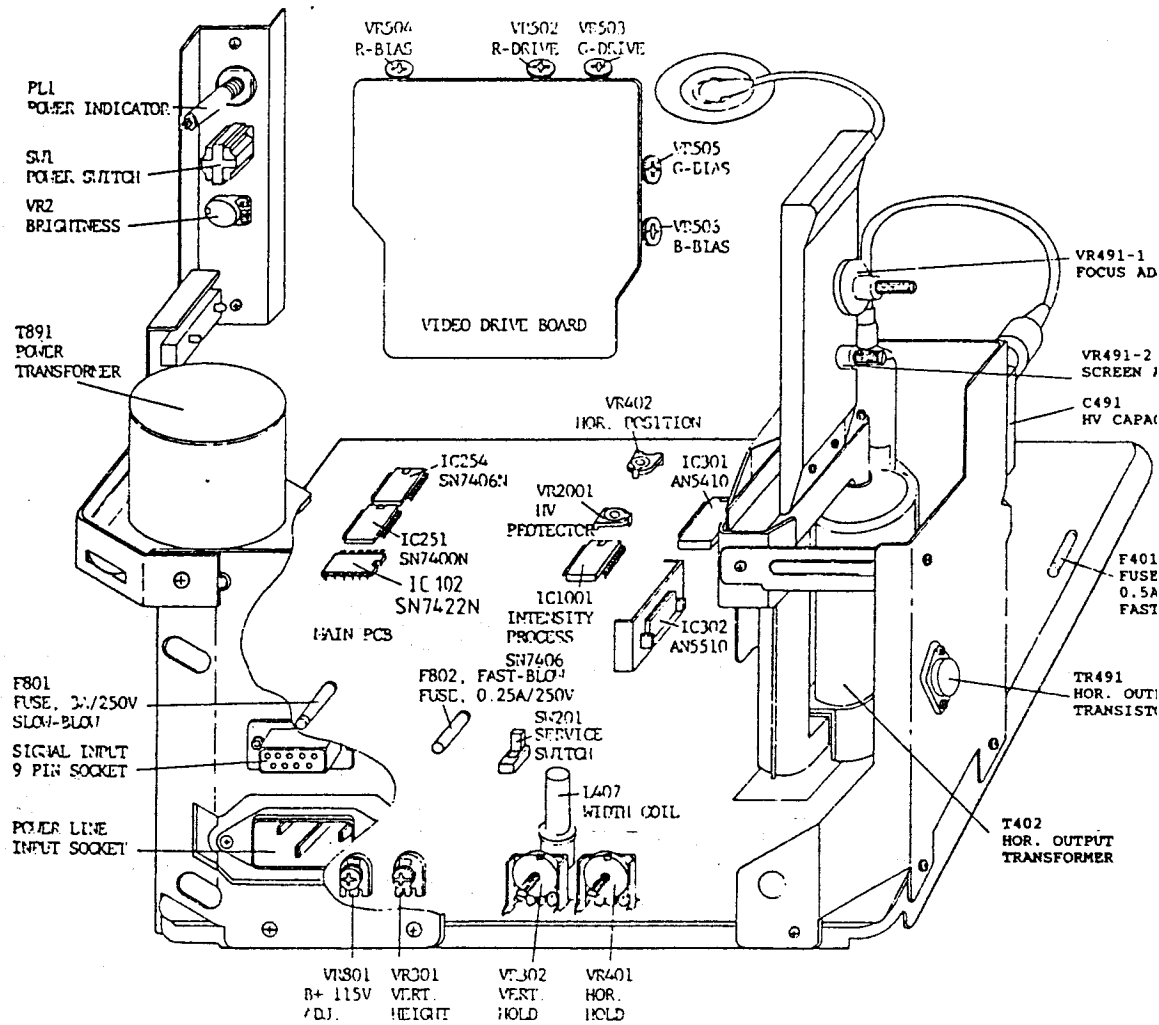
LACK OF HORIZONTAL SYNC

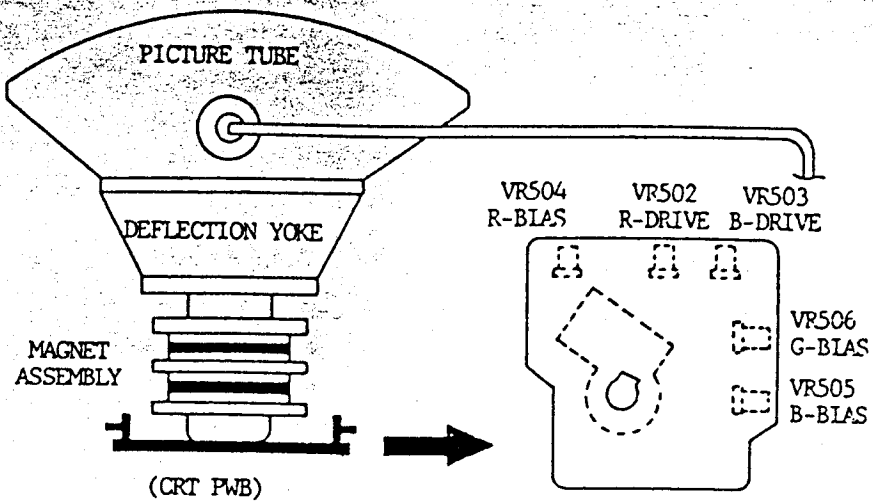
FAILURE OF IC301

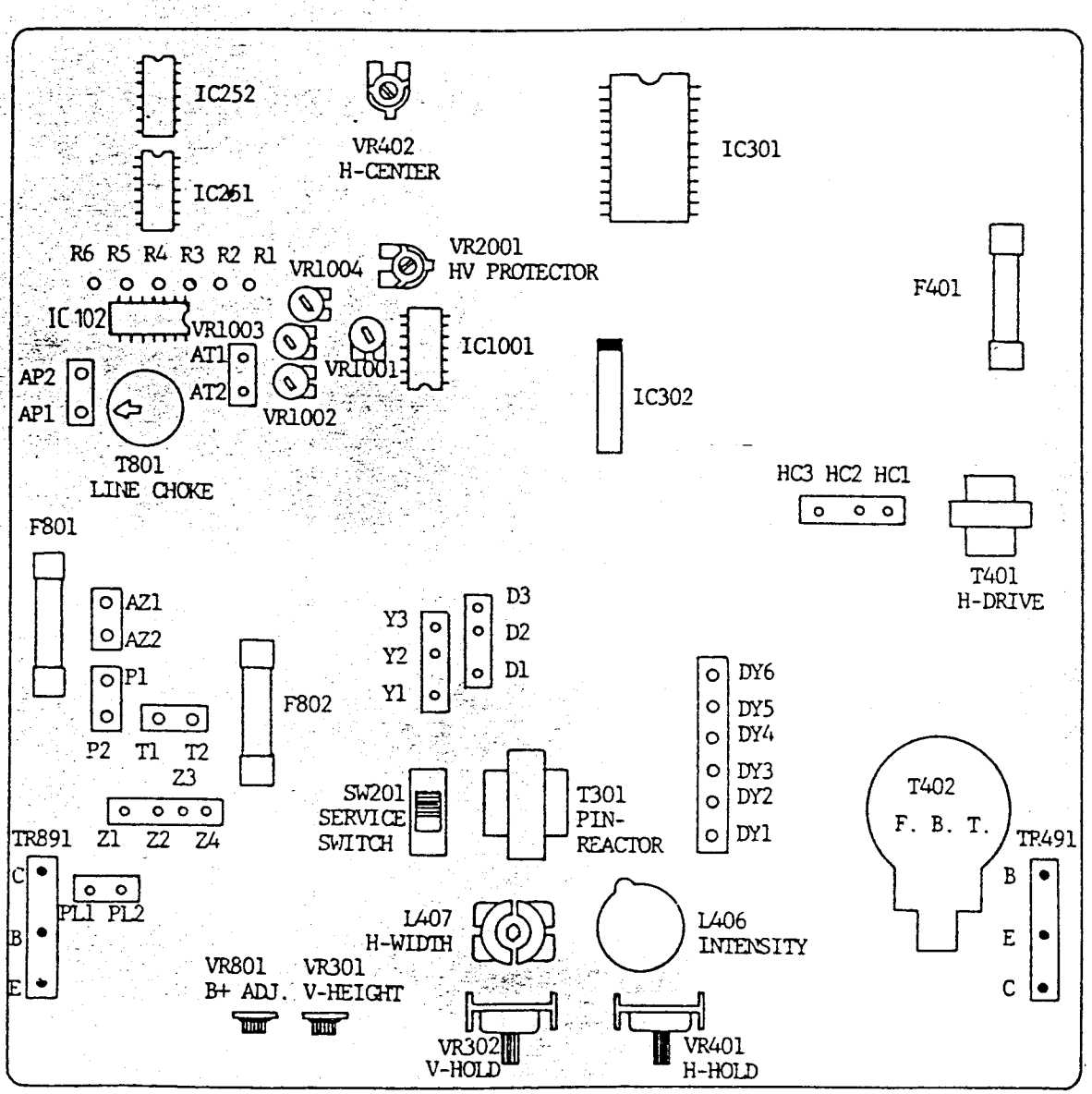
OSCILLATION FREQUENCY SHIFTS

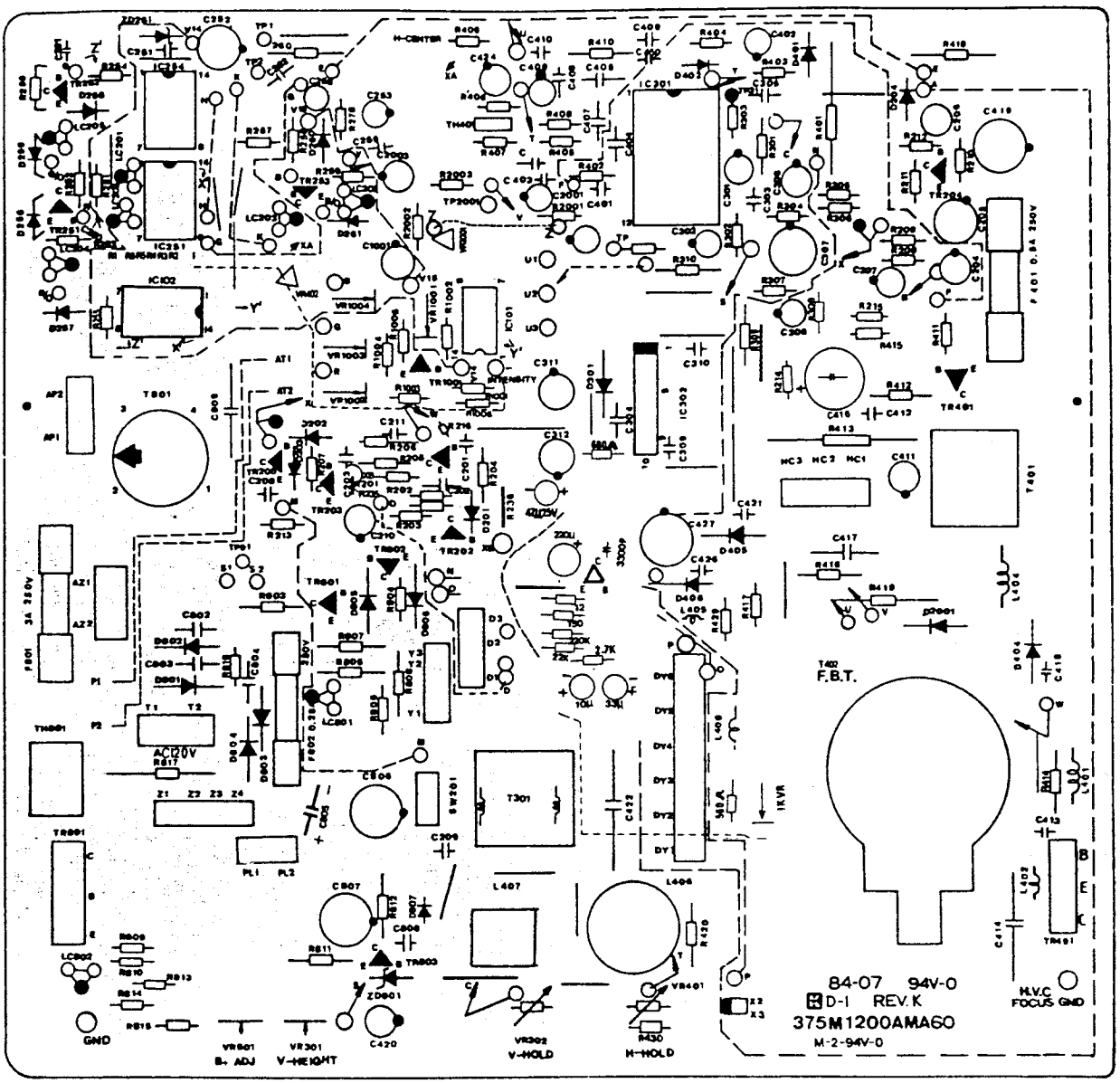
FAILURE OF C404 or C425
FAILURE OF IC301

Critical Components Layout




PICTURE TUBE
DEFLECTION YOKE
MAGNET ASSEMBLY
(CRT PWB)
VR504 R-BIAS
VR502 R-DRIVE
VR503 B-DRIVE
VR506 G-BIAS
VR505 B-BIAS


IC252
IC261
VR402 H-CENTER
IC301
R6 R5 R4 R3 R2 R1
VR1004
VR2001 HV PROTECTOR
F401
IC102
VR1003
AT1
AT2
VR1001
IC1001
AP2
AP1
VR1002
IC302
T801 LINE CHOKE
HC3 HC2 HC1
F801
T401 H-DRIVE
AZ1
AZ2
P1
P2 T1 T2
Z3
Z1 Z2 Z4
F802
Y3
Y2
Y1
D3
D2
D1
DY6
DY5
DY4
DY3
DY2
DY1
SW201 SERVICE SWITCH
T301 PIN-REACTOR
T402 F. B. T.
TR891
C
B
E
PL1 PL2
L407 H-WIDTH
L406 INTENSITY
TR491
B
E
C
VR801 B+ ADJ.
VR301 V-HEIGHT
VR302 V-HOLD
VR401 H-HOLD


84-07 94V-0
D-1 REV.K
375M1200AMA60
M-2-94V-0
F.B.T.
H.V.C
FOCUS GND
GND
B+ ADJ
V-HEIGHT
V-HOLD
H-HOLD
AC120V

MAIN PWB (BOTTOM VIEW)