15—INCH

MULTISCAN COLOR MONITOR

HL—5864

(Micro-Processor Controlled)
TECHNICAL SERVICE MANUAL

HYUNDAI

Excessive EHT (27Kv) will cause set to protect & shut down.

+24v/+55v rails must be correct.

Have modified R129 (1.5k) to 1.7k to ensure correct DC output.

CONTENTS

SAFETY PRECAUTION

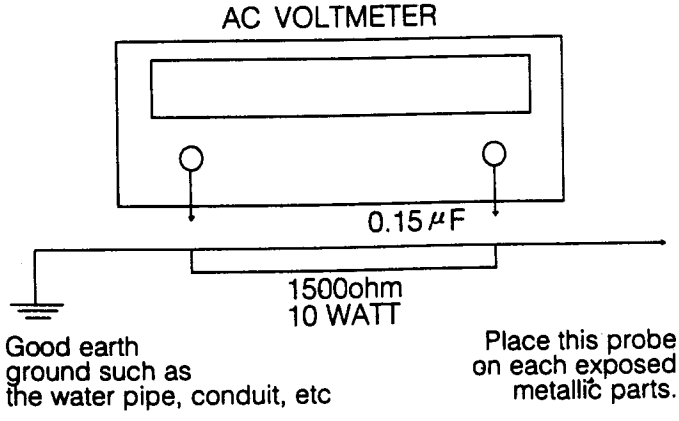
WARNING :

Service should not be attempted by anyone unfamiliar with the necessary precautions on this monitor. The following are the necessary precautions to be observed before servicing.

1. Always discharge the picture tube to the CRT conductive coating before handling the picture tube, The picture tube is highly evacuated and if broken, glass fragments will be violently exploded. Use shatterproof goggles and keep picture tube away from the bare baby while handling.

2. When replacing a chassis in the cabinet, always be certain that all the protective devices are put back in place, such as non-metallic control knobs, insulating covers, shields, isolation resistor-capacitor network etc.

3. Before returning the monitor to the customer, always perform an AC leakage current check on the exposed metallic parts of the cabinet, such as signal connectors, terminals, screw heads, metal overlays, control shafts etc, to be sure the monitor is safe to operate without danger of electrical shock. Plug the AC line cord directly into a AC outlet (do not use a line isolation trasformer during this check.). Use an AC voltmeter having 1500 ohm Per volt or more sensitivity in the following manner : Connect ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC Voltage across the combination of 1500 ohm resistor and 0.15 μF capacitor.
   Reverse the AC plug at the AC outlet and repeat AC voltage measurements for each exposed metallic part. Voltage measure must not exceed 0.3 volts RMS. This corresponds to 0.2 milliamp AC. Any value exceeded this limit constitutes a potential shock hazard and must be corrected immediately.



INSTRUCTIONS TO USER

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been tested and found to comply with the limits for the specifications in Subparts J of Part 15 FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is not guarantee that interfernce will not occur in a particular installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

* reorient the receiving antenna
* relocate the computer with respect to the receiver
* plug the computer into a different outlet so that computer and receiver are on different branch circuits.

X-RAY RADIATION PRECAUTION

1. Excessive high voltage can produce potentially hazardous X-RAY RADIATION. To avoid such hazards, the high voltage must be above the specified limit. The nominal value of the high voltage of this machine is 23.5KV±1KV at zero beam current (minimun brightness) under a 120V AC power sourece. The high voltage must not (under any circumstances) exceed 27.5KV. Each time a monitor requires servicing, the high voltage should be checked following the high voltge check procedure on this manual. It is recommended the reading of the high voltage be recorded as a part of the service record. It is important to use an accurate and reliable high voltage meter.

2. This monitor is equipped with a protection circuit which prevents the monitor from producing and excessively high voltage even if the B+ voltage increases abnormally. Each time the monitor is serviced, the protection circuit must be checked to determine that the circuit is properly functioning, following the protection circuit check procedure in this manual.

3. The only source of X-RAY RADIATION in this machine is the picture-tube.
   For continued X-RAY RADIATION protection, the replacement tube must be exactly the same type tube as specified in the parts list.

4. Some parts in this monitor have special safety-related characteristics for X-RAY RADIATION protection.
   For continued safety, parts replacement should be undertaken only after referring to the product safety notice.

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in this monitor have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can afforded the protection by them be necessarily increased by using replacements rated for high voltage, wattages, etc.

Replacement parts which have these special safety characteristics are identified in this manual ; electrical components having such features indentified in this manual ; electrical components having such features indentified by "!" and in the replacement parts list and schematic diagram.

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

SPECIFICATION

Items		HL 5864
CRT	Size	15", Diagonal, Flat
	Dot Pitch	0.28㎜
	Type	Non-Glare, Anti-Static
Input	Signal	R.G.B. Analog
	Connector	15Pin, D-Type
SYNC	H/F	30-66KHz(Automatic)
	V/F	50-90Hz(Automatic)
Video Bandwidth		85MHz(-3dB)
Display	Area(H×V) Color	260×195㎜(Max. 280×210㎜) Infinite
Resolution(H×V)		Max 1280×1024(64KHz/60Hz)
User Controls		Power Switch, Brightness, Contrast, H/V Size, H-Phase, V-Position, Pincushion, RECALL/SAVE
Power Management		As per VESA Standard, Lower than EPA recommended
Compatibility		VGA, S-VGA, 8514/A, XGA, EVGA
Power Source		100-240 VAC(Universal Power) 1.8A 100w (Max.)
Safety & Regulation	MPR Ⅱ	Basic
	EMI	FCC B, FTZ, CISPR
	Safety	UL, CSA, TUV-GS, ISO-9241-3, DHHS, PTB N. S. D. FI
Temperature	Operating	5 to 35 Degree Celsius
	Storage	-30 to 60 Degree Celsius
Humidity		Operating : 35% to 80% Storage : 30% to 85%
Weight		Unit : 12.8㎏ Carton : 14.3㎏
Dimension(W×H×D㎜)		360×367×385㎜

GENERAL INFORMATION

1. Description

This 15" color display monitor is operated in R, G, B, drive MODE input.

2. Operating instructions

2-1. External instructions

2-2. Front

Power Switch, Brightness, Contrast, H-SHIFT, H-SIZE, V-SHIFT, V-SIZE, Pin, RECALL/SAVE, Function LED, DPMS LED.

2-3. Rear

Input connection, (AC, SIGNAL CABLE)

2-4. Service Instruction(internal controls)

V-Linearity, Focus, Screen, H-Hold, H-Center, Sub Bright, Pinballance

3. Electrical

3-1. 100-240 Volt 60Hz, 50Hz for use all over the world.

This power supply is a 100 Watts multi output SMPS for monitor.

3-2. Video

Input : 0.7V p-p Analog signal(at 75 OHM TERMINATED)

Band width : 85MHz(-3dB)

Polarity : Positive

3-3. Horizontal Drive

Level : TTL High : 2.4V min

Low : 0.4V max

Polarity : Negative or Positive

Frequency : 30Hz~66Hz

3-4. Vertical Drive

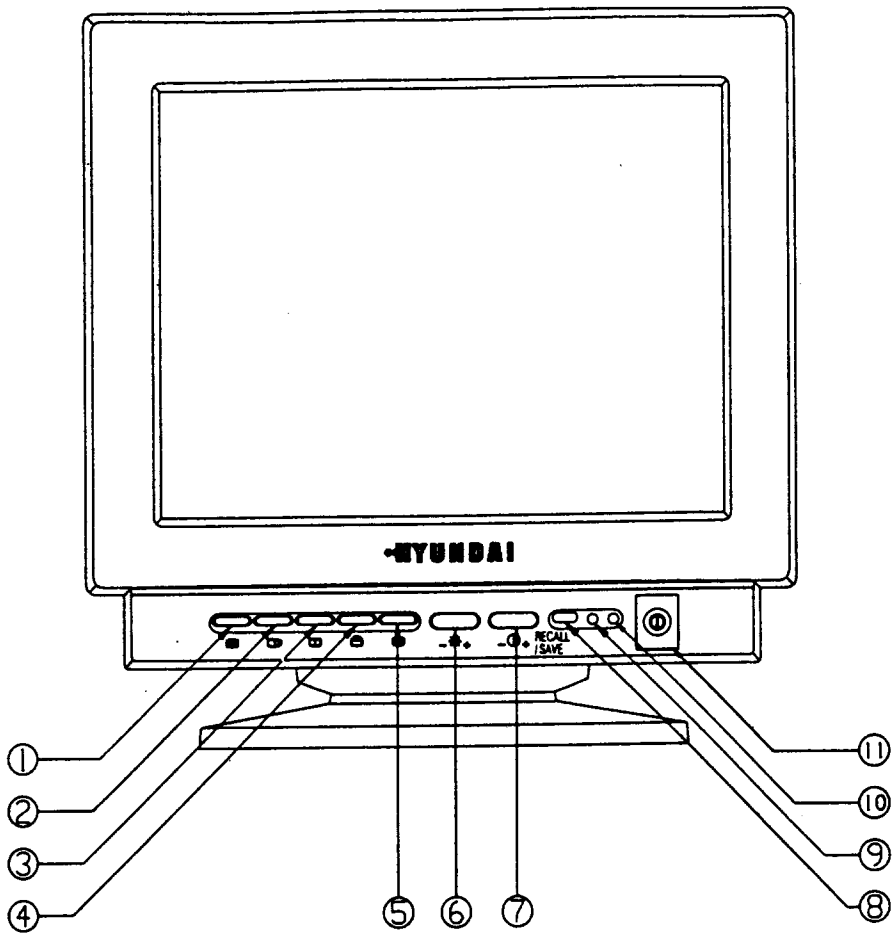
Level : TTL High : 2.4V min

Low : 0.4V max

Polarity : Negative or Positive

Frequency : 50Hz~90Hz

CONTROL DESCRIPTION



① H-Size Control
② H-Shift Control
③ V-Size Control
④ V-Shift Control
⑤ Pin Control
⑥ Brightness Control
⑦ Contrast Control
⑧ RECALL/SAVE
⑨ Save Indicator
⑩ Power Indicator
⑪ Power Switch

FRONT VIEW

VIDEO INPUT SIGNAL

Recommended signals are shown below.

- Signal level

  Video Level : 0 to 700mV

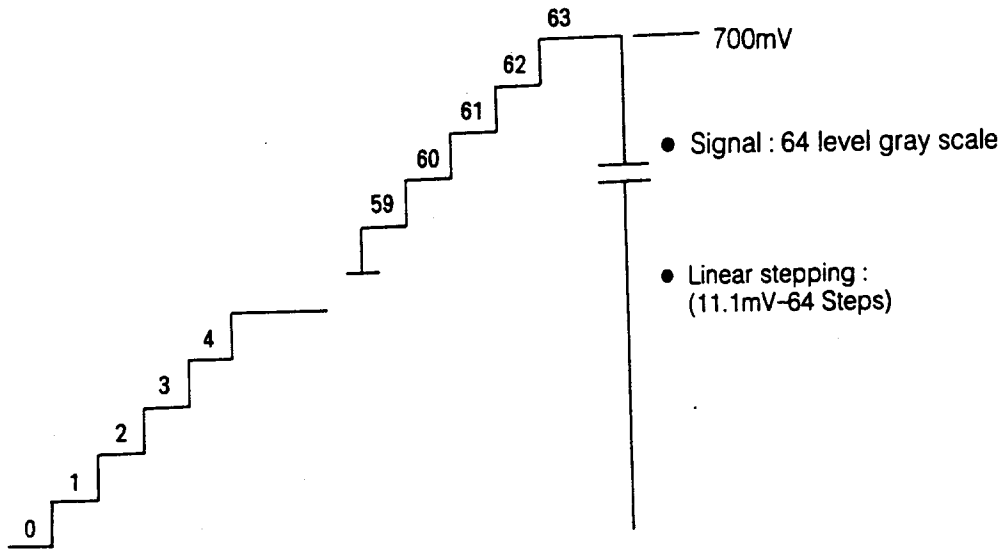
  Polarty : Positive

  Video Input :RGB separated
  Analog level

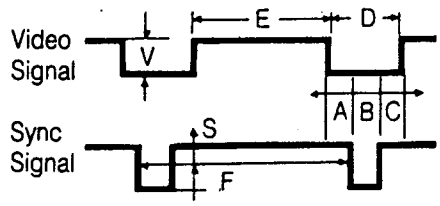
  Sync input : H-sync ; TTL level
  V-sync ; TTL level

- Wave from

  Video input(R, G, B)



A : Front Porch
B : Sync Period
C : Back Porch
D : Blanking Period
E : Display Period
F : Total Cycle
S : Sync Signal Level
V : Video Signal Level



Sync pulse. both for Horizontal and Vertical signals, has positive or negative(as shown here) Polarity combination to encode different modes.

640 Dot×350 Line Mode(VGA1)

	Unit	A	B	C	D	E	F
H	us	0.947	3.770	1.890	6.607	25.170	31.777
V	ms	1.200	0.064	1.880	3.144	11.126	14.270

Frequencies : fd/25.175MHz, fH/31.469KHz, fV/70.080Hz
Interlace : Non
Sync Polarity : H/Positive, V/Negative
Video Signal Level : $0.7V_{p-p}$. 75ohm

720 Dot×400 Line Mode(VGA2)

	Unit	A	B	C	D	E	F
H	us	0.947	3.770	1.890	6.607	25.170	31.777
V	ms	0.410	0.064	1.080	1.554	12.716	14.270

Frequencies : fd/28.322MHz, fH/31.469KHz, fV/70.080Hz
Interlace : Non
Sync Polarity : H/Negative, V/Positive
Video Signal Level : $0.7V_{p-p}$. 75ohm

640 Dot×480 Line Mode(VGA3)

	Unit	A	B	C	D	E	F
H	us	0.947	3.770	1.890	6.607	25.170	31.777
V	ms	0.353	0.064	1.020	1.437	15.246	16.683

Frequencies : fd/25.175MHz, fH/31.469KHz, fV/59.940Hz

Interlace : Non

Sync Polarity : H/Negative, V/Negative

Video Signal Level : $0.7V_{p-p}$. 75ohm

1024 Dot×768 Line Mode(8514/A & XGA)

	Unit	A	B	C	D	E	F
H	us	0.188	3.910	1.250	5.348	22.760	28.100
V	ms	0.014	0.113	0.558	0.585	10.810	11.495

Frequencies : fd/44.912MHz, fH/35.587KHz, fV/87.000Hz

Interlace : Non

Sync Polarity : H/Positive, V/Positive

Video Signal Level : $0.7V_{p-p}$. 75ohm

640 Dot×480 Line Mode(VGA/72Hz)

	Unit	A	B	C	D	E	F
H	us	0.875	1.250	4.375	6.500	20.000	26.500
V	ms	0.239	0.080	0.820	1.139	12.720	13.859

Frequencies : fd/31.500MHz, fH/37.736KHz, fV/72.153Hz

Interlace : Non

Sync Polarity : H/Negative, V/Negative

Video Signal Level : $0.7V_{p-p}$. 75ohm

800 Dot×600 Line Mode(SVGA/56Hz)

	Unit	A	B	C	D	E	F
H	us	0.666	2.000	3.559	6.225	22.219	28.444
V	ms	0.030	0.060	0.610	0.700	17.080	17.780

Frequencies : fd/36.000MHz, fH/35.156KHz, fV/56.250Hz

Interlace : Non

Sync Polarity : H/Posi/Nega, V/Posi/Nega

Video Signal Level : 0.7V_{p-p}. 75ohm

1024 Dot×768 Line Mode(EVGA/60Hz)

	Unit	A	B	C	D	E	F
H	us	0.770	1.000	2.957	4.727	15.950	20.677
V	ms	0.022	0.080	0.540	0.642	15.880	16.522

Frequencies : fd/60.000MHz, fH/48.363KHz, fV/60.500Hz

Interlace : Non

Sync Polarity : H/Negative, V/Negative

Video Signal Level : 0.7V_{p-p}. 75ohm

800 Dot×600 Line Mode(SVGA/72Hz)

	Unit	A	B	C	D	E	F
H	us	1.120	2.400	1.280	4.800	16.000	20.800
V	ms	0.770	0.125	0.479	1.374	12.480	13.854

Frequencies : fd/50.000MHz, fH/48.077KHz, fV/72.181Hz

Interlace : Non

Sync Polarity : H/Positive, V/Positive

Video Signal Level : 0.7V_{p-p}. 75ohm

1024 Dot×768 Line Mode(EVGA/56Hz)

	Unit	A	B	C	D	E	F
H	us	0.320	1.813	1.920	4.053	13.653	17.706
V	ms	0.053	0.106	0.513	0.672	13.599	14.271

Frequencies : fd/70.000MHz, fH/56.476KHz, fV/70.069Hz

Interlace : Non

Sync Polarity : H/Negative, V/Negative

Video Signal Level : $0.7V_{p-p}$. 75ohm

800 Dot×600 Line Mode

	Unit	A	B	C	D	E	F
H	us	1.000	3.200	2.200	6.400	20.000	26.400
V	ms	0.026	0.106	0.607	0.739	15.840	16.579

Frequencies : fd/36.000MHz, fH/37.879KHz, fV/60.310Hz

Interlace : Non

Sync Polarity : H/Positive, V/Positive

Video Signal Level : $0.7V_{p-p}$. 75ohm

1280 Dot×1024 Line Mode

	Unit	A	B	C	D	E	F
H	us	0.750	1.000	2.000	3.75	11.870	15.625
V	ms	0.020	0.080	0.570	0.739	16.000	16.670

Frequencies : fd/85MHz, fH/64.020KHz, fV/59.988Hz

Interlace : Non

Sync Polarity : H/Posi/Nega, V/Posi/Nega

Video Signal Level : $0.7V_{p-p}$. 75ohm

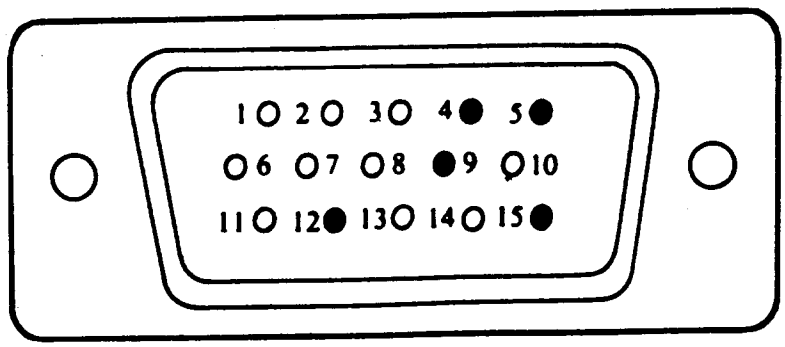
VIDEO INPUT TERMINAL

A 15 pin D-sub connector is used as the input signal connector.
Pin and input signals are shown in the table below.

Pin Description

SIGNAL / PIN NO.	SEPERATE SYNC	COMPOSITE SYNC	SYNC ON GREEN
1	RED	RED	RED
2	GREEN	GREEN	GREEN COMPOSITE SYNC
3	BLUE	BLUE	BLUE
4	-	-	-
5	-	-	-
6	RED GROUND	RED GROUND	RED GROUND
7	GREEN GROUND	GREEN GROUND	GREEN GROUND
8	BLUE GROUND	BLUE GROUND	BLUE GROUND
9	-	-	-
10	GROUND	GROUND	GROUND
11	GROUND	GROUND	GROUND
12	-	-	-
13	H-SYNC	COMPOSITE SYNC	-
14	V-SYNC	-	-
15	-	-	-

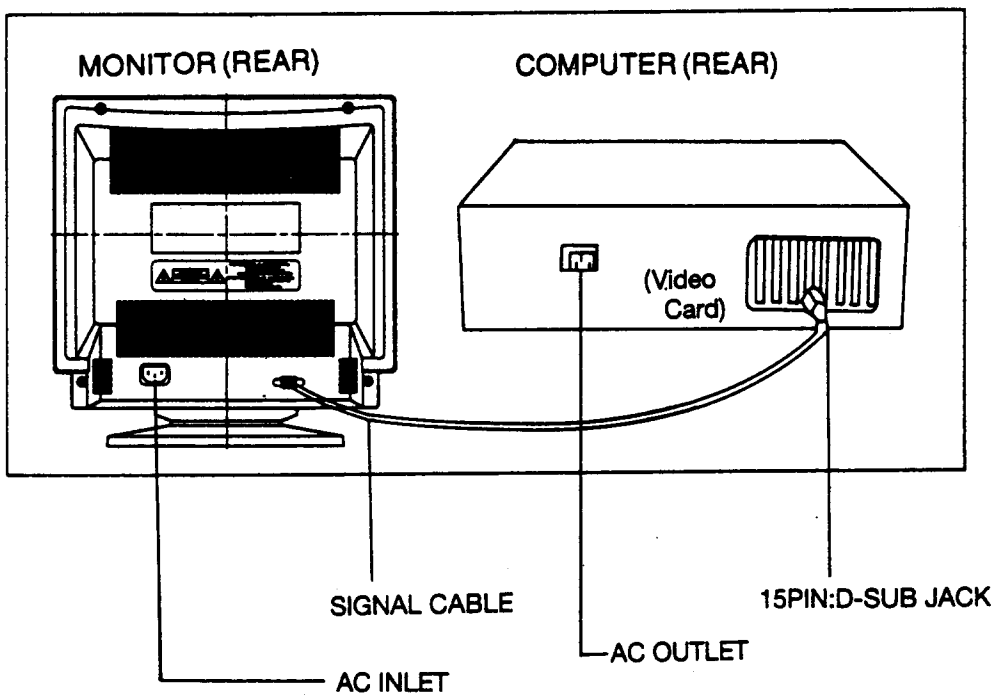
D-Sub miniature connector



CONNECTING WITH EXTERNAL EQUIPMENT

Cautions

Be sure to turn off the power of your computer before connecting the monitor.



THEORY OF OPERATION

1. Power Supply

The SMPS is a current mode controlled PWM flyback converter. The AC line voltage range is from 90V to 264V. The SMPS has +7.5V, +15V, -15V, +24V, +55V and +80V outputs with voltage feedback from +55V.

The inlet connector with a EMI filter is used to reduce the noise from the power supply. The conducted noise is filtered by inlet(P102), X and Y capacitors and a common mode line filter.

The input rectifier section(D102-105) converts the AC line voltage into a DC voltage to power the SMPS. UA3842(U101) is an integrated current mode PWM. It consits of an oscillator, error amplifier, current sense comparator, under voltage lock-out and an output MOSFET driver stage. The switching frequency is locked to horizontal scan frequency by a pulse transformer(T103).

The power supply has two parts of main and co-power supply. The main power supply works in normal mode and co-power supply in DPMS mode (OFF state). A standard ringing choke convrter is used as co-power supply. At first C147 is charged to 15V and U101 starts to switching. AT that time the OFF signal stay HIGH by MCU(pin 32) Then Q103 is turned on, U102 can not operate. When the MCU detects OFF mode, Pin 32 is changed to LOW. It turns Q105 off, U101 pin1 is changed to LOW and Q101 is turned off. At last the main power supply do not operate. It cause Q103 turn-off, so U102 starts to work. The co-power supply delivers energy for MCU and sync processing circuit during OFF mode. The total power consumption must be less than 5 watts in Off mode. The DPMS function contains another mode, SUSPEND. When the MCU detects SUSPEND mode, pin 22 is changed to LOW. Then Q107, Q105 are turned off. So 12V line is not active.

2. Signal Processing and MCU Control

U601, a XOR TTL gate is used for sync signal and polarity buffer. The sync polarity is used to detect VGA mode. Q602-4 operate as sync seperater for sync on green signal and Q605-7 for TTL composite sync.

The positive goning H-sync is input to U603 a frequency divider. V-sync and divided H-sync are input to MCU. MCU can measures the H and V frequency to detect the video mode. MCU has digital to analog converter

(DACs) control function like brightness, contrast, pincushion, H/V size, H/V shift. And the external DAC(U602) is used for other controls like key-stone, R/G/B cut-off, R/B drive. Three parallel ports (pin 7, 8, 10) is used to set the size of flyback capacitor and S correction capacitor.

When power is on or input signal is changed, MCU generates a high voltage shut down signal (pin 15, DC/DC) to pevent unexpected damage. This DC/DC signal, one shot pulse for 100mSec is apllied to Q315, 314. Then the H.V feedback (U303 pin5) is changed to 24V. So the H.V is shut down for 100 -300m Sec.

3. Horizontal Deflection

TDA9102C (U301) is a monolithic IC for H/V svnc and drive processing. In phase comparator between sync and oscillator(PLL1), phase comparator between flyback and oscillator(PLL2), DC controls for phase and frequency setting.

When H-sync applied, the internal oscillator is automatically locked. PLL2 output pulse at U301 pin5 is filtered and input to the OP-AMP(U403). A simple frequency to voltage converter is built around the OP-AMP U403(2/4). This voltage drives U301 pin1, H-frequency adjust terminal. The duty cycle of H-output pulse(pin7) is 43%.

The base drive of H-output TR(Q310) is always turn-on condition. When the driver FET(Q311) is turned on, the H-output TR contucts current through the deflrction yoke onthe right hand side of the screen. This current comes from the S correction capacitors, which have a charge equal to the effective supply voltage. When the drive FET is opened up, the damper diode allows current for left hand side of the screen to flow back through the deflection yoke to the S caoacitors.

The flyback capacitors (C328, 355) determin the size and length of the flayback pulse. A FET (Q324) selects the value of capacitor. The S capacitors correct outside versus center linearity in the horizontal scan.

Three FETs (Q317, 319, 321) selects the value of S capacitors. H-centering is controlled by a switch (S301). The switch selects DC offset current flow through the yoke.

A diode moulator is used to control the E-W correction and H-size. TDA4950 (U402)generates the E-W parabola wave using vertical ramp. LM 3080(U404) is a OP-AMP which able to control amplitude by DC voltage. A DAC is used

to control the amplitude of E-W parabola ; pincushion. And another DAC used to control the DC level of E-W parabola ; H-size. A power buffer (Q312 darlington) drives the diode modulator.

In order to keep the high voltage constant indepandent of the horizontal scan frequency, the supply voltage of FBT must increase with increasing scan frequency proportionally. A step-up mode DC//DC converter with PWM is used to realize this demand. A OP-AMP (U303) compares H.V feedback with H-saw tooth wave. Its output pulse switches a FET(Q309). To adjust the H.V, another OP-AMP controls the gain of feedback voltage.

4. Vertical Deflection

In vertical section of TDA9102C (U301), there is auto-sync processing same way of horizontal section. The vertical sync is applied to a simple F-V converter. This voltage is used to compensate the vertical oscillation(pin12) and vertical S correction(pin17). The vertical ramp is not condtant in different vertical frequency. So there is ampltude correction circuit in this application (U403 4/4).

The vertical output stage consists of a power OP-AMP with extra flyback grnerator. TDA8172 is used as vertical output stage.

5. X-ray Protection and Beam Current Limiting.

A failure in the horizontal scan control section could cause a dangerous situation ; the high voltage might rise to an uacceptable high level. When the flyback voltage rise to unacceptable level, the thyristor consisting of Q303, 304 forces U301 pin5 high. It causes the H-drive stage and oscillator to be turned off. Then high voltage is shut down until the power switch is.

The average anode curren is measured at lower side of the H.V winding of the FBT. the anode current flows through resistor R337, 338, connected against +12V. When the anode current increases, the voltage across R337 increases also. The base voltage of Q313 drops and the BCL will be active.

6. Video Amplifier

LM1205 is a wide band video amplifier with three matched video amplifiers, contrast control, brightness control, drive and cut-off controls, blanking gate and clamp gate. H and V blank signal is applied to pin13. During blanking all three outputs are thrown to the pedestal level. A one shot multivibrator

(U202) is used to generate a back-porch clamp signal. This signal is applied to pin 14.

The output stage is made of descrete power amplifier. The output capale of 40 volts swing in less than 5n Sec. To get good video response, emmiter followers and peaking components are used.

The three cathodes are AC coupled to the video amplifiers. The DC level on each cathode is set by a cut-off amplifier and clmap diode. The value of the DC voltage is adjusted by DACs.

TROUBLE SHOOTING

1. Introduction

This troubleshooting guide is arranged by fault conditions. Following each fault condition is a check for a signal on condition to be answered YES or NO. For NO answer proceed to the right and continue until the fault is located. For a YES answer continue in the left column to the next numbered check. Again followed this procedure until the fault is located.

2. Precaution for Troubleshooting

When Troubleshooting this monitor, some precaution should be observed.

Ise a high quality isolation transformer capable of providing 3 Amps or more.

Never connect primary ground and secondary ground together including use with an isolation transformer.

Measure high voltage with respect to chassing ground only, and with a high impedance prove of 1000 mega-ohm or higher and rated for 30KV DC or higher.

Weasure Q311 collector pulse with a high quality 100:1 probe rated for 1500 volts or higher.

3. Troubleshooting procedure

Symptom	Ckeck(YES)	Action(NO)
a) Image is scrolling.	1) Check for Vsync at pin 9 of U604. 2) Check for negative going Vsync at pin 14 of U301. 3) Will V-oscillator is locked with input signal? (pin 13 of U301) 4) Check V-ramp at pin 15 of U310.	Check 15pin D-sub connector, cable, D609, D602. Check Q305, U604, Q606, Q607. Check C405, R411, R409, R410, Q401, U403. Replace U301.
b) Image is unstable.	1) Check for Hsync at pin 2 of U604 2) Check for negative going Hsync at pin 4 of U301. 3) Will H-oscillator is locked with input signal? (pin 2 of U301)	Check 15pin D-sub connector, cable, D608, D601, Q601. Check Q306, U604. Check R304, C308, R302, R301, V301, Q301, U403, Q302

Symptom	Ckeck(YES)	Action(NO)
	4) Check for flyback pulse at pin 8 of U301 5) Check monostable pulse at pin 7 of U301.	Check R309. Replace U301.
c) Screen is black but high voltage is present.	1) Check for G2, pin4 of CRT. Around 540 volts? 2) Check for heater voltage at pin 7 of CRT. 3) Can screen be lit with brightness control at MAx? 4) Check for video at pin 4, 6, 9 of U201. 5) Check for negative pulse for clamp at pin14 of U201. 6) Check if contrast controls video level at pin 17, 20, 26 of U201. 7) Check for video at base of Q202, Q209, Q214. 8) Check for video of collector of Q203, Q208, Q213. 9) Check if R, G, B cut-off control the video DC level at pin 4, 6, 9 of CRT. 10) Check CRT.	Check R254, G2 wire, CRT socket. Check D204, R140, D124, CRT socket. Check P202, D317, Q322, D312, D313, D323, D338, U304 CRT scocket. Check 15pin D-sub connector, cable, D220-225. Check U202. Check U601, R613, R606, C606. Check P201. Check Q202, Q209, Q214, Q203, Q208, Q213. Check D204-6, D214-7, Q205 Q209-12, Q215-7, U203, P202
d) Screen is black with no high voltage.	1) Check for 55v at cathode of D114. 2) Check for 12V at pin 3 of U106. 3) Check for 24V at cathode of D121. 4) Check for 5V at pin 3 of U109. 5) Check for monostable pulse at gate of Q311. 6) Check for base drive of Q310. Around 3V? 7) Check collector pulse of Q310. 8) Check feedback voltage at pin 5 of U303. Around 11V? 9) Check T301(FBT), Yoke.	Check 55V with no load. If no 55V, Check SMPS. If 55V OK, Check Q309, Q310, Q311, D303, D332, D304 Check 12V with no load. If no 12V, Check Q107, Q106, D122, SMPS. If 12V OK, Check U301, U401, U302, U304, U305, U201 Check U402, 303, D121, SMPS Check D126, U601, U604, U602, U202, U603. Check U301. Check D124, R333, R401, D335-7, Q310. Q310, Q311, D303, D304, D332. Check D306, R335-6, D311, R354, Q314-5, U303.

ADJUSTMENT METHOD

1. Caution

Extremely high voltages are present in the area around the FBT(T301) and the anode high voltage lead. Do not touch Q102 or its heatsink as high voltage is present on these components.

2. Equipment Required

Alignment Template
Video Signal Source : Video Signal Geneator
Digital Voltmeter
Screw Driver : + -
TV Analyzer or equivalent
High Voltage Meter : up to 30KV

3. Before Adjustment

Verify that the video output level is 0.7Vpp at 75 ohm termination and the video timmings are same as standard timing given in specification.
Place the AC power switch to the ON position. Allow the monitor to stabilize thermally for 15 minutes at least before any adjustment about the image parameters. The electron optics of the CRT and electronics of system require time to stabilize.

4. Adjustment Procedure

4-1 High Voltage Setting
- Video signal : cross hatch pattern in 31KHz
- Set the brightness and contrast controls to the minimum position.
- Measuring point : Between chassis and anode cap.(Use H.V meter)
- Adjudtment : VR302, main board
- Limits : 24.5KV + - 0.5KV

4-2 Screen Voltage Setting
- Video signal : cross hatch pattern in 31KHz
- Set the brightness and contrast controls to the minimum position.
- Measuring point : Between chassis and G2 on the CRT board(Use H.V

meter)

– Adjudtment : Screen VR, lower VR of FBT

– Limits : 540V + - 10V

4-3 Horizontal Frequency

– Video signal : cross hatch pattern in 31KHz

– Measuring point : Between ground and TP1(Use DVM)

– Adjustment : VR301, main board

– Limits : 3.4V + - 0.2V

4-4 H-size Presetting

– Video signal : cross hatch pattern in 48KHz, 1024×768 mode

– Set the H-size control to the maximum position.

– Adjustment : VR302, main board

– Limits : Match Both side of the image to the front bezzel.

4-5 Image Geomatry Setting

– Connect the pin 4 and 5 of P602.(FACTORY SET function)

– Video signal : cross hatch pattern in each mode

– Adjust the Geometries using the user controls.
(H-size, H-shift, V-size, V-shift, Pincushion)

– Screen size : 260(H)×195(V) + - 5㎜

– Connect the pin 4, 5 and 6 of P602.(DOUBLE KEY function)

– Adjust the Key-stone using RECALL/SAVE key.

4-6 White Balance

– Connect the pin 4, 5 and 6 of P602.(DOUBLE KEY function)

4-6-1 Cut-off settings

– Video signal : Black pattern in 31KHz.

– Set the brightness control to 0.5 F/L.

– Adjust the White balance using the R, G, B cut-off controls
(See the figure of DOUBLE KEY function.)

– Limit : X=0.281, Y=0.311 + - 0.02

4-6-2 Drive setting

– Video signal : Normal White pattern in 31KHz.
(Input video level is 0.5Vpp)

– Set the Brightness control to minimum, Contrast to 3 F/L.
– Adjust the White balance using the R, B drive controls.
– Limit : X=0.281, Y=0.311 + - 0.02

4-6-3 Brightness setting
– Video signal : Black pattern in 31KHz.
– Adjust the Brightness using the Bright control key.
– Limit : Visible to 0.5 F/L MAX

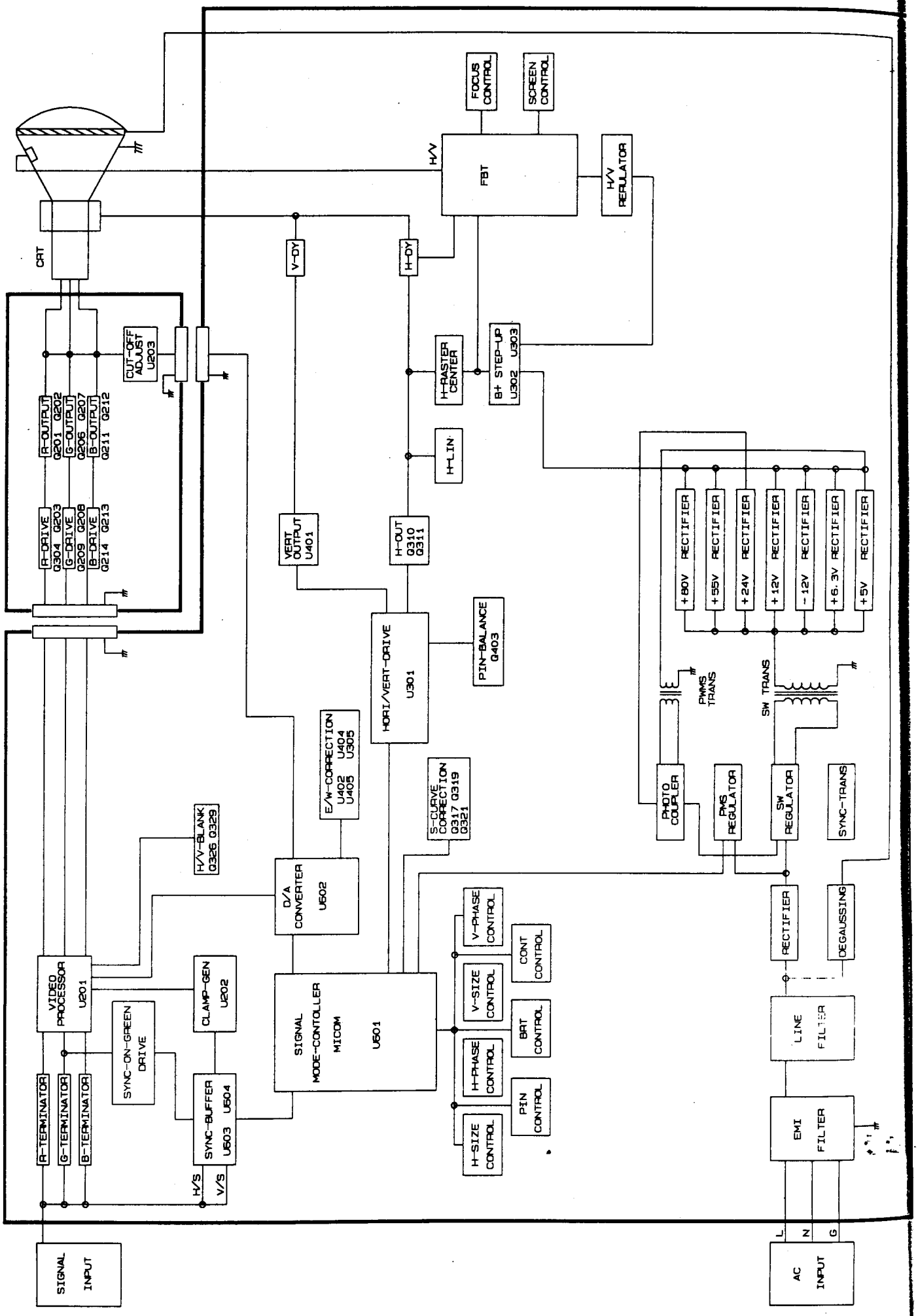
4-6-4 Contrast setting
– Video signal : Normal white pattern in 31KHz.
– Adjust the Brightness using the Contrast control key.
– Limit : 24 F/L MIN
– After adjusting White Balance, disconnect the pin 4,5 and 6 of P602.
Verify the image is not saturated when the Contrast and Bright control is maximum.

4-7 Focus
– Video signal : 'H' character pattern in 56KHz, 1024×768 mode.
– Set the Brightness control to back-raster cut-off, Contrast control to maimum.
– Adjust the Focus VR on the top of the FBT so that the image of whole screen looks clear.

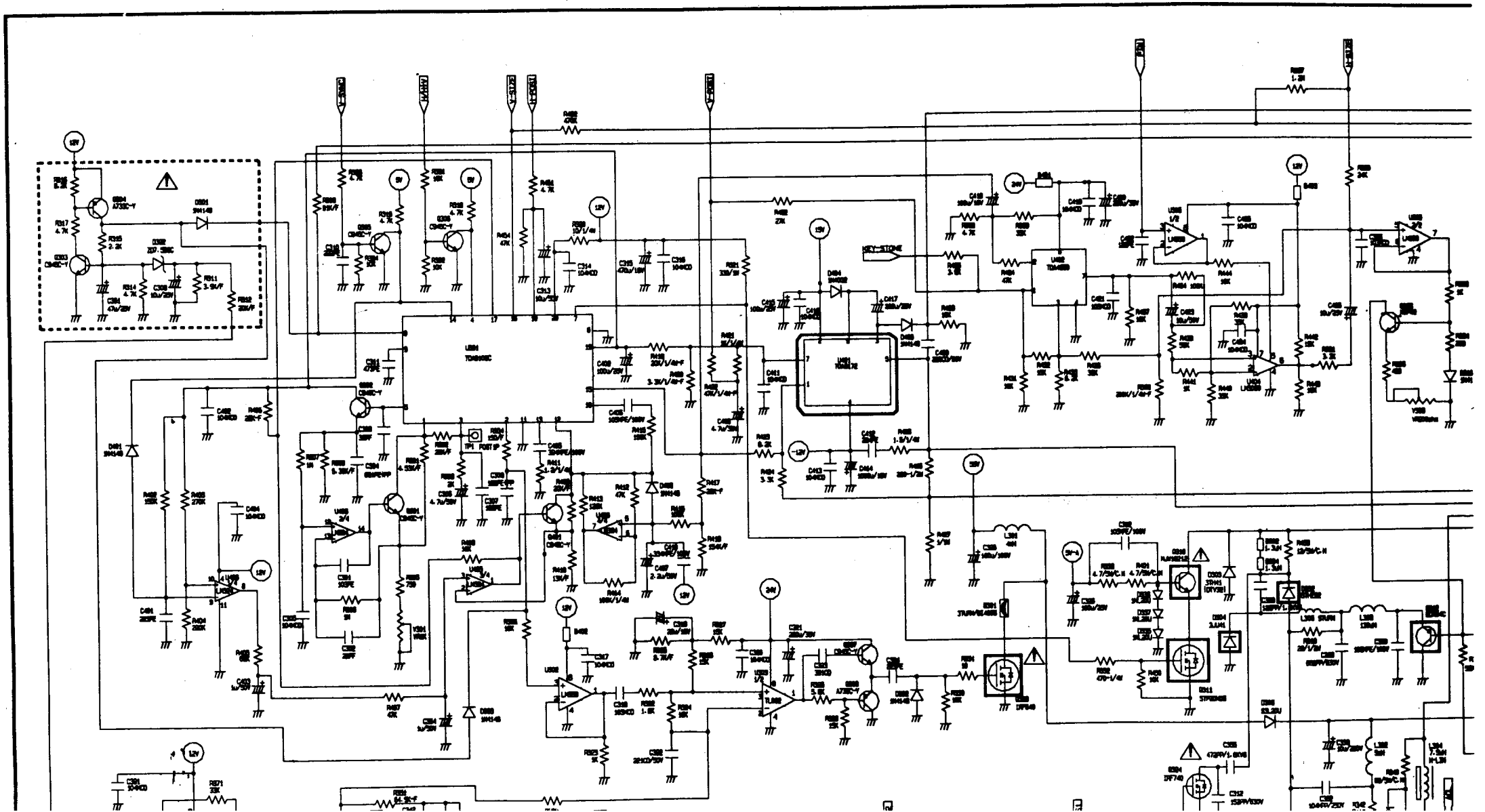
4-8 Static Convergence
– Use a white cross hatch pattern and set the contrast and brightness to obtain a well defined image. Observe the position of the convergence magnets. For each magnet pair, adjust the two tabs to improve the convergence across the screen.
– Turn the Two tabs of the 4-pole magnets seperately to align the red and blue vertical lines.
– Turn the two tabs of the 4-pole magnets as a pair(together) and align the red and blue horizontal lines.
– Turn the two tabs of 6-pole magnets seperately to superimpose the red/blue vertical lines with the green line.
– Turn the two tabs of the 6-pole magnets together to superimpose the red/blue horizontal lines with the green line.

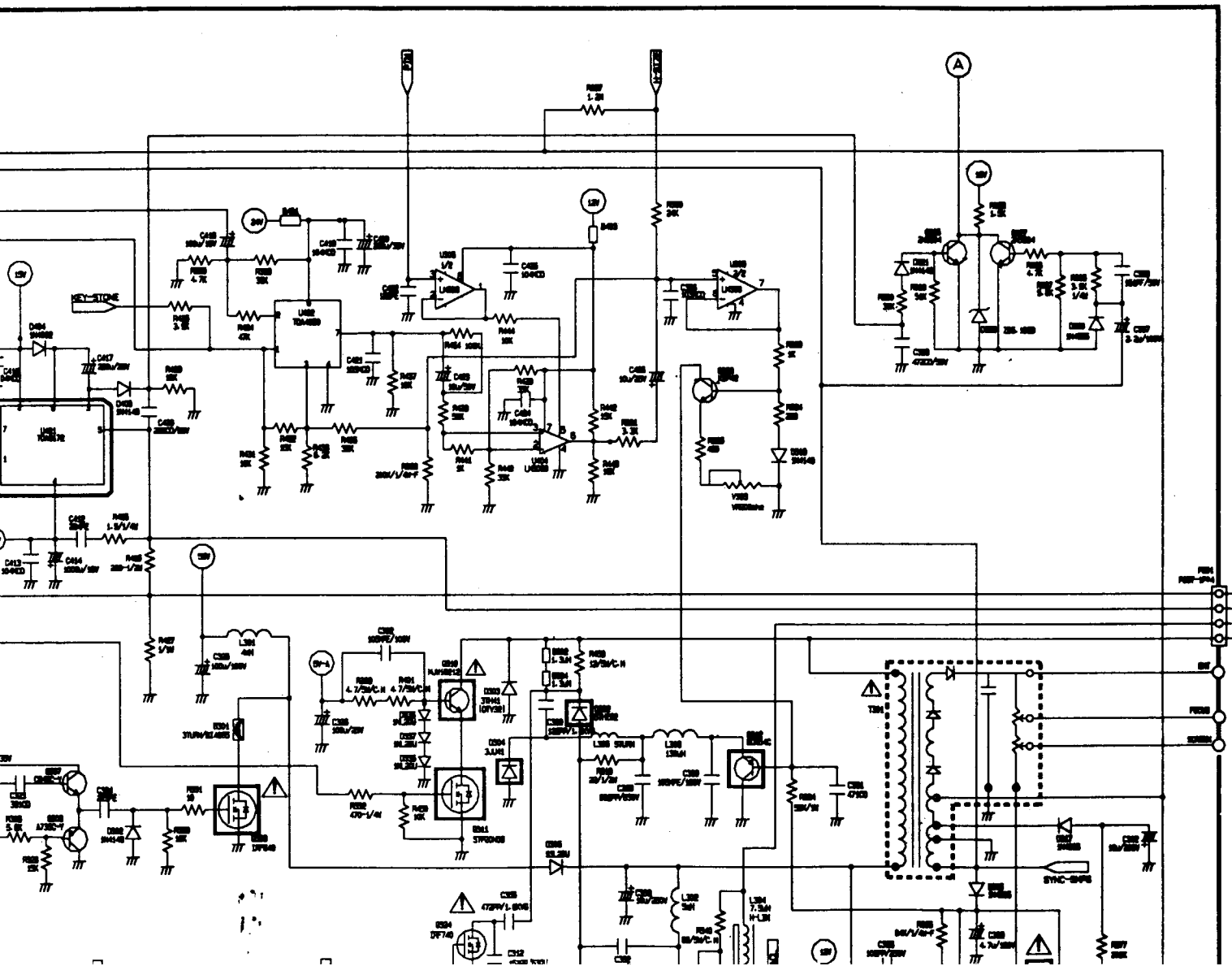
– These adjustment are not orthogonal, the procedure need to be iterated for best result.

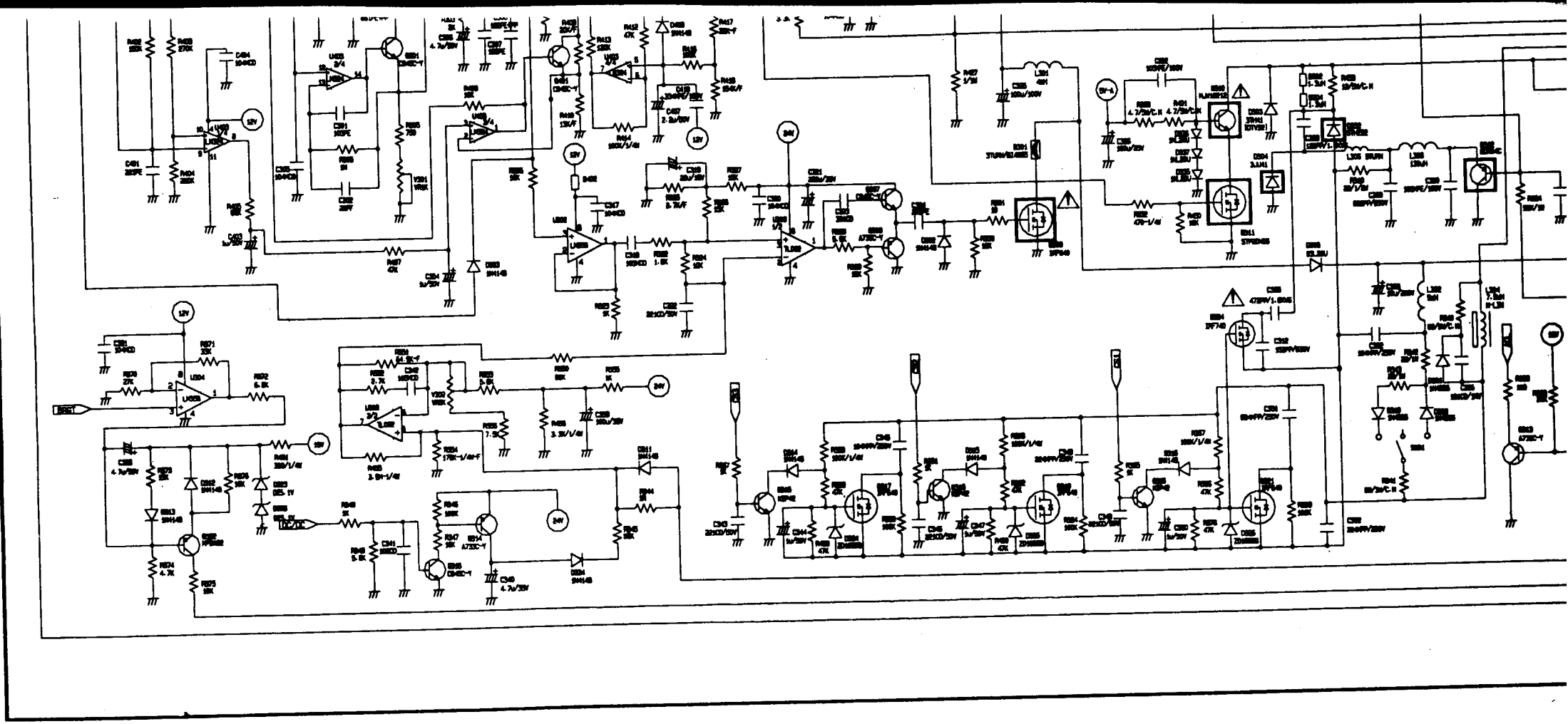
BLOCK DIAGRAM

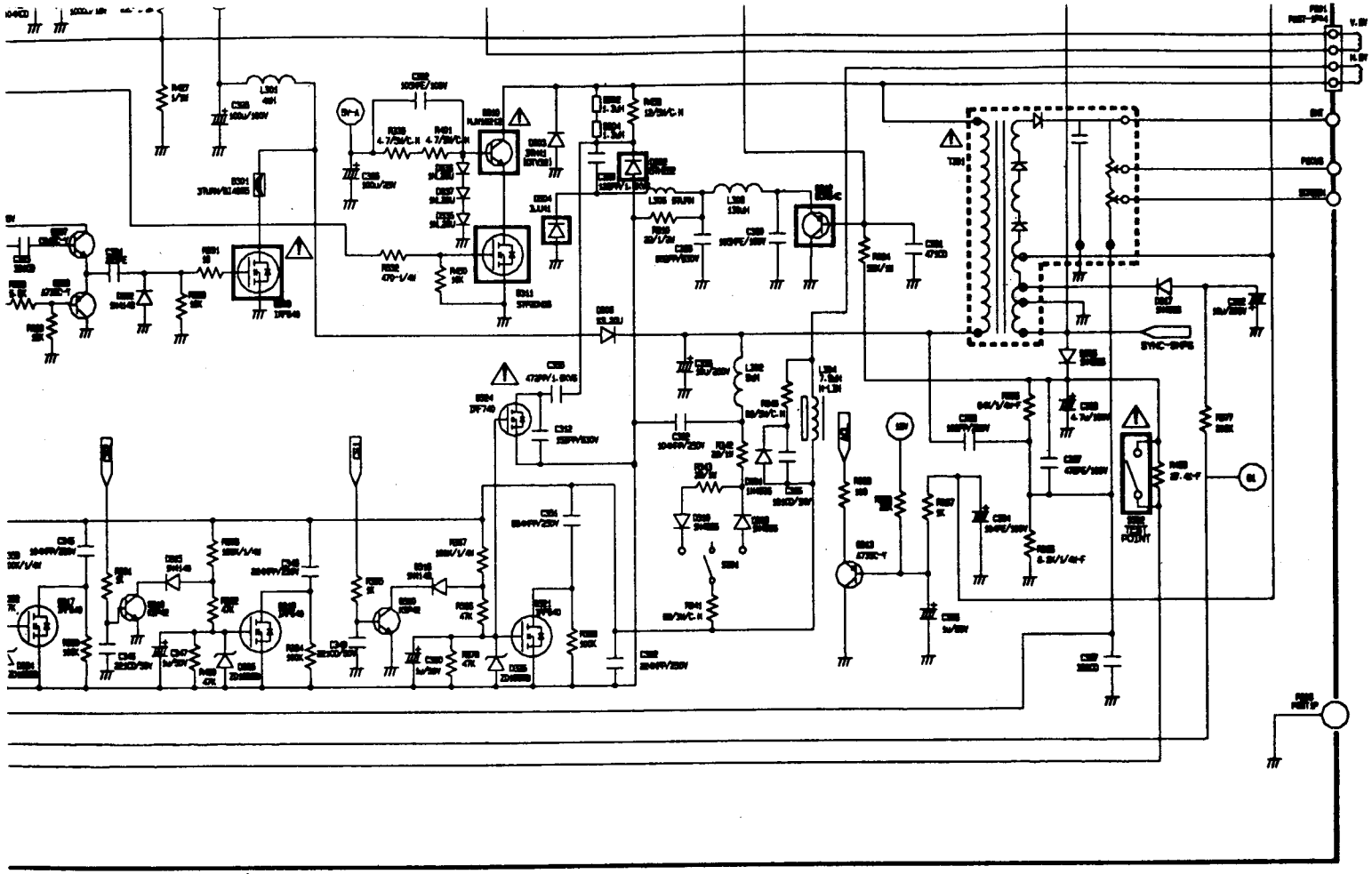


SCHEMATIC DIAGRAM

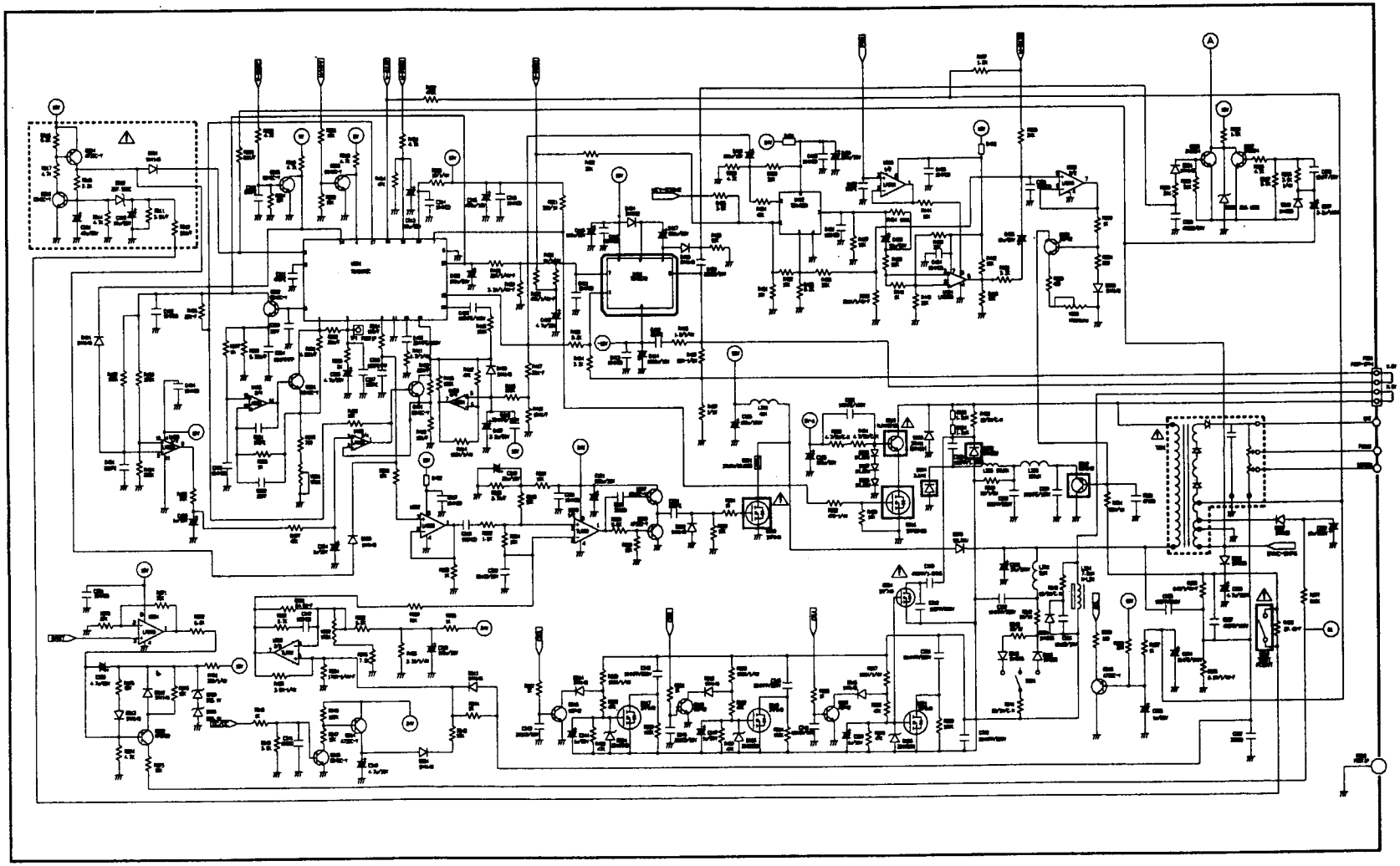




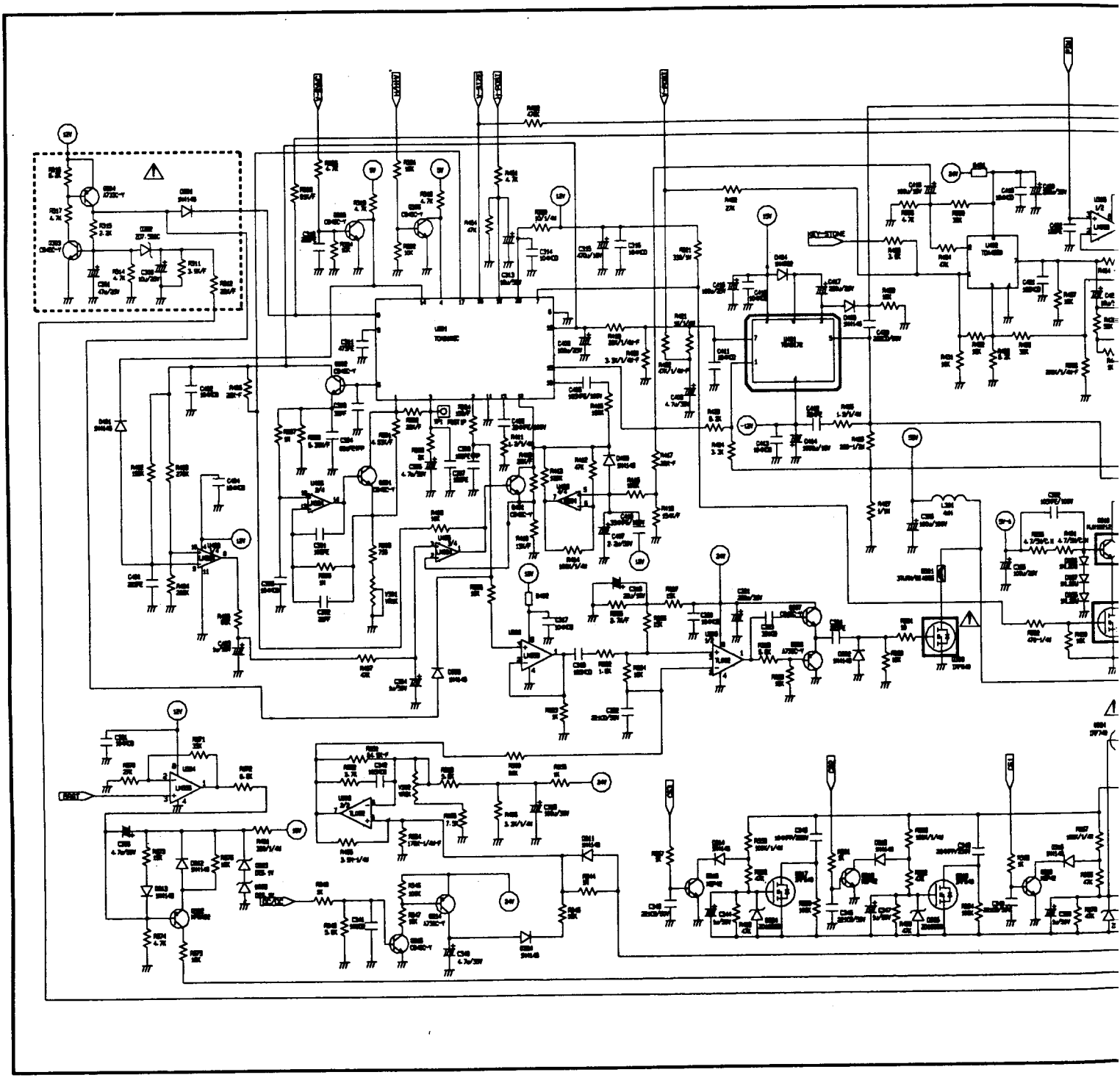


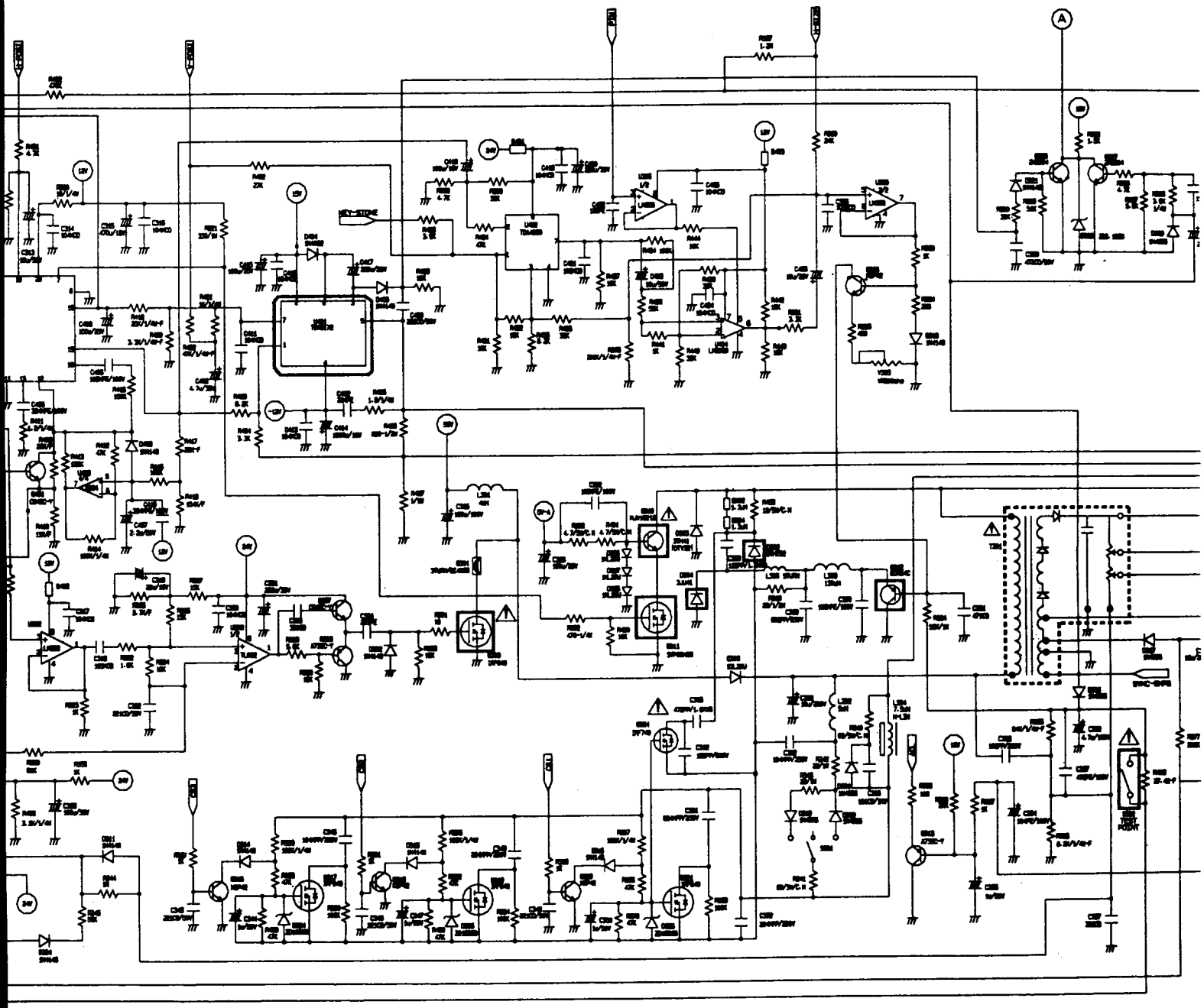


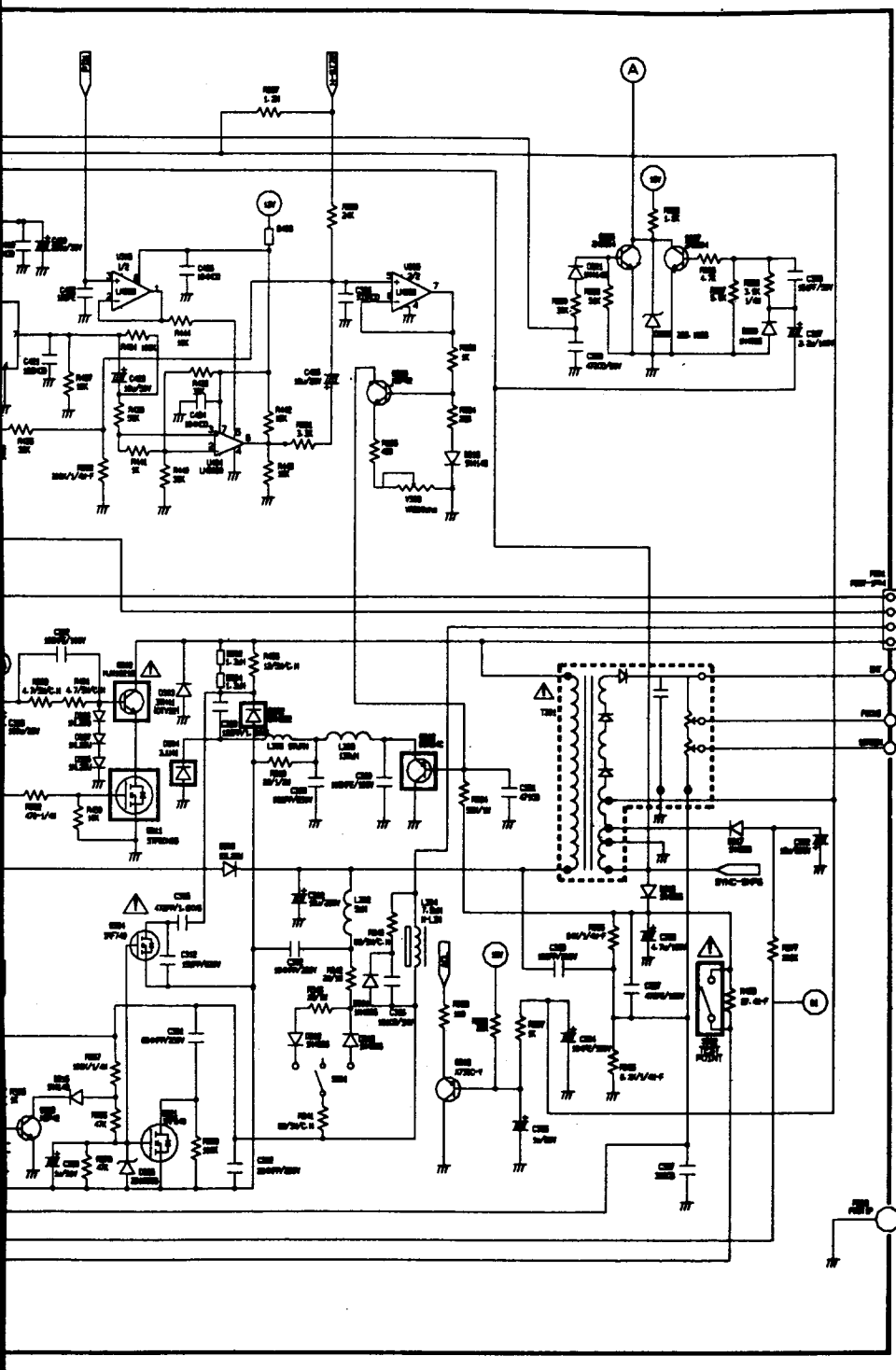
SCHEMATIC DIAGRAM



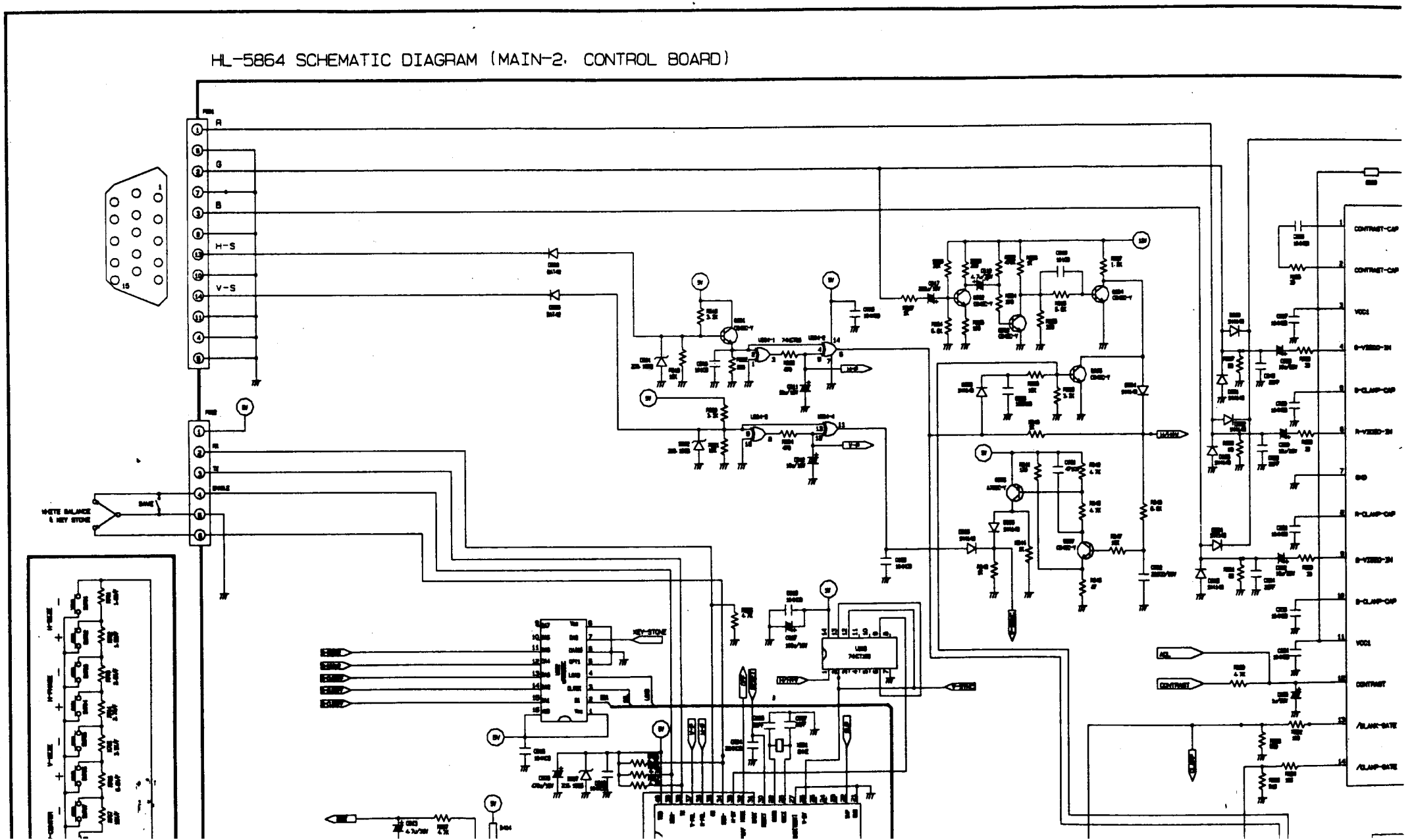
SCHEMATIC DIAGRAM

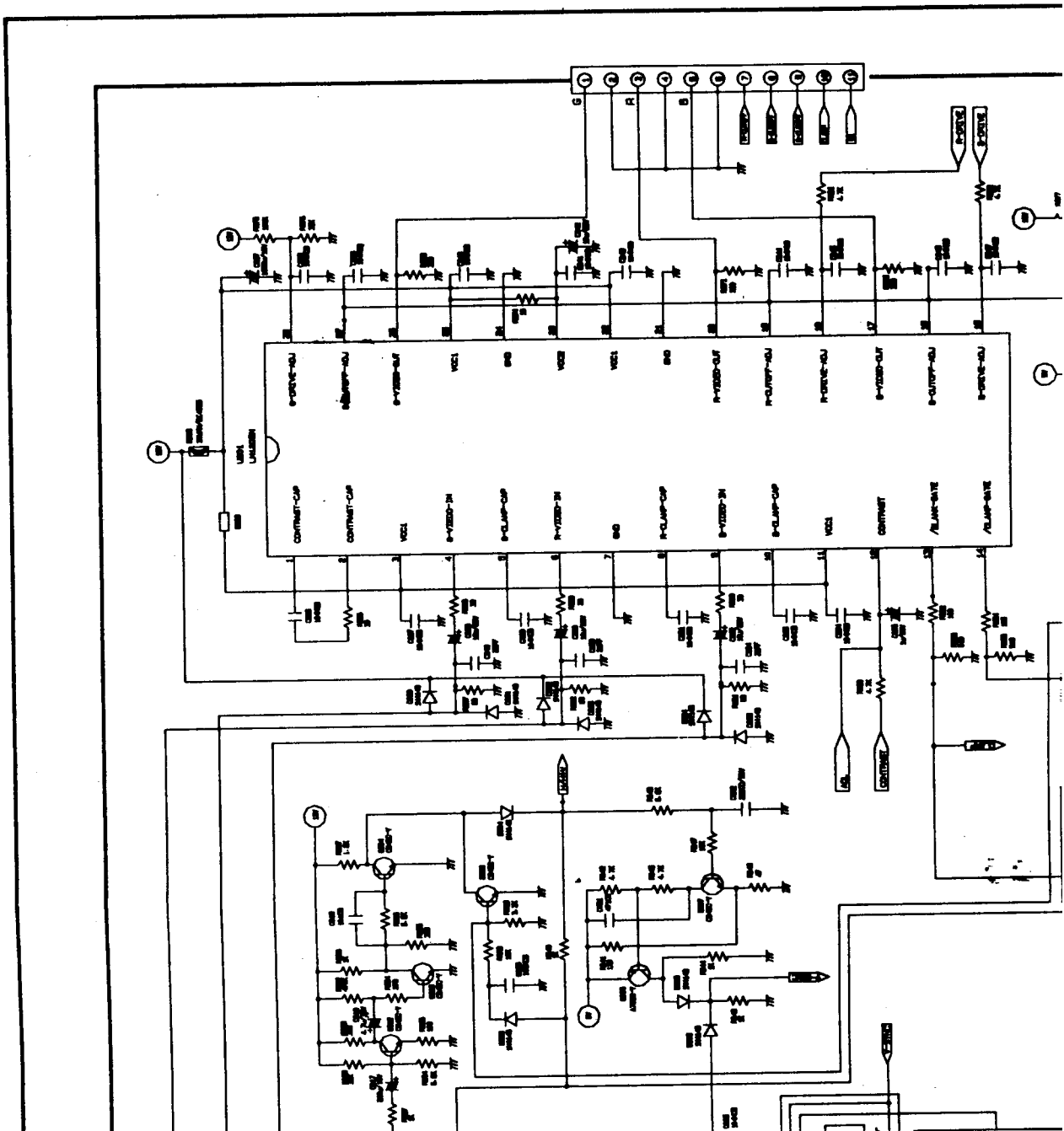


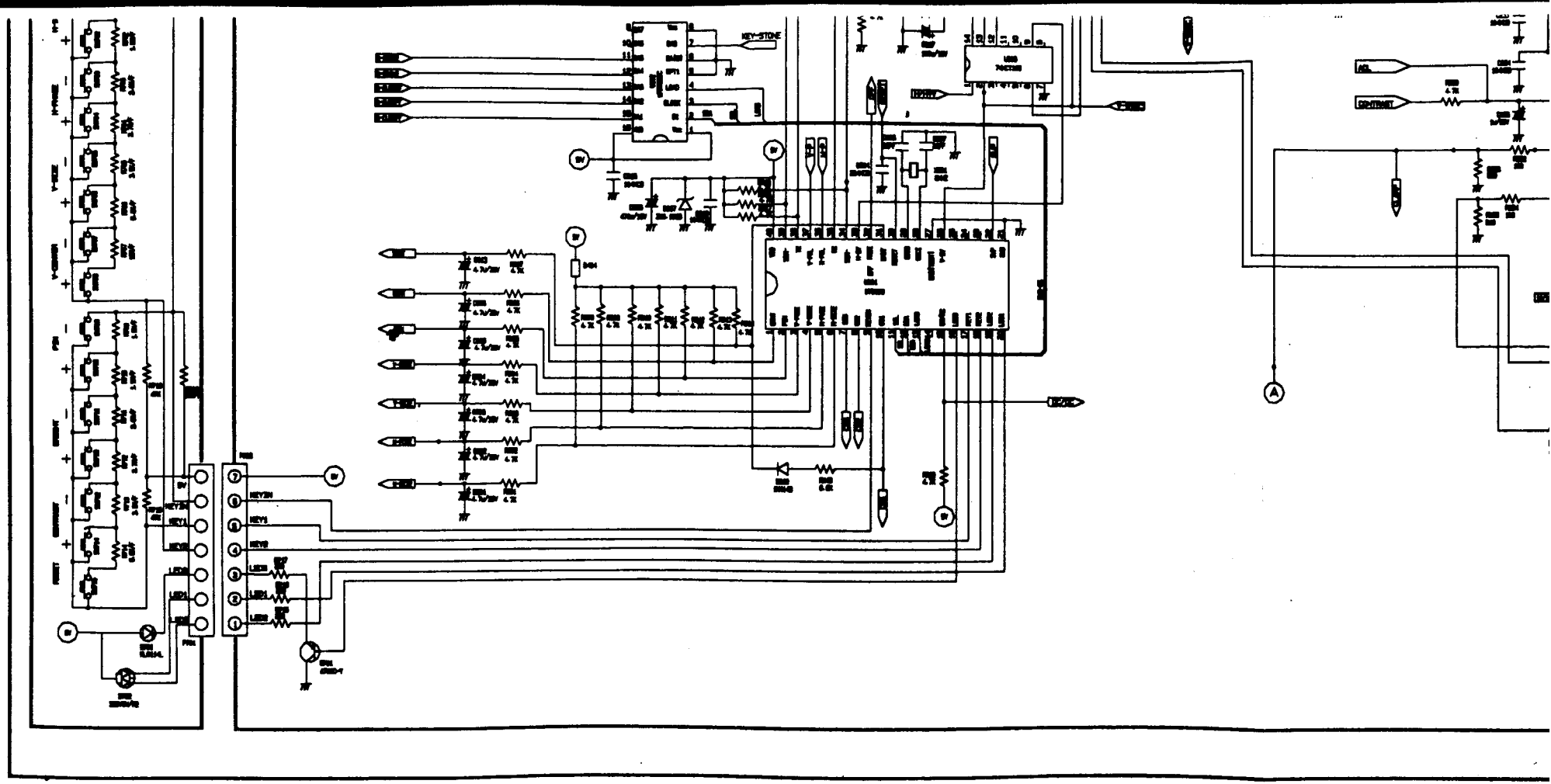


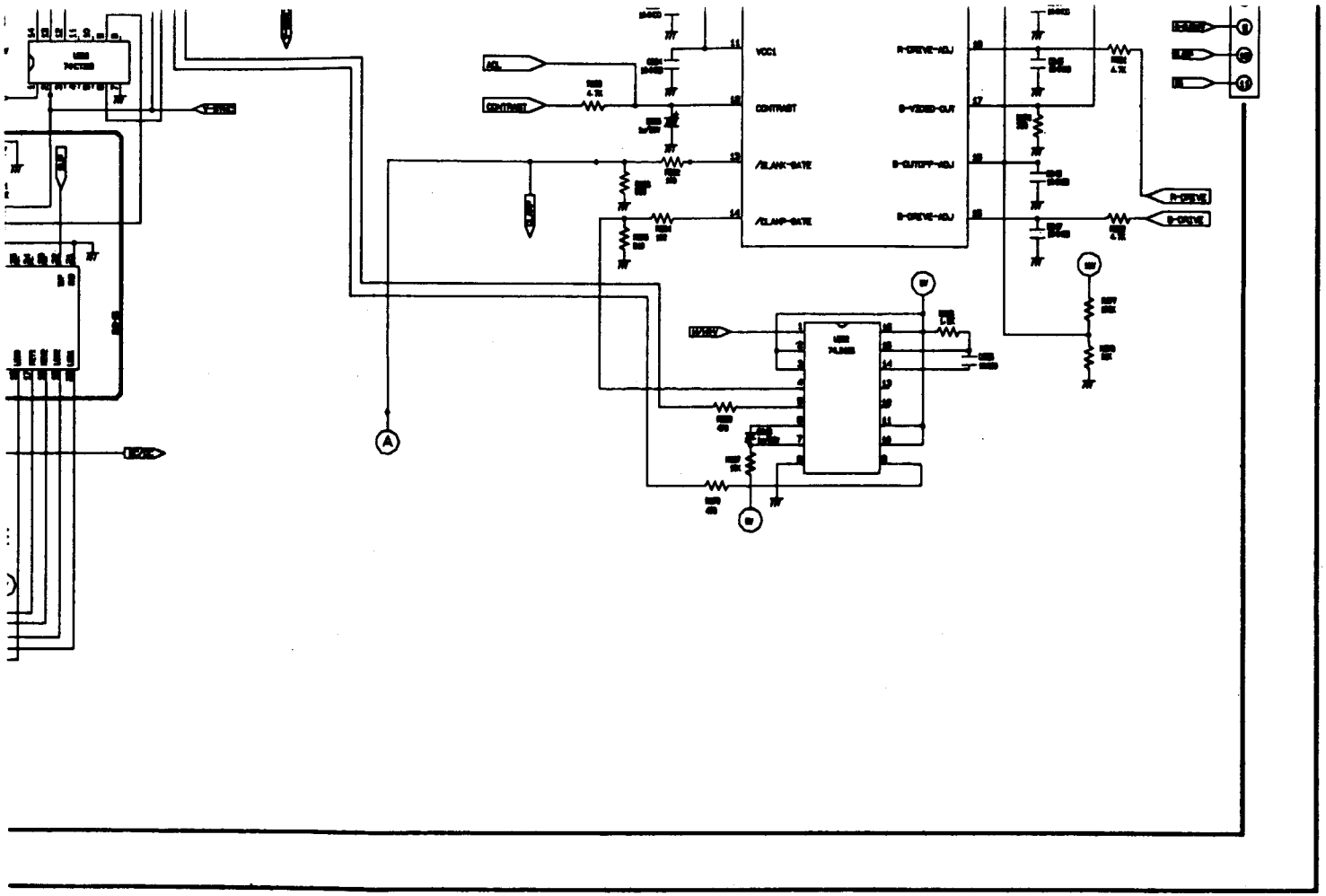


HL-5864 SCHEMATIC DIAGRAM (MAIN-2. CONTROL BOARD)

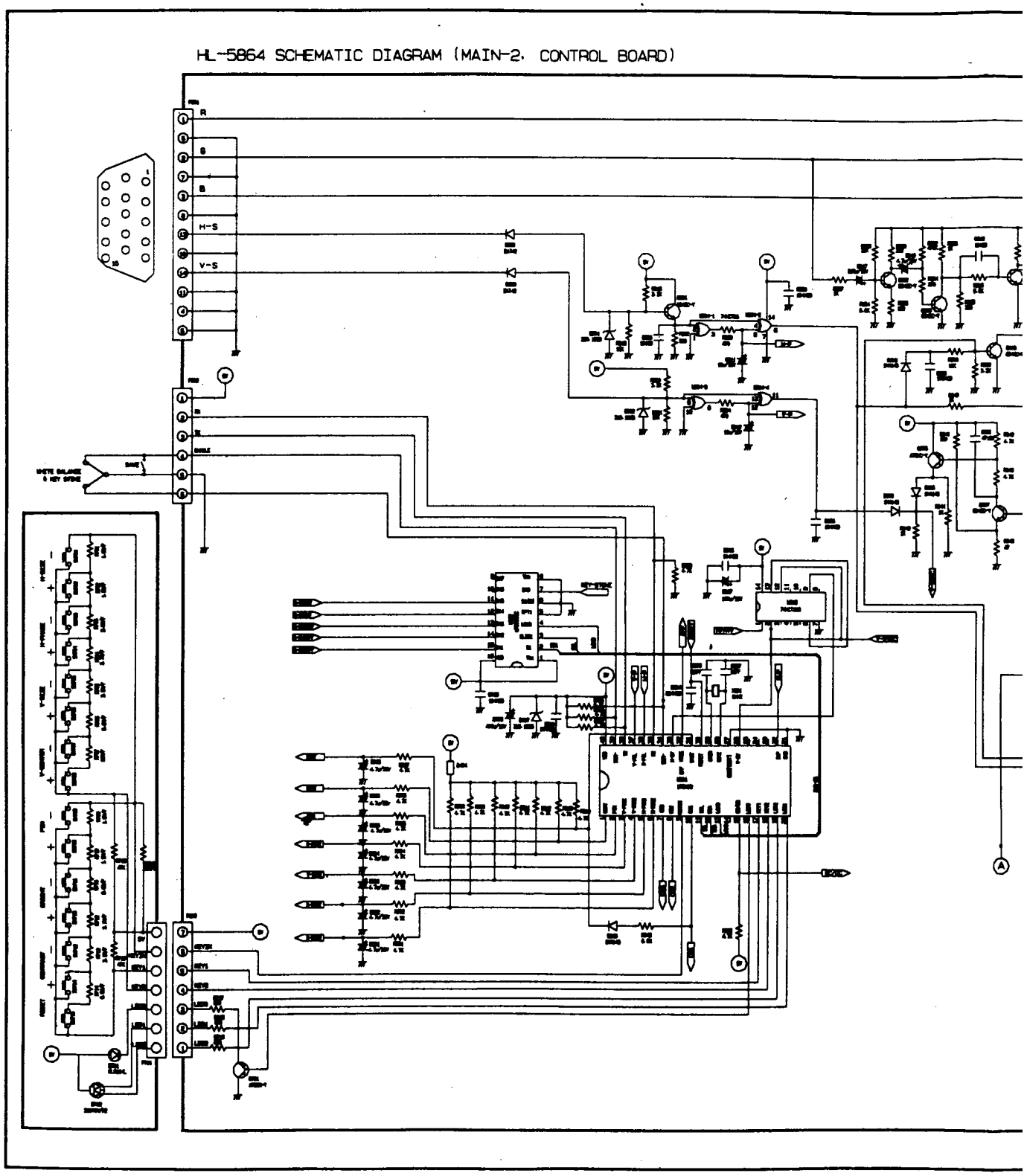




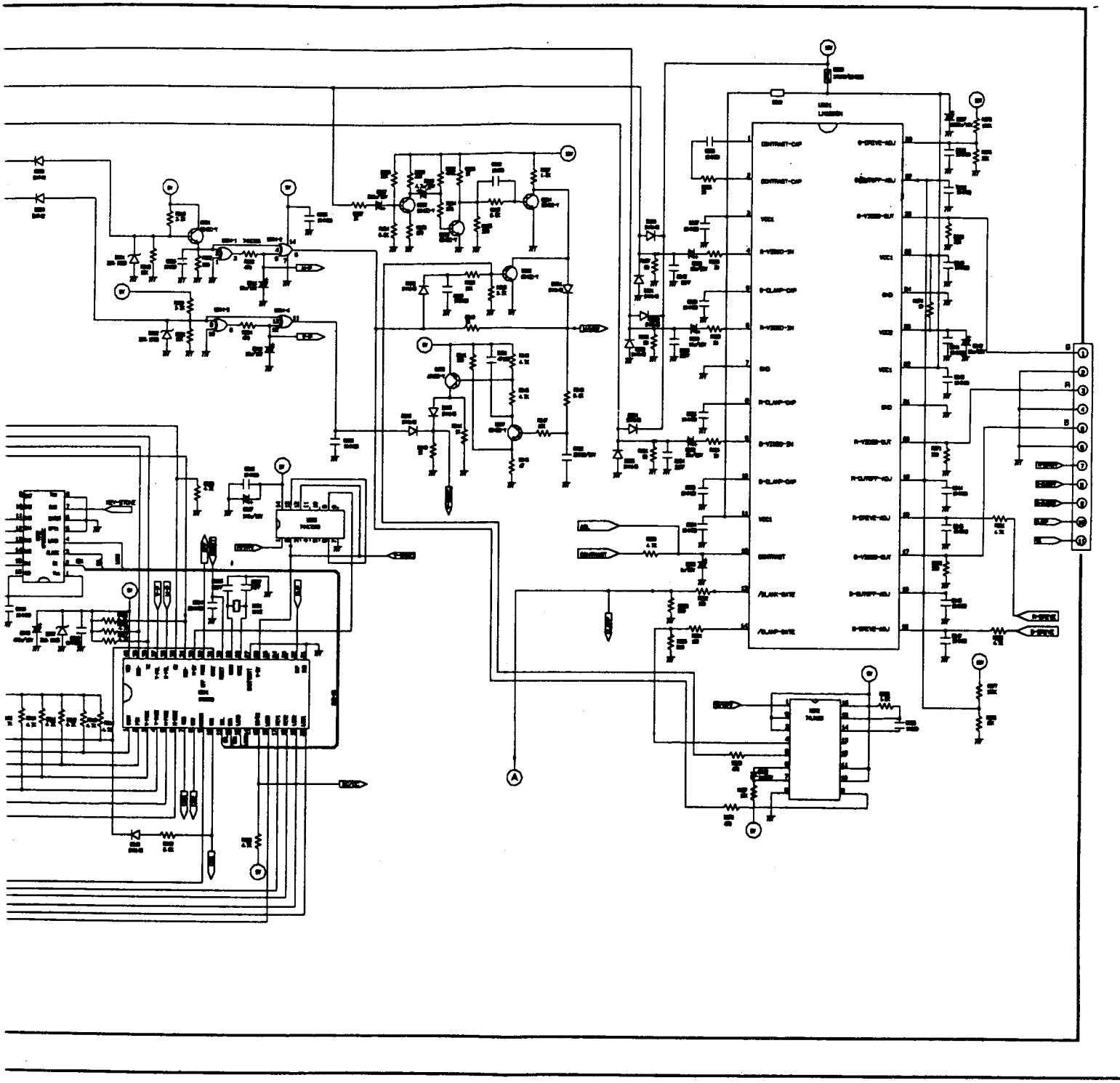


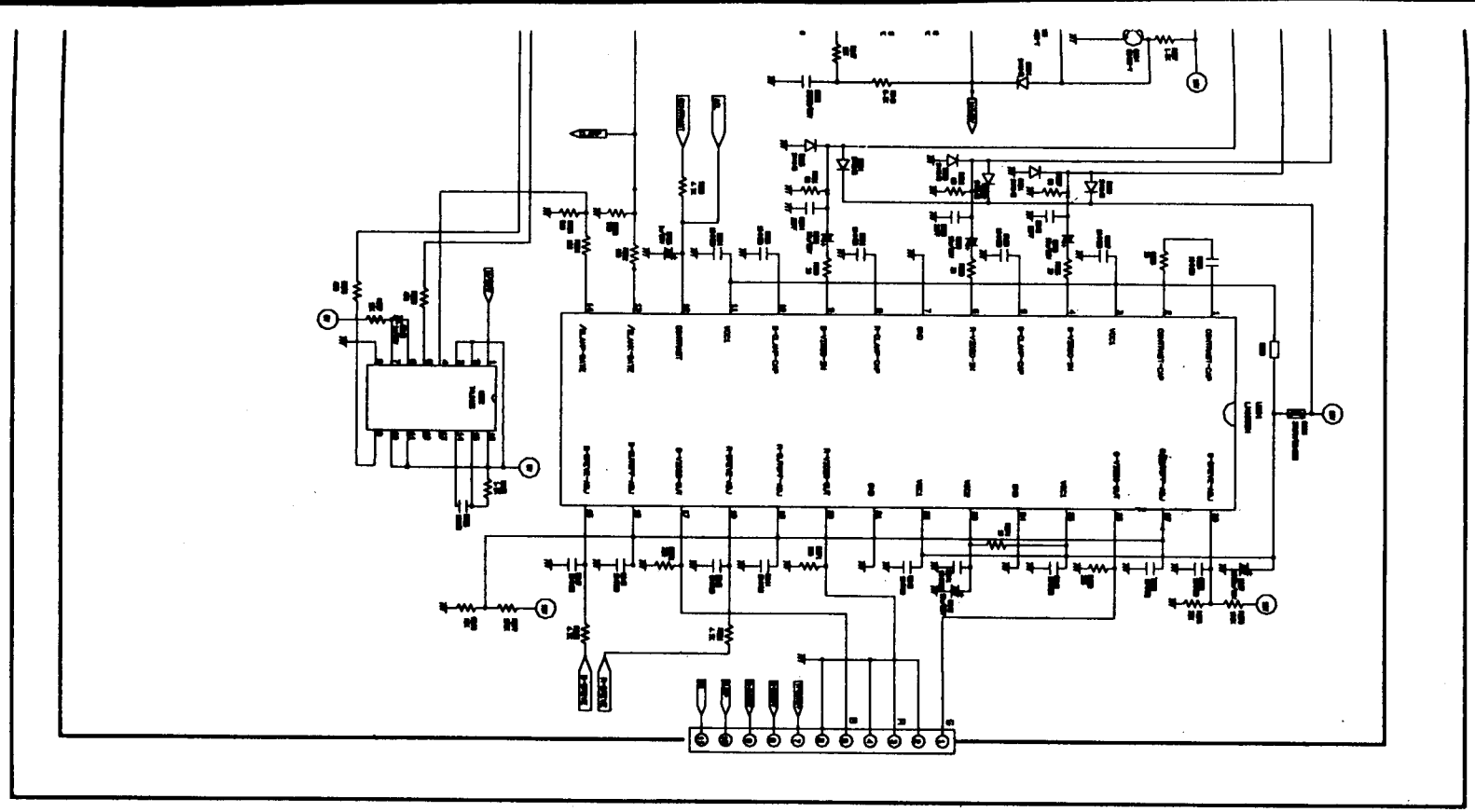

VCC1
CONTRAST
/BLANK-GATE
/CLAMP-GATE
R-DRIVE-ADJ
B-VIDEO-OUT
B-CUTOFF-ADJ
B-DRIVE-ADJ
R-DRIVE
B-DRIVE
CONTRAST
A

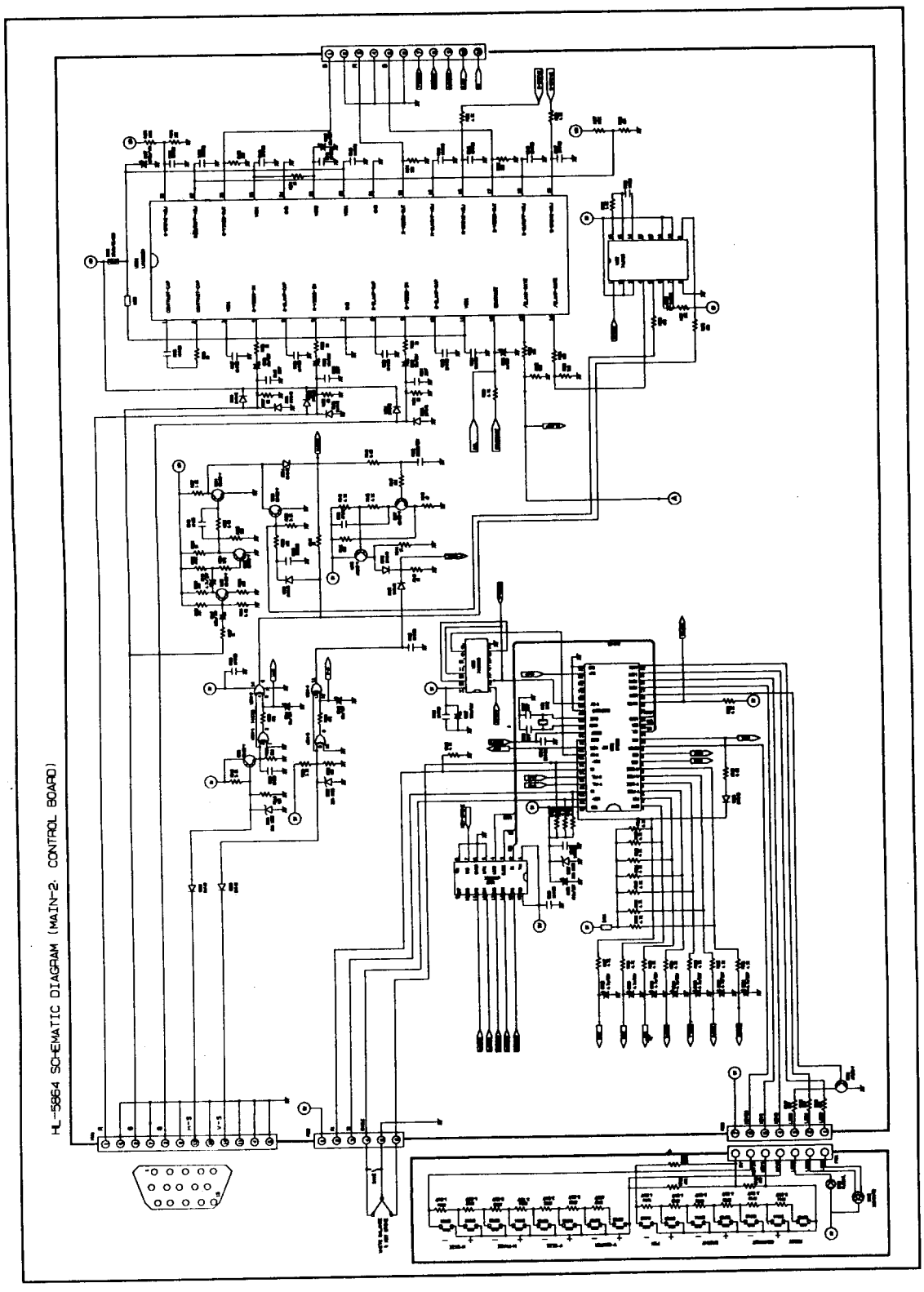
HL-5864 SCHEMATIC DIAGRAM (MAIN-2. CONTROL BOARD)

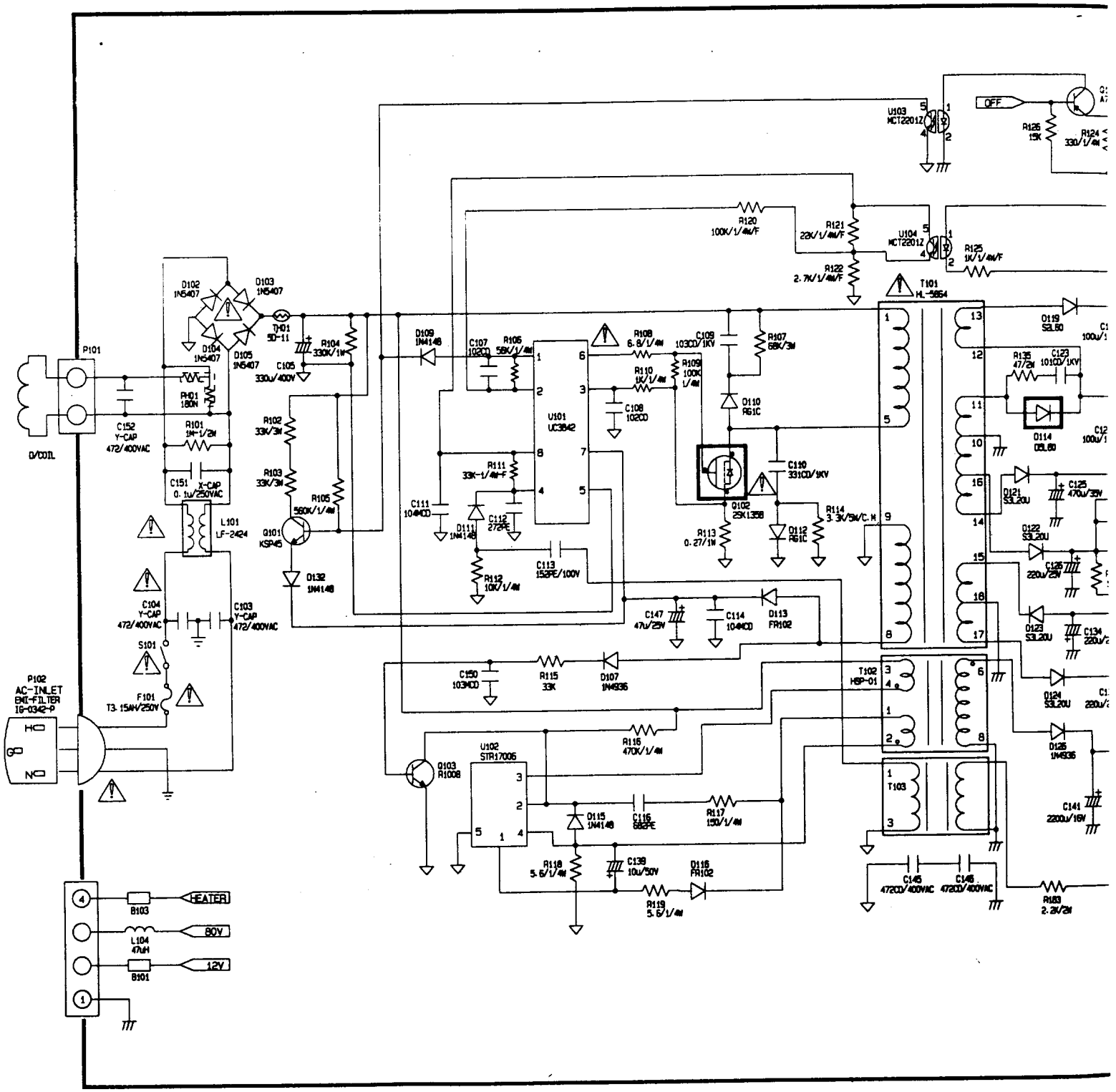


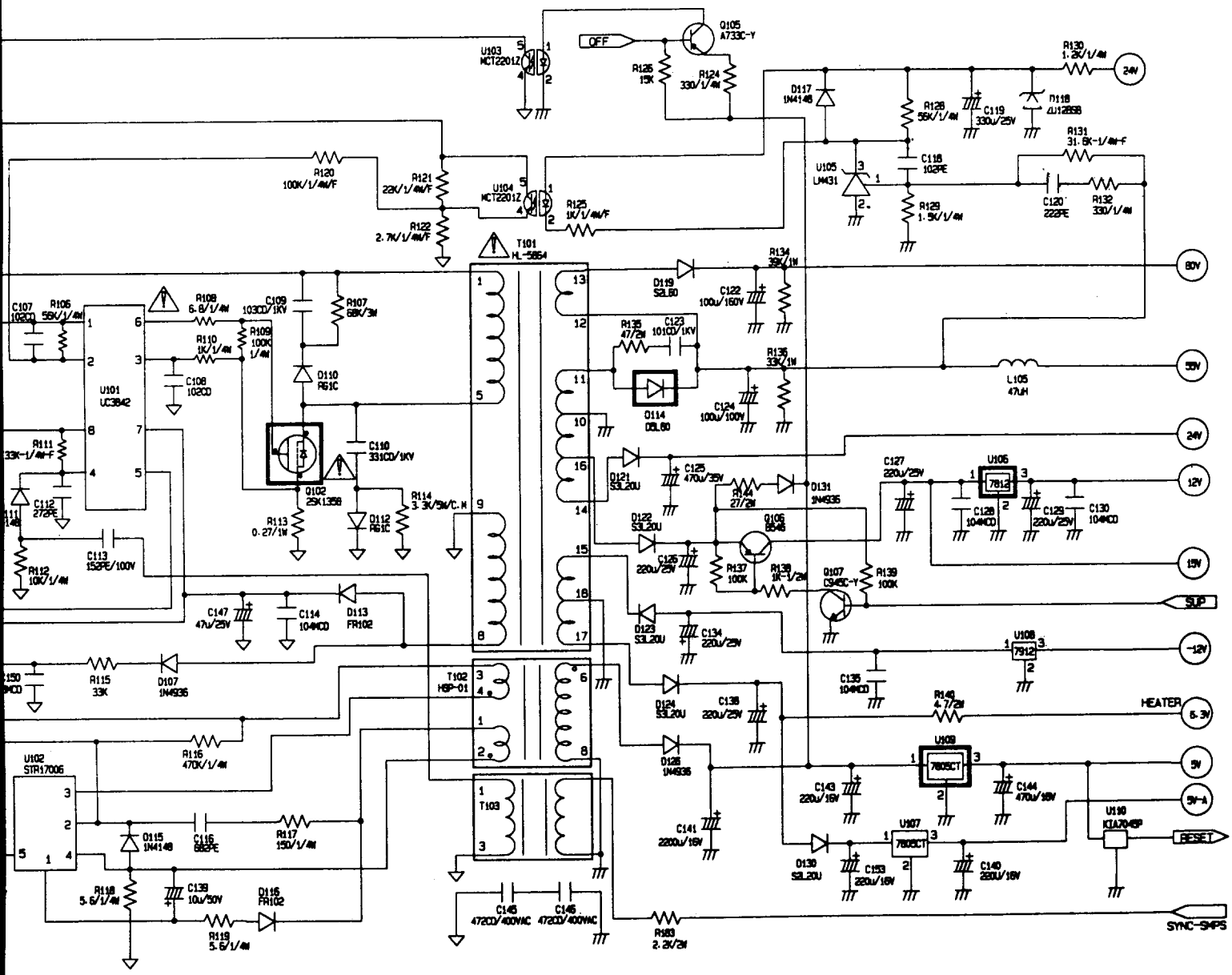
AIN-2. CONTROL BOARD)

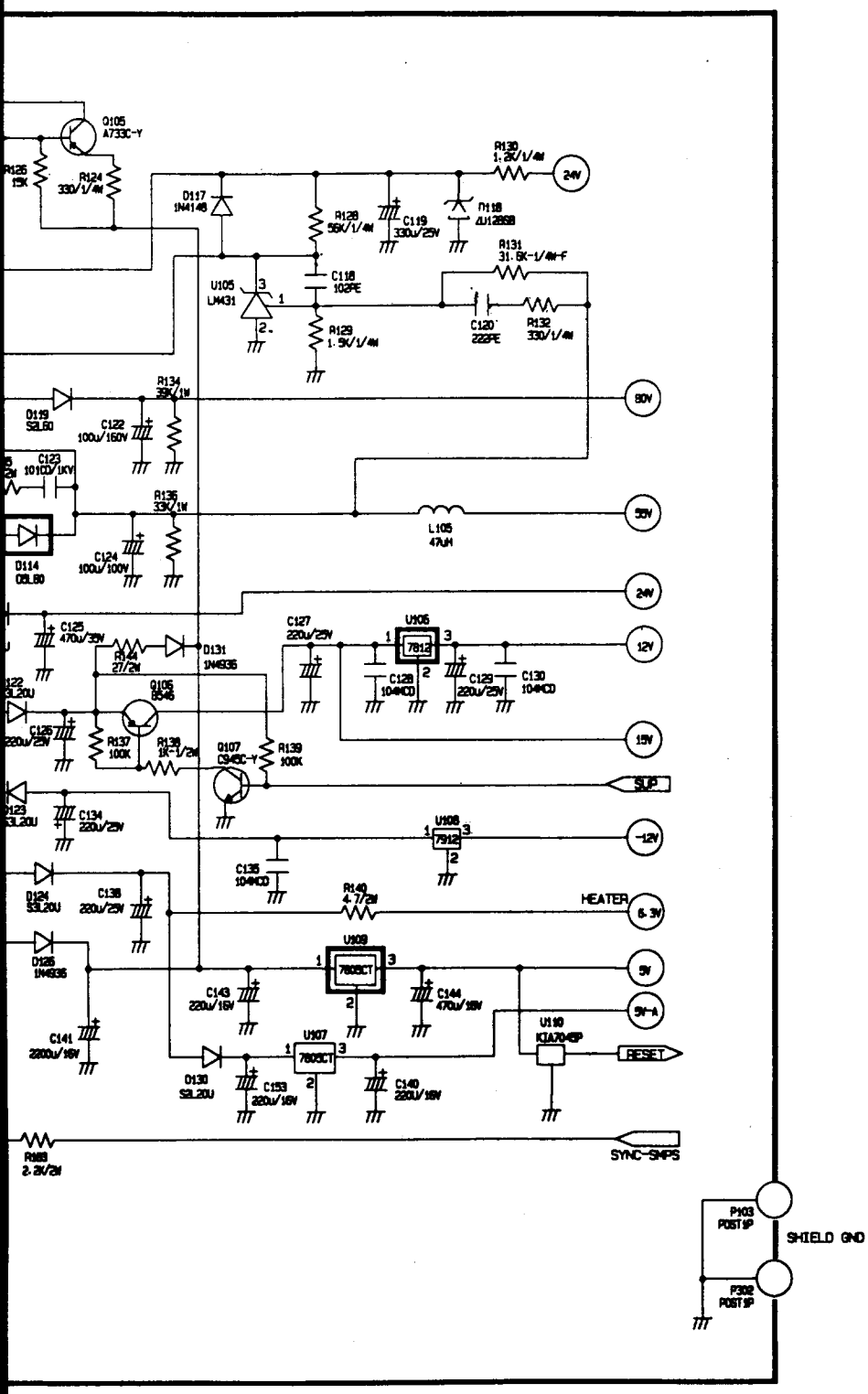


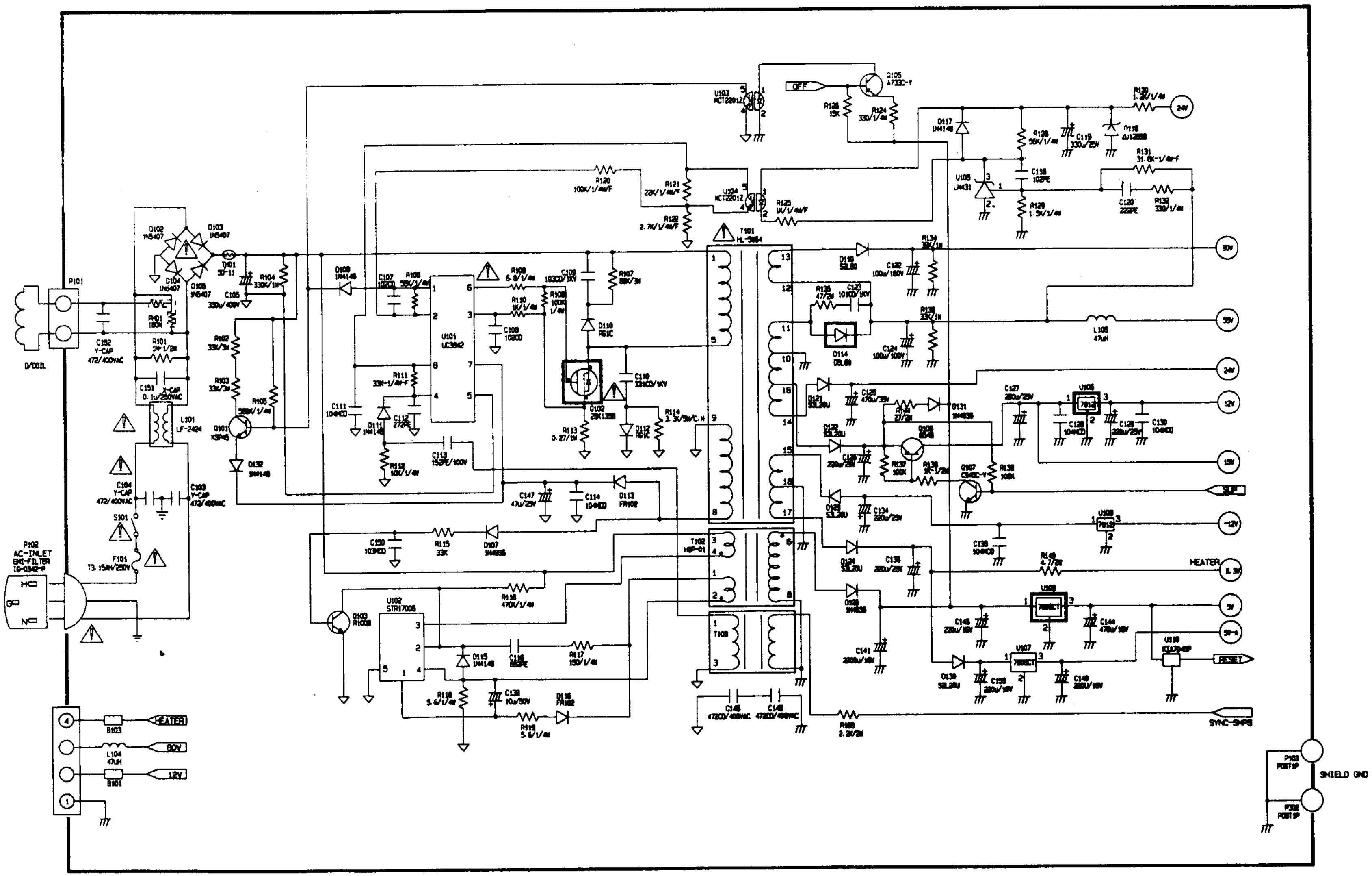



HL-5864 SCHEMATIC DIAGRAM (MAIN-2. CONTROL BOARD)

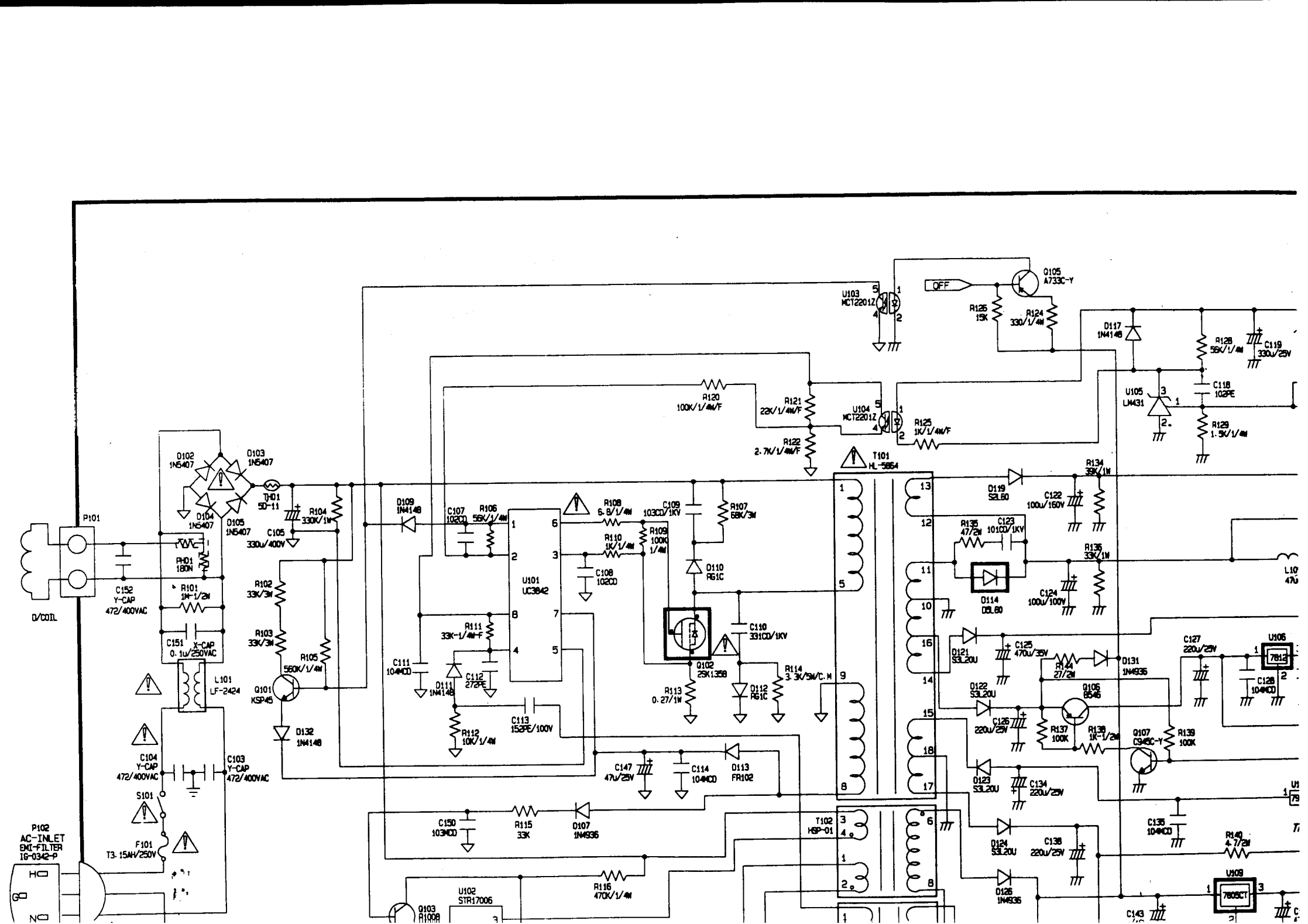

P101
D/COIL
C152 Y-CAP 472/400VAC
R101 1M-1/2W
C151 X-CAP 0.1u/250VAC
L101 LF-2424
C104 Y-CAP 472/400VAC
C103 Y-CAP 472/400VAC
S101
F101 T3.15AH/250V
P102 AC-INLET EMI-FILTER IG-0342-P
HOT
GND
NEU
D102 1N5407
D103 1N5407
D104 1N5407
D105 1N5407
TH01 5D-11
R104 330K/1W
C105 330u/400V
R102 33K/3W
R103 33K/3W
R105 560K/1/4W
Q101 KSP45
D132 1N4148
D109 1N4148
C107 102CD
R106 56K/1/4W
U101 UC3842
R108 6.8/1/4W
C109 103CD/1KV
R107 68K/3W
R110 1K/1/4W
R109 100K 1/4W
C108 102CD
D110 RG1C
C110 331CD/1KV
Q102 2SK1358
R111 33K-1/4W-F
C111 104MCD
D111 1N4148
C112 272PE
R112 10K/1/4W
C113 152PE/100V
R113 0.27/1W
D112 RG1C
R114 3.3K/5W/C.M
R120 100K/1/4W/F
R121 22K/1/4W/F
R122 2.7K/1/4W/F
U103 MCT2201Z
U104 MCT2201Z
OFF
R126 15K
R124 330/1/4W
R125 1K/1/4W/F
T101 HL-5864
D119 S3L60
R135 47/2W
C123 101CD/1KV
D114 DSL60
D121 S3L20U
D122 S3L20U
D123 S3L20U
D124 S3L20U
D125 1N4936
C125 470u/35V
C126 220u/25V
C134 220u/
C141 2200u/16V
C147 47u/25V
C114 104MCD
D113 FR102
C150 103MCD
R115 33K
D107 1N4936
T102 HSP-01
R116 470K/1/4W
U102 STR17006
Q103 R1008
D115 1N4148
C116 682PE
R117 150/1/4W
R118 5.6/1/4W
C139 10u/50V
D116 FR102
R119 5.6/1/4W
T103
C145 472CD/400VAC
C146 472CD/400VAC
R183 2.2K/2W
B103
HEATER
L104 47uH
80V
B101
12V

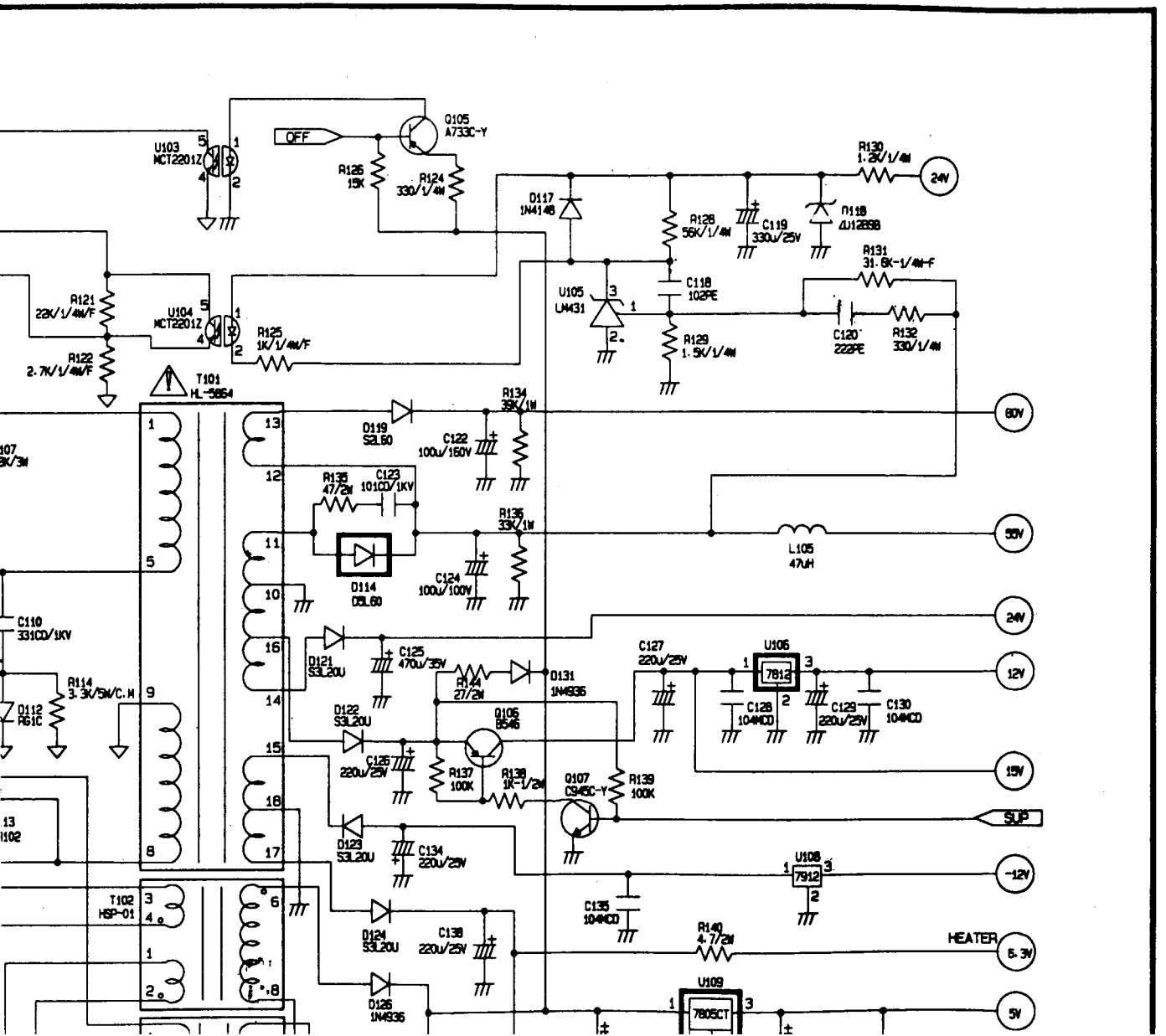

OFF
Q105 A733C-Y
U103 MCT2201Z
U104 MCT2201Z
R120 100K/1/4W/F
R121 22K/1/4W/F
R122 2.7K/1/4W/F
R125 1K/1/4W/F
R126 15K
R124 330/1/4W
D117 1N4148
R128 56K/1/4W
C119 330U/25V
D118 ΔU12B5B
R130 1.2K/1/4W
24V
R131 31.6K-1/4W-F
C118 102PE
U105 LM431
R129 1.5K/1/4W
C120 222PE
R132 330/1/4W
T101 HL-5864
C107 102CD
R105 56K/1/4W
U101 UC3842
R108 6.8/1/4W
C109 103CD/1KV
R107 68K/3W
R109 100K 1/4W
R110 1K/1/4W
C108 102CD
D110 RG1C
R111 33K-1/4W-F
C112 272PE
C110 331CD/1KV
Q102 2SK1358
R114 3.3K/5W/C.M
R113 0.27/1W
D112 RG1C
C113 152PE/100V
R112 10K/1/4W
D119 S3L60
C122 100U/160V
R134 39K/1W
80V
R135 47/2W
C123 101CD/1KV
D114 D6L60
R136 33K/1W
C124 100U/100V
L105 47UH
55V
24V
D121 S3L20U
C125 470U/35V
RX44 27/2W
D131 1N4936
C127 220U/25V
U106 7812
C128 104CD
C129 220U/25V
C130 104CD
12V
D122 S3L20U
C126 220U/25V
Q106 8548
R137 100K
R138 1K-1/2W
Q107 C945C-Y
R139 100K
15V
SUP
D123 S3L20U
C134 220U/25V
U108 7912
-12V
C135 104CD
R146 4.7/2W
HEATER 6.3V
D124 S3L20U
C138 220U/25V
D126 1N4936
U109 7805CT
5V
C143 220U/16V
C144 470U/16V
5V-A
C141 2200U/16V
U107 7805CT
C153 220U/16V
C140 2200U/16V
D130 S3L20U
U110 KIA7045P
RESET
SYNC-SMPS
R147 2.2K/2W
C145 472CD/400VAC
C146 472CD/400VAC
T102 HSP-01
T103
R116 470K/1/4W
U102 STR17006
D115 1N4148
C116 682PE
R117 150/1/4W
R118 5.6/1/4W
C139 10U/50V
D116 FR102
R119 5.6/1/4W
C147 47U/25V
C114 104CD
D113 FR102
R115 33K
D107 1N4936
C150 104CD

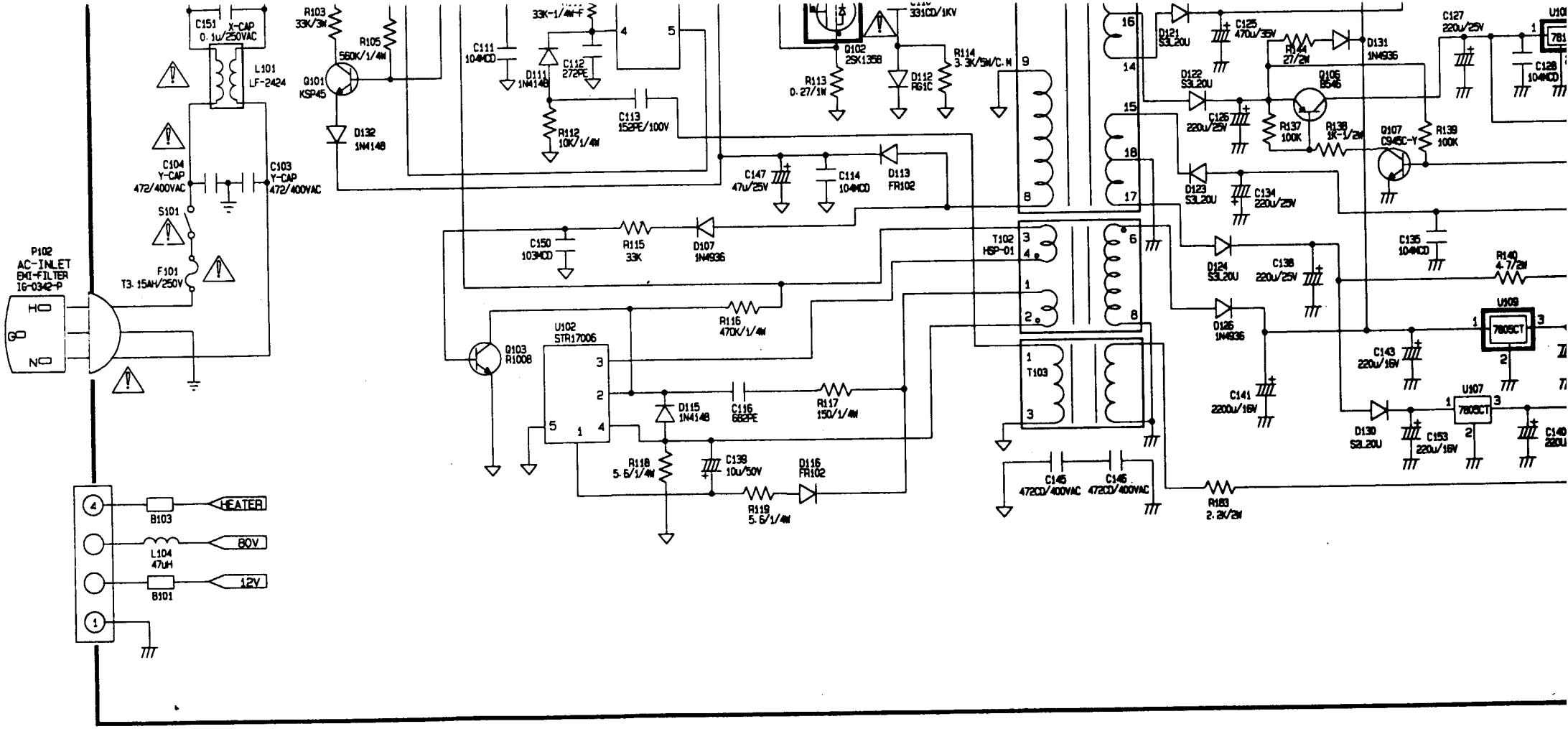


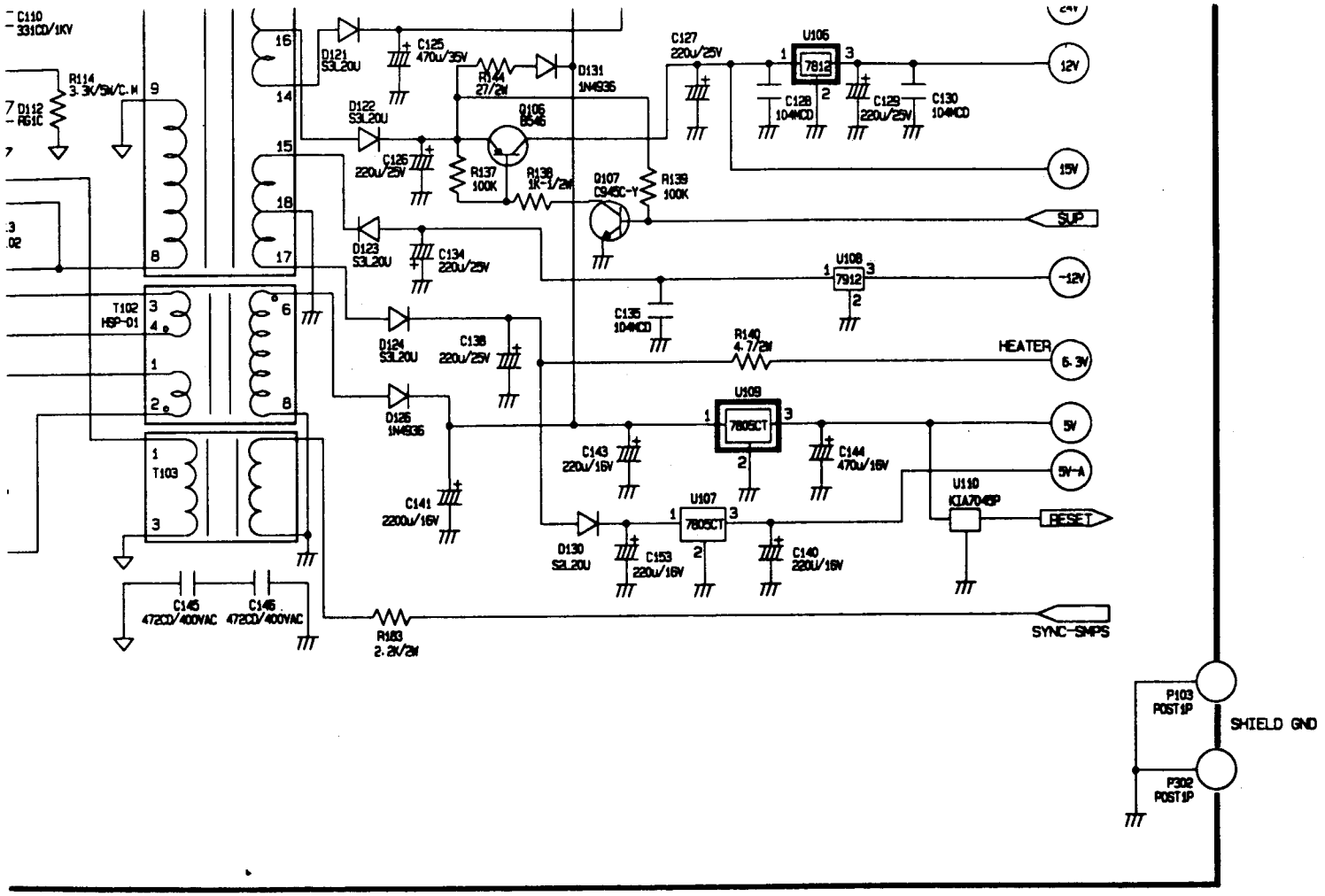


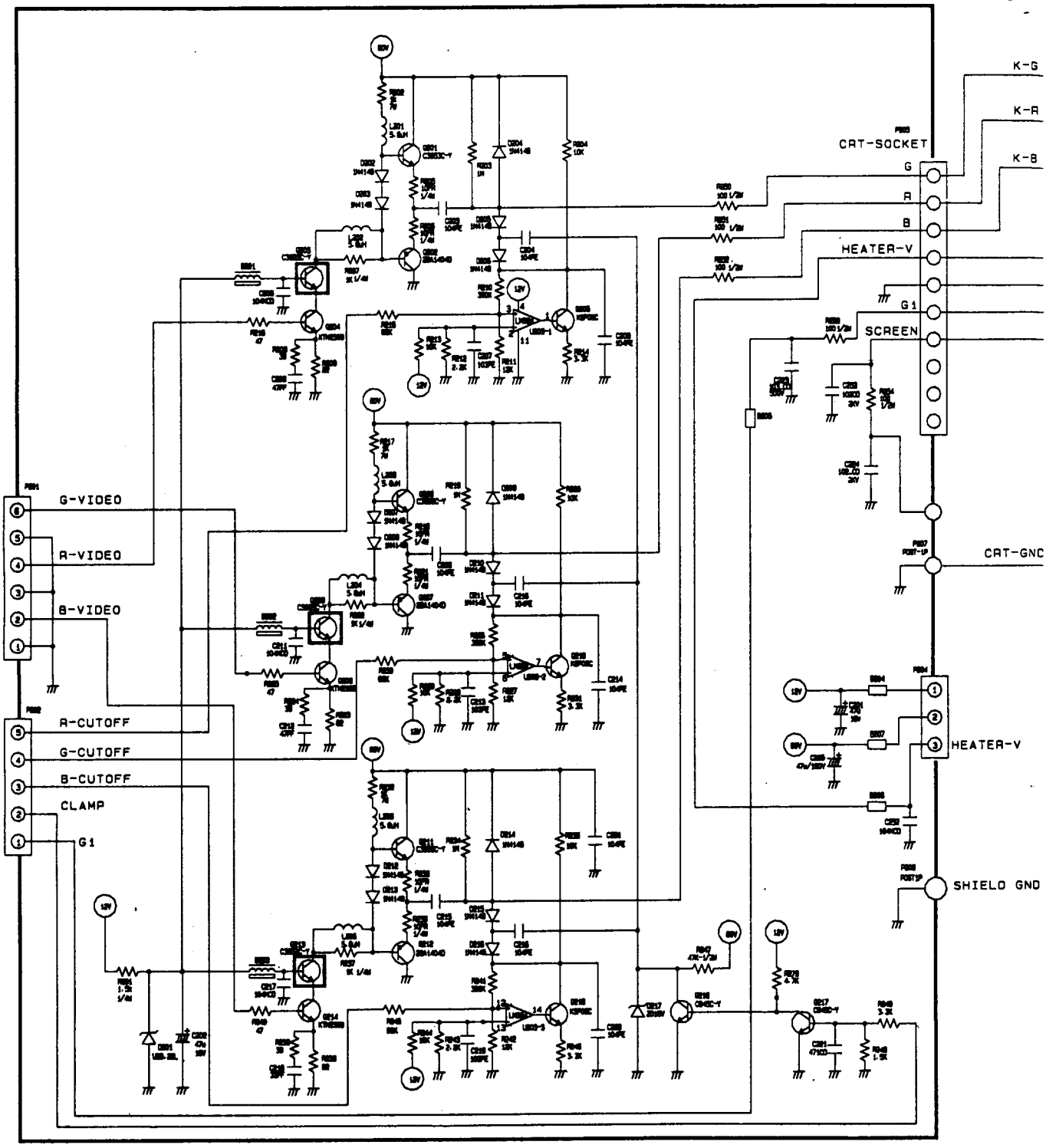
P101
D/COIL
P102
AC-INLET
EMI-FILTER
IG-0342-P
S101
F101
T3.15AH/250V
L101
LF-2424
C104
Y-CAP
472/400VAC
C103
Y-CAP
472/400VAC
C152
Y-CAP
472/400VAC
C151
X-CAP
0.1u/250VAC
D102
1N5407
D103
1N5407
D104
1N5407
D105
1N5407
TH01
SD-11
C105
330u/400V
R104
330K/1W
Q101
KSP45
D132
1N4148
U101
UC3842
Q102
2SK1358
T101
HL-3864
T102
HBP-01
T103
U102
STR17005
Q103
R1008
U103
KCT2201Z
U104
KCT2201Z
Q105
A733C-Y
OFF
U105
LM431
D117
1N4148
D114
D6L60
L105
47uH
U106
7812
U107
7805CT
U108
7912
U109
7805CT
U110
KIA7045P
Q107
C5430-Y
HEATER
6.3V
80V
56V
24V
12V
15V
SLP
-12V
5V
5V-A
RESET
SYNC-SMPS
B103
L104
47uH
B101
HEATER
80V
12V
P103
POST1P
P302
POST1P
SHIELD GND

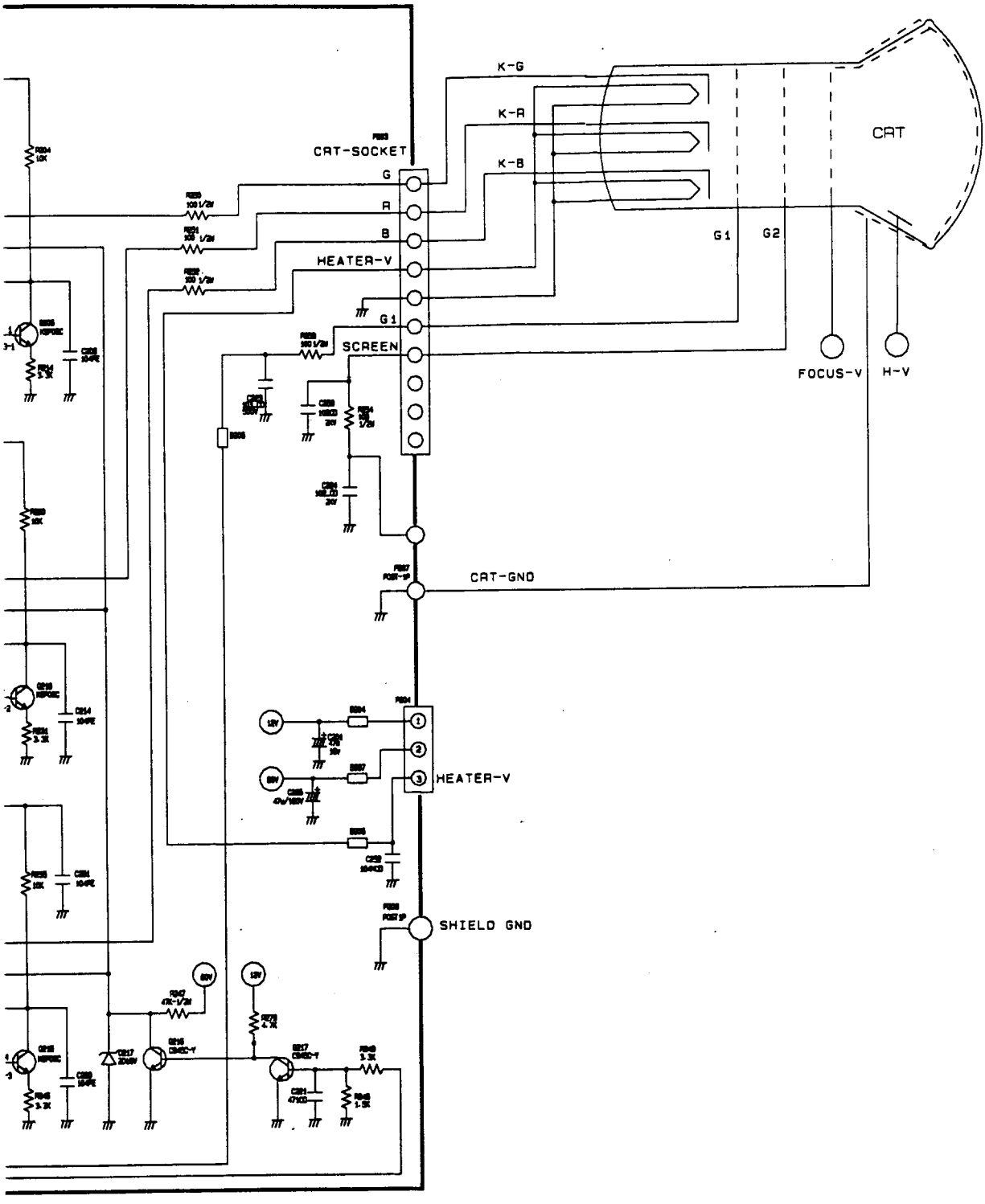

P101
D/COIL
P102
AC-INLET
EMI-FILTER
IG-0342-P
S101
F101
T3.15AH/250V
C152
Y-CAP
472/400VAC
C151
X-CAP
0.1u/250VAC
C104
Y-CAP
472/400VAC
C103
Y-CAP
472/400VAC
L101
LF-2424
D102
1N5407
D103
1N5407
D104
1N5407
D105
1N5407
THD1
5D-11
PHD1
180N
R101
1M-1/2W
C105
330u/400V
R104
330K/1W
R102
33K/3W
R103
33K/3W
R105
560K/1/4W
Q101
KSP45
D132
1N4148
D109
1N4148
C107
102CD
R106
56K/1/4W
U101
UC3842
R108
6.8/1/4W
R110
1K/1/4W
R109
100K
1/4W
C108
102CD
C109
103CD/1KV
R107
68K/3W
D110
RG1C
C110
331CD/1KV
Q102
2SK1358
R114
3.3K/5W/C.M
D112
RG1C
R113
0.27/1W
R111
33K-1/4W-F
C111
104MCD
D111
1N4148
C112
272PE
R112
10K/1/4W
C113
152PE/100V
C147
47u/25V
C114
104MCD
D113
FR102
C150
103MCD
R115
33K
D107
1N4936
R116
470K/1/4W
U102
STR17006
Q103
R1008
R120
100K/1/4W/F
R121
22K/1/4W/F
R122
2.7K/1/4W/F
U103
MCT2201Z
U104
MCT2201Z
R125
1K/1/4W/F
T101
HL-5864
OFF
Q105
A733C-Y
R126
15K
R124
330/1/4W
D117
1N4148
R128
56K/1/4W
C119
330u/25V
C118
102PE
U105
LM431
R129
1.5K/1/4W
R134
39K/1W
D119
S2L60
C122
100u/160V
R135
47/2W
C123
101CD/1KV
R136
33K/1W
D114
DSL60
C124
100u/100V
D121
S3L20U
C125
470u/35V
R144
27/2W
D131
1N4936
C127
220u/25V
U106
7812
C128
104MCD
D122
S3L20U
Q106
8550
C126
220u/25V
R137
100K
R138
1K-1/2W
Q107
C945C-Y
R139
100K
D123
S3L20U
C134
220u/25V
C135
104MCD
R140
4.7/2W
D124
S3L20U
C136
220u/25V
D126
1N4936
U109
7805CT
C143

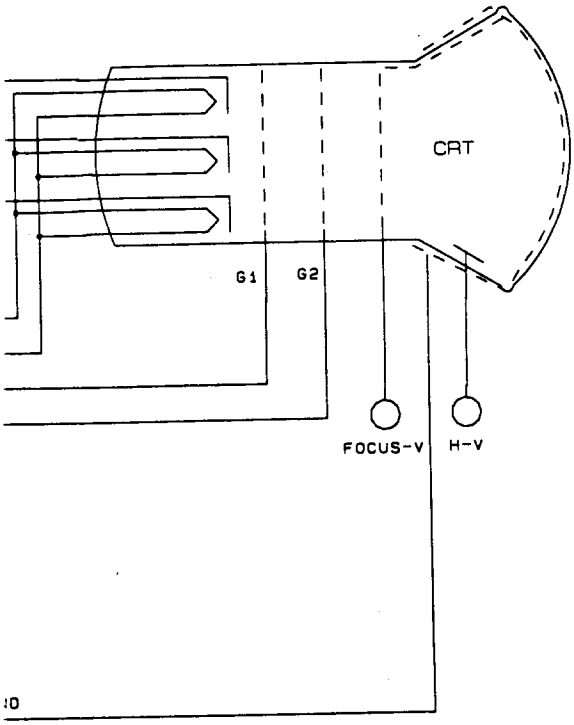

U103 MCT2201Z
Q105 A733C-Y
OFF
R126 15K
R124 330/1/4W
R130 1.2K/1/4W
24V
D117 1N4148
R128 56K/1/4W
C119 330u/25V
D118 DU1288B
R131 31.6K-1/4W-F
C118 102PE
U105 LM431
R129 1.5K/1/4W
C120 222PE
R132 330/1/4W
R121 22K/1/4W/F
U104 MCT2201Z
R125 1K/1/4W/F
R122 2.7K/1/4W/F
T101 HL-5864
R134 39K/1W
80V
D119 S2L60
C122 100u/160V
R135 47/2W
C123 101CD/1KV
R136 33K/1W
55V
D114 05L60
C124 100u/100V
L105 47uH
24V
C110 331CD/1KV
D121 S3L20U
C125 470u/35V
R144 27/2W
D131 1N4936
C127 220u/25V
U106 7812
12V
R114 3.3K/5W/C.M
D112 R61C
D122 S3L20U
Q106 B546
C126 220u/25V
C128 104CD
C129 220u/25V
C130 104CD
R137 100K
R138 1K-1/2W
Q107 C945C-Y
R139 100K
15V
SUP
D123 S3L20U
C134 220u/25V
U108 7912
-12V
C135 104CD
T102 HSP-01
D124 S3L20U
C138 220u/25V
R140 4.7/2W
HEATER 6.3V
D125 1N4936
U109 7805CT
5V

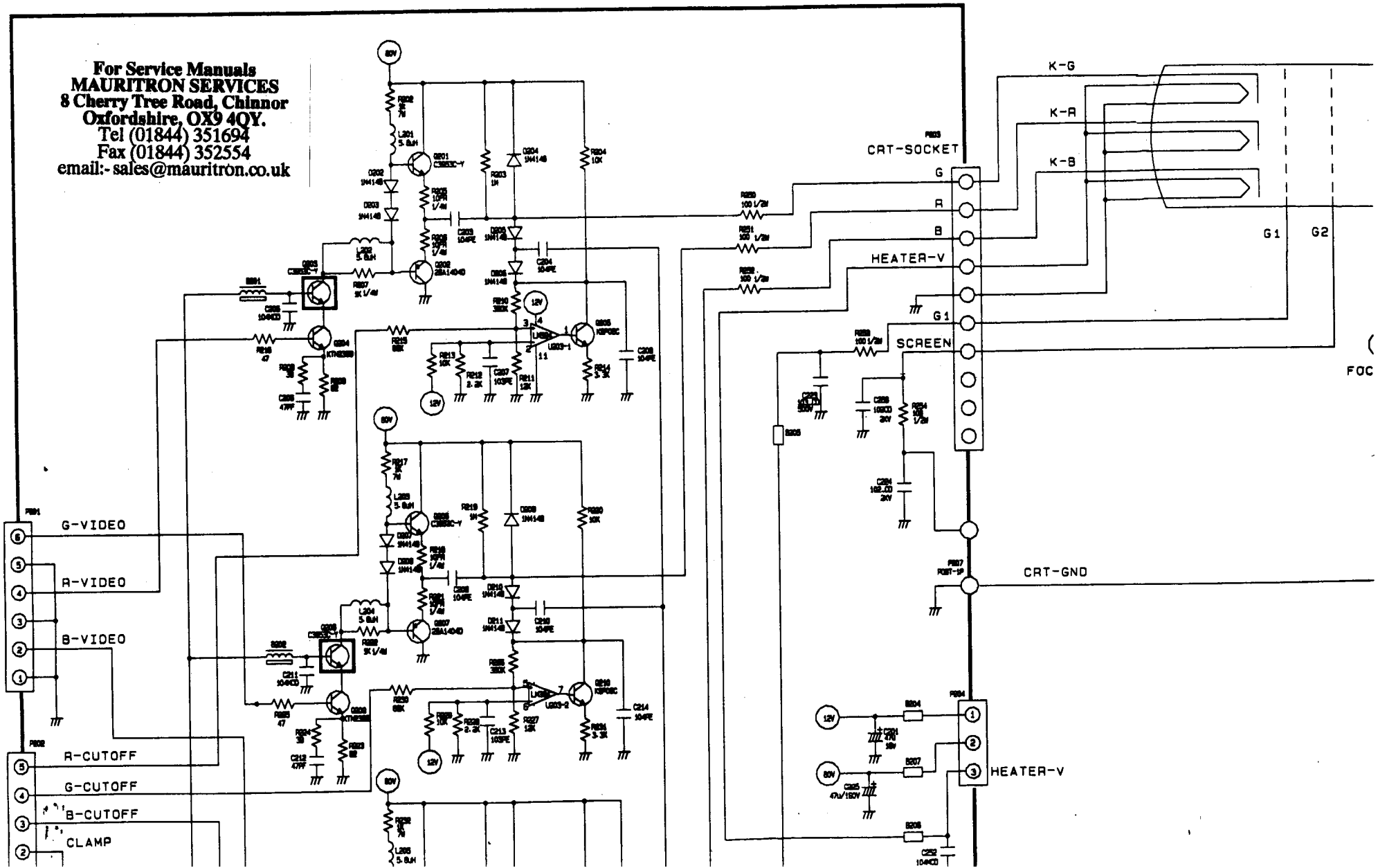

C151 X-CAP 0.1u/250VAC
L101 LF-2424
C104 Y-CAP 472/400VAC
C103 Y-CAP 472/400VAC
S101
F101 T3.15AH/250V
P102 AC-INLET EMI-FILTER 16-0342-P
H
G
N
R103 33K/3W
R105 560K/1/4W
Q101 KSP45
D132 1N4148
C111 104MCD
D111 1N4148
33K-1/4W-F
C112 272PE
C113 152PE/100V
R112 10K/1/4W
Q102 2SK1358
R113 0.27/1W
D112 RG1C
R114 3.3K/5W/C.M
331CD/1KV
C147 47u/25V
C114 104MCD
D113 FR102
C150 103MCD
R115 33K
D107 1N4936
R116 470K/1/4W
Q103 R1008
U102 STR17006
D115 1N4148
C116 682PE
R117 150/1/4W
R118 5.6/1/4W
C139 10u/50V
D116 FR102
R119 5.6/1/4W
T102 HSP-01
T103
C145 472CD/400VAC
C146 472CD/400VAC
R183 2.2K/2W
D121 S3L20U
C125 470u/35V
R144 27/2W
D131 1N4936
C127 220u/25V
D122 S3L20U
C126 220u/25V
Q106 B546
R137 100K
R138 1K-1/2W
Q107 C945C-Y
R139 100K
D123 S3L20U
C134 220u/25V
C135 104MCD
D124 S3L20U
C138 220u/25V
R140 4.7/2W
D125 1N4936
C141 2200u/16V
U109 7805CT
C143 220u/16V
U107 7805CT
D130 S3L20U
C153 220u/16V
HEATER
B103
L104 47uH
B101
80V
12V

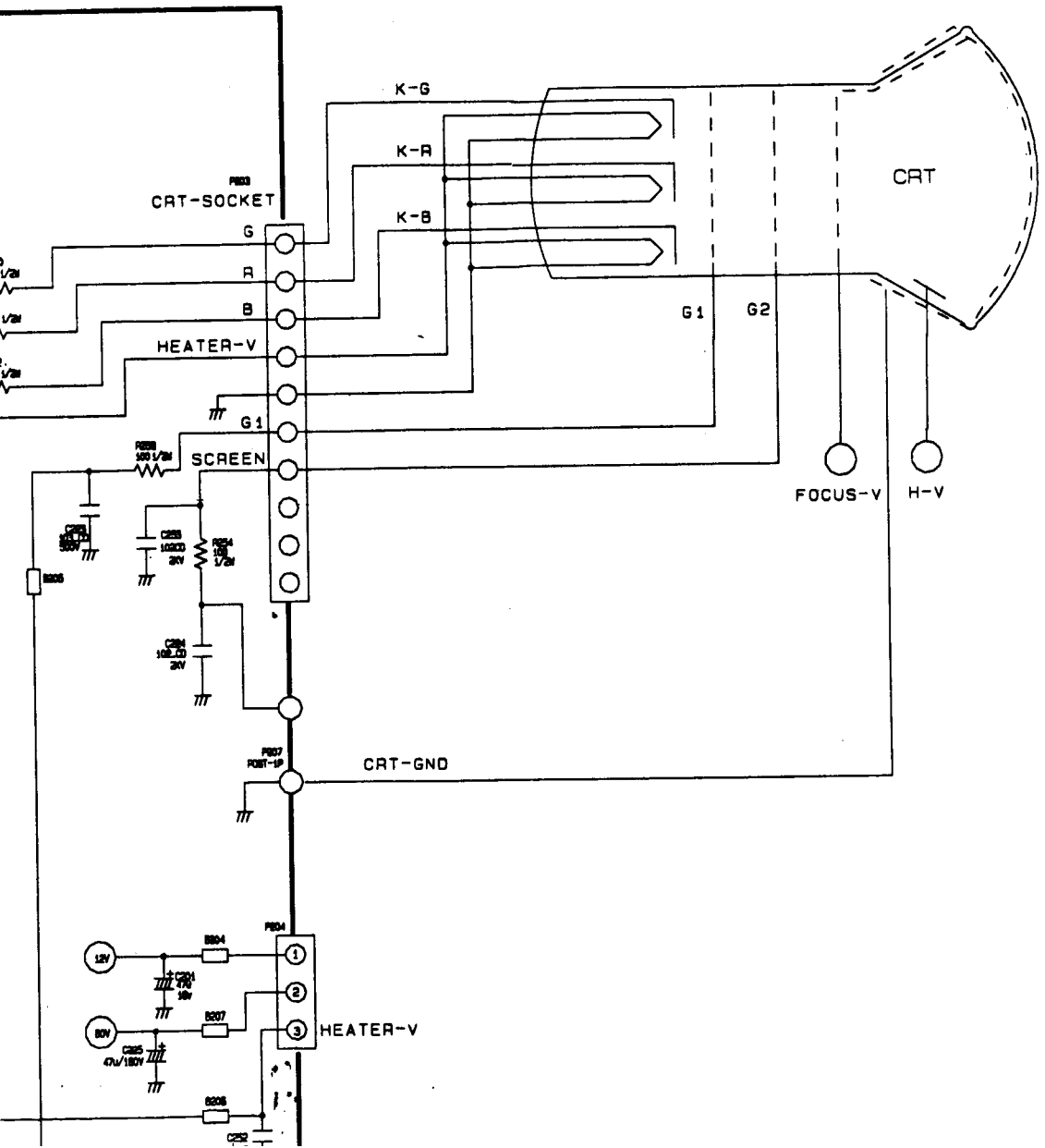

C110
331CD/1KV
R114
3.3K/5W/C.M
D112
RG1C
T102
HSP-01
T103
D121
S3L20U
D122
S3L20U
D123
S3L20U
D124
S3L20U
D125
1N4936
D130
S2L20U
D131
1N4936
C125
470u/35V
C126
220u/25V
C134
220u/25V
C138
220u/25V
C141
2200u/16V
C145
472CD/400VAC
C146
472CD/400VAC
R144
27/2W
R137
100K
R138
1K-1/2W
Q106
B546
Q107
C945C-Y
R139
100K
R183
2.2K/2W
C127
220u/25V
U106
7812
C128
104MCD
C129
220u/25V
C130
104MCD
U108
7912
C135
104MCD
R140
4.7/2W
U109
7805CT
C143
220u/16V
C144
470u/16V
U107
7805CT
C153
220u/16V
C140
220u/16V
U110
KIA7045P
12V
15V
SUP
-12V
HEATER
6.3V
5V
5V-A
RESET
SYNC-SMPS
P103
POST1P
P302
POST1P
SHIELD GND

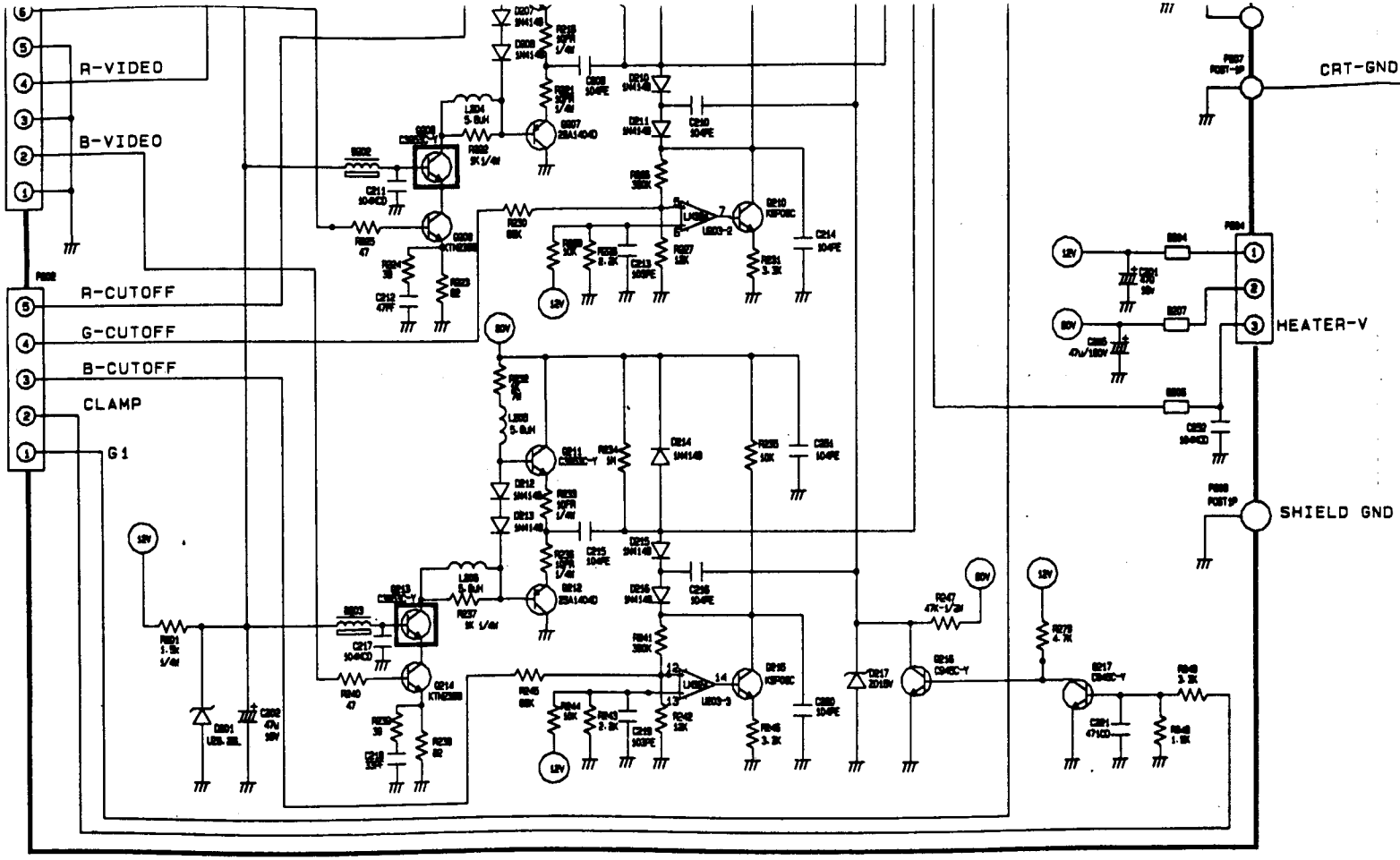

K-G
K-R
K-B
CRT-SOCKET
G
R
B
HEATER-V
G1
SCREEN
CRT-GND
HEATER-V
SHIELD GND
G-VIDEO
R-VIDEO
B-VIDEO
R-CUTOFF
G-CUTOFF
B-CUTOFF
CLAMP
G1

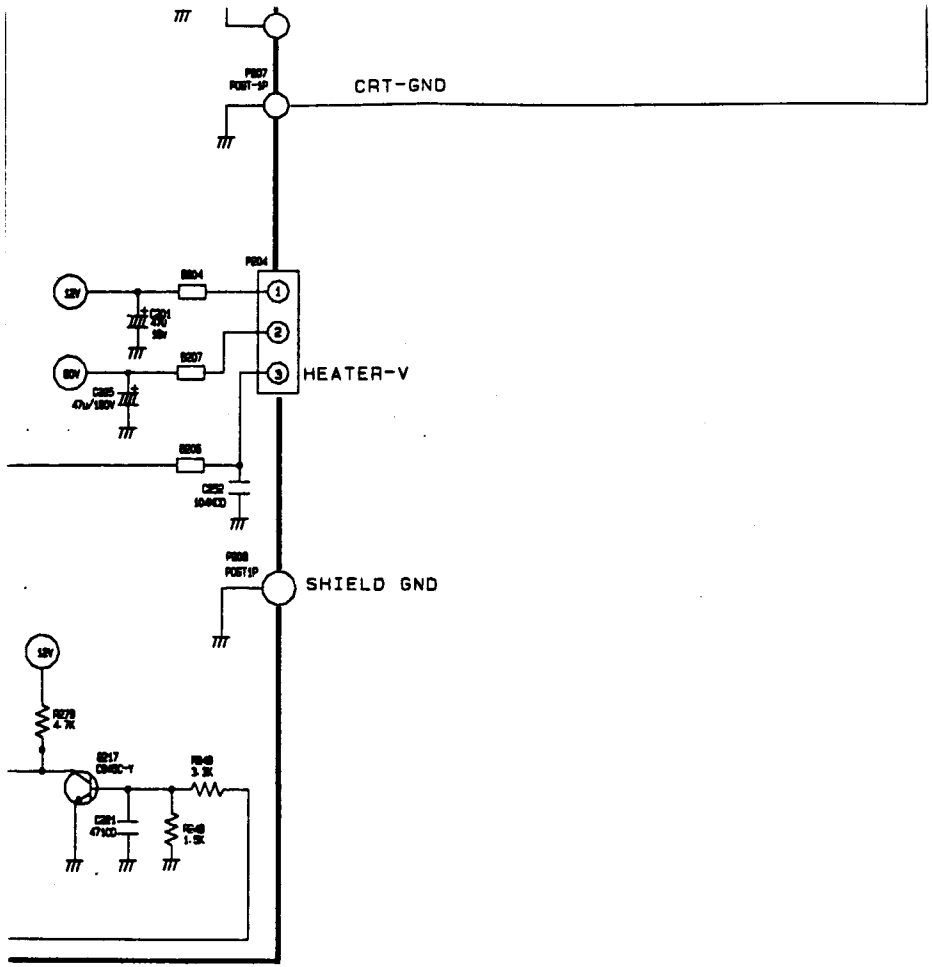

K-G
K-A
K-B
CRT
CRT-SOCKET
G
A
B
HEATER-V
G1
SCREEN
G1
G2
FOCUS-V
H-V
CRT-GND
HEATER-V
SHIELD GND

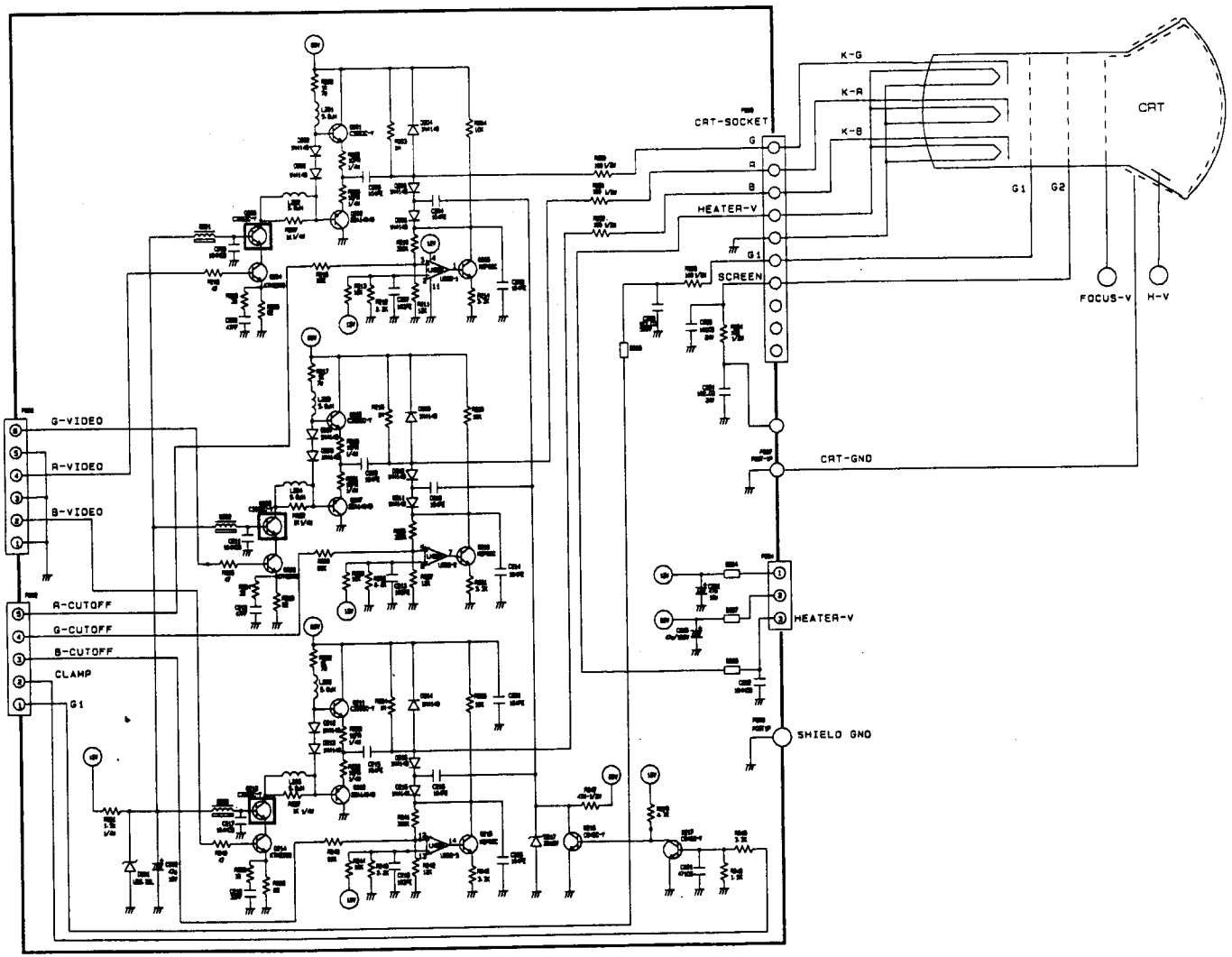

CRT
G1
G2
FOCUS-V
H-V




K-G
K-R
K-B
CRT
P803
CRT-SOCKET
G
R
B
HEATER-V
G1
SCREEN
G1
G2
FOCUS-V
H-V
CRT-GND
P804
12V
80V
HEATER-V


R-VIDEO
B-VIDEO
R-CUTOFF
G-CUTOFF
B-CUTOFF
CLAMP
G1
CRT-GND
HEATER-V
SHIELD GND


CRT-GND
HEATER-V
SHIELD GND


CRT-SOCKET
G
R
B
HEATER-V
G1
SCREEN
K-G
K-R
K-B
CRT
G1
G2
FOCUS-V
H-V
CRT-GND
HEATER-V
SHIELD GND
G-VIDEO
R-VIDEO
B-VIDEO
R-CUTOFF
G-CUTOFF
B-CUTOFF
CLAMP
G1