SERVICE MANUAL

20" HIGH - RESOLUTION
COLOUR DISPLAY MONITOR
MODEL HL6905/6605

X－RADIATION WARNING

The surface of picture tube may generate X－Radiation.
Precaution during servicing, and if possible use of a lead apron or metal for shielding is recommended. To avoid possible exposure to X－radiation and electrical shock hazard, the high voltage compartment and the picture tube shield must be kept in place whenever the chassis is in operation. When replacing picture tube use only designated replacement part since it is a critical component with regard to X－Radiation as noted above.
The high－voltage specification is described on page 3.

CRITICAL COMPONENT REPLACEMENT WARNING

The components marked "⚠" are critical components for X－ray radiation.
When replacing these parts, use exactly the same one indicated in parts list.
Please do not remove the seal of sealed potentio－meter.
If broken the critical component, please contact with qualified personnel of Mitsubishi Eelectric Corp. or the company which indicated on name plate.

注　意

本品は外国為替及び外国貿易管理法に定める戦略物資（又は役務）に該当するため、輸出する場合、同法に基づく輸出（又は役務取引）許可が必要です。

CAUTION

These products or technologies are subject to Japanese and／or COCOM strategic restrictions, and diversion contrary thereto is prohibited.

CONTENTS

1. SPECIFICATION

1.1 FEATURES

1) HIGH RESOLUTION IMAGE

1280 × 1024 pixel resolution image in non – interlace mode comes out. Flicker free imge is enabled by non – interlace operation.

2) AUTO – TRACKING FUNCTION

Input signals which have 30KHz – 64KHz as horizontal scanning freq., and 50Hz – 90Hz as vertical scanning freq can be displayed correctly in the screen of this monitor by the auto – tracking function without any adjustment.

Display image size and position of 11 different signal sources are pre – settable in auto channel (CH0), and 9 different signal sources are pre – settable respectively in enhanced channel (CH1 – CH9).

3) EASY – READJUSTMENT

Adjustment points of display image size and position are easily accessed through the front lid of the standard plastic cabinet, and push buttons.

4) WIDE – BAND – VIDEO AMPLIFIER

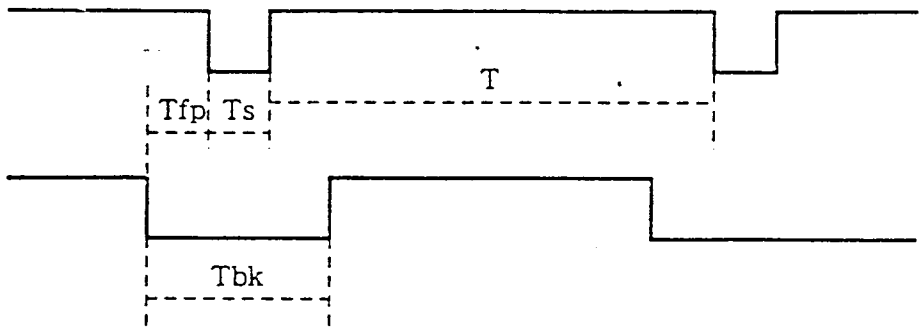
Wide – band – analog video amplifier can display the fine – grained picture with unlimitted colour.

1.2 RATING/SPECIFICATION

1)	AC POWER VOLTAGE	AC90 – 132V or AC180 – 264V (Switchable in rear panel)
2)	AC POWER FREQUENCY	47 – 63Hz
3)	POWER CONSUMPTION	less than 140W
4)	INPUT SIGNAL	
	a) VIDEO SIGNAL	Analog R.G.B. 0.7Vpp (STD) positive bright
	b) SYNC SIGNAL	Composite sync on Green video 0.3Vpp (STD) Composite sync 1.5Vpp – 5.0Vpp (Negative) Separate sync. (HD/VD) 1.5Vpp – 5.0Vpp (Negative/Positive)
5)	INTERFACE	
	a) INPUT CONNECTOR	BNC (Receptacle)
	b) INPUT IMPEDANCE	75 Ω for video and sync signal High impedance can be selected by impedance select SW. Loop – through operation is available with T – type BNC connector.
6)	SCANNING FREQUENCY	HORIZONTAL 30KHz – 64KHz VERTICAL 50Hz – 90Hz
7)	WARM UP TIME	more than 20 minutes.
8)	EFECTIVE DISPLAY AREA	350 (W) × 265 (H) mm
9)	BRIGHTNESS	100nit (STD) with B22 phosphor. standard white window video signal.
10)	OPERATER CONTROLS	Power SW (Front panel) Degauss SW (Front panel) Contrast control (Front panel) Bright control (Front panel)
11)	USER SERVICE CONTROLS	Sync select SW (Rear panel) Impedance select SW (Rear panel) Horizontal width control (Side lid) Horizontal positon control (Side lid) Vertical height control (Side lid) Vertical position control (Side lid) Horizontal raster position control (Side lid) PCC – amp. control (Side lid) PCC – phase control (Side lid)

12)	SERVICE CONTROLS	RGB Video gain controls (Rear panel) RGB Video bias controls (Rear panel) Vertical blanking control (Rear panel) Sub – bright control (in chassis)
13)	VIDEO AMPLIFIER	50Hz – 110MHz ± 3dB Tr/Tf 5nsec typical
14)	RETRACE TIME	Horizontal 53 – 64KHz < 4.0 μ sec 40 – 53KHz < 5.0 μ sec 30 – 40KHz < 6.0 μ sec Vertical < 600 μ sec
15)	LINEARITY	better than 7 %
16)	RASTER DISTORTION	less than 2.5 %
17)	RASTER SIZE REGULATION	less than 1 %
18)	MISCONVERGENCE	Center (within 270mm diameter circle) – typical 0.3mm Other area – typical 0.4mm
19)	HIGH VOLTAGE	26KV (STD)
20)	TEMPERATURE	0 – 40℃ (with standard cabinet)
21)	OUTLINE SIZE	498 (W) × 442 (H) × 544 (D) (with standard cabinet)
22)	WEIGHT	Approx. 31Kg (with standard cabinet)

1.3 RECOMMENDED TIMING CHART



TIMING – 1 (Pre – set in CH.0)

Th	15.72 μ sec	(63.6KHz)
Ths	1.26 μ sec	
Thfp	0.36 μ sec	
Thbp	4.16 μ sec	
Tv	16.775msec	(1066H)
Tvs	47.0 μ sec	(3H)
Tvfp	47.0 μ sec	(3H)
Tvbp	613.0 μ sec	(39H)

TIMING – 2 (Pre – set in CH.0)

Th	20.04 μ sec	(49.9KHz)
Ths	1.42 μ sec	
Thfp	0.58 μ sec	
Thbp	5.00 μ sec	
Tv	16.653msec	(830H)
Tvs	60.0 μ sec	(3H)
Tvfp	60.0 μ sec	(3H)
Tvbp	621.0 μ sec	(31H)

TIMING – 3 (Pre – set in CH.0)

Th	22.80 μ sec	(43.8KHz)
Ths	1.50 μ sec	
Thfp	0.70 μ sec	
Thbp	5.50 μ sec	
Tv	16.769msec	(735H)
Tvs	68.0 μ sec	(3H)
Tvfp	68.0 μ sec	(3H)
Tvbp	911.0 μ sec	(40H)

TIMING – 4 (Pre – set in CH.8)

Compatible Timing for VGA 3modes

Th	31.778 μ sec	(31.5KHz)
Ths	3.813 μ sec	
Thfp	0.636 μ sec	
Thbp	6.356 μ sec	
	480line	
Tv	16.683msec	(60.0Hz)
Tvs	64.0 μ sec	(2H)
Tvfp	318.0 μ sec	(10H)
Tvbp	1048.0 μ sec	(33H)
	400line	
Tv	14.268msec	(70.0Hz)
Tvs	64.0 μ sec	(2H)
Tvfp	381.0 μ sec	(12H)
Tvbp	1112.2 μ sec	(35H)
	350line	
Tv	14.268msec	(70.0Hz)
Tvs	64.0 μ sec	(2H)
Tvfp	1176.0 μ sec	(37H)
Tvbp	1906.7 μ sec	(60H)

TIMING – 5 (Pre – set in CH.9)

Compatible Timing for Mac II mode

Th	28.57 μ sec	(35.0KHz)
Ths	2.12 μ sec	
Thfp	2.12 μ sec	
Thbp	3.17 μ sec	
Tv	15.00 msec	(66.7Hz)
Tvs	86 μ sec	(3H)
Tvfp	86 μ sec	(3Hz)
Tvbp	1114 μ sec	(39H)

2. CIRCUIT DESCRIPTION

2.1 GENERAL

This display monitor is composed of four blocks as shown in Fig. BLOCK DIAGRAM.

(a) Power supply block (PCB – POWER)
(c) Control block (PCB – CONT, PCB – FUNC)
(d) Deflection block (PCB – DEFL)
(d) Video block (PCB – VIDEO, PCB – CRT)

Every blocks will be explained in detail in following chapters.
In this chapter, the auto – tracking function will be explained generally.
Input sync signals whose horizontal scanning frequency of 30KHz – 64KHz and vertical scanning frequency of 50Hz – 90Hz can be automatically locked on without adjusting H – HOLD/V – HOLD. This automatic lock on function is performed by the circuits in PCB – CONT.

To maintain optimum operation of circuits over wide frequency range, some elements in circuits are switched according to horizontal frequenncy of input sync signal which is divided into three ranges as shown below.

30 KHz – 33.7KHz	L – Range
33.7KHz – 46.3KHz	M_1 – Range
46.3KHz – 58.3KHz	M_2 – Range
58.3KHz – 64.0KHz	M – Range

The circuit in PCB – CONT judges the frequency range of input sync signal, and generates changing signals.

PCB – CONT also maintains the other control signals to adjust the brightness, picture sizes etc electronically.

2.2 POWER SUPPLY BLOCK

2.2.1 GENERAL

(1) The power supply block can be operated in case either AC100 – 120V or AC200 – 240V power line.
(2) The selection of power line voltage is performed by changing the switch position on rear panel.
(3) The output lines of this power supply are shown in Table 2 – 1 with

their main loads.

(4) The power supply works as switched mode operation with RCC (ringing choke converter) configulation. Output voltages are regulated by 3rd winding. The swithcing frequency is corresponding to load currents. The 60V – 140V line is regulated by the DC chopper method from 165V line.

Table 2 – 1

OUTPUT LINE	MAIN LOAD
– 6.3V	CRT heater
24V	V – deflection, H – drive
28V	V – deflection
5V	CPU, G/A
12V	VIDEO – circuit, Horizontal – deflection
80V	VIDEO – circuit
165V	VIDEO – circuit
60~140V	H – deflection, HV – circuit

2.2.2 RECTIFY AND FILTER CIRCUIT

(1) The AC input voltage is rectified by the diode bridge D901. The rectified voltage is filtered by charging C901 and C902.

(2) In case of AC100 – 120V line input, the rectify circuit works as a double voltage rectify operation by setting the SW904 to the 100V position.

In case of AC200 – 240V line input, the rectify circuit works as a normal all wave rectify operation by setting the SW904 to the 200V position.

(3) The resistor R901 is equipped to suppress the inrush current when power switched on. The relay RY901 shunts R901 to eliminate the power loss of R901 when the control circuit starts to oscillate.

2.2.3 DEGAUSS CIRCUIT

(1) This monitor is provided the auto and manual degauss function. When power switch SW901 is turned on, transfer terminal Ⓐ of relay RY901 is terminated to Ⓒ to flow the degauss current. C981 is charged in about 3 second, then Q955 is turned on so that transfer terminal

Ⓐ of RY901 is terminated to Ⓑ to shorten inrush current decreasing resister R901.

(2) If SW902 is pushed on at hormal operating condition, Q956 is turned on to discharge C981, then transfer terminal Ⓐ works the same way stated above.

2.2.4 PRIMARY CIRCUIT

(1) Main DC power supply of this monitor consists of RCC (ringing chock converter). When power SW is turned on, triggering current is fed through R905 and R907 to the ②pin of IC991 to flow the collector current of Q1 in IC991. The collector current of Q1 begins to flow, then inductive voltage is generated between ① and ② pins of T931 so that the differential base current caused by C908 and R904 gives to the base of Q1.

As the load currents of secondary winding at power switched on are very small, very small peak collector current Ip' of Q1 is needed.

The circuit comes to stabilize by repeating the action stated above.

(2) In normal operating condition, the circuit works as follows.

The collector current Ic of Q1 increases according to the equation of $Ic = \frac{V_I}{Lp} Ton$. (Lp : primary widing inductance V_I : Input voltage)

When the Ic reaches $Ip = I_B \times hfe$, V_{CE} of Q1 increase immediately and the charge current for C922 flows through D910 and D909.

In the same time secondary currents begin to flow through D951~D955.

As soon as the energy which is stored in primary winding of T931 transfers to secondary circuit, the currrents through D951~D955 also reach to 0 (zero). In that time all winding voltages of T931 are zero, and the Q1 starts by triggering resistor R905 and R907. Next cycle base current of Q1 is supplyed from the charge of C922 by Q902 turned on.

(3) The third winding ③−② works as the detector to stabilize the secondary voltage. If the voltage of secondary widings increase, voltage of ③−② also increase. So the rectified voltage which is supplied to ①pin of IC991 decreases to by−pass the base current of Q1. In that result output voltage decrease.

(4) D912 and Q913 work as the protector for excess AC voltage. If the AC voltage selector SW904 is set to 100V position, D901 is connected as double voltage rectifier. In that time, if the AC Input is connected to 200V line, DC voltage across C901 ⊕ and C902⊖ reaches over 500V,

and D913

then the avanche diode D912 will be on to shorten the circuit. So the fuse F901 will be blowed, and components are avoided to be broken.

2.2.5 SECONDARY CIRCUIT

(1) In this paragraph chopper circit which is applied for Auto – scanning circuit will be explained.

(2) Chopper circuit mainly consists of T951, Q951, Q952, Q953.
During the Q951 is turned on, base current of Q951 is supplied by the discharge current from C969. When Ic of Q951 reaches to the saturated level $Ip = I_B \times hfe$, Q951 is turned off immediately. Then the voltage ⑥pin increase to charge the C969 through D958 to prepare the next switching cycle. The output voltage +B (Q951 emitter voltage) is regulated by following procedure. If the voltage of F/B terminal is higher, base current of Q953 increase. So the base current of Q952 also increase to by – pass the base current of Q951. In that result, peak collector current Ip of Q951 decreases to lower the output voltage.

2.3 CONTROL BLOCK

CONTROL BLOCK consists of 3 PCBs.
1st is PCB function, 2nd is PCB bright/contrast (work as data entry and adjustment) and 3rd is PCB control. Refer to Fig. 2 – 1.

2.3.1 PCB CONTROL

(1) PCB control has 1 (one) CPU IC101, 1 (one) Gate Array IC100, 2 non volatile memories IC108, IC109, D/A converters, and other control ICs. The input signal for PCB control are fed from 4 tact switches on PCB – CONT/Bright, 2 rotary swtiches on PCB function, and horizontal, vertical sync singals, sync polarity detecting signals from PCB Video are also inputted to PCB control.

(2) Based on the above signals, IC101 reads out data like as screen size, screen position etc. which are stored in IC108, IC109, and stores into RAM of IC101. These information are sent from R_{70}~R_{73}, R_{90}~R_{93} of IC101 to IDT1~IDT8 ports of Gate Array IC100 together with other informations like as AFC constant and Cs changing which are stored in ROM of IC101.
IC101 has latches and shift register, and triggering pulses are fed to ITR1~5 to select where the outputs should be sent.
Each outputs of IC100 are as follows.

ODT1~3 : NC
ODT4, 5 : For changing AFC time constant
ODT6~8 : For changing Cs compensate
ODT9, A : NC
ODTB, C : For changing PCC compensate phase

From OFH1~OFH8 horizontal oscillating frequency control signal is outputted, and it's signal is converted from digital level to analogue level by LD102, then sent to PCB - DEFL through voltage follower IC120, amplifier IC124.

(3) IC121, IC122 are D/A converters whose function is 6bit × 8circuits, and data input is performed by serial forward. Data is sent from ODAD of IC100 to ②pin of IC121, and clock signal working at serial forward is inputted from D0 port of IC101.
D/A conversion data syncronized to clock signal ⑪ pin of IC101 is outputted from IC100, and when finished data forward, load pulse is sent from R_{42} port of IC101 to IC121, IC122, then data is maintained in latch of IC121 and IC122.
DC voltages from IC121 and IC122 are used to control screen width, position, and brightness.

(4) IC108, IC109 are E²PROMS which are written control data like screen size, position, brightness etc. In IC108 horizontal frequency and all data of Auto - channel are stored, on the other hand in IC109 contrast/ brightness data and Enhanced - channel data are stored.
IC102, Q101, Q102, IC126 are provided to reset at power on, program run away watching, and + B voltage watching.

2.3.2 PCB FUNCTION

PCB FUNCTION has 1 LED (D140), 1 dip SW (SW103), and 2 binary rotary switches (SW104, SW105). Dip switch consists of 2 circuits, and right one is NC, left one is provided to change the function of contrast and brightness keys to data input keys of screen image.
SW104 is channel SW to change monitor scanning whether auto channel or enhanced channel. The output of this binary switch is converted decimal to binary and is fed to R_{10}~R_{13} ports of IC101. SW105 is provided to set which picture data is changed, and only works when dip SW SW103 is set to adjustment mode. D140 is provided to watch the memory content of non - volatile memory IC108,109.

2.3.3 PCB CONT/BRT

3 swithces (SW106, 107, 109) are provided on PCB - CONT/BRT to work as entry and adjustment switch of screen image.

When SW103 is set to adjustment mode, SW106 and SW107 work as decrement and increment switches respectively, and SW109 works as memory entry key. In case of D140 turning on and off when push entry key to memorize new data, this shows memory address of IC108 and IC109 are already occupied. In this condition, if SW103 is changed from adjustment mode to operation mode again, data in memory are maintained. If SW103 is maintained to adjustment mode and push entry key again, new data will be memorized into E^2PROM (IC108 or IC109).

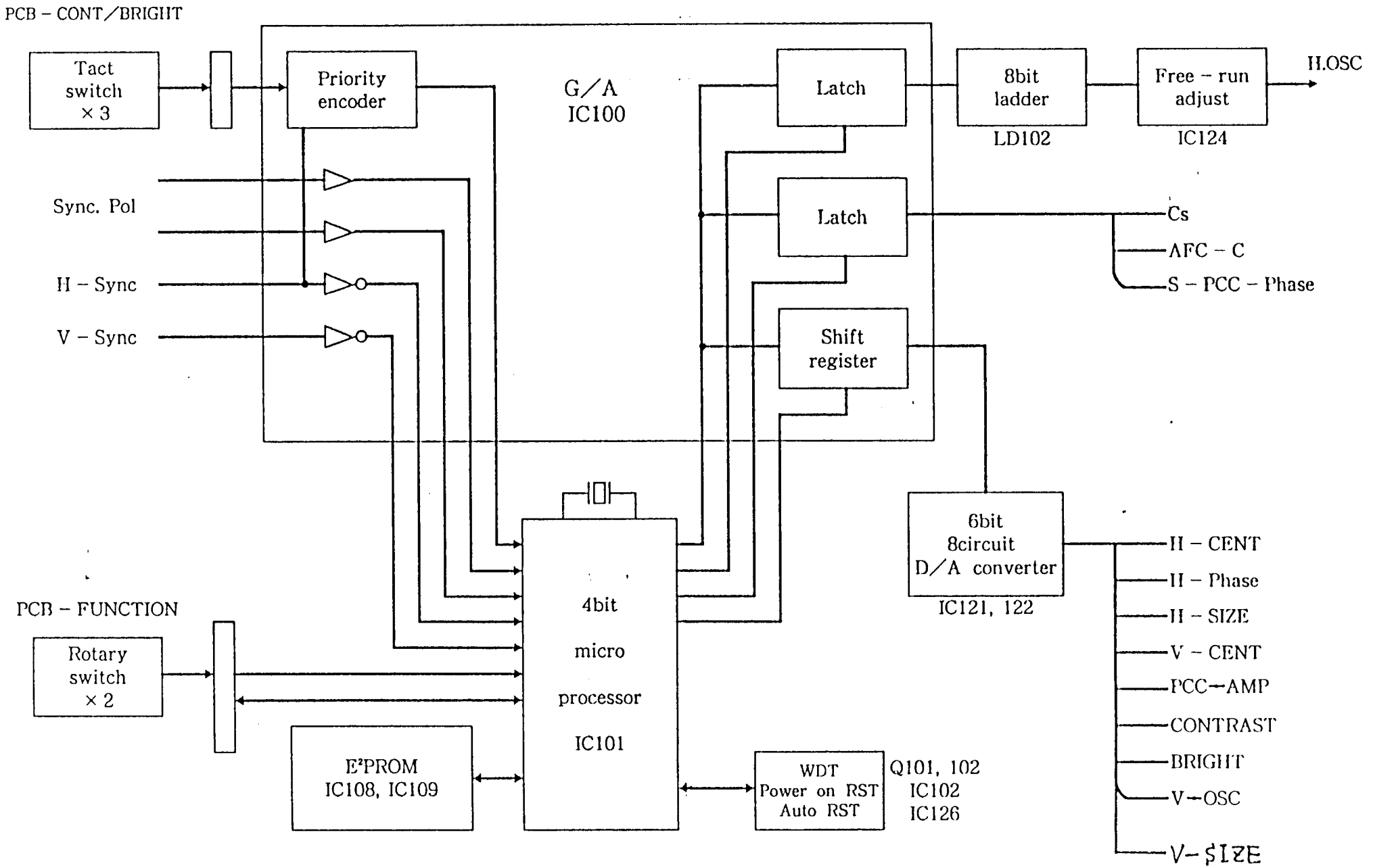


Fig. 2 – 1 Control Block

2.4 DEFLECTION BLOCK

Deflection block consists of horizontal, vertical, high voltage circuits, and are fundamentaly operated by changing DC control voltages.

2.4.1 HORIZONTAL DEFLECTION CIRCUIT

(1) All DC control voltages are fed from PCB – CONT.
Positive H – sync signal is fed from PCB – VIDEO, and DC voltage in accordance with that frequency is given in ②pin of J503 to oscilate horizontal frequency. If H – oscilation frequency is high, relative DC voltage of ②pin of J503 is higher, then the charge current to add to time constant circuit consisting of R587 and C509 increases to shorten charge time.
So the oscilation frequency goes to higher. When no sync signal is connected, free running frequency is about 47KHz.

(2) The output of ⑬pin of IC501 works as a drive voltage for H – deflection, and HV circuits. The principle of horizontal deflection is shown in Fig. 2 – 2.
The voltage in Fig. 2 – 2 indicate approx. value at 64KHz operation. Q507 works as a horizontal output, and D508, D517 and D518 work as dumper diodes. Q514, Q515, Q516 and Q527 are switched on as follows in accordance with the horizontal frequency to compensate the horizontal linearity.

30 ~ 33.7KHz	Q514, 515 and 516 are on.
33.7 ~ 46.3KHz	Q514 and Q515 are on.
46.3 ~ 58.3KHz	Q515 is on.
58.3 ~ 64 KHz	No FET is on.
46.3 ~ 64 KHz	Q527 is on.

(3) In Fig. 2 – 2, the horizontal output Tr Q507 is turned on by the drive pulse from IC501 via Q520 and Q506.
During Q507 is turned on, the deflection current I_{DY} increase from 0 to positive max Ip in accordance with the equation $Ip = \frac{V_{CC}}{L_{DY}} \times Ton.$
(L_{DY} : parallel value of HOT and DY.)
When the drive pulse goes to negative polarity, Q507 is turned off, and I_{DY} begins to flow to charge C527 and C528 until V_{CP} reaches maximum value " $\frac{\pi}{2} \times \frac{Ts}{Tr} \times Vcc$ ".
As soon as V_{CP} reaches maximum value, discharge current from C527 and C528 flows to DY.
This charge and discharge period is called "retrace time" which is

expressed by equation $Tr = \pi\sqrt{L_{DY} \cdot C_R}$.

When the V_{CP} reaches to 0V, the dumper diodes are turned on and I_{DY} begins to flow from $-$ Ip to 0 (zero) ampere.

Normally on period of Q507 overlaps with on period of dumper diodes, so the crossover distortion appeares at 0 (zero) ampere point of I_{DY}. D517 and D518 are high speed dumper diode to flow the transient current, and main dumper current flows through D508.

The horizontal output transformer T502 works as a choke coil connecting between deflection yoke and power supply, and also works to get some DC power sources.

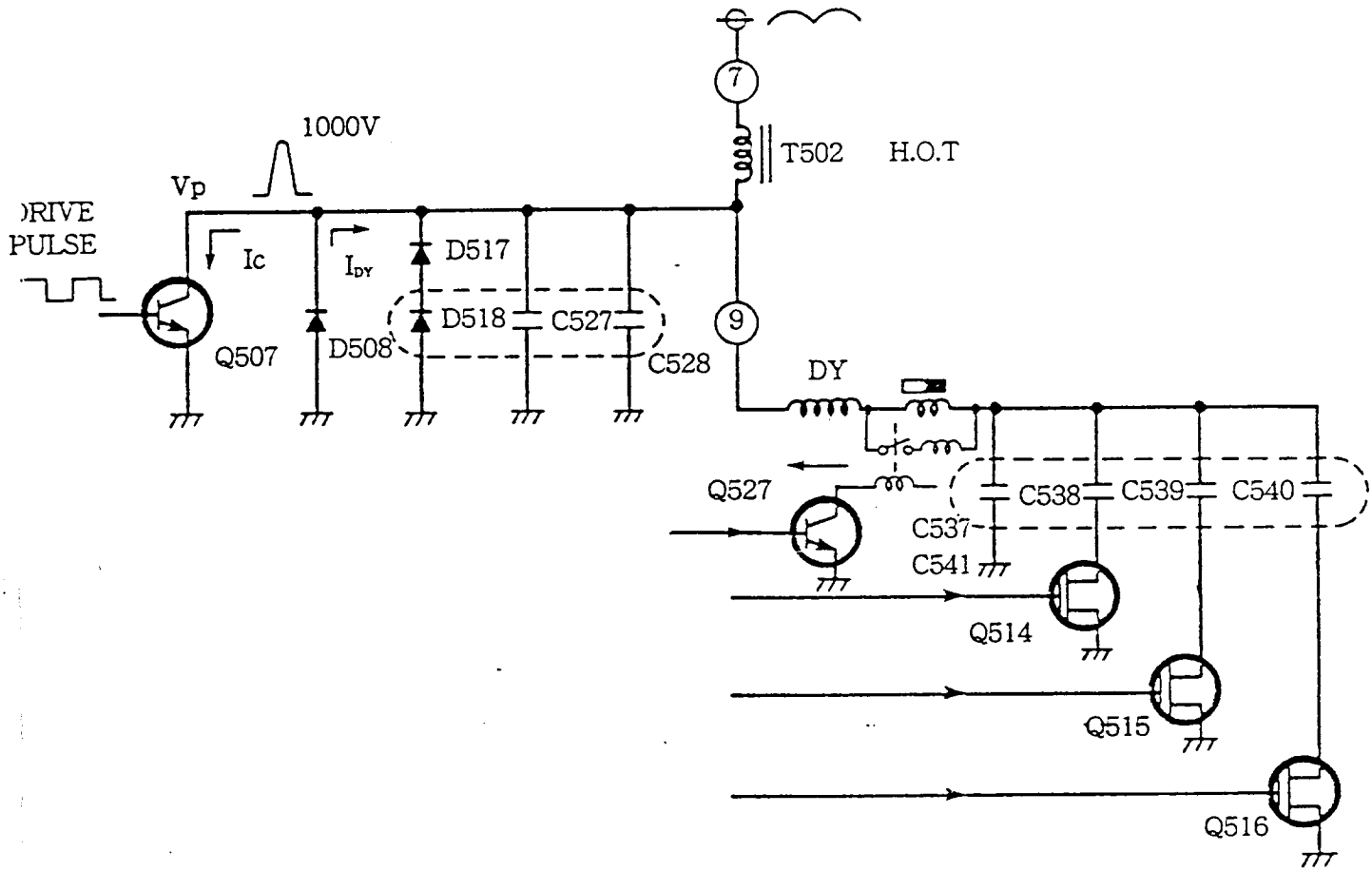
(4) The power supply voltage connected to ⑦pin of T502 is modulated to parabolic wave form by Q410 and Q411 to compensate side pin cushion distortion.

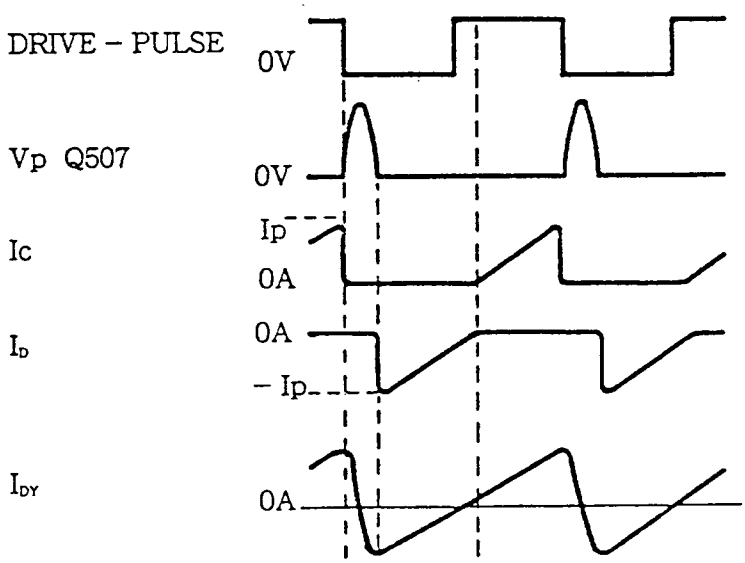
The parabolic wave is generated by IC405 and amplified by Q406~408, Q416~q417 and fed through buffer amplifiers Q415, Q409 to the base of Q410 to modulate. Also ⑦pin voltage is varied from about 50V to 130V to regulate the horizontal width regardless of horizontal frequency.

This is performed to maintain the DC voltage of the cathode of D511 which is proportional to collector pulse voltage of Q507.

The DC voltage across C531 is fed to ②pin of IC503. If DC voltage across C531 is higher, ⑦pin voltage of IC503 also increase. So the + B voltage of ①pin of J501 becomes lower in procedure stated in 2.2.5 (2).

Fig. 2 – 2 Principle of Horizontal Deflection





(5) Q521~Q524 consist of regulator to optimize the driving condition of H – deflection output Tr Q507. Output voltage of Q524 is controlled by 2 modes.

(5 – 1) If the H – width controll voltage from ⑦pin of J504 decreases, emitter current of Q522 also decreases, then output voltage of Q524 increases to supply enough driving power for Q507. Refer to Fig. 2 – 3.

(5 – 2) On the other hand, when the ⑮pin voltage of J504 decreases according to the lower horizontal frequency, base voltage of Q521 also decreases, so the output voltage of Q524 increases to optimize the base current of Q507. Refer to Fig. 2 – 4. By the manner stated (5 – 1), (5 – 2), Q507 is driven enough, and power loss is minimized.

Fig. 2 – 3

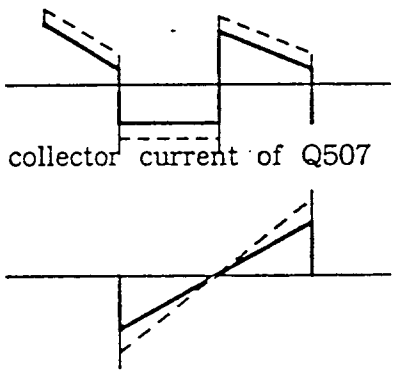
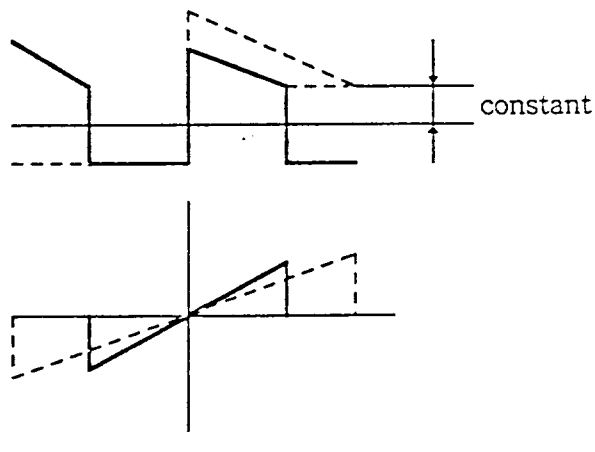


Fig. 2 – 4



(6) ⑬, ⑭pins of J504 are control signals to change AFC components C517 ~520 and R5C2~5C5. Combination of these are as follows.

fH =	30	~ 37.9KHz	C519/R5C5
	37.9	~ 46.3KHz	C520/R5C4
	46.3	~ 58.3KHz	C518/R5C3
	58.3	~ 64.0KHz	C517/R5C2

2.4.2 HIGH VOLTAGE CIRCUIT

(1) HIGH VOLTAGE SUPPLY AND CONTROL CIRCUIT

The principle of the high voltage supply circuit is basically same as the horizontal deflection.

The drive pulse which is same as the horizontal deflection, is connected to the base of Q603 via the emitter follower Q601 and Q602, and switches Q603. The fly back transformer steps up collector pulse generated when Q603 turned OFF to the high voltage.

The high voltage should be stabilized to prevent the fluctuation of the size of image on screen depended on the beam current. In this circuit, the supply voltage of the circuit is controlled to stabilize the high voltage output.

The series regulator composed of Q605, Q606 and Q607 controls the supply voltage of the circuit.

The high voltage is attenuated by the high voltage resistor, approx. 350 mega – ohms, equipped inside the flyback transformer, and R625. This voltage is fed to the base of Q607 which works as the error amplifier for the series regulator via the emitter follower Q608, and compared with the reference voltage stabilized by D606. If the high voltage increases, the feedback voltage increases, and the base current of Q607 increases and the collector voltage of Q607 decreases, and then the emitter voltage of Q605 decreases. It means the decrease of the supply voltage to the high voltage circuit, and the initial increase of the high voltage is corrected.

The high voltage is already set to the pre – arranged value (25KV STD) by VR602 (HV – ADJ).

(2) HIGH VOLTAGE SAFETY CIRCUIT

– CAUTION –

Safety circuits described below are equipped to prevent abnormal increase of the high voltage that may cause a X – radiation of harmful level.

No modification should be applied to the high voltage supply and safety circuits.

The safety circuit works as the over voltage protecter for the high voltage.

The pulse voltage which is in proportion to the high voltage, is generated at the third – winding of the fly – back transformer. The voltage after rectifing and filtering above pulse via D605 and C605

is used as the voltage detecting of high voltage.
This voltage is divided by R611, VR601 (HV – LIMIT), and R612, then fed to ⑭pin of IC501. The voltage of ⑭pin of IC501 is adjusted to reach the triggering voltage level just in case of the high voltage reaches 29KV, by VR601 (HV – LIMIT).
When the high voltage reaches 29KV under trouble conditions, X – Ray protection circuit in IC501 works to inhibit pulse generation at ⑬pin of IC501.
So no switching operation which generates High Voltage works. ⑬pin output of IC501 continues to be 0 (zero) until the main power supply is turned OFF by the operater.

2.4.3 VERTICAL DEFLECTION CIRCUIT

Vertical deflection is performed by 1 (one) IC, and some attached components.

(1) The oscillating frequency is controlled by applying DC voltage at ④ pin of IC401. If the DC voltage at ④pin of IC401 is higher and threshold level goes to high, oscillating frequency goes to lower.
At the same time base voltage of Q418 is higher and resistance between ⑦pin of IC401 and GND goes to higher, so the vertical height is compensated to narrow at lower vertical frequency.

(2) Q402 works as height controller to change the base bias voltage. When base voltage is higher, height goes to wider.

2.5 VIDEO BLOCK

2.5.1 VIDEO AMPLIFIER

(1) The circuits for video amplifiers are in PCB – VIDEO.

(2) There are three video amplifiers for R.G.B. inputs which have identical circuit configuration.
For simplificatin, the green – channel amplifier will be explained in this chapter.

(3) This amplifier is composed of the pre – amplifier section and the main – amplifier section.
The video signal (0.7Vpp STD) is amplified to approx. 3Vpp in the pre – amplifier section and is amplified again to approx. 30Vpp during the main – amplifier section.

(4) The input signal is fed to 1 pin of IC261 via the emitter follower Q261, and Q262. The gain of IC261 is controlled by the DC voltage of 4 pin, higher voltage of 4 pin makes the gain of IC261 larger. This IC also

provides the function of the black level clamp.
For this function, the output signal divided by R289 and R266 is connected to 11 pin, the voltage of clamp level is fed to 9 pin, and the clamp pulse which is added at the back – porch duration of video signal is fed to 12 pin. The voltage level of 11 pin is compared with the voltage level of 9 pin during the clamp pulse active, and the DC level of output signal of this IC is controlled to make the 11 pin voltage to be equal to the 9 pin voltage. This function can provide very good stability of the black level of video output signal.

(5) The output signal of IC261 is connected to the main – amplifier section via the emitter follower Q263, Q264.

(6) The main – amplifier section is composed of the amplifier (Q265, Q266) and the push – pull emitter follower (Q267, Q268).
The amplifier circuit composed of Q265 and Q266 is the complimentary push – pull circuit which has a infinite open loop gain.
To obtain the amplifer which has the linear characteristics, the output signal is feedbacked to the base of Q266 passing through R288.

(7) C283, R284, C285 and R285 compose of the emitter peaking circuit.
The network composed of C279, C280, C281 and other resistors connected to the base circuit of Q266 also improves the characteristics of video frequency response.

(8) To display a pure white image on screen, both the DC level and the amplitude of video output signal should be adjusted as the 3 guns characteristics of CRT's are not identical.
The DC level of cathod can be adjusted by VR262 (G – BIAS) and the amplitude of video output signal can be adjusted by VR261 (G – GAIN).

2.5.2 SYNC SEPARATION CIRCUIT

(1) This monitor can be synchronized under following conditions.
- Composite sync. signal on green video
- Composite sync. signal (negative going)
- Horizontal sync./vertical sync. signals (positive or negative going)

(2) The sync. separation circuit provides following functions.
- Separating the composite sync. signal from the green video signal
- Amplifing the composite sync. signal level to TTL level.
- Separating the horizontal and vertical sync. signal from the composite sync. signal

(3) In case of using the composite sync. signal on green video, the sync.

selector SW302 is set to "INT" position.
In other cases, SW302 is set to "EXT" position.

(4) In case of using the composite sync. signal on green video, IC301 works as a separater which separates the composite syc. signal from the green video, and the amplifier which amplifies signal amplitude to TTL level.
In other cases, IC301 works as only the amplifier.
The TTL level composite sync. or horizontal sync. signal is fed to 12 pin of IC301.

(5) IC302, IC303, and IC304 work as the separater of horizontal and vertical sync. signal, the generater for the clamp pulse, and the generater of the blanking pulse,
The horizontal sync. signal is fed to 1 pin of IC303. The vertical sync. signal is fed to 12 pin of IC303. The clamp pulse is fed to 8 pin of IC302. The blanking pulse is fed to 10 pin of IC302.
Above mentioned circuits are in PCB – VIDEO.

(6) Q3G0, 3G1, IC307 and IC308 are provided to form vertical sync. signal and to apply for dual vertical polarity of PS/2.

2.5.3 ABL CIRCUIT

(1) This circuit is for limiting the beam current of CRT, and is in PCB – VIDEO.

(2) The brightness of CRT is determined by the beam current.
The beam current is detected by R624 (PCB – DEFL).
When the beam current exceeds the limit value, this circuit makes the voltage of 4 pin of IC201, IC231, and IC261 which controls the gain of pre – amplifiers, lower level.
It means that the circuit suppresses the output of pre – amplifiers for limiting the brightness of CRT.

(3) When the voltage drop across R624 exceeds the zenner voltage of D305, Q305 starts to work, and Q306 is supplied its base current and then the collecter voltage of Q306 decreases.
As the result, the gain control voltage of pre – amplifiers are decreased.

2.5.4 PCB – CRT

(1) The blanking circuit and the bright control circuit are in PCB – CRT.

(2) The blanking pulse generated in PCB – VIDEO is fed to Q383 which amplifies the blanking pulse to approx. 60Vpp negative going pulse.

This pulse is connected to G1 of CRT via the emitter follower Q381, Q382 and the coupling capacity C382.

The blanking action is realized so that the voltage of G1 is kept in the negative potential during the blanking period.

(3) The bright control is performed by adjusting the voltage of G1. VR381 (SUB – BRIGHT) can controls the brightness of back – raster.

3. ADJUSTMENT PROCEDURE

This display monitor can be memorized totally 20 different timings of screen images.

Auto channel can be memorized 11 timings. For each timing 7 functions of screen images can be adjusted. All adjustments can be operated by 2 rotary switches, 1 slide SW and 3 push buttons located on front pannel. Refer to Fig. 4 – 1.

The first, internal adjustment mode which has no relation to timings of screen image should be explained. Refer to Fig.5 – 1.

3.1 INTERNAL ADJUSTMENT

Set all switches stated below except when special mentioned.

Mode switch : OFF POSITION

Channel switch : CHO POSITON

Picture control switch : 0 (zero, spare position)

1) HIGH VOLLTAGE ADJUSTMENT

(1) Input only sync. signal. (fH = 30KHz)

(2) Connect HV meter (full scale 30KV) between anode of CRT and chassis.

(3) Turn the screen potentio – meter of FBT to CCW, and turn contrast and brightness controls located on front panel to CCW.
Turn the HV – ADJ (VR602), and HV – Limet (VR601) to fully CCW.

(4) Turn the HV – ADJ (VR602) until HV – meter indicates 29KV ± 0.3KV.

(5) Turn the HV – Limit (VR601) until HV – Limiter circuit works.

(6) Turn off the power SW, and turn the HV – ADJ (VR602) to CCW.

(7) Turn on the power SW, then turn HV – ADJ (VR602) slowly to

CW to check HV – limiter works at 29KV ± 0.3KV.

Turn off power SW, and turn HV – ADJ (VR602) to CCW.

(8) Change the horizontal sync. frequency from 30KHz to 63.6KHz.

(9) Turn on the power SW, and set HV – ADJ (VR602) to 25 ± 0.3KV.

> * CAUTION
> HV – ADJ (VR602) and HV – limit (VR601) are sealed and no field serviceable parts to avoid exposure of X – ray. Please contact to qualified personnel of mitsubishi, if need to re – adjust.

2) SCREEN ADJUSTMENT

(1) Input only sync. signal. (fH – 63.6KHz)

(2) Connect HV meter to ⑦pin of CRT – socket.

(3) Each controls stated below are set to minimum position.

① R, G, B cont (VR201, 231, 261)

② R, G, B bias (VR202, 232, 262)

③Contrast

④Brightness

⑤Sub – Bright (VR381)

(4) Adjust screen potentio – meter of FBT to 600V ± 10V.

> * CAUTION
> Screen potentio – meter are also sealed by adhesive. Please contact to qualified personnel of Mitsubishi, if need to re – adjust.

3) ADJUSTMENT OF HORIZONTAL FREE – RUNNING FREQUENCY

(1) Grasp red lead wire from Defl – PCB to horizontal deflection yoke by frequency counter probe.

(2) Set SW102 on PCB – CONT to center position.

(3) Input sync. signal whose frequency is 30KHz, then adjust VR101 to oscilate free – running frequency at 30 ± 0.2KHz.

(4) Input sync. signal whose frequency is 64KHz, then adjust VR101 to oscilate free – running frequency at 64 ± 0.2KHz.

(5) Repeat (3) and (4).

4) HORIZONTAL DRIVE ADJUSTMENT (fH = 63.6KHz)

(1) Connect digital multi – meter to test point on PCB – REG1.

(2) Adjust VR501 (H – Drive) to get minimum indication.

5) CUT OFF OF CRT ADJUSTMENT (fH = 63.6KHz)

(1) Turn contrast control to CCW and brightness control to CW.
(2) Set VR202, 232, 262 on PCB – VIDEO to fully CCW.
(3) Input only sync, signal (fH = 63.6KHz).
(4) Turn the VR381 on PCB – CRT to get dim raster.
(5) Adjust 2 potentio – meters, except 1 bias control potentio – meter which is the brightest at adjustment (4) item, to get white raster.
(6) Set the VR381 to get dim raster (about 1nit).

6) BRIGHTNESS & WHITE BALANCE ADJUSTMENT (fH = 63.6KHz)
(1) Turn contrast and brightness control to CW.
(2) Turn brightness control to get 0.5nit raster brightness.
(3) Set VR201, 231, 261 to fully CCW.
(4) Input green video signal whose size is about 80 × 80mm square at CRT center position.
(5) Adjust G – CONT (VR261) to 75nits.
(6) Input R, B video signal together with G, then adjust VR201, 231 to get color coordination X = 0.283 ± 0.01, Y = 0.297 ± 0.01.

3.2 SCREEN IMAGE ADJUSTMENT

All adjustments of screen images can be accessible by side lid control and 3 push buttons.

Refer to Fig. 4 – 1.

In this paragraph Auto channel adjustment is explained for example. For enhanced channel same procedure is accepted for adjustment.

(1) Set the channel switch to CH0 (Auto channel) or CH1~CH7 (Enhanced channel). The difference between CH0 and CH1~CH7 is as follows.
(2) Set the mode switch to ON (ADJUSTMENT MODE) position.

CH0 (Auto channel)

Auto channel has 11 area for horizontal frequency of 30~64KHz and picture data can be memorized in each area. Difference between adjacent each horizontal frequency should be kept 3KHz or more, because horizontal frequency which monitor counts has little discrepancy from that input signal.

CH1~CH9

Enhanced channel has 9 channels, and 1 (one) specified timing can be memorized in each channel.

Also each horizontal frequency is not necessary to separate 3KHz or more between adjacent channel.

Set the mode SW and channel SW according to Item (1) and (2).

3.2.1 H – PHASE

Set the picture control SW⑦ to 1.

Push the ADJUSTMENT Button ① to move screen image to right, or push ② to move to left, then push entry SW ③ to memorize. By H – PHASE control, relative position between screen image and raster is adjusted. If in that time entry indicater ⑦ is lit, it shows this area has been occupied. When entry SW ③is pushed again, new data will be memorized instead of old data. Entry indicater ⑦ works same way at other adjustments.

3.2.2 H – SIZE

Set the picture control SW⑦ to 2.

Push the ADJUSTMENT Button ① to widen screen image (raster size), or push ② to narrow, then push entry SW③ to memorize.

3.2.3 H – POSITION

Set the picture control SW⑦ to 3.

Push the ADJUSTMENT Button ① to move raster position to right, or push ② to move to left, then push entry SW③ to memorize.

3.2.4 V – POSITION

Set the picture control SW⑦ to 4.

Push the ADJUSTMENT Button ① to move raster position upward, or push ② to move downward, then push entry SW③ to memorize.

3.2.5 V – SIZE

Set the picture control SW⑦ to 5.

Push the ADJUSTMENT Button ① to widen screen image (raster size), or push ② to narrow, then push entry SW③ to memorize.

3.2.6 PCC – AMP

Set the picture control SW⑦ to A.

Push the ADJUSTMENT Button ① or② to get the optimum raster shape.

3.2.7 PCC – PHASE

Set the picture control SW⑦ to B.

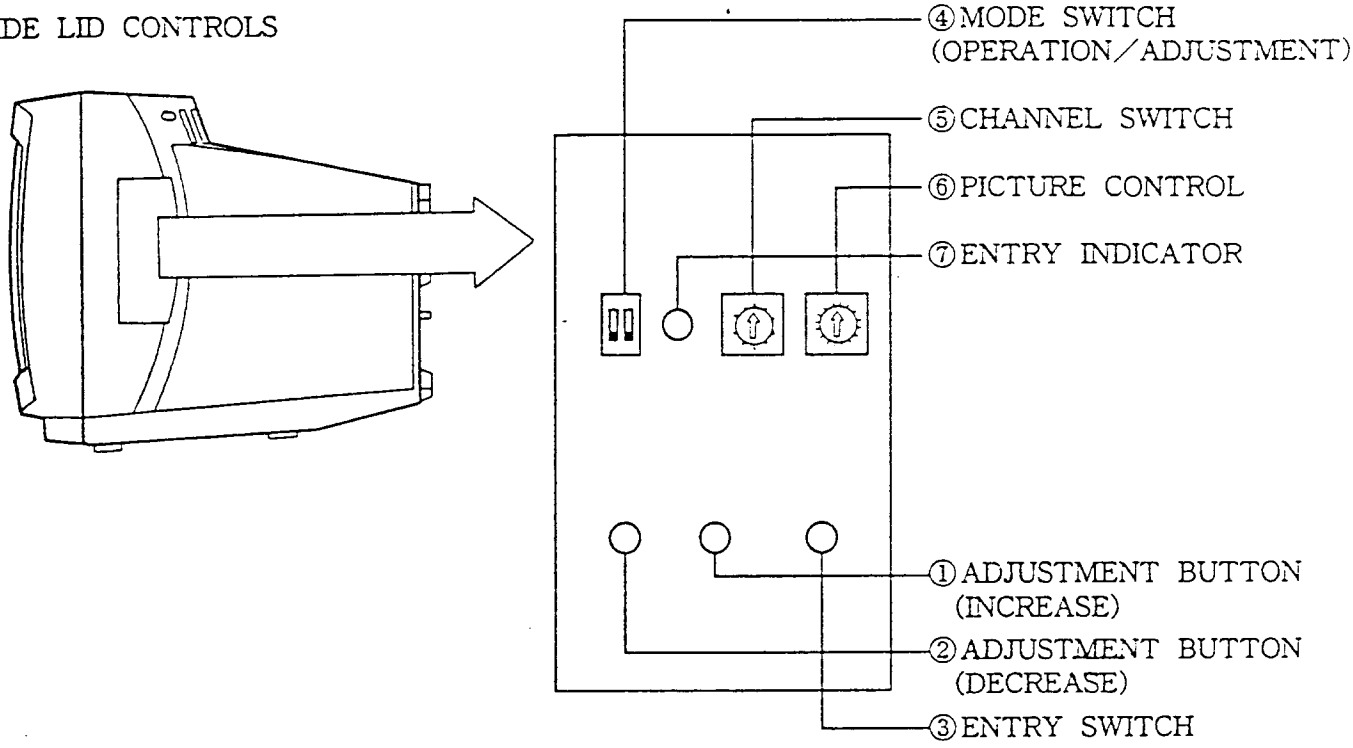
Push the ADJUSTMENT Button ① or ② to get optimum raster shape.

3.2.8 At the time re－adjustment finished, set the mode switch ④ to OFF position.

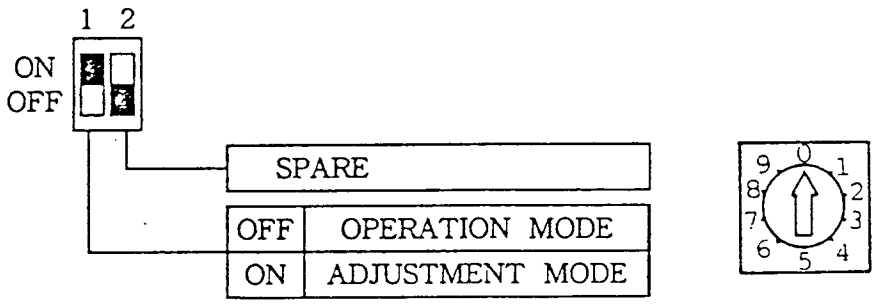
4. SIDE CONTROL

Fig. 4 – 1

SIDE LID CONTROLS



MODE SWITCH

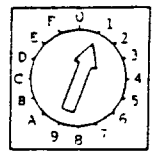


CHANNEL SWITCH

CHANNEL		
CH0	Pre – settable by user (11 timings)	AUTO CHANNEL
CH1 to CH7	Pre – settable by user (1 timing for each CH)	ENHANCED CHANNEL
CH8	VGA 3 modes	
CH9	MAC II	

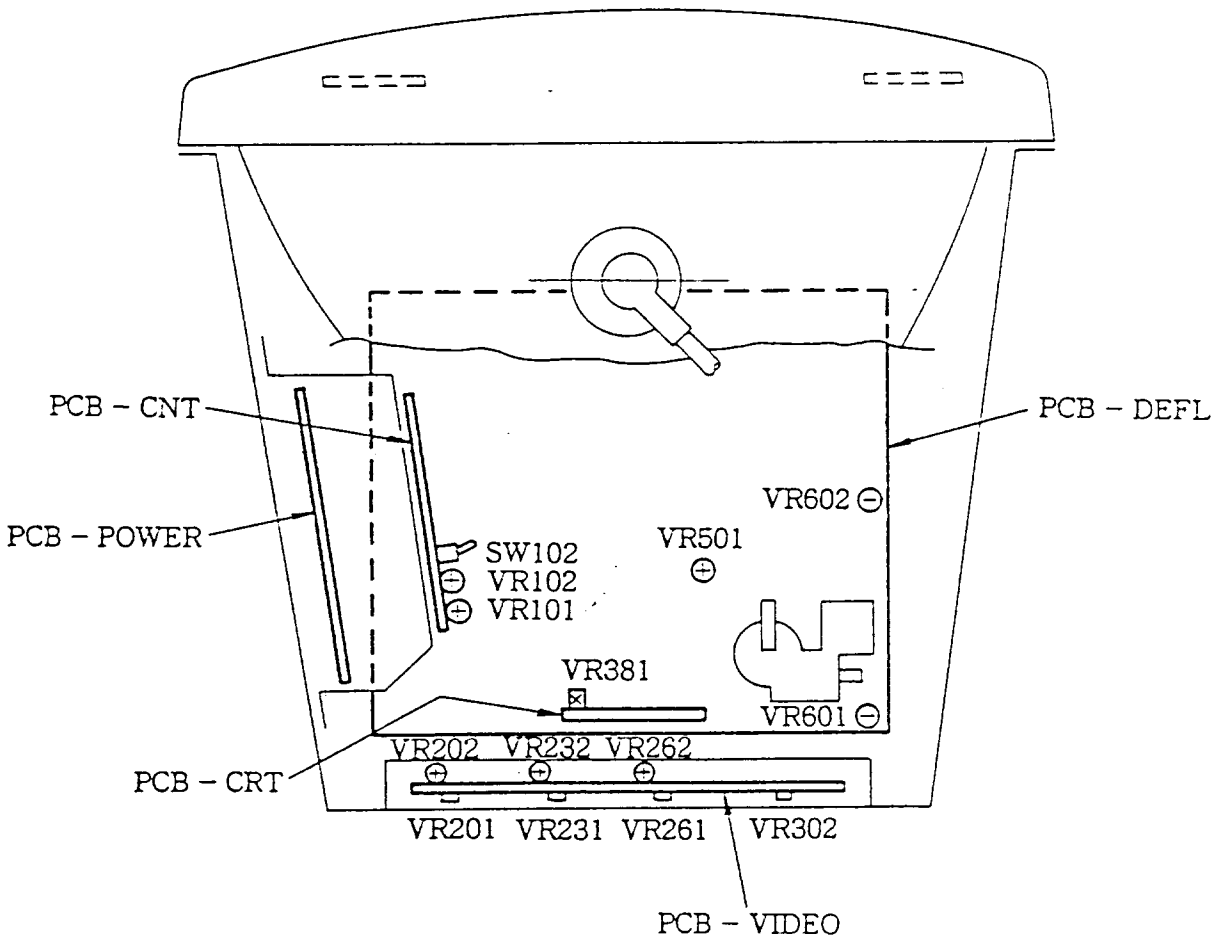
PICTURE CONTROL

0	SPARE	
1	H – PHASE	Re – adjust these items according to the input signal timing.
2	H – SIZE	
3	H – POSITION	
4	V – POSITION	
5	V – SIZE	
6 – 9	SPARE	
A	PCC – AMP	Pre – adjust these items if necessary.
B	PCC – PHASE	
C – F	SPARE	

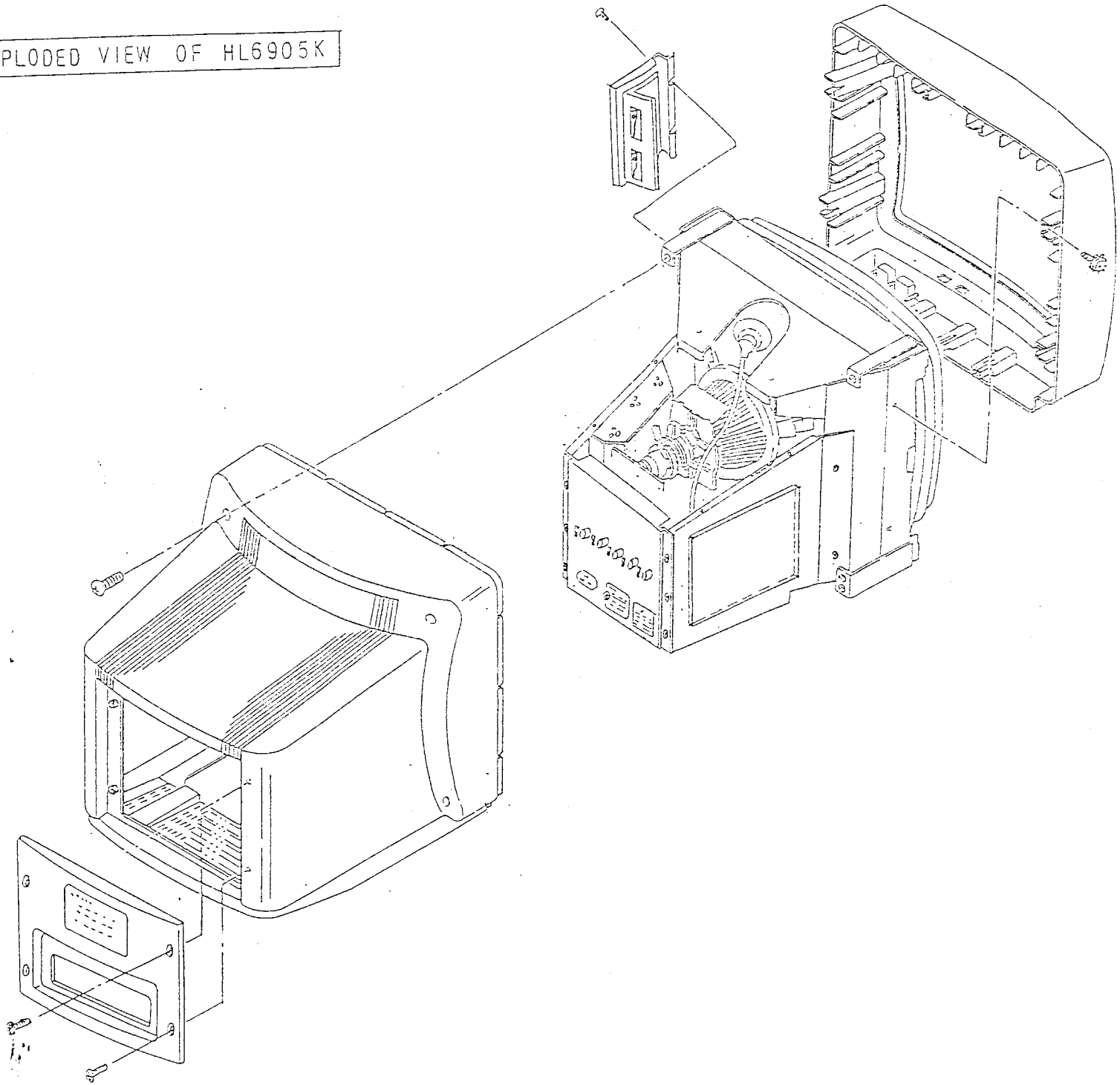


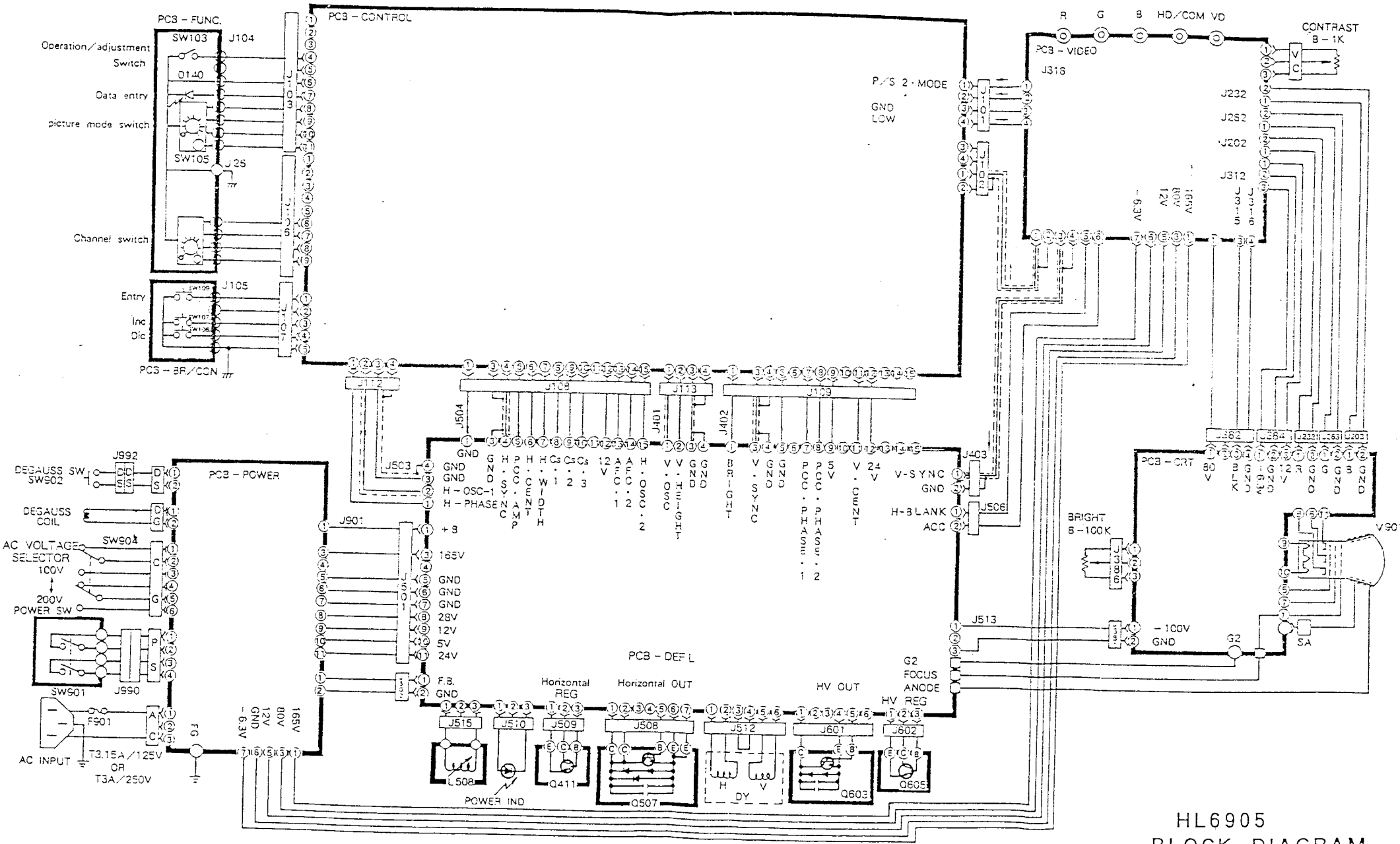
5. PCB/POTENTIO – METER LOCATION

Fig. 5 – 1

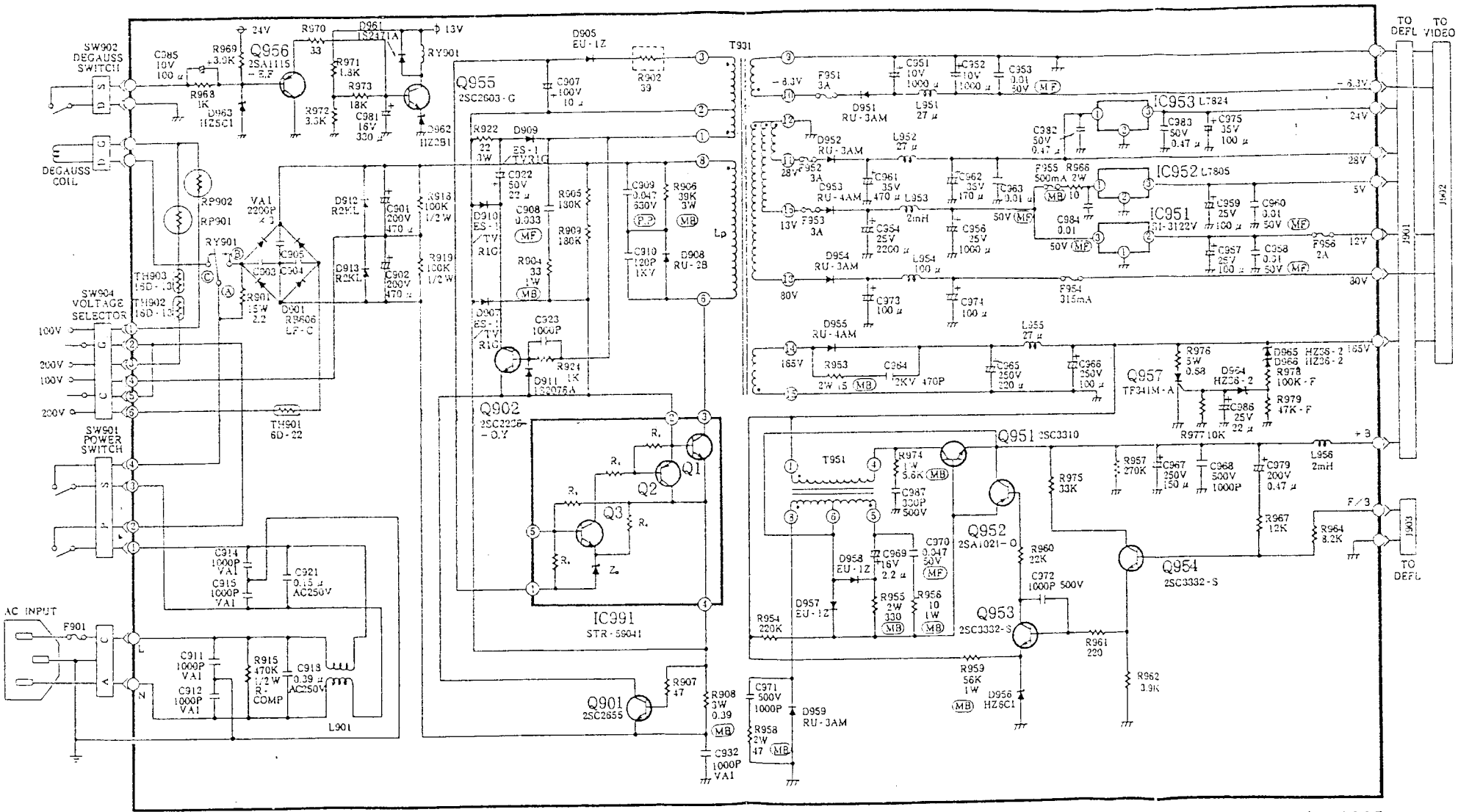


EXPLODED VIEW OF HL6905K

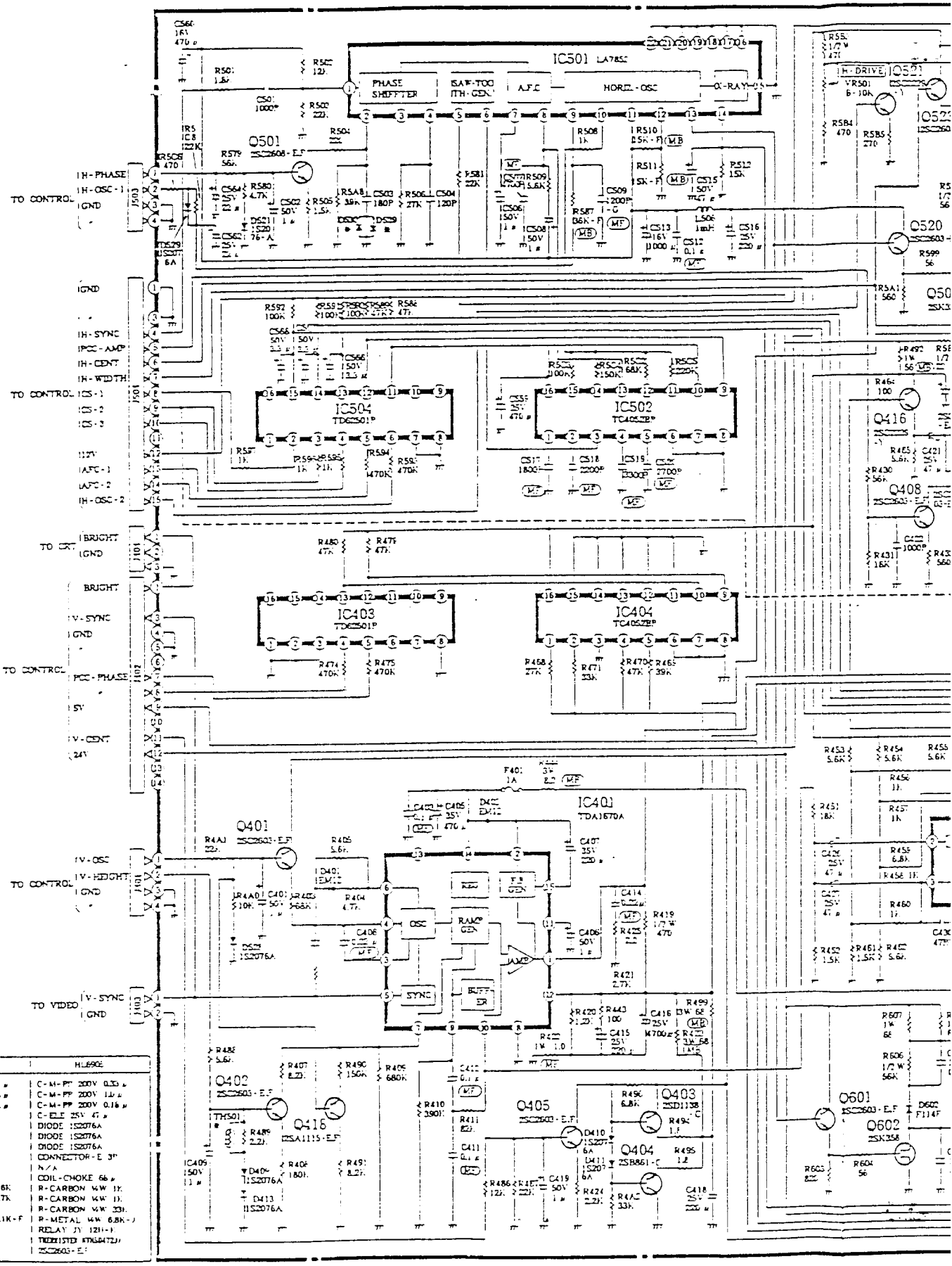




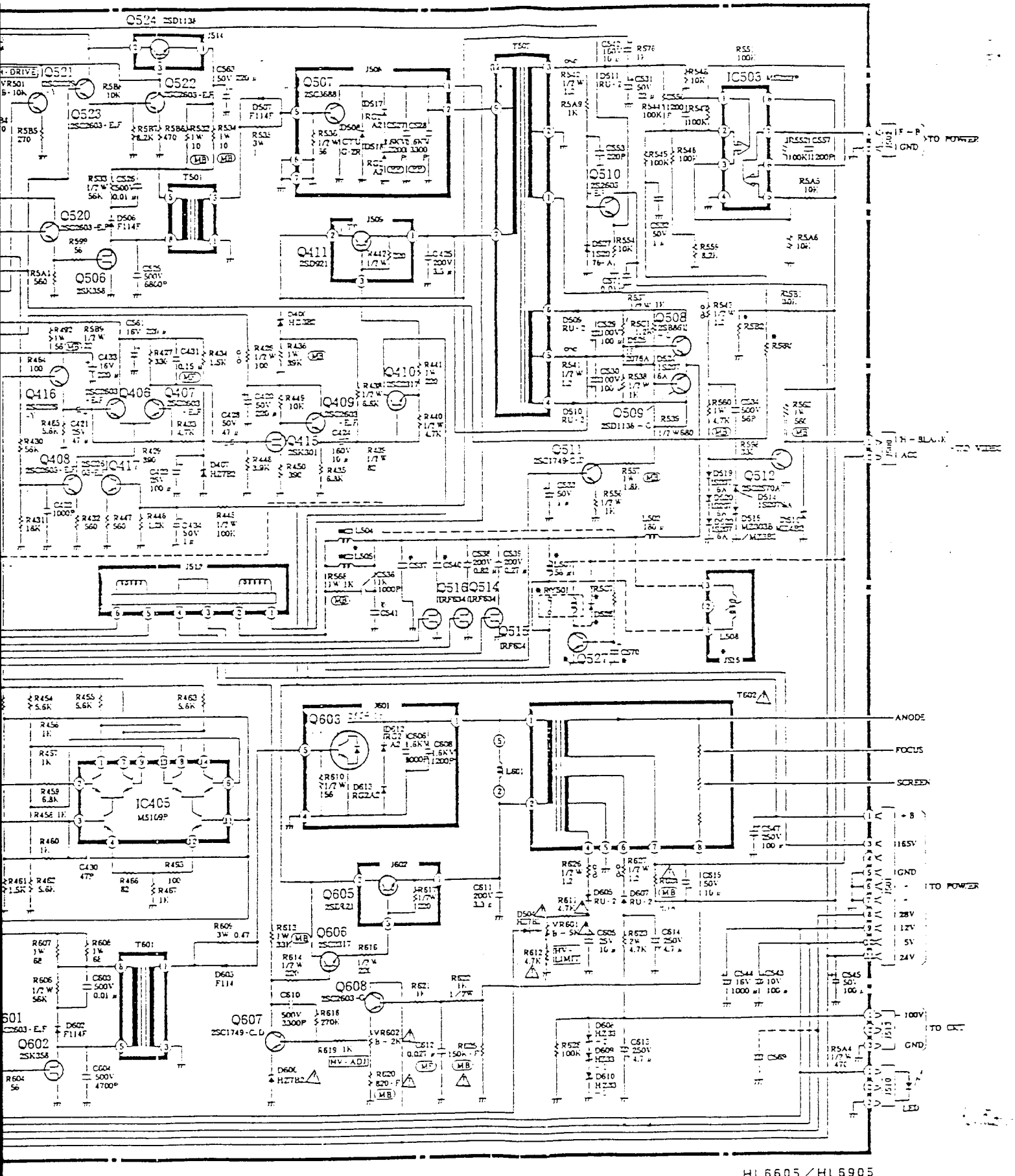
HL6905
BLOCK DIAGRAM



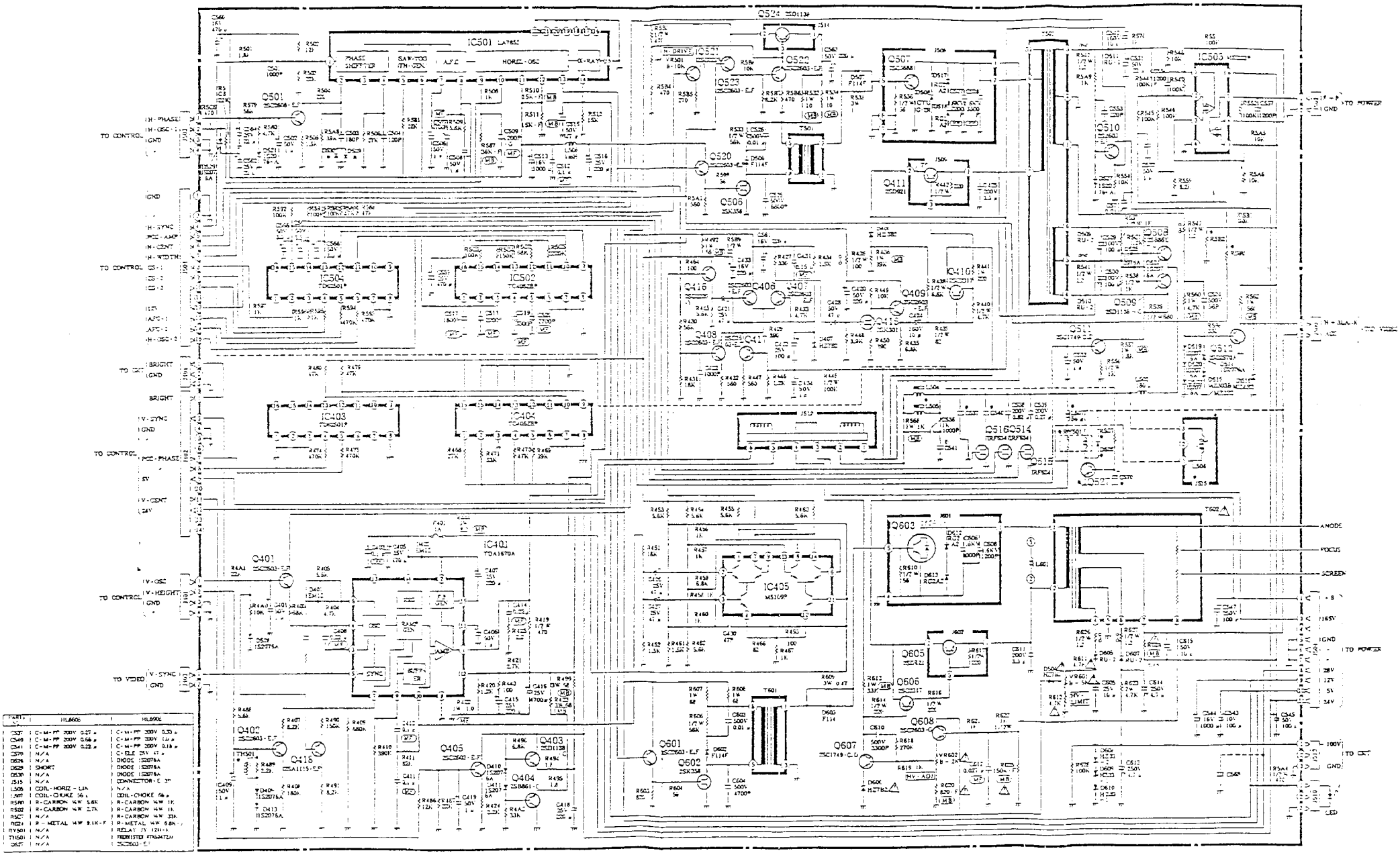
HL6605/HL6905
PWB-POWER



PARTS No.	HL660E	HL690E
C537	C-M-PF 200V 0.27μ	C-M-PF 200V 0.33μ
C540	C-M-PF 200V 0.68μ	C-M-PF 200V 1.0μ
C541	C-M-PF 200V 0.22μ	C-M-PF 200V 0.18μ
C570	N/A	C-ELE 25V 47μ
D526	N/A	DIODE 1S2076A
D529	SHORT	DIODE 1S2076A
D530	N/A	DIODE 1S2076A
J515	N/A	CONNECTOR-E 3P
L505	COIL-HORIZ-LIN	N/A
L507	COIL-CHOKE 56μ	COIL-CHOKE 68μ
R580	R-CARBON 1/4W 5.6K	R-CARBON 1/4W 1K
R582	R-CARBON 1/4W 2.7K	R-CARBON 1/4W 1K
R5C7	N/A	R-CARBON 1/4W 33K
R624	R-METAL 1/4W 9.1K-F	R-METAL 1/4W 6.8K-F
RY501	N/A	RELAY JY 12H-1
T1501	N/A	TRANSISTOR KTB647JJ
D527	N/A	2SC2603-E,F

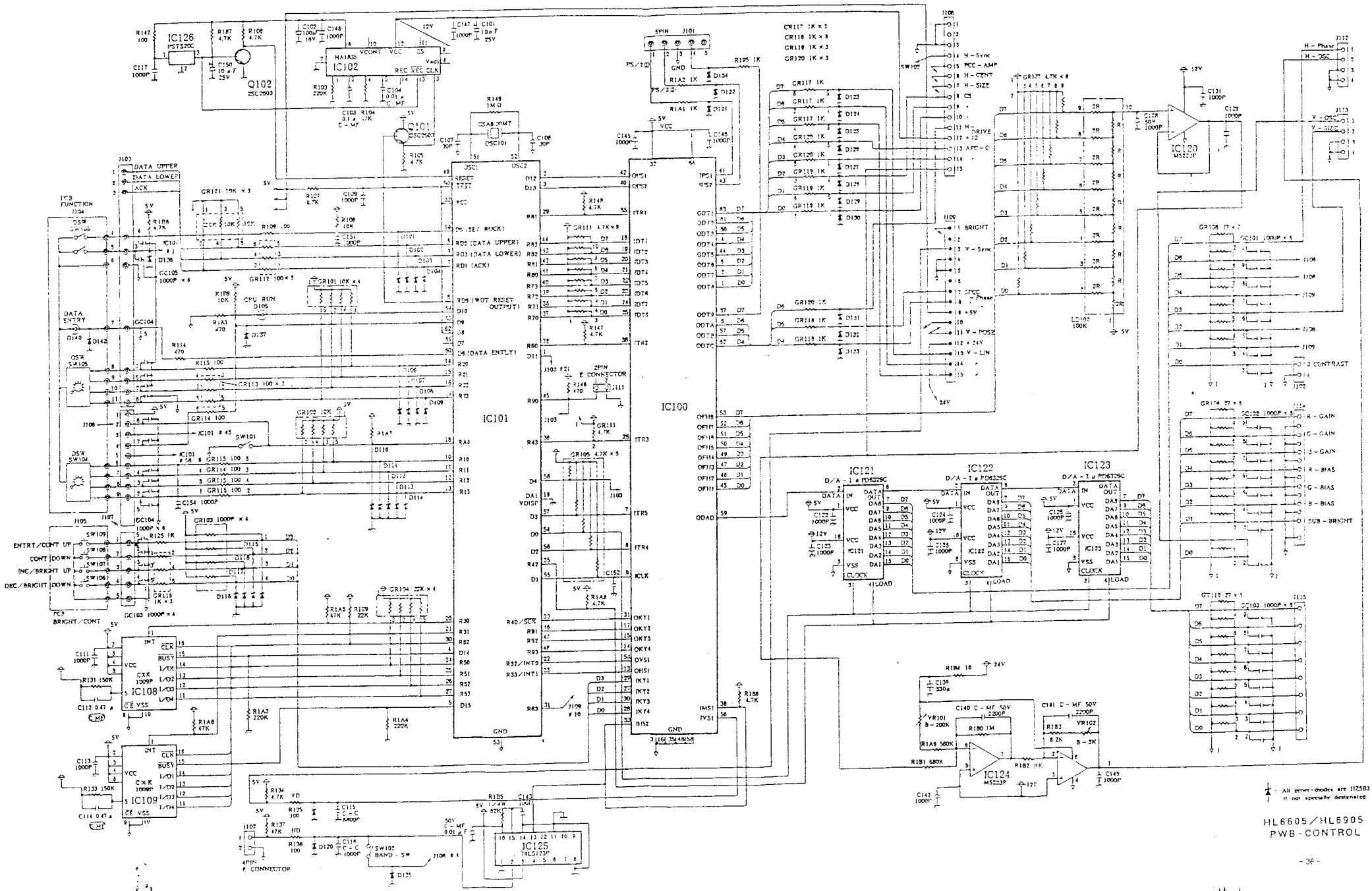


HL6605/HL6905
PWB - DEFL

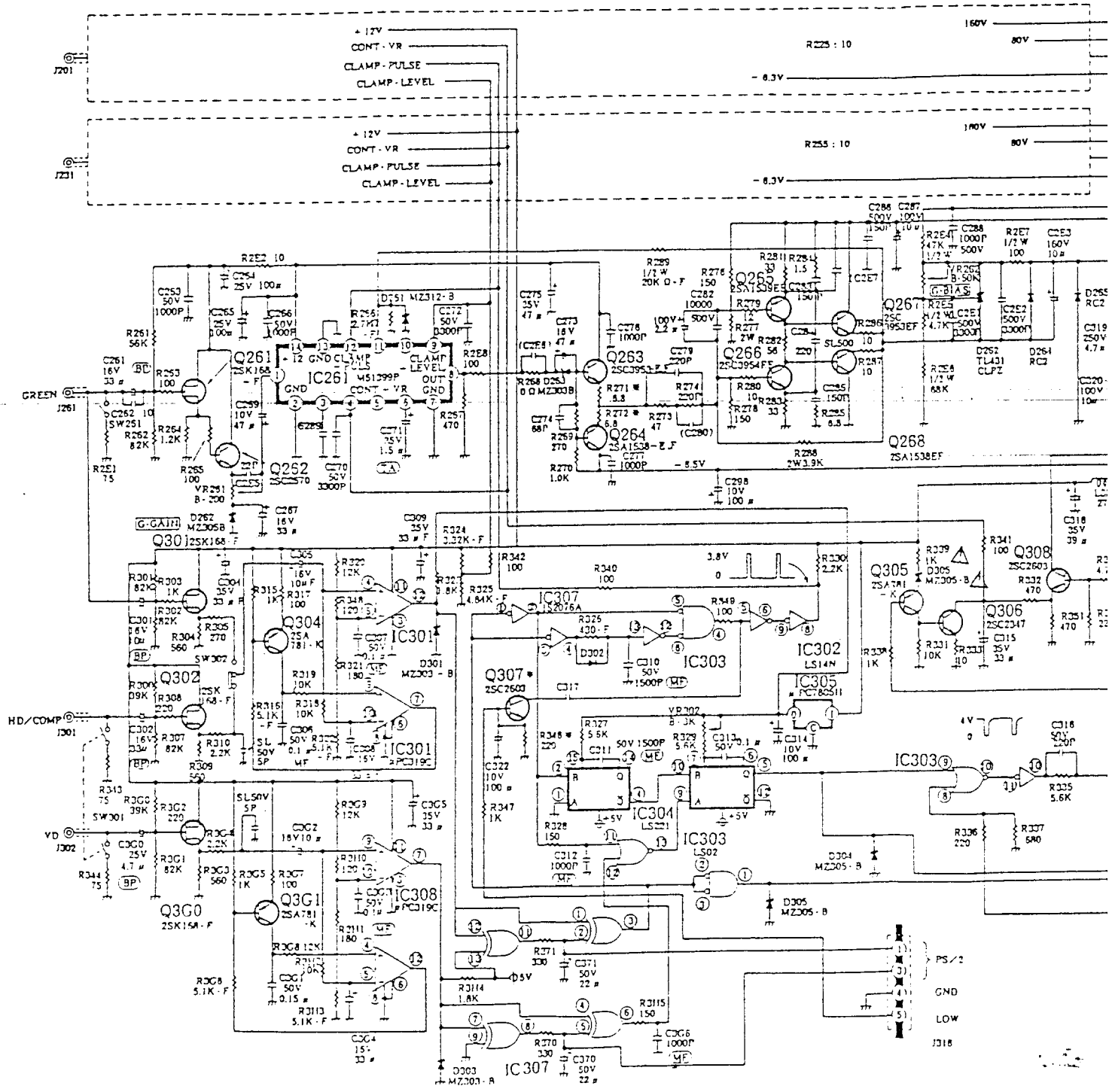


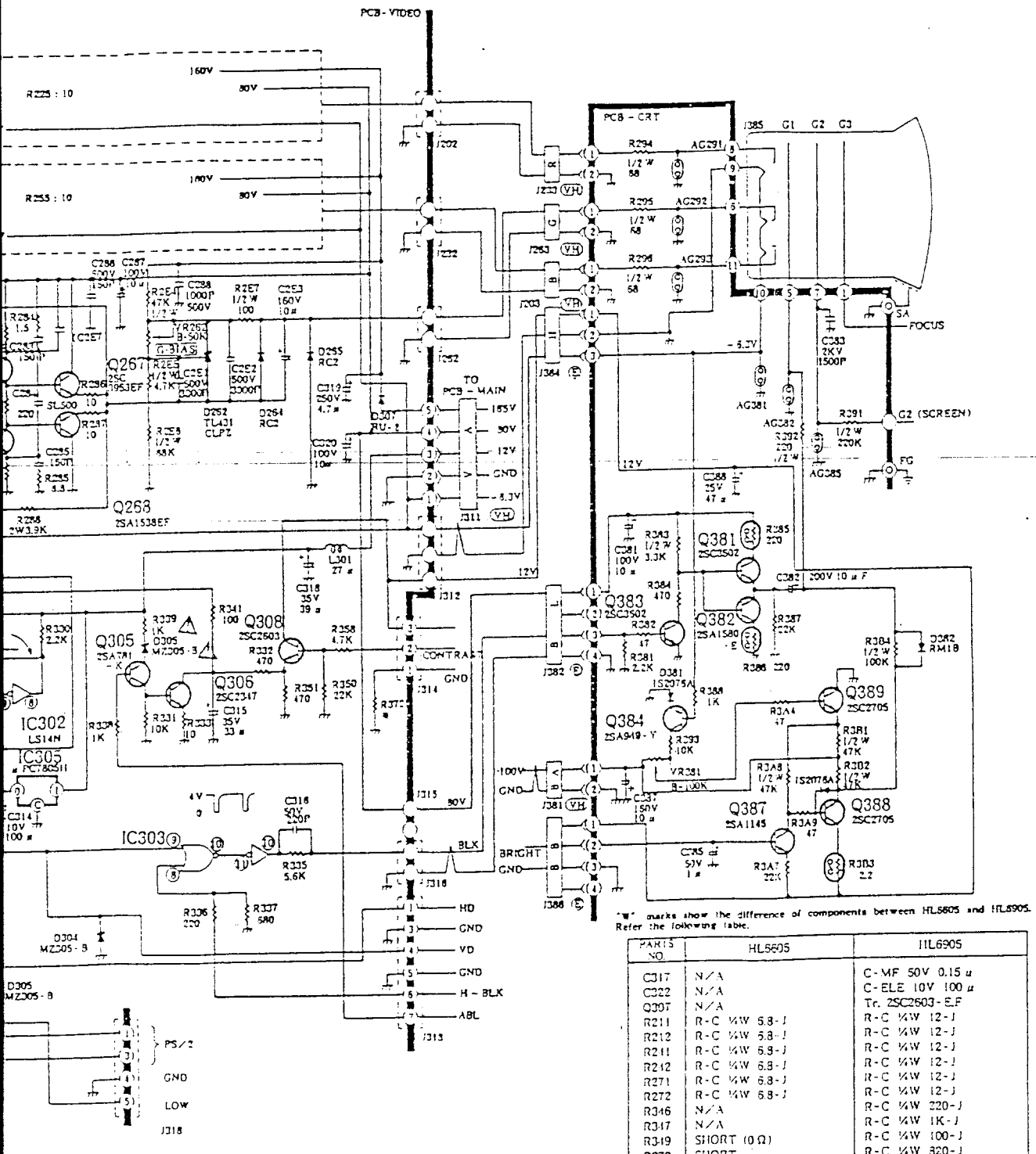
PARTS	HL660E	HL690E
C537	C-M-PP 200V 0.22 μ	C-M-PP 200V 0.33 μ
C548	C-M-PP 200V 0.56 μ	C-M-PP 200V 1.0 μ
C541	C-M-PP 200V 0.22 μ	C-M-PP 200V 0.18 μ
D570	N/A	C-ELE 25V 47 μ
D528	N/A	DIODE 1S2076A
D529	SHORT	DIODE 1S2076A
D530	N/A	DIODE 1S2076A
J515	N/A	CONNECTOR-E 2P
L506	COIL-HORIZ-LIN	N/A
L507	COIL-CHOKE 56 μ	COIL-CHOKE 68 μ
R580	R-CARBON 1/4W 5.6K	R-CARBON 1/4W 1K
R502	R-CARBON 1/4W 2.7K	R-CARBON 1/4W 1K
R5C1	N/A	R-CARBON 1/4W 33K
R624	R-METAL 1/4W 9.31K-F	R-METAL 1/4W 5.6K-F
RY501	N/A	RELAY JS 12V-3
TH501	N/A	THERMISTER 470Ω/47Ω
Q617	N/A	2SC2603-E,F

HL6605/HL5905
PWB-DEFL



HL6605/HL6905
PWB - CONTROL

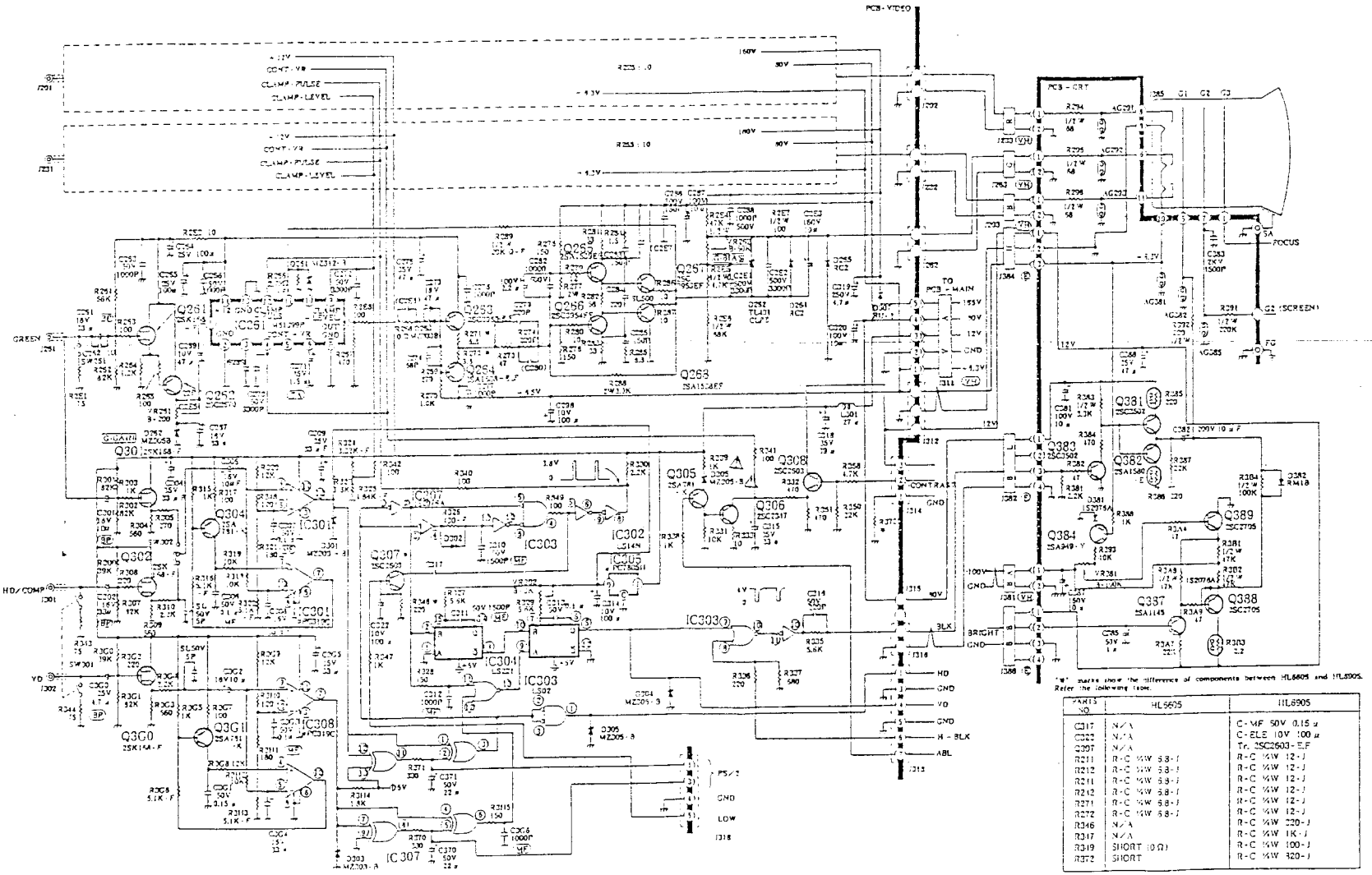

+12V
CONT-VR
CLAMP-PULSE
CLAMP-LEVEL
J201
J231
GREEN
J261
HD/COMP
J301
VD
J302
IC261
M51399P
IC307
LS76A
IC303
LS14N
IC302
IC305
IC304
LS221
IC303
LS02
IC301
IC308
IC307
Q261
Q262
Q263
Q264
Q266
Q267
Q268
Q30
Q304
Q302
Q307
Q305
Q306
Q308
Q3G0
Q3G1
PS/2
GND
LOW
J318



"■" marks show the difference of components between HL6605 and HL6905. Refer the following table.

PARTS NO.	HL6605	HL6905
C317	N/A	C-MF 50V 0.15 μ
C322	N/A	C-ELE 10V 100 μ
Q307	N/A	Tr. 2SC2603-E,F
R211	R-C ¼W 6.8-J	R-C ¼W 12-J
R212	R-C ¼W 6.8-J	R-C ¼W 12-J
R241	R-C ¼W 6.8-J	R-C ¼W 12-J
R242	R-C ¼W 6.8-J	R-C ¼W 12-J
R271	R-C ¼W 6.8-J	R-C ¼W 12-J
R272	R-C ¼W 6.8-J	R-C ¼W 12-J
R346	N/A	R-C ¼W 220-J
R347	N/A	R-C ¼W 1K-J
R349	SHORT (0 Ω)	R-C ¼W 100-J
R372	SHORT	R-C ¼W 820-J

HL6605/HL6905
PWB-CRT. VIDEO



"M" marks show the difference of components between HL6605 and HL5905. Refer the following table.

PARTS NO.	HL6605	HL6905
C317	N/A	C-MF 50V 0.15 μ
C322	N/A	C-ELE 10V 100 μ
Q307	N/A	Tr. 2SC2603-E,F
R211	R-C ¼W 5.6-F	R-C ¼W 12-J
R212	R-C ¼W 5.6-F	R-C ¼W 12-J
R311	R-C ¼W 5.6-F	R-C ¼W 12-J
R312	R-C ¼W 5.6-F	R-C ¼W 12-J
R271	R-C ¼W 5.6-F	R-C ¼W 12-J
R272	R-C ¼W 5.6-F	R-C ¼W 12-J
R346	N/A	R-C ¼W 220-J
R347	N/A	R-C ¼W 1K-J
R319	SHORT (0Ω)	R-C ¼W 100-J
R372	SHORT	R-C ¼W 820-J

HL6605/HL6905
PWB-CRT, VIDEO

BILL OF MATERIALS (HL6905)

In order to expedite delivery of replacement part orders.

Specify : 1. Model number
2. Part number and Description
3. Quantity

Unless full information is supplied, delay in execution of orders will result.

RESISTOR

MARK	TOLERANCE
J	± 5 %
K	± 10 %
M	± 20 %

CAPACITOR

MARK	TOLERANCE	MARK	TOLERANCE
J	± 5 %	Z	+ 80 % − 20 %
K	± 10 %	C	± 0.25pF
M	± 20 %	D	± 0.5pF
P	+ 100 % − 0 %	F	± 1pF

SYMBOL NO.	PARTS NO.	DESCRIPTION
PICTURE TUBE		
		AT20A9SRB22 − TC173
TRANSISTORS		
Q101	QX260P33804	2SC2603 − E,F
Q102	QX260P33804	2SC2603 − E,F
Q201	RX270P60103	2SK168 − F
Q202	RX270P56901	2SC2570A
Q203	CP260P07401	2SC3953 − E,F
Q204	CP260P07402	2SA1538 − E,F
Q205	CP260P51101	2SA1539 − E,F
Q206	CP260P51001	2SC3954 − E,F
Q207	CP260P07401	2SC3953 − E,F
Q208	CP260P07402	2SA1538 − E,F
Q231	RX270P60103	2SK168 − F
Q232	RX270P56901	2SC2570A
Q233	CP260P07401	2SC3953 − E,F
Q234	CP260P07402	2SA1538 − E,F
Q235	CP260P51101	2SA1539 − E,F
Q236	CP260P51001	2SC3954 − E,F
Q237	CP260P07401	2SC3953 − E,F
Q238	CP260P07402	2SA1538 − E,F
Q261	RX270P60103	2SK168 − F
Q262	RX270P56901	2SC2570A
Q263	CP260P07401	2SC3953 − E,F
Q264	CP260P07402	2SA1538 − E,F
Q265	CP260P51101	2SA1539 − E,F
Q266	CP260P51001	2SC3954 − E,F
Q267	CP260P07401	2SC3953 − E,F
Q268	CP260P07402	2SA1538 − E,F
Q3G0	RX270P60103	2SK168 − F
Q3G1	RX270P52401	2SA781 − K
Q301	RX270P60103	2SK168 − F
Q302	RX270P60103	2SK168 − F
Q304	RX270P52401	2SA781 − K
Q305	RX270P52401	2SA781 − K
Q306	RX270P52301	2SC2347
Q307	RX270P56303	2SC2603 − E,F
Q308	QX260D17704	2SC2603 − E,F/2SC2021 − R,S
Q381	RX270P57906	2SC3502 − E,F
Q382	RX270P58003	2SA1380 − E
Q383	RX270P57906	2SC3502 − E,F
Q384	RX270P51002	2SA949 − Y
Q387	CP260P06804	2SA1145 − O
Q388	CP260P06803	2SC2705 − O
Q389	CP260P06803	2SC2705 − O
Q401	QX260P33804	2SC2603 − E,F
Q402	QX260P33804	2SC2603 − E,F
Q403	RX270P52901	2SD1138 − C
Q404	RX270P53001	2SB861 − C
Q405	QX260P33804	2SC2603 − E,F
Q406	QX260P33804	2SC2603 − E,F
Q407	QX260P33804	2SC2603 − E,F
Q408	QX260P33804	2SC2603 − E,F
Q409	QX260P33804	2SC2603 − E,F
Q410	RX270P51201	2SC2317

SYMBOL NO.	PARTS NO.	DESCRIPTION
Q411	RX270P66901	2SD921
Q415	CP260P50301	2SK301 − Q
Q416	RX270P51102	2SC2229 − Y
Q417	QX260P33804	2SC2603 − E,F
Q418	RX270P56705	2SA1115 − E,F
Q501	QX260P33804	2SC2603 − E,F
Q506	RX270P54901	2SK358
Q507	CP260P02201	2SC3688
Q508	RX270P53001	2SB861 − C
Q509	RX270P52901	2SD1138 − C
Q510	QX260P33804	2SC2603 − E,F
Q511	RX260P35202	2SC1749 − C,D
Q512	RX270P56901	2SC2570A
Q514	CP260P07801	MOS FET IRF634
Q515	CP260P07801	MOS FET IRF634
Q516	CP260P07801	MOS FET IRF634
Q520	RX270P51102	2SC2603 − E,F
Q521	QX260P33804	2SC2229 − Y
Q522	QX260P33804	2SC2603 − E,F
Q523	QX260P33804	2SC2603 − E,F
Q524	RX270P52901	2SD1138 − C
Q527	QX260P33804	2SC2603 − E,F
Q601	QX260P33804	2SC2603 − E,F
Q602	RX270P54901	2SK358
Q603	CP260P50601	2SC4123
Q605	RX270P55901	2SD921
Q606	RX270P51201	2SC2317
Q607	RX260P35202	2SC1749 − C,D
Q608	RX270P56308	2SC2603 − G
Q901	QX260P04001	2SC2655
Q902	QX260P38701	2SC2236 − O,Y
Q951	CP260P04302	2SC3310
Q952	CP260P04101	2SA1021 − O
Q953	CP260P07302	2SC3332 − S
Q954	CP260P07301	2SC3332 − R
Q955	QX260C33805	2SC2603 − G
Q956	RX270P56703	2SA1115 − F
INTEGRATED CIRCUITS		
IC100	CP267P01701	MB624124
IC101	CP266P07201	HMCS 408AC
IC102	CP266P05701	HA1835P
IC108	CP266P05801	CXK1009P
IC109	CP266P05801	CXK1009P
IC120	CP263P02201	M5223P
IC121	CP266P06101	MPD6326C
IC122	CP266P06101	MPD6326C
IC124	CP263P02201	M5223P
IC125	CP266P02801	M74LS123P
IC126	CP266P06201	PST520C
IC201	RX277P60301	M51399P
IC202	RX277P65001	TL431CLPB
IC231	RX277P60301	M51399P
IC232	RX277P65001	TL431CLPB
IC261	RX277P60301	M51399P
IC262	RX277P65001	TL431CLPB
IC301	RX266P74601	MPC319C/LM319D
IC302	CP263P00201	M74LS14P

SYMBOL NO.	PARTS NO.	DESCRIPTION
	INTEGRATED CIRCUITS	
IC303	CP266P00301	M74LS02P
IC304	CP266P03002	M74LS221P
IC305	RX277P51902	HA17805P
IC307	CP266P03501	M74LS86P
IC308	RX266P74601	MPC319C/LM319D
IC401	RX277P61801	TDA1670
IC403	CP263P02301	TD62501P
IC404	CP263P02003	TC4052BP/MC14052BCP
IC405	RX266P75201	M5109P
IC501	CP266P01401	LA7852
IC502	CP263P02003	TC4052BP/MC14052BCP
IC503	CP263P02201	M5223P
IC504	CP263P02301	TD62501P
IC951	CP267P00401	S1 - 3122V
IC952	CP266P05001	MPC7805HF/L7805ML
IC953	CP266P05006	MPC7824HF/L7824ML
IC991	CP267P00701	STR59041
	DIODES	
D101	CP264P07707	HZ5B3
D102	CP264P07707	HZ5B3
D103	CP264P07707	HZ5B3
D104	CP264P07707	HZ5B3
D105	CP264P05701	SLP - 281F - 50U
D106	CP264P07707	HZ5B3
D107	CP264P07707	HZ5B3
D108	CP264P07707	HZ5B3
D109	CP264P07707	HZ5B3
D110	CP264P07707	HZ5B3
D111	CP264P07707	HZ5B3
D112	CP264P07707	HZ5B3
D113	CP264P07707	HZ5B3
D114	CP264P07707	HZ5B3
D115	CP264P07707	HZ5B3
D116	CP264P07707	HZ5B3
D117	CP264P07707	HZ5B3
D118	CP264P07707	HZ5B3
D119	CP264P07707	HZ5B3
D120	CP264P07707	HZ5B3
D121	CP264P07707	HZ5B3
D122	CP264P07707	HZ5B3
D123	CP264P07707	HZ5B3
D124	CP264P07707	HZ5B3
D125	CP264P07707	HZ5B3
D126	CP264P07707	HZ5B3
D127	CP264P07707	HZ5B3
D128	CP264P07707	HZ5B3
D129	CP264P07707	HZ5B3
D130	CP264P07707	HZ5B3
D131	CP264P07707	HZ5B3
D132	CP264P07707	HZ5B3
D133	CP264P07707	HZ5B3
D134	CP264P07707	HZ5B3
D135	CP264P07707	HZ5B3
D136	CP264P07707	HZ5B3
D137	CP264P07707	HZ5B3
D140	CP264P05701	SLP - 281F - 50U
D142	CP264P07304	HZ5B3
D143	QX264P24601	LED LN320GP
D201	CP264P08503	HZ12B2
D202	CP264P07700	HZ3B2
D203	CP264P07700	HZ3B2
D204	QX264P20901	RC - 2
D205	QX264P20901	RC - 2
D231	CP264P08503	HZ12B2
D232	CP264P07700	HZ3B2
D233	CP264P07700	HZ3B2
D234	QX264P20901	RC - 2
D235	QX264P20901	RC - 2
D261	CP264P08503	HZ12B2

SYMBOL NO.	PARTS NO.	DESCRIPTION
D262	CP264P07700	HZ3B2
D263	CP264P07700	HZ3B2
D264	QX264P20901	RC - 2
D265	QX264P20901	RC - 2
D301	CP264P07700	HZ3B2
D302	RX264P04509	1S2076APG
D303	CP264P07700	HZ3B2
D304	CP264P07706	HZ5B2
⚠ D305	CP264P07706	HZ5B2
D306	CP264P07706	HZ5B2
D307	CP264P01602	RU2B
D381	QX264P04508	1S2076A/1S2471
D382	QX264P10105	RM - 1B
D401	QX264D05602	S5500-D/EM-1Z/ERB12-02RK
D402	QX264D05602	S5500-D/EM-1Z/ERB12-02RK
D406	CP264P07105	HZ3B2
D407	CP264P07501	HZ7B2
D409	QX264P04502	1S2076A
D410	QX264P04502	1S2076A
D411	QX264P04502	1S2076A
D413	QX264P04502	1S2076A
⚠ D504	CP264P07501	HZ7B2
D506	RX274P52604	F114F
D507	RX274P52604	F114F
D508	RX274P55301	CTU - G2DR
D509	RX264P19601	RU2
D510	RX264P19601	RU2
D511	RX264P19601	RU2
D514	QX264P04502	1S2076A
D515	CP264P07105	HZ3B2
D516	CP264P07204	HZ4R2
D517	CP264P05801	RG2A2
D518	CP264P05801	RG2A2
D519	QX264P04502	1S2076A
D520	QX264P04502	1S2076A
D521	QX264P04502	1S2076A
D522	QX264P04502	1S2076A
D524	QX264P04502	1S2076A
D525	QX264P04502	1S2076A
D526	QX264P04502	1S2076A
D527	QX264P04502	1S2076A
D528	QX264P04502	1S2076A
D529	QX264P04502	1S2076A
D530	QX264P04502	1S2076A
D602	RX274P52604	F114F
D603	RX274P52604	F114F
D605	RX264P19601	RU2
⚠ D606	CP264P07501	HZ7B2
D607	RX264P19601	RU2
D608	CP264P08404	HZ33 - 2
D609	CP264P08404	HZ33 - 2
D610	CP264P08404	HZ33 - 2
D612	CP264P05801	RG2A2
D613	CP264P05801	RG2A2
D901	RX274P53501	RB606LF - C
D905	CP264P00902	EU1Z
D907	QX264D05601	TVR1G/ES - 1
D908	CP264P01602	RU - 2B
D909	QX264D05601	TVR1G/ES - 1
D910	QX264D05601	TVR1G/ES - 1
D911	QX264P04502	1S2076A
D912	CP264P05901	R2KL
D913	CP264P05901	R2KL
D951	CP264P01502	RU - 3AM
D952	CP264P01502	RU - 3AM
D953	CP264P06001	RU - 4AM
D954	CP264P01502	RU - 3AM
D955	CP264P06002	RU - 4AM
D956	CP264P07404	HZ6C1
D957	CP264P00902	EU1Z
D958	CP264P00902	EU1Z
D959	CP264P01502	RU - 3AM
D961	QX264P04504	1S2471

SYMBOL NO.	PARTS NO.	DESCRIPTION
	DIODES	
D962	CP264P07005	HZ2B1
D963	CP264P07305	HZ5C1
D964	CP264P08407	HZ36 – 2
D965	CP264P08407	HZ36 – 2
D966	CP264P08407	HZ36 – 2
	TRANSFORMERS	
T501	CP336P00701	Horizontal Drive
T502	CP332P00101	Horizontal Oscillation
T601	CP336P00701	Horizontal Drive
⚠ T602	CP334P01701	Flyback
T931	CP350P02401	Power
T951	CP350P02001	Chopper
	COILS	
L301	QX409P00603	FILTER 27MH – K
L502	RX409P01706	FILTER 180MH – K
L504	CP333P00701	Horizontal Linearity
L506	RX325D02902	PEAKING 100MH – K
L507	CP321P01302	CHOKE
L508	CP333P00801	Linearity
L601	CP409P01501	CHOKE
L901	CP351P01201	FILTER 2A 15MH
L951	QX409P00603	FILTER 27MH – K
L952	QX409P00603	FILTER 27MH – K
L953	CP321D00201	CHOKE 2MH 1A
L954	QX409P00602	FILTER 100MH – K
L955	QX409P00603	FILTER 27MH – K
L956	CP321D00201	
	CAPACITORS & RESISTORS	
C967	QX185D05405	Electrolytic H250V 150MF-M
R206	QX103P30305	Metal ¼W 2.7K Ω – F
R229	CP103C22301	Metal ¼W 20K Ω – F
R236	QX103P30305	Metal ¼W 2.7K Ω – F
R259	CP103C22301	Metal ¼W 20K Ω – F
R266	QX103P30305	Metal ¼W 2.7K Ω – F
R289	CP103C22301	Metal ¼W 20K Ω – F
R3G6	RX103P30402	Metal ¼W 5.1K Ω – F
R3H3	RX103P30402	Metal ¼W 5.1K Ω – F
R3R3	QX103P37804	Fuse ¼w 2.2 Ω – J
R316	RX103P30402	Metal ¼W 5.1K Ω – F
R322	RX103P30402	Metal ¼W 5.1K Ω – F
R324	RX103C09501	Metal ¼W 3.32K Ω – F
R325	RX103C09605	Metal ¼W 4.64K Ω – F
R326	QX103P30106	Metal ¼W 430 Ω – F
R386	QX103P37107	Fuse ¼W 220 Ω – J
R426	QX109P05201	Fuse ¼W 100 Ω – J
R510	QX103P30503	Metal ¼W 15K Ω – F
R511	QX103P30503	Metal ¼W 15K Ω – F
R541	RX109P01305	Fuse ½W 1.2 Ω – K
R542	RX109P01305	Fuse ½W 1.2 Ω – K
R543	RX109P01305	Fuse ½W 1.2 Ω – K
R587	QX103P30602	Metal ¼W 36K Ω – F
⚠ R620	QX103P30203	Metal ¼W 820 Ω – F
⚠ R624	QX103P30405	Metal ¼W 6.8K Ω – F
⚠ R625	RX103P30707	Metal ¼W 150K Ω – F
R626	RX109P01305	Fuse ½W 1.2 Ω – K
R627	RX109P01305	Fuse ½W 1.2 Ω – K
R901	QX102P08400	Cement Wire 15W 2.2 Ω – K
R976	CP109D00306	Cement Wire 5W 0.68 Ω – K
R978	QX103P30703	Metal ¼W 100K Ω – F
R979	QX103P30605	Metal ¼W 47K Ω – F

SYMBOL NO.	PARTS NO.	DESCRIPTION
	VARIABLE RESISTORS	
VR101	CP129C50204	Semifixed 1/10W B-200K Ω
VR102	CP129C50107	Semifixed 1/10W B-3K Ω
VR201	CP127C00102	Semifixed 1/10W B-200 Ω
VR202	CP129C50202	Semifixed 1/10W B-50K Ω
VR231	CP127C00102	Semifixed 1/10W B-200 Ω
VR232	CP129C50202	Semifixed 1/10W B-50K Ω
VR261	CP127C00102	Semifixed 1/10W B-200 Ω
VR262	CP129C50202	Semifixed 1/10W B-50K Ω
VR302	CP127C00107	Semifixed 1/10W B-3K Ω
VR381	QX127C03102	Semifixed 1/5W B100KΩ ± 25%
VR501	CP127C00109	Semifixed 1/10W B-10K Ω
VR601	RX129C50708	Semifixed ½W B-5K Ω
VR602	RX129C50706	Semifixed ½W B-2K Ω
	SWITCHES	
SW101	CP439P00401	DIP – SW SSGM12
SW102	QX129P00709	BAND – SW
SW103	CP439P00701	DIP – SW
SW104	CP439P00501	ROTARY – SW BCM 10 110
SW105	CP439P00502	ROTARY – SW BCM 10 610
SW106	CP439P00603	TACT – SW SKHHPN
SW107	CP439P00603	TACT – SW SKHHPN
SW109	CP439P00603	TACT – SW SKHHPN
SW201	RX439C52301	SW – SLIDE
SW231	RX439C52301	SW – SLIDE
SW261	RX439C52301	SW – SLIDE
SW301	RX439C52301	SW – SLIDE
SW302	RX439C52301	SW – SLIDE
SW901	CP432C00601	SW – POWER – PUSH
SW902	CP432C00801	SW – PUSH ESB – 62108
	MISCELLANEOUS	
F401	CP283P00104	SSFR – FUSE 1A
F951	CP283P00105	SSFR – FUSE 3A
F952	CP283P00105	SSFR – FUSE 3A
F953	CP283P00105	SSFR – FUSE 3A
F954	CP283P00401	FUSE 315MA
F955	CP283P00501	SSFR – FUSE 500MA
F956	CP283P00109	SSFR – FUSE 2A
	RX283D51002	FUSE TSC 125V 3.15A
OSC101	CP296P00103	CERAMIC RESONATOR
AG291	CP252P00101	SURGE-ABSORBER DSP-301N
AG292	CP252P00101	SURGE-ABSORBER DSP-301N
AG293	CP252P00101	SURGE-ABSORBER DSP-301N
AG381	CP252P00101	SURGE-ABSORBER DSP-301N
AG382	CP252P00101	SURGE-ABSORBER DSP-301N
AG383	RX252C50205	SURGE-ABSORBER
Q957	CP269P00301	THYRISTOR
RY501	CP287P00301	RELAY
RP901	CP265P01303	POSISTOR
RP902	CP265P01301	POSISTOR
RY	CP287C00301	RELAY – POWER
TH501	CP265P02101	THERMISTOR
TH901	CP265P01201	THERMISTOR
	CP409A00305	COIL – DEGAUSSING
	CP451C00101	POWER – JACK
	RX242D12501	AC – POWER – CORD
	PRINTED CIRCUIT BOARDS	
	CT920B08202	ASSY PCB DEFL
	CT920A04102	ASSY PCB POWER
	CT920A03702	ASSY PCB VIDEO
	CT920B08401	ASSY PCB CONTROL
	CT920D90702	ASSY PCB CRT
	CT920D90703	ASSY PCB FUNCTION
	CT920D90706	ASSY PCB LED 20
	CT920D90804	ASSY PCB DEGAUSS

SYMBOL NO.	PARTS NO.	DESCRIPTION
PRINTED CIRCUIT BOARDS		
	CT920D90709	ASSY PCB H – OUT
	CT920D90801	ASSY PCB HV OUT – 1
	CT920D90807	ASSY PCB HV OUT – 2
	CT920D90802	ASSY PCB REG – 1
	CT920D90803	ASSY PCB REG – 2
	CT920D90809	ASSY PCB DRIVE
	CT920D90808	ASSY PCB COIL
	CT940B01901	ASSY POWER SW
	CT940C00701	ASSY VR
CABINET PARTS		
	CP700A03103	MASK FRONT
	CP700A03201	BACK COVER
	CP700A04501	REAR COVER
PACKING PARTS		
	CP802B01003	PACKING CASE
	CP803A01301	CUSHION
	RX831C53001	PACKING BAG