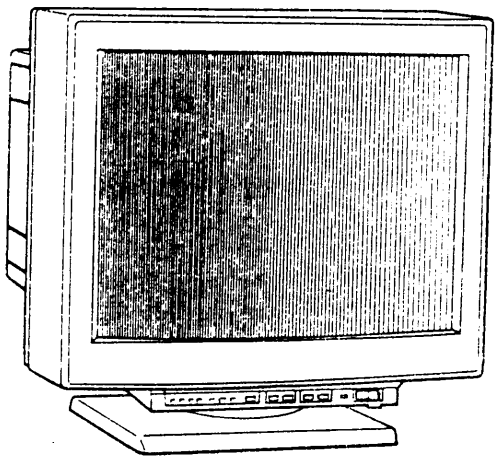
GDM-2039

SERVICE MANUAL

Chassis No. SCC-F59B-A



SPECIFICATIONS

Picture tube	0.30 mm aperture grill pitch 20 inches measured diagonally (19" visual) 90-degree deflection
Effective picture size	Approx. 384 × 290 mm (w/h) (15 1/4 × 11 1/2 inches)
Resolution	Horizontal : Max. 1280 dots Vertical : Max. 1024 lines
Display picture size	Approx. 360 × 270 mm (w/h) (14 1/4 × 10 3/4 inches) or approx. 343 × 274 mm (w/h) (13 5/8 × 10 7/8 inches)
Deflection frequency	Horizontal : 28 to 85 kHz Vertical : 50 to 160 Hz
AC input voltage/current	100 to 120 V, Max. 3.7 A 220 to 240 V, 2.0 A
Dimensions	480 × 479 × 504.5 mm (w/h/d) (19 × 18 7/8 × 19 7/8 inches)
Weight	Approx. 32 kg (70 lb 9 oz)
Supplied accessory	AC power cord (for 100 to 120 V only) (1) or AC power cord (for 220 to 240 V only) (1)

Design and specifications are subject to change without notice.

MICROFILM

MULTISCAN®
COLOR GRAPHIC DISPLAY

SONY®

Detailed Timing Specifications of Preset-Type Models

Mode	1	2	3	4	5	6	7	8
Equiv. Standard	VGA Graphics*	VGA EGA Emulate*	VGA Text*	Sony Std-I	Sony Std-II	Macintosh II Two-Page	Sony Std-III	Sony Std-IV
Resolution (H × V)	640 × 480	640 × 350	720 × 400	1024 × 768	1280 × 1024	1152 × 864	1280 × 1024	1280 × 1024
Dot Clock (MHz)	25.175	25.175	28.322	64.000	108.180	100.00	135.00	140.00
Horizontal								
Hor. freq. (kHz)	31.469	31.469	31.469	48.780	63.337	68.681	78.855	81.206
H-total	31.778	31.778	31.778	20.500	15.789	14.560	12.681	12.314
H-Front porch	0.636	0.636	0.636	1.000	0.407	0.320	0.237	0.229
H-Sync. width	3.813	3.813	3.813	1.500	1.701	1.280	1.067	0.714
H-Back porch	1.907	1.907	1.907	2.000	1.849	1.440	1.896	2.229
H-blanking	6.356	6.356	6.356	4.500	3.956	3.040	3.200	3.174
H-Active (µsec)	25.422	25.422	25.422	16.000	11.832	11.520	9.481	9.143
Vertical								
Ver. freq. (Hz)	59.94	70.086	70.086	60.000	59.978	75.062	74.112	76.179
V-total	525	449	449	813	1056	915	1064	1066
V-Front porch	10	37	12	3	3	6	3	3
V-Sync. width	2	2	2	3	3	3	3	3
V-Back porch	33	60	35	39	26	42	34	36
V-blanking	45	99	49	45	32	51	40	42
V-Active (Lines)	480	350	400	768	1024	864	1024	1024
Sync	External	External	External	Internal	Internal	Internal	External	Internal
H-Polarity	(−)	(+)	(−)	N.A.	N.A.	N.A.	(−)	N.A.
V-Polarity	(−)	(−)	(+)	N.A.	N.A.	N.A.	(−)	N.A.
Scanning mode	Non-interlace	Non-interlace	Non-interlace	Non-interlace	Non-interlace	Non-interlace	Non-interlace	Non-interlace

VGA (Mode 1, 2, 3) does not include border area.

NEVER APPLY A POWER SUPPLY VOLTAGE MORE THAN AC150V IN A CONDITION IN WHICH THE DEGAUSS COIL HAS BEEN REMOVED.

SAFETY-RELATED COMPONENT WARNING !!

COMPONENTS IDENTIFIED BY SHADING AND MARK ⚠ ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY. CIRCUIT ADJUSTMENTS THAT ARE CRITICAL TO SAFE OPERATION ARE IDENTIFIED IN THIS MANUAL. FOLLOW THESE PROCEDURES WHENEVER CRITICAL COMPONENTS ARE REPLACED OR IMPROPER OPERATION IS SUSPECTED.

ATTENTION AUX COMPOSANTS RELATIFS À LA SÉCURITÉ !!

LES COMPOSANTS IDENTIFIÉS PAR UNE TRAME ET PAR UNE MARQUE ⚠ SUR LES SCHÉMAS DE PRINCIPE, LES VUES EXPLOSÉES ET LES LISTES DE PIECES SONT D'UNE IMPORTANCE CRITIQUE POUR LA SÉCURITÉ DU FONCTIONNEMENT. NE LES REMPLACER QUE PAR DES COMPOSANTS SONY DONT LE NUMÉRO DE PIÉCE EST INDIQUÉ DANS LE PRÉSENT MANUEL OU DANS DES SUPPLÉMENTS PUBLIÉS PAR SONY. LES RÉGLAGES DE CIRCUIT DONT L'IMPORTANCE EST CRITIQUE POUR LA SÉCURITÉ DU FONCTIONNEMENT SONT IDENTIFIES DANS LE PRÉSENT MANUEL. SUIVRE CES PROCÉDURES LORS DE CHAQUE REMPLACEMENT DE COMPOSANTS CRITIQUES, OU LORSQU'UN MAUVAIS FONCTIONNEMENT EST SUSPECTÉ.

SAFETY CHECK-OUT
(US Model only)

After correcting the original service problem, perform the following safety checks before releasing the set to the customer:

1. Check the area of your repair for unsoldered or poorly-soldered connections. Check the entire board surface for solder splashes and bridges.
2. Check the interboard wiring to ensure that no wires are "pinched" or contact high-wattage resistors.
3. Check that all control knobs, shelds, covers, ground straps, and mounting hardware have been replaced. Be absolutely certain that you have replaced all the insulators.
4. Look for unauthorized replacement parts, particularly transistors, that were installed during a previous repair. Point them out to the customer and recommend their replacement.
5. Look for parts which, though functioning, show obvious signs of deterioration. Point them out to the customer and recommend their replacement.
6. Check the line cord for cracks and abrasion. Recommend the replacement of any such line cord to the customer.
7. Check the B+ and HV to see they are at the values specified. Make sure your instruments are accurate; be suspicious of your HV meter if sets always have low HV.
8. Check the metal trim, metallized" knobs, screws, and all other exposed metal parts for AC leakage.
   Check leakage as described below.

LEAKAGE TEST

The AC leakage from any exposed metal part to earth ground and from all exposed metal parts to any exposed metal part having a return to chassis, must not exceed 0.5mA (500 microampers). Leakage current can be measured by any one of three methods.

1. A commercial leakage tester, such as the Simpson 229 or RCA WT-540A. Follow the manufacturers' instructions to use these instruments.
2. A battery-operated AC milliammeter. The Data Precision 245 digital multimeter is suitable for this job.
3. Measuring the voltage drop across a resistor by means of a VOM or battery-operated AC voltmeter. The "limit" indication is 0.75V, so analog meters must have an accurate low-voltage scale. The Simpson 250 and Sanwa SH-63Trd are examples of a passive VOM that is suitable. Nearly all battery operated digital multimeters that have a 2V AC range are suitable. (See Fig. A)

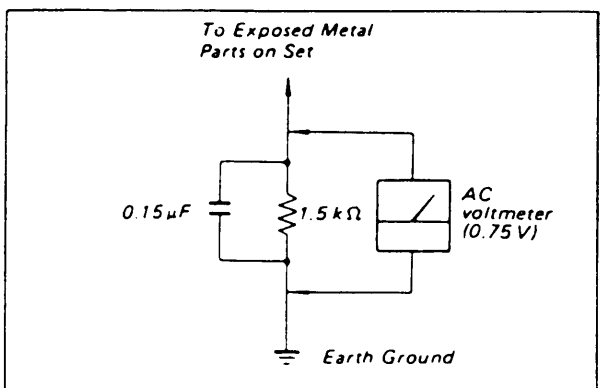


Fig. A. Using an AC voltmeter to check AC leakage.

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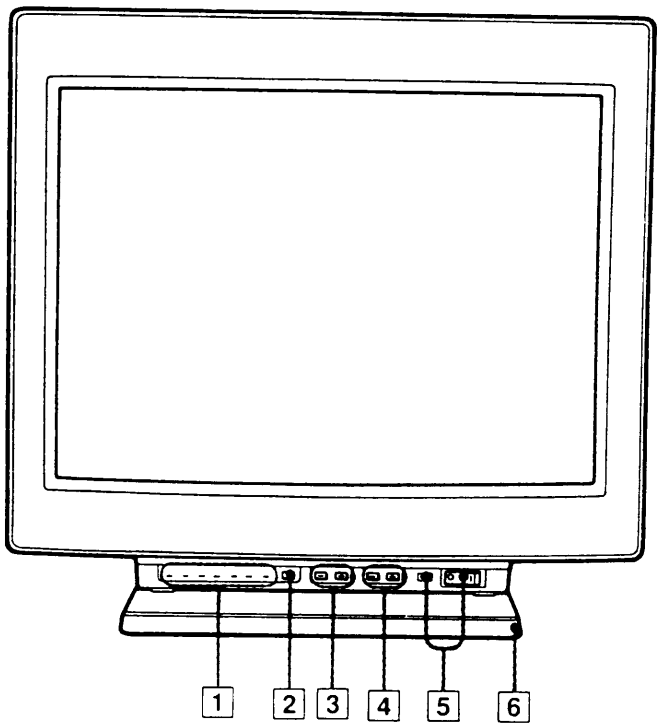
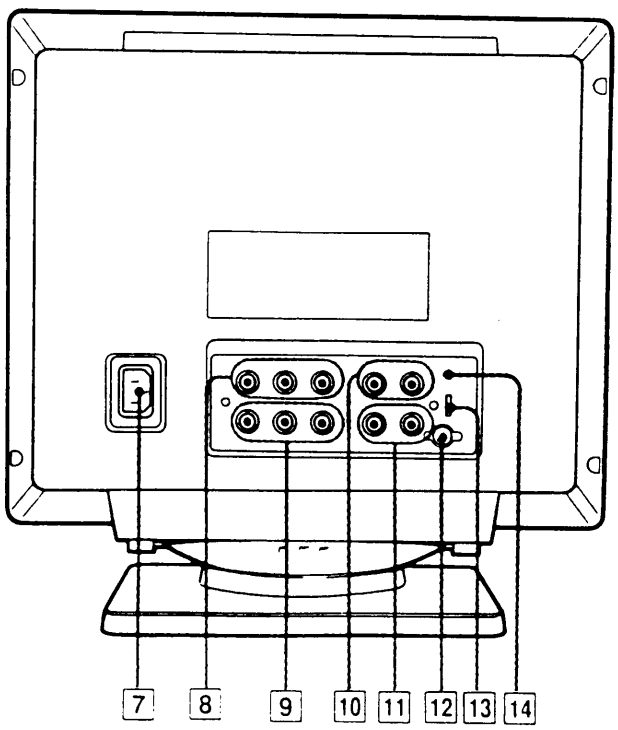
SECTION 1
GENERAL

1-1. FUNCTION OF CONTROLS





[1] **Indicators**
One of the indicators that corresponds to the adjustment item chosen by the SELECT button [2] lights up.
Adjustment by the ADJUST +/– buttons [3] is possible while the indicator is lit.
All indicators light up instantly (for about 0.25 seconds) when the user-stored conditions are cleared.

[2] **SELECT button**
Press to select the adjustment item so that the required indicator lights up.

[3] **ADJUST +/– buttons**
Adjust the item chosen by using the SELECT button [2].

[4] **◑ (contrast) +/– buttons**
Adjust the picture contrast.

[5] **Power switch and lamp**
Press the I side of the switch to turn on the power.
Press the ○ side to turn it off.

[6] **Swivel/Tilt stand**
The stand allows the angle of the screen to be adjusted by 90 degrees horizontally and by 15 degrees vertically.

[7] **AC IN connector**

[8] **VIDEO OUT (video output) connectors (BNC)**
Use these connectors to distribute the video signal fed to this unit to another monitor.
When cables are connected to these connectors, the 75 ohms termination of the VIDEO IN connectors [9] is automatically released.

[9] **VIDEO IN (video input) connectors (BNC)**
Accept RGB video signals (0.714 Vp-p, positive).
When no external sync signal is applied, an internal sync signal (0.286 Vp-p, negative) must be added to the G (green) signal.

Note

The optimum display may not be obtained when using computer or video board of high output level (approx. 1.0 Vp-p). In such a case, adjust the display by lowering the contrast, or use computer or video board of adequate output level.

[10] **SYNC OUT (sync output) connectors (BNC)**
Use these connectors to distribute the external sync signal fed to this unit to another monitror.
When cables are connected to these connectors, the 75 ohms termination of the SYNC IN connectors [11] is automatically released.

[11] **SYNC IN (sync input) connectors (BNC)**
Accept external sync signals (2 to 5 Vp-p, positive or negative).
HD: for horizontal drive pulse or composite drive pulse
VD: for vertical drive pulse
When an external sync signal is applied, the monitor is switched automatically from the internal sync mode to the external sync mode. When the G signal contains the sync signal, however, the hue of the monitor may be changed. In this case, disconnect the external sync signal and apply the internal sync signal mode.

[12] **External communication terminal**
The terminal is to be used by Sony servicemen only for external communication.

[13] **75Ω/2kΩ selector**
Switches the impedance of the SYNC IN connectors [11] termination to 75Ω or to 2kΩ. When external sync signals are input, normally set this selector to the 75Ω position. If good synchronization cannot be obtained, set this selector to the 2kΩ position.

[14] **RESET button**
Press to clear every user-stored display condition for each input signal.
Press the button while the power is turned on.

Notes

- Use a coaxial cable which is shorter than 3 m (10 ft) and of 75 ohms impedance for connection of the VIDEO OUT and SYNC OUT connectors. If the cable is too long, or its impedance is incorrect, or several monitors are connected in cascade, the picture may be noisy with horizontal and vertical lines, etc.
  To connect the VIDEO OUT connector, use a terminated cable, or connect to a terminated second device.
- When not distributing signals to another monitor, disconnect the cables from the VIDEO OUT and SYNC OUT connectors.
- If the BNC connector of the signal distributing cable is not adequate, the termination impedance may not be disconnected properly. Always use the cable with adequate BNC connectors.

1-2. PRESET MODE

The GDM-2039 adjusts automatically the display size and position to the optimum in accordance with the input signals shown in the table below. It has factory-preset setting values for these signals. When a computer or a work station that issues such signal is connected, the optimum display is obtained without any manual adjustment. The factory-preset values (called "preset-type signals" in this manual) are as follows:

No.	Display (dots × lines)	Horizontal frequency	Vertical frequency	Scanning mode	Preset-type signals
1	640 × 480	31.5 kHz	60 Hz	Non Interlace	VGA graphic*
2	640 × 350	31.5 kHz	70 Hz	Non Interlace	VGA EGA Emulate*
3	720 × 400	31.5 kHz	70 Hz	Non Interlace	VGA text*
4	1024 × 768	48.8 kHz	60 Hz	Non Interlace	Sony standard I
5	1280 × 1024	63.3 kHz	60 Hz	Non Interlace	Sony standard II
6	1152 × 864	68.7 kHz	75 Hz	Non Interlace	Macintosh II Two-Page**
7	1280 × 1024	78.9 kHz	74 Hz	Non Interlace	Sony standard III
8	1280 × 1024	81.2 kHz	76 Hz	Non Interlace	Sony standard IV

* VGA is the trademark of International Business Machines Corporation.
** Macintosh II is the trademark of Apple Computer Inc.

Note

If a signal from equipment other than the preset-type signals is input, the picture size may be larger or smaller than the display of the unit, or the picture may not come to the center. Some signals may not be synchronized and the picture may be distorted. Please use one of the preset-type signals.

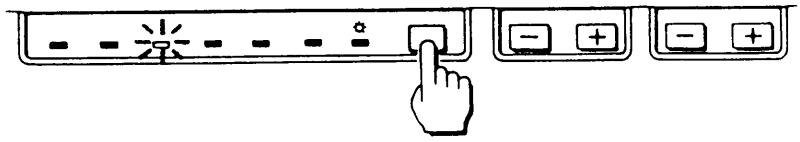
1-3. ADJUSTMENT

Procedure

When one of the preset-type signals is input, no picture adjustment is necessary.
If you want to change the contrast, use the ◑ +/– buttons. You can, however, adjust the brightness, picture size and position and the convergence manually by following the procedure described below.

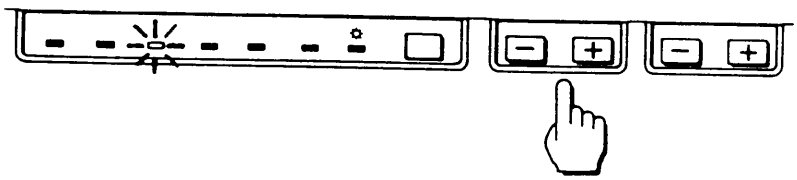
1 **Turn on the unit, and feed the video signal from the connected computer/work station.**

2 **Press the SELECT button to choose the adjustment item.**
The indicator corresponding to the selected item lights up.
When the power is turned on, the ☼ indicator is lit.
Pressing the SELECT button changes the item in the following order:
☼ → H SIZE → H CENT → V SIZE → V CENT → H STAT → V STAT
For what the indicators mean and how to make an adjustment, see the next page.



3

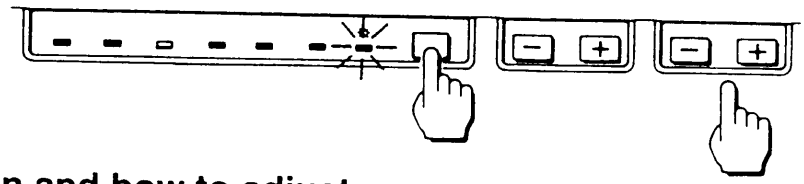
Observe the picture, and press the ADJUST +/– buttons while the target indicator is lit.



If you do not press the SELECT button or the ADJUST +/– buttons within 10 seconds, the ☼ indicator lights up again.

4

Select the color temperature of the picture.
The factory-preset color temperature is approximately 9300°K.
To select approximately 6500°K, press the SELECT button and ◑ – button at the same time for 2 seconds or longer. To select 9300°K again, press the SELECT button and ◑ + button at the same time for 2 seconds or longer.



What the indicators mean and how to adjust

Indicator that is lit	Meaning/How to adjust
☼	**Adjust the brightness of the picture.** Press ADJUST + to increase the picture brightness. Press ADJUST – to decrease the picture brightness.
H SIZE	**Adjust the horizontal size of the picture.** Press ADJUST + to increase the horizontal size. Press ADJUST – to decrease the horizontal size.
H CENT	**Adjust the horizontal centering of the picture.** Press ADJUST + to move the picture to the right. Press ADJUST – to move it to the left.
V SIZE	**Adjust the vertical size of the picture.** Press ADJUST + to increase the vertical size. Press ADJUST – to decrease the vertical size.
V CENT	**Adjust the vertical centering of the picture.** Press ADJUST + to move the picture upward. Press ADJUST – to move it downward.
H STAT	**Adjust the horizontal static convergence.** Press ADJUST + to move blue colors to the left and red colors to the right. Press ADJUST – to move blue colors to the right and red colors to the left. Adjust while observing the center of the picture.
V STAT	**Adjust the vertical static convergence.** Press ADJUST + to move red colors upward and blue colors downward. Press ADJUST – to move red colors downward and blue colors upward. Adjust while observing the center of the picture.

The indicator blinks when ...

The limit value is achieved by pressing ADJUST + or – button.

Storing the Adjusted Condition

The upper 4 adjustment items listed below are stored for each input signal.
The lower 4 adjustment items are stored independently from the types of input signals.

Adjustment item	How stored
H CENT (horizontal centering) **V CENT** (vertical centering) **H SIZE** (horizontal size) **V SIZE** (vertical size)	**They are stored together with the type of the input signal.** The adjusted conditions for each input signal can be stored. The stored conditions are called back from memory when the corresponding signal is input, and the optimum display is obtained for this signal.
◑ (contrast) ○ (brightness) **H STAT** (horizontal static convergence) **V STAT** (vertical static convergence)	**They are stored independently from the input signal.** Normally adjust the convergence when red and blue colors are shifted due to the direction of the unit, or by being affected by the terrestrial magnetism.

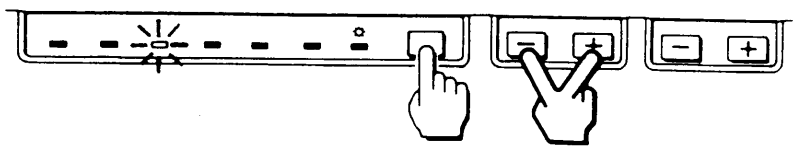
How to Clear User-Stored Conditions for ◑, ☼, H STAT and V STAT

User-stored conditions for the four items — ◑(contast), ○ (brightness), H STAT (horizontal static convergence) and V STAT (vertical static convergence)— can be reset to factory-preset conditions independently.

Method 1

(Clearing the user-stored conditions for ○, H STAT and V STAT)

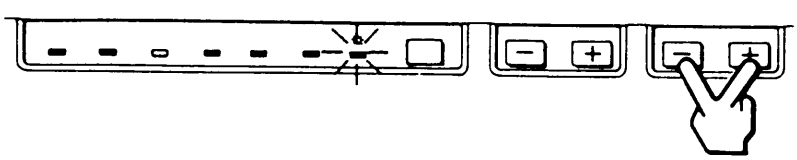
Press the SELECT button to choose the item whose user-stored condition you want to clear. While the target indicator is lit, press the ADJUST + and – buttons simultaneously for 2 seconds or longer.



Method 2

(Clearing the user-stored conditions for ◑)

Press the ◑ + and – buttons simultaneously for 2 seconds or longer.

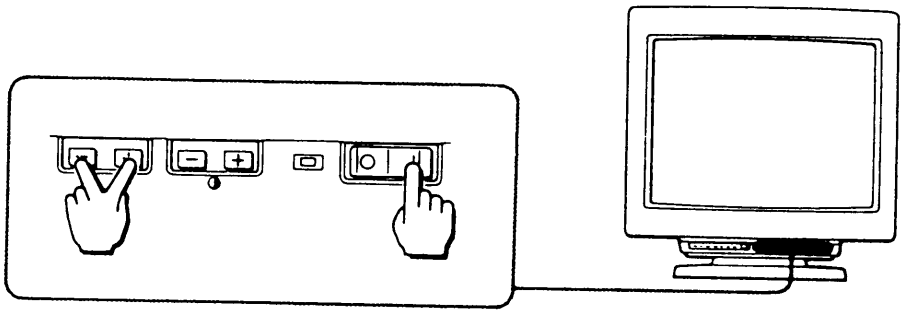


How to Clear All the User-Stored Conditions in the Memory

The following two methods can be used to clear all the user-stored conditions at once. (The factory-preset conditions will not be cleared however.)
The user-stored conditions for H CENT, V CENT, H SIZE and V SIZE cannot be cleared separately; to clear any of them, use either of the two methods to clear all the items.

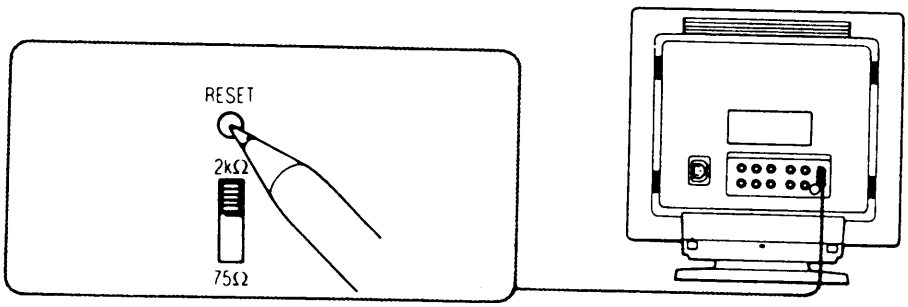
Method 1

Turn off the power and turn it on again while pressing the ADJUST + and – buttons simultaneously.



Method 2

Press the RESET button at the rear with the tip of a ball-point pen or a similar object while the power is turned on.



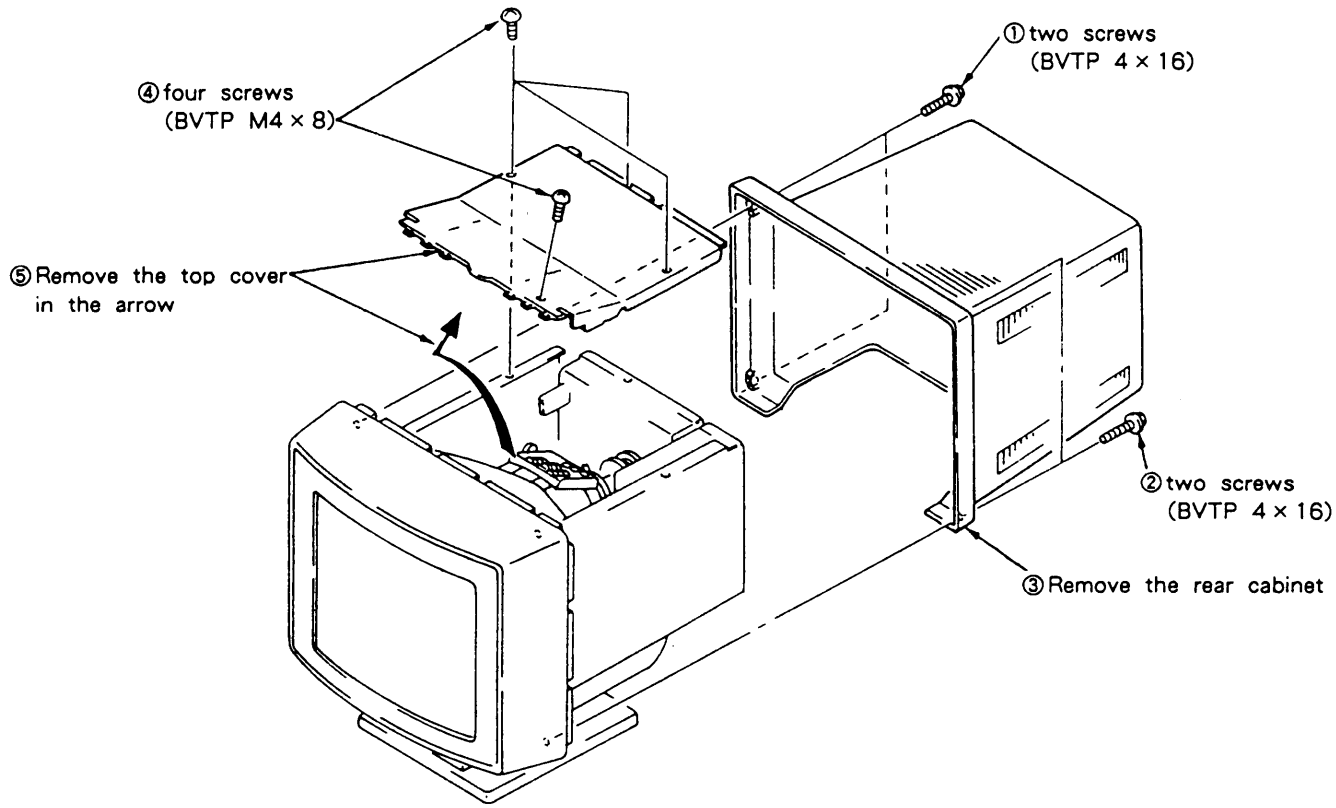
When the user-stored conditions are cleared

The 7 indicators light up at the same time (for about 0.25 seconds), and all the adjustment items return to their factory-preset conditions.

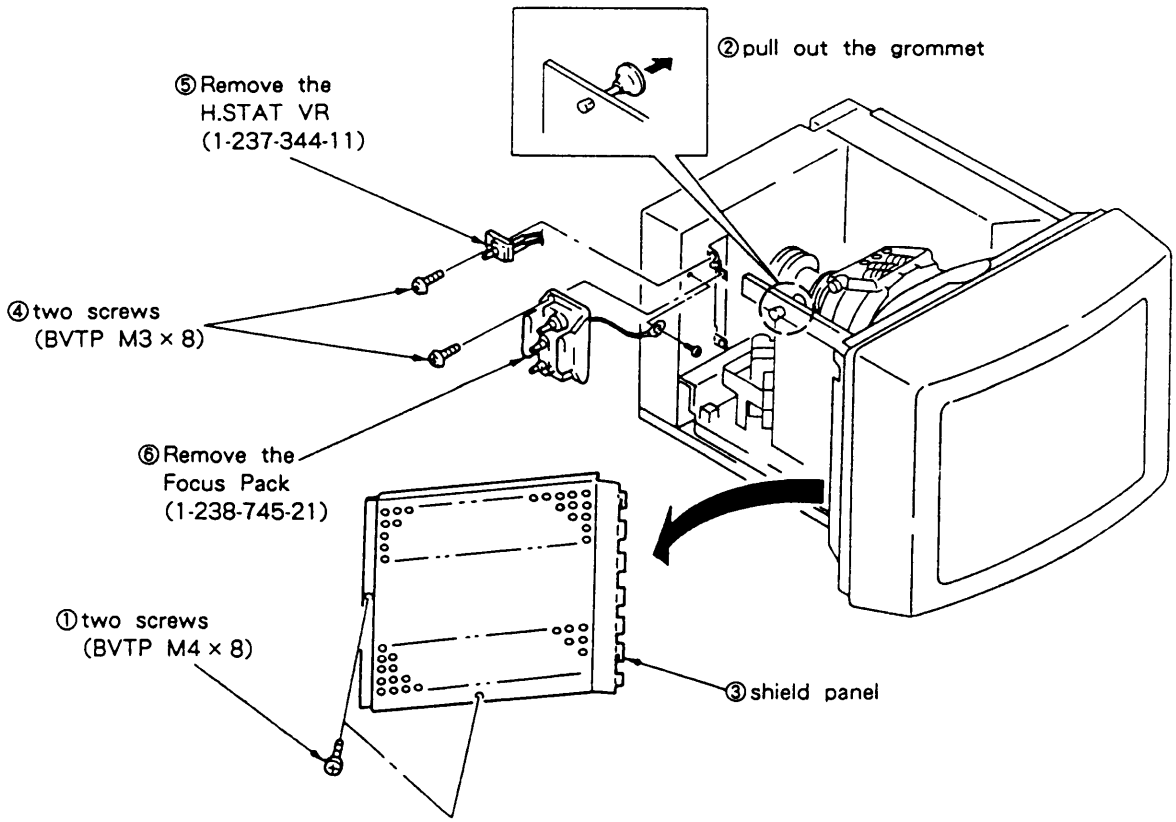
SECTION 2
DISASSEMBLY

Numbers in circles present procedure to do

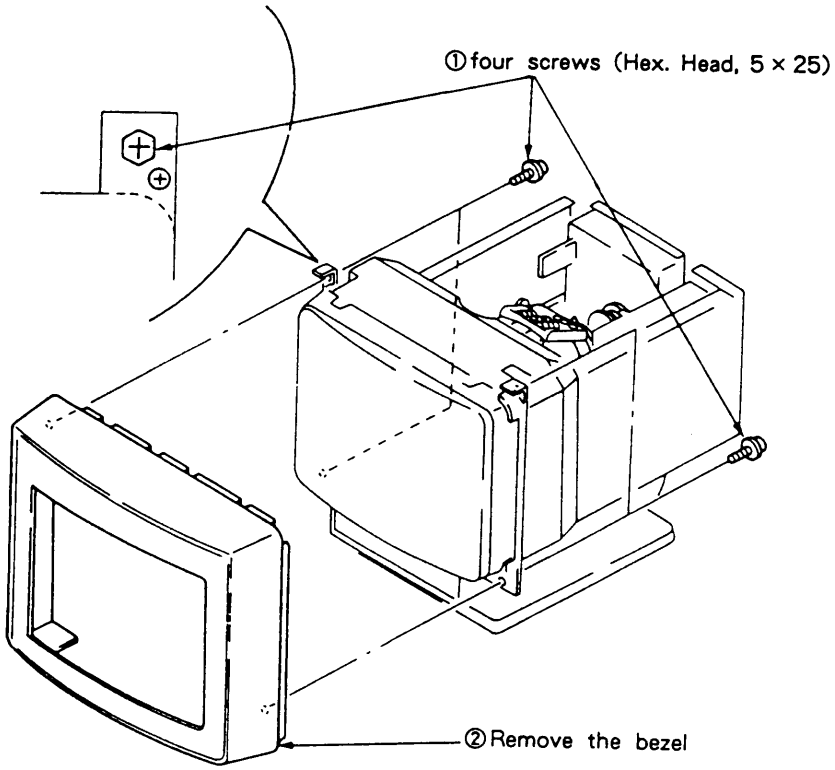
2-1. REAR CABINET AND TOP COVER REMOVAL



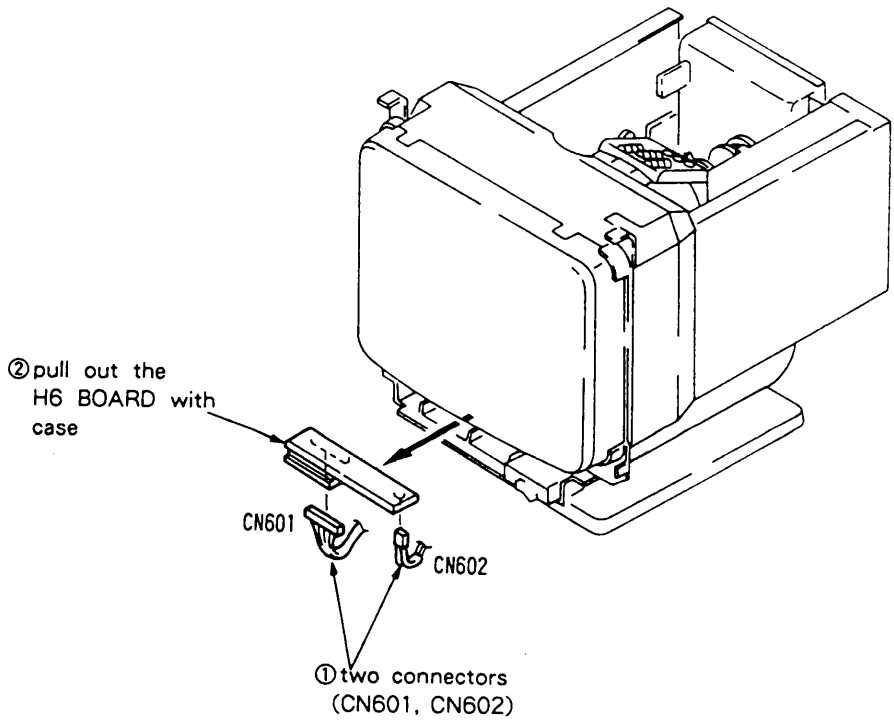
2-2. H-STAT VR AND FOCUS PACK REMOVAL



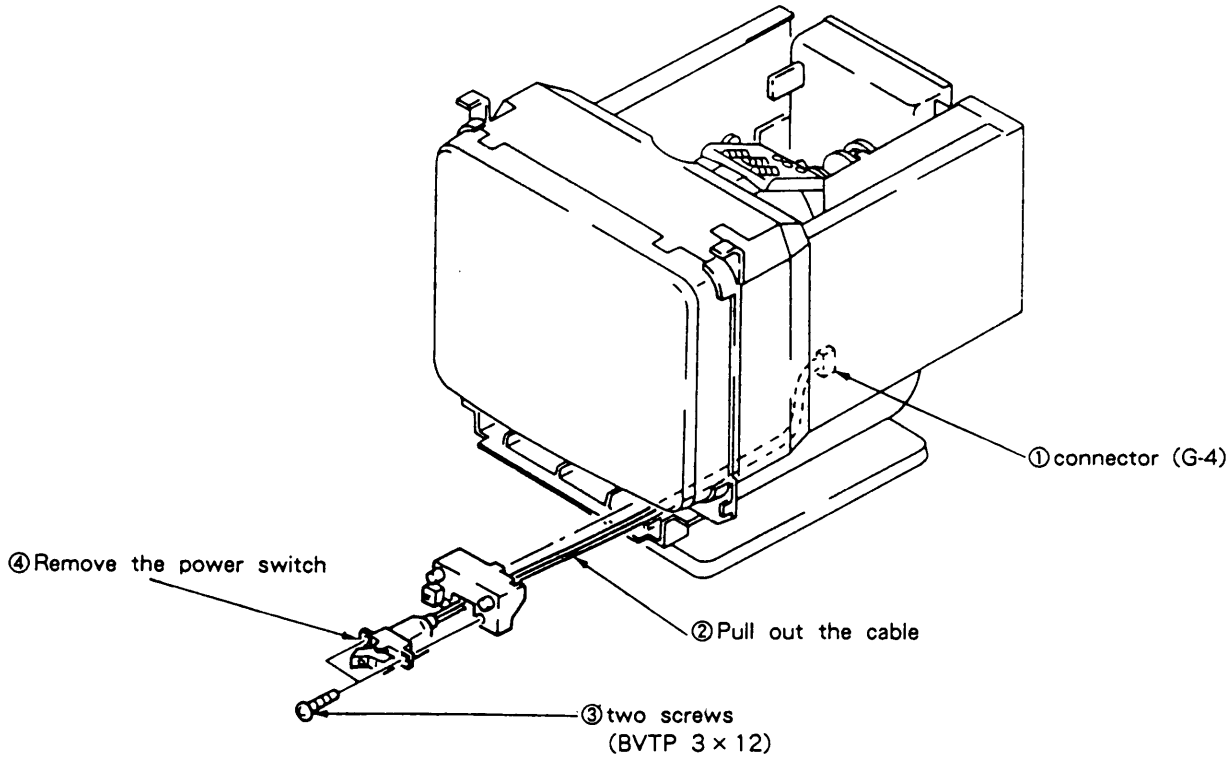
2-3. BEZEL REMOVAL



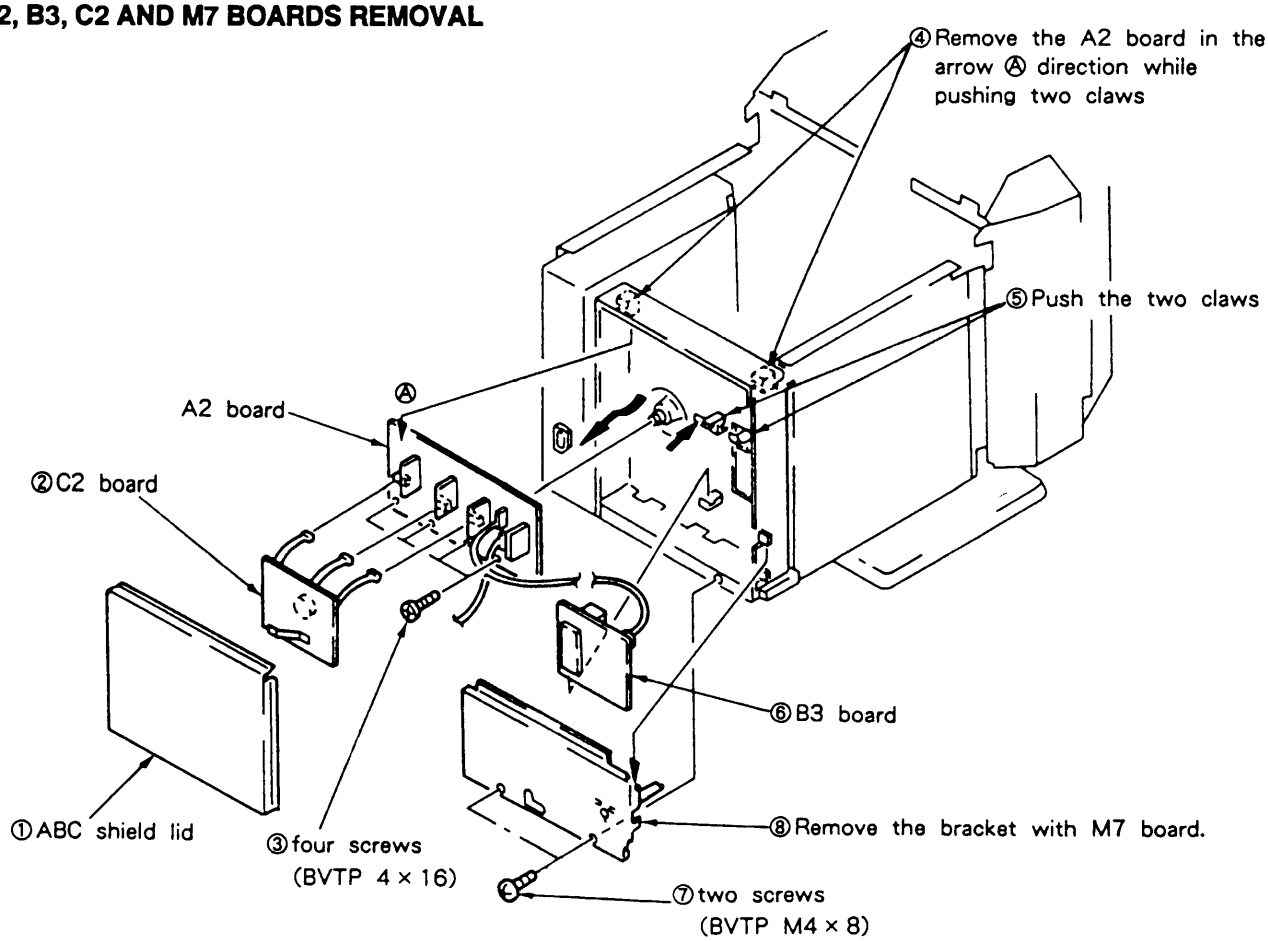
2-4. H6 BOARD REMOVAL



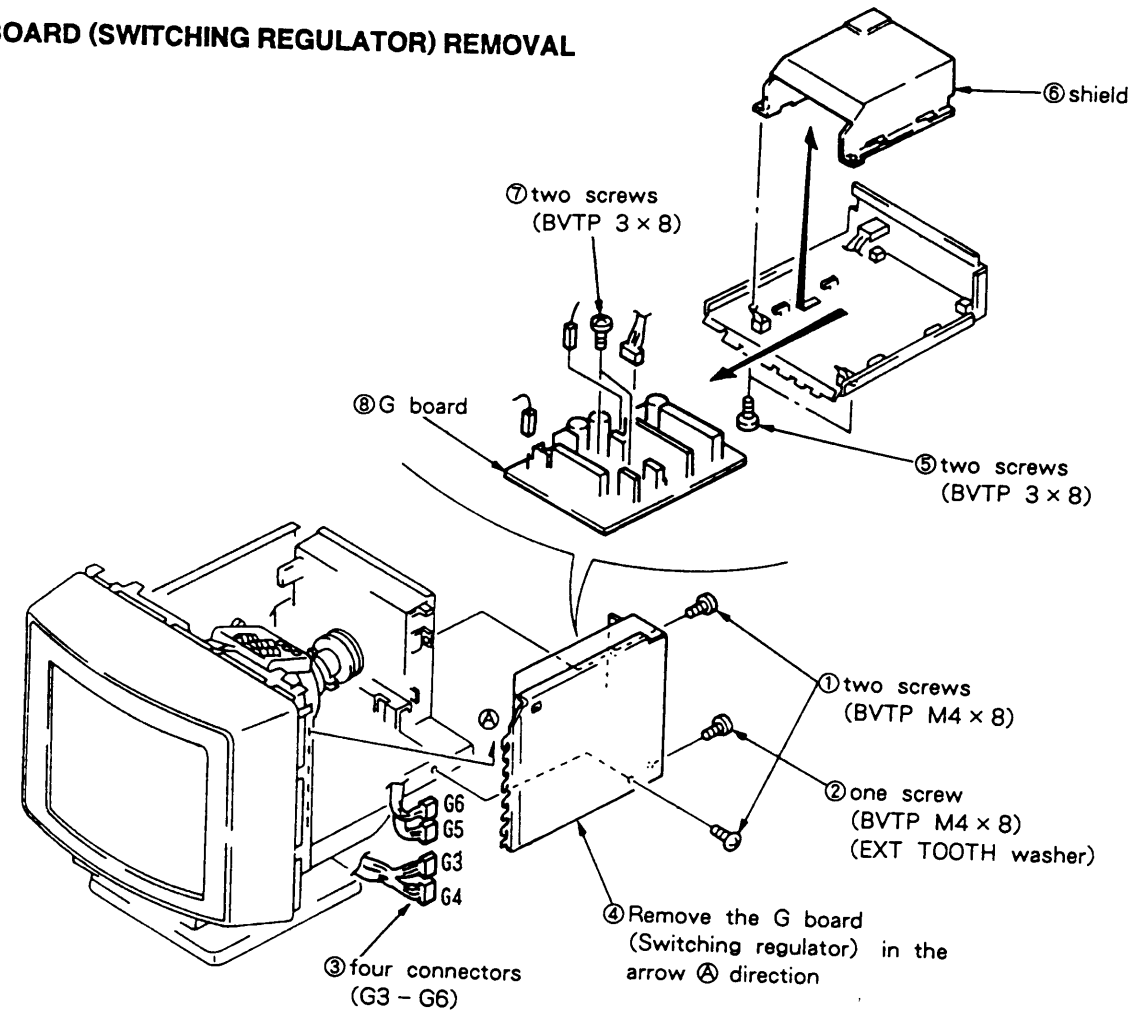
2-5. POWER SWITCH REMOVAL



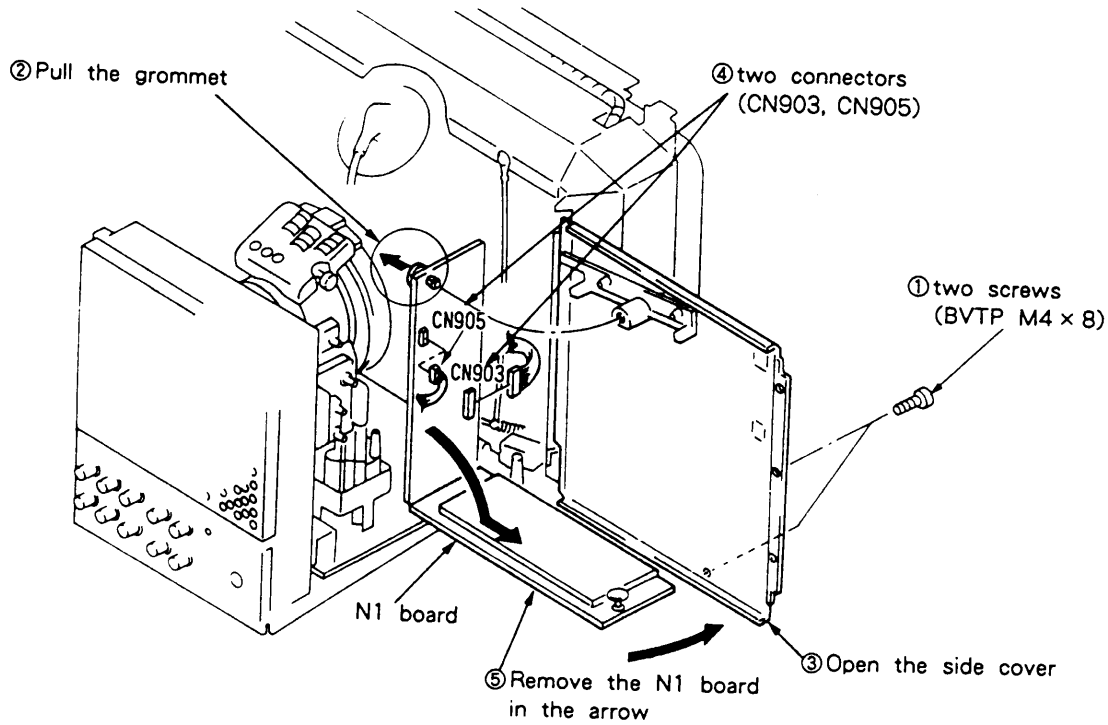
2-6. A2, B3, C2 AND M7 BOARDS REMOVAL



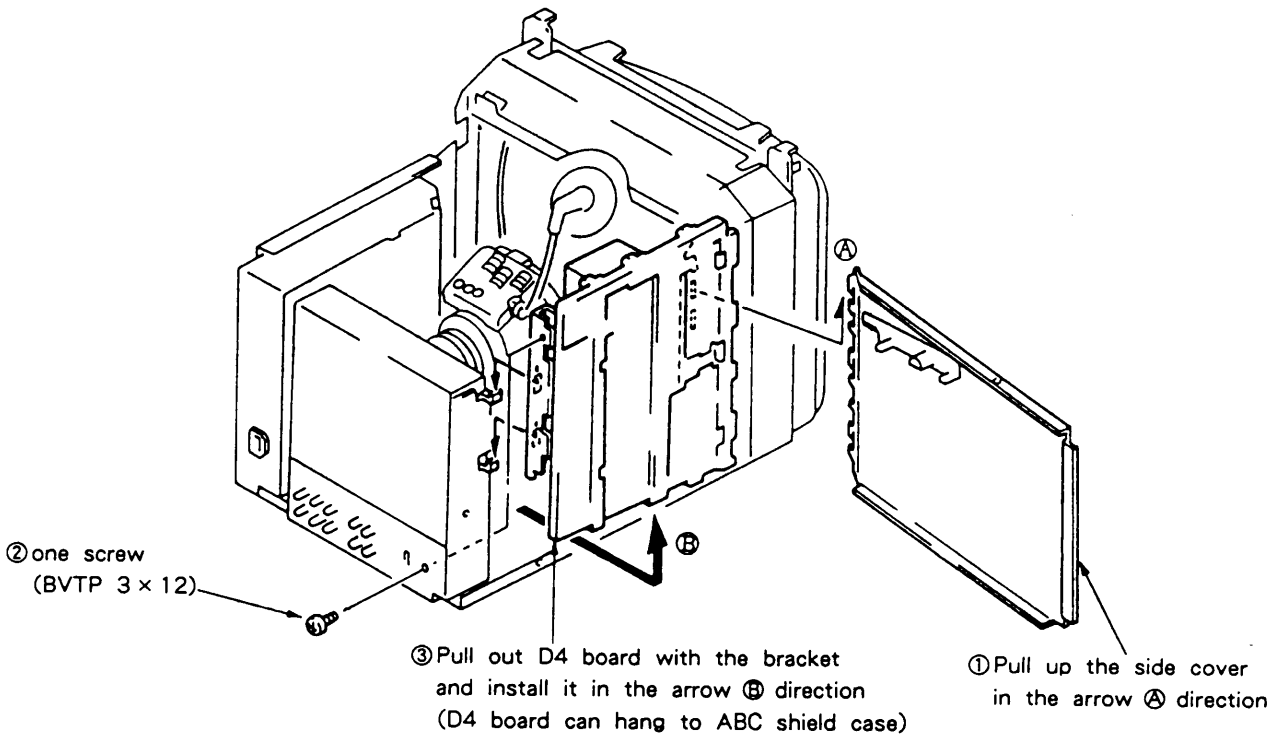
2-7. G BOARD (SWITCHING REGULATOR) REMOVAL



2-8. N1 BOARD REMOVAL

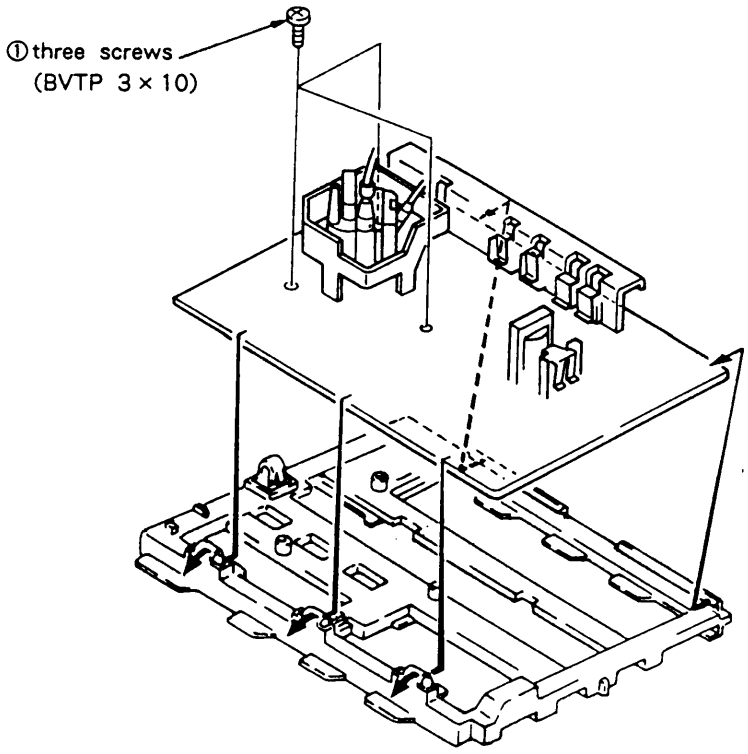


2-9. D4 BOARD SERVICE POSITION

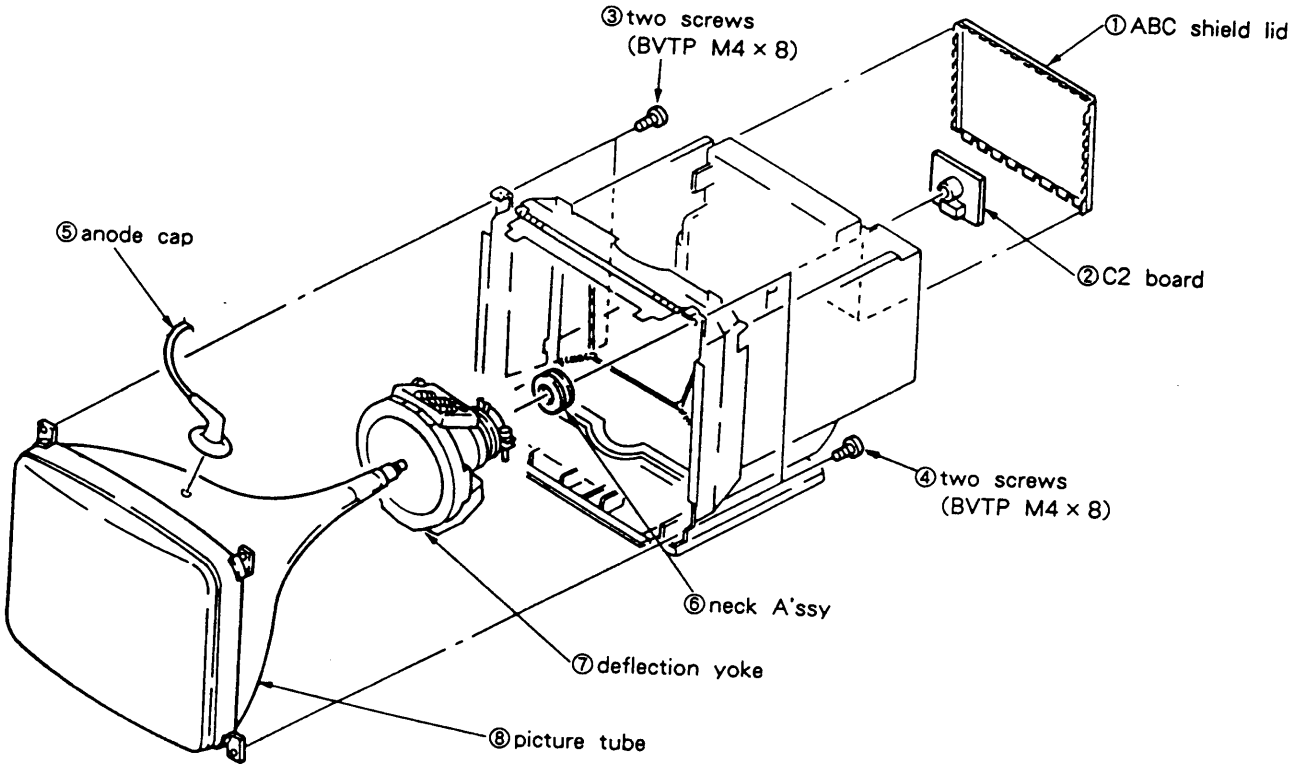


Note: Before pulling out D4 board, remove five lead clampers showed in 2-11-3 and 2-11-4 (①–⑤)

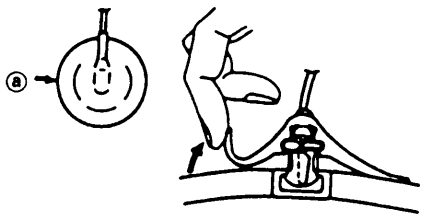
- **D4 Board Bracket Removal**



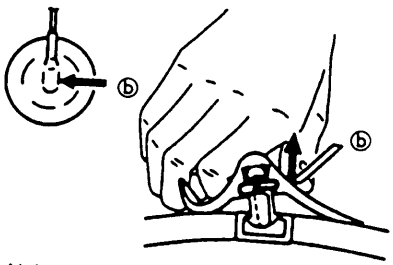
2-10. PICTURE TUBE REMOVAL



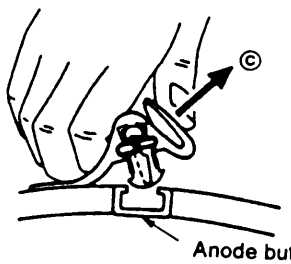
- **REMOVAL OF ANODE-CAP**
- **REMOVING PROCEDURES**



① Turn up one side of the rubber cap in the direction indicated by the arrow ⓐ.



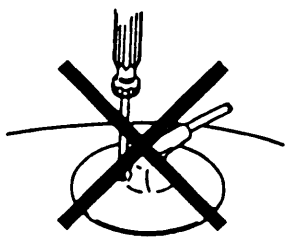
② Using a thumb pull up the rubber cap firmly in the direction indicated by the arrow ⓑ.

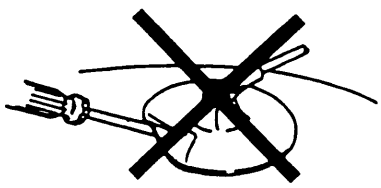


③ When one side of the rubber cap is separated from the anode button, the anode-cap can be removed by turning up the rubber cap and pulling up it in the direction of the arrow ⓒ.

- **HOW TO HANDLE AN ANODE-CAP**

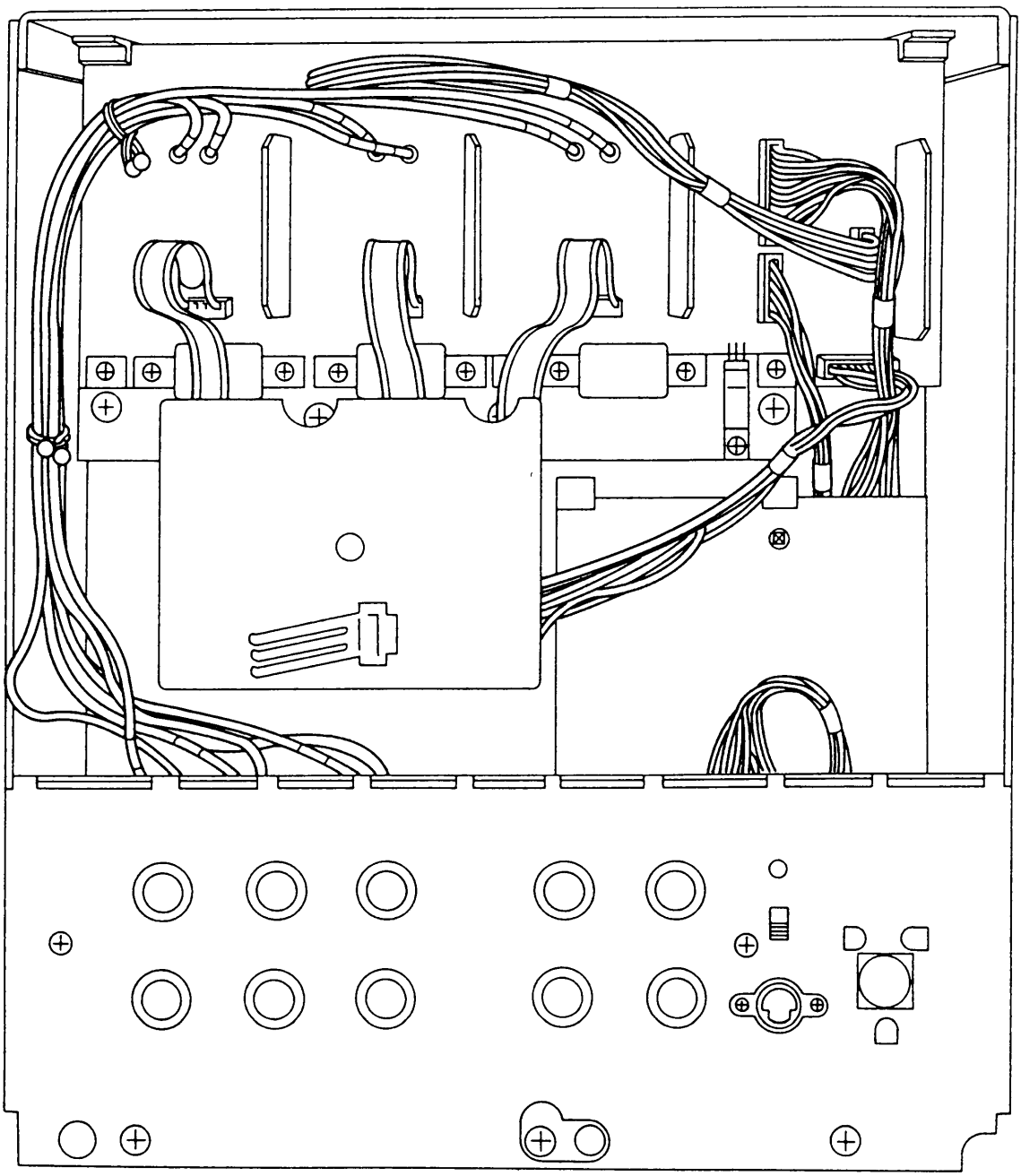
① Don't damage the surface of anode-cap with sharp objects.
② Don't press the rubber too hard or you may damage the inside of the anode-cap !
A metal fitting called a shatter-hook terminal is built into the rubber.
③ Don't turn the foot of the rubber over too hard !
The shatter-hook terminal will stick out and may damage the rubber.



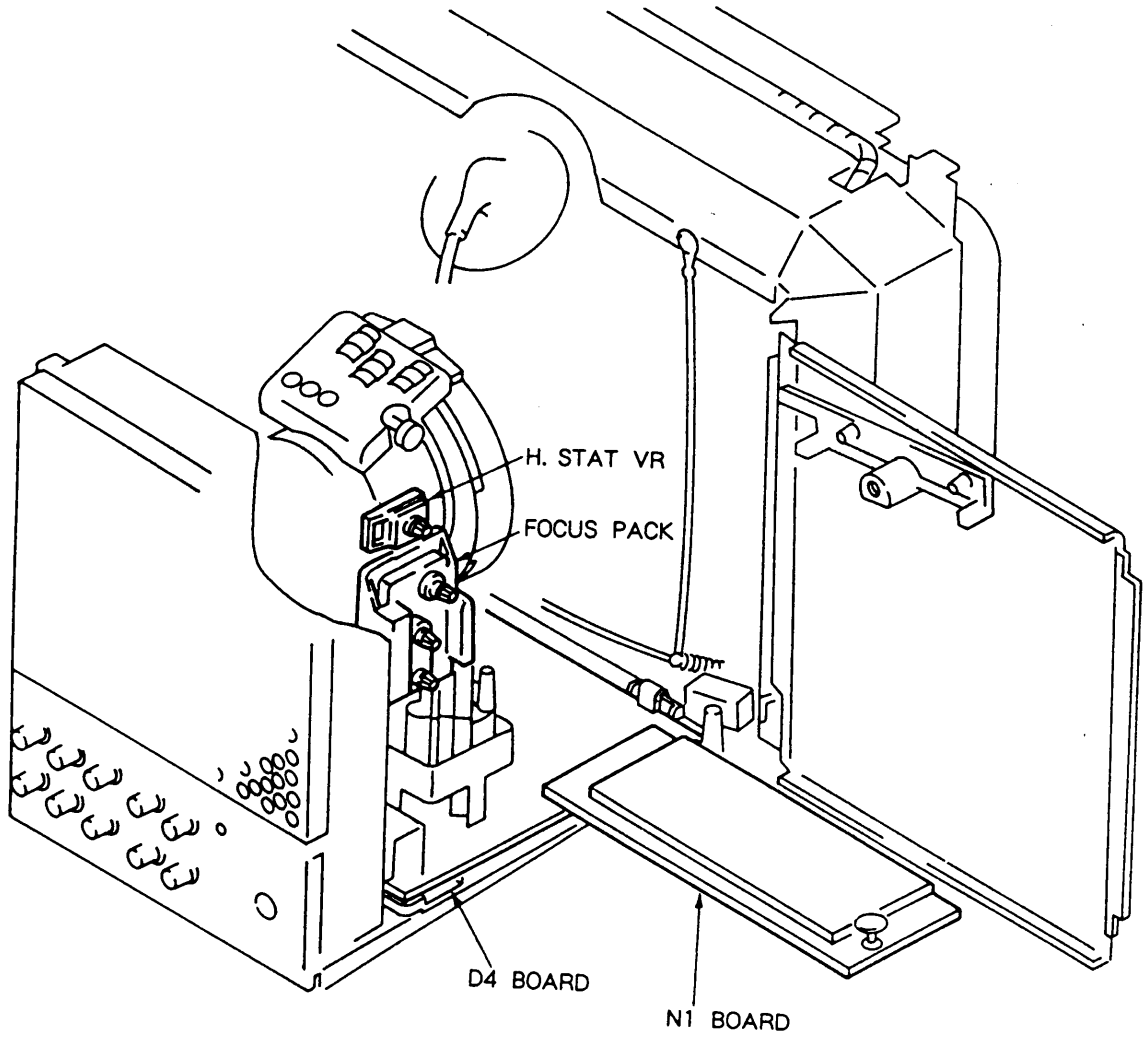


2-11. WIRING HARNESS LAYOUT

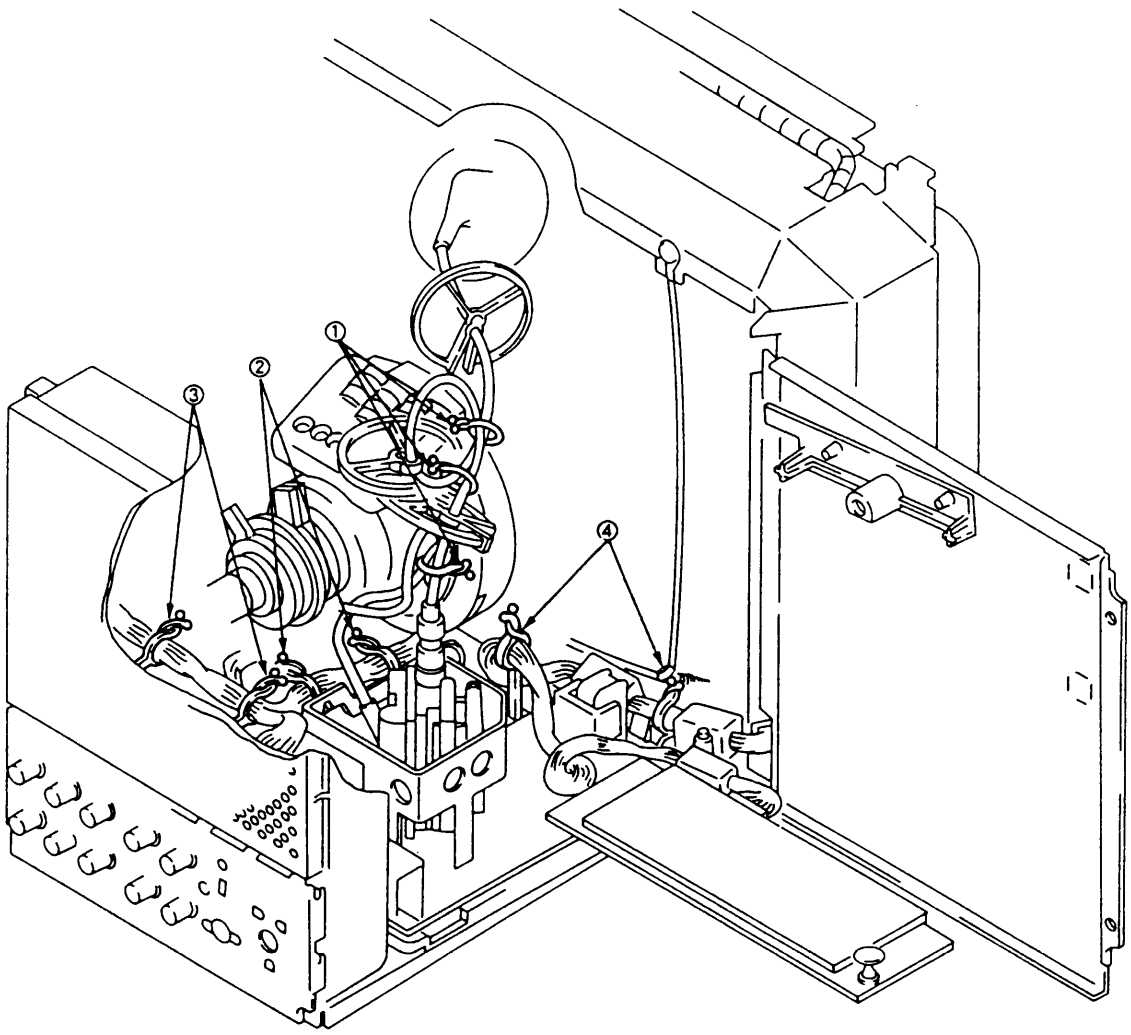
2-11-1. A2, B3, C2 and M7 Boards



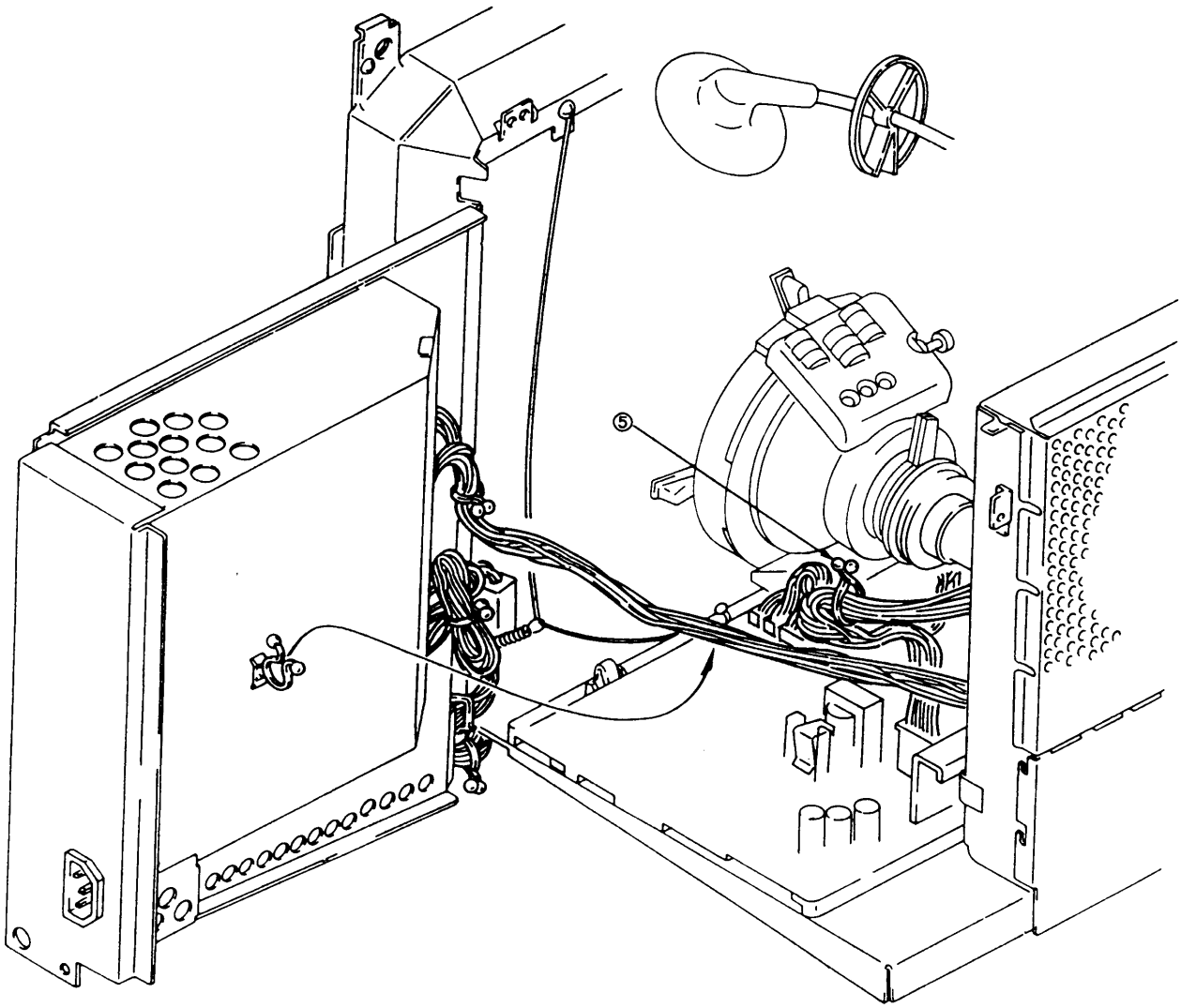
2-11-2. D4, N1 Boards, Focus Pack and H. STAT VR



2-11-3. Lead Clampers Location (1)



2-11-4. Lead Clampers Location (2)



SECTION 3
CIRCUIT DESCRIPTION

3-1. A2 BOARD

3-1-1. Composition

The A2 board consists of three channels of video signal amplifiers that include a contrast control circuit, pedestal clamp circuit, output amplifier (main), and blanking circuit. Each of the three AA3 boards and AB board, mounted on the A2 board, consists of a contrast amplifier and clamp circuit (AA3) and BKG control and BRT control circuit (AB).

3-1-2. Contrast Amplifier (AA3 Board)

The contrast control amplifier utilizes a differential amplifier for current balance control and a feedback circuit to obtain wide frequency response and good tracking between channels. In this circuit, the amplifier gain can be continuously changed by DC adjustment for contrast control. This is achieved with the following signal process. A reference pulse is inserted in every other line on the back porch of the input signal (output of buffer Q1).

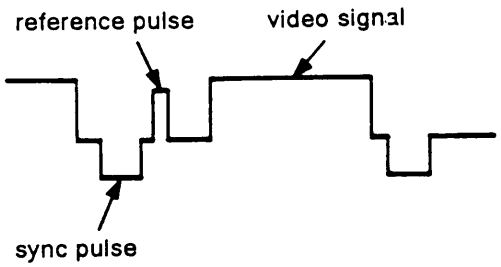


Fig. 3-1 Inserting the reference pulse

The signal is then input to the contrast amplifier consisting of Q2 thru Q7. The gain is set by changing the balance of differential amplifier's collector current of Q3 and Q4. The gain control voltage is obtained from IC1 (2/2) ⑦ pin output voltage through Q6. The peak value of the reference pulse is sampled by Q15, Q16 and C9 so that it is converted to the absolute voltage value from GND and is sent to IC1 (2/2) ⑥ pin.
On the other hand, the data determined by the control circuit (N1 board) is sent to IC501 that is output from ⑮ pin in dc voltage to be supplied to IC1 (2/2) ⑤ pin.
The sampling voltage of IC1 (2/2) ⑥ pin and the ⑤ pin voltage are compared. A feedback loop is made to stabilize the amplifier's gain so that these two voltages become the same value. Contrast can be changed by S4 and S5 on the H6 board, as explained.

3-1-3. Pedestal Clamp (AA3 Board)

This circuit performs pedestal clamping for DC restoration of the input signal since the input stage of the video amplifier is AC coupled. Altering the DC bias at the collector of Q4 restores the DC component of the input signal and stabilizes the pedestal level (black) of the signal at the CRT cathode. Q5 acts as a DC power source to regulate a bias voltage to Q4. The emitter voltage of Q5 is controlled by the output from IC1 (1/2), which is a high gain DC amplifier. A reference voltage (DC) is provided at pin ③ of IC1, and a feedback voltage subtracted by Q17 from the final video stage is at pin ② . Q17 samples and holds the detected voltage at R111 activating the gate by a background pulse. IC1 (1/2) compares the two input voltages and the output, thru Q5, controls the DC level of the collector of Q4 so as to equalize the input voltages.

3-1-4. Inserting the Blank Tip Pulse (AA3 Board)

Video signals amplified by the video output circuit are combined by the capacitor on the C2 board and then clamped again to perform background adjustment. In this instance, a blank tip pulse is inserted to the HD area of the video signals via D5 to clamp the video signals.

3-1-5. Video Output Amplifier

The video signals from the AA3 board preamplifier are input to the pin ① of IC101. Gain of this IC is determined by the ratio of R104 and internal resistance of IC101. It is about 21dB. The frequency response of $^{+1dB}_{-3dB}$ from 60 Hz to 120 MHz is optimized.

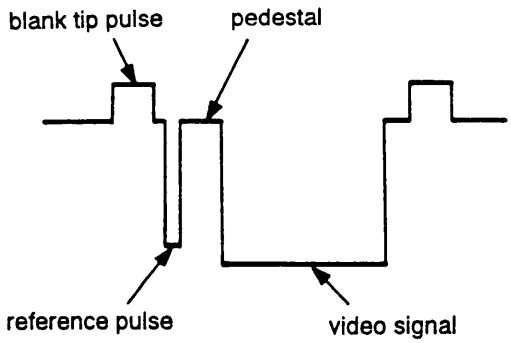


Fig. 3-2 Video output waveforms

3-1-6. BKG Control and BRT Control (AB board)

The emitter voltage of Q304 is controlled by the output from IC402, which is a high gain DC amplifier. A reference voltage is provided at pin ⑤ of IC402 and BKG signal is provided at pin ⑥ of IC402. IC402 compares the two input voltage and output pin ⑦ of IC402. As same as BRT control circuit, IC401 compares the input voltage from IC501 and output.

3-1-7. Blanking Circuit and Bias Circuit G1

A blanking signal sent from the D4 board via the B3 board to the base of Q409 is converted into a pulse of approx. 60 Vp-p at Q409 and Q410, then the pulse is mixed with G1 bias voltage and supplied to G1 for the CRT.
Then the G1 bias voltage is the voltage difference between two voltages; one is the voltage obtained by rectifying the blanking signal by D416, and the other voltage is the bright control voltage generated by AB board via D415.
When the brightness control is turned, G1 bias voltage varies and subsequently the background brightness can be changed.

3-2. B3 BOARD

The B3 board operation consists of the following four functions and circuits:
1. Sync separation circuit
2. Ref. pulse and Clamp pulse waveform generation circuit.
3. H. Blank pulse waveform generation circuit
4. Interface

Following is an explanation of each function:

3-2-1. Sync Separation Circuit

The center of sync separation, IC501 (M52036SP), enables the separation of the sync H and V at the time of inputting the composite video and separate sync.
As for the input of the composite video, it is input to pin ④ of IC501; while the separate sync is input that the horizontal sync to ⑥ pin and the vertical sync to ⑧ pin. The output of HD is acquired from pins ⑭ , ⑮ and that of VD from pin ⑬ . The switchover between the composite video and the separate sync should be done within IC501 giving priority to the separate sync function.
Also, the polarity of the input sync are output to pins ⑱ and ⑲ .
The indicated output signals are used to determine the input signals when they are sent to the N1 board.

3-2-2. Reference Pulse and Clamp Pulse Waveform Generation Circuit

A part of HD +OUT signal of IC501 pin ⑭ output is sent via Q509 and Q510 buffers to output. It is also sent to IC503 input to generate $1/2f_H$ which is necessary to generate the reference pulse and clamp pulse in every other line.
The HD OUT signal that is the output of pin ⑮ is input to the monostable multivibrator IC502 via inverter IC504. The reference pulse for detecting the video level is generated, based on this pulse.
The reference pulse is sent to A2 board via Q504 and Q505 buffers. The clamp pulse is sent to A2 board via Q506 and Q507 buffers.
Relation of the reference pulse and clamp pulse is shown in Fig. 3-3.

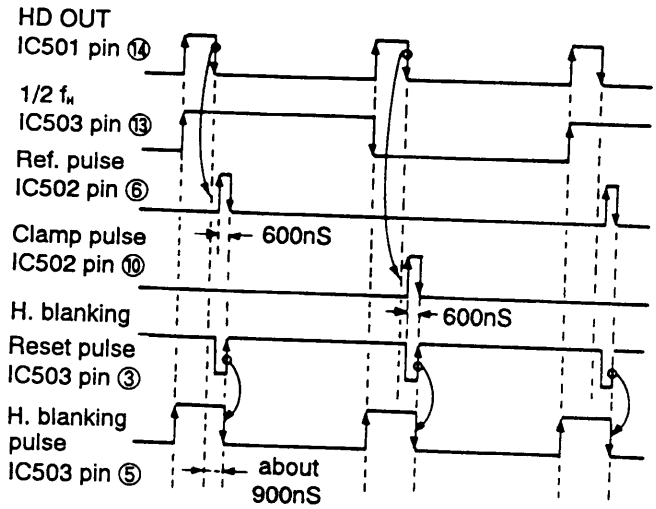


Fig. 3-3

On the other hand, the signal of pin ⑫ of IC504 is also sent to Q502. The signal reversed at Q502 is sent to the A2 board as the blank tip pulse and then used in the AA3 board.

3-2-3. H. Blanking Pulse Waveform Generation Circuit

The HD signal of IC501 pin ⑮ is passed via two stage inverter of IC504 and input to IC503 pin ④ (SET). Because this signal is input by negative logic, the IC503 pin ⑤ output rises to "H" at front edge of HD pulse. Also, because the reference pulse and clamp pulse are output alternately at every line, the IC502 pin ⑦ output and pin ⑨ output are mixed by sending them to negative logic, IC503 output falls to "L" at rise-up edge of either pulse. This pulse and the blanking pulse which is sent from defection board (N1 board) are mixed at Q503 and output to A2 board.

3-2-4. Interface

The B3 board is equipped with A2, M7, N1 and the interface function with the power board other than sync separation circuit, video control pulse generation circuit and blank mix circuit. Also, for the use of EMI, the delivery of signals and power source is performed through the EMI filter.

3-3. C2 BOARD

Video signals input to the C2 board are subject to series peaking and combined by the capacitor. Then, the top end of the blank tip pulse is clamped again by BKG voltage determined by BKG control circuit of A2 board.
The blanking pulse and G1 bias voltage are mixed at D7 and supplied to G1 grid of the CRT. A spark gap and serge protectors are mounted on the board to return the CRT discharge (flash-over) current to chassis ground.

3-4. D4 BOARD

3-4-1. Horizontal Deflection Circuit

The HD pulse generated on the N1 board drives T201 (HDT) by Q203. The current amplified by HDT operates on/off functions of Q204 (H. OUT) and high voltage pulse is generated at Q204 collector by the deflection yoke, damper diode D202 and the resonance capacitor C205, which causes SAW wave current running through the deflection yoke. Also, Q204 collector pulse is voltage divided by C206, C207 and then sent to the N1 board where AFC loop is formed.

H. SIZE and pin signal from the N1 board are amplified after input into IC301 (1/2). These amplified signals are compared with H. SAW at IC201 (1/2), go through Q218 and Q219 as PWM wave, and are finally provided into FET Q217 gate. Q217 makes a switching of +B, controls the power source of horizontal deflection circuit and provides a desired H. SIZE and pin cushion correction.

T202 is the +B choke for horizontal deflection and also forms the boost circuit of +B voltage by D221, D222, C210 and the power source for H. center circuit by D209 and D210. Q213 to Q216 are the transistors for H. center voltage control; and they change the electric potential of bases depending on the H. center signal going through IC301 (2/2), Q102 and provide the voltage to the S-shaped capacitor through HCC.
C221, C222, C223, C234, C235 and C236 are capacitors to make the S-shaped correction. Furthermore, as the value must be changed in accordance with the horizontal frequency, it chooses the appropriate combinations by Q205 – Q209.
The on/off relations between the frequency and the transistors are as shown in Table 3-1.

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
fH [kHz]	28.00 ~ 31.75	31.76 ~ 32.00	32.01 ~ 32.25	32.26 ~ 32.75	32.76 ~ 33.00	33.01 ~ 33.25	33.26 ~ 33.75	33.76 ~ 34.00	34.01 ~ 35.25	35.26 ~ 35.75	35.76 ~ 36.25	36.26 ~ 36.75	36.76 ~ 37.25	37.26 ~ 37.75	37.76 ~ 38.25	38.26 ~ 42.50
Q209	ON															
Q208	ON								OFF							
Q206	ON				OFF				ON				OFF			
Q207	ON		OFF		ON		OFF		ON		OFF		ON		OFF	
Q205	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
IC3, pin ㉜	L	H														
IC3, pin ㊳	L															

RANGE	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
fH [kHz]	42.51 ~ 44.50	44.51 ~ 45.75	45.76 ~ 47.00	47.01 ~ 48.50	48.51 ~ 50.00	50.01 ~ 51.50	51.51 ~ 53.25	53.26 ~ 58.50	58.51 ~ 63.00	63.01 ~ 65.00	65.01 ~ 67.75	67.76 ~ 70.25	70.26 ~ 75.00	75.01 ~ 79.50	79.51 ~ 84.00	84.01 ~ 85.00
Q209	OFF															
Q208	ON								OFF							
Q206	ON				OFF				ON				OFF			
Q207	ON		OFF		ON		OFF		ON		OFF		ON		OFF	
Q205	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
IC3, pin ㉜	L								H							
IC3, pin ㊳	H															

Table 3-1.

3-4-2. High-voltage Circuit

Horizontal drive transistors Q408 and T410 (HDT) drive high-voltage output transistor Q401 along with the H-OUT at Q204.

The series capacitors C401 and C402 are connected to the collector at Q401 and function as the resonate components of the flyback pulse.

The total value is selected by shorting the two capacitors with Q405 in order to get a enough peak voltage for the variable frequency.

The status of the transistor is shown in Table 3-1.

The +B voltage is supplied via L401. Five rectifier diodes are built into the secondary side of the FBT and the voltage at the secondary level is supplied to the focus pack to remove focus voltage and the G2 voltage.

A high-voltage output is built into the FBT and a high-voltage capacitor and high-voltage resistor are installed between each ground where they perform high-voltage rectification and high-voltage detection.

The high-voltage output in the FBT is scaled down to 1/3000 by the high-voltage resistor and then supplied to pin ③ of IC302 (2/2) where it is compared with reference voltage (9.00 V). Next, the differential voltage is amplified and input to pin ⑤ of IC201 (1/2). The H. SAW wave input to pin ⑥ of IC201 (2/2) and subjected to PWM by the comparater. The pulse generated at pin ① of IC201 (2/2) switches Q402 (a damper diode with built-in FET) via Q403 and Q404.

3-4-3. Vertical Deflection Circuit

The V. SIZE signal sent from the N1 board is input by the vertical deflection circuit structured of Q301, Q307 and IC304, while the vertical deflection yoke is driven by the SEPP circuit structured at Q303 to Q306. Q302 which functions as the power source switch to the vertical output circuit from the +B source, is turned on during vertical flyback by the pulse output from pin⑯ of IC101 on the N1 board.

3-4-4. High-voltage Hold-down Circuit

A feedback voltage which is normally 9V is initially sent from the focus pack and it is supplied to the (+) input of IC2 (2/2) where it is compared with (-) input voltage. This voltage is selected so that 9.8 ± 0.1V is adjusted by RV16. Thus, pin ⑦ for IC2 (2/2) on the DA1 board is set at "Low".

If the high-voltage abnormally increases and the (+) input voltage for IC2 (2/2) exceeds the (-) input voltage, pin ⑦ changes to "HIGH" and "HIGH" level voltage is output from pin ⑤ of the connector CN401 or pin ⑦ of the connector CN402 and input the voltage to pin ⑥ of IC801. At this point, the X-ray protector circuit in on the N1 board operates and stops the drive pulse for the output at pin ⑦ of the IC801 and Q305 to turn ON then the high-voltage circuit is suspended.

3-4-5. Beam Protector Circuit

The beam protector circuit is a kind of ABL circuit which stops high-voltage supply in instances when anode current for the CRT increases beyond the necessary level. This circuit features two beam protectors.

Anode current is detected by removing the secondary current (CRT current + high-voltage resistor current + focus current + G2 resistor current) as voltage by detection resistors R2 to R5. ABL current flows through these resistors, the voltage at TP403 drops. At this time, bleeder current flowing to the high-voltage resistors is constant and if CRT current increases, the (-) input voltage at IC1 (1/2) drops below the (+) input voltage and changes output pin ① of IC2 to "HIGH" (beam protector (1)).

If the beam protector circuit (1) fails to operate for some reason, IC1 (beam protector (2)) operates in the same manner as beam protector (1). These outputs are connected to pin ⑤ (HV STOP) of the connector CN401 and pin ⑥ of the connector CN402 and hold-down the high-voltage. Beam protector (2) is designed to operate at a higher current than beam protector (1).

3-4-6. CRT Protector

The CRT protector detects the H. ACT signal by rectifying the secondary output at T202 in order to protect the fluorescent surface of the CRT from burning when the horizontal deflection circuit malfunction and stops operating. Also, for the vertical deflection circuit, the CRT protector rectifies the V middle point voltage of pin ④ of DY2 connector and detects the V. ACT signal.

If H. or V. deflection circuit stops, Q502 or Q503 turn off to stop the high-voltage circuit in the same manner as the hold-down circuit.

3-4-7. H/V-static Convergence

H. STAT and V. STAT signal (DC) is controlled and output from the N1 board.
H. STAT is amplified approx. 300 times by IC303 (1/2) and Q703.
The collector of Q703 is connected to the CRT and controls the H. STAT convergence plate voltage.
V. STAT is amplified by IC303 (2/2), Q701 and Q702, and drives NTC.

3-5. H6 BOARD

From S1 to S5 are the select switches. They are LEDs to indicate the selected items. From D1 to D7 are the matrix circuit to read the states of push switches S1 to S5 on the front panel.

3-6. M7 BOARD

In this section, RGB signals input to J811 to J813 and HD and VD signals input to J804 to J805 are output to J806 to J810; at the same time, HD and VD are sent to the B3 board.
At J806 to J810, the terminal resistor becomes open when BNC connector is inserted. As for HD and VD, terminal resistor values can be selected at S801.

3-7. G BOARD

3-7-1. AC Input-degauss Circuit-rect & Smoothing Section

① After passing through the AC inlet and the filter section, AC is supplied to the rectifier diode. For 5 to 6 seconds after power on, the rush current is restrained by thermistor TH1. (Once RY1 turns on, TH1 is short- circuited.)
VDR1 (varistor) is equipped to protect against AC noise.

② Degauss circuit
As RY1 is open when the power on, the degauss current flows through posistor THP1. The varistor VDR2 clamps in the AC 200V system of excessive voltage. After 5 to 6 seconds from power on, RY1 is short-circuited and the degauss loop is cut off.

③ Rect switching circuit
When the voltage is below approx. AC 150V, the triac in IC1 (STR81145A) is turned on and the AC rectification becomes the double-voltage rectifier circuit. In the AC 200V system, the triac is turned off and the AC rectification becomes the bridge rectifier circuit. Hereafter Rect. Out voltage is referred to as Ei.

3-7-2. Start-up and Oscillation Circuit

When the Ei starts up, the power is supplied to IC102 (Low B system OSC) on the GA board through R5, THP2 and the series regulator Q5 on the G board, which it starts to oscillate. Due to this oscillation, the voltage caused at T3 (SRT-2) is rectified and smoothed by D17 and C19, reaching to 15V Vcc. When the Vcc is completely started up Q5 gets cut off. Also, Vcc is supplied to IC101 of the +B system OSC.
IC101 and IC102 (IR3M02) are the PWM controller, equivalent to TL494, which are used as the frequency controller by varying the time constant.

IC101 peripheral circuit

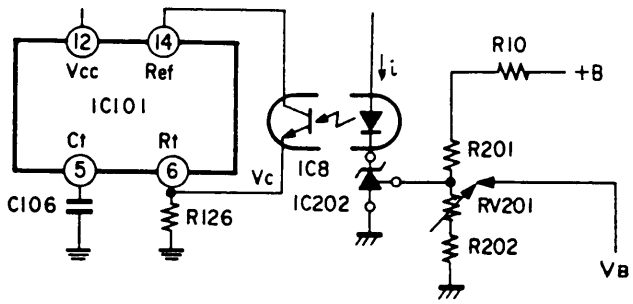


Fig. 3-4

IC202 is the variable shunt regulator (TL431). It controls VC to regulate VB to 2.5V. In this case, by the increasing of +B, the current ι is absorbed and the frequency is lowered with pin ⑥ electric potential of IC101 being increased via IC8.

3-7-3. Converter Section

Principle of operation.

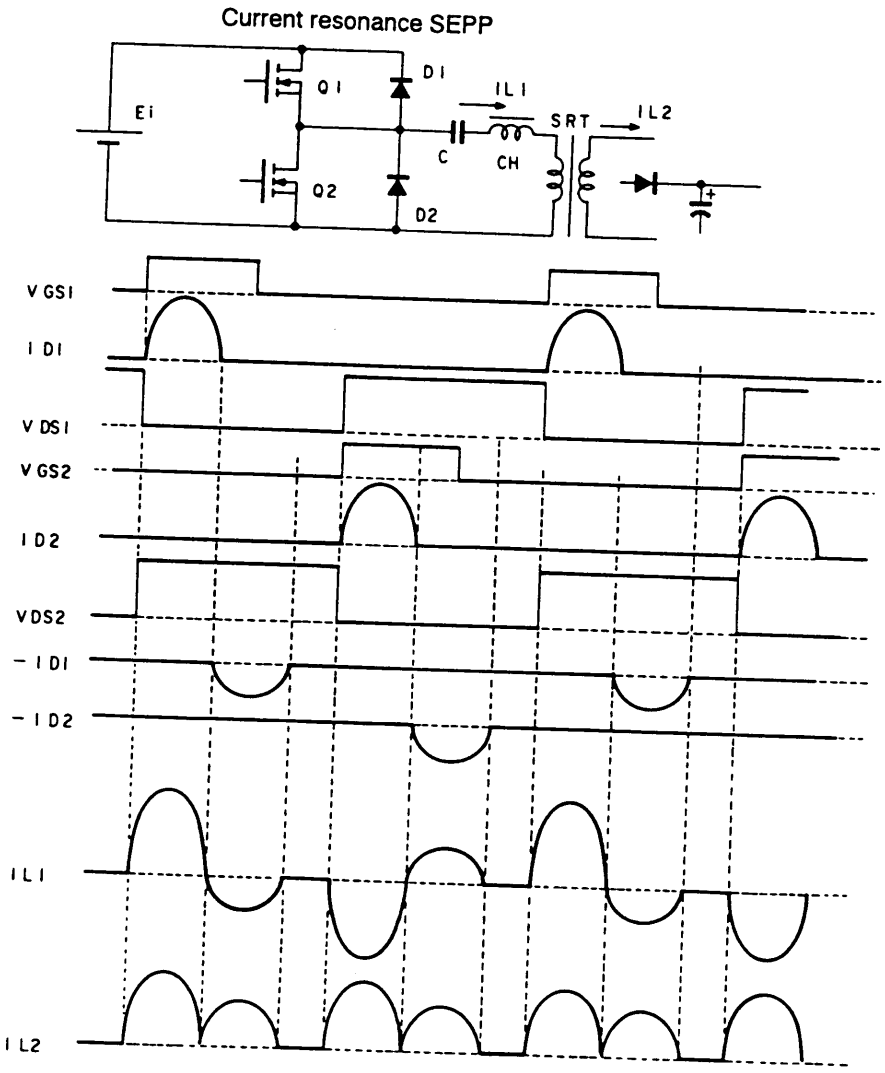


Fig. 3-5

The SRT excitation current is a synthesizing of sine wave, determined by C and L (L CH) of CH. It is obtained by the formula of the resonance frequency $f=1/2\ \pi\ \sqrt{L_{CH} \cdot C}$, being constant. Also, it can be controlled the power flowed to SRT by varying the frequency as shown in Fig. 3-6.
Ⓐ has twice as higher input power as Ⓑ.

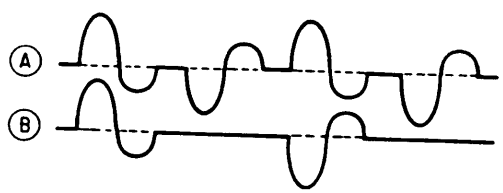


Fig. 3-6

3-7-4. OCP Circuit (Over current protector circuit)

After detecting the source currents of Q2 and Q4, it is integrated and applied to the comparaters of IC101 and IC102 respectively, and their oscillations are stopped.

As the primary 15V of low +B system is used for the Vcc of IC101, when the oscillation of IC102 stops (Low +B OCP, OVP...etc.), that of IC101 also stops. Therefore, the +B is shut off.

In case the OCP and the OVP of +B system, the Low B is output though the +B is shut off.

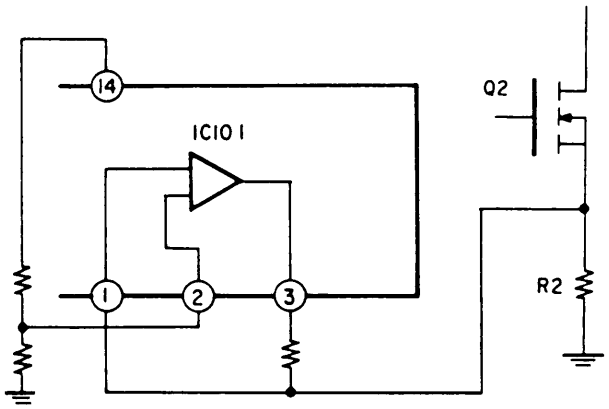


Fig. 3-7

3-7-5. OVP Circuit (Over voltage protector circuit)

The +B OVP circuit (important for DHHS) detects the +B by the absolute value, and returns to the primary side by the photo-coupler IC10 to stop IC101.

3-7-6. Fail Mode

It goes down the +B only when short-circuiting +B, the others are continued to output. When short-circuiting ± 12V, IC2, IC3 and IC4 of 3-terminal regulator's internal protection circuit works. Therefore, only these lines are gone down.

For one of 65V, ± 20V and 6.3V, as IC102 stops when line short-circuiting, all the outputs go down.

Also, turn off the power after clearing the obstruction when +B goes down. And after a few seconds, turn on the power again. Thus, it can be restored. However, it can not be started again till the discharging of Rect. Out Ei as it is latched when low +B goes down. It can be started again by discharging a few times the both ends of D15 (RD10) on the G board. But as it is the primary side, be careful with an electric shock.

3-8. N1 BOARD

3-8-1. Composition

The N1 board is composed of the sync circuit, the basic waveform generation circuit and the picture distortion adjustment circuit by CPU.

3-8-2. Horizontal and Vertical Oscillations Sync Circuit

This circuit is composed around IC101 to make the horizontal and vertical oscillations, AFC and AFC phase control, and vertical oscillation sync. The flyback pulse (FBT) from the D4 board is determined as a trigger, and it generates the SAW wave compared with AFC. The capacity in pin ⑤ of IC101 is switched the value according to the frequency by the CPU (IC3) control to obtain the suitable SAW wave.

The trigger pulse of H is input to pin ④ of IC101. Also, the charged current of pin ② of IC101 is changed by Q207 to Q209 to adjust the phase of the trigger pulse. This pulse is compared with the SAW wave mentioned above to make a horizontal sync.

Also, the capacity in pin ② of IC101 is switched the value according to the frequency by the CPU (IC3) control.

The horizontal oscillation frequency is determined by controlling the charged current to pin ⑧ of IC101 with the adjustment of RV1 and the signal from CPU (IC3). And the horizontal sync signal adjusted the phase and the frequency is output from pin ⑫ of IC101.

The vertical trigger pulse is input to pin ⑲ of IC101. The voltage according to the frequency from the vertical trigger pulse is made in IC27, and its pulse is input to pin ⑱ of IC101 to oscillate at the lower frequency than the trigger pulse. And then it is forcibly locked by the trigger pulse, outputting as the vertical sync signal from pin ⑯ of IC101.

3-8-3. Picture Distortion Correction Waveform Generation Circuit

This circuit is mainly composed of IC201 which makes the waveform generation.

The vertical blanking pulse made in IC101 is input to pin ⑤ of IC201.

The SAW wave of V cycle is output from pins ⑨ and ⑩ . The saw wave (+) from pin ⑨ and the saw wave (-) from pin ⑩ are mixed at IC25 and the mixed saw wave are input to IC10. Also IC502, 503 and Q504 generates H. SAW signal which is the base for the pulse width modulation to control high-voltage and H. SIZE.

VCO pulse made in pin ④ of IC204 is input to IC503 and made double of frequency and then it is added to base of Q504. Q504 is built for resetting purposes for the integrated circuit by IC502. As long as Q504 is on, the output from pin ① of IC502 is clamped to the GND level. Therefore, at every 1H, it generates the SAW wave terminated to GND. IC502 (2/2) detects the peak of SAW wave, and it feeds back to IC502 (1/2) so that the peak becomes equal to the voltage of R521.

The output from pin ① of IC502 is sent to 2 separate routes: one is sent through IC104 (1/2) and to the high-voltage control circuit, the other to the pulse wide modulation circuits of the high-voltage and H. SIZE.

3-8-4. CPU Periphery Circuit

The operation of each pin of CPU (IC3) is explained here.

The horizontal sync signal and the vertical sync signal are respectively input to pins ⑰ and ④ . Also, the sync polarity discrimination signal from the B3 board is input to pins ㉑ and ㉒. Its timing is discriminated from these input signals, the picture distortion correction data of the timing is sent out from the memory, outputting to each DAC. The CPU discriminated the timing, and after it is determined, the mute signal ("H" level) is output from pin ㉛ for approx. 0.7 sec. By this signal, Q6 and Q8 turn on, the H. SIZE becomes low, and the horizontal sync becomes free-running. Also by this signal, the high-voltage becomes low.

In the same way, after the timing is determined, the mute signal sent to DAC (IC501) of A2 board so that the contrast and bright becomes minimum, and the picture becomes dark.
The 5-bit S-shaped capacitor switching signal is output to pins ㉝-㊲ according to the frequency. The LEDs of the front panel are lighted up after the output of pins ㊶ to ㊼. The states of the front panel switches are input to pins ㊼ to ㊾, and pins ㊶ to ㊸ are output of front panel switches Matrix circuit.
Also, the outputs from pins ㉚ and ㊶, ㊷ are the control signals of IC7 and IC8 (E²PROM). IC7 and IC8 are the data memories, and the picture distortion correction waveform data is stored there. The contents of memory are as shown in Table 3-2.

00H~5FH	Preset system data	IC7
60H~78BH	Standard data	
80H~F8H	User system data	
FF	Rom check	
00H~17H	Preset video system	IC8
18H~30H	User video system	
40H~43H	Common data	
60H~70H	Jigs ID data	
80H~90H	User area	
FF	Rom check	

Table 3-2. Memory map (IC7, IC8)

Pins ㉕ to ㉖ are the communication terminals with external.
Pin ⑧ is the reset terminal, receiving the reset signal from IC5 and the that from SW2.
The clock signal is input to pins ⑨ and ⑩. Its clock frequency is 19.6 MHz, it is made from the crystal oscillator (X1).
Pins ㊾ to ㊿ are the color temperature terminal, so that it changed 3 mode by front panel.
Pins ㊶, ㊷ are switching signal of E²PROM, and pins ㊸ to ㊻ are switching signal of DAC and etc.
Pin ㉜ outputs the switching signal of the resonance capacitor by the frequency.
Pins ㊵ and ⑱ connects to SW1. It can be switched to the TEST mode/SERVICE mode by SW1. It is normally NORMAL mode. In the TEST mode, the adjustment value can be set to a maximum value or a minimum value with the user control on the front panel. (Also, when set to the SERVICE mode, front panel SW can be adjust to white balance and geometric.) The NORMAL/TEST/SERVICE mode are discriminated when power on.

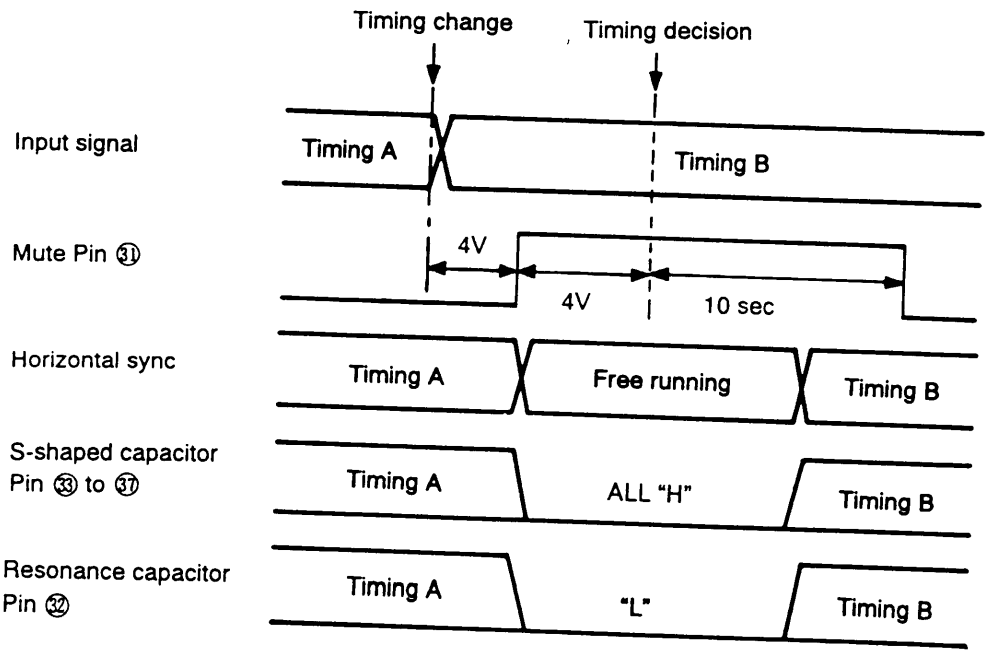


Fig. 3-8 Timing chart

ROM Check

It is checked if data is written in E² PROM already, and if data can be read from E² PROM correctly.

The ROM check is performed as soon as the microprocessor starts up.

When the read data is correct, the operation continues as it is. If the read data is incorrect, appropriate data is output to turn the LEDs on alternatively to show the trouble of E² PROM.

Customer Code

To use the hardware in common, 3 bits of ⑤, ⑥, ⑦ pins are used to select 8 different softwares.

	Pin ⑤ CC0	Pin ⑥ CC1	Pin ⑦ CC2
BRAND	0	0	0
OEM-STD	1	0	0
– – – – –	0	1	0
A	1	1	0
B	0	0	1
C	1	0	1
– – – –	0	1	1
E	1	1	1

Table 3-3

H. FREQ Detect

Count the numbers of H. SYNC that are input during 4 milliseconds which is 500 microseconds after the rise of V. SYNC. Resolution of H. SYNC is 250Hz.

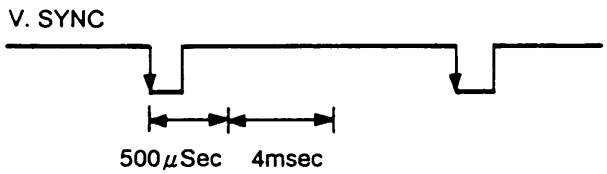


Fig. 3-9

V. FREQ Detect

Count the numbers of internal clock (1228.8kHz) from a V. SYNC until the next V. SYNC comes. Resolution of V. SYNC is 0.002Hz with 50Hz, and 0.02Hz with 160Hz.

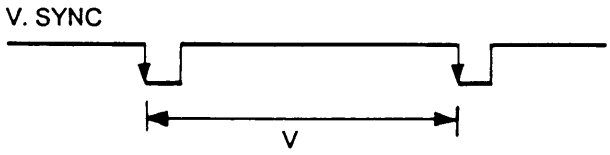


Fig. 3-10

3-8-5. Picture Distortion Correction Adjustment Circuit (D/A converter and its periphery circuits)

The basic waveform from the waveform generation circuit (IC201) is referred to the reference input, the picture distortion correction signal is obtained by changing the input level with the signal from CPU (IC3). There are 6 types of the picture distortion correction waveforms. They are V. SIZE, H. SIZE, PIN and H. CENT which are sent to the D4 board, and PIN BAL and KEY BAL which are input to the horizontal and vertical oscillation sync circuit on the N1 board.

3-8-5-1. V. SIZE correction waveform

The SAW wave of V. SIZE correction is output to pin ⑭ of CN901 connector. This wave includes the correction waveforms of V. SIZE, V. CENT, V. LIN and V. LIN bal.

The block diagram of V. SIZE correction waveform circuit is as shown in Fig. 3-11.

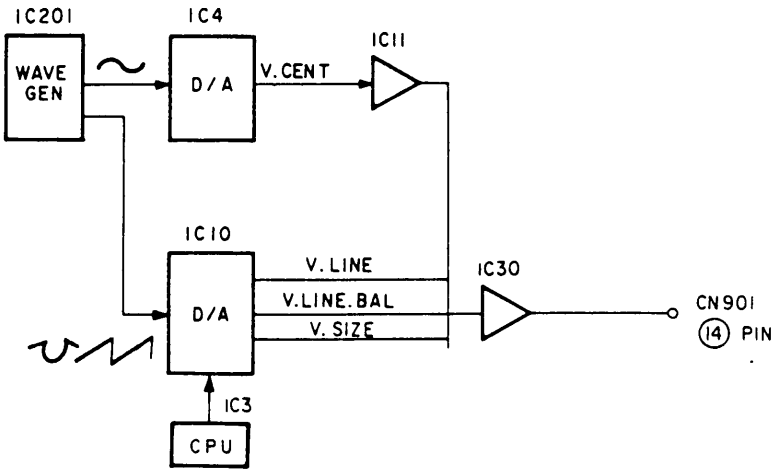


Fig. 3-11 V. SIZE correction block

(a) V. LIN correction waveform
The sine wave output from pin ⑬ of IC201 is input to IC10 (D/A) as the reference signal. It is adjusted the level by the signal from CPU (IC3) to obtain the V. LIN correction waveform to pin ⑦ of IC12.

(b) V. LIN BAL correction waveform
The parabola wave output from pin ⑪ of IC201 is level shifted by IC25. The signal is input to IC10 (D/A) as the reference signal. It is adjusted the level by the signal from CPU (IC3) to obtain the V. LIN BAL correction waveform to pin ⑦ of IC30.

(c) V. CENT correction waveform
The signal sent to IC4 (D/A) from IC3 (CPU) to obtain the V. CENT correction waveform to pin ① of IC11.

(d) V. SIZE correction waveform
The signal which is added the V. LIN, V. LIN BAL correction waveforms mentioned above to the SAW wave amplified pin ⑪ output of IC10.
Its signal is input to IC10. And after being added the V. CENT correction voltage mentioned above to this signal, it is sent to the D4 board as the V. SIZE correction waveform from pin ⑭ of connector CN901.

3-8-5-2. H. SIZE correction waveform

The signal according to the horizontal oscillation frequency is output by the CPU (IC3) control from pin ③ of IC4 (D/A).
The maximum value of this voltage is limited by RV4. This signal is the reference signal, it is input to IC10 (D/A), adjusting the voltage with the CPU (IC3) signal. After being added this voltage to the above voltage, and it sent out to the D4 board as the H. SIZE correction voltage from pin ⑮ of connector CN901.
The block diagram of H. SIZE correction waveform circuit is as shown in Fig. 3-12.

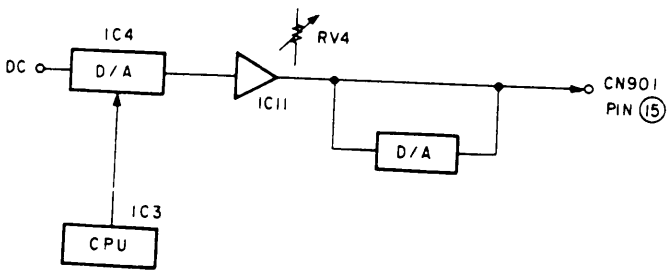


Fig. 3-12 H. SIZE correction block

3-8-5-3. H. CENT correction waveform

The signal of CPU (IC3) is input to IC4 (D/A) to adjust the voltage. And it is sent out to the D4 board as the H. CENT correction voltage from pin ⑳ of connector CN901. The block diagram of H. CENT correction waveform circuit is as shown in Fig. 3-13.

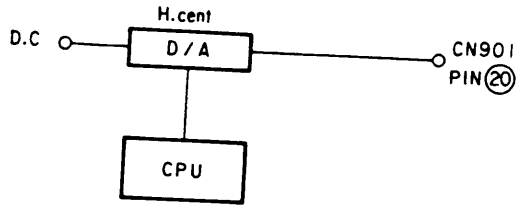


Fig. 3-13 H. CENT correction block

3-8-5-4. PIN correction waveform

The parabola wave of pin correction is output to pin ⑯ of connector CN901. This waveform includes the key correction waveform. And the V. lin and V. lin bal correction waveforms are added to compensate the pin distortion by the V. lin adjustment. The block diagram of pin correction waveform circuit is as shown in Fig. 3-14.

(a) KEY correction waveform
The SAW wave amplified the output of IC201 by IC25 is referred to the reference signal. It is input to IC10 (D/A). This signal is adjusted the level by the signal of CPU (IC3) to obtain the KEY correction waveform to pin ⑦ of IC24.

(b) PIN correction waveform
The PIN signal of pin ⑫ of IC10 which is referred to the input to IC12 and output from pin ① of IC12. After being added this signal to the above KEY signal, and sent out to the D4 board as the PIN correction waveform from pin ⑯ of CN901.

3-8-5-5. KEY BAL, PIN BAL correction waveforms

The SAW wave amplified the output of IC201 by IC25 is referred to the reference signal. The signal is input to IC10 (D/A). This signal is adjusted the level by the signal of CPU (IC3) to obtain the KEY BAL correction waveform.
Also, the parabola wave of IC201 which is referred to the reference signal is input to IC10 (D/A). This signal is adjusted the level by the signal of CPU (IC3) to obtain the PIN BAL correction waveform. The KEY BAL correction waveform mentioned above is added to this waveform, and the signal is input to pin ⑦ of IC101 to modulate the phase of the horizontal oscillation. The block diagram of the KEY BAL, PIN BAL correction waveform circuits are as shown in Fig. 3-15.

3-8-5-6. Blanking pulse generation circuit

The vertical blanking signal of pin ⑮ of IC101 is wave-shaped and amplified by Q301 to Q304, and sent out to the B3 board.

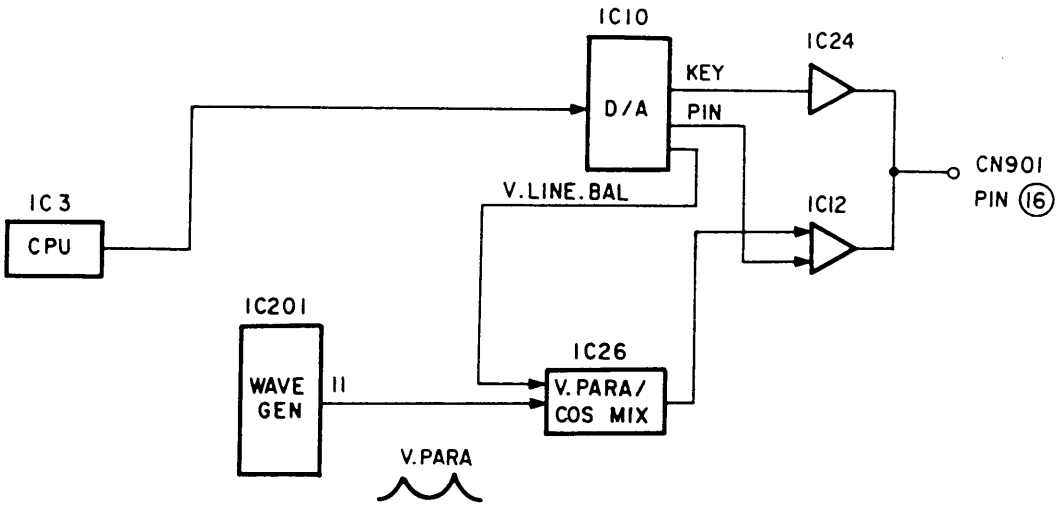


Fig. 3-14 PIN correction block

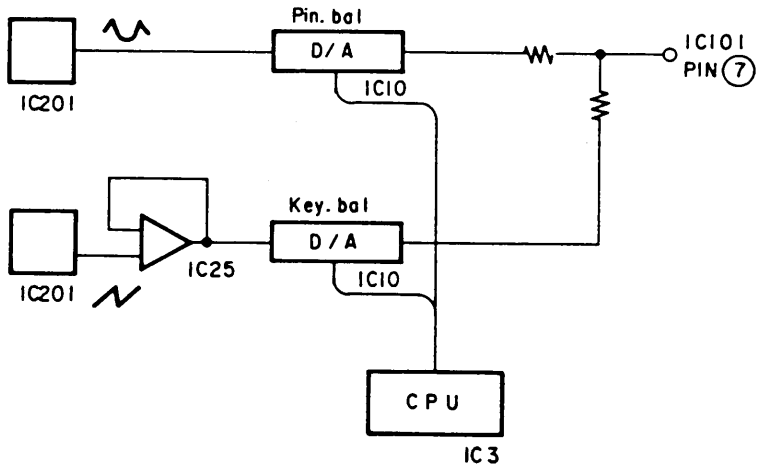


Fig. 3-15 KEY BAL, PIN BAL correction block

SECTION 5
SAFETY RELATED ADJUSTMENT

When replacing or repairing the D4 board, the power block or focus pack, the following adjustments and operational checks must be performed as a safety precaution against X-rays emissions from the unit.

- Compenent side -

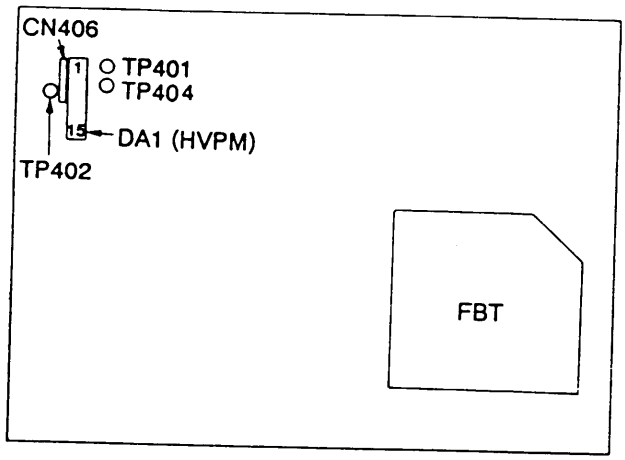


Fig. 5-1. D4 board

a) HV Hold-down and Voltage check.

1) Check parts which require voltage checks at TP401, TP402 and TP404 make replace if necessary.

2) Input a white dot signal and set the contrast and bright to the minimum level.

Check point		Parts to be replaced
TP401	32.0$^{+0.5}_{-1.0}$V DC	DA1 (HVPM)
TP402	9.90$^{+0.05}_{-0.10}$V DC	DA1 (HVPM)
TP404	9.00$^{+0.05}_{-0.10}$V DC	DA1 (HVPM)

Notes:

1. When the voltage at TP401 is out of the specified voltage range, replace DA1 (HVPM).
2. When the voltage at TP402 is out of the specified voltage range, replace DA1 (HVPM).
3. When the voltage at TP404 is out of the specified voltage range, replace DA1 (HVPM).

3) Check that the HV Hold-down circuit operates normally.

<Checking method>

Check if the raster disappears when the voltage less than 9.96V DC is applied between TP405 and GND from the external power source. If the raster appears when replace DA1 (HVPM).

4) Beam protector-1 and protector-2 check.

<Checking method>

(1) Input a white dot signal and adjust the contrast to the minimum level where dots can be seen.
(2) Set the BRIGHT to the minimum.
(3) Short circuit between pin ⑥ of DA1 (HVPM) and GND with the power turned off, then turn the power back on. (At this time check that raster appears.)
(4) Reduce the resistance gradually from the maximum level using a variable resistor of more than 12 [k-ohm] and an ammeter connected in series between TP403 and GND.
Check that the protector circuit operates to disappear the raster when the current level drops below 1.25 [mA].
(5) Move short clip (3) to between pin ② of DA1 (HVPM) and GND.
(6) Check that the protector circuit operates to disappear the raster when the current level drops below 1.30 [mA], same the way (4).
(7) Remove the short clip.
(8) Check that there are no problems with the unit.

b) D4 board and D4 complement replacement

Check all the items indicated in section a) above.

c) Replacing the power block

Check that the B+ voltage (between TP406 and GND on the D4 board) is 144V ± 2.0V.

SECTION 6
CIRCUIT ADJUSTMENTS

Unless otherwise it is specified, the input signal during the adjustment is Mode 6.

6-1. ADJUSTMENTS PROCEDURE

1. Carry out the adjustments according to the following procedure. For reference, the adjustment procedures are shown in units of the main blocks (FRU units).

① When replacing the video amp board (A2 board)
6-2-1. Picture projection Items 1) – 3)
↓
6-3-2. White balance rough adjustment
↓
6-3-13. White balance fine adjustment

② When replacing the EMI filter board (B3 board)
6-2-1. Picture projection Items 1) – 3), Item 6), and Item 8).
↓
6-2-2. Checking the operation of each section Item ① and ② of Item 2)

③ When replacing the CRT socket board (C2 board)
6-2-1. Picture projection Items 1) – 3)
↓
Input a white flat signal and gray scale signal and verify that there is no problem with the white balance.
(See 6-3-13. White balance fine adjustment.)

④ When replacing the deflection board (D4 board)
6-2-1. Picture projection except Item 4)
↓
6-2-2. Checking the operation of each section Items 1) – 3), but Items ⑨ – ⑪ of Item 2) are unnecessary
↓
6-3-7. Vertical and horizontal position and size adjustment
↓
6-3-8. Left and right pin cushion distortion adjustment
↓
6-3-9. Vertical linearity adjustment
↓
6-3-10. Overall image distortion check
↓
5. Safety-related adjustments

⑤ When replacing the power supply block (G board)
6-2-1. Picture projection Items 1) – 3)
↓
6-2-3. Checking the voltage

⑥ When replacing the control block assembly (H6 board)
6-2-1. Picture projection Items 1) – 3)
↓
6-2-2. Checking the operation of each section Item 1), and Items ① – ⑧ of Item 2)

⑦ When replacing the CRT assembly (CRT, deflection yoke, Neck twist coil ITC block)
6-2-1. Picture projection Items 1) – 5)
↓
6-2-2. Checking the operation of each section
↓
6-3-2. White balance rough adjustment
↓
6-3-4. Convergence rough adjustment Items 3) – 5)
↓
6-3-5. Beam landing fine adjustment Item 8) Final check
↓
6-3-7. Vertical and horizontal position and size adjustment
↓
6-3-8. Left and right pin cushion distortion adjustment
↓
6-3-9. Vertical linearity adjustment
↓
6-3-10. Overall image distortion check
↓
6-3-11. Focus adjustment
↓
6-3-13. White balance fine adjustment

⑧ When replacing the focus pack (high-voltage resistor assembly)
6-2-1. Picture projection Items 1) – 5)
↓
6-3-11. Focus adjustment
↓
6-3-13. White balance fine adjustment Items 1) – 4) and Item 11)

⑨ When replacing the H. STAT variable resistor (high-voltage resistor)
6-2-1. Picture projection Items 1) – 5)
↓
6-3-4. Convergence rough adjustment Items 3) and 4)

⑩ When replacing the connector panel assembly (M7 board)
6-2-1. Picture projection Items 1) – 3) and Items 5) and 7).
↓
6-2-2. Checking the operation of each section Item 3)

⑪ When replacing the main harness
6-2-1. Picture projection Items 1) – 3) and Items 5) and 7).
↓
6-2-2. Checking the operation of each section Item 1) and Items ① and ② of Item 2)

⑫ When replacing other FRUs
After replacing any parts, make sure there are no scratches, loosen parts, or any other differences in appearance from the normal state. As necessary, carry out the inspections in 6-2-1. Picture projection Items 1) – 3) and Items 5) and 7).

2. Caution items

The geometric adjustment and white balance adjustment can be performed with two methods. One is from the external personal computer and the other is by the front panel button the Monitor.

1) Using personal computer

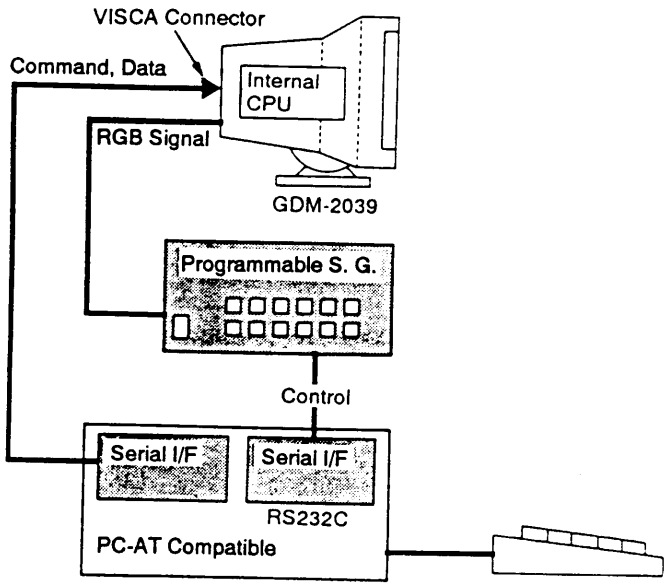
Connect the communication cable of the PC to the connecter located on the rear side of the monitor. Run the service software and then follow the instruction.

2) Using the front panel button.

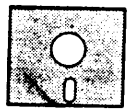
Set the SW1 on the N1 board to the "SERVICE" side and turn on the monitor. The left six LEDs of the seven series LEDs turn on.

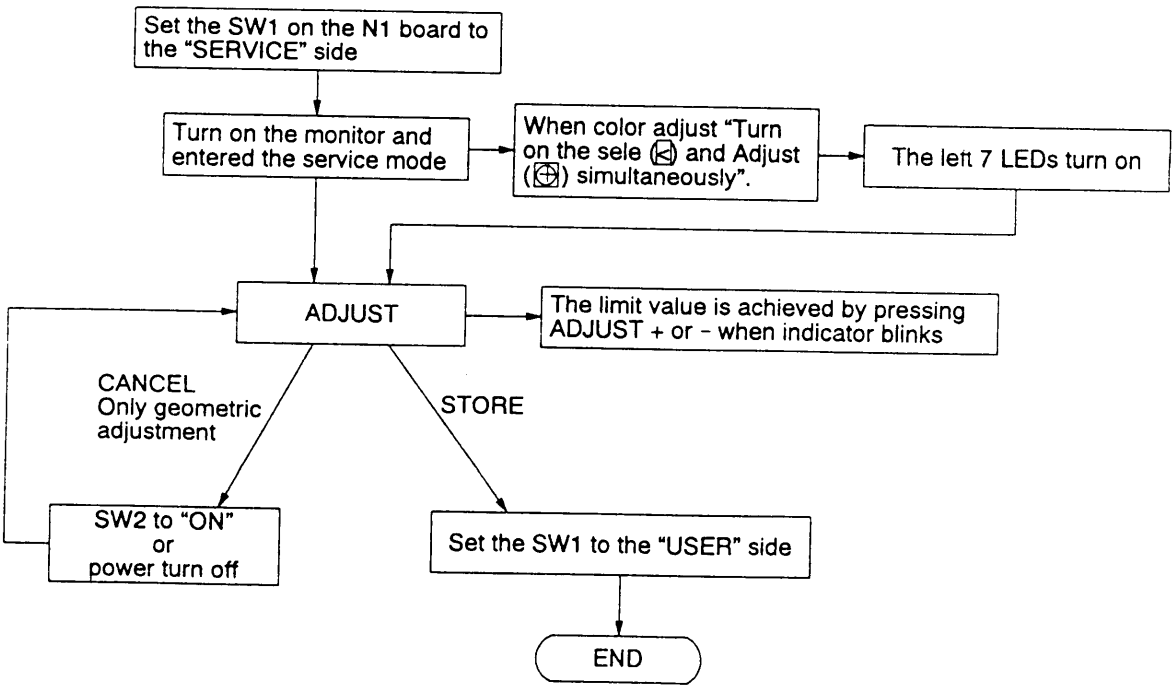
It means that you entered the service mode. In order to control geometric adjustment and White Balance adjustment. Also the limit value is achieved by pressing ADJUST + or - when indicator blinks. They are stored when the SW1 on the N1 board set to "USER" side.

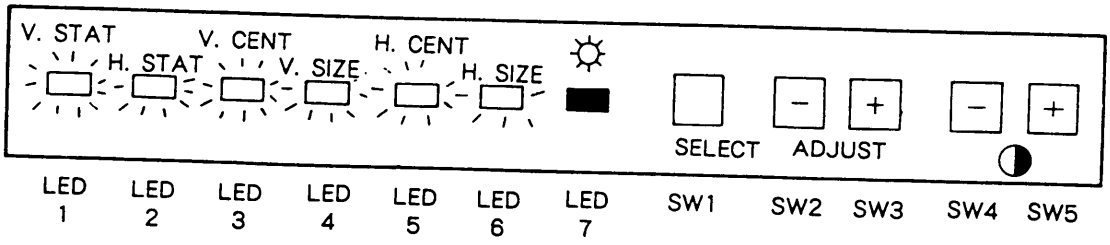
Also they are cancel when set the SW2 to ON and power turn off.



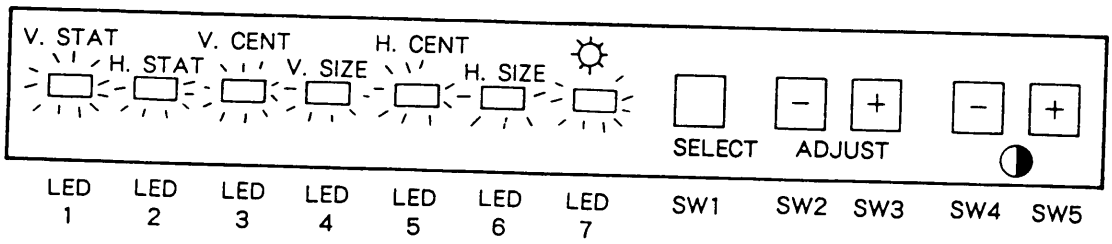
Adjustment Software

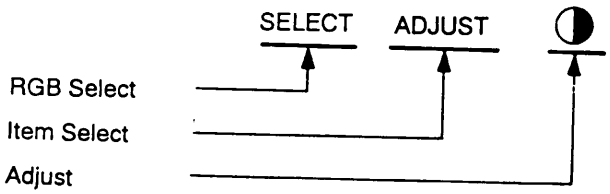






SERVICE MODE (Geometric)





SERVICE MODE (White Balance)

LED							Select	Adjust					Service
V. Sta	H. Sta	V. Cen	V. Siz	H. Cen	H. Siz	☼				◑			
1	2	3	4	5	6	7	Sele	−	+	−	+		
○	○	○	○	○	○		<	−	+			1	Pin
○	○	○	○	○		○	<			−	+	2	Pin Bal.
○	○	○	○		○	○	<	−	+			3	H. CENT
○	○	○		○	○	○	<			−	+	4	Key
○	○		○	○	○	○	<	−	+			5	Key Bal.
○		○	○	○	○	○	<			−	+	6	V. Lin.
	○	○	○	○	○	○	<	−	+			7	V. Lin. Bal
						○	<			−	+	8	BRT
					○		<	−	+			9	H. Size
				○			<			−	+	10	H. Phase
			○				<	−	+			11	V. Size
		○					<			−	+	12	V. Cent
	○						<	−	+			13	H. Stat
○							<			−	+	14	V. Stat

SERVICE MODE (Geometric)

LED													
Color	H. Sta	Key B	Pin B	V. Ct	H. Ph	Brt	Select	Adjust		◑			
1	2	3	4	5	6	7	Sele	−	+	−	+		
							⊖		⊕				COLOR MOD
○	○	○	○	○	○	○	<	<	>	−	+	1	G1
○		○	○			○	<	<	>	−	+	2	R BKC
○	○		○			○	<	<	>	−	+	2	G BKC
○	○	○				○	<	<	>	−	+	2	B BKC
○		○	○		○		<	<	>	−	+	3	R DCM
○	○		○		○		<	<	>	−	+	3	G DCM
○	○	○			○		<	<	>	−	+	3	B DCM
○		○	○		○	○	<	<	>	−	+	4	R DCN
○	○		○		○	○	<	<	>	−	+	4	G DCN
○	○	○			○	○	<	<	>	−	+	4	B DCN
○		○	○	○			<	<	>	−	+	5	R BKM
○	○		○	○			<	<	>	−	+	5	G BKM
○	○	○		○			<	<	>	−	+	5	B BKM
○		○	○	○		○	<	<	>	−	+	6	R DMM
○	○		○	○		○	<	<	>	−	+	6	G DMM
○	○	○		○		○	<	<	>	−	+	6	B DMM

SERVICE MODE (White Balance)

COLOR SELECT

							⊠				⊞	1	COLOR H
							⊠			⊟		2	COLOR L

6-2. PICTURE PROJECTION TEST

6-2-1. Picture Projection

1) Make sure that the power switch for the unit is set to OFF and supply power from an isolated-type variac.
2) Adjust the AC input voltage to the rated value and turn the power on.
3) Supply Mode 9 signal to the set. (Recommended signal is the black cross-hatch on the white flat field pattern).
4) Adjust the SCREEN (G2) VR so that the raster become starting to be visible.
5) Adjust the H. FOCUS (F2) and V. FOCUS (F1) variable resistors in the focus pack and optimize the overall screen focus. If the center vertical static misconvergence is too large (± 0.1mm or greater), adjust the six-pole magnet. (See 6-3-6.)
6) Verify that the image is not moving.
7) If the image is moving left to right or right to left, input Mode 1 signal first and then switch off the SG sync signal or for internal synchronization remove the G input, then turn the H. FREQ control on the N1 board to stop the image.
8) Reconnect the sync signal and supply some other scan mode signal and double check 6).

6-2-2. Checking the Operation of Each Section

1) Check that the green Power On indicator lamp lights up, when the power for the set is switched on.
2) Operate the following controls and check that their circuits are functioning.
‹User's Controls› ····· see P. 7 to know how it works.
① CONTRAST ⑦ V. STAT
② BRIGHTNESS ⑧ H. STAT
③ H. SIZE
④ H. CENT
⑤ V. SIZE
⑥ V. CENT

<Internal Controls>
⑨ SCREEN(G2) ····· changes the overall brightness for the screen.
⑩ V. FOCUS(F1) ···· changes the focus in the vertical direction.
⑪ H. FOCUS(F2) ···· changes the focus in the horizontal direction.

3) Checking the connection for R. G. B
Turn the R, G and B switches for the signal generator ON and OFF to check if each switch renders correct R, G and B color reproduction.

6-2-3. Checking the Voltage

Check that the following voltage are present on each board.

1) +B : 145 ± 3V (G board CNG6 ① pin)
2) +20V : 20 ± 2V (G board CNG6 ⑧ pin)
3) -20V : -20 ± 2V (G board CNG6 ⑨ pin)
4) +12V : 12 ± 0.6V (G board CNG6 ③ pin)
5) -12V : -12 ± 0.6V (G board CNG6 ⑤ pin)
6) +65V : 65 ± 3V (G board CNG6 ⑩ pin)
7) The voltage between TP402 and GND of D4 board is within the $9.90^{+0.06}_{-0.10}$V range. When the voltage is out of the specified voltage range replace DA1.

6-3. ADJUSTMENT

6-3-1. Rough Adjustment

1. Input a Mode 6 signal green cross-hatch signal to the set.
2. Set the SW2 on N1 board to "ON".
3. Check for Mode 6 signal appear.
4. Adjust the horizontal size to the prescribed size with RV719 (H. SIZE Ref. 1) at the prescribed DAC data.
5. Adjust the vertical size to the prescribed size with RV9 (V. SIZE) at the prescribed DAC data.

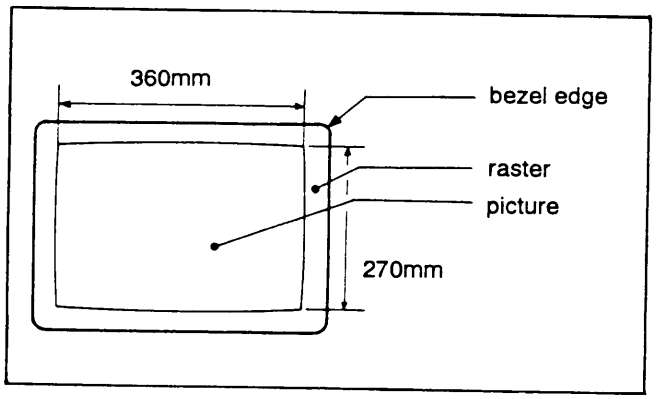


Fig. 6-3-1

6-3-2. White Balance Rough Adjustment

① Input a full-white signal
② Set to the following points
CONTRAST control·····Maximum
BRIGHTNESS control·····Center
③ Connect the oscilloscope probe and observer the waveform at TP202 (KG) on the A2 board. Then set Color Mode to "H".
④ Set GDCM to adjust the video level to 40Vp-p.
⑤ Connect the oscilloscope probe and observer the waveform at TP2 on the C2 board.
⑥ Set GBKC to adjust the pedestal level to 40 ± 1V DC.
⑦ Repeat step ③ through ⑥ to adjust the each CH (Red, Blu).

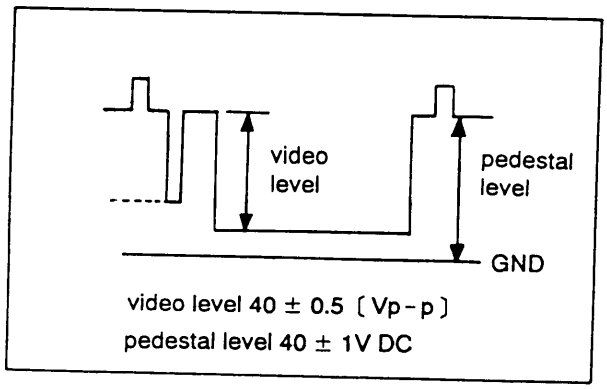


Fig. 6-3-2

⑧ Connect the oscilloscope probe and observe the waveform at TP4 (G1) on the C2 board.
⑨ Set G1 to adjust the G1 level to -50 ± 1V DC.

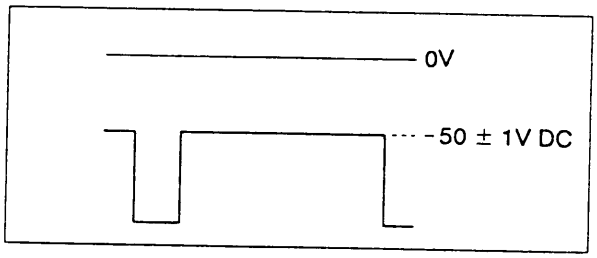


Fig. 6-3-3

⑩ Set color mode SW to "M".
⑪ Input a gray scale signal.
⑫ Adjust the SCREEN (G2) VR so that the pedestal become starting to be visible.
⑬ Adjust the RBKC, GBKC and BBKC control so that the white balance for dark level.

6-3-3. Beam Landing Rough Adjustment

Note: The following beam landing adjustments are not required for servicing CRTs (ITC) supplied by SONY.

1) Input a full-green signal. (100 IRE green flat field signal pattern.)
2) Set the CONTRAST control to minimum.
3) Face the monitor to the east or west.
4) Adjustment the SCREEN (G2) VR to obtain the optimum brightness.
5) Move the deflection yoke backward.
6) Adjust the purity magnets so that the green is positioned at the center of the screen. (See Fig. 6-3-4)
7) Move the deflection yoke forward and adjust it so that the entire screen becomes green.
8) adjust the tilt for the deflection yoke.
9) Fix the deflection yoke lightly.
10) fix the neck twist coil as shown in Fig. 6-3-5.

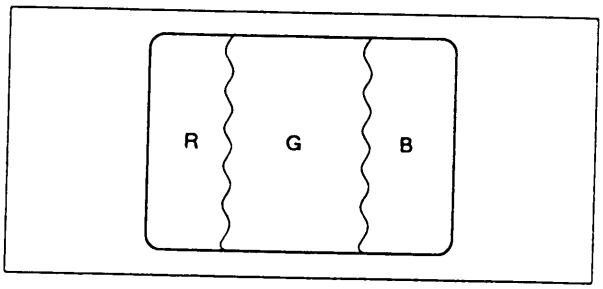


Fig. 6-3-4

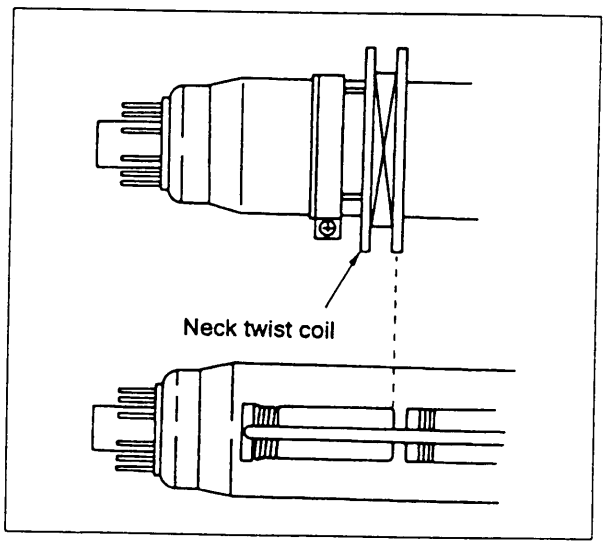


Fig. 6-3-5

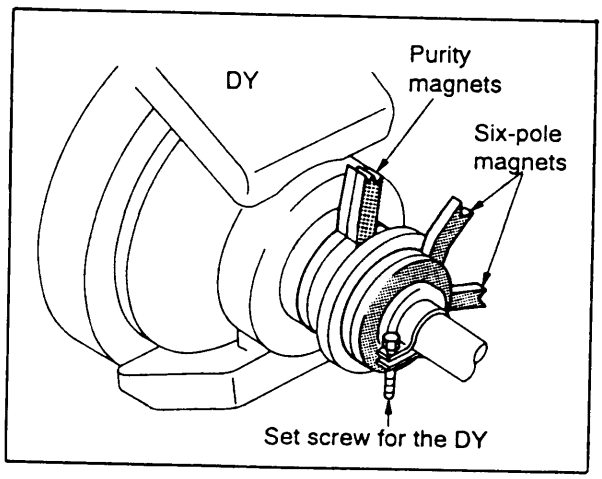


Fig. 6-3-6

6-3-4. Convergence Rough Adjustment

Note: The adjustment in step 2) is not necessary for servicing CRTs (ITC) supplied SONY. (The six-pole magnet is fixed by paint.)

1) Input the Mode 6 white cross-hatch signal to the set.

2) Align the tabs for the six-pole magnet. (See Fig 6-3-6 and 6-3-7.)
3) Fix the [H. STAT] and [V. STAT] controls on the front control panel at the center position. (Reset status)
4) Turn the H. STAT on the video shield case to a point where color separation of the vertical line at the center of the screen disappears.
5) Turn RV5, RV7 and RV8 on the N1 board to adjust the V. STAT.

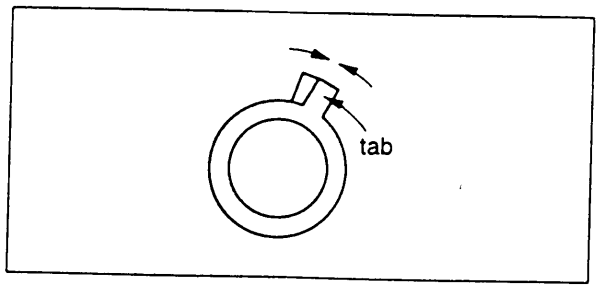


Fig. 6-3-7 Six-pole magnet

6-3-5. Beam Landing Fine Adjustment

Note: Since the CRTs SONY supplies for service have already completed the beam landing adjustment, the following adjustment is not necessary. Carry out Item 9) only.

1) Place the set in the no magnetic field (a Helmholz coil). $IB_H=0$; $IB_V=0.45$
2) Input a 100 IRE green flat field signal (in Mode 6).
3) Set the [CONTRAST] control to maximum.
4) Degauss the steel parts of chassis and with a handheld degausser.
5) Input 120 VAC, switch on the power, and apply auto-degaussing. Then, degauss the CRT screen again.
6) After again the CRT for at least 30 minutes, install a wobbling coil on the neck of the CRT , then adjust the deflection yoke position with the landing checker and adjust the purity, the four corner landing, and the deflection yoke tilt. The four corner landing error must be no greater than 5 μm for green and no greater than 10 μm for blue and red. As necessary, attach CRT magnets as shown in Fig. 6-3-8 (no more than one magnet at each corner).
After installing magnets, degauss the CRT screen with a handled degauss.

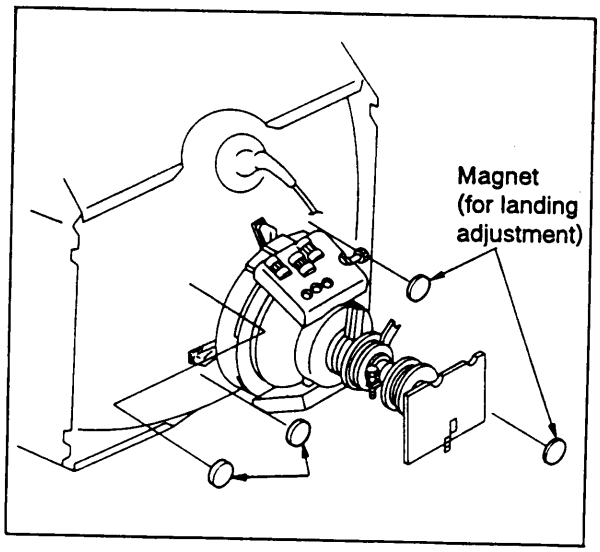


Fig. 6-3-8

7) Tighten the setscrew of deflection yoke, input a white cross-hatch signal, swing the deflection yoke up and down, then fasten the deflection yoke with the deflection yoke spacers at a position where the top and bottom pin cushion distortions are about the same (as shown in Fig. 6-3-9).

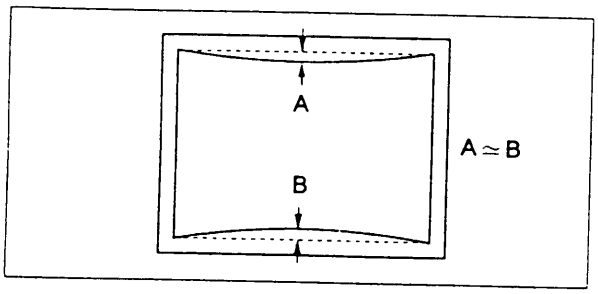


Fig. 6-3-9

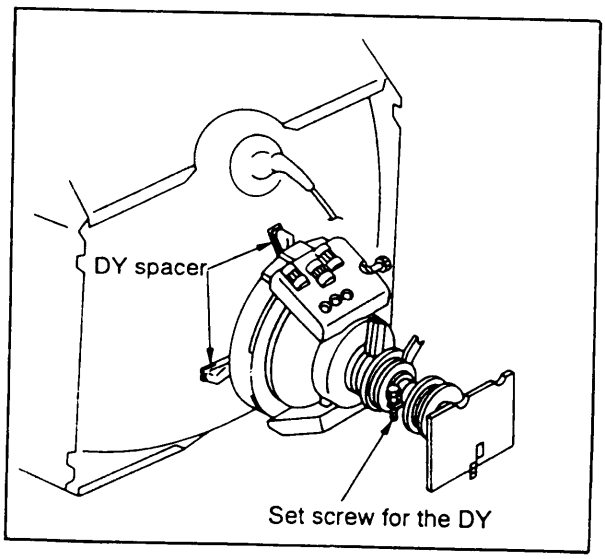


Fig. 6-3-10

8) Final check
When the landing adjustment is complete, face the set in each direction, north, east, south and west, and check for uniformity and mislanding. (Check red, green, blue and white flat field.) Check that the image is not tilted.

9) When the check is complete, fasten the purity magnet with white paint. Continue the adjustment with the set facing east or west.

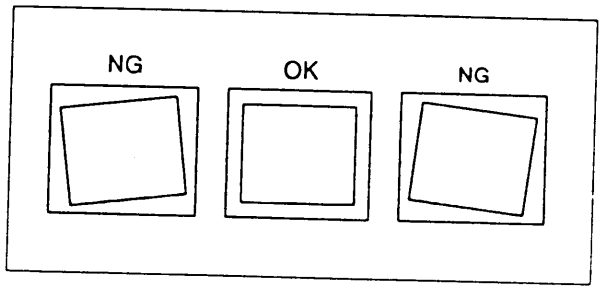


Fig. 6-3-11

6-3-6. Synchronization Check

A black hatch signal is desirable for the following adjustments. Check that normal synchronization is obtained (Check if the set is synchronized at the moment when the switch us turned ON) under the following conditions.

1) Turning the power switch for the monitor ON and OFF.
2) Switching the SYNC switch of SG ON and OFF.
3) Switch the signal mode and check 1) and 2) again.

6-3-7. Vertical and Horizontal Position and Size Adjustment

Recommended magnetic field condition of this section (6-3-7.) is IB_H= 0 ; IB_V=0.45 in the Helmholtz coil, but if it is hard to get this condition, adjust with the following face direction. For the vertical position adjustment in 1), face the CRT screen north or south and set the V. CENT control on the front panel to the center. For other adjustments, face the CRT screen east and west adjust V. CENT control to put the image at the center of the CRT screen. Be sure to degauss when the direction is changed.

1) Adjust V. CENT so that the vertical position of the cross-hatch image is at the center of the CRT screen (at the bezel opening).
2) Adjust the vertical size to the prescribed size with V. SIZE.
3) Adjust the horizontal size to the prescribed size with H. SIZE.
4) Adjust H. PHASE so that the image is at the center of the rasters.

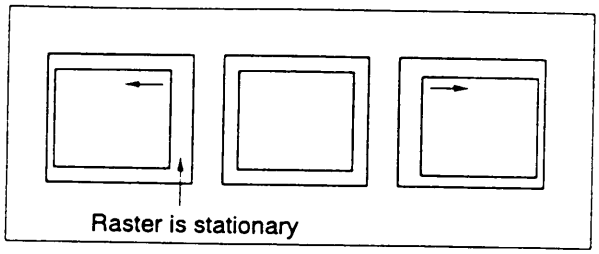


Fig. 6-3-12 H. PHASE movement

5) In case if the H linearity is asymmetrical, change the H. CENT and H. PHASE together so as to retain the picture center position and choose the best point.

Note: The adjustments in the section 6-3-7 have to be performed again after the adjustments in the section 6-3-8 and 6-3-9 are completed. The raster is set as shown in the Fig. 6-3-13 and 6-3-14 after the horizontal and vertical position and size adjustments are completed.

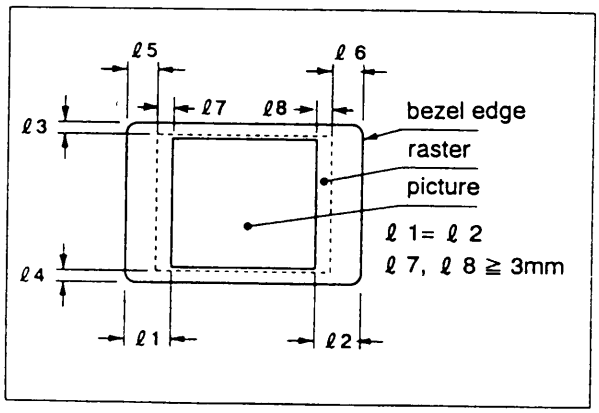
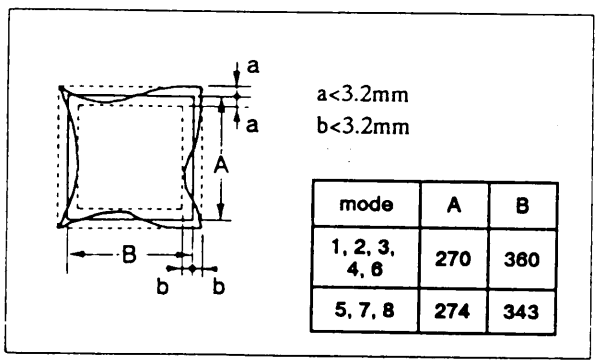


Fig. 6-3-13 Centering Standard



mode	A	B
1, 2, 3, 4, 6	270	360
5, 7, 8	274	343

Fig. 6-3-14 Image size and distortion standards

6-3-8. Left and Right Pin-cushion Distortion Adjustment

1) Adjust the PIN to adjust the right and left sides lines of the image become linear.

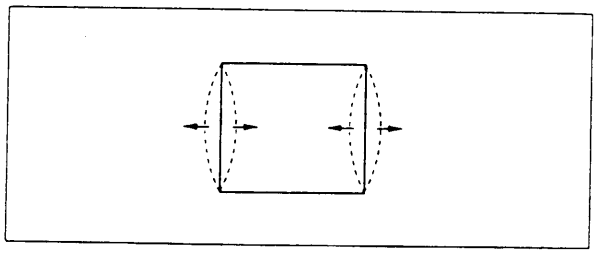


Fig. 6-3-15 PIN movement

2) Adjust the KEY and KEY BAL so that the width at the top and bottom sections of the image becomes equal.

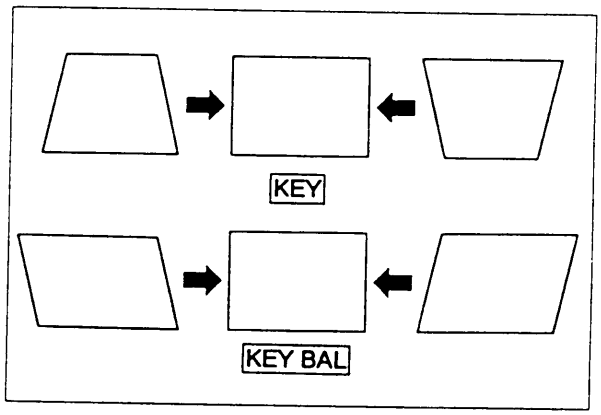


Fig. 6-3-16 Movement of KEY and KEY BAL

3) Check if the pin-cushion distortion balance is even on the right and left sides (i.e., when one side is adjusted to straight line, the correction for the other side is not over or under). If the balance differs, change the PIN BAL to adjust pin-cushion distortion on both right and left sides equally. Then, adjust both sides to become straight lines using the PIN again.

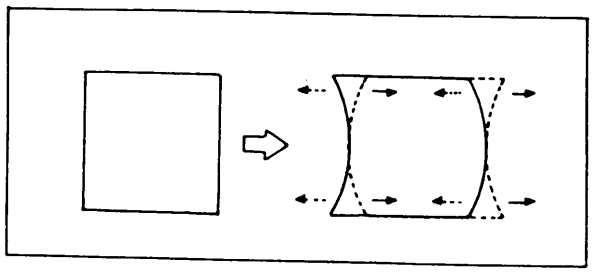


Fig. 6-3-17 Movement of SIDE PIN BAL

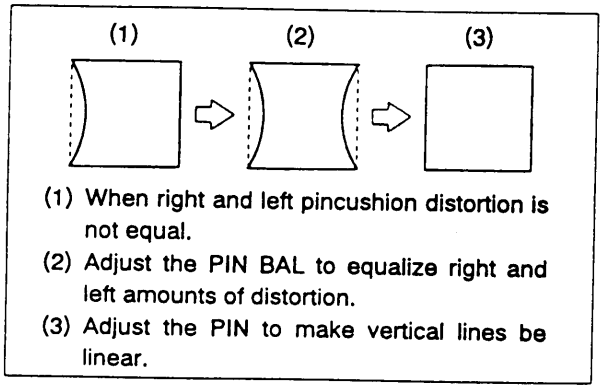


Fig. 6-3-18 Left and Righ PIN cushion distortion adjustment method

6-3-9. Vertical Linearity Adjustment

1) Adjust the V. LIN BAL so that the vertical size of the grid is symmetric with center.
2) Adjust the V. LIN so that the vertical size of the grid at the center is equal to the upper and lower portions of the grid.
3) If the size of the grid cannot be adjusted once, repeat step 1) and 2) above.

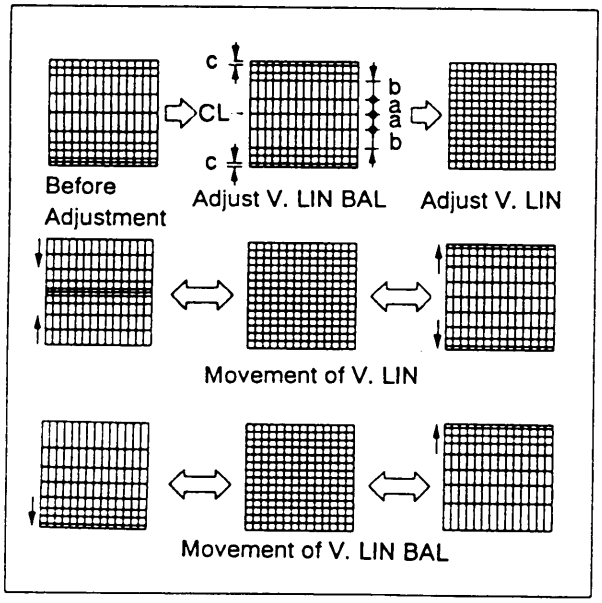


Fig. 6-3-19

6-3-10. Overall Image Distortion Check

1) Image size and image distortion must meet with the conditions specified in Fig. 6-3-14.
2) Attach the linearity gauge (EIA ball-chart) to check that each intersections of cross-hatch is positioned within the ±1% deviation circles.
3) If there are any excess points out of circles, the monitor should be adjusted again.

6-3-11. Focus Adjustment

Note: If the landing fine adjustment, picture size adjustment, convergence fine adjustment, and white balance fine adjustment are not complete, after those adjustments are complete, adjust the focus again.

1) Input a character pattern (an E pattern is recommended) by Mode 8. If the character pattern is not available, use cross-hatch pattern.
2) Set the CONTRAST control to maximum.
3) Turn the V. FOCUS and H. FOCUS knobs to adjust the screen focus. (Balance the focus at the center and on the periphery.)
4) When the adjustment is complete, lock the knobs with white paint.

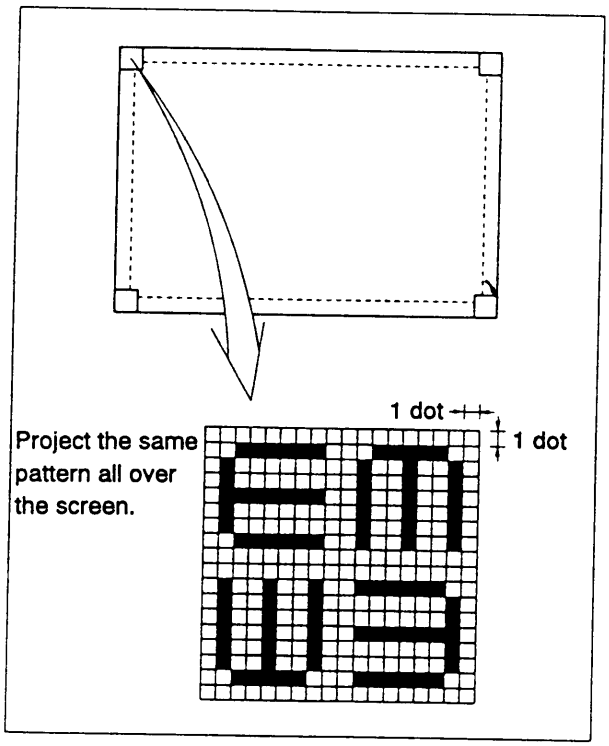


Fig. 6-3-20. E pattern

6-3-12. Static Convergence Adjustment

Note: Since the CRTs SONY supplies for service have already been adjusted, 1) - 6), 7) ①-⑥, ⑫, ⑬ are not necessary.

1) Place the set in the Helmholtz coil. (IB_H=0 ; IB_V=0.45)
2) Input the white cross-hatch signal (Mode 6).
3) Set the front control panel's H. STAT and V. STAT controls to the center data.
4) Turn the H. STAT VR inside the set to separate the red, green and blue lines individually. Turn V. STAT (RV5) on the N1 board to separate the red, green and blue lines individually.

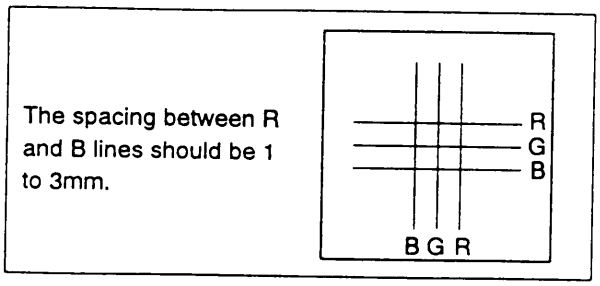


Fig. 6-3-21

5) Turn the six-pole magnet ring behind the DY to equalize the distance between the red and green parallel lines and the distance between the blue and green parallel lines.

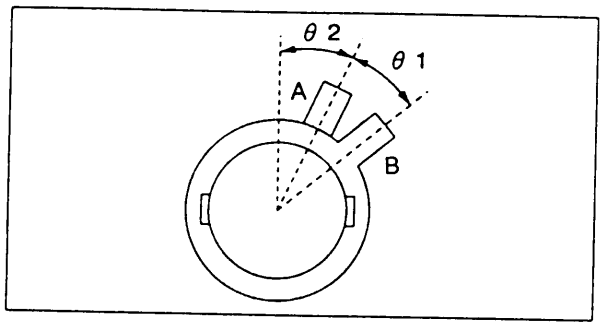


Fig. 6-3-22

* Correction with the six-pole magnet is carried out by adjusting the angle θ 1 between A and B the inclination angle θ 2.
(When θ 1=0, the correction is 0.)

6) Return the H. STAT and V. STAT (RV5) VRs turned in 4) to set misconvergence at center of the screen to 0.

7) Fine convergence adjustment.

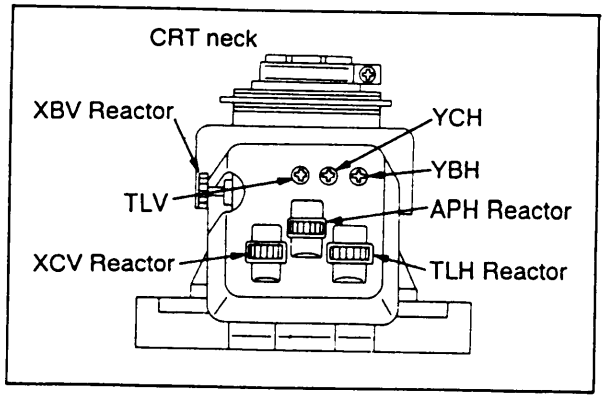
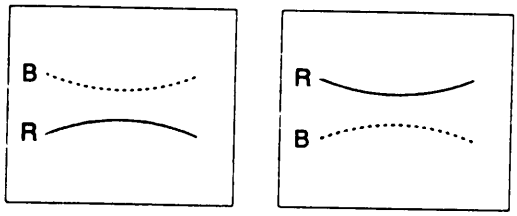


Fig. 6-3-23 Reactors and adjustment

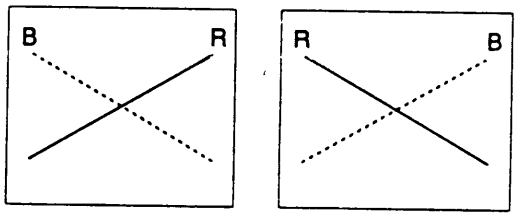
① Set the V. STAT TOP (RV8) and V. STAT BOTTOM (RV7) VRs on the N1 board to their mechanical centers.

② Adjust the vertical convergence on the X axis whit the vertical reactor (the one on the right as seen from the CRT funnel).

a) XBV
Adjust XBV convergence with XBV reactor



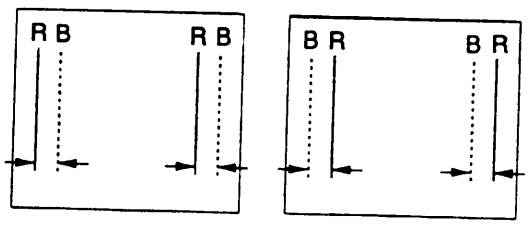
b) XCV
Adjust XCV convergence with XCV reactor



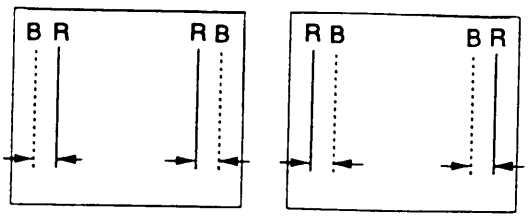
Note: For XBV correction, re-adjust RV5 (V.STAT). If XCV is too large to correct, adjust with the deflection yoke vertical neck swing.

③ Adjust the horizontal convergence at the edges of the X axis with the horizontal rector.

a) H. AMP
Adjust H. AMP convergence with APH reactor



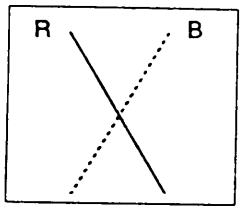
b) H. TILT
Adjust TLH convergence with TLH reactor



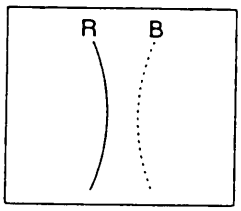
Note: Re-adjust H. STAT too.

④ Adjust the upper YCH convergence with YCH VR on the deflection yoke.

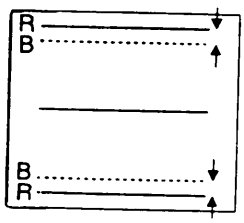
a) YCH



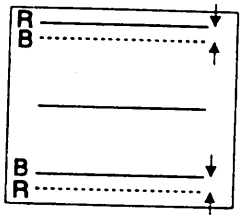
b) YBH



⑤ Adjust the upper and lower TLV (balance) with the TLV VR on the deflection yoke.



⑥ Adjust the APV by turning RV7 and RV8 on the N1 board.

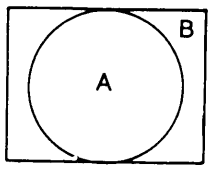


Adjust with V. STAT TOP (RV8)

Adjust with V. STAT BOTTOM (RV7)

⑦ Verify the overall screen convergence. If necessary adjust H. STAT (inside), carry out operations ③-⑩, and carry out the permalloy correction.

⑧ Switch the signal to hi-scan mode, verify the overall screen convergence. Verify that the amount of misconvergence is within the spec given below, in each direction of the CRT screen facing north, south, east or west.



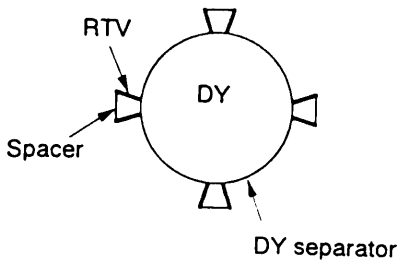
mode 6	other mode
A zone: 0.24mm max	0.28mm max
B zone: 0.32mm max	0.38mm max

⑨ Secure the reactors with RTV and secure the six-pole magnet with white paint.

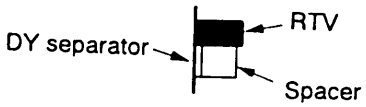
⑩ Fasten the deflection yoke spacers and permalloy with RTV.

Note:

•Spacer installation method(as seen from the rear)

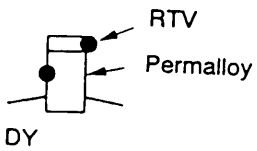


•How to apply RTV to the wedge



Apply RTV directry to
CRT funnel wedge
the separator

•How to apply RTV to the permalloy



6-3-13. White Balance Fine Adjustment

Conditions:

1. Input a 100 IRE white flat field signal and perform aging for more than 30 minutes.
2. Position the unit in the Helmholtz coil (IB_H=0, IB_V=0.45).
3. Make sure that landing fine adjustment, convergence fine adjustment, white balance rough adjustment have been performed beforehand.
4. Perform adjustments using a Minolta Color analyzer Ⅱ, calibrated by SONY's spectrometer.
5. This adjustment have to be performed in a dark room or a drak curtain.
6. Set the [COLOR MODE] SW to "H" and set the [CONTRAST] control to maximum. [BRIGHT] control to center*.
   * Select the BRIGHT control and pressing the ADJUST + and - buttons simultaneously for about 5 seconds.
7. Confirm that G1 level, pedestal level and video level are come up to standard.
   Adjust again them if those levels are not in standard (6-3-2.) refer to the video signal level set up

1) Align the sensor of the measuring instrument to the center of the screen.
2) Input a 32-gradation gray scale signal.
3) Vary the SCREEN (G2) VR gradually so that the 1 step become starting to be visible.
4) Set the RBKC control and BBKC control to minimum.
5) Vary the GBKC control gradually so that the 1 step become starting to be visible.
6) Input a gray signal. (30IRE)
7) Adjust the white balance for dark level using the RBKC and BBKC controls.
   Specification (x, y) = (0.283 ± 0.01, 0.298 ± 0.01)
8) Input white signal and adjust the white balance for high light using the RDCM, GDCM and BDCM controls.
   Specifications (x, y)=(0.283 ± 0.008, 0.298 ± 0.008)
   Y=100 ± 2cd/ m²
9) Make sure the video level to less than 42Vp-p of TP1, TP2, TP3 on C2 board. If over the video level, adjust the video level to 40Vp-p by DCM control and repeat steps 7) to steps 9).
10) Input a 32-gradation gray scale signal, and make sure the G2 level, if the 1 step not become starting to be visible and the pedestal become starting to be visible. Repeat step 3) to step 10).
11) Input a white signal.
12) Set the [CONTRAST] control to minimum and set the [BRIGHT] control to center.
13) Adjust the white balance using the RDCN, GDCN and BDCN controls.
    Specification (x, y)=(0.283 ± 0.01, 0.298 ± 0.01),
    Y=8 ± 1cd/ m²
14) Input a black signal.

15) Set the CONTRAST control to minimum and set the BRIGHT control to maximum.
16) Adjust the white balance using the RBKM, GBKM, and BBKM controls.
specifications (x, y)=(0.283 ± 0.010, 0.298 ± 0.010),
Y=$4^{+1}_{-0.5}$cd/㎡

17) Input a white signal.
18) Set the CONTRAST and BRIGHT control to maximum.
19) Adjust the white balance using the RDMM, GDMM and BDMM controls.
specifications (x, y)=(0.283 ± 0.008, 0.298 ± 0.008),
Y=115 ± 2cd/㎡
20) Vary the CONTRAST control gradually minimum to maximum.
So, make sure CONTRAST is smooth change.
21) Input a 32-gradation gray scale signal and check that the white balance, also set the BRIGHT control to minimum to maximum. So make sure white balance do not change.

22) Set the color mode SW "M".
23) Input a gray signal (30IRE).
24) Adjust the white balance using the RBKC and BBKC controls.
Refer to table 1-2.
25) Input a white signal and adjust the white balance using the GDCM and BDCM controls. Refer to table 1-1

Specification

	MID (6500 K)
x	0.313 ± 0.008
y	0.329 ± 0.008

Table-1-1

	MID (6500 K)
x	0.313 ± 0.01
y	0.329 ± 0.01

Table-1-2

26) Set the CONTRAST control to minimum and BRIGHT control to center.
27) Adjust the white balance using the GDCM and BDCN controls.

Specification

	MID (6500 K)
x	0.313 ± 0.010
y	0.329 ± 0.010

Table-2

28) Input a black signal.
29) Set the CONTRAST control to minimum and BRIGHT control to maximum.
30) Adjust the white balance using the RBKM, GBKM and BBKM controls.

Specification

	MID (6500 K)
x	0.313 ± 0.010
y	0.329 ± 0.010
Y	$4^{+1}_{-0.5}$cd/㎡

Table-3

31) Input a white signal.
32) Set the CONTRAST and BRIGHT controls to maximum.
33) Adjust the white balance using the RDMM, GDMM and BDMM controls.

Specification

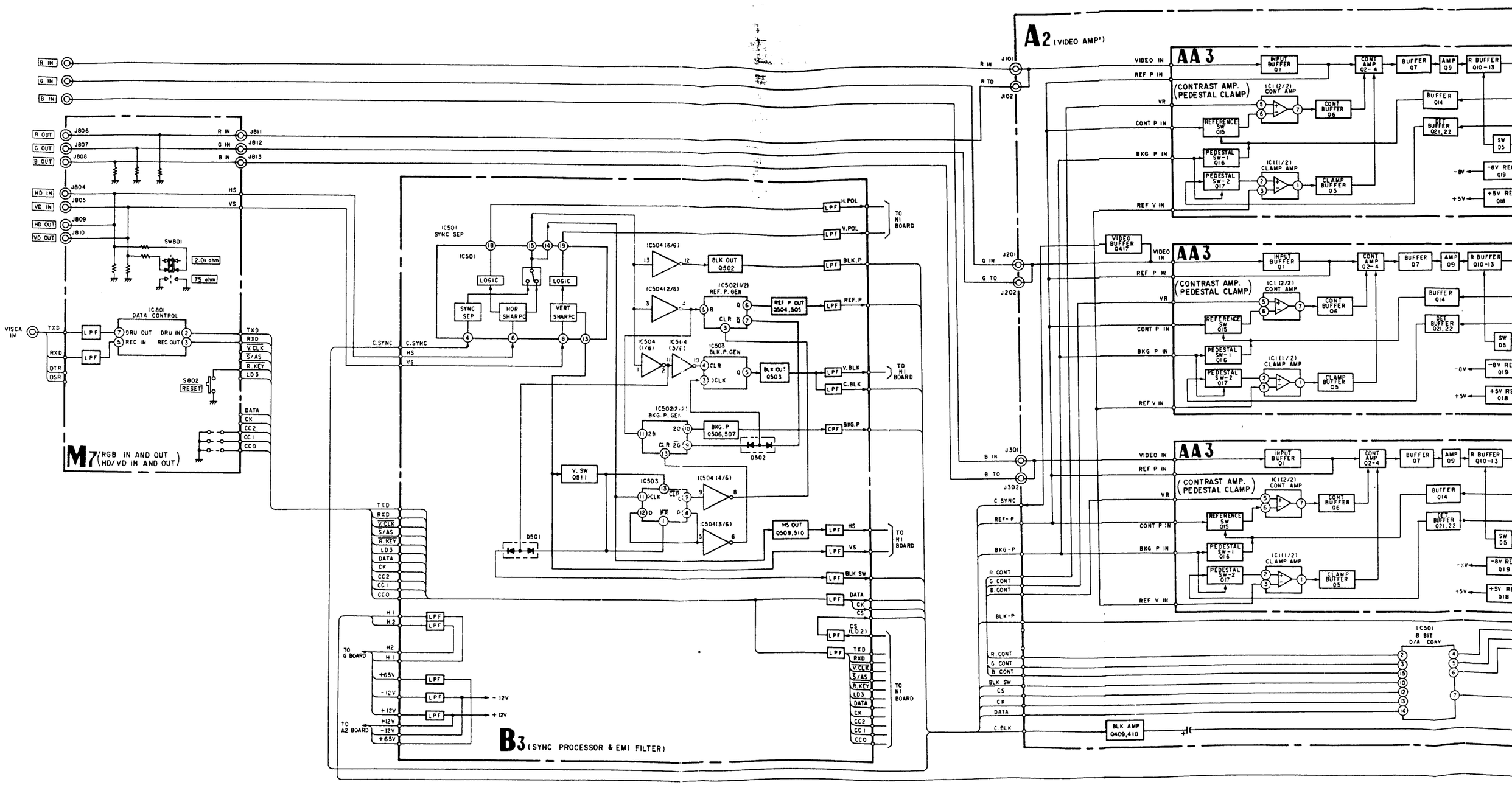
	MID (6500 K)
x	0.313 ± 0.008
y	0.329 ± 0.008
Y	98 ± 2Y cd/㎡

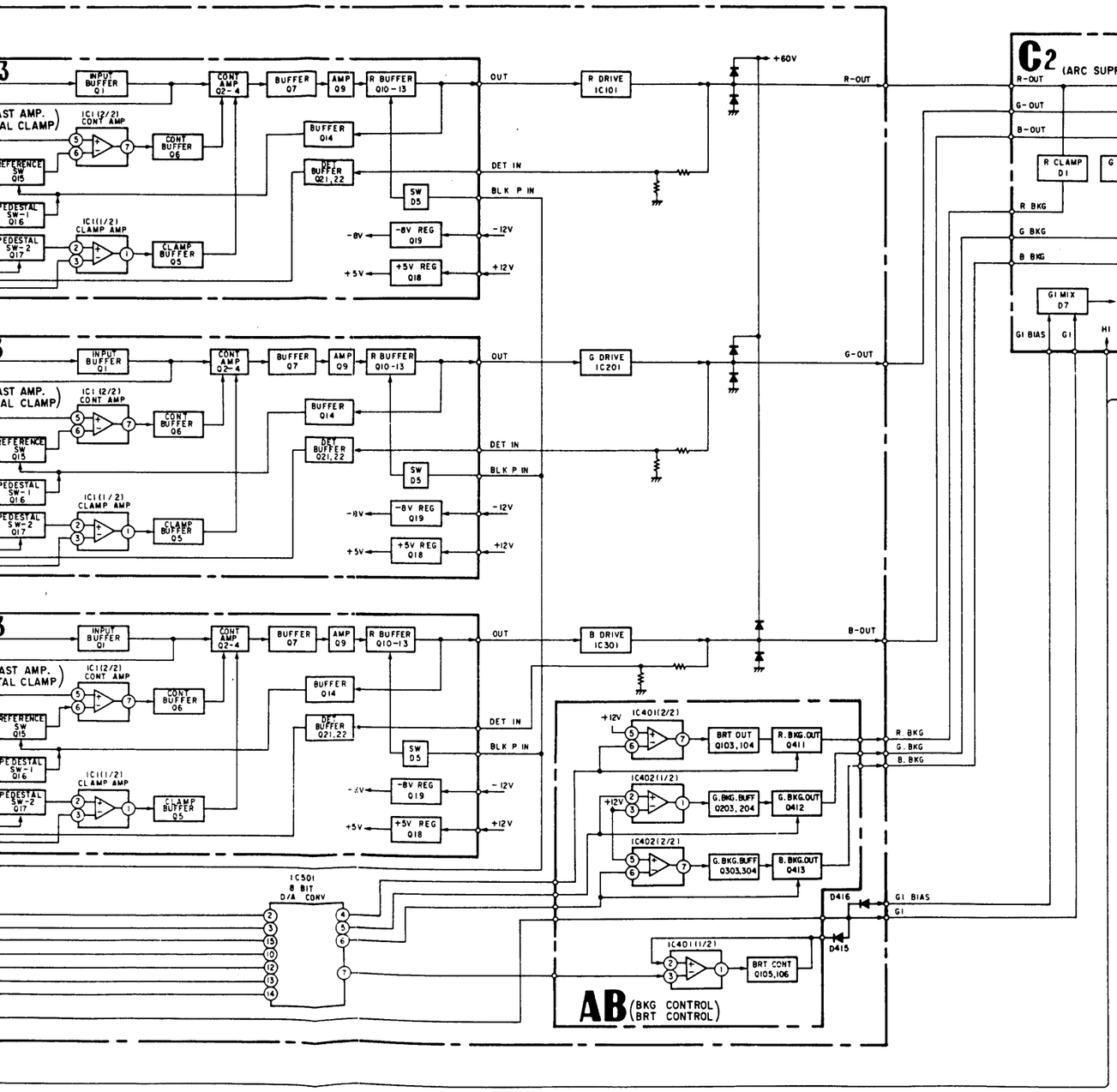
Table-4

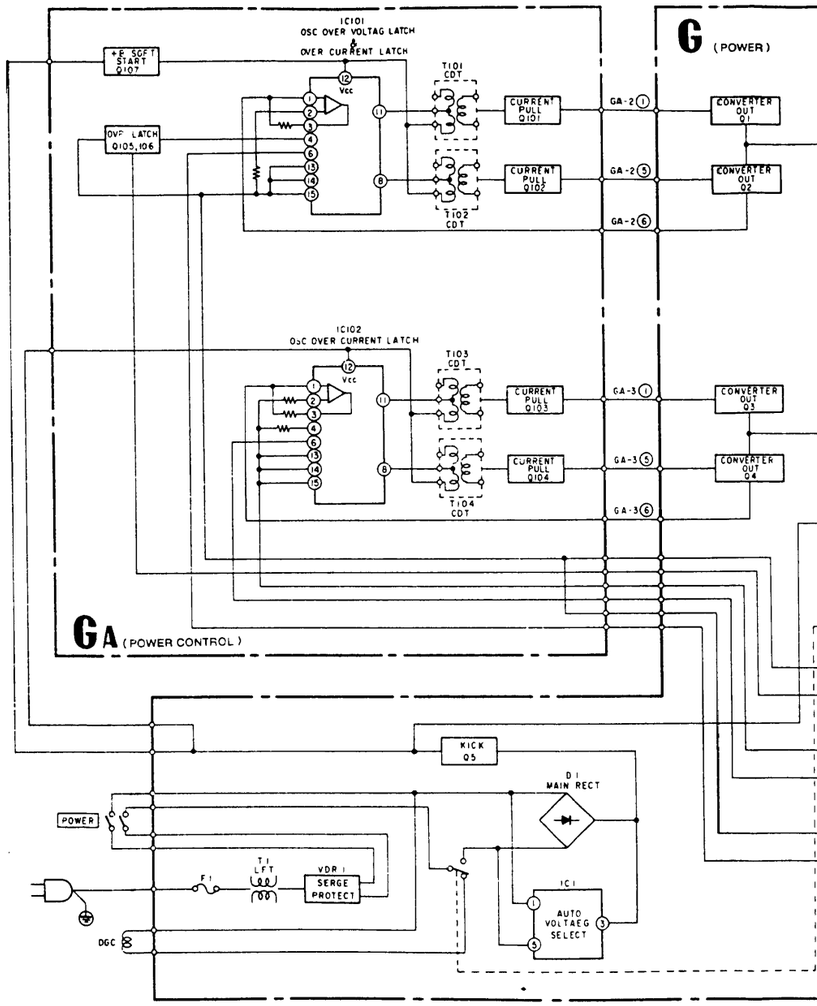
34) Very the CONTRAST control gradually minimum to maximum, so make sure CONTRAST is smooth change.
35) Input a 32-gradation gray scale signal and check that the white balance, also set the BRIGHT control to minimum to maximum, so make sure white balance do not change.

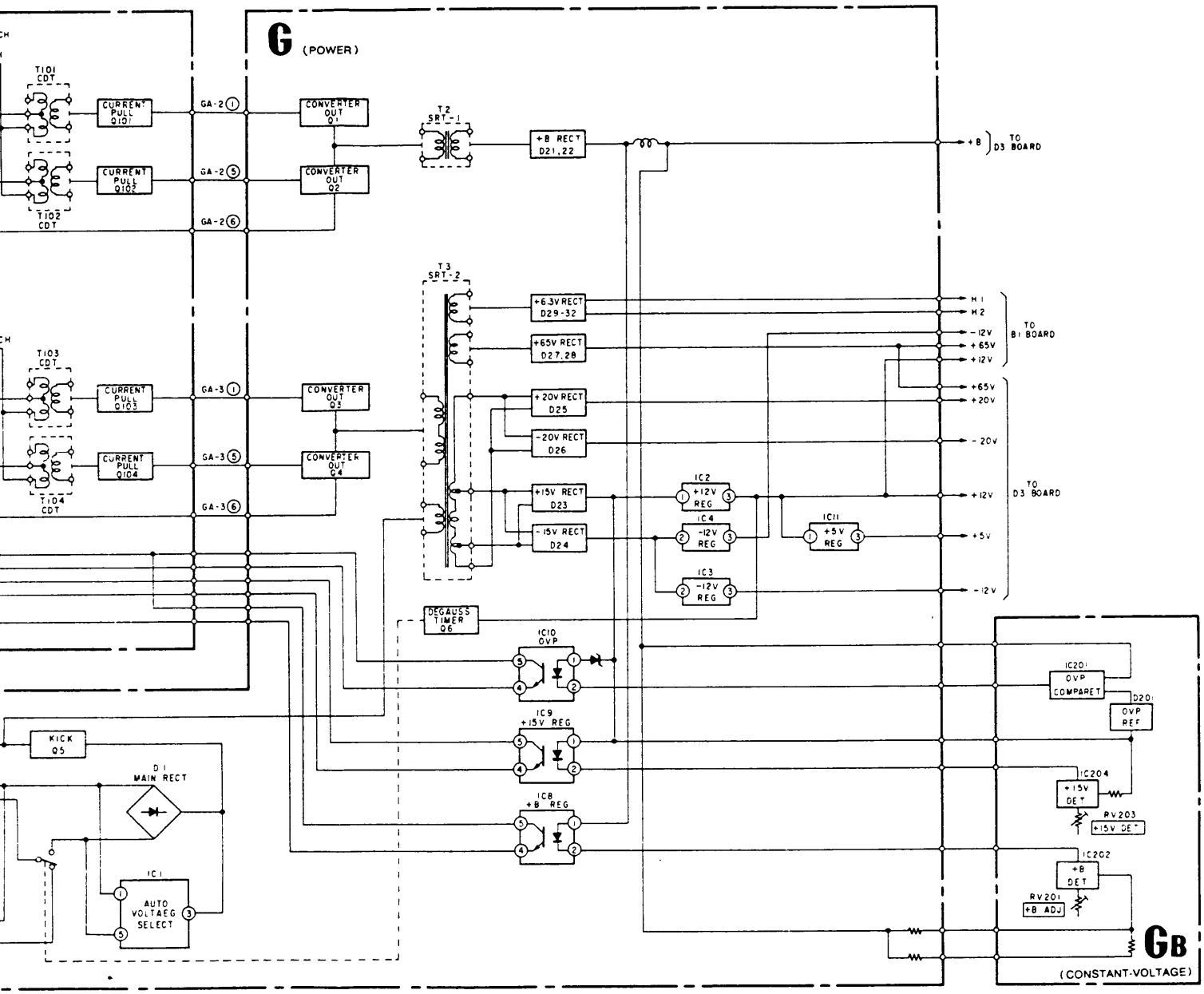
SECTION 7
DIAGRAMS

7-1. BLOCK DIAGRAMS

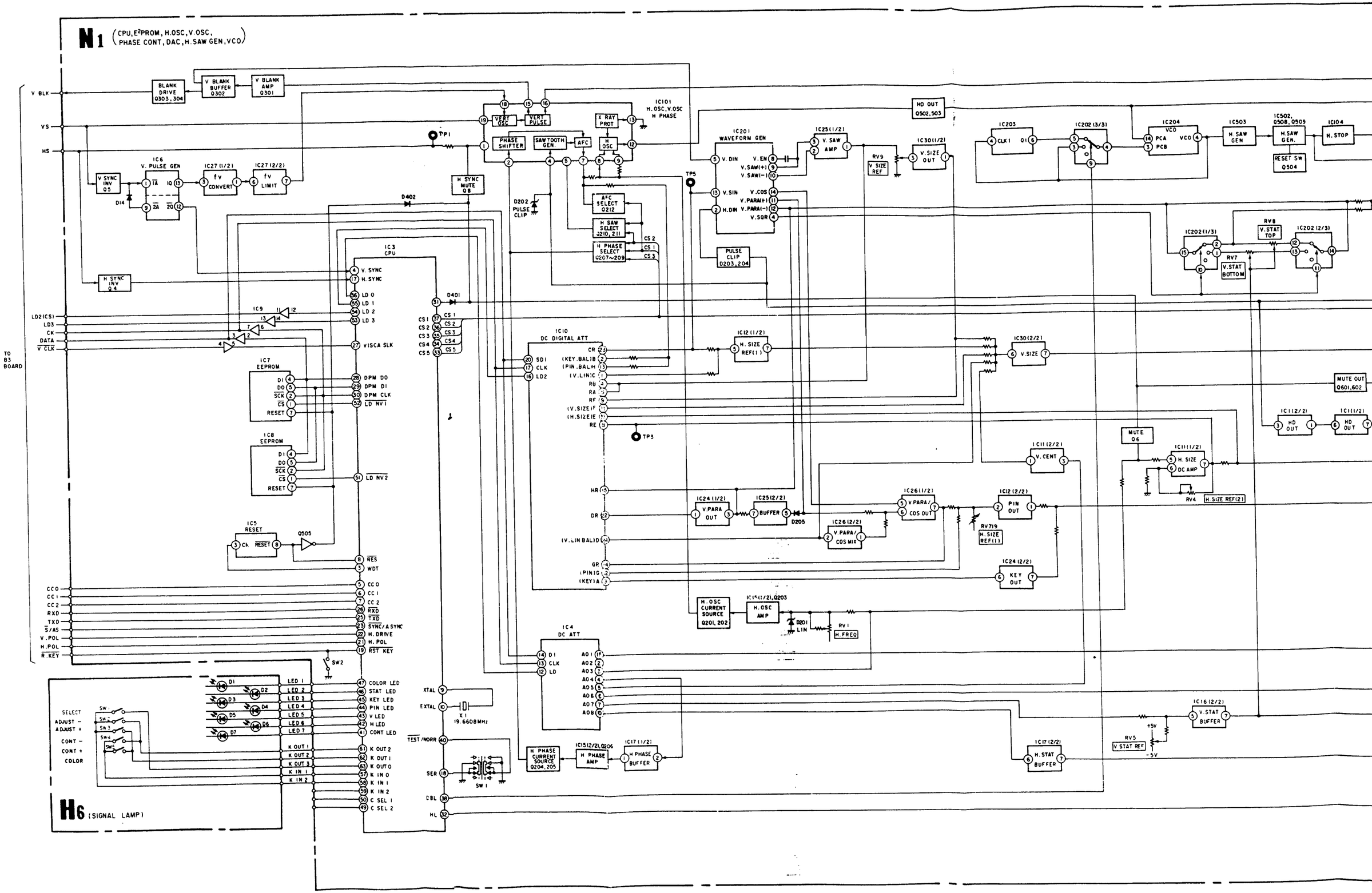



INPUT BUFFER Q1
CONV AMP Q2-4
BUFFER Q7
AMP Q9
R BUFFER Q10-13
OUT
R DRIVE IC101
+60V
R-OUT
IC1 (2/2) CONT AMP
CONT BUFFER Q6
BUFFER Q14
DET BUFFER Q21,22
SW D5
DET IN
BLK P IN
-8V REG Q19
+5V REG Q18
-12V
+12V
IC1 (1/2) CLAMP AMP
CLAMP BUFFER Q5
REFERENCE SW Q15
PEDESTAL SW-1 Q16
PEDESTAL SW-2 Q17
G DRIVE IC201
G-OUT
B DRIVE IC301
B-OUT
IC501 8 BIT D/A CONV
IC401 (2/2)
BRT OUT Q103,104
R.BKG.OUT Q411
G.BKG.BUFF Q203,204
G.BKG.OUT Q412
G.BKG.BUFF Q303,304
B.BKG.OUT Q413
BRT CONT Q105,106
R.BKG
G.BKG
B.BKG
D416
D415
G1 BIAS
G1
AB (BKG CONTROL) (BRT CONTROL)
C2 (ARC SUPPRESSION)
R-OUT
G-OUT
B-OUT
KR
KG
KB
R CLAMP D1
G CLAMP D2
B CLAMP D3
R BKG
G BKG
B BKG
G1 MIX D7
G1
G1 BIAS
H1 H2 GM G4 G2
H STAT
H STAT VR 90M
PICTURE TUBE
HV TO D4 BOARD
FOCUS PACK
S
F1
F2
DF
MV
PRT
TO D4 BOARD


IC101 OSC OVER VOLTAG LATCH & OVER CURRENT LATCH
+B SOFT START Q107
OVP LATCH Q105,106
T101 CDT
T102 CDT
CURRENT PULL Q101
CURRENT PULL Q102
IC102 OSC OVER CURRENT LATCH
T103 CDT
T104 CDT
CURRENT PULL Q103
CURRENT PULL Q104
GA-2 1
GA-2 5
GA-2 6
GA-3 1
GA-3 5
GA-3 6
CONVERTER OUT Q1
CONVERTER OUT Q2
CONVERTER OUT Q3
CONVERTER OUT Q4
G (POWER)
GA (POWER CONTROL)
KICK Q5
D1 MAIN RECT
POWER
F1
T1 LFT
VDR 1 SERGE PROTECT
IC1 AUTO VOLTAEG SELECT
DGC


G (POWER)
T101 CDT
T102 CDT
T103 CDT
T104 CDT
CURRENT PULL Q101
CURRENT PULL Q102
CURRENT PULL Q103
CURRENT PULL Q104
GA-2 1
GA-2 5
GA-2 6
GA-3 1
GA-3 5
GA-3 6
CONVERTER OUT Q1
CONVERTER OUT Q2
CONVERTER OUT Q3
CONVERTER OUT Q4
T2 SRT-1
T3 SRT-2
+B RECT D21,22
+6.3V RECT D29-32
+65V RECT D27,28
+20V RECT D25
-20V RECT D26
+15V RECT D23
-15V RECT D24
DEGAUSS TIMER Q6
IC10 OVP
IC9 +15V REG
IC8 +B REG
IC2 +12V REG
IC4 -12V REG
IC3 -12V REG
IC11 +5V REG
KICK Q5
D1 MAIN RECT
IC1 AUTO VOLTAEG SELECT
+B
H1
H2
-12V
+65V
+12V
+20V
-20V
+5V
TO D3 BOARD
TO B1 BOARD
IC201 OVP COMPARET
D201 OVP REF
IC204 +15V DET
RV203 +15V DET
IC202 +B DET
RV201 +B ADJ
GB
(CONSTANT-VOLTAGE)

GDM-2039 GDM-2039



D4

(HEAT PROTECTOR, H. SIZE, PWM GEN, V STOP PROTECTOR, HV REG 1, HV PROT 1, BEAM PROTECT 1, BEAMPROTECT 2.)

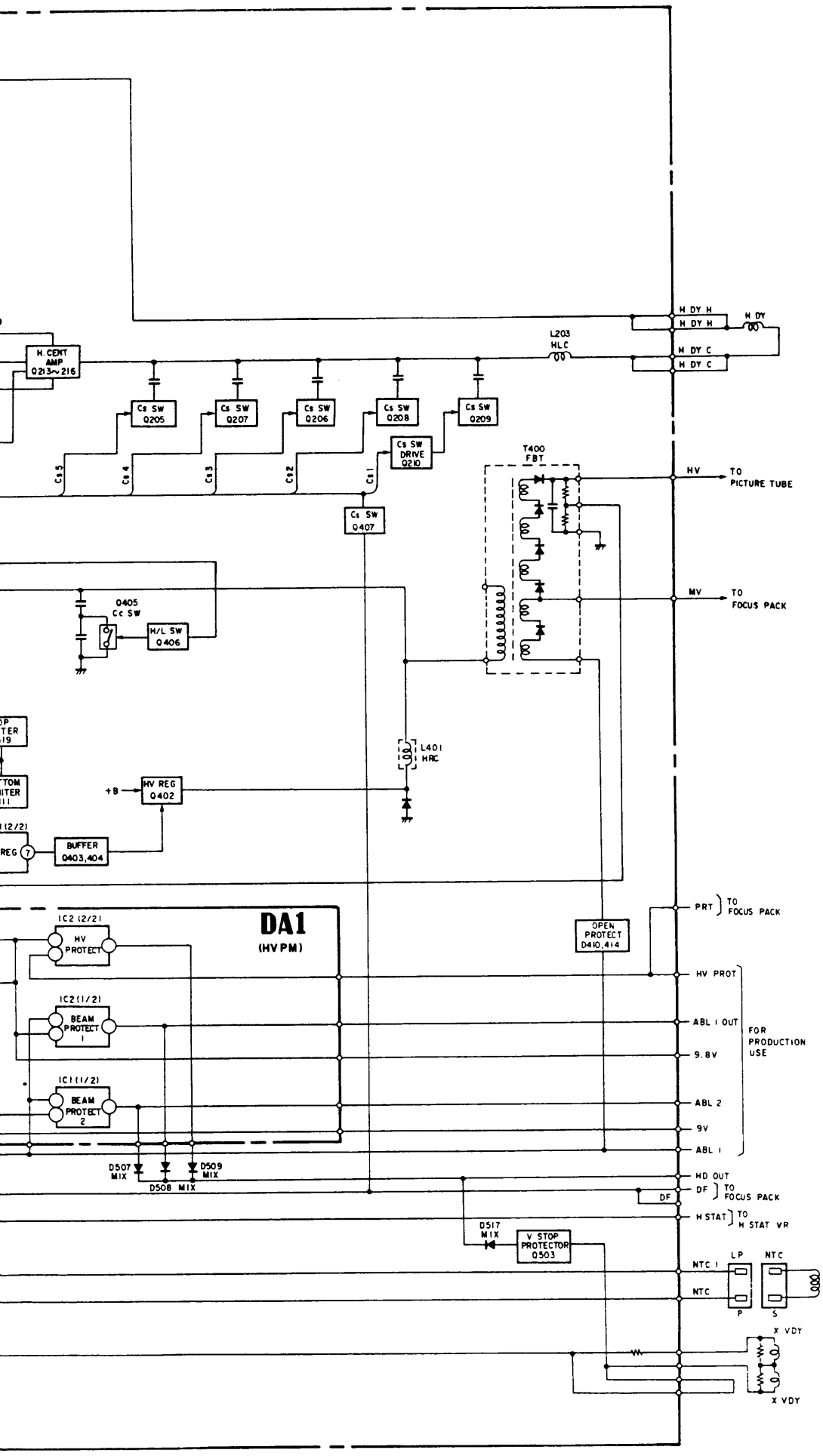
IC503 H. SAW GEN
IC502, 0508, 0509 H.SAW GEN.
RESET SW Q504
IC104 H. STOP
HVD DRIVE Q1, Q2
IC16 (1/2) PIN COR.
RV8 V. STAT TOP
RV7 V. STAT BOTTOM
IC202 (2/3)
BUFFER Q305
IC801 (1/2) RROT.
MUTE OUT Q601,602
IC1 (2/2) H.D OUT
IC1 (1/2) H.D OUT
+12V
LIMITER SW D108

HD
HD
VD
HD
HD
HVD
HVD
TR
V. PARA
HV. STOP
HV. STOP
H. FBP
CS 1
CS 2
CS 3
CS 4
CS 5
V. SIZE
MUTE
H. SIZE
PIN
LIM
DF
H. CENT
V. STAT
H. STAT
HL

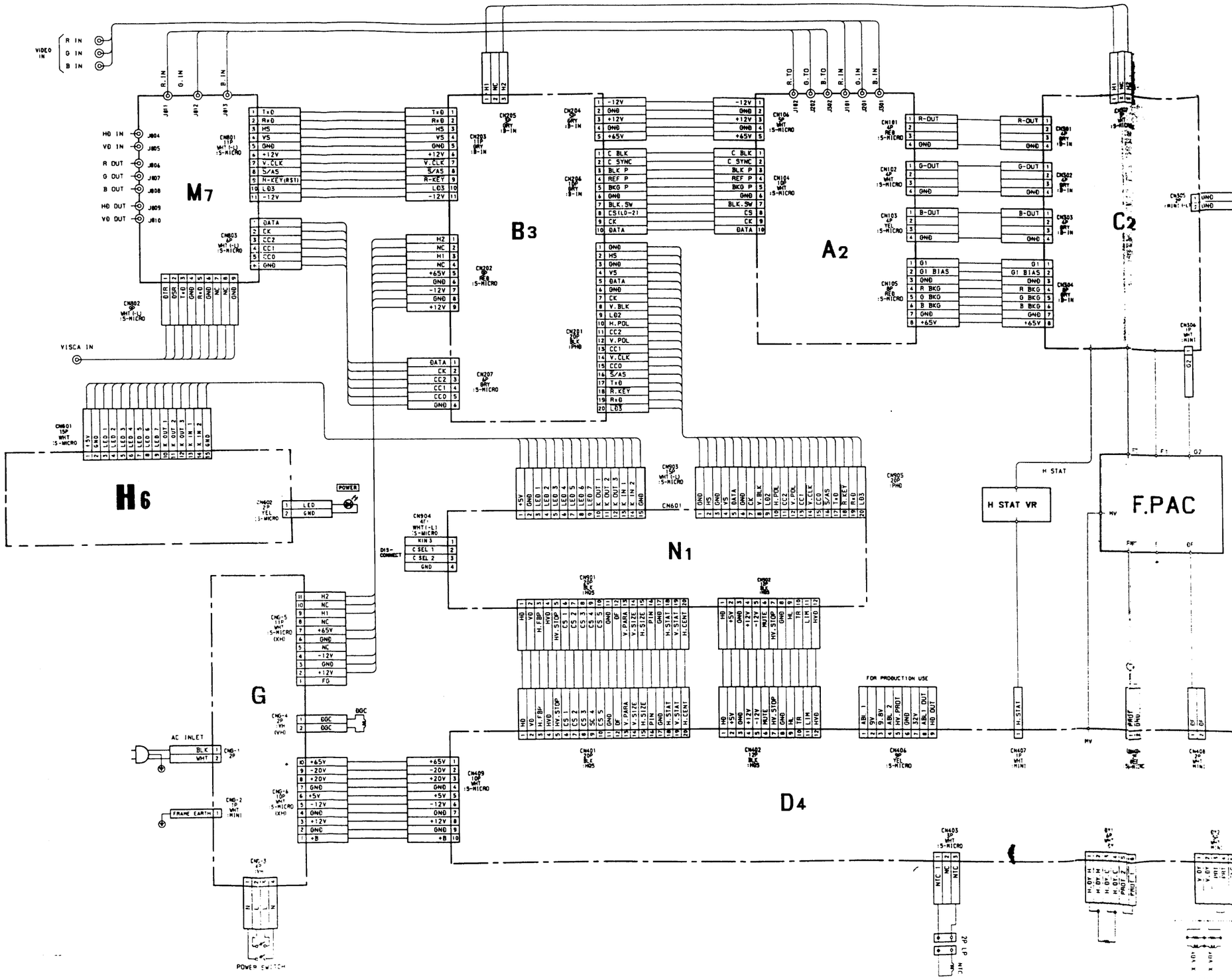
H. DRIVE Q203
T201 HDT
H OUT Q204
D202 DAMPER
+20V
HEAT PROTECT Q220
D220 MIX
H STOP PROTECT Q502
D515 MIX
T410 HDT
HV DRIVE Q408
T202 HOT
LIMITER Q221
IC301 (1/2) H. SIZE AMP
IC201 (1/2) H. SIZE PWM GEN
BUFFER Q218,219
PIN OUT Q217
D212 DUMPER
D221 D222
D209
D210
H CENT AMP Q213~216
L203 HLC
IC301 (2/2) H CENT AMP
H CENT AMP Q102
D107
D106
Cs SW Q205
Cs SW Q207
Cs SW Q206
Cs SW Q208
Cs SW Q209
Cs DRIVE Q210
Cs SW Q407
T400 FBT
CONV OUT Q401
Q405 Cc SW
H/L SW Q406
L401 HRC
TOP LIMITER D519
BOTTOM LIMITER D111
+B
HV REG Q402
IC302 (1/2) ERROR AMP
IC201 (2/2) HV. REG
BUFFER Q403,404
T601 FRT
H DF DRIVE Q601~603
H DF OUT Q605, 606
T602 DFT
IC102 (2/2) V PARA AMP
V DF OUT Q604
IC201 (1/2) V PARA AMP
D602
H DF DRIVE Q607
RV601 V.F
IC303 (1/2) H STAT AMP
H STAT OUT Q703
IC303 (2/2) NTC AMP
NTC DRIVE Q701,702
+20V
+B
Vcc SW Q302
V OUT Q303,305
IC304 V DEF AMP
CURRENT SOURSE Q301
VERT DRIVE Q307
V OUT Q304,306

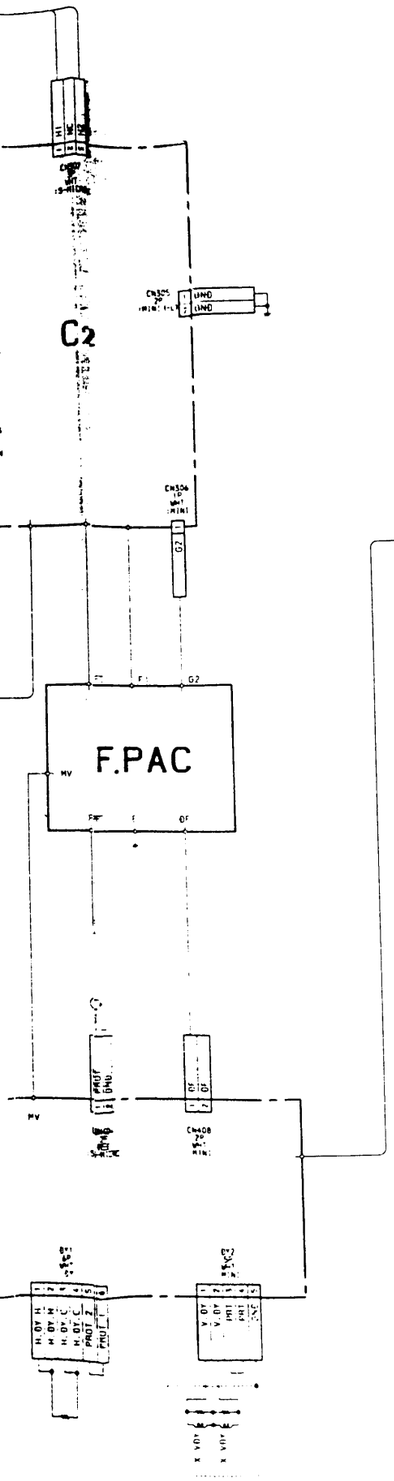
DA1 (HV PM)

IC4 REFERENCE VOL RECT
RV16 PROT ADJ
IC3 HV REF VOL RECT
RV9 HV ADJ
IC2 (2/2) HV PROTECT
IC2 (1/2) BEAM PROTECT 1
IC1 (1/2) BEAM PROTECT 2
D507 MIX
D508 MIX
D509 MIX
D517 MIX
V STOP PROTECTOR Q503

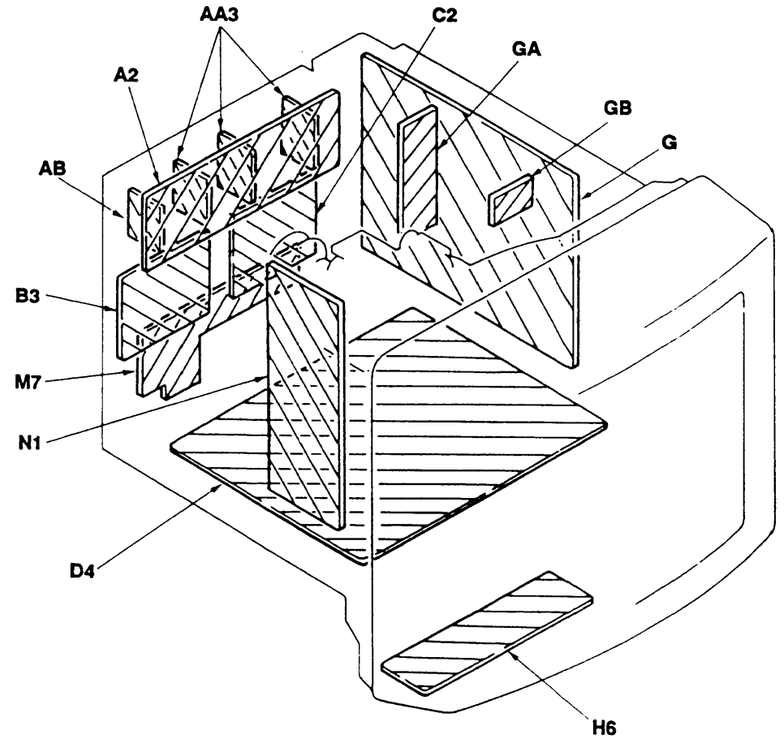

H DY H
H DY H
H DY
H DY C
H DY C
L203
HLC
H. CENT AMP Q213~216
Cs SW Q205
Cs SW Q207
Cs SW Q206
Cs SW Q208
Cs SW Q209
Cs SW DRIVE Q210
Cs5
Cs4
Cs3
Cs2
Cs1
Cs SW Q407
T400 FBT
HV
TO PICTURE TUBE
MV
TO FOCUS PACK
Q405 Cc SW
H/L SW Q406
L401 HRC
+B
HV REG Q402
BUFFER Q403,404
DA1
(HV PM)
IC2 (2/2)
HV PROTECT
IC2 (1/2)
BEAM PROTECT 1
IC1 (1/2)
BEAM PROTECT 2
D507 MIX
D508 MIX
D509 MIX
OPEN PROTECT D410,414
PRT
TO FOCUS PACK
HV PROT
ABL 1 OUT
9.8V
ABL 2
9V
ABL 1
FOR PRODUCTION USE
HD OUT
DF
TO FOCUS PACK
H STAT
TO H STAT VR
D517 MIX
V STOP PROTECTOR Q503
NTC 1
NTC
LP
NTC
P
S
X VDY
X VDY

7-2. FRAME SCHEMATIC DIAGRAM





7-3. CIRCUIT BOARDS LOCATION



7-4 SCHEMATIC DIAGRAMS AND PRINTED WIRING BOARDS

Note:

- All capacitors are in uF unless otherwise noted. pF: uuF 50 WV or less are not indicated except for electrolytics and tantalums.
- Unless otherwise noted is 1/4W resistor and 1/10W chip resistor.
  k Ω :1000 Ω , M Ω 1000k Ω .
- All resistors are in ohms.
- : fusible resistor
- : nonflammable resistor.
- △ : internal component.
- : panel designation and adjustment for repair.
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- HV Hold-down and Voltage check.
  Check parts which require voltage checks at TP401, TP402 and TP404 make replace if necessary.

Check point	Parts to be replaced
TP401 32.0:$^{+0.65}_{-1.00}$V DC	DA1 (HVPM)
TP402 9.90:$^{+0.08}_{-0.10}$V DC	DA1 (HVPM)
TP404 9.00:$^{+0.08}_{-0.10}$V DC	DA1 (HVPM)

(Refer to DA1 (HVPM) on page 83 of section 5)

- All voltages are in V.
- Readings are taken with a 10M Ω digital multimeter.
- Readings are taken with a color-bar signal input.
- Voltage variations may be noted due to normal production tolerance.
- : B + line
- : B – line
  (Actual measured value may be different).
- Circled numbers are waveform references.

Reference information

- RESISTOR

: RN	METAL FILM
: RC	SOLID
: FPRD	NONFLAMMABLE CARBON
: FUSE	NONFLAMMABLE FUSIBLE
: RW	NONFLAMMABLE WIREWOUND
: RS	NONFLAMMABLE METAL OXIDE
: RB	NONFLAMMABLE CEMENT
※	ADJUSTMENT RESISTOR

- COIL

: LF-8L	MICRO INDUCTOR

- CAPACITOR

: TA	TANTALUM
: PS	STYROL
: PP	POLYPROPYLENE
: PT	MYLAR
: MPS	METALIZED POLYESTER
: MPP	METALIZED POLYPROPYLENE
: ALB	BIPOLAR
: ALT	HIGH TEMPERATURE
: ALR	HIGHRIPPLE

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

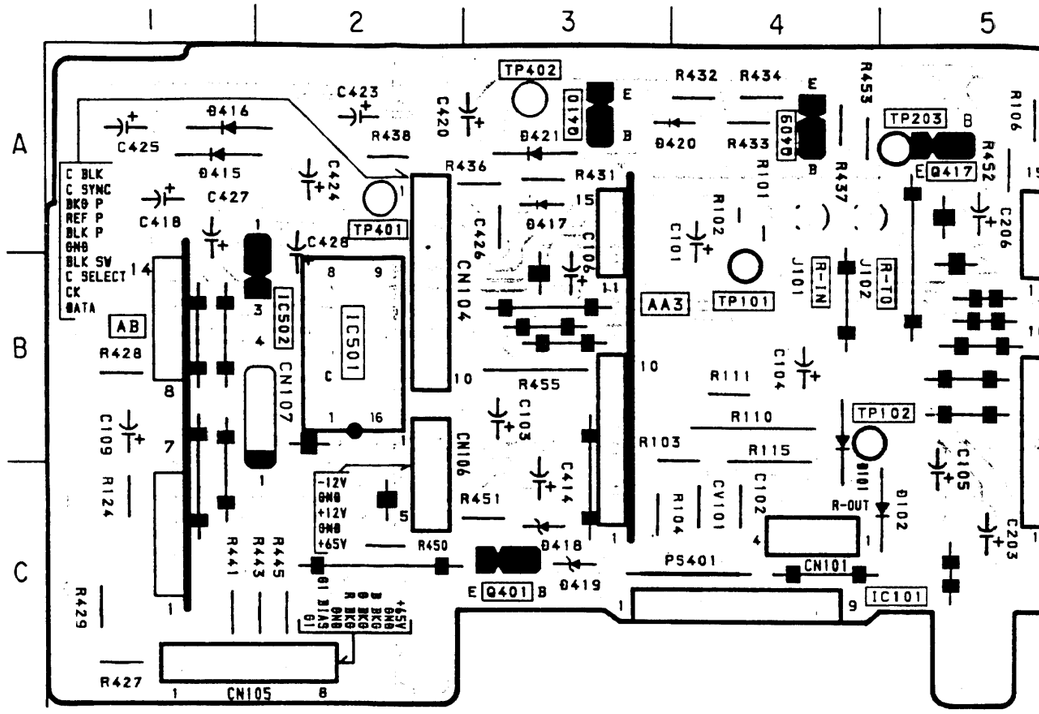
Note: Les composants identifiés par une trame et par une marque ⚠ sont d'une importance critique pour la sécurité. Ne les remplacer que par des pièces de numéro spécifié.

A2 BOARD LOCATION

IC	
IC101	C-5
IC201	C-7
IC301	C-9
IC501	B-2
IC502	B-2
TRANSISTOR	
Q401	C-3
Q409	A-4
Q410	A-3
Q417	A-5
DIODE	
D101	C-4
D102	C-5
D201	B-6
D202	C-6
D301	B-8
D302	C-9
D415	A-1
D416	A-1
D417	A-3
D418	C-3
D419	C-3
D420	A-4
D421	A-3
ADJUSTING ELEMENT	
CV101	C-4
CV201	C-6
CV301	C-8

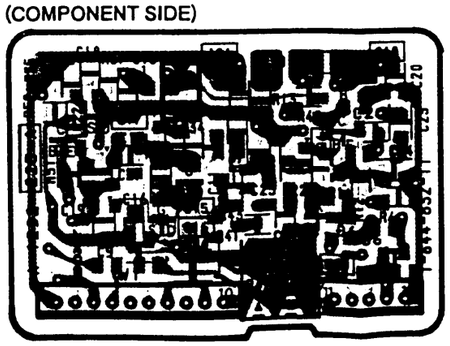
A2 [VIDEO AMP]

– A2 BOARD –

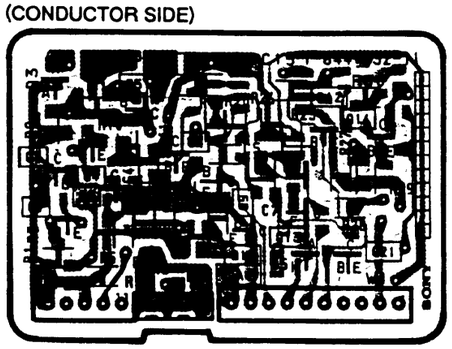


– AA3 BOARD –

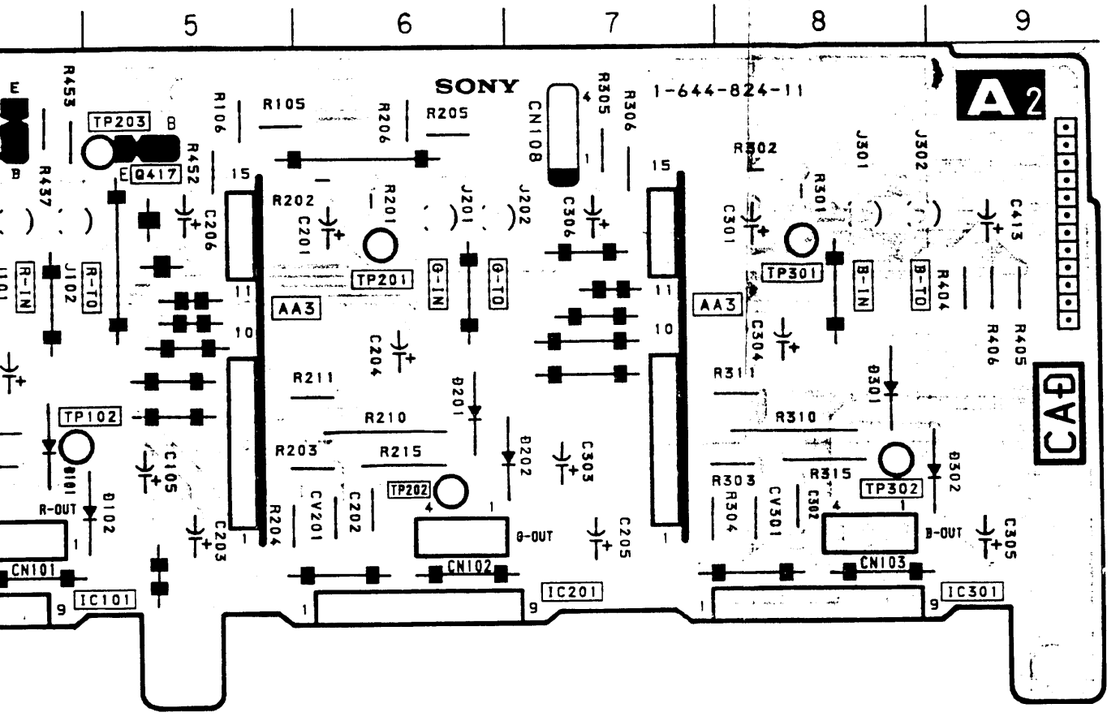
(COMPONENT SIDE)



(CONDUCTOR SIDE)

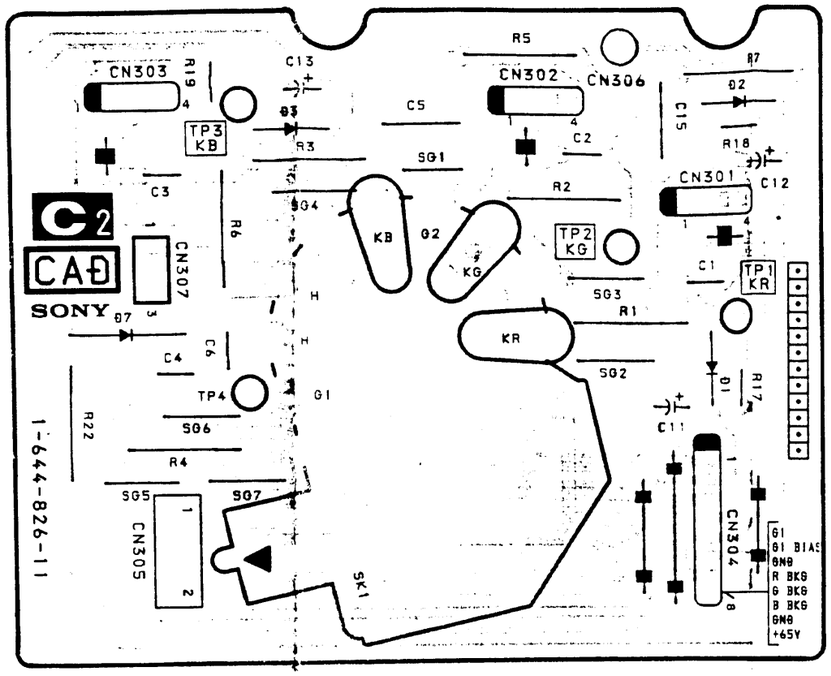


AA3 [CONTRAST AMP PEDESTAL CLAMP]

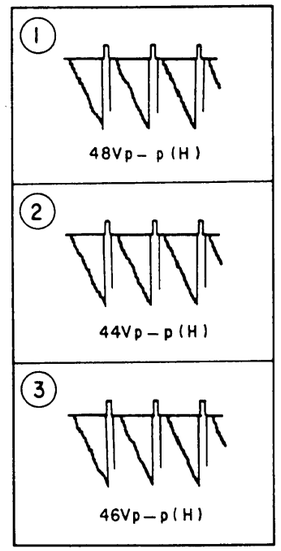


C2 [ARC SUPPRESSION] **AB** [BRT CONT, RGB BKG]

– C2 BOARD –

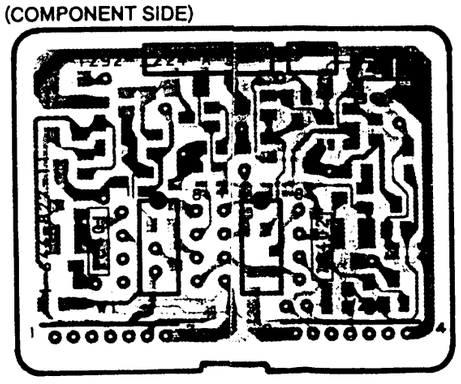


C2 BOARD WAVEFORMS

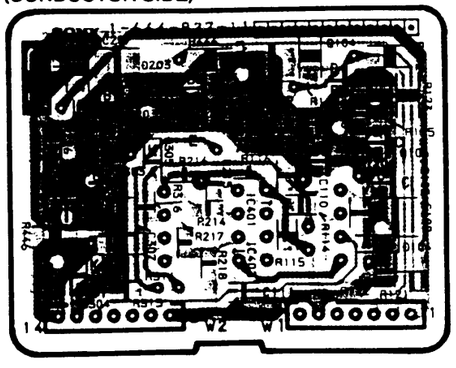


– AB BOARD –

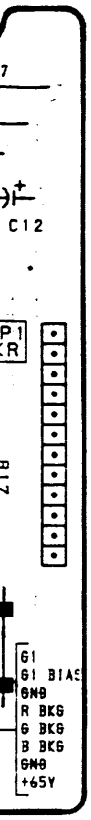
(COMPONENT SIDE)



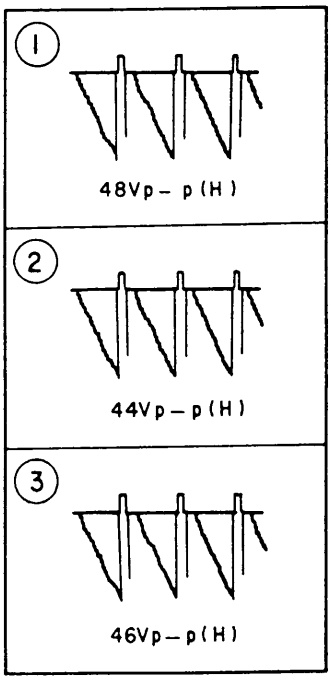
(CONDUCTOR SIDE)



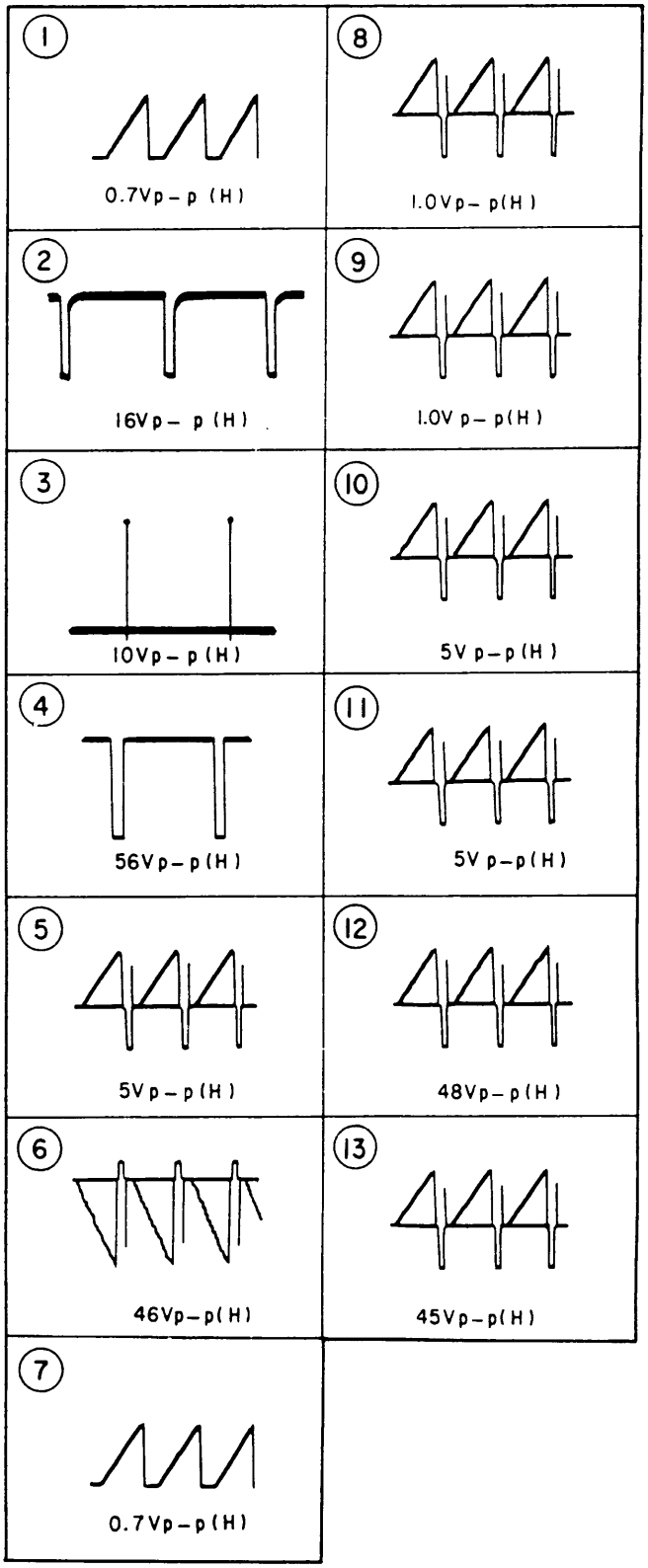
- : Pattern from the side which enables seeing.
- : Pattern of the rear side.



C2 BOARD WAVEFORMS

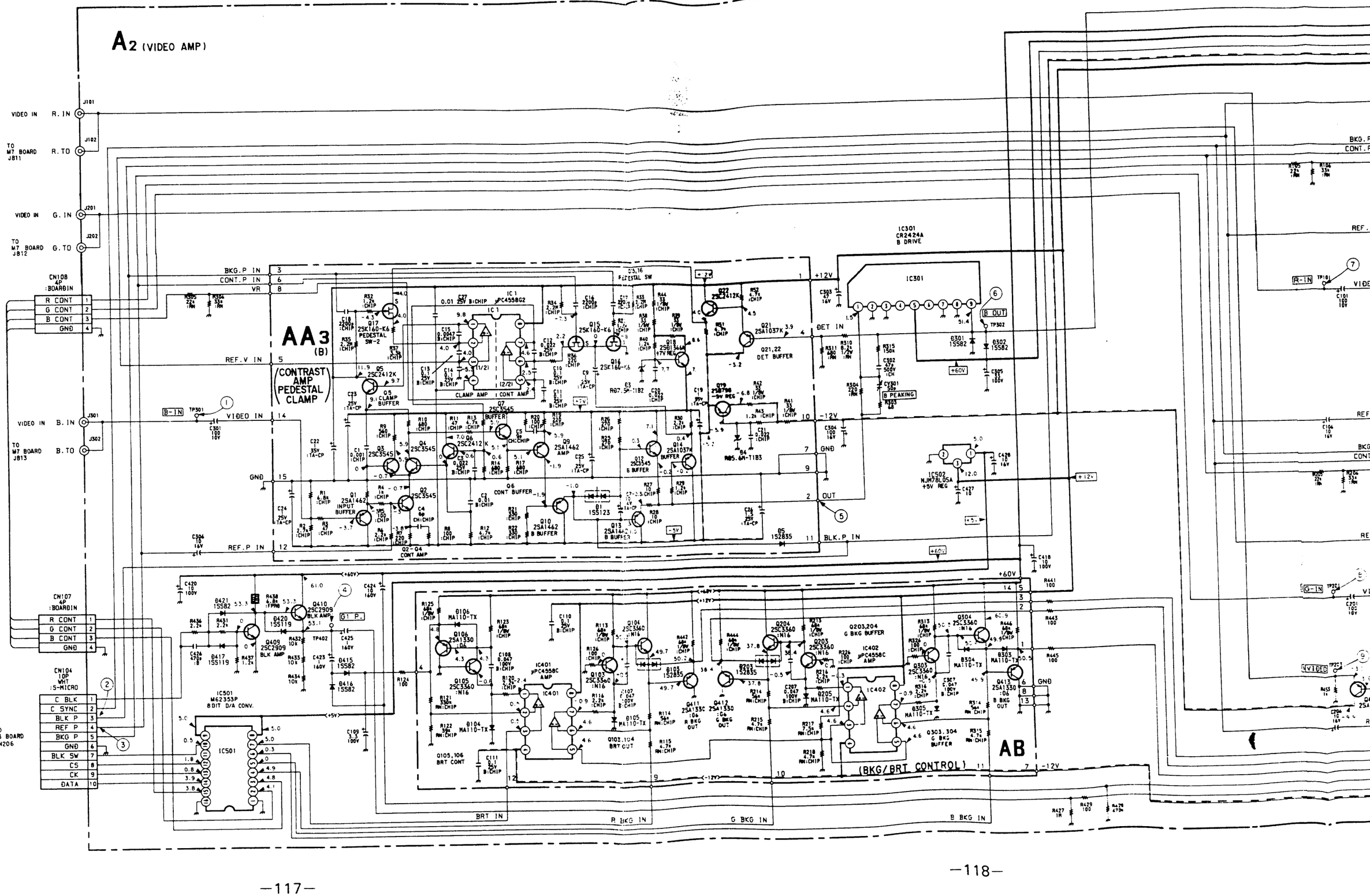


A2 BOARD WAVEFORMS

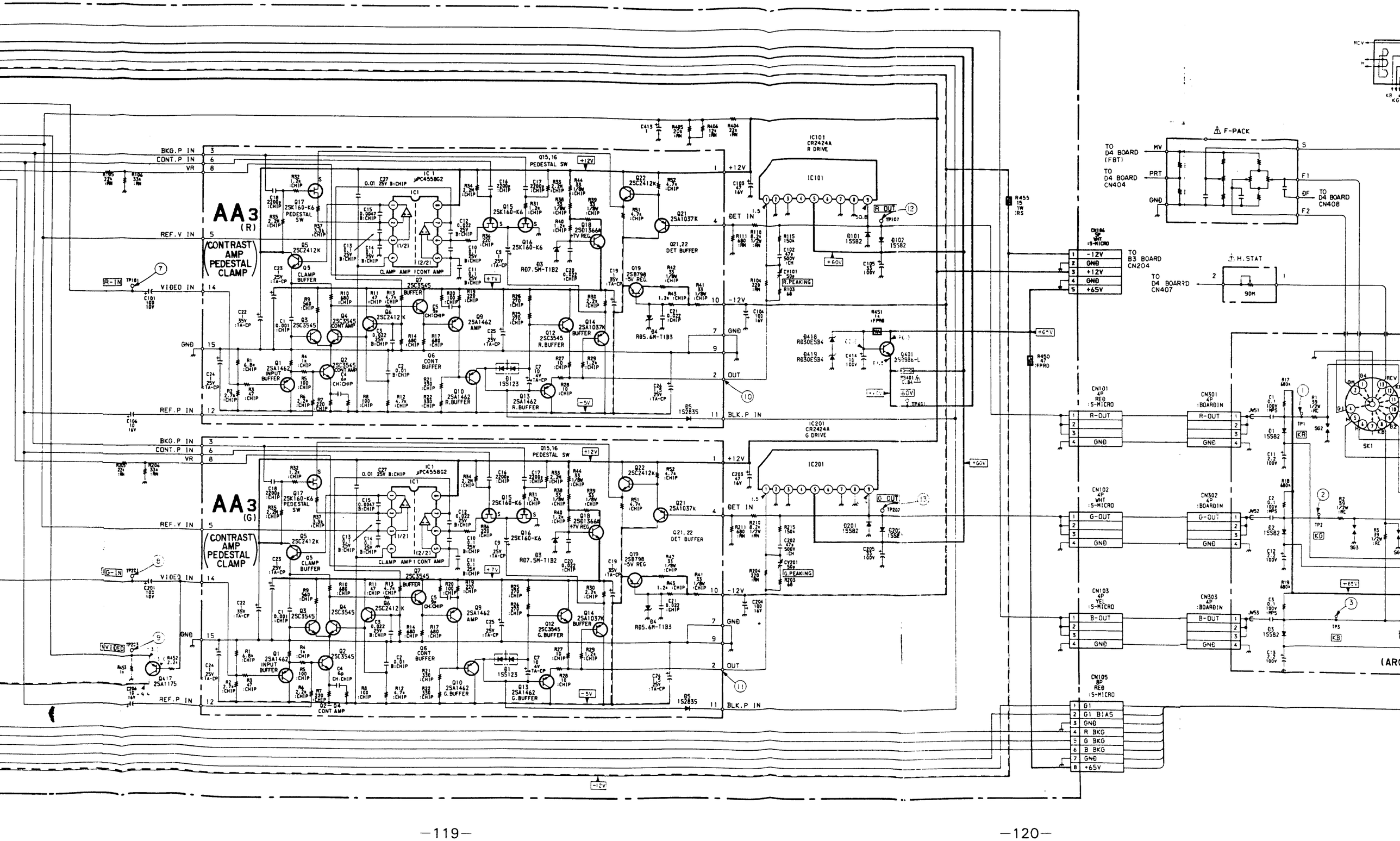


s seeing.

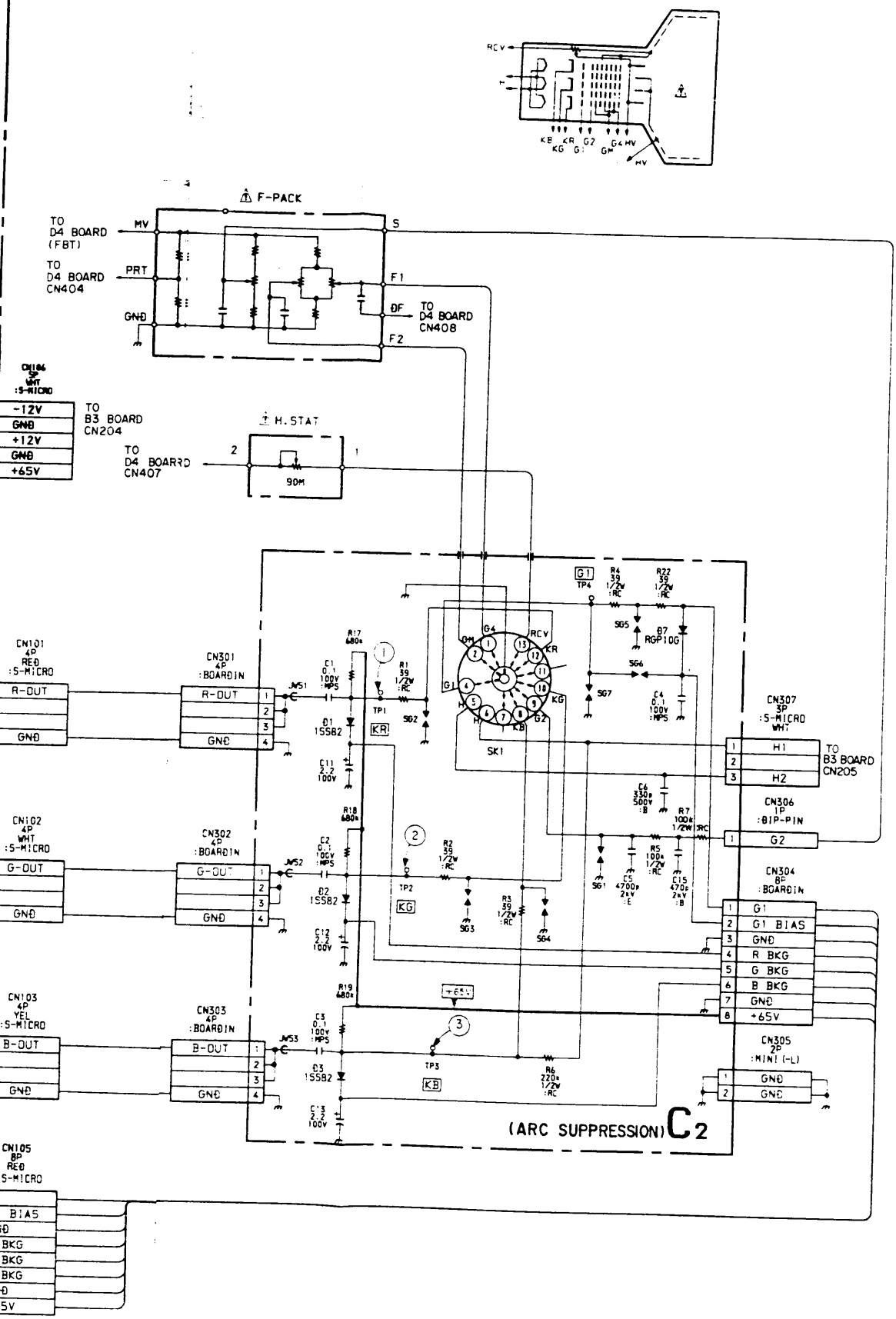
A2 (VIDEO AMP)


VIDEO IN R. IN
TO M7 BOARD J811 R. TO
VIDEO IN G. IN
TO M7 BOARD J812 G. TO
CN108 4P :BOARDIN
R CONT
G CONT
B CONT
GND
BKG. P IN
CONT. P IN
VR
REF. V IN
REF. P IN
BLK. P IN
AA3 (B)
(CONTRAST AMP PEDESTAL CLAMP)
IC1 μPC4558G2
CLAMP AMP
CONT AMP
INPUT BUFFER
CONT BUFFER
B BUFFER
Q2-Q4 CONT AMP
PEDESTAL SW
IC301 CR2424A B DRIVE
DET IN
Q21,22 DET BUFFER
B OUT
+60V
B PEAKING
IC502 NJM78L05A +5V REG
VIDEO IN B. IN
TO M7 BOARD J813 B. TO
B-IN
CN107 4P :BOARDIN
CN104 10P WHT :5-MICRO
TO B3 BOARD CN206
IC501 M62353P 8BIT D/A CONV.
Q409 2SC2909 BLK AMP
G1 P.
IC401 μPC4558C AMP
Q103,104 BRT OUT
Q105,106 BRT CONT
IC402 μPC4558C AMP
Q203,204 G BKG BUFFER
Q303,304 G BKG BUFFER
(BKG/BRT CONTROL)
BRT IN
R BKG IN
G BKG IN
B BKG IN
R-IN
G-IN
B-IN

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

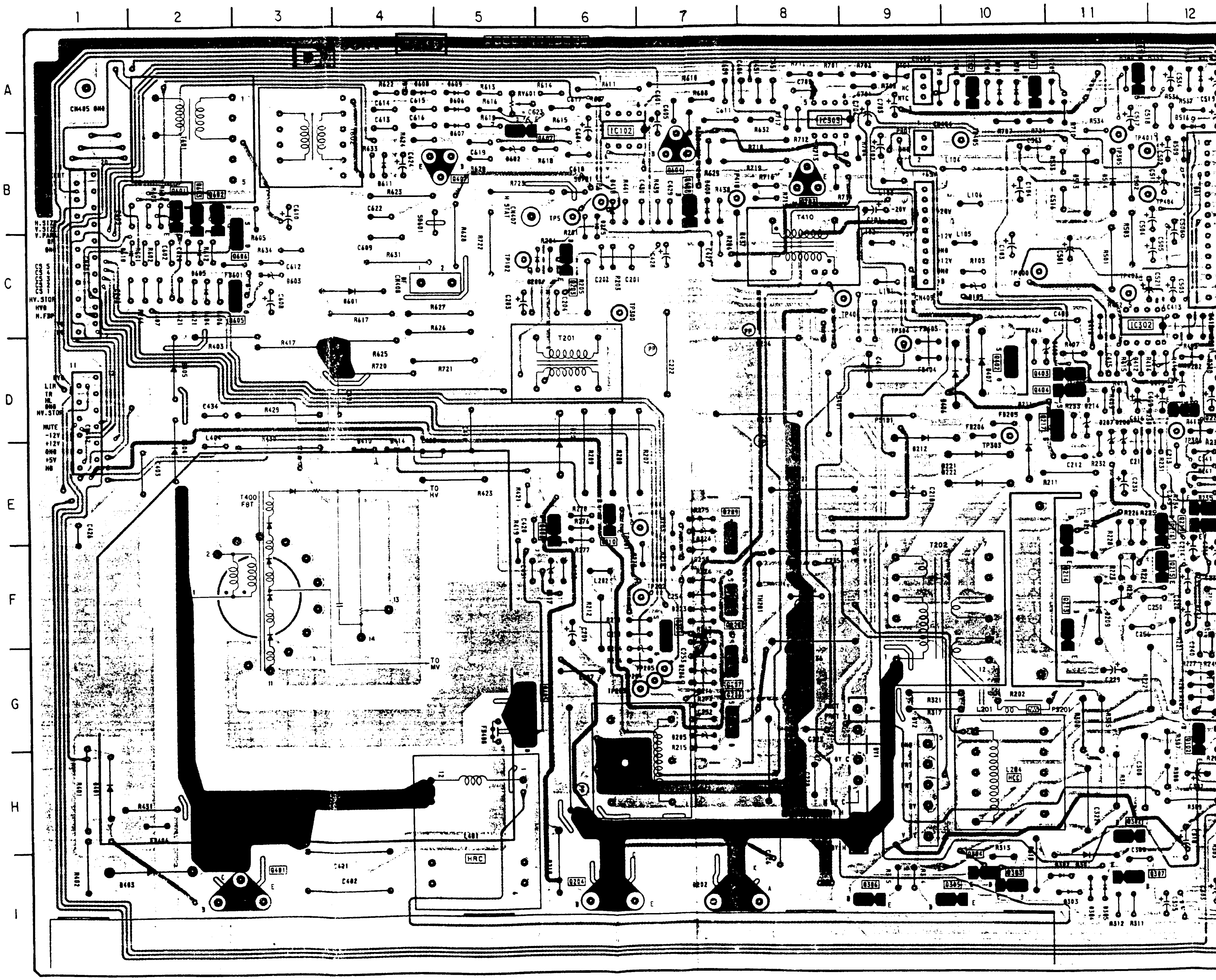


28 29 30 31 32 33

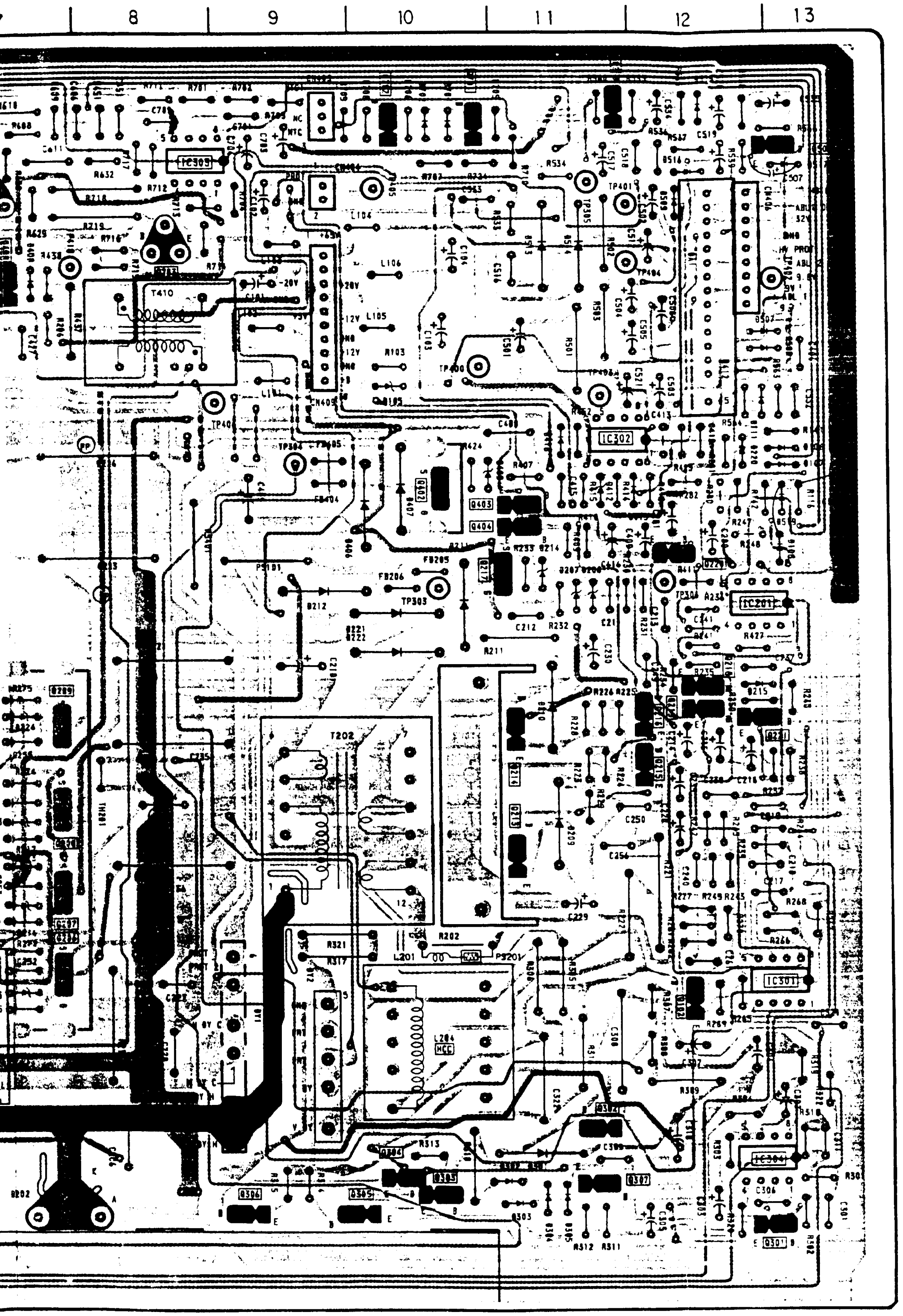


D4 HEAT PROTECTOR, H SIZE PWM GEN, V STOP PROTECTOR, HV REG 1, HV PROT 1, BEAM PROTECT 1, BEAM PROTECT 2

– D4 BOARD –



TOP PROTECTOR,
BEAM PROTECT 2



D4 BOARD LOCATION

IC	
IC102	A-6
IC201	D-12
IC301	F-12
IC302	C-11
IC303	A-8
IC304	H-12

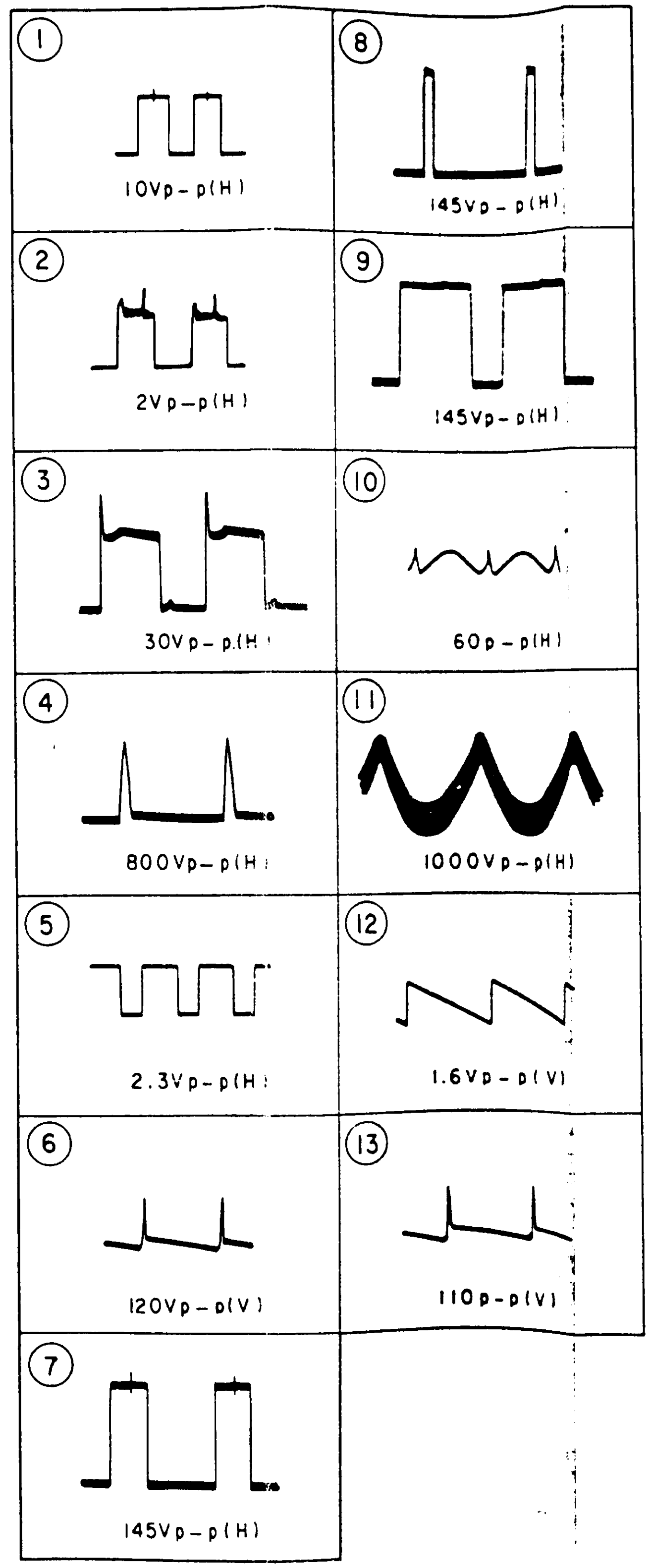
TRANSISTOR	
Q203	C-6
Q204	I-6
Q205	F-7
Q206	G-7
Q207	G-7
Q208	F-7
Q209	E-7
Q210	E-6
Q213	E-11
Q214	E-11
Q215	E-12
Q216	E-12
Q217	E-10
Q218	E-12
Q219	E-12
Q220	D-12
Q221	E-13
Q301	I-12
Q302	H-11
Q303	I-10
Q304	I-10
Q305	I-9
Q306	I-8
Q307	I-11
Q401	I-3
Q402	D-10
Q403	D-10
Q404	D-10
Q405	G-6
Q406	E-6
Q407	B-5
Q408	B-7
Q502	A-11
Q503	A-13
Q601	B-2
Q602	B-2
Q603	B-2
Q604	B-2
Q605	C-7
Q606	B-2
Q607	B-5
Q701	A-10
Q702	A-10
Q703	B-8

DIODE	
D105	C-10
D106	C-13
D107	C-13
D108	D-13
D111	C-12
D200	C-5
D201	D-6
D202	I-7
D204	F-6
D205	D-7
D206	F-7
D207	D-11
D208	D-11
D209	F-11
D210	E-10
D211	D-10
D212	D-9
D214	D-11
D215	F-12
D220	C-12
D221	D-10
D222	D-10
D223	F-7
D224	F-7
D225	C-6
D301	H-11
D302	H-10
D303	I-10
D304	I-10
D305	I-11
D401	H-1
D403	I-1
D404	E-2
D405	D-2
D406	D-9
D407	D-10
D408	B-7
D409	D-11
D410	E-4
D412	D-11
D414	E-4
D415	D-11
D416	D-11
D417	F-6
D418	B-6
D507	C-13
D508	C-13
D509	B-9
D513	B-11
D514	B-11
D515	A-12
D516	A-12
D517	B-13
D519	D-12
D601	C-4
D602	B-5
D603	C-3
D604	C-2
D605	C-2
D606	B-5
D607	B-5
D608	A-4
D609	A-5
D610	C-1
D611	B-4
D701	A-10
D702	A-10

VARIABLE RESISTOR	
RV601	A-5

• : Pattern from the side which enables seeing.
• : Pattern of the rear side.

D4 BOARD WAVEFORMS



D4

(HEAT PROTECTOR, H SIZE PWM GEN, V STOP PROTECTOR, HV REG 1, HV PROT 1, BEAM PROTECT 1, BEAM PROTECT 2

CN401 20P BLK :HDS

HD	1
VD	2
H.FBP	3
HVD	4
HV.STOP	5
CS 1	6
CS 2	7
CS 3	8
CS 4	9
CS 5	10
GND	11
ØF	12
V.PARA	13
V.SIZE	14
H.SIZE	15
PIN	16
GND	17
H.STAT	18
V.STAT	19
H.CENT	20

TO N1 BOARD CN901

CN409 10P WHT :S-MICRO

+65V	1
-20V	2
+20V	3
GND	4
+5V	5
-12V	6
GND	7
+12V	8
GND	9
+B	10

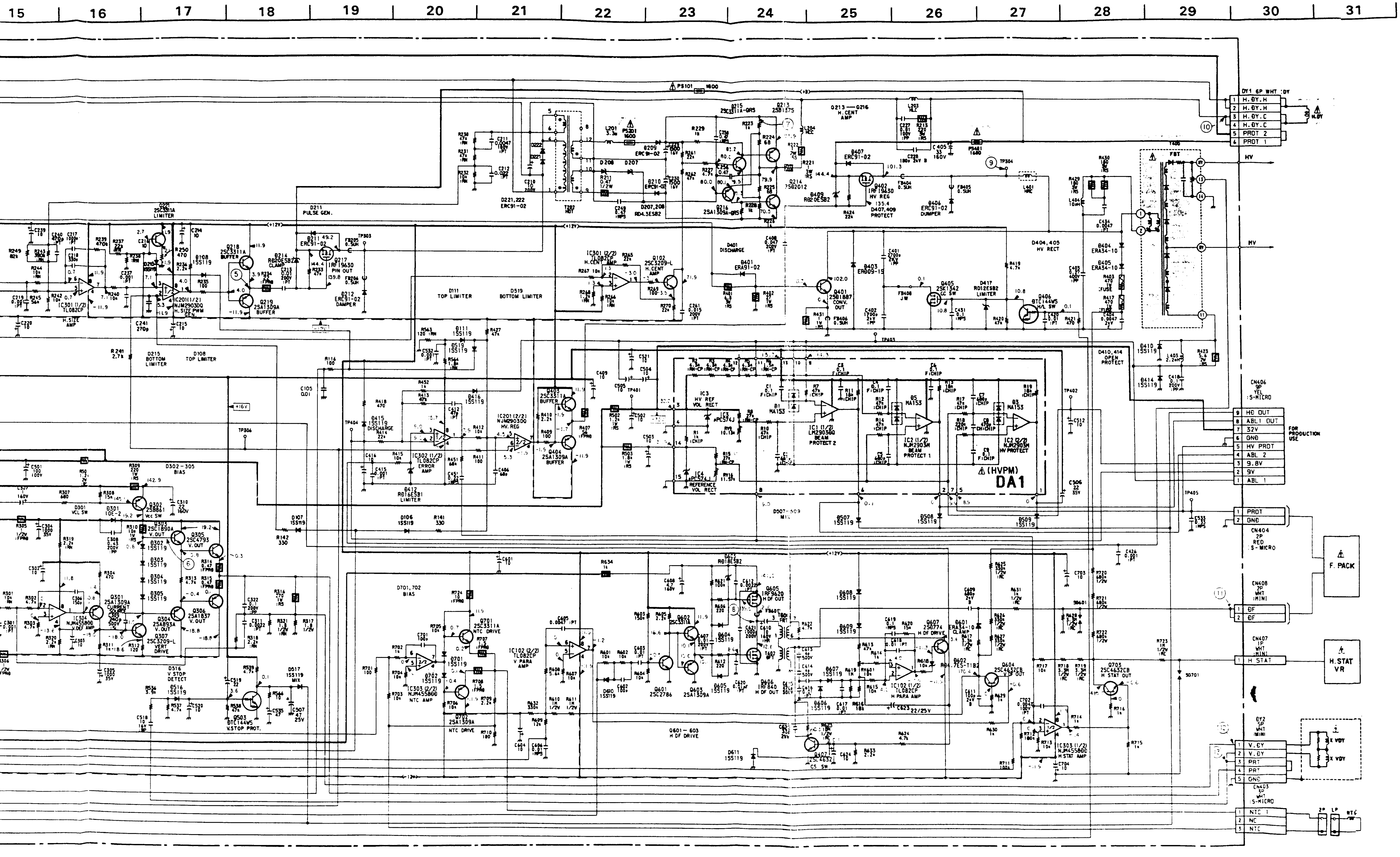
TO G BOARD CNG-6

CN402 12P BLK :HDS

HD	1
+5V	2
GND	3
+12V	4
-12V	5
MUTE	6
HV.STOP	7
GND	8
HL	9
TR	10
LIM	11
HVD	12

TO N1 BOARD CN902

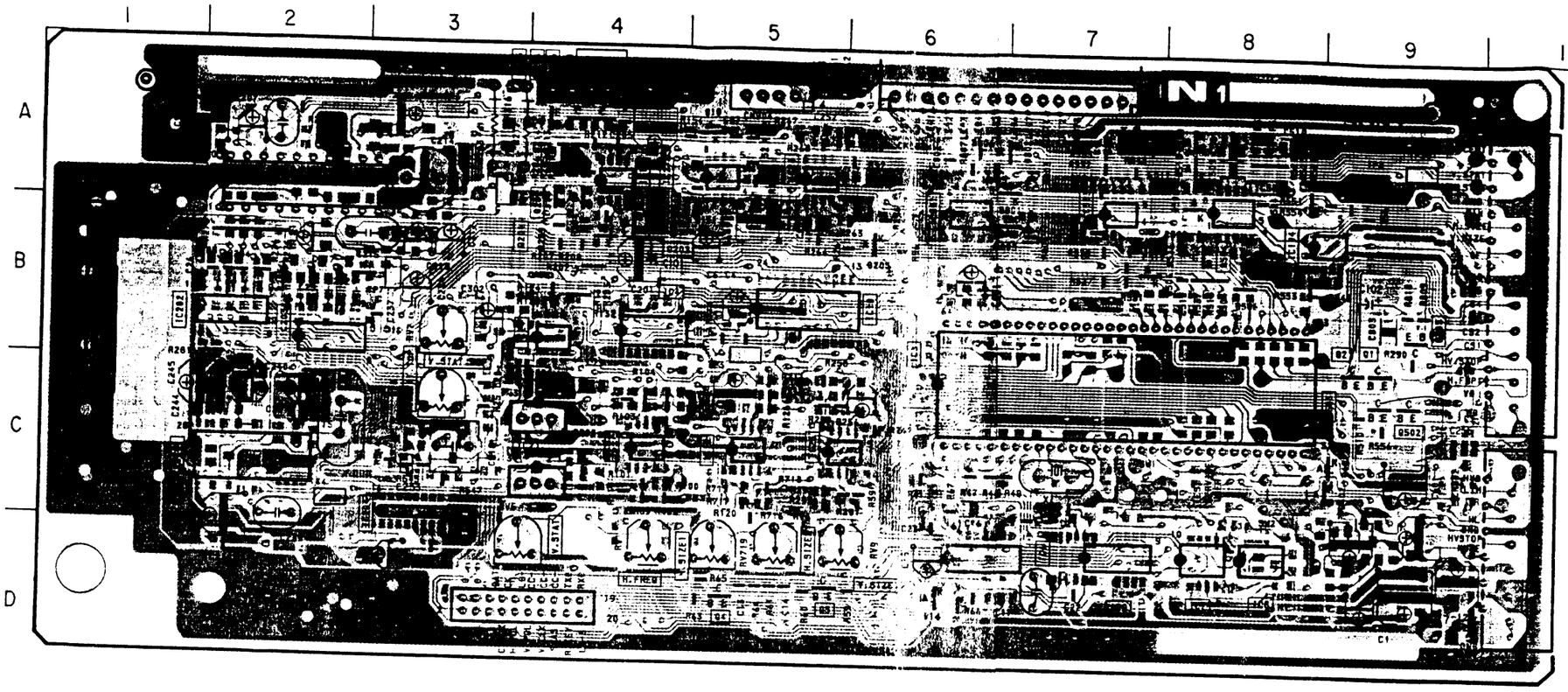
D204 – 206, D223, 224 PROTECT


15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
DY1 6P WHT :DY
H.DY.H
H.DY.H
H.DY.C
H.DY.C
PROT 2
PROT 1
HV
MV
FBT
HD OUT
ABL1 OUT
32V
GND
HV PROT
ABL 2
9.8V
9V
ABL 1
FOR PRODUCTION USE
PROT
GND
F. PACK
DF
DF
H.STAT
H.STAT VR
V.DY
V.DY
PRT
PRT
GND
NTC 1
NC
NTC
(HVPM)
DA1
H.CENT AMP
HV REG
HV RECT
PULSE GEN.
TOP LIMITER
BOTTOM LIMITER
DISCHARGE
BUFFER
LIMITER
CLAMP
DAMPER
PROTECT
OPEN PROTECT
BEAM PROTECT 2
BEAM PROTECT 1
HV PROTECT
HV REF VOL RECT
REFERENCE VOL RECT
ERROR AMP
H.SIZE AMP
V.DEF AMP
VERT DRIVE
V.OUT
V.STOP DETECT
V.STOP PROT.
BIAS
NTC AMP
NTC DRIVE
H PARA AMP
H DF DRIVE
H DF OUT
CS SW
H STAT OUT
H STAT AMP
H DRIVE
MIX

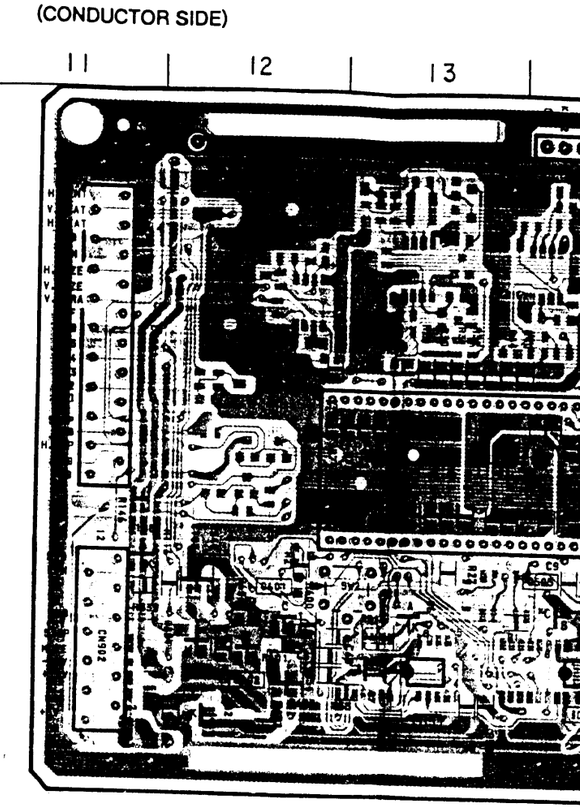
N1

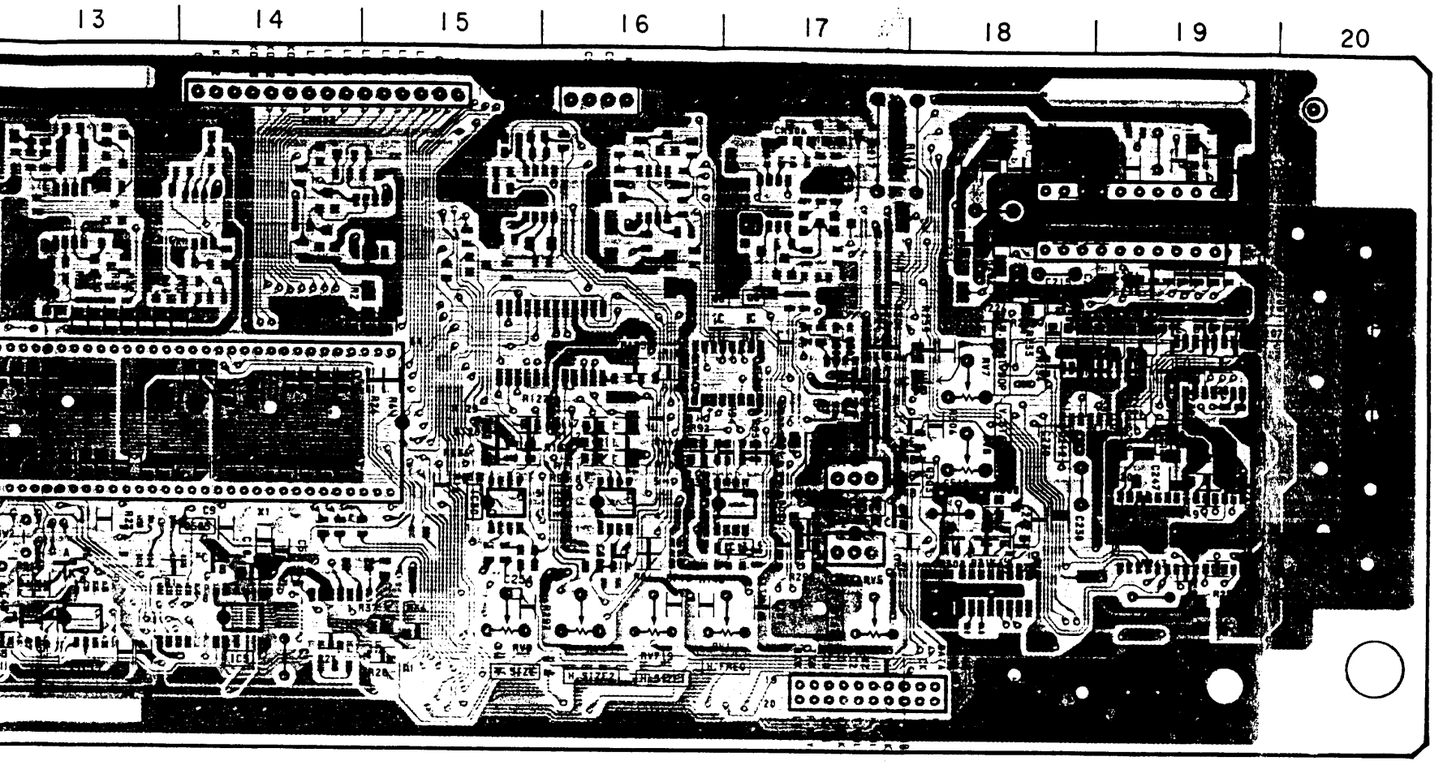
CPU, E² PROM, H. OSC, V. OSC
PHASE CONT, DAC, H. SAW GEN, VCO

– N1 BOARD –
(COMPONENT SIDE)



(CONDUCTOR SIDE)



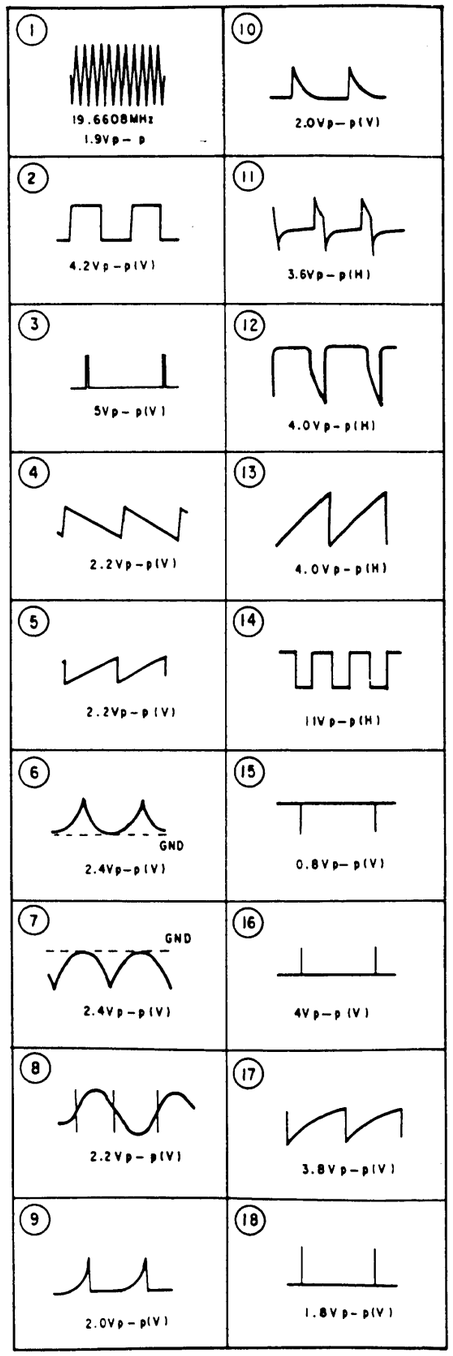


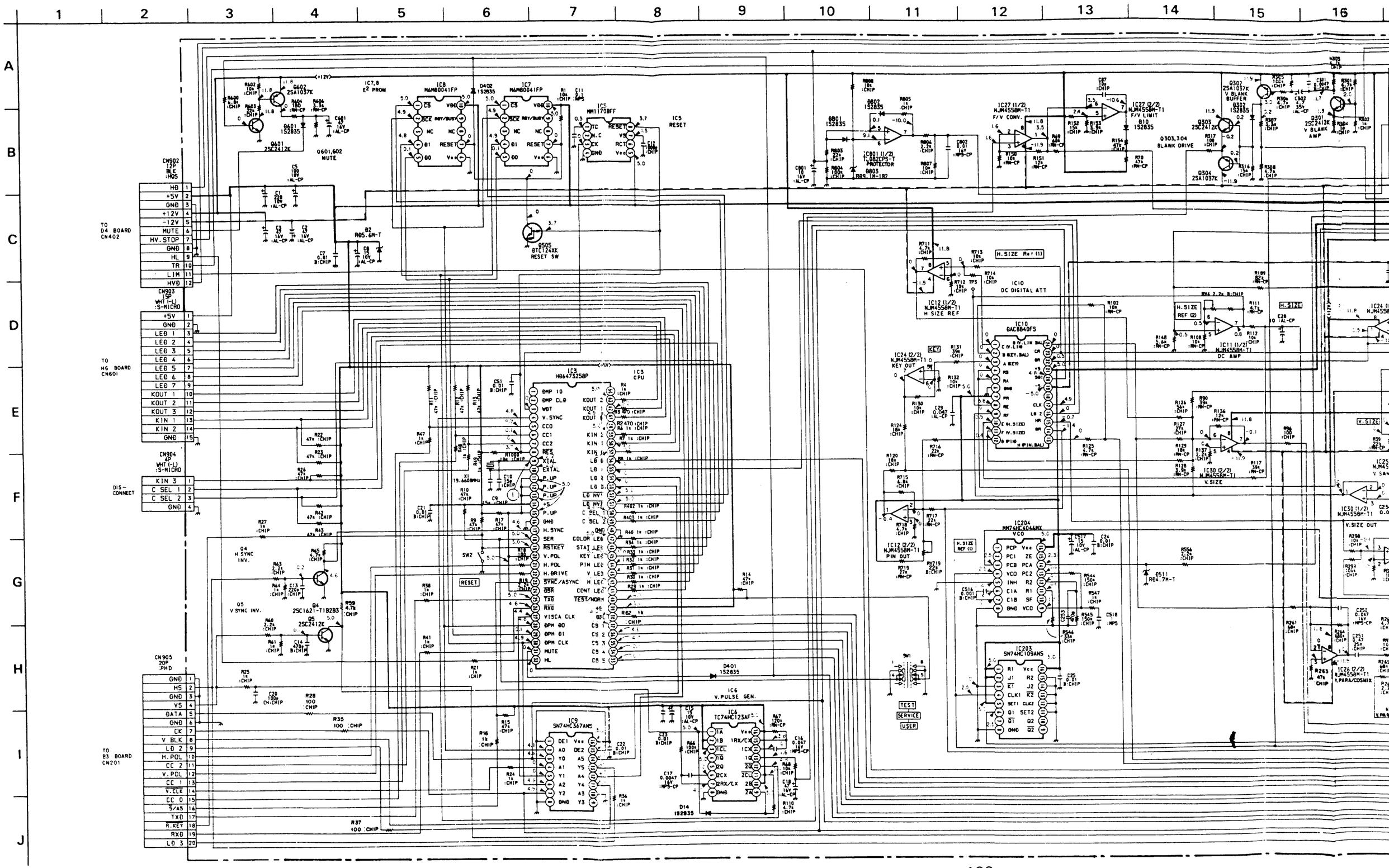
• : Pattern from the side which enables seeing.
• : Pattern of the rear side.

N1 BOARD LOCATION

IC		DIODE	
IC1	D-13	D2	D-12
IC2	C-3	D6	C-13
IC3	C-3	D7	D-13
IC4	B-4	D10	A-5
IC5	D-14	D14	D-6
IC6	D-7	D103	C-11
IC7	D-8	D201	B-4
IC8	D-8	D202	B-2
IC9	D-7	D203	C-19
IC10	B-6	D204	C-19
IC11	C-16	D205	B-6
IC12	C-5	D302	C-18
IC15	A-4	D401	C-9
IC16	C-16	D402	C-9
IC17	C-4	D504	B-8
IC24	B-3	D508	B-8
IC25	C-5	D509	A-8
IC26	A-5	D510	A-8
IC27	A-4	D511	C-3
IC30	C-15	D601	D-12
IC100	B-3	D801	B-7
IC101	A-1	D802	A-7
IC104	B-8	D803	B-7
IC201	C-1		
IC202	B-1	**VARIABLE RESISTOR**	
IC203	B-2		
IC204	C-3	RV1	D-4
IC502	A-8	RV4	D-6
IC503	A-7	RV5	D-4
IC801	A-6	RV7	B-3
		RV8	C-3
TRANSISTOR		RV9	D-6
		RV719	D-5
Q1	B-9		
Q2	B-9		
Q4	D-5		
Q5	D-6		
Q6	B-16		
Q8	B-16		
Q201	A-4		
Q202	A-4		
Q203	B-5		
Q204	A-4		
Q205	A-4		
Q206	A-4		
Q207	B-19		
Q208	B-19		
Q209	B-19		
Q210	B-19		
Q211	B-19		
Q212	B-18		
Q301	B-18		
Q302	C-18		
Q303	C-18		
Q304	C-17		
Q305	B-9		
Q502	C-9		
Q503	B-9		
Q504	B-8		
Q505	C-14		
Q601	D-12		
Q602	D-12		

N1 BOARD WAVEFORMS




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
A B C D E F G H I J
CN902 12P BLK :HDS
H0 1
+5V 2
GND 3
+12V 4
-12V 5
MUTE 6
HV. STOP 7
GND 8
HL 9
TR 10
LIM 11
HV0 12
TO D4 BOARD CN402
CN903 10P WHT (-L) :S-MICRO
+5V 1
GND 2
LED 1 3
LED 2 4
LED 3 5
LED 4 6
LED 5 7
LED 6 8
LED 7 9
KOUT 1 10
KOUT 2 11
KOUT 3 12
KIN 1 13
KIN 2 14
GND 15
TO H6 BOARD CN601
CN904 4P WHT (-L) :S-MICRO
KIN 3 1
C SEL 1 2
C SEL 2 3
GND 4
DIS-CONNECT
CN905 20P :PHD
GND 1
HS 2
GND 3
VS 4
DATA 5
GND 6
CK 7
V BLK 8
L0 2 9
H. POL 10
CC 2 11
V. POL 12
CC 1 13
V. CLK 14
CC 0 15
S/AS 16
TXD 17
R. KEY 18
RXD 19
L0 3 20
TO B3 BOARD CN201
+12V
+5V
IC7,8 E² PROM
IC8 M6M80041FP
IC7 M6M80041FP
IC5 MM1170BFF
IC5 RESET
IC3 H06473258P
IC3 CPU
IC9 SN74HC367ANS
IC6 TC74HC123AF
IC6 V.PULSE GEN.
IC10 BAC8840FS
IC10 DC DIGITAL ATT
IC27 (1/2) NJM4558M-T1 F/V CONV.
IC27 (2/2) NJM4558M-T1 F/V LIMIT
IC11 (1/2) NJM4558M-T1 DC AMP
IC12 (1/2) NJM4558M-T1 H SIZE REF
IC12 (2/2) NJM4558M-T1 PIN OUT
IC24 (2/2) NJM4558M-T1 KEY OUT
IC30 (2/2) NJM4558M-T1 V.SIZE
IC30 (1/2) NJM4558M-T1 V.SIZE OUT
IC26 (2/2) NJM4558M-T1 V.PARA/COSMIX
IC204 MM74HC4046MX VCO
IC203 SN74HC109ANS
Q801 2SA1037K
Q802 2SA1037K
Q601 2SC2412K
Q602 2SA1037K
Q505 DTC124XK RESET SW
Q4 2SC1621-T1B2B3
Q5 2SC2412K
Q302 2SA1037K V BLANK BUFFER
Q303 2SC2412K
Q304 2SA1037K
Q301 2SC2412K V BLANK AMP
0303,304 BLANK DRIVE
D401 1S2835
D402 1S2835
D14 1S2835
D801 1S2835
D802 1S2835
D803 RBS-1H-1B2
D511 RB4.7M-T
X1 19.6608MHz
SW1
SW2
TEST
SERVICE
USER
RESET
H.SIZE REF (1)
H.SIZE REF (2)
H.SIZE
V.SIZE
V.SIZE OUT
KEY
MUTE
H SYNC INV.
V SYNC INV.

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

H.SAW GEN.

IC104 H STOP

IC15 H.PHASE AMP

IC1C1 H.OSC V.OSC H.PHASE X-RAY PROT.

IC101 LA7856

IC201 CXA1470M WAVE GEN.

IC4 M62353FP DC ATT

IC202 TC40539FHB

IC100 μPC78M05H +5V REG

IC2 μPC79M05H -5V REG

V.STAT TOP

V.STAT BOTTOM

V.SIZE REF

V.STAT REF

H.CENT

H SIZE MUTE

H SYNC MUTE

H.PHASE SELECT

H SAW SELECT

AFC SELECT

CN901 20P BLK :HDS

1	H0
2	V0
3	H.FBP
4	HVD
5	HV.STOP
6	CS1
7	CS2
8	CS3
9	CS4
10	CS5
11	GND
12	OF
13	V.PARA
14	V.SIZE
15	H.SIZE
16	PIN
17	GND
18	H.STAT
19	V.STAT
20	H.CENT

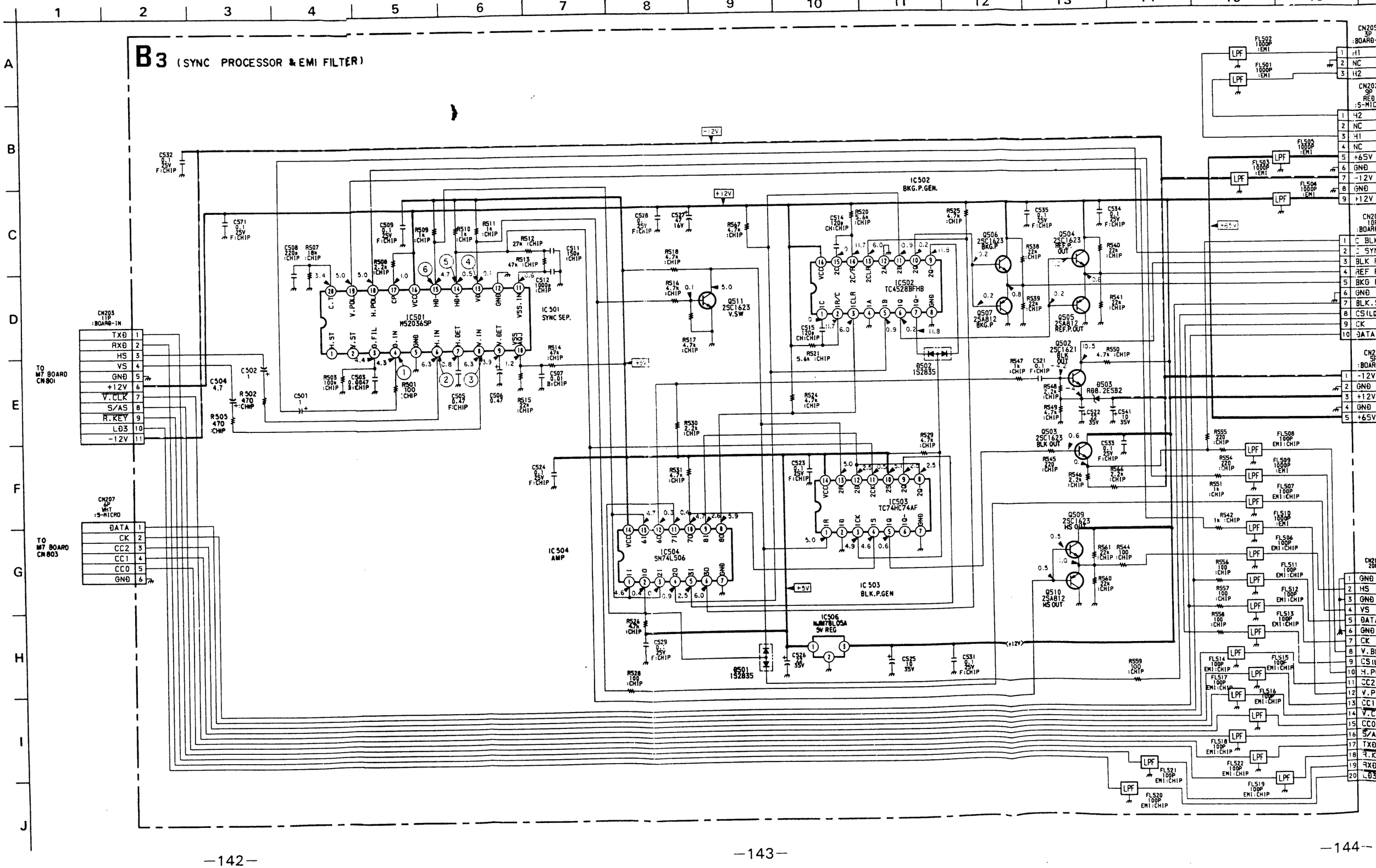
TO D4 BOARD CN401

N1

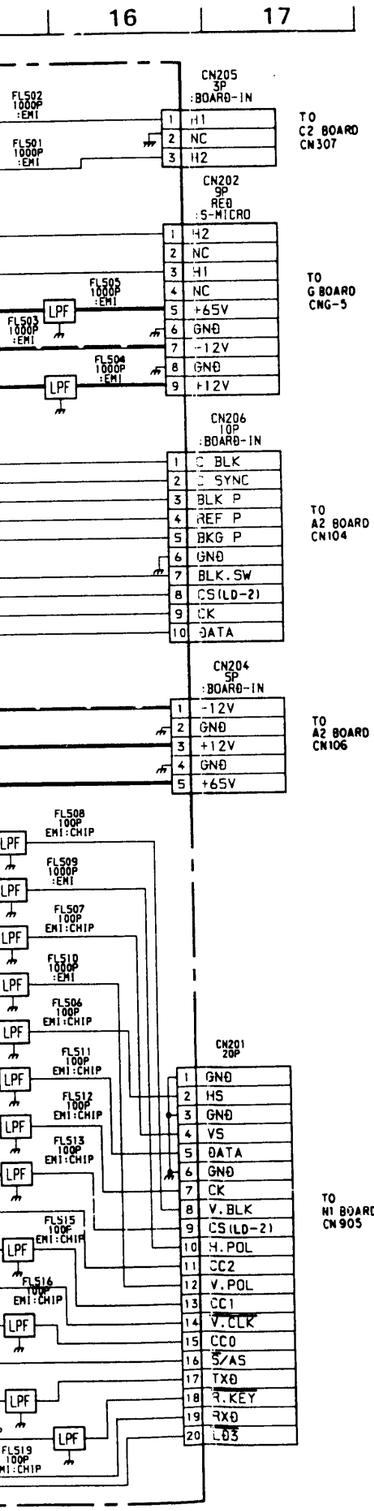
(CPU, E² PROM, H.OSC, V.OSC PHASE CONT, DAC, H.SAW GEN, VCO)

GDM-2039 GDM-2039

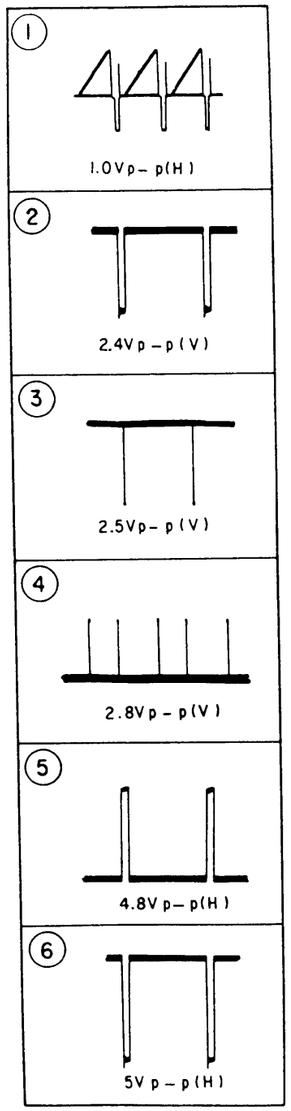
B3 (SYNC PROCESSOR & EMI FILTER)



B3 [SYNC PROCESSOR & EMI FILTER]

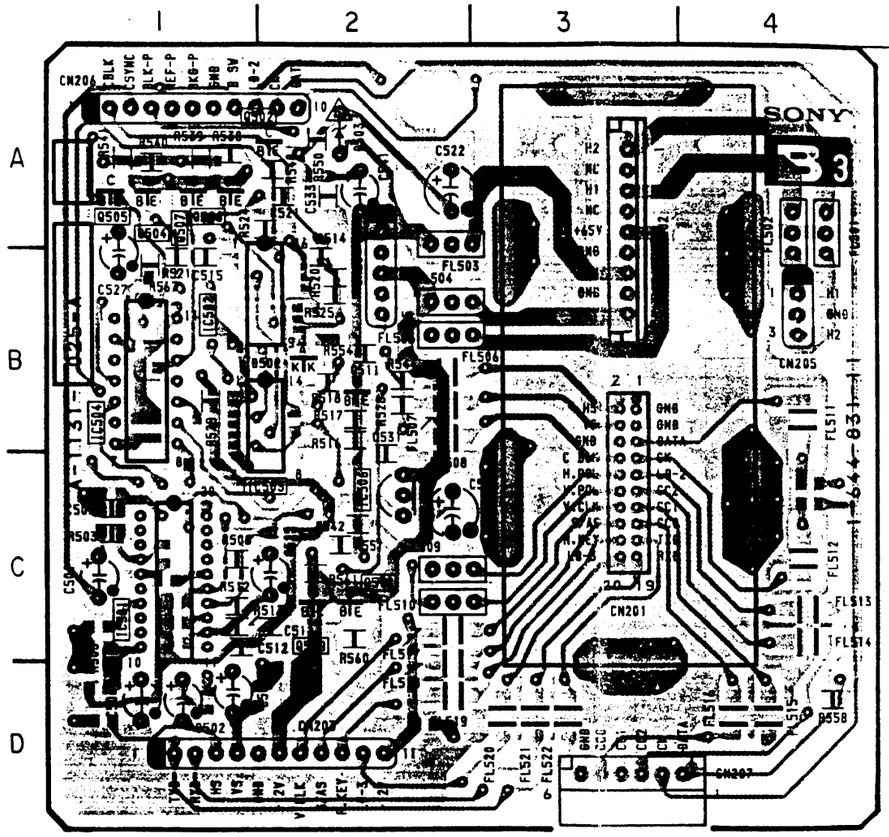


B3 BOARD WAVEFORMS

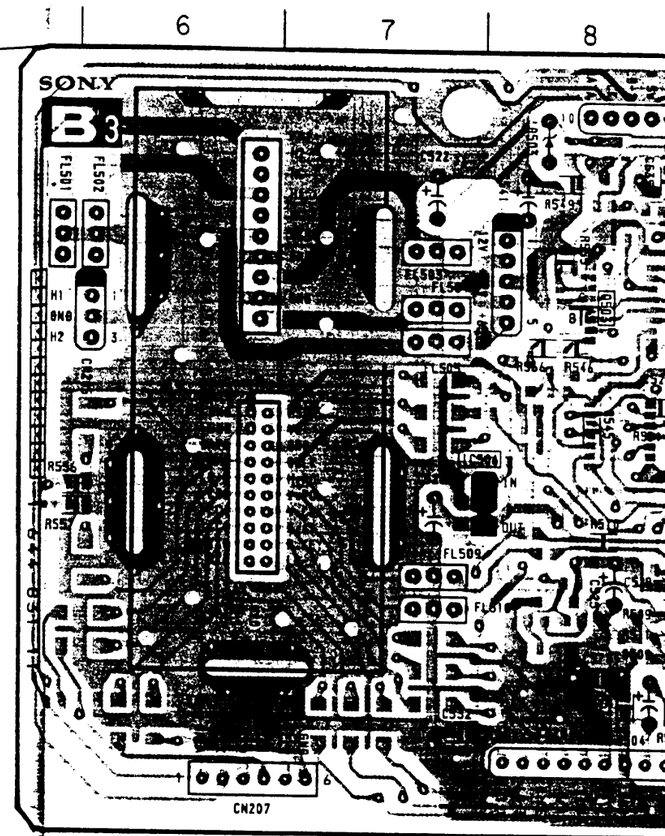


– B3 BOARD –

(COMPONENT SIDE)

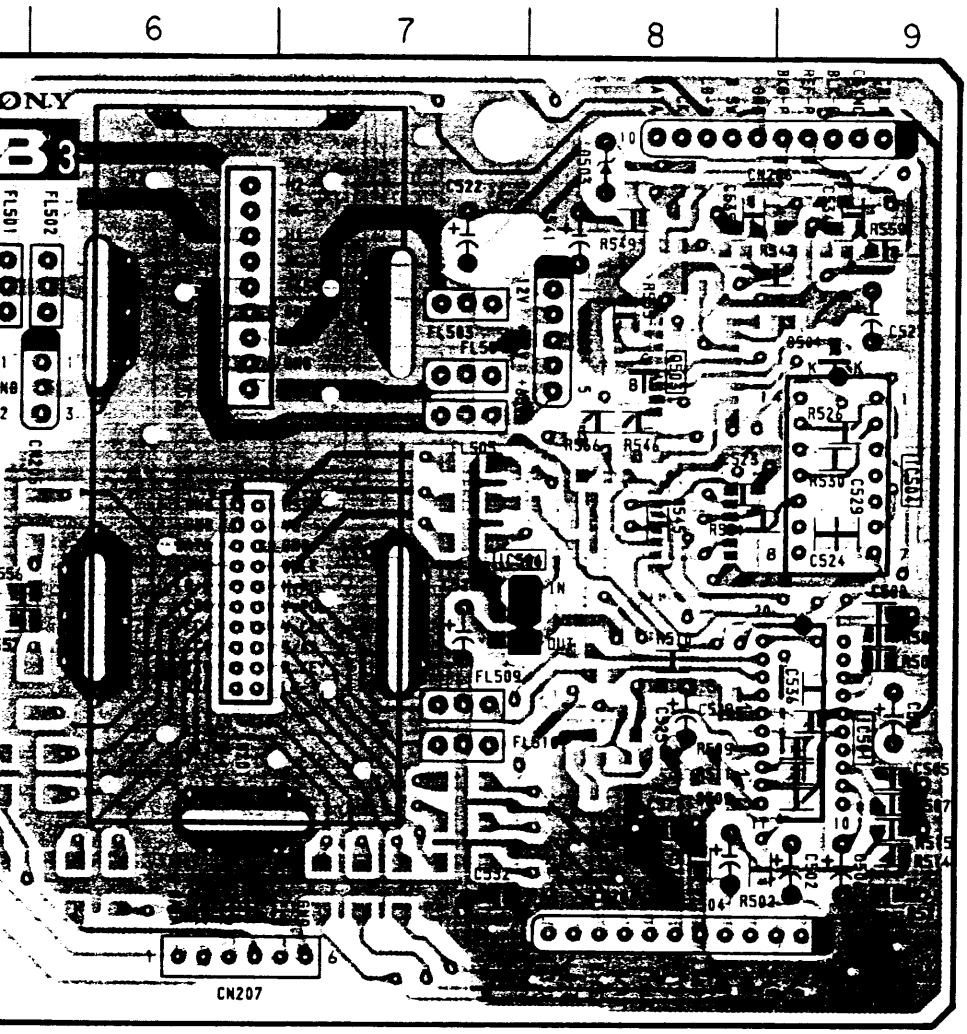


(CONDUCTOR SIDE)



• : Pattern from the side
• : Pattern of the rear sic

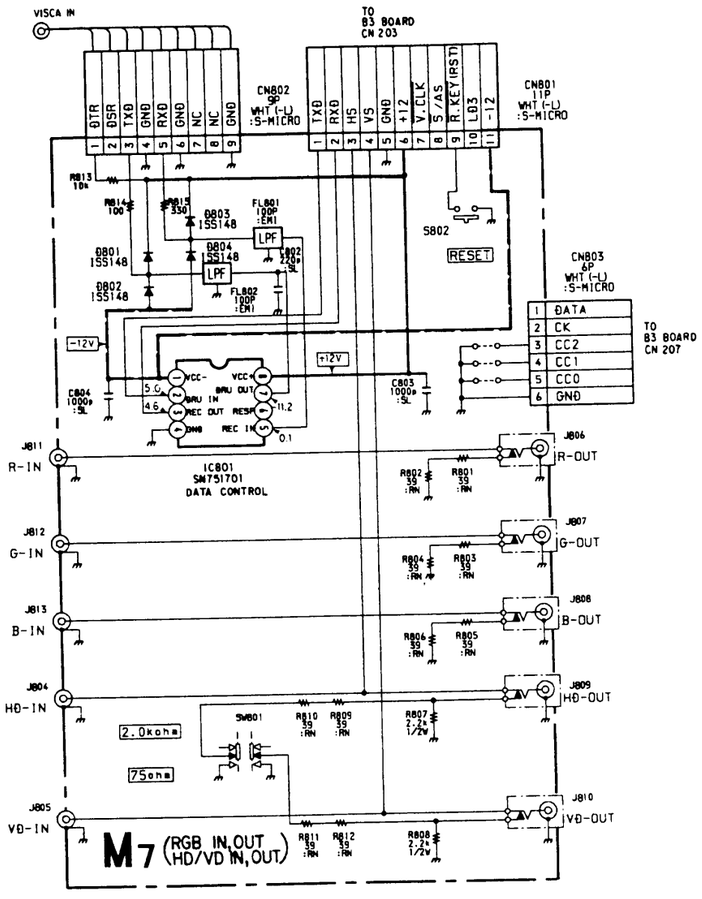
DUCTOR SIDE)

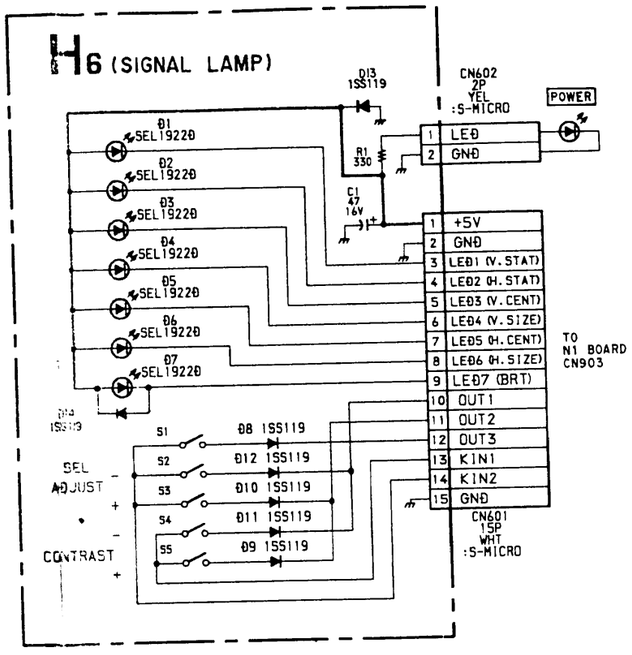


B3 BOARD LOCATION

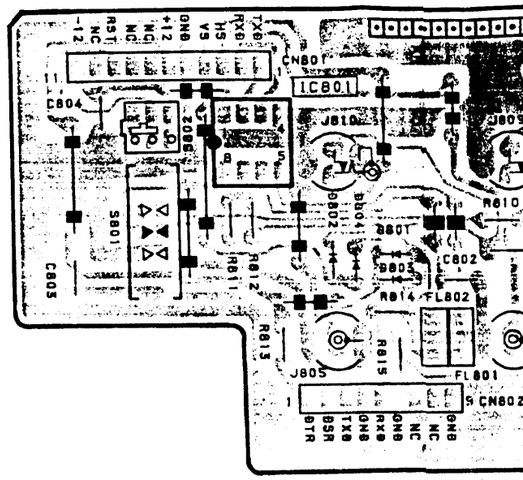
IC	
IC501	C-1
IC502	B-1
IC503	C-1
IC504	B-1
IC506	C-2
TRANSISTOR	
Q502	A-1
Q503	B-8
Q504	A-1
Q505	A-1
Q506	A-1
Q507	A-1
Q509	C-2
Q510	C-2
Q511	B-2
DIODE	
D501	B-9
D502	B-1
D503	A-2

• : Pattern from the side which enables seeing.
• : Pattern of the rear side.

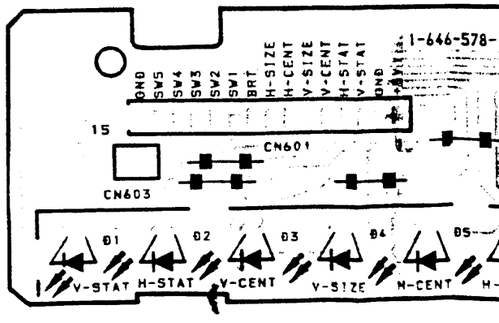




– M7 BOARD –

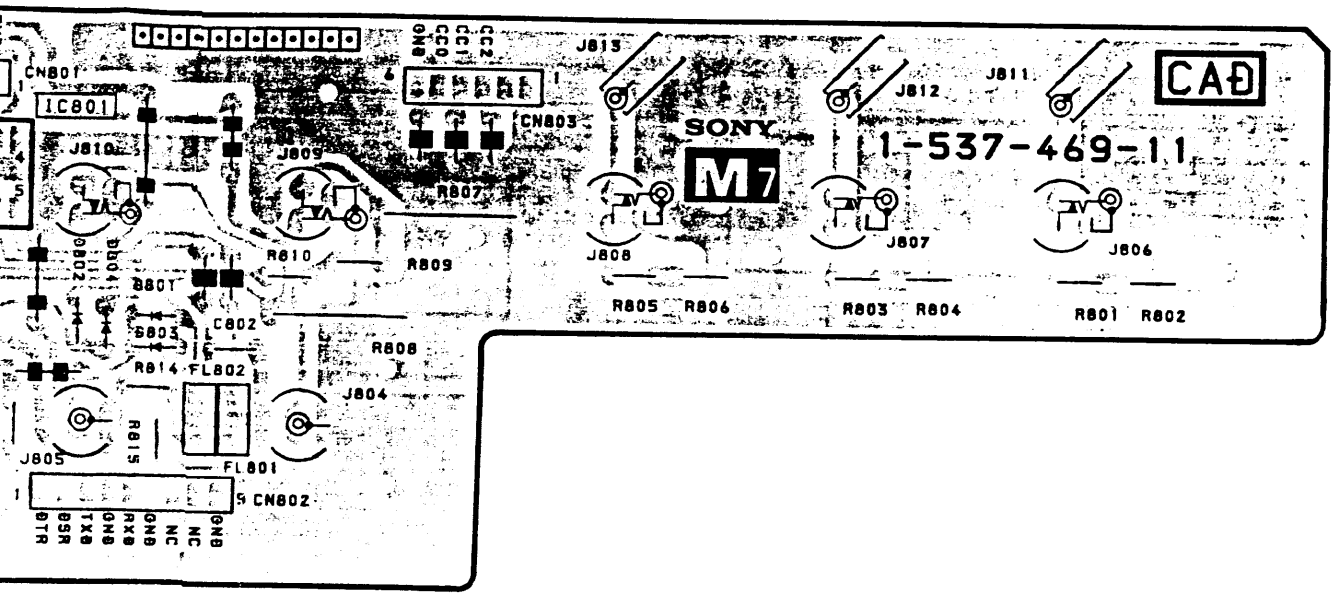


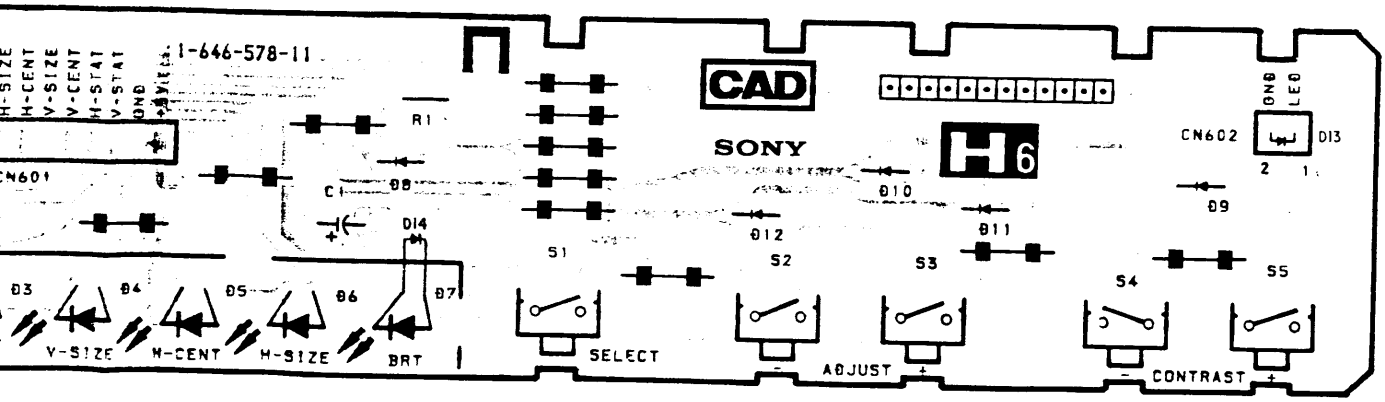
– H6 BOARD –



HD/VD IN, OUT]

H6 [SIGNAL LAMP]

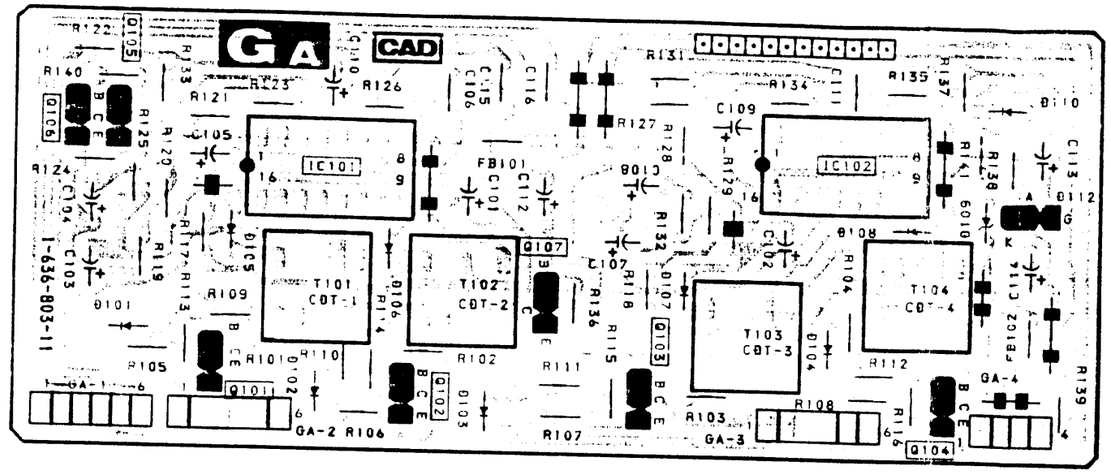




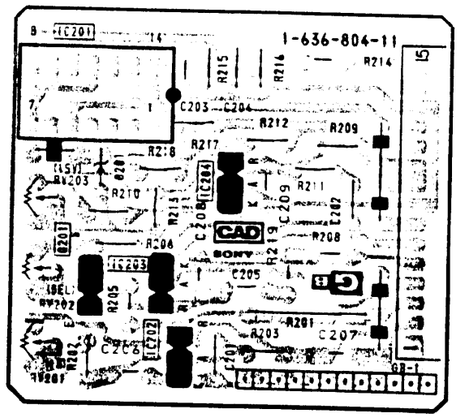
GA [POWER CONTROL]

GB [CONSTANT-VOLTAGE]

– GA BOARD –

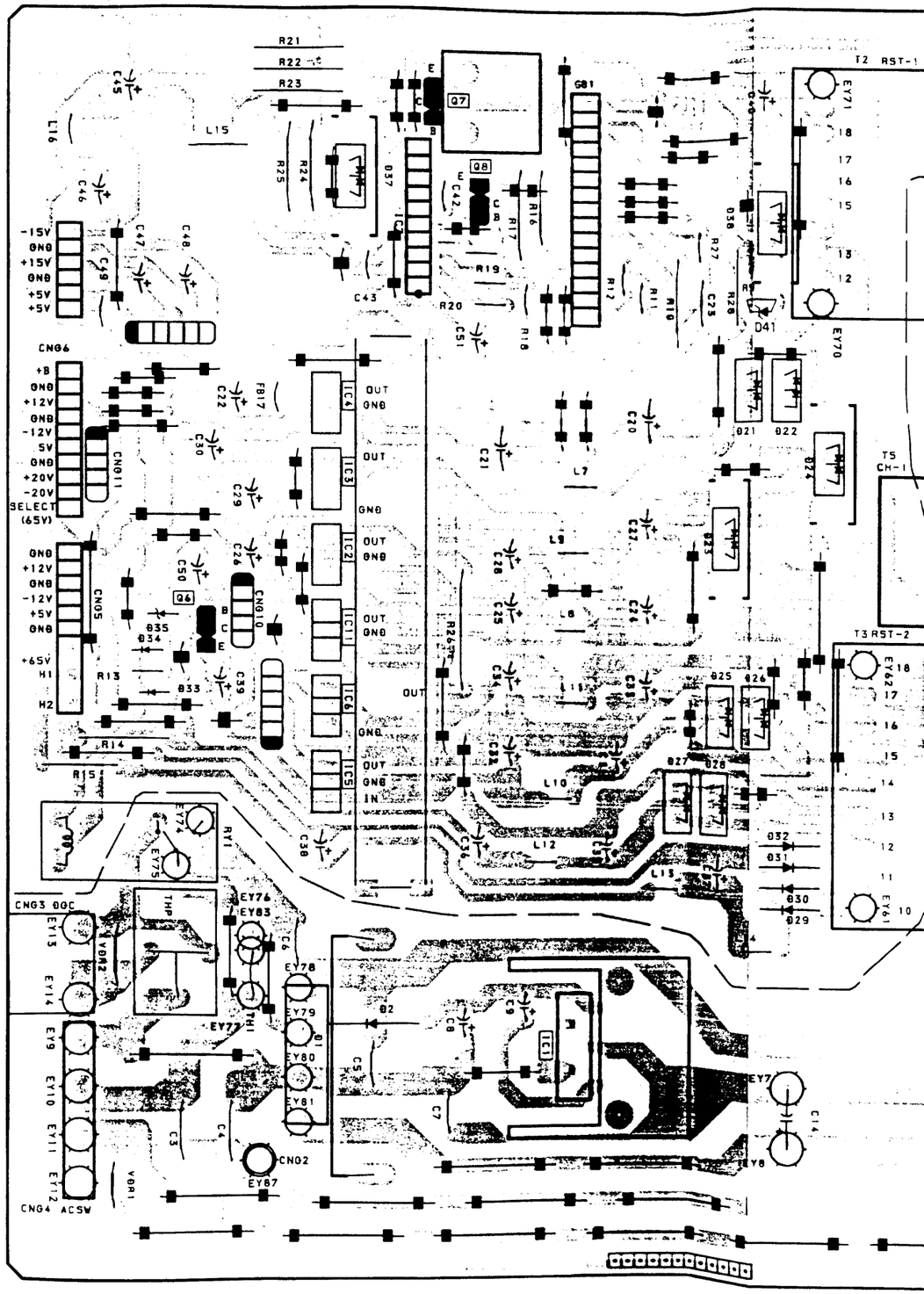


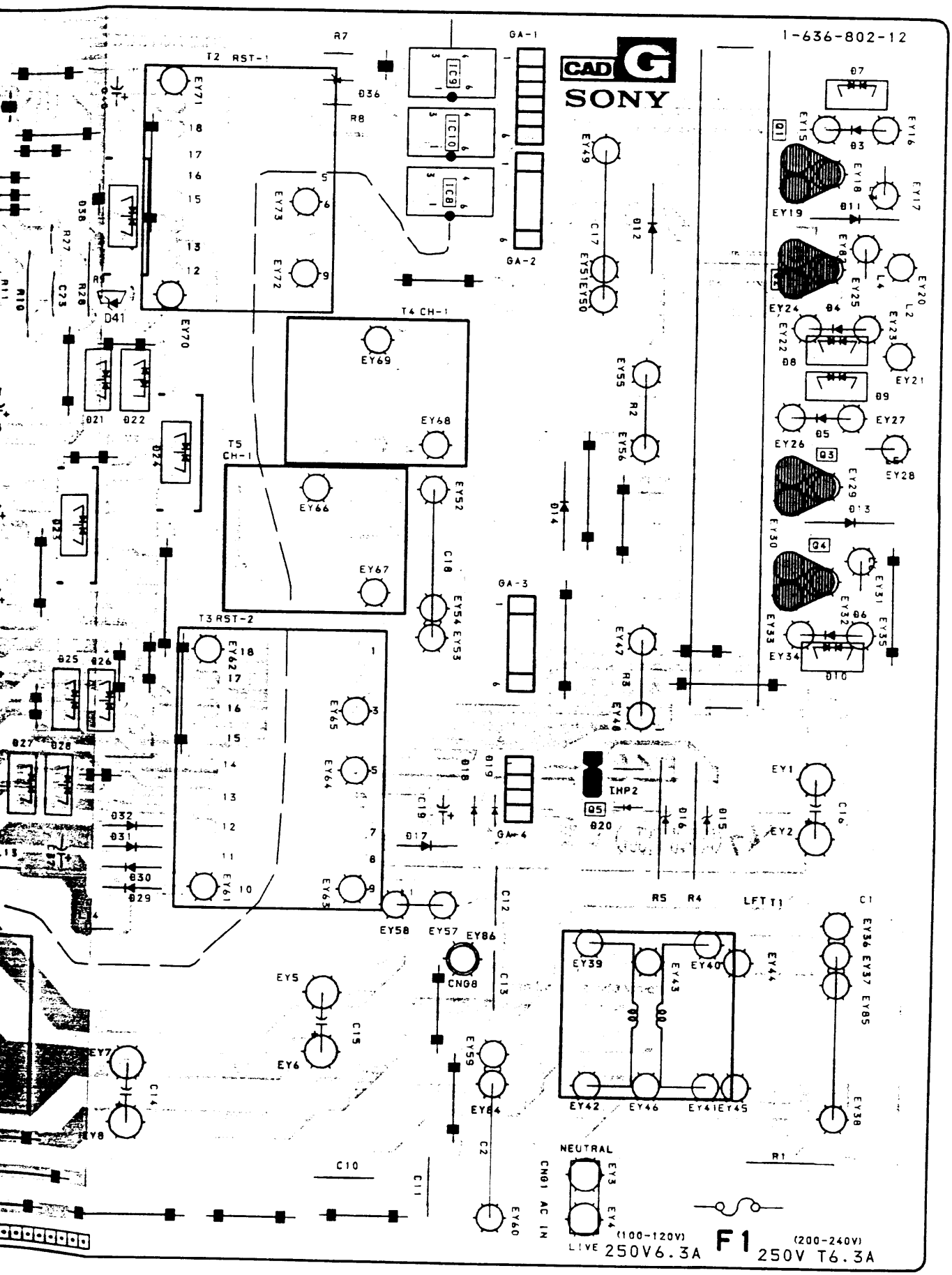
– GB BOARD –

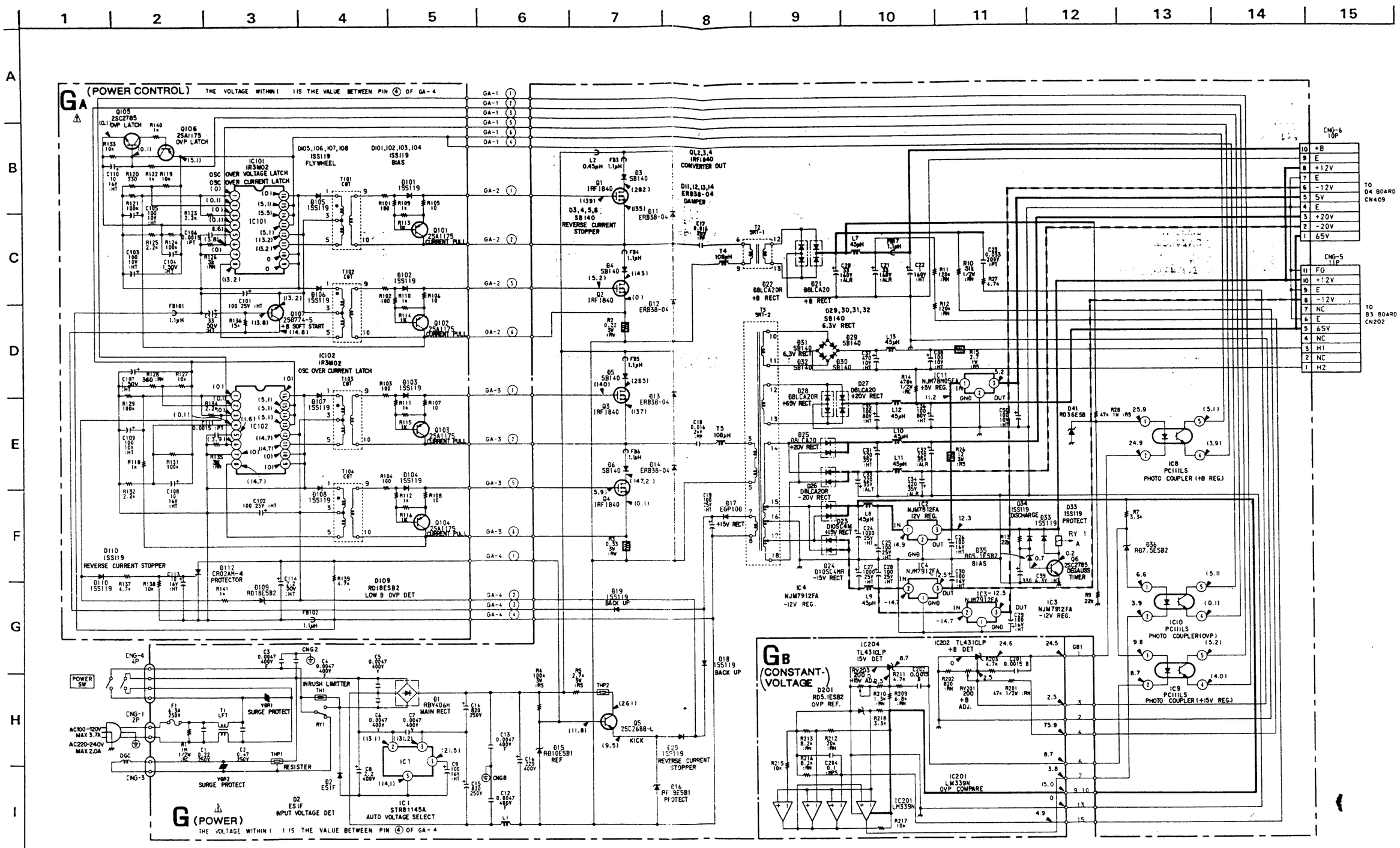


G [POWER]

– G BOARD –

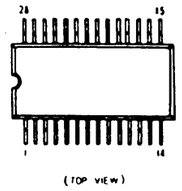



1-636-802-12
CAD
SONY
T2 RST-1
T4 CH-1
T5 CH-1
T3 RST-2
GA-1
GA-2
GA-3
GA-4
D41
IMP2
NEUTRAL
LIVE
(100-120V)
250V6.3A
F1
(200-240V)
250V T6.3A

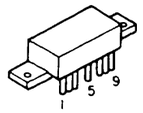

GA (POWER CONTROL) THE VOLTAGE WITHIN ( ) IS THE VALUE BETWEEN PIN ④ OF GA-4
Q105 2SC2785 OVP LATCH
Q106 2SA1175 OVP LATCH
IC101 IR3M02 OVER VOLTAGE LATCH OSC OVER CURRENT LATCH
IC102 IR3M02 OSC OVER CURRENT LATCH
D105,106,107,108 1SS119 FLYWHEEL
D101,102,103,104 1SS119 BIAS
Q101 2SA1175 CURRENT PULL
Q102 2SA1175 CURRENT PULL
Q103 2SA1175 CURRENT PULL
Q104 2SA1175 CURRENT PULL
Q107 2SB774-S +B SOFT START
Q1 IRF1840
Q2 IRF1840
Q3 IRF1840
Q4 IRF1840
D1,2,3,4 ERB38-04 DAMPER
D3,4,5,6 SB140 REVERSE CURRENT STOPPER
Q105 1SS119 BACK UP
Q1,2,3,4 IRF1840 CONVERTER OUT
T2 SWT-1
T3 SWT-2
T4 108μH
T5 108μH
D22 B8LCA20R +B RECT
D21 B8LCA20 +B RECT
D29,30,31,32 SB140 6.3V RECT
D31 SB140 6.3V RECT
D32 SB140
D29 SB140
D30 SB140
D28 B8LCA20R +65V RECT
D27 D8LCA20 +20V RECT
D25 D8LCA20 +20V RECT
D26 D8LCA20R -20V RECT
D23 D10SC4M +15V RECT
D24 D10SC4MR -15V RECT
D17 EGP10B +15V RECT
D18 1SS119 BACK UP
D19 1SS119 BACK UP
D110 1SS119 REVERSE CURRENT STOPPER
D112 ERA24N-4 PROTECTOR
D109 RD18ESB2 LOW B OVP DET
D111,12,13,14 ERB38-04 DAMPER
D11 ERB38-04
D12 ERB38-04
D13 ERB38-04
D14 ERB38-04
D15 RD10ESB1 REF
D16 RD9.1ESB1 PROTECT
D33 1SS119 PROTECT
D34 1SS119 DISCHARGE
D35 RD5.1ESB2 BIAS
D41 RD36ESB
D36 RD7.5ESB2
IC1 STR81145A AUTO VOLTAGE SELECT
IC2 NJM7812FA 12V REG.
IC3 NJM7912FA -12V REG.
IC4 NJM7912FA -12V REG.
IC8 PC111LS PHOTO COUPLER (+B REG.)
IC9 PC111LS PHOTO COUPLER (+15V REG.)
IC10 PC111LS PHOTO COUPLER (OVP)
IC11 NJM78M05FA +5V REG.
IC201 LM339N OVP COMPARE
IC202 TL431CLP +B DET
IC204 TL431CLP 15V DET
Q6 2SC2785 DEGAUSS TIMER
Q5 2SC2688-L KICK
D201 RD5.1ESB2 OVP REF.
CNG-6 10P
CNG-5 11P
TO D4 BOARD CN409
TO B3 BOARD CN202
GB (CONSTANT-VOLTAGE)
G (POWER) THE VOLTAGE WITHIN ( ) IS THE VALUE BETWEEN PIN ④ OF GA-4
POWER SW
AC100-120V MAX 3.7A
AC220-240V MAX 2.0A
INRUSH LIMITTER
SURGE PROTECT
RESISTER
D2 ESIF INPUT VOLTAGE DET
D1 RBV406M MAIN RECT

7-5. SEMICONDUCTORS

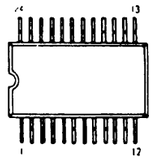
CXA1470M



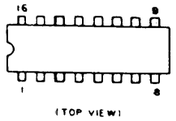
CR2424A



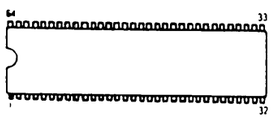
DAC8840FS



HD14053BFP
IR3M02
M62353P
SM74HC367ANS
TC74HC123AF

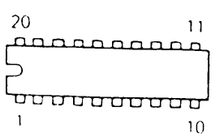


HD6433258P10
HD6473258P10



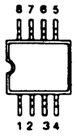
(Top view)

LA7856A
M52036SP



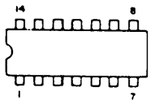
(Top view)

LM2903M
MM1170BF
NJM2903M
NJM4558M
TL082CPS
μPC4558G2



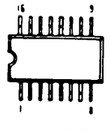
(TOP VIEW)

LM339N
SN74LS06N



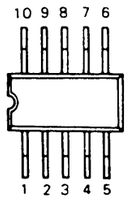
(TOP VIEW)

MC14528BF
MM74HC4046M
M62353FP
SN74HC109ANS
TC4053BF
TC4528BFHB

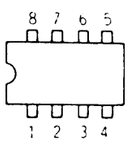


(TOP VIEW)

M6M80041FP

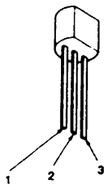


NJM2903D
NJM4558D-D
TL082CP
μPC4558C
μPC814G2-1

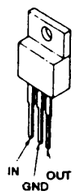


(Top view)

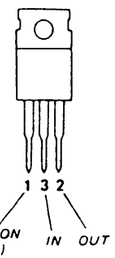
NJM78L05A



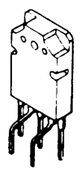
NJM78M05FA
NJM7812FA



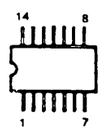
NJM7912FA



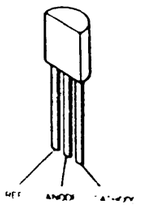
STR-81145FA



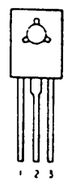
TC74HC74AF



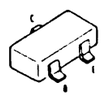
TL431CLP



μPC78N05H
μPC79N05H

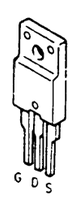


DTC124XK
2SA1037K-QR
2SA1162-G
2SA1462
2SA812
2SC1621
2SC1623-L5L6
2SC2412K
2SC2412K-QR
2SC3052F
2SC3360-N16
2SC3545



DTC144WS

IRFI1004
IRF19620
IRF840



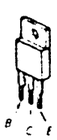
IRFI840
IRFI9630

IRL520

2SA1130-06
2SC3209-L
2SC3209-LK
2SD774-34
2SD774-5

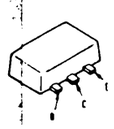
2SA1175
2SA1175-HFE
2SA1309A-QRS
2SC2785-HFE
2SC2786
2SC3311A-QRS

2SA1837
2SB1094-LK
S2B1375
2SB861
2SC4632-CB7
2SC4793
2SD2012

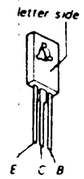


2SA893A
2SC1890A
2SC2909

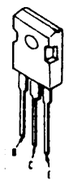
2SB1005-BV
2SB798
2SB798-DL
2SD1366A
2SD999



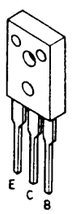
2SC2688
2SD986-L



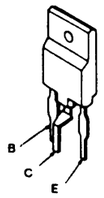
2SC3997-CA



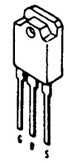
2SD1724



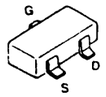
2SD1887-CA



2SK1342



2SK160-06



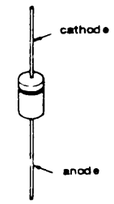
CR02AM-4

DD50R

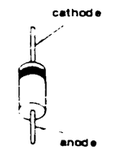
D8LCA20
D10SC4M

D8LCA20R
D10SC4MR

EGP10D
ERA34-10
ERA91-02
ERB38-04
ERC38-06
ERC91-02
RGP10G
RU-3AM



ERD09-15



ES1F
SB140
1SS82
1SS83

MA110

RBV-406H-01

RD10ES-B1
RD12ES-B2
RD16ES-B1
RD18ES-B1
RD18ES-B2
RD20ES-B2
RD30ES-B2
RD30ES-B4
RD36ES-B
RD4.7ES-B2
RD5.1ES-B2
RD7.5ES-B2
RD8.2ES-B1
RD8.2ES-B2
1SS119

RD10M-B2
RD12M-B2
RD4.7M-B2
RD5.6M-B3
RD9.1M-B2

V19E

1SS123
1SS226

1S2835
1S2836

PC111LS

SEL1922D-C

SECTION 8
EXPLODED VIEWS

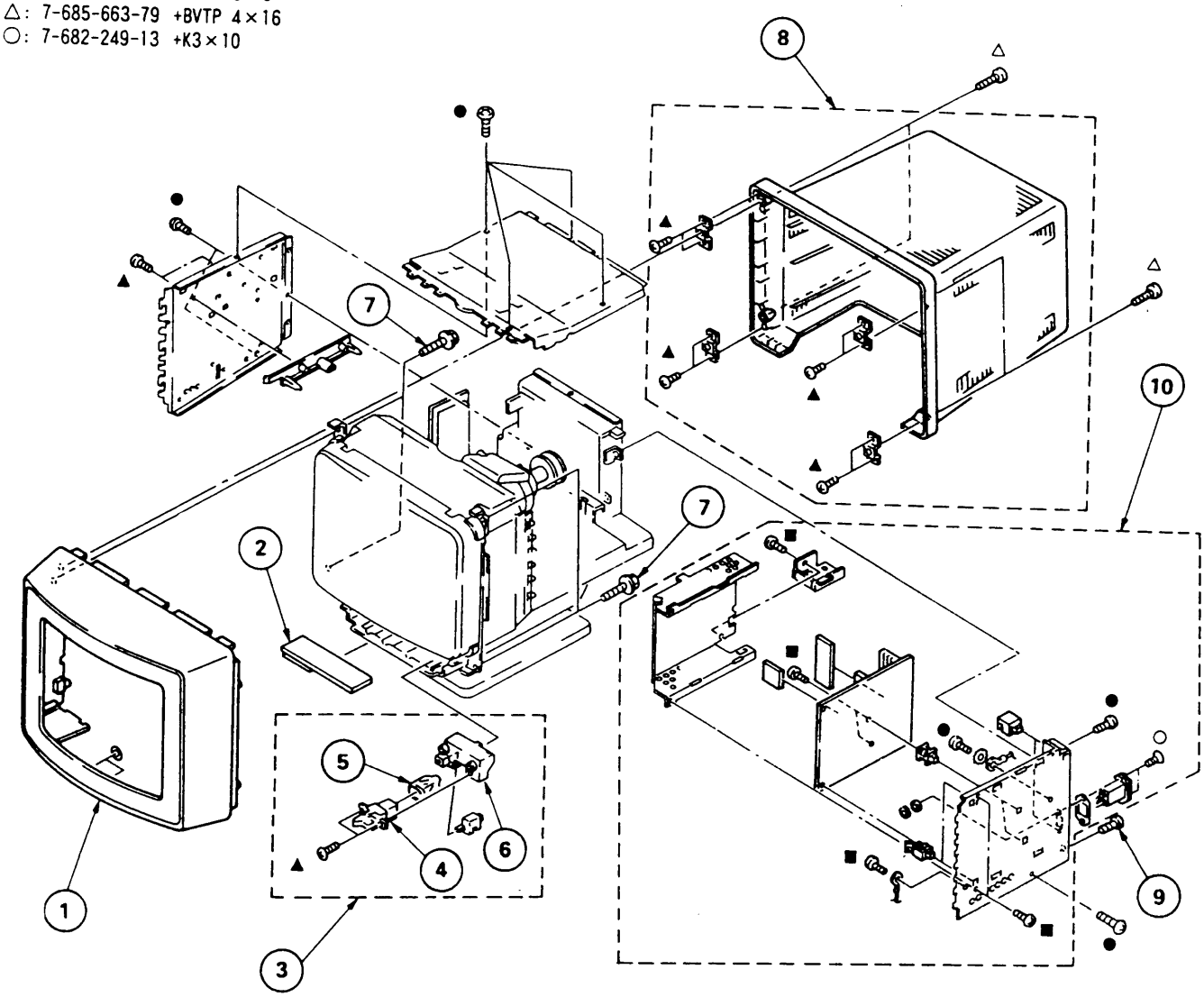
NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a collation number in the remark column.
- Items marked " ★ " are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

The components identified by shading and mark ⚠ are critical for safety.
Replace only with part number specified.

Les composants identifies par une trame et une marque ⚠ sont critiques pour la securite.
Ne les remplacer que par une piece portant le numero specifie.

8-1. BEZEL, CABINET

▲: 7-685-648-79 +BVTP 3×12
●: 7-682-561-04 +BVTP M4×8
■: 7-685-646-79 +BVTP 3×8
△: 7-685-663-79 +BVTP 4×16
○: 7-682-249-13 +K3×10



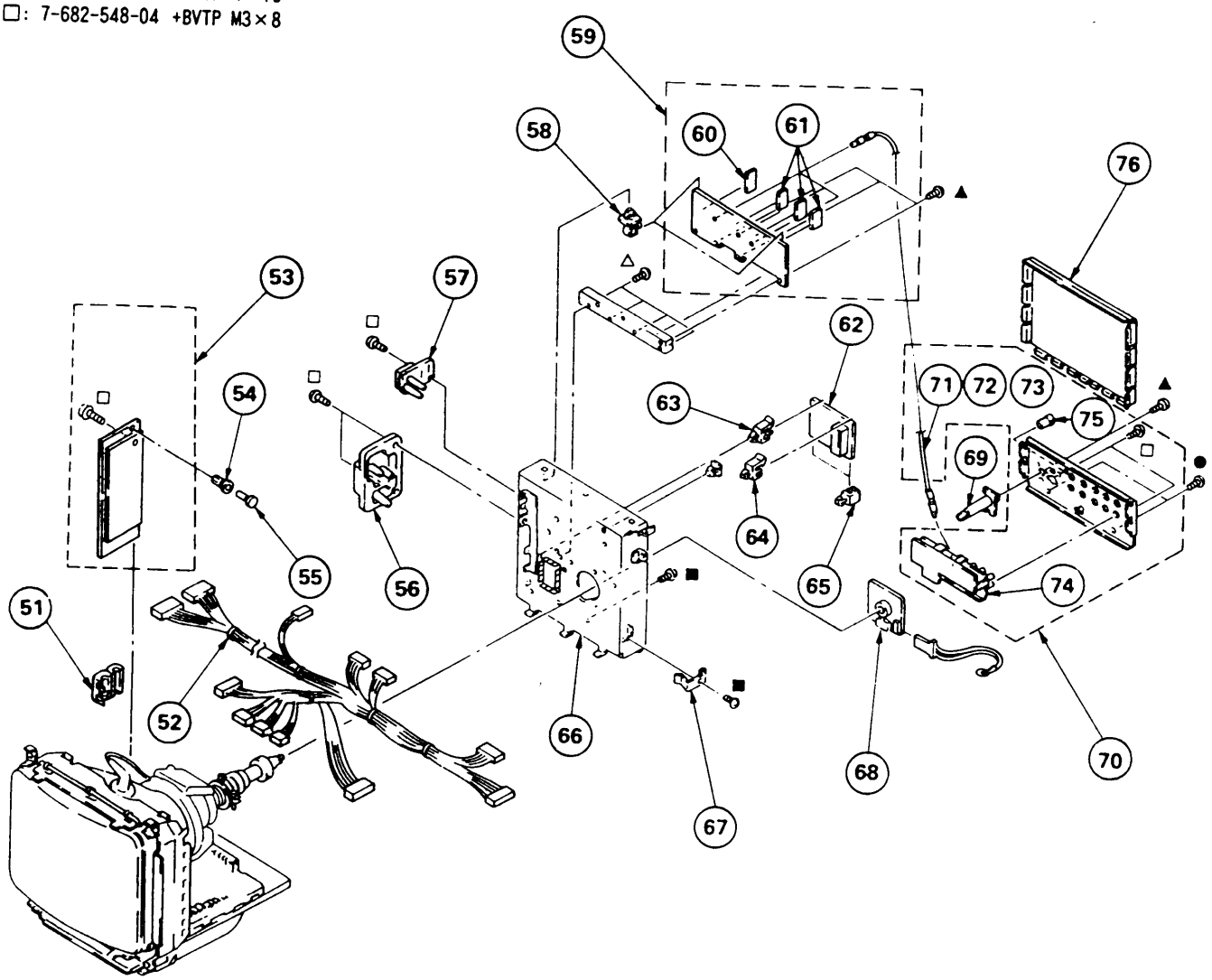
REF.NO.	PART NO.	DESCRIPTION	REMARK
1	X-4030-583-1	BEZEL ASSY	
2	A-1500-480-A	H6 BOARD, COMPLETE	
3	⚠*A-1404-584-A	SW ASSY, POWER	
4	⚠1-570-778-31	SWITCH, SEESAW (AC POWER)	4-6
5	*4-381-806-01	COVER, SWITCH	
6	*4-395-845-01	BRACKET, POWER SWITCH	
7	4-365-808-01	SCREW (5), TAPPING	
8	X-4030-151-1	CABINET ASSY	
9	4-389-025-01	SCREW (M4X8)(EXT TOOTH WASHER)	
10	⚠*A-1500-160-B	REGULATOR, SWITCHING ("G")(CB-100D)	

The components identified by shading and mark ⚠ are critical for safety.
Replace only with part number specified.

Les composants identifies par une trame et une marque ⚠ sont critiques pour la securite.
Ne les remplacer que par une piece portant le numero specifie.

8-2. CHASSIS

▲: 7-685-648-79 +BVTP 3×12
●: 7-682-561-04 +BVTP M4×8
■: 7-685-646-79 +BVTP 3×8
△: 7-685-663-79 +BVTP 4×16
□: 7-682-548-04 +BVTP M3×8



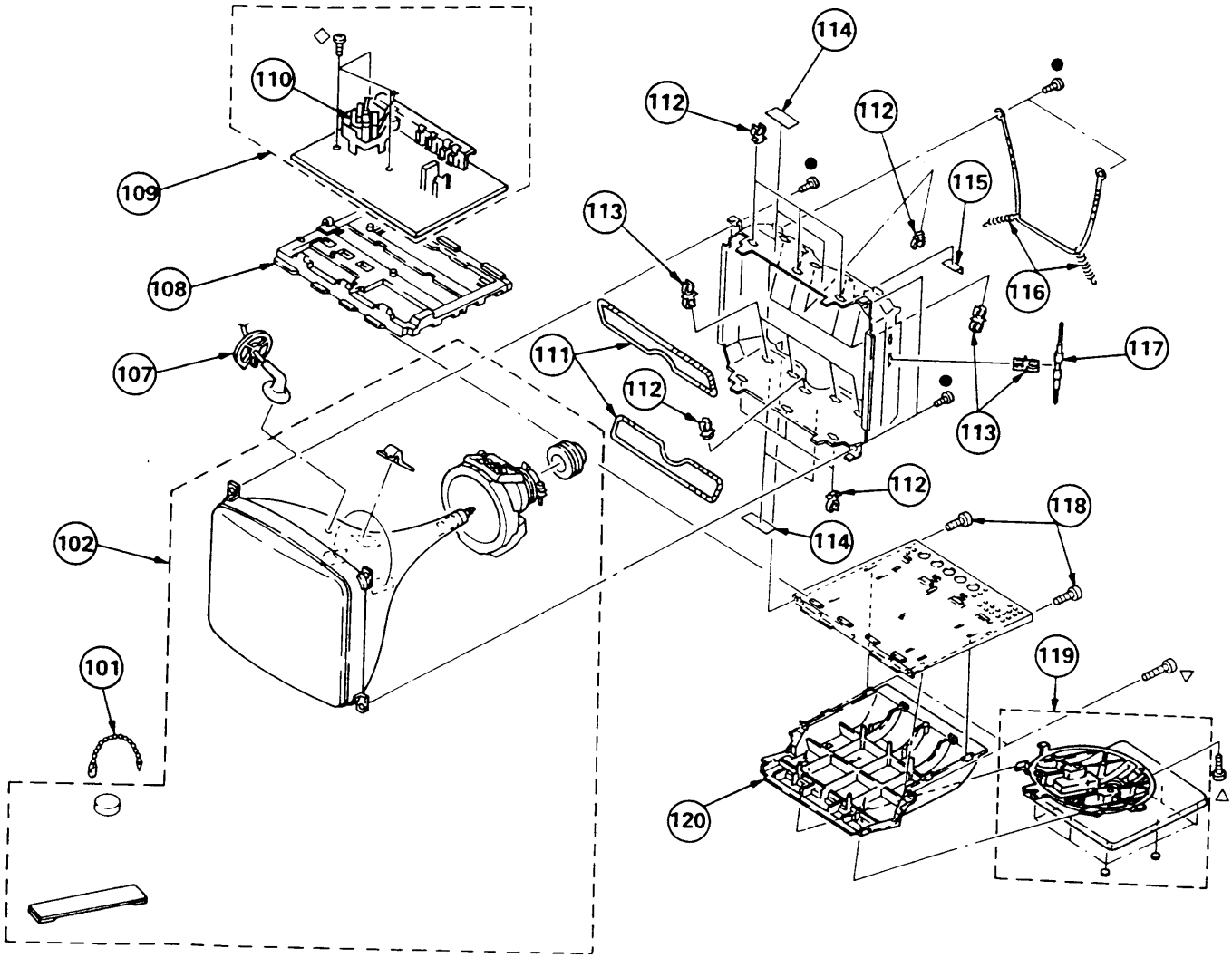
REF.NO.	PART NO.	DESCRIPTION	REMARK
51	1-543-653-11	CORE ASSY, BEAD	
52	*1-951-006-11	HARNESS (MAIN (D))	
53	*A-1500-481-A	N1 BOARD, COMPLETE	
54	*4-927-131-01	SOLENOID	
55	3-609-177-03	GROMMET	
56	⚠1-238-745-21	RESISTOR ASSY, HIGH-VOLTAGE (FOCUS)	
57	⚠1-237-344-11	RESISTOR ASSY, HIGH-VOLTAGE (H-STAT)	
58	*3-703-072-00	HOLDER, PCB	
59	A-1500-473-A	A2 BOARD, COMPLETE	
60	*A-1292-224-A	AB BOARD, COMPLETE	60,61
61	*A-1297-042-A	AA3 BOARD, COMPLETE	
62	*A-1500-474-A	B3 BOARD, COMPLETE	
63	*3-703-141-00	HOLDER, PCB	
64	*4-321-929-00	HOLDER, PC BOARD	
65	*3-701-903-00	HOLDER, PC BOARD	
66	*4-395-831-05	CASE, SHIELD, ABC	
67	*4-395-810-01	RETAINER	
68	*A-1500-415-A	C2 BOARD, COMPLETE	
69	*4-395-803-01	GUIDE, SCREW	
70	*A-1500-478-A	PANEL ASSY, CONNECTOR	71-75
71	⚠*1-575-135-12	CABLE, COAXIAL (B)	
72	⚠*1-575-135-22	CABLE, COAXIAL (G)	
73	⚠*1-575-135-32	CABLE, COAXIAL (R)	
74	1-537-469-11	TERMINAL BOARD ASSY, I/O (M7 BOARD)	
75	4-038-522-01	CAP (VISCA)	
76	*X-4029-341-1	LID ASSY, SHIELD, ABC	

The components identified by shading and mark ⚠ are critical for safety.
Replace only with part number specified.

Les composants identifies par une trame et une marque ⚠ sont critiques pour la securite.
Ne les remplacer que par une piece portant le numero specifie.

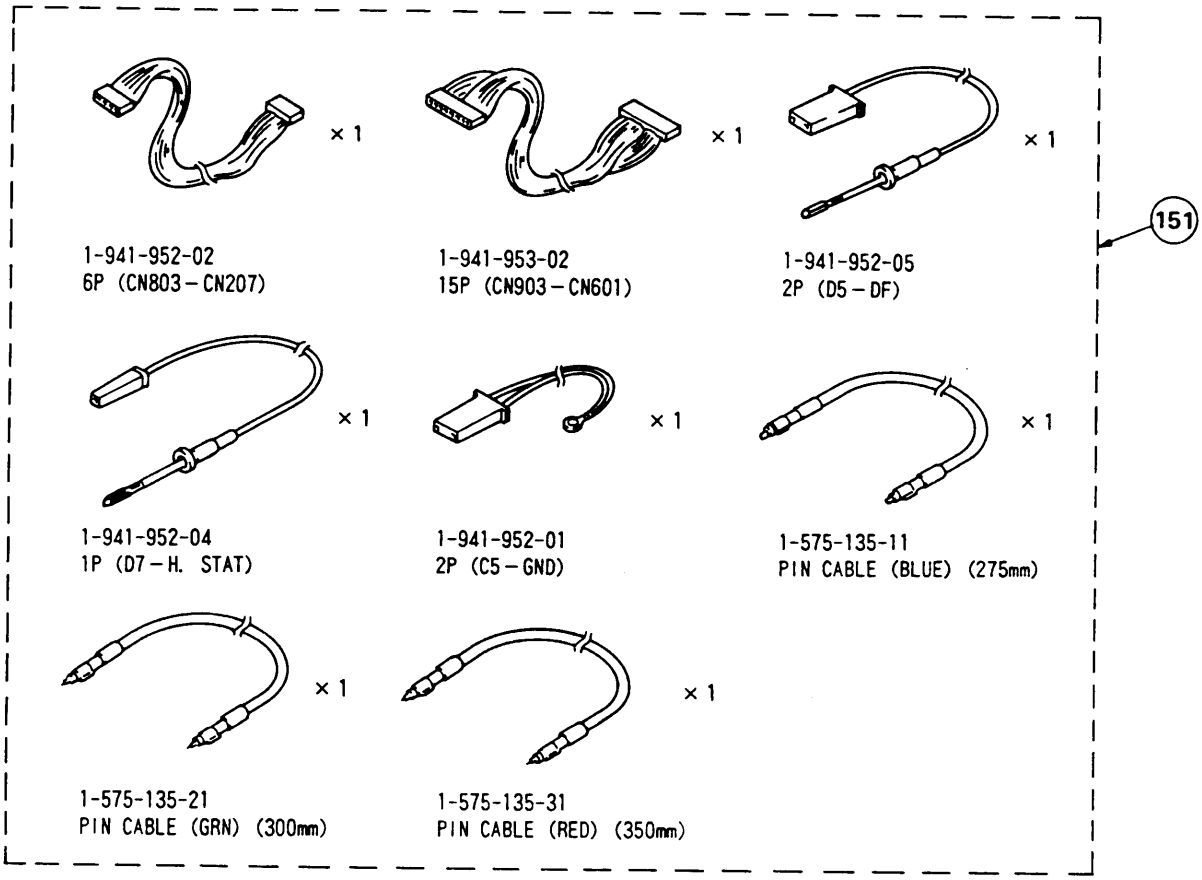
8-3. PICTURE TUBE

●: 7-682-561-04 +BVTP M4×8
△: 7-685-663-79 +BVTP 4×16
◇: 7-685-647-79 +BVTP 3×10
▽: 7-682-563-04 +BVTP M4×12



REF.NO.	PART NO.	DESCRIPTION	REMARK
101	4-308-870-00	CLIP, LEAD WIRE	
102	⚠736-043-90	CRT COMPLETE ASSY (CRT,DY,NA)	
107	*3-704-372-01	HOLDER, HV CABLE	
108	*4-029-289-01	BRACKET, PCB	
109	A-1500-538-A	D4 BOARD, COMPLETE	110
110	⚠1-453-137-11	TRANSFORMER ASSY, FLYBACK (NX-2760AI)	
111	⚠1-426-449-11	COIL, DEMAGNETIZATION	
112	*4-395-824-01	HOLDER, DEGAUSSING COIL	
113	*4-322-922-00	HOLDER, COIL, DEGAUSSER	
114	3-831-441-XX	CUSHION	
115	*4-035-517-01	SHEET, PROTECTION	
116	4-369-318-00	SPRING, TENSION	
117	4-382-826-01	SCREW DRAIVER, ADJUSTMENT	
118	4-389-025-01	SCREW (M4X8)(EXT TOOTH WASHER)	
119	X-4029-226-1	STAND ASSY	
120	4-034-719-11	COVER, BOTTOM	

8-4 KIT



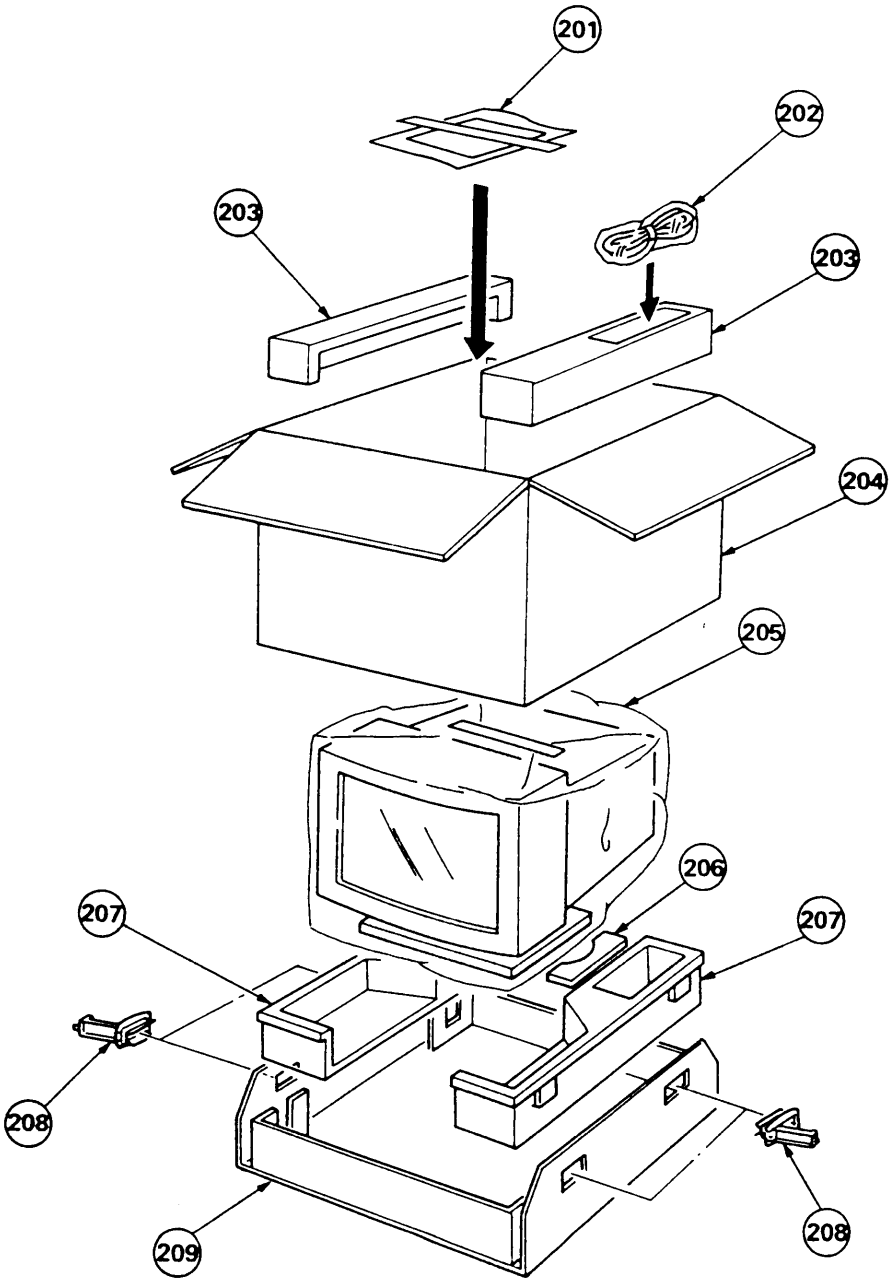
REF.NO.	PART NO.	DESCRIPTION	REMARK
151	*A-1500-482-A	CABLE ASSY	
152	*A-1500-013-A	CRT MOUNTING PARTS	

Note: Each part in these kits is not available to order individually.

8-5. ACCESSORIES & PACKING MATERIALS

The components identified by shading and mark ⚠ are critical for safety.
Replace only with part number specified.

Les composants identifies par une trame et une marque ⚠ sont critiques pour la securite.
Ne les remplacer que par une piece portant le numero specifie.



REF.NO.	PART NO.	DESCRIPTION	REMARK
201	3-755-968-11	MANUAL (ALL), INSTRUCTION	
202	⚠1-534-827-14	CORD, POWER (7.0A/125V)	
203	*4-038-261-01	CUSHION (UPPER) (ASSY)	
204	*4-038-260-01	INDIVIDUAL CARTON	
205	*4-368-079-01	BAG, PROTECTION	
206	*4-029-335-01	PAT, TILT FIXED	
207	*4-038-262-01	CUSHION (LOWER) (ASSY)	
208	*4-396-077-01	JOINT	
209	*4-038-264-01	TRAY	