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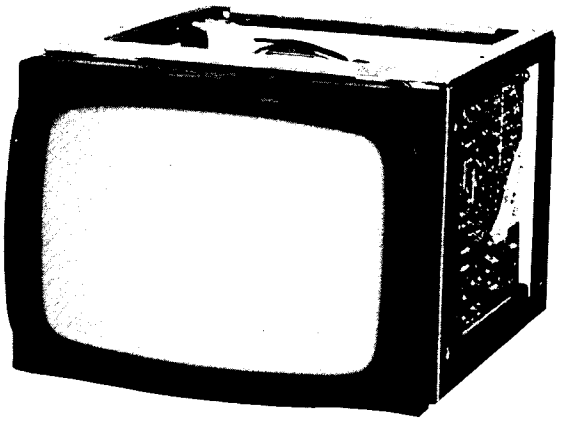
CODE NO. FTD86055079C1

Service Manual

CRT Data Display

MODEL TR-60S1A

Chassis No. Y21



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SAFETY PRECAUTIONS

1-1 CAUTION:

No modification of any circuit should be attempted. Service work should only be performed after you are thoroughly familiar with all of the following safety checks and servicing guide lines.

1-2 SAFETY CHECK

Care should be taken while servicing this CRT display because of the high voltage used in the deflection circuits. These voltages are exposed in such areas as the associated flyback and yoke circuits.

1-3 FIRE & SHOCK HAZARD

1-3-1 Insert an isolation transformer between the CRT display and AC power line before servicing chassis.

1-3-2 In servicing pay attention to original lead dress especially in the high voltage circuit. If a short circuit is found, replace all parts which have been overheated as a result of the short circuit.

1-3-3 All the protective devices must be reinstalled per original design.

1-3-4 Soldering must be inspected possible for cold solder joints, frayed leads, damaged insulation, solder splashes or sharp solder points. Be certain to remove all foreign material.

1-4 IMPLOSION PROTECTION

All Panasonic picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage and scratching during installation. Use only Panasonic replacement picture tubes.

1-5 X-RADIATION

WARNING: The only potential source of X-Radiation is the picture tube. However when the high voltage circuitry is operating properly there is no possibility of X-Radiation problem. The basic precaution which must be exercised is to keep the high voltage at the following factory-recommended level.

Note: It is important to use an accurate periodically calibrated high voltage meter.

1-5-1 To measure the high voltage, use a high impedance high voltage meter.
Connect (-) to chassis and (+) to the CRT anode button.

1-5-2 Turn the Brightness control fully counterclockwise.

1-5-3 Measure the high voltage. The high voltage meter should indicate at the following factory-recommended level.

1-5-4 If the upper meter indication exceeds the maximum level, immediate service is required to prevent the possiblity of premature component failure.

1-5-5 To prevent X-Radiation possibility, it is essential to use the specified picture tube.

1-5-6 The nominal high voltage is 7KV and must not exceed 8KV at zero beam current at rated voltage.

IMPORTANT SAFETY NOTICE

There are special components used in Panasonic CRT displays which are important for safety. These parts are identified on the schematic diagram and on the replacement parts list. It is essential that these critical parts should be replaced with manufacture's specified parts to prevent X-RADIATION, shock, fire or other hazards. Do not modify the original design without written permission of the Panasonic company and this will void the original parts and labor guarantee.

GENERAL INFORMATIONS

The Model TR-60S1A is CRT DATA DISPLAY of metal frame type.
TR-60S1A uses P31 (Green color) phosphor and polish Cathode Ray Tube.
Input signal is separate type and each input signal is put through 5 pin-header connector on the P.C. Board.
Input signal is for TTL level.

When connecting to equipment, directly connect it to printed circuit board input terminal through 5 pin-header connector.

In addition, +B is supplied from the outside through 5 pin-header connector, operating the monitor on +12V DC.

Features:
CRT is exceptionally superb in quality and reliability and is of polish type. Phosphor P31.

The deflecting coil is a yoke equipped with 4-P magnet and is of PANASONIC's own design that permits adjustment of geometric distortion on the raster.
Chassis is fully equipped with ICs:
Vertical deflection
H.P.C. (horizontalphase control)
H.AFC/OSC

SPECIFICATIONS

1. MECHANICAL DESCRIPTION

Dimension:

Height:	4.4" (112mm) max.
Width:	6.0" (152mm) max.
Depth:	7.4" (188mm) max.
Weight:	3.75 lbs (1.7kg) max.
Picture Tube:	150BGB31
	Size 5"
	Def. Angle 70°
	Neck dia 0.79" (20mm)
	Phosphor P31
Tilt:	0°

2. ENVIRONMENTAL

Temperature:

Operating:	0 ~ 55°C
Non-operating:	–40 ~ 65°C
Storage and shipment:	–40 ~ 65°C

Humidity:

Operating, Non-operating, Storage and Shipment: 5 ~ 90% (No condensation)

Altitude:

Operating:	0 ~ 12,000 feet (0 ~ 3,600m)
Non-operating:	0 ~ 12,000 feet (0 ~ 3,600m)
Storage and shipment:	0 ~ 40,000 feet (0 ~ 12,000m)

Vibration and shock (Packaged condition):

Vibration:

Frequency:	5 ~ 50 Hz
Vertical:	1.25G
Horizontal:	0.75G

Shock:

Bottom:	Height	21.65" (55cm)
Front, Back, Side, Corner and Edge:	Height	9.84" (25cm)

3. ELECTRIC PERFORMANCE

Power Supply:

Input Voltage:	12V DC
Input Current:	0.8A max.

Input Signals:

Video Signal:

Polarity:	Positive
Signal Level:	TTL
Input Imp.:	75 ohm min. 40pF max.

Vertical Sync:

Polarity:	Positive
Signal Level:	TTL
Input Imp.:	1k ohm min. 40pF max.

Horizontal Sync:

Polarity:	Positive
Signal Level:	TTL
Input Imp.:	1k ohm

Note: Max rise and fall times (from 10% to 90%) of input signals are less than 10ns.

Image test condition:

Display:	Full flat field (40 ft-L)
Brightness:	Max.
View Direction:	Parallel to the CRT axis
Ambient Temperature:	Room temperature
Supply Voltage:	12V DC
Terrestrial Magnetism:	
	Horizontal field 0 Gauss
	Vertical field 0.5 Gauss

Note:
1. All measurements shall be made under normal conditions after an initial warm-up time of more than 20 minutes.
2. Normal conditions are as stated in above image test condition. (Condition of following each item is normal condition unless otherwise stated.)

Image:

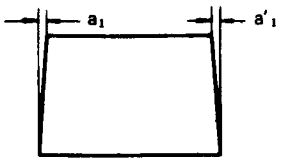
Image Size:	Horizontal 4.17 ± 0.18" (106 ± 4mm)
	Vertical 2.95 ± 0.18" (75 ± 4mm)
Distortion:	See Fig. 1
Centering:	See Fig. 2
H. Tilt:	See Fig. 3

Image size variation:

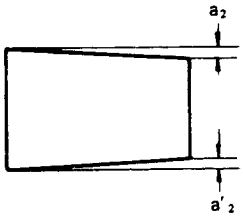
Cause	Image size variation from the normal image size	Range of variation
By Brightness	within 0.1" (2.5mm) (Horizontal and Vertical)	0 ~ 60 FL
By Power Supply Voltage	within ± 0.14" (± 3.5mm) (Horizontal and Vertical)	12V DC ± 3%
By Temperature	within ± 0.14" (± 3.5mm) (Horizontal and Vertical)	25^{+30}_{-25} °C

Resolution: 500 TV line type (center)
350 TV line type (center)

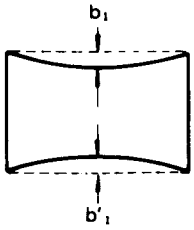
1. Trapezoid



$a_1, a'_1 \leqq 0.06''(1.5mm)$
$a_2, a'_2 \leqq 0.06''(1.5mm)$



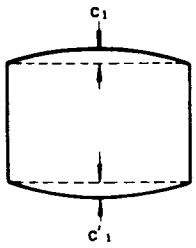
2. Pincushion



$b_1, b'_1 \leqq 0.06''(1.5mm)$
$b_2, b'_2 \leqq 0.06''(1.5mm)$



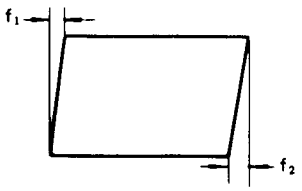
3. Barrelling



$c_1, c'_1 \leqq 0.06''(1.5mm)$
$c_2, c'_2 \leqq 0.06''(1.5mm)$



4. Parallelogram



$f_1, f_2 \leqq 0.06''(1.5mm)$

Fig. 1 GEOMETRIC DISTORSION

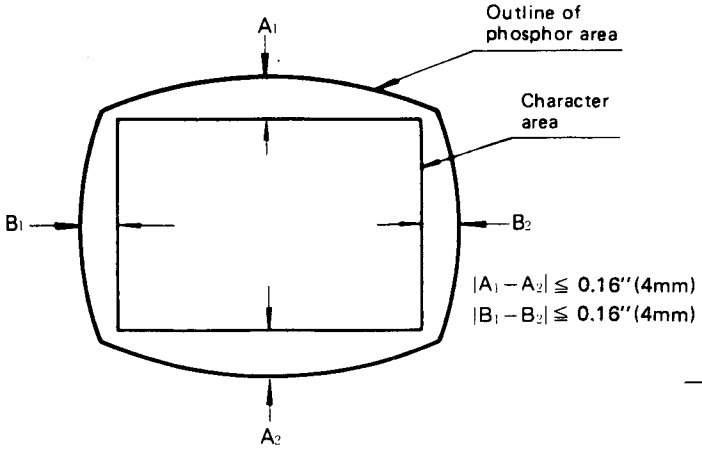


Fig. 2 CENTERING

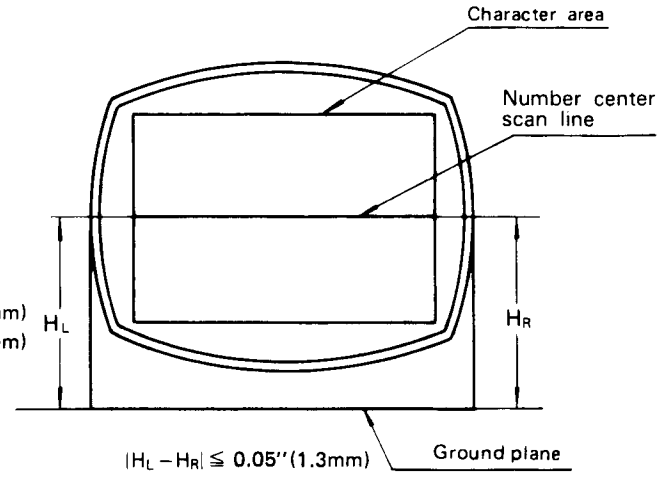
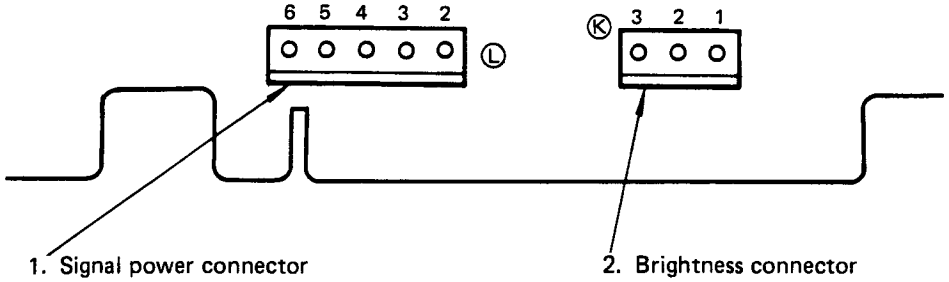


Fig. 3 HORIZONTAL TILT

CONNECTOR WIRING

P.C.B. HEADER CONNECTION



1. Signal power connector

2. Brightness connector

5P header : AMP641215-5

Pin No.	Description
2	H. Sync
3	+ 12V
4	Video
5	V. Sync
6	SG

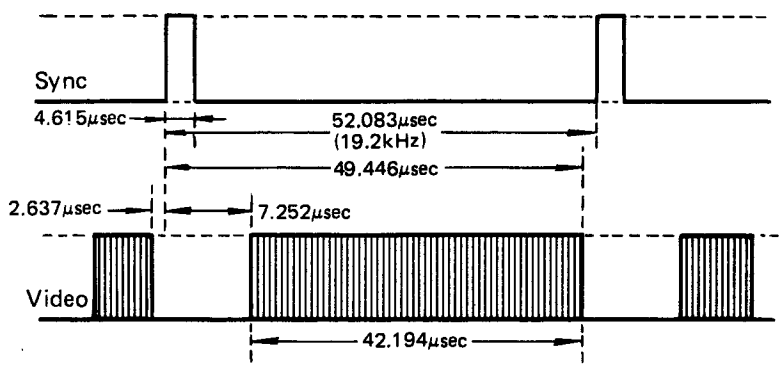
3P header : AMP6412515-5

Pin No.	Description
1	High
2	Arm
3	Low

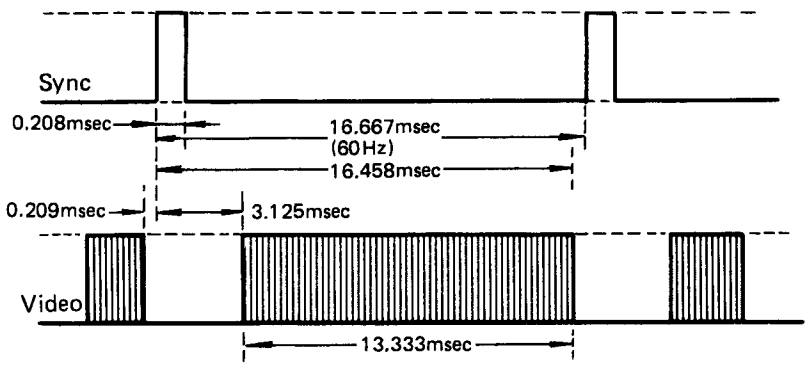
NOTE: BRIGHT. VR
100KB±1% USER SUPPLY

TIMING CHART

Horizontal Sync.

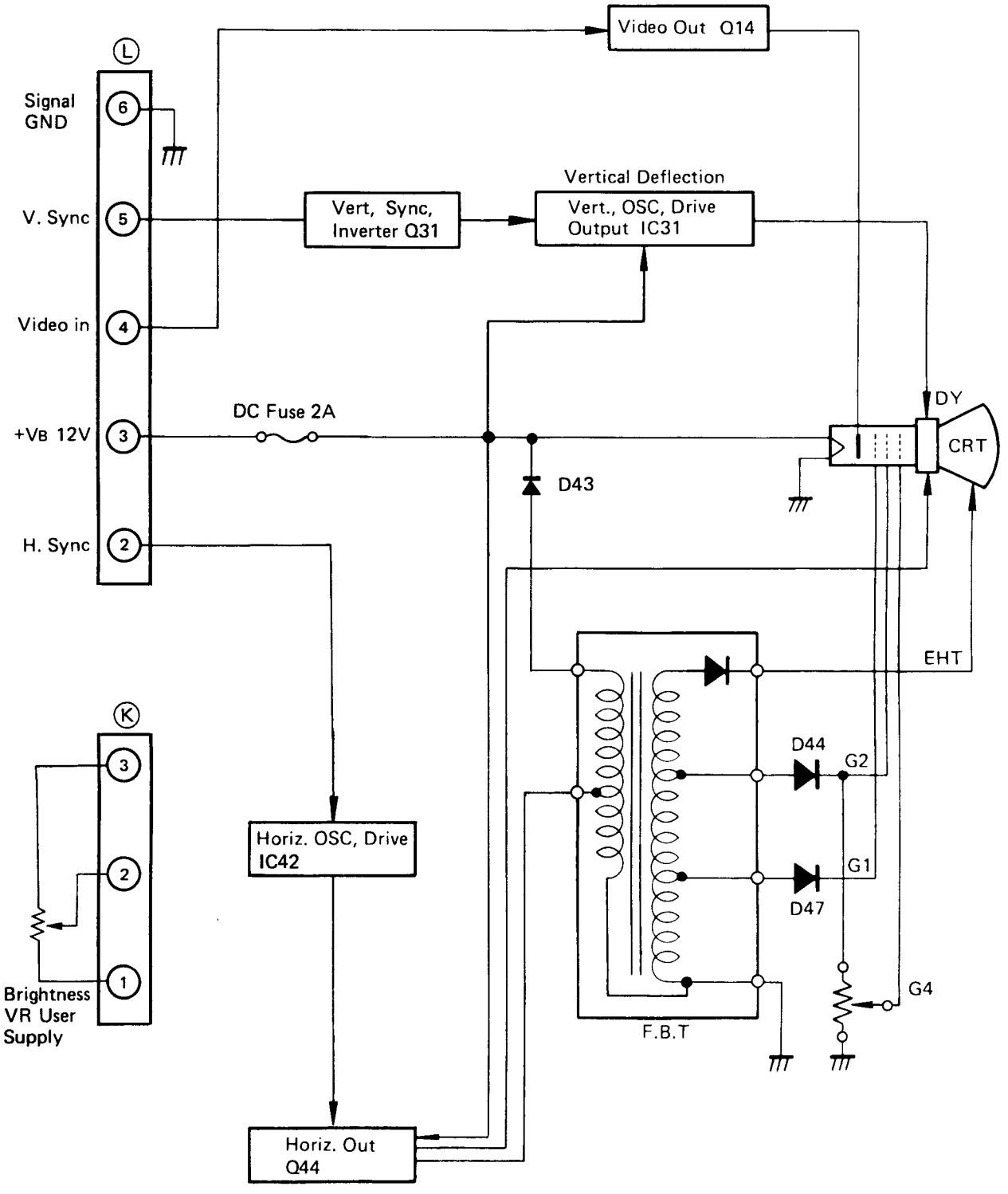


Vertical Sync.

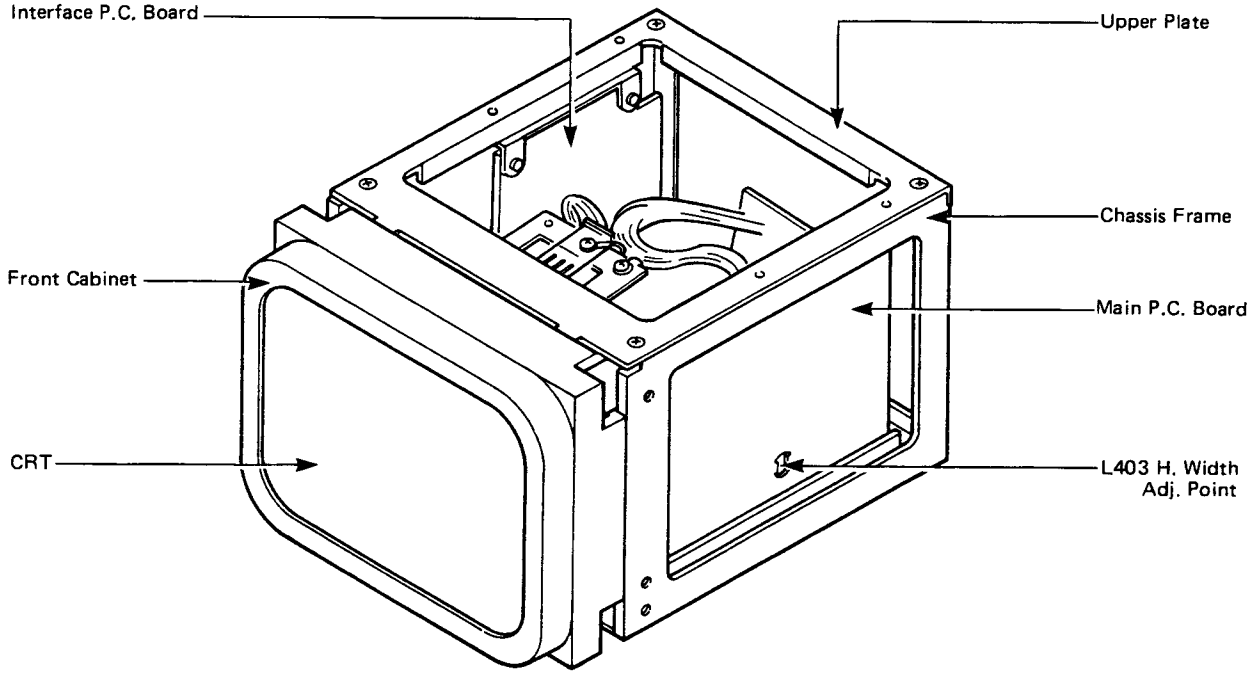


Note : Time tolerance ±0.1%.
Sample unit is adjusted according to this timing and frequency
Video Signal : 50% Duty 100% Mod.

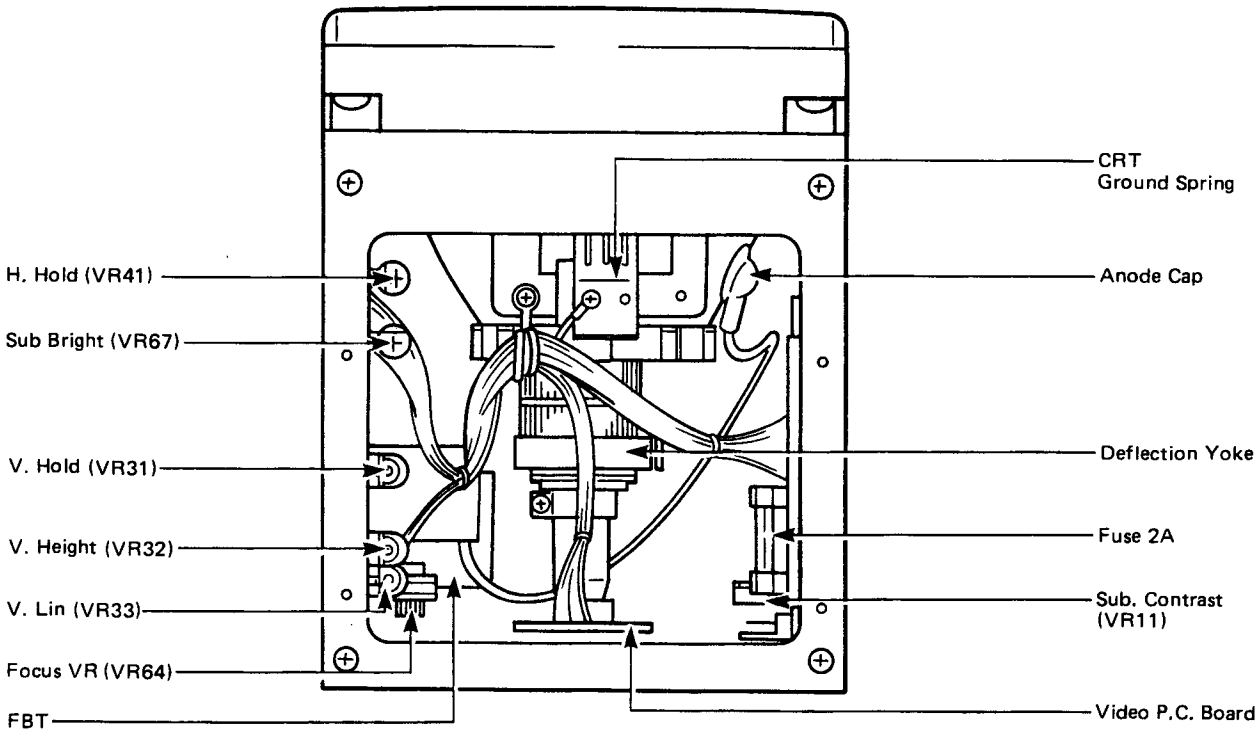
BLOCK DIAGRAM



MONITOR CIRCUIT BOARD DETAIL COMPONENT LOCATION



Front Chassis View



Upper Part Chassis View

ALIGNMENT PROCEDURE

PREPARATION

1. Connect the 5-Pin connector from the proper logic to the defined input signal.
2. Apply power to the CRT data display and allow the monitor to stabilize.
3. Adjust coils by means of a hexagonal tuning tool (non-metalic).
   Variable resister by – screw driver and deflection yoke (deflection distortion) by square tuning tool (non-metalic).
4. All controls are set at optimum position prior to shipment.

Checking of height, width and bright should be performed more than 30 minutes after power is applied.
Measure the luminous intensity near the center of CRT and set at 50 Lx ±20% (40 to 60 Lx). These adjustment are performed on the basis of the input signal of timing chart (page 4).

ADJUSTMENT PROCEDURE

• Image Tilt Adjustment

Loosen the deflection yoke clamp and turn in the arrow directions to adjust tilt. (See Fig. 4).

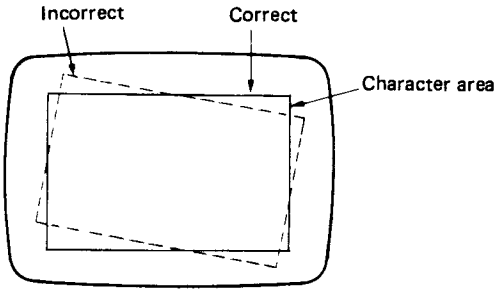


Fig. 4

• Vertical Hold Adjustment

Adjust the vertical hold control (VR31) until the image becomes stable vertically as shown in Fig. 5.

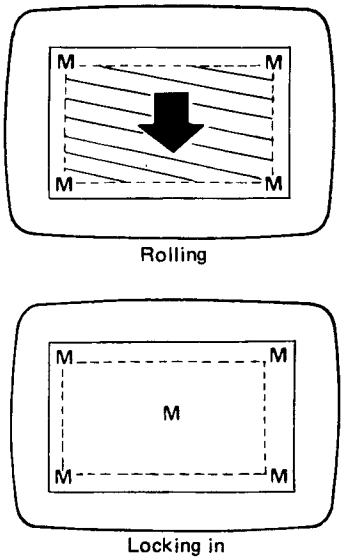


Fig. 5

• Horizontal Hold Adjustment

Adjust the horizontal hold control (VR41) to get stable character (syncroning condition) as shown in below (See Fig. 6).
Under the condition of free running i. e. horizontal sync signal is disconnected.

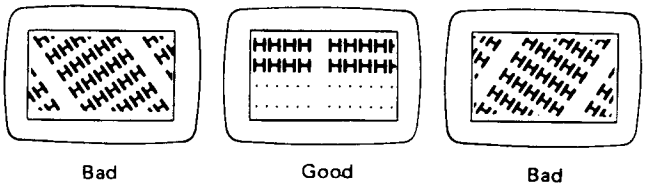


Fig. 6

• Vertical Height Adjustment

Adjust the vertical height control (VR32) to set the vertical height of the active character area as shown in Fig. 8.

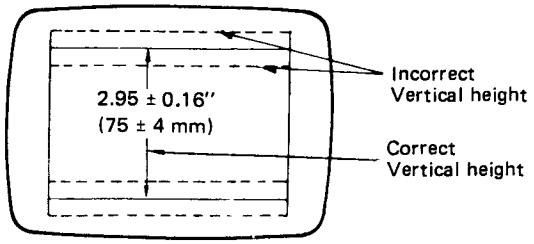


Fig. 8

• Horizontal Width Adjustment

Adjust the horizontal width coil (L403) to set the proper width of the active character area as shown in Fig. 9.

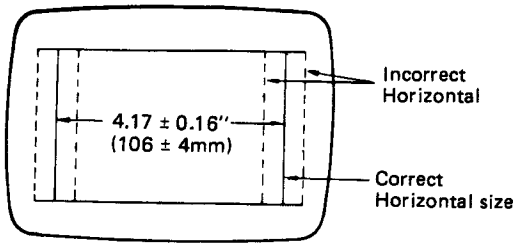


Fig. 9

• Vertical Linearity Adjustment

Adjust the vertical linearity control (VR33) for uniform character height within the active character area as shown in Fig. 10.

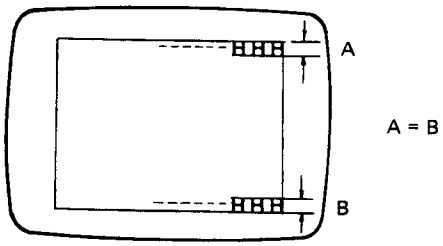


Fig. 10

• Centering Magnet Adjustments

Rotate the centering magnet tabs away from each other until the character area is centered on the screen as shown in Fig. 11.

Before this adjustment, be sure to as certain H. hold.

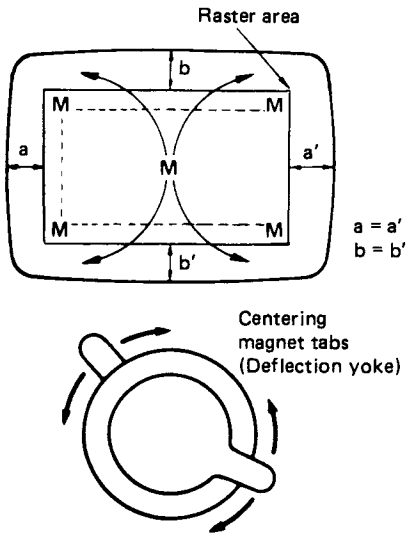


Fig. 11

• Focus Control Adjustment

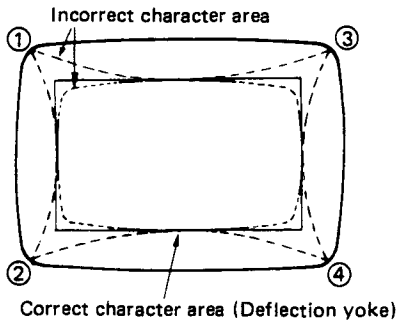
Adjust the focus control (VR64) until optimum is seen on the characters displayed within the active character area.

• Sub Brightness Adjustment

Look at a place 11.81" (30cm) distant from the CRT surface and set at a point where the raster slightly comes out, with the contrasts VR set at min.

• Correcting Magnet of Geometric Distortion (4)

Adjust each "Distortion Correcting Magnet" until the active character area is adjusted to the proper shape as shown in Fig. 12.



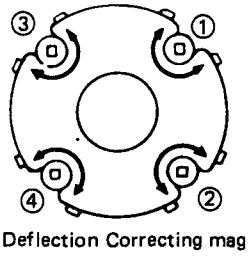


Fig. 12

PREASSEMBLY INSPECTION AND HANDLING INSTRUCTIONS

Caution:
Be sure all handling of the CRT Display is done by the CRT mounting brackets. At no time should the wires be used as a means of moving or carrying a given CRT Display. The CRT neck is the most fragile part of the CRT Display Module and extreme care should be taken not to bump, tap, or otherwise excert force on this neck.
Before applying power to the CRT Display an inspection should be preformed to insure that any foreign material has not been dropped in any part of the CRT Display.

1. Insure that the proper signal and power connections are made in accordance.
2. Apply power to CRT display under test and allow CRT display to stabilize for a minimum of 5 minutes.
   Note: All adjustments have made at the factory. This procedure is to insure that these adjustments have been made correctly.
3. When turn External Brightness Control to maximum and raster should be slightly visible.
4. Check CRT display for proper centering.
5. Check CRT display for the specified active character area per Page 3, 4 of this Manual.
6. Check Geometric Distortion.
7. Check focus.
8. Check Power Supply Voltages in accordance per Page 2 of this Manual.

CAUTION FOR SERVICING

Be sure to provide power supply sequence of more than 100 ms.

Power ON-OFF
Do not turn OFF power supply when the CRT heater is not sufficiently heated. Otherwise, CRT may be burned in spot.

In case of servicing or replacing CRT, high voltage sometimes remains in the anode of CRT. So, completely discharge high voltage before servicing or replacing CRT so as to prevent a shock to the serviceman.
In this case, discharge to the external conductive coating (aquadac) of CRT.

Discharging to other places will cause troubles. The heat sink of horizontal output transistor is applied with +B. So, do not earth it in case of servicing.

Take care to handle IC42.
Special care should be taken not to apply overvoltage or static electricity to IC42, as it is of C-MOS.

In case of storaging or transporting it, be sure to take some countermeasures for static electricity. When using a soldering iron, be sure to connect it to the earth.

The unused terminal should be soldered without fail.

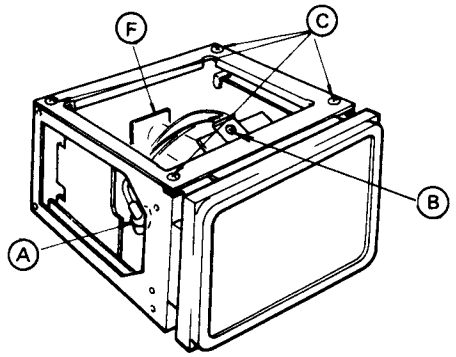
DISASSEMBLY INSTRUCTION

- **How to replace the Main P.C.Board Ass'y**

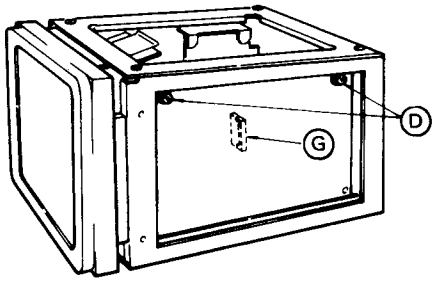
(1) Remove the anod cap Ⓐ
(Care must be taken as high voltage may be remaining)
(2) Remove the ground terminal fixing screw Ⓑ
(3) Remove the upper plate fixing four screws Ⓒ
(4) Remove the main P.C. Board fixing two screws Ⓓ
(5) Remove the interface P.C. Board fixing two screws Ⓔ
(6) Remove the CRT socket P.C. Board Ⓕ from the CRT
(7) Remove the deflection yoke connector Ⓖ of the main P.C. Board

- **How to replace the CRT**

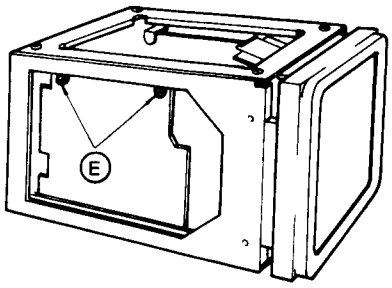
(1) Remove the anod cap Ⓐ
(Care must be taken as high voltage may be remaining)
(2) Remove the upper plate fixing four screws Ⓒ
(3) Remove the CRT socket P.C. Board Ⓕ from the CRT
(4) Remove the deflection yoke connector Ⓖ of the main P.C. Board
(5) Expand the frame Ⓗ a little bit and pull out the front cabinet Ⓘ upward, then CRT block is removed form chassis frame Ⓗ
(6) Remove the deflection yoke from the CRT
(7) Remove the fixing four screw Ⓙ from the front cabinet



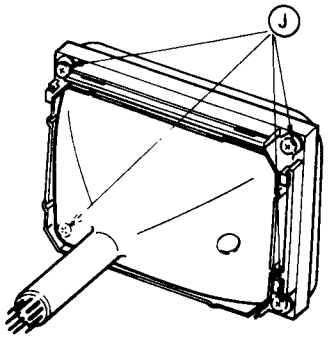
Top View



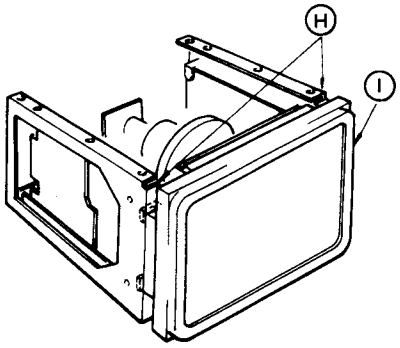
Right Side View



Left Side View

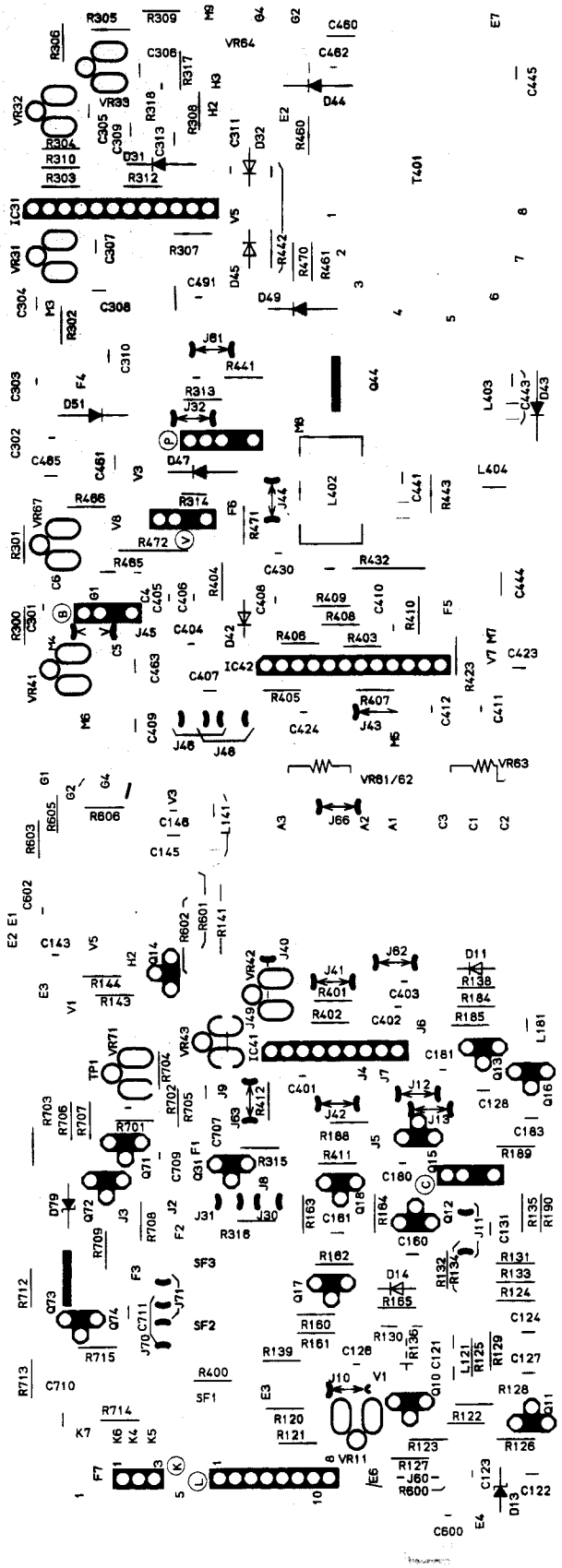


CRT. Block



Top View

MONITOR CIRCUIT BOARD-SOLDER VIEW



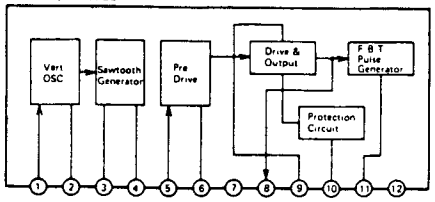
NOTE

1. **RESISTOR**
   All resistors are carbon 1/4W resistor, unless otherwise noted the following marks.
   Unit of resistance is OHM (Ω). (K=1,000, M=1,000,000)
   - ▲ : Solid resistor
   - Ⓕ : Non Flame

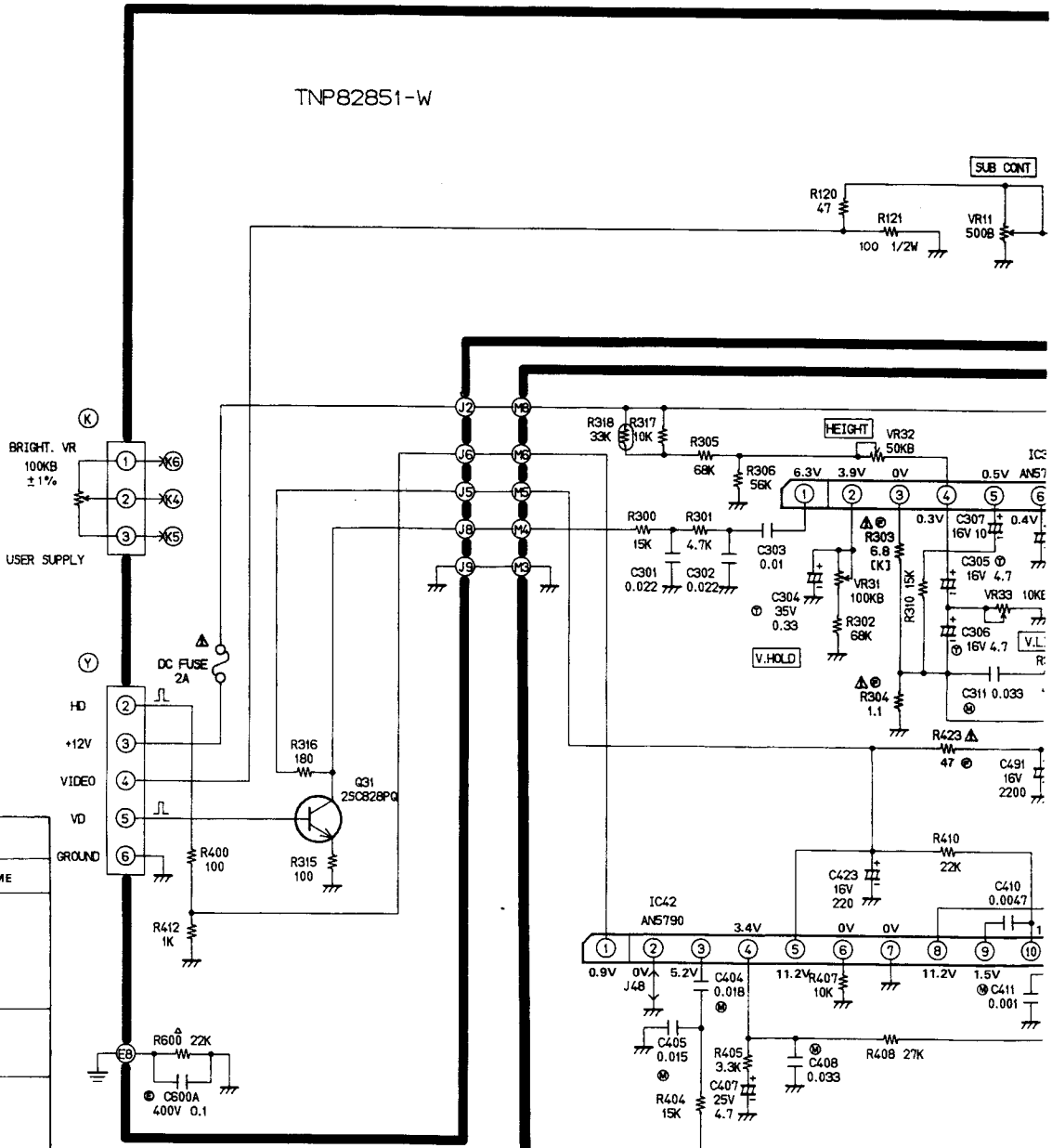
2. **CAPACITOR**
   All capacitors are ceramic 50V capacitor, unless otherwise noted the following marks.
   Unit of capacitance is μF, unless otherwise noted.
   - Ⓜ : Polyester
   - Ⓢ : Polystylene capacitor
   - ⁺‖⁻ : Electrolytic capacitor
   - Ⓣ : Tantalum

3. **COIL**
   Unit of inductance is μH.

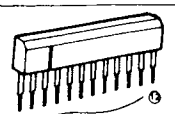
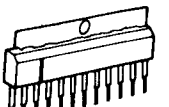
AN5763, AN5763



TNP82851-W

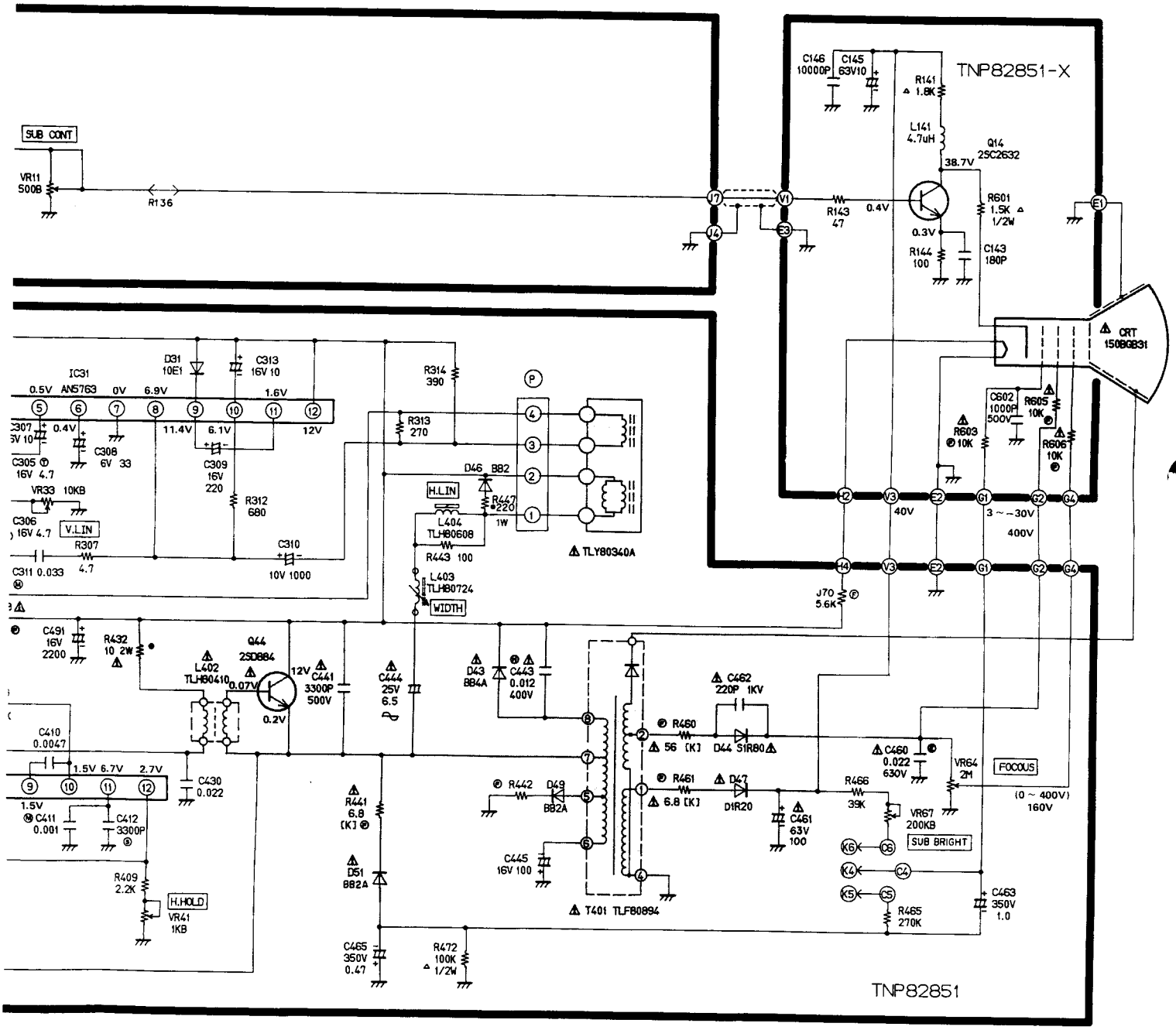


POWER	DC 12V 0.8A
fH	19.20 KHz
fV	60Hz

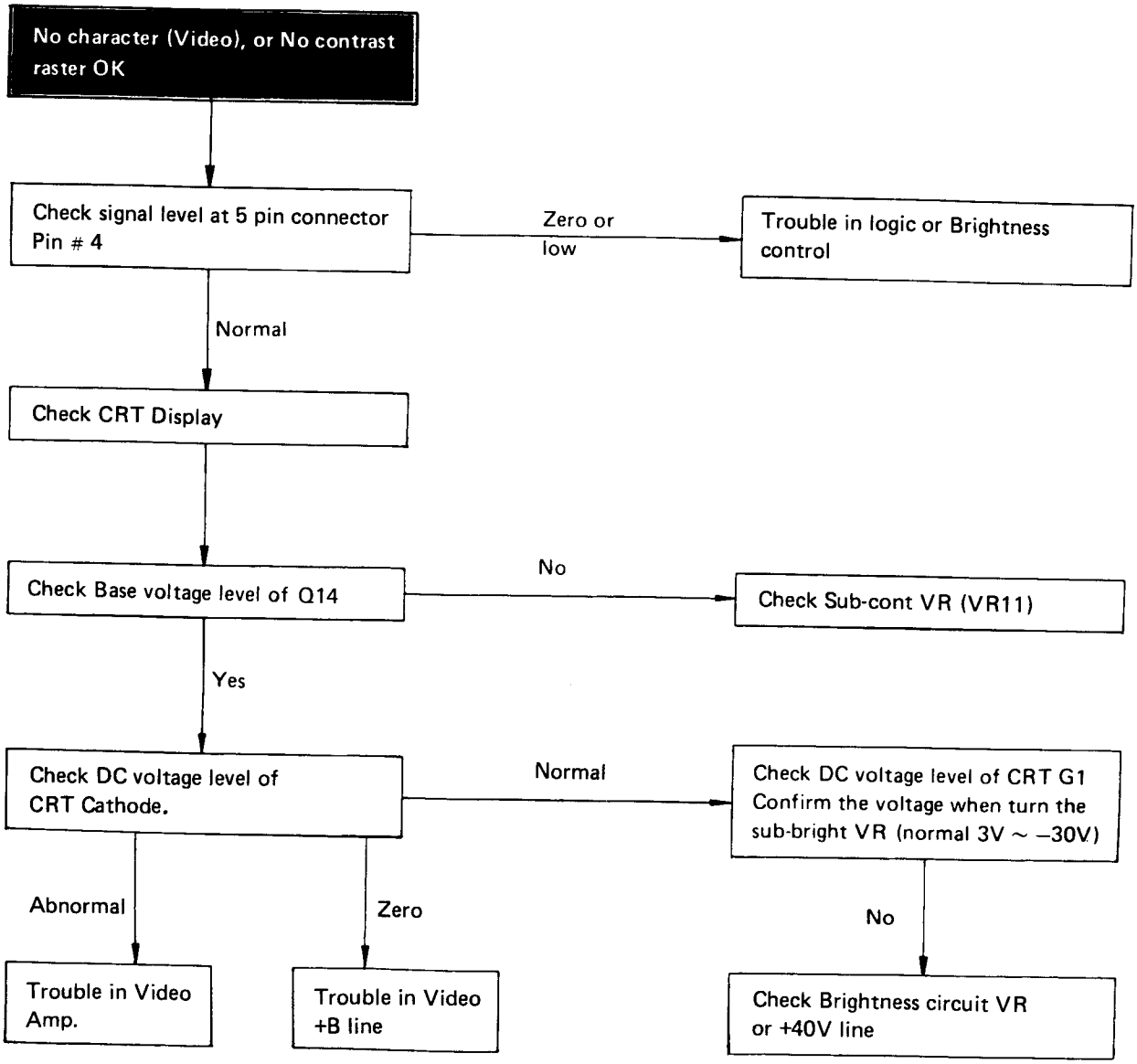
TRANSISTOR BASE INFORMATION	
LOCATION	PARTS NAME
	2SC828
	2SC2632
	2SD884
	AN5790
	AN5762 AN5763 AN5763(N)

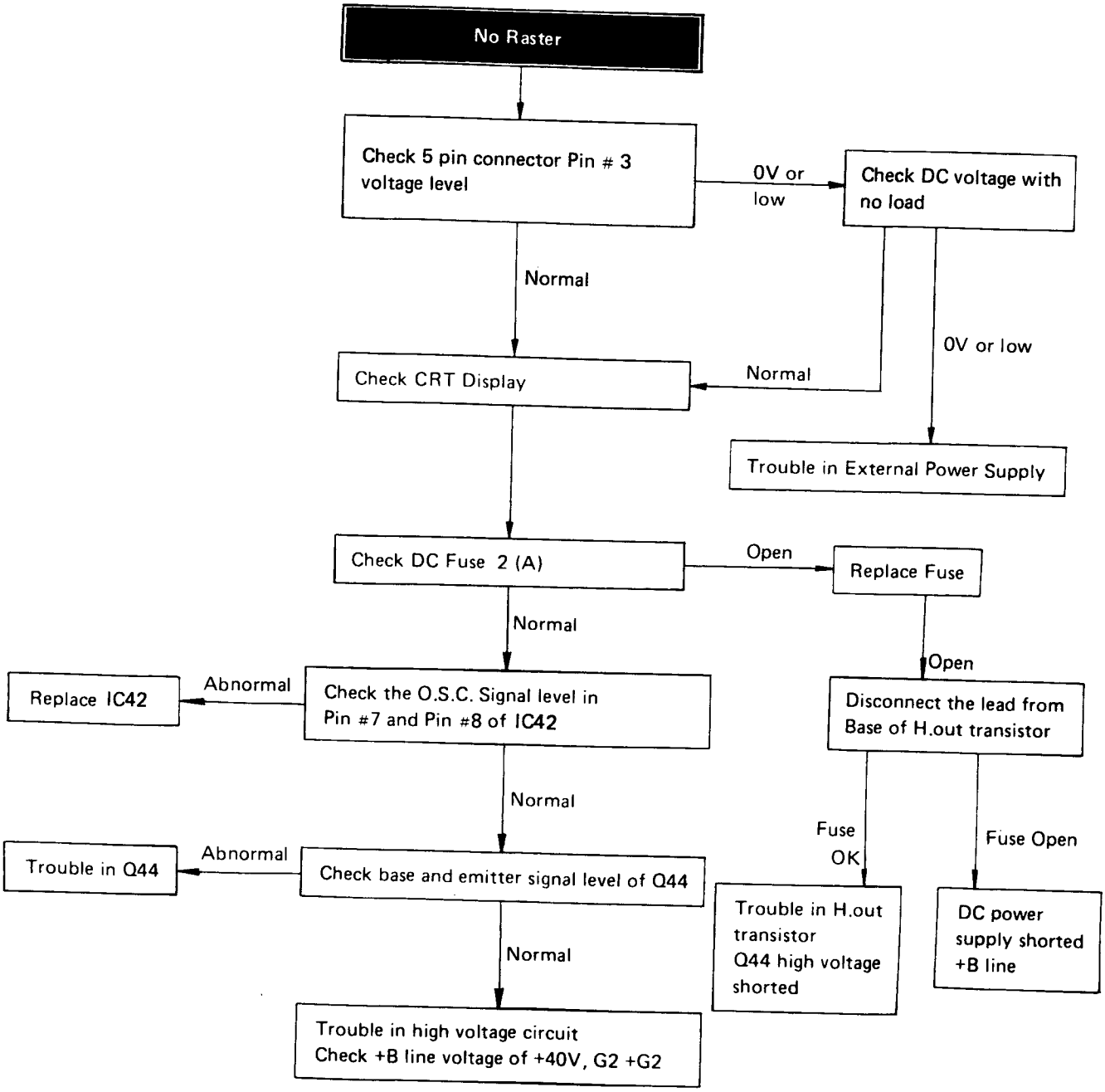
IMPORTANT SAFETY NOTICE

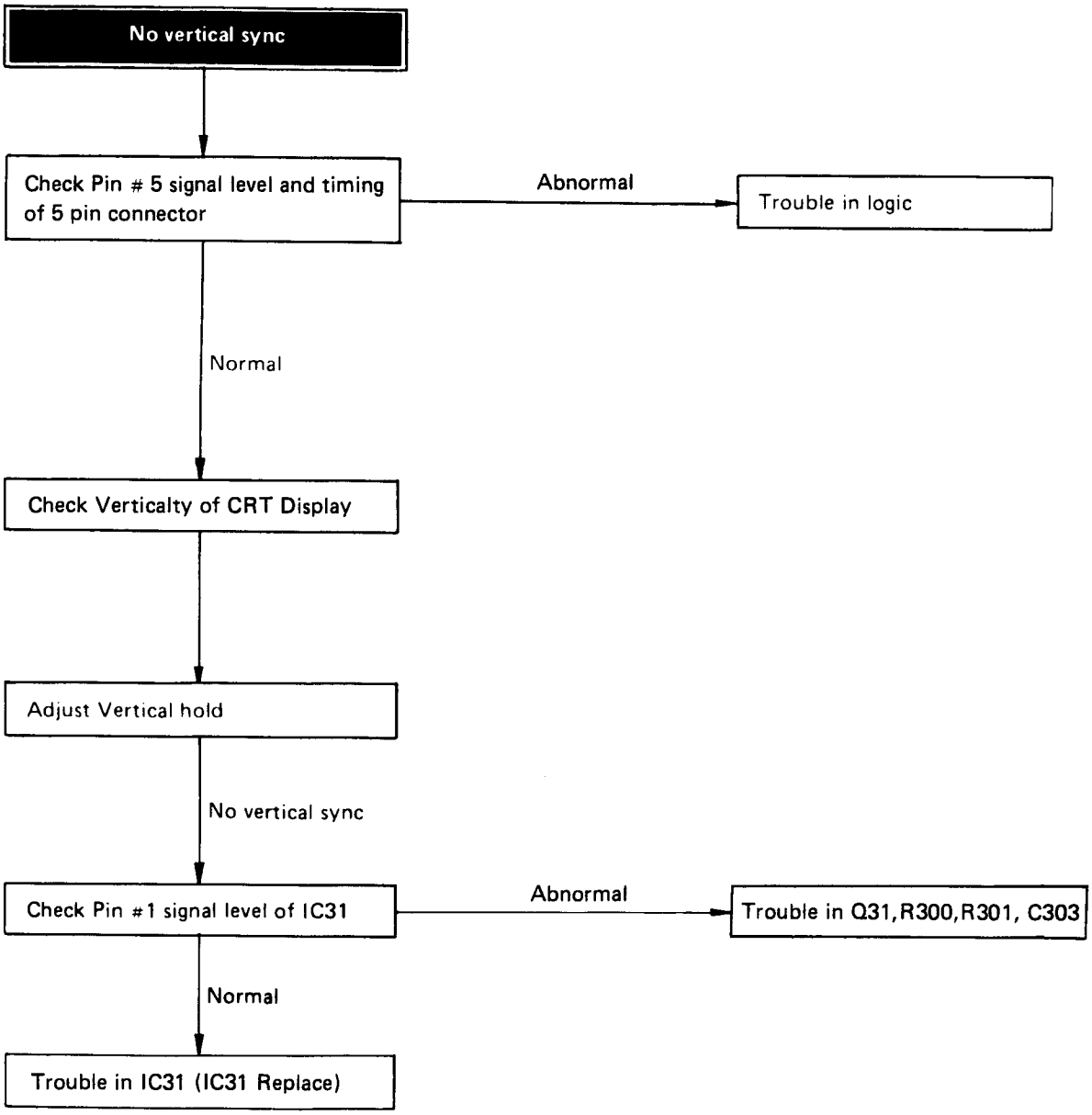
The component identified by shading or the international symbol ⚠ on this schematic diagram incorporates special features important for protection from X-Radiation, fire and electrical shock hazards. When servicing it is essential that only manufacturer's specified parts be used for those critical components.

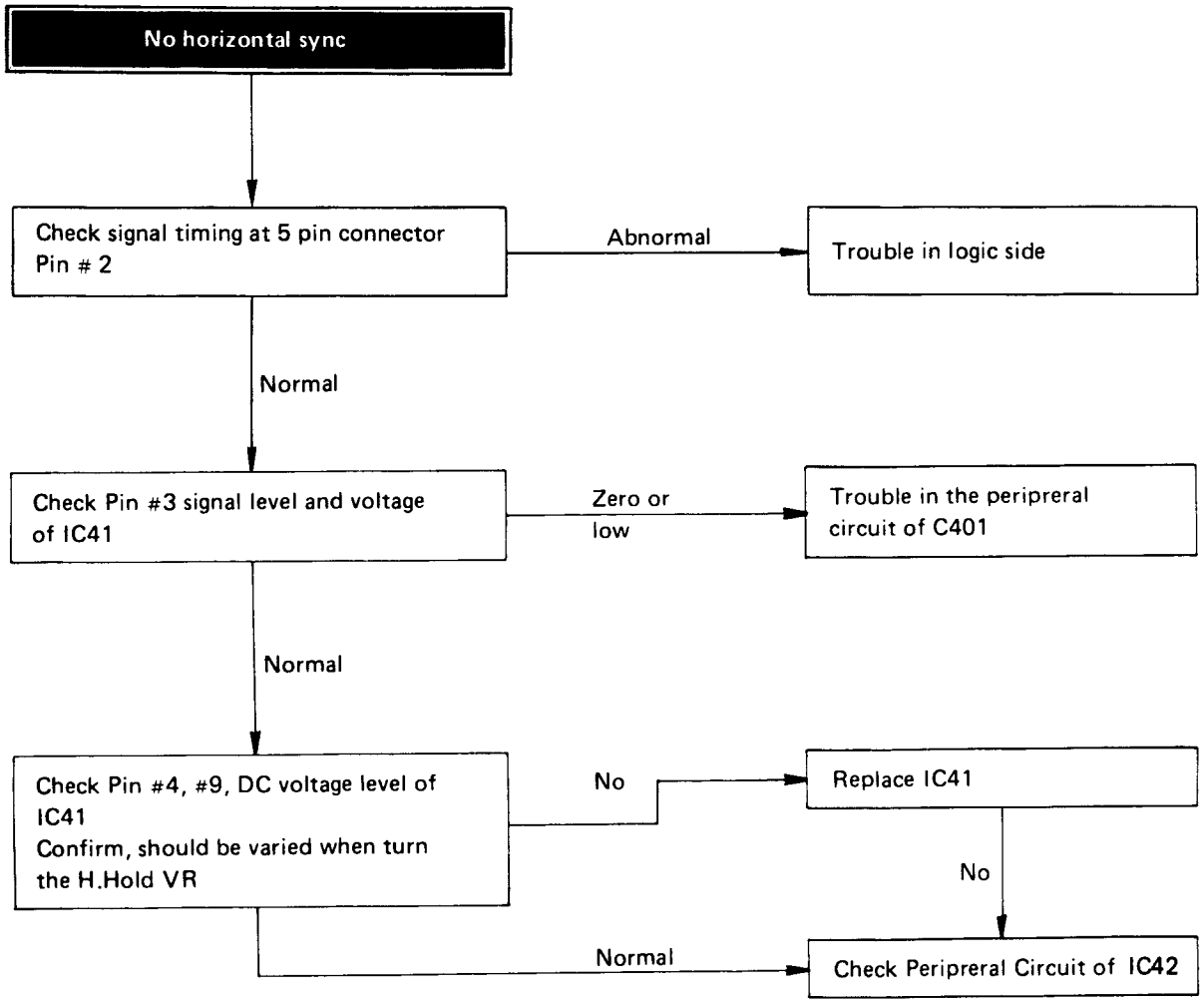


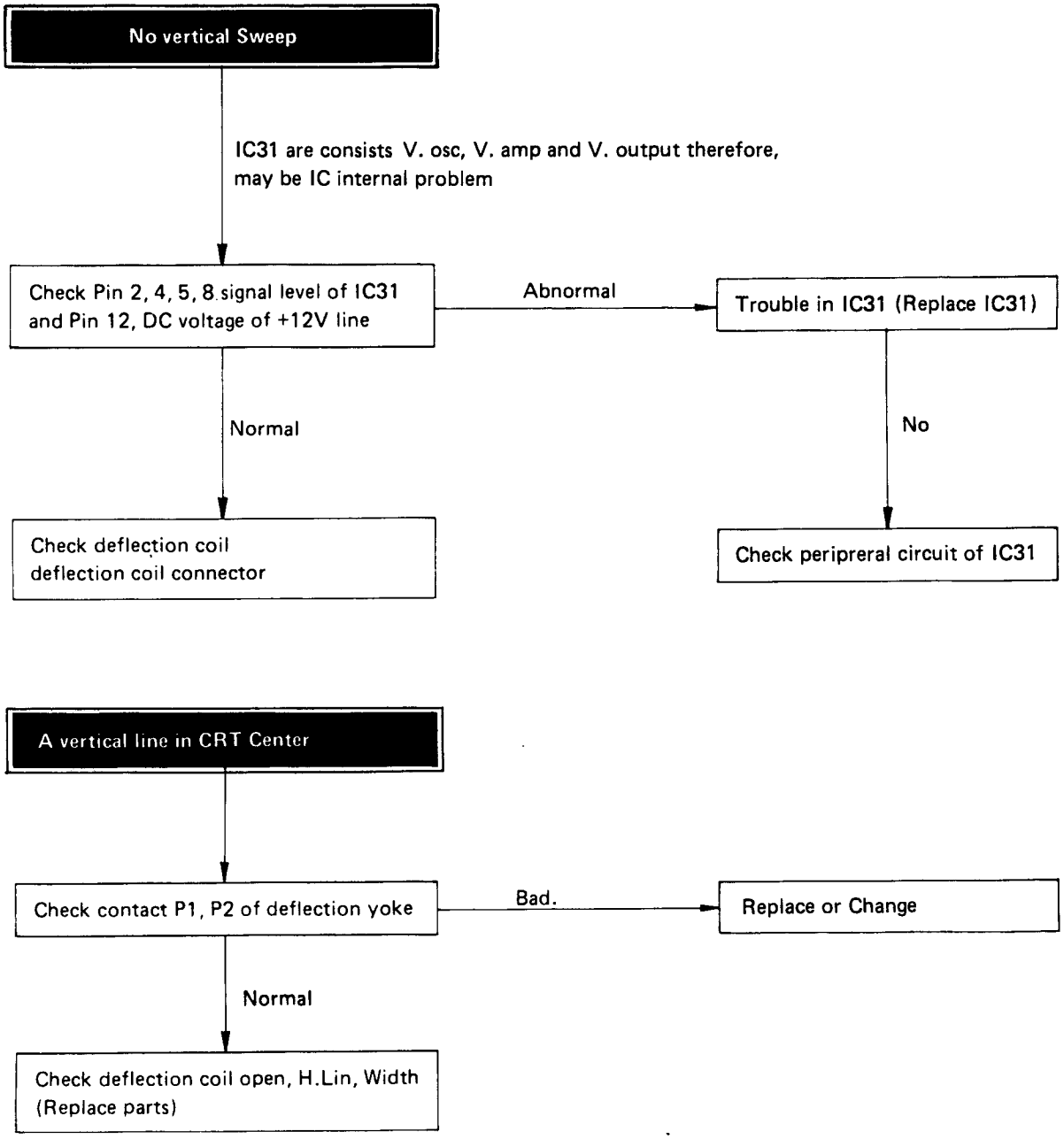
TROUBLE SHOOTING HINTS




No Raster
Check 5 pin connector Pin # 3 voltage level
0V or low
Check DC voltage with no load
Normal
Check CRT Display
Normal
0V or low
Trouble in External Power Supply
Check DC Fuse 2 (A)
Open
Replace Fuse
Normal
Open
Replace IC42
Abnormal
Check the O.S.C. Signal level in Pin #7 and Pin #8 of IC42
Disconnect the lead from Base of H.out transistor
Normal
Fuse OK
Fuse Open
Trouble in Q44
Abnormal
Check base and emitter signal level of Q44
Trouble in H.out transistor Q44 high voltage shorted
DC power supply shorted +B line
Normal
Trouble in high voltage circuit
Check +B line voltage of +40V, G2 +G2


No vertical sync
Check Pin # 5 signal level and timing of 5 pin connector
Abnormal
Trouble in logic
Normal
Check Verticalty of CRT Display
Adjust Vertical hold
No vertical sync
Check Pin #1 signal level of IC31
Abnormal
Trouble in Q31,R300,R301, C303
Normal
Trouble in IC31 (IC31 Replace)


No horizontal sync
Check signal timing at 5 pin connector Pin # 2
Abnormal
Trouble in logic side
Normal
Check Pin #3 signal level and voltage of IC41
Zero or low
Trouble in the peripreral circuit of C401
Normal
Check Pin #4, #9, DC voltage level of IC41
Confirm, should be varied when turn the H.Hold VR
No
Replace IC41
No
Normal
Check Peripreral Circuit of IC42


No vertical Sweep
IC31 are consists V. osc, V. amp and V. output therefore, may be IC internal problem
Check Pin 2, 4, 5, 8 signal level of IC31 and Pin 12, DC voltage of +12V line
Abnormal
Trouble in IC31 (Replace IC31)
Normal
No
Check deflection coil deflection coil connector
Check peripreral circuit of IC31
A vertical line in CRT Center
Check contact P1, P2 of deflection yoke
Bad.
Replace or Change
Normal
Check deflection coil open, H.Lin, Width (Replace parts)

REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by the International symbol ⚠ have special characteristics important for safety.
When replacing any of these components use only manufacture's specified parts.

RESISTOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

Example: Part No. ERD25TJ104 (C) Description 100K (J) 1/4W

CAPACITOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
PP	Polypropylene	L	± 15%
		M	± 20%
		P	+100% −0%
		Z	+80% −20%

Example: Part No. ECKF1H103ZF (C) Description 0.01μF (Z) 50V

	Ref.No.	Part No.	Description
		CABINET & MAIN PARTS	
		TKY809301	FRONT CABINET
		TKX828001	PC BOARD HOLDER
		TUW82932	CRT BAND
		TUX80702-1	CHASSIS FLAME
		TUX80703-1	UPPER PLATE
		TUX80971	CORD BRACKET
⚠		TBM800049	MODEL PLATE
		TES8143-6	SPRING(CRT EARTH)
		TMM1455	BEADS BAND
		TMM81438	RIVET
		TMK81526	STOPPER
		TMK81744	CRT RUBBER
		XTB4+10A	SCREW
		XTB4+12A	SCREW
		XTV3+8F	SCREW
		XTW3+8L	SCREW
		XWC4B	WASHER
		XYE3+EF8	SCREW
⚠		150BGB31	PICTURE TUBE
		TNP82851-24	PC BOARD W/COMPONENT
⚠		TLY80340A	DEFLECTION YOKE
		XTS3+8F	SCREW
		TJC341	TERMINAL(1P)
		TXAJTC4P285	4P CONNECTOR ASSY
		TSN85511	MAGNET
		TPC822151	OUTER CARTON
		TXAPD15001A	FILLER
		TPE84044	SET COVER
⚠		TQF80809	DATE LABEL
		TQF83825	SERIAL NO LABEL
		I.C	
	IC31	AN5763	INTEGRATED CIRCUIT
	IC42	AN5790	INTEGRATED CIRCUIT
		TRANSISTORS	
	Q14	2SC2632R	TRANSISTOR
	Q31	2SC828AQ	TRANSISTOR
⚠	Q44	2SD884LB	TRANSISTOR
		DIODES	
	D31	TVS10E1	DIODE
⚠	D43	TVSBB4A	DIODE
⚠	D44	TVSS1R80	DIODE
	D46	TVSBB2	DIODE
⚠	D47	TVSD1R20	DIODE
	D49	TVSBB2A	DIODE
⚠	D51	TVSBB2A	DIODE
		COIL & TRANSFORMERS	
	L141	TLT047-999	PEAKING COIL
⚠	L402	TLH80410	COIL
	L403	TLH80724	COIL
	L404	TLH80608	COIL
⚠	T401	TLF80894	FLYBACK TRANS
		CONTROL	
	VR11	EVMHOGA00B52	CONTROL B 500 OHM
	VR31	EVNKOAA00B15	CONTROL B 100K OHM
	VR32	EVNKOAA00B54	CONTROL B 50K OHM
	VR33	EVNKOAA00B14	CONTROL B 10K OHM
	VR41	EVMHOGA00B13	CONTROL B 1K OHM
	VR64	EVTJ6US05B26	CONTROL B 2M OHM
	VR67	EVMHOGA00B25	CONTROL B 200K OHM
		CAPACITORS	
	C143	ECCF1H181J	C 180PF J 50V
	C145	ECEA1JU100	E 10UF 63V
	C146	ECKF1H103ZF	C 0.01UF Z 50V
	C301	ECQM1H223JZ	P 0.022UF J 50V

	Ref.No.	Part No.	Description
	C302	ECQM1H223JZ	P 0.022UF J 50V
	C303	ECQM1H103JZ	P 0.01UF J 50V
	C304	ECSF1VE334V	T 0.33UF 35V
	C305	ECSF1CE475Y	T 4.7UF 16V
	C306	ECSF1CE475Y	T 4.7UF 16V
	C307	ECEA1CU100	E 10UF 16V
	C308	ECEA0JU330	E 33UF 6.3V
	C309	ECEA1CU221	E 220UF 16V
	C310	ECEA1AU102	E 1000UF 10V
	C311	ECQM1H333JZ	P 0.033UF J 50V
	C313	ECEA1CU100	E 10UF 16V
	C404	ECQM1H183JZ	P 0.018UF J 50V
	C405	ECQM1H153JZ	P 0.015UF J 50V
	C407	ECEA1EU4R7	E 4.7UF 25V
	C408	ECQM1H333JZ	P 0.033UF J 50V
	C410	ECQM1H472JZ	P 4700PF J 50V
	C411	ECQM1H102JZ	P 1000PF J 50V
	C412	ECQS1332JWT	S 3300PF J 100V
	C423	ECEA1CU221	E 220UF 16V
	C430	ECQM1H223JZ	P 0.022UF J 50V
⚠	C441	ECKD2H332KB9	C 3300PF K 500V
⚠	C443	ECQM4123KZ	P 0.012UF K 400V
⚠	C444	ECEA25W6R5Q	E 6.5UF 25V
	C445	ECEA1CU101	E 100UF 16V
⚠	C460	ECQE6223KZ	P 0.022UF K 600V
⚠	C461	ECEA1JU101	E 100UF 63V
⚠	C462	ECKC3A221KB6	C 220PF K 1KV
	C463	ECEA2VS010Y	E 1UF 350V
	C465	ECEA2VSR47Y	E 0.47UF 350V
	C491	ECEA1CU222	E 2200UF 16V
	C600A	ECQE4104KZ	P 0.1UF K 400V
	C602	ECKD2H102KB2	C 1000PF K 500V
		RESISTORS	
	R120	ERD25FJ470K	C 47 OHM J 1/4W
	R121	ERD50FJ101	C 100 OHM J 1/2W
	R141	ERC12GJ182	S 1.8K OHM J 1/2W
	R143	ERD25FJ470K	C 47 OHM J 1/4W
	R144	ERD25FJ101K	C 100 OHM J 1/4W
	R300	ERD25FJ153K	C 15K OHM J 1/4W
	R301	ERD25FJ472K	C 4.7K OHM J 1/4W
	R302	ERD25FJ683K	C 68K OHM J 1/4W
⚠	R303	ERD25FJ6R8K	C 6.8 OHM J 1/4W
⚠	R304	ERD25FJ1R1K	C 1.1 OHM J 1/4W
	R305	ERD25FJ683K	C 68K OHM J 1/4W
	R306	ERD25FJ563K	C 56K OHM J 1/4W
	R307	ERD25FJ4R7K	C 4.7 OHM J 1/4W
	R310	ERD25FJ153K	C 15K OHM J 1/4W
	R312	ERD25FJ681K	C 680 OHM J 1/4W
	R313	ERD25FJ271K	C 270 OHM J 1/4W
	R314	ERD25FJ391K	C 390 OHM J 1/4W
	R315	ERD25FJ101K	C 100 OHM J 1/4W
	R316	ERD25FJ181K	C 180 OHM J 1/4W
	R317	ERD25FJ103K	C 10K OHM J 1/4W
	R318	ERTD2ZHL333S	THERMISTOR
	R400	ERD25FJ101K	C 100 OHM J 1/4W
	R404	ERD25FJ153K	C 15K OHM J 1/4W
	R405	ERD25FJ332K	C 3.3K OHM J 1/4W
	R407	ERD25FJ103K	C 10K OHM J 1/4W
	R408	ERD25FJ273K	C 27K OHM J 1/4W
	R409	ERD25FJ222K	C 2.2K OHM J 1/4W
	R410	ERD25FJ223K	C 22K OHM J 1/4W

	Ref.No.	Part No.	Description
	R412	ERD25FJ102K	C 1K OHM J 1/4W
⚠	R423	ERD25FJ220K	C 22 OHM J 1/4W
⚠	R432	ERQ1CJP100	F 10 OHM J 1W
⚠	R441	ERD25FJ6R8K	C 6.8 OHM J 1/4W
	R442	ERD50FJ1R0	C 1 OHM J 1/2W
	R443	ERD25FJ101K	C 100 OHM J 1/4W
	R447	ERG1ANJ221	M 220 OHM J 1W
⚠	R460	ERD25FJ560K	C 56 OHM J 1/4W
⚠	R461	ERD25FJ6R8K	C 6.8 OHM J 1/4W
	R465	ERD25FJ274K	C 270K OHM J 1/4W
	R466	ERD25FJ393K	C 39K OHM J 1/4W
	R472	ERC12GJ104	S 100K OHM J 1/2W
	R600	ERC12GJ223	S 22K OHM J 1/2W
	R601	ERC12GJ152	S 1.5K OHM J 1/2W
⚠	R603	ERD25FJ103K	C 10K OHM J 1/4W
⚠	R605	ERD25FJ103K	C 10K OHM J 1/4W
⚠	R606	ERD25FJ103K	C 10K OHM J 1/4W
		OTHERS	
		TJS25640V	CRT SOCKET
		TMK81565	BARRIER(CRT PC BOARD)
		TMM81416	CORD BAND (SMALL)
		TMM81434	RIVET
		TQF81862	FUSE LABEL
⚠		XBA1C20NU100	FUSE(2A)
		XTV3+8B	SCREW
	CL1	TJE81110	TERMINAL
	K	TJS8A4150	3P CONNECTOR
	P	TJS868260	4P SOCKET
	SF1	TJC3316	FUSE HOLDER
	SF2	TJC3316	FUSE HOLDER
	Y	TJS8A4160	5P CONNECTOR

ORDER NO FTD89025172S1
G4

Service Manual

CRT Data Display

MODEL TR-60S1A

Chassis No. Y21

Supplement - 1

Please use this manual together with the service manual for Model No. TR-60S1A Order No. FTD86055079C1.

No.	Reason	Ref. No.	Original Part No.	New Part No.	Part Name & Description	Applicable S/N
1	Countermeasure for short/open test	R307 R423 R432 R442	ERD25FJ4R7K ERD25FJ220K ERQ1CJP100 ERD50FJ1R0	ERQ14AJ4R7 ERD25FJ470K ERG2ANJ100 ERD25FJ1R0K	F 4.7Ω J 1/4W C 47Ω J 1/4W M 10Ω J 2W C 1.0Ω J 1/4W	F□6330001
2	Customer request (Change +B-Voltage)	J70 H2-H2 H4-H2 Input voltage:12V	None Lead wire (22cm) AWG24, Red None	ERD25FJ5R6K Delete Lead wire (26cm) AWG24, Red Insert H2 on CRT socket board Input voltage : 11.75V	C 5.6Ω J 1/4W	F□6330001
3	To improve temperature derating	C307 C308 C461	ECEA1CU100 ECEA0JU330 ECEA1JU101	ECEA1CG100S ECEA1CG330S ECEA1JG101S	E 10μF 16V E 33μF 16V E 100μF 63V	F□6330001
4	Cost down	R121	ERD50FJ101	ERD25FJ101K	C 100Ω J 1/4W	F□6330001
5	To improve temperature derating	R314	ERD25FJ391K	ERDS1FJ391	C 390Ω J 1/2W	F□7350001
6	Countermeasure for malfunction of X-ray protector	R407	ERD25FJ103K	ERD25FJ101K	C 100Ω J 1/4W	F□7350001
7	To improve reliability	R472 R600	ERC12GJ104 ERC12GJ223	ERC12AGK104 ERC12AGK223	S 100kΩ K 1/2W S 22kΩ K 1/2W	F□7460001
8	Customer request (To ensure securing the deflection yoke)		Amount of resin to the deflection yoke is about 0.5g	Increase amount of resin to the deflection yoke (About 1.0g)		F□7360001

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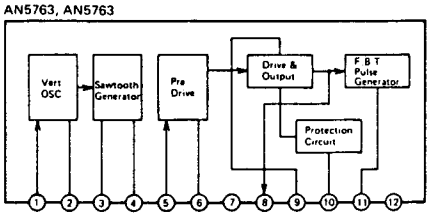
NOTE

1. **RESISTOR**
   All resistors are carbon 1/4W resistor, unless otherwise noted the following marks.
   Unit of resistance is OHM (Ω). (K=1,000, M=1,000,000)
   ▲ : Solid resistor ⊗ : Fusible
   Ⓕ : Non Flame

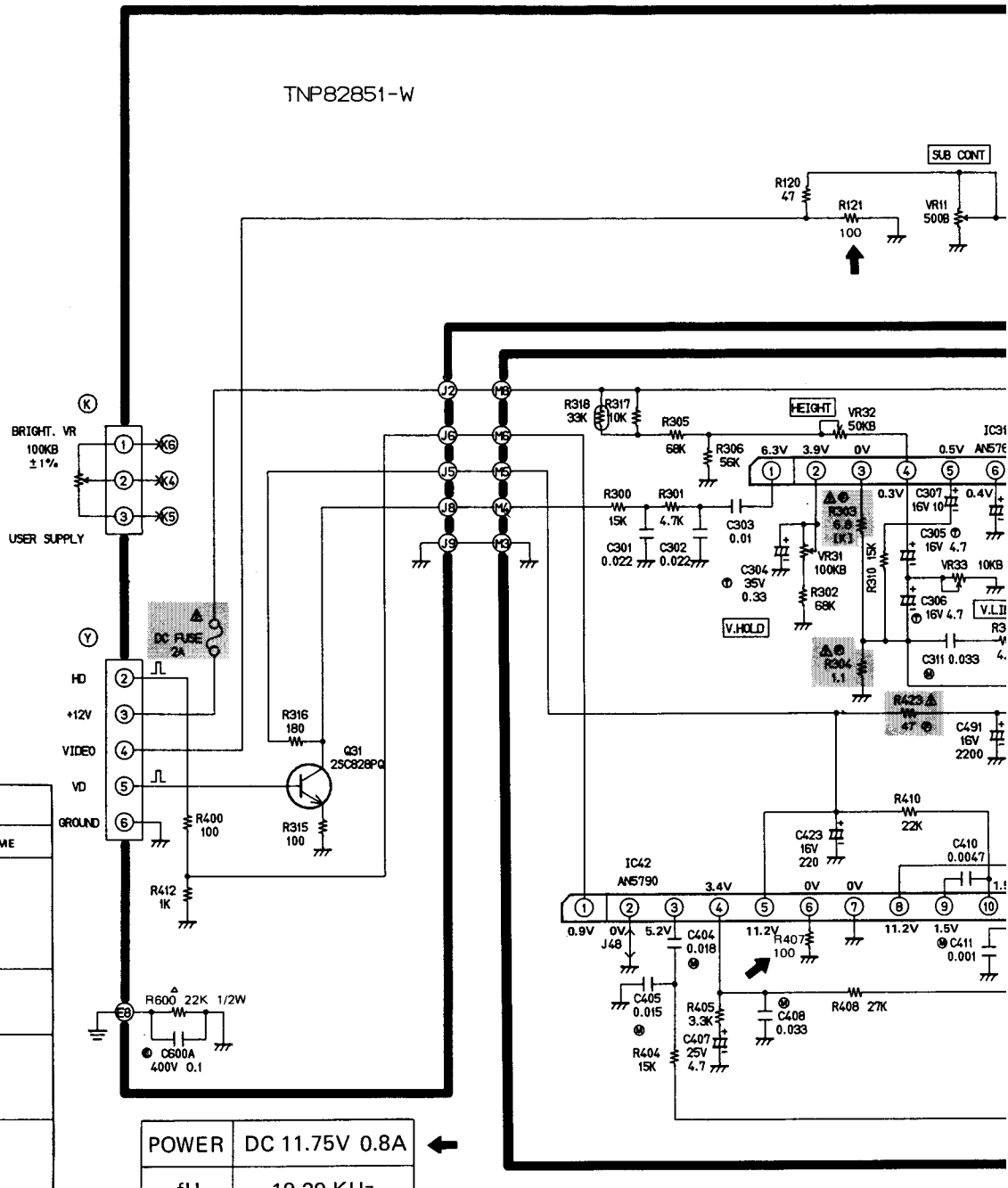
2. **CAPACITOR**
   All capacitors are ceramic 50V capacitor, unless otherwise noted the following marks.
   Unit of capacitance is μF, unless otherwise noted.
   Ⓜ : Polyester Ⓢ : Polystylene capacitor
   ±Ⓔ : Electrolytic capacitor Ⓣ : Tantalum

3. **COIL**
   Unit of inductance is μH.

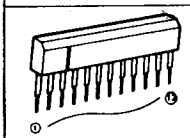
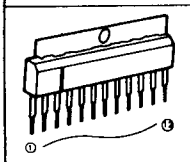
AN5763, AN5763



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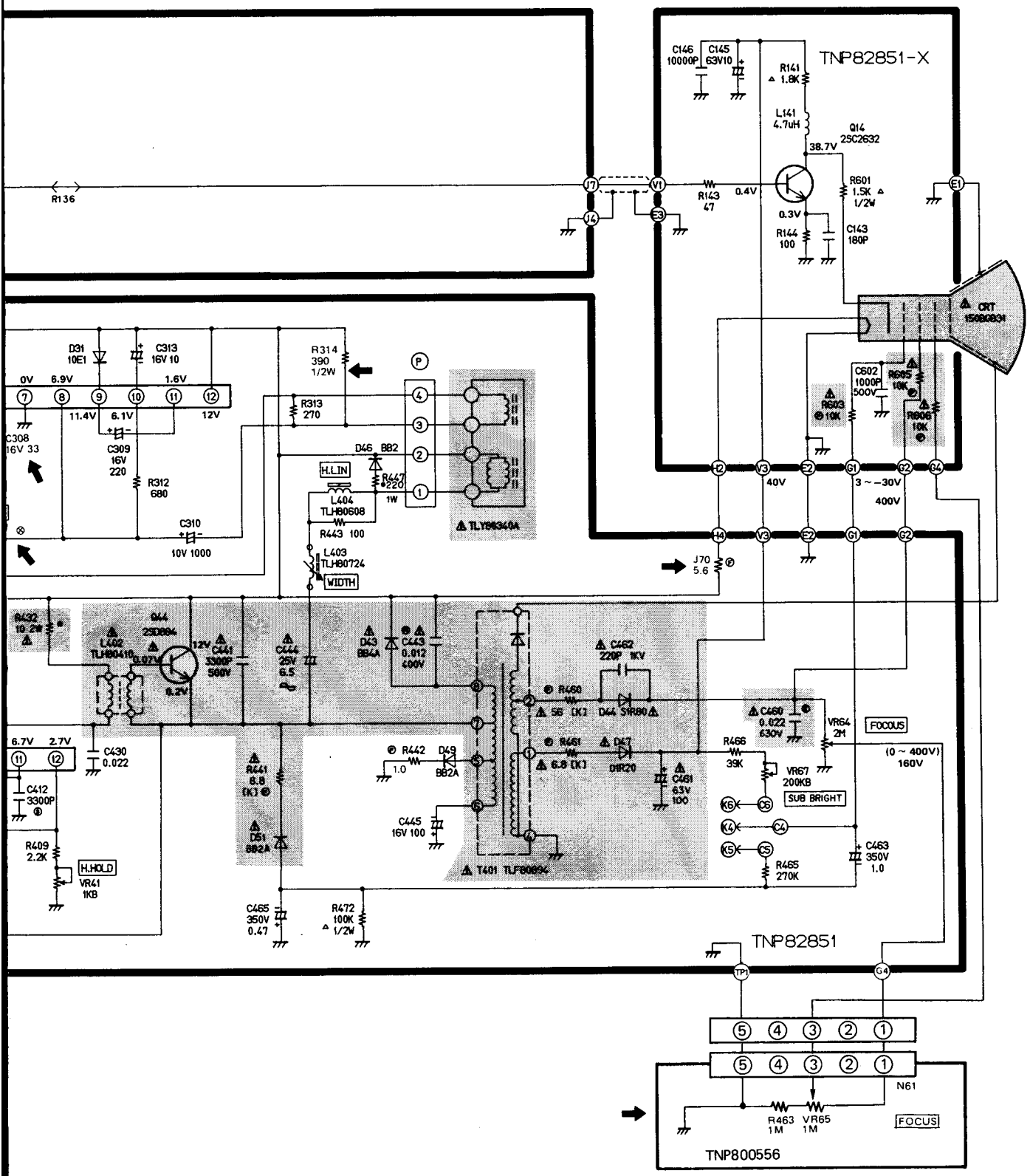
POWER	DC 11.75V 0.8A
fH	19.20 KHz
fV	60 Hz

TRANSISTOR,BASE INFORMATION	
LOCATION	PARTS NAME
	2SC828
	2SC2632
	2SD884
	AN5790
	AN5762 AN5763 AN5763(N)

FOR MODEL TR-60S1A

IMPORTANT SAFETY NOTICE

The component identified by shading or the international symbol ⚠ on this schematic diagram incorporates special features important for protection from X-Radiation, fire and electrical shock hazards. When servicing it is essential that only manufacturer's specified parts be used for those critical components.



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