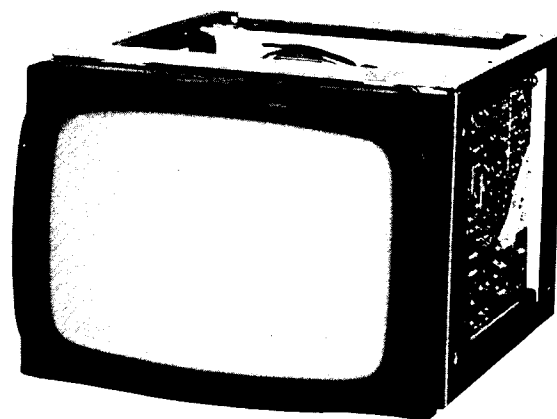


# Service Manual

CRT Data Display  
MODEL TR-60S1A

**Chassis No. Y21**



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**Panasonic**®

Panasonic Industrial Company Division of  
Matsushita Electric Corporation of America  
One Panasonic way, Secaucus, New Jersey 07094.

## 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 possibility 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. (horizontal phase 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

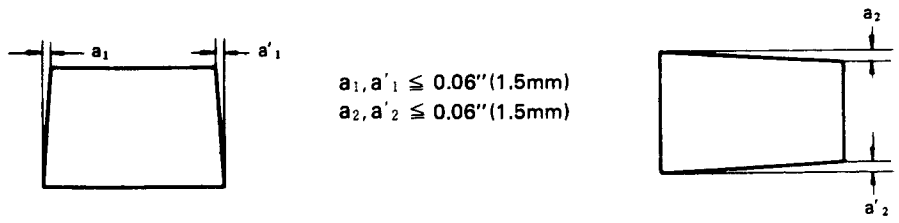
**Image size variation:**

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 <sup>+30</sup> <sub>-25</sub> °C

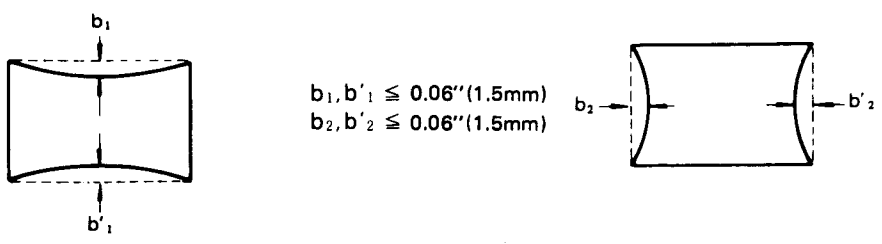
**Resolution:**

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

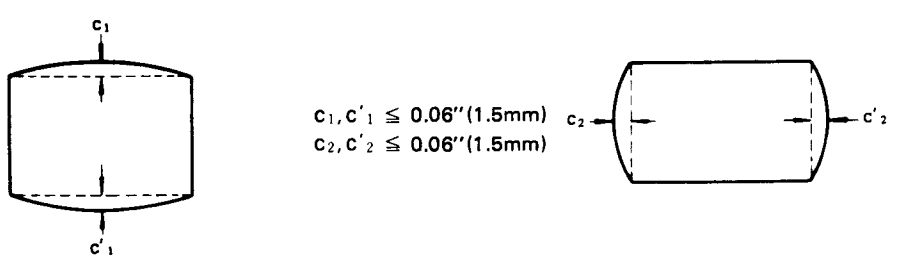
1. Trapezoid



2. Pincushion



3. Barrelling



4. Parallelogram

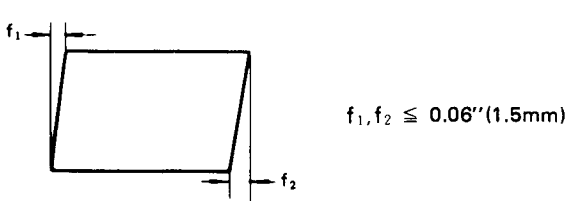


Fig. 1 GEOMETRIC DISTORSION

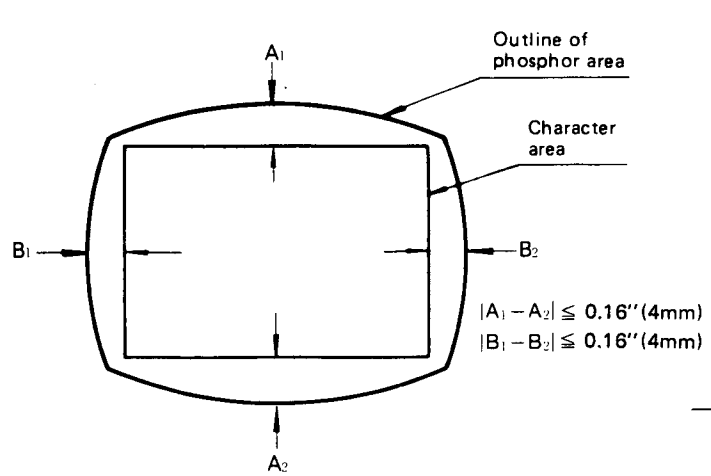


Fig. 2 CENTERING

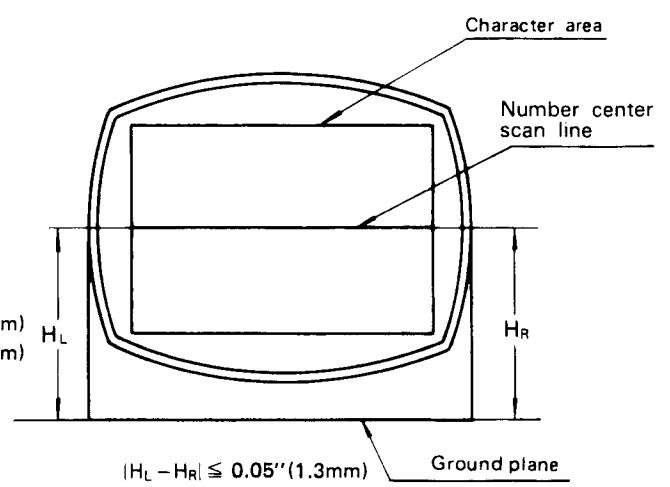
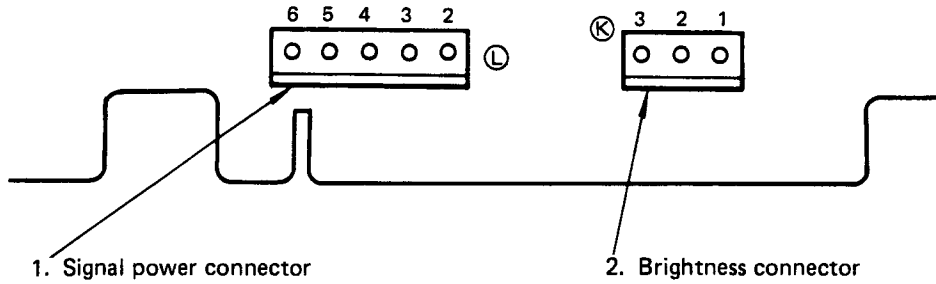


Fig. 3 HORIZONTAL TILT

# CONNECTOR WIRING

## P.C.B. HEADER CONNECTION



5P header : AMP641215-5

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

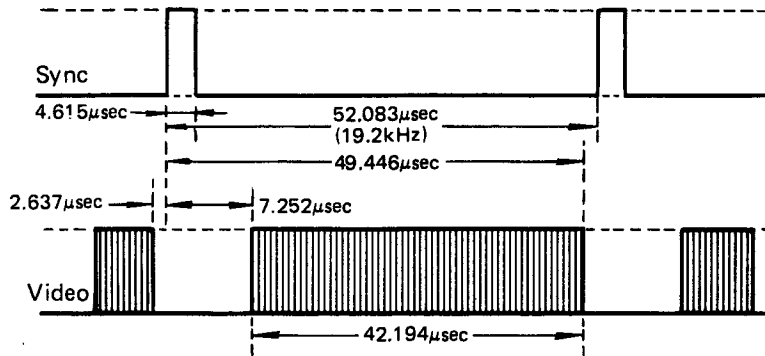
3P header : AMP6412515-5

Pin No.	Description
1	High
2	Arm
3	Low

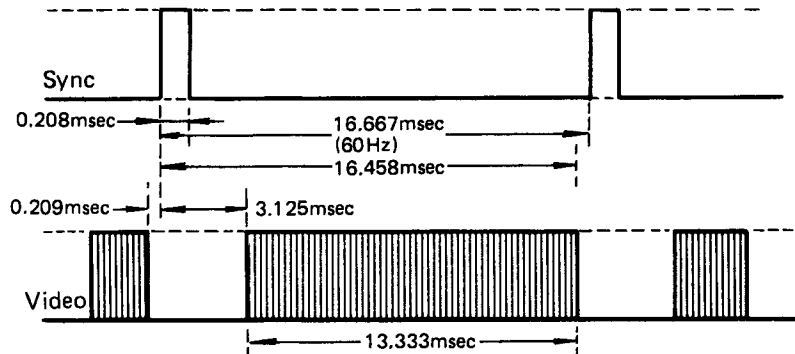
NOTE: BRIGHT. VR  
100KB±1% USER SUPPLY

## TIMING CHART

### Horizontal Sync.

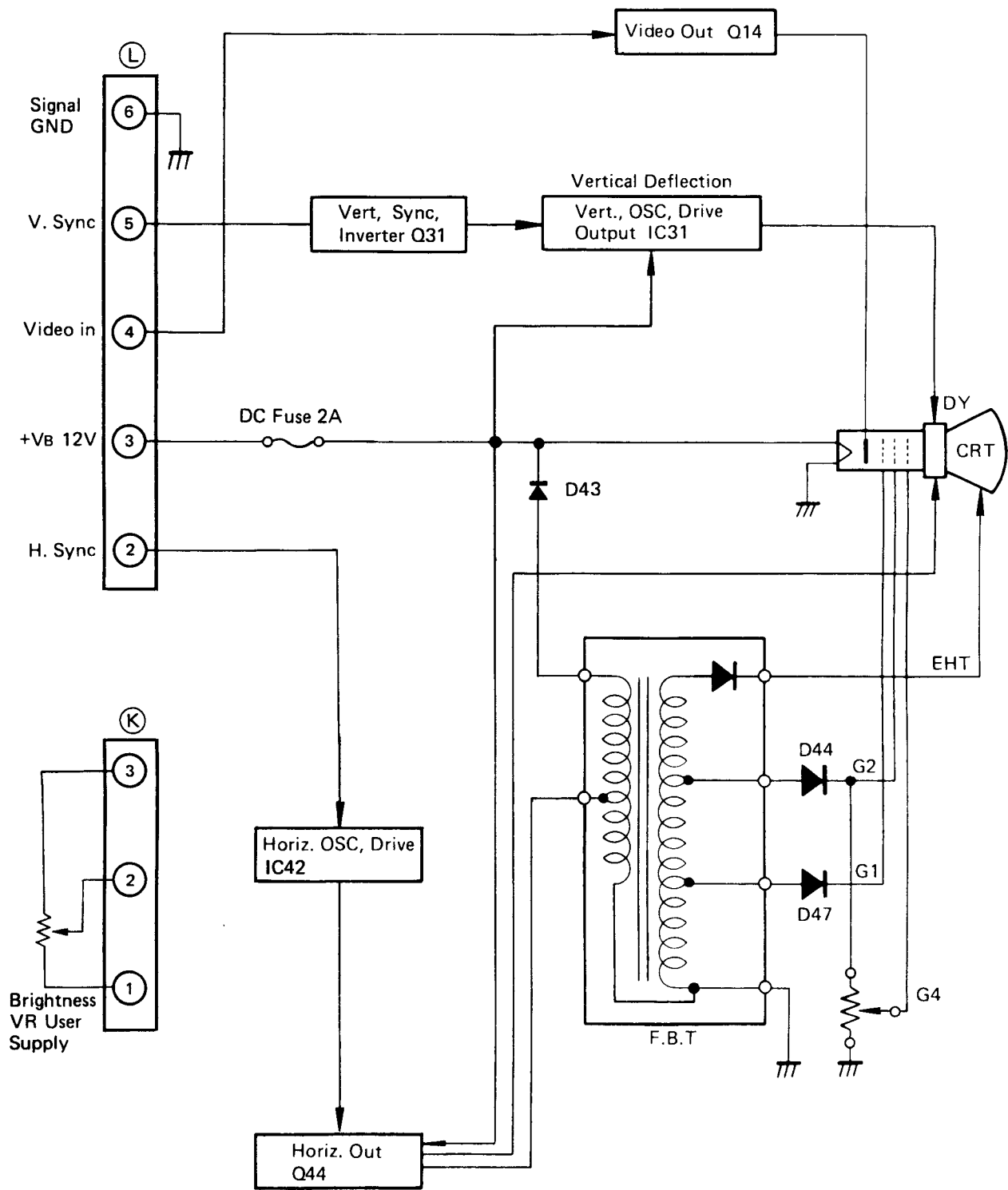


### Vertical Sync.

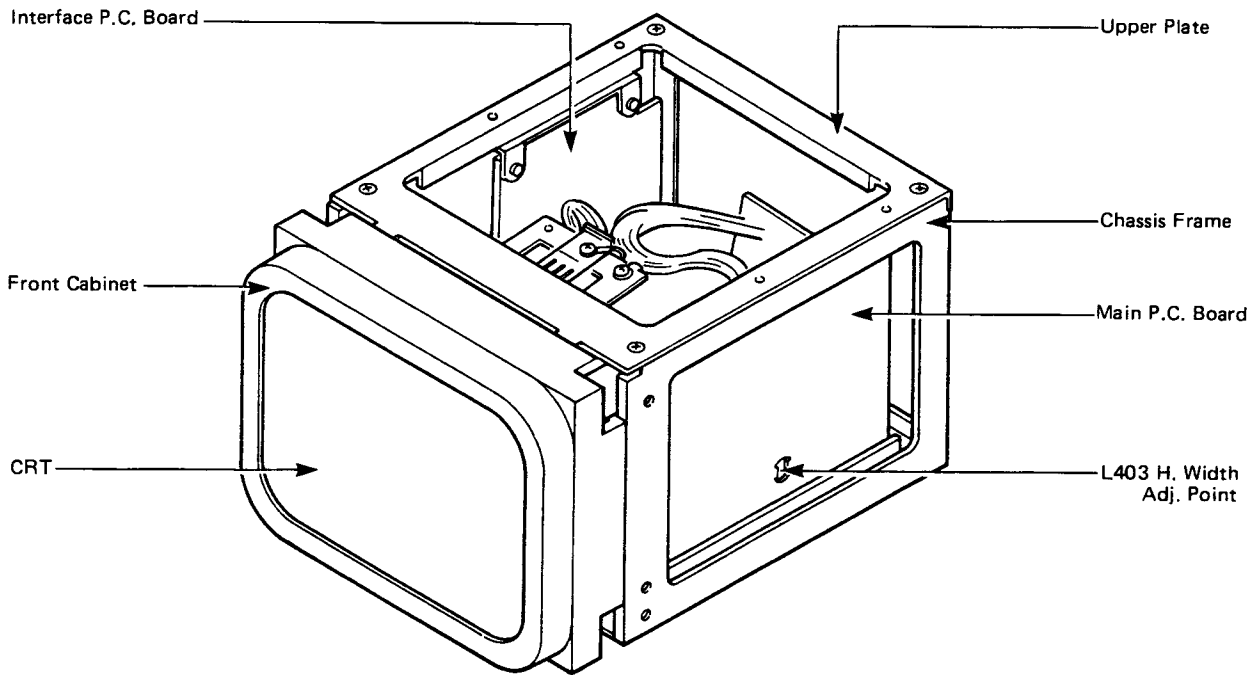


Note : Time tolerance ±0.1%.  
Sample unit is adjusted according to this timing and frequency  
Video Signal : 50% Duty 100% Mod.

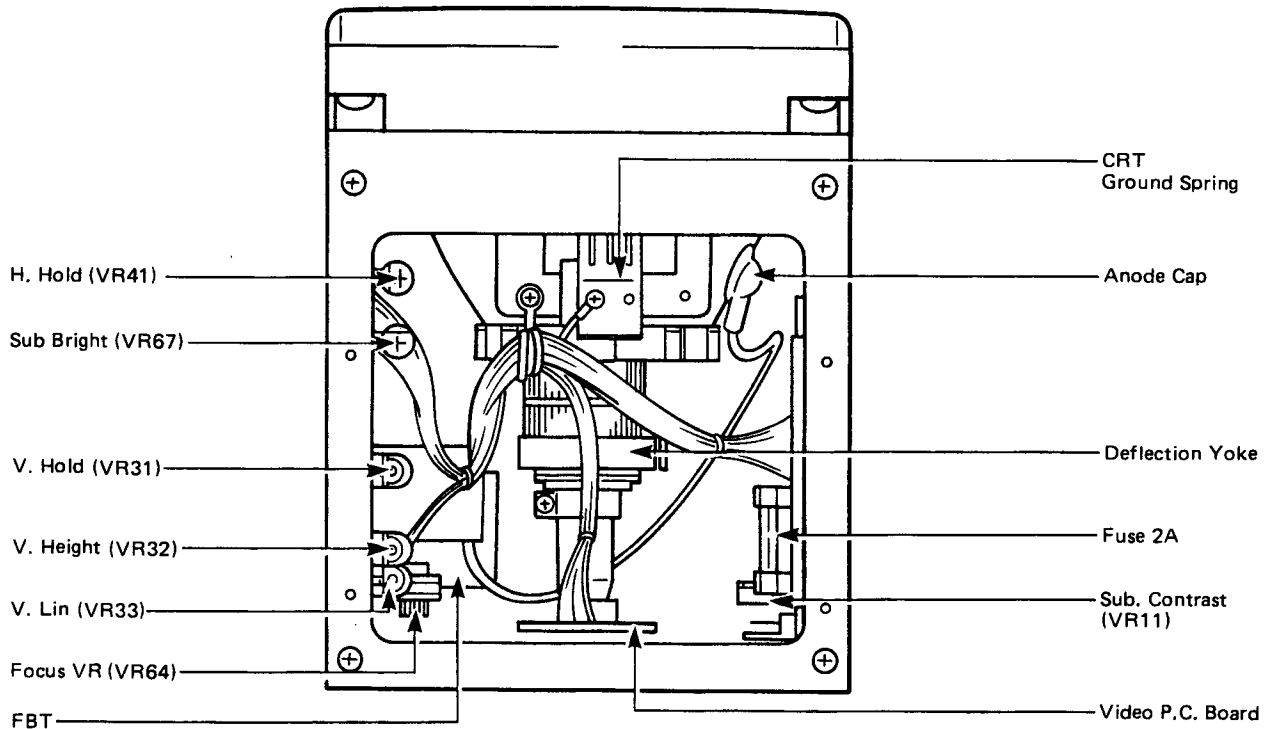
BLOCK DIAGRAM



# 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-metallic).  
Variable resistor by – screw driver and deflection yoke (deflection distortion) by square tuning tool (non-metallic).
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  $50 \text{ Lx} \pm 20\%$  (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).

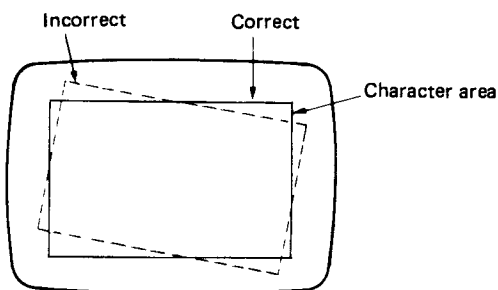


Fig. 4

### • Horizontal Hold Adjustment

Adjust the horizontal hold control (VR41) to get stable character (syncing condition) as shown in below (See Fig. 6).

Under the condition of free running i. e. horizontal sync signal is disconnected.

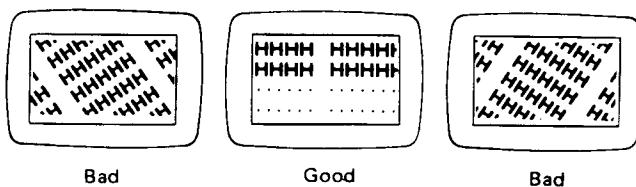
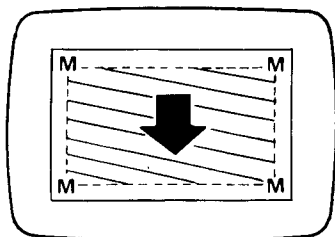


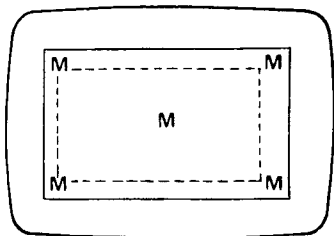
Fig. 6

### • Vertical Hold Adjustment

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



Rolling



Locking in

Fig. 5

### • Vertical Height Adjustment

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

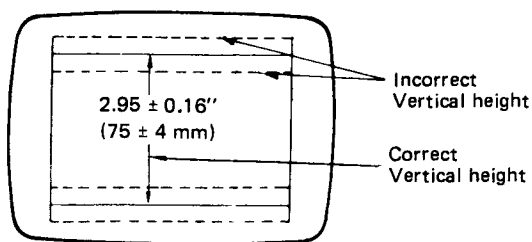


Fig. 8



• **Horizontal Width Adjustment**

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

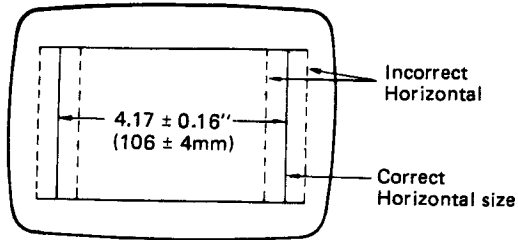


Fig. 9

• **Vertical Linearity Adjustment**

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

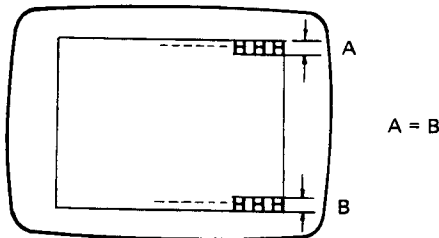


Fig. 10

• **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.

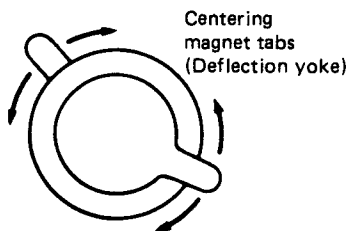
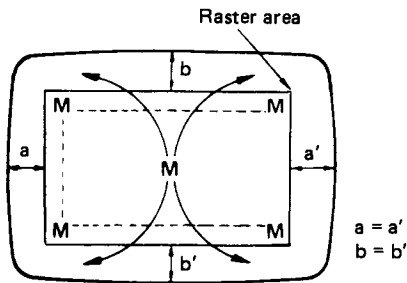


Fig. 11

• **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.

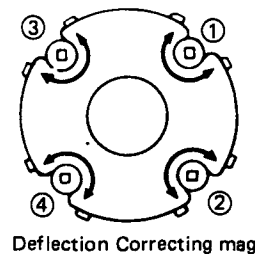
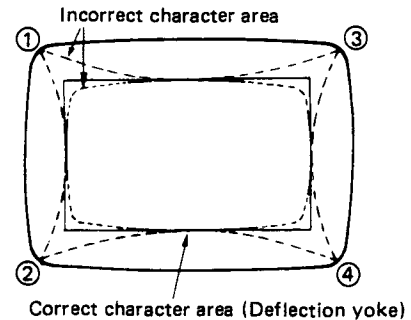


Fig. 12

## 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 exert force on this neck.

Before applying power to the CRT Display an inspection should be performed 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 storing 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.

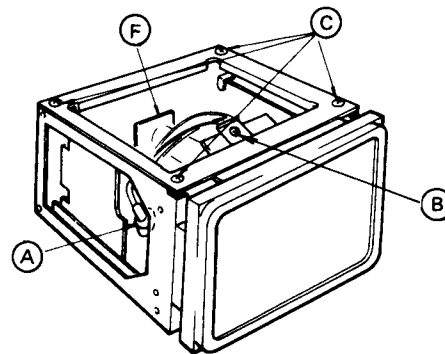
## DISASSEMBLY INSTRUCTION

### • How to replace the Main P.C.Board Ass'y

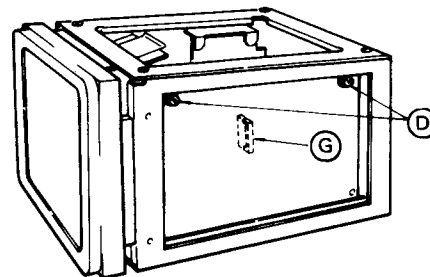
- (1) Remove the anod cap (A)  
(Care must be taken as high voltage may be remaining)
- (2) Remove the ground terminal fixing screw (B)
- (3) Remove the upper plate fixing four screws (C)
- (4) Remove the main P.C. Board fixing two screws (D)
- (5) Remove the interface P.C. Board fixing two screws (E)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

### • How to replace the CRT

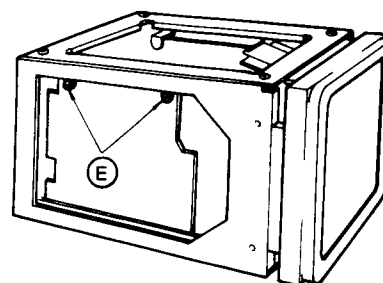
- (1) Remove the anod cap (A)  
(Care must be taken as high voltage may be remaining)
- (2) Remove the upper plate fixing four screws (C)
- (3) Remove the CRT socket P.C. Board (F) from the CRT
- (4) Remove the deflection yoke connector (G) of the main P.C. Board
- (5) Expand the frame (H) a little bit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



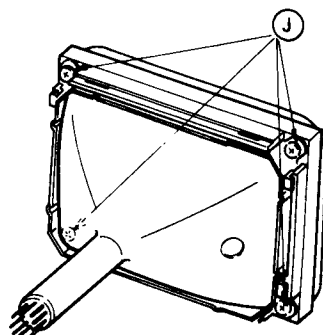
Top View



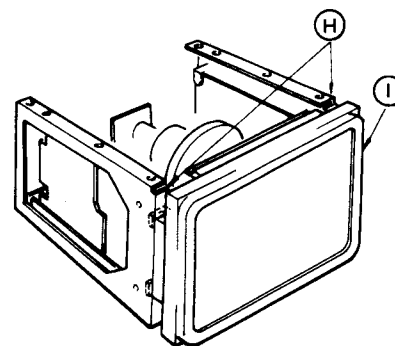
Right Side View



Left Side View

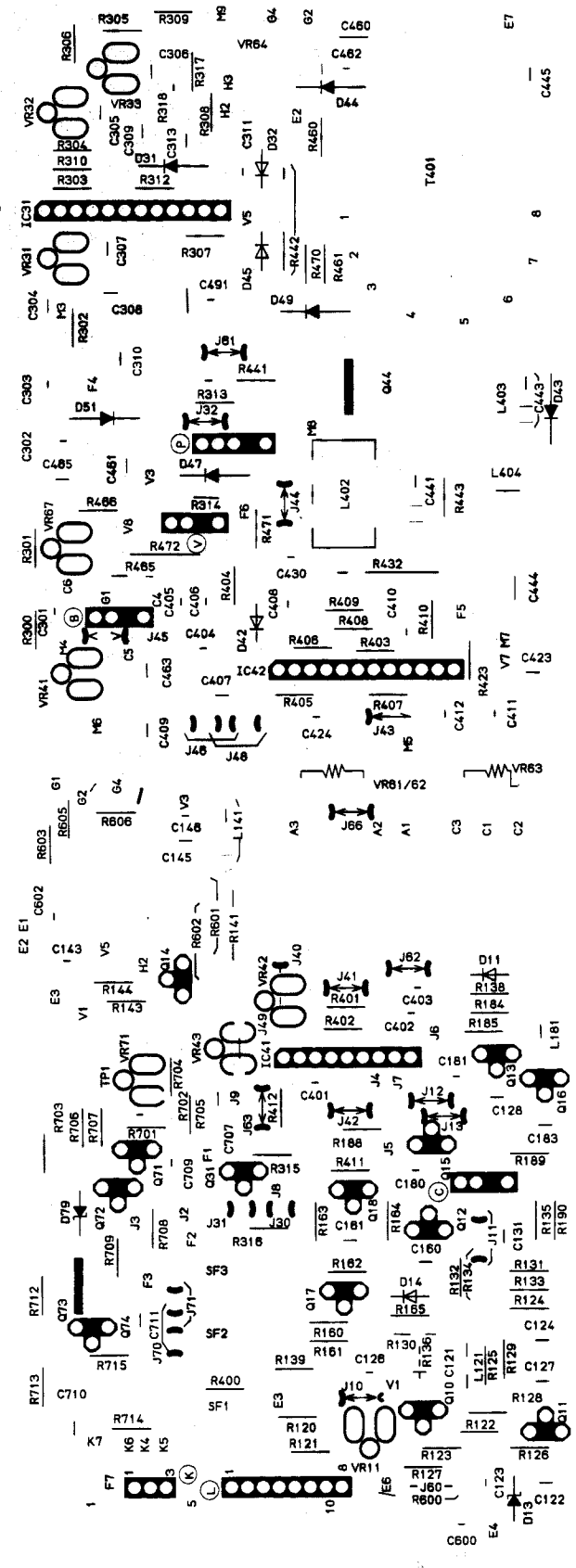


CRT. Block



Top View

MONITOR CIRCUIT BOARD-SOLDER VIEW



# SCHEMATIC DIAGRAM

**NOTE**

**1. RESISTOR**

All resistors are carbon 1/4W resistor, unless otherwise noted the following marks.  
Unit of resistance is OHM ( $\Omega$ ). (K=1,000, M=1,000,000)

- △ : Solid resistor
- ⊙ : Non Flame

**2. CAPACITOR**

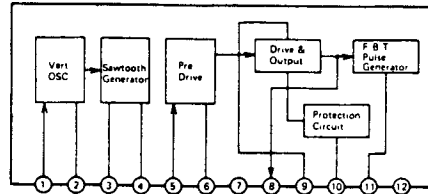
All capacitors are ceramic 50V capacitor, unless otherwise noted the following marks.  
Unit of capacitance is  $\mu$ F, unless otherwise noted.

- ⊙ : Polyester
- ⊕ : Electrolytic capacitor
- ⊖ : Polystyrene capacitor
- Ⓢ : Tantalum

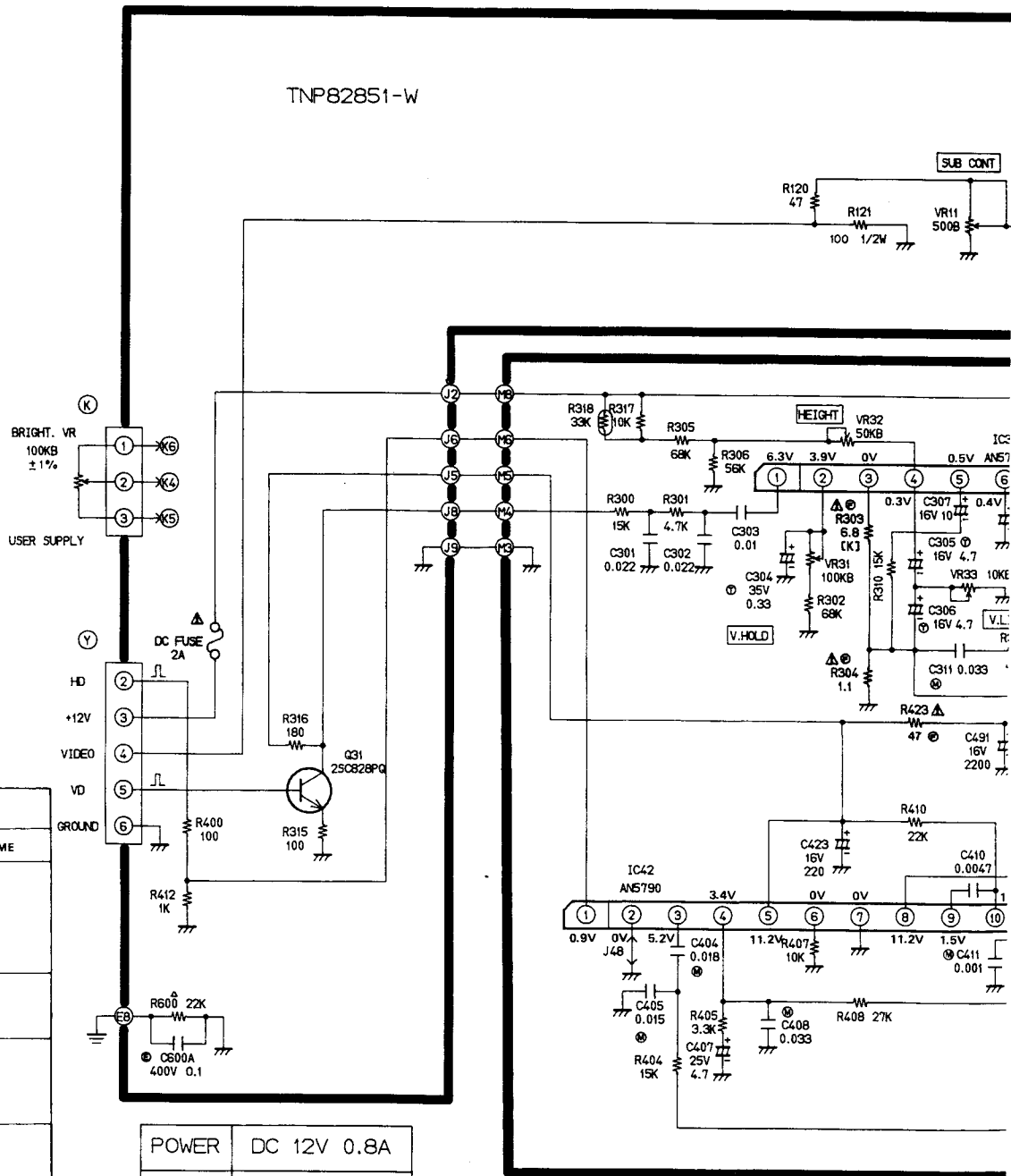
**3. COIL**




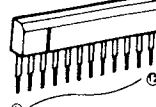
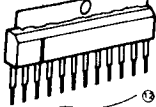
Unit of inductance is  $\mu$ H.

AN5763, AN5763



TNP82851-W

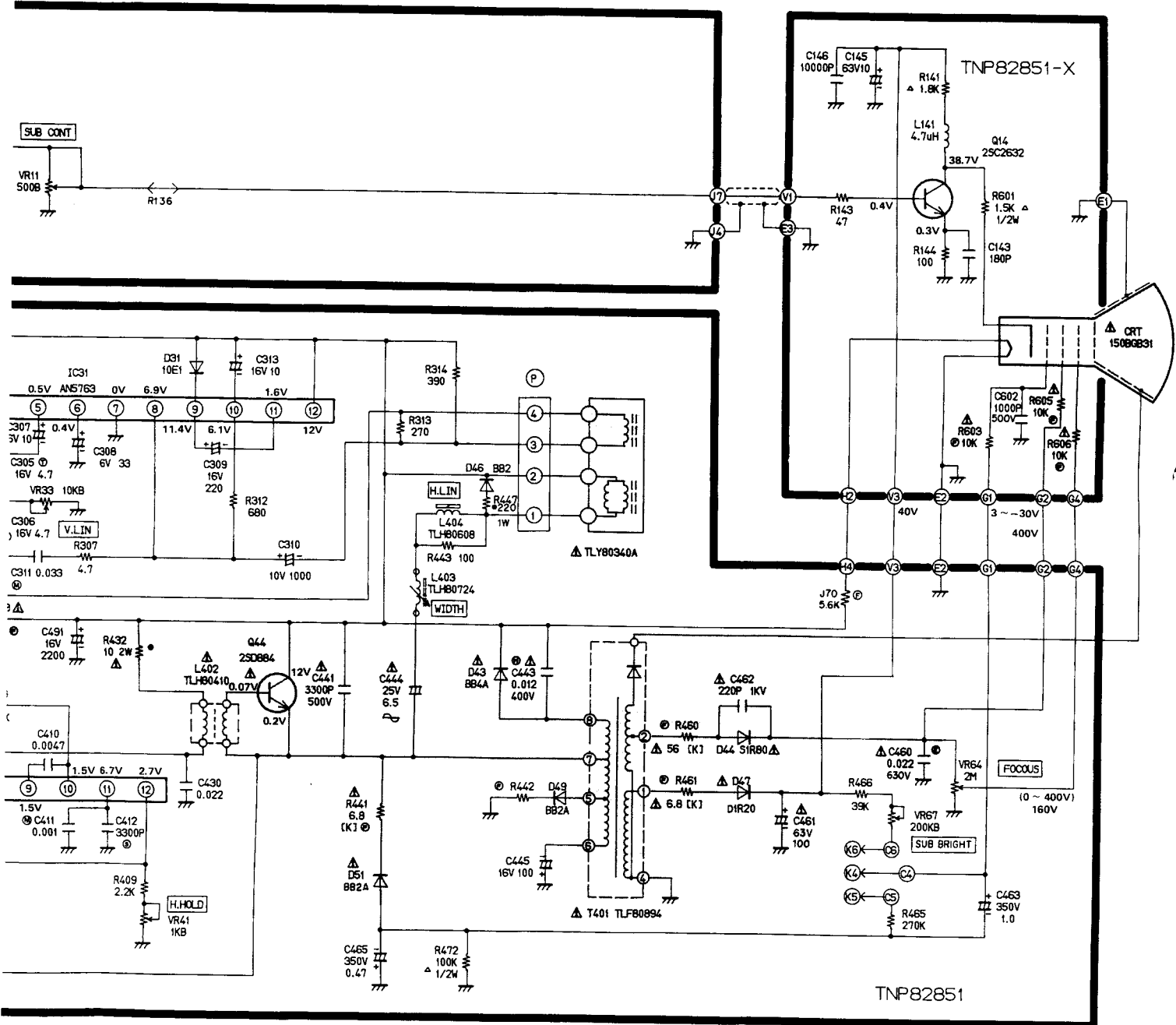


TRANSISTOR BASE INFORMATION	
LOCATION	PARTS NAME
	25C828
	25C2632
	2SD884
	AN5790
	AN5762 AN5763 AN5763(N)

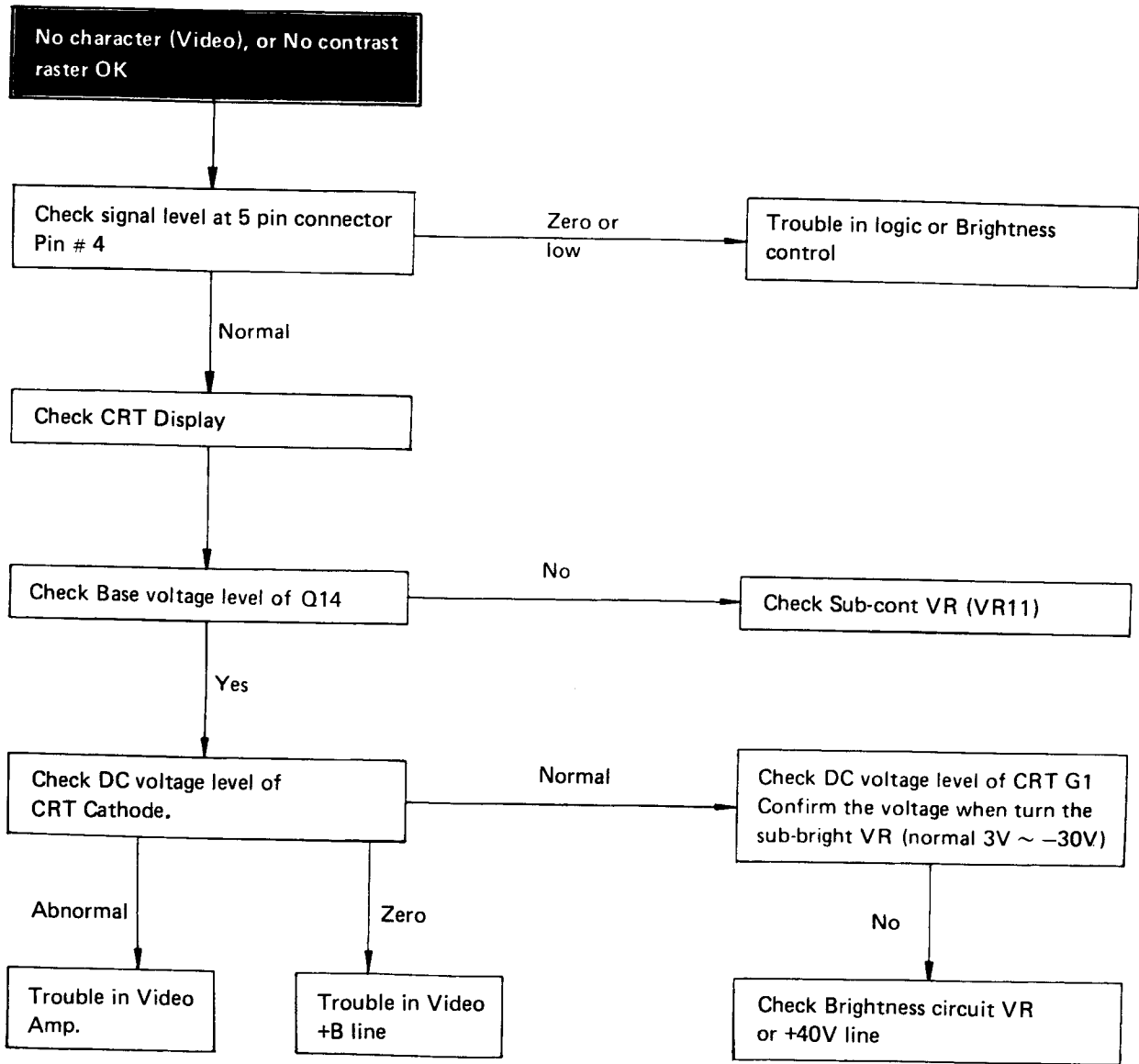
POWER	DC 12V 0.8A
fH	19.20 KHz
fV	60Hz

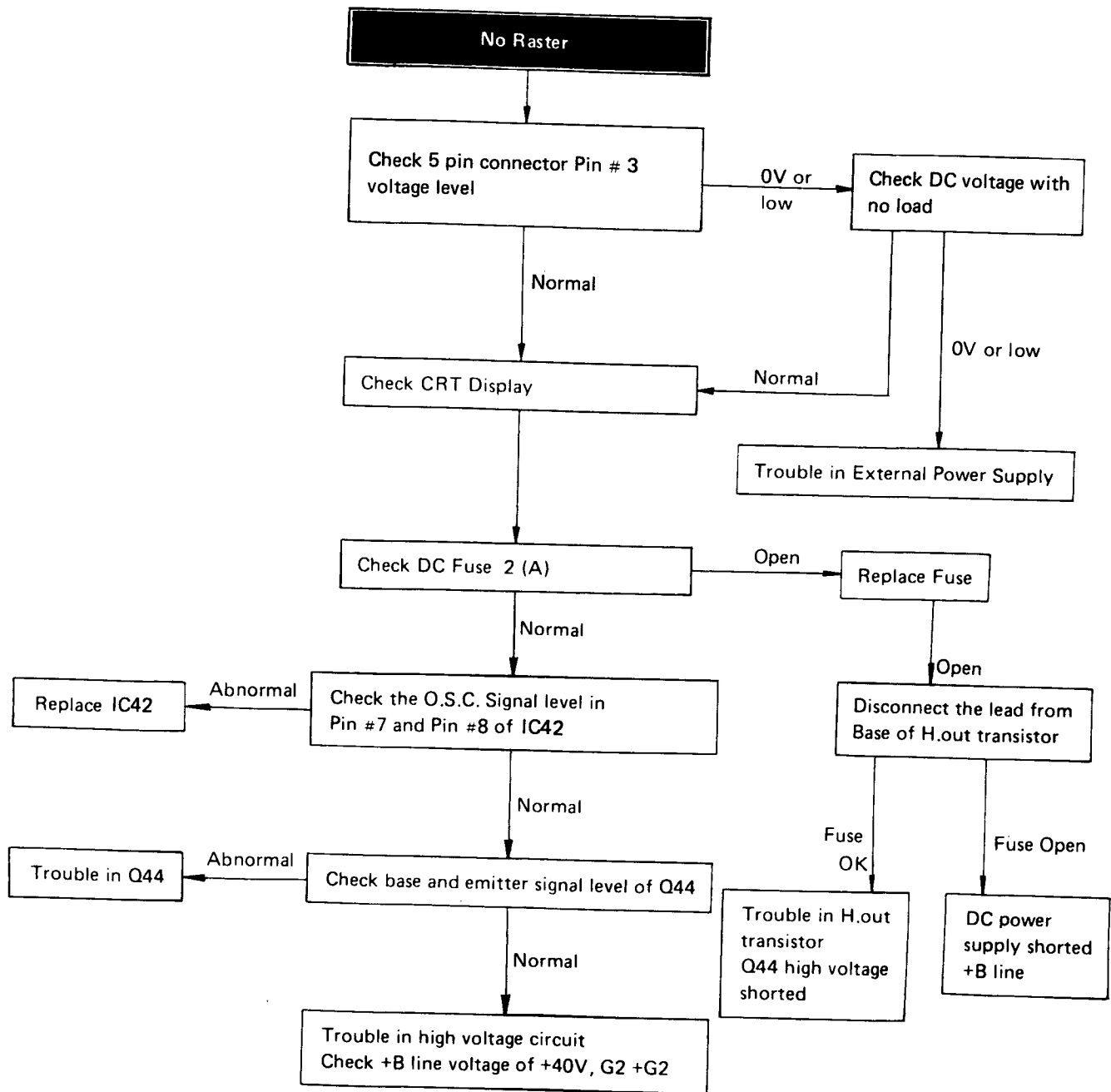
IMPORTANT SAFETY NOTICE

The component identified by shading or the international symbol  $\Delta$  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.

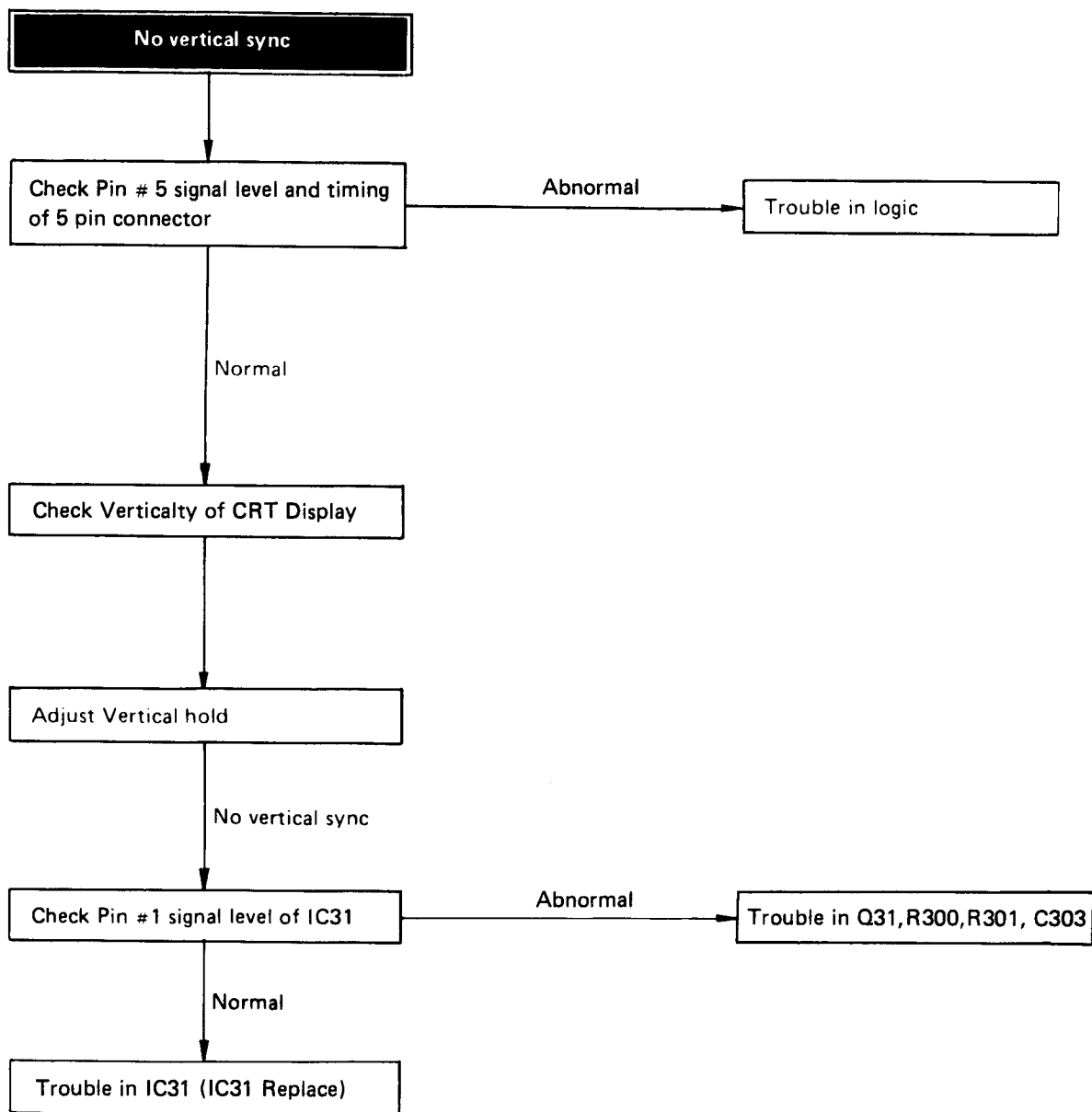


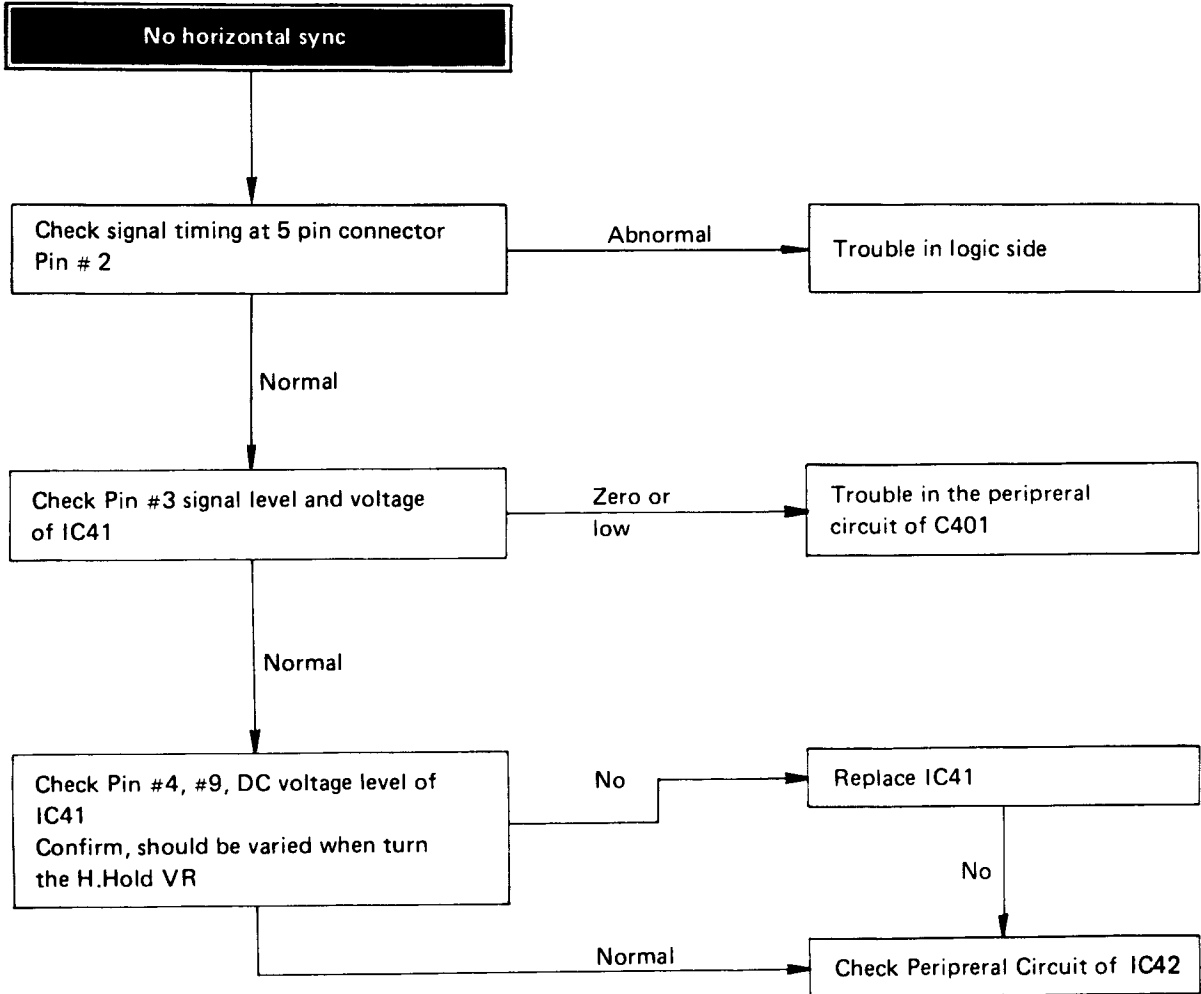
—TROUBLE SHOOTING HINTS—

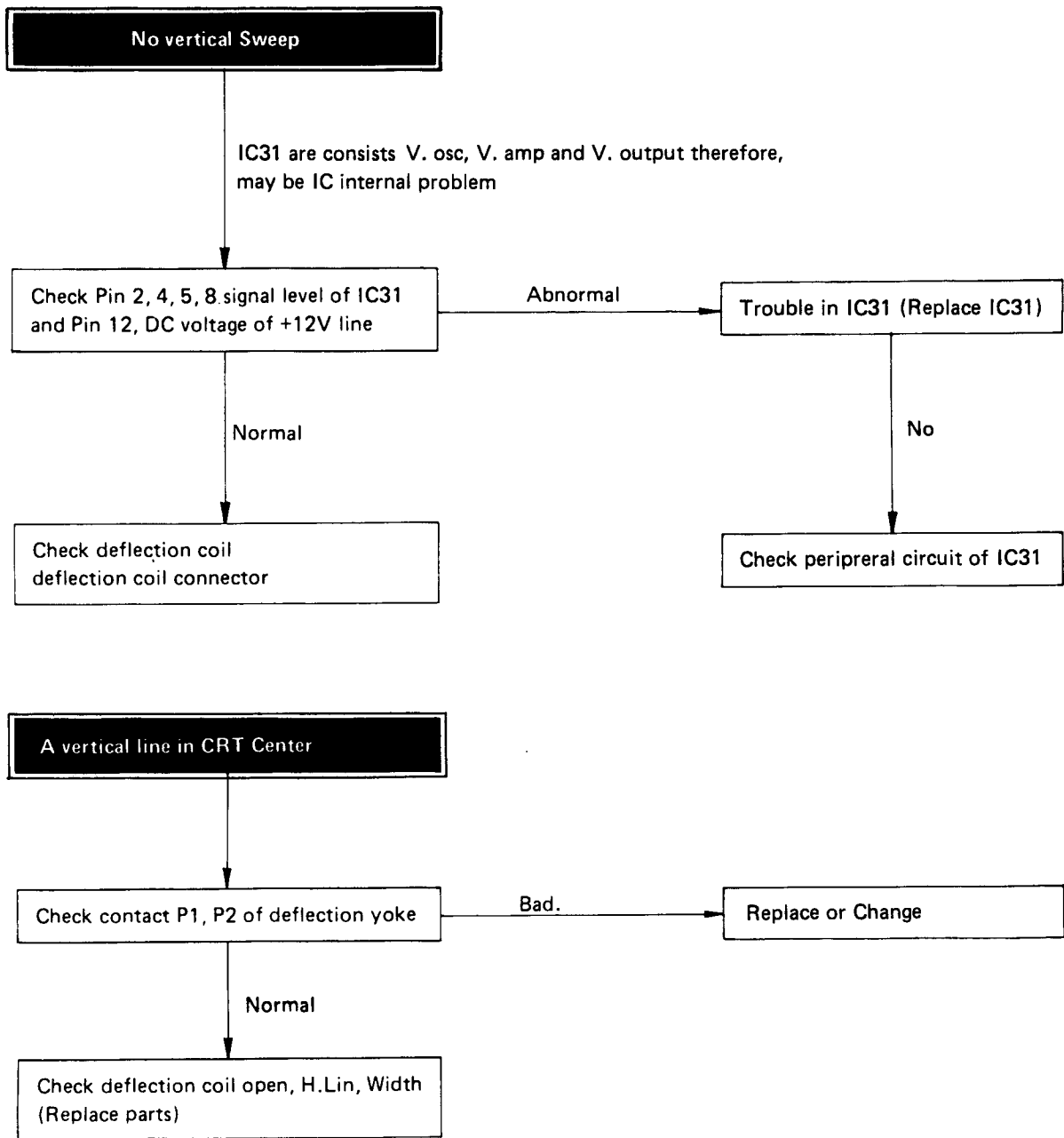












# REPLACEMENT PARTS LIST

## Important Safety Notice

Components identified by the International symbol  $\Delta$  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	$\pm 1\%$
F	Fuse	J	$\pm 5\%$
M	Metal Oxide	K	$\pm 10\%$
S	Solid	M	$\pm 20\%$
W	Wire Wound	G	$\pm 2\%$

Part No. Description

Example: ERD25TJ104  $\text{\textcircled{C}}$  100K  $\text{\textcircled{J}}$  1/4W

### CAPACITOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Ceramic	C	$\pm 0.25\mu\text{F}$
E	Electrolytic	D	$\pm 0.5\mu\text{F}$
P	Polyester	F	$\pm 1\mu\text{F}$
S	Styrol	J	$\pm 5\%$
T	Tantalum	K	$\pm 10\%$
PP	Polypropylene	L	$\pm 15\%$
		M	$\pm 20\%$
		P	+100% -0%
		Z	+80% -20%

Part No. Description

Example: ECKF1H103ZF  $\text{\textcircled{C}}$  0.01 $\mu\text{F}$   $\text{\textcircled{Z}}$  50V

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



# 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	ERD25FJ4R7K	ERQ14AJ4R7	F	4.7Ω J 1/4W	F□6330001
		R423	ERD25FJ220K	ERD25FJ470K	C	47Ω J 1/4W	
		R432	ERQ1CJP100	ERG2ANJ100	M	10Ω J 2W	
		R442	ERD50FJ1R0	ERD25FJ1R0K	C	1.0Ω J 1/4W	
2	Customer request (Change +B-Voltage)	J70	None	ERD25FJ5R6K	C	5.6Ω J 1/4W	F□6330001
		H2-H2	Lead wire (22cm) AWG24, Red	Delete			
		H4-H2	None	Lead wire (26cm) AWG24, Red Insert H2 on CRT socket board Input voltage : 11.75V			
3	To improve temperature derating	C307	ECEA1CU100	ECEA1CG100S	E	10μF 16V	F□6330001
		C308	ECEA0JU330	ECEA1CG330S	E	33μF 16V	
		C461	ECEA1JU101	ECEA1JG101S	E	100μF 63V	
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	ERC12GJ104	ERC12AGK104	S	100kΩ K 1/2W	F□7460001
		R600	ERC12GJ223	ERC12AGK223	S	22kΩ K 1/2W	
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

# SCHEMATIC DIAGRAM

## NOTE

### 1. RESISTOR

All resistors are carbon 1/4W resistor, unless otherwise noted the following marks.

Unit of resistance is OHM ( $\Omega$ ). (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.

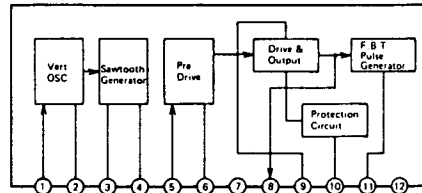
Unit of capacitance is  $\mu$ F, unless otherwise noted.

- ⊙ : Polyester                      ⊕ : Polystyrene capacitor
- ⊠ : Electrolytic capacitor      ⊕ : Tantalum

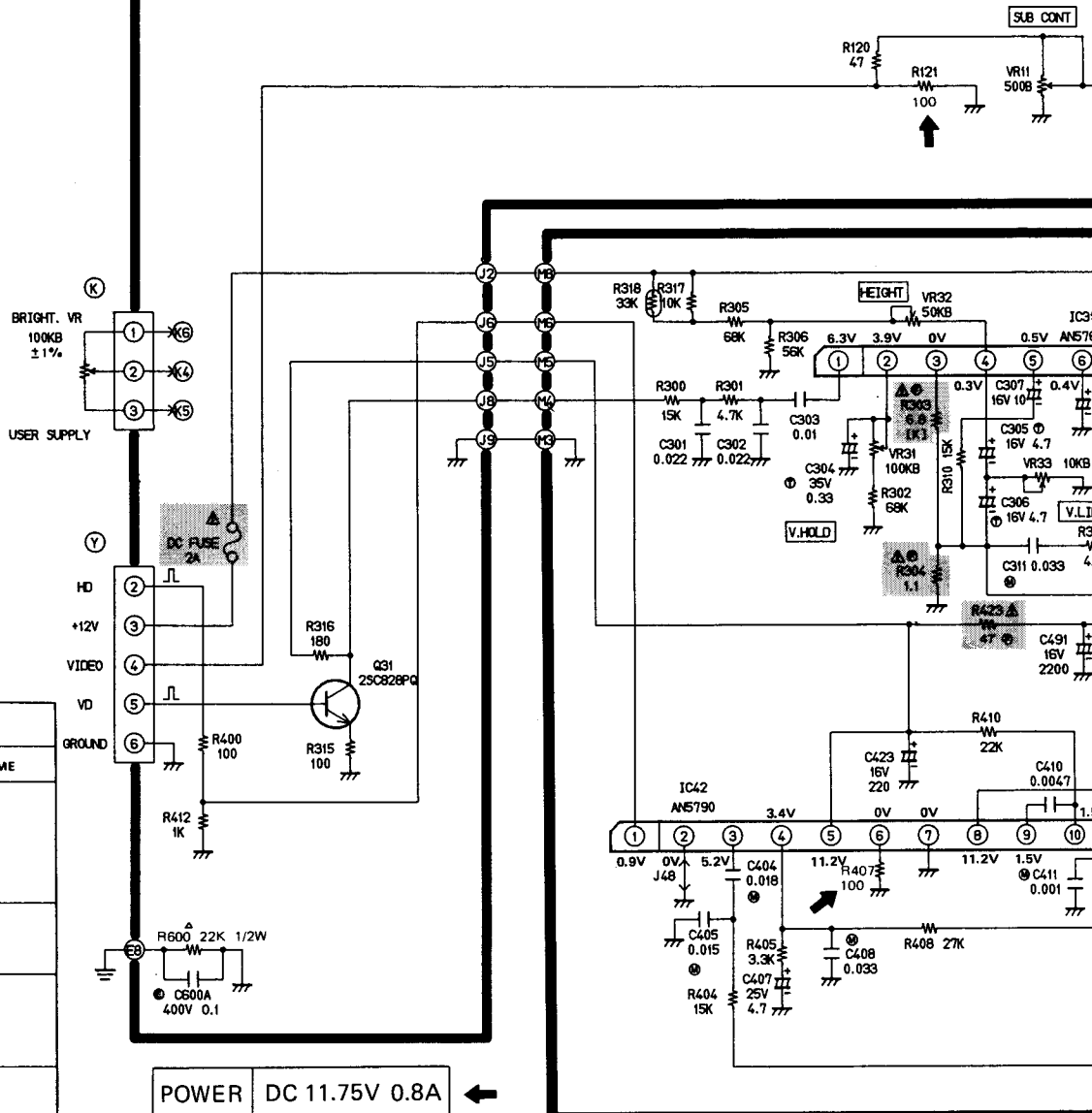
### 3. COIL

Unit of inductance is  $\mu$ H.

AN5763, AN5763



TNP82851-W

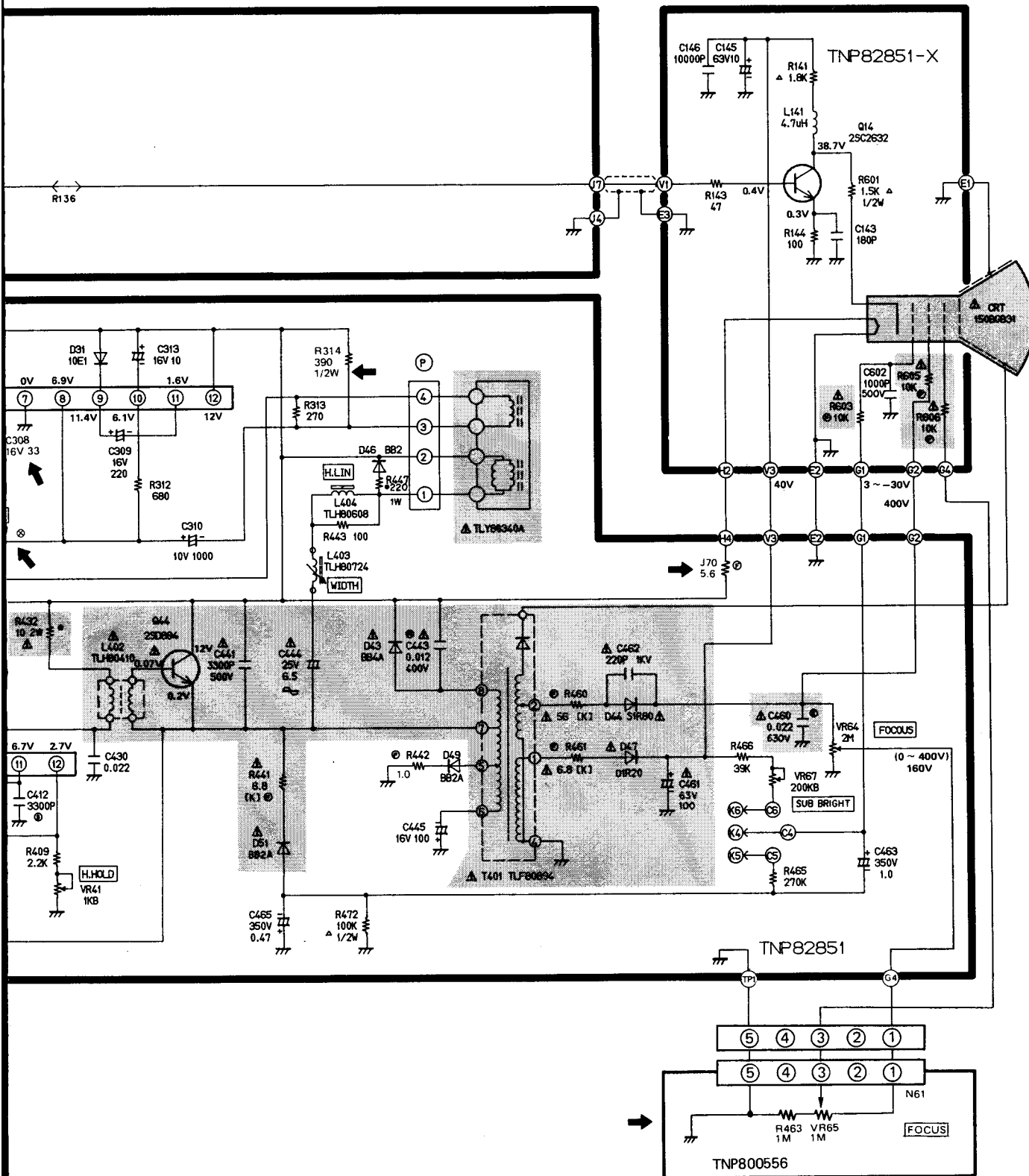


TRANSISTOR BASE INFORMATION	
LOCATION	PARTS NAME
	2SC828
	2SC2632
	2SD884
	AN5790
	AN5762 AN5763 AN5763(IN)

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

IMPORTANT SAFETY NOTICE

The component identified by shading or the international symbol  $\Delta$  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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