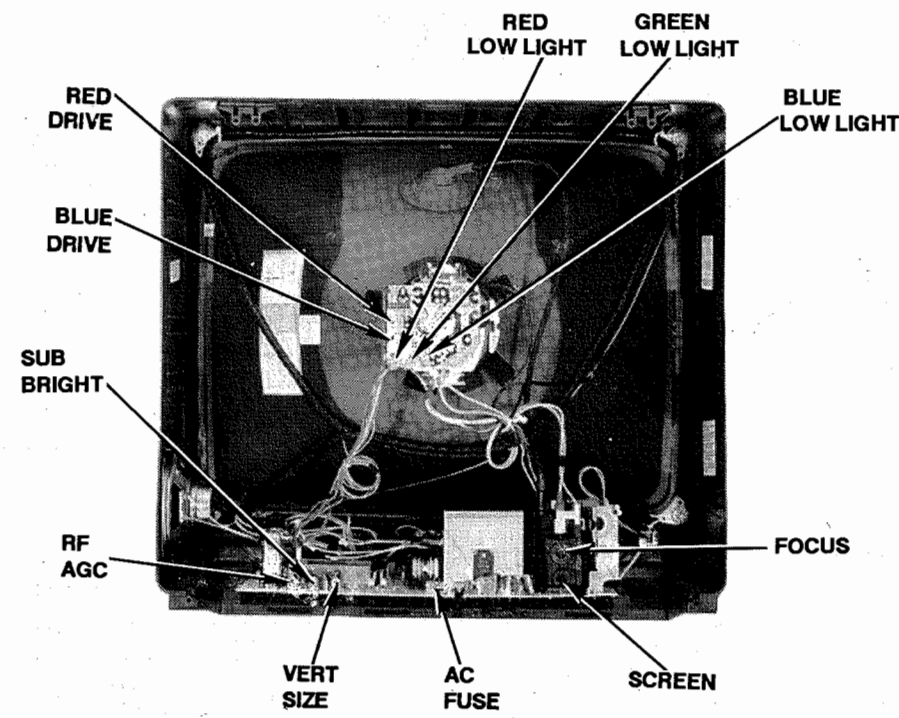


CABINET - REAR VIEW



TEST JIG HOOKUP

Function	Chek-A-Color Adapter No.	PC Board Plug	Pin	Color
CRT	B239	# DY	1	Black
Yoke	D482		2	Yellow
Yoke Setting	YP2A		4	Blue
Comments	Focus Tap		6	Red

The listing of any available replacement part herein in no case constitutes a recommendation, warranty, or guarantee by Howard W. Sams & Company as to the quality and suitability of such replacement part. The numbers of the listed parts have been compiled from information furnished to Howard W. Sams & Company by the manufacturers of the specific type of replacement part listed.

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Indianapolis, IN 46214-2012

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91SF02201



PHOTOFACT® Technical Service Data

SET 2924

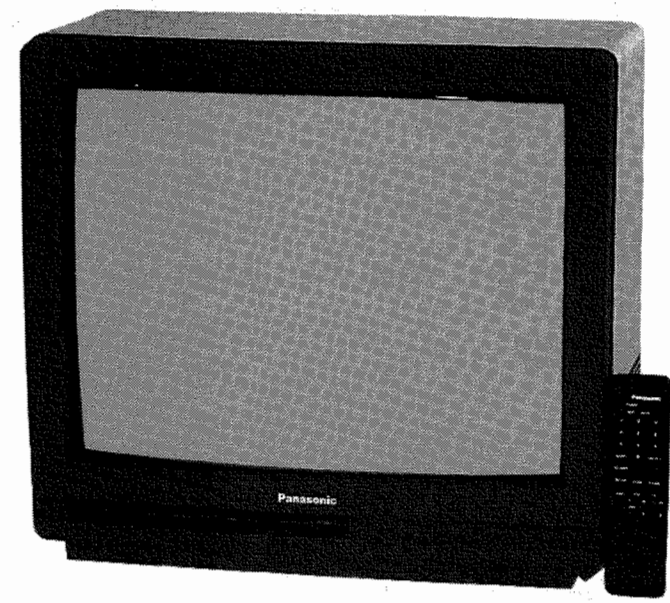
MODEL CTN-2032R-1 (CHASSIS AMDP205)

PANASONIC

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PANASONIC
Model CTN-2032R-1 (Chassis AMDP205)



Complete coverage
for servicing a television receiver...

- Schematics
- Parts lists
- Component locations
- Troubleshooting guide

Coverage includes these additional models and chassis:

MODEL	CHASSIS
CTN-2032R	ADP213
CTN-2032R-2	AMDP211
CTN-2033R	ADP213
CTN-2033R-1	AMDP205
CTN-2033R-2	AMDP211

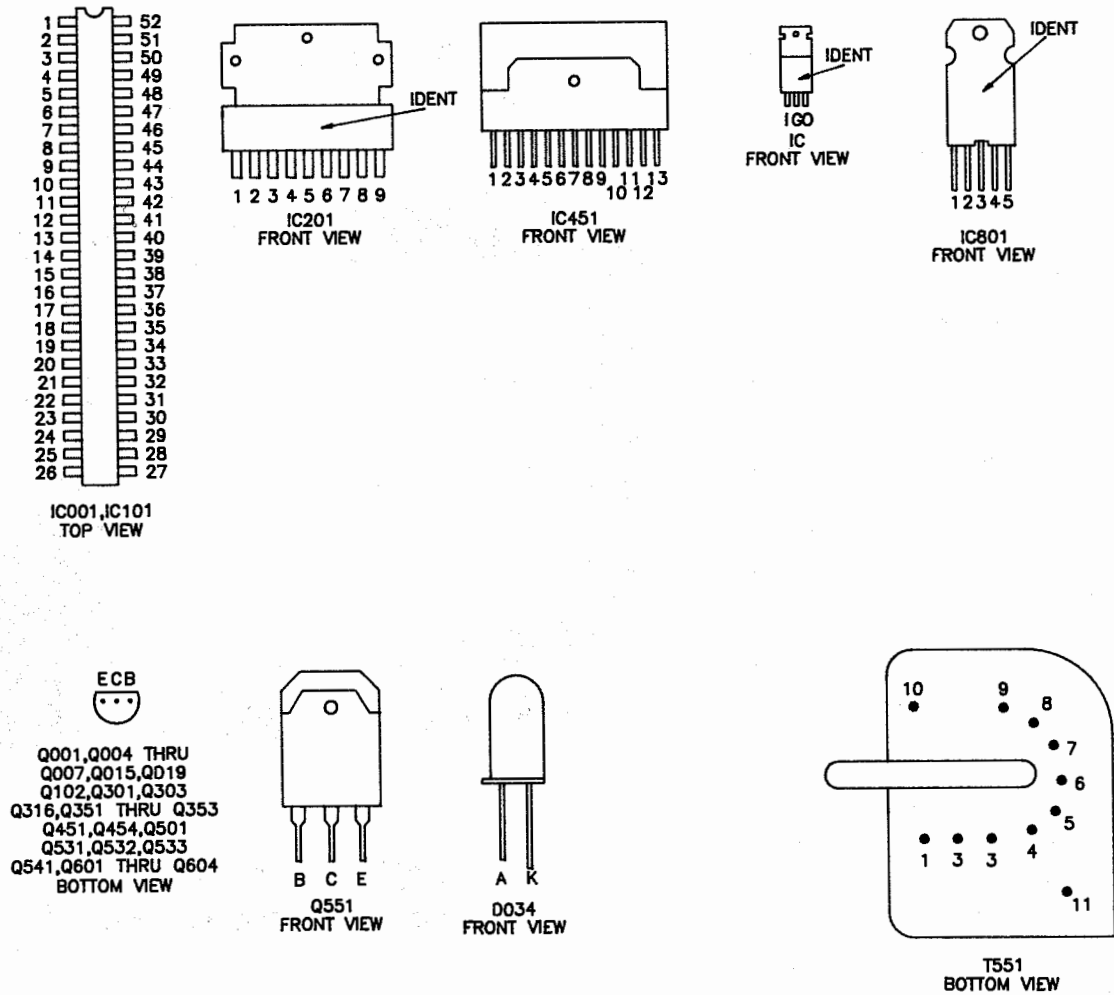


HOWARD W. SAMS & COMPANY
JANUARY 1992 SET 2924

For Supplier Address,
See PHOTOFACT Annual Index

TERMINAL GUIDES AND NOTES

CRT SCHEMATIC

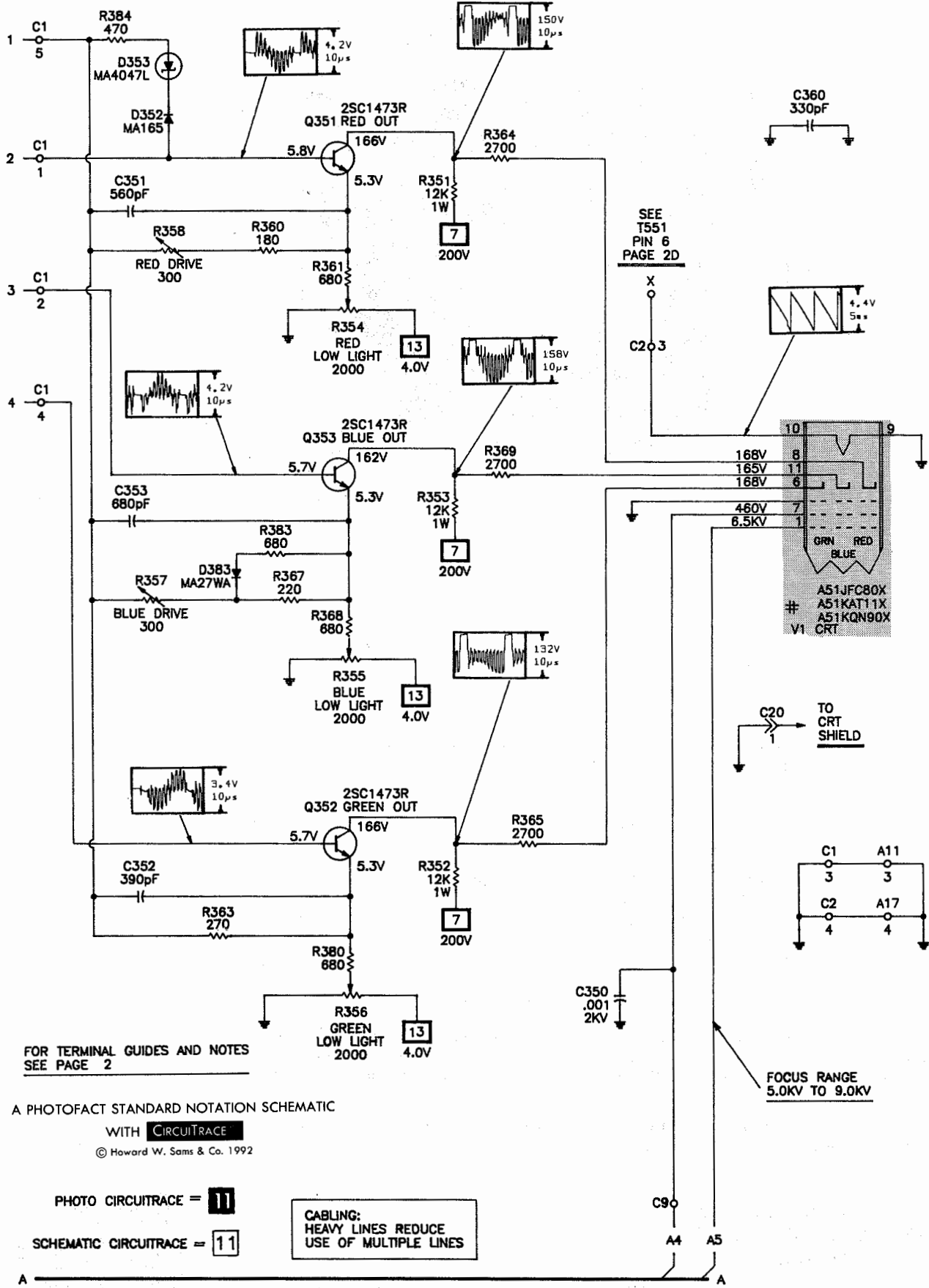


For SAFETY use only equivalent replacement part, see parts list.

--- Circuitry not used in some versions
 --- Circuitry used in some versions

* Nominal value
 ⏏ Ground
 ⏏ Chassis
 ▽ Common tie point

Waveforms and voltages are taken from ground, unless noted otherwise.
 Waveforms: triggered scope, keyed rainbow generator.
 Item numbers in rectangles appear in the alignment/adjustment instructions.
 Supply voltage maintained as shown at input.
 Voltages measured with digital meter, no signal.
 Controls adjusted for normal operation.
 Terminal identification may not be found on unit.
 Capacitors are 50 volts or less.
 5% or greater unless noted.
 Electrolytic capacitors are 50 volts or less.
 20% or greater unless noted.
 Resistors are 1/2W or less.
 5% or greater unless noted.
 Value in () used in some versions.
 Measurements with switching as shown, unless noted.



MISCELLANEOUS ADJUSTMENTS

PRETUNING

NOTE: All procedures require an antenna connected and power applied to the set. Select TV/ANT tuning mode.

Auto Memory

1. Press the Set-Up button until the arrow points at "AUTO CH".
2. Press the Plus button. Available channels are scanned and stored in memory.

Add Channel

1. Select channel.
2. Press the Set-Up button until the arrow points at the channel display.
3. Press the plus button.
4. Repeat step one thru three to add other channels.

Delete Channel

1. Select channel
2. Press the Set-Up button until the arrow points at the channel display.
3. Press the Minus button.
4. Repeat step one thru three to erase other channels.

Clock Setting

1. Press the Set-Up button until the arrow points to "Time Set"
2. Press the Plus button to advance the hours, Minus button to decrement the hours.
3. Press the Set-Up button to turn minutes red.
4. Press the Plus button to advance the minutes, Minus button to decrement minutes.

On/Off Timer Setting

1. Press the Timer button until the arrow points to "On Time".
2. With the On Time hours in red, press the Plus button to advance hours, Minus buttons to decrement hours.
3. Press the Timer button to turn the On Time minutes red.
4. With the On Time minutes red, press the Plus button to advance the minutes, Minus button to decrement minutes.
5. Press the Timer button until the Channel number is red.
6. Press the Plus or Minus buttons to select desired Channel.(only programmed channels are accessible).
7. Press the Timer button until "Set" is red.
8. Press the Select button to select "YES" or "NO".

Sleep Timer

1. Press the Sleep button.
2. Unit can be set to turn off after 30, 60 or 90 minutes.

Normalize Settings

1. Press the Video button.
2. Press the Norm button.

NOTE: This set employs Digital customer controls. All adjustments are at normalized position unless otherwise indicated. Tuning system in TV/ANT mode.

B+ CHECK

Connect a digital DC voltmeter to TP91, low side to TP92. Set Brightness, Picture and Color to MINIMUM. With AC line voltage set to 120VAC, B+ should read 130.5VDC \pm 1VDC.

HIGH VOLTAGE CHECK

Tune in a picture. Connect a high voltage probe to CRT anode. High Voltage must read 28.0KV (+1.0KV -1.5KV).

RF AGC

Tune in a picture. Adjust AGC Control (R106) Counterclockwise until snow appears in pictures, then clockwise to a point just past where snow disappears.

SUB-BRIGHTNESS

Tune in a picture. Set Brightness, Picture and Color Controls to MINIMUM. Adjust Sub-Brightness Control (R318) for just visible highlights. Set Brightness, Picture and Color Controls to Maximum. Check for blooming and readjust if required.

SUB-CONTRAST

NOTE: Do not make adjustments to Sub-Contrast Control unless CRT, CRT Board, or associated components are replaced.

Tune in a color bar pattern. Connect an oscilloscope to TP13, low side to ground. Adjust Sub-Contrast Control (R304) for 2.0Vp-p level of the video portion of the waveform.

HORIZONTAL CENTERING

Tune in a color bar pattern. Adjust Horizontal Centering Control (R524) for best horizontal centering.

MISCELLANEOUS ADJUSTMENTS continued

COMB FILTER

Tune in a color bar pattern. Connect an oscilloscope to TP13, low side to ground. Adjust Balance Control (R335), and Phase Coil (L304) for MINIMUM chroma component of waveform.

MPU REFERENCE OSCILLATOR

Tune in channel 13. Connect a frequency counter to connector A3 pin 4. Set tuning system to TV/ANT. Connect a jumper from pin 7 of IC001 to ground. Adjust MPU Reference Oscillator (C031) for exactly 500kHz \pm 3.5Hz.

SUB-TINT

Tune in an active channel. Adjust Sub-Tint Control (R619) for normal skin tones.

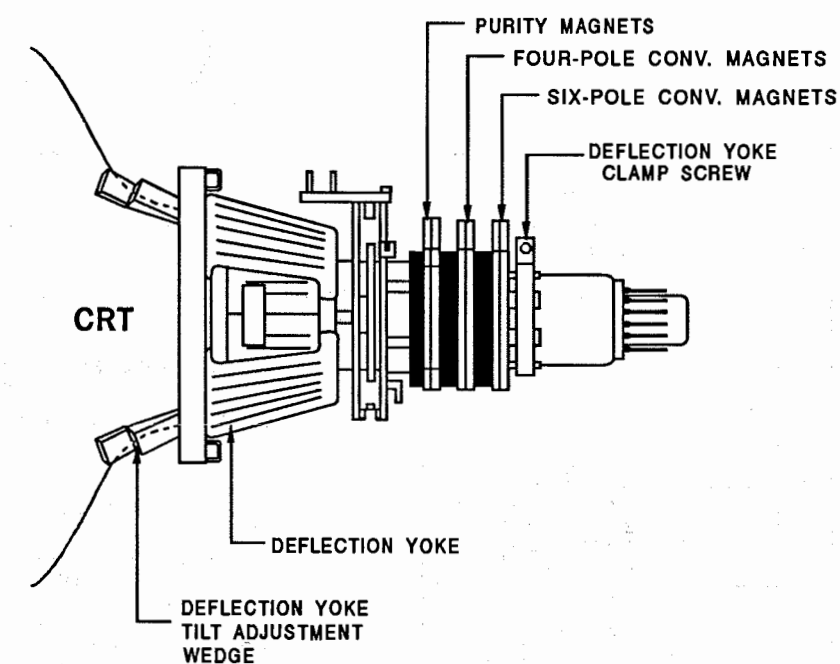
PURITY

Use a degaussing coil to demagnetize the CRT. Place a jumper between TP14 and ground. Turn Red Low Light (R354) and Blue Low Light (R355) Counterclockwise to obtain a green screen. Adjustment of Drive Controls is necessary. Loosen Deflection Yoke (L570) and move it back as far as possible. Loosen locking ring and move the purity tabs to center the vertical green band. Slowly slide the deflection yoke forward until a uniform green screen is obtained.

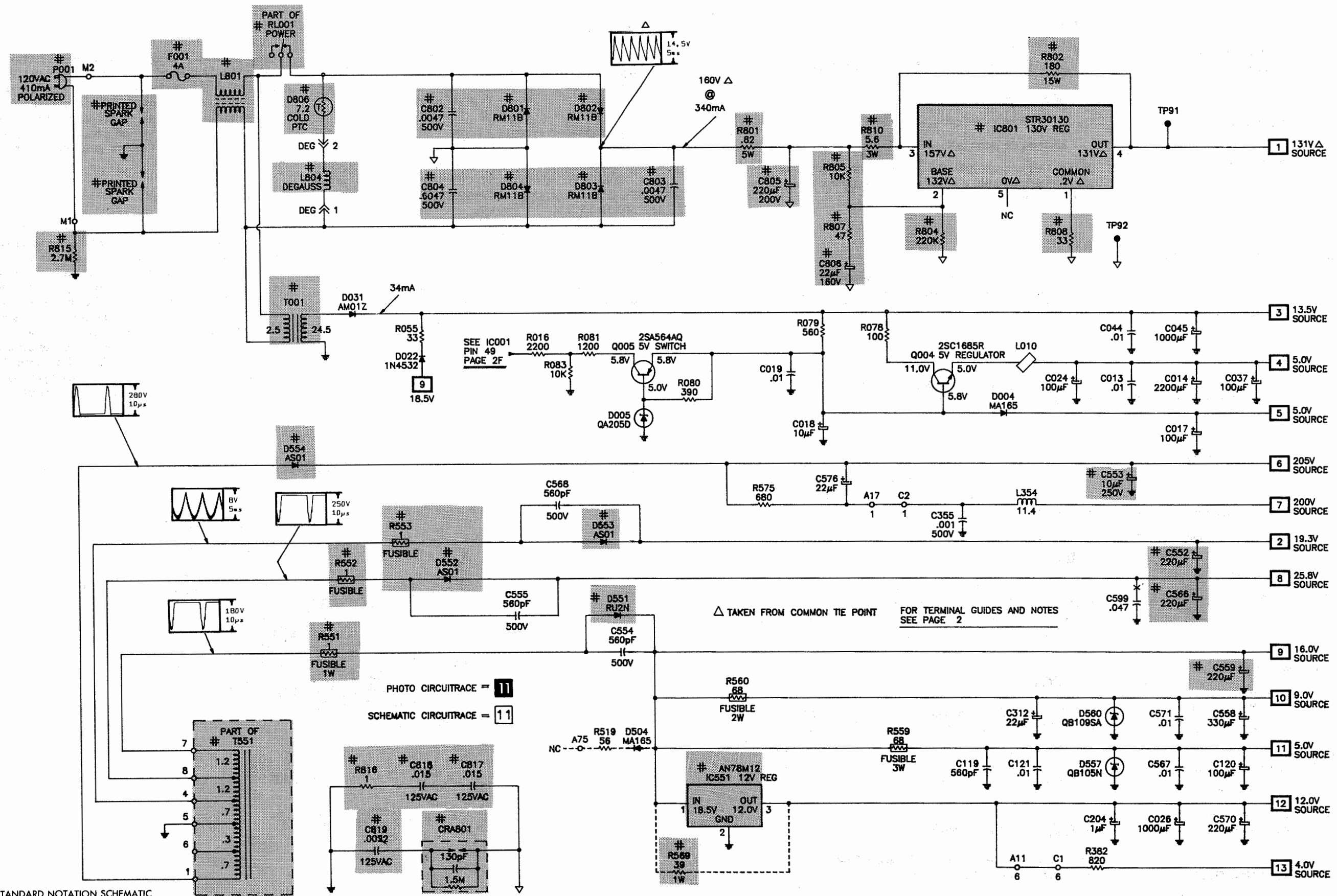
CONVERGENCE

Connect a signal generator to antenna terminals and tune in a dot pattern. Adjust 4-pole magnets to coverge the red and blue dots at the center of the screen. Adjust 6-pole magnets to converge the red/blue dots over the green dots at the center of the screen. Tune in a crosshatch pattern. Remove rubber wedges between the Deflection Yoke (L570) and the CRT. Tilt deflection yoke up or down to converge the vertical lines at the top and bottom of the screen and the horizontal lines at the left and right sides of the screen. Tilt the deflection yoke left or right to converge the horizontal lines at the top and bottom of the screen and the vertical lines at the left and right sides of the screen. Repeat convergence procedure if necessary to obtain the best overall convergence. Replace rubber wedges.

CRT NECK ASSEMBLY



POWER SUPPLY SCHEMATIC



A PHOTOFAC STANDARD NOTATION SCHEMATIC
WITH CIRCUITACE

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SAFETY PRECAUTIONS

SERVICE WARNING

ONLY qualified service technicians who are familiar with safety checks and guidelines should perform service work. For continued SAFETY:

- 1. Before replacing parts, disconnect power source to protect electrostatically sensitive parts.
- 2. Do not attempt to modify any circuit unless so recommended by the manufacturer.
- 3. When servicing chassis, use an isolation transformer between the line cord and power receptacle.

SERVICING HIGH VOLTAGE AND PICTURE TUBE

Use EXTREME CAUTION when servicing the High Voltage circuits.

- 1. To discharge static High Voltage, connect a 10-kilohm resistor in series with a test lead between chassis and picture tube anode lead.
- 2. DO NOT lift picture tube by the neck.
- 3. ALWAYS wear shatterproof goggles when handling picture tube to protect eyes in case of implosion.

X-RAY RADIATION AND HIGH VOLTAGE LIMITS

Be aware of the instructions and procedures covering x-ray radiation. In solid-state receivers and monitors, the picture tube is the only potential source of x-rays.

- 1. Keep an accurate High Voltage meter available at all times. Check meter calibration periodically.
- 2. Whenever servicing a chassis, check High Voltage at various brightness levels to be sure it is regulating properly.
- 3. Keep High Voltage at rated value, NO HIGHER. Excessive High Voltage may cause x-ray radiation or failure of associated components. DO NOT depend on protection circuits to keep voltage at rated value.
- 4. When troubleshooting a set with excessive High Voltage, avoid close contact with picture tube. DO NOT operate set longer than necessary. To locate the cause of excessive High Voltage, use a variable AC transformer to regulate voltage.
- 5. In present chassis, many electrical and mechanical components have safety-related characteristics which are not detectable by visual inspection. Such components are identified by a # on both the schematic and the parts list. For SAFETY, use only equivalent replacement parts when replacing these components.

SAFETY CHECKS – FIRE AND SHOCK HAZARD

Cold Leakage Checks for Sets with Isolated Ground

- 1. Unplug the AC cord, connect a jumper across the plug prongs, and turn the power switch ON.
- 2. Use an ohmmeter to measure the resistance between the jumpered AC plug and any exposed metal cabinet parts such as antenna screw heads, control shafts, or handle brackets. Exposed metal parts with a return path should measure between 200 kilohms and 5 megohms. Parts without a return path must register infinity.

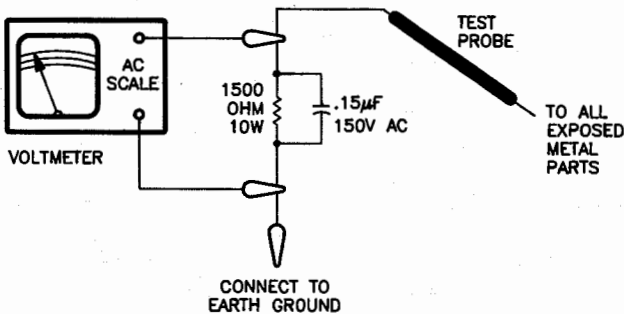
Hot Leakage Current Check

- 1. Plug the AC cord directly into AC outlet. DO NOT use an isolation transformer.
- 2. Use a 1500-ohm, 10-watt resistor in parallel with a .15-microfarad 150-volt AC capacitor to connect between any exposed metal parts on the set and a good earth ground. (See figure below.)
- 3. Use an AC voltmeter with at least 1000 ohms-per-volt sensitivity to measure the voltage across the resistor. Check all exposed metal parts and measure voltage at each point.
- 4. Voltage readings should not exceed .75 volts RMS (5 milliamps AC). Any value exceeding this limit constitutes a potential shock hazard and must be corrected.
- 5. If AC plug is not polarized, reverse the AC plug and repeat exposed metal part voltage measurement at each point.

GENERAL GUIDELINES

Perform a final SAFETY CHECK before returning set to customer.

- 1. Check repaired area for poorly soldered or de-soldered connections, and check entire circuit board for solder splashes.
- 2. Check inner board wiring for pinched wires or wires contacting any high-wattage resistors.
- 3. Check that all control knobs, shields, covers, grounds and mounting hardware have been replaced. Be sure to replace all insulators and restore proper lead dress.



TROUBLESHOOTING

POWER SUPPLY

Check the AC Fuse F001. If Fuse is open:

Check Power Supply Transformer (T001), Audio Power Transformer (T2401), Bridge Rectifiers (D801 thru D804), Capacitors C802 thru C804 and Electrolytic C805.

Apply 120V AC and check for 160V* at the cathode of Diode D802. If 160V* is missing:

Check Line Filter L801, Relay Drive Transistor (Q007), and Power Relay (RL001).

If 160V* is present at the cathode of D802:

Check for 131V* at TP91

If this Voltage is missing:

Check the voltages and components associated with the 131V Regulator IC (IC801).

Check for 13.0V at the cathode of Diode (D031). If 13.0V is missing:

Check T001, D031, Capacitor C044, and Electrolytic C045.

If the proper voltage is present at TP91:

Refer to the "Horizontal" section of this Troubleshooting guide.

* With respect to isolated ground.

AUDIO

Select an active TV channel and check for an audio waveform at pin 28 of VIF/SIF/AFT/DET/Video/Sync IC(IC101). If there is no audio:

Check the voltages, waveforms and components associated with pins 25, 28, 29, 30 of IC101.

If waveform is present at pin 28 of IC101, check for an audio waveform at pin 8 of the Audio Out IC (IC201). If waveform is missing:

Check voltages, waveforms and components associated with IC201.

VIDEO

Inject a video signal at TP121 and check for video on the CRT. If video is present:

Refer to the "IF-AGC" section of this Troubleshooting guide.

If there is no video on the CRT:

Check for a video waveform at pin 13 of IC101.

If the waveform is missing:

Check the voltages, waveforms and components associated with Video Amp Transistor (Q102) and Y-Amp Transistor (Q301).

If the waveform is present at pin 13 of IC101:

Check the voltages, waveforms and components associated with pin 40, 48 thru 50 of IC101 and Video Amp Transistors (Q303, Q304).

If the Brightness is inadequate or cannot be controlled:

Check the voltages, waveforms and components associated with pin 50 of IC101.

IF-AGC

Inject a video IF signal at the IF input and check for video on the CRT. If video is present:

Check the Tuner, Tuner Control and Tuner AFC circuits.

If there is no video on the CRT:

Check for a video waveform at TP121.

If video is present at TP121:

Refer to the "Video" section of this Troubleshooting guide.

If there is no video at TP121:

Apply AGC bias to TP14.

If video is now present TP121:

Check the voltages, waveforms and components associated with pins 31, 32 and 33 of VIF/SIF/AFT/DET/Video/Sync IC (IC101).

If there is still no video at TP121:

Check the voltages, waveforms and components associated with pins 17, 18, 19, 21 thru 24, 26, 27 and 31 thru 37 of IC101.

A defective AGC circuit can cause overloaded picture, excessive snow or loss of video.

See the AGC Voltage Chart for AGC voltages with signal.

AGC VOLTAGE CHART

IC101	
Pin 31	2.7V
Pin 32	4.7V
Pin 33	7.7V

CHROMA

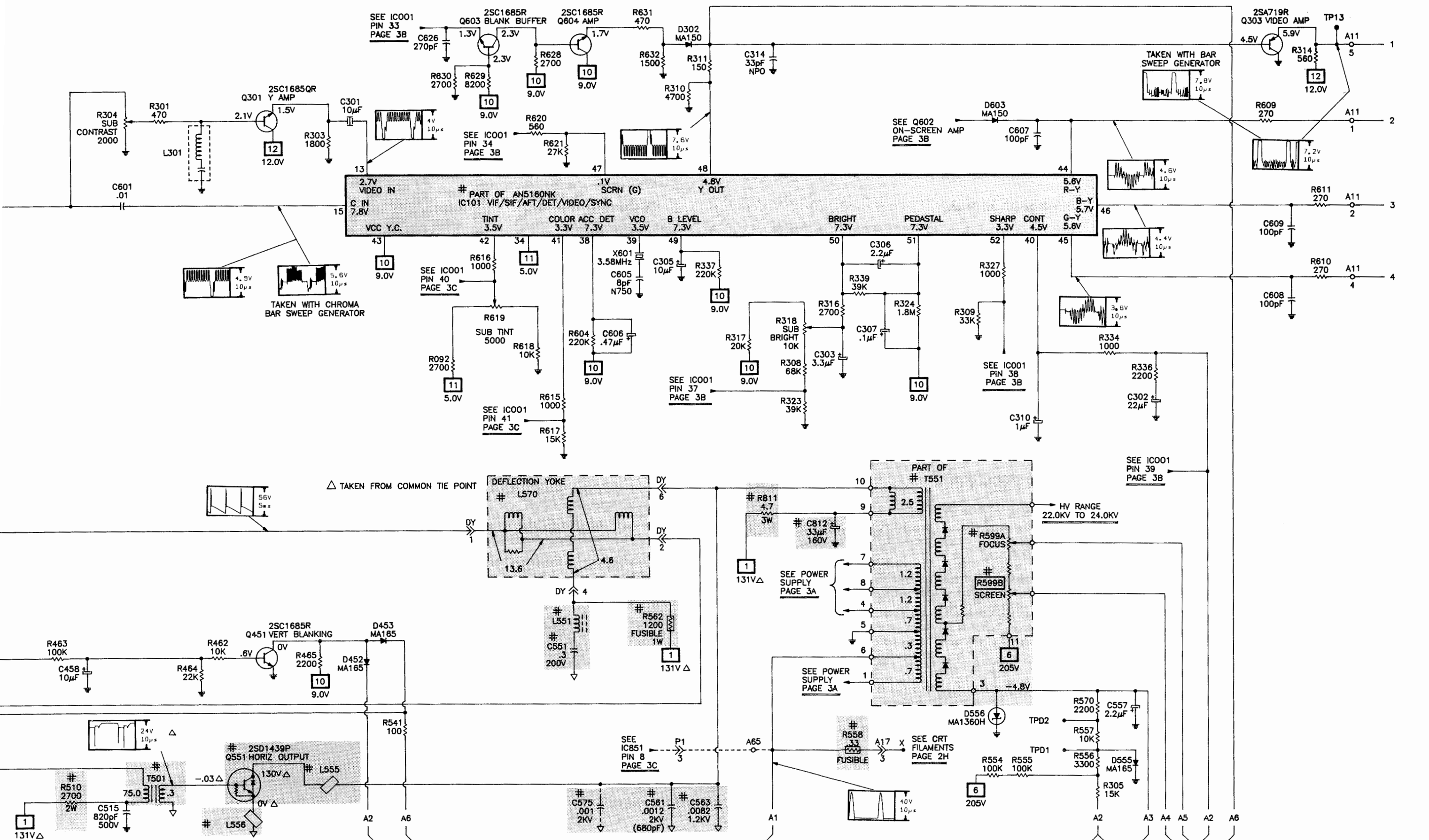
Check for a chroma waveform at pin 15 of the VIF/SIF/AFT/DET/Video/Sync IC (IC101). If the waveform is missing:

Check the voltages, waveforms and components associated with Video Amp Transistor (Q102).

If a chroma waveform is present at pin 15 of IC101:

Check for the proper waveforms at pins 44, 45, 46 of IC101.

If these waveforms are missing:

TELEVISION SCHEMATIC continued

TROUBLESHOOTING continued

Check the voltages, waveforms and components associated with pins 38, 39 and 41 thru 47 of IC101. Check the 3.58MHz oscillator at pin 39 of IC101. Check the voltages and components associated with pin 40 of IC101.

If there is inadequate tint range:

Check the voltages and components associated with the Sub-Tint Control and pin 42 of IC101.

If the proper waveforms are present at pins 44, 45 and 46 of IC101:

Refer to the "Raster" section of this Troubleshooting guide.

HORIZONTAL

Determine if the TV is in shutdown:

Refer to the "Horizontal Oscillator Disable" section of this troubleshooting guide.

If the TV is not in shutdown, inject a horizontal signal at the base of the Horizontal Output Transistor (Q551). If horizontal deflection is now present:

Check the voltages, waveforms and components associated with Horizontal Drive Transistor (Q501) and pins 4 thru 10 of VIF/SIF/AFT/DET/Video/Sync IC (IC101).

If there is still no horizontal deflection:

Check the voltages, waveforms and components associated with Q551 and Horizontal Output Transformer (T551). Check Rectifier Diodes (D541 thru D554) and associated components for defects.

The High Voltage Rectifier is part of Transformer T551 and if defective will affect the performance of the horizontal circuits. If the Horizontal Oscillator is off frequency:

Check the voltages, waveforms and components associated with pins 6 and 7 of IC101.

Horizontal linearity or width problems may be caused by Capacitors C551, C561, C563, C575 and Linearity Coil (L551) being defective.

HORIZONTAL OSCILLATOR DISABLE

The high voltage is monitored by Diode D531, rectifying pulses from the Horizontal Output Transformer (T551). Should the high voltage increase, the rectified voltage at the cathode of Diode D531 will also increase and turn on X-Ray Protect Transistors (Q454, Q531, Q532, Q533). This causes the horizontal oscillator frequency to increase which lowers the high voltages.

To troubleshoot, remove Diode D531. Use a variable AC power supply to supply 90VAC and turn on the set. Slowly increase AC voltage and check for 131V* at TP91.

If voltage is high:

Refer to the "Power Supply" section of this troubleshooting guide.

If 131V* is present at TP91:

Check the voltages, waveforms and components associated with T551, Q454, Q531, Q532, Q533 and pin 7 of VIF/SIF/AFT/DET/Video/Sync IC (IC101).

NOTE: Care should be taken in defeating the high voltage shutdown circuit, as this may cause excessive X-radiation and damage to the CRT, Transformer T551 and associated components. Monitor the high voltage and troubleshoot.

Voltages Taken in Shutdown

IC101

Pin 7 .6V

* With respect to isolated ground.

HORIZONTAL OSCILLATOR DISABLE TEST

Connect the positive lead of a voltmeter to TPD2 and the negative lead to TPD1. Apply 120VAC and turn on set. Normalize Video menu and adjust Brite to zero. Adjust picture for .9V on voltmeter. Turn set off and place a jumper between pins 1 and 4 of 130V Regulator IC (IC801). Use a variable AC power supply to supply 90VAC to the set. Turn on the set and slowly increase the AC voltage while monitoring the high voltage with a voltage probe. The high voltage should not exceed 32.2KV and the set should lose horizontal sync.

If the high voltage should exceed 32.2KV or the set fails to lose horizontal sync:

Refer to the "Horizontal Oscillator Disable" section of this troubleshooting guide.

VERTICAL

Inject a vertical signal at pin 2 of the VIF/SIF/AFT/DET/Video/Sync IC (IC101). If vertical deflection is present:

Check the voltages, waveforms and components associated with pins 2, 12, 14 of IC101.

If there is still no vertical deflection:

Check the voltages, waveforms and components associated with the Vertical Output IC (IC451) and CRT Protect Transistor (Q451).

Vertical linearity or height problems may be caused by vertical feedback and bias circuits, check Electrolytics C451 thru C455 and C457 for defects.

SYNC

If there is no vertical sync:

Check the voltages, waveforms and components associated with 2, 12 and 14 of VIF/Chroma Jungle IC (IC101).

If there is no horizontal sync:

Check the voltages, waveforms and components associated with pins 4, 6, 8 and 10 of IC101.

RASTER

Check the CRT and CRT voltages. If there is no Red:

Check the voltages and components associated with pin 4 of VIF/SIF/AFT/DET/Video/Sync IC (IC101) and the Red Output Transistor (Q351).

If there is no Green:

Check the voltages and components associated with pin 45 of IC101 and the Green Output Transistor (Q352).

If there is no Blue:

Check the voltages and components associated with pin 46 of IC101 and the Blue Output Transistor (Q353).

If raster has height or width problems:

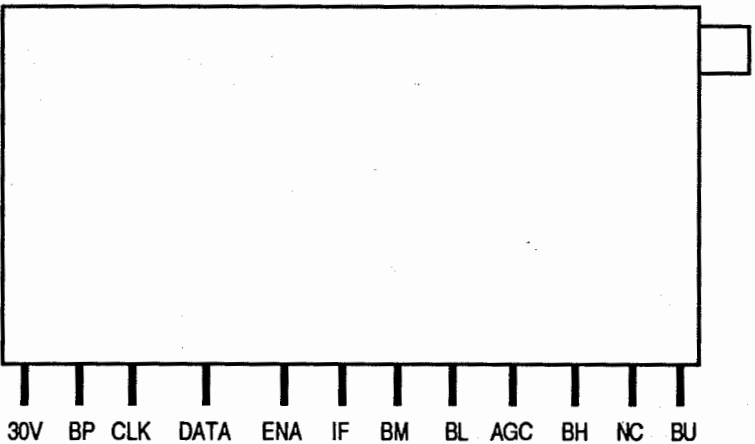
Refer to the "Vertical", "Horizontal", and "Power Supply" sections of this troubleshooting guide.

TUNER VOLTAGE CHART

	VHF Low Band	VHF High Band	UHF Band
30V	3.7V	7.0V	7.7V
BP	5.0V	5.0V	5.0V
CLK	.1V	.1V	.1V
DATA	.1V	.2V	.2V
ENA	.6V	.6V	.6V
BM	11.9V	11.9V	11.9V
BL	11.7V	4.5V	11.7V
AGC	7.7V	7.7V	7.7V
BH	0V	11.7V	0V
NC	.9V	4.0V	4.8V
BU	.1V	.1V	11.6V

Note: VHF Low Band voltages taken on channel 2.
VHF High Band voltages taken on channel 7.
UHF Band voltages taken on channel 14.

TUNER TERMINAL GUIDE



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MAIN BOARD

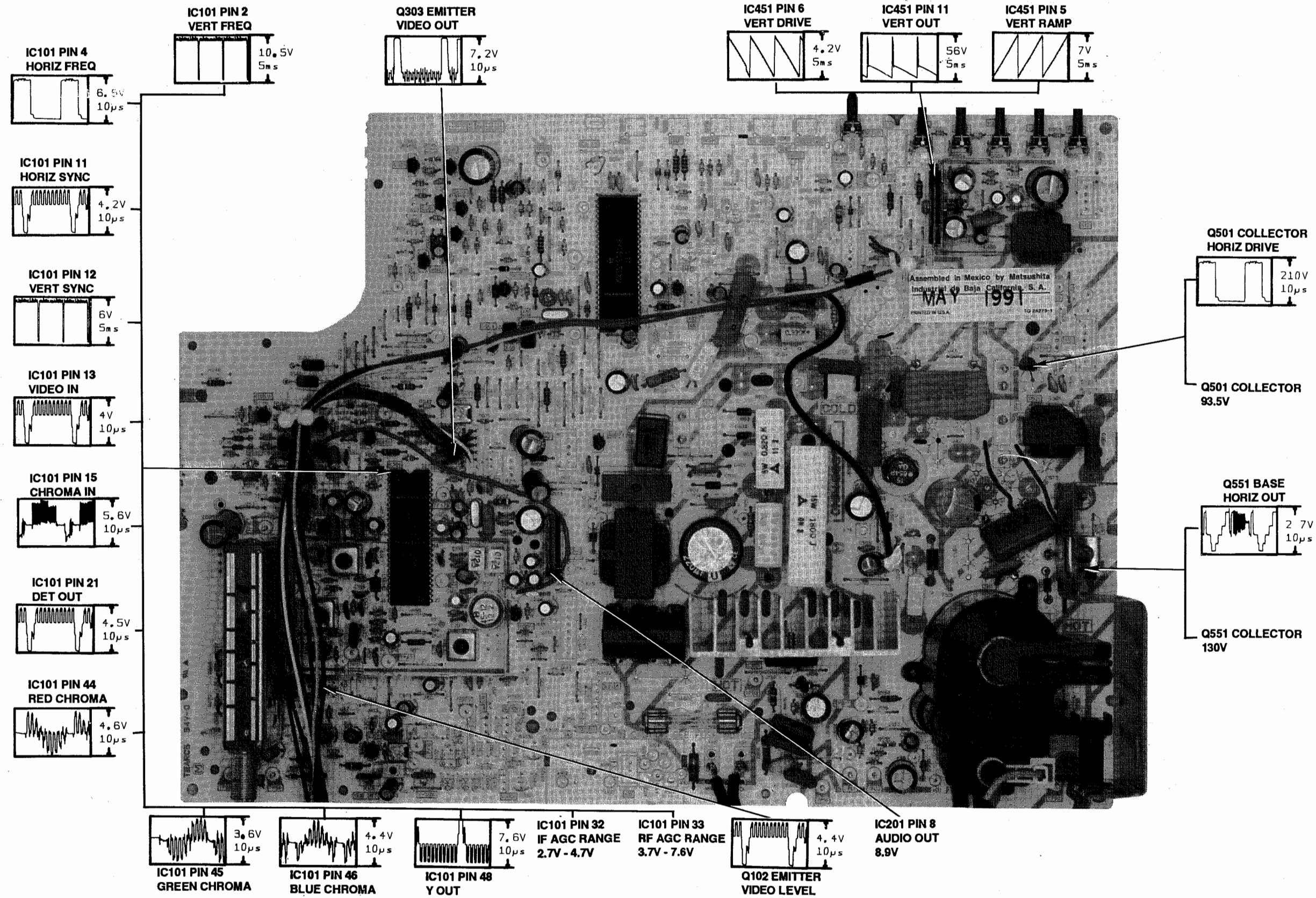
CRT BOARD

Legend:

- S009 SETUP
- S005 CH+
- S004 CH-
- S003 VOL +
- S002 VOL -
- S001 POWER



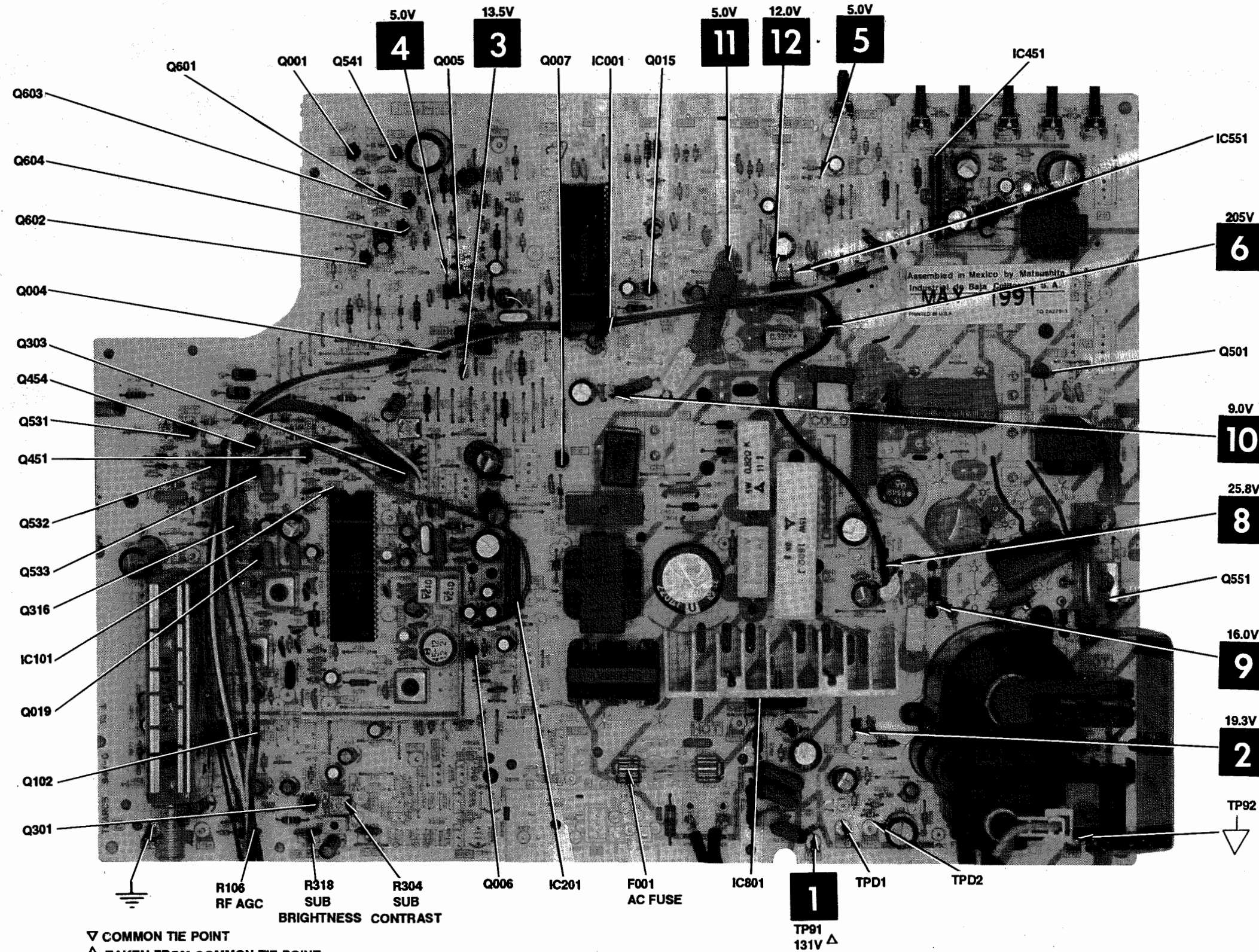
MAIN BOARD



PANASONIC

MODEL CTN-2032R-1 (CHASSIS AMDP205)

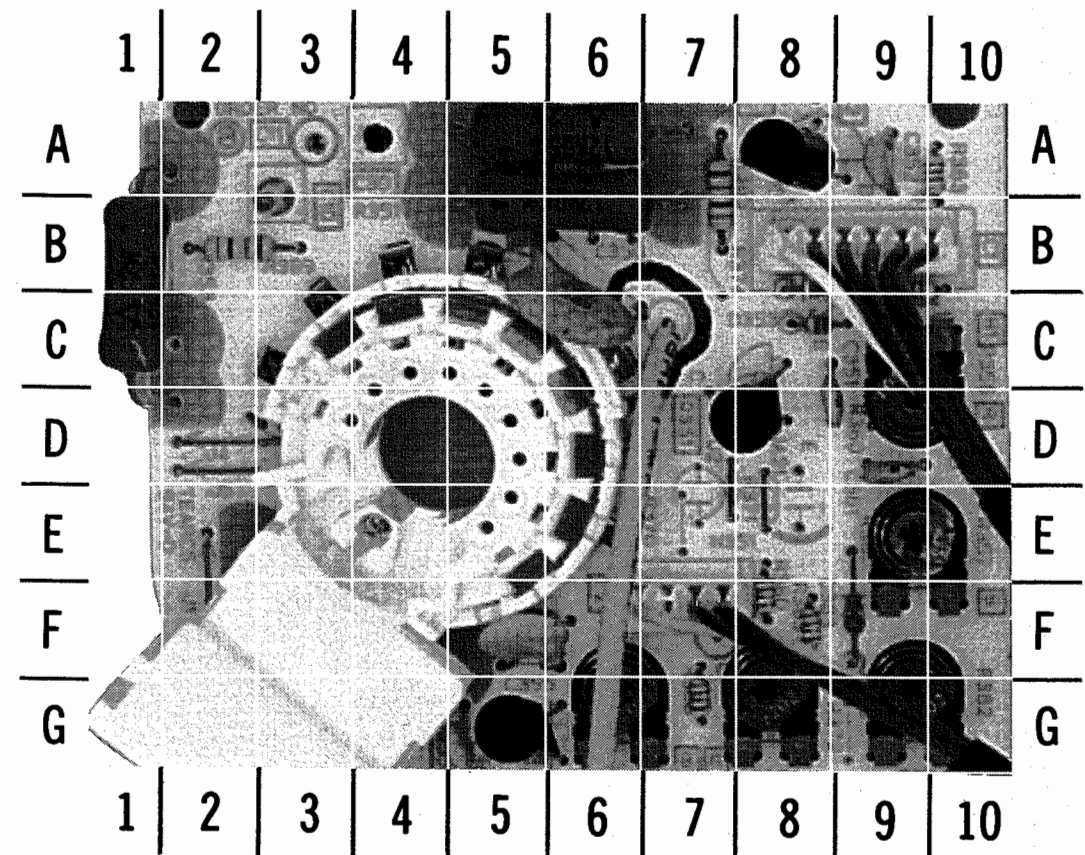
MAIN BOARD



PANASONIC

MODEL CTN-2032R-1 (CHASSIS AMP205)

CRT BOARD

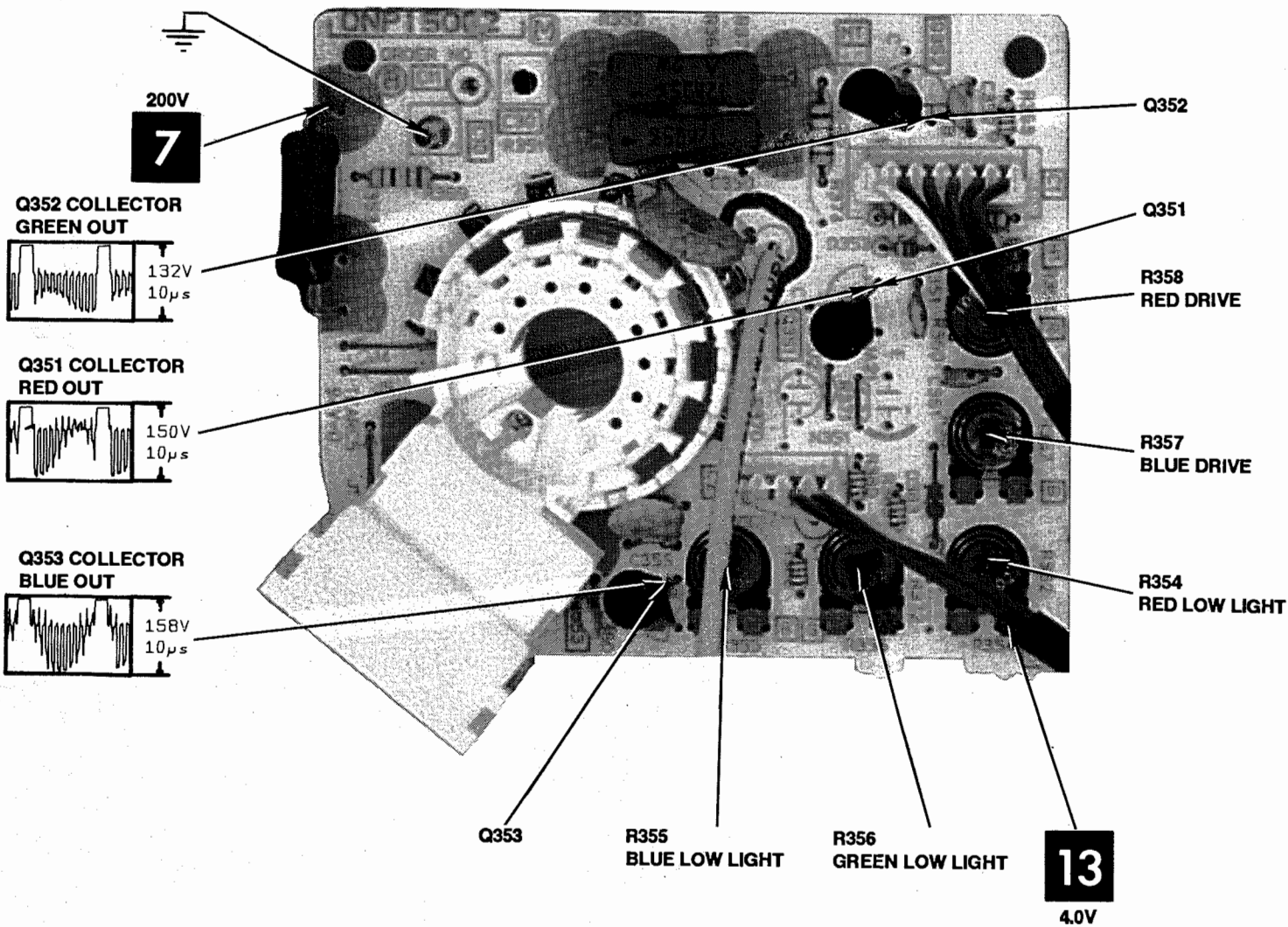


A Howard W. Sams GRIDTRACE™ Photo

CRT BOARD, GRIDTRACE LOCATION GUIDE

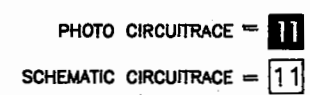
C1	B-8	C360	G-5	R351	B-6	R360	C-9	R380	F-8
C2	F-7	D352	B-8	R352	A-6	R361	E-9	R382	G-10
C11	B-3	D353	C-8	R353	B-1	R363	A-10	R383	F-8
C350	C-6	D383	F-9	R354	G-9	R364	A-6	R384	B-9
C351	D-7	L354	F-5	R355	G-6	R365	A-7		
C352	A-9	Q351	D-8	R356	G-8	R367	G-8		
C353	D-9	Q352	A-8	R357	E-9	R368	G-7		
C355	F-5	Q353	G-5	R358	D-9	R369	B-2		

CRT BOARD



NOTE: ARROWS ON TRANSISTORS INDICATE BASE UNLESS NOTED.

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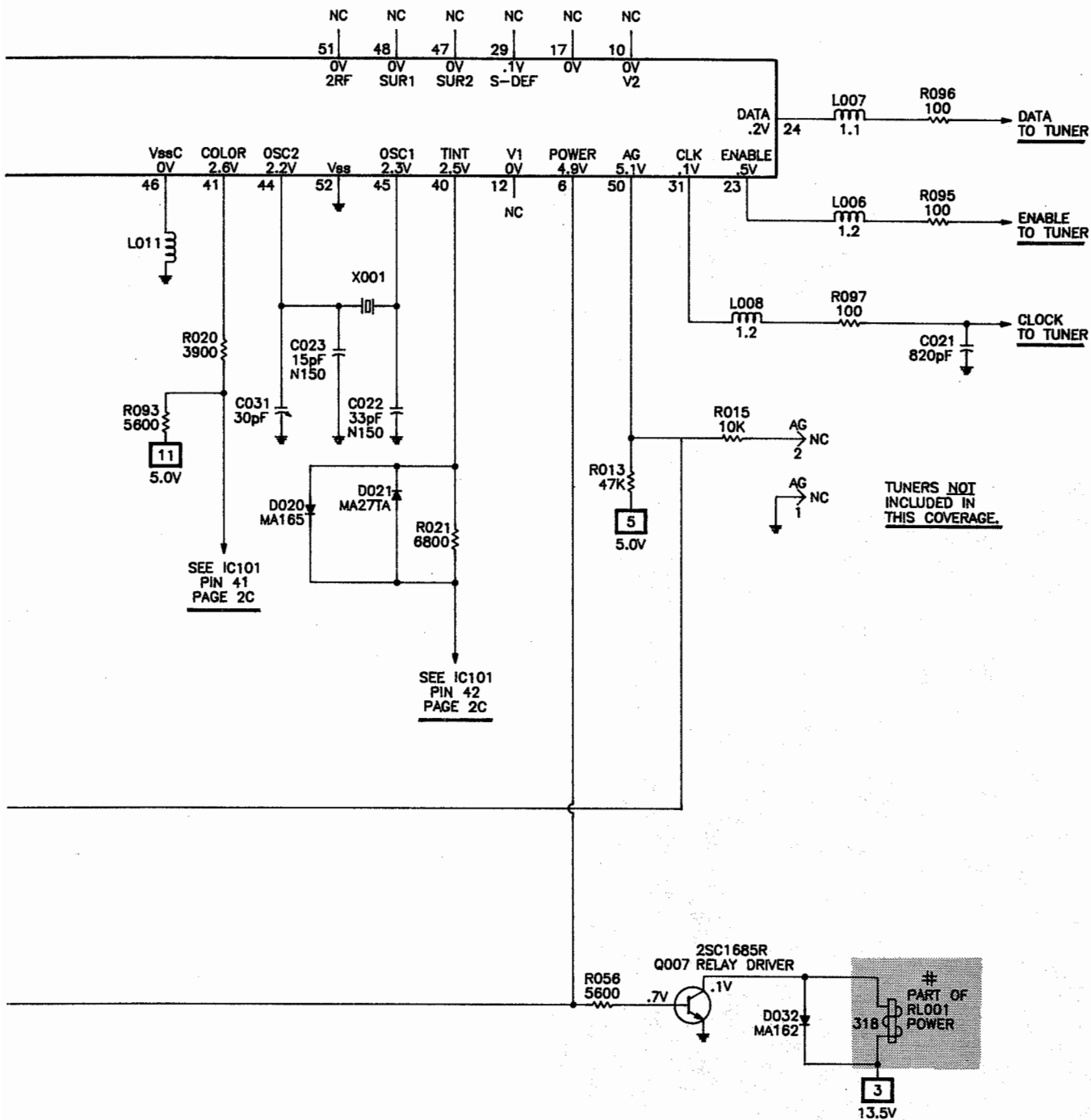
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WITH **CIRCUITRACE**
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MAIN BOARD, GRIDTRACE LOCATION GUIDE

A6	E-10	C205	J-7	C559	J-14	D557	F-3	Q604	C-5	R111	M-3	R466	B-15	R624	C-5
A8	E-7	C206	I-6	C561	J-16	D560	F-3	R001	E-10	R112	J-3	R469	G-3	R626	D-5
A11	H-6	C207	K-6	C563	I-16	D603	E-5	R008	B-10	R151	K-3	R471	B-11	R628	D-6
A17	C-14	C208	J-7	C566	I-13	D801	H-10	R009	B-10	R152	L-2	R501	H-3	R629	C-6
A33	G-10	C209	I-6	C567	D-13	D802	G-11	R012	C-10	R153	K-3	R502	G-3	R630	C-6
AG	E-7	C210	J-7	C568	L-14	D803	G-11	R013	E-7	R201	M-4	R503	H-2	R631	D-6
C001	B-11	C211	I-7	C570	D-12	D804	H-10	R015	E-7	R202	J-7	R505	H-4	R632	C-6
C002	D-9	C212	L-4	C571	F-9	D806	G-9	R016	E-7	R203	K-3	R506	G-3	R801	G-12
C004	C-10	C213	H-7	C576	D-13	DY	F-16	R020	C-6	R204	I-6	R508	H-2	R802	I-12
C009	C-10	C214	K-4	C599	C-16	F001	M-9	R021	D-6	R205	J-7	R509	G-18	R804	L-12
C013	D-8	C215	I-6	C601	L-7	IC001	E-9	R022	D-8	R206	F-10	R510	F-13	R805	I-11
C014	B-6	C301	M-3	C605	H-6	IC101	H-4	R023	C-7	R207	I-6	R512	H-1	R807	L-12
C017	B-13	C302	B-7	C606	I-5	IC201	J-7	R024	C-8	R209	K-4	R513	I-3	R808	L-12
C018	C-12	C303	N-4	C607	H-6	IC451	B-15	R025	B-7	R210	I-6	R515	H-2	R810	I-12
C019	C-11	C305	L-5	C608	H-5	IC551	D-12	R026	B-8	R211	H-7	R516	F-5	R811	G-4
C021	J-2	C306	F-5	C609	H-5	IC801	L-12	R028	C-7	R212	K-5	R524	H-2	R815	N-10
C022	E-8	C307	F-5	C625	C-5	L006	B-10	R030	F-1	R213	K-4	R531	F-3	R816	M-12
C023	E-8	C309	I-3	C626	B-7	L007	B-9	R031	B-12	R214	K-4	R532	G-2	R1101	E-11
C024	D-7	C310	I-6	C802	H-10	L008	B-7	R035	H-7	R301	M-4	R533	G-2	RL001	H-9
C025	C-7	C312	I-6	C803	G-11	L010	D-6	R037	C-10	R303	M-4	R534	G-2	S001	A-18
C026	I-1	C314	H-5	C804	I-11	L011	E-8	R045	C-9	R304	M-4	R535	G-1	S002	A-17
C027	K-1	C401	I-4	C805	I-10	L103	K-3	R049	D-4	R305	E-5	R536	G-1	S003	A-16
C028	M-1	C402	I-4	C806	L-13	L104	J-6	R050	B-14	R308	M-3	R537	G-2	S004	A-15
C029	M-1	C403	M-5	C812	H-15	L105	J-3	R051	B-14	R309	C-7	R538	G-2	S005	A-15
C030	N-2	C405	L-6	C817	M-12	L106	K-3	R055	C-13	R310	H-5	R539	H-3	S009	A-13
C031	E-7	C451	B-15	C818	M-12	L108	J-6	R056	F-8	R311	G-5	R540	G-2	SP	H-6
C034	B-8	C452	C-15	C819	N-12	L109	J-4	R058	A-17	R314	G-5	R541	G-4	T001	I-9
C035	B-9	C453	C-16	CRA801	N-12	L201	K-6	R059	A-16	R316	E-16	R542	H-4	T501	G-17
C036	D-11	C454	B-17	D004	B-13	L202	J-3	R060	A-16	R317	N-3	R544	C-6	T502	C-15
C037	E-9	C455	C-15	D005	D-7	L301	N-4	R061	A-15	R318	N-4	R547	B-5	T551	L-16
C044	H-8	C457	C-16	D020	D-7	L551	H-14	R064	B-13	R320	I-3	R551	J-14	TP91	N-13
C045	G-7	C458	C-16	D021	D-6	L555	J-17	R071	K-5	R323	N-3	R552	J-14	TP92	N-17
C057	L-1	C501	H-3	D022	C-13	L556	J-18	R072	L-1	R324	F-5	R553	L-14	TPD1	N-13
C071	K-2	C502	H-2	D025	E-10	L801	K-9	R074	E-12	R326	I-3	R554	M-14	TPD2	N-14
C103	J-4	C503	H-4	D026*	B-9	Q001	B-5	R075	B-12	R327	F-6	R555	M-13	X001	E-7
C014	J-5	C504	I-4	D031	I-8	Q004	E-6	R078	F-7	R334	E-5	R556	M-13	X101	K-6
C105	J-5	C505	G-3	D032	H-8	Q005	D-6	R079	B-13	R336	C-6	R557	N-14	X102	L-2
C106	J-5	C506	H-2	D302	E-5	Q006	K-7	R080	D-7	R337	H-5	R558	E-16	X201	K-3
C109	J-5	C507	H-3	D451	C-15	Q007	G-8	R081	E-7	R339	G-5	R559	E-11	X501	H-3
C110	J-3	C510	H-1	D452	G-4	Q015	D-10	R083	D-7	R401	I-4	R560	F-9	X601	I-6
C112	J-4	C512	H-2	D453	G-4	Q019	I-3	R085	I-3	R402	L-6	R562	F-14		
C115	M-3	C513	F-17	D454	G-3	Q103	L-3	R086	I-3	R403	K-7	R570	M-14		
C119	K-5	C514	G-18	D470	B-10	Q301	M-4	R087	K-7	R451	B-14	R575	E-13		
C120	J-6	C515	F-17	D502	H-2	Q303	H-5	R088	L-1	R452	C-14	R604	I-5		
C121	J-6	C518	I-3	D503	H-2	Q316	I-2	R090	E-6	R453	N-5	R609	H-6		
C122	K-7	C531	G-2	D506	G-1	Q451	G-4	R092	F-6	R454	C-17	R610	H-6		
C126	K-4	C533	G-2	D531	G-3	Q454	G-3	R093	C-6	R455	B-16	R611	H-5		
C151	K-3	C541	B-5	D532	G-2	Q501	F-17	R094	C-7	R456	B-16	R615	E-6		
C152	K-4	C542	B-5	D533	G-1	Q531	G-2	R095	J-1	R457	B-16	R616	G-5		
C153	K-3	C551	F-15	D542	B-5	Q532	G-2	R096	J-1	R458	B-16	R617	C-7		
C154	K-3	C552	M-13	D551	J-15	Q533	H-3	R097	J-1	R460	B-17	R618	G-6		
C155	J-4	C553	N-14	D552	I-14	Q541	B-5	R106	N-3	R461	B-10	R619	G-6		
C201	M-4	C554	I-14	D553	L-13	Q551	J-18	R107	N-2	R462	F-7	R620	C-5		
C202	M-4	C555	I-13	D554	L-17	Q601	C-5	R108	J-4	R463	C-16	R621	C-5		
C203	K-4	C557	M-14	D555	M-14	Q602	D-5	R109	J-3	R464	C-16	R622	D-5		
C204	K-7	C558	F-9	D556	N-15	Q603	C-6	R110	M-3	R465	H-4	R623	C-5		

*Located on
bottom of board.

C
CPU SCHEMATIC continued

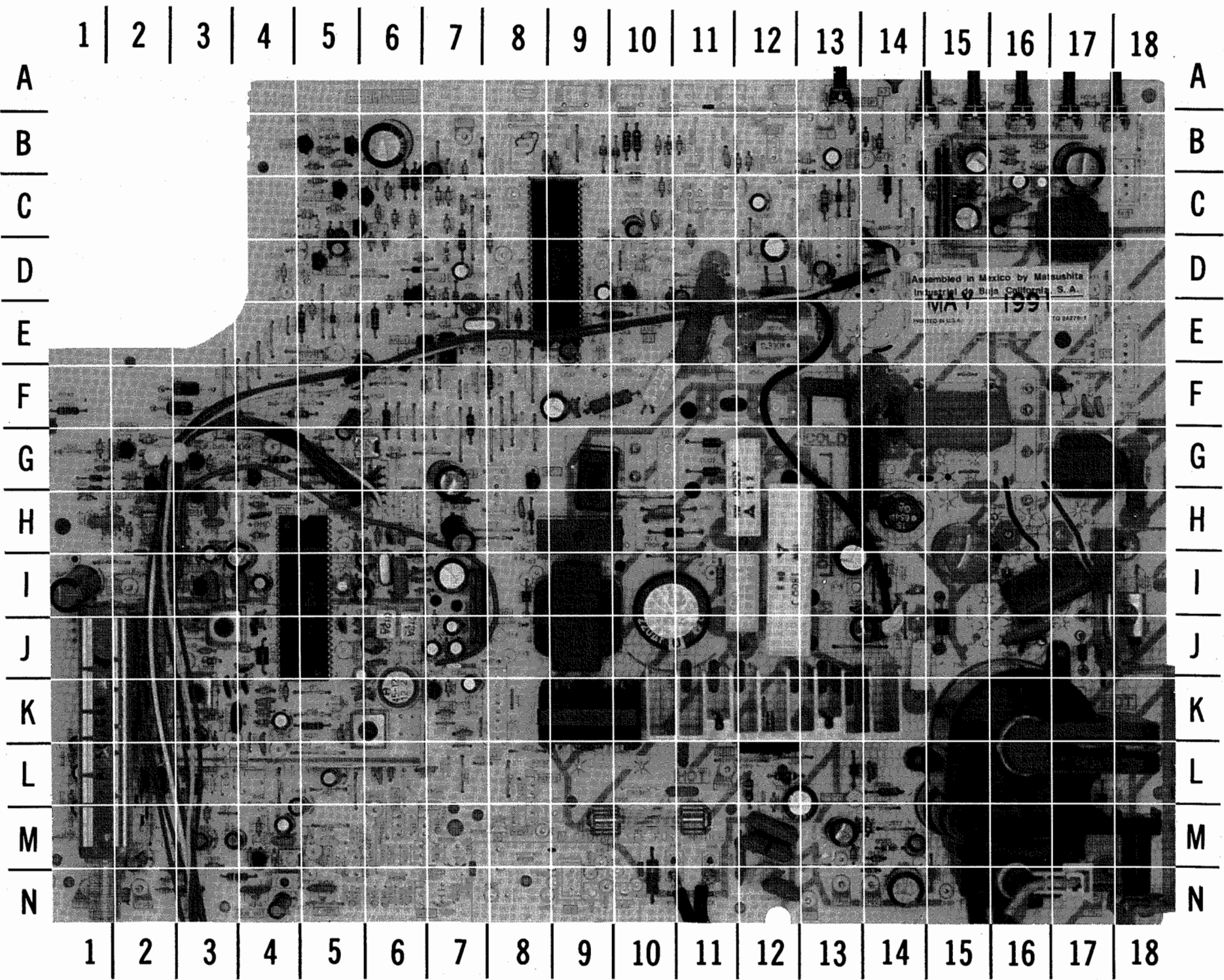


TEST EQUIPMENT

Test equipment listed by participating manufacturers illustrates typical or equivalent equipment used by Sams engineers to obtain measurements. This equipment is compatible with most types used by field service technicians.

Equipment	B&K Precision No.	Sencore No.
Oscilloscope	1541A, 2120, 2125, 2160, 2190, 2522	SC61
Generators		
RGB	1249A, 1260	RG67
Multiburst Signal	1251, 1260	VA62A
Color Bar	1211A, 1249A, 1251, 1260	VA62A, CG25, NT64
TV Stereo	2009	ST65, ST66
Analog VOM	114, 117, 177, 214	-
Digital VOM	377, 388HD, 2700 Series, 2831A, 2860, 2900 Series	DVM37, DVM56A, SC61
Frequency Meter	1803A, 1804A, 1805, 1822, 1851, 1855	FC71, SC61
Hi-Voltage Probe	HV-44	HP200
VOM/DMM	-	TP212
Accessory Probes	PR-28(HV)	-
Isolation Transformer	TR110, 1604, 1653, 1655	PR57
Capacitance Analyzer	810A, 815, 820, 830	LC76, LC101, LC102
CRT Analyzer	480, 490	CR70
Temperature Probe	TP-28, TP-30	-
AC Leakage Tester	1655	PR57
Logic Probe	DP21, DP51	-
Logic Pulser	DP31, DP101	-
Inductance Analyzer	875A	LC76, LC101, LC102
Flyback Yoke Tester	875A	VA62A, LC76, LC101, LC102
TV Stereo Power Monitor	-	SR68
Field Strength Meter	-	FS73, FS74
Transistor Tester	510, 520B, 530	TF46
Video Analyzer	-	VA62A
Modulator/Converter	1201	-

MAIN BOARD



PARTS LIST

SEMICONDUCTORS

(Select replacement for best results.)

Item No.	Type No.	Mfr. Part No.	NTE Part No.	ECG Part No.	TCE Part No.
D004	MA165	-	NTE519	ECG519	SK3100
D005	QA205D	TVSQA205D	NTE5010A	ECG5010A	SK5A1
D020	MA165	-	NTE519	ECG519	SK3100
D021	MA27TA	-	NTE605A	ECG605A	SK7952
D022	1N4532	-	NTE177	ECG177	SK9091
D025, 6	MA165	-	NTE519	ECG519	SK3100
D031	AM01Z	-	NTE116	ECG116	SK3313
	ERA1501	-	NTE552	ECG552	SK9000
D032	1N4532	-	NTE177	ECG177	SK9091
D034	SEL1410G	-	-	-	-
D302	1N4532	-	NTE177	ECG177	SK9091
D352	MA165	-	NTE519	ECG519	SK3100
D353	MA4047L	-	NTE5009A	ECG5009A	SK4A7
D383	MA27WA	-	NTE605A	ECG605A	SK7952
D451	ERA15-01	-	NTE552	ECG552	SK9000
D452, 3	MA165	-	NTE519	ECG519	SK3100
D454	1N4532	-	NTE177	ECG177	SK9091
D470	MA4051H	-	NTE5010A	ECG5010A	SK5A1
D502	QA208C	TVSQA208C	NTE5016A	ECG5016A	SK8A2
D503	MA165	-	NTE519	ECG519	SK3100
D506	QA206B	TVSQA206B	NTE5012A	ECG5012A	SK6A0
# D531	AU01	-	NTE552	ECG552	SK9000
	AS01	-	NTE552	ECG552	SK9000
	ERA2204	-	NTE552	ECG552	SK9000
# D532	MA165	-	NTE519	ECG519	SK3100
# D533	QA208G	TVSQA208G	NTE5016A	ECG5016A	SK8A2
D542	MA165	-	NTE519	ECG519	SK3100
# D551	RU2N	-	NTE552	ECG552	SK9000
# D552, 3, 4	AS01	-	NTE552	ECG552	SK9000
	AU01	-	NTE552	ECG552	SK9000
	ERA2204	-	NTE552	ECG552	SK9000
D555	MA165	-	NTE519	ECG519	SK3100
D556	MA1360H	-	-	-	-
D557	QB105N	TVSQB105N	NTE135A	ECG135A	SK5V1
D560	QB109SA	TVSQB109SA	-	-	-
D603	1N4532	-	NTE177	ECG177	SK9091
# D801 - D804	RM11B	-	NTE125	ECG125	SK3081
	EM02BM	-	NTE125	ECG125	SK3081
	ERC13-08	-	NTE125	ECG125	SK3081
	ERC12-08	-	NTE125	ECG125	SK3081
# D806	-	ERPF5B0M050K	-	-	-
IC001	MN15151Q14N	-	-	-	-
	MN15151Q14R	-	-	-	-
# IC101	AN5160NK	-	-	-	-
	AN5160NK-N	-	-	-	-
IC201	AN5265	-	NTE1789	ECG1789	SK9876
IC451	LA7835	-	NTE1855	ECG1855	SK10085
	LA7835-TV	-	NTE1855	ECG1855	SK10085

For SAFETY use only equivalent replacement part.

SEMICONDUCTORS continued

(Select replacement for best results.)

Item No.	Type No.	Mfr. Part No.	NTE Part No.	ECG Part No.	TCE Part No.
# IC551	AN78M12	-	NTE966	ECG966	SK3592
	AN78M12LB	-	NTE966	ECG966	SK3592
# IC801	STR30130	TVSSTR30130	NTE1777	ECG1777	SK9870
Q001	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q004	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q005	2SA564AQ	-	NTE290A	ECG290A	SK3932
	2SA564AQR	-	NTE290A	ECG290A	SK3932
	2SA564A	-	NTE290A	ECG290A	SK3932
Q006, 7	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q015	2SA564AQ	-	NTE290A	ECG290A	SK3932
	2SA564AQR	-	NTE290A	ECG290A	SK3932
Q019	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q102	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
Q301	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q303	2SA719R	-	NTE290A	ECG290A	SK3114A
	2SA719QR	-	NTE290A	ECG290A	SK3114A
Q316	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q351 - Q353	2SC1573Q	-	NTE399	ECG399	SK9352
	2SC1573A	-	NTE399	ECG399	SK9352
	2SC1573NC	-	NTE399	ECG399	SK9352
Q451	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
Q454	2SA564AQ	-	NTE290A	ECG290A	SK3932
	2SA564AQR	-	NTE290A	ECG290A	SK3932
Q501	2SC1573A	-	NTE399	ECG399	SK9352
	2SC1573AH	-	NTE399	ECG399	SK9352
# Q531	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
# Q532	2SA564AQ	-	NTE290A	ECG290A	SK3932
	2SA564AQR	-	NTE290A	ECG290A	SK3932
	2SA564A	-	NTE290A	ECG290A	SK3932
# Q533	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229

For SAFETY use only equivalent replacement part.

PARTS LIST continued

CONTROLS

(All wattages 1/2 watt or less, unless otherwise listed.)

Item No.	Function	Resistance	Mfr. Part No.
R106	RF AGC	5000	EVN60AA00B53
R304	Sub Contrast	2000	EVND4AA00B23
R318	Sub Bright	10K	EVN60AA00B14
R354	Red Low Light	2000	EVN49AA00B23
R355	Blue Low Light	2000	EVN49AA00B23
R356	Green Low Light	2000	EVN49AA00B23
R357	Blue Drive	300	EVN49AA00B32
R358	Red Drive	300	EVN49AA00B32
R453	Vert Size	50K	EVN60AA00B54
R524	Horiz Cent	200	EVND4AA00B22
R619	Sub Tint	5000	EVND4AA00B53

COILS (RF-IF)

Item No.	Rating	Mfr. Part No.
L006	Coil 5.6uH	TLUABTA5R6K
L007	Coil 5.6uH	TLUABTA5R6K
L008	Coil 5.6uH	TLUABTA5R6K
L011	Coil 1.0uH	TLUABTA1R0K
L103	AFT	TLI67394-1
L104	Coil 1.2uH	TLQ012K205C
L105	VCO	TLI158755
L106	Coil 15uH	TLUABTA150K
L108	Coil 1.2uH	TLQ012K205C
L202	Coil 4.7uH	TLUABTA4R7K
L354	Coil 150uH	TLUABTA151K
L3205	Coil 12uH	TLUABTA120K
L3207	Coil 39uH	ELEPH390JA

RESISTORS

Item No.	Rating	Mfr. Part No.	NTE Replacement
# D806	7.2 Cold PTC	ERPF5BOM050K	-
R050	10K 1% 1/4W Mtl Flm	ER0S2CKF1002	-
# R509	5600 5% 2W Mtl Flm	ERG2ANJ562	2W256
# R510	2700 5% 2W Mtl Flm	ERG2ANJ272	2W272
# R531	47 5% 1/4W Cbn Flm	ERD25FJ470	QW047
# R532	24.3K 1% 1/4W Mtl Flm	ER0S2CKF2432	-
# R533	16.2K 1% 1/4W Mtl Flm	ER0S2CKF1622	-
	16.5K 1% 1/4W Mtl Flm	ER0S2CKF1652(1)	-
# R534	150K 5% 1/4W Cbn Flm	ERDS2TJ154	QW415
# R535	2700 5% 1/4W Cbn Flm	ERDS2TJ272	QW272
# R536	820 5% 1/4 Cbn Flm	ERDS2TJ821	QW182
# R537	18K 5% 1/4W Cbn Flm	ERDS2TJ183	QW318
# R538	8200 5% 1/4W Cbn Flm	ERDS2TJ822	QW282
# R539	15K 5% 1/4W Cbn Flm	ERDS2TJ153	QW315
# R551	1 5% 1W Fusible	ERQ1CJP1R0	F1W1D0
# R552	1 5% 1/2W Cbn Flm	ERDS1FJ1R0	HW1D0
# R553	1 5% 1/2W Cbn Flm	ERDS1FJ1R0	HW1D0
# R558	.22 10% 1/2W Fusible	ERQ12HKR22(1)	-
	.33 10% 1/2W Fusible	ERQ12HKR33	-
R559	68 5% 3W Mtl Flm	ERG3ANJ680	3W068
# R562	1200 5% 1W Mtl Flm	ERG1ANJ122	1W212
# R569	100 5% 1/2W Cbn Flm	ERDS1FJ101	HW101
# R801	.82 10% 5W WW	ERF5ZKR82	5WD82
# R802	180 5% 15W WW	ERF15ZJ181	-
# R804	220K 5% 1/4W Cbn Flm	ERDS2TJ224	QW422
# R805	10K 5% 1/2W Cbn Flm	ERDS1TJ103	HW103
# R807	47 5% 1/4W Cbn Flm	ERD25FJ470	QW047
# R808	33 5% 1/4W Cbn Flm	ERD25FJ330	QW033
# R810	5.6 5% 3W Fusible	ERQ3CJ5R6	-
# R811	4.7 5% 3W Mtl Flm	ERX3ANJ4R7	3W4D7
# R815	2.7M 10% 1/2W Cbn Cmp	ERC12ZGK275	HW527
# R816	1 10% 1/2W WW	ERW12PK1R0	-

For SAFETY use only equivalent replacement part.

Created with pride by the
employees of Howard W. Sams
& Company.

R. Bryant, B. Buchanan,
D. Curran, G. Farrell, B. Fink,
M. Herkless, M. McDonald,
J. Watson, B. Smith

PARTS LIST continued

SEMICONDUCTORS continued

(Select replacement for best results.)

Item No.	Type No.	Mfr. Part No.	NTE Part No.	ECG Part No.	TCE Part No.
Q541	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229
# Q551	2SD1439P	-	NTE2302	ECG2302	SK9422
	2SD1439PLB	-	NTE2302	ECG2302	SK9422
Q601 - Q604	2SC1685R	-	NTE85	ECG85	SK9229
	2SC1685QR	-	NTE85	ECG85	SK9229
	2SC1685	-	NTE85	ECG85	SK9229

For SAFETY use only equivalent replacement part.

COILS & TRANSFORMERS

Item No.	Function	Mfr. Part No.	Russell Part No.
# L570	Yoke 90° Horiz 2.5mh Vert 17.3mh	TLY26317F OLY15307F (2)	-
# T001	Power	TLP16297	-
# T501	Horizontal Driver	ETH19Y70AY	-
# T502	Horizontal Coupling	ETE19Z30AY	-
# T551	Horizontal Output	TLF15615F OLF04505F (1)	FBT-211

For SAFETY use only equivalent replacement part.
(1) Used in Models CTN-2032R-2 and CTN-2033R-2.
(2) Used in Models CTN-2032R and CTN-2033R.

SPEAKER

Item No.	Description	Mfr. Part No.	Quam Part No.
SP1	4" SQ 16 Ohm 1.5W	EAS10P534KG	4A1Z16

CAPACITORS

Item	Rating	Mfr. Part No.
C022	33 N150 50V 5%	ECCF1H330JP
C023	15 N150 50V 5%	ECCF1H150JP
C031	30pF Trimmer	ECRHA030E41
C103	2 NPO 50V 5%	ECCF1H020CC
C104	2 NPO 50V 5%	ECCF1H020CC
C112	18 NPO 50V 5%	ECCF1H180JC
C151	68 NPO 50V 5%	ECCF1H680JC
C152	15 NPO 50V 5%	ECCF1H150JC
C155	2 NPO 50V .25pF	ECCF1H020CC
C207	68 N150 50V 10%	ECCF1H680KP
C503	220 N750 50V 5%	ECCF1H221JU
# C533	.01 50V	ECKF1H103ZF
# C551	.3 200V 5%	ECQF2H304JS
# C561	.0012 2KV 5%	ECKD3D122JB
	.001 2KV 5%	ECKD3D102JB
	.0015 2KV 5%	ECKD3D152JB
	.0018 2KV 5%	ECKD3D182JB
	680 2KV 5%	ECKD3D681JB
	820 2KV 5%	ECKD3D821JB
# C563	.0082 1.2KV 5%	ECWH12H822JS
# C575	.001 2KV 5%	ECKD3D102JB
C605	8 N750 50V .25pF	ECCF1H080DU
C609	100 NPO 50V 10%	ECKF1H101KB
# C802	.0047 500V	ECKD2H472PU
# C803	.0047 500V	ECKD2H472PU
# C804	.0047 500V	ECKD2H472PU
# C817	.015 125V AC 10%	ECQU1A153KH
# C818	.015 125V AC 10%	ECQU1A153KH
# C819	.0022 125V AC	ECKCFL222ZE

For SAFETY use only equivalent replacement part.

ELECTROLYTIC CAPACITORS

Item	Rating	Mfr. Part No.
C452	1 25V	ECSF25E1VB
# C531	33 25V	ECEA1EU330
# C552	220 25V	ECEA1EU221
# C553	10 250V	ECEA2EU100W
# C559	220 25V	ECEA1EU221
# C566	220 35V	ECEA1VU221
# C805	220 200V	ECES2DU221E4
# C806	22 160V	ECEA2CU220W
# C812	33 160V	ECEA160V33Z

For SAFETY use only equivalent replacement part.

PANASONIC
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PARTS LIST continued

MISCELLANEOUS

Item No.	Description	Mfr. Part No.	Notes
# CRA801	Capristor	EXNG131P155	130PF/1.5Meg
# F001	Fuse	XBA1F40NU100	4.0A 125V AC
L010	Ferrite Bead	EXCELSA24	-
L109	Ferrite Bead	EXCELSA35	-
L201	Quadrature	TLS63318-2	-
L304	Comb Filter	TLK153152	-
L306	Delay line	EFDEN645B35B	-
# L551	Linearity	TLH15652P	-
# L555	Ferrite Bead	EXCELSA24	-
# L556	Ferrite Bead	TSC925-4	-
L580	Ferrite Bead	EXCELSA39	-
# L801	Choke	ELF18D650A	AC Line
# L804	Degaussing	OLK19025M	-
# P001	Cord	TSX3134X	AC Line
# RL001	Relay	TSE1864	-
S001	Switch	EVQQBH12T	Power
S002	Switch	EVQQBH12T	Vol Down
S003	Switch	EVQQBH12T	Volume Up
S004	Switch	EVQQBH12T	Channel Down
S005	Switch	EVQQBH12T	Channel Up
S009	Switch	EVQQBH12T	Set Up
S010	Switch	EVQQBH12T	Video
# V1	CRT	A51JFC80X	Models CTN-2032R-2, CTN2033R-2
		A51KAT11X	Models CTN-2032R-1, CTN2033R-1
		A51KQN90X	Models CTN-2032R, CTN2033R
X001	Crystal	TSS2077MX	Oscillator
X101	Filter	EFCH45MVK12N	SAW
X102	Trap	EFCS4R5MW3BA	4.5 MHz
X201	Filter	EFCS4R5MSA	BandPass
X501	Crystal	EF0A503KS41	Oscillator
X601	Crystal	TSS816MXI	3.58MHz
	Board	ONP190010GA(1)	Main
	Board	ONP15002ZA(1)	CRT
	Board	TNP101655EC(1)	Timer
	Convergence	TLC2047-2	Yoke
	Remote Receiver	TNQ2683	-
	Remote Transmitter	EUR641033	-
	Socket	TJS1A5050	-
	U/V Tuner	ENV568C4G3(1)	-
	Wedge	TMM2A30201	-

For SAFETY use only equivalent replacement part.
(1) Contact PTS Electronics Corporation for replacement; order by manufacturer's part number.

CABINET PARTS

MODEL CTN-2032R

Item	Part No.
Cabinet Back	TXFKU201SER
Cabinet Front	TXFKY331SER
Pushbutton (7 Used)	TXFB011SER

MODEL CTN-2032R-1

Item	Part No.
Cabinet Back	TXFKU380SER
Cabinet Front	TXFKY111SER
Pushbutton (7 Used)	TXFB011SER

MODEL CTN-2032R-2

Item	Part No.
Cabinet Back	TXFKU380SER
Cabinet Front	TXFKY630SER
Pushbutton (7 Used)	TXFB011SER

MODEL CTN-2033R

Item	Part No.
Cabinet Back	TXFKU201SER
Cabinet Front	TXFKY321SER
Pushbutton (7 Used)	TXFB011SER

MODEL CTN-2033R-1

Item	Part No.
Cabinet Back	TXFKU380SER
Cabinet Front	TXFKY051SER
Pushbutton (7 Used)	TXFB011SER

MODEL CTN-2033R-2

Item	Part No.
Cabinet Back	TXFKU380SER
Cabinet Front	TXFKY640SER
Pushbutton (7 Used)	TXFB011SER

Important Parts Information

- The parts listed here are those not usually available from a well-stocked supply cabinet or bin.
- Where items may be replaced with equivalent parts, several alternates are shown from participating vendors.
- On the parts lists, safety items are marked with a # to remind you that only exact replacements are recommended for these items.
- When ordering parts, state the model number, part number, and description.

Obtaining Parts

Many of these parts are available from your local Sams authorized distributor or the manufacturer of the equipment. Call Sams for the name of your nearest distributor:

800-428-7267

Or consult the Sams *Annual Index* for the address of the original equipment manufacturer.

Participating Vendors

Information on test equipment and replacement parts is listed in these pages for the following participating vendors. Consult the Sams *Annual Index* for their current address.

- B&K Precision
- Custom Components Corporation (Chek-A-Color)
- EVG / Russell Industries, Inc.
- NTE Electronics, Inc. (NTE)
- Philips ECG Company (ECG)
- PTS Electronics Corporation (PTS)
- Quam-Nichols Co. (Quam)
- Sencore, Inc.
- Thomson Consumer Electronics, Inc.

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