

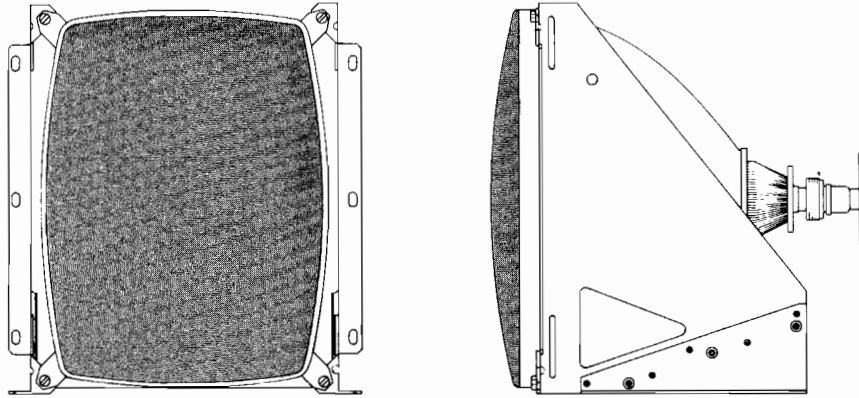
Williams[®]

19" RASTER MONITOR

**types A & C
instruction manual**

Call TOLL-FREE with your
monitor problems!
800-621-1253
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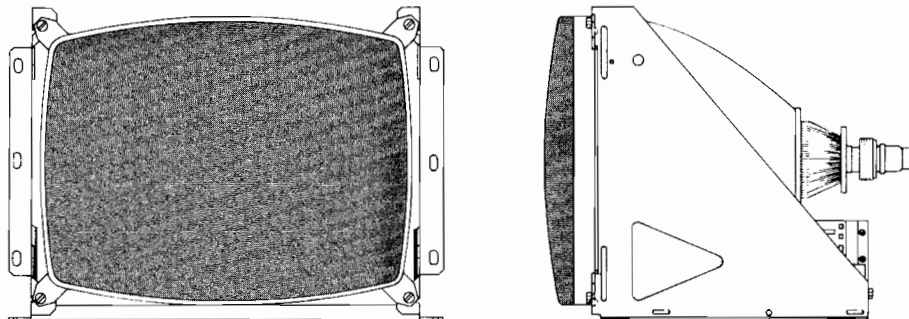
Williams[®] 
ELECTRONICS, INC.
3401 N. California Avenue
Chicago, Illinois 60618



19" RASTER MONITOR TYPES A & C

instruction manual

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19" RASTER MONITOR TYPE A

NOTES

THIS MANUAL APPLIES TO THOSE MONITORS WITH SERIAL NUMBERS OF 576001 AND ABOVE.

WARNINGS

1. Power Up Warning—

An isolation transformer must be used between the AC supply and the AC plug of the monitor before servicing or testing is performed since the chassis and the heat sink are directly connected to one side of the AC line which could present a shock hazard.

Before servicing is performed, read all the precautions labelled on the CRT and chassis.

2. **X-RAY RADIATION WARNING NOTICE**

WARNING: PARTS WHICH INFLUENCE X-RAY RADIATION IN HORIZONTAL DEFLECTION, HIGH VOLTAGE CIRCUITS AND PICTURE TUBE ETC. ARE INDICATED BY (★) IN THE PARTS LIST FOR REPLACEMENT PURPOSES. USE ONLY THE TYPE SHOWN IN THE PARTS LIST.

3. High Voltage—

This monitor contains HIGH VOLTAGES derived from power supplies capable of delivering LETHAL quantities of energy. Do not attempt to service until all precautions necessary for working on HIGH VOLTAGE equipment have been observed.

4. CRT Handling—

Care must be taken not to bump or scratch the picture tube as this may cause the picture tube to implode resulting in personal injury. Shatter proof goggles must be worn when handling the CRT. High voltage must be completely discharged before handling. Do not handle the CRT by the neck.

5. **PRODUCT SAFETY NOTICE**

WARNING: FOR CONTINUED SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER RECOMMENDED PARTS. THESE PARTS ARE IDENTIFIED BY SHADING AND BY (△) ON THE SCHEMATIC DIAGRAM.

AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

For replacement purposes, use the same type or specified type of wire and cable, assuring the positioning of the wires is followed (especially for H.V. and power supply circuits). Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

PERFORMANCE AND OPERATING DATA

1. Apply a suitable power source to the monitor through an isolation transformer.
2. Apply a suitable signal source to the monitor PCB by means of P201 and P202
3. Set Up Controls.

All controls are preset at the factory, but may be adjusted to suit program material.

1.0 Supply

Voltage 108 VAC-132 VAC

Frequency 50 Hz-60 Hz

Note: Apply supply voltage through an isolation transformer with 1 Amp. minimum capability.

2.0 High Voltage (EHT)

For 19"V models 24.3 ± 0.8 K.V. at 0 Beam; 22.8 ± 0.8 K.V. at 1 mA Beam

Note: Condition for above: A.C. = 120V

3.0 Service Set-Up Controls

MAIN PC BOARD

- 3.1 Vertical Hold Control, VR301
- 3.2 Vertical Size Control, VR303
- 3.3 Horizontal Hold Control, VR351
- 3.4 Vertical Raster Position Control, VR 901
- 3.5 Horizontal Raster Position Adjustment Jumper (3 positions)
- 3.6 Screen Control (Part of H.V. Unit, T352)
- 3.7 Focus Control (Part of H.V. Unit, T352)
- 3.8 Horizontal Width Coil, L352 (L601 on Model K4904)
- 3.9 Black Level Control, VR201

- 3.10 Horizontal Video Position Control, (Horizontal Shift) VR352
- 3.11 Vertical Damping Control, VR302

NECK PC BOARD

- 3.12 Video Drive Controls, Red VR401
Green VR402
- 3.13 CRT Cut Off Controls, Red VR403
Green VR404
Blue VR405

SERVICE INSTRUCTIONS

NOTE: All monitors are equipped with automatic degaussing coils (L701) which demagnetize the picture tube every time the monitor is turned on after being off for a minimum of 5 minutes. Should any part of the chassis become magnetized it will be necessary to degauss the affected area with a manual degaussing coil. Move the coil slowly around the CRT face area and all surrounding metal parts. Then slowly withdraw for a distance of 6 feet before turning off.

Horizontal vs. Vertical:

Some models have the picture tube mounted vertically rather than horizontally. That is, the picture tube is mounted in the frame such that the long dimension of the tube is up and down. Examples of this include (but are not limited to) Models K4951, K4952, K4956, K4956R, and K4961 as in the pictures on the bottom of the front cover. Other than the physical orientation of the picture tube, there is no electrical difference between these models and their horizontal counterparts. The same circuits, the vertical circuits, produce and control deflection along the short dimension of the tube in all models.

The same circuits, the horizontal circuits, produce and control deflection along the long dimension of the tube in all models. Therefore, wherever "vertical" appears in this manual or on the monitor, it refers to the short dimension of the picture tube; wherever "horizontal" appears, it refers to the long dimension of the picture tube.

BLACK LEVEL CONTROL ADJUSTMENT

This control has been set at the factory and should not need further attention. However, when the game is connected a slight adjustment of VR201 may be necessary to obtain the proper black level (the black portion of the picture just extinguished).

VERTICAL SIZE (HEIGHT)

Location of this control is shown in Fig. 1. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct vertical proportions.

NOTE: This adjustment interacts with the vertical damping adjustment described in the paragraph below. It may be necessary to readjust the vertical size after the vertical damping control has been adjusted.

VERTICAL DAMPING

Adjustment of this control is required only if the monitor is being used with a game in which the top several raster lines are visible on the screen. Adjust the vertical damping control for uniform spacing of the top raster lines.

CIRCUIT PROTECTION

A 4.0A pigtail fuse, mounted on the Main Board has been provided to protect the Power Output Circuit.

FOCUS

Adjust the Focus control, located on the HV unit (T352), for maximum over-all definition and fine picture detail.

HORIZONTAL HOLD CONTROL ADJUSTMENT, VR351 (See Fig. 1a or 1b)

A warm-up period of at least five minutes should be allowed before alignment is carried out. With the monitor being driven from the game signal, short TP601 to TP31. Adjust VR351 until the picture stops sliding horizontally. Remove the short.

HORIZONTAL VIDEO POSITION

If the video is off center on the raster, some compensation can be made by adjusting this control.

VERTICAL RASTER POSITION ADJUSTMENT

If the video is off center vertically, (short dimension of picture tube) some compensation can be made by turning the vertical raster position control.

HORIZONTAL RASTER POSITION ADJUSTMENT

If the video is off center horizontally (long dimension of the picture tube), some compensation can be made by moving the horizontal raster position adjustment jumper to either positions "R" or "L".

NOTE: This adjustment is not provided on Model K4903.

HORIZONTAL WIDTH ADJUSTMENT

The horizontal width coil is a hexagonal tuning tool adjustment. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct horizontal proportions.

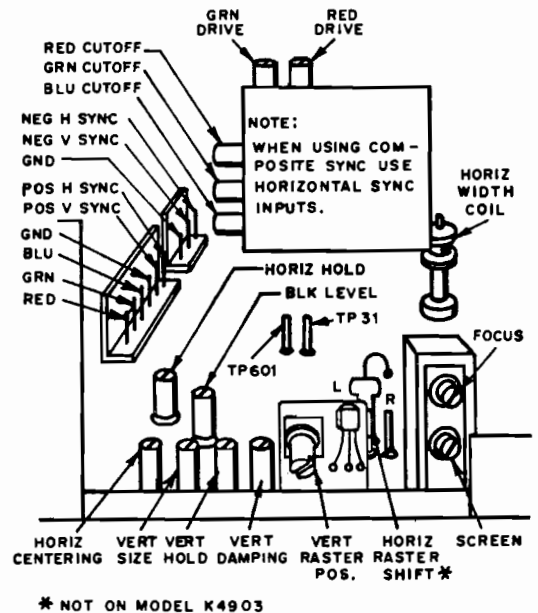


Figure 1(a)

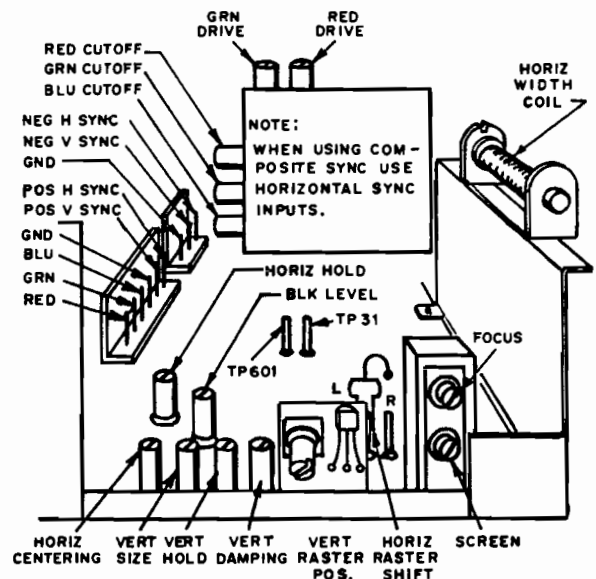


Figure 1(b)

INSTALLATION INSTRUCTIONS

NOTE: All of the following procedures have been performed at the factory and should require no further attention. If the monitor is serviced for any reason, it should be observed afterward to determine whether any of these procedures need to be performed again.

DEGAUSSING

The monitor is equipped with an automatic degaussing circuit. However, if the CRT shadow mask has become excessively magnetized, it may be necessary to degauss it with a manual coil. Do not switch the coil OFF while the raster shows any effect from the coil.

WHITE BALANCE

- 1 Equipment Required: An oscilloscope with a DC coupled mode in the vertical amplifier, or a digital multimeter, or a VOM with a DC input impedance of at least 20,000 ohms/volt.
- 2 Referring to Fig. 1(a) or 1(b) and 3, do the following adjustments in subdued light after degaussing and setting the purity of the CRT.
- 3 Ground the R/G/B video inputs.
- 4 Set the Red and Green drive controls, VR401 and VR402, to approximately 80% of full CW rotation.
- 5 Set the screen and R/G/B cutoff controls to their minimum (fully CCW) positions.
- 6 Connect the oscilloscope, multimeter, or VOM, to the collector of a video output transistor (Q401, Q402, or Q403) on the CRT neck PCB at TP47R, TP47G, or TP47B as shown in Fig. 2.
- 7 Adjust the black level control (VR201) to obtain the waveform shown in Fig. 3 or a $\$$ 150 volt DC reading on the multimeter or the VOM.
- 8 Slowly turn the screen control CW until the raster is just visible. The color of this raster is called the lead color gun. DO NOT adjust its associated cutoff control. It must remain fully CCW.
- 9 Adjust the screen control CCW until the raster is just extinguished. Then adjust the black level control for a dim raster.

- 10 Adjust the two remaining cutoff controls (NOT the lead color gun cutoff control) for best gray uniformity.
- 11 Adjust the black level control for a bright raster but not maximum brightness. Adjust the R/G drive controls, if necessary, for best neutral white.
- 12 Repeat steps 10 and 11 until good tracking of white balance is achieved.
- 13 With the oscilloscope, multimeter, or VOM connected to the collector of the lead color video output transistor (See Fig. 2), adjust the black level control to obtain the waveform in Fig. 3 or a $\$$ 150 volt DC reading on the multimeter or VOM.

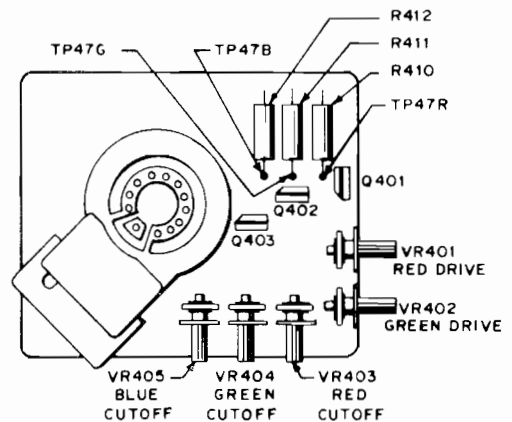


FIGURE 2

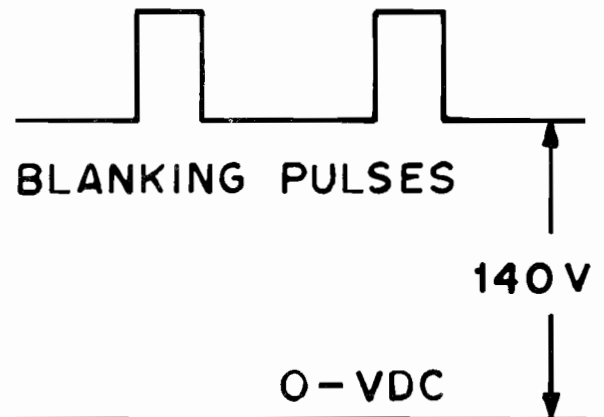


FIGURE 3

REPLACEMENT PARTS LIST

PART-ORDERING PHONE NO.: (312) 252-8220 (WELLS-GARDNER MONITORS ONLY)

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic or Δ ★ on parts list should be replaced with exact factory replacement parts.

The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

MAIN BOARD

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS			RESISTORS (Cont.)		
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R372	203X9104-809	12K Ohm, 5%, 2W Metal Oxide
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R375	203X9014-724	3.9K Ohm, 5%, 1W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R207	340X2221-934	220 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R209	340X2221-934	220 Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R384	203X6501-088	68K Ohm, 5%, 1/4W Carbon
R211	340X2221-934	220 Ohm, 5%, 1/4W Carbon	R385	340X2122-934	1.2K Ohm, 5%, 1/4W Carbon
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R387	340X2224-934	220K Ohm, 5%, 1/4W Carbon
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R389**	—	Not Used
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R390	340X4222-633	2.2K Ohm, 5%, 1W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R506	204X1425-196	15 Ohm, 5%, 5W Wire Wound
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	Δ ★ R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm Variable
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm Variable
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR302	204X2070-084	5K Ohm Variable
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	VR303	204X2070-055	500 Ohm Variable
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	VR351	204X2070-072	2K Ohm Variable
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	VR352	204X2070-072	2K Ohm Variable
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon			
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon			
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon			
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon			
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon			
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon			
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon			
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon			
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon			
R311	203X9014-709	3.3K Ohm, 5%, 1W Carbon			
R312	203X9014-741	4.7K Ohm, 5%, 1W Metal Oxide			
R313	204X1527-528	470 Ohm, 5%, 7W Carbon			
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon			
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon			
R317	203X6700-061	8.2 Ohm, 5%, 1/2W Carbon			
R318	203X6500-584	560 Ohm, 5%, 1/4W Carbon			
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon			
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon			
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon			
R353	203X6501-088	68K Ohm, 5%, 1/4W Carbon			
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon			
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide			
R358	340X3683-934	68K Ohm, 5%, 1/2W Carbon			
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon			
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide			
★ R363	204X1450-516	3.9K Ohm, 5%, 5W Metal Oxide			
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon			
R365	340X2183-934	18K Ohm, 5%, 1/4W Carbon			
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.			
R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.			
R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide			
			C201	203X0014-088	1000 uF, 16V, Electrolytic
			C202	202X7200-064	330 pF, 500V, Ceramic
			C203	202X7200-043	220 pF, 500V, Ceramic
			C204	202X7200-043	220 pF, 500V, Ceramic
			C205	203X0014-076	470 uF, 16V, Electrolytic
			C206	203X1810-149	0.1 uF, 125V Mylar
			C207	349X2232-109	.022 uF, 100V Mylar
			C301	203X0014-065	330 uF, 50V Electrolytic
			C302	203X1600-563	0.033 uF, 50V Mylar
			C303	203X0629-037	3.3 uF, 50V Electrolytic
			C304	203X1600-366	0.068 uF, 50V Mylar
			C306	203X0412-012	2.2 uF, 16V Tantalum
			C307	203X1600-634	0.033 uF, 50V Mylar
			C308	203X0025-163	2.2 uF, 50V Electrolytic
			C309	203X1207-100	0.068 uF, 100V PP
			C310	203X0629-061	10 uF, 100V Electrolytic
			C311	203X0041-162	4.7 uF, 160V Electrolytic
			C312	202X7050-248	1000 pF, 500V Ceramic
			C313	203X0040-068	100 uF, 160V Electrolytic
			C314	203X1201-096	0.039 uF, 200V PP
			C315	203X0629-023	1 uF, 50V Electrolytic
			C351	203X0629-023	1 uF, 50V Electrolytic
			C352	203X0619-045	47 uF, 25V Electrolytic
			C353	203X1190-015	0.0082 pF, 50V Mylar-PP
			C354	203X0619-045	47 uF, 25V Electrolytic
			C355	203X1600-366	0.0068 pF, 50V Mylar
			C356	203X1130-287	0.0047 uF, 50V, Mylar
			C359	202X8065-606	100 pF, 500V Ceramic
			C360	202X7050-366	0.0033 pF, 500V Ceramic
			C361	202X7050-483	0.01 uF, 500V Ceramic
			C362	202X7203-032	0.01 uF, 50V Ceramic
			Δ ★ C363	203X1270-911	8700 pF, 1.5 KV PP
			★ C365*	203X1201-265	0.33 uF, 200V PP
			C365**	46X0536-022	0.15 uF, 400V PP
			C366	203X0019-026	22 uF, 25V Electrolytic

*C365 and R389 value for 50 uS Horiz. sweep TC.

**C365 value for 40 uS Horiz. sweep TC; R389 not used.

MAIN BOARD (CONT.)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
CAPACITORS (Cont.)					
C367	202X8065-162	6 pF, 500V Ceramic	Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM
C368	202X7203-032	0.01 uF, 50V Ceramic	Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM
C369	203X1207-087	0.047 uF, 100V, PP	Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM
C372	203X1207-125	0.1 uF, 100V PP	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
C373	203X0029-021	1 uf, 50V, Electrolytic	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
C380	202X7200-087	470 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
C381	80X0099-006	470 pF, 500V, Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1815GR
△ C501	203X1810-149	0.1 uF, 125V Mylar	Q210	200X3181-523	Transistor (NPN) 2SC1815GR
△ C502	202X7050-282	1500 pF, 500V Ceramic	Q301	200X3181-523	Transistor (NPN) 2SC1815GR
△ C503	202X7810-214	2200 pF, 125V Ceramic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
△ C504	202X7810-214	2200 pF, 125V Ceramic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C505	203X0220-075	560 uF, 200V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C506	203X0040-034	22 uF, 160V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C507	203X0041-057	47 uF, 160V Electrolytic	ZD301	66X0040-031	Diode, Zener 24V, 3%, 1/2W
C701	203X0019-092	1000 uF, 25V Electrolytic	IC301	200X2300-033	IC HA11423
C702	203X0634-061	10 uF, 100V Electrolytic	△★ IC501	200X2600-183	IC STR381
C703	202X7050-248	1000 pF, 500V Ceramic			

SEMICONDUCTORS					
D203	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D204	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D205	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D206	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D207	201X2010-159	Diode, IS2076-27	△★ T352	200X9720-301	HV-Unit M-11
D208	201X2010-159	Diode, IS2076-27			
D209	201X2010-159	Diode, IS2076-27			
D302	201X2010-159	Diode, IS2076-27	△ F501	204X7120-073	Fuse, 4 Amp. 125V
D303	201X2010-159	Diode, IS2076-27	J402	206X5008-632	Recep W Wire 3P-M-BG
D304	201X2120-009	Diode, RH-IV	P201	204X9600-466	Plug, PWB 3P-J
D305	201X2120-009	Diode, RH-IV	P202	204X9601-477	Plug, PWB 6P-Q
D306	201X2010-159	Diode, IS2076-27	P401	204X9600-298	Plug, PWB 4P-B
D307	201X2010-165	Diode, ISS81	P501	204X9600-249	Plug, PWB 2P-B
△ D501	201X3120-216	Diode, RM-1AV	P601	204X9600-304	Plug, PWB 4P-C
△ D502	201X3120-216	Diode, RM-1AV	TH501	201X0100-112	Thermistor
△ D503	201X3120-216	Diode, RM-1AV			
△ D504	201X3120-216	Diode, RM-1AV			
D505	201X3120-216	Diode, RM-1AV			
D506	201X3120-216	Diode, RM-1AV			
D701	201X2130-234	Diode, RU-2V			
D702	201X2120-009	Diode, RH-1V			
Q201	200X3181-523	Transistor (NPN) 2SC1815GR			
Q202	200X3181-523	Transistor (NPN) 2SC1815GR			

SEMICONDUCTORS (Cont.)

TRANSFORMERS & COILS

201X4710-134	Coil, (RF Choke)
201X5000-083	Coil, Horiz. Size
611X0004-007	Coil, Adg.
202X1300-080	Transformer, Hor. Drive
200X9720-301	HV-Unit M-11

MISCELLANEOUS

204X7120-073	Fuse, 4 Amp. 125V
206X5008-632	Recep W Wire 3P-M-BG
204X9600-466	Plug, PWB 3P-J
204X9601-477	Plug, PWB 6P-Q
204X9600-298	Plug, PWB 4P-B
204X9600-249	Plug, PWB 2P-B
204X9600-304	Plug, PWB 4P-C
201X0100-112	Thermistor

FINAL ASSEMBLY PARTS

△★ 88X0138-506	19VLT22 Pix Tube
205X9800-158	Lateral/Purity Assembly
△★ 202X1111-258	Yoke Deflection
or 202X1111-264	
291X5004-262	Automatic Degaussing Coil Unit

NECK BOARD

RESISTORS

R401	203X6000-729	220 Ohm, 5% 1/4W Carbon	C401	202X7050-269	1200 pF, 500V Ceramic
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon	C402	202X7050-248	1000 pF, 500V Ceramic
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon	C403	202X7050-248	1000 pF, 500V Ceramic
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon	C404	202X7050-282	1500 pF, 1.5KV Ceramic
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon	C405	202X7050-483	0.01 uF, 500V Ceramic
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon			
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon			
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon			
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon			
R410	203X9104-824	15K Ohm, 5% 2W Metal Oxide			
R411	203X9104-824	15K Ohm, 5% 2W Metal Oxide	Q401	200X3206-800	Transistor (NPN) 2SC2068LB
R412	203X9104-824	15K Ohm, 5% 2W Metal Oxide	Q402	200X3206-800	Transistor (NPN) 2SC2068LB
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.	Q403	200X3206-800	Transistor (NPN) 2SC2068LB
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide			
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon			
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon			
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	J401	206X5009-296	RECEP W Wire 4P-E
VR401	204X2115-014	500 Ohm, Variable	P402	204X9600-254	Plug, PWB 3P-A
VR402	204X2115-014	500 Ohm, Variable	P403	204X9600-981	Plug, Pin 1P-D
VR403	204X2115-006	5K Ohm, Variable	P701	204X9601-020	Plug, PWB 4P-E
VR404	204X2115-006	5K Ohm, Variable		204X9301-255	CRT Socket
VR405	204X2115-006	5K Ohm, Variable			

CAPACITORS

SEMICONDUCTORS

MISCELLANEOUS

VERTICAL POSITION BOARD

RESISTORS

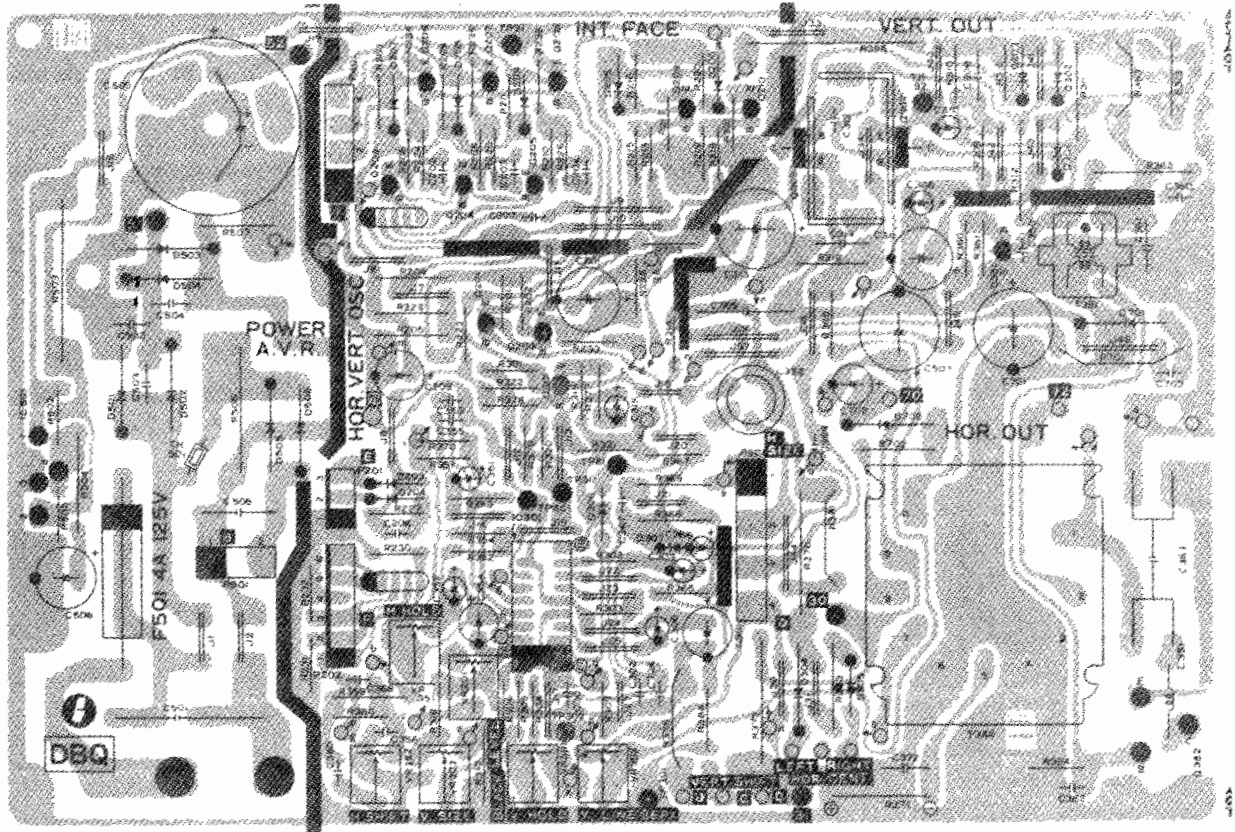
VR901	40X0645-001	25K Ohm Vert. Position Control
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SEMICONDUCTORS

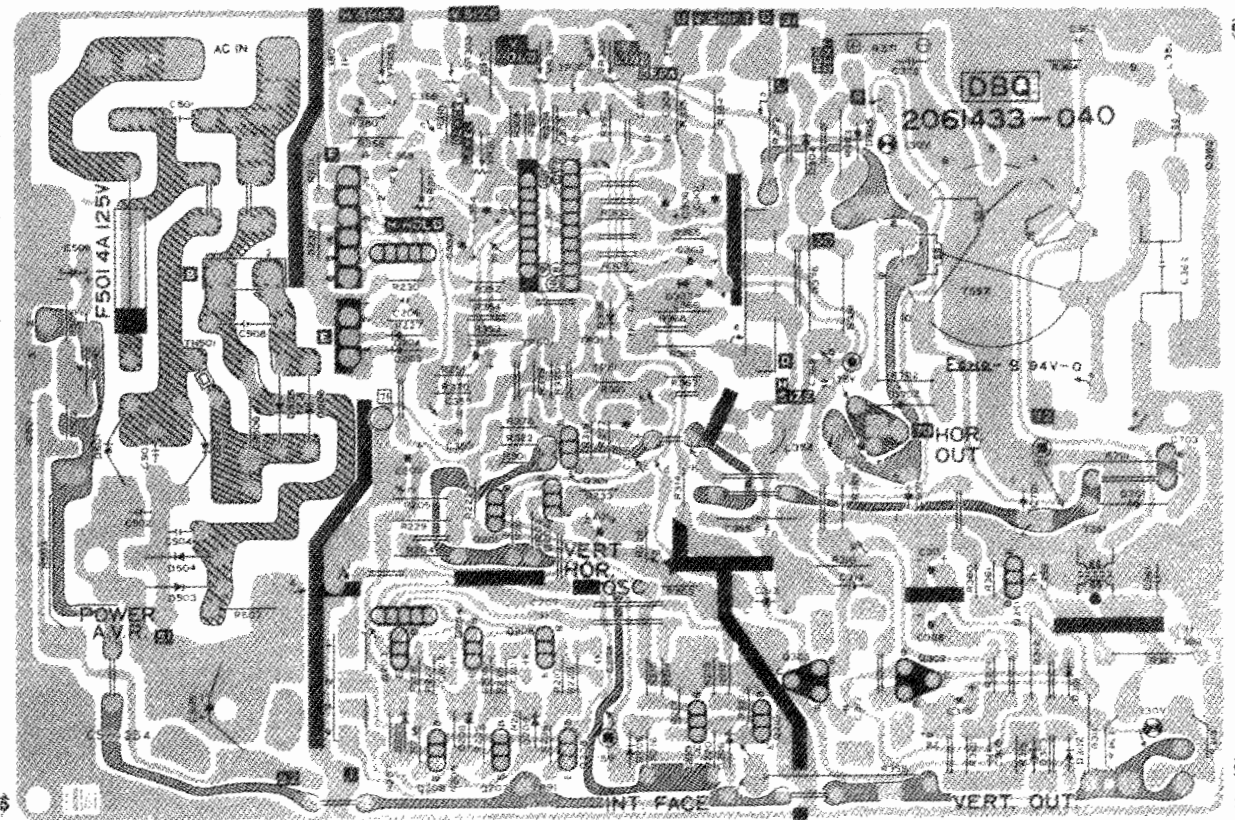
Q901	86X0127-001	Transistor (NPN) TPS98
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NOTES

PC BOARD LAYOUT



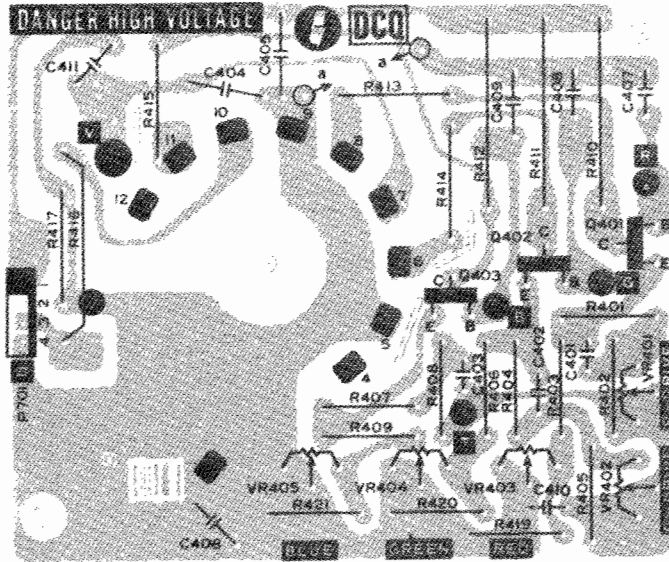
TOP VIEW



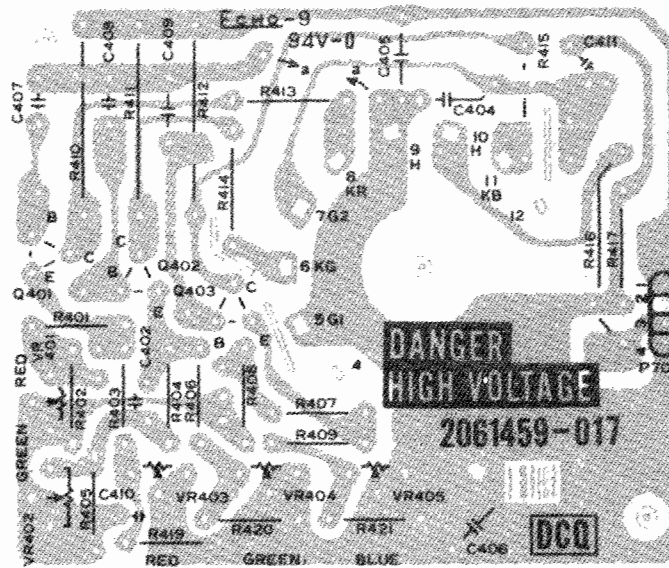
BOTTOM VIEW

MAIN PC BOARD

PC BOARD LAYOUT



TOP VIEW



BOTTOM VIEW

NECK PC BOARD

TYPICAL DC VOLTAGES WITH INPUT SIGNAL

TRANSISTOR NO.	TERMINAL		
	COLLECTOR	BASE	EMITTER
Q201	8.1	0.43	0.36
Q202	9.8	8.1	9.3
Q203	0	0.35	1.0
Q204	0	0.35	1.0
Q205	0	0.35	1.0
Q206	9.7	5.5	4.8
Q207	9.7	5.5	4.8
Q208	9.7	5.5	4.8
Q209	15.4	-0.30	0.01
Q210	14.0	0.31	0.17
Q301	15.5	4.7	4.2
Q302	79	37.8	37.7
Q303	37	0.51	0
Q351	41.4	0.41	0
Q352	DO NOT MEASURE	-0.03	0
Q401	139	9.7	9.3
Q402	139	9.7	9.3
Q403	139	9.7	9.3

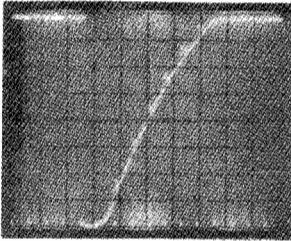
I.C. 301	
PIN NO.	VOLTAGE
1	1.16
2	4.0
3	6.8
4	3.9
5	12.1
6	4.1
7	4.1
8	1.9
9	12.2
10	14.2
11	3.6
12	7.9
13	6.8
14	12.8
15	1.52
16	0
17	0.83
18	0

I.C. 501	
PIN NO.	VOLTAGE
1	163
2	130
3	0
4	132

OSCILLOSCOPE WAVEFORM PATTERN

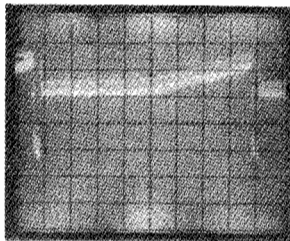
The waveforms shown are as observed on the wide band oscilloscope with the monitor turned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak amplitudes. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corner of the pulses will tend to more rounded than those shown and the amplitude of any high frequency pulse will tend to be less.

A



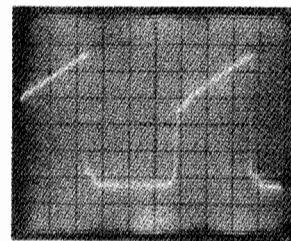
1V/DIV 100uSEC/DIV

TP-81



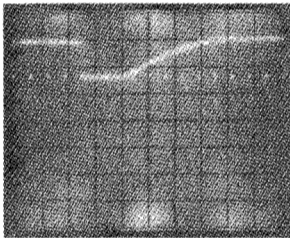
0.5/DIV 2MSEC/DIV

Q351 COLLECTOR



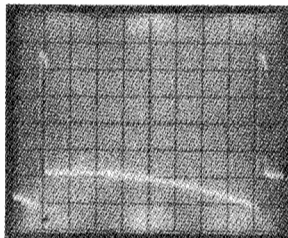
20V/DIV 10uSEC/DIV

TP-31 DC COUPLED
BOTTOM LINE = 0 VDC



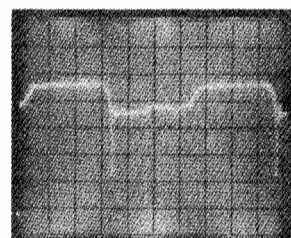
2V/DIV 100uSEC/DIV

TP-82



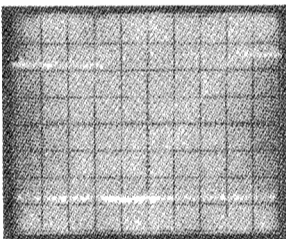
20V/DIV 2MSEC/DIV

D



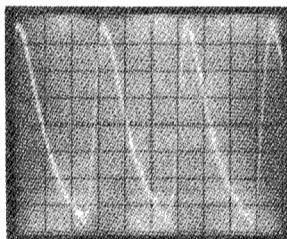
2V/DIV 10uSEC/DIV

TP-31, AC COUPLED



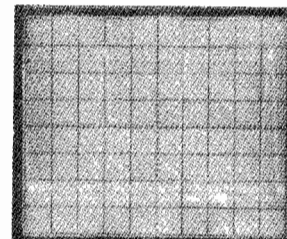
0.5V/DIV 100uSEC/DIV

B



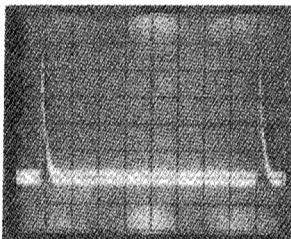
0.2V/DIV 20uSEC/DIV

J402-3



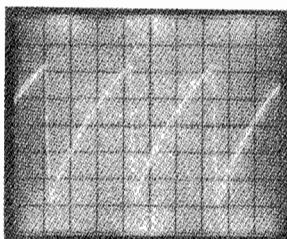
5V/DIV 20uSEC/DIV

NEGATIVE SIDE OF C303



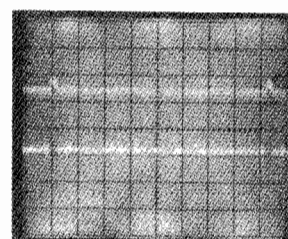
1V/DIV 2MSEC/DIV

I.C. 301, PIN 13



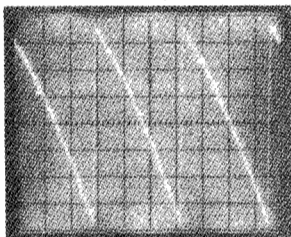
1V/DIV 20uSEC/DIV

F



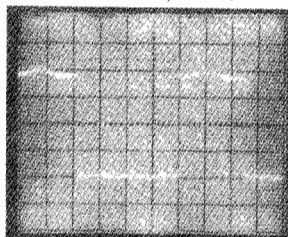
1V/DIV 2MSEC/DIV

I.C. 301, PIN 3



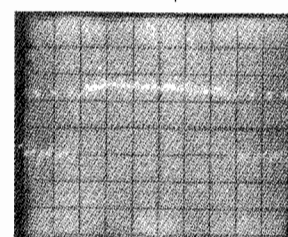
0.5V/DIV 5MSEC/DIV

I.C. 301, PIN 15



1V/DIV 10uSEC/DIV

F



1V/DIV 100uSEC/DIV

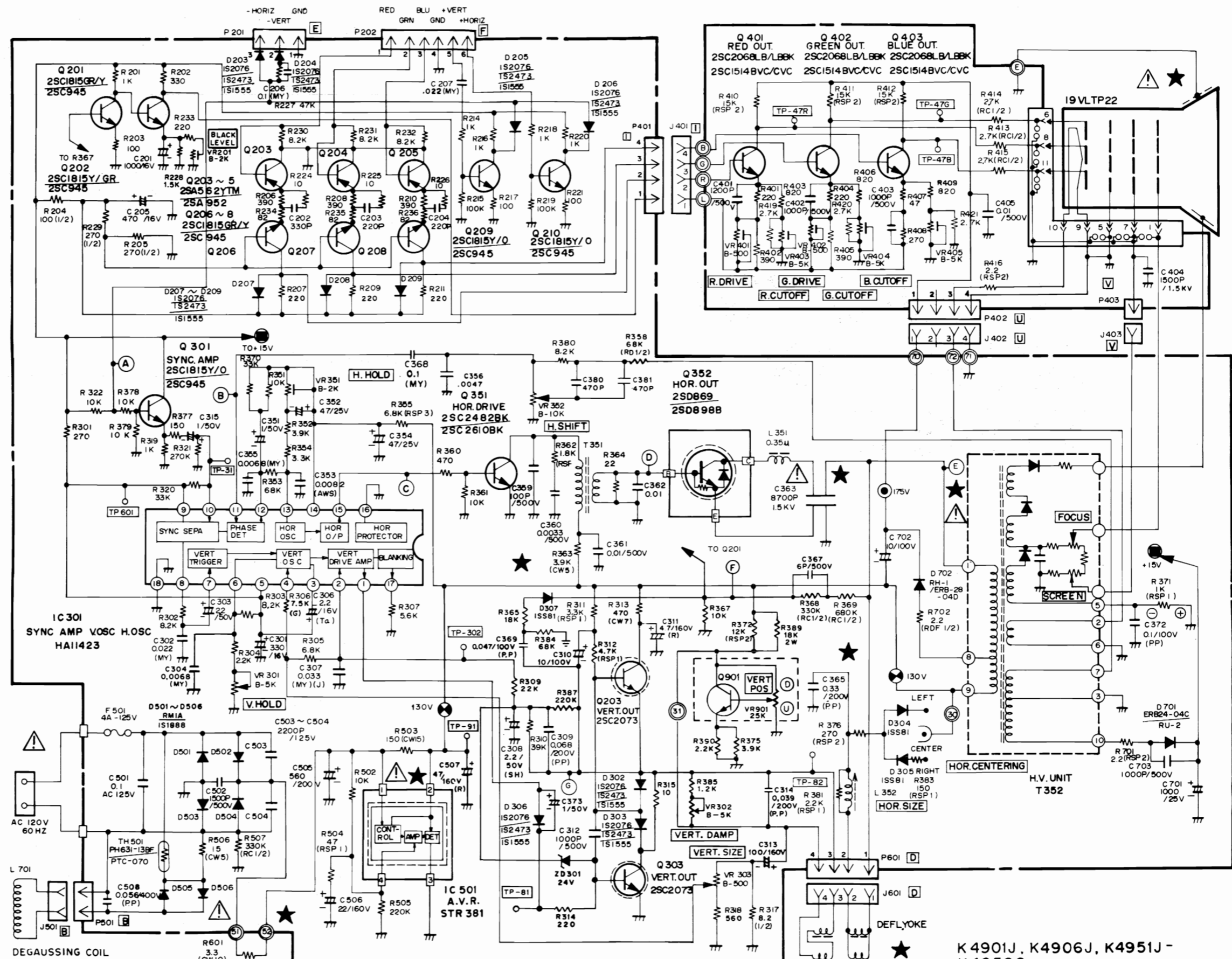
19" COLOR MONITOR SCHEMATIC DIAGRAM

Power Supply Voltage and Symbols

Symbol	Voltage	Operating Circuit
	15V	Vert. Osc. Sync Blanking CRT Cut-Off
	130V	Horiz. Osc. Horz. Drive Horz. Output Vert. Output
	175V	Video Output

CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

SERVICE TECHNICIAN WARNING
X-RAY RADIATION PRECAUTION:
 THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
 FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.



K 4901J, K 4906J, K 4951J - K 4956G

**19" RASTER
MONITOR
TYPE C**

SETUP PROCEDURE

INSTRUMENTS REQUIRED

- Digital multimeter with input impedance of 10M
- Oscilloscope with a bandwidth of 10MHz
- 10/1 probe attenuator

Turn on the monitor and let the circuitry heat up for about 5 minutes. Then adjust the controls for an acceptable image. Next align the chassis according to the following instructions.

POWER SUPPLY WITHOUT SIGNAL

Variable resistor RV 12 adjusts the **supply voltage** and requires adjustment only following repair. Proceed as follows:

- turn **brightness grid** control all the way counterclockwise.
- connect digital voltmeter to SP20 and adjust RV12 to obtain 115VDC.

CAUTION: Voltages greater or less than nominal impair the functioning of the monitor.

RGB INPUT LEVELS (signal: color bars)

Turn RV10 **brightness control** up all the way; checking voltage at R27, R28, R31, adjust input control RV1/RV2/RV3 (**contrast**) to obtain 0.6Vpp for each color.

RGB VIDEO OUTPUT (signal: color bars)

—Adjust RV5, RV7 and RV9 on neckboard to obtain a **black level** of 140VDC at KG, KR and KB.

—Adjust RV4, RV6, RV8 for a gain of 50Vpp at KG, KR and KB.

—Adjust RV10 (**input brightness**) for a **black level** of 160VDC at KG, KR and KB.

—Adjust G2 to obtain CRT cutoff.

WHITE BALANCE (no signal)

With RV10 adjusted to make a white background visible, correct the gray by means of RV5, RV7 and RV9.

HORIZONTAL OSCILLATOR (signal: crosshatch)

Jumper TP7 to TP8. Adjust RV13 to obtain maximum horizontal stability. Then remove the jumper.

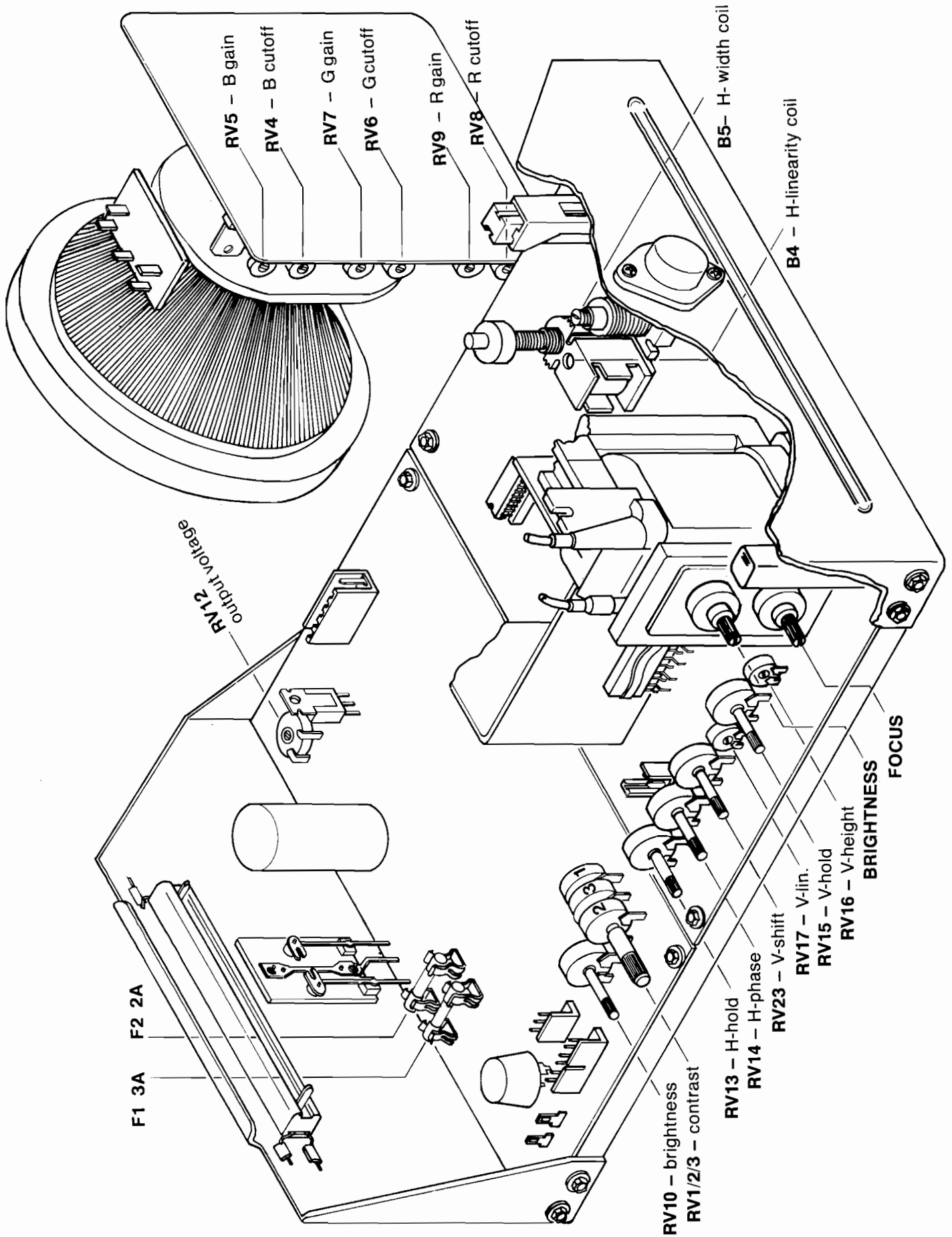
VERTICAL OSCILLATOR (signal: crosshatch)

Adjust RV15 to obtain a slight downward rollover of the image. Then turn back slowly to eliminate rollover.

FOCUS (signal: crosshatch)

Adjust **focus grid** control for clearest picture.

ADJUSTMENT CONTROLS



PERFORMANCE AND OPERATING DATA

	min	max
1) PRIMARY (HV) VOLTAGE SUPPLY		
VOLTAGE.....	98VAC	130VAC
FREQUENCY.....	44Hz	65Hz

WARNING: SHOCK HAZARD! Apply supply voltage **ONLY** through an isolation transformer with 1.5A capability.

2) EHV		
for 19" models.....	22.5kV	25.5kV

NOTE: conditions for above:

I (beam) = 0mA
DC supply voltage = 1.15VDC

3) CONNECTOR CA

PIN	DESCRIPTION	IMPEDANCE	SIGNAL RANGE
1	red input	1k nom.	0 to 4V
2	green input	1k nom.	0 to 4V
3	blue input	1k nom.	0 to 4V
4	ground		
5	vertical sync pulse	10k nom.	1.5V to 4V
6	horizontal sync pulse	10k nom.	1.5V to 4V

4) SERVICE SETUP CONTROLS

INTERFACE BOARD

RV 12 supply voltage adjustment—should be set for 115VDC
RV 10 brightness control
RV 1/2/3 contrast

DEFLECTION BOARD

RV 13 horizontal hold
RV 14 horizontal phase
RV 23 vertical shift
RV 17 vertical linearity
RV 15 vertical hold
RV 16 vertical height
B 4 horizontal linearity coil
B 5 horizontal width coil

FLYBACK TRANSFORMER

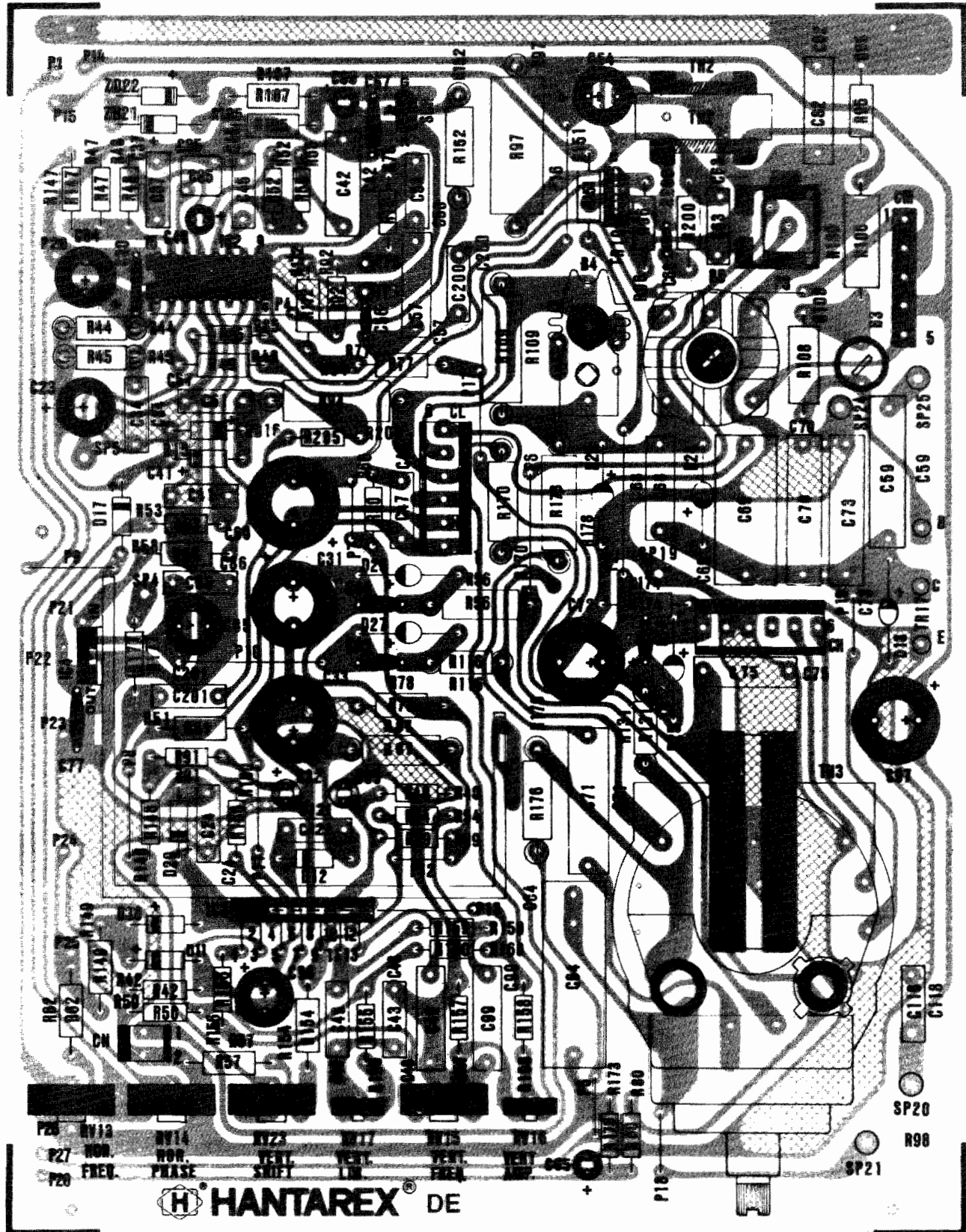
— G2—brightness control (preset)
— G3—focus control

NECKBOARD

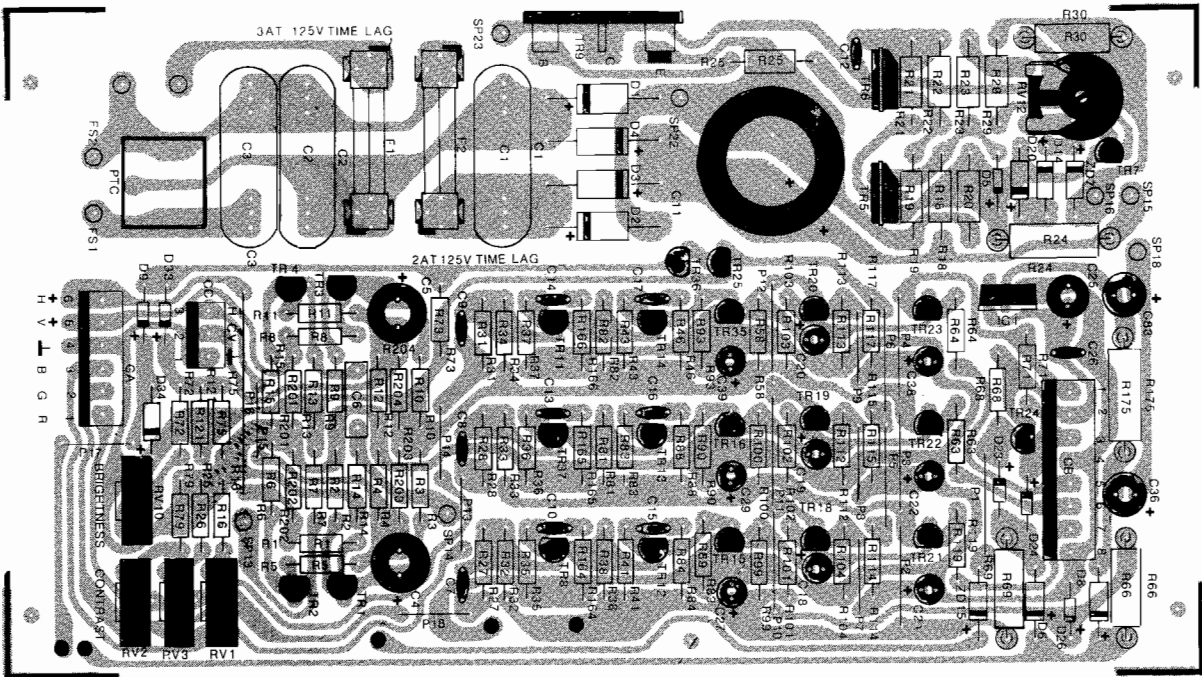
video drive (gain) controls—RV4 (blue), RV6 (green), RV8 (red)
CRT cutoff (black level) controls—RV5 (blue), RV7 (green), RV9 (red)

PRINTED CIRCUIT BOARDS

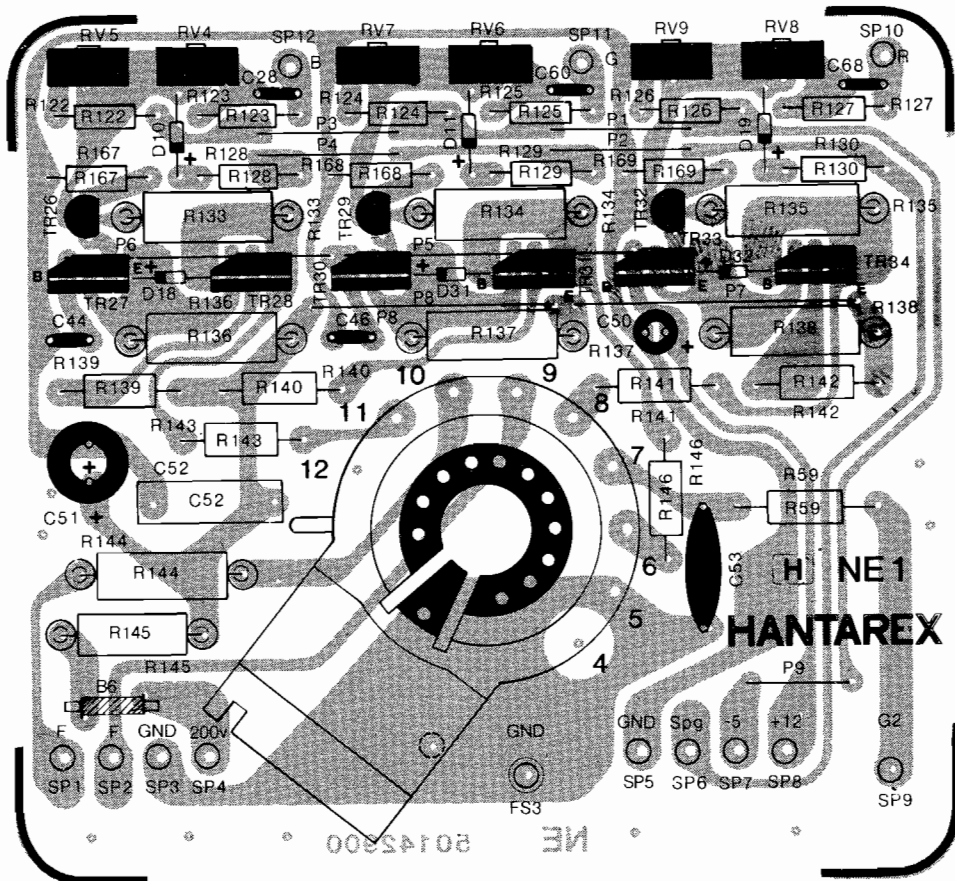
DEFLECTION BOARD DE



INTERFACE BOARD IE

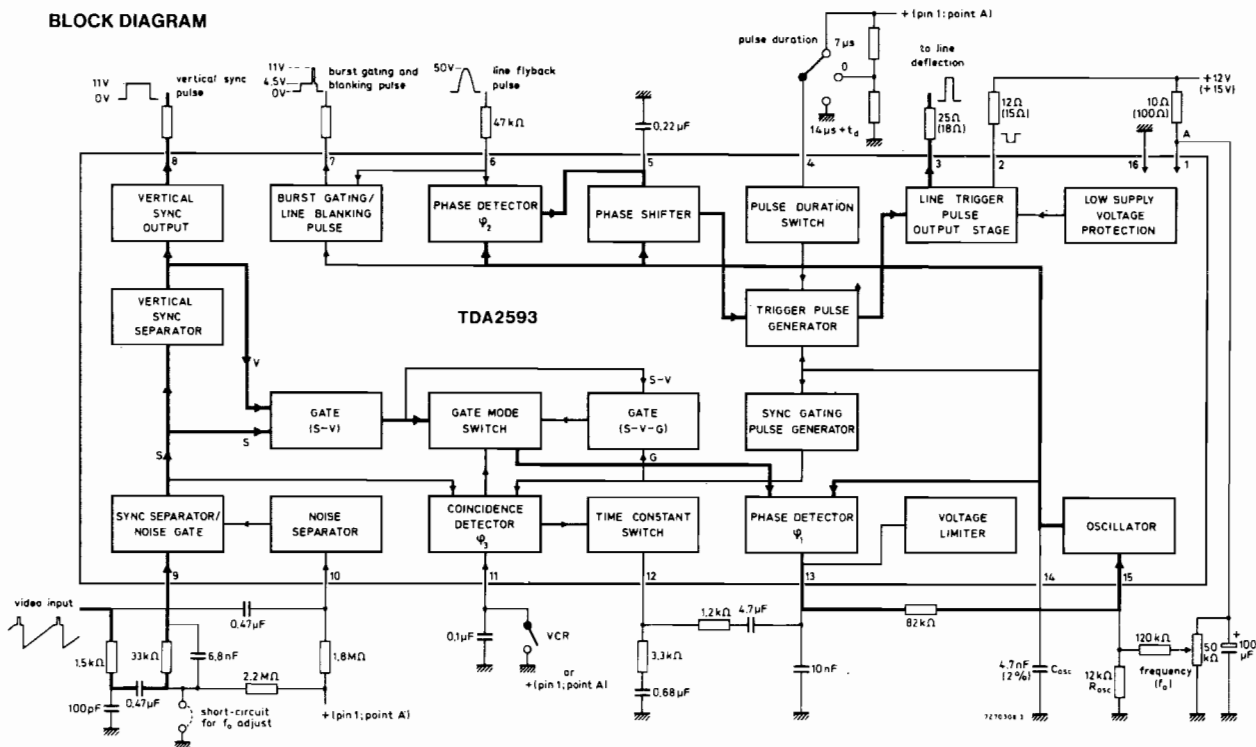


NECK BOARD NE



HORIZONTAL COMBINATION IC PHILIPS TDA 2593

BLOCK DIAGRAM



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage

at pin 1 (voltage source)	V_{1-16}	max.	13.2 V
at pin 2	V_{2-16}	max.	18 V

Voltages

Pin 4	V_{4-16}	max.	13.2 V
Pin 9	$\pm V_{9-16}$	max.	6 V
Pin 10	$\pm V_{10-16}$	max.	6 V
Pin 11	V_{11-16}	max.	13.2 V

Currents

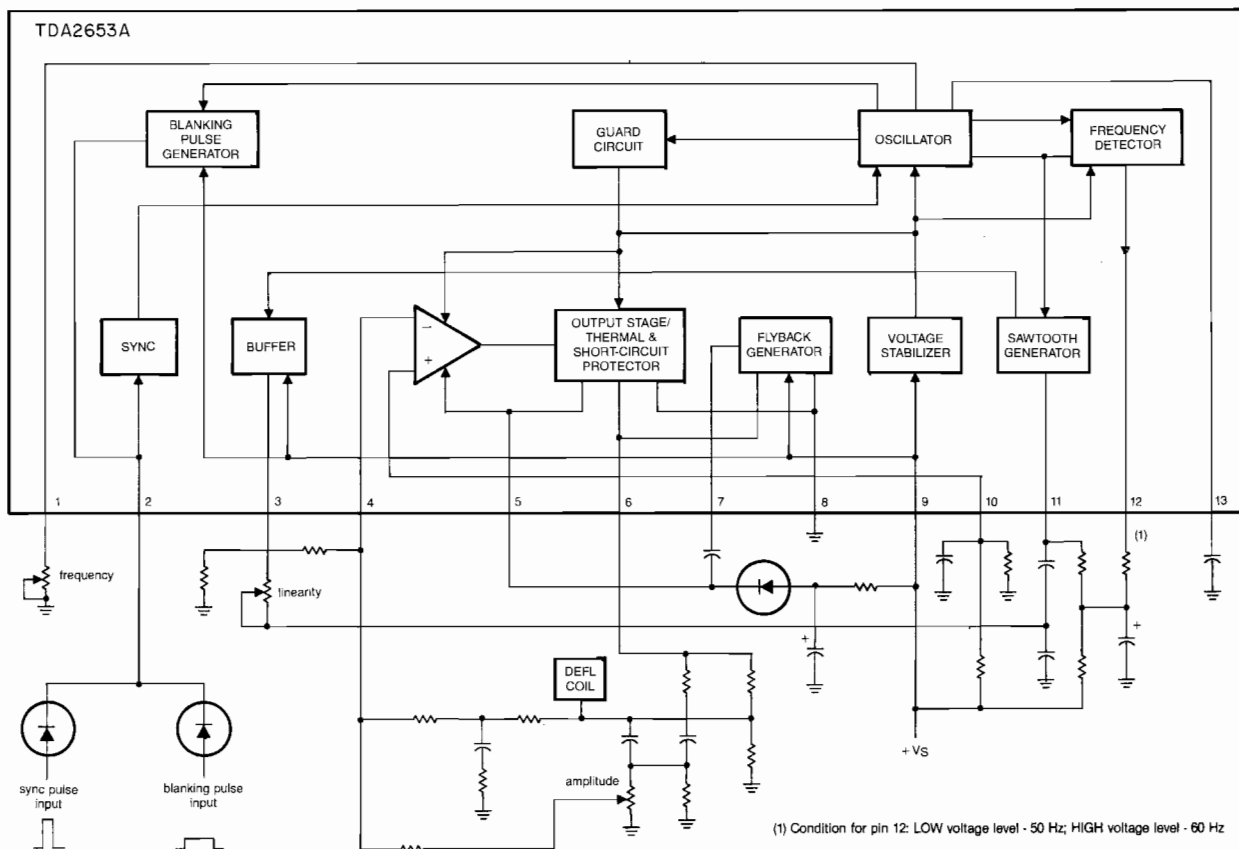
Pins 2 and 3 (peak value)	I_{2M-13M}	max.	400 mA
Pin 4	I_4	max.	1 mA
Pin 6	$\pm I_6$	max.	10 mA
Pin 7	$-I_7$	max.	10 mA
Pin 11	I_{11}	max.	2 mA
Total power dissipation	P_{tot}	max.	800 mW
Storage temperature	T_{stg}		-25 to +125 °C
Operating ambient temperature	T_{amb}		-20 to +70 °C

CHARACTERISTICS at $V_{1-16} = 12V$; $T_{amb} = 25\text{ °C}$

Sync separator

Input switching voltage	V_{9-16}	typ.	0.8 V
Input keying current	I_g		5 to 100 μA
Input leakage current at $V_{9-16} = 5V$	I_g	<	1 μA
Input switching current	I_g	\leq	5 μA
Switchoff current	I_g	<	100 μA
		typ.	150 μA
Input signal (peak-to-peak value)	V_{9-16} (p-p)		1 to 7 V

VERTICAL DEFLECTION CIRCUIT IC PHILIPS TDA 2653 A



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 9)	$V_{9-8} = V_S$	max.	40 V
Supply voltage output stage (pin 5)	V_{5-8}	max.	58 V

Voltages

Pin 3	V_{3-11}	max.	7 V
Pin 13	V_{13-8}	max.	7 V
Pins 4 and 10	$V_{4;10-8}$	max.	24 V
Pin 8	V_{6-8}	max.	58 V
	$-V_{6-8}$	max.	0 V
Pins 7 and 11	$V_{7; 11-8}$	max.	40 V

Currents

Pin 1	I_1	max.	0 mA
	$-I_1$	max.	1 mA
Pin 2	$\pm I_2$	max.	10 mA
Pin 3	I_3	max.	0 mA
	$-I_3$	max.	5 mA
Pin 7	I_7	max.	1.2 A
	$-I_7$	max.	1.5 A
Pin 11	I_{11}	max.	50 mA
	$-I_{11}$	max.	1 mA
Pin 12	I_{12}	max.	3 mA
	$-I_{12}$	max.	0 mA

Pins 5, 6 and 8: internally limited by the short-circuit protection circuit.

Total power dissipation: internally limited by the thermal protection circuit.

Storage temperature range T_{stg} -25 to + 150 °C

Operating ambient temperature range T_{amb} -20 °C to limiting value

MONITOR PARTS LIST

PART-ORDERING
PHONE NO.: (212) 423-2672
(Hantarex monitors only)

DE DEFLECTION code 62001590

CODE	DESCRIPTION	REF. NO.	QTY.
SEMICONDUCTORS			
20100010	diode BA 159	D 29-D30	2
20110100	zener diode 1.3 W 8ZY 97 C 12	D 16	1
20110300	zener diode 1.3 W ZY 100	D 21	1
20110500	zener diode 1.3 W ZPY 110	D 22	1
20150007	diode 1N 4007	D 12-D 15-D 17	3
20150170	diode BYV 95/C-600	D 25-D 27-D 28	3
20150200	diode BY 448	D 13	1
20420140	transistor FB 459	TR 10	1
20440000	thyristor C 106 C	SCR	1
20620190	integrated circuit TDA 2593	IC 2	1

CODE	DESCRIPTION	REF. NO.	QTY.
RESISTORS			
21215600	res. 1/4 W 5% 5.6 Ω	R 60	1
21231000	res. 1/4 W 5% 100 Ω	R 157	1
21232700	res. 1/4 W 5% 270 Ω	R 42	1
21241000	res. 1/4 W 5% 1K	R 80	1
21241200	res. 1/4 W 5% 1.2 K	R 52	1
21241500	res. 1/4 W 5% 1.5 K	R 85	1
21242200	res. 1/4 W 5% 2.2 K	R 91	1
21243300	res. 1/4 W 5% 3.3 K	R 50-R 55	2
21243900	res. 1/4 W 5% 3.9 K	R 158	1
21244700	res. 1/4 W 5% 4.7 K	R 205	1
21351000	res. 1/2 W 5% 10 K	R 172	1
21251200	res. 1/4 W 5% 12 K	R 40	1
21251202	metal film resistor 1/4 W 1% 12 K PH MR 25	R 47	1
21251800	res. 1/4 W 5% 18 K	R 150	1
21252200	res. 1/4 W 5% 22 K	R 173	1
21252700	res. 1/4 W 5% 27 K	R 148	1
21253300	res. 1/4 W 5% 33 K	R 76	1
21254700	res. 1/4 W 5% 47 K	R 53-R 160	2
21255600	res. 1/4 W 5% 56 K	R 155	1
21258200	res. 1/4 W 5% 82 K	R 156	1
21261000	res. 1/4 W 5% 100 K	R 48	1
21261200	res. 1/4 W 5% 120 K	R 147	1
21262200	res. 1/4 W 5% 220 K	R 39-R 54	2
21265600	res. 1/4 W 5% 560 K	R 159	1
21272200	res. 1/4 W 5% 2.2 M	R 94	1
21305000	res. 1/2 W 5% 0.5 Ω	R 116	1
21311201	metal film resistor 1/2 W 2% 1.2 Ω PHVR 37	R 78	1
21311500	res. 1/2 W 5% 1.5 Ω	R 87	1
21321000	res. 1/2 W 5% 10 Ω	R44-R 131	2
21321200	res. 1/2 W 5% 12 Ω	R 45	1
21332200	res. 1/2 W 5% 220 Ω	R 49-R 200	2
21333300	res. 1/2 W 5% 330 Ω	R 51-R 154	2
21338200	res. 1/2 W 5% 12 Ω	R 45	1
21332200	res. 1/2 W 5% 220 Ω	R 49-R 200	2
21333300	res. 1/2 W 5% 330 Ω	R 51-R 154	2
21338200	res. 1/2 W 5% 820 Ω	R 105	1
21342200	res. 1/2 W 5% 2.2 K	R 96	1
21351000	res. 1/2 W 5% 10 K	R 149	1
21352200	res. 1/2 W 5% 22 K	R 107	1
21362200	res. 1/2 W 5% 220 K	R 77-R 174	2
21402200	res. 1 W 10% 0.22 Ω VTM 200-0	R 106	1
21411000	res. 1 W 5% 1 Ω WK4	R 152	1
21416800	res. 1 W 5% 6.8 Ω	R 56	1
21422200	res. 1 W 5% 22 Ω	R 108	1
21461000	res. 1 W 5% 100 Ω	R 170	1
21641000	res. 3 W 5% 1 K	R 109	1
21651000	metal oxide res. 3 W 5% 10 K	R 94	1
23100000	trimmer PT 10 H 100 Ω	RV 16	1
23041000	vertical trimmer PT 15 NH 1 K	RV 23	1
23054703	vertical trimmer PT 15 NH 47 K	RV 13-RV 14	1
23061002	vertical trimmer PT 10 NH 100 K	RV 17	1
23062201	vertical trimmer PT 15 NH 220 K	RV 15	1

CODE	DESCRIPTION	REF. NO.	QTY.
CAPACITORS			
24314700	electrolytic capacitor EN 12.35 4.7 μF 16 V	C 40-C 65	2
24331000	electrolytic capacitor EN 12.35 100 μF 16 V	C 23-C 94-C 98	3
24342200	electrolytic capacitor EN 12.35 2200 μF 16 V	C 60	1
24421000	electrolytic capacitor EN 12.35 10 μF 25 V	C 55	1
24431000	electrolytic capacitor EN 12.35 100 μF 25 V	C 85	1
24541000	electrolytic capacitor EN 12.35 1000 μF 35 V	C 31-C 33	2
24612200	electrolytic capacitor EN 12.35 2.2 μF 63 V	C 32-C 66	2
24914700	electrolytic capacitor EN 12.35 4.7 μF 250 V	C 54	1
24924702	electrolytic capacitor EN 12.35 4.7 μF 250 V	C 72-C 97	2
25144701	polyester capacitor 4.7 nF 2.5% 63 V 142	C 35	1
25262200	polyester capacitor 220 nF 10% 100 V 1.60	C 41-C 61-C 86	3
25264700	polyester capacitor 470 nF 10% 100 V 1.60	C 48-C 57-C 99	3
25266800	polyester capacitor 680 nF 10% 100 V 1.60	C 42	1
25361001	polyester capacitor 1 μF 10% 160 V 1.60	C 43-C 45-C 47-C 49-C 200-C 201-C 121	6
25444700	polyester capacitor 4.7 nF 10% 250 V 1.60	C 118	1
25451000	polyester capacitor 10 nF 10% 250 V 1.60	C 24-C 37	2
25452200	polyester capacitor 22 nF 10% 250 V 1.60	C 63	1
25464710	polyester capacitor 470 nF 10% 250 V 1.76	C 69	1
25472200	polyester capacitor 2.2 μF 10% 250 V 1.60	C 64	1
25553300	polyester capacitor 33 nF 10% 630 V 1.60	C 75	1
25646800	polyester capacitor 6.8 nF 10% 630 V 1.60	C 58	1
25741000	polyester capacitor 1 nF 10% 1000 V 1.60	C 34	1
25941001	polyester capacitor 5.6 nF 10% 2000 V 1.73	C 59	1
25944700	polyester capacitor 4.7 nF 5% 1750 V 1.73	C 70-C 73	1
26310100	ceramic capacitor 100 pF 5% 50 V NPO	C 56	1
26322400	ceramic capacitor 220 pF 10% 1000 V	C 74-C 88-C 93	3
26422608	ceramic capacitor 2.2 nF -20 + 50 500 V	C 62	1
26610601	ceramic capacitor 0.1 μF -20 + 80 50 V	C 30-C 67-C 77	3

CODE	DESCRIPTION	REF. NO.	QTY.
INDUCTORS			
28010081	driver transformer	TH 2	1
28010250	transf. diode split HIT. 2433011	TH 3	1
28020200	choke 8 mH with ferrite core	B 3	1
28040020	horizontal linearity coil	B 4	1
28060330	horizontal width coil	B 5	1
29300010	Ferric beads 8 mm		24
MISCELLANEOUS PARTS			
34020000	terminal PE 1120/D	TP 7-TP 8-TP 16	3
34020090	socket for integrated circuit 16 pin		1
50142930	printed circuit deflection	DE	1

IE INTERFACE code 62001500

CODE	DESCRIPTION	REF. NO.	QTY.
SEMICONDUCTORS			
20100000	diode 1N4148	D 5-9-23	
20100010	diode BA 159	D 24-26-33	6
20110100	zener diode 1.3 W BZY 97 C 12	D 6-8-34	3
20110200	zener diode 1.3 W ZY 7.5	D 15	1
20150007	diode 1N 4007	ZD 7	1
20150130	diode BY 255	D 14-D 20	2
20400403	transistor BC 557 B	D 1-D 2-D 3-D 4	4
20420500	transistor BF 871	TR 6-TR 10-TR 18-TR 19-TR 20-TR 21-TR 22-TR 23-TR 24-TR 25-TR 26	17
20420510	transistor BF 872	TR 6	1
20620071	integrated circuit MA 7905	TR 5	1
21000038	dual PTC thermistor 2322.552.98013 110V	IC 1	1
		PTC	1

CODE	DESCRIPTION	REF. NO.	QTY.
RESISTORS			
21215600	res. 1/4 W 5% 5.6 Ω	R 114-R 115-R 117	3
21221500	res. 1/4 W 5% 15 Ω	R 164-165-166	3
21222200	res. 1/4 W 5% 22 Ω	R 63-R 64-R 19	3
21231000	res. 1/4 W 5% 100 Ω	R 16-R 26-R 79	3
21231200	res. 1/4 W 5% 120 Ω	R 35-R 36-R 37	3
21232700	res. 1/4 W 5% 270 Ω	R 104-R 112-R 113	3
21233900	res. 1/4 W 5% 390 Ω	R 2-R 9-R 15	3
21234700	res. 1/4 W 5% 470 Ω	R 38-R 81-R 82	3
21241000	res. 1/4 W 5% 1 K	R 41-R 43-R 46-R 58-R 68-R 71-R 83-R 84-R 88-R 89-R 90-R 93-R 99-R 100	14
21241200	res. 1/4 W 5% 1.2 K	R 75	1
21241800	res. 1/4 W 5% 1.8 K	R 6	1
21242200	res. 1/4 W 5% 2.2 K	R 1-R 5-R 7-R 8-R 11-R 13	6
21242700	res. 1/4 W 5% 2.7 K	R 27-R 28-R 29	3
21244700	res. 1/4 W 5% 4.7 K	R 3-R 10-R 72-R 121	4
21251000	res. 1/4 W 5% 10 K	R 4-R 12-R 14-R 201-R 202	5
21252200	res. 1/4 W 5% 22 K	R 101-R 102-R 103-R 203-R 204	5
21254700	res. 1/4 W 5% 47 K	R 32-R 33-R 34-R 73	4
21324700	res. 1/2 W 5% 47 Ω	R 25	1
21328200	res. 1/2 W 5% 82 Ω	R 19	1
21341000	res. 1/2 W 5% 1 K	R 21-R 29	2
21342200	res. 1/2 W 5% 2.2 K	R 22	1
21343300	res. 1/2 W 5% 3.3 K	R 23	1
21355600	res. 1/2 W 5% 56 K	R 18	1
21361200	res. 1/2 W 5% 120 K	R 20	1
21407500	res. 1 W 5% 0.75 Ω	R 30	1
21444700	res. 1 W 5% 4.7 K	R 69	1
21451000	res. 1 W 5% 10 K	R 66	1
21535600	metal oxide res. 2 W 5% 560 Ω	R 175	1
21652200	res. 3 W 5% 22 K RESISTA WK B	R 24	1
23041000	vertical trimmer PT 15 NH 1 K	RV 1/2/3	3
23042203	horizontal trimmer PT 15 V 2.2 K	RV 12	1
23051004	vertical trimmer PT 15 NH 10 K	RV 10	1

CODE	DESCRIPTION	REF. NO.	QTY.
CAPACITORS			
24314700	electrolytic capacitor EN 12.35 4.7 μF 16 V	C 18-C 19-C 20	3
24321000	electrolytic capacitor EN 12.35 10 μF 16 V	C 21-C 22-C 28-C 29-C 38-C 39	6
24324700	electrolytic capacitor EN 12.35 4.7 μF 16 V	C 25	1
24332200	electrolytic capacitor EN 12.35 220 μF 16 V	C 4-C 5	2
24424700	electrolytic capacitor EN 12.35 4.7 μF 25 V	C B3	1
24522200	electrolytic capacitor EN 12.35 22 μF 35 V	C 36	1
24933302	electrolytic capacitor 330 μF 200 V	C 11	1
25651000	polyester capacitor 10 nF 10% 630 V 1.60 P 10	C 6	1
25751003	polyester capacitor 10 nF U.L. listed [across-the-line capacitor]	C 3	1
25754703	polyester capacitor 47 nF U.L. listed [across-the-line capacitor]	C 1	1
25761003	polyester capacitor 100 nF U.L. listed [across-the-line capacitor]	C 2	1
26222100	ceramic capacitor 22 pF 5% 50 V NPO	C 15-C 16-C 17	3
26210100	ceramic capacitor 100 pF 5% 50V NPO	C 7-C 8-C 10-C 13-C 14	6
26410803	ceramic capacitor 1 nF 10% 50 V	C 12	1
26510501	ceramic capacitor 10 nF -20 + 80 50 V	C 26	1
FUSES			
29100080	fuse holder for printed circuit		4
29100200	fuse 2A SB 250V	F 2	1
29100212	fuse 3A SB 250V	F 1	1

MISCELLANEOUS PARTS

29300010	ferric beads 8 mm.		10
34020004	fast-on terminal	FS 1-FS 2	2
34023358	AMP connector 8 D 280612/1	CB	1
34025103	MOLEX connector 3190-03	CC	1
34025106	MOLEX connector 3190-06	CA	1
50142910	printed circuit interface	IE	1

**NE C.R.T. BASE
code 62001580**

CODE	DESCRIPTION	REF. NO.	QTY.
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SEMICONDUCTORS

20100000	diode 1N4148	D 10-D 11-D 18-D 19-D 31-	
		D 32	6
20400422	transistor BC 547 B	TR 26-TR 29-TR 32	3
20420500	transistor BF 871	TR27-TR 28-TR 30-TR 31-TR 33-TR 34	6

RESISTORS

21231000	res. 1/4 W 5% 100 Ω	R 128-R 129-R 130	3
21236800	res. 1/4 W 5% 680 Ω	R 122-R 124-R 126	3
21238200	res. 1/4 W 5% 820 Ω	R 123-R 125-R 127	3
21324700	res. 1/4 W 5% 47 Ω	R 167-R 168-R 169	3
21335600	res. 1/2 W 5% 560 Ω	R 139-R 140-R 142	3
21342200	res. 1/2 W 5% 2.2 K	R 59	1
21343300	res. 1/2 W 5% 3.3 K	R 141-R 143-R 146	3
21424700	res. 1 W 5% 47 Ω	R 145	1
21512700	res. 2 W 5% 2.7 Ω Resista WK 5	R 144	1
21551800	res. 2 W 5% 18 K	R 136-R 137-R 138	3
21552200	metal oxide res. 2 W 5% 33 K	R 133-R 134-R 135	3
23034703	vertical trimmer PT 10 H 470 μ	R 4-RV 5-RV 6-RV 7-RV 8-RV 9	6

CAPACITORS

24321000	electrolytic capacitor EN 12.35 10 μF 16 V	C 50	1
24914700	electrolytic capacitor EN 12.35 4.7 μF 250 V	C 51	1
25461000	polyester capacitor 100 nF 10% 250 V 1.60	C 52	1
26222100	ceramic capacitor 22 pF 5% 50 V NPO	C 28-C 60-C 68	3
26468720	ceramic capacitor 6800 pF 20% 2000 V 507.6	C 53	1
26510601	ceramic capacitor 10 nF -20 + 80 50 V	C 44-C 46	2

MISCELLANEOUS PARTS

28020130	choke 10 mH with ferrite core	B 6	1
29300010	Ferric beads 8 mm		16
34020004	terminal AMP Fast-on M. 735084/2	FS3	1
50142940	socket printed circuit	NE	1

**VERTICAL ALUMINUM HEAT SINK ASSEMBLY
code 62001390**

CODE	DESCRIPTION	REF. NO.	QTY.
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20620080	integrated circuit MA 7812	IC 4	1
20620270	integrated circuit TDA 2653 A	IC 3	1
40029065	self-tapping screw 2.9x6.5 TCC		1
5011 1530	aluminum heat sink		1

**POWER UNIT HEAT SINK ASSEMBLY
code 62001510**

CODE	DESCRIPTION	REF. NO.	QTY.
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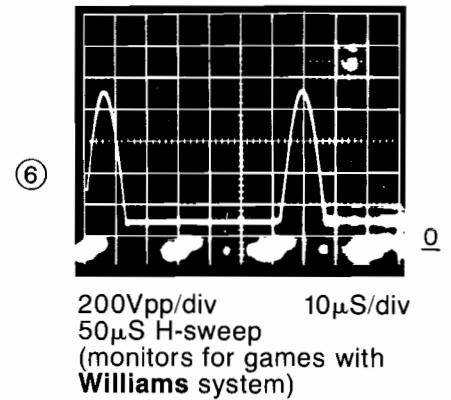
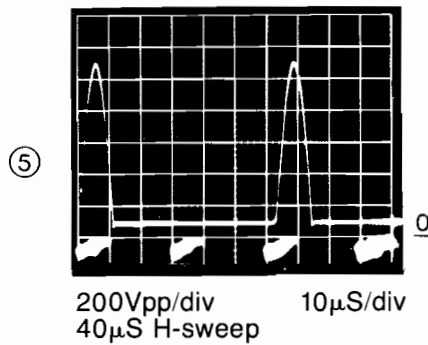
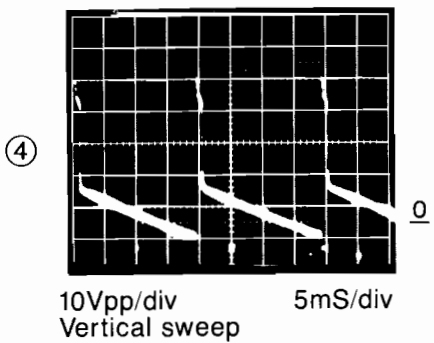
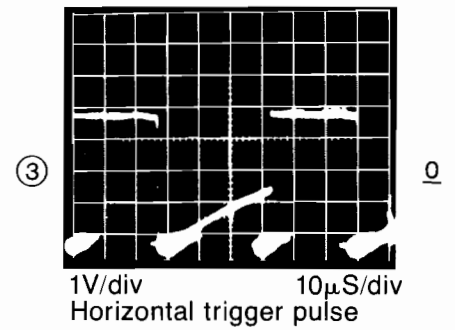
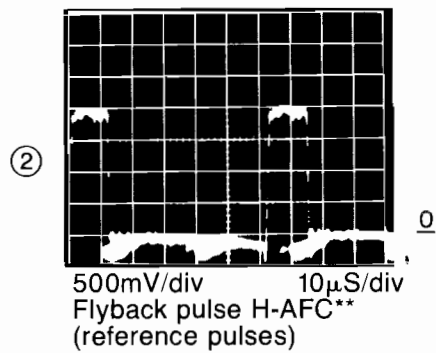
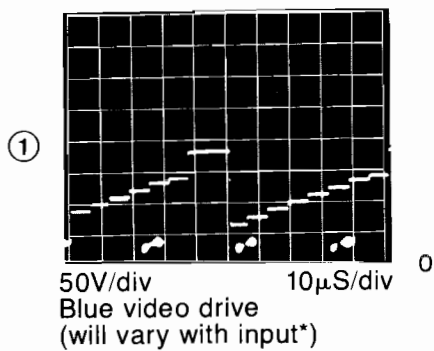
20430430	transistor HAN 20430430	TR 9	1
34020210	socket for transistor TO3		1
40029010	self-tapping screw 2.1x10 TCC		1
40029014	self-tapping screw	2.9x14 TCC	2
501 10540	wirewound resistor 30 W 10% 220 Ω	R 17	1
501 1 1040	heat sink 205 MO 32		1
50420120	mica insulator for TO3/500 V		1

**ALUMINUM HEAT SINK ASSEMBLY
code 62000613**

CODE	DESCRIPTION	REF. NO.	QTY.
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20430200	transistor BU 208 A	TR 17	1
22621000	wirewound resistor 15 W 10% 10 Ω	R 98	1
34020211	socket for transistor TO3	-	1
40029010	self-tapping screw 2.9x10 TCC	-	1
40029014	self-tapping screw 2.9x14 TCC	-	2
42000070	washer 3.2x6	-	2
50110550	heat sink	-	1
50420180	mica insulator for TO3/2000 V	-	1

WAVEFORMS

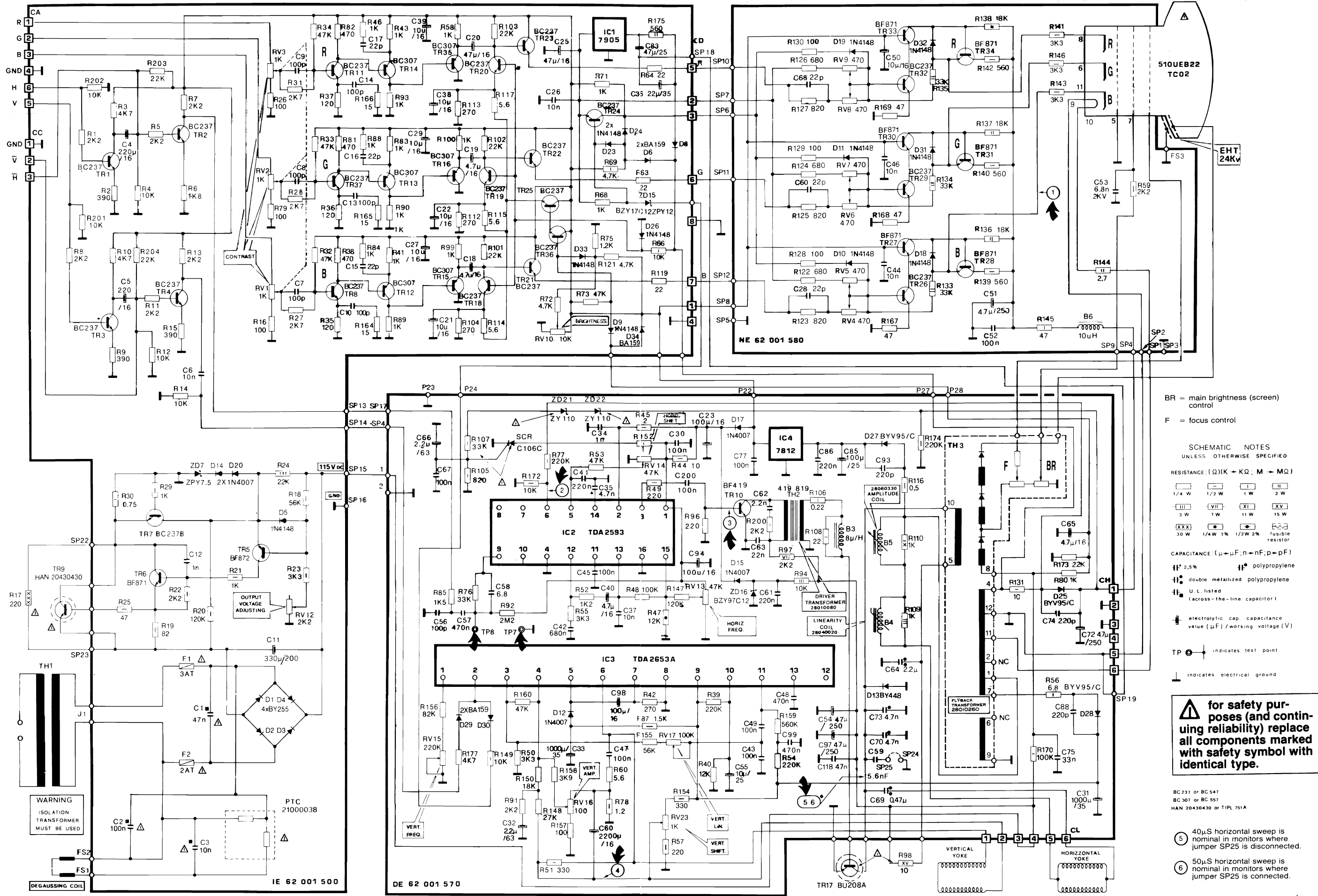


*shown: 7-step gray bars

**H = horizontal

AFC = automatic frequency control

SCHEMATIC DIAGRAM



TYPICAL DC VOLTAGES WITH INPUT SIGNAL

TRANSISTOR	VOLTS +VDC		
	COLLECTOR	BASE	EMITTER
TR1	12	0	0
TR2	8.1	3.8	3.1
TR3	12	0	0
TR4	1.8	2.5	1.8
TR5	55.2	8.2	8.8
TR6	0.3	55.7	56
TR7	8.8	0	0.5
TR8	11	0.8	0.2
TR9	0.3	56.8	57
TR10	75	1	0
TR11	11.2	0.8	0.2
TR12	0.2	11.3	11.9
TR13	0.2	11.3	11.8
TR14	0.24	11.2	11.8
TR15	0	0.2	0.9
TR16	0	0.2	0.9
TR17	110	0.2	0
TR18	1.6	0.15	1.5
TR19	1.6	0.15	1.5
TR20	1.6	0.15	1.5
TR21	12	1.6	1
TR22	12	1.6	1
TR23	12	1.6	1
TR24	8	4.9	5.1
TR25	12	2.2	1.6
TR26	11.5	0.2	0.03
TR27	198	12	11.5
TR28	210	198	197.9
TR29	11.5	0.2	0.05
TR30	194	12	11.5
TR31	210	194	193.9
TR32	11.5	0.20	0.05
TR33	193	12	11.5
TR34	210	192.6	192.3
TR35	0	0.2	0.9
TR36	12	2.7	2.2
TR37	11	.8	0.2

Williams[®] 
ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
(312) 267-2240, Telex 253095