

HP 13220

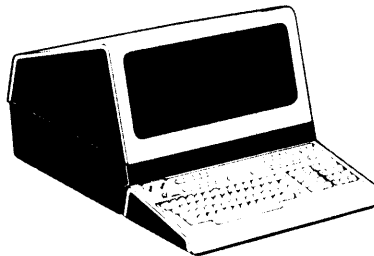
SWEEP MODULE

Manual Part No. 13220-91002

REVISED

NOV-06-78

# *DATA TERMINAL* TECHNICAL INFORMATION



HEWLETT  PACKARD

HP 13220

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NOTE: This document is part of the 262XX DATA TERMINAL product series Technical Information Package (HP 13220).

1.0 INTRODUCTION.

The Sweep Module interfaces the low level logic signals from the Processor PCA to the CRT. It generates all drive signals and specialized voltages required by the CRT display.

2.0 OPERATING PARAMETERS.

A summary of operating parameters for the Sweep Module is contained in tables 1.0 through 4.0

Table 1.0 Physical Parameters

Part Number	Nomenclature	Size (L x W x D) +/-0.100 Inches	Weight (Pounds)
02620-60002	Sweep PCA	11.5 x 6.8 x 2	1

Table 2.0 Reliability and Environmental Information

<p>Environmental:        ( X ) HP Class B        (   ) Other:</p> <p>Restrictions: Type tested at product level</p> <p>Failure Rate:    1.83    (percent per 1000 hours)</p>
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Table 3.0 Power Supply Requirements - Measured  
(At +/-5% Unless Otherwise Specified)

+16 Volt Supply	+12 Volt Supply	+5 Volt Supply	-12 Volt Supply
@ mA	1.5 Amp	@ 100 mA	
N/A			N/A
115 volts ac		220 volts ac	
@ A		@ A	
N/A		N/A	

Table 4.0 Connector Information

Connector and Pin No.	Signal Name	Signal Description
P1, Pin 1	+5V	+5 Volt Power Supply )
-2		Not Used ) From
-3	+12V	+12 Volt Power Supply ) Power
-4	GND	Ground Common Return ) Supply
-5	SYNC	Syncs Power Supply to Sweep rate ) Assembly
P2, Pin 1	HLF BRT	Negative True, Half Bright Video )
-2		Not Used )
-3	RETURN	Return for half bright )
-4	Full BRT	Normal Video ) From Processor
-5	RETURN	Return for Video ) PCA
-6	RETURN	Return for Drive signals )
-7	VER DR	Negative True Vertical Drive )
-8	HOR DR	Horizontal Drive )
P3, Pin 1	CRT G2	Screen Grid )
-2		Not Used )
-3	CRT G4	Focus Grid ) To
-5	AQUADAG GND	) CRT
-6	CRT G1	Control Grid ) Cable
-7	CRT FILAMENT	) Assembly
-8	CRT FILAMENT	)
-9	CRT CATHODE	)
P4, Pin 1	HOR YOKE	)
-2		Not Used ) To
-3	VERTICAL YOKE	) Yoke
-4	HOR YOKE	) Cable
-6	VERTICAL YOKE	)

- 3.0 FUNCTIONAL DESCRIPTION. Refer to the block diagram (figure 1), schematic diagram (figure 2), timing diagram (figure 3), the component location diagram (figure 4), and parts list (02620-60002) located in the appendix.

The Sweep module consists of video, vertical and horizontal drive circuits. The Sweep module generates all of its special voltages within the horizontal section, and requires only +12 volts and +5 volts as input power.

3.1 VIDEO DRIVE.

- 3.1.1 The function of the video drive circuit is to interface the low level logic input signals from the processor PCA to the higher levels required to drive the CRT. The video circuitry must be very fast, and features rise and fall times of typically less than 10 nanoseconds.

- 3.1.2 Switching transistors Q4 and Q5 are open-collector buffers, while transistor Q6 acts as an active pull-up to +30 volts. Transistor Q4 with diodes CR13 and CR15 sets the half-bright level (+6 volts on the CRT cathode), while Q5 sets the full-bright level (0 volts on the CRT cathode). Blanked raster is obtained when both Q4 and Q5 are turned off, allowing Q6 to bias the CRT cathode at +30 volts. Neon bulb DS2 protects the video section during a CRT flashover.

3.2 VERTICAL DRIVE.

- 3.2.1 The vertical drive circuit generates the vertical scanning waveform which causes the electron beam in the CRT to be moved from the top to the bottom of the screen. Its input is a TTL vertical drive signal which goes low during vertical retrace.

- 3.2.2 Operational amplifier U3 is a Norton (current differencing) input op-amp. The vertical ramp is generated by U3-A. The ramp starts at 0 volts and integrates positive at a rate determined by U3-B and R1 (the height control). Reset occurs when the output of U2 goes high allowing the current through R6 to reset the integrator.

- 3.2.2.1 U3-B is another integrator which samples the vertical ramp and integrates it into a parabola which is used to slow the deflection down at the extremes of the ramp to correct for non-linearity due to the flatness of the CRT screen.

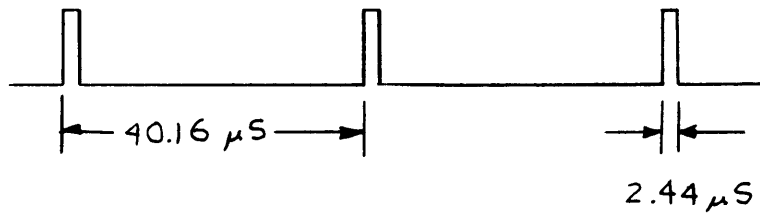
- 3.2.2.2 The output amplifier converts the voltage ramp from the integrators to a current which is applied to the deflection yoke. U3-C samples the current through the yoke (taken as a voltage across R23) and compares it to the ramp voltage. The yoke is AC coupled through C12 and C22. The DC operating point of the amplifier is stabilized by R21 and R22. Q1, C11, and CR14 form a boost circuit which raises the power supply voltage on the amplifier to 22 volts during vertical retrace.
- 3.3 HORIZONTAL DRIVE.
- 3.3.1 The Horizontal drive circuit generates the horizontal scan which sweeps the beam from left to right on the face of the CRT, and also the special voltages including the anode voltage (+12 KV) of the CRT.
- 3.3.2 The TTL Horizontal Drive signal is applied to one shot U1 which allows an adjustable delay that is used to center the raster by delaying horizontal reset with respect to video blanking.
- 3.3.2.1 The delayed Horizontal Drive signal is applied to transistor Q7 which drives the horizontal output transistor Q8 through T1. T1 is a regenerative transformer which samples the collector current of Q8 and adjusts its base current to "force" a beta of five. Q7 stops this action during horizontal retrace by overcoming the feedback action of T1 and keeping Q8 turned off with current supplied by R14 and C6.
- 3.3.2.2 The components associated with Q8 and the flyback transformer primary form a "ringing" horizontal sweep circuit. The flyback primary is connected so that +40 volts is generated and appears as a virtual input voltage due to the diode connected in series with the +12 volt actual input. The damper diode CR8 is two turns away from Q8 on the flyback transformer to improve linearity. C26 corrects non linearity due to the flatness of the CRT faceplate by slowing down the beam deflection at the sides.
- 3.3.2.3 In addition to +40 volts, the flyback supplies -40 volts, +800 volts, and +12 KV for CRT biasing. The +12 KV output is rectified inside the transformer, but the other supplies are rectified and filtered externally.

HLF BRT  
P2, PIN 1

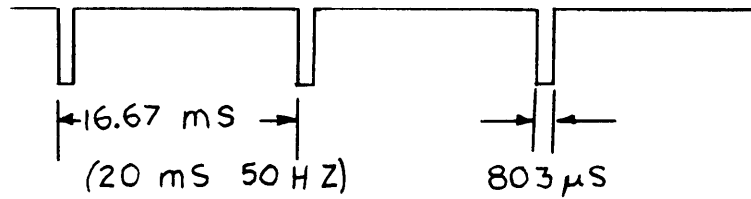
FULL BRT  
P2, PIN 4

TIMING DEPENDS ON VIDEO

HOR DR  
P2, PIN 8



VER DR  
P2, PIN 7



ALL TTL LEVELS

Figure 1  
Sweep Module Block Diagram  
NOV-06-78 13220-91002



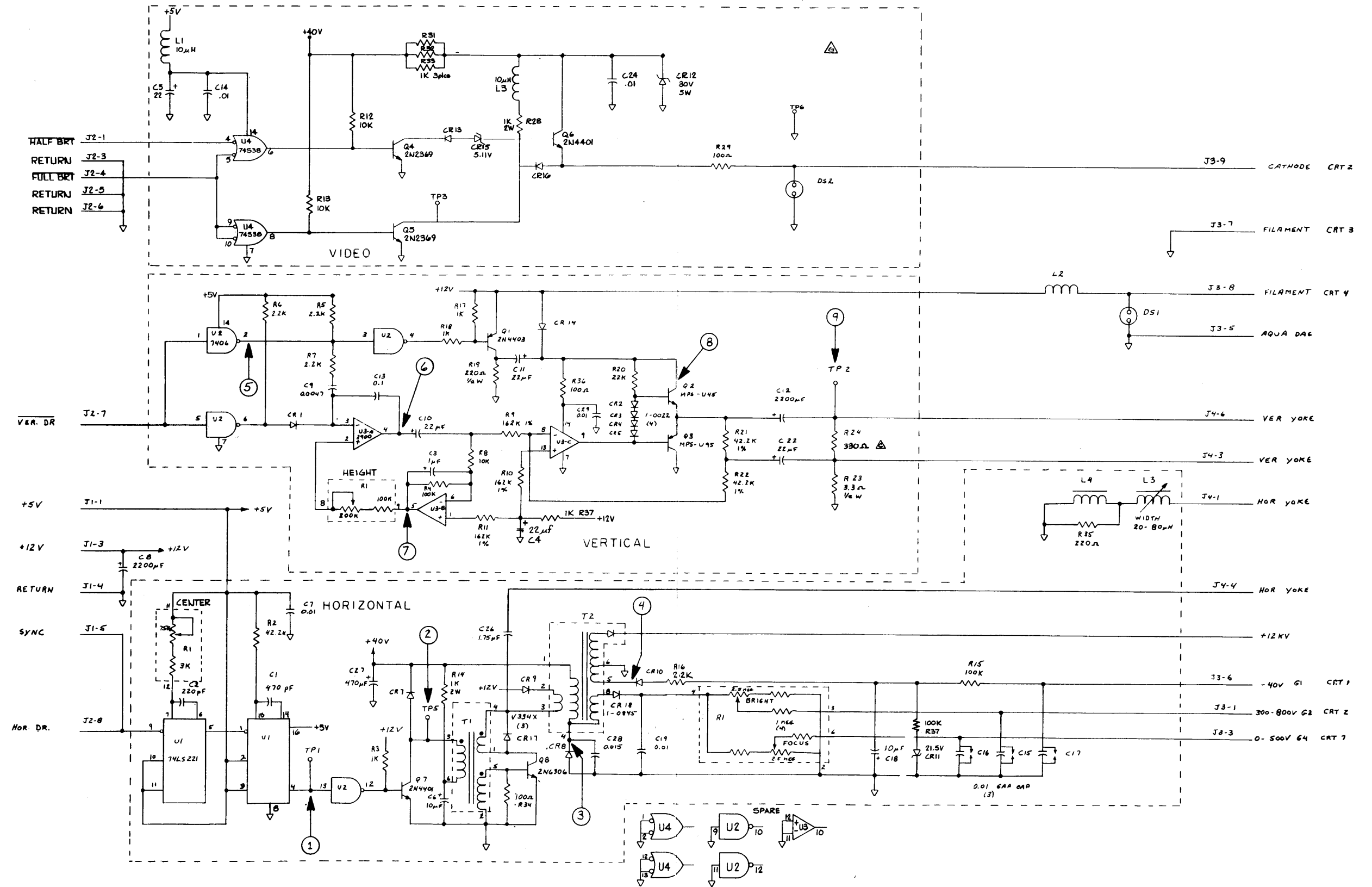


Figure 2  
Sweep PCA Schematic Diagram  
NOV-06-78 13220-91002

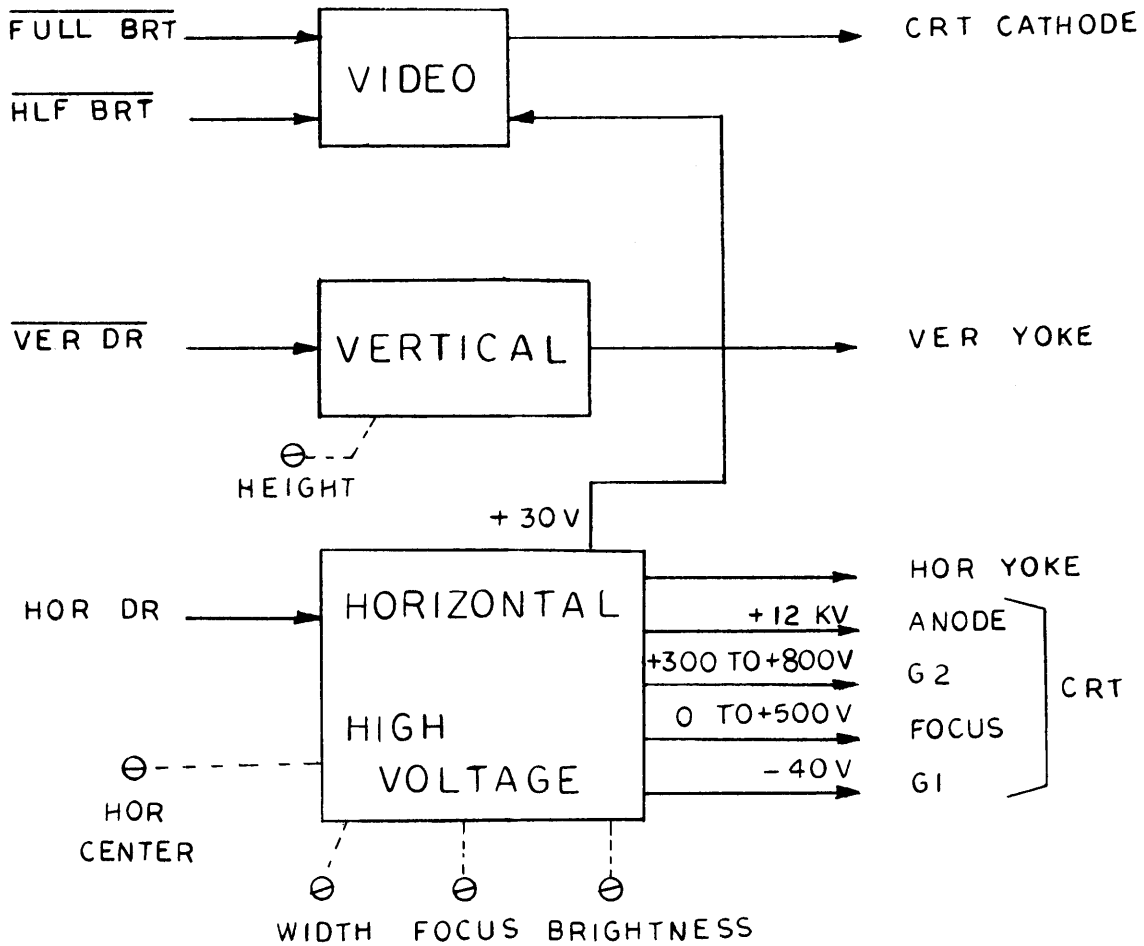


Figure 3  
 Sweep PCA Timing Diagram  
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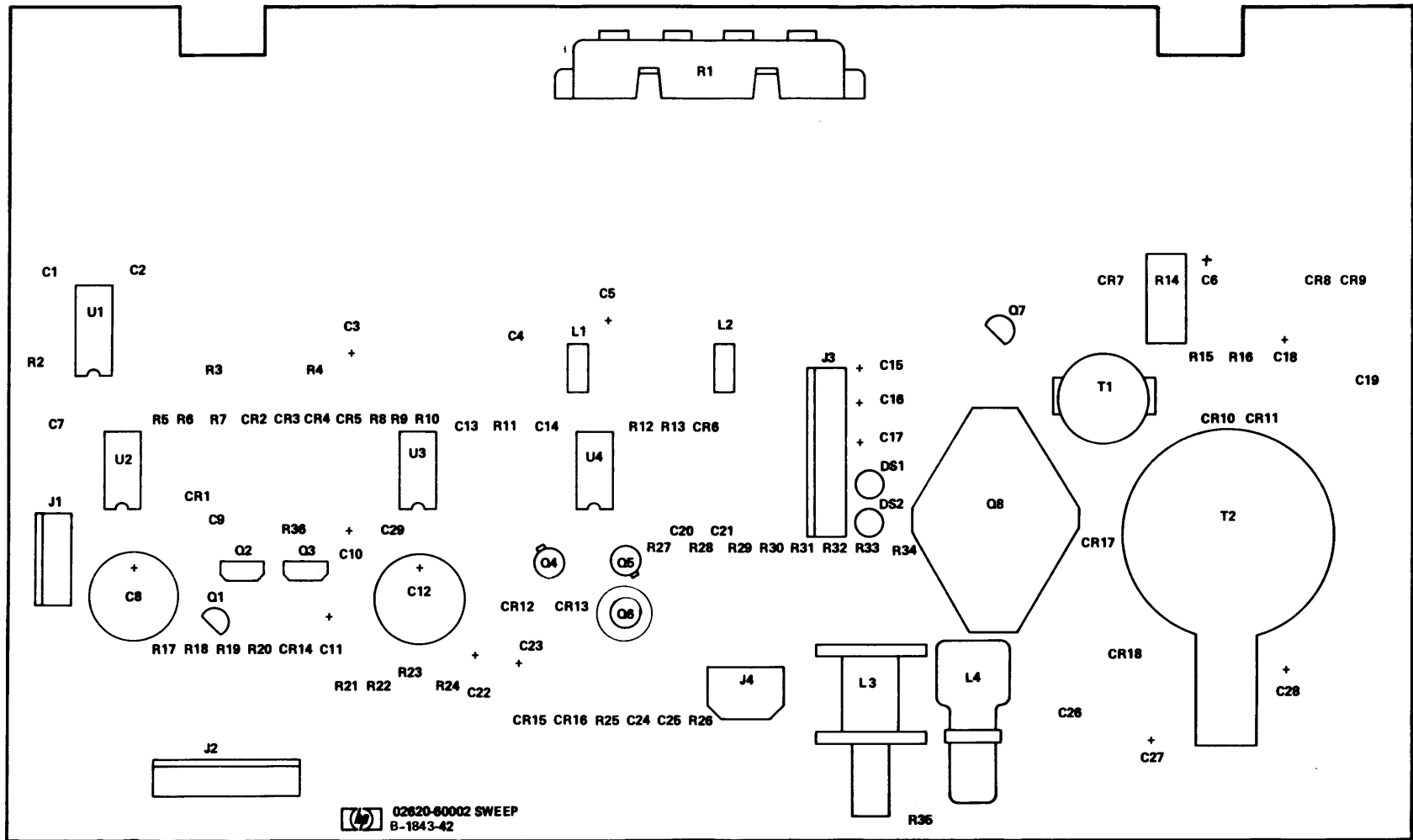


Figure 4  
Sweep PCA Component Location Diagram  
NOV-06-78  
13220-91002

DATE CODE: B-1843-42

C2	CAP 220PF 5%	0160-0134	1
C9	CAP .0047UF 200V	0160-0157	1
C13	CAP .1UF 200V	0160-0168	1
C20,21	CAP 47PF 300V	0160-2307	2
C19	CAP .01 UF 1KV	0160-2902	1
C1	CAP 470PF 5%	0160-3533	1
C15-17	CAP .01UF 20%	0160-4230	3
C4,7,14,23,24,25,29	CAP.01UF 20%	0160-4554	7
C26	CAP 1.75 UF 5%	0160-4706	1
C28	CAP .015 UF 5%	0160-4740	1
C3	CAP 1UF 10%	0180-0291	1
C5,10,11,22	CAP 22 UF 25V	0180-2879	4
C8,12	CAP 2200 UF 16V	0180-2880	2
C6,18	CAP 10 UF 50V	0180-2881	2
C27	CAP 470 UF 50V	0180-2913	1
TP1-6	STUD SOLDER TERM	0360-0124	6
	TERMINAL	0360-1913	2
	SCR-TPG 4-20	0624-0324	2
	RES 100 5% .25	0683-1015	4

PART NO CONT	0683-1015	
R25,29,34,36		
RES 1K 5% .25	0683-1025	3
R3, 17,18		
RES 10K 5% .25	0683-1035	1
R8		
RES 100K 5% .25	0683-1045	3
R4,15,37		
RES 220 5% .25	0683-2215	3
R12,13,35		
RES 2200 5% .25	0683-2225	5
R5,6,7,33,16		
RES 22K 5% .25	0683-2235	1
R20		
RES 330 5% .25	0683-3315	1
R24		
RES 470 5% .25	0683-4715	3
R26,28,32		
RES 3.3 OHM 5%	0686-0335	1
R23		
RES 220 5% .5W	0686-2215	1
R19		
RES 470 5% .5	0686-4715	1
R31		
RES 4.7K 5% .5W	0686-4725	2
R27,30		
RES 42.2K 1%	0698-3450	3
R2,21,22		
RES 162K 1%	0757-0470	3
R9-11		
RES 1K 5% 2W MO	0764-0016	1
R14		
HEAT SINK TO-18	1205-0037	1
HEAT SINK TO-3	1205-0289	1
CONN 4 CKT	1251-5502	1
J4		

J1	CONN POST 4M CKT	1251-5519	1
J2	CONN POST 7M CKT	1251-5520	1
J3	CONN POST 8M CKT	1251-5522	1
	FSTNR-SNP-IN	1390-0104	2
	FSTNR SNP IN	1390-0281	2
	CA TIE 3.6L	1400-0249	1
U2	IC SN7406N	1820-0471	1
U1	IC SN74LS221N	1820-1437	1
U4	IC SN74S38N	1820-1451	1
U3	IC OP AMP	1826-0120	1
Q6	XSTR PNP SI	1853-0034	1
Q1	XSTR 2N4403 TO92	1853-0271	1
Q3	XSTR MPSU95	1853-0449	1
Q4,5	XSTR 2N2369 TO18	1854-0019	2
Q7	XSTR 2N4401 TO92	1854-0467	1
Q8	XSTR 2N6306 TO3	1854-0623	1
Q2	XSTR MPSU45	1854-0798	1
CR2-5	DIO STABISTOR	1901-0022	4
CR1,6,7,10,12,13,14, CR16	DIODE-SILICON	1901-0050	8

CR18	DIO FAST REC 2KV	1901-0845	1
CR8,9,17	POWER-RECTIFIER	1901-0848	3
CR11,15	DIO-ZNR 21.5V 5%	1902-3245	2
R1	RES TRIMMER	2100-3730	1
DS1,2	LAMP G10 5AB-A	2140-0013	2
	NUT-HEX	2260-0009	2
	SCR #6-32X.375L	2360-0117	2
T2	TRANS FLYBACK	9100-4071	1
T1	TRANS HOR	9100-4075	1
L1,2	COIL-FXD 10UH	9140-0114	2
L3	COIL	9140-0306	1
L4	COIL	9140-0319	1
	TRIMMER COVER	02620-40003	1
	ETCHED BOARD	02620-80002	1