

hp 526A

Video Amp. Unit

526A

Hewlett-Packard




HEWLETT-PACKARD COMPANY / OPERATING AND SERVICE MANUAL

# 526A

## VIDEO AMPLIFIER UNIT

CERTIFICATION

THE HEWLETT-PACKARD COMPANY CERTIFIES THAT THIS INSTRUMENT WAS THOROUGHLY TESTED AND INSPECTED AND FOUND TO MEET ITS PUBLISHED SPECIFICATIONS WHEN IT WAS SHIPPED FROM THE FACTORY.

 FURTHER CERTIFIES THAT ITS CALIBRATION MEASUREMENTS ARE TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS TO THE EXTENT ALLOWED BY THE BUREAU'S CALIBRATION FACILITY.

# hp MANUAL CHANGES

MODEL 526A

VIDIO AMPLIFIER UNIT

Manual Serial Prefixed: 033-  
Manual Printed: 7/61

To adapt this manual to instruments with other serial prefixes check for errata below, and make changes shown in tables.

Instrument Serial Prefix	Make Manual Changes	Instrument Serial Prefix	Make Manual Changes
001-	None		
459-	1		
138 to 01587	1, 2		
4 to 137	1, 2, 3		

CHANGE 1      R28: Change to 100,000 ohms; Ⓟ Stock No. 23-100K.

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CHANGE 2      R21: Change to 1,000 ohms; Ⓟ Stock No. 24-1000.  
 C23: Change to 82 pf; Ⓟ Stock No. 14-19.  
 R22: Change to 2,700 ohms; Ⓟ Stock No. 23-2700.  
 R23: Add 1,500 ohms potentiometer; Ⓟ Stock No. 210-33, in parallel with  
 R22 and connect J3 to R23 rotor instead of to V5 pin 7.  
 R27: Change to 180 ohms; Ⓟ Stock No. 23-180.

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CHANGE 3      R32: Delete and replace with wire jumper.  
 C11: Change to .01  $\mu$ f; Ⓟ Stock No. 15-43.  
 C33B: Delete.  
 C33A: Change to 2,000 pf.

# MANUAL CHANGES

MODEL 526A

VIDEO AMPLIFIER UNIT

Manual Serial Prefixed: 033-  
Manual Printed: 7/61

To adapt this manual to instruments with other serial prefixes check for errata below, and make changes shown in tables.

Instrument Serial Prefix	Make Manual Changes	Instrument Serial Number	Make Manual Changes
033-	ERRATA	033-02939	1

ERRATA: Section III, Figure 3,  
Change to show black lead from R18 going to ground.

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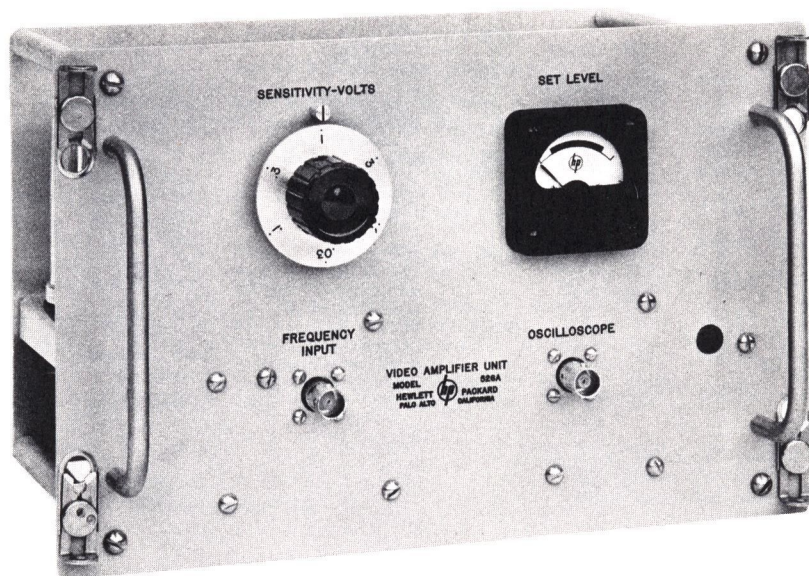
CHANGE 1 Table of Replaceable Parts,  
J1, 2: Change  $\phi$  Stock No. to 1250-0118.

OPERATING AND SERVICING MANUAL



MODEL 526A  
VIDEO AMPLIFIER UNIT  
SERIALS PREFIXED: 033 -

FOR  
MODEL 524B/C/D ELECTRONIC COUNTERS



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1501 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U. S. A.

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Printed: JULY 1961

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# SECTION I

## GENERAL DESCRIPTION

### 1-1 GENERAL

The Model 526A Video Amplifier Unit increases the sensitivity of the Model 524B/C/D Electronic Counter by one hundred times. This amplification permits the frequency measurement of low level voltages and the remote operation of the counter. An input-signal meter is provided so that the operator may assure himself that the low level signal has been amplified a sufficient amount to drive the counter. The signal level meter also functions as a safeguard against errors which would result from overloading the amplifier. The Model 526A is equipped with an output jack for oscilloscope monitoring of the voltage under measurement. A high input impedance probe is also provided to facilitate measurement in highly sensitive circuits.

Like other accessory equipments for the Model 524B/C/D, the Video Amplifier Unit is designed as a plug-in unit for the front panel of the Model 524B/C/D counter.

### 1-2 INSPECTION

This instrument was thoroughly tested and inspected before being shipped from the factory. After the instrument is unpacked, it should be carefully checked for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" section in this instruction manual.

### SPECIFICATIONS

RANGE:	10 cps to 10.1 mc
ACCURACY:	Retains accuracy of 524 Counter
MINIMUM INPUT VOLTAGE:	Approximately 10 mv rms
LEVEL CONTROL:	Meter indicates input signal level, correct voltage adjustment
OUTPUT TERMINAL:	BNC connector provides 10 times input voltage from 93-ohm source. Allows oscilloscope monitoring of input signal without loading circuit.
READS IN:	Same as basic 524 Counter
ACCESSORIES FURNISHED:	Supplied with $\phi$ 526A-16A probe assembly which increases input impedance to 10 megohms shunted by 15 pf; maximum sensitivity using probe is 0.1 volt rms.
ACCESSORIES AVAILABLE:	525A-45A Transit Case, with handles
WEIGHT:	Net 5 lbs, shipping 8 lbs.

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# SECTION II OPERATING INSTRUCTIONS

## 2-1 CONTROLS AND TERMINALS

### A. SENSITIVITY-VOLTS

This rotary switch, which is the 526A range switch, controls the voltage divider in the amplifier input. The markings on the engraved knob-skirt correspond to the level of the input signal.

### B. SET LEVEL

This meter indicates whether or not the amplifier output is at a sufficient level to drive the counter. When the SENSITIVITY-VOLTS control is adjusted so that the input signal causes the meter to indicate in the green area the output is at least 1 volt rms.

### C. FREQUENCY INPUT

This BNC connector is the input terminal for the signal under count.

### D. OSCILLOSCOPE

This BNC connector is a special output terminal which enables the signal under count to be monitored by an oscilloscope. The output from this terminal has a source impedance of 93 ohms and, on the most sensitive ranges, a level 10 times greater than that of the input signal.

## 2-2 OPERATION

### A. INSTALLATION

The Model 526A Video Amplifier is secured to the Model 524B/C/D Electronic Counter by means of snap-slide fasteners. Electrical connections are completed through two multiple connector plugs.

When the 526A Video Amplifier is installed in the 524B/C/D Electronic Counter, the input signal for frequency measurement must be connected to the

FREQUENCY INPUT connector on the 526A; the SIGNAL INPUT connector on the counter is then disconnected. For PERIOD and 10 PERIOD measurements, the signal input connector on the counter must be used for the input signal.

### NOTE

Procedures to be followed in setting up the Model 524B/C/D Electronic Counter for operation are covered in detail in the instruction manual for the Model 524B/C/D.

### B. MEASUREMENT OF FREQUENCIES IN THE 10 CPS TO 10 MC RANGE

1) With the Video Amplifier Unit installed, turn on the counter and allow at least a 15-minute warm-up period.

2) With the 526A in use, the SIGNAL INPUT connector on the 524B/C/D operates in a normal manner except in the FREQUENCY position of the FUNCTION SELECTOR. In FREQUENCY you must use the FREQUENCY INPUT connector on the 526A.

3) Adjust the SENSITIVITY-VOLTS control until the SET LEVEL meter indicates in the green zone. If the level of the signal under count is known, the SENSITIVITY-VOLTS control for that level may be set directly. It is pointed out that the Model 524B/C/D receives a driving signal of at least 1 volt rms when the meter indicates green. If the meter indicates beyond the green zone, it means that the amplifier is being overdriven. Under these conditions it is possible to trigger the counter with noise or other undesired modulation.

4) It is advisable under all circumstances of measurement to utilize the signal at the OSCILLOSCOPE output terminal for monitoring the signal under count.



Many counting errors may be avoided by the simple precaution of verifying the appearance of the signal under count on an oscilloscope. It is possible to observe the signal-to-noise ratio, evidence of spurious modulation or pulses, and undesired rf bursts and distortion which could produce erroneous results from the counter.

#### C. USE OF THE HIGH-IMPEDANCE PROBE

The Model 526A is provided with an accessory high-impedance probe for accepting countable signals from sensitive tuned circuits, tubes, and sources which would be adversely affected by the loading of the Video Amplifier alone. The probe lead connector fits the FREQUENCY INPUT terminal on the Model 526A panel.

The probe serves to decrease the capacitive loading at high frequencies, and to decrease the effects of resistive loading on the external circuit at low frequencies. It also minimizes the loading effect of shielded cable capacitance during remote operation of the counter.

When using the probe the sensitivity of the Video Amplifier is decreased by the factor 1/10. As a result, with the probe in use, the maximum sensitivity of the Video Amplifier becomes .1 volt rms.

#### D. USE OF THE SET LEVEL METER WITH PULSE INPUT SIGNALS

Because the SET LEVEL meter is an average-responding device it will read low with a pulse input signal, particularly with a short duty cycle pulse.

The Video Amplifier output should be monitored at the OSCILLOSCOPE terminal to insure that the anticipated level is sufficient to yield accurate results.

### **2-3 CIRCUIT DESCRIPTION**

The Model 526A consists of an input voltage divider controlled by S1 followed by a straight forward video amplifier consisting of V1 and V2 as one direct coupled pair followed by the direct coupled pair V3 and V4. A shunt peaking coil L1 is employed for high-frequency compensation.

The meter and associated bridge circuit comprise an average-responding type voltmeter, with V5 acting as the VTVM amplifier. Germanium diodes are connected for full-wave rectification of the input current. The bridge is frequency-compensated to minimize the efficiency loss of the crystals at high frequencies.

V5 is a cathode follower output for the Video Amplifier.

On the most sensitive range, the amplifier delivers to the OSCILLOSCOPE terminal (J<sub>2</sub>) approximately 10 times the signal input voltage. The source impedance at J<sub>2</sub> is 93 ohms.

# SECTION III MAINTENANCE

## NOTE

Two special connector cables are required for completing the necessary electrical connections to a plug-in unit when it has to be removed from the main instrument for test, maintenance, and adjustment. These cables are available on order from the Hewlett-Packard Company:

<u>Cable</u>	<u>Stock Number</u>
8 Connector	524B - 16Q
16 Connector	524B - 16P

-----

The design of the Model 526A is of such a nature that the unit should experience a long and trouble-free life. Little maintenance is anticipated except the replacement of tubes from time to time.

### 3-1 TUBE REPLACEMENT

To remove any of the tubes the Video Amplifier must be removed from its mounting in the Model 524B/C/D. Once removed, all tubes are readily accessible from the top of the unit. V1 and V2 are shock-mounted on a floating plate, and they are weight shielded to reduce microphonic transients. The weighted shields are secured by means of a ridge and groove, and they are removed by a firm upward pull.

None of the tube positions require selection of tubes within type, and normal precautions only are required when replacing tubes in the Video Amplifier Unit.

### 3-2 GAIN

The interstage gain in the Model 526A is approximately 12 for each direct coupled pair. This factor should be verified upon replacing tubes and when isolating trouble sources.

### 3-3 SET LEVEL METER ADJUSTMENT

Access to R27, SET LEVEL meter adjust, is obtained by removing the button plug on the right side of the front panel.

- 1) Set the SENSITIVITY-VOLTS control to the .01 range.
- 2) Apply approximately 10 millivolts at 10 megacycles to the FREQUENCY INPUT connector.
- 3) Adjust the input signal amplitude to obtain 1 volt rms at J3. (Connector for removable banana type plug shown in Figure 2.)
- 4) Set R27 until the meter indication is at the lower (left) end of the green zone.

### 3-4 ACCESS TO UNDERSIDE CHASSIS

To remove coverplate on underside chassis:

- 1) Remove banana type plug from J3.
- 2) Remove four (4) retaining nuts.
- 3) Raise plate so that it clears stud bolts.
- 4) Slide cover out free side of instrument.

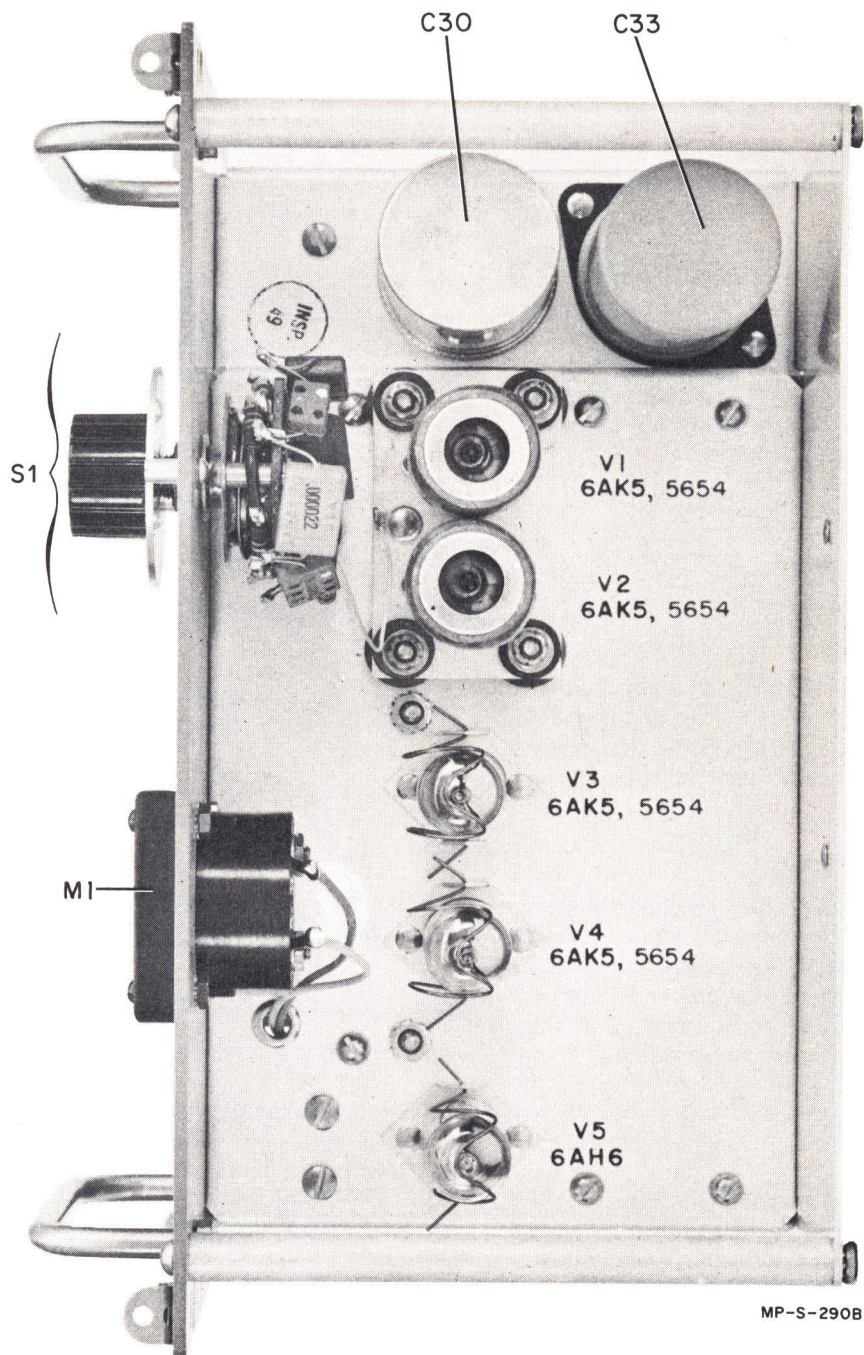


Figure 1. Model 526A Video Amplifier - Top View

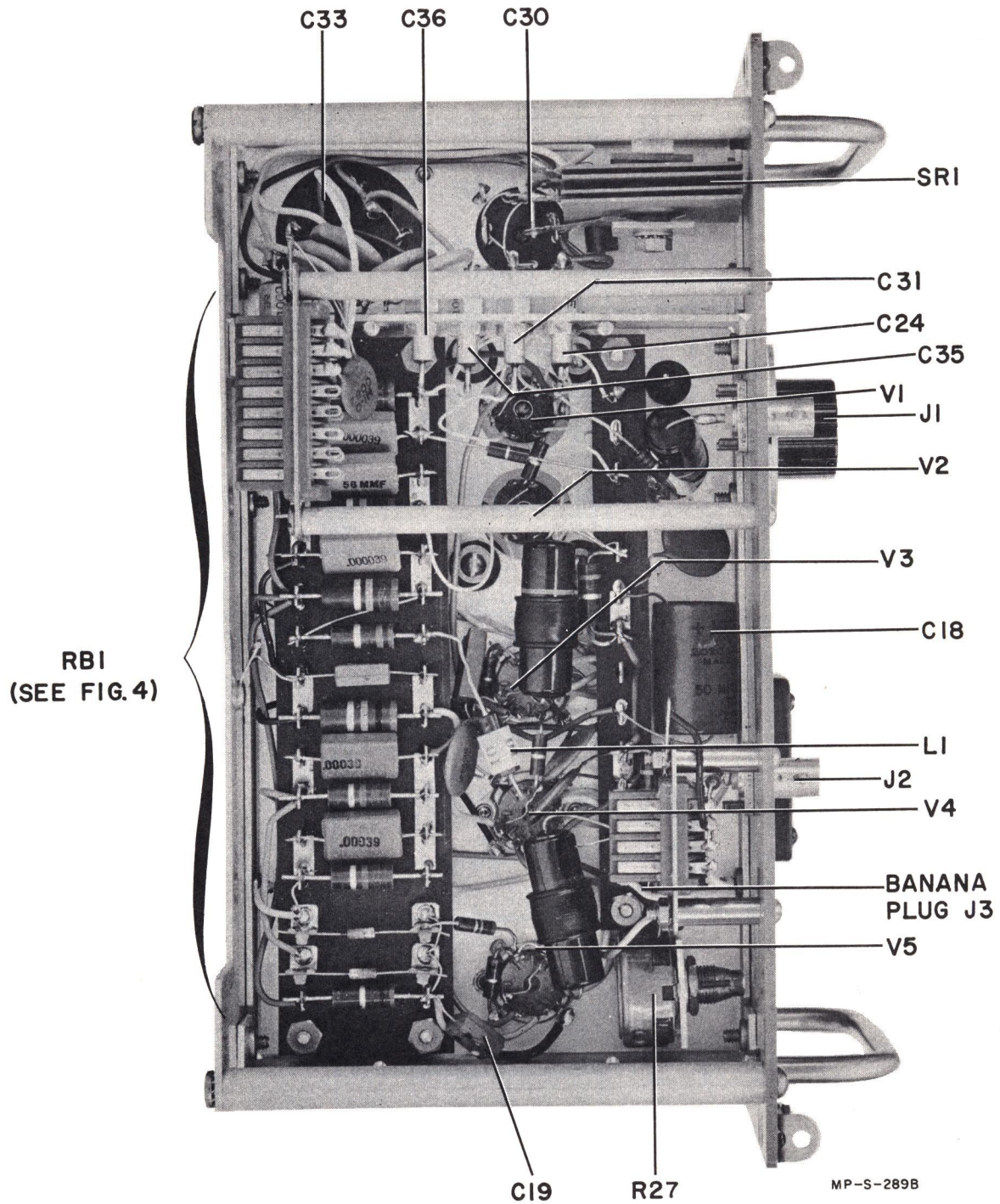


Figure 2. Model 526A Video Amplifier - Bottom View

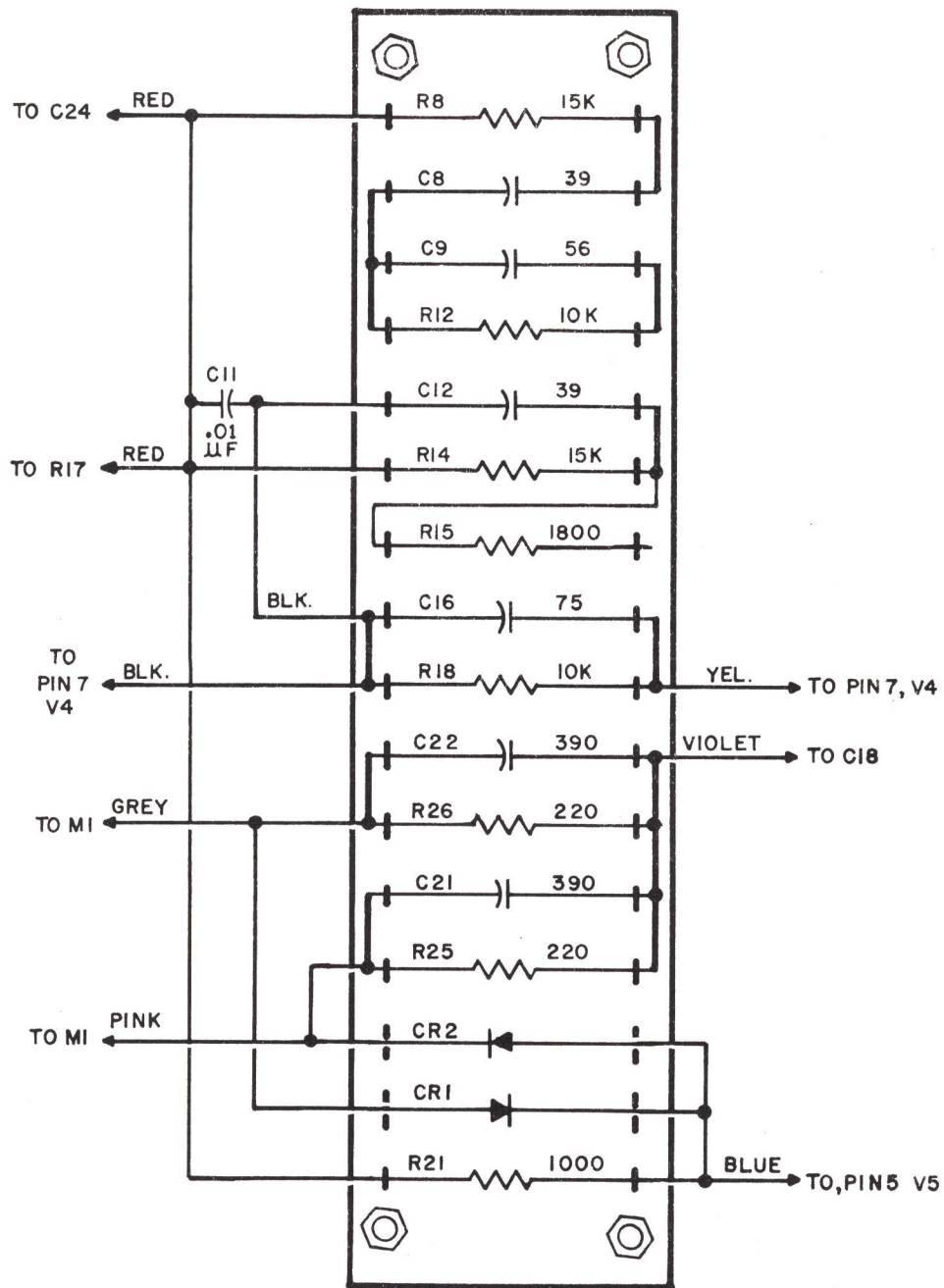
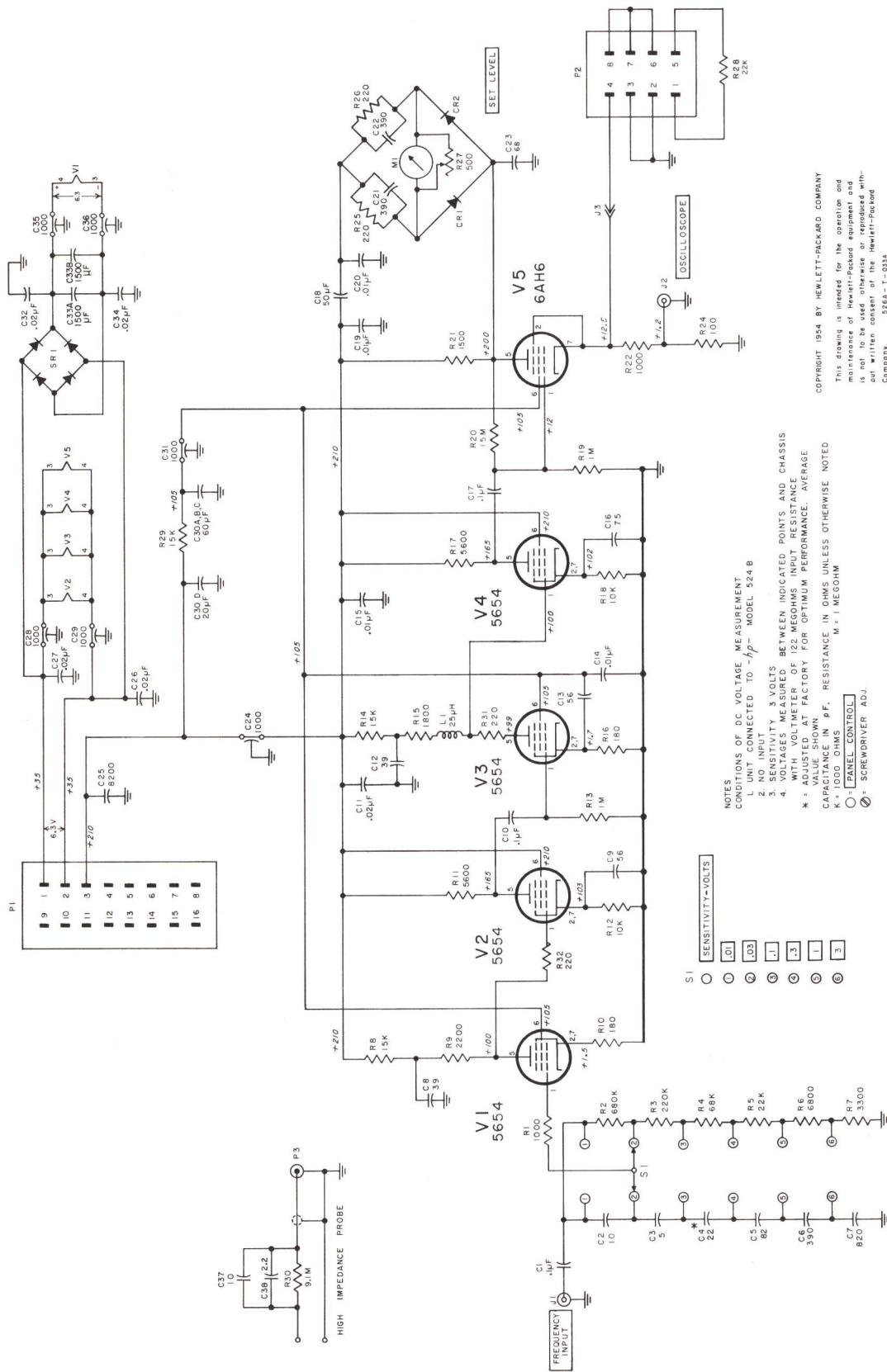


Figure 3. Model 526A Video Amplifier - Resistor Board Detail



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 526A-1-033A

- NOTES OF DC VOLTAGE MEASUREMENT
1. UNIT CONNECTED TO -hp- MODEL 524 B
  2. NO INPUT
  3. SENSITIVITY - 3 VOLTS
  4. VOLTAGES MEASURED BETWEEN INDICATED POINTS AND CHASSIS
- \* - ADJUSTED AT FACTORY FOR OPTIMUM PERFORMANCE AVERAGE VALUE SHOWN
- CAPACITANCE IN PF. RESISTANCE IN OHMS UNLESS OTHERWISE NOTED
- K = 1000 OHMS M = 1 MEGOHM
- PANEL CONTROL  
 ⊕ SCREWDRIVER ADJ.

S1	○	SENSITIVITY-VOLTS
○	○	.01
○	○	.03
○	○	.1
○	○	.3
○	○	1
○	○	3

Figure 4. Model 526A Video Amplifier

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[www.SteamPoweredRadio.Com](http://www.SteamPoweredRadio.Com)

# SECTION IV REPLACEABLE PARTS

## 4-1 INTRODUCTION

This section contains information for ordering replacement parts for the Model 526A Video Amplifier Unit.

Table 4-1 lists replaceable parts in alpha-numerical order of their reference designators. Detailed information on a part used more than once in the instrument is listed opposite the first reference designator applying to the part. Other reference designators applying to the same part refer to the initial designator. Miscellaneous parts are included at the end of the list. Detailed information includes the following:

- 1) Reference designator.
- 2) Full description of the part.
- 3) Manufacturer of the part in a five-digit code; see list of manufacturers in appendix.
- 4) Hewlett-Packard stock number.
- 5) Total quantity used in the instrument (TQ col).
- 6) Recommended spare quantity for complete maintenance during one year of isolated service (RS col).

## 4-2 ORDERING INFORMATION

To order a replacement part, address order or inquiry either to your authorized Hewlett-Packard sales representative or to

CUSTOMER SERVICE  
Hewlett-Packard Company  
395 Page Mill Road  
Palo Alto, California

or, in Western Europe, to

Hewlett-Packard S. A.  
Rue du Vieux Billard No. 1  
Geneva, Switzerland

Specify the following information for each part:

- 1) Model and complete serial number of instrument.
- 2) Hewlett-Packard stock number.
- 3) Circuit reference designator.
- 4) Description.

To order a part not listed in table 4-1, give a complete description of the part and include its function and location.

Table 4-1. Replaceable Parts (Sheet 1 of 5)

Ckt Ref	Description	Mfr	Ⓜ Stock No.	TQ	RS		
C1	Capacitor: fixed, paper dielectric, 0.1 μf ±20%, 400 vdcw	56289	0160-0013	3	1		
C2	Capacitor: fixed, mica, 10 pf ±10%, 500 vdcw	76433	0140-0002	1	1		
C3	Capacitor: fixed, mica, 5 pf ±20%, 500 vdcw	76433	0140-0001	1	1		
C4	Capacitor: fixed, mica, 22 pf ±10%, 500 vdcw Optimum value selected at factory. Average value shown.	00853	0140-0026	1	1		

Table 4-1. Replaceable Parts (Sheet 2 of 5)

Ckt Ref	Description	Mfr *	Ⓟ Stock No.	TQ*	RS*		
C5	Capacitor: fixed, mica, 82 pf $\pm 10\%$ , 500 vdcw	76433	0140-0006	1	1		
C6	Capacitor: fixed, mica, 390 pf $\pm 5\%$ , 500 vdcw	00853	0140-0016	3	1		
C7	Capacitor: fixed, mica, 820 pf $\pm 10\%$ , 500 vdcw	76433	0140-0010	1	1		
C8	Capacitor: fixed, mica, 39 pf $\pm 10\%$ , 500 vdcw	00853	0140-0021	2	1		
C9	Capacitor: fixed, mica, 56 pf $\pm 10\%$ , 500 vdcw	76433	0140-0014	2	1		
C10	Same as C1						
C11	Capacitor: fixed, ceramic, 0.02 $\mu$ f, 600 vdcw	96095	0150-0024	5	2		
C12	Same as C8						
C13	Same as C9						
C14, 15	Capacitor: fixed, ceramic dielectric, 0.01 $\mu$ f $\pm 20\%$ , 1000 vdcw	56289	0150-0012	4	1		
C16	Capacitor: fixed, mica, 75 pf $\pm 5\%$ , 300 vdcw	76433	0140-0040	1	1		
C17	Same as C1						
C18	Capacitor: fixed, electrolytic, 50 $\mu$ f $+200\%$ , $-10\%$ , 50 vdcw	37942	0180-0029	1	1		
C19, 20	Same as C14						
C21, 22	Same as C6						
C23	Capacitor: fixed, mica, 68 pf $\pm 10\%$ , 500 vdcw	76433	0140-0025	1	1		
C24	Capacitor: fixed, ceramic, 1000 pf $\pm 20\%$ , 500 vdcw	72982	0150-0019	6	2		
C25	Capacitor: fixed, ceramic, 8200 pf, 500 vdcw	96095	0150-0082	1	1		
C26, 27	Same as C11						
C28, 29	Same as C24						
C30	Capacitor: fixed, electrolytic, 4 sections 20 $\mu$ f/sect., 450 vdcw	56289	0180-0025	1	1		

\* See introduction to this section

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Table 4-1. Replaceable Parts (Sheet 3 of 5)

Ckt Ref	Description	Mfr *	Ⓣ Stock No.	TQ*	RS*		
C31	Same as C24						
C32	Same as C11						
C33	Capacitor: fixed, electrolytic, 2 sections, 1500 $\mu$ f/sect., 15 vdcw	56289	0180-0028	1	1		
C34	Same as C11						
C35,36	Same as C24						
C37	Capacitor: fixed, ceramic, 10 pf $\pm$ 0.5 pf, 500 vdcw	96095	0150-0009	1	1		
C38	Capacitor: fixed, ceramic, 2.2 pf $\pm$ 10%, 500 vdcw	78488	0150-0015	1	1		
CR1,2	Crystal diode: germanium diode	73293	1910-0011	2	2		
J1,2	Connector, female: BNC	91737	1250-0047	2	1		
J3	Plug, banana, male	78947	1251-0028	1	1		
L1	Reactor: 25 $\mu$ h, wound on 1 megohm resistor	28480	526A-60A	1	1		
M1	Meter, ammeter	55026	1120-0043	1	1		
P1	Connector, male: 8 contact	02660	1251-0008	1	1		
P2	Connector, male: 16 contact	02660	1251-0006	1	1		
R1	Resistor: fixed, composition, 1000 ohms, $\pm$ 10%, 1/2 W	01121	0687-1021	2	1		
R2	Resistor: fixed, composition, 680,000 ohms, $\pm$ 10%, 1/2 W	01121	0687-6841	1	1		
R3	Resistor: fixed, composition, 220,000 ohms, $\pm$ 10%, 1/2 W	01121	0687-2241	1	1		
R4	Resistor: fixed, composition, 68,000 ohms, $\pm$ 10%, 1/2 W	01121	0687-6831	1	1		
R5	Resistor: fixed, composition, 22,000 ohms, $\pm$ 10%, 1/2 W	01121	0687-2231	1	1		
R6	Resistor: fixed, composition, 6800 ohms, $\pm$ 10%, 1/2 W	01121	0687-6821	1	1		
R7	Resistor: fixed, composition, 3300 ohms, $\pm$ 10%, 1/2 W	01121	0687-3321	1	1		

\* See introduction to this section

Table 4-1. Replaceable Parts (Sheet 4 of 5)

Ckt Ref	Description	Mfr *	Ⓟ Stock No.	TQ*	RS*		
R8	Resistor: fixed, composition, 15,000 ohms, $\pm 10\%$ , 2 W	01121	0693-1531	3	1		
R9	Resistor: fixed, composition, 2200 ohms, $\pm 10\%$ , 1/2 W	01121	0687-2221	1	1		
R10	Resistor: fixed, composition, 180 ohms, $\pm 10\%$ , 1/2 W	01121	0687-1811	2	1		
R11	Resistor: fixed, composition, 5600 ohms, $\pm 10\%$ , 1 W	01121	0690-5621	2	1		
R12	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 2 W	01121	0693-1031	2	1		
R13	Resistor: fixed, composition, 1 megohm, $\pm 10\%$ , 1/2 W	01121	0687-1051	2	1		
R14	Same as R8						
R15	Resistor: fixed, composition, 1800 ohms, $\pm 10\%$ , 1 W	01121	0690-1821	1	1		
R16	Same as R10						
R17	Same as R11						
R18	Same as R12						
R19	Same as R13						
R20	Resistor: fixed, composition, 15 megohms, $\pm 10\%$ , 1/2 W	01121	0687-1561	1	1		
R21	Resistor: fixed, composition, 1500 ohms, $\pm 10\%$ , 1 W	01121	0690-1521	1	1		
R22	Same as R1						
R23	Not assigned						
R24	Resistor: fixed, composition, 100 ohms, $\pm 10\%$ , 1/2 W	01121	0687-1011	1	1		
R25,26	Resistor: fixed, composition, 220 ohms, $\pm 10\%$ , 1 W	01121	0690-2211	2	1		
R27	Resistor: variable, composition, linear taper, 500 ohms, $\pm 30\%$	71450	2100-0078	1	1		
R28	Same as R5						
R29	Same as R8						

\* See introduction to this section

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Table 4-1. Replaceable Parts (Sheet 5 of 5)

Ckt Ref	Description	Mfr *	Ⓢ Stock No.	TQ*	RS*		
R30	Resistor: fixed, composition, 9.1 megohms, ±5%, 1/2 W	01121	0686-9155	1	1		
R31, 32	Resistor: fixed, composition, 220 ohms, ±10%, 1/2 W	01121	0687-2211	2	1		
SR1	Rectifier, selenium	81483	1882-0002	1	1		
S1	Sensitivity Switch Assembly	28480	526A-19	1	1		
	Switch, rotary: (less components)	76854	3100-0088	1	0		
V1, 2, 3, 4	Tube, electron: 5654	80131	1923-0001	4	4		
V5	Tube, electron: 6AH6	80131	1923-0017	1	1		
	<u>MISCELLANEOUS</u>						
	Probe Assembly	28480	526A-16A	1	1		
	Knob	28480	G-74H	1	0		
	Sensitivity dial	28480	526A-40	1	0		
	Transit case: (for 524 plug-in units)	28480	525A-45A	1	0		

\* See introduction to this section

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## APPENDIX

### CODE LIST OF MANUFACTURERS (Sheet 1 of 2)

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 handbooks.

CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS
00334	Humidial Co.	Colton, Calif.	09250	Electro Assemblies, Inc.	Chicago, Ill.	71218	Bud Radio Inc.	Cleveland, Ohio
00335	Westrex Corp.	New York, N.Y.	10411	Ti-Tal, Inc.	Berkeley, Calif.	71286	Camloc Fastener Corp.	Paramus, N.J.
00373	Garlock Packing Co., Electronic Products Div.	Camden, N.J.	10646	Carborundum Co.	Niagara Falls, N.Y.	71313	Allen D. Cardwell Electronic Prod. Corp.	Plainville, Conn.
00656	Aerovox Corp.	New Bedford, Mass.	11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.	71400	Bussmann Fuse Div. of McGraw- Edison Co.	St. Louis, Mo.
00779	Amp, Inc.	Harrisburg, Pa.	12697	Clarostat Mfg. Co.	Dover, N.H.	71450	Chicago Telephone Supply Co.	Elkhart, Ind.
00781	Aircraft Radio Corp.	Boonton, N.J.	14655	Cornell Dubilier Elec. Corp.	So. Plainfield, N.J.	71468	Cannon Electric Co.	Los Angeles, Calif.
00853	Sangamo Electric Co., Cap. Div.	Marion, Ill.	15909	The Daven Co.	Livingston, N.J.	71471	Cinema Engineering Co.	Burbank, Calif.
00866	Goe Engineering Co.	Los Angeles, Calif.	16758	Delco Radio Div. of G. M. Corp.	Kokomo, Ind.	71482	C. P. Clare & Co.	Chicago, Ill.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.	18873	E. I. DuPont and Co., Inc.	Wilmington, Del.	71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
01121	Allen Bradley Co.	Milwaukee, Wis.	19315	Eclipse Pioneer, Div. of Bendix Aviation Corp.	Teterboro, N.J.	71700	The Cornish Wire Co.	New York, N.Y.
01255	Litton Industries, Inc.	Beverly Hills, Calif.	19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.	71744	Chicago Miniature Lamp Works	Chicago, Ill.
01281	Pacific Semiconductors, Inc.	Culver City, Calif.	19701	Electra Manufacturing Co.	Kansas City, Mo.	71753	A. O. Smith Corp., Crowley Div.	West Orange, N.J.
01295	Texas Instruments, Inc., Semiconductor Components Div.	Dallas, Texas	20183	Electronic Tube Corp.	Philadelphia, Pa.	71785	Cinch Mfg. Corp.	Chicago, Ill.
01349	The Alliance Mfg. Co.	Alliance, Ohio	21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.	71984	Dow Corning Corp.	Midland, Mich.
01561	Chassi-Trak Corp.	Indianapolis, Ind.	21335	The Fafnir Bearing Co.	New Britain, Conn.	72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
01961	Pulse Engineering Co.	Santa Clara, Calif.	21964	Fed. Telephone and Radio Corp.	Clifton, N.J.	72354	John E. Fast & Co.	Chicago, Ill.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.	24446	General Electric Co.	Schenectady, N.Y.	72619	Dialight Corp.	Brooklyn, N.Y.
02286	Cole Mfg. Co.	Palo Alto, Calif.	24455	G. E., Lamp Division	Nela Park, Cleveland, Ohio	72656	General Ceramics Corp.	Keasbey, N.J.
02660	Amphenol Electronics Corp.	Chicago, Ill.	24655	General Radio Co.	West Concord, Mass.	72758	Girard-Hopkins	Oakland, Calif.
02735	Radio Corp. of America Semiconductor and Materials Div.	Somerville, N.J.	26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.	72765	Drake Mfg. Co.	Chicago, Ill.
02777	Hopkins Engineering Co.	San Fernando, Calif.	26992	Hamilton Watch Co.	Lancaster, Pa.	72825	Hugh H. Eby Inc.	Philadelphia, Pa.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.	28480	Hewlett-Packard Co.	Palo Alto, Calif.	72928	Gudeman Co.	Chicago, Ill.
03705	Apex Machine & Tool Co.	Dayton, Ohio	31373	G. E. Receiving Tube Dept.	Owensboro, Ky.	72982	Erie Resistor Corp.	Erie, Pa.
03797	Eldema Corp.	El Monte, Calif.	35434	Lectrohm Inc.	Chicago, Ill.	73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
03877	Transitron Electronic Corp.	Wakefield, Mass.	37942	P. R. Mallory & Co., Inc.	Indianapolis, Ind.	73138	Helipot Div. of Beckman Instruments, Inc.	Fullerton, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.	39543	Mechanical Industries Prod. Co.	Akron, Ohio	73293	Hughes Products Div. of Hughes Aircraft Co.	Newport Beach, Calif.
04062	Elmenco Products Co.	New York, N.Y.	40920	Miniature Precision Bearings, Inc.	Keene, N.H.	73445	Amperex Electronic Co., Div. of North American Phillips Co., Inc.	Hicksville, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.	42190	Cuter Co.	Chicago, Ill.	73506	Bradley Semiconductor Corp.	New Haven, Conn.
04404	Dymec Inc.	Palo Alto, Calif.	43990	C. A. Norgren Co.	Englewood, Colo.	73559	Carling Electric, Inc.	Hartford, Conn.
04651	Special Tube Operations of Sylvania Electronic Systems	Mountain View, Calif.	44655	Ohmite Mfg. Co.	Skokie, Ill.	73682	George K. Garrett Co., Inc.	Philadelphia, Pa.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona	47904	Polaroid Corp.	Cambridge, Mass.	73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
04732	Filtron Co., Inc., Western Division	Culver City, Calif.	48620	Precision Thermometer and Inst. Co.	Philadelphia, Pa.	73793	The General Industries Co.	Elyria, Ohio
04777	Automatic Electric Sales Corp.	Northlake, Ill.	49956	Raytheon Mfg. Co.	Waltham, Mass.	73905	Jennings Radio Mfg. Co.	San Jose, Calif.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.	54294	Shallcross Mfg. Co.	Selma, N.C.	74455	J. H. Winns, and Sons	Winchester, Mass.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.	55026	Simpson Electric Co.	Chicago, Ill.	74861	Industrial Condenser Corp.	Chicago, Ill.
05624	Barber Colman Co.	Rockford, Ill.	55933	Sonotone Corp.	Elmsford, N.Y.	74868	Industrial Products Co.	Danbury, Conn.
05783	Stewart Engineering Co.	Soquel, Calif.	55938	Sorenson & Co., Inc.	So. Norwalk, Conn.	74970	E. F. Johnson Co.	Waseca, Minn.
06004	The Bassick Co.	Bridgeport, Conn.	56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.	75042	International Resistance Co.	Philadelphia, Pa.
06812	Torrington Mfg. Co., West. Div.	Van Nuys, Calif.	56289	Sprague Electric Co.	North Adams, Mass.	75173	Jones, Howard B., Division of Cinch Mfg. Corp.	Chicago, Ill.
07115	Corning Glass Works Electronic Components Dept.	Bradford, Pa.	59446	Telex, Inc.	St. Paul, Minn.	75378	James Knights Co.	Sandwich, Ill.
07137	Transistor Electronics Corp.	Minneapolis, Minn.	61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.	75382	Kulka Electric Mfg. Co., Inc.	Mt. Vernon, N.Y.
07261	Avnet Corp.	Los Angeles, Calif.	62119	Universal Electric Co.	Owosso, Mich.	75818	Lenz Electric Mfg. Co.	Chicago, Ill.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.	64959	Western Electric Co., Inc.	New York, N.Y.	75915	Littelfuse Inc.	Des Plaines, Ill.
07933	Rheem Semiconductor Corp.	Mountain View, Calif.	65092	Weston Inst. Div. of Daystrom, Inc.	Newark, N.J.	76005	Lord Mfg. Co.	Erie, Pa.
07980	Boonton Radio Corp.	Boonton, N.J.	66346	Wollensak Optical Co.	Rochester, N.Y.	76210	C. W. Marwedel	San Francisco, Calif.
08718	Cannon Electric Co. Phoenix Div.	Phoenix, Ariz.	70119	Advance Electric and Relay Co.	Burbank, Calif.	76433	Micamold Electronic Mfg. Corp.	Brooklyn, N.Y.
08792	CBS Electronics Semiconductor Operations, Div. of C.B.S. Inc.	Lowell, Mass.	70276	Allen Mfg. Co.	Hartford, Conn.	76487	James Millen Mfg. Co., Inc.	Malden, Mass.
09134	Texas Capacitor Co.	Houston, Texas	70309	Allied Control Co., Inc.	New York, N.Y.	76530	Monadnock Mills	San Leandro, Calif.
			70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.	76545	Mueller Electric Co.	Cleveland, Ohio
			70563	Amperite Co., Inc.	New York, N.Y.	76854	Oak Manufacturing Co.	Chicago, Ill.
			70903	Belden Mfg. Co.	Chicago, Ill.	77068	Bendix Corp., Bendix Pacific Div.	No. Hollywood, Calif.
			70998	Bird Electronic Corp.	Cleveland, Ohio	77221	Phaotron Instrument and Electronic Co.	South Pasadena, Calif.
			71002	Birnbach Radio Co.	New York, N.Y.	77342	Potter and Brumfield, Inc.	Princeton, Ind.

## APPENDIX

### CODE LIST OF MANUFACTURERS (Sheet 2 of 2)

CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS
77630	Radio Condenser Co.	Camden, N.J.	84396	A. J. Giesener Co., Inc.	San Francisco, Calif.	97539	Automatic and Precision Mfg. Co.	Yonkers, N.Y.
77634	Radio Essentials Inc.	Mt. Vernon, N.Y.	84411	Good All Electric Mfg. Co.	Ogallala, Neb.	97966	CBS Electronics, Div. of C.B.S., Inc.	Danvers, Mass.
77638	Radio Receptor Co., Inc.	Brooklyn, N.Y.	84970	Sarkes Tarzian, Inc.	Bloomington, Ind.	98141	Axel Brothers Inc.	Jamaica, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.	85474	R. M. Bracamonte & Co.	San Francisco, Calif.	98220	Francis L. Mosley	Pasadena, Calif.
78283	Signal Indicator Corp.	New York, N.Y.	85660	Koiled Kords, Inc.	New Haven, Conn.	98278	Microdot, Inc.	So. Pasadena, Calif.
78471	Tilley Mfg. Co.	San Francisco, Calif.	85911	Seamless Rubber Co.	Chicago, Ill.	98291	Sealectro Corp.	New Rochelle, N.Y.
78488	Stackpole Carbon Co.	St. Marys, Pa.	86684	Radio Corp. of America, RCA Electron Tube Div.	Harrison, N.J.	98405	Carad Corp.	Redwood City, Calif.
78790	Transformer Engineers	Pasadena, Calif.	88140	Cutler-Hammer, Inc.	Lincoln, Ill.	98734	Palo Alto Engineering Co., Inc.	Palo Alto, Calif.
78947	Ucinite Co.	Newtonville, Mass.	89473	General Electric Distributing Corp.	Schenectady, N.Y.	98925	Clevite Transistor Prod. Div. of Clevite Corp.	Waltham, Mass.
79142	Veeder Root, Inc.	Hartford, Conn.	90179	U.S. Rubber Co., Mechanical Goods Div.	Passaic, N.J.	98978	International Electronic Research Corp.	Burbank, Calif.
79251	Wenco Mfg. Co.	Chicago, Ill.	90970	Bearing Engineering Co.	San Francisco, Calif.	99109	Columbia Technical Corp.	New York, N.Y.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.	91418	Radio Materials Co.	Chicago, Ill.	99313	Varian Associates	Palo Alto, Calif.
80130	Times Facsimile Corp.	New York, N.Y.	91506	Augat Brothers, Inc.	Attleboro, Mass.	99515	Marshall Industries, Electron Products Division	Pasadena, Calif.
80131	Electronic Industries Association Any brand tube meeting EIA standards	Washington, D.C.	91637	Dale Products, Inc.	Columbus, Neb.	99800	Delevan Electronics Corp.	East Aurora, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.	91662	Elco Corp.	Philadelphia, Pa.	99821	North Hills Electric Co.	Great Neck, L.I., N.Y.
80411	Acro Manufacturing Co.	Columbus, Ohio	91737	Gremer Mfg. Co., Inc.	Wakefield, Mass.	99848	Wilco Corporation	Indianapolis, Ind.
80486	All Star Products Inc.	Defiance, Ohio	91827	K F Development Co.	Redwood City, Calif.	99934	Renbrandt, Inc.	Boston, Mass.
80583	Hammerlund Co., Inc.	New York, N.Y.	91929	Micro-Switch Div. of Minneapolis Honeywell Regulator Co.	Freeport, Ill.	99942	Hoffman Semiconductor Div. of Hoffman Electronics, Corp.	Evanston, Ill.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.	92196	Universal Metal Products, Inc.	Bassett Puente, Calif.	99957	Technology Instruments Corp. of Calif.	No. Hollywood, Calif.
81030	International Instruments, Inc.	New Haven, Conn.	93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.			
81415	Wilkor Products, Inc.	Cleveland, Ohio	93369	Robbins and Myers, Inc.	New York, N.Y.			
81453	Raytheon Mfg. Co., Industrial Tube Division	Quincy, Mass.	93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio			
81483	International Rectifier Corp.	El Segundo, Calif.	93983	Insuline-Van Norman Ind., Inc. Electronic Division	Manchester, N.H.			
81860	Barry Controls, Inc.	Watertown, Mass.	94144	Raytheon Mfg. Co., Receiving Tube Div.	Quincy, Mass.			
82042	Carter Parts Co.	Skokie, Ill.	94145	Raytheon Mfg. Co., Semiconductor Div.	Newton, Mass.			
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.	94148	Scientific Radio Products, Inc.	Loveland, Colo.			
82170	Allen B. DuMont Labs., Inc.	Clifton, N.J.	94154	Tung-Sol Electric, Inc.	Newark, N.J.			
82209	Maguire Industries, Inc.	Greenwich, Conn.	94197	Curtiss-Wright Corp., Electronics Div.	Carlstadt, N.J.			
82219	Sylvania Electric Prod. Inc., Electronic Tube Div.	Emporium, Pa.	94310	Tru Ohm Prod. Div. of Model Engineering and Mfg. Co.	Chicago, Ill.			
82376	Astron Co.	East Newark, N.J.	95236	Allies Products Corp.	Miami, Fla.			
82389	Switchcraft, Inc.	Chicago, Ill.	95238	Continental Connector Corp.	Woodside, N.Y.			
82647	Texas Instruments, Inc., Metals and Controls Div., Spencer Products	Attleboro, Mass.	95263	Leecraft Mfg. Co., Inc.	New York, N.Y.			
82866	Research Products Corp.	Madison, Wis.	95265	National Coil Co.	Sheridan, Wyo.			
82893	Vector Electronic Co.	Glendale, Calif.	95987	Weckesser Co.	Chicago, Ill.			
83148	Electro Cords Co.	Los Angeles, Calif.	96067	Huggins Laboratories	Sunnyvale, Calif.			
83186	Victory Engineering Corp.	Union, N.J.	96095	Hi-Q Division of Aerovox	Olean, N.Y.			
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.	96296	Solar Manufacturing Co.	Los Angeles, Calif.			
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.	96330	Carlton Screw Co.	Chicago, Ill.			
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.	96341	Microwave Associates, Inc.	Burlington, Mass.			
83821	Loyd Scruggs Co.	Festus, Mo.	96501	Excel Transformer Co.	Oakland, Calif.			
84171	Arco Electronics, Inc.	New York, N.Y.						

THE FOLLOWING H.P. VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000C	Connor Spring Mfg. Co.	San Francisco, Calif.
0000D	Connex Corp.	Oakland, Calif.
0000E	Fisher Switches, Inc.	San Francisco, Calif.
0000F	Malco Tool and Die	Los Angeles, Calif.
0000G	Microwave Engineering Co.	Palo Alto, Calif.
0000H	Philco Corp. (Lansdale Division)	Lansdale, Pa.
0000I	Telefunken (c/o American Elite)	New York, N.Y.
0000L	Winchester Electronics, Inc.	Santa Monica, Calif.
0000M	Western Coil Div. of Automatic Ind., Inc.	Redwood City, Calif.
0000N	Nahm-Bros. Spring Co.	San Leandro, Calif.
0000P	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
0000R	Metro Cap. Div., Metropolitan Telecommunications Corp.	Brooklyn, N.Y.
0000S	Moulton Electronics	San Carlos, Calif.


From: F.S.C. Handbook Supplements  
 H4-1 Dated Oct. 1960  
 H4-2 Dated Oct. 1960

00015-8  
 Revised: 26 April 1961



## WARRANTY

*All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing products (except tubes) which prove to be defective during the warranty period. We are not liable for consequential damages.*

For assistance of any kind, including help with instruments under warranty, contact your authorized  Sales Representative for instructions. Give full details of the difficulty and include the instrument model and serial numbers. Service data or shipping instructions will be promptly sent to you. There will be no charge for repair of instruments under warranty, *except transportation charges*. Estimates of charges for non-warranty or other service work will always be supplied, if requested, before work begins.


## CLAIM FOR DAMAGE IN SHIPMENT

Your instrument should be inspected and tested as soon as it is received. The instrument is insured for safe delivery. If the instrument is damaged in any way or fails to operate properly, file a claim with the carrier or, if insured separately, with the insurance company.

## SHIPPING

On receipt of shipping instructions, forward the instrument prepaid to the destination indicated. You may use the original shipping carton or any strong container. Wrap the instrument in heavy paper or a plastic bag and surround it with three or four inches of shock-absorbing material to cushion it firmly and prevent movement inside the container.

## GENERAL

Your authorized  Sales Representative is ready to assist you in any situation, and you are always welcome to get directly in touch with Hewlett-Packard service departments:

### CUSTOMER SERVICE

Hewlett-Packard Company  
395 Page Mill Road  
Palo Alto, California, U.S.A.  
Telephone: (415) 326-1755  
TWX No. PAL AL 117-U  
Cable: "HEWPACK"

### OR (In Western Europe)

Hewlett-Packard S.A.  
54-54bis Route Des Acacias  
Geneva, Switzerland  
Telephone: (022) 42. 81. 50  
Cable: "HEWPACKSA"





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