

HORIZONTAL CIRCUIT BOARD

PARTS LIST

Open Pack #6 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. Return any part that is packed in an individual envelope, with the part number on it, back to the envelope after you identify it until that part is called for in a step. Do not throw away any packing material until all of the parts are accounted for.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

TAPED COMPONENTS

Refer directly to the "Taped Component Chart (Pack #6)." Follow the instructions at the top of that chart to check the following components.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS

NOTE: The following resistors are rated at 1/4-watt and have a tolerance of 5% unless otherwise stated. A 5% tolerance is indicated by a fourth color band of gold. 1% is indicated by a **brown** fifth color band. 1/4% is indicated by a **blue** fifth color band.

6-229-12	9	2.2 Ω (red-red-gld)	R836, R889, R984, R985, R986, R987, R988, R989, R991
6-1009-12	2	10 Ω, 1% (brn-blk-blk-gld)	R912, R992
6-3019-12	2	30.1 Ω, 1% (org-blk-brn-gld)	R731, R732
6-4759-12	4	47.5 Ω, 1% (yel-viol-grn-gld)	R727, R797, R954, R955

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS (Cont'd.)

6-510-12	2	51 Ω (grn-brn-blk)	R751, R839
6-6199-12	1	61.9 Ω, 1% (blu-brn-wht-gld)	R733
6-680-12	1	68 Ω (blu-gry-blk)	R713
6-6819-12	1	68.1 Ω, 1% (blu-gry-brn-gld)	R708
6-9099-12	3	90.9 Ω, 1% (wht-blk-wht-gld)	R712, R914, R915
6-1000-12	3	100 Ω, 1% (brn-blk-blk-blk)	R735, R927, R928
6-121-12	1	120 Ω (brn-red-brn)	R793
6-151-12	1	150 Ω (brn-grn-brn)	R756
6-2000-12	6	200 Ω, 1% (red-blk-blk-blk)	R704, R737, R738, R763, R828, R831
6-2150-12	2	215 Ω, 1% (red-brn-grn-blk)	R895, R902
6-221-12	2	220 Ω (red-red-brn)	R824, R825

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS (Cont'd)

6-2370-12	1	237 Ω, 1% (red-org-viol-blk)	R743
6-271-12	3	270 Ω (red-viol-brn)	R786, R796, R865
6-3010-12	4	301 Ω, 1% (org-blk-brn-blk)	R714, R716, R742, R744
6-391-12	4	390 Ω (org-wht-brn)	R814, R817, R860, R979
6-4260-12	1	426 Ω, 1% (yel-red-blu-blk)	R935
6-4990-12	5	499 Ω, 1% (yel-wht-wht-blk)	R707, R833, R896, R901, R956
6-5230-12	2	523 Ω, 1% (grn-red-org-blk)	R916, R921
6-561-12	2	560 Ω (grn-blu-brn)	R952, R999
6-6040-12	2	604 Ω, 1% (blu-blk-yel-blk)	R709, R711
6-681-12	5	680 Ω (blu-gry-brn)	R746, R749, R761, R852, R883
6-821-12	4	820 Ω (gry-red-brn)	R717, R719, R938, R939
6-8250-12	1	825 Ω, 1% (gry-red-grn-blk)	R739
6-9090-12	1	909 Ω, 1% (wht-blk-wht-blk)	R741
6-1001-12	8	1000 Ω, 1% (brn-blk-blk-brn)	R904, R905 R906, R922, R925, R926, R929, R931 R798, R869
6-1211-12	2	1210 Ω, 1% (brn-red-brn-brn)	R936, R941
6-1331-12	2	1330 Ω, 1% (brn-org-org-brn)	R918
6-1471-12	1	1470 Ω, 1% (brn-yel-viol-brn)	R754, R777, R778, R792 R919
6-152-12	4	1500 Ω (brn-grn-red)	R924, R934
6-1691-12	1	1690 Ω, 1% (brn-blu-wht-brn)	R832
6-1821-12	2	1820 Ω, 1% (brn-gry-red-brn)	R783, R791
6-1911-12	1	1910 Ω, 1% (brn-wht-brn-brn)	R857, R964, R982 R829
6-202-12	2	2000 Ω (red-blk-red)	R897, R899
6-222-12	3	2200 Ω (red-red-red)	R974
6-2261-12	1	2260 Ω, 1% (red-red-blu-brn)	R734
6-2431-12	2	2430 Ω, 1% (red-yel-org-brn)	R819
6-332-12	1	3300 Ω (org-org-red)	R762, R771, R802, R881 R827, R862, R879, R894, R898, R975
6-3901-12	1	3900 Ω, 1% (org-wht-blk-brn)	
6-432-12	1	4300 Ω (yel-org-red)	
6-472-12	4	4700 Ω (yel-viol-red)	
6-562-12	6	5600 Ω (grn-blu-red)	

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS (Cont'd.)

6-622-12	2	6200 Ω (blu-red-red)	R963, R965
6-682-12	4	6800 Ω (blu-gry-red)	R846, R856, R858, R859
6-103-12	8	10 kΩ, 5% (brn-blk-org)	R757, R758, R799, R866, R962, R969, R973, R933 R946, R947
6-1072-12	2	10.7 kΩ, 1% (brn-blk-viol-red)	R848
6-123-12	1	12 kΩ (brn-red-org)	R968, R972
6-153-12	2	15 kΩ (brn-grn-org)	R845
6-223-12	1	22 kΩ (red-red-org)	R878, R997
6-243	2	24 kΩ, 1/2-watt (red-yel-org)	R723, R967
6-333-12	2	33 kΩ (org-org-org)	R822
6-393-12	1	39 kΩ (org-wht-org)	R943, R944
6-4122-12	2	41.2 kΩ, 1% (yel-brn-red-red)	R855
6-473-12	1	47 kΩ (yel-viol-org)	R703, R722, R958 R702
6-104-12	3	100 kΩ, 5% (brn-blk-yel)	R701
6-1003-12	1	100 kΩ, 1% (brn-blk-blk-org)	R721, R794, R966
6-9003-12	1	900 kΩ, 1% (wht-blk-blk-org)	
6-105-12	3	1M Ω (brn-blk-grn)	

CAPACITORS

21-769	20	.01 μF (103) glass	C705, C706, C708, C709, C712, C717, C721, C734, C745, C746, C747, C749, C762, C763, C765, C773, C784, C785, C788, C796, C719, C733, C766, C769, C787
21-762	5	.1 μF (104) glass	

DIODES

56-71	4	1N825A	D708, D709, D723, D724 D719
56-85	1	5V zener	D713, D714, D715, D716, D717, D745 D712, D725 D728
56-602	6	Selected germanium	
56-613	2	1N5230B	
56-616	1	1N5232B	

NON-TAPED PARTS

Most of the following parts are not taped on strips. The key numbers correspond to the number on the "Horizontal Circuit Board Parts Pictorial" (Illustration Booklet, Page 16).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS

1/4-Watt Resistors

A1	6-101-12	23	100 Ω , 5% (brn-blk-brn) (packed separately on tape strips; do not use with Tape Chart.)	R724, R747, R813, R886, R903, R908, R909, R911, R907, R923, R933, R937, R942, R945, R948, R951, R953, R957, R961, R971, R981, R993, R995
A1	6-511-12	32	510 Ω (grn-brn-brn) (packed separately on tape strips; do not use with Tape Chart.)	R706, R726, R745, R748, R752, R753, R755, R764, R765, R766, R767, R768, R769, R772, R773, R774, R775, R776, R779, R781, R782, R785, R787, R788, R789, R818, R835, R837, R841, R863, R882, R976
A1	6-102-12	23	1000 Ω , 5% (brn-blk-red) (packed separately on tape strips; do not use with Tape Chart.)	R729, R750, R759, R784, R811, R815, R816, R823, R826, R834, R842, R843, R844, R847, R854, R861, R887, R891, R892, R893, R959, R978, R984

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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1/4% Precision Resistors

A2	2-770-12	2	25 k Ω (red-grn-blk-red)	R809, R877
A2	2-769-12	2	50 k Ω (grn-blk-blk-red)	R808, R876
A2	2-768-12	2	125 k Ω (brn-red-grn-org)	R807, R875
A2	2-767-12	2	250 k Ω (red-grn-blk-org)	R806, R874
A2	2-766-12	2	500 k Ω (grn-blk-blk-org)	R805, R873
A2	2-765-12	2	1.25 M Ω (brn-red-grn-yel)	R804, R872
A2	2-764-12	2	2.5 M Ω red-grn-blk-yel)	R803, R871

CAPACITORS

Ceramic

B1	21-701	1	3.3 pF	C707
B1	21-111	1	15 pF (15k)	C759
B1	21-6	1	27 pF	C716
B1	21-121	3	56 pF	C704, C715, C713
B1	21-744	1	82 pF (820)	C761
B1	21-75	4	100 pF (100 k) (JK100)	C727, C737, C758, C789
B1	21-162	1	180 pF	C752
B1	21-22	1	220 pF	C702
B1	21-17	4	270 pF	C722, C728, C736, C753
B1	21-36	3	.002 μ F (2000 pF)	C741, C742, C748
B1	21-43	3	.001 μ F	C703, C711, C735
B2	21-175	2	.001 μ F (102k)	C743, C744

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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CAPACITORS (Cont'd.)**Electrolytic**

B3	25-900	1	1 μ F	C732
B3	25-924	1	2.2 μ F	C729
B3	25-879	2	4.7 μ F	C738, C739
B3	25-820	2	10 μ F, 10V (nonpolarized)	C714, C786
B3	25-880	14	10 μ F, 35V	C731, C768
				C774, C775,
				C776, C777,
				C778, C779,
				C781, C782,
				C783, C792,
				C793, C794
B3	25-929	1	39 μ F	C718
B4	25-299	2	1.5 μ F	C791, C795
B5	25-883	1	47 μ F	C751

Other Capacitors

B6	20-101	2	47 pF mica	C725, C756
B7	28-5	2	.22 pF phenolic (red-red-slv)	C772, C764
B8	29-43	2	.01 μ F (10000) (103) polystyrene	C724, C755
B9	27-188	2	.1 μ F (.1K) polyester	C767, C771
B10	27-175	2	1 μ F Mylar	C754, C723
B11	31-85	3	5-25 pF trimmer (brn)	C701, C726, C757

DIODES

C1	56-56	24	1N4149 (packed separately on tape strips; do not use with Tape Chart.)	D701-D706, D711, D718, D721, D722, D726, D727, D729, D731-D735, D739, D741-D744, D746
C2	412-637	2	NSL5076A LED	D707, D747
C3	56-670	2	MBD101	D737, D738

TRANSISTORS

NOTE: Transistors may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

D1	417-154	6	2N2369	Q715, Q717, Q719, Q727, Q728, Q733
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KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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TRANSISTORS (Cont'd.)

D2	417-235	7	2N4121	Q716, Q718, Q722, Q732, Q734, Q736, Q758
D2	417-260	7	2N4258A	Q702, Q711, Q712, Q713, Q714, Q724, Q726
D2	417-291	1	2N5458	Q729
D2	417-293	9	2N5770	Q706, Q707, Q708, Q709, Q723, Q747, Q748, Q749, Q751
D2	417-874	1	2N3906	Q725
D2	417-875	4	2N3904	Q759, Q761, Q762, Q763
D2	417-887	10	MPSH10	Q703, Q704, Q735, Q737, Q738, Q739, Q741, Q742, Q743, Q744
D2	417-917	2	MPSH81	Q745, Q746
D3	417-947	4	MDS-21	Q752, Q753, Q755, Q756
D3	417-948	2	MDS-60	Q754, Q757
D4	417-902	4	NPD5566 transistor module	Q701, Q705, Q721, Q731

INTEGRATED CIRCUITS (IC's)

NOTE: Integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number (This refers only to the numbers and letters in **bold** print in the Parts List. Disregard any other numbers or letters on the IC.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

E1	442-742	1	LF347	U716
E1	443-1	4	SN7400	U707, U711, U712, U714
E1	443-16	1	SN7476	U709
E1	443-44	1	SN7413	U706
E1	443-45	1	SN7408	U713
E1	443-625	1	SN74132	U715
E1	443-636	1	MC10116	U701
E1	443-679	1	MC10131	U703
E1	443-683	1	MC10102	U702
E1	443-765	2	MC10105	U704, U705
E1	443-942	1	74LS123	U708

Heathkit®

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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CONTROLS

F1	10-1139	2	100 Ω	R868, R932
F1	10-1155	2	200 Ω	R725, R838
F1	10-1140	4	500 Ω	R705, R795, R864, R913
F1	10-1141	2	1000 Ω (1K)	R849, R888
F1	10-1137	4	2000 Ω (2K)	R736, R812, R853, R867
F1	10-1138	1	10 k Ω	R907
F2	10-1187	1	1000 Ω (1K)	R851
F3	10-1186	1	2000 Ω (2K)	R718
F4	10-1202	1	10 k Ω	R801
F5	19-749	1	10 k Ω control w/switch	R821, SW705
F6	19-757	1	1000 Ω dual control w/switch	R884, R885, SW706

SWITCHES

G1	63-1391	1	1-wafer rotary switch	SW704
G2	63-1389	1	2-wafer rotary switch	SW701
G3	63-1390	1	Rotary switch assembly w/control	SW702, R728
G4	64-897	1	Pushbutton switch assembly	SW703

PIN-CONNECTOR-SOCKETS-PLUGS

H1	432-121	2	PCB pin	
H2	432-758	1	BNC connector w/hardware	
H3	432-1039	1	15-pin plug	
H4	432-1041	1	2-hole jumper socket	
H5	432-1044	3	7-pin right-angle plug	
H6	432-1129	1	4-pin plug	
H7	434-230	4	8-pin IC socket	
H7	434-298	8	14-pin IC socket	
H7	434-299	7	16-pin IC socket	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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HARDWARE

J1	250-1347	4	4-40 \times 3/32" setscrew	
J2	250-1282	10	6-32 \times 1/8" setscrew	
J3	252-39	3	1/4" nut	
J4	252-7	4	Control nut	
J5	254-14	3	1/4" lockwasher	
J6	254-4	2	Control lockwasher	
J7	259-10	3	Control solder lug	

KNOBS

K1	462-1106	1	Knob 23/32" dia.	
K2	462-1108	2	Knob (red inlay)	
K3	462-1110	3	Knob (gray inlay), 7/16" dia.	
K4	462-1139	1	Knob (clear)	
K5	462-1140	1	Knob 29/32" dia.	
K6	462-1141	1	Knob 19/32" dia.	
K7	462-1142	1	Knob (gray inlay), 9/16" dia.	

MISCELLANEOUS

L1	45-73	2	2.2 μ H choke (red-red-gld-slvr)	L701, L702
L2	203-2120	1	Front panel	
L3	206-1434	1	Shield	
L4	255-89	1	1-1/2" spacer	
L5	258-718	1	Spring	
L6	453-303	1	Shaft	
L7	456-51	1	Shaft coupler	
L8	475-16	2	Ferrite bead	
		1	Tape Chart (2-Page)	

PART FROM THE FINAL PACK

85-2880-1	1	Horizontal circuit board
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STEP-BY-STEP ASSEMBLY

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

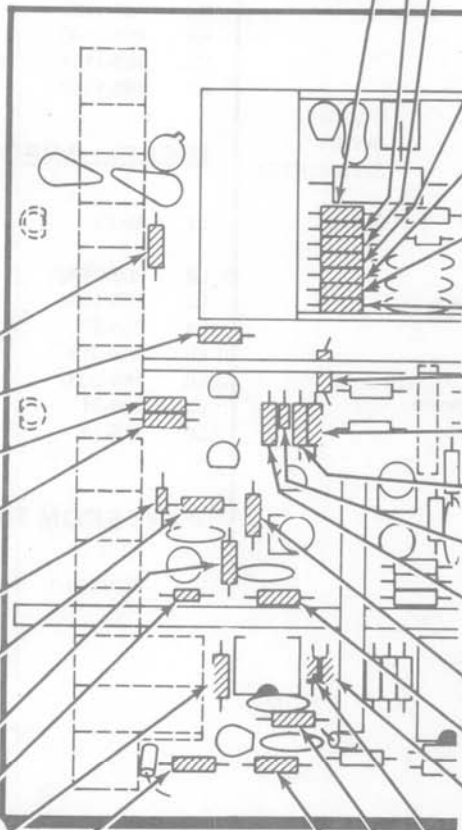
PART
NUMBER

START

NOTE: Because of its large size, only a part of the circuit board is shown. The shaded area in the identification drawing at the top of the Page indicates the area you are assembling. Refer to this drawing on each Pictorial before you begin the assembly. Note that you may be required to reposition the circuit board in some Pictorials.

All resistors are 5% unless specified otherwise.

- () R792: 1500 Ω (brn-grn-red).
- (✓) R789: 510 Ω (grn-brn-brn).
- (✓) R713: 68 Ω (blu-gry-blk).
- (✓) R708: 68.1 Ω , 1% (blu-gry-brn-gld).
- (✓) C712: .01 μ F (103) glass ceramic.
- (✓) R707: 499 Ω , 1% (yel-wht-wht-blk).
- () R723: 33 k Ω (org-org-org).
- (✓) C785: .01 μ F (103) glass ceramic.
- (✓) R777: 1500 Ω (brn-grn-red).
- () R701: 900 k Ω , 1% (wht-blk-blk-org).
- () Solder the leads to the foil and cut off the excess lead lengths.

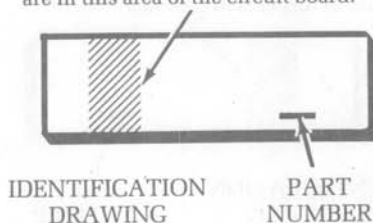


PICTORIAL 6-1

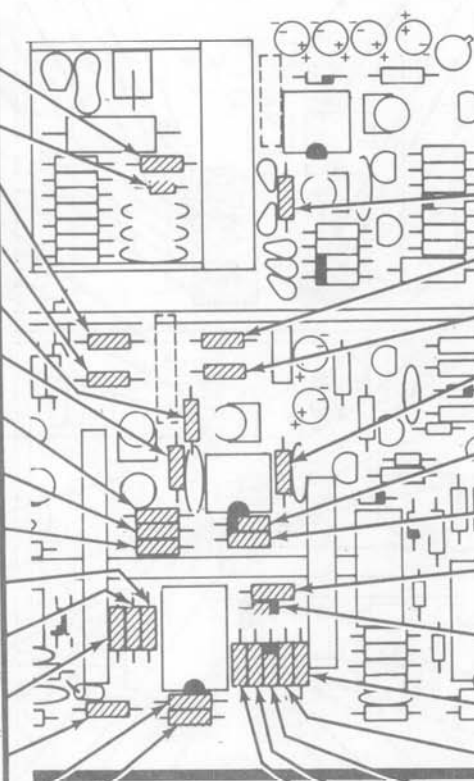
CONTINUE

- () R807: 125 k Ω , 1/4% (brn-red-grn-org).
- (✓) R806: 250 k Ω , 1/4% (red-grn-blk-org).
- (✓) R805: 500 k Ω , 1/4% (grn-blk-blk-org).
- () R809: 25 k Ω , 1/4% (red-grn-blk-red).
- () R808: 50 k Ω , 1/4% (grn-blk-blk-red).
- (✓) R804: 1.25 M, 1/4% (brn-red-grn-yel).
- () R803: 2.5 M, 1/4% (red-grn-blk-yel).
- (✓) R887: 1000 Ω (brn-blk-red).
- (✓) R711: 604 Ω , 1% (blu-blk-yel-blk).
- (✓) R709: 604 Ω , 1% (blu-blk-yel-blk).
- (✓) C708: .01 μ F (103) glass ceramic.
- () R712: 90.9 Ω , 1% (wht-blk-wht-gld).
- () R706: 510 Ω (grn-brn-brn).
- (✓) R704: 200 Ω , 1% (red-blk-blk-blk).
- (✓) C709: .01 μ F (103) glass ceramic.
- (✓) D701: 1N4149 diode (#56-56). Note the position of the banded end.
- () R703: 100 k Ω (brn-blk-yel).
- () R702: 100 k Ω , 1% (brn-blk-blk-org).
- () Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.

**START** ➡

- () C733: .1 μ F (104) glass ceramic.
- () C734: .01 μ F (103) glass ceramic.
- () R716: 301 Ω , 1% (org-blk-brn-blk).
- () R714: 301 Ω , 1% (org-blk-brn-blk).
- () R721: 1 M Ω (brn-blk-grn).
- () R722: 100 k Ω (brn-blk-yel).
- () R964: 2200 Ω (red-red-red).
- () R963: 6200 Ω (blu-red-red).
- () R959: 1000 Ω (brn-blk-red).
- () R962: 10 k Ω (brn-blk-org).
- () R983: 10 k Ω (brn-blk-org).
- () R958: 100 k Ω (brn-blk-yel).
- () C784: .01 μ F (103) glass ceramic.
- () R961: 100 Ω (brn-blk-brn).
- () R984: 1000 Ω (brn-blk-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

**PICTORIAL 6-2****CONTINUE** ➡

- () R799: 10 k Ω (brn-blk-org).
- () R719: 820 Ω (gry-red-brn).
- () R717: 820 Ω (gry-red-brn).
- () R724: 100 Ω (brn-blk-brn).
- () D702: 1N4149 diode (#56-56). Note the banded end.
- () R965: 6200 Ω (blu-red-red).
- () C787: .1 μ F (104) glass ceramic.
- () D744: 1N4149 diode (#56-56). Note the banded end.
- () R967: 33 k Ω (org-org-org).
- () R982: 2200 Ω (red-red-red).
- () D745: Diode (#56-602). Note the banded end.
- () R981: 100 Ω (brn-blk-brn).
- () R966: 1 M Ω (brn-blk-grn).
- () Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

PART
NUMBER

START

- () R796: 270 Ω (red-viol-brn).
- () D711: 1N4149 diode (#56-56).
Note the banded end.
- () R971: 100 Ω (brn-blk-brn).
- () R802: 4700 Ω (yel-viol-red).
- () D709: 1N825A diode (#56-71).
Note the banded end.
- () D708: 1N825A diode (#56-71).
Note the banded end.
- () R738: 200 Ω , 1% (red-blk-blk-blk).
- () R727: 47.5 Ω , 1% (yel-viol-grn-gld).
- () C773: .01 μ F (103) glass ceramic.
- () R726: 510 Ω (grn-brn-brn).
- () D703: 1N4149 diode (#56-56).
Note the banded end.
- () D704: 1N4149 diode (#56-56).
Note the banded end.
- () C788: .01 μ F (103) glass ceramic.
- () R754: 1500 Ω (brn-grn-red).
- () R750: 1000 Ω (brn-blk-red).
NOTE: The circuit board may be
screened "R959."
- () R972: 15 k Ω (brn-grn-org).
- () R968: 15 k Ω (brn-grn-org).
- () R969: 10 k Ω (brn-blk-org).
- () Solder the leads to the foil and cut
off the excess lead lengths.

CONTINUE

- () R862: 5600 Ω (grn-blu-red).
- () R814: 390 Ω (org-wht-brn).
- () R813: 100 Ω (brn-blk-brn).
- () D712: 1N5230B diode (#56-613).
Note the banded end.
- () R797: 47.5 Ω , 1% (yel-viol-grn-gld).
- () R798: 1210 Ω , 1% (brn-red-brn-brn).
- () R749: 680 Ω (blu-gry-brn).
- () R997: 24 k Ω , 1/2-watt (red-yel-org).
- () R737: 200 Ω , 1% (red-blk-blk-blk).
- () R731: 30.1 Ω , 1% (org-blk-brn-gld).
- () D706: 1N4149 diode (#56-56).
Note the banded end.
- () R732: 30.1 Ω , 1% (org-blk-brn-gld).
- () C717: .01 μ F (103) glass ceramic.
- () D705: 1N4149 diode (#56-56).
Note the banded end.
- () R735: 100 Ω , 1% (brn-blk-blk-blk).
- () R733: 61.9 Ω , 1% (blu-brn-wht-gld).
- () R734: 3900 Ω , 1% (org-wht-blk-brn).
- () R729: 1000 Ω (brn-blk-red).
- () C796: .01 μ F (103) glass ceramic.
- () R988: 2.2 Ω (red-red-gld).
- () R991: 2.2 Ω (red-red-gld).
- () Solder the leads to the foil and cut
off the excess lead lengths.

PICTORIAL 6-3

The steps performed in this Pictorial are in this area of the circuit board.

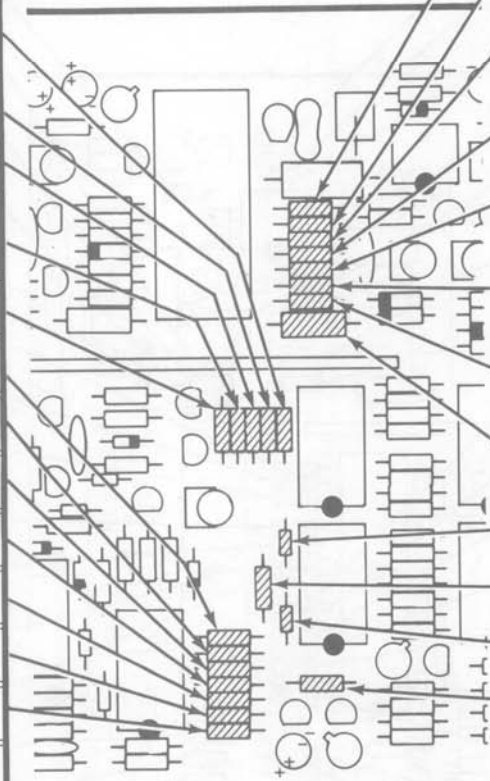


IDENTIFICATION
DRAWING

PART
NUMBER

START

- () R743: 237 Ω , 1% (red-org-viol-blk).
- () R744: 301 Ω , 1% (org-blk-brn-blk).
- () R742: 301 Ω , 1% (org-blk-brn-blk).
- () R741: 909 Ω , 1% (wht-blk-wht-blk).
- () R739: 825 Ω , 1% (gry-red-grn-blk).
- () R775: 510 Ω (grn-brn-brn).
- () R774: 510 Ω (grn-brn-brn).
- () R755: 510 Ω (grn-brn-brn).
- () R976: 510 Ω (grn-brn-brn).
- () R772: 510 Ω (grn-brn-brn).
- () R757: 10 k Ω (brn-blk-org).
- () R756: 150 Ω (brn-grn-brn).
- () Solder the leads to the foil and cut off the excess lead lengths.

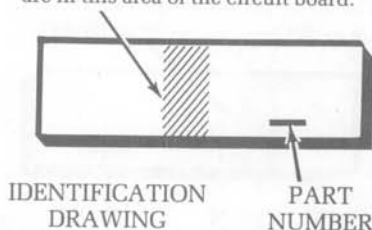


CONTINUE

- () R875: 125 k Ω , 1/4% (brn-red-grn-org).
- () R874: 250 k Ω , 1/4% (red-grn-blk-org).
- () R873: 500 k Ω , 1/4% (grn-blk-blk-org).
- () R877: 25 k Ω , 1/4% (red-grn-blk-red).
- () R876: 50 k Ω , 1/4% (grn-blk-blk-red).
- () R872: 1.25 M Ω , 1/4% (brn-red-grn-yel).
- () R871: 2.5 M Ω , 1/4% (red-grn-blk-yel).
- () R878: 24 k Ω , 1/2-watt (red-yel-org).
- () C705: .01 μ F (103) glass ceramic.
- () R773: 510 Ω (grn-brn-brn).
- () C746: .01 μ F (103) glass ceramic.
- () R758: 10 k Ω (brn-blk-org).
- () Solder the leads to the foil and cut off the excess lead lengths.

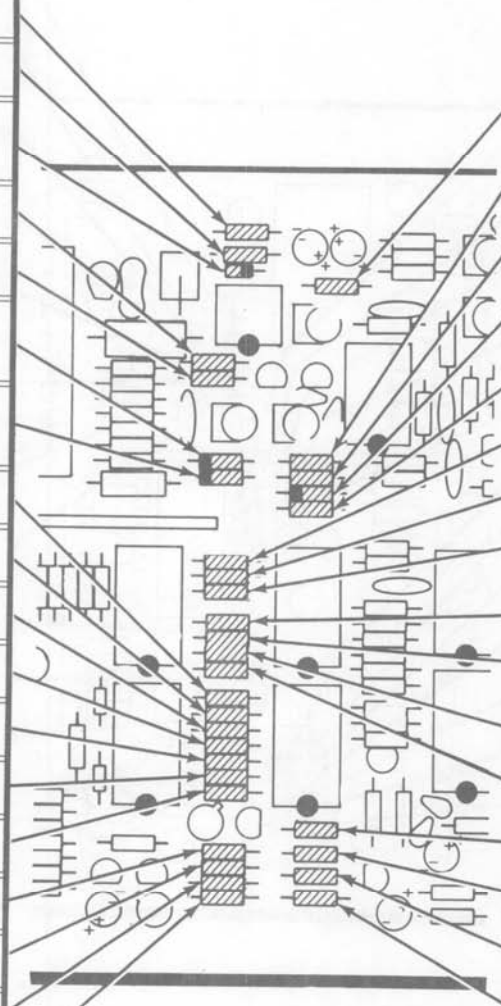
PICTORIAL 6-4

The steps performed in this Pictorial are in this area of the circuit board.



START

- () R889: 2.2 Ω (red-red-gld).
- () R986: 2.2 Ω (red-red-gld).
- () D726: 1N4149 diode (#56-56).
Note the banded end.
- () R866: 10 k Ω (brn-blk-org).
- () R995: 100 Ω (brn-blk-brn).
- () D724: 1N825A diode (#56-71).
Note the banded end.
- () D723: 1N825A diode (#56-71).
Note the banded end.
- () C721: .01 μ F (103) glass ceramic.
- () R778: 1500 Ω (brn-grn-red).
- () R776: 510 Ω (grn-brn-brn).
- () R768: 510 Ω (grn-brn-brn).
- () R781: 510 Ω (grn-brn-brn).
- () R765: 510 Ω (grn-brn-brn).
- () R782: 510 Ω (grn-brn-brn).
- () R783: 2000 Ω (red-blk-red).
- () R784: 1000 Ω (brn-blk-red).
- () C719: .1 μ F (104) glass ceramic.
- () R761: 680 Ω (blu-gry-brn).
- () Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 6-5

CONTINUE

- () R865: 270 Ω (red-viol-brn).
- () R869: 1210 Ω , 1% (brn-red-brn-brn).
- () R863: 510 Ω (grn-brn-brn).
- () D725: 1N5230B diode (#56-613).
Note the banded end.
- () R746: 680 Ω (blu-gry-brn).
- () C706: .01 μ F (103) glass ceramic.
- () R745: 510 Ω (grn-brn-brn).
- () R748: 510 Ω (grn-brn-brn).
- () R747: 100 Ω (brn-blk-brn).
- () R752: 510 Ω (grn-brn-brn).
- () R751: 51 Ω (grn-brn-blk).
- () R753: 510 Ω (grn-brn-brn).
- () R764: 510 Ω (grn-brn-brn).
- () R767: 510 Ω (grn-brn-brn).
- () R759: 1000 Ω (brn-blk-red).
- () R762: 4700 Ω (yel-viol-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

START ➡

- () R858: 6800 Ω (blu-gry-red).
- () R861: 1000 Ω (brn-blk-red).
- () R859: 6800 Ω (blu-gry-red).
- () C765: .01 μ F (103) glass ceramic.
- () R860: 390 Ω (org-wht-brn).
- () R793: 120 Ω (brn-red-brn).
- () R794: 1 M Ω (brn-blk-grn).
- () R786: 270 Ω (red-viol-brn).
- () R785: 510 Ω (grn-brn-brn).
- () R771: 4700 Ω (yel-viol-red).
- () R787: 510 Ω (grn-brn-brn).
- () R788: 510 Ω (grn-brn-brn).
- () R779: 510 Ω (grn-brn-brn).
- () R791: 2000 Ω (red-blk-red).
- () R769: 510 Ω (grn-brn-brn).
- () R766: 510 Ω (grn-brn-brn).
- () R763: 200 Ω , 1% (red-blk-blk-blk).
- () R979: 390 Ω (org-wht-brn). NOTE:
The circuit board may be screened
"R893."
- () Solder the leads to the foil and cut
off the excess lead lengths.

CONTINUE ➡

- () R848: 12 k Ω (brn-red-org).
- () R852: 680 Ω (blu-gry-brn).
- () R846: 6800 Ω (blu-gry-red).
- () R857: 2200 Ω (red-red-red).
- () R854: 1000 Ω (brn-blk-red).
- () R847: 1000 Ω (brn-blk-red).
- () D721: 1N4149 diode (#56-56).
Note the banded end.
- () D722: 1N4149 diode (#56-56).
Note the banded end.
- () R845: 22 k Ω (red-red-org).
- () R855: 47 k Ω (yel-viol-org).
- () R856: 6800 Ω (blu-gry-red).
- () R817: 390 Ω (org-wht-brn).
- () R822: 39 k Ω (org-wht-org).
- () R842: 1000 Ω (brn-blk-red).
- () L701: 2.2 μ H (red-red-gld-slvr)
(#45-73).
- () L702: 2.2 μ H (red-red-gld-slvr)
(#45-73).
- () Solder the leads to the foil and cut
off the excess lead lengths.

PICTORIAL 6-6

The steps performed in this Pictorial are in this area of the circuit board.

START ➔

() R984: 2.2 Ω (red-red-gld).

() R987: 2.2 Ω (red-red-gld).

() R836: 2.2 Ω (red-red-gld).

() R844: 1000 Ω (brn-blk-red).

() R985: 2.2 Ω (red-red-gld).

NOTE: When you install the diodes as directed on this Pictorial, be sure to observe the position of their banded ends.

() D713: Selected germanium diode (#56-602).

() D714: Selected germanium diode (#56-602).

() D715: Selected germanium diode (#56-602).

() D716: Selected germanium diode (#56-602).

() R816: 1000 Ω (brn-blk-red).

() D717: Selected germanium diode (#56-602).

() R818: 510 Ω (grn-brn-brn).

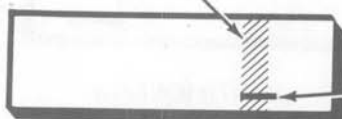
() R819: 4300 Ω (yel-org-red).

() C745: .01 μ F (103) glass ceramic.

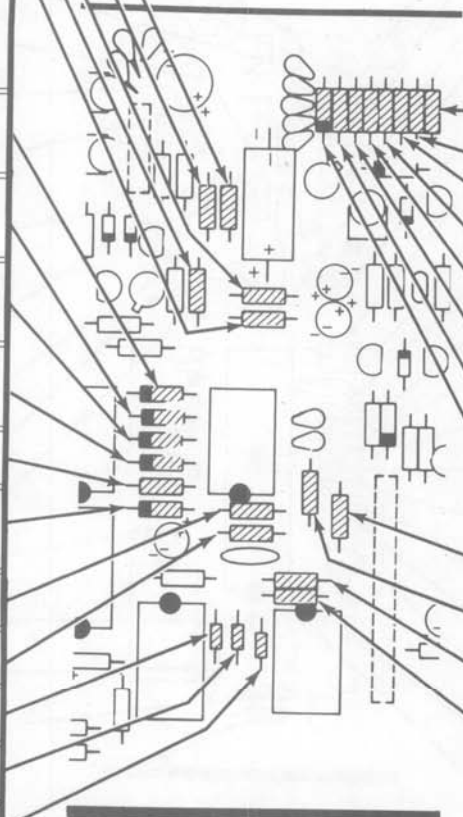
() C747: .01 μ F (103) glass ceramic.

() C749: .01 μ F (103) glass ceramic.

() Solder the leads to the foil and cut off the excess lead lengths.



PART
NUMBER

IDENTIFICATION
DRAWING**CONTINUE** ➔

() R903: 100 Ω (brn-blk-brn).

() R909: 100 Ω (brn-blk-brn).

() R975: 5600 Ω (grn-blu-red).

() R881: 4700 Ω (yel-viol-red).

() R886: 100 Ω (brn-blk-brn).

() R883: 680 Ω (blu-gry-brn).

() R882: 510 Ω (grn-brn-brn).

() D727: 1N4149 diode (#56-56).

() R839: 51 Ω (grn-brn-blk).

() R815: 1000 Ω (brn-blk-red).

() R811: 1000 Ω (brn-blk-red).

() R843: 1000 Ω (brn-blk-red).

() Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 6-7

The steps performed in this Pictorial are in this area of the circuit board.

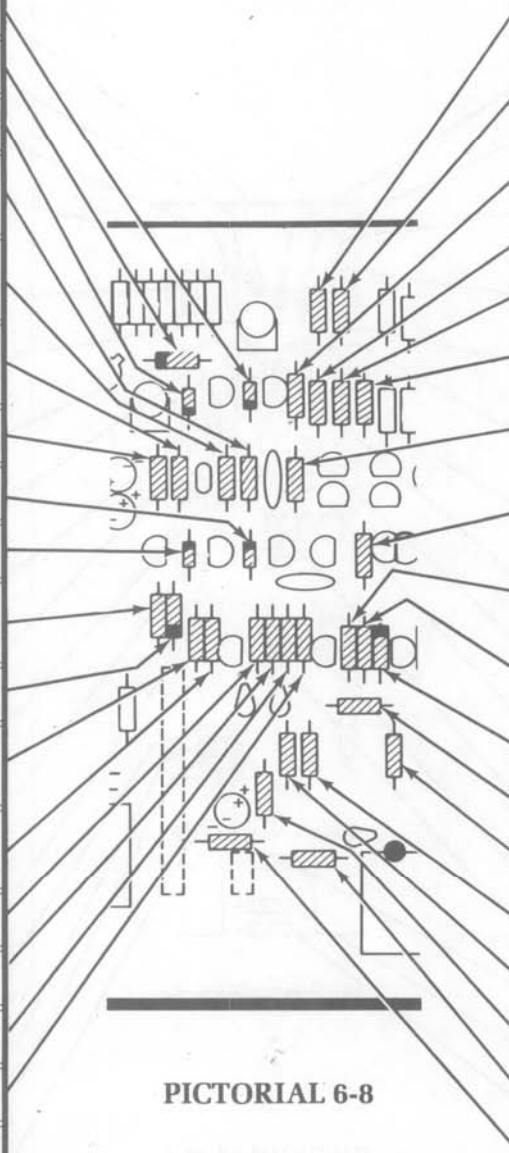


START

NOTE: When you install diodes as directed on this Pictorial, be sure to observe the position of their banded ends.

- () D732: 1N4149 diode (#56-56).
- () D728: 1N5232B diode (#56-616).
- () D734: 1N4149 diode (#56-56).
- () R905: 1000 Ω , 1% (brn-blk-blk-brn).
- () R914: 90.9 Ω , 1% (wht-blk-wht-gld).
- () R915: 90.9 Ω , 1% (wht-blk-wht-gld).
- () R912: 10 Ω , 1% (brn-blk-blk-gld).
- () D733: 1N4149 diode (#56-56).
- () D735: 1N4149 diode (#56-56).
- () R902: 215 Ω , 1% (red-brn-grn-blk).
- () D731: 1N4149 diode (#56-56).
- () R901: 499 Ω , 1% (yel-wht-wht-blk).
- () R899: 2430 Ω , 1% (red-yel-org-brn).
- () R898: 5600 Ω (grn-blu-red).
- () R911: 100 Ω (brn-blk-brn).
- () R908: 100 Ω (brn-blk-brn).
- () R894: 5600 Ω (grn-blu-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

IDENTIFICATION DRAWING

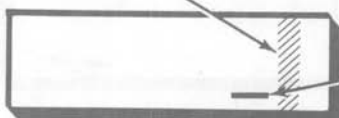


PICTORIAL 6-8

CONTINUE

- () R919: 1690 Ω , 1% (brn-blu-wht-brn).
- () R918: 1470 Ω , 1% (brn-yel-viol-brn).
- () R906: 1000 Ω , 1% (brn-blk-blk-brn).
- () R917: 100 Ω (brn-blk-brn).
- () R921: 523 Ω , 1% (grn-red-org-blk).
- () R923: 100 Ω (brn-blk-brn).
- () R904: 1000 Ω , 1% (brn-blk-blk-brn).
- () R895: 215 Ω , 1% (red-brn-grn-blk).
- () R897: 2430 Ω , 1% (red-yel-org-brn).
- () R896: 499 Ω , 1% (yel-wht-wht-blk).
- () D729: 1N4149 diode (#56-56).
- () R879: 5600 Ω (grn-blu-red).
- () R978: 1000 Ω (brn-blk-red).
- () R893: 1000 Ω (brn-blk-red).
- () R892: 1000 Ω (brn-blk-red).
- () R989: 2.2 Ω (red-red-gld).
- () R891: 1000 Ω (brn-blk-red).
- () R834: 1000 Ω (brn-blk-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.



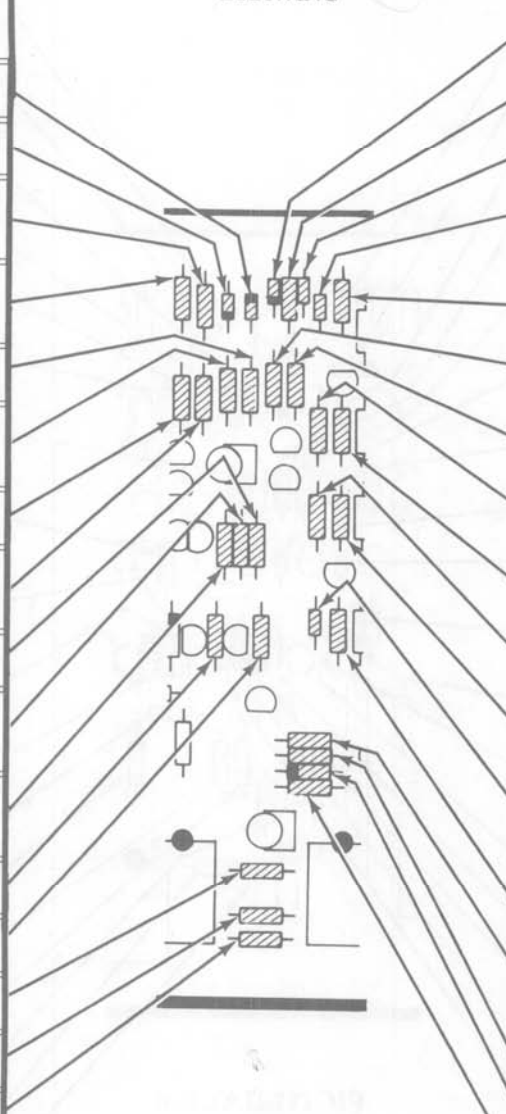
PART
NUMBER

START

NOTE: When you install diodes as directed on this Pictorial, be sure to observe the position of their banded ends.

- () D741: 1N4149 diode (#56-56).
- () D746: 1N4149 diode (#56-56).
- () R922: 1000 Ω , 1% (brn-blk-blk-brn).
- () R924: 1820 Ω , 1% (brn-gry-red-brn).
- () R927: 100 Ω , 1% (brn-blk-blk-blk).
- () R926: 1000 Ω , 1% (brn-blk-blk-brn).
- () R916: 523 Ω , 1% (grn-red-org-blk).
- () R925: 1000 Ω , 1% (brn-blk-blk-brn).
- () R928: 100 Ω , 1% (brn-blk-blk-blk).
- () R931: 1000 Ω , 1% (brn-blk-blk-brn).
- () R929: 1000 Ω , 1% (brn-blk-blk-brn).
- () R974: 3300 Ω (org-org-red).
- () R973: 10 k Ω (brn-blk-org).
- () C744: .001 μ F (102 k) ceramic.
- () C743: .001 μ F (102 k) ceramic.
- () R841: 510 Ω (grn-brn-brn).
- () Solder the leads to the foil and cut off the excess lead lengths.

IDENTIFICATION DRAWING



CONTINUE

- () D739: 1N4149 diode (#56-56).
- () R935: 426 Ω , 1% (yel-red-blu-blk).
- () C763: .01 μ F (103) glass ceramic.
- () C764: .22 pF (red-red-gld-slvr) phenolic.
- () R943: 41.2 k Ω , 1% (yel-brn-red-red).
- () R933: 100 Ω (brn-blk-brn).
- () R934: 1820 Ω , 1% (brn-gry-red-brn).
- () R937: 100 Ω (brn-blk-brn).
- () R936: 1330 Ω , 1% (brn-org-org-brn).
- () R942: 100 Ω (brn-blk-brn).
- () R941: 1330 Ω , 1% (brn-org-org-brn).
- () C722: .22 pF (red-red-gld-slvr) phenolic.
- () R944: 41.2 k Ω , 1% (yel-brn-red-red).
- () R829: 2260 Ω , 1% (red-red-blu-brn).
- () R828: 200 Ω , 1% (red-blk-blk-blk).
- () D718: 1N4149 diode (#56-56).
- () R831: 200 Ω , 1% (red-blk-blk-blk).
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 6-9

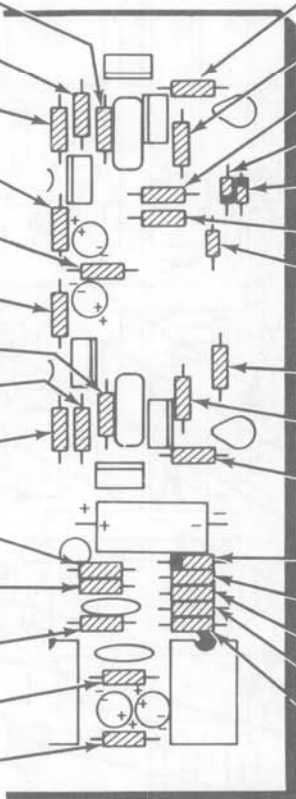
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

START

- () R948: 100 Ω (brn-blk-brn).
- () C766: .1 μ F (104) glass ceramic.
- () R938: 820 Ω (gry-red-brn).
- () R954: 47.5 Ω , 1% (yel-viol-grn-gld).
- () R956: 499 Ω , 1% (yel-wht-wht-blk).
- () R955: 47.5 Ω , 1% (yel-viol-grn-gld).
- () R951: 100 Ω (brn-blk-brn).
- () C769: .1 μ F (104) glass ceramic.
- () R939: 820 Ω (gry-red-brn).
- () R827: 5600 Ω (grn-blu-red).
- () R832: 1910 Ω , 1% (brn-wht-brn-brn).
- () R837: 510 Ω (grn-brn-brn).
- () R835: 510 Ω (grn-brn-brn).
- () R825: 220 Ω (red-red-brn).
- () Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 6-10

CONTINUE

- () R953: 100 Ω (brn-blk-brn).
- () R999: 560 Ω (grn-blu-brn).
- () R945: 100 Ω (brn-blk-brn).
- () D742: 1N4149 diode, (#56-56). Note the banded end.
- () D743: 1N4149 diode (#56-56). Note the banded end.
- () R946: 10.7 k Ω , 1% (brn-blk-viol-red).
- () C762: .01 μ F (103) glass ceramic.
- () R947: 10.7 k Ω , 1% (brn-blk-viol-red).
- () R952: 560 Ω (grn-blu-brn).
- () R957: 100 Ω (brn-blk-brn).
- () D719: 5 V zener diode (#56-85). Note the banded end.
- () R833: 499 Ω , 1% (yel-wht-wht-blk).
- () R826: 1000 Ω (brn-blk-red).
- () R823: 1000 Ω (brn-blk-red).
- () R824: 220 Ω (red-red-brn).
- () Solder the leads to the foil and cut off the excess lead lengths.

NOTE: You should have 2 resistors left at this time: One 10 Ω , 1% (brn-blk-blk-gld) and one 100 Ω 5% (brn-blk-brn). Save these resistors for use later.

The steps performed in this Pictorial are in this area of the circuit board.

PART
NUMBER

IDENTIFICATION
DRAWING

START

Position the circuit board as shown in the Identification Drawing.

NOTE: When you install the following controls and trimmers, match the outline of the part with the outline on the board. Insert the leads, solder them to the foil, and cut off the excess lead lengths.

() C701: 5-25 pF trimmer (brn).

() R705: 500 Ω control.

() C726: 5-25 pF trimmer (brn).

() R888: 1000 Ω (1K) control.

() R725: 200 Ω control.

() R812: 2000 Ω (2K) control.

() R795: 500 Ω control.

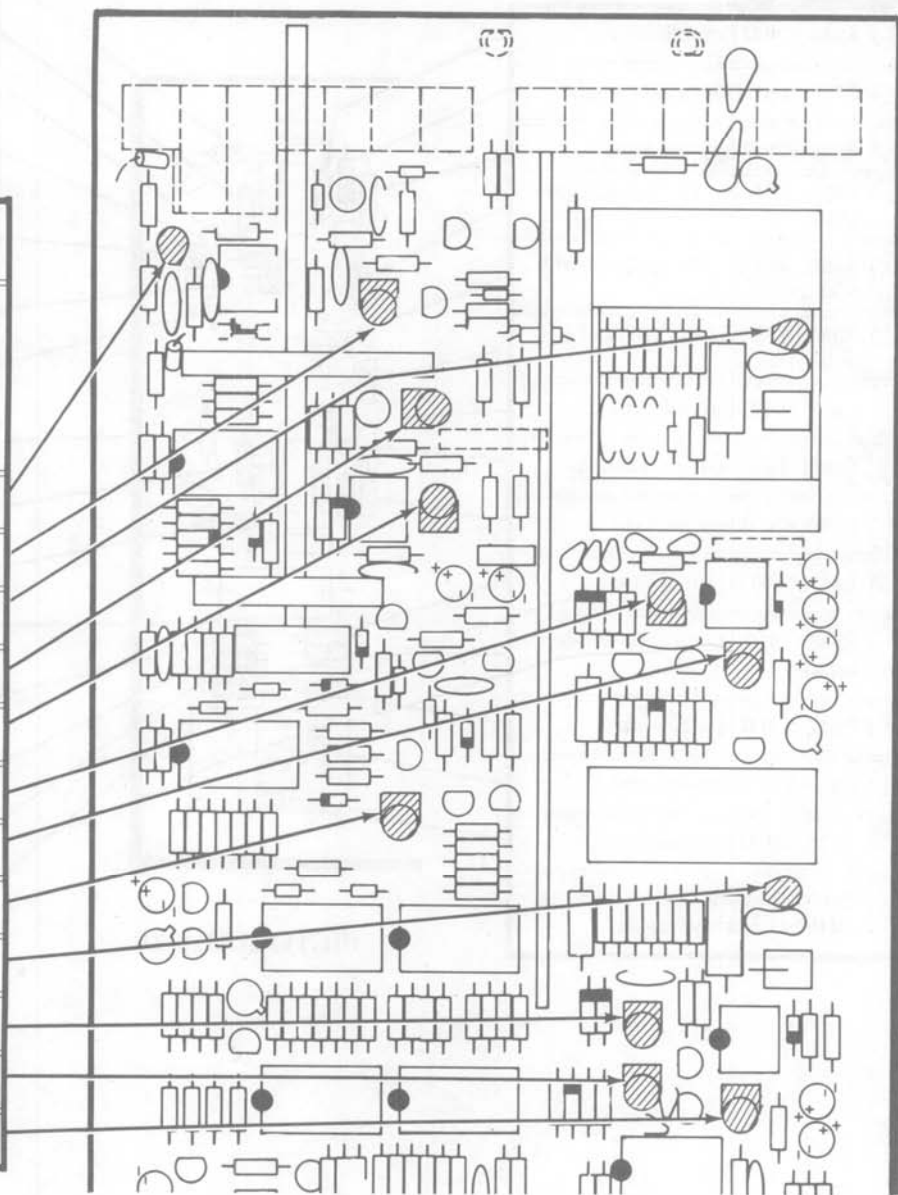
() R736: 2000 Ω (2K) control.

() C757: 5-25 pF trimmer (brn).

() R867: 2000 Ω (2K) control.

() R868: 100 Ω control.

() E864: 500 Ω control.



PICTORIAL 6-11

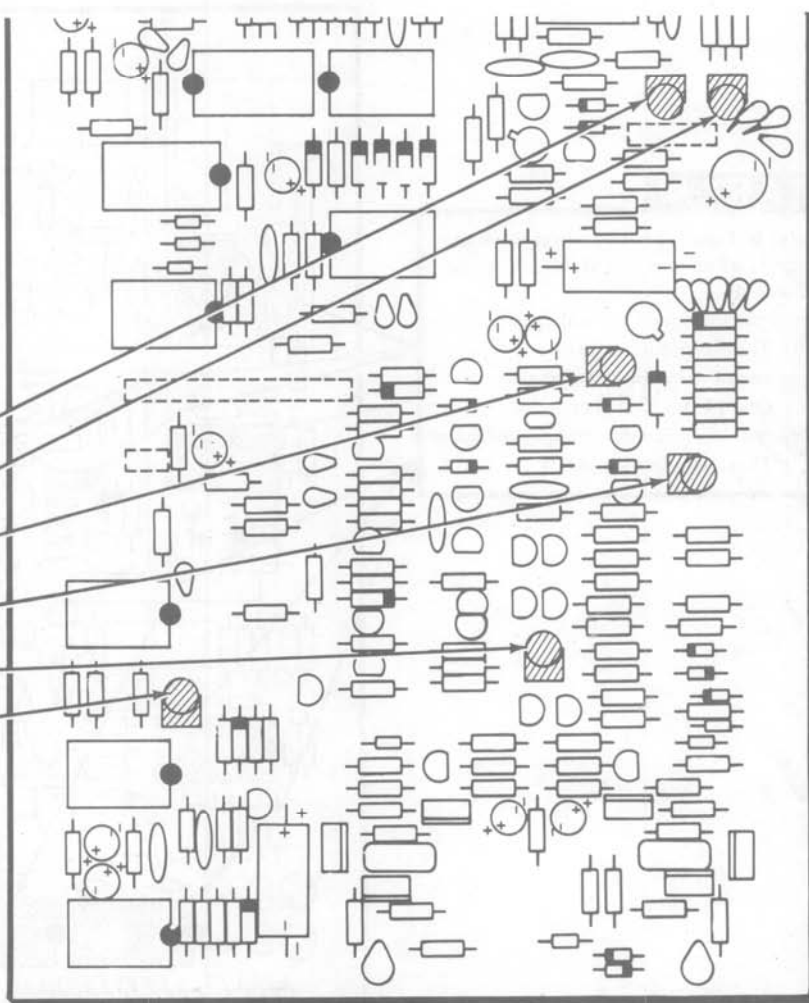
The steps performed in this Pictorial are in this area of the circuit board.

PART
NUMBER

IDENTIFICATION
DRAWING

START ➡

- () R853: 2000 Ω (2K) control.
- () R849: 1000 Ω (1K) control.
- () R913: 500 Ω control.
- () R907: 10 k Ω control.
- () R932: 100 Ω control.
- () R838: 200 Ω control.



PICTORIAL 6-12

The steps performed in this Pictorial are in this area of the circuit board.

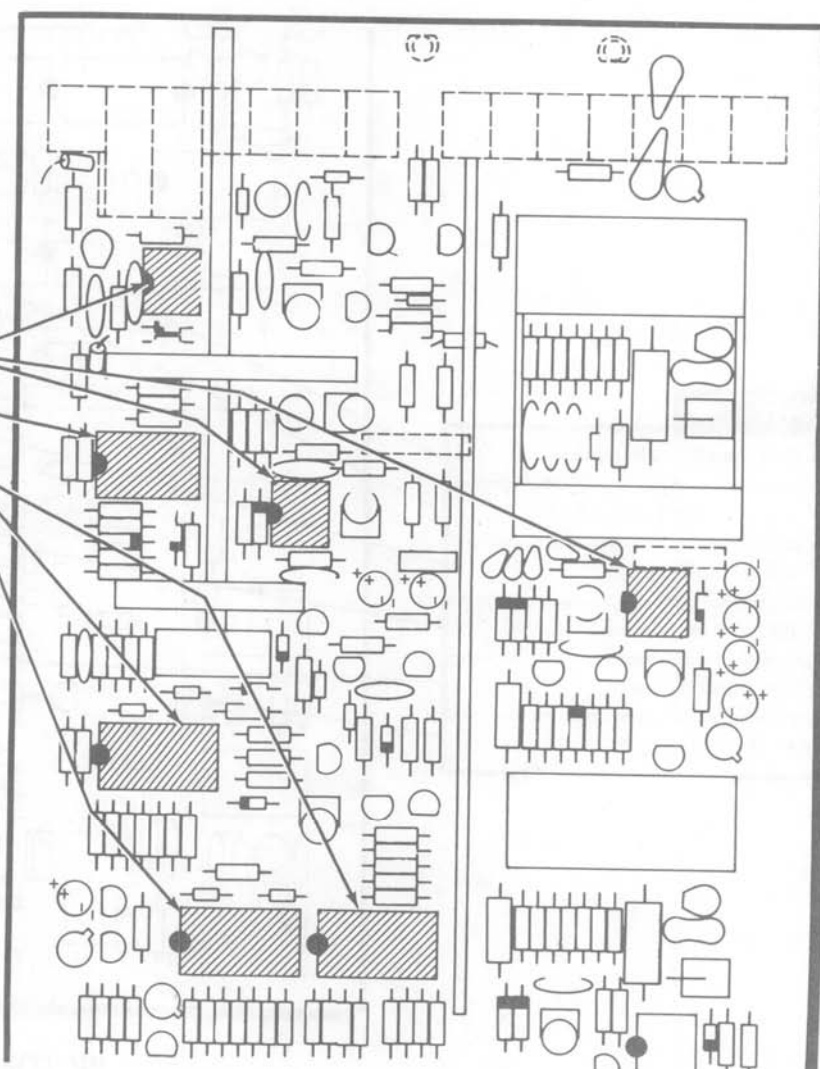
PART
NUMBER

IDENTIFICATION
DRAWING

START

Refer to Figure 1 (Illustration Booklet, Page 1) when you install the following IC sockets.

- () Three 8-pin IC sockets.
- () One 14-pin IC socket.
- () Three 16-pin IC sockets.



PICTORIAL 6-13

The steps performed in this Pictorial are in this area of the circuit board.

IDENTIFICATION
DRAWING

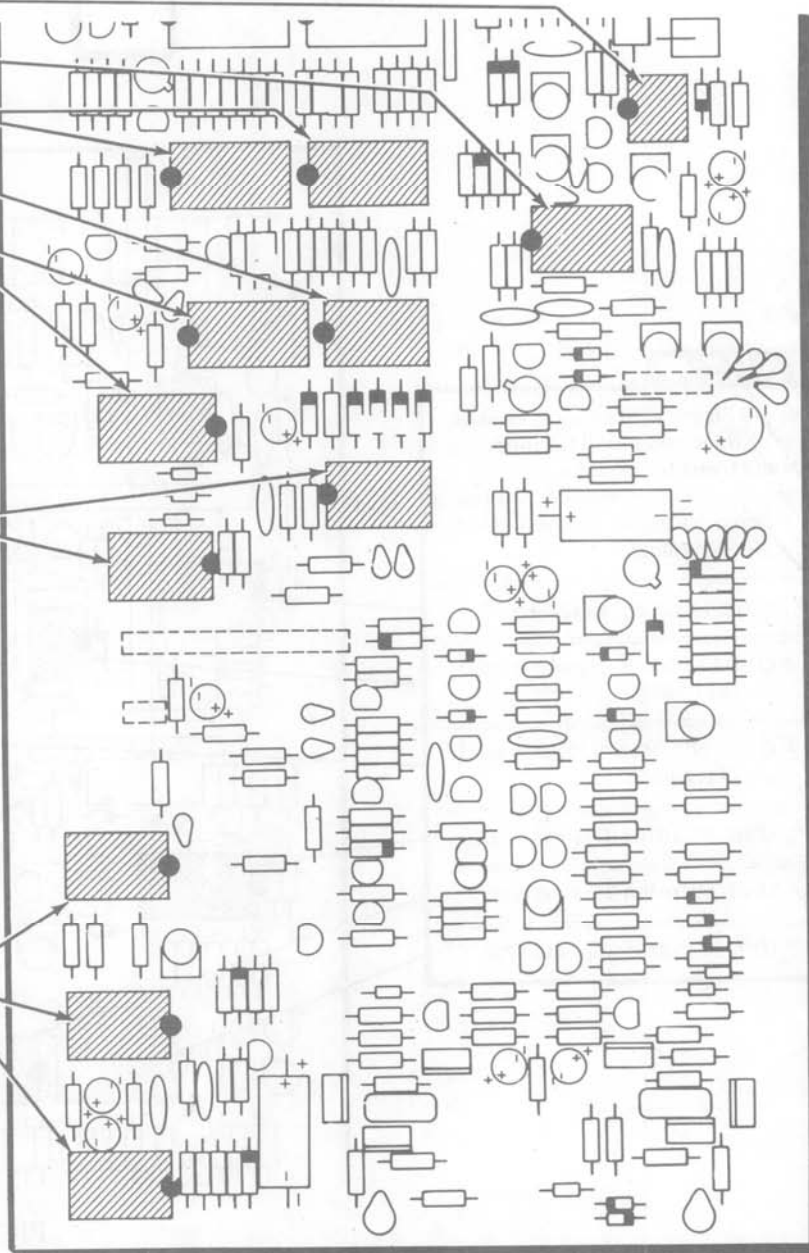
PART
NUMBER

START →

- () One 8-pin IC socket.
- () One 14-pin IC socket.
- (✓) Two 16-pin IC sockets.
- () One 14-pin IC socket.
- () Two 16-pin IC sockets.

- () Two 14-pin IC sockets.

- () Three 14-pin IC sockets.



PICTORIAL 6-14

The steps performed in this Pictorial are in this area of the circuit board.

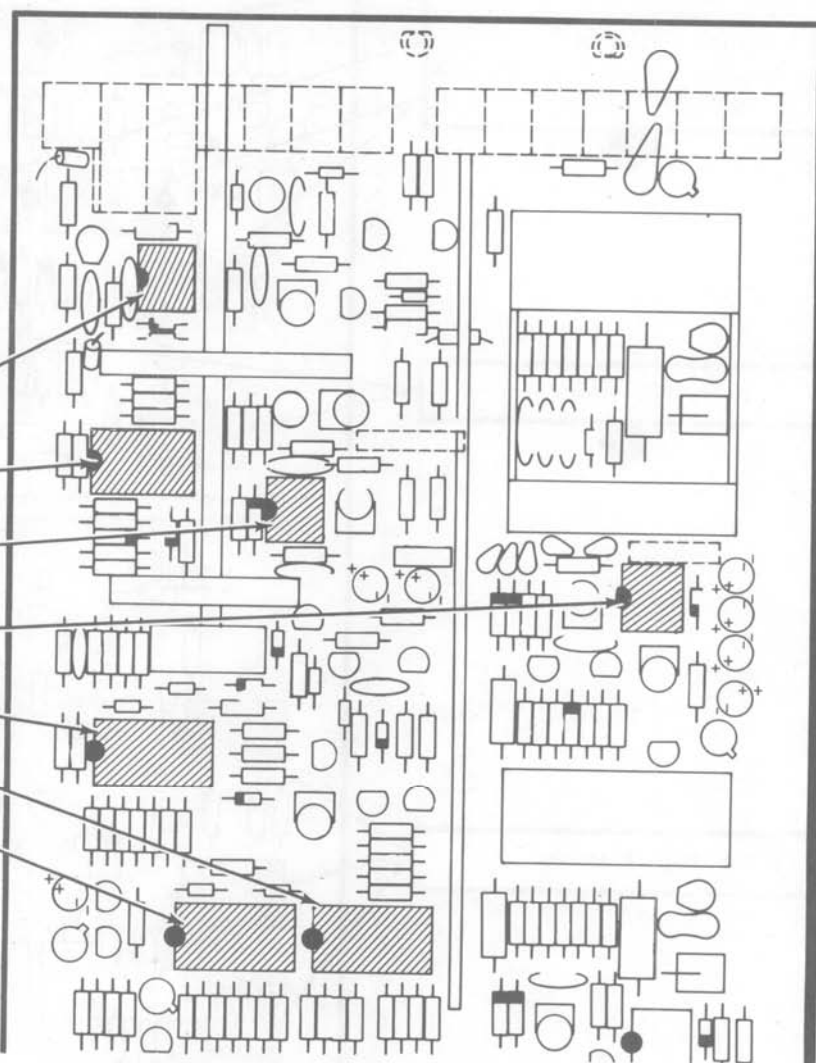
PART
NUMBER

IDENTIFICATION
DRAWING

START

Refer to Figure 1 (Illustration Booklet, Page 1) when you install the following IC's and transistor modules.

- () Q701: NPD5566 transistor module (#417-902).
- () U716: LF347 IC (#442-742).
- () Q705: NPD5566 transistor module (#417-902).
- () Q721: NPD5566 transistor module (#417-902).
- () U702: MC10102 IC (#443-683).
- () U701: MC10116 IC (#443-636).
- () U703: MC10131 IC (#443-679).



PICTORIAL 6-15

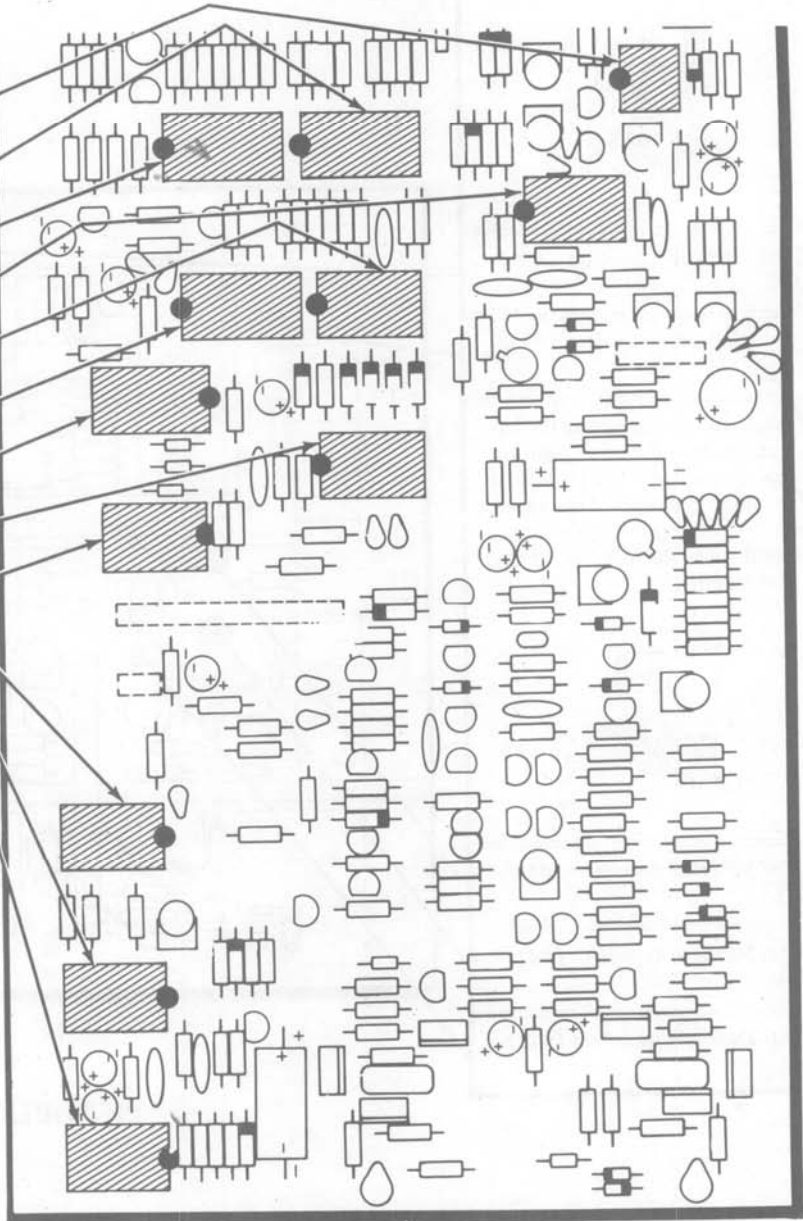
The steps performed in this Pictorial are in this area of the circuit board.

PART
NUMBER

IDENTIFICATION
DRAWING

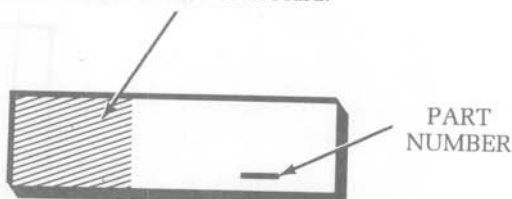
START

- () Q731: NPD5566 transistor module (#417-902).
- () U705: MC10105 IC (#443-765).
- () U704: MC10105 IC (#443-765).
- () U715: SN74132 IC (#443-625).
- () U706: SN7413 IC (#443-44).
- () U708: SN74LS123 IC (#443-942).
- () U709: SN7476 IC (#443-16).
- () U707: SN7400 IC (#443-1).
- () U711: SN7400 IC (#443-1).
- () U713: SN7408 IC (#443-45).
- () U712: SN7400 IC (#443-1).
- () U714: SN7400 IC (#443-1).



PICTORIAL 6-16

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

START

Position the circuit board as shown in the Identification Drawing

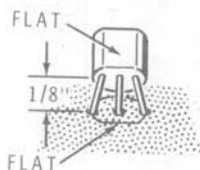
NOTE: When you install the next two transistors, position the tab over the outline of the tab on the circuit board. Then insert the leads into the circuit board holes and solder them to the foil. Cut off the excess lead lengths.



() Q728: 2N2369 transistor (#417-154).

() Q719: 2N2369 transistor (#417-154).

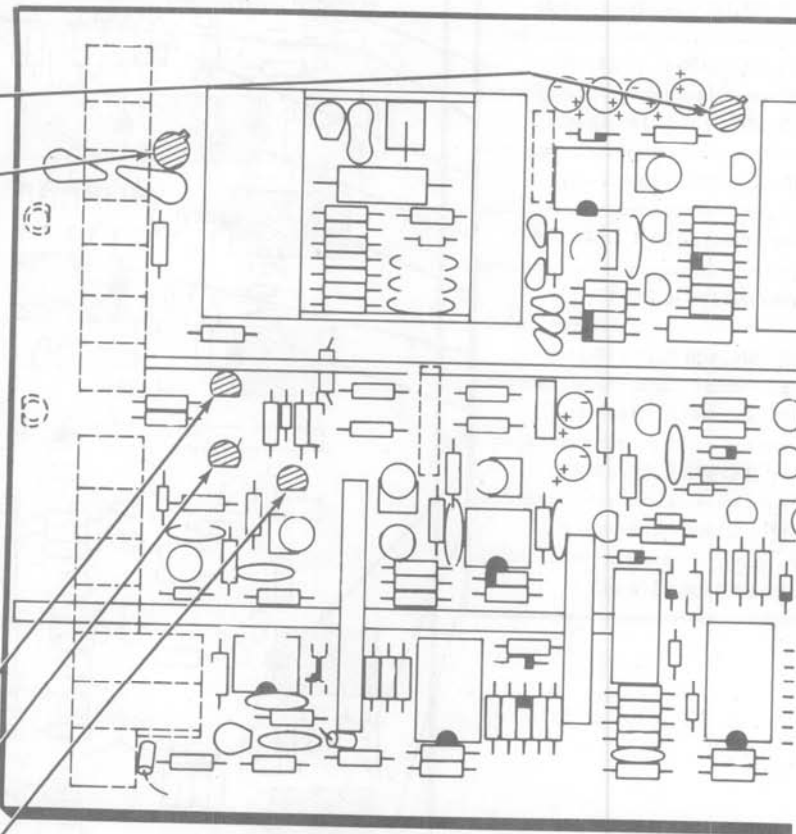
NOTE: When you install each of the following transistors and diodes, position the flat on the part over the outline of the flat on the circuit board. Then insert the leads into the circuit board holes and solder them to the foil. Cut off any excess lead lengths.



() Q704: MPSH10 transistor (#417-887).

() Q703: MPSH10 transistor (#417-887).

() Q702: 2N4258A transistor (#417-260).



PICTORIAL 6-17

The steps performed in this Pictorial are in this area of the circuit board.

START ➔

() Q729: 2N5458 transistor (#417-291).

() Q722: 2N4121 transistor (#417-235).

NOTE: As you install the next transistor, slide a ferrite bead onto the indicated lead as shown. Push the transistor all the way down to the top of the bead.



() Q761: 2N3904 transistor (#417-875).

() Q711: 2N4258A transistor (#417-260).

() Q712: 2N4258A transistor (#417-260).

() Q707: 2N5770 transistor (#417-293).

() Q708: 2N5770 transistor (#417-293).

() Q706: 2N5770 transistor (#417-293).

() Q709: 2N5770 transistor (#417-293).

() Q713: 2N4258A transistor (#417-260).

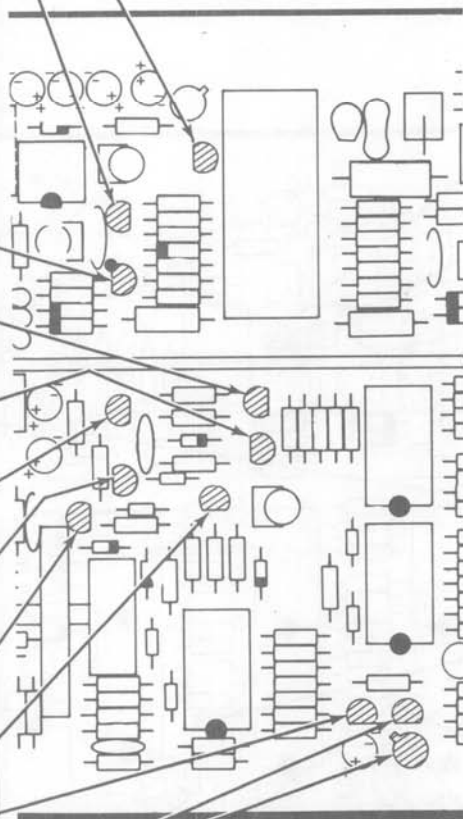
() Q714: 2N4258A transistor (#417-260).

() Q715: 2N2369 transistor (#417-154). Note the installation instructions at the top of the preceding page.



PART
NUMBER

IDENTIFICATION
DRAWING



PICTORIAL 6-18

The steps performed in this Pictorial are in this area of the circuit board.



PART
NUMBER

IDENTIFICATION
DRAWING

START →

NOTE: As you install the next transistor, slide a ferrite bead onto the indicated lead as shown. Push the transistor all the way down to the top of the bead.



() Q762: 2N3904 transistor (#417-875).

() Q732: 2N4121 transistor (#417-235).

() Q725: 2N3906 transistor (#417-874).

() Q726: 2N4258A transistor (#417-260).

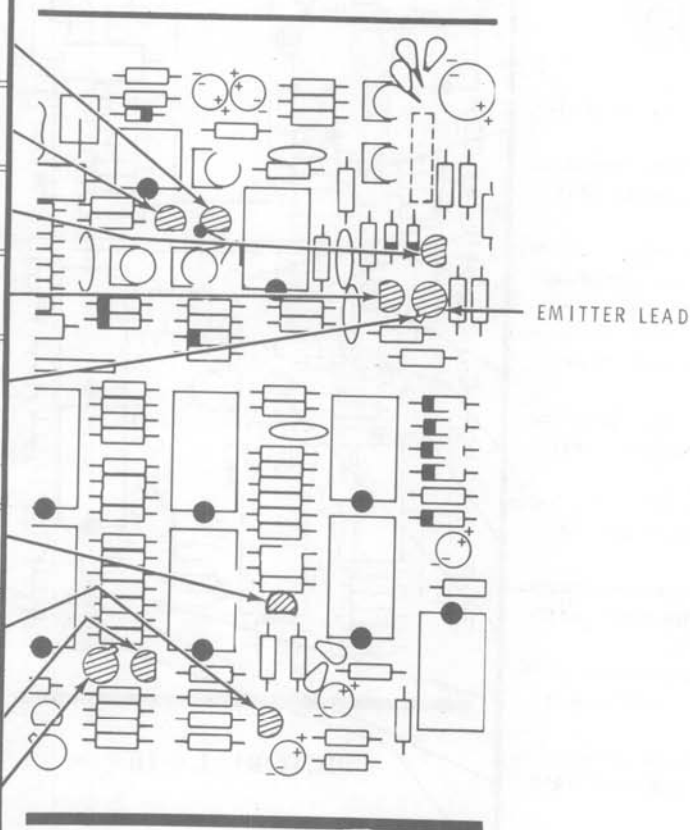
() Q727: 2N2369 transistor (#417-154). NOTE: Check the indicated lead of this transistor; it must **not** touch the adjacent resistor. Reposition the body of the resistor slightly, if necessary.

() Q763: 2N3904 transistor (#417-875).

() Q716: 2N4121 transistor (#417-235).

() Q718: 2N4121 transistor (#417-235).

() Q717: 2N2369 transistor (#417-154).



PICTORIAL 6-19

The steps performed in this Pictorial are in this area of the circuit board.

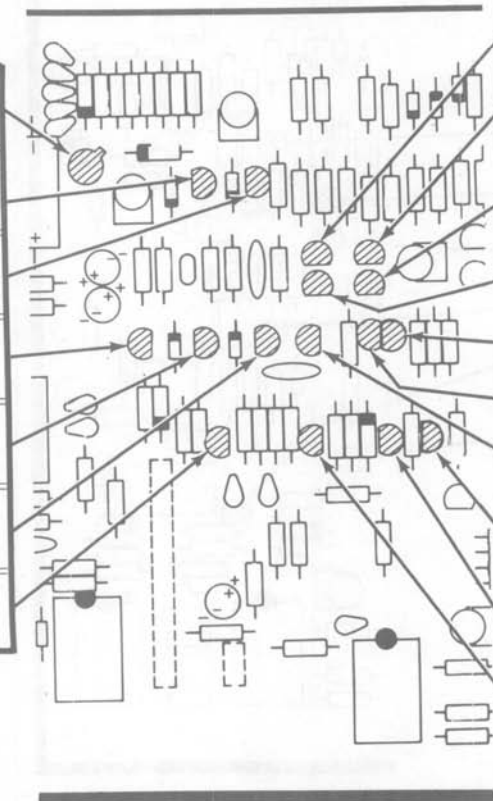
PART
NUMBER



IDENTIFICATION
DRAWING

START

- (✓) Q733: 2N2369 transistor (#417-154).
- (✓) Q741: MPSH10 transistor (#417-887).
- () Q738: MPSH10 transistor (#417-887).
- () Q737: MPSH10 transistor (#417-887).
- () Q742: MPSH10 transistor (#417-887).
- () Q739: MPSH10 transistor (#417-887).
- () Q736: 2N4121 transistor (#417-235).



CONTINUE

- () Q743: MPSH10 transistor (#417-887).
- () Q745: MPSH81 transistor (#417-917).
- () Q746: MPSH81 transistor (#417-917).
- () Q744: MPSH10 transistor (#417-887).
- () D738: MBD101 diode (#56-670).
- () D737: MBD101 diode (#56-670).
- () Q735: MPSH10 transistor (#417-887).
- () Q758: 2N4121 transistor (#417-235).
- () Q759: 2N3904 transistor (#417-875).
- () Q734: 2N4121 transistor (#417-235).

PICTORIAL 6-20

IDENTIFICATION
DRAWING

The steps performed in this Pictorial are in this area of the circuit board.

PART
NUMBER

START ↓

Install five 2N5770 transistors (#417-293) in the following steps.

() Q749:

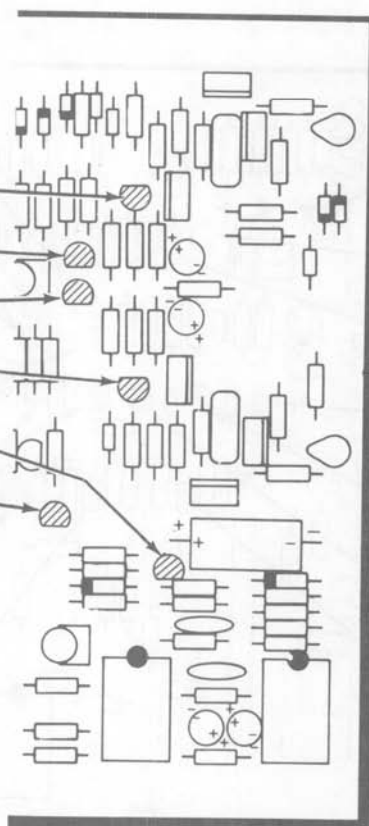
() Q747:

() Q748:

() Q751:

() Q723:

() Q724: 2N4258A transistor (#417-260).



PICTORIAL 6-21

IDENTIFICATION
DRAWING

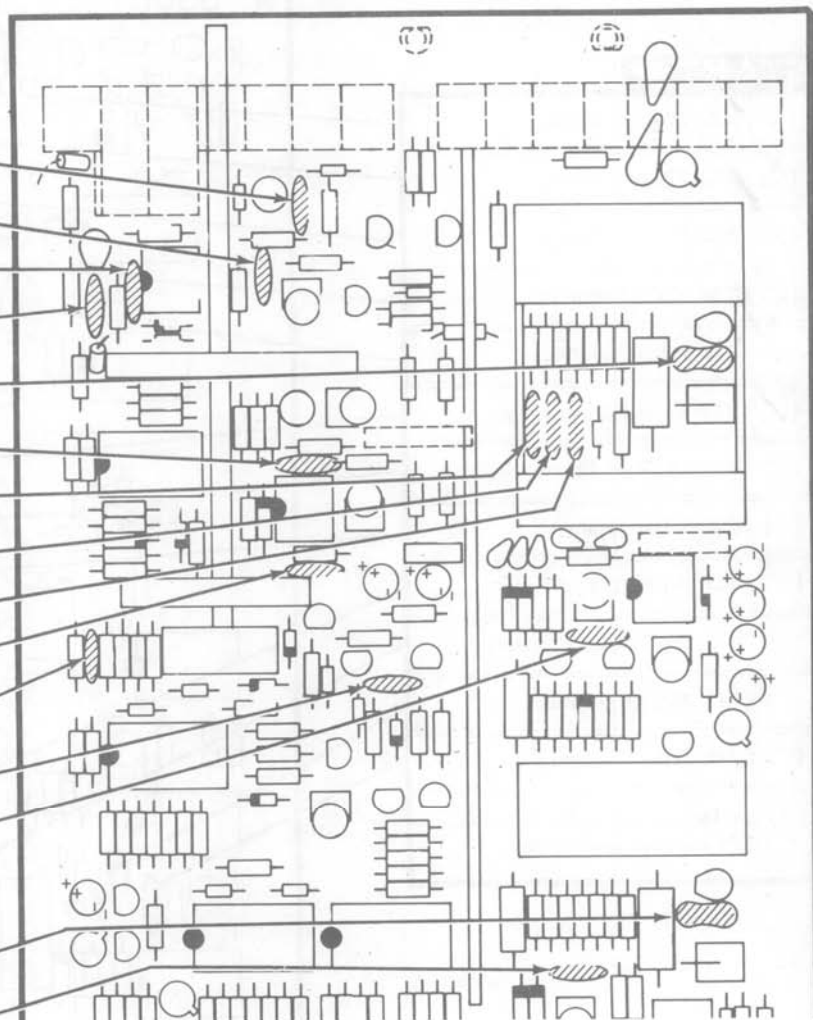
PART
NUMBER

The steps performed in this Pictorial
are in this area of the circuit board.

START →

Position the circuit board as shown in
the Identification Drawing.

- () C713: 56 pF ceramic.
- () C704: 56 pF ceramic.
- (✓) C703: .001 μ F ceramic.
- (✓) C702: 220 pF ceramic.
- (✓) C725: 47 pF mica.
- (✓) C711: .001 μ F ceramic.
- () C735: .001 μ F ceramic.
- (✓) C736: 270 pF ceramic.
- () C737: 100 pF (100 k) ceramic.
- (✓) C715: 56 pF ceramic.
- () C789: 100 pF (100 k) ceramic.
- () C716: 27 pF ceramic.
- (✓) C727: 100 pF (100 k) ceramic.
NOTE: The callout for this capacitor
may be partially concealed by
the adjacent control.
- () C756: 47 pF mica.
- () C758: 100 pF (100 k) ceramic.
- () Solder the leads to the foil and cut
off the excess lead lengths.



PICTORIAL 6-22

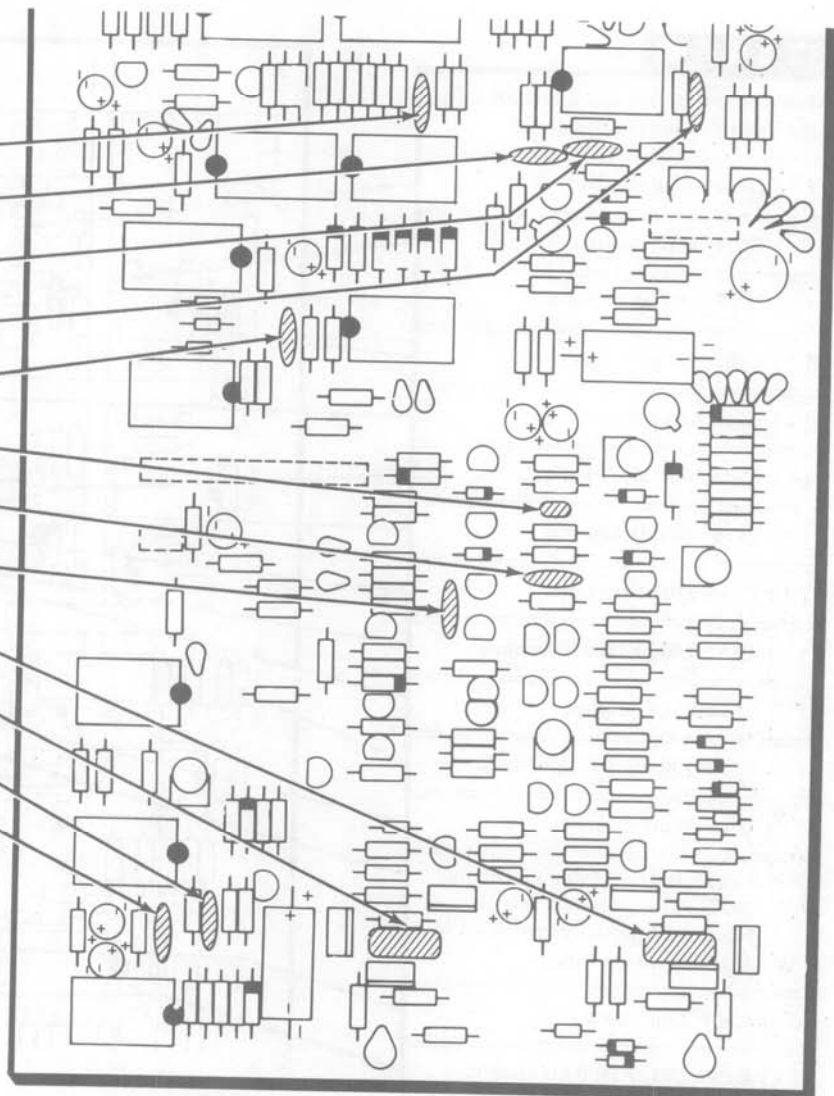
IDENTIFICATION
DRAWING

PART
NUMBER

The steps performed in this Pictorial
are in this area of the circuit board.

START →

- () C722: 270 pF ceramic.
- () C753: 270 pF ceramic.
- () C752: 180 pF ceramic.
- () C748: .002 μ F ceramic.
- () C728: 270 pF ceramic.
- () C761: 82 pF (820) ceramic.
- () C759: 15 pF (15 k) ceramic.
- () C707: 3.3 pF ceramic.
- () C767: .1 μ F (.1 k) polyester.
- () C771: .1 μ F (.1 k) polyester.
- () C741: .002 μ F ceramic.
- () C742: .002 μ F ceramic.
- () Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 6-23

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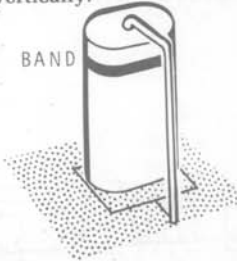
START

() C714: 10 μ F, 10V nonpolarized electrolytic. This capacitor can be installed either way.

() C724: .01 μ F (10000 pF)(103) polystyrene.

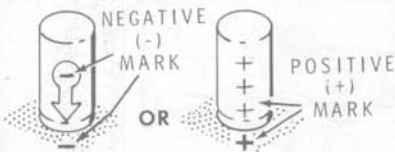
() C723: 1 μ F Mylar. Mount this capacitor vertically.

BAND



() C786: 10 μ F, 10V nonpolarized electrolytic. This capacitor can be installed either way.

NOTE: When you install electrolytic capacitors, always match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board OR match the minus (-) mark on the capacitor with the minus (-) mark on the circuit board.



() C783: 10 μ F, 35V electrolytic.

() C794: 10 μ F, 35V electrolytic.

() C731: 10 μ F, 35V electrolytic.

() C732: 1 μ F, 50V electrolytic.

() C776: 10 μ F, 35V electrolytic.

() C779: 10 μ F, 35V electrolytic.

() C718: 39 μ F electrolytic.

() C755: .01 μ F (10,000 pF) polystyrene.

(103)

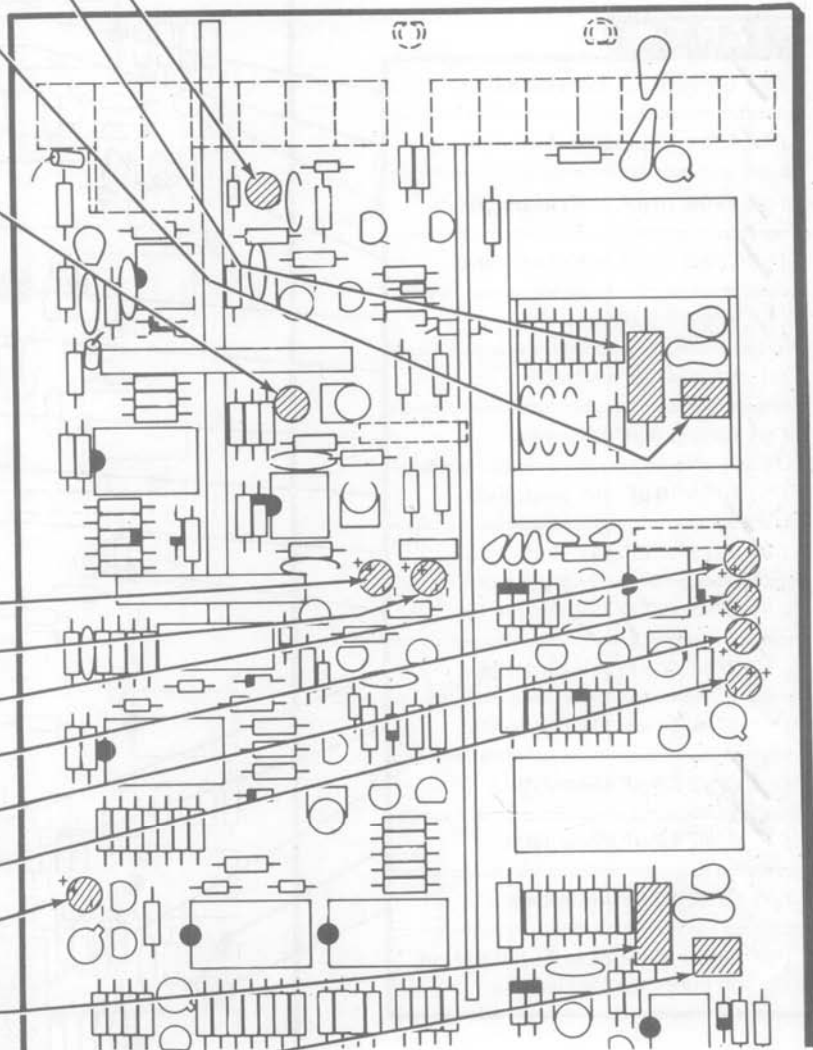
() C754: 1 μ F Mylar. Mount this capacitor vertically.

() Solder the leads to the foil and cut off the excess lead lengths.

IDENTIFICATION
DRAWING

PART
NUMBER

The steps performed in this Pictorial are in this area of the circuit board.



PICTORIAL 6-24

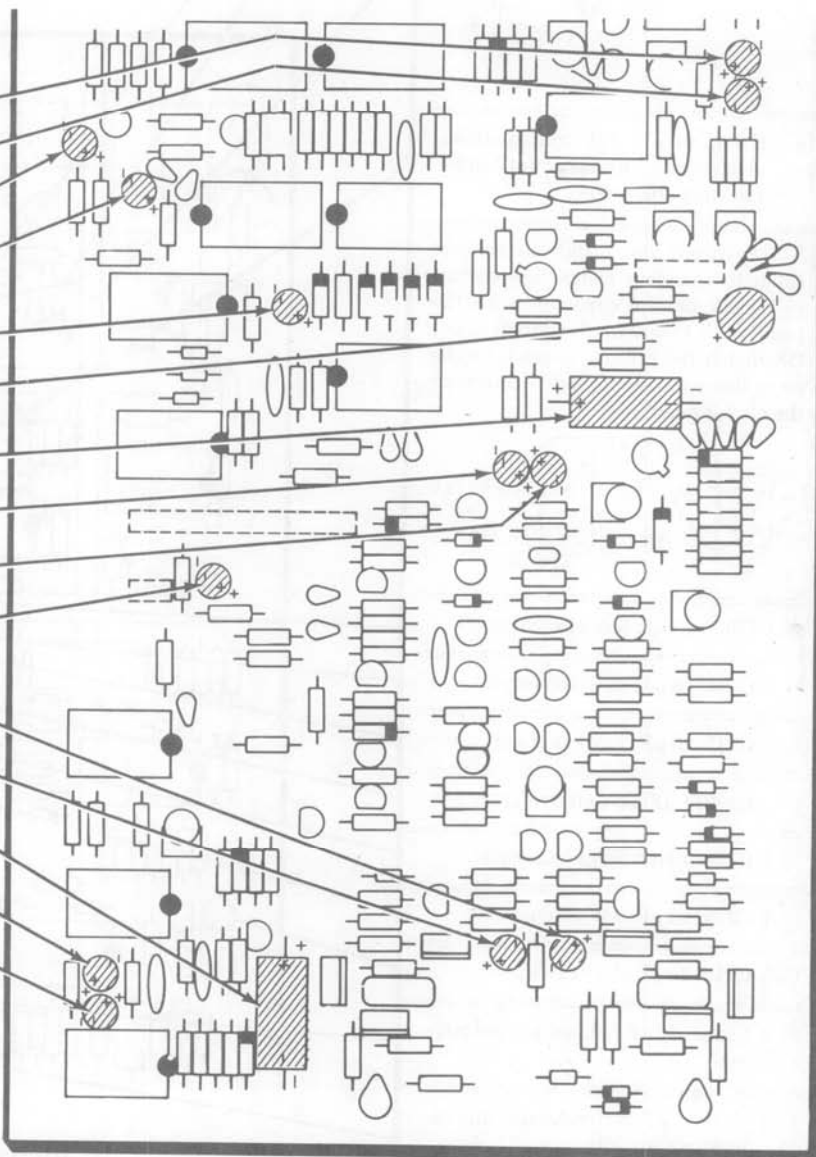
IDENTIFICATION
DRAWING

PART
NUMBER

The steps performed in this Pictorial
are in this area of the circuit board.

START →

- () C777: 10 μ F, 35V electrolytic.
- () C781: 10 μ F, 35V electrolytic.
- () C792: 10 μ F, 35V electrolytic.
- () C782: 10 μ F, 35V electrolytic.
- () C729: 2.2 μ F electrolytic.
- () C751: 47 μ F electrolytic.
- () C795: 1.5 μ F electrolytic.
- () C778: 10 μ F, 35V electrolytic.
- () C775: 10 μ F, 35V electrolytic.
- () C793: 10 μ F, 35V electrolytic.
- () C768: 10 μ F, 35V electrolytic.
- () C774: 10 μ F, 35V electrolytic.
- () C791: 1.5 μ F electrolytic.
- () C739: 4.7 μ F electrolytic.
- () C738: 4.7 μ F electrolytic.
- () Solder the leads to the foil and cut off the excess lead lengths.



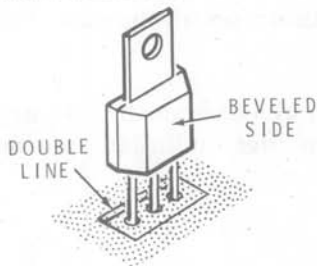
PICTORIAL 6-25

IDENTIFICATION
DRAWING

The steps performed in this Pictorial are in this area of the circuit board.

START

NOTE: When you install the following transistors, place the beveled side of the transistors AWAY from the double line of the outline on the board. Insert the leads as far as they will go into the holes. Solder the leads to the foil and cut off the excess lengths.



() Q752: MDS-21 (#417-947).

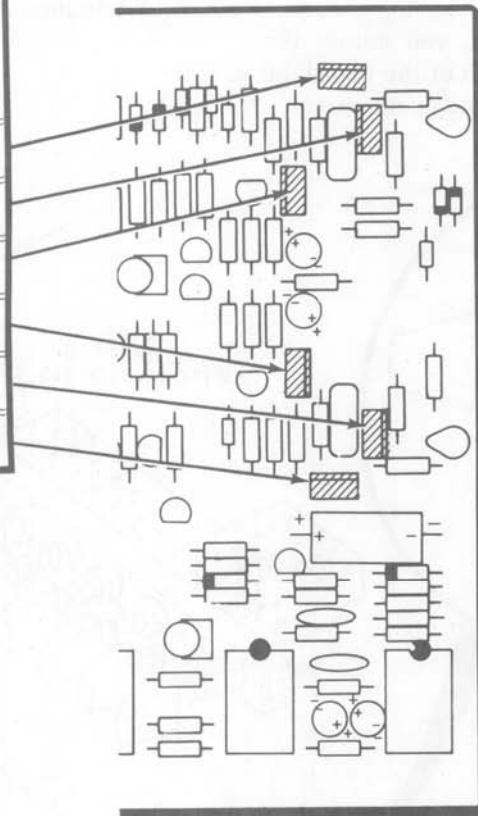
() Q754: MDS-60 (#417-948).

() Q755: MDS-21 (#417-947).

() Q756: MDS-21 (#417-947).

() Q757: MDS-60 (#417-948).

() Q753: MDS-21 (#417-947).

PART
NUMBER

PICTORIAL 6-26

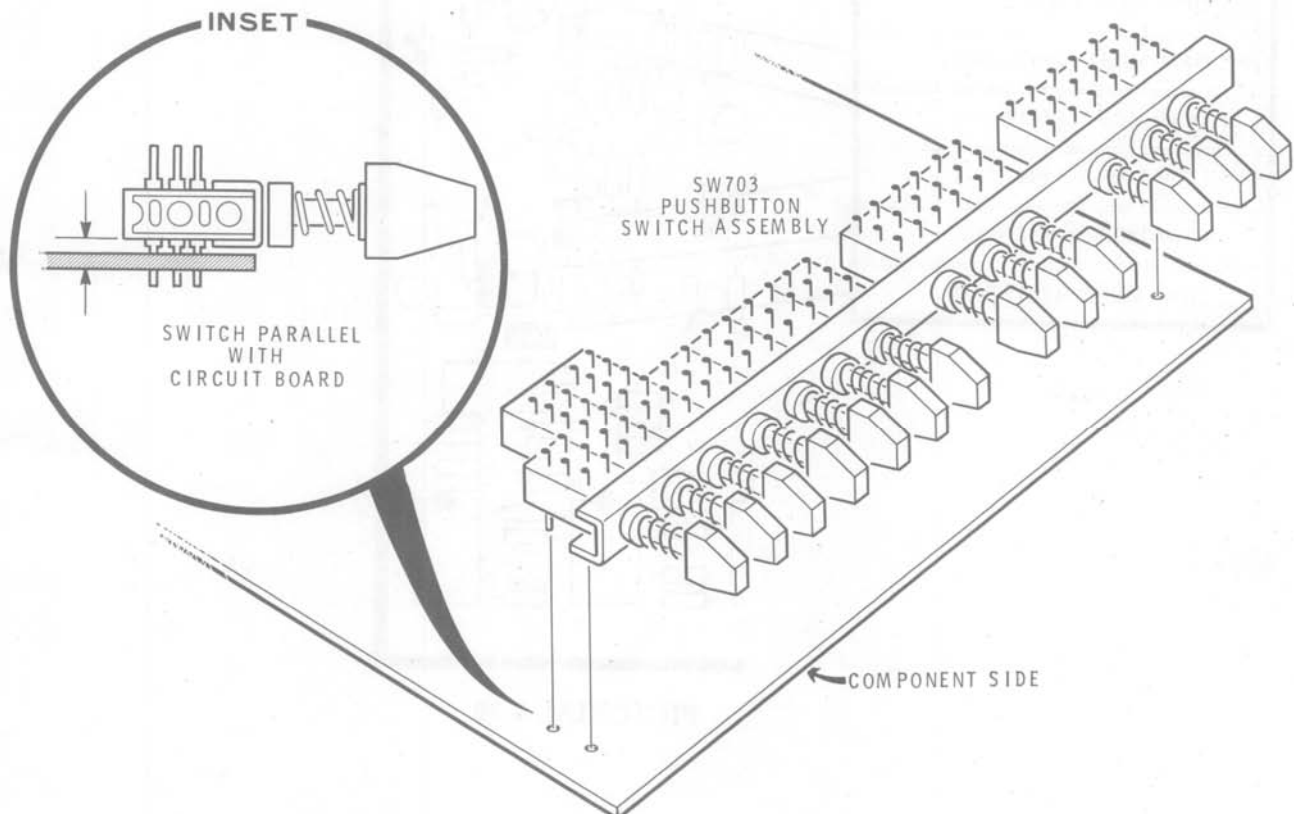
Refer to Pictorial 6-27 (Illustration Booklet, Page 18) for the following steps.

- () Position the circuit board with the component side down as shown.
- () SW703: Install the pushbutton switch assembly (#64-897) on the circuit board as follows. Refer to Detail 6-27A.

1. Make sure all of the switch pins are straight.
2. Carefully insert all the switch pins into their mounting holes.
3. Push the assembly onto the circuit board. Make sure the crimped portion of each pin is fully seated against the circuit board.
4. Check the switch assembly to make sure it is parallel with the board as shown in the inset drawing.

5. Turn the board over and, on the component side, solder one pin on each end and at the middle of the switch assembly.
 6. Turn the board over again and check the switch to make sure the assembly is still parallel. Turn the board over and solder the remaining pins to the component-side foils. Be sure the solder "wicks" onto each switch pin at the small foil pads.
- () Turn the circuit board component-side down.
 - () Insert the short end of a PCB pin into hole AA on the foil side of the board. Solder the pin to the foil.
 - () In the same manner, install the other PCB pin in hole BB.
 - () Refer to the Pictorial and cut all of the exposed top pins from the indicated pushbutton switches.

NOTE: In the following steps, as you solder the switch pins on the component side of the board, be careful not to heat and damage any adjacent parts.



Detail 6-27A

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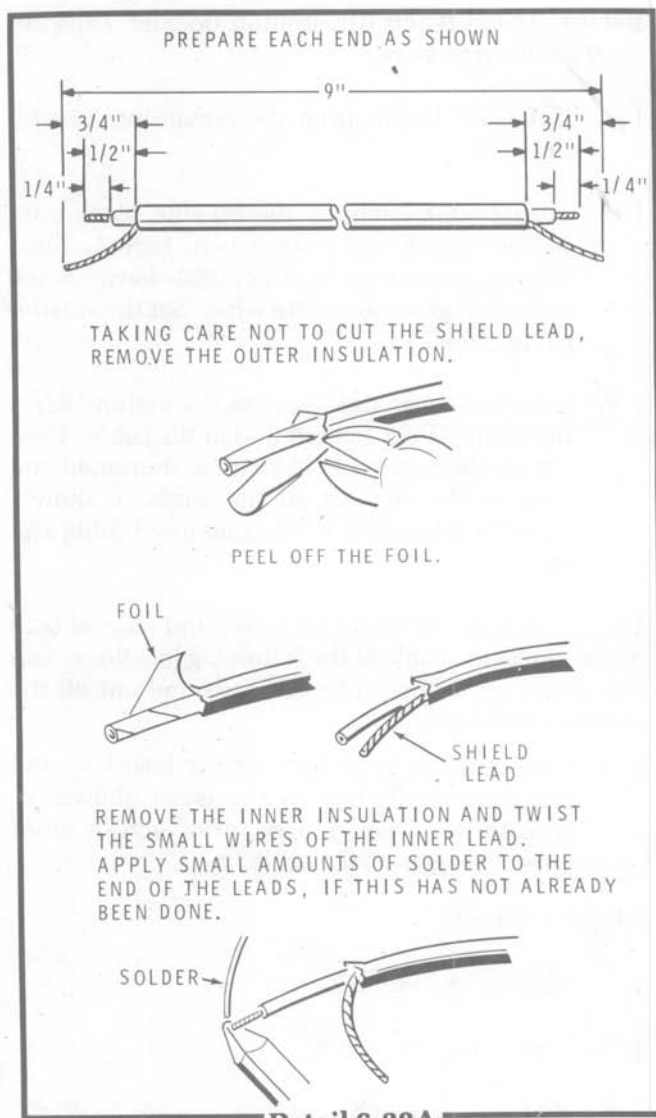
When you install the following plugs on the back of the board, insert the short pins into the board and solder them to the **component-side** foil.

- () Pull pin 3 from a 7-pin right-angle plug.
- () P701: Install the prepared 6-pin right-angle plug.
- () Cut off one end pin from **two** 7-pin right-angle plugs as shown in the inset drawing.
- () P703: Install one of the 6-pin right-angle plugs.
- () P704: Install the remaining 6-pin right-angle plug. NOTE: Check the component-side screen to make sure this plug is in the correct holes.
- () Cut pin 6 from right-angle plugs P703 and P704.
- () P702: Pull pin 6 from a 15-pin plug. Install the 15-pin plug at P702 as shown.
- () P705: Cut off one end pin from the 4-pin plug. Then install the plug.
- () Push a 2-hole jumper socket onto P704 pins 1 and 2 as shown.
- () D707: Cut two 1/2" lengths of small sleeving and place them on the leads of a NSL5076A LED (#412-637). Mount the LED vertically with the flat side **toward the rear** of the board at D707. Solder the leads to the component-side foil and cut off the excess lead lengths. Sharply bend the LED so its leads are parallel to the surface of the board as shown.
- () D747: Similarly install the other NSL5076A LED (#412-637). However, mount the LED with the flat **toward the front edge** of the board.

Refer to Pictorial 6-28 (Illustration Booklet, Page 19) for the following steps.

- () Refer to Detail 6-28A and prepare both ends of two 9" AMW style 1435 shielded cable.

Connect the cables to the component side of the circuit board in the following steps. Use 1/2" of small sleeving on the shield leads. Solder the leads to the underside foils and cut off the excess lead lengths.



Detail 6-28A

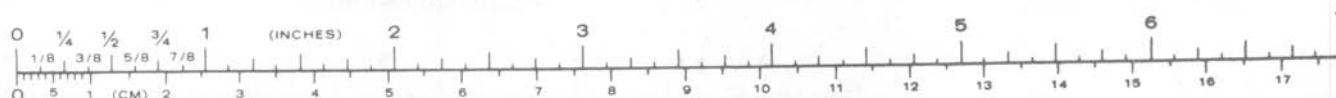
NOTE: At EE and FF, solder the leads to the component side foils as necessary.

EITHER CABLE:

- () Inner lead at one end of the cable in hole EE. Shield lead in hole FF.
- () Inner lead at the other end of the cable in hole CC. Shield lead in hole DD.

OTHER CABLE:

- () Inner lead at one end of the cable in hole R. Shield lead in hole S.
- () Inner lead at the other end of the cable in hole T. Shield lead in hole U.



Refer to Detail 6-28B (Illustration Booklet, Page 20) for the following steps.

- ☐ Cut a 14" length from the remaining 25-wire flat cable.
- ☐ Position the cable so the outside black wire is toward the top as shown in Part A. Then separate the entire length of cable between the indicated green and blue wires. Set the smaller cable aside.
- ☐ Refer to Part B and separate the various wires measuring from the **left** end of the cable. Then cut off the wires that have to be shortened and prepare the ends of all the wires as shown. Save the leftover 8" black-brown-red cable segment.

Position the circuit board as shown in Pictorial 6-28 and connect the cable at the following locations. Solder the wires to the underside foils and cut off the excess wire lengths.

- ☐ Place the cable on the circuit board so the breakouts come out in the areas shown. A "breakout" is where a group of one or more wires comes from the cable.

BREAKOUT #1:

- ☐ Black wire in hole V.
- ☐ Brown wire in hole W.
- ☐ Red wire in hole X.

BREAKOUT #2:

- ☐ Orange wire in hole K.
- ☐ Yellow wire in hole L.
- ☐ Green wire in hole M.

BREAKOUT #3:

- ☐ Blue wire in hole O.
- ☐ Violet wire in hole Q.
- ☐ Gray wire in hole P.
- ☐ White wire in hole N.
- ☐ Black wire in hole Z.

BREAKOUT #4:

- ☐ Brown wire in hole Y.

BREAKOUT #5:

- ☐ Red wire in hole G.
- ☐ Orange wire in hole F.

BREAKOUT #6:

- ☐ Yellow wire in hole I.
- ☐ Green wire in hole H.

Refer to Pictorial 6-29 (Illustration Booklet, Page 21) for the following steps.

- ☐ Position the circuit board as shown.

You will install the rotary switches next; to install them use the following procedure:

1. Make sure all of the wafer pins are straight.
 2. Carefully insert all of the wafer pins into their mounting holes.
 3. Make sure all of the wafers are completely seated against the board.
 4. Turn the board over and tack-solder one rear-corner pin to the foil, and one front-corner pin, diagonal to the soldered rear pin.
- ☐ SW702/R728: Install the rotary switch assembly.

Refer to Detail 6-29A for the following steps.

- ☐ Cut two 1-5/8" pieces of black tape. Place a piece of tape on the lower front of switches SW701 and SW704 as shown. Press half the tape width on the vertical part of the switch; then form the other half onto the bottom surface.
- ☐ SW704: Install the single wafer rotary switch. Then turn the switch shaft fully counterclockwise as you view the switch from the shaft end. Tack-solder one rear-corner pin to the foil and one front-corner pin, diagonal to the soldered rear pin.



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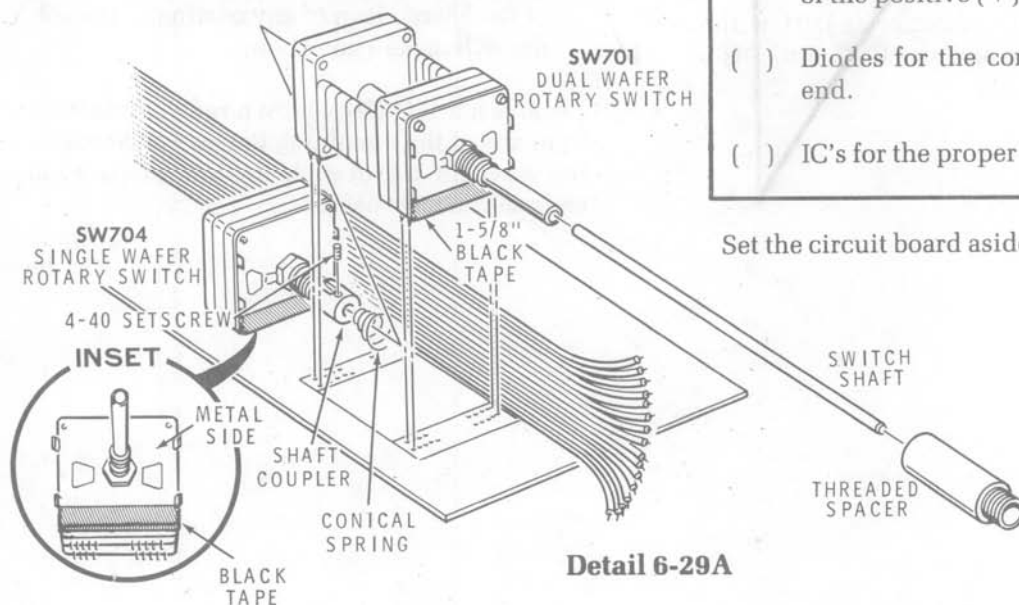
- () SW701: In the same manner, install the dual wafer rotary switch.
- () Push the switch shaft all the way through SW701 outer shaft and into the outer shaft of SW704.
- () Install the threaded spacer on the dual wafer rotary switch. Turn the spacer to 3/16" from the switch body.
- () Refer to Detail 6-31A on Page 7-37 and temporarily mount the front panel (without other components installed) onto the switch assemblies as shown. Secure the shafts with two control nuts. Be sure the two LEDs are positioned into their front panel holes.
- () Slightly readjust the threaded spacer so the front panel is exactly parallel to the front edge of the board.
- () Check to be sure all switches and controls operate freely. If they do not, unsolder the switch pins and readjust the switch position until the switches operate freely. Then turn the circuit board over and solder all the switch pins to the foil.
- () Remove the control nuts and front panel from the switches and set them aside temporarily. Remove the switch shaft from the switches.
- () Locate the shaft coupler and start two 4-40 setscrews into the side holes in the coupler.
- () Place the coupler onto SW704 outer switch shaft so that one of the setscrews is visible from the top.
- () Locate the conical spring. Install the spring between the coupler and switch SW701. Position the larger portion of the spring on the switch shaft and toward SW701. Then compress the spring between the coupler and the switch.
- () Insert the switch shaft through the shaft of switch SW701, from the front panel, through the spring, the coupler, and switch SW704. Leave 1/8" of the shaft protruding from the back of switch SW704. Then tighten both setscrews.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- () Unsoldered connections.
- () Poor solder connections.
- () Solder bridges between foil patterns.
- () Protruding leads which could touch together.
- () Transistors for the proper type and installation.
- () Electrolytic capacitors for the correct position of the positive (+) or negative (-) marks.
- () Diodes for the correct position of the banded end.
- () IC's for the proper type and installation.

Set the circuit board aside temporarily.



Refer to Pictorial 6-30 (Illustration Booklet, Page 21) for the following steps.

The following parts will be mounted on the front panel.

NOTE: When you mount the following controls, make sure you position the lugs as shown in the Pictorial.

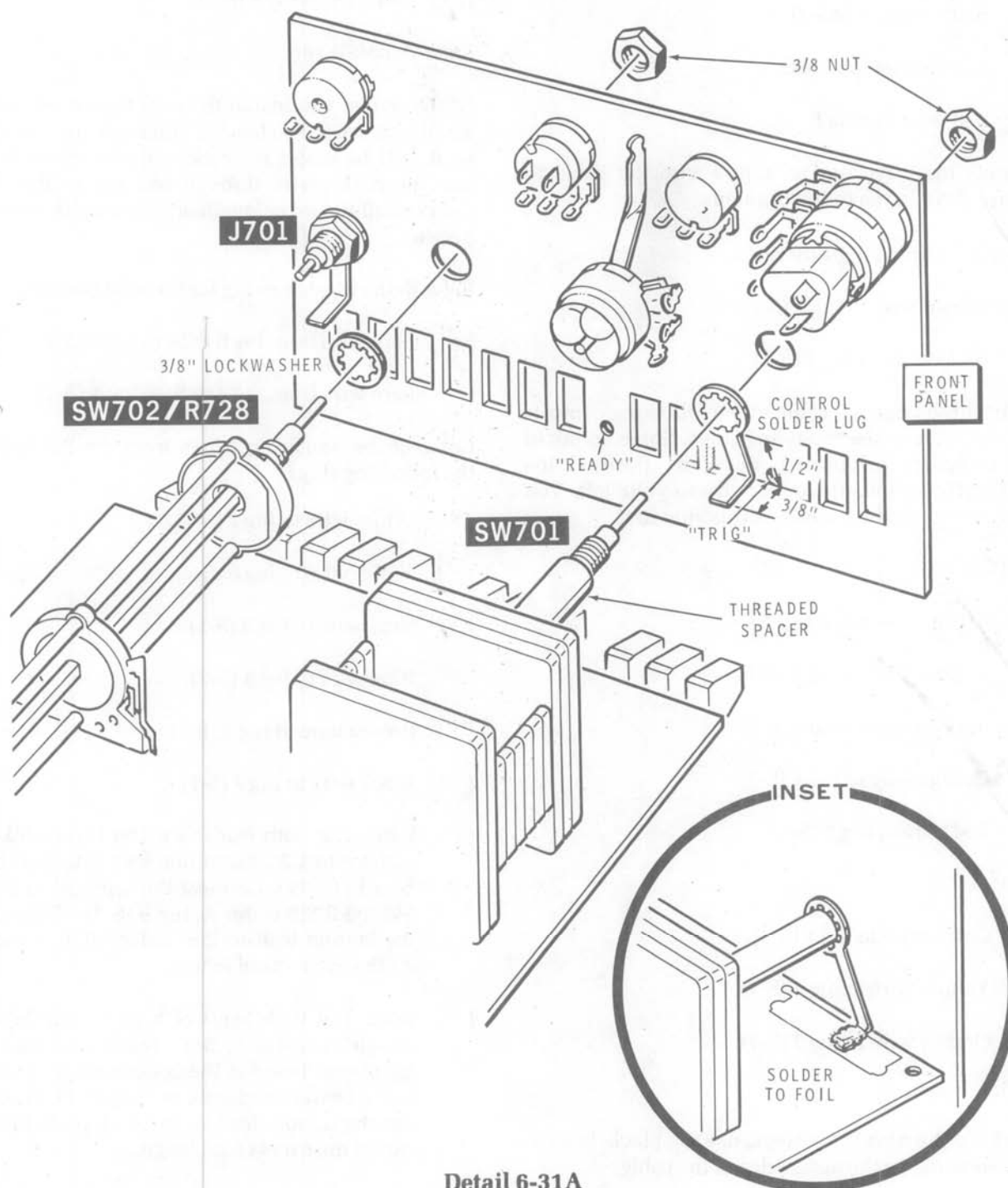
- () R718: Mount the 2000 Ω (2 K) control (#10-1186) with a 1/4" lockwasher and 1/4" nut.
- () R821/SW705: Mount the 10 k Ω control with switch (#19-749) with a 1/4" lockwasher and 1/4" nut.
- () R801: Mount a 10 k Ω control (#10-1202) with a 1/4" lockwasher and 1/4" nut.
- () R884/R885/SW706: Mount a 1000 Ω (1 K) dual control with switch (#19-757). Use a 3/8" control lockwasher and control 3/8" nut.
- () R851: Mount a 1000 Ω (1 K) control (#10-1187) with a control solder lug and 3/8" control nut. Position the solder lug at approximately the 1 o'clock position and bend it as shown in the inset drawing.
- () Locate another control solder lug and straighten it. Cut off 3/8" from the end. Then bend it at a 90° angle as shown at J701 where it will be used in the next step.
- () J701: Mount the BNC connector at J701 with the control solder lug and the BNC nut. Discard the BNC lockwasher.

Refer to Pictorial 6-31 (Illustration Booklet, Page 22) for the following steps.

Refer to Detail 6-31A for the next seven steps.

- () 1. Position the horizontal circuit board as shown.
- () 2. Locate a control solder lug and straighten it. Cut off 3/8" from the end. Then bend it at a 90° angle as shown.
- () 3. Place the control solder lug on the threaded spacer of switch SW701.
- () 4. Place a 3/8" control lockwasher on the shaft of switch SW702/R728.
- () 5. Place the front panel over the switch shafts and secure it with two 3/8" control nuts. Before you tighten the nut on SW701, make sure the control solder lug is positioned as shown. Also insert LED's D707 and D747 in panel holes TRIG and READY.
- () 6. Recheck and make sure the front panel and the edge of the board are parallel. Readjust the threaded spacer if necessary.
- () 7. Refer to the inset drawing, and solder this control solder lug and the one at J701 to the foil. Make sure the end of the solder lugs do not protrude over the edge of the foil pad and touch any other foil or connections. NOTE: If necessary, scrape this area of the board clean of any coating so the solder will make a good bond.
- () Remove a 5-1/4" black-brown-red combination from any of the remaining flat cables. Separate the wires for 1/2" at each end and prepare the ends as you have before.





Detail 6-31A

Connect one end of the cable to the circuit board at location R718 in the following steps. Solder the wires to the underside foil and cut off the excess wire lengths.

- ☐ Black wire to hole D.
- ☐ Brown wire to hole C.
- ☐ Red wire to hole B.

Connect the other end of this 3-wire flat cable to control R718 in the following steps.

- ☐ Red wire to lug 1 (S-1).
- ☐ Brown wire to lug 2 (S-1).
- ☐ Black wire to lug 3 (S-1).

Connect the large flat cable to the following controls and switches in the following steps. Some colors in this cable are duplicated; therefore, position the cable with the **outside green wire to your left**. You will connect the four wires on this side first.

R821/SW705:

- ☐ Green wire to lug 1 (S-1).
- ☐ Yellow wire to lug 2 (S-1).

Lug 3 has no connection to it.

- ☐ Orange wire to lug 4 (S-1).
- ☐ Red wire to lug 5 (S-1).

R851:

- ☐ Green wire to lug 1 (S-1).
- ☐ Yellow wire to lug 2 (S-1).
- ☐ Orange wire to lug 3 (S-1).

R801:

NOTE: In the next three steps, use the black, brown, and red wires on the **outer edge** of the cable.

- ☐ Black wire to lug 1 (S-1).
- ☐ Brown wire to lug 2 (S-1).
- ☐ Red wire to lug 3 (S-1).

R884/R885/SW706:

NOTE: When you install the next two wires, use the small bare wire. The lengths you need are very short, so it will be easier to work with the entire length and insert the wire through one lug to the other, then cut off the extra length after you solder the connection.

Refer to the inset drawing for the next two steps.

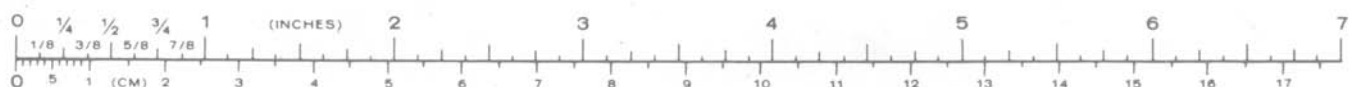
- ☐ Bare wire from lug 6 (NS) to lug 3 (S-1).
- ☐ Bare wire from lug 4 (NS) to lug 1 (S-1).

Connect the remaining wires from the flat cable in the following steps.

- ☐ White wire to lug 2 (S-1).
- ☐ Violet wire to lug 6 (S-2).
- ☐ Gray wire to lug 5 (S-1).
- ☐ Blue wire to lug 4 (S-2).
- ☐ Brown wire to lug 8 (S-1).
- ☐ Black wire to lug 7 (S-1).

- ☐ R993: Cut both leads of a 100 Ω (brn-blk-brn) resistor to 1/2". Insert one lead into the circuit board at R993. Connect the top lead to switch SW702/R728 wafer A, lug 9 (S-1). Then solder the bottom lead to the underside foil and cut off the excess lead length.

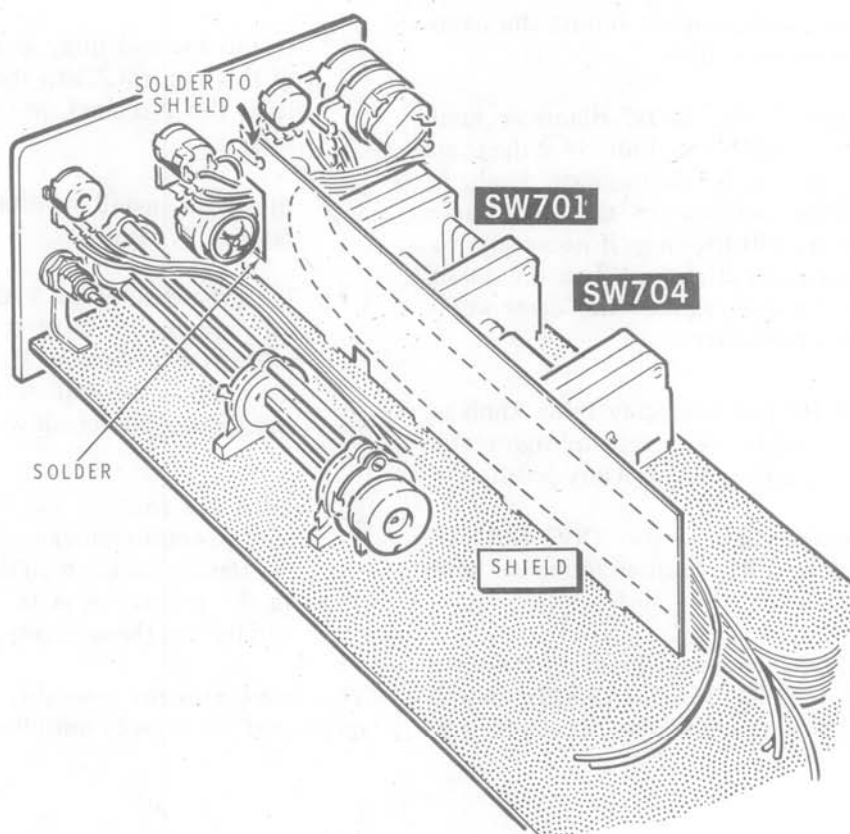
- ☐ R992: Cut both leads of a 10 Ω , 1% (brn-blk-blk-gld) resistor to 5/8". Insert one lead into the circuit board at R992. Connect the top lead to the center conductor of J701 (S-1). Then solder the bottom lead to the underside foil and cut off the excess lead length.



Refer to Pictorial 6-32 for the following steps.

- (/) Position the shield so the cutout is toward the front as shown. Then insert the five tabs into the circuit board holes near switches SW701 and SW704. Be sure to route the large flat cable and two shielded cables on the right side of the shield. The control solder lug should be on the left side of the shield. Turn the board over and solder the four tabs to the foil. Then solder the control solder lug to the shield, and the first shield tab to the component side of the board.

This completes the circuit board assembly. The knobs will be installed next.



PICTORIAL 6-32

KNOB INSTALLATION

Refer to Pictorial 6-33 for the following steps.

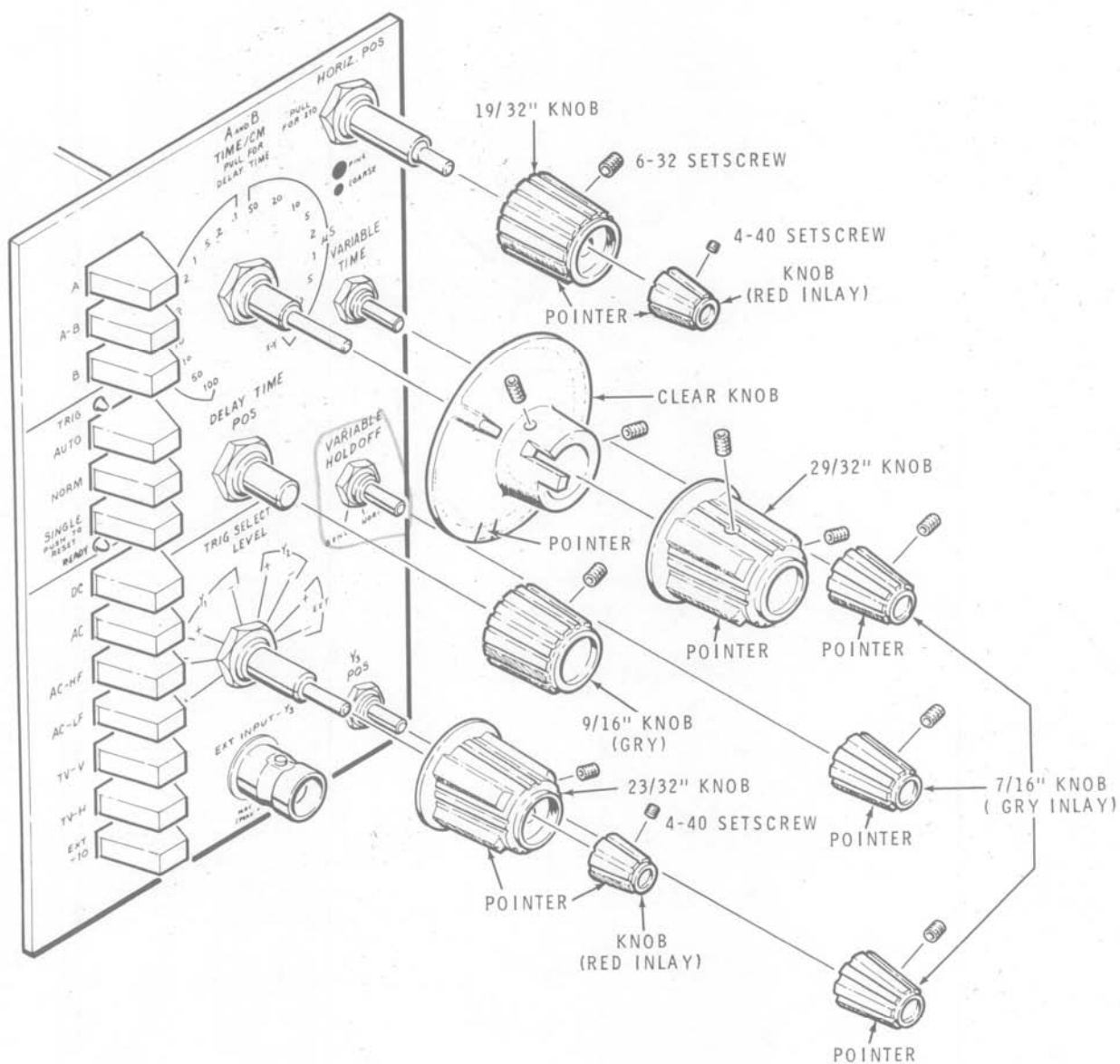
- () Start 4-40 setscrews into both red inlay knobs.
- () Start 6-32 setscrews into all of the remaining knobs. The clear knob and the 29/32" diameter knob will take two setscrews each.

NOTE: In the following steps, space the knobs just far enough from the panels so they do not rub.

- () Install the clear knob on the outer shaft of the A and B TIME/CM switch. Tighten one setscrew and turn the knob fully counterclockwise. Then loosen the setscrew, line up the pointer with number 100 on the panel and tighten both setscrews.
- () Similarly, mount the 29/32" diameter knob over the clear knob so its pointer is at the same position as the pointer on the clear knob. At this point, the notches on the two knobs should align and fit together. If necessary, rotate the outer knob slightly. When the 29/32" knob is all the way against the clear knob, tighten its two setscrews.
- () Install the 9/16" diameter gray inlay knob on the DELAY TIME POS control, and tighten the setscrew. The pointer can be at any position.
- () Turn the inner shaft of the TRIG SELECT/LEVEL switch fully counterclockwise with your fingers.
- () Install the 23/32" diameter knob on the outer shaft of the TRIG SELECT/LEVEL switch. Tighten the setscrew and turn the knob fully counterclockwise. Then loosen the setscrew, line up the pointer with positive (+) mark in the LINE position, and tighten the setscrew.
- () Install a red inlay knob on the inner shaft of the TRIG SELECT/LEVEL switch. Turn the knob so the pointer is at the 7 o'clock position, and tighten the setscrew.
- () Turn the inner and outer shafts of the HORIZ POS control fully counterclockwise with your fingers.
- () Install the 19/32" knob on the outer shaft of this control. Turn the knob so the pointer is at the 7 o'clock position, and tighten the setscrew.
- () Install the red inlay knob on the inner shaft of this control. Turn the knob so the pointer is at the 7 o'clock position, and tighten the setscrew.
- () Similarly install another gray inlay knob on control Y₃ POS.
- () Turn the shaft of the VARIABLE TIME control fully clockwise until it clicks. Install a gray inlay 7/16" diameter knob on the shaft, turn the knob so the pointer is at the CAL position, and tighten the setscrew.
- () Turn the shaft of the VARIABLE HOLDOFF control counterclockwise until it clicks. Install the remaining knob on the shaft, turn the knob so the pointer is at the B ENDS A position, and tighten the setscrew.

This completes the assembly of the horizontal circuit board. Set it aside until it is called for.

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PICTORIAL 6-33



CHASSIS

PARTS LIST

Unpack the remainder of the kit. Then check each part against the following list. The key numbers correspond to the numbers on the "Chassis Parts Pictorial" (Illustration Booklet, Pages 23 through 25).

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form supplied with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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ELECTRONIC COMPONENTS

A1	6-104-12	1	100 k Ω , 1/4-watt (brn-blk-yel) resistor	R1
A2	2-17	1	10 M Ω , 1/2-watt, 1% resistor	Test
A3	21-72	2	.005 μ F (5000 pF) ceramic capacitor	C1, C2
A4	41-9	1	Delay line	L2
A5	54-1028	1	Power transformer	T1
A6	411-870	1	D14651P31 CRT	V1

NOTE: Transistors may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

A7	417-195	2	MJE340 transistor	Q201, Q202
A8	421-23	1	1-ampere slow-blow fuse	F1
A9	422-1	1	Fuseholder	

56-45

1 IN 4747A Diode

D1

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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CONTROLS-SWITCHES

B1	10-1188	1	7.5 M Ω control	R365
B2	19-751	1	1000 Ω (1K) control w/switch	R364/SW1
B3	60-54	1	120/240 slide switch	SW2
B4	60-608	1	NOR/LOW slide switch	SW3

HARDWARE

NOTE: Hardware packets are marked to show the size of the hardware they contain (#4 HDW, #6 HDW, etc.). You may have to open more than one packet to locate all of the hardware of any one size (#6, for example).

#4 Hardware

C1	250-1410	4	4-40 \times 1/4" flat head screw	
C2	250-1414	43	4-40 \times 1/4" screw	
C3	250-1450	3	4-40 \times 5/16" flat head screw	
C4	250-1415	2	4-40 \times 3/8" screw	
C5	252-2	2	4-40 nut	
C6	254-9	2	#4 lockwasher	

KEY	HEATH	QTY.	DESCRIPTION
No.	Part No.		

#6 Hardware

D1	250-1282	2	6-32 × 1/8" allen setscrew
D2	250-70	4	6-32 × 3/16" flat head screw
D3	250-1174	2	6-32 × 3/16" screw
D4	250-1325	31	6-32 × 1/4" black screw
D5	250-1422	12	6-32 × 1/4" flat head screw
D6	250-1419	1	6-32 × 1/4" black flat head screw
D7	250-1280	1	6-32 × 3/8" screw
D8	250-1430	4	6-32 × 1/2" screw
D9	250-1322	1	#6 × 5/8" self-tapping screw
D10	250-406	6	6-32 × 5/8" flat head screw
D11	250-1427	1	6-32 × 1" screw
D12	252-3	19	6-32 nut
D13	254-1	20	#6 lockwasher
D14	259-1	3	#6 solder lug
D15	259-29	2	#6 long lug

Other Hardware

E1	250-329	2	8-32 × 5/8" screw
E2	250-1278	4	#10 × 7/8" self-tapping screw
E3	252-4	4	8-32 nut
E4	252-7	2	Control nut
E5	253-9	4	#8 flat washer (3/8" dia.)
E6	253-45	2	#8 flat washer (1/2" dia.)
E7	254-2	6	#8 lockwasher
E8	254-14	1	1/4" lockwasher
E9	259-27	1	BNC solder lug

SPACERS

F1	255-74	2	1/16" thick spacer
F2	255-49	6	5/16" spacer
F3	255-809	1	1/2" spacer
F4	255-746	4	6-32 × 5/8" hex spacer

KEY	HEATH	QTY.	DESCRIPTION
No.	Part No.		

METAL PARTS

G1	90-1287-1	1	Cabinet top
G2	90-1284-1	1	Cabinet bottom
G3	203-2118-1	1	Rear panel
G4	203-2121	1	Control panel
G5	210-132-1	1	Front bezel

NOTE: The following four parts appear to be nearly identical; they are not. Clearly mark each piece at this time to save some possible confusion later.

G6	204-2833	1	Upper left strut
G7	204-2834	1	Lower left strut
G8	204-2835	1	Upper right strut
G9	204-2836	1	Lower right strut
G10	204-2764	1	CRT rear bracket
G11	204-2609	1	CRT left pivot bracket
G12	204-2646	1	CRT right pivot bracket
G13	205-1886	2	Circuit board mounting bracket
G14	205-1887	3	Compartment cover
G15	205-1908-1	1	Cabinet cover plate
G16	205-1909	1	Cabinet sub cover
G17	205-1911-1	1	Preamplifier cover
G18	206-1417	1	High-voltage enclosure
G19	206-1428	1	CRT shield
G20	206-1451	1	Preamplifier top cover
G21	206-1452	1	Preamplifier bottom cover
G22	211-92	1	Handle
G23	266-807	2	Handle detent

PLASTIC AND RUBBER PARTS

H1	73-34	2	Alligator clip insulator
H2	73-59	1	Grommet
H3	73-188	1	CRT cushion strip
H4	75-139	2	Transistor insulator
H5	75-785	2	Switch cover
H6	75-754	1	Line cord strain relief
H7	75-837	1	Side rail insulator
H8	211-67	1	Handle top grip
H9	211-68	1	Handle bottom grip
H10	261-9	4	Foot
	305-67	4	Cord retainer set, consisting of:
H11	261-51	1	Cord retainer
H12	261-52	1	Cord retainer base
H13	414-41	1	Blue filter



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KEY	HEATH	QTY.	DESCRIPTION
No.	Part No.		

CONNECTORS

J1	432-120	7	Female terminal
J2	432-148	2	3-hole white socket
J3	432-149	2	3-hole plug w/ears
J4	432-753	15	Large spring connector (1 extra)
J5	432-758	1	BNC connector with hardware
J6	432-803	2	Large 3-hole socket
J7	432-817	1	4-hole square plug
J8	432-821	1	Large 6-hole socket
J9	432-854	4	Male connector pin
J10	432-855	7	Female connector pin
J11	432-866	8	Small spring connector
J12	432-954	1	4-hole socket

KEY	HEATH	QTY.	DESCRIPTION
No.	Part No.		

CONNECTORS (Cont'd.)

J13	432-970	2	Small 5-hole socket
J14	438-55	2	Polarizing plug
J15	436-38	1	Banana jack

MISCELLANEOUS

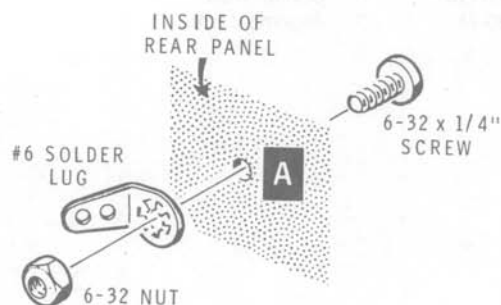
	89-54	1	Line cord
	134-237	1	BNC cable assembly
K1	258-192	2	Coil spring
K2	260-16	2	Alligator clip
K3	350-12	1	Glue
K4	434-375	1	CRT socket
K5	462-908	2	Detent cover
K6	462-1107	2	Control knob
K7	490-71	1	Alignment tool

STEP-BY-STEP ASSEMBLY

REAR PANEL ASSEMBLY

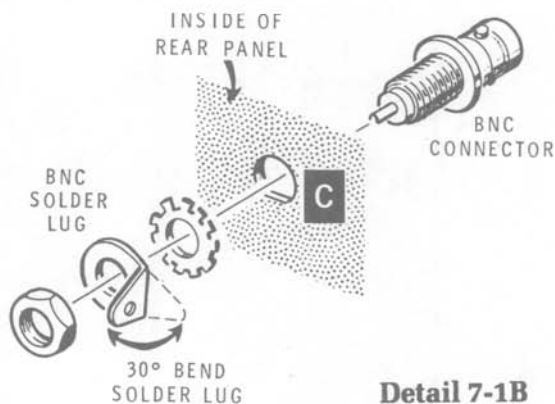
Refer to Pictorial 7-1 (Illustration Booklet, Page 26) for the following steps.

- () Position the rear panel on your work area as shown.
- () Refer to Detail 7-1A and mount a #6 solder lug on the rear panel at A as shown. Use a 6-32 \times 1/4" screw and a 6-32 nut. Position the solder lug as shown in the Pictorial.



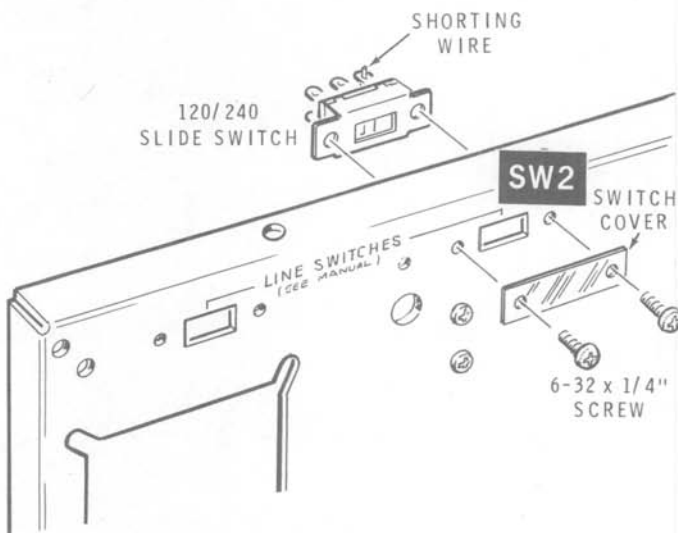
Detail 7-1A

- () In the same manner, install another #6 solder lug on the rear panel at B.
- () Refer to Detail 7-1B and mount a BNC connector on the rear panel at C in the manner shown. Use the hardware supplied with the connector and a BNC solder lug. Bend the end of the solder lug upward approximately 30 degrees as shown. Position the solder lug as shown in the Pictorial.



Detail 7-1B

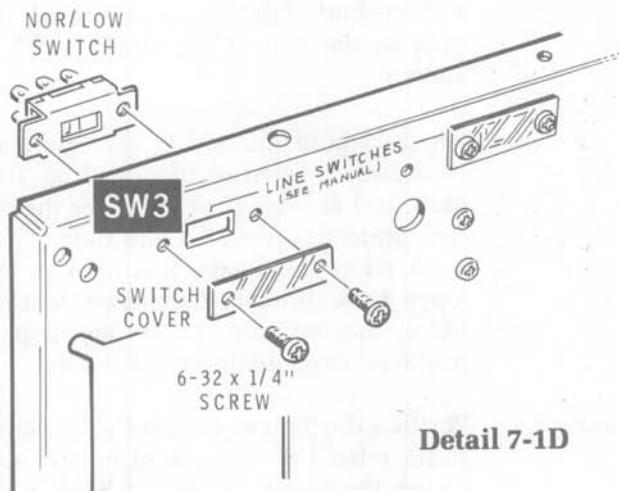
- () Locate the 120/240 slide switch. If necessary, use the tip of a screwdriver and set the switch slide to expose the numbering for the voltage in your area. If you are going to use 120-volts AC, set the switch slide to expose the "120" as shown in the inset drawing on the Pictorial.
- () SW2: Refer to Detail 7-1C and mount the 120/240 slide switch and a switch cover on the rear panel at SW2 with two 6-32 \times 1/4" screws. Be sure to mount the switch so the shorting wire is positioned as shown in the Pictorial. NOTE: Push out the cover holes to clear them if necessary.



Detail 7-1C

- () If the line voltage in your area is normally less than 115-volts AC (or less than 230-volts AC for 240-volt service), set the NOR/LOW slide switch to "LOW". If your voltage is higher than 115 VAC (or 230 VAC) set the switch so the lettering "NOR" (normal) is exposed.

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Detail 7-1D

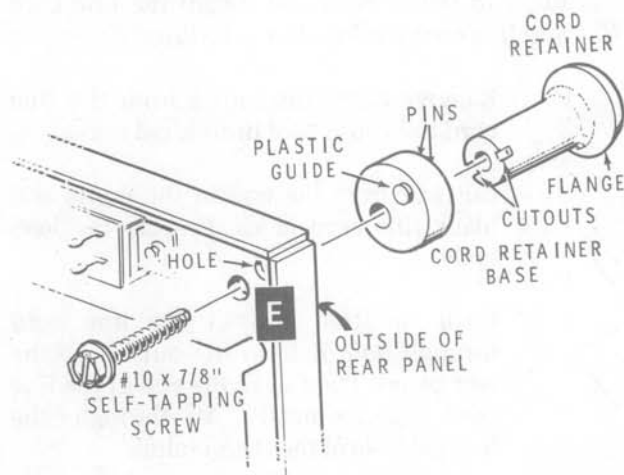
- () SW3: Refer to Detail 7-1D and, in the same manner as with switch SW2, mount the NOR/LOW switch and a switch cover on the rear panel at SW3. Position the "NOR" on the switch to the side nearer the center of the panel.

- () Refer to Detail 7-1E and mount a cord retainer on the outside of the rear panel at E as follows:

1. Hold the cord retainer base against the outside of the rear panel so the plastic guide is in the hole as shown in the Detail.
2. Align the pins on the cord retainer base with the cutouts in the cord retainer. Then hold the cord retainer and base together. Be sure the flange on the end of the cord retainer is toward the corner of the panel.
3. Use a #10 x 7/8" self-tapping screw to secure the cord retainer to the rear panel.

- () In the same manner, mount cord retainers on the outside of the rear panel at F, G, and H.

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if 6-32 x 3/8" hardware is called for, use a 6-32 x 3/8" screw, one or more #6 lockwashers, and a 6-32 nut. The Pictorial or Detail will show the number of lockwashers to use.

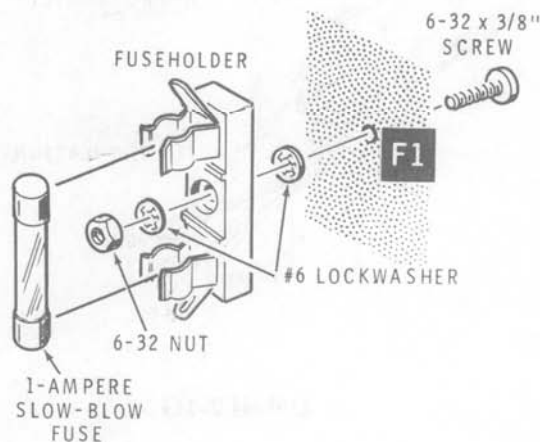


Detail 7-1E

- () Refer to Detail 7-1F and mount the fuseholder onto the rear panel at F1 using 6-32 x 3/8" hardware. Position the fuseholder as shown in the Pictorial.

- () F1: Push a 1-ampere, slow-blow fuse into the fuseholder clips. **IMPORTANT:** If your line voltage is nominally 240 VAC, use a 3AG 1/2-ampere, slow-blow fuse (not supplied).

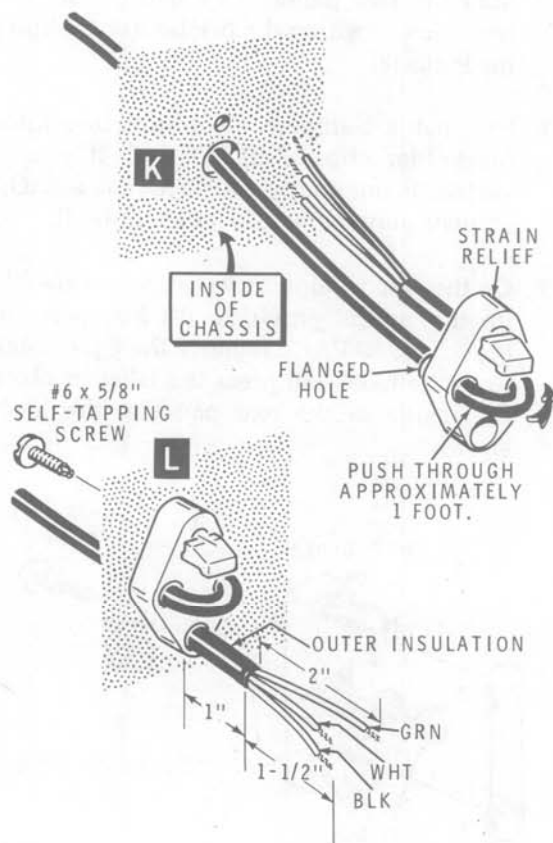
- () On the fuse label write "1-ampere, slow-blow" in the space provided ("1/2-ampere, slow blow," if 240 VAC). Remove the paper backing from the label and press the label in place on the inside of the rear panel at the location shown.



Detail 7-1F

() Refer to Detail 7-1G and install the line cord and line cord strain relief as follows:

1. Remove outer insulation from the line cord to expose 2" of individual wires.
2. Cut 1/2" from the end of the white and black line cord leads. Prepare the lead ends.
3. Push the free end of the line cord through hole K from the outside of the rear panel. Then push the end of the line cord approximately 1' through the flanged hole of the strain relief.
4. Loop the line cord over and through the other hole in the center of the strain relief.
5. Pull the end of the line cord through the hole in the end of the strain relief as shown.
6. Securely hold the end of the line cord in the strain relief so that 3" of the line cord, and at least 1" of the outer insulation protrudes from the end hole. Then work all of the excess line cord in the loops back through their respective (2) holes, making sure the center loop is pushed down into the center recess.
7. Position the flanged hole of the line cord strain relief into rear panel hole K and secure the adapter at hole L with a #6 × 5/8" self-tapping screw.



Detail 7-1G

IMPORTANT:

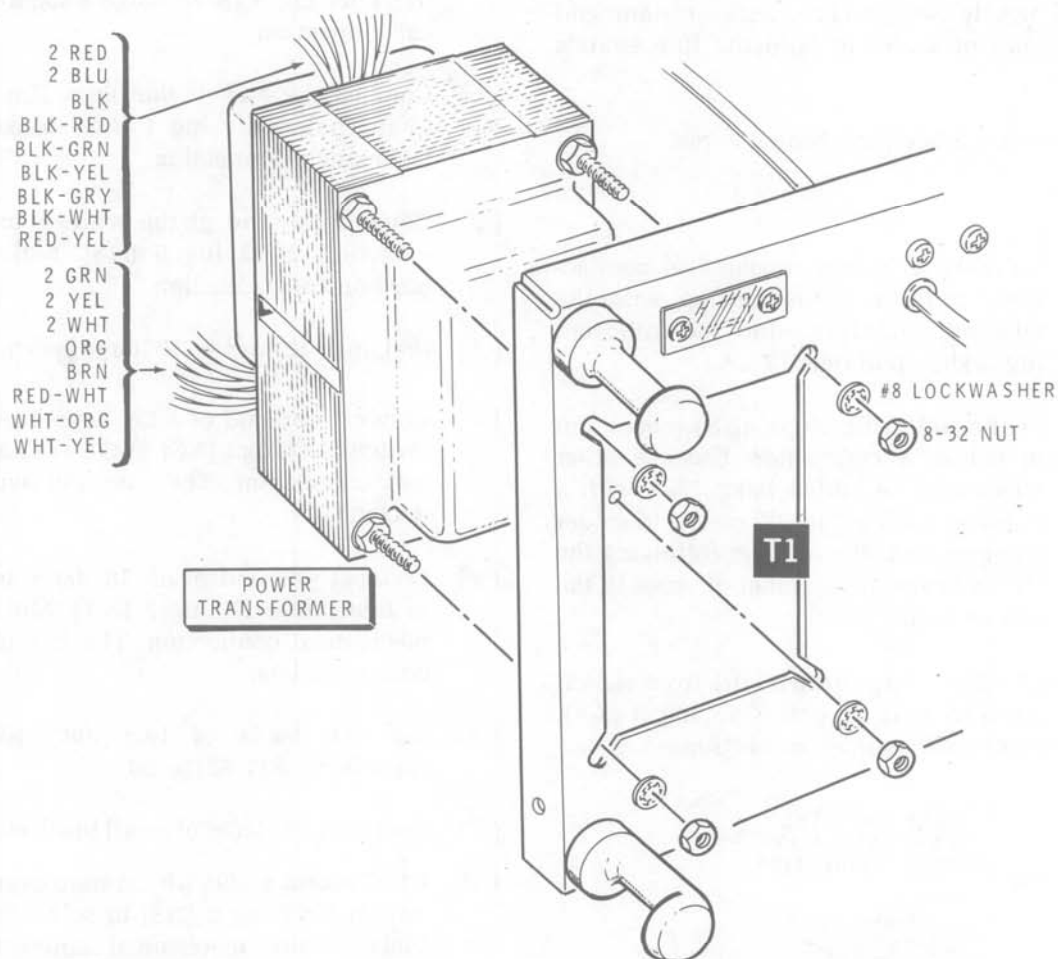
The plug on the power cord for this kit is for standard 120 VAC outlets. For 240 VAC operation in the U.S.A., cut off and replace this plug with a permanent plug that matches your 240 VAC receptacle in a manner such that your power connection conforms with section 210-21 (b) of the National Electric code, which reads, in part:

"Receptacle connected to circuits having different voltage, frequencies, or types of current (AC or DC) on the same premises shall be of such design that attachment plugs used on such circuits are not interchangeable."

When you install the new plug, make sure it is connected according to your local electrical code. Keep in mind that the green line cord wire is connected to the Oscilloscope chassis.

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- () T1: Refer to Detail 7-1H and secure the power transformer to the rear panel at T1 with four #8 lockwashers and four 8-32 nuts as shown. Be sure to position the transformer leads as shown in the Pictorial.



Detail 7-1H

REAR PANEL WIRING

Refer to Pictorial 7-2 (Illustration Booklet, Page 27) for the following steps.

- () Position the rear panel as shown.

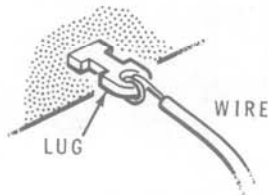
NOTE: To prepare a wire, as in the following step, cut the wire to the length indicated; then remove 1/4" of insulation from each wire end. If the wire is stranded, tightly twist the bare wire ends and add a small amount of solder to hold the fine strands together.

- () Prepare two 3-3/4" large brown wires.

NOTES:

1. To make a "secure mechanical connection," as in the following step, wrap the wire end tightly around the indicated lug as shown in Detail 7-2A.
 2. In the following steps, (NS) means not to solder a connection because other wires will be added later. "S-" with a number, such as "(S-2)" means to solder a connection; the number following the "S" indicates the number of wires in the connection.
- () Connect a 3-3/4" large brown wire from switch SW2 lug 5 (S-1) to switch SW3 lug 5 (S-1). Make secure mechanical connections.

1. WRAP AND MAKE A MECHANICALLY SECURE CONNECTION.



2. THEN SOLDER AS DIRECTED IN THE STEP.

Detail 7-2A

- () Connect a 3-3/4" large brown wire from switch SW2 lug 2 (S-1) to switch SW3 lug 2 (S-1). Make secure mechanical connections.
- () Tightly twist the ends of the line cord and add a small amount of solder to each end to hold the fine strands together. Cut each bare wire end to 1/4".
- () Connect the end of the green line cord lead to solder lug A (S-1). Make a secure mechanical connection.
- () Connect the end of the black line cord lead to fuseholder F1 lug 1 (NS). Make a secure mechanical connection.
- () Connect the end of the white line cord lead to switch SW2 lug 6 (NS). Make a secure mechanical connection.
- () Prepare a 22" and an 18" large brown wire.
- () Connect one end of a 22" large brown wire to switch SW2 lug 1 (NS). Make a secure mechanical connection. The free end will be connected later.
- () Connect one end of an 18" large brown wire to fuseholder F1 lug 2 (S-1). Make a secure mechanical connection. The free end will be connected later.
- () Cut the leads of two .005 μ F ceramic capacitors (#21-72) to 3/4".
- () Cut two 1/2" pieces of small black sleeving.
- () C1: Connect a .005 μ F ceramic capacitor from switch SW2 lug 6 (NS) to solder lug B (NS). Make secure mechanical connections. Use 1/2" of sleeving on the indicated lead.
- () C2: Connect a .005 μ F ceramic capacitor from solder lug B (S-2) to fuseholder F1 lug 1 (S-2). Make secure mechanical connections. Use 1/2" of sleeving on the indicated lead.
- () Carefully check to make sure that none of the four capacitor leads are touching any other lugs or connections. Move a lead slightly if necessary.

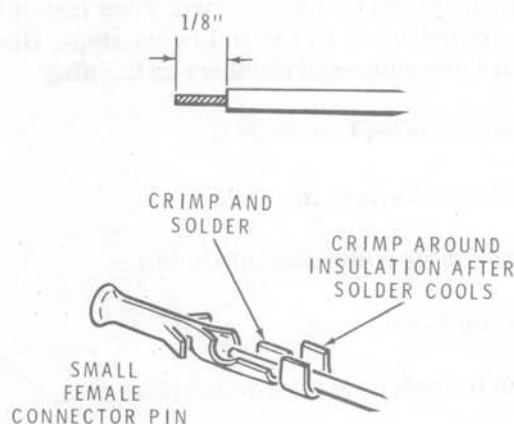


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Refer to Pictorial 7-3 (Illustration Booklet, Page 28) for the following steps.

Connect the free ends of the transformer leads in the following steps. As you connect each wire, make a secure mechanical connection.

- () Black-green lead to switch SW3 lug 6 (S-1).
- () Black-yellow lead to switch SW3 lug 1 (S-1).
- () White-black lead to switch SW3 lug 4 (S-1).
- () Gray-black lead to switch SW3 lug 3 (S-1).
- () Black-red lead to SW2 lug 1 (S-2).
- () Black lead to SW2 lug 6 (S-3).
- () Position all of the connected transformer leads inside the rear panel flange as shown in the Pictorial.
- () Route the large brown wire coming from SW2 lug 1 between the line cord strain relief and the inner side of the power transformer as shown. Then twist this wire with the brown wire coming from fuseholder F1 lug 2, approximately one turn per inch, for their entire lengths.
- () Cut the longer twisted brown wire to the same length as the other brown wire. Remove $\frac{1}{4}$ " of insulation from the end of the cut wire; then cut the bare ends of both wires to $\frac{1}{8}$ ".
- () Refer to Detail 7-3A and crimp and solder a female connector pin onto the ends of each of the twisted brown wires in the manner shown.
- () Refer to the Pictorial and push the connector on the end of either brown wire into hole 1 of a 3-hole plug (with ears) as shown. Tug on the wire to make sure the pin is firmly latched in the plug.
- () In the same manner, push the connector pin on the other brown wire into plug hole 3.



Detail 7-3A

- () Cut the two ears from the 3-hole plug. The plug will be connected later.
- () In the same manner, prepare the two green transformer leads. Then crimp and solder female connector pins onto the ends of both leads.
- () As in a previous step, install the green-wire connectors into holes 1 and 3 of a 3-hole plug (with ears). Twist the green leads together along their lengths; the plug will be connected later. NOTE: These connectors may fit tightly; reform the connectors slightly with pliers if necessary.
- () Cut the ears from the plug.
- () Cut the bare wire ends of all of the remaining transformer leads to $\frac{1}{8}$ ".
- () Along their insulated lengths, twist together the two white and the red-white transformer leads.
- () Crimp and solder a female connector pin onto the end of each of these leads. NOTE: Cut the longer tab ends from each connector; then crimp the four tabs down onto the **bare** wire ends (not around the insulation).

- () Refer to Pictorial 7-3 and position a 4-hole square plug exactly as shown. Then install the prepared leads in the following steps. **Disregard any embossed numbers on the plug.**

() Red-white lead into hole 2.

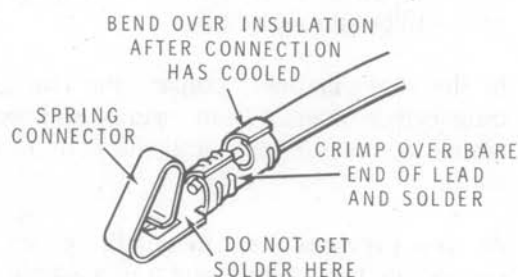
() Either white lead into hole 1.

() Remaining white lead into hole 3.

NOTE: Hole 4 is not used.

() Cut the ears from the 4-hole square plug.

() Along their insulated lengths, twist together the brown, orange and white-orange transformer leads. Then crimp and solder a large spring connector onto the end of each of the three leads as shown in Detail 7-3B.



Detail 7-3B

() Push the spring connector on the end of the brown lead into hole 1 of a 4-hole socket. Make sure the latching tab on the connector is upward as shown in the Pictorial. Tug on the lead to make sure the connector is latched in the socket.

() In the same manner, install the connector on the end of the white-orange lead into socket hole 2.

() In the same manner, install the connector on the end of the orange lead into socket hole 3.

() Along their insulated lengths, twist together the two yellow and the white-yellow transformer leads. As in the previous steps, crimp and solder a large spring connector onto the end of each of these three leads.

Push the yellow and white-yellow leads into a 3-hole socket as follows:

() Either yellow into hole 1.

() White-yellow into hole 2.

() Remaining yellow into hole 3.

() Twist together the two red, the two blue, and the red-yellow transformer leads.

() As in a previous step, crimp and solder large spring connectors onto the ends of the five leads.

Push the connectors on the ends of the five leads into a large 6-hole socket as follows:

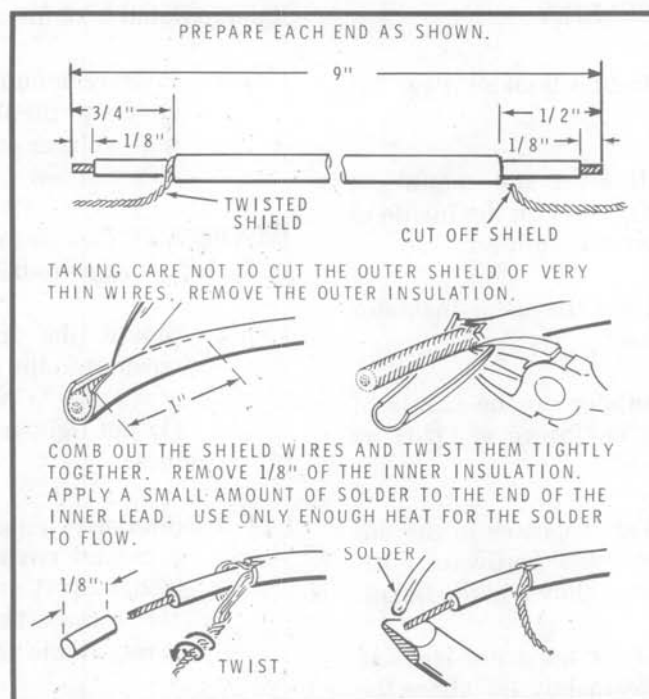
() Push the connector on one of the blue leads into socket hole 2. Tug on the lead to make sure the connector is latched.

() Install the other blue lead into socket hole 3.

() Either red lead into socket hole 4.

() The other red lead into socket hole 5.

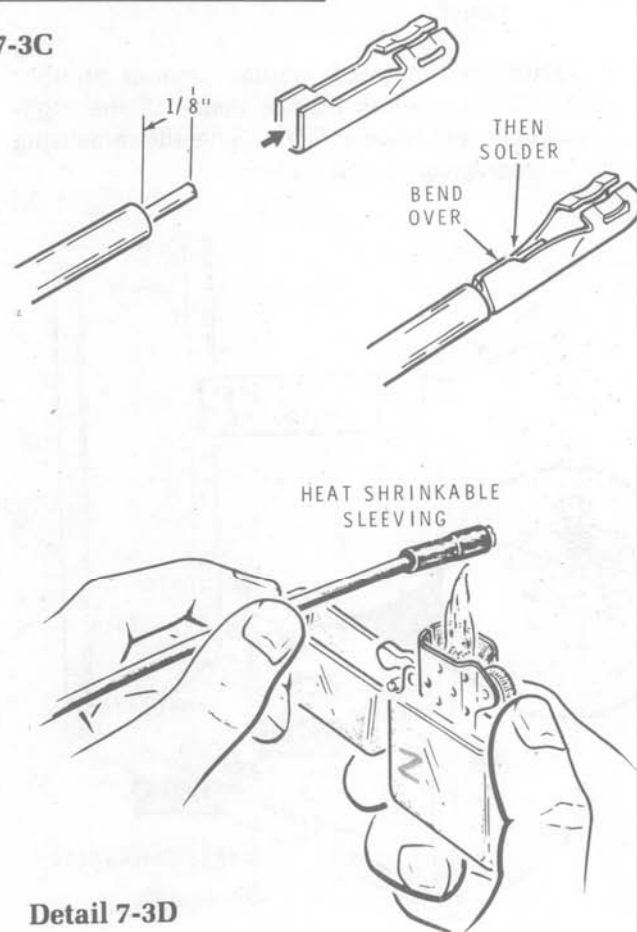
() The red-yellow lead into hole 6.



Detail 7-3C

- () Refer to Detail 7-3C and cut and prepare 9" RG-174/u (braid) shielded cable in the manner shown.
- () Refer to Detail 7-3D and, on the end of the cable without a shield lead, crimp and solder a female terminal onto the end of the inner lead in the manner shown.
- () Cut a 3/4" piece of small heat-shrinkable sleeving. Push the sleeving all the way up onto the terminal. Then heat the sleeving evenly, using a match or some similar source of heat until the sleeving is snug around the connector.
- () On the other end of the shielded cable, connect the inner lead to the center conductor of BNC connector C (S-1). Connect the shield lead to the BNC solder lug (S-1).

This completes the rear panel wiring. Carefully check all the connections to make sure they are well soldered.



Detail 7-3D



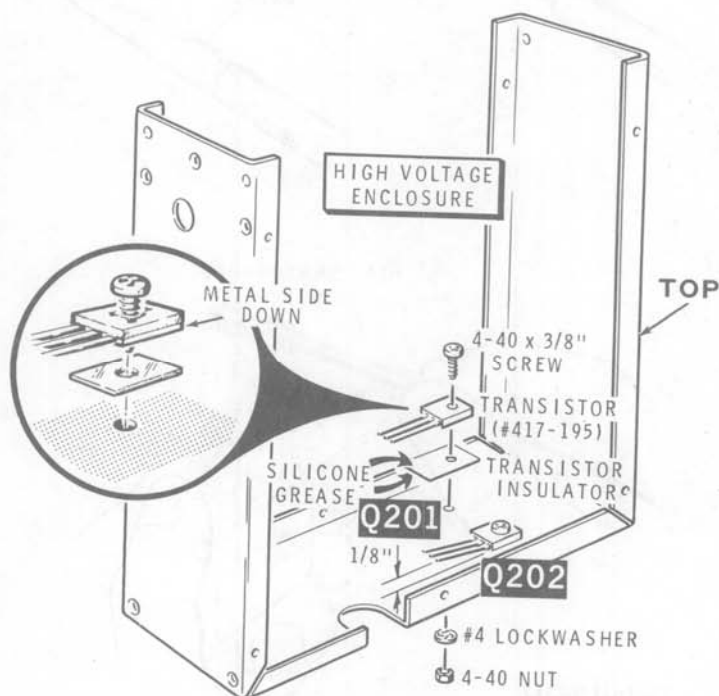
FRAME AND BEZEL ASSEMBLY

Refer to Pictorial 8-1 (Illustration Booklet, Page 29) for the following steps.

- () Q201: Refer to Detail 8-1A and mount an MJE340 transistor (#417-195) on the inside of the high-voltage enclosure as follows:

1. Coat both sides of a transistor insulator with silicone grease.
2. Position the insulator on the inside of the high-voltage enclosure at Q201 as shown in the Detail.
3. Secure an MJE340 transistor to the enclosure with 4-40 \times 3/8" hardware. Position the transistor as shown in the Detail.
4. Raise the ends of the transistor leads so the tips are approximately 1/8" above the panel.

- () Q202: In the same manner, mount another MJE340 transistor on the inside of the high-voltage enclosure at Q202. Save the remaining silicone grease for use later.



Detail 8-1A

Refer to Detail 8-1B for the next three steps.

- () 1. Loosely mount one of the compartment covers to the top center of the back of the high-voltage enclosure at AA with a 4-40 \times 1/4" screw.

IMPORTANT: Be sure to correctly identify each strut in the following steps before you proceed.

- () 2. Mount the high-voltage enclosure and cover onto the upper left strut (#204-2610) at AB and AC with two 4-40 \times 1/4" screws. Do not tighten the screws securely at this time.

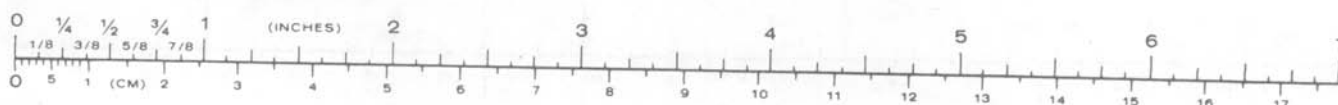
- () 3. Similarly, mount the high-voltage enclosure and cover onto the lower left strut (#204-2611) at AD and AE with 4-40 \times 1/4" screws. Do not tighten the screws securely at this time.

- () 1. Install a circuit board mounting bracket on the rear end of the lower left strut at BE, BF, and BG with three 5/16" spacers and three sets of 6-32 \times 5/8" flat head hardware. NOTE: The bracket is symmetrical and may be mounted with either end toward the rear. See inset drawing #1.

- () 2. Similarly, install another circuit board mounting bracket on the rear end of the lower right strut (#204-2613) at BH, BJ, and BK with three 5/16" spacers, two #6 long lugs, and 6-32 \times 5/8" flat head hardware. Mount the #6 long lugs under the lockwashers at BH, and BJ as shown in Detail inset drawing #2.

- () 3. Sharply bend solder lugs BH and BJ straight up toward the top of the unit. Then cut each solder lug to a length of 1" as shown.

- () Position the strut and enclosure assembly into the rear panel as shown in Pictorial 8-1.



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CAUTION: In the following steps, you will install the struts and their attached components on the rear panel. To avoid bending or breaking any parts, handle the assembly carefully until you have secured all parts and tightened the hardware. Reposition the assembly as necessary by grasping the rear panel.

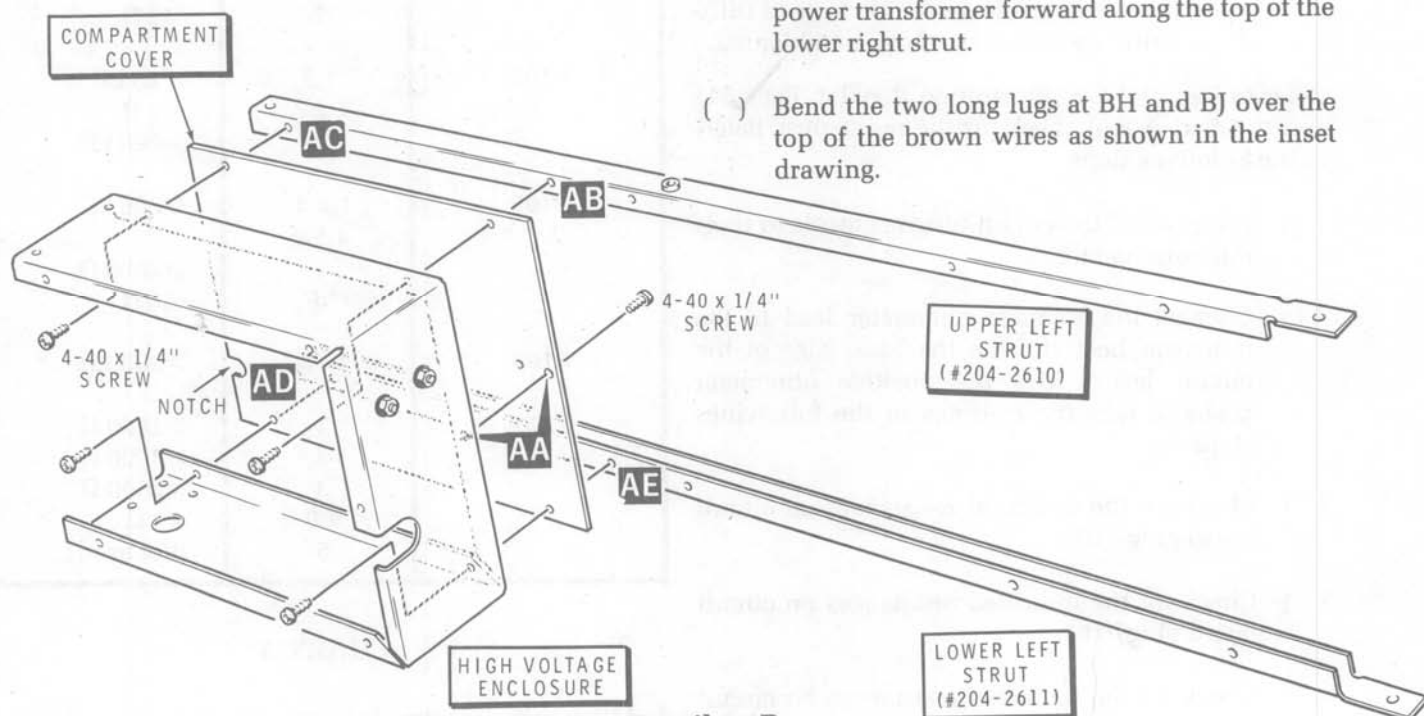
- () Secure the upper and lower left struts to the rear panel flanges at J and K with two 6-32 \times 1/4" flat head screws. Do not tighten the screws securely at this time.
- () Secure the high-voltage enclosure to the top flange of the rear panel at L and N with 6-32 \times 1/4" flat head hardware.
- () In the same manner, secure the bottom of the high-voltage enclosure to the rear panel flange at P and R using 6-32 \times 1/4" flat head hardware.
- () Securely tighten all of the enclosure and strut mounting hardware.
- () Secure the upper right strut (#204-2612) onto the top rear panel flange at S with a 6-32 \times 1/4" flat head screw. NOTE: Reposition the wires as necessary.

- () Similarly, secure the lower right strut to the bottom rear panel flange at T with a 6-32 \times 1/4" flat head screw.
- () Position the bezel onto the free ends of the four struts as shown. Then secure the bezel to the struts as follows:

1. At BA and BB on the lower bezel flange, secure the bezel to the two lower struts with 6-32 \times 1/4" flat head hardware as shown in the Pictorial.
2. At BC, on the upper bezel flange, secure the bezel and the upper left strut with a 6-32 \times 1/4" flat head screw and the CRT left pivot bracket (#204-2609). Position the bracket as shown in the Pictorial.
3. Similarly, secure the bezel and the upper right strut at BD with a 6-32 \times 1/4" screw and the CRT right pivot bracket (#204-2646). Position the bracket as shown in the Pictorial.

Refer to Detail 8-1C (Illustration Booklet, Page 30) for the next two steps.

- () Locate the two twisted brown wires with the 3-hole plug coming from the rear panel. Route the twisted wires from the lower corner of the power transformer forward along the top of the lower right strut.
- () Bend the two long lugs at BH and BJ over the top of the brown wires as shown in the inset drawing.



Detail 8-1B

LOW VOLTAGE ASSEMBLY**Resistance Checks****NOTES:**

1. In all of the of the following sections, when you are directed to make resistance measurements, set your ohmmeter to the most suitable range to include the indicated value. For Infinity and Zero readings, use the same meter range you would use for the measurement of 1000 ohms.
2. All resistances indicated in the charts were measured from a circuit board (foil) ground connection. Therefore, you should always connect the common lead of your meter to a convenient ground point on a ground lead or a ground foil. Measure with the positive meter probe to the points indicated in the charts.
3. If all of your resistance readings are significantly different, reverse the leads and try again.
4. If you fail to obtain any desired resistance reading, do NOT proceed until you have found and corrected any problem. If necessary, refer to the "In Case of Difficulty" section in the Operation Manual.

Refer to Pictorial 8-2 (Illustration Booklet, Page 31) and to Chart A and check for the resistances listed in the following steps.

- () Preset all of the circuit board controls to their rotational centers.
- () Connect the common ohmmeter lead to the transistor heat sink on the back edge of the circuit board. Use the positive ohmmeter probe to take the readings in the followings steps.
- () Check for the indicated resistances on circuit board plug P101.
- () Check for the indicated resistances on circuit board plug P102.
- () Check for the indicated resistances on circuit board plug P103.

- () Check for the indicated resistances on circuit board plug P104.
- () Check for the indicated resistances on circuit board plug P105.
- () Check for the indicated resistances on circuit board plug P106.
- () Check for the indicated resistances on circuit board plug P111.

PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
P101	1	<2 Ω
	2	>6000 Ω
	3	>1800 Ω *
	4	>8000 Ω
	5	>200 k Ω
	6	>3000 Ω
	7	>2000 Ω
	8	>200 k Ω
	9	(not used)
	10	<2 Ω
P102	1	<2 Ω
	2-5	>50 k Ω *
	6	<2 Ω
P103	1,3	>20 k Ω *
	2	<2 Ω
P104	1,3	>20 k Ω *
	2	<2 Ω
	4	>200 k Ω
P105	1,2,3,4,5,6	>200 k Ω
	7	>2000 Ω
	8	<2 Ω
P106	1,2,3	>200 k Ω
P111	1	>1800 Ω
	2	>3000 Ω
	3	>2000 Ω
	4,6	<2 Ω
	5	(not used)

CHART A

* Allow sufficient time for capacitors to become charged.

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NOTE: Check the individual wires coming from the circuit board for the resistances indicated in the following steps.

- () White wire coming from A: Infinity.
- () Orange wire coming from B: Over 100 k Ω .
- () Red wire coming from C: Over 100 k Ω .
- () White-yellow wire coming from D: Over 50 k Ω .
- () White-brown wire coming from E: Over 20 k Ω .
- () White-red wire coming from F: Over 100 k Ω .

NOTES:

1. In the following steps, refer to the call-outs on the top of the circuit board to locate the wires running to the plugs where you will measure the resistances.
2. Refer to Chart B to check for the resistances indicated in the following steps.
3. To measure resistances on connector housings, as in the following steps, wrap a piece of small wire around the tip of your ohmmeter probe, then measure the indicated connector pin with the tip of the wire.

- () Measure the connectors on 15-pin socket S702 for the indicated resistances.

- () Measure the connectors on 10-pin socket S601 for the indicated resistances.
- () Measure the connectors on 5-pin socket S302 for the indicated resistances.

PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
S702	1,2	>200 k Ω
	3	>2000 Ω
	4	>2000 Ω
	5	>200 k Ω
	6	(not used)
	7	>200 k Ω
	8	>8000 Ω
	9	>200 k Ω
	10	<2 Ω
	11	>400 Ω
	12	>2000 Ω
	13	>3000 Ω
	14	>200 Ω
	15	>200 k Ω
S601	1	>200 k Ω
	2	>400 Ω
	3,4	>200 k Ω
	5	>1800 Ω
	6	>2000 Ω
	7	>3000 Ω
	8	>200 k Ω
	9	(not used)
	10	<2 Ω
S302	1	>8000 Ω
	2	(not used)
	3	>3000 Ω
	4	>2000 Ω
	5	<2 Ω

CHART B

() White-green wire coming from the top of Cap. C155: Approx. 82 K Ω .

Refer to Chart C and check for the indicated resistances on the heat sink-mounted integrated circuits and transistor as follows:

- () Check IC U104 for the indicated lead resistances.
- () Check IC U105 for the indicated lead resistances.
- () Check IC U101 for the indicated lead resistances.
- () Check IC U103 for the indicated lead resistances.
- () Check transistor Q105 for the indicated lead resistances.

COMPONENT	LEAD	RESISTANCE
U104	In	$>10\text{ k}\Omega^*$
	Com	Zero $<2\text{ }\Omega$
	Out	$>1800\text{ }\Omega$
U105	Adj	$>400\text{ }\Omega$
	In	$>5000\text{ }\Omega^*$
	Out	$>400\text{ }\Omega$
U101	Adj	$>2000\text{ }\Omega$
	Out	$>2000\text{ }\Omega$
	In	$>10\text{ k}\Omega^*$
U103	Adj	$>20\text{ k}\Omega$
	In	$>6000\text{ }\Omega^*$
	Out	$>3000\text{ }\Omega$
Q105	B	$>9000\text{ }\Omega$
	C	$>20\text{ k}\Omega^*$
	E	$>8000\text{ }\Omega$

CHART C

* Allow time for capacitors to charge.

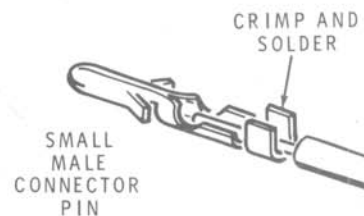
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CRT Socket

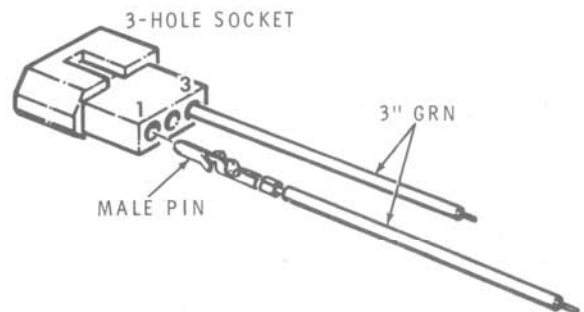
Refer to Pictorial 8-3 (Illustration Booklet, Page 32) for the following steps.

- () Position the CRT socket as shown.
- () Connect the large red wire coming from the low voltage circuit board to CRT socket lug 3 (S-1).
- () Cut the leads of a 100 k Ω (brn-blk-yel) resistor to 1/2".
- () R1: Connect the resistor leads between CRT socket lugs 2 (NS) and 4 (NS) as shown.
- () Cut the leads of a 1N4747A diode (#56-45) to 1".
- () Connect the lead on the **banded end** of the diode to CRT socket lug 14 (NS) and the other lead to lug 12 (NS).
- () Connect the large orange wire from the low voltage circuit board to socket lug 4 (S-2).
- () Connect the large white wire coming from the low voltage circuit board to socket lug 5 (S-1).
- () Connect the small white-brown wire to lug 6 (S-1).
- () Connect the small white-red wire to lug 9 (S-1).
- () Connect the small white-green wire to lug 12 (S-2).
- () Connect the small white-yellow wire to lug 14 (S-2).
- () Cut and prepare two 3" large green wires. Remove 3/16" of insulation from each wire end.
- () Refer to Part A of Detail 8-3A and crimp and solder a male connector pin onto one end of each green wire as shown.
- () Refer to Part B of Detail 8-3A and push the pins on the green wires into holes 1 and 3 of a 3-hole white socket. Tug on each of the wires to make sure the pins are latched in the socket holes.
- () Connect one of these green wires to CRT socket lug 2 (S-2) and the other green wire to lug 1 (S-1). NOTE: The socket will be connected later.

PART A



PART B



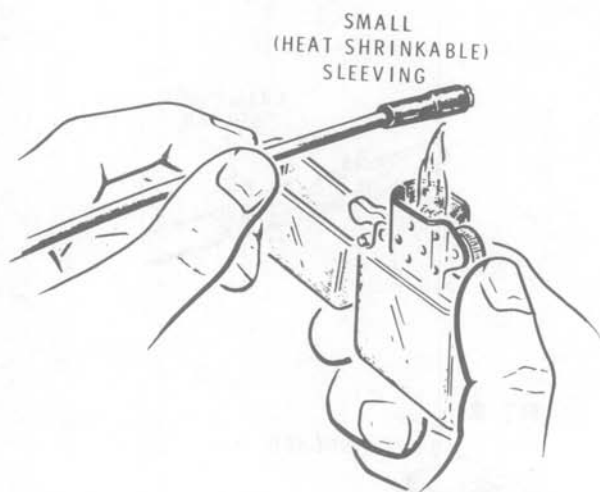
Detail 8-3A



- () Cut and prepare the following small stranded wires. Remove 1/8" of insulation from one end of each wire.

6" orange 5" blue
6" red 4-1/2" brown

- () As in a previous step, crimp and solder a female terminal onto one end of each of the four small wires.
- () Cut four 3/4" pieces of small heat-shrinkable sleeving.
- () Slide a piece of heat-shrinkable sleeving all the way down over each small wire and onto the female terminal. Then, using a match or other suitable heat source, shrink the sleeving onto each terminal as shown in Detail 8-3B.

**Detail 8-3B**

- () Connect the free end of the small orange wire to CRT socket lug 7 (S-1).
- () Connect the free end of the small red wire to CRT socket lug 6 (S-1).
- () Connect the free end of the small blue wire to CRT socket lug 9 (S-1).

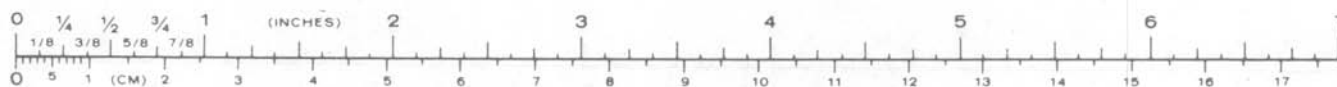
- () Connect the free end of the small brown wire to CRT socket lug 11 (S-1).
- () Cut a 2" piece of black tape. Then gather together the six wires coming from the low-voltage circuit board to the CRT socket and tightly wrap the piece of tape around the wires approximately midway between the board and the socket as shown in Pictorial 8-3.

Circuit Board Installation.

Refer to Pictorial 8-4 (Illustration Booklet, Page 33) for the following steps.

NOTE: In the following step, the low-voltage circuit board will help to align the upper and lower struts, and to position each of them at ninety degrees to the front and rear panels. Slightly loosen the strut-mounting hardware temporarily if necessary to achieve this. You may want to check the angle of the struts against the front and rear panels with a small carpenter's square to make sure these components are truly squared.

- () Taking care to keep all wires and leads below the circuit board, position the low-voltage circuit board into the bottom of the frame assembly. Loosely secure the circuit board to the two circuit board mounting brackets with six 4-40 × 1/4" screws as shown.
- () Secure the low-voltage circuit board heat sink to the rear panel with two 6-32 × 1/4" screws as shown.
- () Recheck the struts to make sure they are squared with the front and rear panels, adjust them slightly if necessary, and tighten the strut hardware. Then tighten the six circuit board mounting screws.
- () Recheck all brackets, panel, and circuit board mounting hardware installed to this point to make sure it is all secured tightly.



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CONTROL CIRCUIT BOARD

Refer to Pictorial 9-1 (Illustration Booklet, Page 34) for the following steps.

- () Push a banana jack through hole CA in the bottom center of the bezel.
- () While holding the banana jack in place, on the inside of the bezel, position the circuit board over the banana jack as shown. Carefully position the red LED and the terminal post through their respective holes in the front panel. Place a 1/4" lockwasher and a 1/2" spacer onto the end of the banana jack, then loosely mount the jack with a #6 solder lug and a 6-32 × 1/4" screw.
- () Position the control panel onto the lower front of the bezel as shown. Hold the panel in place as you perform the next two steps.
- () R365: Push the shaft of a 7.5 MΩ control (#10-1188) through the control circuit board, through the bezel, and out the front panel FOCUS hole. Loosely mount the control shaft to the control panel with a control nut. Cut the locating tab from the front of this control.
- () SW1/R364: Similarly, mount the 1000 Ω control with switch (#19-751) through the control circuit board, bezel, and control panel at the hole labeled INTENSITY. Loosely mount the control shaft with a control nut. Cut the locating tab from the front of this control, if necessary.
- () Make sure the terminal post and the red LED are centered in their respective control panel holes; then making sure each control is positioned as shown in the Pictorial, tighten the control nuts on the front panel.
- () Position the banana jack solder lug as shown and tighten its mounting screw.

Refer to Pictorial 9-2 (Illustration Booklet, Page 34) for the following steps.

- () Locate the 2" black wire on the foil side of the circuit board. Connect the free end of this wire to the banana jack solder lug (NS).
- () Pass the free end of the bare wire coming from the control circuit board foil upward through the solder lug and over onto the bare metal case of control R365. Solder the wire to the solder lug (S-3). The end of this wire will be connected later.

Connect the short violet, gray, and white wires coming from the rear of the control circuit board to the lugs of control R364 as follows:

- () Violet wire to lug 1 (S-1).
- () Gray wire to lug 2 (S-1).
- () White wire to lug 3 (S-1).
- () Cut and prepare two 3" large brown wires.
- () Crimp and solder a male connector pin onto one end of each wire. Cut the tab ends from the connectors; then crimp the connectors around the bare wire ends.
- () Push the connector pin on one brown wire into hole 1 of a 3-hole white socket. Tug on the wire to make sure the pin is securely latched.
- () In the same manner, push the connector on the other brown wire into socket hole 3.
- () Cut two 3/4" pieces of small heat-shrinkable sleeving. Push one piece of sleeving up onto each brown wire.
- () Connect the end of either brown wire to switch 1 lug 4 (S-1). Make a secure mechanical connection.

- () Connect the end of the other brown wire to SW1 lug 5 (S-1). Make a secure mechanical connection.
- () After the connections have cooled, slide the sleeving down both brown wires, all the way until the switch lug connections are entirely covered. Then, using a match or other suitable heat source, heat the sleeving and shrink it onto the switch connections.
- () Cut and prepare a 16" large white, large gray, and large violet wire.
- () Cut three 3/4" pieces of small heat-shrinkable sleeving. Slide one piece of this sleeving up onto one end of each of the three prepared wires.

Connect one end (with sleeving) of each of the three prepared wires to the lugs of control R365 in the following steps.

- () Large violet to lug 1 (S-1).
- () Large white to lug 2 (S-1).
- () Large gray to lug 3 (S-1).
- () After the soldered connections have cooled, slide the heat-shrinkable sleeving down onto the three control lugs as far as possible. Then, using a match or other suitable heat source, shrink the sleeving onto the control lugs.
- () Slide a 15" piece of large black sleeving all the way down onto the large violet, gray, and white wires.

- () Cut the bare ends of the three heavy wires to 3/16".
- () Crimp and solder a large spring connector onto the end of each of the three heavy wires. NOTE: Do NOT crimp the connector over the insulation.
- () Push the connector on the end of the large white wire into hole 1 of a large 3-hole socket. Tug on the wire to make sure its connector is latched in the socket.
- () In the same manner, push the gray wire connector into socket hole 2, and the violet wire connector into hole 3.

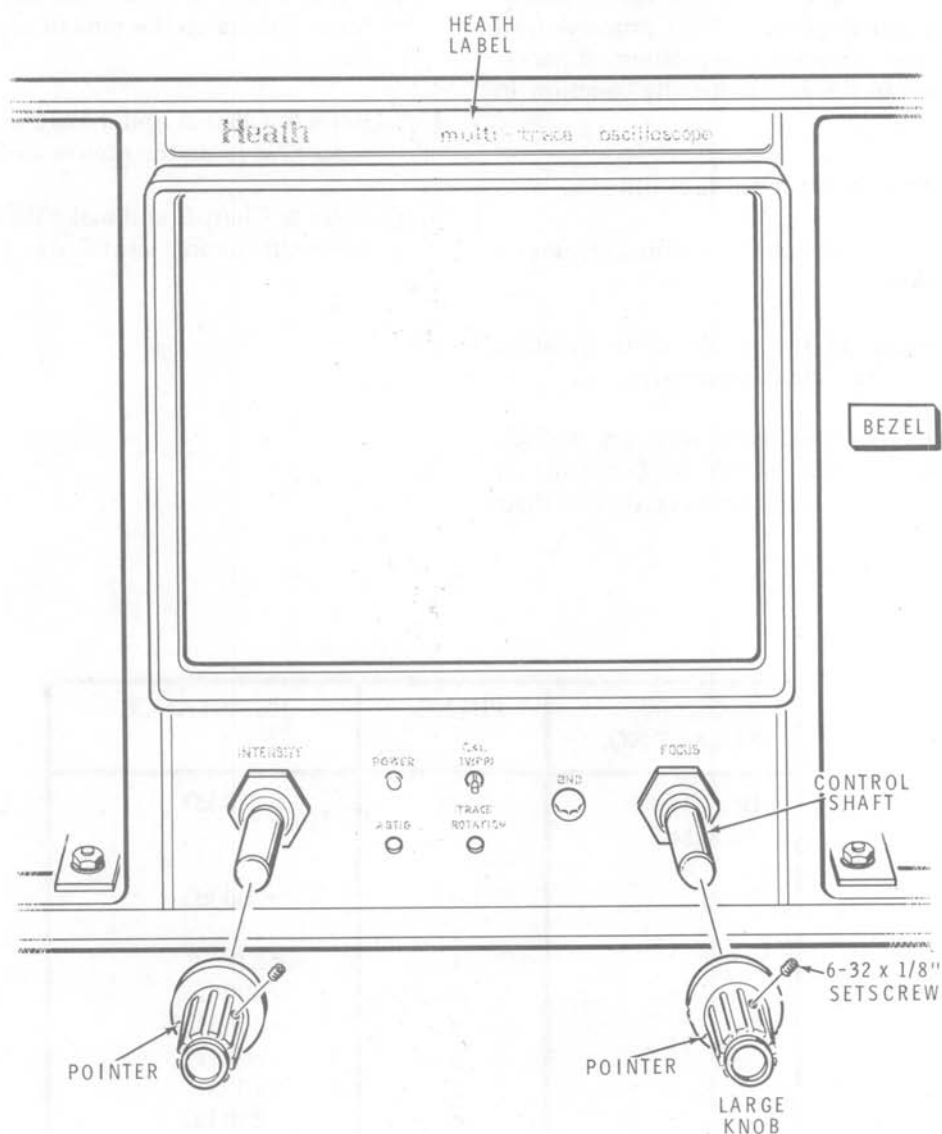
Refer to Pictorial 9-3 for the following steps.

- () Turn the INTENSITY and the FOCUS controls fully counterclockwise; the INTENSITY control should click to indicate it is off.
- () Using an allen wrench, start a 6-32 × 1/8" allen setscrew into each of the control knobs.

NOTE: In the next two steps, space the knobs slightly away from the panel surface so they do not rub.

- () Position a knob onto the FOCUS control shaft. Position its pointer at the 7 o'clock position and tighten the setscrew.
- () Similarly, install the other knob on the INTENSITY control shaft, making sure the pointer is over the "Off" index mark.
- () Remove the paper backing from the "Heath" label and press the label in place in the narrow slot at the top of the bezel as shown in the Pictorial.



Heathkit®**PICTORIAL 9-3**

Resistance Checks

Refer to Pictorial 9-4 for the following steps.

NOTE: In the following steps, if you fail to obtain the desired resistance reading, do NOT proceed until you have found and corrected any problem. If necessary, refer to the "In Case of Difficulty" section in the Operation Manual.

- () Preset the front panel controls as follows:

INTENSITY control fully counterclockwise until it clicks off.

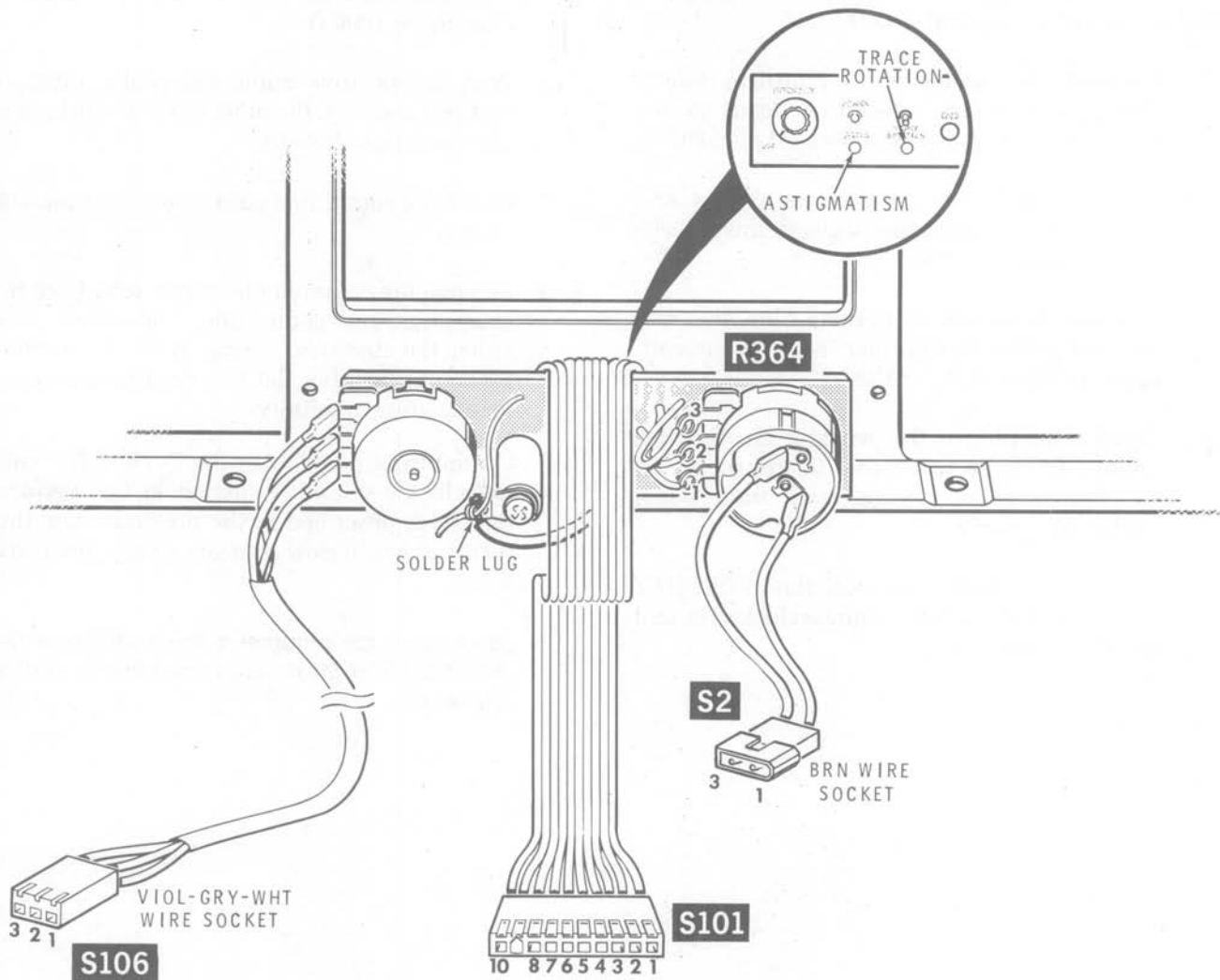
FOCUS control to the center of its rotation (pointer at the 12 o'clock position).

Using a small screwdriver, turn the ASTIGMATISM and TRACE ROTATION controls on the control circuit board to the centers of their rotations.

- () Connect the common ohmmeter lead to the solder lug on the rear of the banana plug spacer.
- () Refer to Chart A and make the indicated resistance checks on the pins of brown-wire socket S2.
- () Refer to Chart A and make the indicated resistance checks on the pins of socket S106.
- () Refer to Chart A and make the indicated resistance checks on socket S101.

PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
Brn wire socket S2	1,3	>200 k Ω
S106	1,2,3	>200 k Ω
S101	1	<2 Ω
	2	>900 Ω
	3	>900 Ω
	4	>90 k Ω
	5	>40 k Ω
	6	>200 k Ω
	7	>200 k Ω
	8	>200 k Ω
	9	(not used)
	10	<2 Ω

CHART A



PICTORIAL 9-4

Refer to Pictorial 9-5 (Illustration Booklet, Page 35) for the following steps.

In the following steps, when you are instructed to connect a socket to a circuit board plug, be sure to position the socket as shown in the Pictorial. Be sure to observe the correct pin spacing, matching pin for pin between each plug and socket.

- () Connect the socket on the brown, white-orange, and orange transformer leads to low voltage power supply circuit board plug P104.
- () Connect the socket on the two yellow and white-yellow transformer leads to low voltage circuit board plug P103.
- () Connect the socket on the two blue, two red, and red-yellow transformer leads to low voltage circuit board plug P102.
- () Connect the plug on the two large brown wires coming from the rear panel to the socket on the brown wires coming from front panel switch SW1.
- () On the front panel, make sure the INTENSITY control is turned fully counterclockwise and that it is clicked Off.

Refer to Pictorial 9-6 (Illustration Booklet, Page 36) for the following steps.

- () Connect your ohmmeter negative lead to any convenient bare metal chassis ground.
- () Set your ohmmeter for the appropriate range to measure 1000 Ω .
- () With the positive ohmmeter probe, measure first one and then the other flat line cord prong for a reading of infinity.
- () Check the round line cord prong for a reading of zero.
- () Remove the common ohmmeter lead from the chassis ground connection, and attach it to either flat line cord prong. With the positive probe on the other flat line cord prong, check for a reading of infinity.
- () On the front panel, turn the INTENSITY control clockwise until it just clicks On. Perform the check described in the previous step; this reading should now indicate a very low resistance.
- () Disconnect the ohmmeter leads and turn the INTENSITY control counterclockwise until it clicks Off.

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INITIAL VOLTAGE TESTS

CAUTION: In the following steps, when power is applied to your unit, take all precautions to keep your hands away from the "High Voltage Areas" shown in Pictorial 9-6; THE VOLTAGES IN THESE AREAS ARE POTENTIALLY LETHAL. Keep one hand in your pocket as you make any checks with the meter probe in your other hand.

IMPORTANT: Check to make sure the CRT socket and its wires are positioned where they cannot become shorted to the chassis or other components.

- () Plug the line cord into an AC outlet.
- () Connect the common voltmeter lead to a convenient bare metal point on the oscilloscope frame.

NOTES:

1. Set your voltmeter to the proper DC-voltage range to obtain meaningful readings in the following steps. Be sure to switch your voltmeter leads or voltmeter polarity switch to check for negative (-) voltages.
2. Be sure to touch only the indicated socket pin; to do otherwise might short a connection and damage a regulator or an IC. You may wish to turn the Oscilloscope

power on and off between each voltage check, using an alligator-clip and a short bare wire to connect to the designated pin.

- () On the front panel, turn the INTENSITY control until it just clicks on; the front panel red LED ("On") will **not** turn on at this time.
- () Refer to Chart A and check for the indicated voltages on 15-wire flat cable socket S702 coming from circuit board wire connections designated P107 and P108.

SOCKET NO.	PIN NO.	DC VOLTAGE
S702	8	+ 85-95 V
	9	+ 150-200 V
	11	- 4.7-5.3 V
	12	+ 4.7-5.3 V
	13	- 14.5-15.5 V
	14	+ 14.5-15.5 V

CHART A

- () Turn off the Oscilloscope power and remove the line cord from the AC outlet.

NOTE: Do **not** proceed until the power has been turned off for at least **five minutes**.

HIGH VOLTAGE ASSEMBLY**Resistance Checks**

Refer to Pictorial 10-1 for the following steps.

NOTE: When you make the following resistance checks, if you do not obtain the correct results, do NOT proceed until you have found and corrected the problem. If you are not able to locate the problem, refer to the "In Case of Difficulty" section in the Operation Manual.

Check the leads of the enclosure-mounted transistors, Q201 and Q202, for the resistances indicated in the following steps. NOTE: As these two components are identical, only one reading will be stated. Be sure to check both devices.

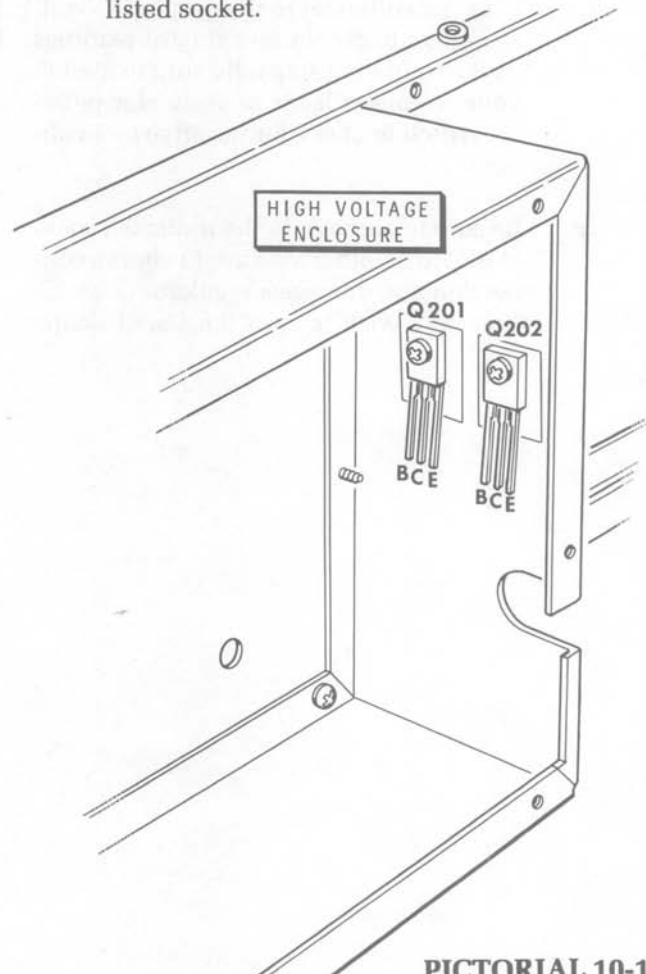
- () Connect the common lead of your ohmmeter to any bare-metal area on the high-voltage enclosure.
- () Check the transistor emitter (E) lead for a reading of infinity.
- () Check the transistor collector (C) lead for a reading of infinity.
- () Check the transistor base (B) lead for a reading of infinity.

Refer to Pictorial 10-2 for the following steps.

- () Preset the High Volts Adj control to the center of its rotation.
- () Connect your common ohmmeter lead to the circuit board shield.
- () Refer to Chart A and check the resistance checks on the 8-hole socket as indicated.
- () Refer to Chart A and make the resistance check on the high-voltage anode lead as indicated.

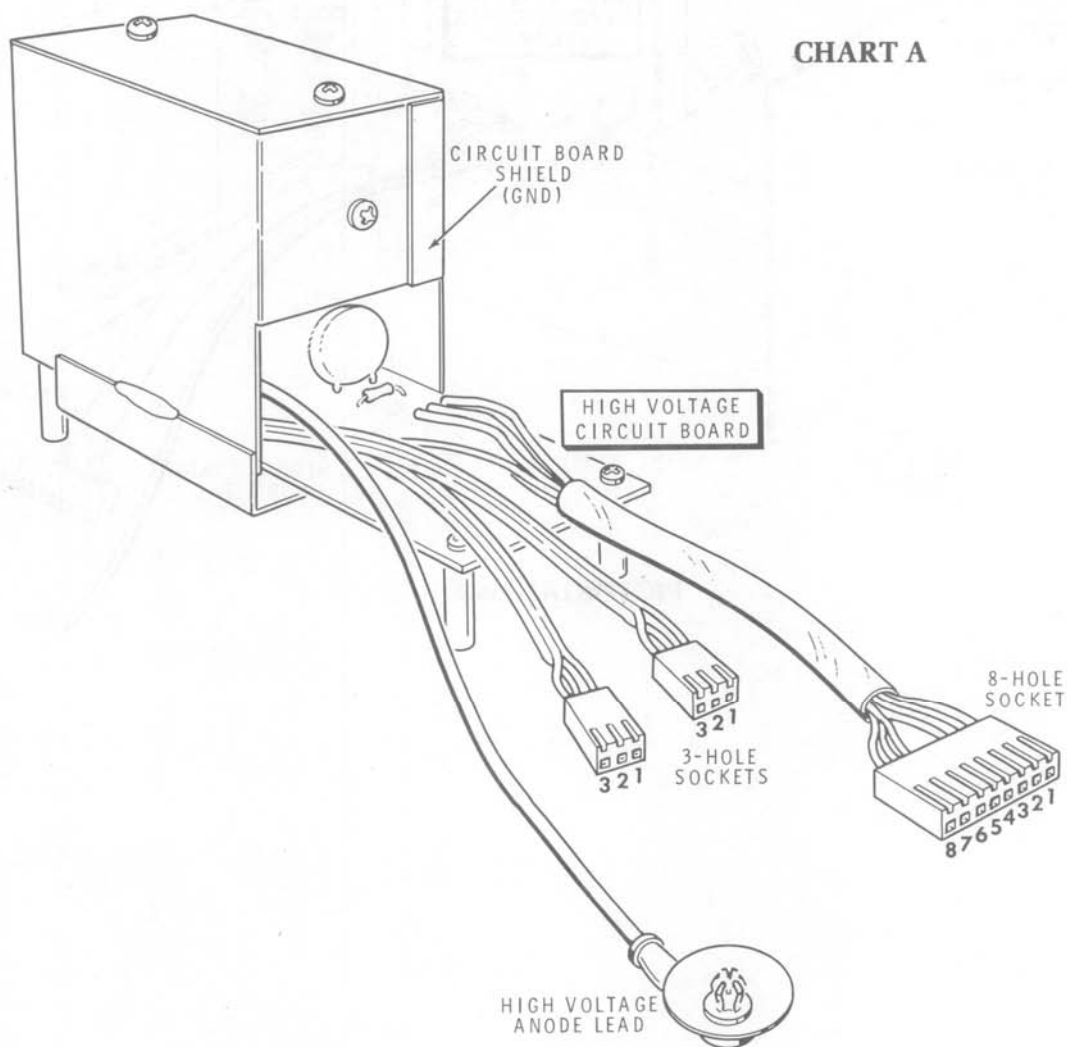
NOTE: Although the 3-hole sockets may be connected to Q201 and Q202 interchangeably, their resistances are different.

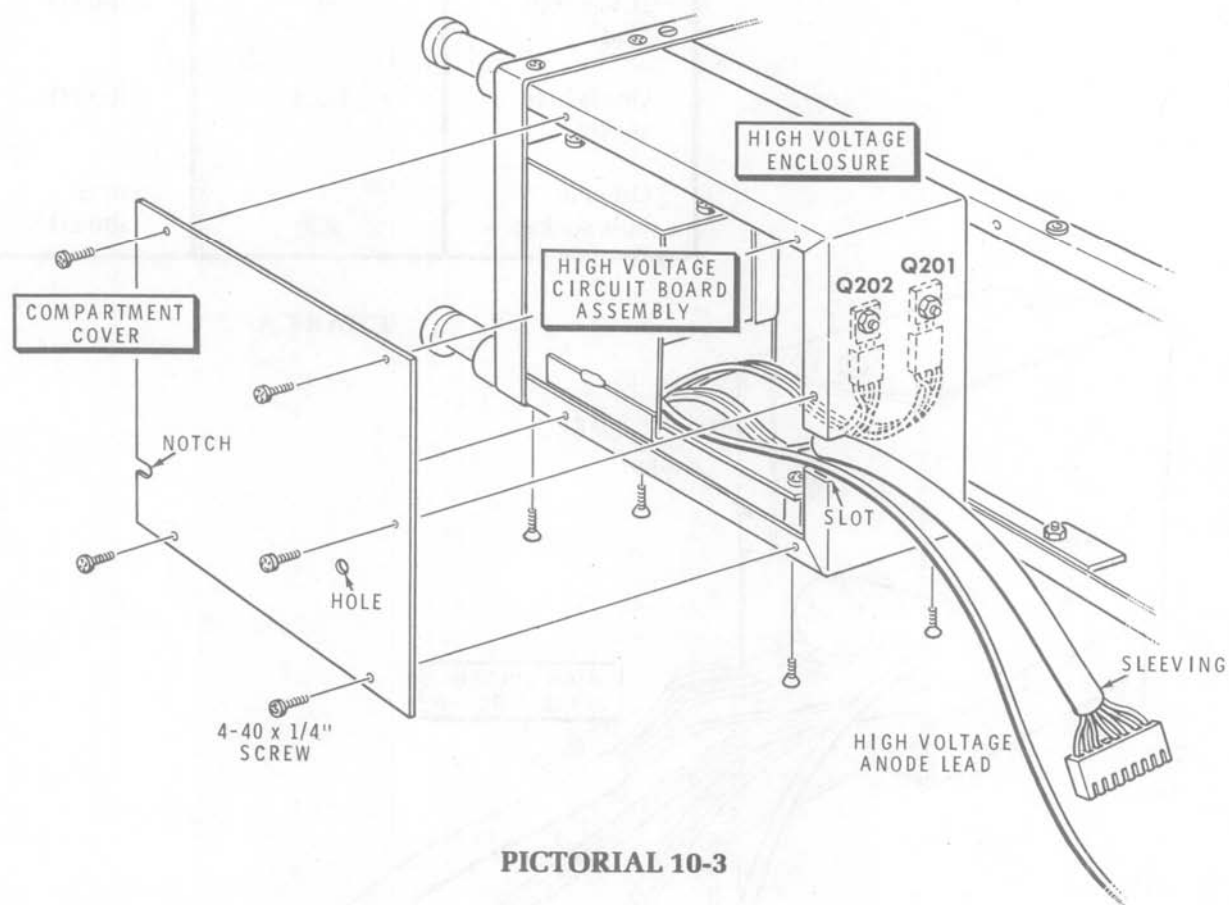
- () As you refer to Chart A, first check one of the 3-hole sockets and determine which of the two indicated readings applies to that socket; then take the reading and compare it to the other listed socket.

**PICTORIAL 10-1**

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PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
8-hole socket	1-4	>200 k Ω
	5	(not used)
	6	>200 k Ω
	7	>6000 Ω
	8	<2 Ω
H.V. anode lead	1	>200 k Ω
One 3-hole socket	1,2,3	>200 k Ω
Other 3- hole socket	1	>30 Ω
	2,3	>200 k Ω

CHART A**PICTORIAL 10-2**



PICTORIAL 10-3

Heathkit

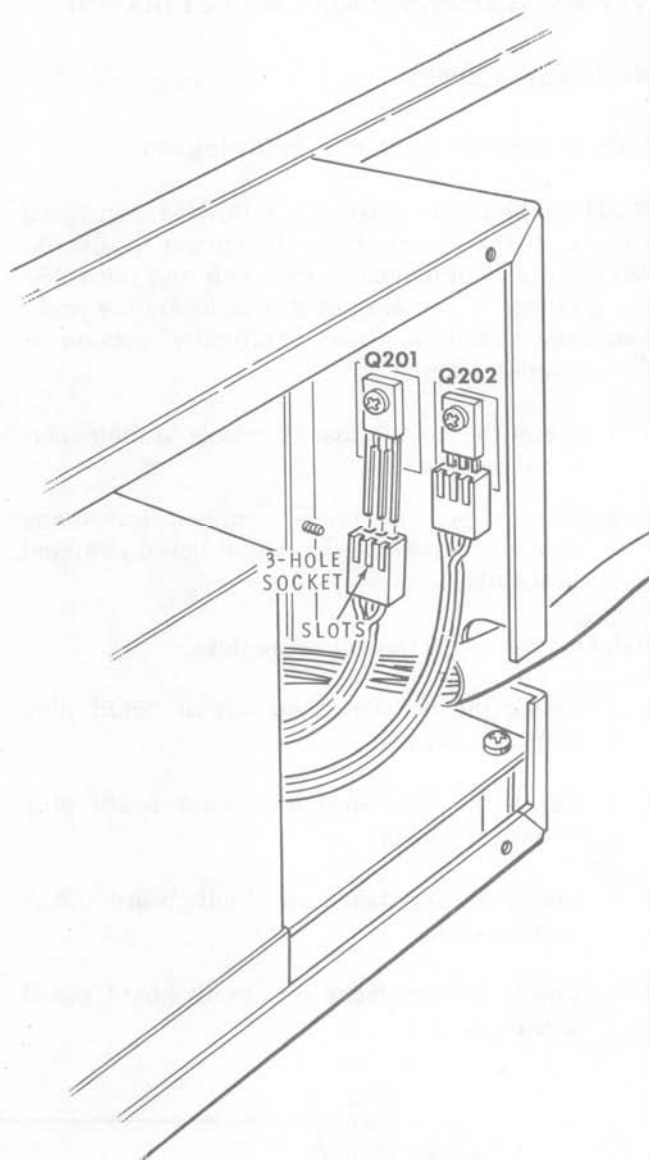
Circuit Board Installation

Refer to Pictorial 10-3 for the following steps.

- () Position the oscilloscope assembly as shown.
- () Carefully position the high-voltage circuit board assembly into the high-voltage enclosure as shown. Then secure the spacers to the bottom of the enclosure with four 4-40 \times 1/4" flat head screws.

NOTE: In the following steps, when you install connector sockets onto the leads of the transistors, you can connect either of the sockets (and wires) to either of the transistors; they are interchangeable.

- () Refer to Detail 10-3A and, on the inside of the enclosure, carefully push one of the small 3-hole sockets on the leads coming from the high-voltage circuit board onto the leads of transistor Q201 in the manner shown.
- () In the same manner, install the other 3-hole socket onto the leads of transistor Q202.
- () Carefully check to make sure the two transistor sockets are positioned onto their respective transistor leads with the housing slots as shown. If they are upside down, the transistor will not operate correctly and it may become damaged.
- () Route the high-voltage anode lead and the sleeving-enclosed wires through the slot in the outer flange of the high-voltage enclosure as shown.
- () Making sure the hole in the compartment cover and the small notch in one edge are positioned as shown in the Pictorial, slide the rear edge of the cover under the rear panel flange. Then secure the compartment cover on the outside of the high-voltage enclosure with five 4-40 \times 1/4" screws.



Detail 10-3A

VERTICAL DEFLECTION CIRCUIT BOARD

Resistance Checks

Refer to Pictorial 11-1 for the following steps.

NOTE: When you make the following resistance checks, if you do not obtain the correct results, do NOT proceed until you have found and corrected the problem. If you are not able to locate the problem, refer to the "In Case of Difficulty" section in the Operation Manual.

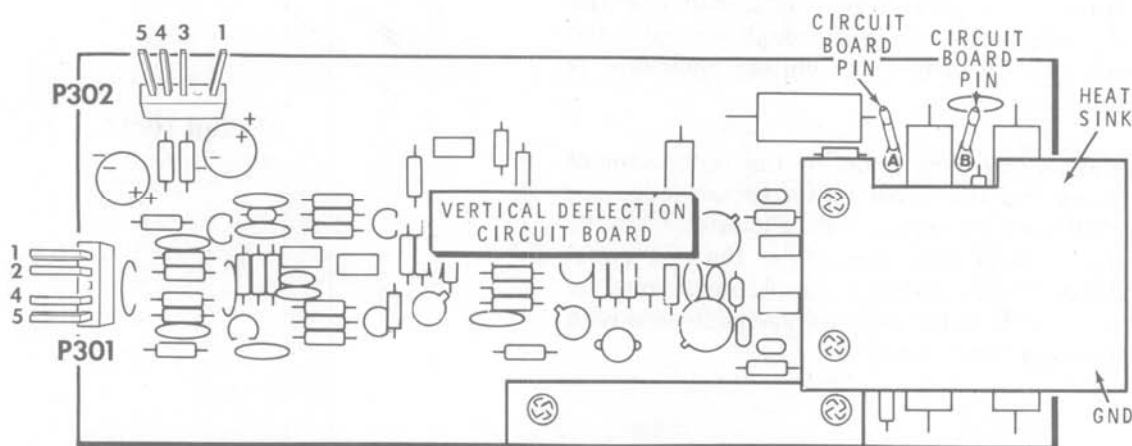
- () Preset the circuit board controls to their rotational centers.
- () Connect your ohmmeter common lead to any convenient area on the circuit board-mounted heat sink.

PLUG OR PIN NO.	PIN NO.	RESISTANCE
P301	1	$< 2 \Omega$
	2	$> 6000 \Omega$
	3	(not used)
	4	$> 6000 \Omega$
	5	$< 2 \Omega$
P302	1	$> 200 \text{ k}\Omega$
	2	(not used)
	3	$> 8000 \Omega$
	4	$> 6000 \Omega$
	5	$< 2 \Omega$
Pin A		$> 200 \text{ k}\Omega$
Pin B		$> 200 \text{ k}\Omega$

Refer to Chart A for the following steps.

CHART A

- () Check the resistance on circuit board plug P301 as indicated.
- () Check the resistance on circuit board plug P302 as indicated.
- () Check the resistance on circuit board pin A as indicated.
- () Check the resistance on circuit board pin B as indicated.



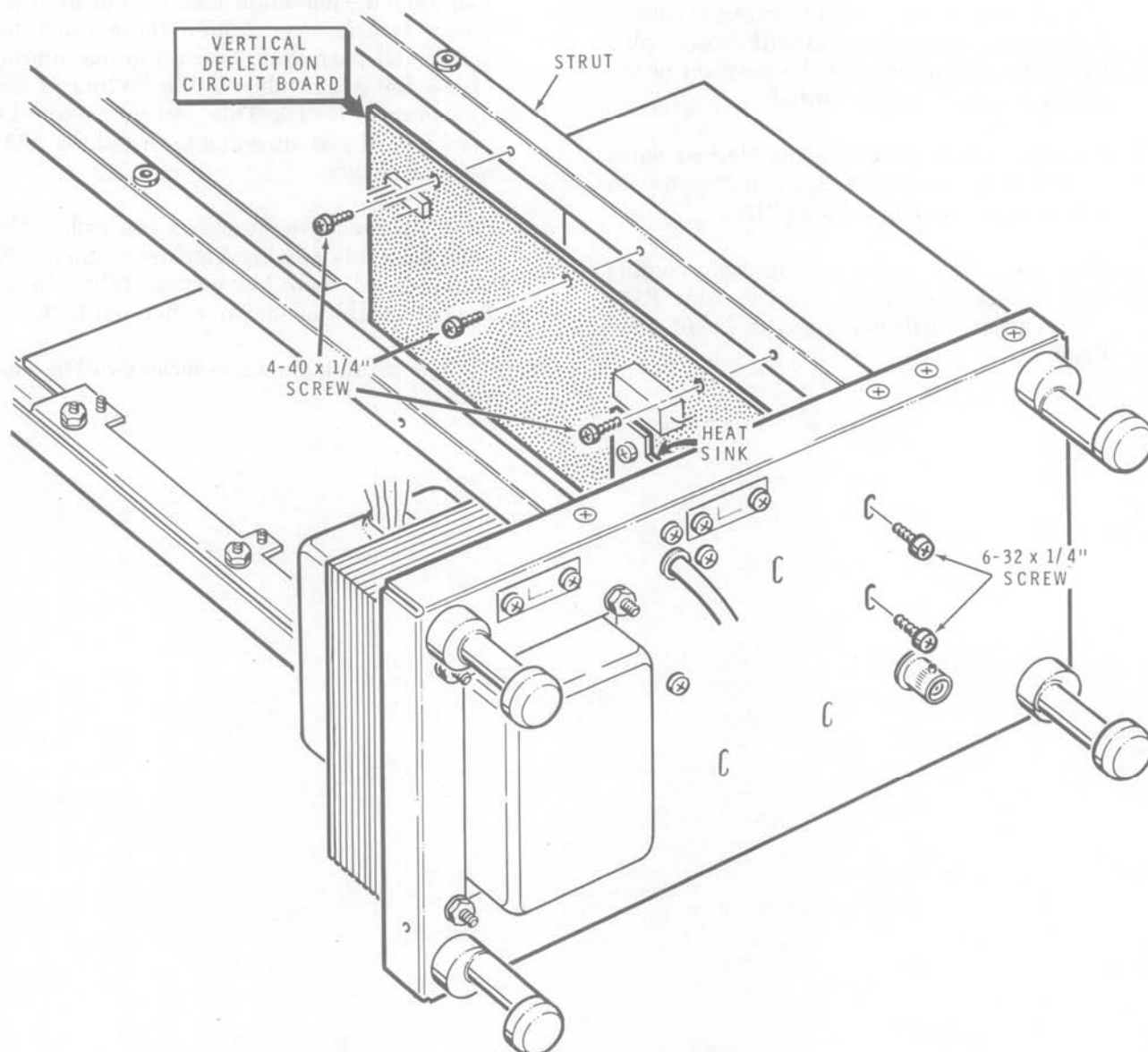
PICTORIAL 11-1

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Circuit Board Installation

Refer to Pictorial 11-2 for the following steps.

- () Position the frame assembly as shown.
- () Position the vertical deflection circuit board on the inside flange of the upper left strut as shown. Then loosely mount the board to the strut with three 4-40 \times 1/4" screws. NOTE: The two end holes on the circuit board will not be used.
- () Secure the vertical deflection circuit board heat sink to the rear panel with two 6-32 \times 1/4" screws.
- () Tighten the three 4-40 \times 1/4" circuit board strut mounting screws.



PICTORIAL 11-2

INTERCONNECT WIRING

Refer to Pictorial 12-1 (Illustration Booklet, Page 37) for the following steps.

- () Push the 10-hole socket on the cable coming from the control circuit board onto low-voltage circuit board plug P101. NOTE: This socket is "keyed" and will fit correctly in only one manner.
- () Push the 3-hole socket on the end of the sleeved three wires coming from Focus control R365 onto low-voltage circuit board plug P106. Be sure to observe the position of the socket as shown in the Pictorial.
- () Push the 8-hole socket on the sleeved wires coming from the high-voltage enclosure onto low-voltage circuit board plug P105.
- () Push the 5-hole socket on the cable coming from low-voltage circuit board location P110 onto vertical deflection circuit board plug P302.
- () Locate the small blue and small brown wires coming from the CRT socket. Push the female terminal on the end of the blue wire onto deflection circuit board PCB pin A and the brown wire female terminal onto pin B.
- () On the CRT socket, locate the two large green wires with the 3-hole socket. Push the plug on the green wires coming from the power transformer into this socket.
- () Locate the 4-hole socket on the end of the two white and the red-white leads coming from the power transformer. Bundle these leads together and push them down into the interior of the frame assembly at the bottom of the transformer. NOTE: This connector will be used later if you are going to install the IOA-4200 Accessory.
- () Push the female terminal on the end of the shielded cable coming from rear panel BNC connector C onto low-voltage PCB pin G. Route this cable as shown in Pictorial 12-1.

NOTE: The remaining plugs and sockets will be connected later.

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VERTICAL PREAMP ASSEMBLY

Resistance Checks

Refer to Pictorial 13-1 (Illustration Booklet, Page 38) for the following steps.

- () Position the vertical preamp circuit board as shown.

NOTES:

1. In the following steps, when you are directed to make resistance measurements, set your ohmmeter to the most suitable range to include the indicated value. For infinity and zero readings, use the meter range you would use to measure 1000 ohms.
 2. All resistances in the charts were measured from a circuit board ground (foil) connection. Therefore, you should always connect the common lead of your meter to a convenient point on a ground lead or a ground foil. Measure with the positive meter probe to the points indicated in the charts.
- () On the vertical preamp front panel, push in the Y1 DISPLAY MODE switch.

Refer to Pictorial 13-1 and to Chart A and check for the resistances listed in the following steps.

- () Set the circuit board controls to their rotational centers.
- () Check for the indicated resistances on circuit board plug P601.
- () Check for the indicated resistances on circuit board plug P602.
- () Position the 7-pin socket on the end of the four shielded cables as shown in the Pictorial; then check each connector pin in the socket for the indicated resistance.

PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
P601	1	>200 k Ω
	2	>290 Ω
	3	>200 k Ω
	4	<2 Ω
	5	>3000 Ω
	6	>2000 Ω
	7	>1000 Ω
	8	>5000 Ω
	9	(not used)
	10	<2 Ω
P602	1	<2 Ω
	2	>2000 Ω
	3	(not used)
	4	>2000 Ω
	5	<2 Ω
7-pin socket	1,5	<2 Ω
	2,4	>200 k Ω
	6,7	>400 Ω

CHART A

Circuit Board Installation

Refer to Pictorial 13-2 (Illustration Booklet, Page 39) for the following steps.

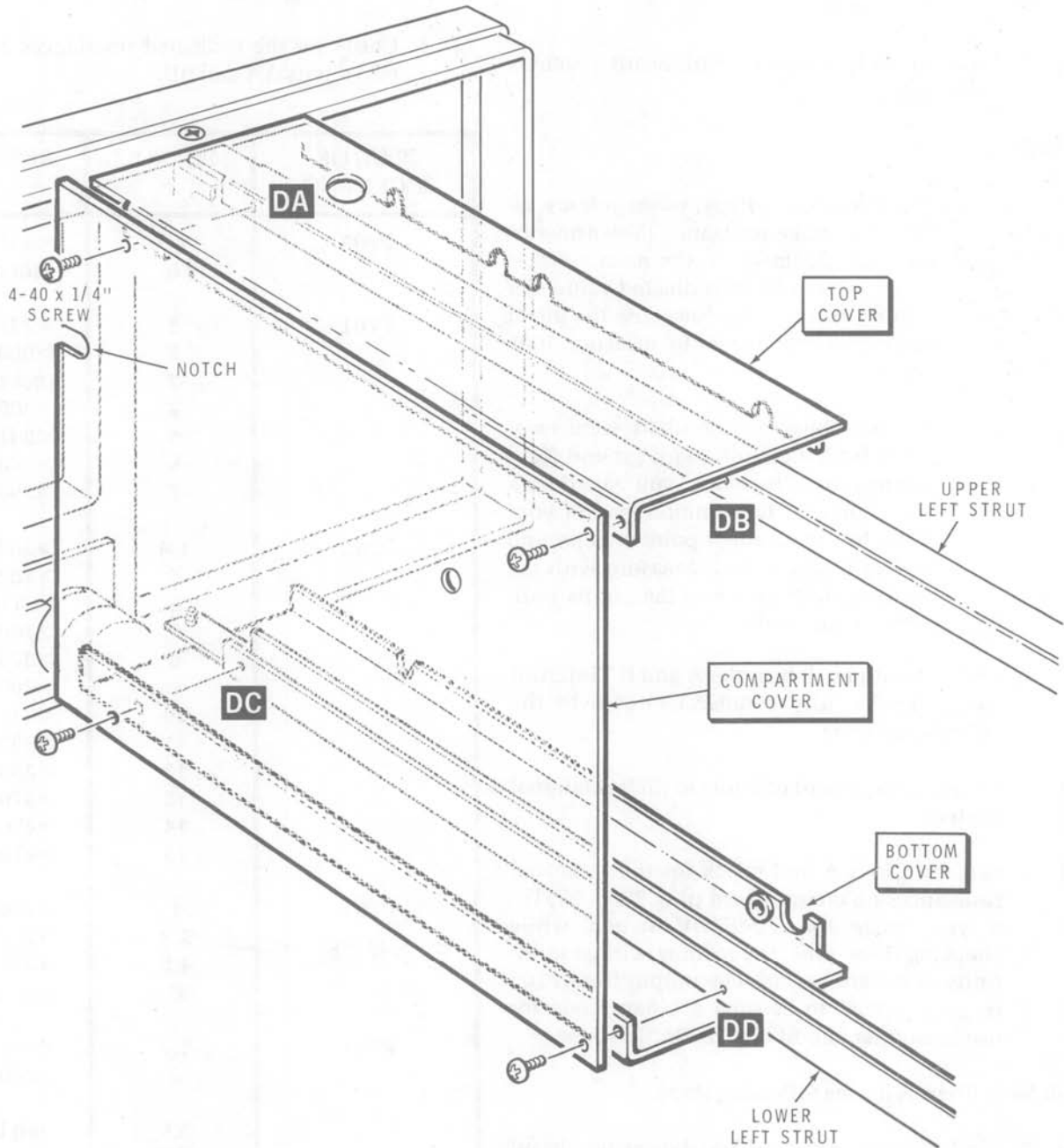
- () Position the frame assembly as shown.

Refer to Detail 13-2A for the next three steps.

- () Loosely mount a compartment cover and the preamplifier top cover onto the upper left strut at DA and DB with two 4-40 \times 1/4" screws.
- () Secure the compartment cover and the preamplifier bottom cover onto the lower left strut at DC and DD with two 4-40 \times 1/4" screws.
- () Tighten all four cover mounting screws.

Position all cables and harnesses out of the way as follows, and as shown in the Pictorial.

- () High voltage anode lead and sleeved wires: Bend sharply over the top of the high-voltage enclosure and into the center area of the frame assembly.
- () All wires and cables from the low-voltage circuit board: To the rear and to the right side of the frame assembly.
- () Carefully position the vertical preamplifier assembly into the frame assembly. As you do this, route the 8-wire flat cable over the rear of the circuit board and toward the center of the frame assembly. Position the bundled shielded cables (coming from the foil side of the board) to the interior of the assembly.
- () After the circuit board assembly is positioned as far as possible into the frame, line up the circuit board mounting holes with the holes in the top left strut. Then secure the circuit board to the upper and lower struts with six 4-40 \times 1/4" screws.

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HORIZONTAL CIRCUIT BOARD

Resistance Checks

Refer to Pictorial 14-1 (Illustration Booklet, Page 40) for the following steps.

- () Position the horizontal circuit board assembly as shown.

NOTES:

- In the following steps, when you are directed to make resistance measurements, set your ohmmeter to the most suitable range to include the indicated value. For infinity and zero readings, use the meter range you would use to measure 1000 ohms.
 - All resistances in the chart were measured from a circuit board ground (foil) connection. Therefore, you should always connect the common lead of your meter to a convenient point on a ground lead or a ground foil. Measure with the positive meter probe to the points indicated in the chart.
- () On the front panel, turn the A and B TIME/CM switch knobs fully counterclockwise to the 100 mS positions.
- () Set all circuit board controls to their rotational centers.
- () Refer to Chart A and check for the indicated resistances on circuit board plug P703. NOTE: If you rotate the TIME/DIV switch while checking these pins, the reading will go to infinity at certain points. The output from P703 is programmed to become a binary code for use in another circuit of your Oscilloscope.

Refer to Chart A for the following steps.

- () Check for the indicated resistances on circuit board plug P701.
- () Check for the indicated resistances on circuit board plug P702.

- () Check for the indicated resistances on circuit board plug P704. **Temporarily remove the jumper (for this test only)** from pins 1 and 2.
- () Check for the indicated resistances on circuit board plug P705.
- () Check for the indicated resistances on circuit board pins AA and BB.

PLUG OR SOCKET NO.	PIN NO.	RESISTANCE
P703	1-5 6	<2 Ω (not used)
P701	1 2 3 4 5 6 7	<2 Ω >800 Ω (not used) >800 Ω <2 Ω >900 Ω >200 k Ω
P702	1-4 5 6 7 8 9 10 11 12 13 14 15	>200 k Ω >1000 Ω (not used) >1000 Ω >30 k Ω >200 k Ω <2 Ω >380 Ω >290 Ω >470 Ω >470 Ω >470 Ω
P704	1 2,3 4,5 6	>400 Ω >200 k Ω <2 Ω (not used)
P705	1,3 2 AA BB	<2 Ω >200 k Ω >40 k Ω >40 k Ω

CHART A

41.6K

128.0-2

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Circuit Board Installation

Refer to Pictorial 14-2 (Illustration Booklet, Page 41) for the following steps.

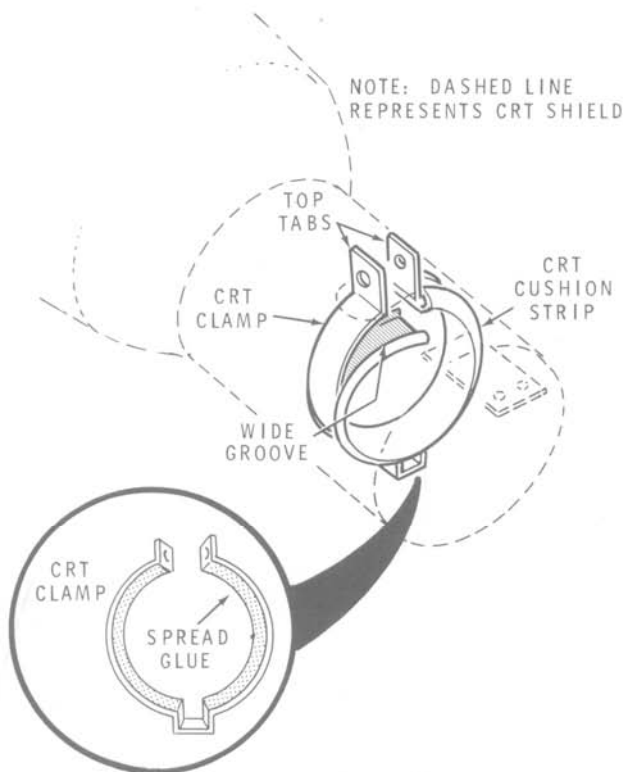
- () Remove the paper backing from the narrow side rail insulator and press the insulator on the upper right strut so that the insulator holes are directly over the mounting holes at DG and DH as shown.
- () Carefully slide the horizontal circuit board rearward through the right front bezel opening until the front circuit board panel is all the way into the bezel recess.
- () Secure the horizontal circuit board to the upper and lower right struts with eight 4-40 \times 1/4" screws.

Refer to Pictorial 14-3 (Illustration Booklet, Page 42) for the following steps.

- () Push the 10-hole socket coming from low voltage circuit board plug P109 onto vertical preamp plug P601. Position the "keyed" socket as shown.

- () Push the 3-hole connector on the shielded cable coming from vertical preamp plug P601 onto horizontal circuit board plug P705. NOTE: The plug may be installed in either direction.
- () Push the female pin on the end of the small orange wire coming from the CRT socket onto horizontal circuit board pin BB.
- () Push the female pin on the end of the small red wire coming from the CRT socket onto horizontal circuit board pin AA.
- () Push the 15-hole socket on the cable coming from low voltage circuit board P107/P108 onto horizontal circuit board plug P702. NOTE: The socket is "keyed" and will fit correctly in only one manner.
- () Locate the 7-pin socket on the end of the four shielded cables coming from the vertical preamp circuit board. Push this socket onto horizontal circuit board plug P701. NOTE: This plug is "keyed" and will fit correctly in only one manner.

The remaining plugs and sockets will be installed later.



Detail 15-1A

CRT ASSEMBLY AND INSTALLATION

Refer to Pictorial 15-1 (Illustration Booklet, Page 43) for the following steps.

- () Open the small tube of glue and, using a safety pin or other sharp pointed tool, push a hole through the tube tip.
- () Cut 1/4" from one end of the CRT cushion strip.
- () Refer to Detail 15-1A and spread a layer of glue onto the CRT clamp as shown. Then, working from one of the top tabs in a circular direction toward the other tab, press the CRT cushion strip onto the clamp. Be sure the wide groove in the bottom of the strip is all the way down onto the clamp surface as you work the strip from one tab toward the other. Save the remaining glue.



Detail 15-1B

- () Refer to Detail 15-1B and install a 1/4" rubber grommet in hole TA in the CRT shield.

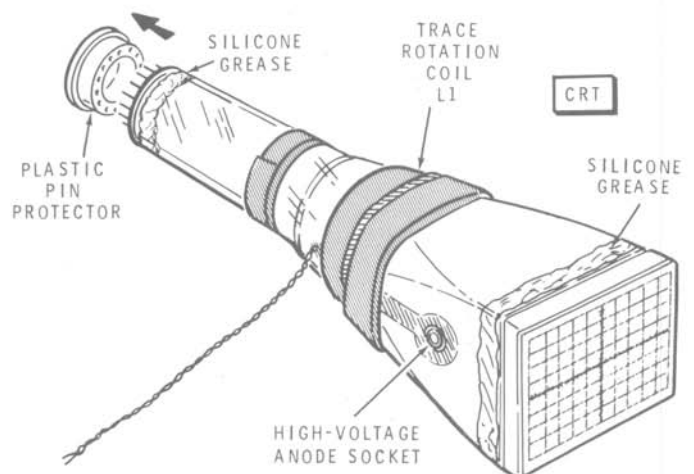
Set the CRT shield aside temporarily.

WARNING: Be careful when you handle the CRT. Do not strike, scratch or subject the CRT to more than moderate pressure at any time. Due to its high vacuum, a fracture of the glass could cause an implosion of considerable violence capable of causing personal injury.

- () Carefully unpack the CRT.

Refer to Detail 15-1C for the next two steps.

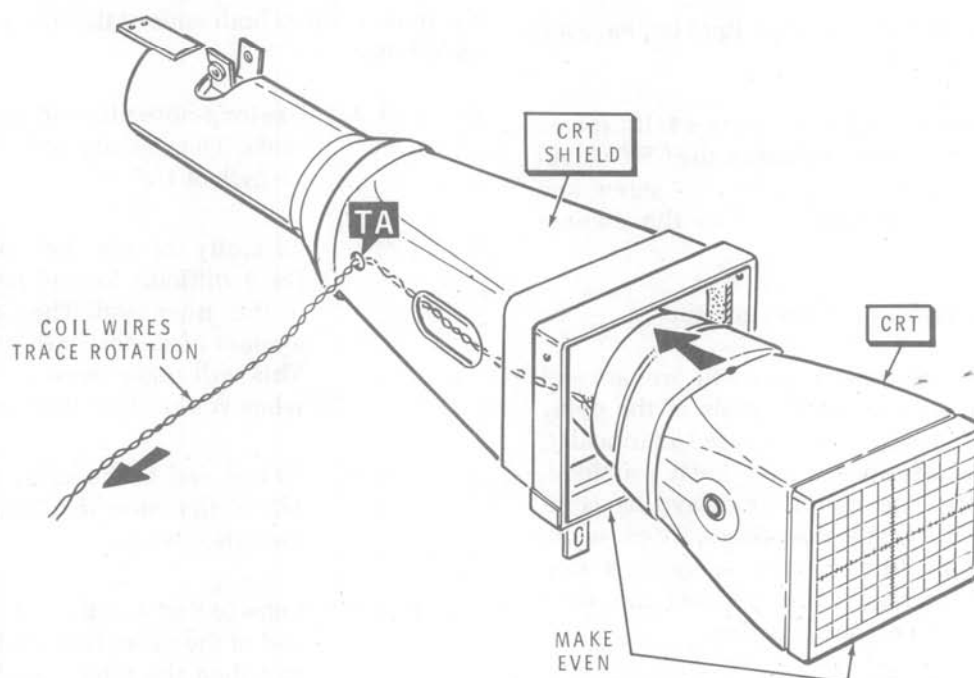
- () Position the CRT so the high-voltage anode socket is toward you as shown in the Detail.
- () Remove all of the white tape (front and rear) and the plastic pin protector from the back end of the CRT.



Detail 15-1C

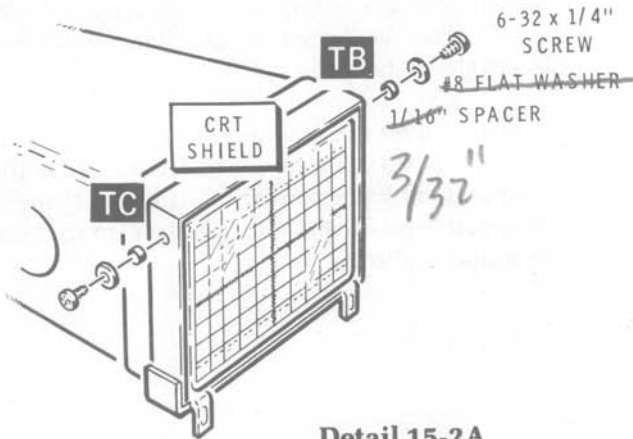
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- () Smear a thin layer of silicone grease around the neck of the CRT as shown. *and the front surfaces.*
- () Refer to Detail 15-1D and install the CRT in the CRT shield. Route the wires coming from the trace rotation coil through grommet TA in the shield. The face of the CRT should finally be exactly even with the front edges of the shield.
- () Secure the CRT clamp tabs snugly with a 6-32 \times 1" screw as shown in the Pictorial. Do not overtighten the screw.
- () Crimp and solder a female terminal onto the end of each trace rotation coil wire. After the connections have cooled, shrink a 3/4" piece of small heat-shrinkable sleeving onto each terminal as shown.



Detail 15-1D



**Detail 15-2A**

Refer to Pictorial 15-2 (Illustration Booklet, Page 43) for the following steps.

- () Refer to Detail 15-2A and secure a 1/16" spacer to each of the upper corners of the CRT shield at TB and TC using a 6-32 × 1/4" screw and a #8 flat washer (3/8" dia.) in the manner shown.

Refer to Detail 15-2B for the following steps.

NOTE: In the following steps, you will prepare and install wires and sockets on the ends of the delay line. Since both ends will be prepared identically, two sets of check-off spaces have been provided. Completely prepare one end of the delay line as directed, checking the first set of spaces. Then, when you are directed to do so, return to the first step of double check-off spaces and perform the same steps on the other end of the delay line.

- () () 1. Refer to Part 1 of Detail 15-2B and prepare the ends of a 3" 4-wire flat cable in the manner shown. Use a black-brown-red-orange 4-wire cable removed from the 25-wire flat cable supplied with the kit. Be sure to tightly twist the wire ends and to add a small amount of solder to each bare end to hold the fine strands together.
- () () 2. Refer to Part 2 of the Detail and crimp and solder small spring connectors onto the even ends of the wires on the 4-wire cable. Push the connectors into a 5-hole socket as follows:

Black wire into hole 1.
Brown wire into hole 2.
Red wire into hole 4.
Orange wire into hole 5.

- () () 3. Push a polarizing plug into hole 3 of the 5-hole socket.

IMPORTANT: The delay line, which you will be working with in the following steps, is delicate. Handle it gently and do not bend it sharply.

NOTE: Perform the next two steps only if they have not already been done.

Refer to Part 3 of Detail 15-2B and expose 1/2" of the inner leads at both ends of the delay line (#41-9) as follows:

- () () 4. Use long-nose pliers to grasp the inner leads. Then gently pull them out for a length of 1/2".
- () () 5. Carefully scrape 1/4" of insulation (very difficult to see) from the ends of the inner lead. Then melt a small amount of solder on these leads ends. This will make them easier to solder when you connect them later.
- () () 6. At one end of the delay line, remove 1/2" of the outer insulation to expose the shield wires.
- () () 7. Refer to Part 4 of the Detail and at one end of the delay line, on first one side and then the other, comb out, pinch together, and tightly twist approximately half of the cable shield braid as shown. Add solder to these twisted shield ends.
- () () 8. Refer to Part 5 of the Detail and form a small hook in the ends of the four wires on one of the socket assemblies. Also form small hooks on the ends of the two inner leads and the two shield leads on one end of the delay line.
- () () 9. Cut two 1/2" pieces of small heat-shrinkable sleeving.

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- () () 10. Place a 1/2" piece of sleeving over the end of the brown wire and over the red wire on the socket assembly.

- () () 11. Connect the socket assembly wires to the delay line as follows:

Brown wire to either inner lead (S-1).
Red wire to the other inner lead (S-1).
Black wire to either shield lead (S-1).
Orange wire to the other shield lead (S-1).

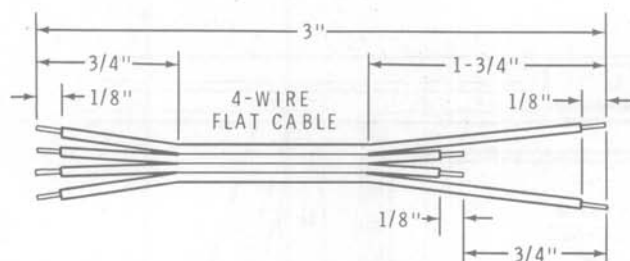
- () () 12. Slide the sleeving on the red and brown wires down over the solder-connections and shrink the sleeving in place.

- () () 13. Refer to Part 6 of the Detail and tightly tape the end of the delay line and the flat 4-wire cable to hold the connections firmly in place.

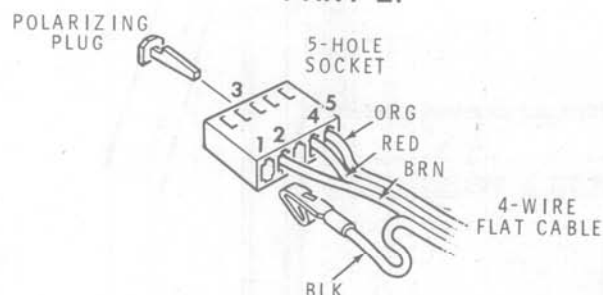
Return to Step 1 of the delay line instructions and complete all 13 steps on the other end of the delay line before you proceed with the following steps.

- () Position one end of the delay line on the top of the CRT shield as shown in the Pictorial. Route the cable rearward toward the CRT clamp and down onto the narrow portion of the shield. Then start wrapping the delay line around the shield, keeping each turn flat against the previous turn and tight against the shield. As you come upward with the third and final turn, route it forward toward the face of the CRT as shown.
- () Using black electrical tape, tightly secure the delay line to the CRT shield. Be sure to overlap the tape so as to cover the delay line as shown in the Pictorial.

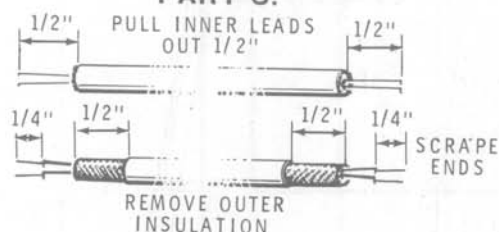
PART 1.



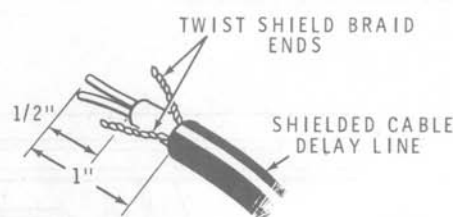
PART 2.



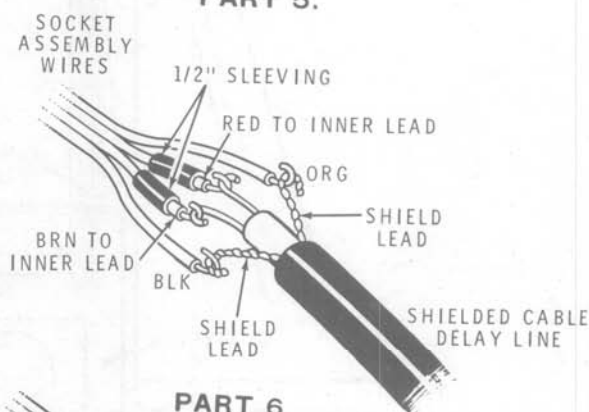
PART 3.



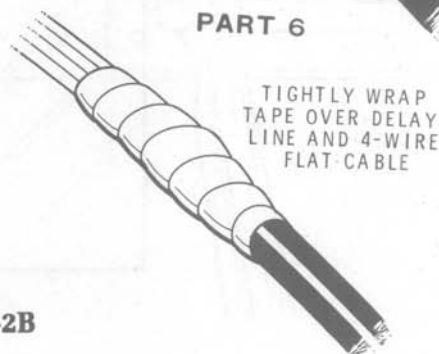
PART 4.



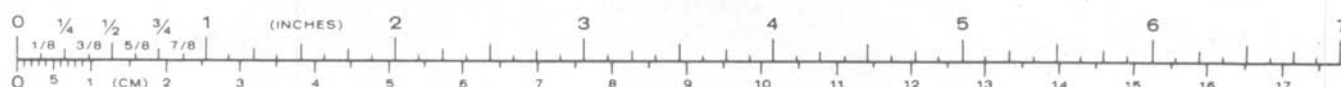
PART 5.



PART 6



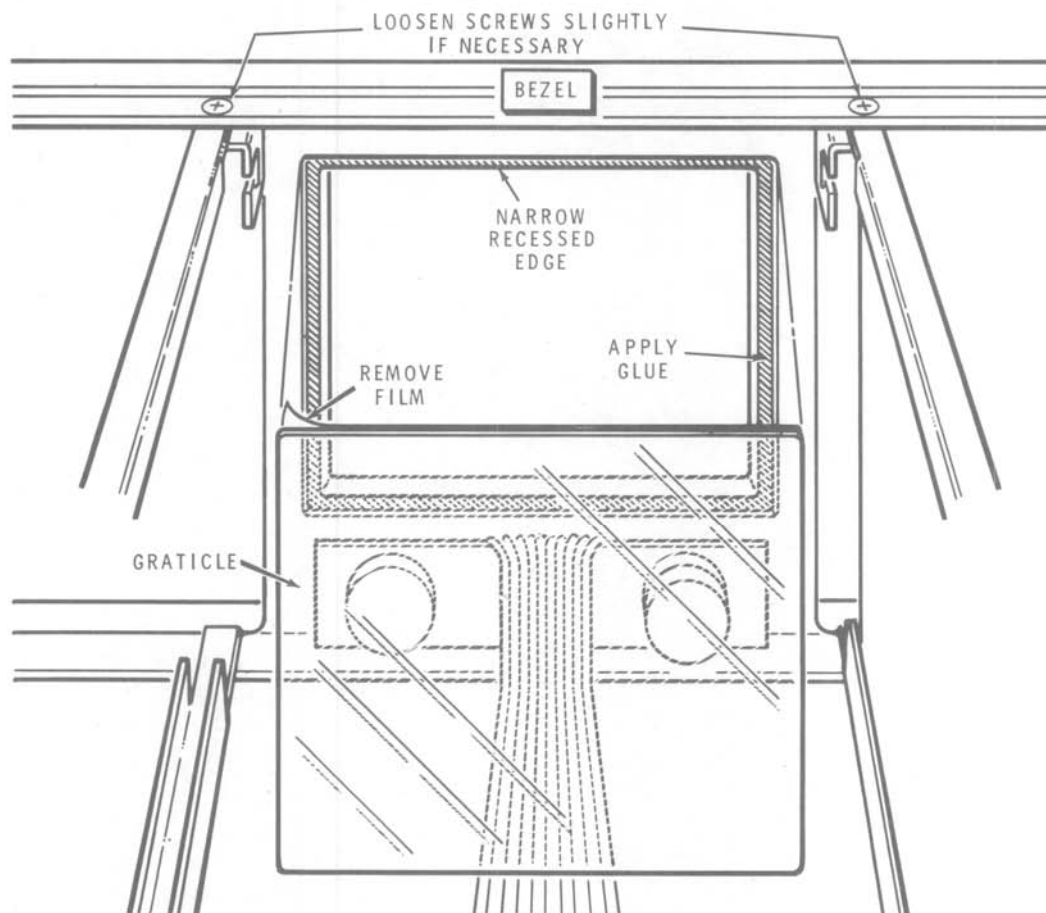
Detail 15-2B



Refer to Pictorial 15-3 (Illustration Booklet, Page 44) for the following steps.

Refer to Detail 15-3A for the next two steps.

- () Apply a small amount of glue to the narrow recessed edges of the bezel opening as shown. Use the glue **sparingly** to avoid its squeezing out around the filter in the next step.
- () If necessary, remove the thin film from both sides of the graticule and position the blue filter into the bezel as shown. Set the assembly aside for approximately one hour to allow the glue to set.
- () On the front panel, remove the knob from the FOCUS control. Then loosen the control nut. Temporarily rotate the FOCUS control on the inside of the assembly so the lugs are toward the bottom of the bezel.
- () Position the upper corner pivot spacers on the front of the CRT into the slots in the pivot brackets on the top of the bezel as shown. Holding the CRT at approximately 30 degrees up from the horizontal position, work the CRT shield forward into the pivot bracket slots as far as possible. NOTE: Loosen the bracket screws temporarily if necessary. See Detail 15-3A.
- () Tilt the CRT shield upward as necessary, and push the high-voltage clip on the anode lead coming from the high-voltage enclosure into the high-voltage anode on the left side of the CRT as shown.
- () Making sure all the leads, plugs, and sockets (not yet connected) on the inside of the frame assembly are positioned upward and to either side, carefully lower the CRT assembly downward into the frame as shown. Be certain the lower left tab (as shown in the Pictorial) does not come in contact with the FOCUS control lugs.

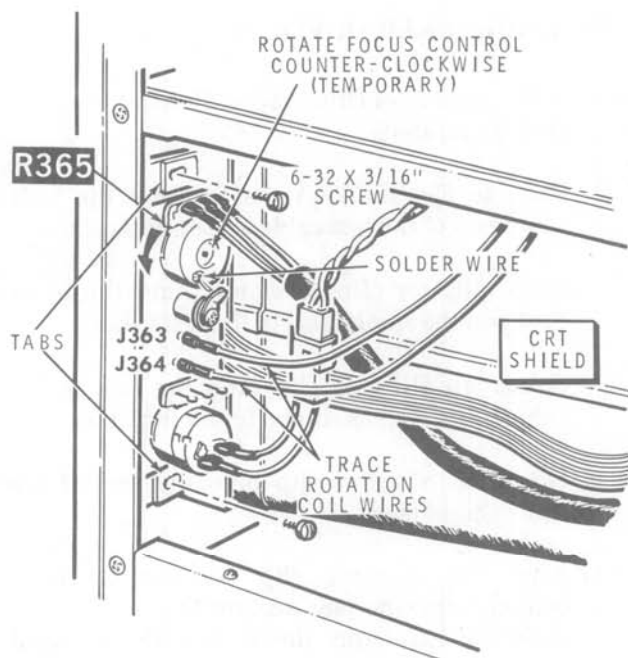


Detail 15-3A

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591-4425

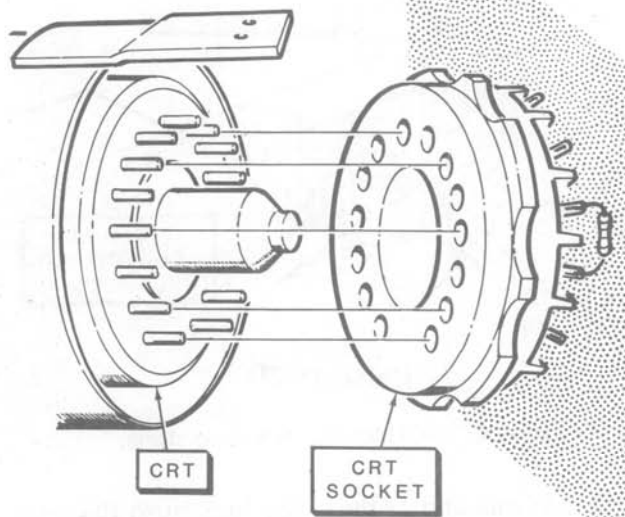


Detail 15-3B

- () Refer to Detail 15-3B for the following steps.

NOTE: In the following step, be **sure** to use only the hardware specified to avoid damage to the front panel.

- () Loosely secure the tabs on the lower front of the CRT shield to the bezel with two 6-32 × 3/16" screws. NOTE: You may have to press downward slightly on the top front of the CRT shield to align these holes.
- () Check the graticule lines on the CRT to make sure they are aligned with the front panel opening. If necessary, grasp the CRT shield and twist it slightly to correctly position the graticule lines. Then tighten the two tab mounting screws.
- () Rotate the FOCUS control back to its original position and tighten the control nut. Reinstall the knob.
- () Solder the end of the short bare wire, coming from the banana jack solder lug, to the case of control R365.



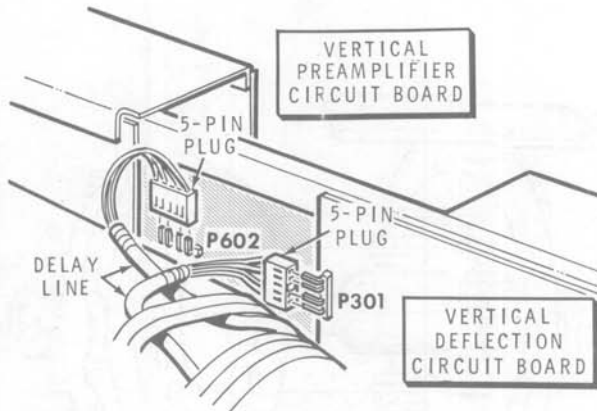
Detail 15-3C

- () Locate the two small trace rotation coil wires. Push the female terminals on these wires onto control circuit board pins J363 and J364 as shown in Detail 15-3B.

NOTE: In the following step, make sure the CRT wires to the vertical deflection horizontal circuit boards are routed as straight as possible to their connections without crossing or twining with other wires. If necessary, remove a wire from its connecting point, reroute it, and then reconnect it.

- () Refer to Detail 15-3C and, using the fingers of both hands, position the CRT socket onto the CRT in the manner shown. After the socket has started onto the CRT pins, push the socket as far forward as possible onto the pins.
- () Refer to the Pictorial and, on the rear panel, loosely secure the CRT rear bracket to hole D. Then secure the bracket to the CRT shield tab. Use three 6-32 × 1/4" screws as shown in the Pictorial. Tighten the screw at hole D.



**Detail 15-3D**

Refer to Detail 15-3D for the next two steps.

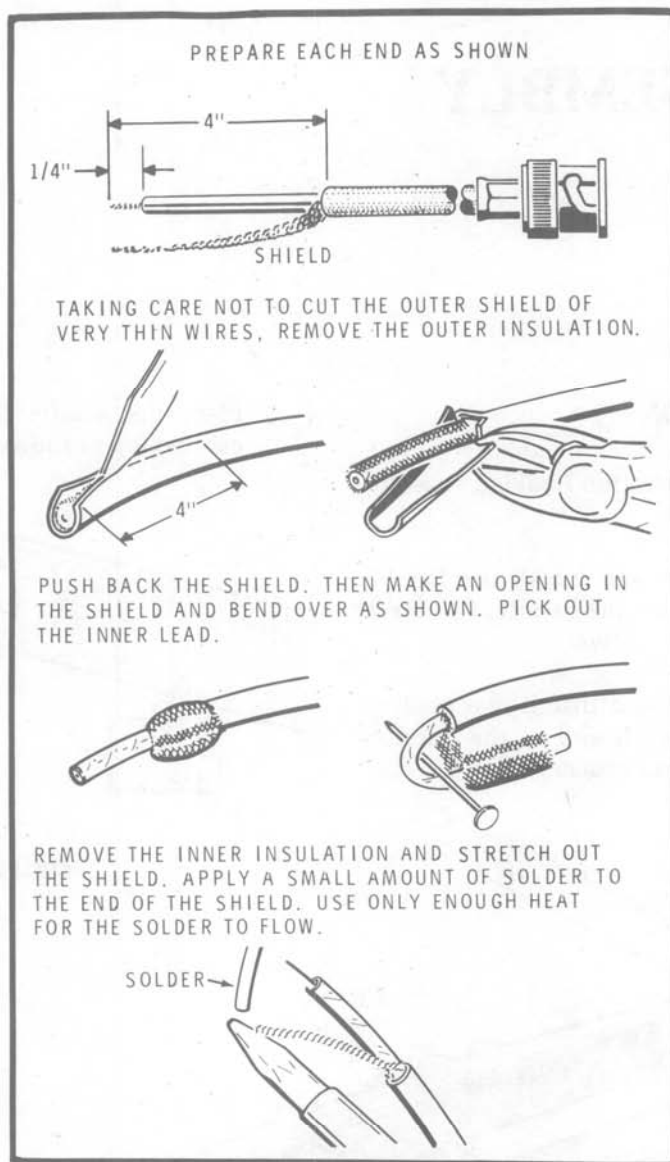
- () On one end of the delay line, push the 5-pin socket down and onto vertical preamplifier plug P602 in the manner shown.
- () Similarly, connect the other delay line plug onto vertical deflection circuit board plug P301.
- () Remove the paper backing from the "Danger" label and press the label in place on the top of the high voltage enclosure as shown.
- () Remove the backing paper from the blue and white label and press the label in place on the Oscilloscope rear panel as shown in the Pictorial. NOTE: Be sure to refer to the Model and Series numbers on the blue and white label in any correspondence you have with the Heath Company about your kit.
- () You may store connectors P401 and P501 down between the CRT shield and the inner side of the vertical preamp shield.

TEST CABLE PREPARATION

Refer to Pictorial 15-4 (Illustration Booklet, Page 44) for the following steps.

- () Refer to Detail 15-4A and prepare the indicated end of the test cable assembly as shown.
- () Push alligator clip insulators onto the inner lead and the shield lead of the test cable.
- () Solder an alligator clip onto the end of the cable inner lead as shown in the Pictorial.
- () Solder an alligator clip onto the end of the cable shield lead.
- () After the alligator clip connections have cooled, bend the tabs around the leads. Then slide the insulators down over the alligator clips.

Except for the "Final Assembly," this completes the step-by-step assembly of your Oscilloscope. Refer to your Operation Manual, Section 14, and perform all the necessary steps to test and calibrate your Oscilloscope. When you have completed all of the necessary adjustments and have determined that your Oscilloscope is completely operational, return to this Assembly Manual to perform the steps under "Final Assembly."



Detail 15-4A

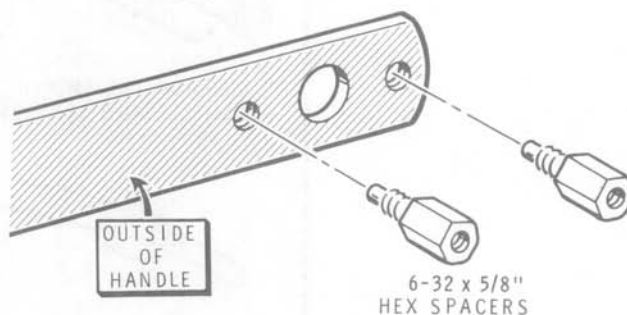


FINAL ASSEMBLY

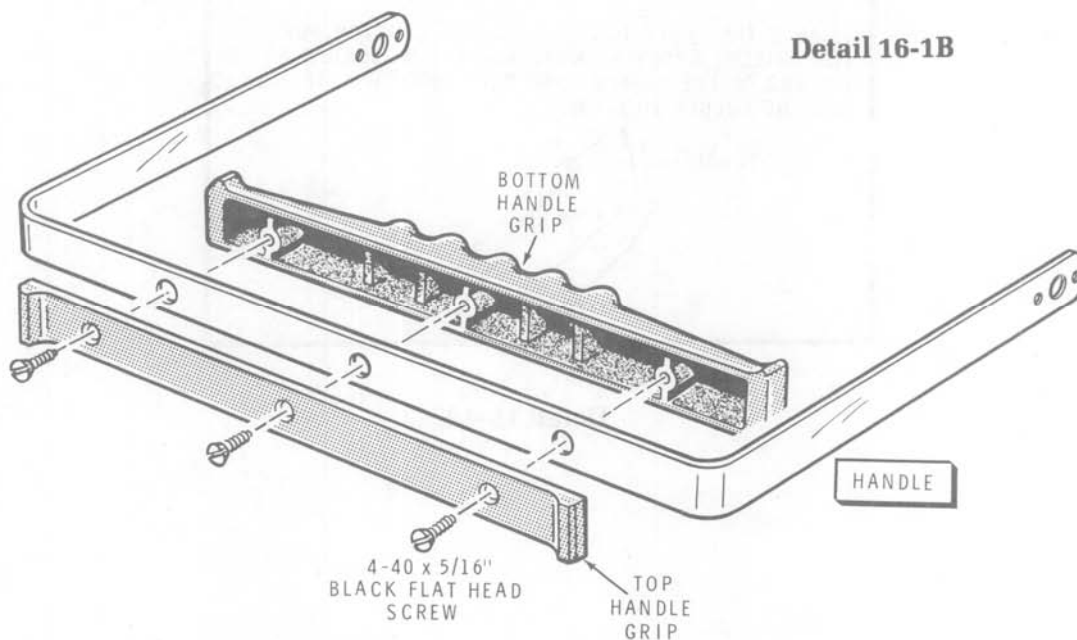
HANDLE INSTALLATION

Refer to Pictorial 16-1 (Illustration Booklet, Page 45) for the following steps.

- () Refer to Detail 16-1A and install the handle top and bottom grips on the handle. Use three 4-40 × 5/16" flat head screws.
- () Refer to Detail 16-1B and install two 6-32 × 5/8" hex spacers in each end of the handle. Be sure to install these spacers from the outside of the handle.



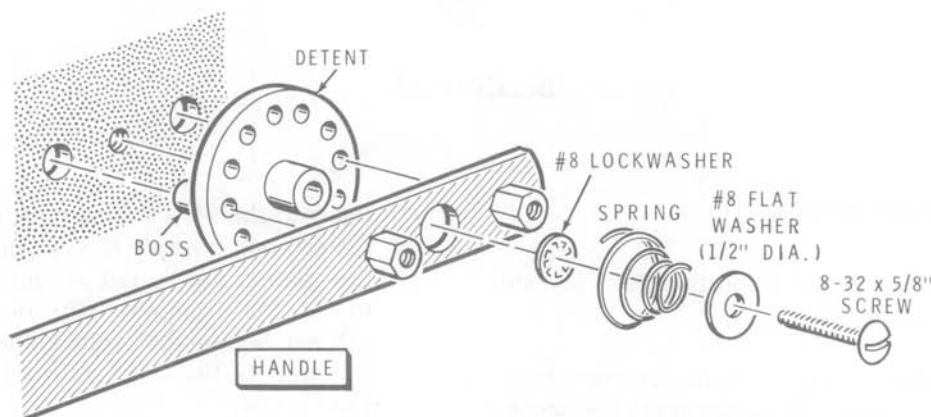
Detail 16-1B



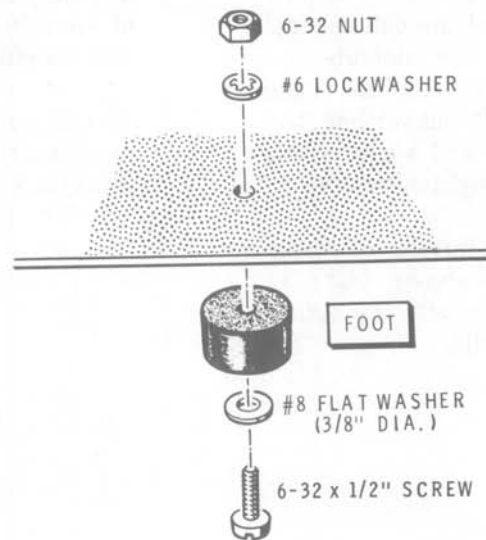
Detail 16-1A

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- () Refer to Detail 16-1C and mount the handle and a detent on each side of the cabinet top. Be sure the bosses on the detents are positioned in the holes in the cabinet. Then install a #8 lockwasher, a #8 flat washer (1/2" dia.), an 8-32 x 5/8" screw and a coil spring at each location. Do not overtighten the screw.
- () Carefully inspect the two knob inserts. If either of them has a protective film over the shiny side, carefully peel away this film.
- () Carefully remove the paper backing from each knob insert. Then press the insert into the center of each detent cover as shown.
- () Refer to the Pictorial and mount detent covers on each end of the handle as shown. Use 6-32 x 3/16" flat head screws. Be sure the cutout in the cover fits over the handle.



Detail 16-1C



Detail 16-2A

CABINET INSTALLATION

Refer to Pictorial 16-2 (Illustration Booklet, Page 46) for the following steps.

NOTE: If you have not aligned and calibrated your Oscilloscope yet, you should perform all the necessary steps to complete these operations before you install the Oscilloscope in the cabinet.

- () Refer to Detail 16-2A and mount four feet on the underside of the cabinet bottom at holes EA, EB, EC, and ED in the manner shown. Use #8 (3/8" dia.) flat washers and 6-32 × 1/2" hardware.
- () Secure the cabinet bottom to the frame assembly, the front bezel, and the rear panel at EF, EG, EH, EJ, EK, and EL with six 6-32 × 1/4" screws. Be sure to position the perforated portion of the cabinet bottom toward the rear as shown.
- () Position the cabinet top down onto the frame assembly in such a manner that the sides of the top are on the outside of the cabinet bottom flanges as shown. Secure the cabinet top to the front bezel, the rear panel, and to the frame assembly with nine 6-32 × 1/4" screws.

- () Refer to the Pictorial and, on the top front of the cabinet, position the cabinet subcover into the cabinet top cutout as shown. Be sure not to let the subcover slip down inside the cabinet. Secure the cabinet cover plate and the subcover to the bezel with a 6-32 × 1/4" flat head screw.

IMPORTANT: If you have purchased the Heathkit Model IOA-4200 Time-Voltage Module Accessory for use with this Oscilloscope, we recommend that you use the Oscilloscope for a minimum of 10 operating hours to get thoroughly acquainted with all its functions and applications before you install and use the Time-Voltage Module. It was for this reason that you were not previously instructed to assemble and install your Accessory kit. If you have this Module, you should assemble it now and prepare to install it after the Oscilloscope has been in operation for the prescribed time. However, you should **not** install the Module if you believe the Oscilloscope to not be operating properly in all respects.

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



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