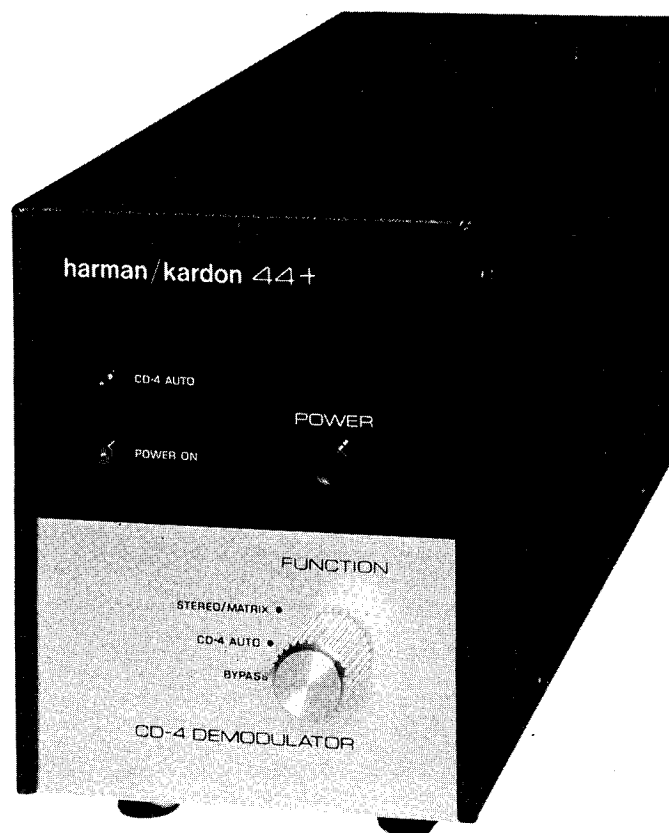


ERIC NELSON - CUST. SVC. DEPT.

The Harman-Kardon Model 44+

CD-4 Demodulator

Technical Manual

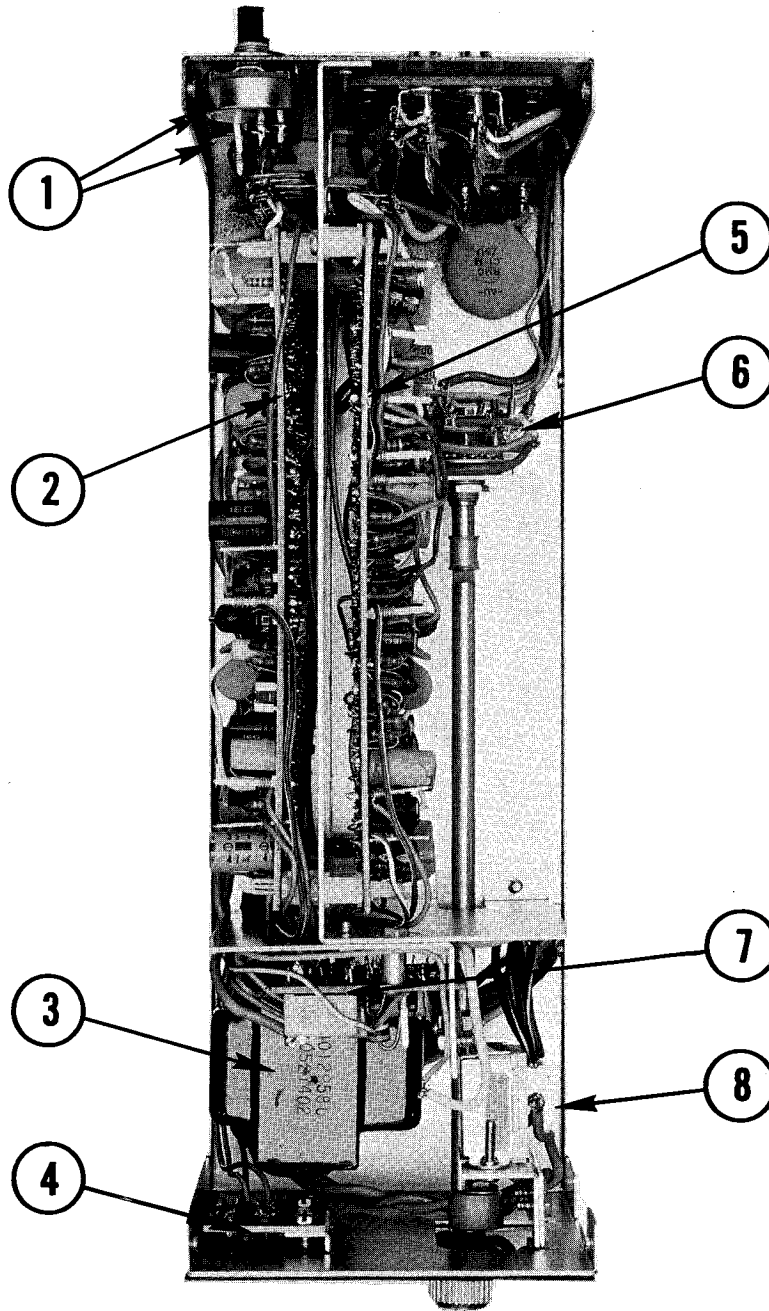


harman/kardon

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TOP VIEW



- (1) SEPARATION CONTROLS
- (2) CD 4 BOARD (PC-1)
- (3) POWER TRANSFORMER
- (4) LED BOARD

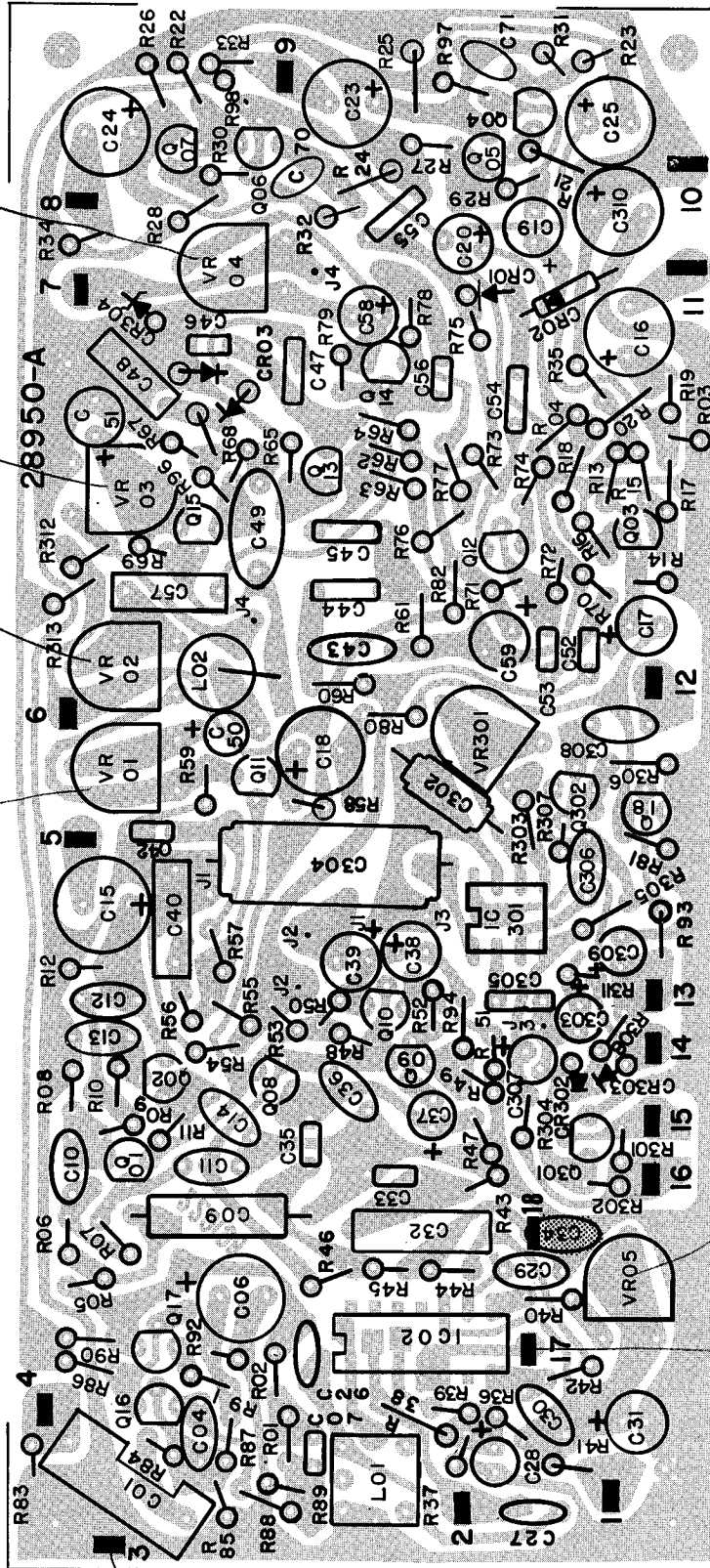
- (5) CD-4 BOARD (PC-2)
- (6) FUNCTION SWITCH
- (7) POWER SUPPLY BOARD
- (8) POWER SWITCH

4KHZ LAW

4KHZ GAIN

630 LAW

630 GAIN

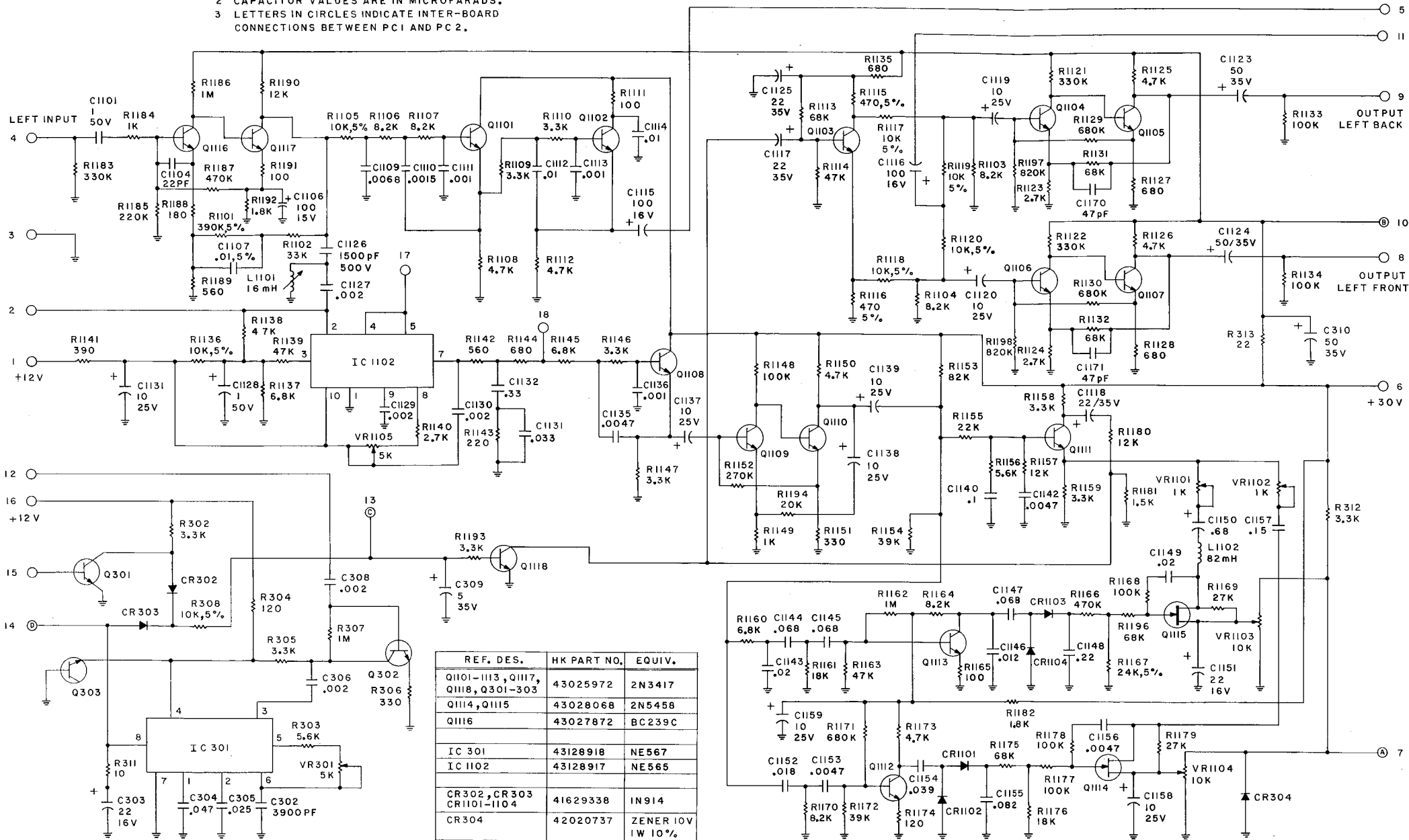


VR301 FOR LITE ON w/ CD-4 UNIT

set for 30.0 kHz
FF50 current

NOTES

- UNLESS OTHERWISE SPECIFIED:
 1 RESISTOR VALUES ARE IN OHMS $\pm 10\%$, 1/4 W.
 2 CAPACITOR VALUES ARE IN MICROFARADS.
 3 LETTERS IN CIRCLES INDICATE INTER-BOARD CONNECTIONS BETWEEN PC1 AND PC2.



TEST POINTS IC 1102				
INPUT	TEST POINT	VOLTMETER	OSCILLOSCOPE	FREQUENCY
Short	Pin 17	5.7 DC		30kHz
30kHz Tone -46dBm or CD-4 Signal -50dBm	Pin 2	3.5 DC		30kHz
30kHz Tone -56dBm or CD-4 Signal -60dBm	Pin 2	3.5 DC		30kHz
30kHz Tone -50dBm or CD-4 Signal No Mod	Top of R42 Pin 7	7.8 DC		60kHz
CD-4 Signal 1kHz Mod 1.25kHz Deviation	Top of R42 Pin 7	7.8 DC		1kHz
CD-4 Signal No Mod or 30kHz Tone -50dBm	Pin 9			30kHz

* Signal is frequency modulated
 The output level from a CD-4 cartridge is normally between -50 and -60 dBm.

TEST POINTS ON 567 (IC 301)				
INPUT	TEST POINT	DC VOLTS	OSCILLOSCOPE	FREQUENCY
Short or CD-4 Signal No Modulation or 30kHz Tone -50dBm	Top of R303 Pin 5	4.2		30kHz
30kHz Tone -50dBm	C302 - end near IC	4.2		30kHz
CD-4 Signal -54dBm or 30kHz Tone -50dBm	Pin 3	1.9		30kHz

IC 1102 DC VOLTAGES	
INPUT SHORTED	
IC PIN	VOLTS DC
1	0
2	3.5
3	3.5
4	6
5	6
6	7.8
7	7.8
8	8
9	4
10	9
11-14	No Connection

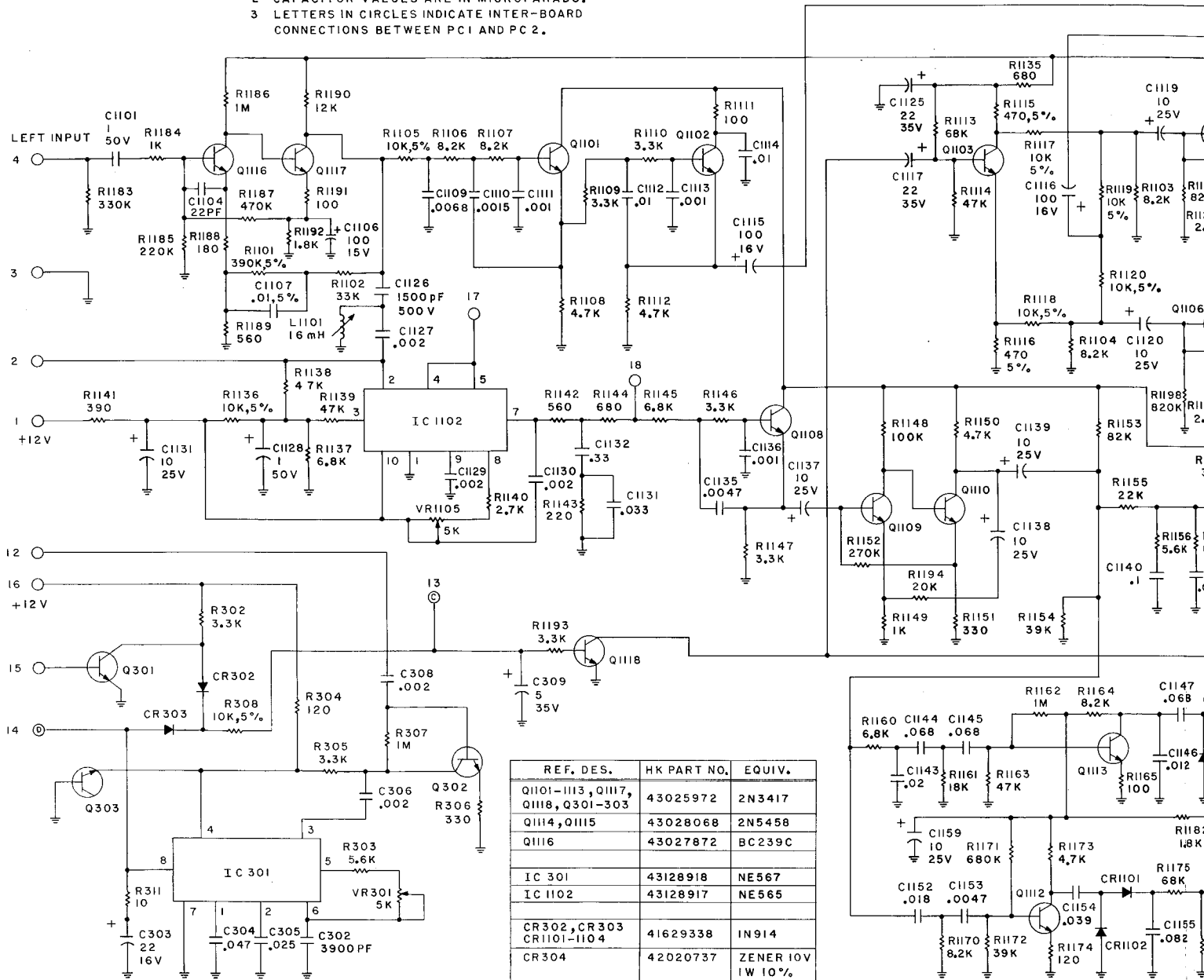
IC 301 DC VOLTAGE - CD-4 AUTO MODE		
IC PIN	INPUT SHORTED VOLTS DC	CD-4 INPUT VOLTS
1	6.7	5.0
2	6.2	6.5
3	2.0	1.9
4	8.9	8.7
5	4.2	4.3
6	4.2	4.1
7	0	0
8	8.1	.03 (BYPASS 9.6)

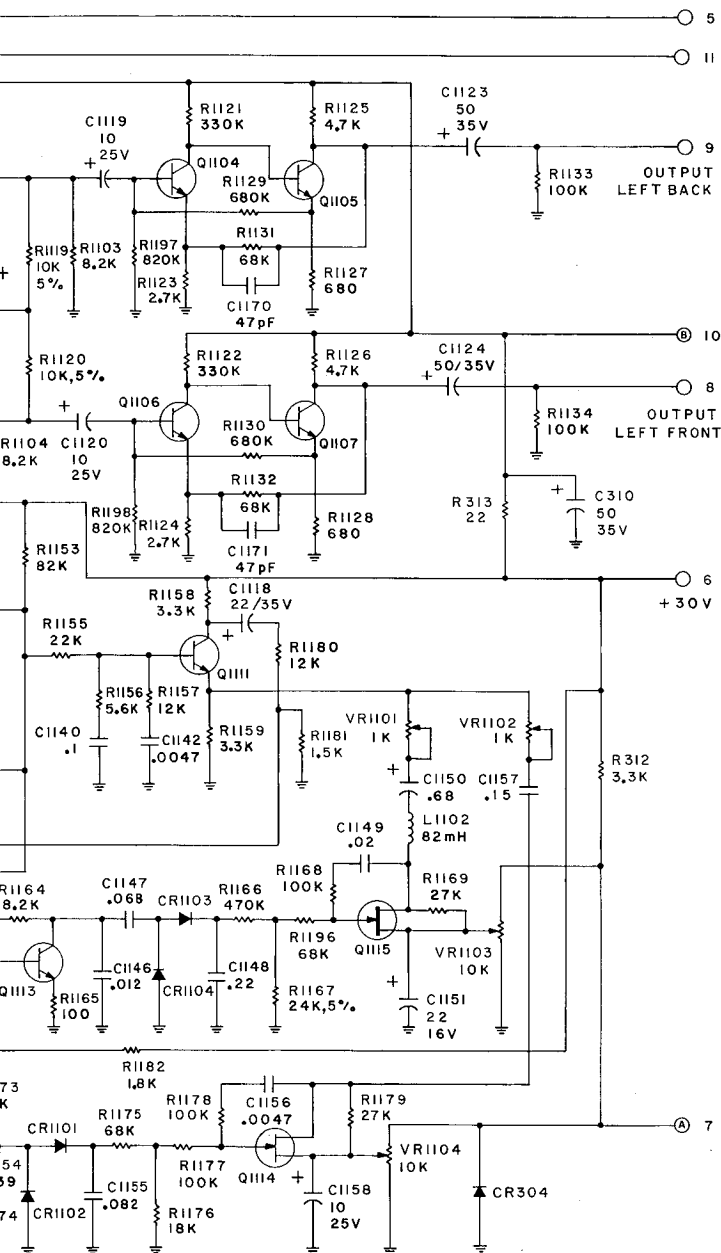
SCHEMATIC DIAGRAM CD-4 (PC-1)

Pt. No. 00128950

NOTES

- UNLESS OTHERWISE SPECIFIED:
 1 RESISTOR VALUES ARE IN OHMS $\pm 10\%$, 1/4 W.
 2 CAPACITOR VALUES ARE IN MICROFARADS.
 3 LETTERS IN CIRCLES INDICATE INTER-BOARD CONNECTIONS BETWEEN PCI AND PC 2.





TEST POINTS IC 1102

INPUT	TEST POINT	VOLTMETER	OSCILLOSCOPE	FREQUENCY
Short	Pin 17	5.7 DC		30kHz
30kHz Tone -46dBm or CD-4 Signal -50dBm	Pin 2	3.5 DC		30kHz
30kHz Tone -56dBm or CD-4 Signal -60dBm	Pin 2	3.5 DC		30kHz
30kHz Tone -50dBm or CD-4 Signal No Mod	Top of R42 Pin 7	7.8 DC		60kHz
CD-4 Signal 1kHz Mod 1.25kHz Deviation	Top of R42 Pin 7	7.8 DC		1kHz
CD-4 Signal No Mod or 30kHz Tone -50dBm	Pin 9			30kHz

* Signal is frequency modulated

The output level from a CD-4 cartridge is normally between -50 and -60 dBm.

TEST POINTS ON 567 (IC 301)

INPUT	TEST POINT	DC VOLTS	OSCILLOSCOPE	FREQUENCY
Short or CD-4 Signal No Modulation or 30kHz Tone -50dBm	Top of R303 Pin 5	4.2		30kHz
CD-4 Signal -54dBm or 30kHz Tone -50dBm	C302 - end near IC Pin 3	4.2 1.9		30kHz

IC 1102 DC VOLTAGES

INPUT SHORTED	
IC PIN	VOLTS DC
1	0
2	3.5
3	3.5
4	6
5	6
6	7.8
7	7.8
8	8
9	4
10	9
11-14	No Connection

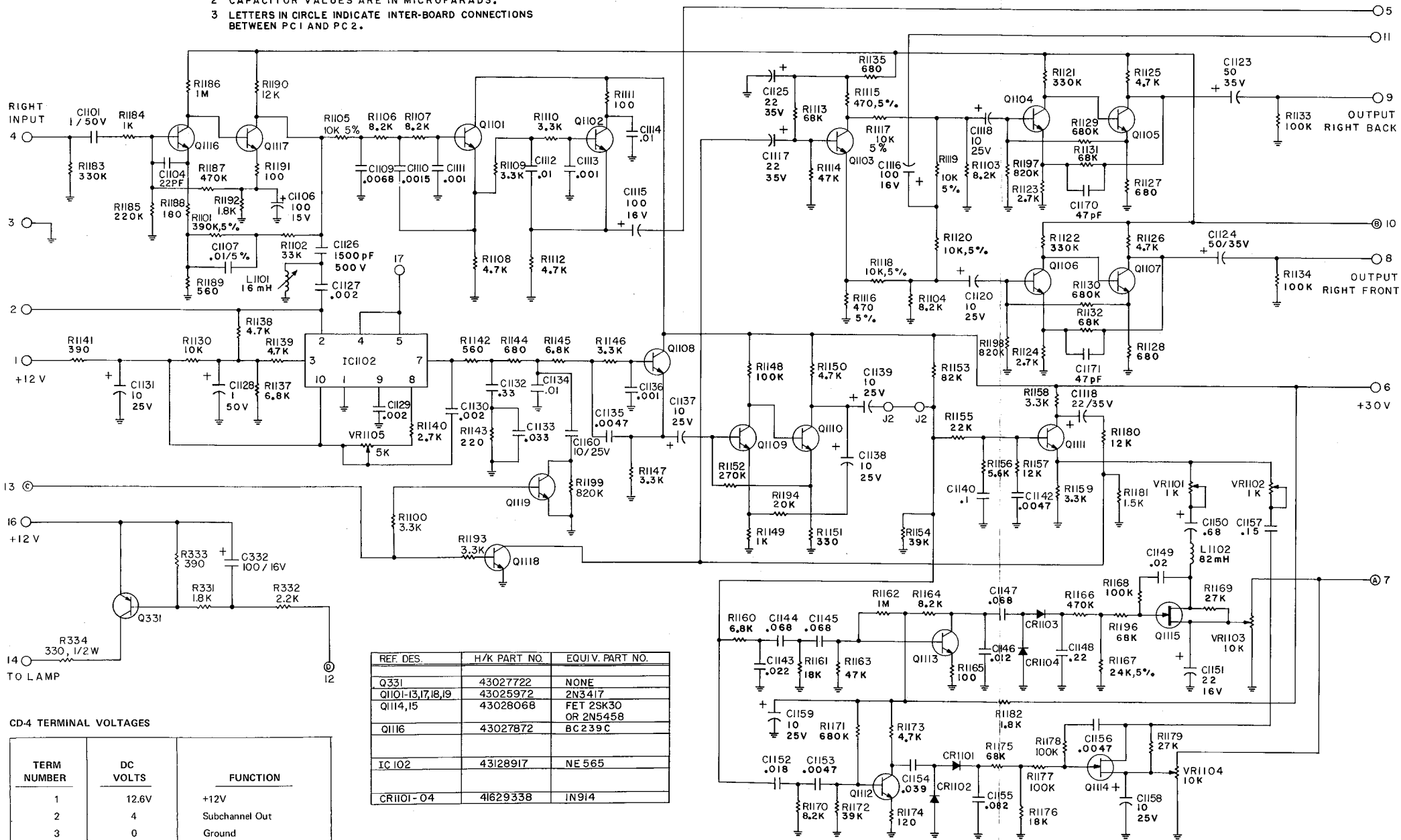
IC 301 DC VOLTAGE - CD-4 AUTO MODE

IC PIN	INPUT SHORTED VOLTS DC	CD-4 INPUT VOLTS
1	6.7	5.0
2	6.2	6.5
3	2.0	1.9
4	8.9	8.7
5	4.2	4.3
6	4.2	4.1
7	0	0
8	8.1	.03 (BYPASS 9.6)

SCHEMATIC DIAGRAM CD-4 (PC-2)
Pt. No. 00128953

NOTES

- UNLESS OTHERWISE SPECIFIED:
- 1 RESISTOR VALUES ARE IN OHMS $\pm 10\%$, 1/4 W.
- 2 CAPACITOR VALUES ARE IN MICROFARADS.
- 3 LETTERS IN CIRCLE INDICATE INTER-BOARD CONNECTIONS BETWEEN PC 1 AND PC 2.



REF. DES.	H/K PART NO.	EQUIV. PART NO.
Q331	43027722	NONE
Q1101-13,17,18,19	43025972	2N3417
Q114,15	43028068	FET 2SK30 OR 2N5458
Q116	43027872	BC 239C
IC 102	43128917	NE 565
CR1101-04	41629338	1N914

CD-4 TERMINAL VOLTAGES

TERM NUMBER	DC VOLTS	FUNCTION
1	12.6V	+12V
2	4	Subchannel Out
3	0	Ground
4	0	Input
5	0	Main Channel Out
6	28	+30V
7	10	+10V (PC 1 is Source)
8	0	Front Out
9	0	Back Out
10	27	+27V (PC 1 is Source)
11	0	Main Channel In
16	12.6	+12V
17	6	Test Point

CD-4 TRANSISTOR VOLTAGES

Q NUMBER	EMITTER		BASE		COLLECTOR	
	VOLTS	T. P.	VOLTS	T. P.	VOLTS	T. P.
1	14	R09	14.5	R07	28	Supply
2	13.3	R12	14	-	28	R11
3	5.7	R16	6.3	R14	12	R15
4	.6	R31-PC1 R23-PC2	1.1	R97	3	
5	2.3	R27	3		11	*R25
6	.6	R32	1.1	R98	3	R22
7	2.3	R28	3	R22	11	R26
8	8	R47	8.6		28	Supply
9	.3	R49	.8	R52	1.8	R48
10	1.1	R51	1.8	R48	12	
11	7.9	R59	8.5	R55	20	R58
12	.3	R74	.9	R71	11.5	R73
13	.2	R65	.8	R63	11	R64
16	0	R88	.6	R85	2.6	R86
17	2		2.6	R86	15	R90
302	.4	R306	1.0	R307	5.6	R305
303	9	R304	0	Ground	No Connection	

*Marked R26 on PC2

Q NUMBER	PART	T. P.	MODES				
			BYPASS ANY INPUT	CD-4 AUTO NO INPUT	CD-4 SIGNAL	STEREO NO INPUT	CD-4 SIGNAL
18, 19	E	GND	0	0	0	0	0
	B		.65	.65	<.3	.65	.65
	C		0	0	0	0	0
301	E	GND	0	0	0	0	0
	B	TERM 15	0	.7	.7	0	0
	C	R302	11	0	0	11	10
331	E	12V SUPPLY	12.6	12.6	12.6	12.6	12.6
	B		12.5	12.4	11.8	12.4	11.8
	C	R334	.4	.5	12.4	0	12.6
332	E	GND	0	0	0	0	0
	B		0	.7	.75	0	0
	C		0	0	.12	0	12

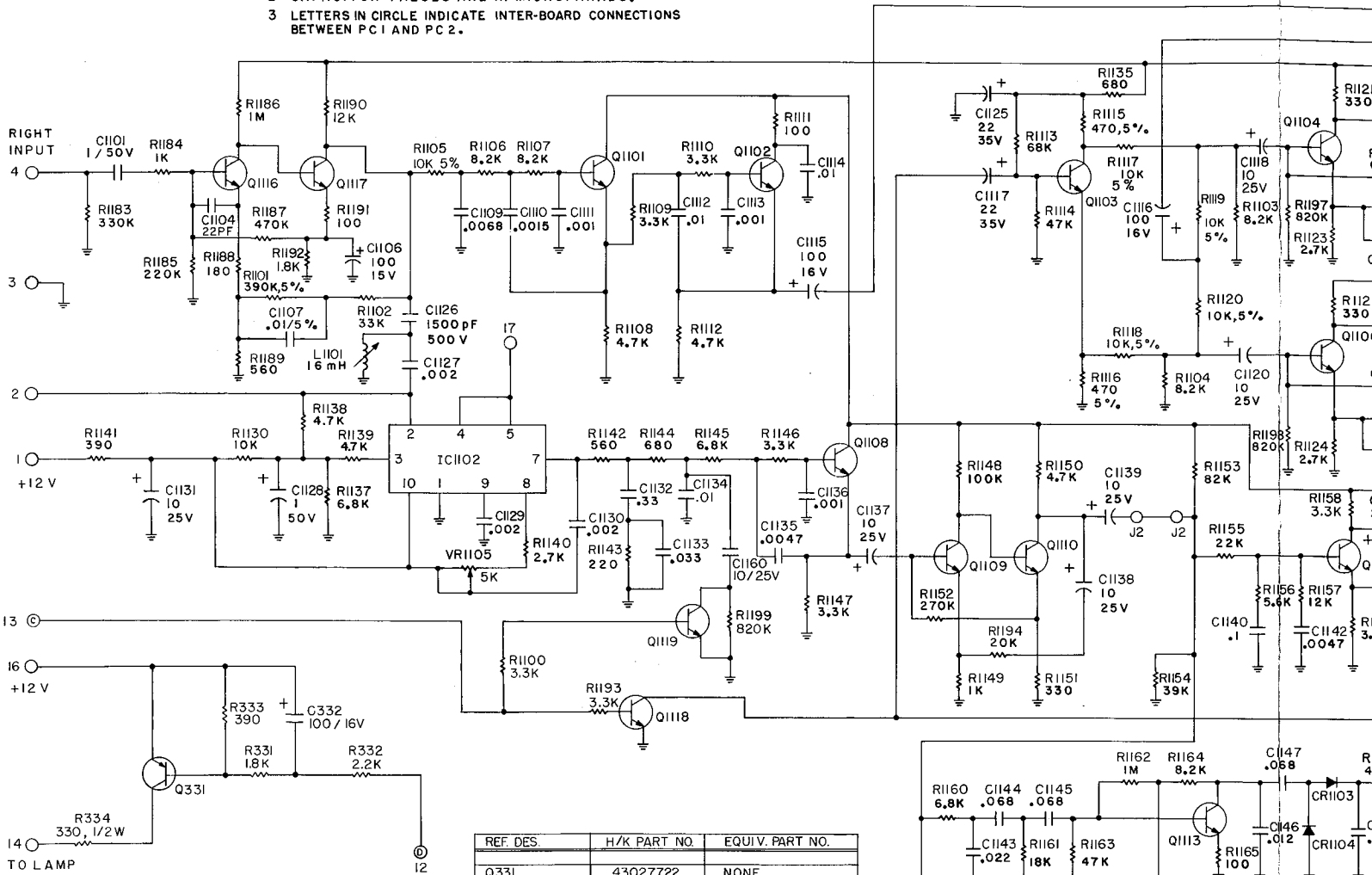
PC #	TERM NUMBER	MODES				
		BYPASS ANY INPUT	CD-4 AUTO NO INPUT	CD-4 SIGNAL	STEREO NO INPUT	CD-4 SIGNAL
PC #1	12	4	4	4	4	4
	13	1.4	1.25	<.3	1.4	1.3
	14	11	9	0	11	0
	15	0	.7	.7	0	0
PC #2	12	11	9	0	11	0
	13	1.4	1.25	<.3	1.3	1.3
	14	.3	.7	1.8	0	12.6

SCHEMATIC DIAGRAM CD-4 (PC-2)

Pt. No. 00128953

NOTES

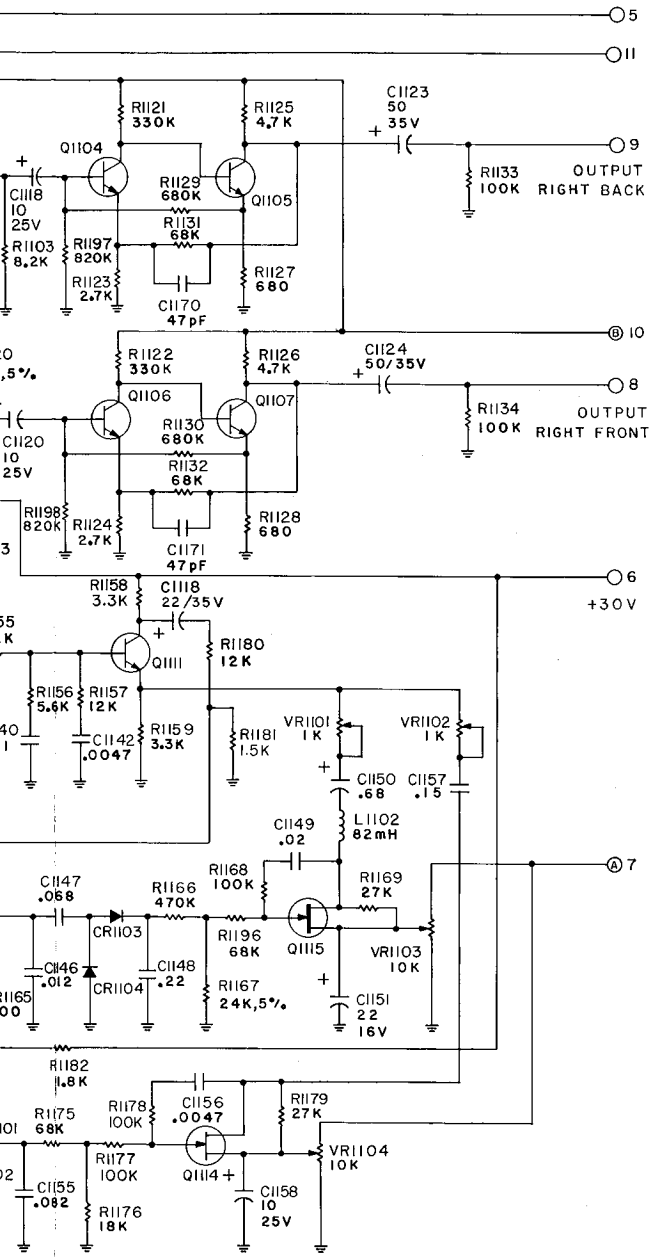
- UNLESS OTHERWISE SPECIFIED:
 1 RESISTOR VALUES ARE IN OHMS $\pm 10\%$, 1/4 W.
 2 CAPACITOR VALUES ARE IN MICROFARADS.
 3 LETTERS IN CIRCLE INDICATE INTER-BOARD CONNECTIONS BETWEEN PC 1 AND PC 2.



CD-4 TERMINAL VOLTAGES

TERM NUMBER	DC VOLTS	FUNCTION
1	12.6V	+12V
2	4	Subchannel Out
3	0	Ground
4	0	Input
5	0	Main Channel Out
6	28	+30V
7	10	+10V (PC 1 is Source)
8	0	Front Out
9	0	Back Out
10	27	+27V (PC 1 is Source)
11	0	Main Channel In
16	12.6	+12V
17	6	Test Point

REF. DES.	H/K PART NO.	EQUIV. PART NO.
Q331	43027722	NONE
Q1101-13,17,18,19	43025972	2N3417
Q1114,15	43028068	FET 25K30 OR 2N5458
Q1116	43027872	BC239C
IC 102	43128917	NE 565
CR1101-04	41629338	1N914



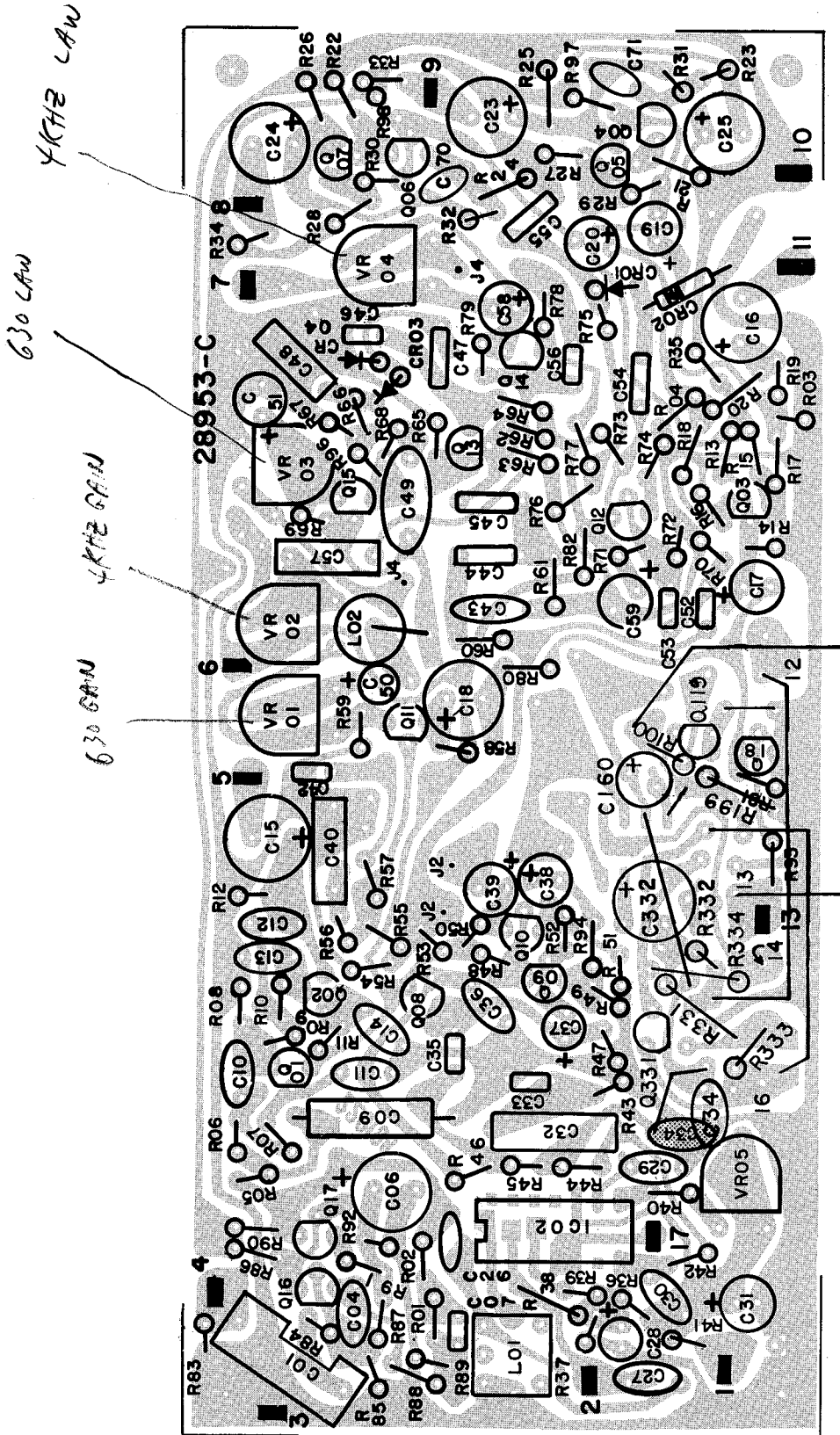
CD-4 TRANSISTOR VOLTAGES

Q NUMBER	EMITTER		BASE		COLLECTOR	
	VOLTS	T. P.	VOLTS	T. P.	VOLTS	T. P.
1	14	R09	14.5	R07	28	Supply
2	13.3	R12	14	-	28	R11
3	5.7	R16	6.3	R14	12	R15
4	.6	R31-PC1 R23-PC2	1.1	R97	3	
5	2.3	R27	3		11	*R25
6	.6	R32	1.1	R98	3	R22
7	2.3	R28	3	R22	11	R26
8	8	R47	8.6		28	Supply
9	.3	R49	.8	R52	1.8	R48
10	1.1	R51	1.8	R48	12	
11	7.9	R59	8.5	R55	20	R58
12	.3	R74	.9	R71	11.5	R73
13	.2	R65	.8	R63	11	R64
16	0	R88	.6	R85	2.6	R86
17	2		2.6	R86	15	R90
302	.4	R306	1.0	R307	5.6	R305
303	9	R304	0	Ground	No Connection	

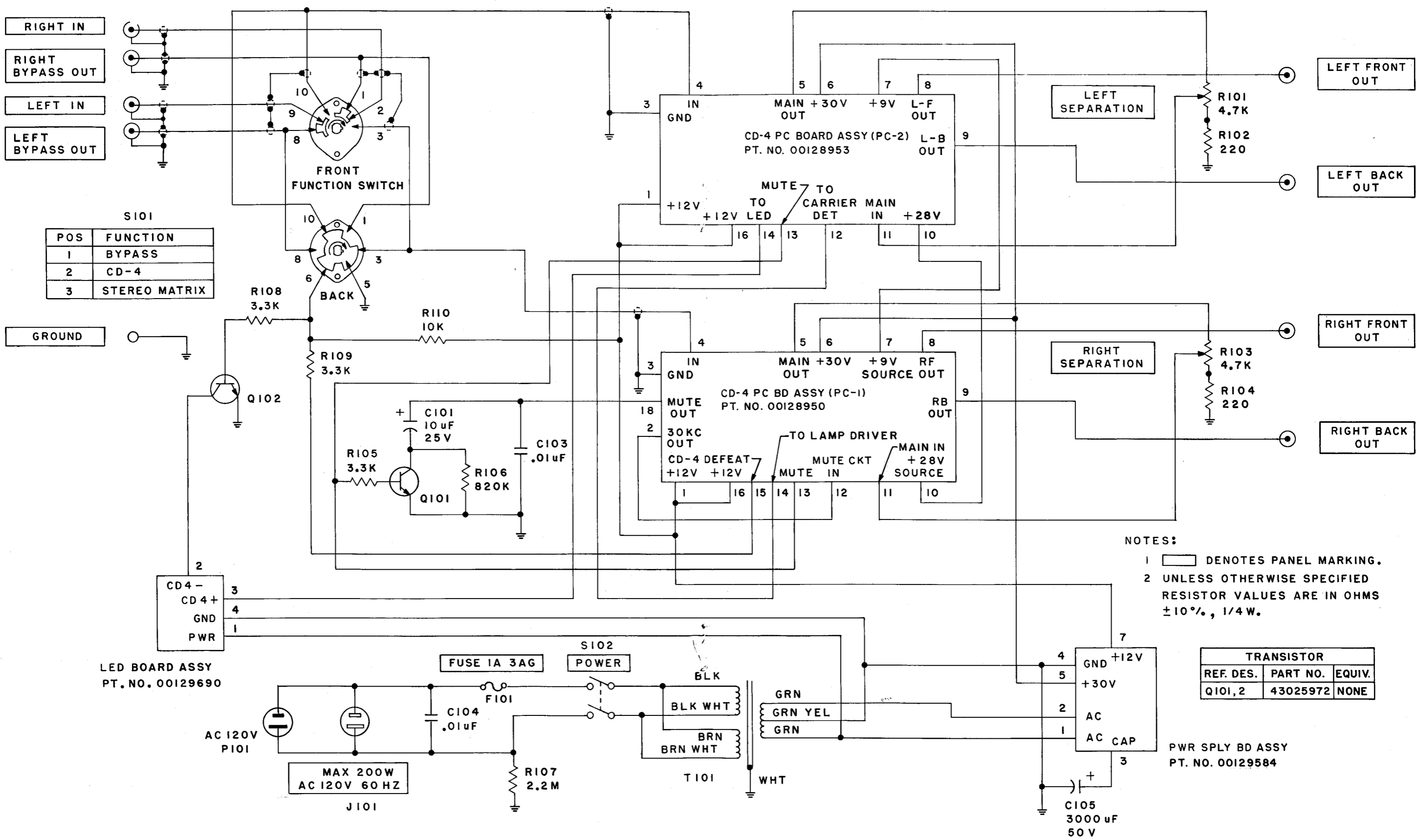
*Marked R26 on PC2

Q NUMBER	PART	T.P.	MODES				
			BYPASS ANY INPUT	CD-4 AUTO NO INPUT	CD-4 SIGNAL	STEREO NO INPUT	CD-4 SIGNAL
18, 19	E	GND	0	0	0	0	0
	B		.65	.65	<.3	.65	.65
	C		0	0	0	0	0
301	E	GND	0	0	0	0	0
	B	TERM 15	0	.7	.7	0	0
	C	R302	11	0	0	11	10
331	E	12V SUPPLY	12.6	12.6	12.6	12.6	12.6
	B		12.5	12.4	11.8	12.4	11.8
	C	R334	.4	.5	12.4	0	12.6
332	E	GND	0	0	0	0	0
	B		0	.7	.75	0	0
	C		0	0	.12	0	12

PC #	TERM NUMBER	MODES				
		BYPASS ANY INPUT	CD-4 AUTO NO INPUT	CD-4 SIGNAL	STEREO NO INPUT	CD-4 SIGNAL
PC #1	12	4	4	4	4	4
	13	1.4	1.25	<.3	1.4	1.3
	14	11	9	0	11	0
	15	0	.7	.7	0	0
PC #2	12	11	9	0	11	0
	13	1.4	1.25	<.3	1.3	1.3
	14	.3	.7	1.8	0	12.6



SCHEMATIC DIAGRAM — MODEL 44+



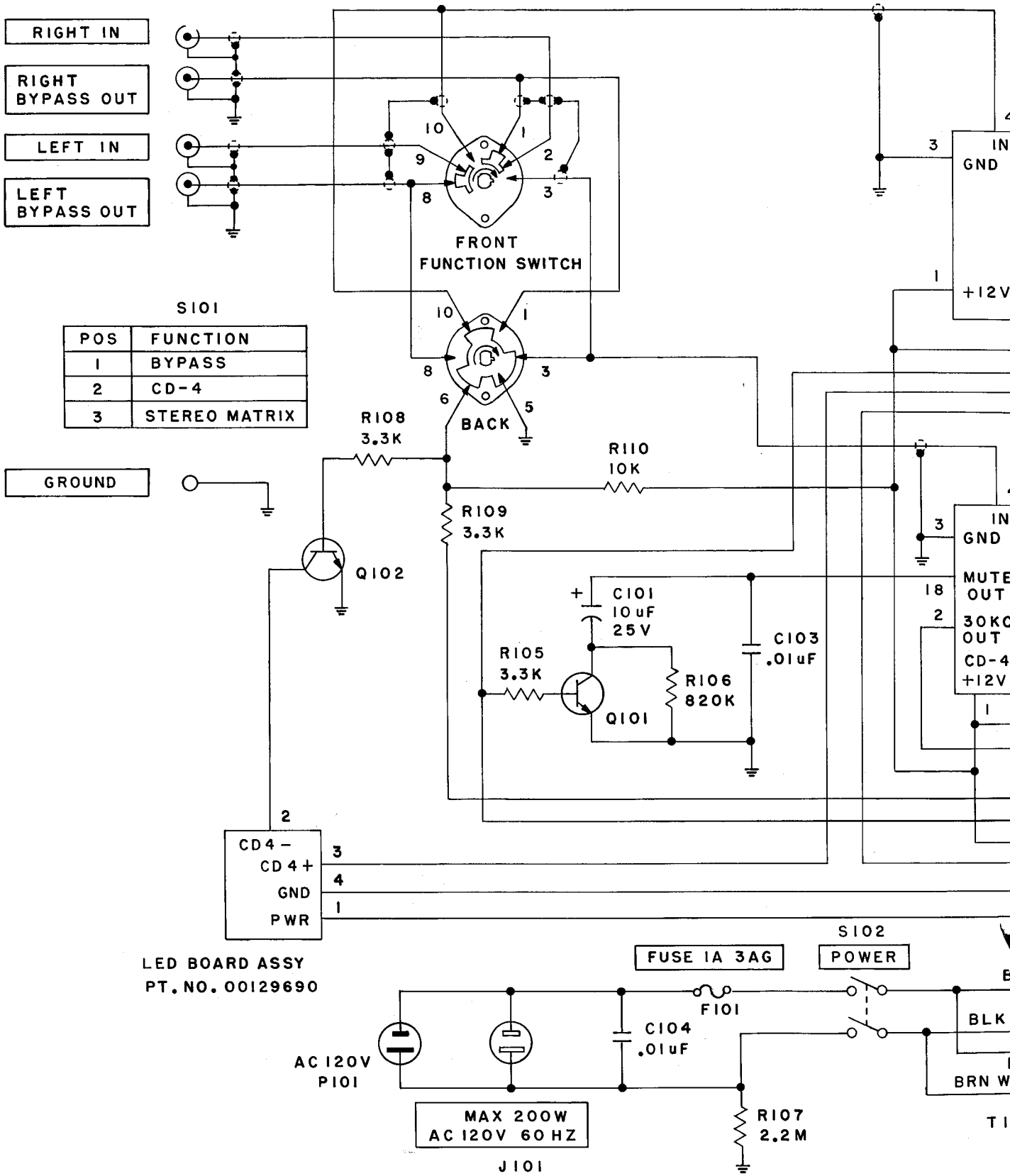
S101

POS	FUNCTION
1	BYPASS
2	CD-4
3	STEREO MATRIX

NOTES:
 1 [] DENOTES PANEL MARKING.
 2 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS ±10%, 1/4 W.

TRANSISTOR		
REF. DES.	PART NO.	EQUIV.
Q101,2	43025972	NONE

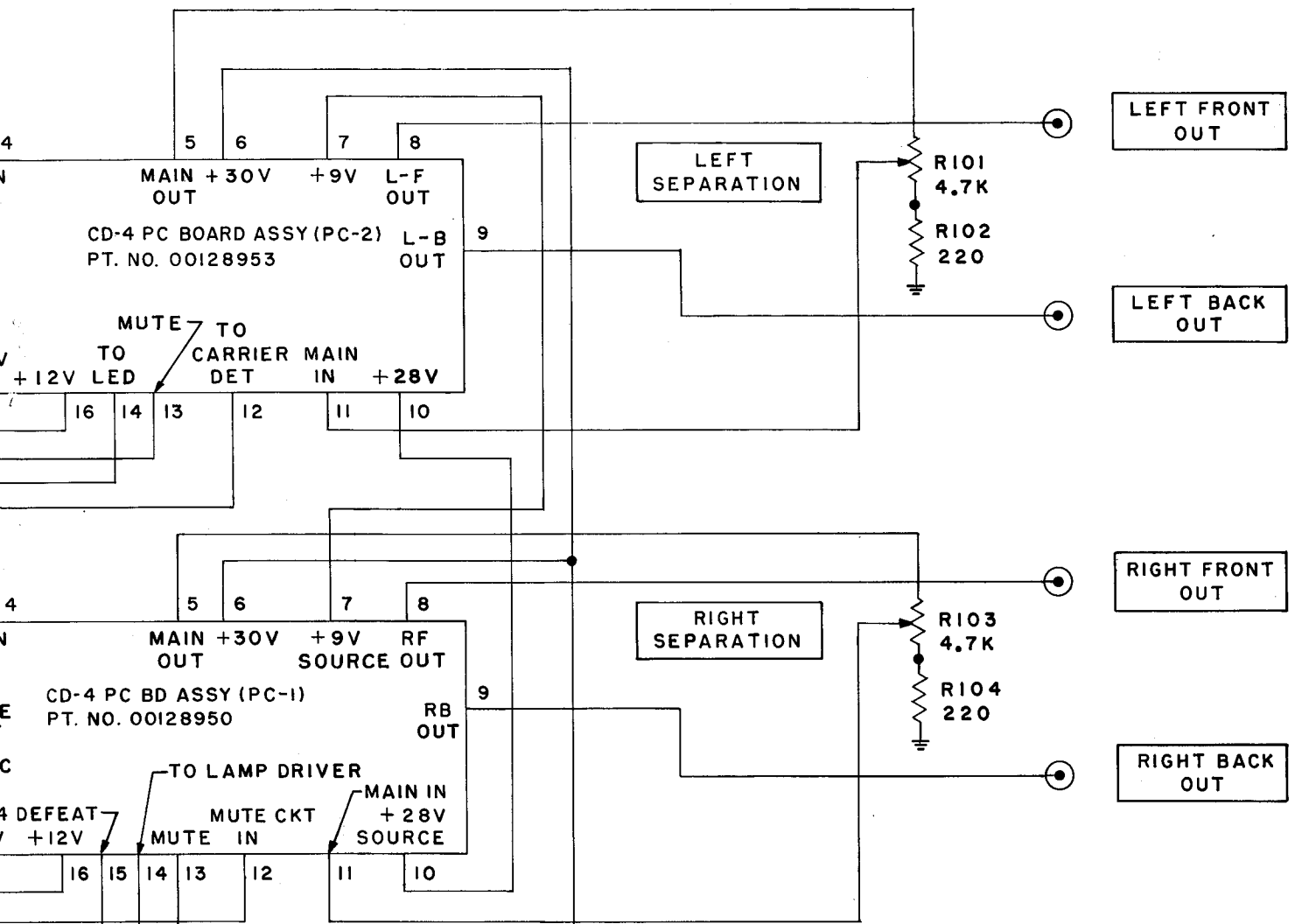
SCHEMATIC DIAGRAM — MODEL 44+



S101

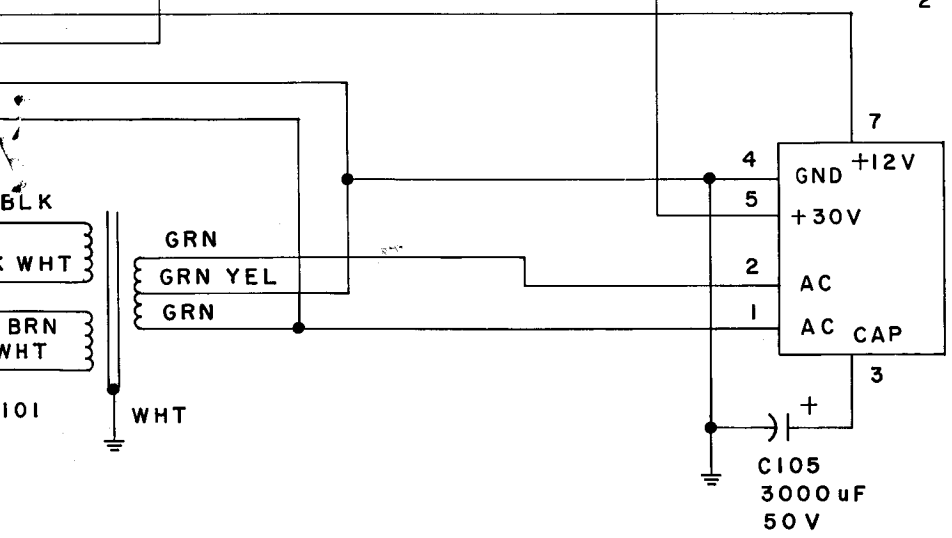
POS	FUNCTION
1	BYPASS
2	CD-4
3	STEREO MATRIX

LED BOARD ASSY
PT. NO. 00129690



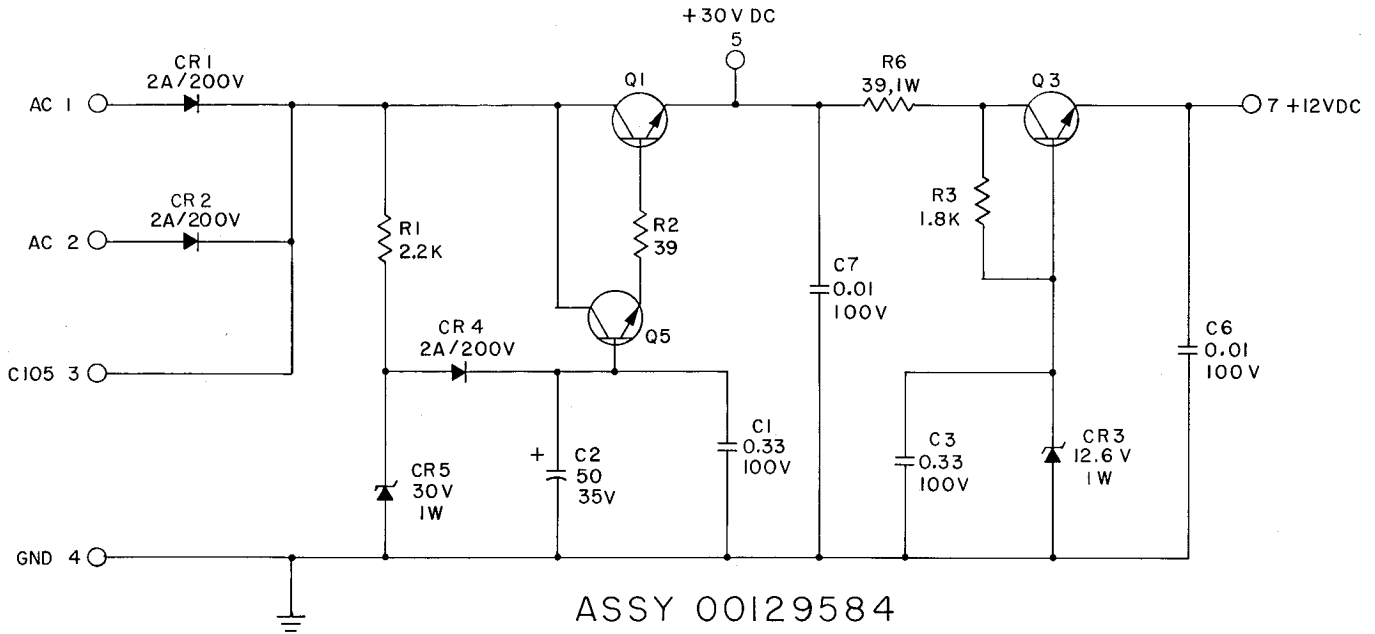
NOTES:
 1 [] DENOTES PANEL MARKING.
 2 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS ±10%, 1/4W.

TRANSISTOR		
REF. DES.	PART NO.	EQUIV.
Q101,2	43025972	NONE



PWR SPLY BD ASSY
 PT. NO. 00129584

POWER SUPPLY SCHEMATIC



ASSY 00129584

NOTES

UNLESS OTHERWISE SPECIFIED

1- RESISTOR VALUES ARE IN OHMS $\pm 10\%$ 1/4 W.

2- CAPACITOR VALUES ARE IN MICROFARADS.

REF DES.	PART NO	EQUIV.
Q1	43029710	2N5298
Q3	43029550	NONE
Q5	43025972	2N3417

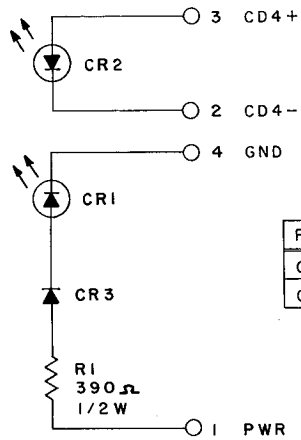
POWER SUPPLY BOARD

TERMINAL VOLTAGES	
TERMINAL NUMBER	VOLTS
1	32 AC
2	32 AC
3	38 DC <1 AC
4	0 (Ground)
5	28
6	No Connection
7	12.6

TRANSISTOR VOLTAGES							
Q	VOLTS		E	T.P.	VOLTS		C
1	28		Pin 5		28.6		38
3	12.6		Pin 7		13	CR3	26
5	28.8		R2		29.2		38

Top of CR 5 30V

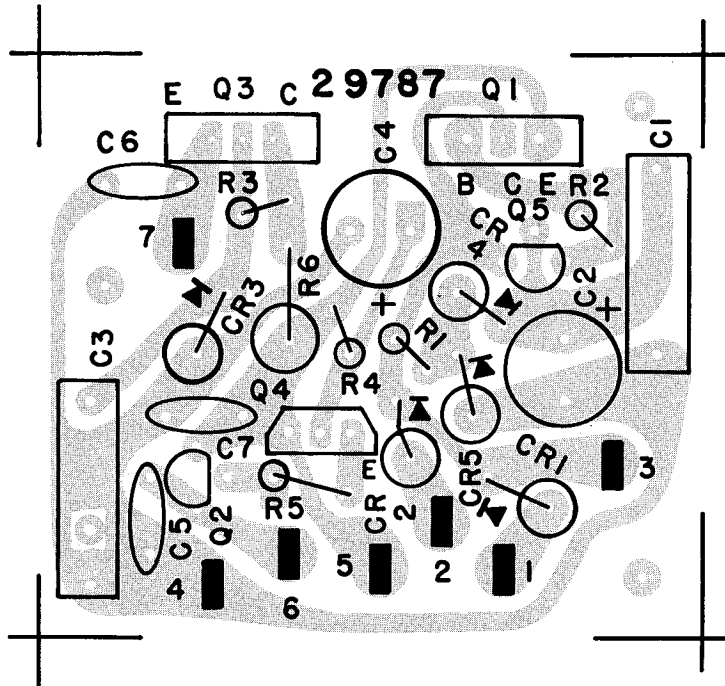
LED SCHEMATIC



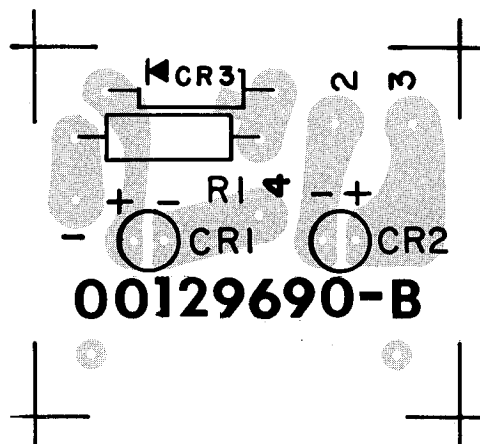
REF. DES.	HK PART NO.	EQUIV.
CR1,2	46729554	NONE
CR3	41029089	NONE

ASSY 00129690

POWER SUPPLY BOARD



LED BOARD



00129690-B

ALIGNMENT PROCEDURE

CONNECT JUMPER FROM
BYPASS GND TO FRONT OUTPUT
GND FOR TEST PURPOSES

DEMODULATION CIRCUIT

The following adjustment sets the center frequency of the demodulation phase locked loop to 30kHz:

If a frequency counter is available:

1. Set the function switch to the "bypass" position and connect the counter to Pin 17 and Ground (Pin 3).
2. Connect power and turn the unit ON. Allow a 5 minute warm-up time.
3. Adjust VR1105 to obtain a free running frequency of 30.0kHz.
4. Disconnect power and remove measuring equipment.

In the absence of a counter, an accurate source of 30kHz signal at a level of 1-2mV is required, or a CD-4 record may be used, according to the following procedure:

1. Connect a clip lead from Pin 13 of either board to Ground (Pin 3).
2. Connect a 100uf capacitor from Pin 2 to Ground (Pin 3). If a polarized capacitor is used, the positive lead is connected to Pin 2.
3. Turn the "CD- Separation" controls fully counterclockwise.
4. Set the Function switch to "CD-4" position.
5. Connect the signal generator or a turntable with a CD-4 cartridge and record to the input.
6. Connect the output of the channel to be adjusted to an amplifier which can be used for listening.
7. Connect power (to both units) and turn them ON. Allow 44+ to warm-up for 5 minutes.
8. Set the signal generator to 30kHz at 1-2mV or place the tone arm on the record in an area where an unmodulated subcarrier exists, such as the space between selections. It is essential that an *unmodulated* signal be used.
9. Adjust the volume so that a beat note can be heard.

NOTE: A beat may not be heard if VR1105 is already adjusted for zero beat or if the beat is out of the audible range. If a beat is not heard when rocking VR1105 through its extremes, there is a problem with the unit or the test setup.

10. Adjust VR1105 for zero beat.

NOTE: Within a small range of this adjustment the beat will disappear. This is due to the phase locked loop locking to the input. Set VR1105 to the approximate center of this range.

11. Disconnect power and remove the added components and jumpers.
12. Repeat this procedure for the other CD-4 board.

NOTE: L1101 is factory set and need not be adjusted. If it is misadjusted by mistake, the core may be set flush with the top of the form.

ANRS ALIGNMENT PROCEDURE

This procedure must be performed if any components in the ANRS are replaced.

1. Cut the Jumper "J2" and remove the insulation from the pieces.
2. Connect an audio oscillator through an attenuator and a 10uf, 25 volt capacitor to the piece of the jumper nearest to the input (Pin 4). The positive lead of the capacitor connects to the CD-4 board.
3. Connect a clip lead from Pin 13 of either CD-4 board to Ground.
4. Place the function switch in the "bypass" position.
5. Connect power to the unit and turn in ON. Allow it to warm-up at least 1 minute.
6. Set the ANRS controls as follows: VR1101, 1102 at center, VR1103 fully clockwise, VR1104 fully counterclockwise.
7. Set the frequency of the oscillator to 30Hz and the level to 320mV (-8dBm) and observe the output level at Pin 9. It should be 210mV (-11.5dBm) \pm 2dB.

This level is a reference to which the following readings are compared:

Step No.	Frequency	Set Level To	Adjust	To Obtain at Tape Output
8.	4kHz	300mV (-1dB)	4kHz GAIN VR1102	-1 \pm 1dB
9.	4kHz	68mV (-13dB)	4kHz LAW VR1104	-21 \pm 1dB
10.	Repeat 8 & 9 until no further improvement is noticed.			
11.	4kHz	130mV (-8dB)	Check	-11 \pm 1dB
12.	4kHz	32mV (-20dB)	Check	-32 \pm 2dB
13.	If 11 & 12 are not within limits, return to Step 8.			
14.	630Hz	78mV (-12dB)	630 LAW VR1103	-20 \pm 1dB
15.	630Hz	350mV (+1dB)	630 GAIN VR1101	0 \pm 1dB
16.	Repeat 14 & 15 until no further improvement is noticed.			
17.	630Hz	160mV (-6dB)	Check	-10 \pm 1dB
18.	630Hz	35mV (-19dB)	Check	-30 \pm 2dB
19.	Repeat steps 8 through 17 until no further improvement is noticed.			
20.	Disconnect power and oscillator.			
21.	Remove the clip lead from Pin 13 to Ground.			
22.	Reconnect the Jumper at J2.			

REPLACEMENT PARTS LIST

H/K Part No.	Ref. No.	Description	H/K Part No.	Ref. No.	Description
TRANSFORMERS AND COILS			CD-4 BOARD (PC-2) (cont.)		
10129580	T101	Transformer, Power	31819166	C118,25	Lytic 22 uF, 35V
12029348	L1	Inductor, Variable 16 MH	31819176	C119,20,31	Lytic 10 uF, 25V
12029626	L2	Inductor, Fixed 82 MH		37-39, 58-60	
TRANSISTORS AND IC'S			31819156	C123,24	Lytic 50 uF, 35V
43029710	Q1	Transistor, NPN, Power Silicon	31819157	C128	Lytic 1 uF, 50V
43029550	Q3	Transistor, NPN, Power Silicon	CD-4 BOARD (PC-1)		
43025972	Q2, 5, Q101-13, 17-19	Transistor, NPN GP	31819180	C6,15,16	Lytic 100 uF, 16V
43028068	Q14,15 Q114,15	Transistor, FET 2SK30	31819178	C17,51,303	Lytic 22 uF, 16V
43027872	Q16, Q116	Transistor, NPN Low Noise BC239C	31819166	C18,25	Lytic 22 uF, 35V
43027722	Q331	Transistor, PNP GP	31819176	C19,20,31, 37-39, 58,59	Lytic 10 uF, 25V
43128917	IC1102	IC Phase Lock Loop NE565	31819156	C23,24,310	Lytic 50 uF, 35V
43128918	IC301	IC Phase Lock Loop NE567	31819157	C28	Lytic 1 uF, 50V
DIODES & LYTICS			31827109	C309	Lytic 5 uF, 35V
41629338	CR01-04 CR302,303 1101-1104	Diode 1N914	CONTROLS AND SWITCHES		
42020737	CR304	Diode, Zener 10V 1w	21729321	VR1,2	Pot, 1K
POWER SUPPLY PC BOARD				VR101,2	
41029089	CR1,2,4	Diode, Silicon 2 Amp 200V	21729324	VR3,4	Pot, 10K
41029340	CR3	Diode, Zener 12.6V 1w		VR103,4	
42029676	CR5	Diode, Zener 30V 1w	21729323	VR5,105,301	Pot, 5K
LED INDICATOR PC BOARD			21529273	R101,R103	Trimpot, 4.7K (with hardware)
46729554	CR1,2	Lamp, LED	24029635	S101	Switch, Function
41029089	CR3	Diode, Silicon 2 Amp 200V	25028964	S102	Switch, AC ON/OFF, Power
CD-4 BOARD (PC-2)			MISCELLANEOUS		
31819156	C2	Lytic 50 uF, 35V	61629672		Front Panel Plexiglas
31519169	C105	Lytic 3000 uF, 50V	63229741		Pushbutton
	C106, 15, 16, 332	Lytic 100 uF, 16V	63228698		Knob, Function Switch
			45019684	F101	Fuse, 1 Amp. 125V.
			60129669		Top Cover
			65427001		Fuse Holder, with Hardware
			65429087		Jack, Phono
			65416751	J101	Receptacle, AC
			62029686		Feet, Mounting 1/2" High

NOTE: To speed handling of your order be sure to include both the model and serial numbers which appear at the back of the chassis, in addition to the quantity, part number and part description of the items ordered. Orders from independent dealers, independent servicemen, and retail customers will be shipped on a cash in advance basis. Harman-Kardon reserves the right to substitute equivalent parts for those originally installed in this chassis. All parts should be ordered from Harman-Kardon, 55 Ames Court, Plainview, L.I., N.Y. 11803, Att: Parts Department.

TEST SPECIFICATIONS

The following test specifications are to be used as a guide and indicate satisfactory performance within established quality control limits.

All measurements are taken at 120 volts AC line.

SPECIFICATIONS	TEST CONDITIONS	TEST SPECIFICATIONS
1. Sensitivity — main channels	1kHz, separation pots set for max. gain 2 mV input, 30 kHz carrier on, no deviation main channels. . .	.775 V \pm 2 dB at output
— with sub-channel	2mV at 1 kHz 2mV at 30 kHz 1.25 kHz deviation of subcarrier, set separation pots for max. separation 40 microsecond delay	.4 V \pm 2 dB at output
2. Channel separation	100%, 1 channel only modulated, -50 dBm input 40 microsecond delay 300–1200 Hz	20 dB
3. Signal-to-noise ratio —main channel	CD-4 defeated bandwidth 5 Hz – 15 kHz 0 dB=.775 V RMS reference	60 dB
—sub channel	CD-4 enabled input = 2 mV at 30 kHz bandwidth = 5 Hz to 15 kHz	55 dB