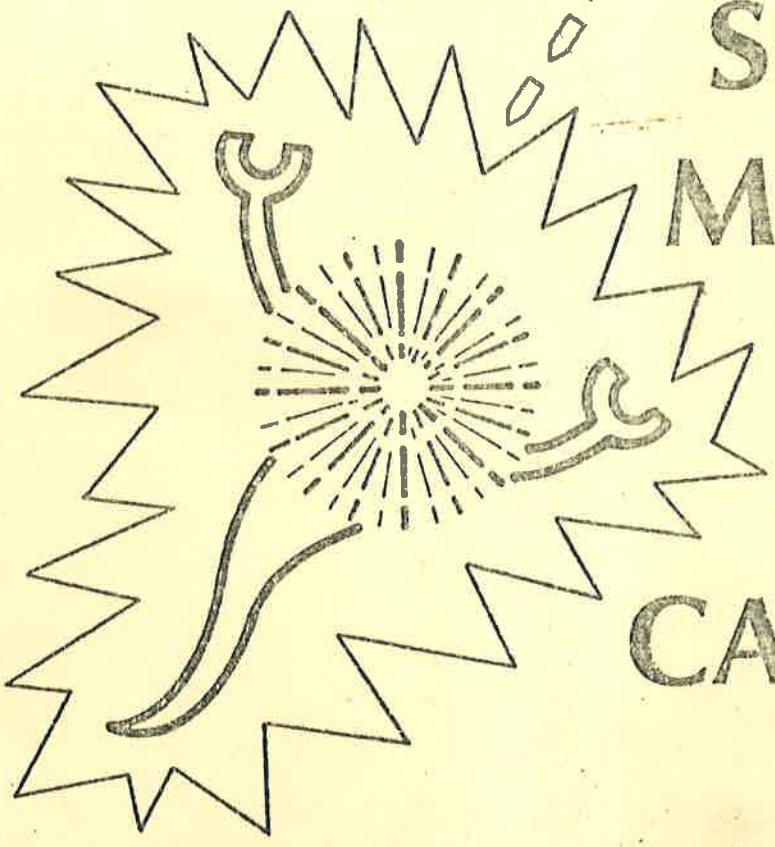
ROCK-OLA

MODEL G-301

DEMON



SERVICE MANUAL AND PARTS CATALOG

FORM 828 PRINTED IN U.S.A. PART NO. G-6287

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GAME PLAY

Astronauts are armed with a laser that starts with 100 shots. There is a line-gauge which indicates the amount of laser remaining. The player may also use his panic bomb to destroy all enemies on the screen once per life. Obstacles protect the astronaut from drones and their lasers. Drones can crash into players or hit them with laser from their cannons. Picking up a fire gem recharges the astronauts's laser with 25 shots. The firegem must be dropped off at the cargo shuttle before it turns critical and soon kills the astronaut. A firegem which is not picked up eventually turns into the deadly fireball. When the Demon enters the game, he may chase the astronauts and jump on top of an obstacle. He is then able to fire over both obstacles directly at the astronaut.

For each 10 firegems a player drops off at the shuttle, the player is awarded an extra life and his present astronaut's panic bomb is recharged. The availability of a panic bomb is shown by the letter "P" near the player's score.

SCORING

Drone 100 Pts.	(400 while Drone is "Bright")
Fireball 700 Pts.	(1500 while it is on its way to "Zap")
Demon Hit	500 + Bonus Pts.
Demon Kill	1500 Pts.
Firegem Pick-Up	100 Pts.
Firegem Drop-Off	Bonus Pts. and increase Bonus Pts. by 100 Pts.
Keep Alive	About 10 Pts. per second

PLAY OPTIONS

The operator may control his profits by changing the difficulty of the game to any of four switchable levels. The game is normally shipped on "moderate". This can be changed to "easy", "hard", or "extremely hard" by changing the setting of two dip-switches on the CPU Board. It is recommended that "moderate" be used at first. As the players learn the game, "hard" and later "extremely hard" may be desired to increase the difficulty and skill level. The "easy" setting is available for an occasional location that requires a slower-paced game when first installed, but should be advanced to "moderate" as soon as practical.

There is also a special switch for test purposes only that brings out the Demon regardless of score. The game difficulty does not increase in this mode at all and should be turned off as soon as the testing is over.

Other options, such as pricing and lives are covered in another section.

RECEIVING AND INSTALLATION
(VIDEO GAMES)

RECEIVING INSPECTION

Your game was shipped in ready-to-play condition. However, after removal of the shipping carton, a brief visual examination is suggested.

Naturally, you'll want to make note of any physical damage to the game cabinet and its external components for freight claim purposes. Considering the quality of the shipping carton, any damage to the exterior would indicate possible interior damage as well.

The interior of the game should also undergo a brief examination for: loose mounting hardware (check to be sure that the major components are still securely mounted); disconnected or loose wires, cables or harnesses; electronic devices loose in their sockets; etc.

At this time the game serial number should be logged. Please remember that the game serial number will be required if you need service from your distributor.

ELECTRICAL REQUIREMENTS

A good earth ground is essential for the proper operation of this game or for that matter any electronic device. Problems with instability and erratic operation of computer-type devices can usually be traced to an ineffective ground system. Therefore, plug the game into a properly wired 3 prong outlet. If a 3 prong to 2 prong AC adaptor must be used, an alternate method of grounding the third prong must be used.

INITIAL ADJUSTMENTS

When the game is connected to AC power, one of the game sounds may be heard. This is normal.

The audio level (volume) can be easily adjusted. This is achieved by rotation of the volume control located on the coin door. The audio level should compete with other machines "on the floor" to maximize play time.

OPERATOR OPTIONS

The option switches allow you to select how many credits per coin, how many chances to play per game & bonus scoring. If your machine DOES NOT have multiple pricing capability, refer to page 2-2. If it DOES have multiple pricing capability, skip 2-2 and refer to page 2-3.

CREDIT BUTTON. When you push this button you can increase credits without affecting the counter. It's the red button on the coin door.

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

DEMON OPTION SWITCHES

(LOCATED ON GAME BOARD)

CHANGE OF DIP SWITCH							
DESCRIPTION	8P. DIP SWITCH POSITION (DS1)						
COINAGE	SW1	SW2	SW3	SW4	SW5	SW6	SW7
1 COIN / 1 PLAY	OFF	OFF					
2 COINS / 1 PLAY	OFF	ON					
2 COINS / 3 PLAYS	ON	OFF					
4 COINS / 3 PLAYS	ON	ON					
FREE PLAY							OFF
ASTRONAUTS PER GAME			SW3	SW4			
3			ON	ON			
4			OFF	ON			
5			ON	OFF			
6			OFF	OFF			
GAME DIFFICULTY					SW5	SW6	
EASY					OFF	OFF	
MODERATE					ON	OFF	
HARD					OFF	ON	
EXTREMELY HARD					ON	ON	

NORMAL SETTING: 3 ASTRONAUTS PER PLAYER
GAME DIFFICULTY - MODERATE
1 COIN / 1 PLAY

TURN OFF POWER TO GAME BEFORE CHANGING SWITCH POSITIONS
NEW SWITCH POSITIONS BECOME EFFECTIVE ON POWER UP

GENERAL INFORMATION
AND PERIODIC MAINTENANCE

Your "Demon" video game contains the following major assemblies:

1 - POWER SUPPLY - Provides necessary voltages for the Logic Board, Sound & Score Board, Monitor and Fluorescent Light. CAUTION: Always unplug the main power cord before replacing fuses.

2 - LOGIC BOARD - Receives inputs from Coin Switches, Control Panel, (Rotary Control and Buttons) Option Switches on the Coin Door and from the Rotary Control Logic Board.
The Logic Board determines all of the games activities and then drives the Display Board. It also instructs the Sound Board.

3 - SOUND & SCORE BOARD - Receives sound codes from the CPU Board and converts these codes to analog signals, amplifies them and drives the Speaker.

4 - MONITOR - Converts the logic signals to analog signals and amplifies them to drive the black & white picture tube. (Some of the large drive transistors for this function are on the sides of the metal chassis).

5 - CONTROL PANEL - Contains Player Switches

6 -

7 - MAIN WIRING HARNESS - Carries power from the Power Supply to the CPU Board, Sound Board and Monitor.
It connects to each section thru molex plugs.
CAUTION: Never connect or disconnect the molex plugs unless the game is unplugged.

8 - RIBBON CONNECTORS - Carries data to and from the Logic Board. Since they can plug in two different ways, care must be taken to plug them in correctly. The red stripe indicates Pin #1. Connectors should be plugged in so Pin 1 connects to Pin 1. Check red stripe and corresponding red indicator dots.

9 - PERIODIC MAINTENANCE - The only Periodic Maintenance required is an occasional cleaning. The very high voltage used on the picture tube attracts dust that gradually degrades picture quality. To clean: unplug game and let sit for at least 5 minutes to let voltages "bleed-off".

To clean the face of the picture tube and associated plastic parts, remove the control panel by loosening clamps on each side of panel on inside of cabinet. These clamps are accessible thru coin door. Remove the plexiglas window being careful not to scratch clear or painted areas. Window, Gray Filter (Color Monitor), Colored Overlay (Black & White Monitor) and Picture Tube may now be cleaned with a mild solution of dish detergent. Dry all parts with a soft cloth and reassemble.
NOTE: Monitor may be pivoted down for cleaning by removing two wing nuts and carriage bolts from rear holes of Mounting Brackets.

"DEMON" PARTS LIST (G-301)

OVERALL ASSEMBLY

ITEM NO.	PART NO.	DESCRIPTION
1	G-6175-A	Cabinet Assembly
2	G-6190-A	Control Panel Assembly
3	G-6185-A	Monitor Assembly - Complete
4	G-6240-A	Logic/Sound - Comp.
5	G-5035-1A	Power Supply - Complete - "Condor"
6	G-6287	Service Manual & Parts Catalog
7	G-6288	Schematic - "Demon"

CABINET ASSEMBLY - DEMON

G-6175-A

1	G-24515-A	Cabinet - Wood
2	G-6180-A	Coin Door - Complete - Canada & Domestic
	G-6180-AA	Coin Door - Complete - Australia
	G-6180-BA	Coin Door - Complete - Belgium
	G-6180-FA	Coin Door - Complete - France
	G-6180-GA	Coin Door - Complete - Germany
3	G-6285-A	Counter #1 - Complete (Single Price)
4	G-5067-A	Counter Assembly Only
5	G-6291-A	Coin Switch Cable
6	G-5092-A	Braided Shield - Short
7	G-5454	Bracket - Volume Control
8	G-5209	Potentiometer
9	33463	Pointer Knob
10	G-6219-A	Credit Counter P.C.B. Only (w/o Brkt)
11	G-6107-2	Counter & P.C.B. Brkt
12	ST-10977-D	10-24 X 1" Carriage Bolt
13	ST-4813	.203 I.D. X 1/2 O.D. Flat Washer
14	ST-8724	10-24 Hex Flg. Whiz Lock Nut
15	G-6311	Speaker Grille
16	G-6312	10" - 16 Oz. Speaker
17	G-6296	Mounting Rail - 19"
18	ST-1443-D	1/4-20 X 1 1/4" Carriage Bolt
19	ST-1376	1/4-20 Wingnut
20	G-5671	Mounting Brkt - Cash Box
21	G-5683-A	Cash Box & Cover - Complete
22	G-5678-A	Cash Box (w/o Cover)
23	G-5682-A	Cover & Hinge Assembly Only
24	G-5035-1A	Power Supply - Complete (Condor)
25	G-6185-A	Monitor 19" - Modular - Complete
26	G-0831	Bezel - CRT (Blk)
27	G-6210	Overlay - Plastic - CRT
28	G-6208-A	Light Assembly - 120V
	G-6209-A	Light Assembly - 220/240V
29	ST-3341-D	8-32 X 1 Carriage Bolt - Blk Ox
30	ST-8721	8-32 Hex Flg Whiz Lock Nut - Z.P.
31	49557	Ballast Plate
32	49554-2	Ballast Insulator
33	11556	14-15-20 Watt Starter (FS-2)
	49301	Insulated Starter 20 Watt 220/240V

CABINET ASSEMBLY - DEMON

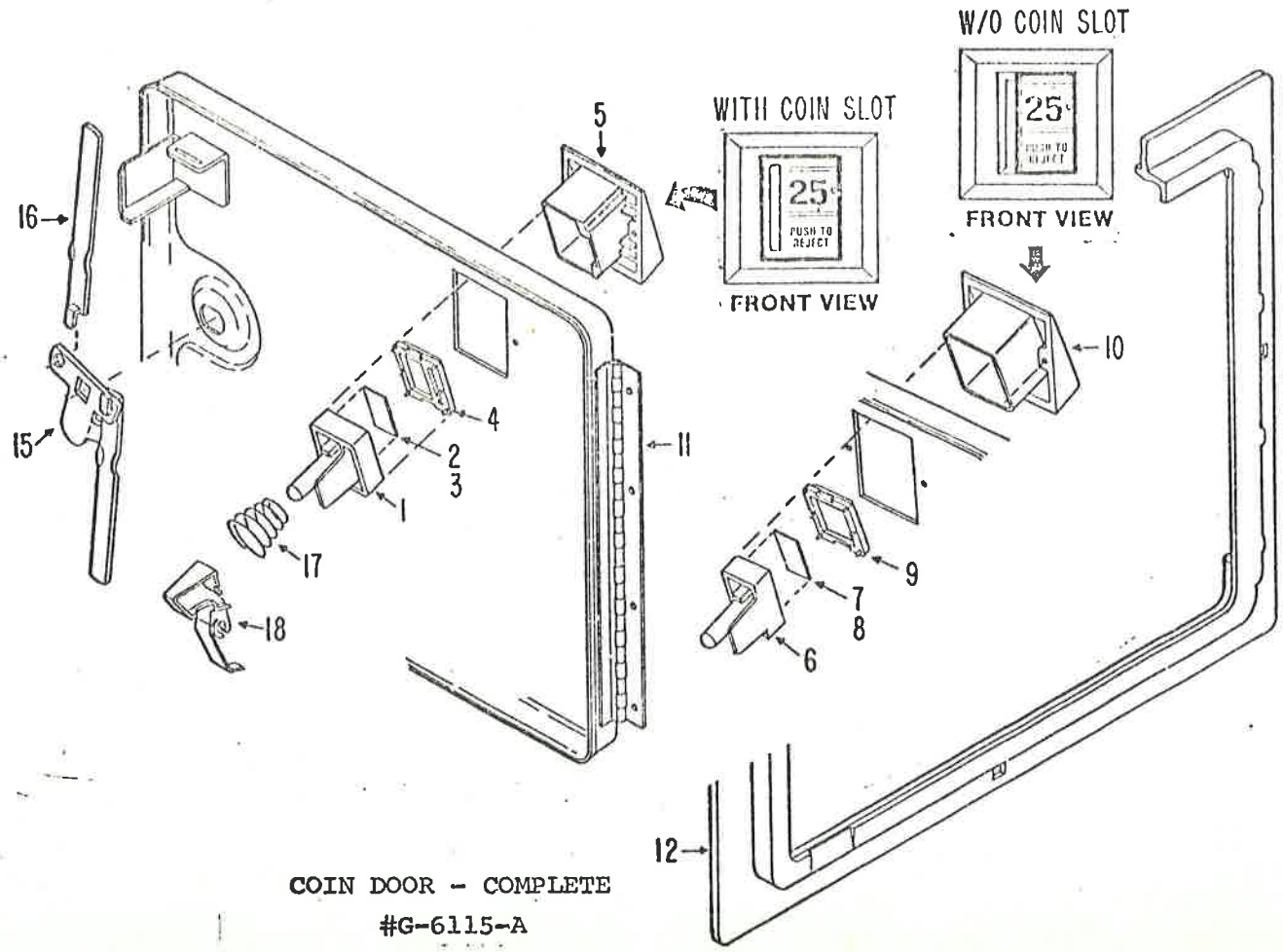
G-6571-A

ITEM NO.	PART NO.	DESCRIPITON
34	G-5043	Fluorescent Lamp (F15T12) CW 15 Watt
35	G-6294	Top Window - Demon
36	G-6303	Retainer - Inner Top (Blk)
37	G-6304	Retainer - Top (Blk)
38	ST-10753-D	8 X 5/8 Pan Hd. Box Dr. (Type A) Blk Ox
39	G-5342	Clamp Fastener (Cabinet)
40	G-6190-A	Control Panel - Demon - Complete
41	G-6284-A	Control Panel & Studs Only
42	G-6295	Control Panel (Screened Overlay)
43	G-5766	Switch & Mtg. Assembly
44	ST-10754	5/8-11 Hex Palnut
45	G-5764	Button Assembly (Short)
46	G-6307-1	Hinge - Control Panel
47	G-6309	Control Panel Clip
48	G-6244-A	Distribution P.C.B. - Complete
49	G-6245-A	Rotary Control Unit (Complete)
50	G-5763	Knob
51	G-5767-A	Hub & Disc Assembly
52	G-6225-A	Rotary Opto P.C.B. - Complete
53	G-6297	Retainer - Rear
54	G-6314-1	CRT Window - Horizontal (Black)
55	G-5031-2	Price Card - 25¢
	G-5032-1	Price Card - Germany
	G-5033-1	Price Card - Belgium
	G-5034-1	Price Card - France
	G-5037-1	Price Card - England
56	G-6155-A	On/Off Interlock Sw. Cable Assembly (Includes Two Switches) -A (Canada and Domestic - 120V) White Plug -EA (England - 240V) Green Plug -GA (Germ - Belg - France - 220V) Blue Plug
57	V-22637	Switch - Cheat Interlock
58	49240	DPST Rocker Switch (On/Off)
59	G-5409-A	Braided Shield Assembly
60	G-6423-A	Main Cable Assembly (Cab)
61	G-6201-A	Back Door Assembly - Complete
62	G-24542-A	Back Door Assembly - (Wood Only)
63	G-5126-1	Lock Bracket
64	ST-10972	Lock, Cam Bolts & Keys

"DEMON" PARTS LIST (G-301)

MONITOR-19" (MODULAR)
G-6185-A

ITEM NO.	PART NO.	DESCRIPTION
1	G-5212-1A	Monitor Mtg. Bracket Assembly R.H. (Notched)
2	G-5213-1A	Monitor Mtg. Bracket Assembly L.H. - Complete
3	G-5191	Monitor Mtg. Bracket R.H. (Notched)
4	G-5192	Monitor Mtg. Bracket L.H.
5	G-6233-A	Socket and Cable Assembly - Vertical
6	G-5217-A	Socket and Cable Assembly - Horizontal
7	G-0841-A	Video Power Supply - Keltron
8	G-0719	Insulator, TO3
9	G-0823	Transistor NPN 2N5878
10	G-0822	Transistor PNP 2N5876
11	G-6214	Heat Sink - AAVID 5427-B
12	ST-10763	6-32 X 5/8 Phil. Pan H.M.S. - Cad.
13	ST-10764	6 X 3/8 Hex. Flg. (Type A) Z.P.
14	G-0860	CRT 19" (Amperex) M50-102W
15	ST-4808	.203 I.D. X 3/4 O.D. X 1/16 Fl. Washer
16	ST-9720	10-32 X 1/2 Hex. Flg. Swageform Z.P.
17	G-0583	Spring - Grounding
18	G-5119-A	Yoke Assembly - Complete
19	G-0615	.093 Socket
20	G-0614	.093 Pin
21	G-0657	6-Circuit Receptacle Housing
22	G-5196	Display Board Rail
23	ST-10402	1/2" Locking Clamp
24	ST-10403	3/4" Locking Clamp
25	ST-8256	6-32 X 1/4 Hex. Flg. Swageform Z.P.
26	G-5093-A	16 Conductor Ribbon Cable
27	G-6282-A	26 Conductor Ribbon Cable
28	G-5219-A	34 Conductor Ribbon Cable
29	G-5201-2A	Mounting Panel Assembly
30	ST-4554	6-32 X 1/2 Phil. Pan Hd. M.S.
31	G-5040-1A	Display P.C. Board
32	G-6235-A	Logic P.C. Board - Complete
33	G-6215-A	Sound & Score P.C. Board
34	G-6230-A	Rotary Control Logic P.C. Board
35	G-6289-A	Main Cable Assembly
36	ST-10647	P.C. Board Support - 7/8"



COIN DOOR - COMPLETE

#G-6115-A

ITEM NO.	PART NO.	DESCRIPTION
		Coin Return Button (<u>with</u> Coin Slot)
1	G-6102	Coin Return Button (Red)
2	G-6088	25¢ Price Decal
3	G-6089	Token Decal
4	G-6103	Coin Return Button Cover (Red)
5	G-6104	Coin Button Housing
		Coin Return Button (w/o Coin Slot)
6	G-6111	Coin Return Button (Ornage)
7	G-6088	25¢ Price Decal
8	G-6089	Token Decal
9	G-6112	Coin Return Button Cover (Orange)
10	G-6113	Coin Button Housing
		COMMON PARTS
11	G-6241	Coin Door (includes Hinge) - 2 Coin
12	G-6242	Door Frame (Die Cast)
13	G-6243	Switch
14	G-6246	25¢ Acceptor (5301-10)
15	G-6247	Pivot Arm
16	G-6248	Locking Arm (2)
		SPECIAL PARTS (Service Original Doors)
17	G-6249	Spring
18	G-6239	Coin Return Lever (New Style)

DEMON LOGIC/SOUND - COMPLETE

G-6240-A

ITEM NO.	PART NO.	DESCRIPTION	REQ'D
1	G-6215-A	Sound & Score P.C.B. Assembly	1
2	G-6230-A	Rotary Control Logic P.C.B. Assembly	1
3	G-6235-A	Logic P.C.B. Assembly	1

DEMON LOGIC P.C.B. ASSEMBLY

G-6235-A

ITEM NO.	PART NO.	DESCRIPTION	COORDINATE REF. DES.	MFGR. PART NO.
1	G-0676	I.C. ALU	L6, M6, N6	25LS181
2	G-0677	I.C. NAND Gate	A4, A10, B4, J6	74LS00
3	G-0678	I.C. NOR Gate	A6, D10, H8, K4	74LS02
4	G-0679	I.C. Hex Inverter	B6, E12, I8	74LS04
5	G-0680	I.C. AND Gate	C10	74LS08
6	G-0681	I.C. NAND Gate	B12, F4, L2	74LS10
7	G-0682	I.C. NOR Gate	C12, D12, F6	74LS27
8	G-0683	I.C. OR Gate	A12, B10, J2, K2	74LS32
9	G-0684	I.C. Quad D Latch	T9, U9	74LS75
10	G-0685	I.C. Mag Comparator	L9, M9, N9	74LS85
11	G-0686	I.C. Exclusive OR	J8	74LS86
12	G-0687	I.C. Dual J-K Flip Flop	A8, B2, B8, C8, G4, G8, J10	74LS107
13	G-0688	I.C. 1 of 8 Data Selectors	C4, D4, E4, F10	74LS151
14	G-0689	I.C. Quad Data Selector	L11, M11, N11, P9, R9, S9, T11, U11	74LS157
15	G-0690	I.C. Binary Counter	C6, D6, E6, E10, F8, I14, P11, R11, S11	74LS163
16	G-0691	I.C. 8 Bit Shift Regist	H6	74LS164
17	G-0692	I.C. 4 Bit Shift Regist	G10, H12, N4, M4 P4, P13, R4, S4, T4	74LS194
18	G-0693	I.C. Tri-State Quad	N2, R2, T2	74LS257
19	G-0694	I.C. 8 Bit Latch	F2	74LS259/ DM8334
20	G-0695	I.C. Quad 2-Input Multi.	I12, J12	74LS298
21	G-0696	I.C. Octal D Flip Flop	M2, P2, R13, S2, S12, T13	74LS377
22	G-0697	I.C. Dual 4 Bit Counter	H4, I4	74LS393
23	G-0698	I.C. NAND Gate	A2, I10	74S00
24	G-0699	I.C. NOR Gate	H14	74S02
25	G-0700	I.C. Hex Inverter	I2, U2	74S04
26	G-0701	I.C. AND Gate	A14	74S08
27	G-0703	I.C. OR Gate	B14, H10	74S32
28	G-0704	I.C. Dual J-K Flip Flop	G2, H2	74S113
29	G-0705	I.C. Quad 2 to 1 Data Sel.	G14	74S158
30	G-0706	I.C. Look Ahead Carry	L4	74S182
31	G-0671	I.C. Dual 4 in NOR Gate	F12	7425
32	G-0675	I.C. Quad Comp. Output	J4	74265
33	G-0702	I.C. Triple 3 in NAND	G12	74S10
34	G-0667	I.C. RAM 256x4	L14, M14, N14	2101A2
35	G-0707	I.C. PROM DROM 1	F14	2085
36	G-0708	I.C. PROM DROM 2	E14	2086
37	G-0709	I.C. PROM DROM 3	D14	2087
38	G-0710	I.C. PROM DROM 4	C14	2088
39	G-0711	I.C. PROM DROM 5	E8	2089
40	G-0712	I.C. PROM DROM 6	J14	2090

DEMON LOGIC P.C.B. ASSEMBLY

G-6235-A

ITEM NO.	PART NO.	DESCRIPTION	COORDINATE REF. DES.	MFGR. PART NO.
41.1	G-0960-65	Demon EPROM UE	U6	2732
41.2	G-0960-66	Demon EPROM LE	T6	2732
41.3	G-0960-67	Demon EPROM UO	R6	2732
41.4	G-0960-68	Demon EPROM LO	P6	2732
42	G-0625	7 Pole Dip Switch	E2	
43	G-0833	Crystal 20 MHz	I1	
44	G-0811	Diode	CR1, CR2	1N914B
45	G-0816	Transistor	Q2, Q3	2N3904
46	G-0825	Transistor	Q1	2N6292
47	G-0783	Cap Disk 50V	C1 THRU C58	0.02 MFD
48	47723	Cap Disk 500V	C59	680 PF
49	G-0808	Cap Tant Dip 35V	C62	3.3 MF
50	G-0995	Cap Elec 50V	C61	100 MF
51	51289	Resistor 1/4W 5%	R21	100 OHM
52	52344	Resistor, 1/4W 5%	R2, R3	330 OHM
53	49264	Resistor, 1/4W 5%	R5	470 OHM
54	51564	Resistor, 1/4W 5%	R1, R4, R6, R7, R8, R9, R10, R11, R17, R18, R19, R20	1K OHM
55	52358	Resistor, 1/4W 5%	R15	2.2K OHM
56	51293	Resistor, 1/4W 5%	R13, R16	10K OHM
57	53868	Resistor, 1/4W 5%	R12	30K OHM
58	49266	Resistor, 1/4W 5%	R14	560K OHM
59	G-0779	Resistor, Dip Pak 1K	C2, D2	
60	G-0616	Test Points		
61	G-0655	Molex, Wafercon 12 Cir	J1	09-18-5127
62	G-0652	Male Header PCB 16 Pin	J4	
63	G-0653	Male Header PCB 26 Pin	J3	
64	G-0654	Male Header PCB 34 Pin	J2	
65	G-0965	Jumper, Dip 16 Pin	D8, U14	
66	52720	Socket, Dip 14 Pin	F6	
67	52724	Socket, Dip 16 Pin	D8, F14, U14	
68	52722	Socket,Dip 24 Pin	L6, M6, N6 P7, R7, T7, U7	
69	G-6234	Printed Circuit Board		
70	51994	L.E.D.		

DEMON SOUND & SCORE P.C.B. ASSEMBLY

G-6215-A

ITEM NO.	PART NO.	DESCRIPTION	REF. DES.	MF'GR. PART NO.
1	54182	Z-80 CTC	U1	MK3882
2	G-0670	Schmitt Trigger	U2	7414
3	G-6206	Sound Generator	U3, U17, U18	AY-3-8910
4	G-6005	1 of 8 Decoder/De-Plexer	U5, U15	74LS138
5	G-0677	Nand Gate	U6	74LS00
6	G-0678	Nor Gate	U7, U16	74LS02
7	G-6207	COS/MOS Fifo Register	U8	40105
8	54181	Z-80 CPU	U10	MK3880
9	G-0960-20	Demon Sound Program	U12	2732
10	G-6019	RAM	U13, U14	2114
11	G-0718	351 OP. Amplifier	U20	TL081CP
12	51991	Timer	U21	555
13	G-0679	Hex Inverter	U23	74LS04
14	53706	Dual D Latch	U24	74LS74
15	G-5298	Power Amplifier	U25	LA4250
16	G-0673	Regulator	U26	7815
17	53708	Crystal 3.579 MHz	Y1	
18	47831	Transistor	Q1, Q5	MPSA56
19	49415	Transistor	Q2, Q3, Q4, Q6	MPSA06
20	G-0811	Diode, Signal	CR1	1N914B
21	G-0812	Rectifier, 200 PRV	CR2, CR3	1N4003
22	46617	Diode, Zener 15V	VR2	1N4744A
23	G-5106	Diode, Zener 3.9V	VR4, VR5	1N748A
24	51293	Resistor 1/4 Watt 5%	R1, R2, R31, R32, R33, R38	10K OHM
25	51294	Resistor 1/4 Watt 5%	R3	47K OHM
26	53982	Resistor 1/4 Watt 5%	R4	220 OHM
27	52358	Resistor 1/4 Watt 5%	R5, R30, R46	2.2K OHM
28	51292	Resistor 1/4 Watt 5%	R6, R27, R37	4.7K OHM
29	52374	Resistor 1/4 Watt 5%	R7	47 OHM
30	54226	Resistor 1/4 Watt 5%	R8	68 OHM
31	47832	Resistor 1/4 Watt 5%	R9 thru R16	5.6K OHM
32	49264	Resistor 1/4 Watt 5%	R17	470 OHM
33	49268	Resistor 1/4 Watt 5%	R18, R21	33K OHM
34	51568	Resistor 1/4 Watt 5%	R19, R40, R44	5.1K OHM
35	51564	Resistor 1/4 Watt 5%	R20, R26, R45	1K OHM

DEMON SOUND & SCORE P.C.B. ASSEMBLY

G-6215-A

ITEM NO.	PART NO.	DESCRIPTION	REF. DES.	MFGR. PART NO.
36	53886	Resistor 1/4 Watt 5%	R22	220K OHM
37	52381	Resistor 1/4 Watt 5%	R23	120 OHM
38	52378	Resistor 1/4 Watt 5%	R25, R25	680 OHM
39	50966	Resistor 1/4 Watt 5%	R28, R47, R48	100K OHM
40	53593	Resistor 1/4 Watt 5%	R29	470K OHM
41	52344	Resistor 1/4 Watt 5%	R34	330 OHM
42	52376	Resistor 1/4 Watt 5%	R35, R36	270 OHM
43	40254	Resistor 1/2 Watt	R42	15 OHM
44	G-6217	Resistor Pack	RP5	100K OHM X 7
45	45788	Capacitor, Disc 500V	C36	39 PF
46	33762	Capacitor, Disc 1000V	C19, C20, C39	470 PF
47	G-6202	Capacitor, Monolythic 50V	C26, C27, C37	0.47 MFD
48	53299	Capacitor, Monolythic 50V	C1, C3 thru C18, C22, C28	0.1 MFD
49	G-6203	Capacitor, Monolythic 100V	C30, C31, C32	0.1 MFD
50	G-6204	Capacitor, Monolythic 50V	C23	1.0 MFD
51	G-0943	Capacitor, Electrol. 35V	C38	4.7 MFD
52	G-0941	Capacitor, Electrol. 35V	C33	2.2 MFD
53	G-0788	Capacitor, Electrol. 50V	C29, C44	22 MFD
54	G-0993	Capacitor, Electrol. 35V	C2, C40, C41	47 MFD
55	G-0944	Capacitor, Electrol. 35V	C35	100 MFD
56	53893	Capacitor, Electrol. 35V	C34	470 MFD
57	53697	Capacitor, Electrol. 25V	C43	1000 MFD
58	53894	Capacitor, Mylar 100V	C42	0.15 MFD
59	52354	Capacitor, Mylar 250V	C21, C24	0.012 MFD
60	48947	Capacitor, Mylar 250V	C25	0.015 MFD
61	52722	24 Contact Solder Dip Socket		
62	52721	28 Contact Solder Dip Socket		
63	53711	40 Contact Solder Dip Socket		
64	ST-10577	14 Circuit Post Connector	J1	
65	G-0652	Male Header PCB 16 Pin	J2	
66	G-5299	Heat Sink Bracket		
67	ST-10318	Screw, Mach. 4-40 X 5/16 Pan Hd. Cad.		
68	ST-10469	Nut, Hex 4-40 Twin Serrated		
69	G-6216	Sound & Score P.C.B.		

DEMON DISPLAY P.C.B. ASSEMBLY

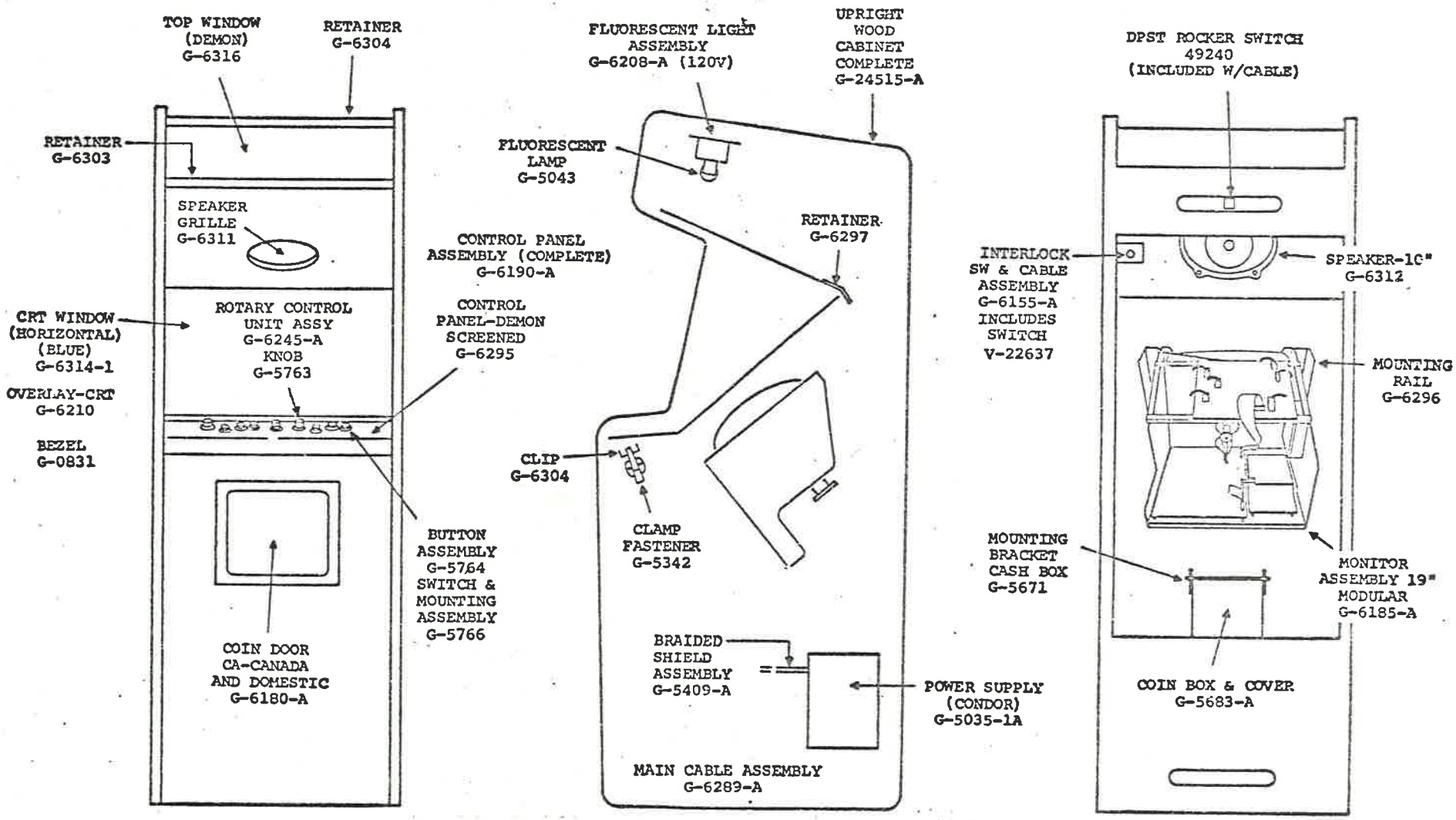
G-5190-A

ITEM NO.	PART NO.	DESCRIPTION	REF. DES.	MFGR. PART NO.
1	53837	Resistor, 1/4W 5%	R115, R215	15 OHM
2	51561	Resistor, 1/4W 5%	R116, R216	33 OHM
3	52374	Resistor, 1/4W 5%	R108, R130, R131, R210, R230, R231	47 OHM
4	51289	Resistor, 1/4W 5%	R110, R208	100 OHM
4.5	53875	Resistor, 1/2W 5%	R117, R217	100 OHM
5	53841	Resistor, 1/4W 5%	R113, R213	200 OHM
6	52344	Resistor, 1/4W 5%	R207	330 OHM
7	49264	Resistor, 1/4W 5%	R1, R2, R4, R5, R18	470 OHM
8	53844	Resistor, 1/4W 5%	R112, R132, R212, R232	820 OHM
9	51564	Resistor, 1/4W 5%	R20, R24	1K OHM
10	53863	Resistor, 1/4W 5%	R104	1.8K OHM
11	52358	Resistor, 1/4W 5%	R9, R204	2.2K OHM
12	53864	Resistor, 1/4W 5%	R105, R107, R205	3K OHM
13	47832	Resistor, 1/4W 5%	R10, R40, R206	5.6K OHM
14	51293	Resistor, 1/4W 5%	R6, R22, R23, R26, R106	10K OHM
15	52621	Resistor, 1/4W 5%	R25	68K OHM
16	14097	Resistor, 1/2W 5%	R118, R119, R218, R219	47 OHM
17	32831	Resistor, 1/2W 5%	R21	2.2K OHM
18	43533	Resistor, 1/2W 5%	R111, R114, R211, R214	8.2K OHM
19	35331	Resistor, 1/2W 5%	R3	10K OHM
20	46056	Resistor, 1W 5%	R124 thru R129 R224 thru R229	2.7K OHM
21	53872	Resistor, 1W 5%	R123, R223	360 OHM
22	53871	Resistor, 1W 5%	R7, R8	10K OHM
23	53873	Resistor, 2W 5%	R27	100 OHM
24	53874	Resistor, 3W 5%	R120, R121, R220, R221	.18 OHM
25	G-0776	Resistor, Metal Film 1/4W, 1%	R101	1.43K OHM
26	G-0777	Resistor, Metal Film 1/4W, 1%	R201	2.1K OHM
27	G-0778	Resistor, Metal Film 1/4W, 1%	R103, R203	10K OHM
28	52602	Trimpot	R109, R209	100 OHM
29	G-0721	Trimpot	R102, R202	5K OHM
30	G-0811	Diode, Signal	D17, D19, D20 D101 thru D104 D200 thru D204	1N914B
31	G-0812	Rectifier 200 PRV	D4, D5, D8, D12, D13, D15, D16, D18, D105 thru D115, D205 thru D215	1N4003
32	G-0669	I.C. Hex Inverter O.C.	IC7	7406
33	G-0672	I.C. Regulator +5V	IC8	7805
34	G-0673	I.C. Regulator +15V	IC4	7815
35	G-0674	I.C. Regulator -15V	IC6	7915

DEMON DISPLAY P.C.B. ASSEMBLY

G-5190-A

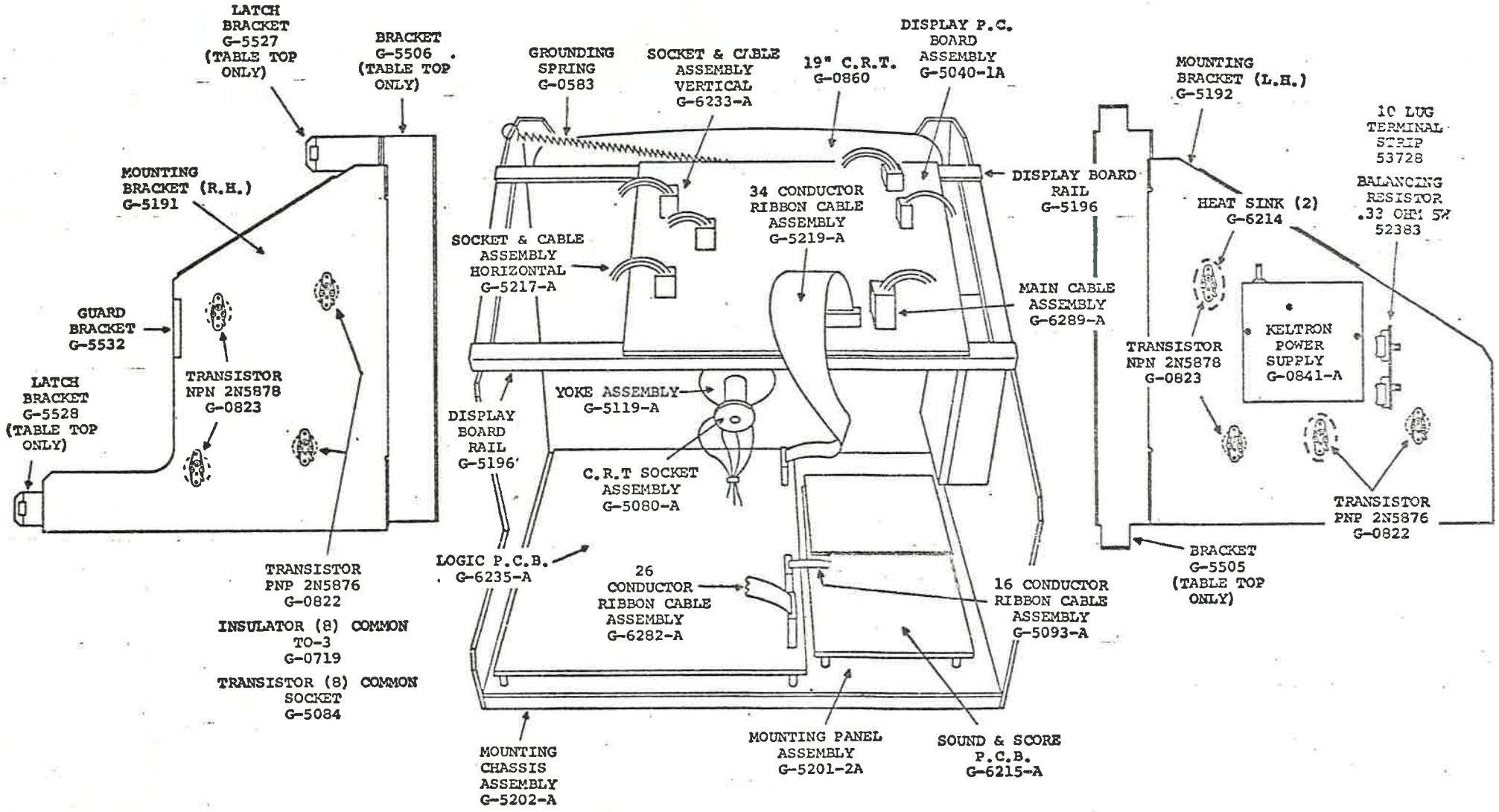
ITEM NO.	PART NO.	DESCRIPTION	REF. DES.	MFGR. PART NO.
36	G-0718	I.C. OP. AMP.	IC102, IC202	TL081P/LF351
37	G-0714	I.C. Digital Analog Con	IC101, IC201	DAC80/CB1/V
38	G-0815	Transistor, NPN	Q105, Q106, Q205, Q206	2N2102
39	G-0816	Transistor, NPN	Q2, Q7, Q8	2N3904
40	G-0817	Transistor, PNP	Q107, Q207	2N3906
41	G-0818	Transistor, NPN	Q6, Q101, Q102, Q103, Q201, Q202, Q203	2N5210
42	G-0819	Transistor, NPN	Q108, Q208	2N5320
43	G-0820	Transistor, PNP	Q104, Q109, Q204, Q209	2N5322
44	G-0821	Transistor, NPN	Q1, Q3	2N5550
45	G-0781	Capacitor, Disc 50V	C8, C9	.005 MFD
46	G-0784	Capacitor, Disc 50V	C24, C27, C103, C104, C203, C204, C209	.1 MFD
47	G-0948	Capacitor, Film 100V	C102, C202	.1 MFD
48	G-0950	Capacitor, Film 100V	C1	.33 MFD
49	G-0802	Capacitor, Polycarb. 200V	C10, C201	.022 MFD
50	G-0805	Capacitor, Tantalum 35V	C25	.47 MFD
51	52359	Capacitor, Tantalum 35V	C12, C13	1 MFD
52	G-0807	Capacitor, Tantalum 35V	C4, C10, C15, C23, C105	2.2 MFD
53	G-0943	Capacitor, Electrol. 35V	C26	4.7 MFD
54	G-0790	Capacitor, Electrol. 50V	C205, C207	47 MFD
55	52720	I.C. Socket-14 Pin		
56	52724	I.C. Socket-16 Pin		
56.1	52722	I.C. Socket-24 Pin		
56.2	G-0649	Molex Receptacle-9 Circ.	J7	03-09-1093
57	G-0660	Molex Receptacle-15 Circ.	J2	03-09-1152
57.5	G-0613	Molex Male Pin-Solder Tail	J2, J7	02-09-2134
58	G-0661	Molex Wafercon-6 Circ.	J5	09-18-5061
59	G-0662	Molex Wafercon-6 Circ.	J3	09-18-5062
61	G-0654	Male Head P.C.B.-34 Pin	J1	
62	G-5200	Display P.C.B.		
63	G-0506	Neon Lamp	LT1, LT2	NE-2
64	G-0722	10K Potentiometer	R11	RV4NAYSD103A
65	G-5159	Heat Sink-Thermalloy	Q104, Q105, Q108, Q109, Q204, Q205, Q208, Q209	



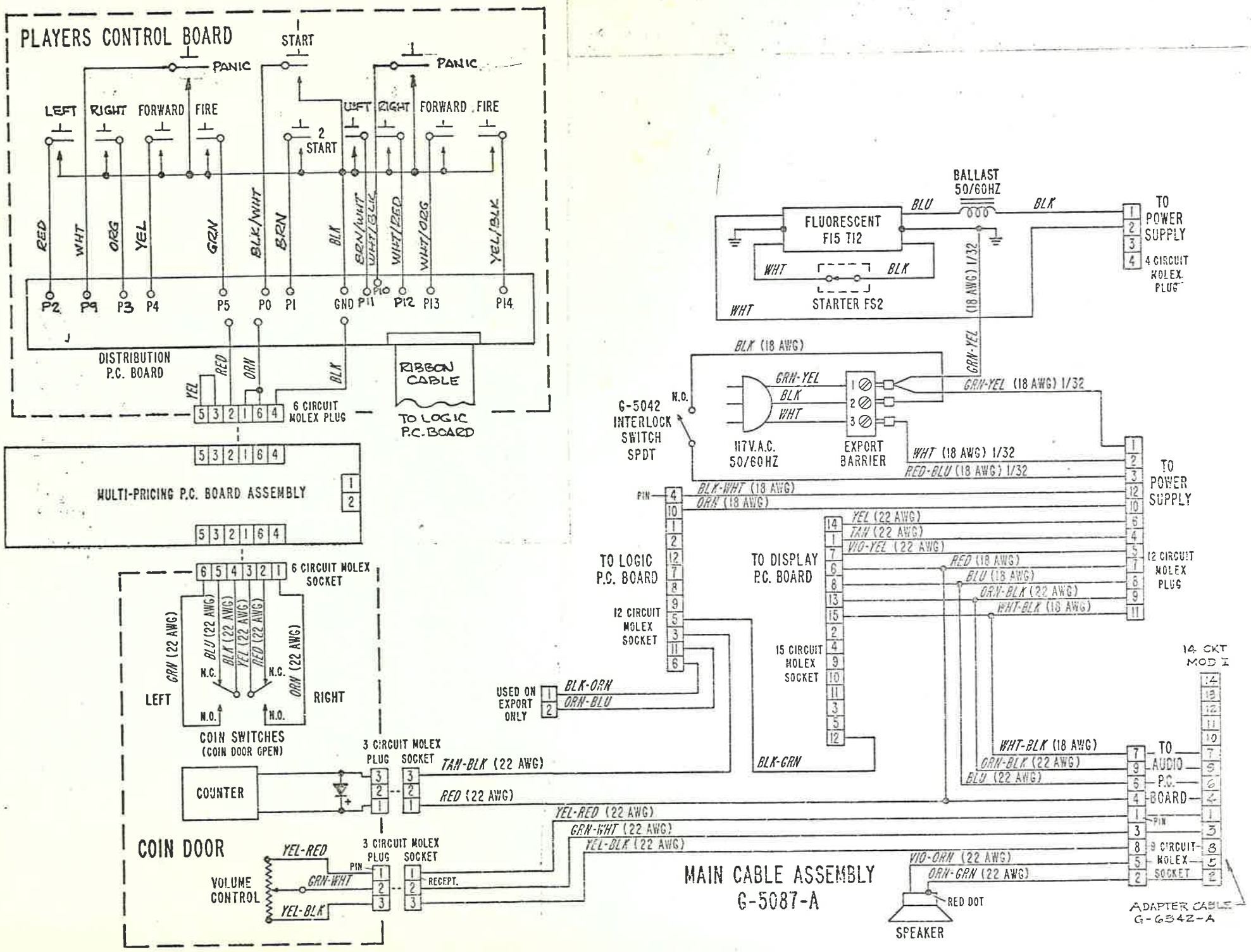
DEMON

G-301

CABINET PARTS



DEMON G-301 & GC-301
MONITOR-19" MODULAR
G-6185-A


PLAYERS CONTROL BOARD
START
PANIC
LEFT
RIGHT
FORWARD
FIRE
2 START
RED
WHT
ORG
YEL
GRN
BLK/WHT
BRN
BLK
BRN/WHT
WHT/BLK
WHT/RED
WHT/ORG
YEL/BLK
P2
P9
P3
P4
P5
P0
P1
GND
P11
P12
P13
P14
DISTRIBUTION P.C. BOARD
6 CIRCUIT MOLEX PLUG
RIBBON CABLE
TO LOGIC P.C. BOARD
MULTI-PRICING P.C. BOARD ASSEMBLY
6 CIRCUIT MOLEX SOCKET
GRN (22 AWG)
BLU (22 AWG)
BLK (22 AWG)
YEL (22 AWG)
RED (22 AWG)
ORN (22 AWG)
N.C.
N.O.
LEFT
RIGHT
COIN SWITCHES
(COIN DOOR OPEN)
COUNTER
3 CIRCUIT MOLEX PLUG
SOCKET
TAN-BLK (22 AWG)
RED (22 AWG)
COIN DOOR
YEL-RED
GRN-WHT
YEL-BLK
VOLUME CONTROL
PIN
RECEPT.
BALLAST 50/60HZ
FLUORESCENT FI5 TI2
BLU
BLK
WHT
STARTER FS2
(18 AWG) 1/32
TO POWER SUPPLY
4 CIRCUIT MOLEX PLUG
BLK (18 AWG)
GRN-YEL
GRN-YEL (18 AWG) 1/32
G-5042 INTERLOCK SWITCH SPDT
N.O.
117V.A.C. 50/60HZ
EXPORT BARRIER
WHT (18 AWG) 1/32
RED-BLU (18 AWG) 1/32
BLK-WHT (18 AWG)
ORN (18 AWG)
TO LOGIC P.C. BOARD
TO DISPLAY P.C. BOARD
YEL (22 AWG)
TAN (22 AWG)
VIO-YEL (22 AWG)
RED (18 AWG)
BLU (18 AWG)
ORN-BLK (22 AWG)
WHT-BLK (18 AWG)
12 CIRCUIT MOLEX PLUG
12 CIRCUIT MOLEX SOCKET
15 CIRCUIT MOLEX SOCKET
USED ON EXPORT ONLY
BLK-ORN
ORN-BLU
BLK-GRN
14 CKT MOD I
TO AUDIO P.C. BOARD
9 CIRCUIT MOLEX SOCKET
VIO-ORN (22 AWG)
ORN-GRN (22 AWG)
RED DOT
SPEAKER
ADAPTER CABLE G-6342-A
MAIN CABLE ASSEMBLY G-5087-A

A3

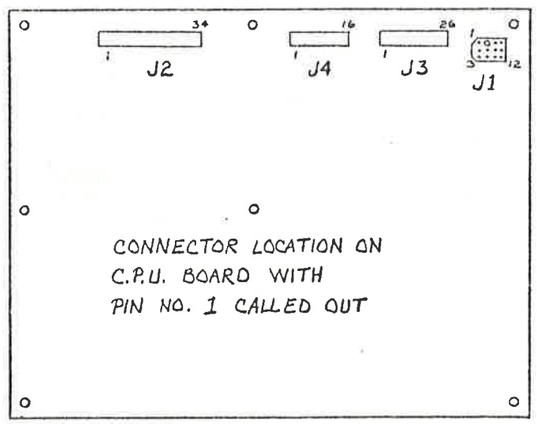
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

CONNECTOR J1

PIN NO.	FUNCTION	FROM / TO IC - PIN NO.	SCHMTC LOCATION SHT-AREA
1	NC		
2	NC		
3	COIN COUNTER	FROM COLLECTOR OF Q1	1-C4
4 (FEMALE)	GND		
5	GND		
6	GND		
7	NC		
8	NC		
9	LED CATHODE	FROM A2-3,6	6-D3
10	+5		
11	+5		
12	NC		

CONNECTOR J2

PIN NO.	FUNCTION	FROM / TO IC - PIN NO.	SCHMTC LOCATION SHT-AREA
1	YDAC BIT 1	FROM M2-9	6-A4
2	YDAC BIT Ø	FROM M2-19	
3	YDAC BIT 3	FROM M2-2	
4	YDAC BIT 2	FROM M2-6	
5	YDAC BIT 5	FROM P2-9	6-A5
6	YDAC BIT 4	FROM P2-19	
7	YDAC BIT 7	FROM P2-2	
8	YDAC BIT 6	FROM P2-6	
9	YDAC BIT 9	FROM S2-9	6-A6
10	YDAC BIT 8	FROM S2-19	
11	YDAC BIT 10	FROM S2-6	
12	INTENSITY	FROM J2-3	6-D3
13	YDAC BIT 11	FROM S2-2	6-A6
14	BRIGHT	FROM J2-11	6-C3
15	GND		
16	XDAC OUTPUT	FROM DISPLAY PCB TO CONN. J4-4	
17	GND		
18	INITIALIZE SWITCH	FROM H8-13	6-C6
19	DRAW SWITCH	FROM I8-2	6-C5
20	GND		
21	XDAC BIT Ø	FROM M2-16	6-A4
22	GND		
23	XDAC BIT 1	FROM M2-12	
24	GND		
25	XDAC BIT 2	FROM M2-15	
26	XDAC BIT 3	FROM M2-5	
27	XDAC BIT 4	FROM P2-16	6-A5
28	XDAC BIT 5	FROM P2-12	
29	XDAC BIT 6	FROM P2-15	
30	XDAC BIT 7	FROM P2-5	
31	XDAC BIT 8	FROM S2-16	6-A6
32	XDAC BIT 9	FROM S2-12	
33	XDAC BIT 10	FROM S2-15	
34	XDAC BIT 11	FROM S2-5	



CONNECTOR LOCATION ON C.P.U. BOARD WITH PIN NO. 1 CALLED OUT

CONNECTOR J3

PIN NO.	FUNCTION	FROM / TO IC - PIN NO.	SCHMTC LOCATION SHT-AREA
1	C_7	TO F2-12	1-B4
2	+5		
3	R-COIN	TO F2-10	1-B4
4	SECONDARY INPUT 3	TO E4-1	
5	SECONDARY INPUT 2	TO E4-2	
6	SECONDARY INPUT 1	TO E4-3	
7	SECONDARY INPUT 6	TO E4-13	
8	PRIMARY INPUT 3	TO D4-1	1-B6
9	PRIMARY INPUT 2	TO D4-2	
10	PRIMARY INPUT 1	TO D4-3	
11	PRIMARY INPUT Ø	TO D4-4	
12	PRIMARY INPUT 7	TO D4-12	
13	PRIMARY INPUT 6	TO D4-13	
14	PRIMARY INPUT 5	TO D4-14	
15	PRIMARY INPUT 4	TO D4-15	
16	PRIMARY INPUT 11	TO C4-1	1-A6
17	PRIMARY INPUT 10	TO C4-2	
18	PRIMARY INPUT 9	TO C4-3	
19	PRIMARY INPUT 8	TO C4-4	
20	PRIMARY INPUT 12	TO C4-15 CONN. J4-3	
21	PRIMARY INPUT 13	TO C4-14 CONN. J4-1	
22	PRIMARY INPUT 14	TO C4-13 CONN J4-5	
23	PRIMARY INPUT 15	TO C4-12 CONN. J4-2	
24	COIN SWITCH (NORMALY CLOSED)	TO A4-5	1-D5
25	COIN SWITCH (NORMALY OPEN)	TO A4-1	
26	GND		

CONNECTOR J4

PIN NO.	FUNCTION	FROM / TO IC- PIN NO.	SCHMTC LOCATION SHT-AREA
1	PRIMARY INPUT 13	TO C4-14 CONN. J3-21	1-A6
2	PRIMARY INPUT 15	TO C4-12 CONN. J3-23	
3	PRIMARY INPUT 12	TO C4-15 CONN. J3-20	
4	XDAC OUTPUT	FROM DISPLAY PCB TO CONN. J2-16	
5	PRIMARY INPUT 14	TO C4-13 CONN. J3-22	1-A6
6	NC		
7	NC		
8	GND		
9	NC		
10	EXTERNAL HIGH OUTPUT	TO A8-8 B6-9	5-A7
11	OUTPUT Ø	FROM F2-4	1-B4
12	OUTPUT 1	FROM F2-5	
13	OUTPUT 2	FROM F2-6	
14	OUTPUT 3	FROM F2-7	
15	OUTPUT 4	FROM F2-9	
16	OUTPUT 7	FROM F2-12	

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: davescott	DATE	ROCK-OLA
	PROJECT ENGR.	DATE	DWG TITLE: 16K C.P.U. SCHEMATIC
	RELEASE APPROV	DATE	
FINISH:	DO NOT SCALE DWG		
	TOLERANCE UNLESS OTHERWISE SPECIFIED		MODEL NO. / DWG SIZE D / DWG NO. G-5045-S / REV.
	PROJECTION:	SCALE:	CODE IDENT. / SHEET 7 OF 7

BRUNING 40-21 40423-1

RESET INDICATOR CIRCUITRY

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

C32P RESET (5C3)

74LS163 F8 — D C B A — LOAD — CLR — CRY — P — T

VECTOR (5C6) CLK2 — F9U6

74LS04 — 403F CLEAR TIMER (6B7)

403F

74LS02 H8 — 5547 (5C5) I4 — C530 (5C6) VECTOR — CLK1

74LS107 G8 — J — K — Q — 65984 — 2 239A

F9U6 — (INITIALIZE SWITCH) INITIAL POSITION — J2-18 34 PIN — U97A

NORMALIZE VECTOR (5C6)

(2B4) PA11 PA9 F6A4 — (2B7) SA11 SA9 HAFA 651H — J8 — 74LS86 — OUHA — CUH7

(5B5) XORP — PROCEED (1B3)

(5B5) XORS — OUHA CUH7 IP02 — F6 — 74LS27 — 74LS04

6598 — LOAD TIMER — 6598 (5C4)(6B7)

+5 — R9 1K — 74LS10 J16 — (1A5) C9U0 BRIGHT* — 9820

NORM — VAR. — INTENSITY OPTION

J2 — 74LS32 — 3 INTENSIFY — J2-12 9820 34 PIN

J2 — 74LS32 — BRIGHT — J2-14 2873 34 PIN

"B" REV. ONLY.

9820 5 — 98204 — J2 — 74LS32 — 6 9820

9820 — 13 — I6 — 74LS08 — 11 9820 — 12

9 — J2 — 74LS32 — 8 9820

5547 I4 (4A5) — C530 (5C6) VECTOR — CLK1 — 74LS02 H8 — 74LS107 G8 — J — K — Q — 10 8 U50F

LINE DONE 0109 (6B5) — 0109 11 — 018F — 5 DRAWING 018F (5A6)

L532 A12 — 13 12 — 11 204A

74LS04 — CDRAW SWITCH) LINE DRAWING — J2-19 — 204A

74LS164 A,B H6 QH — CLR — 204A 1,2 8 — CLK1 — R10 1K

0109 — 74LS02 H8 — 3980 ENABLE TIMER — (6B7)

(6A7)(6A7)(6A6)(6A6)(6A5) — A8F8 90P2 7U69 A19U 0495

A0 A1 A2 A3 A4 — CS 745288 E8 2089 D-ROM 5 — O1 O2 O3 O4 O5 O6 O7

5C13 26U2 1825 9890 — 049C — AUH7 673F FH67 — A3UI — CH8U

IP24 0495 — R20 1K — LINE DONE (6C8) — 0109

3980 (6B5) ENABLE TIMER — 403F (6D7) CLEAR TIMER — 6598 (6C4) LOAD TIMER — CLK2

E6 74LS163 — D6 74LS163 — C6 74LS163 — A P CLR LOAD QA QB QC QD

A8F6 9170 9620 90P2 (6B7) — FA81 7U69 A19U PF0A — A3UI IP24 0495 10* (6B6) H3PU

F6A4 74S04 (2B4) PA11 PA10 PA9 PA8 — HA32 F97P 0C22 — SA11 SA10 SA9 SA8 HAFA 74S04 — UAC5 651H F567

C530 (5C6) VECTOR — CLK1 — 74LS377 S2 — D1 D2 D3 D4 D5 D6 D7 D8 — Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 — C530

(2B3) PA7 PA6 PA5 PA4 — P38A 30CC J5 725C — (2B6) SA7 SA6 SA5 SA4 — 9172 711H FPF2 HAC9

74LS377 P2 — 6P3U Lo P415 6P3U 2ACF 1H2A C7P5 AA58

(2B2) PA3 PA2 PA1 PA0 — 0U1F 0841 242C AC5H — (2B5) SA3 SA2 SA1 SA0 — 26PP 67HU 166U C432

74LS377 M2 — 8A2A 6P3U 8A2A Lo Lo C7P5 PP4F Lo

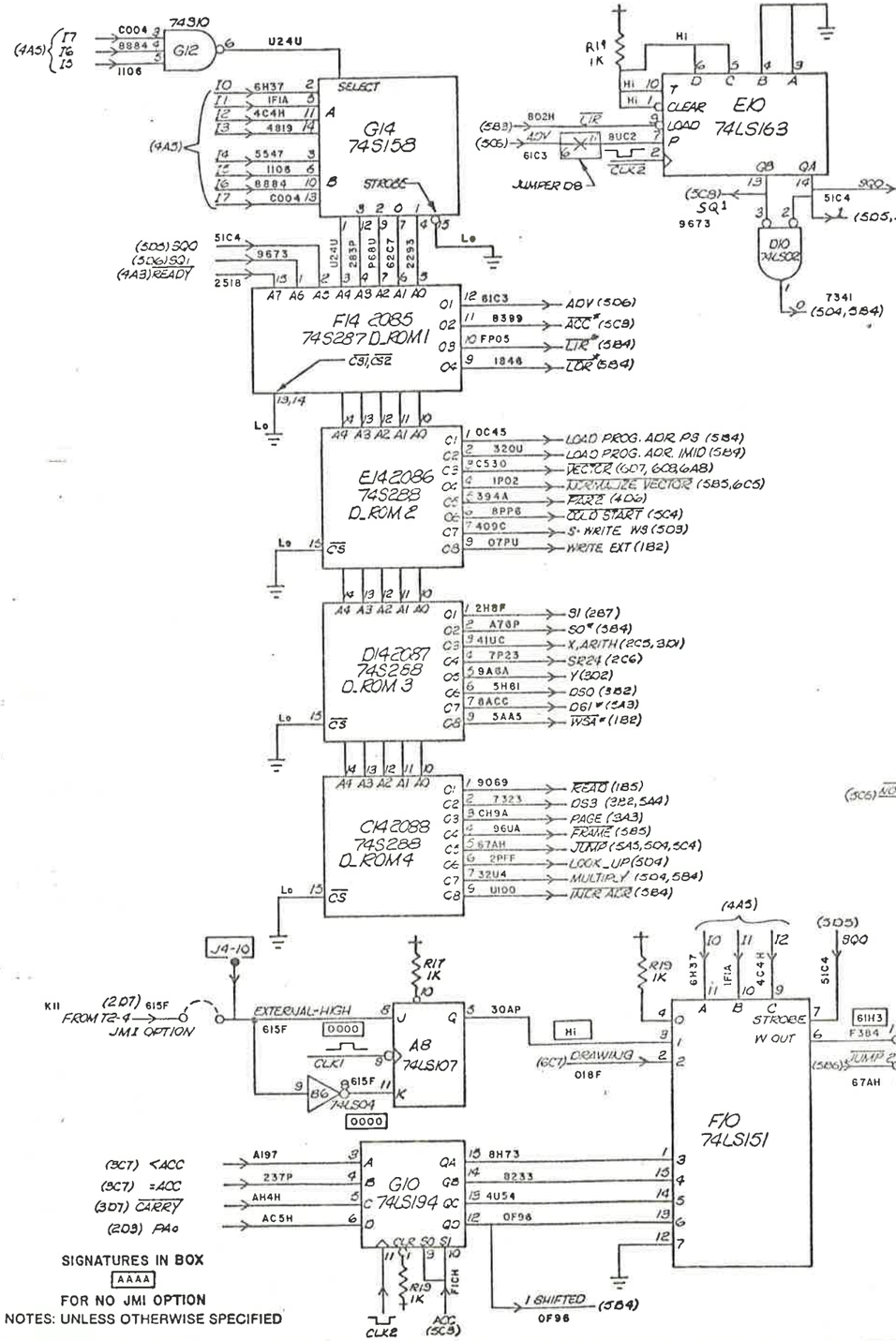
204A 1,2 — A,B H6 QH — CLR — R10 1K — 13

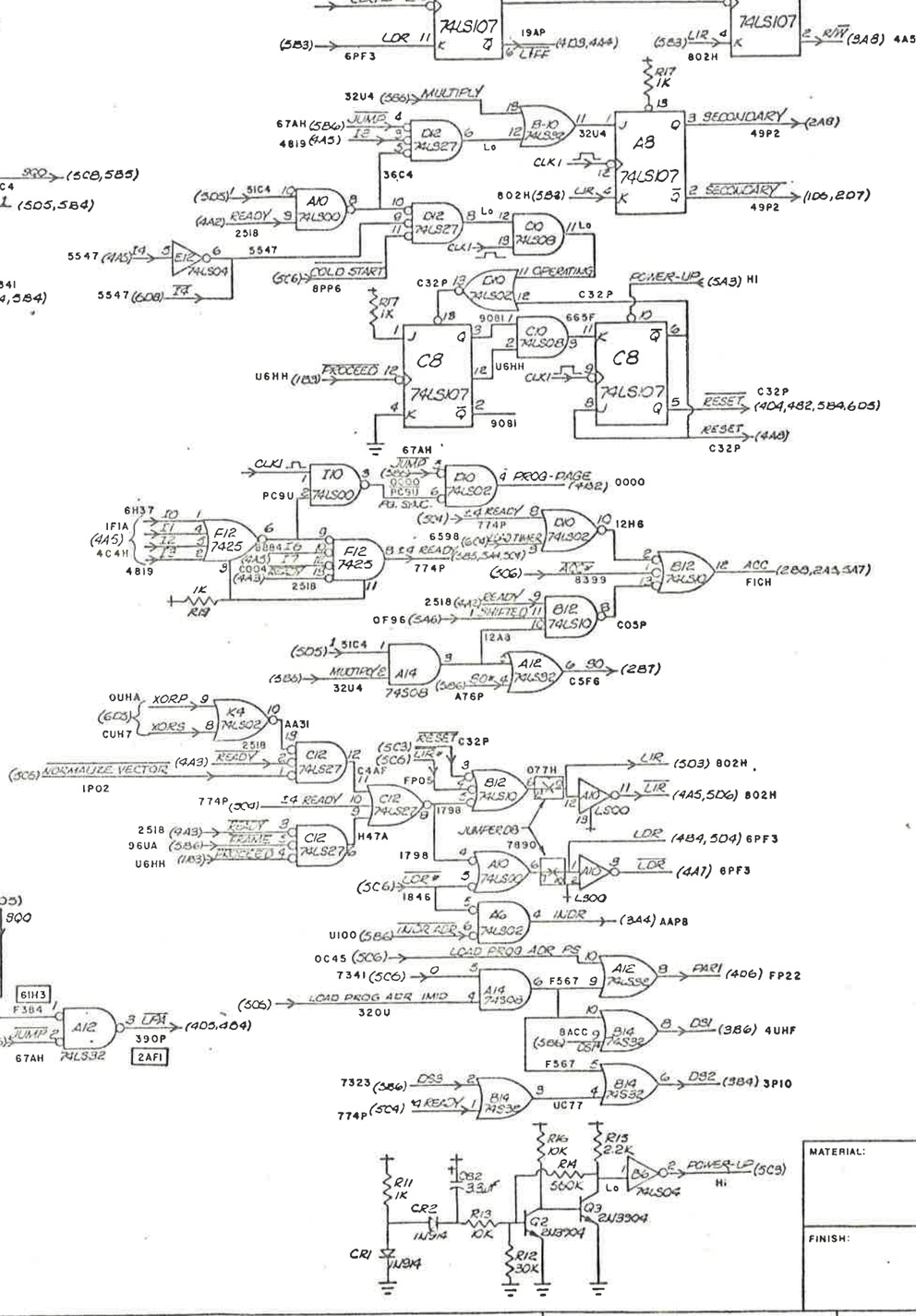
9820 — 9 — 10 J2 8 — TO J6-13 9820

NOTES: UNLESS OTHERWISE SPECIFIED — J2 → 34 33 32 31 13 11 9 10

MATERIAL:	DRAWN BY: S.HURLBERT	DATE 12-79	ROCK-OLA
	PROJECT ENGR:	DATE	DWG TITLE 16K CPU. SCHEMATIC DIAGRAM WITH SIGNATURES
	RELEASE APPROV	DATE	
FINISH:	DO NOT SCALE DWG		MODEL NO — DWG SIZE D — DWG NO. G-5045-S — REV.
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		
	PROJECTION:	SCALE: NONE	CODE IDENT. — SHEET 6 OF 7

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED





MATERIAL:	DRAWN BY: (Tillman)	DATE 1-79	ROCK-OLA
	PROJECT ENGR: T.R.	DATE 2/1/79	DWG TITLE 16K CPU SCHEMATIC DIAGRAM WITH SIGNATURES
	RELEASE APPROV.	DATE	
FINISH:	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO. / DWG SIZE D / DWG NO. G-5045-S / REV.
	PROJECTION:	SCALE: NONE	CODE IDENT. / SHEET 5 OF 7

BRUNING 4021 4043 1

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

SIGNATURES IN BOX
AAAA
FOR NO JMI OPTION

74LS377 S13 — (1D6, 1B6, 1B4, 3B3, 3A3, 3B6)

74LS374 P13 — (3C4)
74LS377 R13 — (3C5)
74LS377 T13 — (3C6)

74LS163 S11
74LS163 R11
74LS163 P11

74LS157 S9
74LS157 R9
74LS157 P9

U11, 74LS157 STROBE
T11, 74LS157 STROBE

2732 P_ROM4 U7 EVEN
2732 P_ROM3 R7 ODD
2732 P_ROM2 T7 EVEN
2732 P_ROM1 P7 ODD

U9 74LS75 — (4C2, 4D2)
T9 74LS75

J14, 74S288 DROM6

J10, 74LS107
J/0 74LS107

74S00
74S02
74S04
74S08
74S32

U801, 1285, UUF5
0AFI, HI62, FF86, FA46
4473, 3124, A8PF, 4UIH

(4A3) (2D3) (2D5) (2D6) (4B8, 4C8)
(4A4) (4D1) (5B3)(5A5)(5D4) (4B3) (5C3) (5C6) (5B3) (4C4, 4D4) (5C8; 5C4, 5B5, 5B4) (5D5, 5B4) (5D8, 5D7, 5C5, 5B6, 6C8) (4B4) (1B3) (3B5)

ADDRESS MODE

FOR SIGNATURES SUCH AS
REVERSE CLOCK POSITION TO OBTAIN BOTTOM SIGNATURE.

SIGNATURES IN BOX
AAAA
FOR NO JMI OPTION

MATERIAL:	DRAWN BY:	DATE	ROCK-OLA
	PROJECT ENGR:	DATE	DWG TITLE 16K C.P.U. SCHEMATIC DIAGRAM WITH SIGNATURES
	RELEASE APPROV	DATE	
FINISH:	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO / DWG SIZE D / DWG NO. G-5045-S / REV.
	PROJECTION:	SCALE: NONE	CODE IDENT. / SHEET 4 OF 7

BRUNING 80-21 40423-1

REV	DESCRIPTION	DATE	APPROVED

L4 74S182

N6 25LS181 · M6 25LS181 · L6 25LS181

N9 74LS85 · M9 74LS85 · L9 74LS85

N11 74LS157 · M11 74LS157 · L11 74LS157

N14 9101C · M14 9101C · L14 9101C

J12 74LS298 · I12 74LS298 · H12 74LS194

74S04 · 74LS32 · 74LS02 · 74LS86

CARRY (5A8) AH4H

(2A7, 2A4) (2A6, 2A3) (2A5, 2A2)

(5A8) ACC A197 · (5A8) =ACC 237P

READ-X (1A5) 9069 · DSO (5B6) 5H61 · JUMPER D8 · DS3 (5B6) 7323 · DS2 (5A3) 3P10 · DS1 (5A3) 4UHF

X, ARITH 41UC (5B6)

(3A3) W7 W6 W5 W4 · W3 W2 W1 W0

(4A7) (4A5) (4A7)

(4B0) PG1 (4B2) · (3B6)

(5D3) R/W 4A50 LS04 LS04

22,17 · 8,18,19 · 20

(2D6) (2D5) (2D3)

AAP8 INDR (5B3) (1B3) · 0000 Ø2WSA

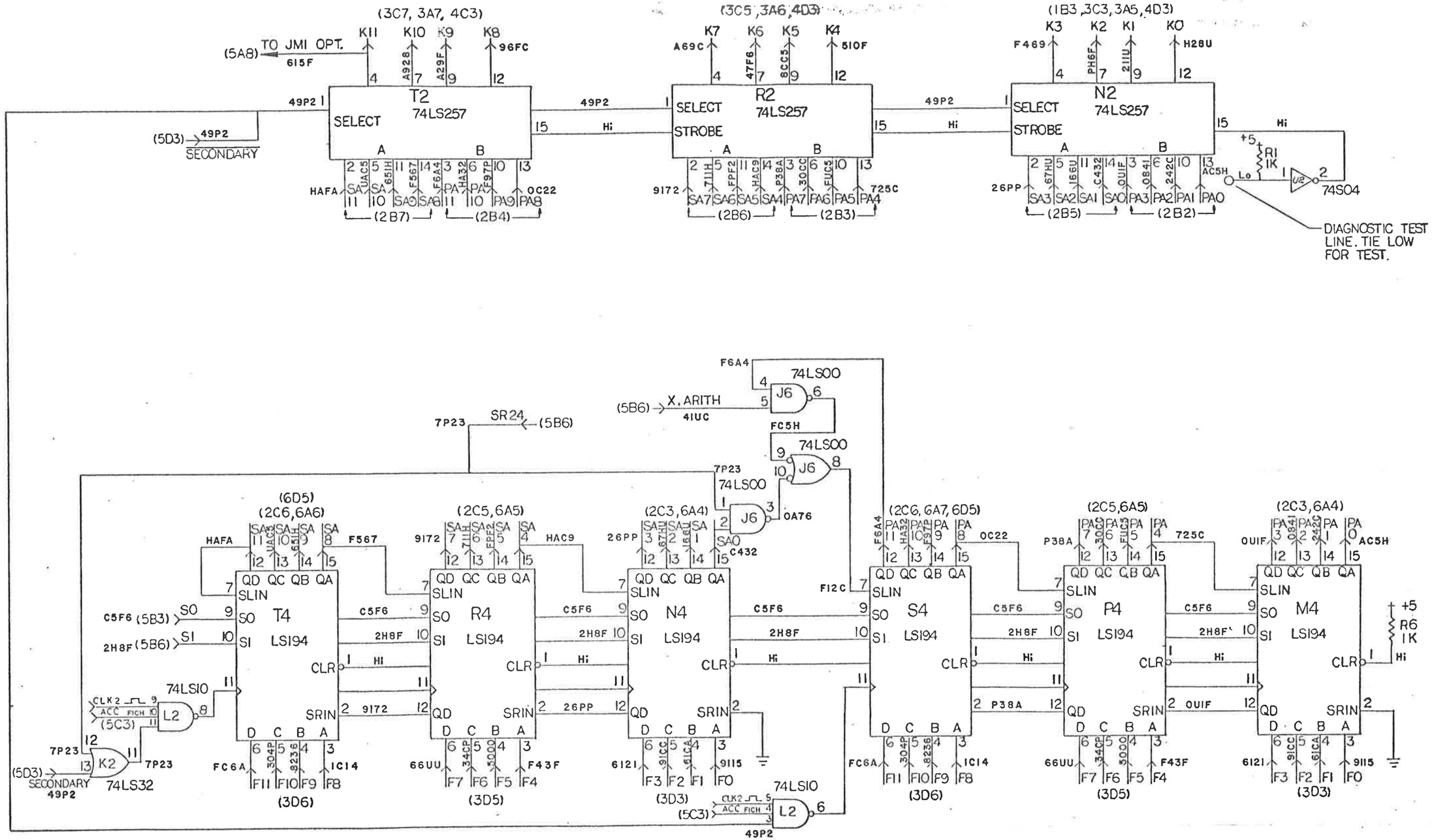
CLK1 · PAGE (5B6) · CH9A

* TO OBTAIN THESE SIGNATURES, PIN 10 OF J12 AND I12 MUST BE TIED TO GROUND

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: S. HUBBERT	DATE 1-79	ROCK-OLA
	PROJECT ENGR: T.K.	DATE 7/31/81	DWG TITLE I.G.K. C.P.U. SCHEMATIC DIAGRAM WITH SIGNATURES
	RELEASE APPROV	DATE	
FINISH:	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO · DWG SIZE D · DWG NO. G-5045-S · REV.
	PROJECTION:	SCALE: NONE	CODE IDENT. · SHEET 3 OF 7

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: S. HURLBERT	DATE 12 79	ROCK-OLA
	PROJECT ENGR:	DATE	DWG TITLE 16K C.P.U. SCHEMATIC DIAGRAM WITH SIGNATURES
	RELEASE APPROV:	DATE	
FINISH:	DO NOT SCALE DWG		MODEL NO. / DWG SIZE D / DWG NO. G-5045-S / REV.
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		CODE IDENT. / SHEET 2 OF 7
	PROJECTION:	SCALE: NONE	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

1K (TYP)
+5 (TYP)
J3-25 N.O
J3 24 N.C
OPTION SWITCHES E2
SI0 SI1 SI2 SI3 SI4 SI5 SI6
J3-7 J3-4 J3-5 J3-6
RESISTOR PACK D2
80HP 29A9 PHO7 49P2
(4A7) D2 D1 D0 SECONDARY (3D3)
E4 74LS151
STROBE A B C
Y-OUT
*Hi
49P2
D3 (1B5) 392C
F4 74LS10
A522
RESISTOR PACK D2
J3-11 PI0
J3-10 PI1
J3-9 PI2
J3-8 PI3
J3-15 PI4
J3-14 PI5
J3-13 PI6
J3-12 PI7
CONTROL INPUTS
D4 74LS151
Y-OUT A522
J3-2 +5
RESISTOR PACK C2
J3-19 PI8
J3-18 PI9
J3-17 PI10
J3-16 PI11
J3-20 PI12
J3-21 PI13
J3-22 PI14
J3-23 PI15
CONTROL INPUTS
C4 74LS151
D3 (4A7) 392C
74LS04 B6 (1C6)
A522
F6 74LS27
Y-OUT
READ (5B6)
9069
READ-X (3C2)
9069
74LS500 A4
74LS04 B6
74LS02 A6
74LS107 B2
74LS107 G4
74LS107 G4
74LS393 1A 1B 1C 1D 2A 2B 2C 2D
CLR
CLK 2
2.12
TP1
TP4
TP5
76 HZ (1D5)
39 KHZ
26.5 ms
15% duty cycle
PROCEED (5C4) (5B5) (6D4)
JUMPER D8
U6HH
R-COIN (1B5)
A328
*A328
B4 74LS00
R5 470
J1-12
Q1 2N6292
COIN COUNTER DRIVER
(1C3) 76 HZ
(1C5) A-COIN
J3-3 A328
J4-11 Q0 FHIH
J4-12 Q1 54P5
J4-13 Q2 8CAU
J4-14 Q3 2043
J4-15 Q4 A941
J4-16 82CU
C9UC
BRIGHT (6C3)
J3-1 82CU
F2 74LS259
SEE NOTE ONE
CLR
OUTPUT CONTROLS
0000
READ (5B6)
74LS04 H28U
H28U
Ko (2D3)
(4A4) D2 D1 D0
80HP 29A9 PHO7
* TO OBTAIN THESE SIGNATURES ON THIS PAGE, GROUND PIN 1 OF A4 FOR A SECOND.
C59 680pf
74504
20 MHZ
R2 330 Ω
R3 330 Ω
R4 1K
74LS113 1/2 H2
74LS113 G2
TP1
TP3
TP2
Ø2 + Ø3 (4A4)
RSA * (6C6)
WRITE-EXT. (6C5)
74LS27 F6
74LS10 F4
74265 J4
Ø2 WISA (3A4)
Ø2 OUT
CLK2 CLK2 CLK1 CLK1

1. DM8334 MAY BE USED AS SUBSTITUTION FOR 74LS259 (IC F2)

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: SHUBERT	DATE 11-79	ROCK-OLA
	PROJECT ENGR:	DATE	DWG TITLE 16K C.P.U. SCHEMATIC DIAGRAM - WITH SIGNATURES
	RELEASE APPROV	DATE	
FINISH:	DO NOT SCALE DWG		MODEL NO. / DWG SIZE D / DWG NO. G-5045-S / REV.
	TOLERANCE UNLESS OTHERWISE SPECIFIED		CODE IDENT. / SHEET 1 OF 7
	PROJECTION:	SCALE: NONE	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

Q2 BASE: 10V, 6.5V, 27 μ SEC.

Q2 COLLECTOR: 42V, 8V, 27 μ SEC.

(4) +25 VDC — R15 1.3 ½W — 25.4 V

(2) N/C

(6) N/C

(5) GND — J1

C1 22μf 50V

R16 10K

R1 2.7K — 22.2V

R2 680 1W — 22.5V

IC 1 MA723CN: V+ (12), Vc (11), Vo (10), Vz (9), CL (2), CS (3), I (4), FC (13), V- (7), NI (5), VR (6)

R9 100K — 7.2V — 7.0V

1.1V — R3 100 — 0.15V

C16 .001μf — 9.1V — 7.1V

R17 33K — R4 4.7K — R27 4.7K — ~0V

R13 270

C3 .022 μf — R5 10K — C7 0.1μf 12V — R11 1K

D3 IN 758 — 9.7V

D2 IN456A — 7.1V

D1 IN456A

R6 133 K RN-C (NOMINAL)

C4 1000 pf 1KV

25.1 V — C5 22μf 25V

TIP41A Q2 — R18 10 — C15 0.1μf

R14 18 — D10 IN281

0.8 V — Q1 TIP31 — 0.15 V

1K R8 — R7 0.75 BWH

C6 1 μf 35 V

R10 10K

T1 — ENCAPSULATED ASSEMBLY

VOLTAGE QUADRUPLER BLOCK

400 V P-P (150 V RMS)

150 V P-P (35 V RMS)

BLEEDER RESISTOR 300 M

HIGH VOLTAGE ANODE CONN. — 16K VDC 250 ma

C31 .0016μf 400V — D31 HX10M — R31 1K ½W — R33 100

D32 HX10M — C33 .01μf 500V — C34 .01μf 500V

DT230H1 D42 — C44 47μf 100V

C41 .036 μf 100V — D41 DT230H1 — R42 27 ½W

(3) +400 V DC 1 ma

(1) +90 VDC 8ma — J1

Q1 COLLECTOR: 8.5V, 7V, 27 μ SEC.

T1 TERMINAL 4: 27 μ SEC.

1. ALL RESISTOR VALUES ARE IN OHMS

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: davesco	DATE	CINEMATRONICS INC. El Cajon Ca. 92020
	PROJECT ENGR:	DATE	DWG TITLE KELTRON HIGH VOLTAGE POWER SUPPLY
	RELEASE APPROV:	DATE	
FINISH:	DO NOT SCALE DWG		MODEL NO. / DWG SIZE C / DWG NO. 72-10841-02 / REV.
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		CODE IDENT. / SHEET 1 OF 1
	PROJECTION: / SCALE:		

BRUNING 40-21 4042-1

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

R1 2.7K
R2 680 1W
R3 100
R4 4.7K
R5 10K
R6 133 K RN-C (NOMINAL)
R7 0.75 BWH
R8 1K
R9 100K
R10 10K
R11 1K

R13 270
R14 18
R15 1.3 ½W
R16 10K
R17 33K
R18 10

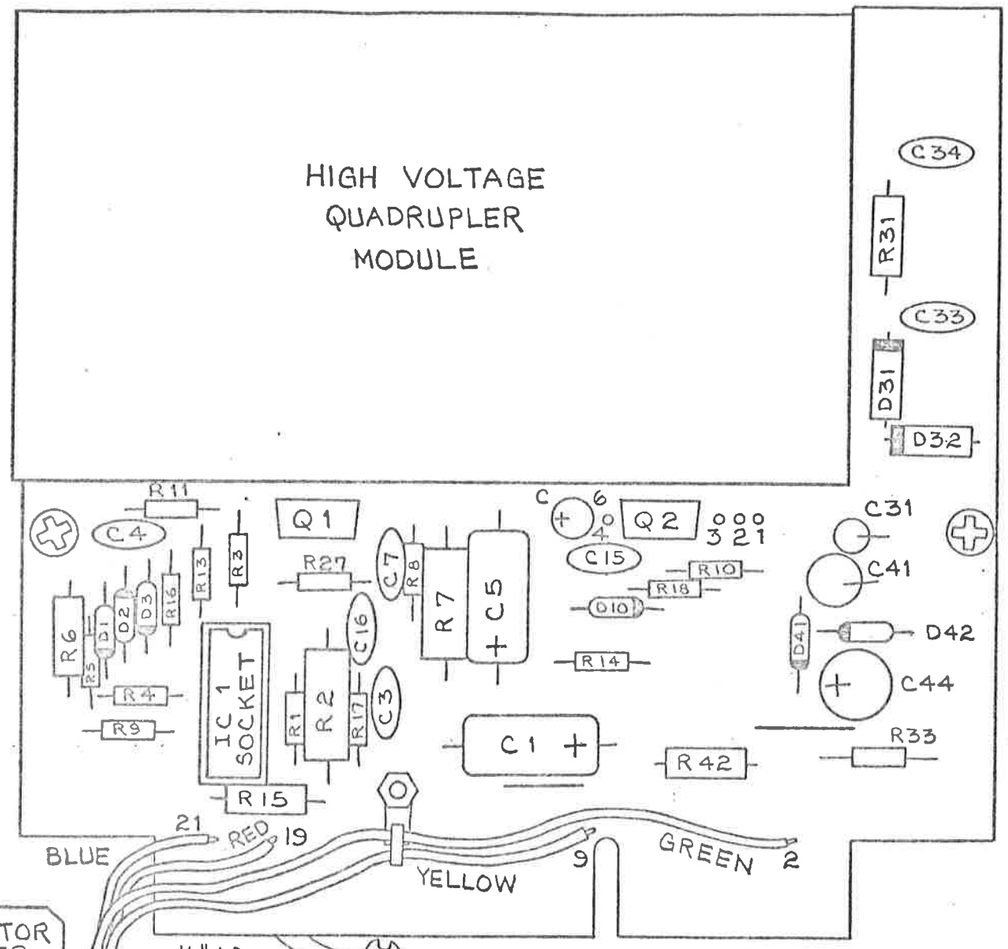
R27 4.7K

R31 1K ½W

R33 100

R42 27 ½W

HIGH VOLTAGE QUADRUPLER MODULE



P.C.B HOLE NUMBER	WIRE	CONNECTOR NUMBER
2	GREEN	3
9	YELLOW	1
19	RED	4
21	BLUE	5

1. RESISTOR VALUES IN OHMS

NOTES: UNLESS OTHERWISE SPECIFIED

C1 22μf 50V

C3 0.022μf
C4 1000pf 1KV
C5 22μf 25V
C6 1μf 35V
C7 0.1μf 12V

C15 0.1μf 12V
C16 .001μf

C31 .0016μf 400V

C33 .01μf 500V
C34 .01μf 500V

C41 .036μf 100V

C44 47μf 100V

D1 IN456A
D2 IN456A
D3 IN758

D10 IN281

D31 HX10M
D32 HX10M

D41 DT230HI
D42 DT230HI

J1 03-09-1063

Q1 TIP 31
Q2 TIP 41

IC1 MA 723 CN

MATERIAL:	DRAWN BY: daveseo	DATE	CINEMATRONICS INC. El Cajon Ca. 92020
	PROJECT ENGR:	DATE	DWG TITLE KELTRON HIGH VOLTAGE POWER SUPPLY
	RELEASE APPROV:	DATE	
FINISH:	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO. / DWG SIZE C / DWG NO. 72-10841-01 / REV.
	PROJECTION:	SCALE:	CODE IDENT. / SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

J2 POWER SUPPLY CONN.

+25V
+25 V
C1 .33 FILM
C103 .1
C203 .1
D12
SEE CAUTION
GND
6.3VAC
C27 .1
-25V
C4 2.2 TANT 35V
C104 .1
C204 .1
D15
IC4 7815
D13
+15V
C12 1 TANT 35V
C13 1 35V TANT
-25V
IC6 7915
D16
-15V
C15 2.2 35V TANT
C16 1 35V TANT

NOTE: USE 5.6K RES. BETWEEN D4(CATH) AND R11 WITH AMPEREX CRT ONLY.

+90 VOLTS
R11 10K
R7 10K 1W
R8 10K 1W
D4
R9 2.2K
R10 5.6K
D3
Q1 2N5550
LT1 NE2
LT2 NE2
+5
R19 470
D18
Q8 2N3904
C23 2.2 TANT 35V
R20 1K
R21 2.2K
D19 IN914
IC7 7406 OC
ZERO VOLTS
R24 1K
R25 68K
R26 10K
Q7 2N3904
Q3 2N5550
Q2 2N3904
Q6 2N5210
R22 10K
R23 10K
IC7 PIN 2
IC7 PIN 4
C24 .1 50V
C8 .005
R4 470
D17 IN914
IC7 7406 OC
R1 470
+4 VOLTS
IN914 D20
C9 .005
R5 470
R2 470
R3 10K 1/2W
R6 10K
C10 2.2 TANT 35V
D5

KELTRON HP 160124A

DISPLAY P.C.B.

16KV HIGH VOLTAGE ANODE
WHITE
YELLOW 1K 1/2W
BRIGHTNESS POT
G1
BRN
BLK
6.3V AC
GREEN 1K 1/2W
G2
RED 1K 1/2W
G4 FOCUS
BLUE 1K 1/2W
400V
CRT SOCKET

TO CRT (CATHODE)
R11 WIPER BRIGHTNESS
100V
40V
0V

+25
R27 100 2W
C25 .47 35V TANT
IC8 7805
+5
C26 4.7 35V TANT

+5 13
+25 UNFILTERED 14
J1 LOGIC BD. CONN.
14
12

IC 7, PIN 3
IC7, PIN 4

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: HERRY H.	DATE 5-80	CINEMATRONICS INC. El Cajon Ca. 92020
	PROJECT ENGR:	DATE	DWG TITLE DISPLAY ELECTRONICS KELTRON
FINISH:	RELEASE APPROV.	DATE 5/81	
	DO NOT SCALE DWG		MODEL NO
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		DWG SIZE D
	PROJECTION:	SCALE:	DWG NO. 72-10628-02
			REV. G
			CODE IDENT.
			SHEET 2 OF 2

BRUNING 4021 4023-1

WHEN BECKMAN 7580VS DAC IS UTILIZED FOR IC101 AND IC201:
R101 CHANGED TO 7.5 K 1% METAL FILM
R201 CHANGED TO 11.0 K 1% METAL FILM
BECKMAN DAC NOT COMPATABLE WITH BURR BROWN DAC.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

J1

DAC80 IC101 — SEE NOTE ABOVE

INIT. POS
LINE DWG

R101 1.43K 1/2W MF

C211 2.2 TANT 35V

DAC80 IC201 — SEE NOTE ABOVE

R201 2.1K 1/2W MF

J1 TO LOGIC BD CONNECTOR

IC1 LF13331D

N/C, DIS, V_V

R103 10K 1%
R102 5K
R102 VERT. LINE LENGTH ADJ.
TL081 IC102
R105 3K, R106 10K, R107 3K
R108 47
R109 100
R109 VERTICLE PICTURE SIZE
R104 1.8K
C101 .022
R110 100
D101, D102 IN9148 4 PLCS., D103, D104

R203 10K 1%
D200 IN914

R202 5K
R202 HORIZON. LINE LENGTH ADJ.
TL081 IC202
R205 3K, R206 5.6K, R207 330
R208 100
R209 100
C205 47 ELEC
C201 022 FILM
R204 2.2K
D201, D202 IN914B 4 PLCS., D203
R210 47
R209 HORIZONTAL PICTURE SIZE

DAC OUTPUT PIN 15

PIN 3 OP AMP
PIN 6 OP AMP

R111 82K 1/2W
R112 820
Q101 2N5210
Q103 2N5210
Q102 2N5210
R113 200
D105, D106

R211 82K 1/2W
R212 820
Q201 2N5210
Q203 2N5210
Q202 2N5210
R213 200
D205, D206

R114 82K 1/2W
R214 82K 1/2W

D107, D108
R116 33
Q105 2N2102

D207, D208
R216 33
Q205 2N2102

R117 100
R115 15
Q104 2N5322
Q106 2N2102
Q107 2N3906
Q109 2N5322

R217 100
R215 15
Q204 2N5322
Q206 2N2102
Q207 2N3906
Q209 2N5322

D109, D110, D111, D112, D113
D209, D210, D211, D212, D213

Q108 2N5320
Q110 2N5878
R118 47 1/2W
R119 47 1/2W
R120 .18,3W
R121 .18,3W
R130 47
R131 47
D114, D115

Q208 2N5320
Q210 2N5878
R218 47 1/2W
R219 47 1/2W
R220 .18 3W
R221 .18 3W
R230 47
R231 47
D214, D215

Q111 2N5876
Q211 2N5876

R124 THRU R129
C102 .1 FILM 100V
R123 360 1W
J4
VERTICAL DEFLECTION COIL

R224 THRU R229
C202 .1 FILM 100V
R223 360 1W
J3
HORIZONTAL DEFLECTION COIL

J5

COLLECTOR Q104, Q204: 30, 0V, -30
BASE Q104, Q204: 30, 0V

SEE CAUTION

—CAUTION—
DO NOT APPLY POWER TO DISPLAY ELECTRONICS UNLESS POWER TRANSISTORS ARE CONNECTED. FAILURE TO DO SO WILL RESULT IN PERMANENT DAMAGE TO DRIVE ELECTRONICS.

7. ALL SCOPE WAVEFORMS ARE WITH GAME IN DIAGNOSTIC MODE AND WITH YOKE OFF

6. ALL DIODES ARE IN4003.
5. ALL CAPS ARE IN uF, 50V, DISC.
4. ALL RESISTOR ARE IN OHMS, 1/4W, CARBON.
3. SOLDER POINTS ON P.C. BOARD.
2. POWER TRANSISTORS ARE MOUNTED ON HEATSINKS & ARE SEPARATE FROM P.C. BOARD. (DWG.# SD100214).
1. R124-R129 & R224-R229 ARE COMPOSED OF 6 EACH 2.7Ω, 1W, RESISTORS IN PARALLEL.

NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: SHERRY H	DATE 5-80	CINEMATRONICS INC. El Cajon Ca. 92020
	PROJECT ENGR:	DATE	
	RELEASE APPROV	DATE 6-80	DWG TITLE: DISPLAY ELECTRONICS KELTRON
FINISH:	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO. / DWG SIZE D / DWG NO. 72-10628-02 / REV. G
	PROJECTION:	SCALE:	CODE IDENT. / SHEET 1 OF 2

BRUNING 40-21 40431

DEMON SCHEMATIC
SOUND & SCORE P.C.B.
G-6215-A

U10 MK 3880 Z-880 CPU

U1 MK 3882 7-80 CTC

U3 AY-3-8910 PSG3

U18 AY-3-8910 PSG1

U17 AY-3-8910 PSG2

U15 LS138

U5 LS138

U21 555

U8 CD40105B

U2 7414

U9, U4, U22, U19

RP2, RPI, RP4, RP3

RAM 2114

ROM 1 2732

ROM 2 2732

U23 LS04

U24 LS74

U6 LS00

U7, U16 LS02

Q1 MPSA06

Q2 MPSA06

Q3 MPSA06

Q5 MPSA56

A56

VR5 3.9V

XI

J3

J2

RP5 4308R-101-100K SIP RESISTOR NTW.

220 PF CAPACITOR ON EACH LINE

--32 CAPACITORS

4.4 VAC HI LO

AUDIO

LPF

MUTE

RESET

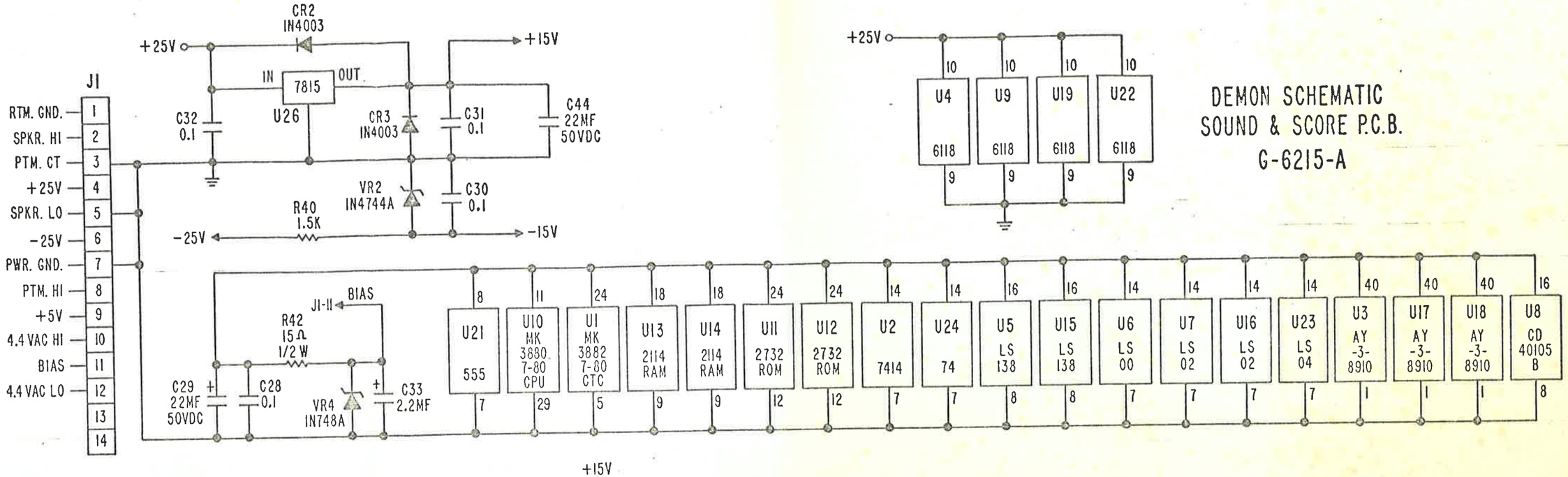
WD

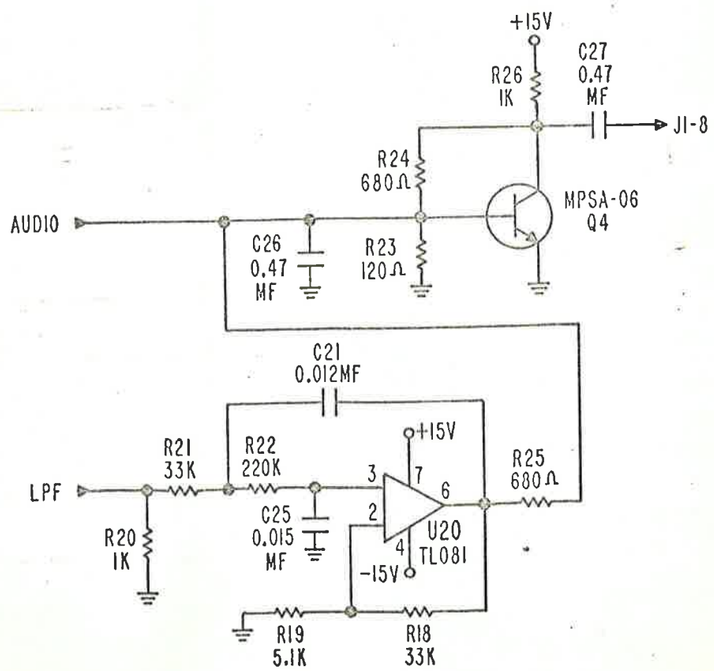
IREQ

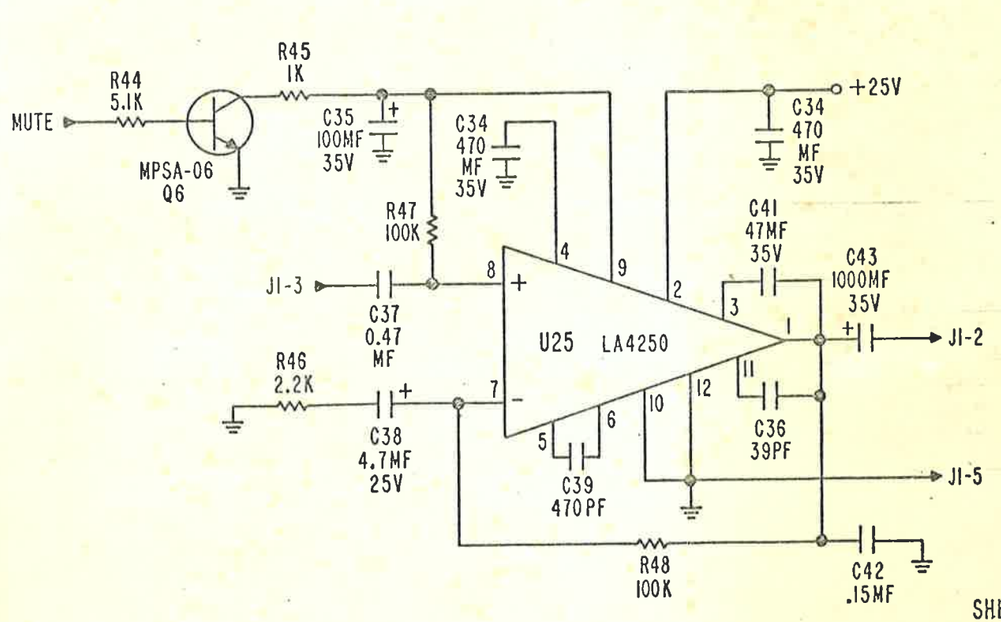
FROM J1-7 J1-9 J1-6 J1-4

SHEET 1A OF 2
RMC #G-6288

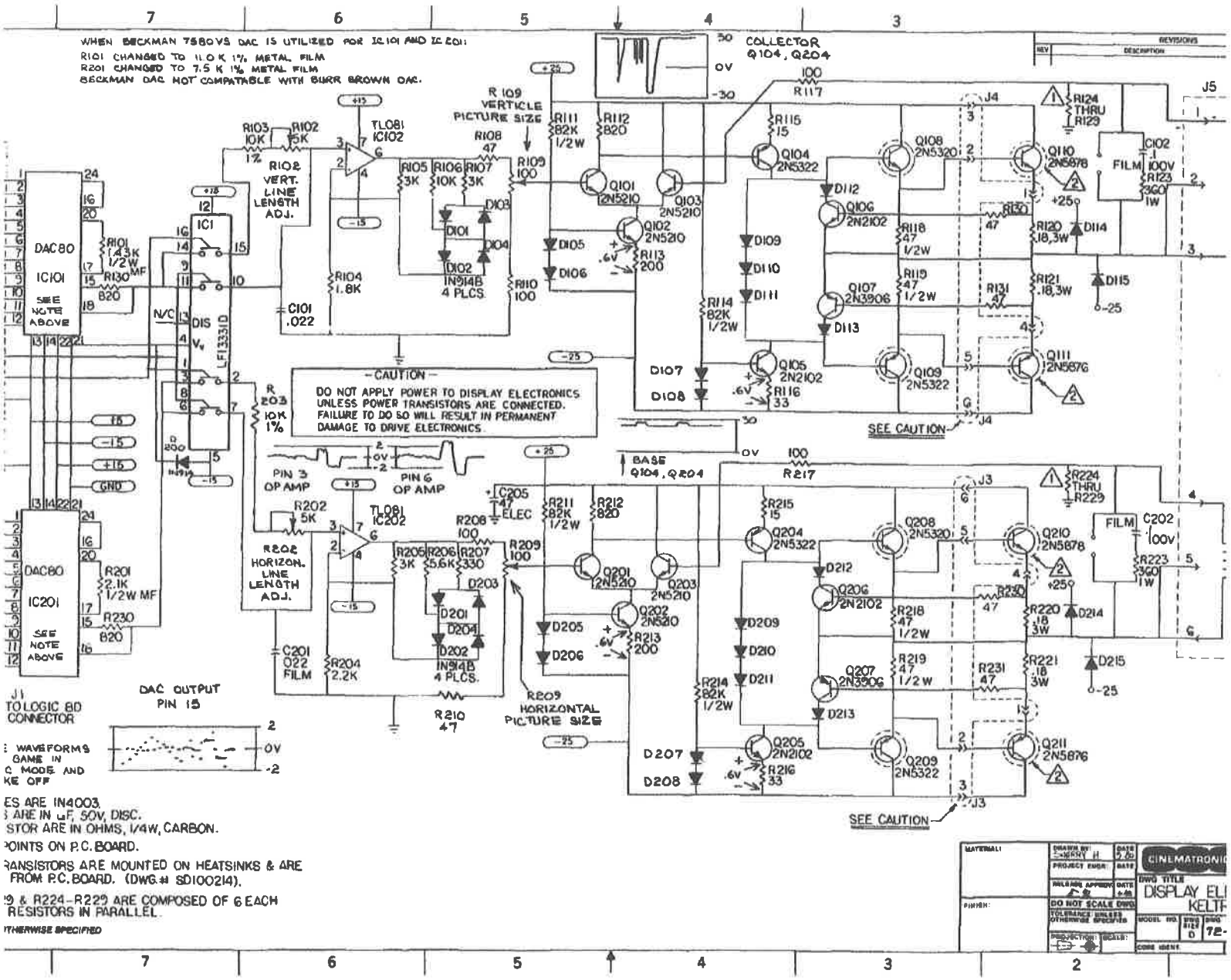
DEMON SCHEMATIC
SOUND & SCORE P.C.B.
G-6215-A







SHEET 1B OF 2
RMC # G-6288


WHEN BECKMAN 7580VS DAC IS UTILIZED FOR IC101 AND IC201:
R101 CHANGED TO 11.0 K 1% METAL FILM
R201 CHANGED TO 7.5 K 1% METAL FILM
BECKMAN DAC NOT COMPATABLE WITH BURR BROWN DAC.
REVISIONS
REV
DESCRIPTION
COLLECTOR Q104, Q204
50
0V
-30
R109 VERTICLE PICTURE SIZE
R102 VERT. LINE LENGTH ADJ.
R202 HORIZON. LINE LENGTH ADJ.
DAC80 IC101
DAC80 IC201
SEE NOTE ABOVE
TL081 IC102
TL081 IC202
LF13331D
-CAUTION-
DO NOT APPLY POWER TO DISPLAY ELECTRONICS UNLESS POWER TRANSISTORS ARE CONNECTED. FAILURE TO DO SO WILL RESULT IN PERMANENT DAMAGE TO DRIVE ELECTRONICS.
SEE CAUTION
BASE Q104, Q204
PIN 3 OP AMP
PIN 6 OP AMP
DAC OUTPUT PIN 15
J1 TO LOGIC BD CONNECTOR
R209 HORIZONTAL PICTURE SIZE
FILM
D101
D102 IN914B 4 PLCS.
D201
D202 IN914B 4 PLCS.
Q101 2N5210
Q102 2N5210
Q103 2N5210
Q201 2N5210
Q202 2N5210
Q203 2N5210
Q104 2N5322
Q204 2N5322
Q105 2N2102
Q205 2N2102
Q106 2N2102
Q206 2N2102
Q107 2N3906
Q207 2N3906
Q108 2N5320
Q208 2N5320
Q109 2N5322
Q209 2N5322
Q110 2N5878
Q210 2N5878
Q111 2N5876
Q211 2N5876
D114
D214
D115
D215
+25
-25
GND
: WAVEFORMS GAME IN C MODE AND KE OFF
ES ARE IN4003.
ARE IN uF, 50V, DISC.
STOR ARE IN OHMS, 1/4W, CARBON.
OINTS ON P.C. BOARD.
RANSISTORS ARE MOUNTED ON HEATSINKS & ARE FROM P.C. BOARD. (DWG.# SD100214).
9 & R224-R229 ARE COMPOSED OF 6 EACH RESISTORS IN PARALLEL.
OTHERWISE SPECIFIED
CINEMATRONIC
DISPLAY ELI
KELTF

From: zonn@concentric.net (Zonn Moore)
Newsgroups: rec.games.video.arcade.collecting
Subject: Re: TECH:Cinematronics vectors
Date: Tue, 18 Mar 1997 06:55:00 GMT
Organization: Concentric Internet Services
Lines: 67
Message-ID: <332e3261.814372@news.concentric.net>
References: <01bc3420$86b5f200$228480d0@default>
Reply-To: zonn@concentric.net
NNTP-Posting-Host: cnc132049.concentric.net
Mime-Version: 1.0
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit
X-Newsreader: Forte Agent .99g/16.339
Xref: news.spies.com rec.games.video.arcade.collecting:58680

On 18 Mar 1997 04:51:49 GMT, "David Whitman" <dwhitman@netunlimited.net> wrote:

~ Someone,PLEASEEEEE help me.My Ripoff monitor has died.It pops the -25V
~ breaker.I found a bad deflection transistor and resistor,so I replaced
~ those and checked all the other diodes and transistors in the vertical
~ circuit.Are there any common failure items in this piece of
~ #$%#^,err,beuitful monitor?Also,FWIW,it gets great deflection sounds for
~ about 4-6 seconds before the breaker pops,so I doubt there's a dead short
~ to ground.
~
~ Any info Zonn,or any other Cinematronics gurus out there?

Geeze! What a pathetic cry for help! ;^)

Well you GOT to get RipOff going, it's a totally cool game.

At this point all I can ask is the obvious things, like did you check all the transistors in the Horizontal section, both sides use the -25v.

Also have you tried unplugging your sound card? Maybe it's not the monitor popping the breaker.

Easy things to try if you have the parts are swapping out the DACs and the LF13331D analog switch.

The number one failure I've seen in these monitors, that cause the breakers to blow, (not counting the output transistors) are those damned tantalum capacitors. If they get reverse voltaged for just microseconds they become wires. Since you can hear deflection noises your output transistor are *probably* working. (Careful though, you can still hear the noise even if one channel is dead.) It also means you didn't connect the ribbon cable upside down. This is the most common problem in "4 seconds and the circuit blows" symptom.

Since it takes a few seconds to blow, try testing resistance on the outputs of the voltage regulators, like right across C16 the 1uf Tantalum Cap. The regulators will go into their current limit mode when shorted and that delays the breakers popping.

If it's an original Rip Off monitor, then it still has the discreet HV section. You might check Q4 too see if it's shorted.

Basically check resistance across ALL tantalum capacitors.

Check the output damping diodes D114, D115, D214, D215.

You can try running the monitor without the Yoke plugged in, this is ok. But

DON'T run it with the yoke plugged in and without the power transistors plugged in! The outputs are darlingtons and if you unplug the output transistors the pre-drivers will try to drive the whole thing, and they just can't do it! Since you had an output blow, you might want to test these predrivers also. (Q108, Q109, Q208 and Q209).

If the circuit breakers quit blowing when you uplug the yoke, you may want to put a scope on the outputs of IC102 and IC202, (or even a voltmeter if you don'thave a sc the place. If it just sits at some negative voltage (like -5) then something iswrong.) : blown, you might be driving an output maximally negative. If this is the case, trace back through the OP amps and analog switches (these things are also notorious for going bad) and find the bad part. If you suspect a bad DAC, try swapping them. If the trouble moves it's a DAC, if not it could be the CPU itself.

Well that's a start anyways, good luck!

-Zonn

This was from a news article from a while ago:

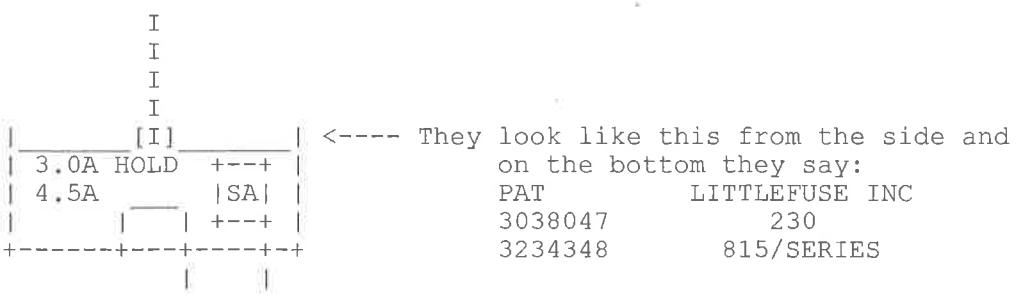
So your Cinematronics/Vectorbeam vector game doesn't work, eh? Maybe I can help.

Does your game have power; does it do anything at all (other than light the attractor if it has one)? It is best to check with a meter if you have +5VDC, +/-25VDC, and 6.3VAC but you can get a good idea if you are getting +5VDC by watching the red LED on the CPU board which is the largest of the game PCBs (some early versions of the CPU board don't have this LED.). Even if your power supply is bad, you can easily bench test this board by wiring up Ground and +5 volts to it from a modern day power supply. This is enough to get the CPU board running (but not the monitor or the audio board). When the power is turned on, the LED should come on very brightly for about 1-2 seconds and then turn off. Most games give some kind of sound burst for a second, too. If it never lights you either have severe game board problems or, more likely, power supply problems. If it stays lit then you almost definitely have game board problems.

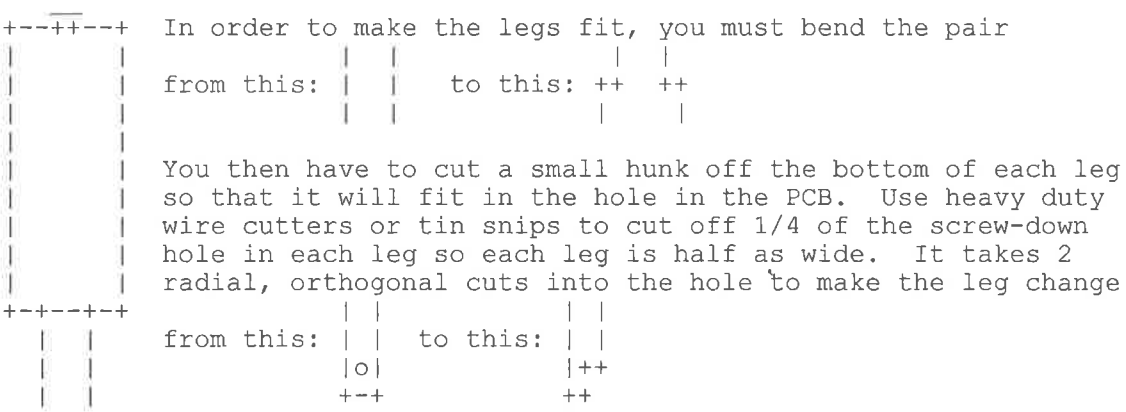
If you don't have power, you need to fix/replace your power supply or wiring harness, obviously. Check to make sure your power cord is OK as they often go bad (on any game) and be sure to replace the plug if some idiot has broken off the earth ground pin. Also check to make sure the safety interlock for the back door is functional (conducts when pushed in and also when pulled out). I only have experience with the Condor brand power supply (CP 573) but Cinematronics also used another vendor, National Power Technology, who made a very different but pinout compatible unit which I have never seen. Vectorbeam used yet another power supply that was incompatible with the Cinematronics harnesses.

No matter what power supply you have, start out by checking the fuses and resetting the circuit breakers. If you have a Condor supply and are using USA power, make sure the switch in the upper left is in the 115 VAC (down) position and check fuse F1 and make sure it is good and is rated 4 Amps at 250 Volts. If it is bad or a different rating, replace it with the proper fuse. Other countries' power systems may require different values of these 2 things but the PCB tells you what they should be. Next check/reset the strange looking circuit breakers in the middle left of the board. There are 2 right next to one another and each has a thin red rod sticking out of it. There is no way to tell if these have been tripped or not and they are old and unreliable so push them down a few times to be sure they get reset. Lots of times this is all that is wrong. I replace these with new breakers on all my power

supplies since the original ones are almost always flaky and rusted and probably not breaking very well (and sometimes not conducting either :). The original breakers are rated at 3.0A hold and 4.5A spike and are made by Littlefuse Inc. but I have been unable to locate that company and they probably aren't around any more (Condor has no information about them or the power supply but Condor still exists and builds power supplies to this day).



I have been unable to find an exact match for the breakers but I found something that works well after a minor amount of modification. I use Heinemann brand "Series KD1 Re-Cirk-It" breakers rated at 3.0A (they generally don't list the spike Amps anymore, I guess). They cost about $5 each and any large electronics supplier should be able to order them or you can call the manufacturer at 609.882.4800 to find a distributor in your area (or maybe they will even sell direct; I don't know for sure). I got mine at Geeco Sales near me at 214.341.2626. These are adequate subs since I had a bad machine which would trip both the breakers after 5 minutes of warmup and it tripped these replacements right on cue without damaging anything. When these breakers trip, the button on top pops up so you can tell that it needs to be reset just by looking. Anyways, the new breakers look like this:



Now that you have power coursing through your power supply you should check the DC outputs for AC ripple which might be present. If so, check the electrolytic filter capacitors and the rectifier diodes; especially the capacitors. They tend to dry out after a while and lose their capacitance. This will give you a pulsing DC on the outputs which shows up as considerable AC voltage on a meter. Clip another capacitor of equal or greater value and greater voltage across each power supply capacitor and measure the outputs again. If you get good values then you have bad capacitors.

The only other problems I have seen were caused by idiots who shorted out the fuse and/or the circuit breakers. On one bypassed power supply, diodes CR9 and CR13 were blown apart and needed to be replaced. I could not find the original P600B diodes so I used MR751 substitutes (you can also use NTE5812, ECG5812 or SK3639). NOTE: The schematic lists these

diodes as type "MR8008" which, evidently, is a Motorola part but I was unable to find any reference to this part anywhere and resorted to reading the part number off the diodes themselves to figure out what they were. On another bypassed power supply, the T0-3 package transistor Q1 was bad. I replaced the original 2N6055 with an NTE243.

Now we move onto the monitors since, hopefully, your game boards are working and your power supply is fixed. First a little bit of history. Solar Quest uses a different model than all the other games. Most games have a tri-state (2-bit) intensity which is off/low/high. In Star Castle, for example, walls that have not been hit are "high" intensity and walls that have been hit once are "low" intensity. Solar Quest has a little vertical board mounted on the back of the monitor frame. The ribbon cable from the logic board goes first to this board and then on to the main monitor board. This board has a bunch of transistors which apparently make up a 6-bit DAC for the 64-level intensity. As with the game boards, they figured they could save money by designing their own circuits instead of using off-the-shelf ICs; Cinematronics really liked discrete components which I guess is a good thing since replacements for 74-series TTL and plain transistors will be around for a LONG time and make repair possible. In any case, I don't know much about that extra board since my Solar Quest is missing the board and the game boards are dead to boot. When I do fix it, I'll chronicle it here.

I should mention that early versions of the monitor had the HV transformer and circuit right on the monitor PCB versus in the metal box mounted on the chassis which most monitors have. The ones on the board had VERY fine wires exposed that were easily damaged. I've had more than one report of these wires being done in by mice. The HV often dies with the boxed HV supply too but the problem is often not the transformer itself. If you open it up you find more of those neat discrete devices so you have a chance of fixing it.

If you get no picture at all, you should disconnect both of the 6-pin Molex connectors that lead to the heat sinks on the side of the monitor to check if this generates a picture. Without these final output stage amplifiers, the picture will be small (about 2 inches square) but easily visible and in proportion to the way it should look.

A lot of testing will require you to remove these connectors. Please note that running your game this way without the final stage amplifiers is very rough on your monitor so you should run with them disconnected for as short a time as possible. I mention this mainly because you will probably see a gigantic sticker on your heat sink that screams, "_WARNING_ DO NOT OPERATE WITH POWER TRANSISTOR MODULE UNPLUGGED" and the schematic in the manual says, "-CAUTION- DO NOT APPLY POWER TO DISPLAY ELECTRONICS UNLESS POWER TRANSISTORS ARE CONNECTED. FAILURE TO DO SO WILL RESULT IN PERMANENT DAMAGE TO DRIVE ELECTRONICS". I have never damaged my monitor by ignoring this warning (and I ignore it a lot) but do not run the game like this longer than a few minutes at a time without freeze spraying R<fixme> and R<fixme> every few minutes.

Further explanation comes from the following article found in Star*Tech Journal:

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INSERT ARTICLE ABOUT BURNING THE RESISTORS HERE.

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Anyway, if after removing the connector you get a small picture then you know your problem is in your monitor. If you don't get a picture and you think (or know) that your game boards are good (are generating an

image signal) then check the several 3-pin regulators that supply the various voltages on the monitor PCB. These go bad frequently so check each one for proper output DC voltage at the 3rd pin. You might get some indication of a problem with these by looking at the neon lams clusered around the center of the board a little off to the right. They are normally supposed to be off; if any is on, it indicates an overvoltage condition. If your low voltages are OK, check your HV.

If you are tripping the breakers, it is probably something in the X or Y circuit on the monitor. Isolate it to the monitor by disconnecting the large Molex connector to remove the monitor from the rest of the game and power on. If the breakers hold then the problem is related to (in) the monitor. One by one, disconnect the 6-pin Molex connectors. See which disconnection (if any) prevents the breakers from tripping. If you unplug X and the breakers don't trip then you have a problem in the X circuit. If you unplug both and the breaker still trips then you have problems elsewhere.

If you are losing portions of your screen, follow the instructions in the troubleshooting section of the manual [included below]. If none of the 3 suggested transistors is the problem, then feel the heat sinks. If either is too hot to touch then suspect that the cluster of 5 diodes (D107-D111) in the center of the monitor PCB has at least 1 bad diode. They are type 1N4003 (but you can use any 1N400# as long as # >= 3) and are VERY inexpensive so rather than figure out which one is bad, just replace all five. When I had this problem, the picture would start out OK but after a few minutes the Y heat sink would get super hot and this would cause the weaker of the two TO-3 transistors to fail which caused a loss of -Y deflection followed shortly thereafter by both breakers tripping. Freeze spray narrowed the bad part to those diodes and now everything runs cool and steady.

If this doesn't get your picture back, you will need to dig deeper into the monitor circuit using a scope to trace through from the DAC's to the outputs checking to see where the signal starts looking bad (i.e. chopped off to only the top/bottom/left/right half). One last thing to check first is the many tantalum capacitors that were used which have a nasty habit of failing with either a short or an open unlike regular electrolytics that dry out and loose micro Farads. Another trick to use to further isolate the problem is to cross the horizontal and vertical stages between the control and power sides. Notice those two long jumper wires going from the area with the pots, over to the power amp sections? Those carry the final deflection signals to the amps. By crossing them, you turn the display 90 degrees, and you can isolate the problem to either the control or power sections. Get going in the right direction and then keep looking. Replace whichever component you isolate as the one dropping the signal. [The majority of this paragraph courtesy of Mike Inglem inglem@adnetsol.com]

If your picture needs centering, use the 2 metal rings on the neck of the tube with tabs on them. Each controls a magnet that will "pull" the picture in the direction the tab points. To move the image to one side, make the tab on a ring point towards that direction. The 2 rings are used in conjunction to create varying degrees of pull in a particular direction. To pull the screen as strongly as possible to a side, point both tabs to that side. If you then adjust 1 ring 45 degrees up and the other 45 degrees down, you are still pulling in the same direction as before but you are now pulling with 1/2 the intensity since the other 1/2 intensity is cancelled out by one magnet pulling up and the other magnet pulling down. Finally you get to use your high school trig and vector algebra skills in real life! This 2-ring centering method is used on most black and white monitors (vector and raster).

If your image is too dim even when the brightness adjustment is all the

way up then you most likely have a bad picture tube which should be replaced since it is going bad. For some reason, I see a lot of Star Castles with dim tubes but never any other game. Even though Star Castle (undoubtedly) got much more use than the other titles, poor initial tube quality, not on-time, is generally the cause of this kind of tube failure so perhaps the Star Castle production run(s) used a different (worse) tube supplier. Rick claims that this dimness in Star Castles was prevalent even when the games first hit the arcades which would also point to manufacturing defects in the tubes. My dim Star Castle has an Amperex M50-102W tube but my bright RipOff has a Sylvania tube. Strangely enough, my bright Armor... Attack... also has the Amperex tube so it would seem that not all Amperex tubes go bad even though most (if not all) tubes that go bad are Amperex.

The above information solves every problem I have run across so far but I have only fixed 4 games :>

There is TONS of fantastic information in all of the Cinematronics manuals for technicians to use in troubleshooting; I wish all game companies put as much effort into their manuals. Here are some excerpts from the Armor... Attack... manual.

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SECTION 4

OPERATOR'S GUIDE TO TROUBLESHOOTING

or

How do I Figure out Which Board
to Send Out for Repair?

O.K. - this is where we get technical on you - but don't panic! We'll keep this as simple as possible so you can figure out which board to send out for repair. For some of the steps in this section you will need a simple VOM [multi-meter], and know how to use it.

Here are two important procedures we will refer back to in this section:

Checking the LED:

Whenever there is a problem with the game, a good place to start is the LED (light-emitting diode) on the CPU board near the Molex power plug. This LED indicates whether most of the CPU circuit is working. When everything works right, here's what happens: Power to the game is turned on, the LED flashes on, then stays off. If the LED is flickering or on continuously, there is a problem with the CPU or the +5 volt supply. Check +5 volts on the logic board (follow procedures in this section). If the +5 is O.K., have CPU repaired.

Checking the +5 Volt Supply:

To check the +5 volts, you need a voltmeter. Turn power on in the game. Notice on the upper corner of the logic board nearest you is a little pin marked gnd. This is a great place to put the negative probe of the voltmeter. Near this pin in position T13 (see CPU layout, pg. A-8) is a 20 pin IC marked 74LS377. Ignore the other numbers on this chip. We can measure the +5 volt supply at pin 20. Pin 20 is the bottom pin on the far side of the chip. Put your

positive probe there, without touching any other pins, and you should get a reading. Anything between +4.8 volts and +5.1 volts is o.k., otherwise, adjust the voltage.

The adjustment is located on the power supply, and it is the only screwdriver adjustment on the power supply. Adjust _slowly_ WHILE READING THE VOLTAGE. Too much voltage will destroy IC's fast. If voltage cannot be adjusted into the correct range (+4.8 - +5.1 volts), repair power supply.

The following is a guide compiled from experience. It cannot be right 100% of the time:

SYMPTOM	WHAT TO DO
Circuit breakers trip	1. Unplug game. Unplug Molex power plug from monitor and reset breakers. Turn POWER ON. If breakers trip: POWER OFF, see 2. If breakers don't trip: Coin-up game and "play" it. Are all sound effects normal? Yes - repair monitor. No - Problem is probably in CPU or power supply. Check LED on CPU. Check +5 volts on CPU (see procedure) If +5 volts is good, repair CPU. 2. Unplug Molex power connector from audio board, reset breakers and turn POWER ON. If breakers trip: Problem is in coin meter circuit or call factory for help. If breakers don't trip: Repair audio board. POWER OFF, reconnect molex plug to monitor. Turn power on to see if there is a good picture. If the picture is bad, problem is probably in the monitor. If breakers trip: Check LED and +5 volt supply. If LED and + 5 volts is O.K., problem is probably in monitor.

MONITOR PROBLEMS

Here is a systematic guide to trouble shooting a monitor that blows breakers. Monitor must be connected to a good CPU. Check for burned components. The first thing we want to do is be able to power up the monitor without blowing breakers - then do troubleshooting.

POWER OFF. Unplug yoke from monitor board. Unplug socket from CRT. POWER ON.

If breakers blow: POWER OFF. See 1.

If breakers hold: Check outputs of -15v, +15v, and +5v regulators. Output must be within +/-0.5 volt tolerance.

A. Use O-scope to check deflection circuits for proper signal. 1mv/div time base is a good scope setting. Between DAC-80 output and input of Q101 or Q201, signal amplitude is about +/-3 volts peak. DC component should be less than +/-200mv. Too much DC component will trip the breakers. If signal into Q101/Q201 is good, problem is in transistorized deflection amps. With yoke disconnected, a good amp will

put out an odd looking "square wave", swinging between +25 volts. To check a bad deflection amp, check all transistors. Look for burned R118, R119, R113, R117, or R218, R219, R213, R217. R115, R116, R120, R121 may open with no burn marks. For test purposes, protection transistors Q106, Q107, Q206, Q207 may be removed from the circuit and amplifier can be powered up. Always replace protection transistors before returning monitor to normal service.

1. POWER OFF. Unplug heat sink wiring harnesses from monitor board. POWER ON. Breakers blow: POWER OFF See 2. Breakers hold: one or more of Q110, Q111, Q210, Q211 are shorted. Damage elsewhere is likely. Follow procedure at A.

2. Problem is most likely Video High Voltage module. Unplug from board and POWER ON. Breakers hold: replace or repair Video power supply. Breakers blow: Maybe a shorted tantalum capacitor. Or call us.

TABLE 7-1. TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE SOLUTIONS
No Picture	Listen for audible "clatter" from the deflection yoke on the CRT neck. If the clatter is present, deflection circuitry is working and the problems is in the intensity circuit. No high voltage. [supposed to be in left col?] If game audio is present, the CPU board is functional and the problem is in the monitor. If the audio is distorted or absent, the CPU board is suspect. If CPU board is equipped with red led near the input power plug, verify that it flashes once when power is applied and remains off thereafter. If no LED, verify that C8 pin 6 is constantly low with a voltmeter. Check the neck of the CRT for a glowing filament. If there is no glow, check the brown & black twisted pair of the CRT plug for 6.3 volts AC. Be sure all connections to the CPU board and monitor are firmly seated. Connect a scope to the yellow wire leading to the CRT connector. Set the brightness full clockwise. There should be an 80-100 volt DC base with pulses dropping down to a 40 volt level. If no pulses, probe IC7 pin 4 with a scope and observe data pulses. If present, check Q2 & Q3 with an ohm[m]eter or transistor checker. Check cathode of D5 for a full wave recti-fied, unfiltered voltage signal floating at +25 volts. Check seating of CRT plug. Remove and probe with scope to verify presence of proper signals.

Narrow Line on Display	Check IC1. Check for open yoke windings with ohm[m]eter. Check for bad solder & crimp connections to yoke wires. Verify continuity between display board and heat sunk power transistors Q110, Q210, Q111 and Q211. Check Q110, Q210, Q111, Q211 with ohm[m]eter or transistor tester. Inspect solder connections on circuit board molex connector socket pins.
Half Picture	Left Half [present]: Check Q206, 208, 210 Right Half [present]: Check Q207, 209, 211 Top Half [present]: Check Q107, 109, 111 Left Half [present]: Check Q106, 108, 110 Check solder connections on heat sink molex plugs J3 & J4. Check diodes CR109, 110, 111 Check diodes CR209, 210, 211 Check transistors Q105, Q205 Check resistors R116, R216.
No Brightness Control	Check intensity pot R111 for open wiper or internal short. Check for open capacitor C17. Check for bad solder connections to R111.
Picture on Display Jitters	Replace analog switch IC1. Check size pots R109 and R209 for wiper noise by turning briskly while observing the screen. Readjust for proper screen size. Check for bad solder connections on R109 & R209. Check DAC IC101 & IC201 for bad solder connections. Insure [sic] that all molex connectors are properly seated.
Suspect High Voltage too high/too low	An accurate High Voltage meter will read close to 16KV if high voltage is good. Self-contained HV meters vary widely in accuracy. If +90 and +400 volts out of high voltage supply are good, chances are 16KV is good. If +90 or +400 volts are bad, repair or replace high voltage supply.
Dotted Display	Check IC-7 pins 2, 4. Verify proper operation of IC1. Check for proper +25 and -25 volts DC. Check operation of DAC's IC101 and IC201. On logic board, check I[C]8 pin 2 for pulses. Verify presence at analog switch.

No Audio	Check for open speaker coil. Check transistors 2N6292 and 2N6107 and nearby output components on audio board with ohm[m]eter or transistor checker. Check 7815 and 7915 outputs. Check for open wiper on volume control mounted Refer to audio board theory of operation and troubleshooting guide. Replace F2 on logic board.
Coin Counter is Inoperative	Check 2N6292 transistor on logic board with oh[m]meter or transistor tester. Verify proper operation of A4 by grounding A4 pin 1. Coin counter should click. Disconnect coin counter molex connector. Measure DC voltage on red wire. Meter should read +25 volts DC.
Gives No Credits	Tie E4 pin 12 to ground. If credits fail to appear, replace E4. If credits appear, disconnect logic board ribbon J3. Measure +5 volts on A4 pins 1 & 5. If missing, replace pull up resistor pack C2. Alternately ground A4 pins 1 & 5. If credits appear, problem is in switches on coin door. Verify proper coin door microswitch operation. Reconnect J3. Observe A4 pins 3 & 6 alternately while depressing microswitch lever on coin mechanism. Pins 3 & 6 should change states. Replace A4 [if they don't]. Replace F2 (74LS259) on logic board.
Player Control Button(s) Inoperative	Refer to player control schematic in APPENDIX. Verify with oh[m]meter proper closure of player control leaf blade switches. Remove J3 connector. Measure +5 volts on D4 - 1, 2, 3, 4, 12, 13, 14, 15. If missing, replace D4. Replace pull up resistor pack D2. Measure +5 volts on C4 - 1, 2, 3, 4, 12, 13, 14, 15. If missing, replace C4. Replace pull up resistor pack C2. Coin up a game and, with J3 disconnected, ground aforementioned pins on C4 & D4. If display responds[,] problem is in continuity from J3 to player control switches [i.e. in the wiring harness].

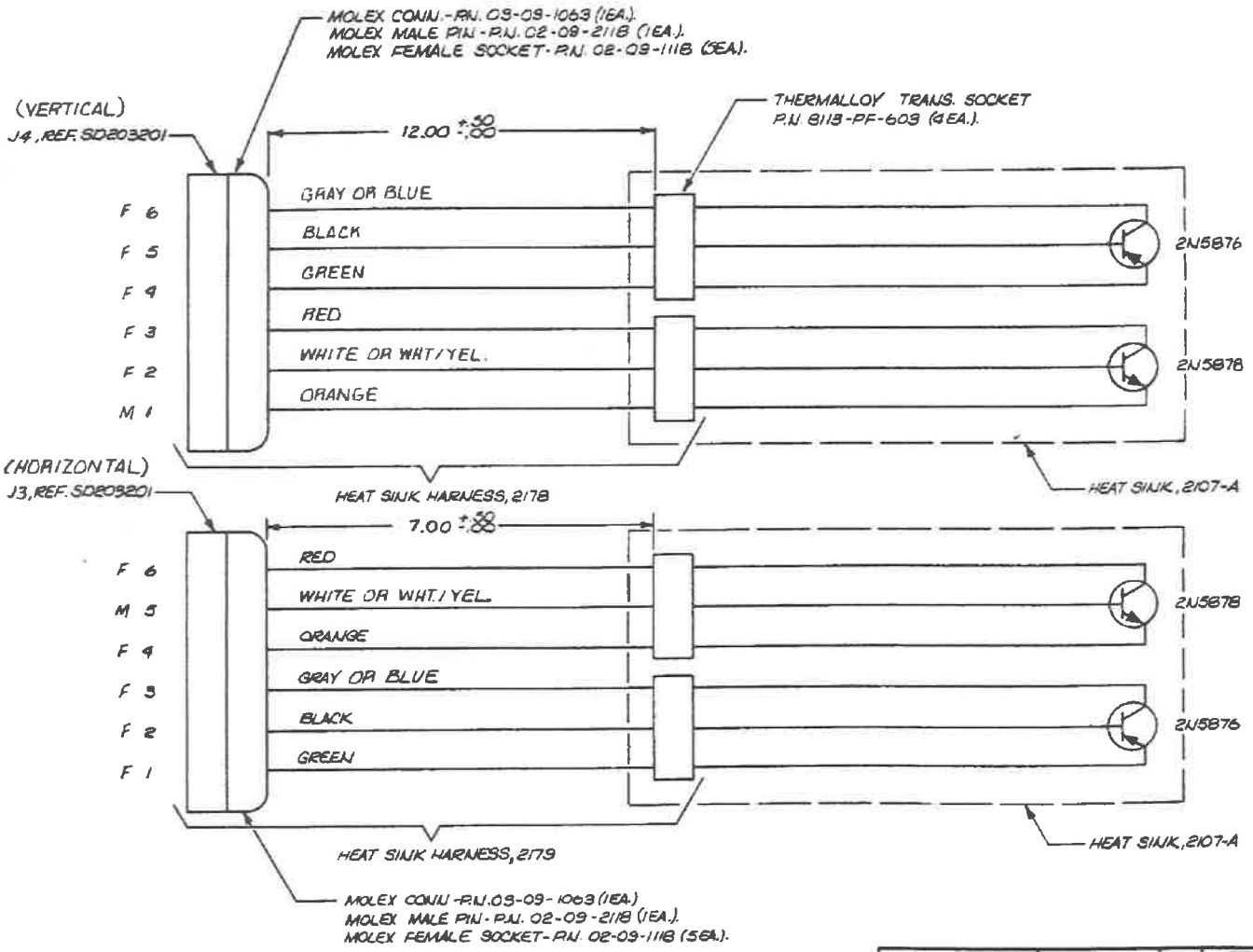
SECTION 8
SUGGESTED PARTS FOR STOCK

The following parts fail most frequently:

MONITOR

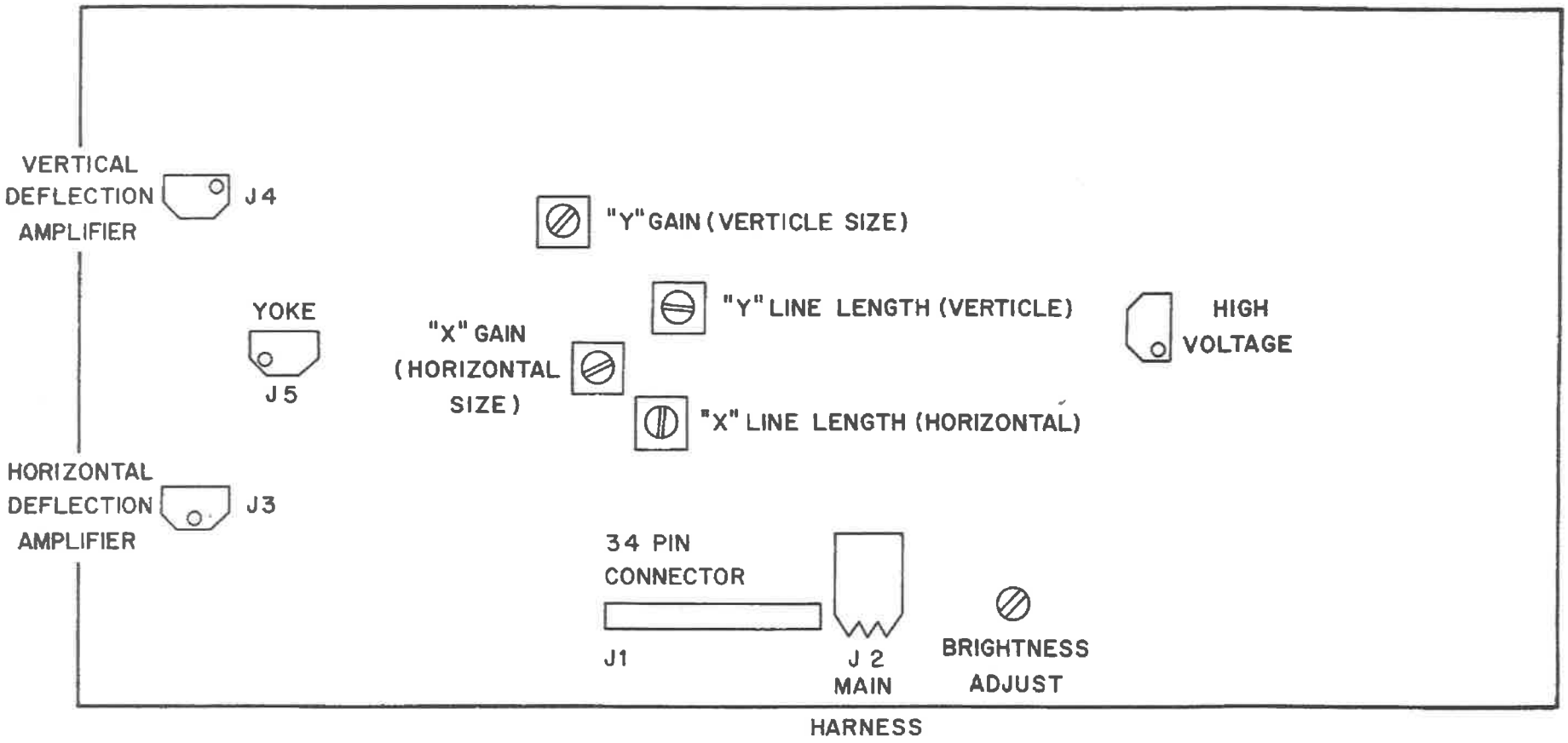
```
   LF13331 - Analog switch [NTE861]
   2N5876  - PNP output transistor [NTE219]
   2N5878  - NPN output transistor [NTE284]
   2N5320  - PNP driver transistor [NTE16005]
   2N5322  - NPN driver transistor [NTE16004]
   7406    - IC inverter package [NTE7406]
   2N5550  - NPN transistor 140 volt BVçeo [NTE194]
   7805    - +5 volt regulator IC [NTE960]
   7815    - +15 volt regulator IC [NTE968]
   7915    - -15 volt regulator IC [NTE969]

CPU
---
   74LS259/DM8334 - IC 8 bit latch [NTE74LS259]
   74LS32         - IC or gate [NTE74LS32]
   D ROM1         - IC PROM
   20101A2        - IC RAM 256x4

AUDIO
-----
   2N6107      - PNP output transistor [NTE197]
   2N6292      - NPN output transistor [NTE196]
   TL081/LF351 - IC op-amp [NTE857M]
   CA3080      - IC transconduct. [NTE902]
   74LS377     - IC octal D flip-flop (also used in CPU) [NTE74LS377]

The following parts don't fail frequently but are not readily available
[from] local supply houses:

MONITOR
-------
   DAC-80 - digital to analog converter

CPU
---
   Masked ROMS - set of four contain game program
   D ROMS      - custom made for CPU
   25LS181     - ALU
```

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
B	PER ECR 058	3 MAY 80	



NOTES: UNLESS OTHERWISE SPECIFIED

MATERIAL:	DRAWN BY: C. Thomas	DATE 5-7-79	CINEMATRONICS INC. 11 Cayen Ca. 92020
	PROJECT ENGR:	DATE	DWG TITLE SCHEMATIC, VERTICAL & HORIZONTAL HEAT SINK ASSY.
FINISH: BREAK ALL SHARP EDGES AND DEBURR ALL HOLES.	RELEASE APPROV:	DATE	
	DO NOT SCALE DWG		MODEL NO. / DWG SIZE C / DWG NO. 72-10969-01 / REV. B
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		CODE IDENT. / SHEET 1 OF 1
	PROJECTION:	SCALE: NONE	



DISPLAY P.C.B.

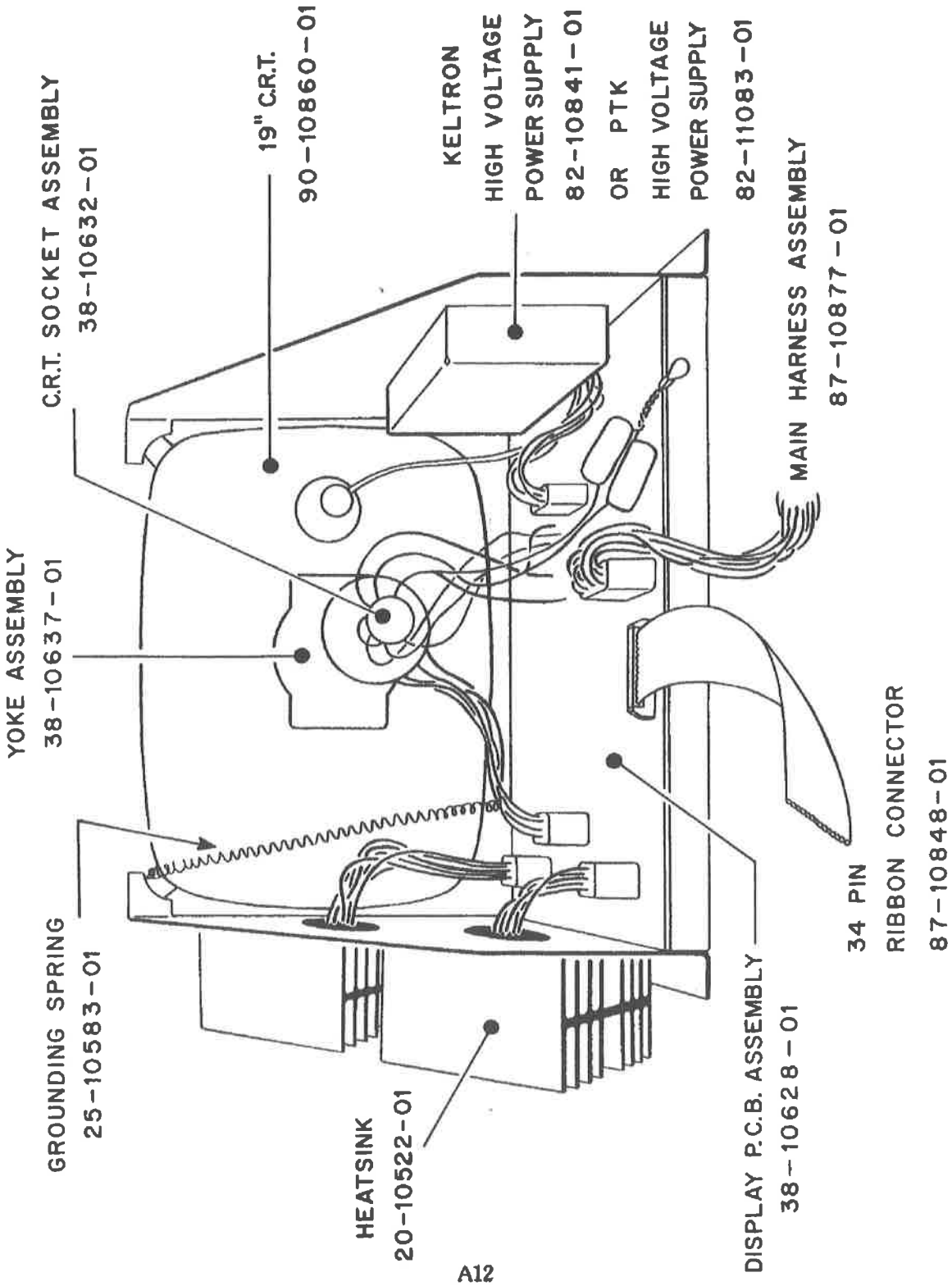
CONNECTORS AND ADJUSTMENTS

MONITOR ASSEMBLY (KELTRON)

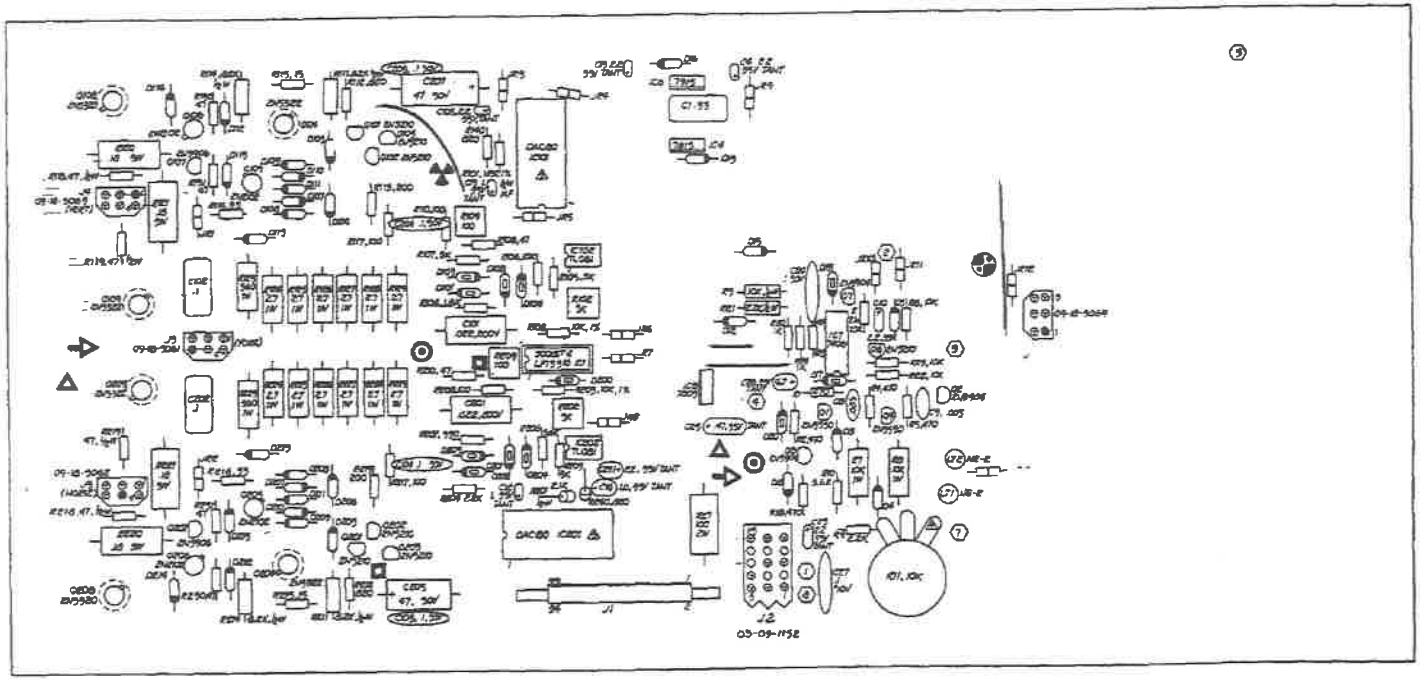
38-10633-01

MONITOR ASSEMBLY (PTK)

38-11207-01



A11



REQUIRED JUMPERS			
SYM	SIZE/TYPE	COLOR	QTY
	22 AWG	BRN	6"
	22 AWG	GRN	3 1/4"
	22 AWG	BLK	4 3/8"
	22 AWG	RED	9"
	22 AWG	BLU	4"

CRT SOCKET CONNECTIONS			
SYM.	SIZE/TYPE	COLOR	LENGTH
1	18 AWG	BLK	10 1/2"
2	18 AWG	GRN	13"
3	18 AWG	RED	12"
4	18 AWG	BLU	11 1/2"
5	18 AWG	WHT	15"
7	18 AWG	YEL	10"
8	18 AWG	BRN	10 1/2"

TWIST BRN & BLK WIRES TOGETHER

6. JR = JUMPER WIRE. (ZERO OHM, -□□-)

△ WHEN SIEMENS T980 V8 DAC IS UTILIZED FOR R268 & R269:
R269 CHANGE TO 7.5K 1% METAL FILM. (BECAUSE DAC NOT COMPATABLE
R268 CHANGE TO 11.8K 1% METAL FILM. WITH OLDER BROWN DAC.)

▲ MODEL 34K, 36K MAY USE ON CIRCUIT. SIZE OF BOARD UNDER ASSURANCE DOC. IS CONTROLLED.

3. DIODES MARKED "HED" ARE BAW56, ALL OTHERS ARE 1N4009.

4. ALL RESISTANCE VALUES ARE IN OHMS 1/4 W 5% UNLESS.

5. ALL CAPACITANCE ARE IN μF.

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISED STATUS			
LTR	DESCRIPTION	DATE	APPROVED
K	REORDER 6-15-87 WITH NO CHANGE (J-77666)		

CONTRACT NO.			
DRAWN BY			
ENGINEER			
DO NOT SCALE DRAWING			
TOLERANCE UNLESS OTHERWISE SPECIFIED			
PROJECTION	SCALE	SHEET	
CONTROL			

CINE MAGNETRONICS INC.

TITLE: OSP-N/RCB ASSY. (KELTRON)

SIZE: A | DWG NO: 72-10528-01 | REV: K

SHEET 1 OF 1