

ATARI

Q.A. TEST PROCEDURES

i or 2 ply

(edge conn) Cannon 'B' Con 'B' Con 'A' Space Force

Logic grd	- A -	R6 -	A6 Tran 1 C.T.	Grd	7 VAC - 1 -	V4 -	A6 Tran 1 C.T.
tech grd	- B -	5 -		Grd	- 2 -	V3 -	A6
	- C -	4 -	A5 Tran				
	- D -	3 -	B1 Tran		7 VAC - 3 -	V2 -	A5 Tran 1 sec
unreg 5V for lamps	- E -	2 -			7 VAC - 4 -	V1 -	B1 Tran 1 sec
1 ply light	- F -	R1 -		unreg 5V counter	5 -	U6 -	
coin count 2	- H -	P6 -		ply 2 lamp	- 6 -	U5 -	
coin mech 1	- J -	5 -	56 coin 1 N.O.	coin count 1	- 7 -	4 -	
thrust 1 (N.C.)	- K -	4 -	A5 joy 1 up N.O.	coin mech 2	- 8 -	3 -	T3 - coin switch 2 h
1 ply start	- L -	3 -	H3 S1 N.O.		- 9 -	2 -	
stern (left) CCW	- M -	2 -	A3 Joy 1 Left N.O.	2 ply start	- 10 -	U1 -	H6 S2 N.O.
Fire 1 (up)	- N -	P1 -	D6 Joy 2 N.O.	Turn CW 1 (push)	- 11 -	T6 -	B1 Joy 2 Right 1
Fire 2	- P -	N6 -	B5 Joy 2 Left	fire 2 (2 up)	- 12 -	5 -	E2 Joy 2 P.M N.O.
test	- R -	5 -	K6 S6 N.O.	right 2	- 13 -	4 -	C3 Joy 2 Right N.O.
	- S -	4 -		thrust 2 (N.C.)	- 14 -	3 -	C1 Joy 2 up N.O.
Video	- T -	3 -	L6 Ext test	video grd	- 15 -	2 -	H4 M1 video grd
Blue Video	- U -	2 -	L6 Ext	Green vid	- 16 -	1 -	L6
Reset (down)	- V -	M1 -	L3 S7 N.O.	neg sync	- 17 -	5 6 -	L6
	- W -	M6 -	B2 Trans 2 sec	speaker	- 18 -	5 -	R2 Speaker out right
	- X -	5 -	B4 Tran 2 sec	16 VAC	- 19 -	4 -	B2 Transformer 2 sec
Grd	- Y -	4 -	B3 Tran 2 C.T.	16 VDC	- 20 -	3 -	B4 " 2 sec
Speaker Grd	- Z -	M3 -	R1 Speaker com		- 21 -	2 -	B3 v " "
				Grd 16V CT	- 22 -	51 -	B3 v " 2 C.T.

Pac-Man - on board regulators

Venture

TABLE OF CONTENTS

AVALANCHE 1

BREAKOUT 5

CANYON BOMBER 6

CRASH & SCORE 8

DOMINOS 9

FIRETRUCK 10

FLYBALL 12

FOOTBALL 16

HIT THE BEAR 18

JET FIGHTER 19

NIGHT DRIVER 20

ORBIT 22

OUTLAW 25

POOL SHARK 27

POLE POSITION

QUACK 30

SKY DIVER 31

SKY RAIDER 33

SPRINT II 35

SPRINT 8 42

STARSHIP 47

STEEPLECHASE 53

STUNT CYCLE 56

SUPER BREAKOUT 60

SUPER BUG 63

TANK 2 65

TOURNAMENT TABLE 66

TRACK 10 69

TWIN RACER 70

Pole Position

ASTEROIDS SELF-TEST

And Diagnostics (Additions)

For Self-Test/Diagnostics to work ROM/PROMs for address 7800-7FFF must be functioning properly.

For the vector generator pattern to function properly in self-test the ROM/PROM at address 5000-57FF must be functioning properly.

SELF-TEST ADDITIONS

1. The diagnostic step switch will cause a bleep to occur. This audio feedback will be useful for trouble shooting problems with this switch.
2. Option Switch Test: All eight option switches will be displayed as a sequence of eight zeros and ones (from left to right for switch 1 thru 8 respectively). These digits should appear above the intensity lines in the center of the screen.
3. Coin Mech. Options: A two digit number will be displayed below the option switch values. These two digits are intended to allow the operator to check the value of the center and right coin mechs. The left digit will be either 1 or 2. The right digit will be 1, 4, 5 or 6. The left coin mech. always has value 1. See the option switch table for which switches effect these digits.

SELF-TEST CHANGES (From the Pre-Prod Description)

1. If the vector generator fails and does not halt the new self-test will wait for watchdog to reset the game P.C.B. This was felt to be easier to debug. (The pre-prod program would turn on the saucer sound and wait for reset to be pushed).

DIAGNOSTIC STEP:

When the self-test switch is on and the diagnostic step switch is on then the vector generator portion of self-test will be different. Any switch activation will still cause a bleep and both start lights will stay on. The cross hatch pattern will not occur but rather one of four patterns will be displayed:

Pattern 1

A diagonal line will be drawn from lower left to upper right corner. This pattern requires the minimal amount of vector generator hardware to be functioning. The vector generator instructions used are:

LABS	0,128	Position to lower left corner.
WAIT	7	Wait for beam to settle.
VCTR	1023,767,7	Drawn to upper right corner-long vector.
HALT		Stop the vector generator.

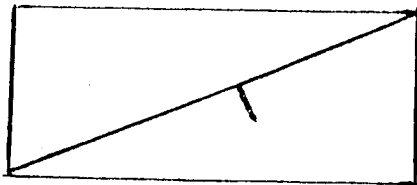
To advance to the next pattern in the diagnostic step push the hyperspace button. Pushing the hyperspace button again will advance to the third pattern and another push will advance to the last pattern. To restart the patterns push the restart button on the P.C.B. Releasing diagnostic step will cause the cross hatch pattern of self-test to appear. Pushing diagnostic step again will return to the last pattern displayed.

Pattern 2

The second pattern is a short vector test. Three instructions have been inserted before the halt and they are:

LABS	560,464	Position off of center.
WAIT	7	Wait for beam to settle.
VCTR	48,48,7	Short vector to draw to the center.

The picture should look like:

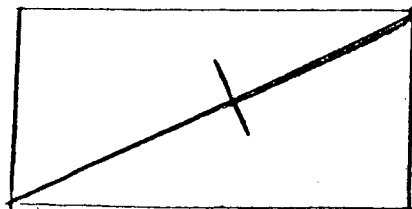


Pattern 3

A jump test is included in the third pattern. The three instructions inserted after the second pattern are:

JMP	NEXT	Jump to next valid instruction.
HALT		Should not get here.
NEXT: VCTR	-32,32,7	Vector away from center.

The picture should now look like:

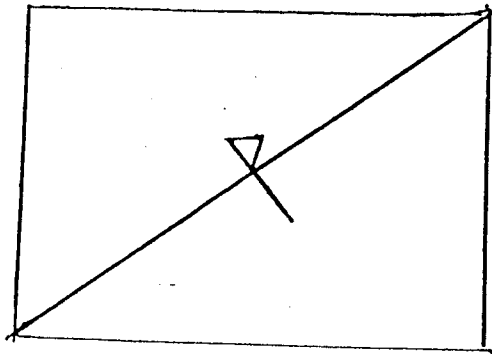


Pattern 4

This pattern tests 4 levels of JSRLs and RTSLS. The order of execution in this test are:

JSRL First JSRL
JSRL Second JSRL
JSRL Third JSRL
JSRL Forth JSRL
VCTR 32,0,7 Draw a VCTR to prove we got this for.
RTSL First JSRL
RTSL Second JSRL
RTSL Third JSRL
RTSL Forth JSRL.
VCTR 0,-32,7 Proof that we got back where we wanted.

The picture should now look like:



GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
25V C.T.	1	BV4		CH4, AT4, AN2 BJ5, AH3, 	GND
	A	BR6		AS4, AT1, BJ6, AH6	"
POWER SOURCE	2	BV3		CH2	+5V
"	B	BR5		CH3	+5V
		BV2			
		BR4			
		BV1			
		BR3			
AUDIO 1	5	BU6		BL1	INPUT 1
AUDIO 2	E	BR2		BL2	INPUT 2
START 1 LED	6	BU5		AU6	LED 1
		BR1			
		BU4			
		BP6			
START 2 LED	8	BU3		AU4	LED 2
		BP5			
SLAM	9	BU2		AN3	SWITCH 11
DIAG. STEP	K	BP4		AK6	SWITCH 6
HYPERSPACE	10	BU1		AK3	SWITCH 5
SELF TEST	L	BP3		AL3	SWITCH 7
GND	11	BT6		 , , , , BJ1	
VIDEO OUT	M	BP2		BJ2	TO MON.
COIN CENTER	12	BT5		AT3	COIN SWITCH 2
START 2	N	BP1		AH2	SWITCH 2
COIN LEFT	13	BT4		AS6	COIN SWITCH 1
START 1	P	BN6		AH5	SWITCH 1
THRU	14	BT3		AJ5	SWITCH 4
COIN RT.	R	BN5		AT6	START SWITCH
ROTATE LT.	15	BT2		AM3	SWITCH 9

LINE # PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
ROTATE RT.	S	BN4		AM6	SWITCH 10
		BT1			
FIRE	T	BN3		AJ2	SWITCH 3
OUT	17	BS6		BJ4	TO MON.
		BN2		BH5	
OUT	18	BS5		BJ3	TO MON.
		BN1		BH6	
	19	BS4		AY5	S16 COM
		BM6			
25 VAC	20	BS3		BK5	FROM X FORMER
"	X	BM5		BK6	"
+5V SENSE	21	BS2		CG6	FROM SUPPLY
+5V T	Y	BM4		AU3, AU5, AS3	LED'S 1&2 COIN CTR.
+5V SENSE	22	BS1		CG5	FROM SUPPLY
GND	Z	BM3	1	CH5, AL2, AL3, AK5	BOARD GND.
SPEAKER OUT		BL4		AP6	BRIDGE AMP
"		BL5		AR1	"
COIN CTR. COM.		AG3		AS2	GEAR SELECT COM.
COIN CTR, LT.		AG4		BR3	1st
COIN CTR. RT.		AG5		BR1	2nd
COIN CTR. CTR.		AG6		BV1	3rd
		Aa 2		AM2, AM5, AK2, AJ3, AJ6	
		AX 2		Aa 1	
		BP 5		AX 1	
		Bu 4		AX 3, AY 6	
		BS 4		AY 5	

Asteroids Deluxe
Test Procedure

1. Tools Needed:

- A. Program plugs (Asteroids Deluxe)
- B. 44 Pin Connector cable

2. Power Supply:

- A. 5. Volts DC
- B. Variac-I NOT used
- C. Variac-II NOT used

3. Visually inspect the board for any workmanship defects.

4. After visually inspecting board, plug it in and power up, video will come on the X, Y Monitor. (Attract Mode) See the Asteroids tumble across screen.

5. Credit Lamps used:

- A. LEDs 1&2 don't flash when PCB is powered up, but flash on and off after Coin up.

6. Switches and Controls used:

- A. Coin-I, Coin-II, start Credit
- B. S-1 1 player start
- C. S-2 2 player start
- D. S-3 Ship Fire
- E. S-4 Ship Thrust
- F. S-5 Force Field
- G. S-6 Diag. Step ; Not used but will have Audio tone
- H. S-7 Diag. Mode
- I. S-8 Slam
- J. S-9 Rotates Left
- K. S-10 Rotates Right
- L. S-11 Diag. Mode (only) - Horizontally inverts video
(No Audio tone)
- M. S-12 Diag. Mode (only) - Vertically inverts video

- N. S-15 Up second player
O. S-15 Down first player
7. Diag. Test: S-7 up
Audio tones on Coin 1&2, start credit S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10.
S-11 Inverts video horizontally.
S-12 Inverts video vertically
8. DIP switch settings
9. Adjust X and Y gain controls on PCB to adjust picture size.
END TEST S-7 down.
10. Game Mode
A. Coin counter DIP switch 1&2 on for coin counter.
Coin up by pressing Coin 1&2. LEDs 1 and 2 start flashing.
Press S-2 for two player start. The score window for second player will be small until it is the second player's play.
Listen for audio tone on ship when it materializes from score window to center of screen.
Compared to Asteroids, thump audio is pretty much the same. Ship fire audio is a little different. Bonus can be set at 10,000 like Reg. Asteroids.
The Big Saucer and the Little Saucer is more accurate when it fires on the ship.
There is an audio tone when the Death Star comes out. The Death Star comes out after the first set of Asteroids and when you are down 3 to 5 Asteroids on screen. Once the Death Star is broke up, it will come after you.
The game is all around different from Reg. Asteroids. More difficult and alot faster.

(Good Luck & Happy Shooting!!)

Led Ward
Greg Crawford
Linn Nyberg 3/2/81

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4		AK5, AL2, AL1 , CH5, AN2	GND
-SENSE	22	BS1		CG5	-SENSE
+SENSE	21	BS2		CG6	+SENSE
GND	A	BR6		AH3, AH6, AN5, CH4	GND
+5V	2	BV3		CH2, AM1	+5V
+5V	B	BR5		CH3	+5V
AUDIO 2	E	BR2		BL2	INPUT 2
AUDIO 1	5	BU6		BL1	INPUT 1
36 VAC	20	BS3		BK5	XFORMER
36 VAC	X	BM5		BK6	XFORMER
GND	U	BN2		BH5	XGND
YGND	V	BN1		BH6	YGND
ZGND	11	BT6		BJ1	ZGND
XOUT	17	BS6		BJ4	XOUT
YOUT	18	BS5		BJ3	YOUT
ZOUT	M	BP2		BJ2	ZOUT
DIAG. STEP	K	BP4		AK6	SW.6
+5V OUT	Y	BM4		AU3, AU5	
START 2 LED	8	BU3		AU4	AUX LITE 2
START 1 LED	6	BU5		AU6	AUX LITE 1
START 1	12	BT5		AH2	SW. 1
START 2	13	BT4		AH5	SW. 2
FIRE	T	BN3		AJ2	SW. 3
THRUST	14	BT3		AJ5	SW. 4
ROTATE RIGHT	15	BT2		AM6	SW. 10
ROTATE LEFT	S	BU1		AM2	SW. 9

AVALANCHE

I. TOOLS NEEDED:

1. Program Plugs, Avalanche (A & B Program).

II. POWER SUPPLY:

1. 9.5 Volts D.C., DB1 & 2.
2. 25.0 Volts A.C., CB4, Variac 2, 53%.
3. CB3 Off (Not Used).

III. SWITCHES USED: (On Board)

1. Option Switch, 8 Button Location J4 (8 & 4 Off).
2. Reset Button M5.

IV. SWITCHES, CONTROLS USED: (CTS1 Master Power & Control)

1. CB1, 2, & 4. (Master Power)
2. Coin 1 & 2.
3. S1 - Single Player Start.
4. S2 - Two Player Start.
5. S8 - Serve. (Control Panel)
6. Pot 4 - One Or Two Player Control.
7. S18 - Diagnostics . . Self Test.

V. CREDIT LAMPS USED:

1. 1 ---- Coin Credit.
2. 2 ---- Coin Credit.
3. 6 ---- Coin Lock Out.

VI. AUDIO TONES: (During Game Play)

1. Avalanche Audio:
 - a. Low Rumbling Audio Gaining Slowly In Volume Until A Miss.
2. Catch Audio:
 - a. Standard Beep Audio Gaining In Frequency As Paddles Disappear
 1. 1-2 Pts. Per Catch -- Low Beep Tone.
 2. 3-4 Pts. Per Catch -- Midrange Beep Tone.
 3. 5-6 Pts. Per Catch -- Highest Beep Tone.
3. Extended Play Audio:
 - a. High/Low Audio Beep 6 Or 7 Times In rapid succession Upon Reaching 450, 750 Pts. (During Game).
 - b. High/Low Audio Beeps 6 Or 7 Times Plus Inverting

Video In Rapid Succession Upon Final Miss (End Of First Game).
Miss Audio:

4. Miss Audio:
 - a. 2.5 Second Beep When Ball Is Missed And Touches Base line.
5. Audio Tones:
 1. Slightly Higher Than Catch Audio Beep For Each Switch Pressed.
 - a. Coins 1, 2, S1, 2, & 8.

NOTE: No Audio For Paddle Control.
(Pot 4 Control Panel CTS-1).

VII. FUNCTIONAL TEST: (Diagnostic Mode)

A. Power Up In Attract Mode: (S18 Down)

B. S18 Up:

1. Check Credit Lamp #6 (On Bright).
2. Check Video Diagnostic Routine.
 - a. Inverted Screen.
 - b. Blank Screen.
 - c. Video Readout:

RAM OK
ROM OK
14

*NOTE: Two Digits Under ROM OK Are For Player Paddle Control They Count 14 To BE ± 5%.

C. Check Credit Lamps & Start Credit:

1. Credit Lamps 1 & 2 On Bright.
2. Credit Lamp 6 On Dim.
3. Start Credit On Bright.

D. Switch Test: (Audio Beep Tone) (CTS-1 Master Power And Control)

1. Press Coin 1
2. Press Coin 2
3. Press S1
4. Press S2
5. Press S8

*NOTE: Pressing Any Of These Switches Should Result In An Audio Beep Tone

Diagnostic Test Completed Move S18 Into The Game Attract Mode.

VIII. FUNCTIONAL TEST: (Game Mode)

A. Check Video Attract Mode*

B. Press Coin 1 Or 2 Once.

1. Attract Mode Video Frozen.
2. Credit Lamps 1 & 6 On.

C. Press S1

1. Start Credit Switch Lamp Blinks In Unison With Player-1 Video Eight Times, Then Snow Balls Begin To Fall Automatically. Start Credit Lamp Switch Stays Lit Until A Miss Then The Cycle Is Repeated Until Game Is Ended.

D. Check Pot 4 CTS-1 Control Panel

1. Rotate Pot Full Left, Full Right, Insuring That Paddles Move All The Way From One End Of "Bottom Bar Base Line" To The Other, Also Note That The Paddles Are Stacked 6 High.

E. Play Game:

1. As Snowballs Fall And Are Caught By Paddles A Rumble Audio Will Begin And Increase In Volume Until A Snowball Is Missed.
2. Upon Catching Snowballs Score Will Be Tallied In The Players Score Window (Player 1 Or 2) And On The First Game After Power Up Score Tally Will Read Out On HIGH SCORE Also. On Games Played There-After Scores Will Only Read Out On The Designated Player, (Players) Score Window Until The Previous HIGH SCORE Amount Has Been Exceeded. At This Point The Player Score Will Be Shown In Both PLAYER Score Window And HIGH SCORE Window At The Same Time.

IX. BALL/PADDLE/SNOWBALL SCORE VALUES: Approx.

1. Pt. Per Catch 6 Paddles 30 Pts.
2. Pts. Per Catch 5 Paddles 90 Pts.
3. Pts. Per Catch 4 Paddles 190 Pts.
4. Pts. Per Catch 3 Paddles 320 Pts.
5. Pts. Per Catch 2 Paddles 470 Pts.
6. Pts. Per Catch 1 Paddle Etc.

A. Clearing Walls:

1. First Wall Starts With 6 Paddles Stacked.
2. Second Wall 3 Paddles Stacked.
3. Third Wall 2 Paddles Stacked.
4. Fourth Wall 1 Paddle Ect. Ect.

X. GAME END:

1. Upon Missing Last Serve.
 - a. Start Credit Switch Lamp Switch Lamp Goes Out.
 - b. Credit Lamp 6 On Bright.
 - c. Game Over In Middle Of T.V. Screen. (Blinking)
 - d. Video Then Reverts Back To Attract Mode.

- e. Credit Light Goes Out. (No Extended Game).

XI. EXTENDED PLAY MODE:

- 1. If During A Game A Score Of 450 Pts. Or More Is Accrued At That Moment A Beeping Audio Will Happen And Continue For Not More Than 2.5 Seconds. Upon Finishing Game EXTENDED PLAY Flashes On Screen With Inverting Video Field And Beeping Audio.
 - a. Credit Lamp #1 Stays Lit.
 - b. Credit Lamp #6 On Bright.
 - c. Frozen Video (Attract).
In This Mode Credit For An Extra Game Is Given Automatically And There Is No Need For Pressing Coins 1 Or 2.*

NOTE: When Playing (Extended Play) Game Upon Reaching 450 Pts. No Extra Game Will Be Given, Only One Extended Play Per Coin.

Battle Zone Test Procedure

This procedure is to be used for GO-NO-GO testing, a check off list for Technicians troubleshooting and correcting boards and as a Final QA Test.

There will be NO Pre-Burn-In QA Test of game boards.

Testing and troubleshooting of an Analog Vector Generator PCB will be done with a "known good" Battle Zone Auxiliary Board. Testing and troubleshooting of a Battle Zone Auxiliary PCB will be done with a "known good" Analog Vector Generator PCB assembly.

- 1.. Install program ROM's on AVG and PROMS on Aux Bd. Connect cable between Auxiliary Board and AVG Board.
2. SELF Test switch OFF.
3. Option switches on PCB ON (all 16).
4. Connect PCB to CTS-1 cable and apply power to PCB.
5. LED on CTS-1 (for start 1) flashes on and off.
6. Verify there is a picture on monitor.
7. Turn SELF TEST ON.
8. Verify MATH BOX region on monitor is blank (If not, debug MATH BOX).
9. Check LED on CTS-1 ON?
10. Check all game function switches. Listen for beep sounds as switches are pressed and released.
11. Check 16 option DIP switches on PCB.
12. Is ROM region on monitor blank? (If not, bad memory)
13. Adjust X and Y Gain controls on PCB to adjust picture size
14. Turn on diagnostic step.
15. Step through all diagnostic steps.
16. Turn SELF TEST OFF.
17. Test Coin Counters.

18. Test Coin Counter DIP switches on PCB. Switches 1&2 must be ON to get all 3 coin counters to work.
19. "Coin Up" game credit on coin switches.
20. Press Start 1.
21. Observe operating game mode.
22. Check tread controls and trigger. There is an engine idle and engine active sound. When a shot is fired from the operator's tank there is a loud shot noise and a small explosion sound when the shot hits something.
23. Allow opponent to fire at operator. There will be a small shot noise and loud explosion sound.
24. Toggle SW7 to verify that Audio 1 and Audio 2 are operating.
25. Turn off POWER.

SWITCH LISTING

1.COIN LEFT	COIN 1 SWITCH
2.COIN CENTER	COIN 2 SWITCH
3.COIN RIGHT	START CREDIT SWITCH
4.START	SWITCH 1
5.LEFT FORWARD AND REVERSE	J/S1
6.RIGHT FORWARD AND REVERSE	J/S2
7.FIRE	PUSH BUTTON ON J/S1
8.TEST	SWITCH 18
9.DIAGNOSTIC STEP	SWITCH 5
10.SLAM	SWITCH 8
11.COIN LEFT ENABLE	SWITCH 10
12.COIN CENTER ENABLE	SWITCH 11
13.COIN RIGHT ENABLE	SWITCH 12
14.AUDIO 1 AND 2	SWITCH 7

BATTLE ZONE

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
RESET	V	BN1		PIN V	AUX HARNESS
+5V OUT	Y	BN1		PIN 2	AUX HARNESS
GND	Z	BM3		PIN Z	AUX HARNESS
COIN LEFT	E	BR2		AS6	COIN 1 SW.
COIN CENTER	F	BR1		AT3	COIN 2 SW.
COIN RIGHT	H	BP6		AT6	START CREDIT SV
TEST	7	BU4		Ab6	SW 18
SLAM	6	BU5		AL6	SW8
COIN CTR. RIGHT	J	BP5		AN6	SW12
COIN CTR. CENTER	9	BU2		AN3	SW11
COIN CTR. LEFT	8	BU3		AM6	SW10
-12VDC	19	BS4		CJ4	AUD/REG BD.
GND	N	BP1		AS4, AT1, AT4, AL5, Ab5, CJ5, AK2	AUD/REG BD.
-22VDC	4	BV1		CJ2	AUD/REG BD.
GND	12	BT5			AUD/REG BD.
+12VDC	20	BS3		CJ3	AUD/REG BD.
+22VDC	3	PIN 3-AUX HARN BV2		CJ1	AUD/REG BD.
+5V REG	2	<i>Pin 2 HARN.</i> BV3		CH2	AUD/REG BD.
+5V REG	B	BR5		CH3	AUD/REG BD.
+5V RETURN	A	PIN 1-AUX HARN BR6		CH4	AUD/REG BD.
+ SENSE	21	BS2		CG6	AUD/REG BD.
- SENSE	22	BS1		CG5	AUD/REG BD.
0V RETURN	1	PIN A-AUX HARN BV4		CH5, AH2	AUD/REG BD.
COIN COUNTER		AS2		AN5, AN2, AM5	COMMON
COIN COUNTER		AS3		BG1	10V UNREG.

BATTLE ZONE (CONT)

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
OUT	S	BN4		BJ2	TO MONITOR
Y OUT	17	BS6		BJ3	TO MONITOR
X OUT	T	BN3		BJ4	TO MONITOR
Z GND	15	BT2		BJ1	
Y GND	U	BN2		BH6	
X GND	16	BT1		BH5	
START/SWITCH 1		AH3		PIN 13	AUX HARNESS
START LED/ AUXLITE 1		AU4		PIN 7	AUX HARNESS
AUX LITE PWR.		AU3		PIN Y	AUX HARNESS
LFT FORWARD		AC1		PIN 15	AUX HARNESS
LFT REVERSE		AB3		PIN 14	AUX HARNESS
RT FORWARD		AA5		PIN 17	AUX HARNESS
RT REVERSE		AA1		PIN 16	AUX HARNESS
FIRE		AE1		PIN 12	AUX HARNESS
GND		AE2, AA2, AA6, AB4, AC2		PIN 22	AUX HARNESS
AUD - OUT		BL1		PIN 6	AUX HARNESS
AUD + OUT		BL2		PIN 5	AUX HARNESS
+5V RTN				PIN 1	AUX HARNESS
+5V RTN				PIN A	AUX HARNESS
AUDIO RTN		AR1		PIN E	AUX HARNESS
		BL4		AL3	SWITCH 7
		BL5		AL4	SWITCH 7
KR		AP6		AL2	SWITCH 7 COMMON
DIAG. STEP	5	BU6		AK3	SW5

BREAKOUT

Variac #1 19.5 - 20.0 Volts A.C.
 Variac #2 Not Used
 D.C. Power Not Used

I. After Visually Inspecting Board, Plug It In And Turn On CB3.

Insure That All Switches On The Board Operate. Set Switch At Location M7 As Follows:

1 ON, This Gives You 2 Plays
 Cocktail
 3 Balls

II. Press Either Coin 1 Or Coin 2 JUST ONCE. This Should Light Credit Lights 1 & 2 Right Over Digital Multimeter On CTS-1. (Note; Make Sure S6 Is Up!)

Then Press S5. The Game Should Now Be Ready To Serve. (Pot 4 Is Player 1 Paddle Control On CTS-1). To Serve, Press S8. Play With The Ball For 3 To 4 Volleys Then See If The Game Switches Sides (Inverts). Press Serve And Repeat Using Left Pot 1. Pulse K & L6, Pin 14 For Free Game. Then Pulse Down Serves To End Game At F6, Pin 9. At The End Of Your First Game, Your Credit Light Should Be On, So Press S5 & S8 To Serve Ball. Let The Ball Go While Watching The Screen For Game Inverting, Then Hit Static Mod Q2. Switch All Switches:

BOARD LOCATION-Above A6-From Cocktail Mode To Normal Mode,

BOARD LOCATION-Above A4-From 3 Ball Mode To 5 Ball Mode,

BOARD LOCATION-Below N7-From 1 Coin Per Player/Game To 2 Coins Per Player/Game.

Then Serve, S8. After Counting Down Serves To Five (F6, Pin 9), The Game Should End. Press Either Coin 1 Or 2, Start Credit, Then Pulse D4 To See Breakthru Mode, Smaller Paddle And Free Game.

END OF TEST

TEST UNIT SET UP

GAME: BREAKOUT

VARIAC SETTING: #1 16.5 VAC

#2 NOT USED

CREDIT LIGHT: AUX LITES #1 AND #2

POTS USED: #1 PADDLE CONTROL RT

#4 PADDLE CONTROL LFT

AUX LITES USED: #1 CREDIT

#2 CREDIT

#3 SERVE

AUX SWITCHES USED: #5 TWO PLAYER CONTROL

#8 SERVE SWITCH

#6 CREDIT LITE

AUX CONTROLS USED: NONE

BREAKOUT

<u>FROM</u>	<u>TO</u>	<u>DESCRIPTION</u>
BV4	BR6, BM4, BM3, AL6	
BV3	AT4, AK2, AS4, AT1	16.5 VAC C.T.
BV2	BR5, BA6,	16.5 VAC SEC.
BV1	BR4, BA5	16.5 VAC SEC.
BU6	BR3, BB1	POT #1, & POT #4
	BR2, AE3, AP6, AV2,	
	AS3	
BU5	AU3	AUX. LITE #1 COM
BU4	BP6, BC4	GROUND FOR 6.3 VAC
BU3	AU5	AUX. #2 COM
BU2	AT2	COIN #2 N.C.
BULU	AT3	COIN #2 N.O.
BT6	AS5	COIN #1 N.C.
BT5	AS6	COIN #1 N.O.
BT4	AT6	START 1 N.O.
BT2	AK3	SWITCH 5 N.O.
BS5	AE4	POT #1 WIPER
BS4	AL5	SWITCH 8 COM
BS3	AR5, AP6, AR2	SPEAKER AND HEAD
	AR3	SET HOT
BS2	AR1, AR4	SPEAKER & HEAD COM
BS1	BM1	VIDEO GROUND
BP5	AV1	AUX. LITE #3 COM
BN2	AG1	POT #4 WIPER
BN1	BL6	VIDEO HOT
BN3	AS2	COIN COUNTER
AU4	AK5, AU6	CHECK 7 & H IF GOES TO
AK6	BC3	GROUND

CANYON BOMBERI. TEST EQUIPMENT REQUIRED:

- A. Universal Test Fixture.
 - 1. Fluke Meter Installed.
 - 2. External Speaker Plugged Into "SPKR" Jack On Control Panel.
- B. 44 Pin Edge Connector.
- C. Canyon Bomber Program Plug.

II. SET UP PROCEDURE:

- A. Universal Test Fixture.
 - 1. Turn Power "On" To Video Display Monitor.
 - 2. Install Canyon Bomber Program Plugs A, B, & C Into The respective Sockets On The Master Power Panel.
 - 3. Connect The 44 Pin Edge Connector To The P.C. Board Observing The TOP Designation Is Facing Up.
 - 4. Insure 6502 Micro-Processor (Atari P/N (90-6010) Is Installed At Location C3 On The P.C. Board.
- B. Power Up.
 - 1. Turn "On" CB's 1, 2, & 4 Of Master Power Panel.
 - 2. Adjust Variac #2 For 25 VAC Measured At Test Points E & G On Master Power Panel.
 - 3. Insure Switches Inside The Left Hand Panel Of The Test Fixture Are On.

CAUTION: TOUCH ONLY THE SWITCHES HIGH VOLTAGE IS PRESENT INSIDE THE CABINET.

III. TEST PROCEDURE:

- A. Self Test.
 - 1. S18 On The Control Panel Should Be Up. The Volume Pots Are Located At A10 And C-D 10.
 - 2. Pressing The Following Switches Should Give An Audio Tone Decreasing In Frequency Until Switch Is Released; Coin 1, Coin 2, Start Credit, S1, S2, S3, S5, & S8.
 - 3. The Canyon Should Appear And Alpha-nums should Fill The Canyon.
 - 4. S18 Can Now Be Placed Down.
- B. Game Play.
 - 1. The Switch Located At F7 Should Produce The Following Options:

a.	S1 & S2	Language
	OFF OFF	German
	ON OFF	French
	OFF ON	Spanish
	ON ON	English

NOTE: The Language Proms Must Be Installed

- | | | |
|----|---------|-------------------|
| b. | S3 & S4 | Are Not Used |
| c. | S5 & S6 | # MISSES |
| | OFF OFF | 6 |
| | ON OFF | 5 |
| | OFF ON | 4 |
| | ON ON | 3 |
| d. | S7 & S8 | COINS |
| | OFF OFF | 2 Coins Per Play |
| | ON OFF | 1 Coin Per Play |
| | OFF ON | 1 Player Per Coin |
| | ON ON | Free Play |
2. The Screen Should Have The Canyon Outline And It Should Be Filled With Targets Numbered From 1 To 4 In Descending Order.
 3. A White Blimp And Black Blimp Should Be Crossing The Screen At Various Altitudes.
 4. Pressing Coin 1 And Start Credit Will Cause Black Ship To Be In Play. S1 Will Drop Bombs From Black Ship.
 5. After 5 Passes The Blimps Become Airplanes But The Results Remain The Same.
 6. Coin Up And Press S8 For White Ships To Be In Play. S15 Should Be Up For White Audio.
 7. S2 Will Fire White Bombs.
 8. S3 Is High Score Reset And Will Only Effect The High Score Total After Coin Is Up.
 9. S5 When Held In Will Not Allow Coin Up.
 10. If All The Targets Are Removed And Game Is Not Over The Canyon Will Refill Itself With Targets.

CENTIPEDA

PROGRAM PLUG SWITCH LIST

SWITCH 1 ~ PLAYER 1 START

SWITCH 2 ~ PLAYER 2 START

SWITCH 4 ~ FIRE 1

SWITCH 5 ~ FIRE 2

SWITCH 7 ~ SELF TEST

SWITCH 8 ~ SLAM

SWITCH 15 ~ COCKTAIL

DOWN POS. - STAND UP

UP POS. - COCKTAIL

* SWITCH 16 } PLAYER 1 / PLAYER 2 ~
* SWITCH 17 } USED ONLY WHEN
COCKTAIL SWITCH IS
IN THE "UP" POSITION
STEERING SELECT.

SWITCH 18 ~ HORIZ / VERT STEERING
SELECT.

COIN SW. 1 ~ COIN L

COIN SW. 2 ~ COIN C

START CREDIT SW ~ COIN R

1ST GEAR ~ LEFT COIN CNTR ENABLE

2ND GEAR ~ CENTER COIN CNTR ENABL

3RD GEAR ~ RIGHT COIN CNTR ENABLE

* SWITCH 16 & 17 ~ UP POSITION PLAYER
DOWN POSITION PLAYER 1

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4	5-SHORT 2-ML	CH4, AS6, AT3, AT6, AP5, AP2, AP4	GND
= SENSE	22	BS1	ML	CG5	REG/AUDIO BOARD
+ SENSE	21	BS2	ML	CG6	REG/AUDIO BOARD
GND	A	BR6	5-S 2-ML	CH5, AL3, AL6, AB2 AX3, AC4, AAB,	REG/AUDIO BOARD
+5V	2	BV3	ML	CH2	REG/AUDIO BOARD
+5V	B	BR5	1-S 1-M 1-ML	CH3, AU3, AU5	REG/AUDIO BOARD
+22V	3	BV2	ML	CJ1	REG/AUDIO BOARD
-22V	4	BV1	ML	CJ2	REG/AUDIO BOARD
+12V	C	BR4	ML	CJ3	REG/AUDIO BOARD
-5V	D	BR3	ML	CJ4	REG/AUDIO BOARD
COIN L	14	BT3	m	AS4	COIN SW. 1
COIN C	T	BN3	ML	AT1	COIN SW. 2
COIN R	R	BN5	ML	AT4	START SW.
SELF TEST	13	BT4	ML	AL2	SW. 7
SLAM	S	BN4	L	AL5	SW. 8
GND	Z	BM3	6-S 2-L	CS5, AH3, AH6, AS6 AK3, AB4, AB6, AC2	Sw. Common
COCKTAIL	15	BT2	M	AX2	SW. 15
L COIN CNTR.	F	BR1	ML	AG4	1 ST GEAR
C COIN CNTR	5	BU6	ML	AG5	2 ND GEAR
R COIN CNTR	6	BU5	ML	AG6	3 RD GEAR
+5V	Y	BM4	ML	AP2	STEERING BD. POWER
START 1 LED	J	BP5	M	AU4	AUX LITE 1
START 2 LED	8	BU3	M	AU6	AUX LITE 2
START 1	M	BP2	ML	AH2	SW. 1
START 2	L	BP3	ML	AH5	SW. 2

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
FIRE 2	9	Bu 2	ML	AK 2	SW. 5
HORIZ. DIR. A	U	BN 2	ML	AY 4	STEERING A
HORIZ. CLK. A	N	BP 1	m	AZ 4	STEERING A
VERT. DIR. A	18	BS 5	m	AZ 1	STEERING A
VERT. CLK. A	P	BN 6	M	AQ 1	STEERING A
HORIZ. DIR. B	16	BT 1	m	AY 6	STEERING B
HORIZ. CLK. B	11	BT 6	m	AZ 6	STEERING B
VERT. DIR. B	17	BS 6	m	AZ 3	STEERING B
VERT. CLK. B	12	BT 5	M	AQ 3	STEERING B
		AQ 2	S	AC 3	SWITCH 17 PLAYER 1-2 STEER.
		AY 5	S	AD 4	SW. 16 PLAYER 1 PLAYER 2
		AZ 2	S	AD 6	
		AZ 5	S	AC 1	STEERING SELECT
		AP 3	S	AD 5	SWITCH 18 HORIZ/VERT.
		AP 4	S	AC 2	STEERING SELECT
		AS 3	ML	BG 1	COIN COUNTER POWER
		AS 2	S	AG 3	GEAR SELECT COMMON
SPEAKER OUT		AP 6	ML	BL 4	AMP
SPEAKER OUT		AR 1	ML	BL 5	AMP
AUDIO 1		J19 PIN 2	HARNES 30"	BL 1	INPUT 1
AUDIO 2		J19 PIN 1		BL 2	INPUT 2
VIDEO HOT		J19 PIN 11		BL 6	VIDEO HOT
VIDEO RETURN		J19 PIN N		BM 1	VIDEO GND
RIGHT 1		J19 PIN 5		AA 1	PLAYER 1 CONT.
LEFT 1		J19 PIN E	AA 5	" "	

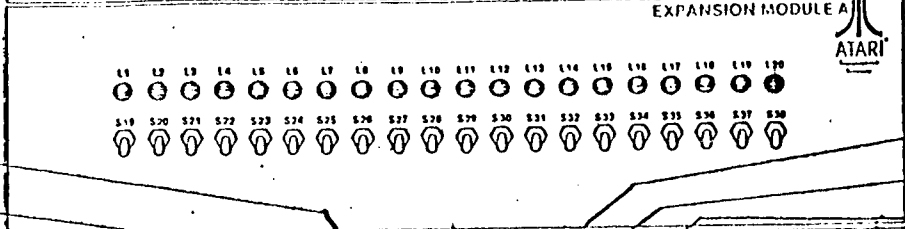
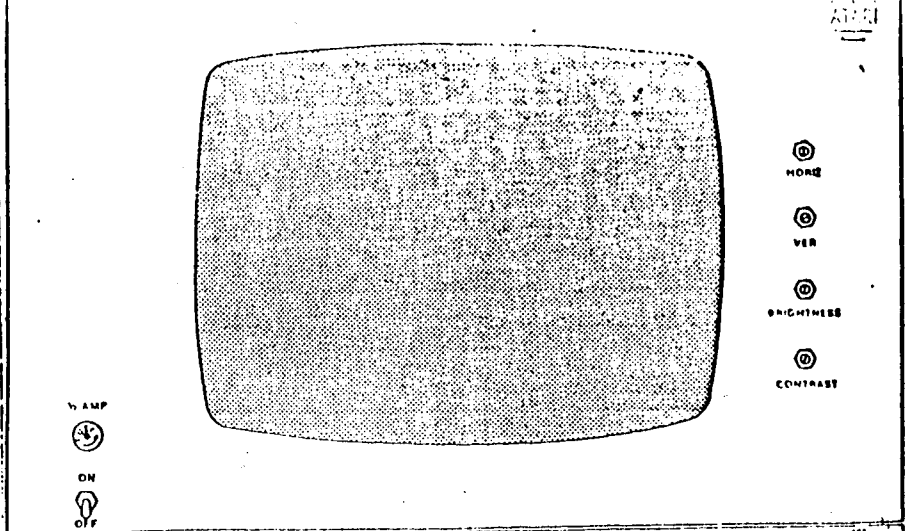
CRASH & SCORE

1. To Start 1 Player-Push Coin Once And Start Credit Once.
2. To Start 2 Player-Push Coin Twice And 5-5 For 6.5 (S6-White S7 Black)
3. Put Cars Going Upside Turn On Gas.
Check Car Motors (D11-#1, P11 #2) With Scope.
Check For Barriers S8.
Check For Crash.
Check For Skid.
Check For Double Score When Score Is Flashing.
Check For Flashing Score At End Of Game.
4. For Quick Score Count Pulse At L-2 Pin 14 And M-2 Pin 14.

For Free Play-Push S5 To Start Game.
Check Static Mode.

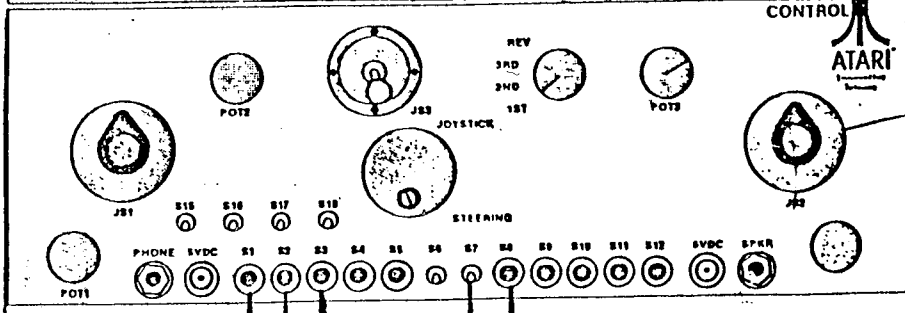
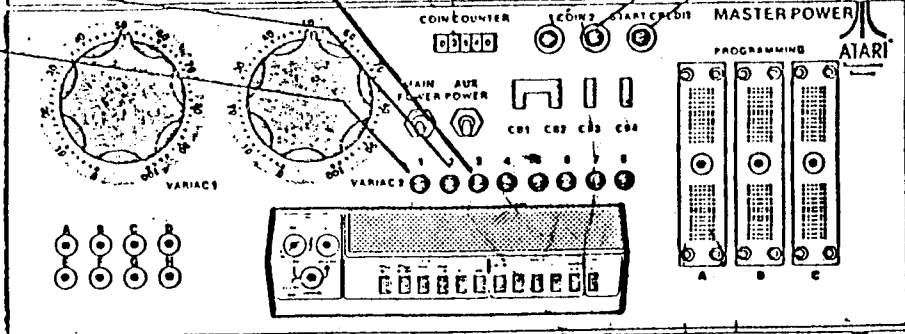
DOMINOS

1. Set Switches (All Switches On Except 1 & 3).
2. Turn On S15 For Diagnostics. Coin 1, Coin 2 & Start Credit & S8 Check Joystick In All Directions For Audio Tone.
3. Turn Off S15.
4. Check Black Player (Coin 1 & Push Start Credit), Push Reset Button.
5. Check White Player (Coin 1 & S8) Push Reset Button.
6. Check 2 Player Mode (Coin #1 Twice - Start Credit And S8 Before Tone Ends).
7. Turn Game Off.
8. Check Leads And Give Board General Visual Inspection.
9. Stamp Board Between F & H If Preburn.
" " " K & L If Postburn.
Date Stamp (If Postburn).



Lockout
Start 2
Start 1

Coin 1
Coin 2
Aux, Coin



Joystick

1 Player Start
2 Player Start
Pump
Cocktail
Self Test

CTS-1
Dig Dug
Switch Locations

GAME 14 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
5V RETURN	A	BR 6		AS6, AT3, AT6, CH4, AH3, AH6,	REG/AUDIO BOARD
- SENSE	22	BS 1		CG 5	REG/AUDIO BOARD
+ SENSE	21	BS 2		CG 6	REG/AUDIO BOARD
+5V RETURN	I	BV 4		CH5, AL5, AJ3	REG/AUDIO BOARD
+5V REG.	B	BR5		CH2	REG/AUDIO BOARD
+5V REG.	Z	BV 3		CH3	REG/AUDIO BOARD
AUDIO 2	D	BR3		BL 2	INPUT 2
AUDIO 1	C	BR4		BL 1	INPUT 1 X-Y
+36 VAC	3	BV 2		BK 6	TRANSFORMER X-Y
10.6 VDC	E	BR2		BF 6	TRANSFORMER
START LED 1	S	BN 4		AU 4	AUX LITE 1
START 1	10	BU 1		AH 2	SWITCH 1
START LED 2	6	BU 5		AU 6	AUX LITE 2
START 2	K	BP 4		AH 5	SWITCH 2
PLUMP	11	BT 6		AJ 2	SWITCH 3
LEFT	P	BN 6		(AB5-COLOR ONLY) AB3-B/W	JOYSTICK J
DOWN	14	BT 3		(AB3-COLOR ONLY) AC3-B/W	JOYSTICK JS
RIGHT	R	BN 5		(AC3-COLOR ONLY) AC1-B/W	JOYSTICK J
UP	15	BT 2		(AC1-COLOR ONLY) AB5-B/W	JOYSTICK JS
+5V	Y	BM 4		AU3, AU5, AV1	AUX. LITE POWER
GND.	Z	BM 3		AC2, AC4, AL3 AB4, AB6, BT6	SW. COMMON
GND.	17	BS 6		BMI	VIDEO GND
BLUE	W	BM 6	1K		6 FOOT COLOR HARNESS
GREEN	20	BS 3	2.2K		
RED	19	BS 4	3.3K		

FIRETRUCK

I. TOOLS NEEDED

- A. Program Plugs A & B For Firetruck.
- B. Edge Connector Harness (44 Pin).

II. POWER SETTINGS

- A. Variac 1 Not Used.
- B. Variac 2 25 V. A.C.
- C. Master Power CB1 & 2 -9.5 V. D.C.

III. VISUALLY INSPECT THE BOARD FOR ANY WORKMANSHIP DEFECT

IV. POWER UP

- A. Turn On CB's 1, 2, & 4 On Master Power Panel.
- B. Set Variac 2 For 25 V.A.C.
- C. Insure Switches Inside Left Panel Of Test Fixture Are On.

Caution: Touch Only The Switches. High Voltage Is Present Inside The Cabinet.

V. TEST PROCEDURE

- A. Self Test
 - 1. S18 On Control Panel Should Be Up.
 - 2. S7 Is Diag. Hold Should Be Up.
 - 3. Pressing The Following Switches Should Give An Audio Tone; (Coin 1, Coin 2, S1, 2, 3, 10, 11, 12, And 17) And Steering.
 - 4. Aux. Lites In Pos. 1, 2, 3, 5, Should Lite (L.E.D.'s Need To Be Installed).
 - 5. S9 Push To Advance Program (Counts From 1 To C).
- B. Game Play
 - 1. Option Switches
 - a. 8 Position Dip Switch, Located At E11
 - 1) Positions 1, 2, 4, 5, 6, 7, 8 On, Position 3 Off, This Gives You Bonus For 100, Time Of 90, English.
 - b. 4 Position Dip Switch Located At B3.
 - 1) Positions 1, 2, 3, On, Position 4 Off, Will Give You 1 Coin Per Play.
 - 2. The Screen Should Have A Picture Of A Firetruck In The Middle Of The Playfield. (With Roadway, Buildings, Parked Cars) And Writing On Sides (Left Says Score 00 & Sorry, Right Side Says Top Score 60 & Bonus For 100).

3. Press Coin 1, Put S15 In Down Position, Press S1, (Press Start) Will Flash From Side To Side. Put S6 Up, You Are Now Driving The Cab Section Of The Firetruck. Check Steering (The Game Will Drive The Tail Section).
4. Press Coin 2, Put S15 In Up Position, Press S2, (Press Start Will Flash From Side To Side). You Are Now Driving The Tail Section Of The Firetruck. Check Steering (The Game Will Drive The Cab Section).
5. Press Both Coins 1 & 2, Press S3, Should Start Both Players. (In This Mode You Can Not Drive The Firetruck Because The Test Fixtures Only Have 1 Steering Board).
6. Press And Hold S5 Down. To Test The Smokey Joe Cabinet Functions:
 - a. Press Coin 1, Put S15 Down, Press S1, Put S6 Up, You Are Now Driving The Cab Section.
 - b. Press Coin 2, Put S15 Down, Press S3, You Are Now Driving The Tail Section.
7. Test For Bonus.

FLYBALL CHECKOUT (SHORT FORM)

1. PLAYFIELD GENERATOR

W/O processor - recognizable graphics

With processor - normal playfield - if letters at top of screen screw-up, check processor speed. Should be 900 KHZ or more.

2. MAN + BALL GENERATOR

W/O processor - man & ball can be randomly placed by shorting out VMT, JMT, VBT, HLT - V = Vertical

M = Man

B = Ball

T = Test

With processor - Pitcher pitches - 8 pictures

Run left - 4 pictures

Run right - 4 pictures

3. SOUNDS

W/O processor:

Crowd noises - short one of the crowd volume control resistors to ground to get crowd noise.

Footsteps - short footstep envelope volume control resistor to ground for loud rushing sound.

Bat hit - not testable W/O processor.

With processor - 3 levels of crowd noise during play.

Footstep "TSCH" "TSCH" "TSCH"

Bat sound - tone adjustable with pot.

LAMP DRIVERS + SWITCHES

1. All coin combinations on board mode switches (25¢ / 50¢ / 4 coins).
2. Diagnostic entered form attract mode with diagnostic switches.
3. Both coin buttons work with coin messages.
4. Start game lamp comes on with proper coinage.
5. Lamp goes out & game starts with start button.

GAME PLAY (Align the joystick adjustment pots first) (Set processor to 1.4 MHZ for tests)

1. Attract mode with a correct playfield.
 - a. All player directions & game over sign
 - b. All coin messages.
 - c. One runner.

FLYBALL CHECKOUT (SHORT FORM CON'T)

2. Game accepts coins & starts with start button
 - a. "Wipe clean".
 - b. Correct playfield.
 - c. BALL, STRIKE, OUTS, INNINGS, SCORES, BATTER, and PITCHER.
 - D. Crowd noises
3. Pitcher pitches after "cocking" his arm.
4. Ball controlable in flight
5. Bat works
6. Bat hit = "PONK", miss = "TSCH"
7. Pitcher can catch ball & run left & right.
8. Out generated if player tagged - runner = "TSCH", "TSCH", "TSCH".
9. Outs register on score.
10. Ball if not caught goes off screen = HOME RUN = loud crowd.
11. Try to load bases.
12. Get home run & to score over 3 runs.
13. Balls when hit should go slower & may creep after 3 runs.
14. Get 3 outs - players switch.
15. Hit some fast balls (aim pitch to tip of bat!)
16. Game ends after 1 or 2 innings.
17. Test stop runner on base by hitting slow bunt & not catching ball.

TEST OVER - SET PROCESSOR TO 900 KHZ & GLUE SHUT!

SETUP PROCEDURE FOR FLYBALL JOYSTICK TRIMPOTS

The Flyball joystick wipers are connected to an Analog to Digital converter circuit. It is necessary to adjust the wiper voltage range of each joystick pot for correct digital output. This requires that both the minimum and maximum voltages be set to correspond to minimum and maximum stick travel. The following procedure will accomplish this setup.

Those of you who have ever aligned a radio receiver for proper tuning range will recognize that the pot alignment procedure is very similar. It is a convergent sequence of adjustments which eventually will reach the correct answer after doing the sequence a number of times.

For the radio receiver, we have the rule "adjust the inductor for the proper low frequency indication, and adjust the capacitor for the proper high frequency indication." In Flyball, we adjust one resistor for proper low number indication and the other resistor for proper high number indication. We must always remember which resistor is which, or else the sequence diverges, that is takes you farther and farther from the correct answer. Use the memory aids given below to remember the sequence.

Memory aid #1 - With the circuit board set so the edge connector is on your right, the adjustment pots are in groups of 2 going down:

Right Control Up / On - 2 pots
 Right Control Left / Right - 2 pots
 Left Control Up / On - 2 pots
 Left Control Left / Right - 2 pots

Memory aid #2 - The little pictures on the board near the adjustment pots are labeled R and L, with up / down arrows or right / left arrows. These correctly correspond to the adjustments.

Memory aid #3 - Top pot (of the set of 2) set high value.
 Bottom pot (of the set of 2) set for low value.

Memory aid #4 - Low value = 01, 02, or 03.
 High value = 67, 70, or 71.

Procedure: (set board to diagnostic mode - set diagnostic switch and enter diagnostics from attract mode).

Set the adjustment pots for approx. mid range. Play with them until you get a variation of numbers on the screen with joystick motion. Note which set of numbers on the screen is associated with the joystick motion. One set is assigned to each joystick pot Right player vertical, horizontal, Left player vertical or horizontal.

SETUP PROCEDURE FOR FLYBALL JOYSTICK TRIMPOTS (CON'T)

Push the joystick to get a low value on the screen. Hold it there and adjust lower trimpot for proper low value. Push joystick to get high value on screen, and adjust upper trimpot for proper high value.

Repeat above until you achieve Lo = 01, 02, 03 and High = 67, 70, 71. This will take several tries.

Once you get the hang of it, you will find that by overshooting your trimpot adjustments you will achieve correct values in a minimum amount of time.

NOTES:

Vertical motion endpoint set. (as if to pitch or bat)

- a. Failure to achieve an endpoint number less than 10 will prevent pitching from taking place.
- b. If high number is 77 for the batter, you will find that the ball will go through the bat and appear to wrap through Vertical blanking if the batter holds his bat all the way down.

Horizontal motion.

- a. It is better to make the endpoints about 05 to 72 rather than 02 to 70. This will balance the horizontal running speed. That is the pot when in spring center should have a reading of about 37 or 40.

FOOD FIGHT RASTER # 8116
PROG. PLUG SWITCH LIST

COIN L	COIN SW. 1
COIN R	COIN SW. 2
COIN AUX	START CREDIT SW.
COIN COUNTER L	1 ST GEAR
COIN COUNTER R	2 ND GEAR
TEST	SW. 7
START 1	SW. 1
START 2	SW. 2
START LED 1	AUX LIGHT 1
START LED 2	AUX LIGHT 2
HORIZONTAL	KRAFT JOYSTICK
VERTICAL	KRAFT JOYSTICK
THROW	SW. 3

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION		CIS-1 DESTINATION	CIS-1 COMPONENT DESCRIPTION
GND	A	BR6		CH4	R/A BOARD
-SENSE	22	BS1		CG5	R/A BOARD
+SENSE	21	BS2		CG6	R/A BOARD
+5V REG.	2	BV3		CH2, AU3	R/A BOARD
+5V REG.	B	BR5		CH3, AU5	R/A BOARD
+10.3V UNREG	C	BR4		BF6	R/A BOARD
GND	I	BV4		CH5	R/A BOARD
COIN L	T	BN3		AS6	COIN SW. 1
COIN R	S	BN4		AT3	COIN SW. 2
COIN AUX	13	BT4		AT6	START CREDIT SWITCH
COIN COUNTER L	X	BM5		AG4	1 ST GEAR
COIN COUNTER R	W	BM6		AG5	2 ND GEAR
GND		BG6		AD4, AD1, AT4	SW. COMMON
TEST	16	BT1		AL3	SW. 7
START 1	R	BN5		AH3	SW. 1
START 2	P	BN6		AH6	SW. 2
START LED 1	U	BN2		AU4	AUX. LIGHT 1
START LED 2	V	BN1		AU6	AUX. LIGHT 2
THROW	14	BT3		AJ3	SW. 3
VERTICAL	19	BS4		BS3, AC5	KRAFT JOYSTICK
HORIZONTAL	17	BS6		BS5, AD2	KRAFT JOYSTICK
GND	Z	BM3		AS4, AT1, AL2, AH2, AH5, AJ2, AJ5	SWITCH COMMON
COIN SELECT COMMON		AG3		AS2	COIN COUNTER
COIN COUNTER POWER		BG1		AS3	COIN COUNTER
+5V OUT	Y	BM4		AC6, AD3	KRAFT JOYSTICK POWER

DIAGNOSTIC SELF TEST:

1. While Game Is In Attract Mode Move S18 To The UP Position. Video Should Freeze For About 5 Seconds. Crowd Audio Should Come On And Can Be Adjusted At This Time. Video Should Read ROM OK & RAM OK, A, B, C Or D Below ROM OK. Playfield Video Should Be 2/3 Full Of Players And Various Video Alphanumerics. Boardering Playfield, Player #1 (Left Side) Will Show ROM OK, RAM OK And Both Boarders Will Be Full Of Video Alphanumerics.

DIAGNOSTIC SWITCH AND CONTROLS TEST:

1. A "Click" Audio Should Be Audible And An Increase In Crowd Audio Should Occur When Pressing Coins 1 & 2, And S6 Video Images In Upper Right Hand Corner Of Playfield Will Disappear One By One When These Switches Are Pressed. S4 & S5 Will Do The Same Things With The Addition Of Moving Playfield Right Or Left. S4 = Right, S5 = Left.

FUNCTIONAL TEST ATTRACT MODE:

1. Making Sure That All Power Is OFF, Plug In P.C.B. To Harness.
2. Apply Power: Video Should Come On Without Hesitation And Immediately Go Into An Attract Mode With Players Running, Passing & Defense In Pursuit. At The Time Both Teams Line Up, A Credit Light 1, 2, 3 Or 4 Will Light Up Showing What Play Offence Is Going To Do & By Switching S15 Up Or Down The Defensive Play Which Has Been Selected Can Be Seen. By Using This Method You Can Tell Before The Actual Play If A Gain In Yardage Or Possible Score Will Be Made. There Should Not Be Any Audio In Attract Mode Alphanumeric Displays Are Located On Each End Of The Monitor. Framing Of Playfield Video, With Information Blinking GAME OVER, INSERT COINS, EACH COIN ADDS TIME & The Outcome Of Each Play; For Example, RUN, TACKLED, INCOMPLETE, INTERSEPTION, TOUCH DOWN & Occasionally A SAFETY.

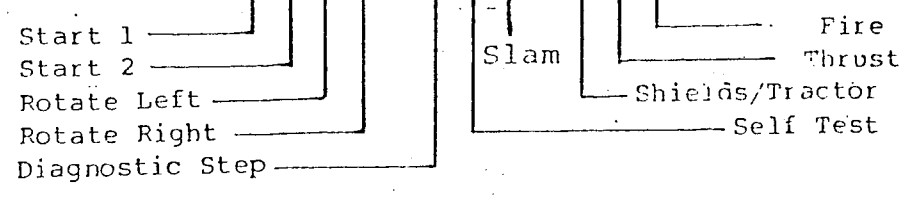
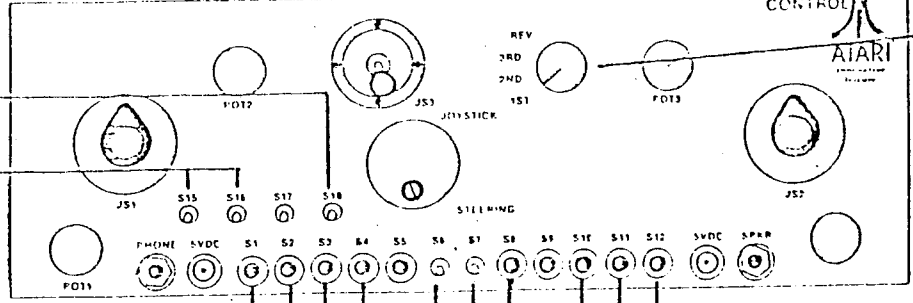
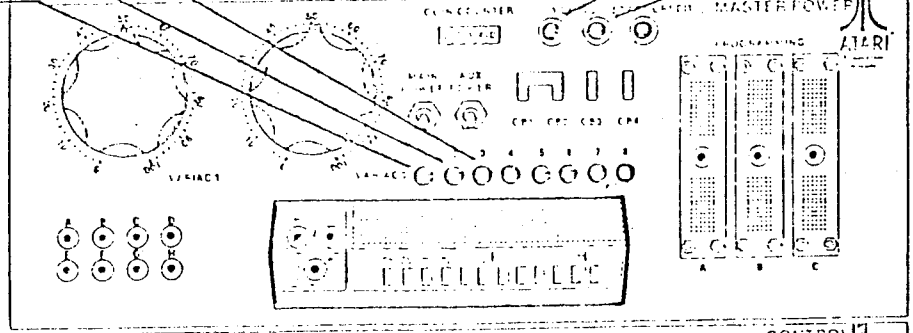
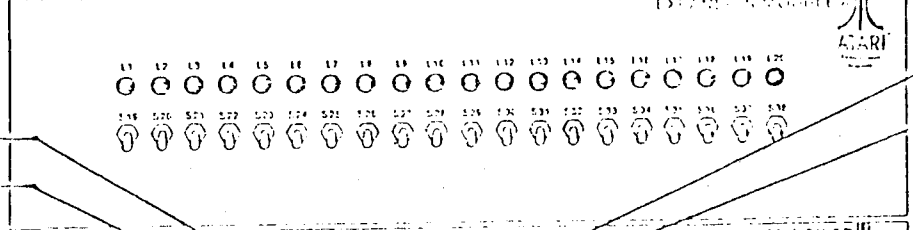
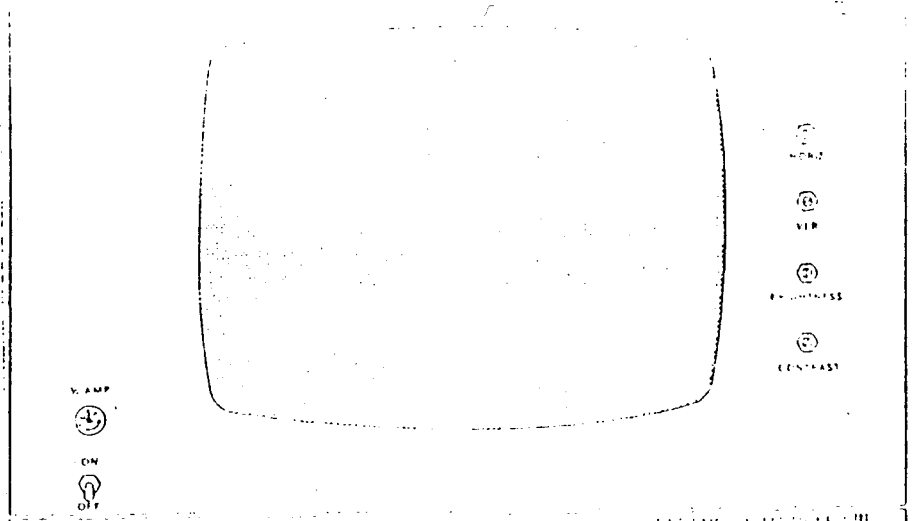
GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
1 V AC C.T.	1	BV4		B-G4	
1 V AC C.T.	A	BR6		B-G5	
+10V Unreg.	2	BV3		B-F6	DC Supply
+10V Unreg.	B	BR5		B-G1	
	3	BV2			
	C	BR4			
	4	BV1			
	D	BR3			
	5	BU6			
Anode B	E	BR2		A-L4	SW 7
Anode D	6	BU5		A-L3	SW 7
Anode C	F	BR1		A-W2	Aux Lite 6
Video Out	7	BU4		B-L6	Video
Video Gnd.	H	BP6		B-M1	Video Gnd.
Coin Counter	8	BU3		A-S2	Coin Counter
LED C2	J	BP5		A-V2	Aux Lite 3
LED C0	9	BU2		A-U4	Aux Lite 1
+5V	K	BP4		C-K1, C-L5	+5V To Control
VTB2 CK	10	BU1		A-Y6	
VTB2 DIR	L	BP3		A-Z3	
HZTB2 CK	11	BT6		A-X6	
HZTB2 DIR	M	BP2		A-X3	
VTB1 DIR	12	BT5		A-Z1	
HZTB1 DIR	N	BP1		A-X1	
HZTB1 CK	13	BT4		A-X4	
VTB1 CK	P	BN6		A-Y4	
LED C3	14	BT3		A-V4	Aux Lite 4
Select 2 N.O.	R	BN5		A-J6	SW 4
Test N.O.	15	BT2		Ab6	SW 18
Coin 2 N.O.	S	BN4		A-T3	Coin SW 2

AME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
C 1	16	BT1		A-S6	Coin SW 1
S	T	BN3		A-K6	SW 6
Select 1	17	BS6		A-K3	SW 5
LED C1	U	BN2		A-U6	Aux Lite 2
Speaker	18	BS5		A-R2, A-P6	Speaker
Speaker Gnd	V	BN1		A-R1	Gnd
25V AC	19	BS4		B-B2	Varriac 2
25V AC	W	BN6			
25V AC	20	BS3		B-B4	Varriac 2
25V AC	X	BM5			
Gnd	21	BS2		A-K5, A-K2	Gnd
Gnd	Y	BM4		A-S4, C-L3	Gnd
Gnd	22	BS1		A-J5, B-B3	Gnd
	Z	BM3		Ab5, A-V5, A-W1	Gnd
		CK 6		A-X2	To Control
		CL 1		A-X5	Panel
		CM 4		A-Y5	
		CM 5		A-Z2	
SW 7 Com.		AL 2		A-U3, A-U5, A-V1, A-V3	Aux Lite 1, 2, 3, 4 Com.

GRAVITAR
Switch Locations

I. Switches and Controls used on CTS-1

<u>Game Control or Switch Name</u>	<u>Switch on CTS-1</u>
Start 1	S-1
Start 2	S-2
Rotate Left	S-3
Rotate Right	S-4
Diagnostic Step	S-6
Self Test	S-7
Shielf/Tractor	S-10
Thrust	S-11
Fire	S-12
Coin Counter Left	1st
Coin Counter Right	2nd
Coin Left	Coin 1
Coin Right	Coin 2
Player 1 LED	LED-1
Player 2 LED	LED-2
Lockout LED	LED-3
Cocktail Test	S-18
Gameplay Switches Control	S-15/16
Slam	S-8



GAME REPAIR CORN. DESCRIPTION	TER #	D TERMINAL IDENTIFICATION	TEST POINT	COMPONENT DESCRIPTION
+5V RETURN	A	BR6	CH4, AT6, AT3, AS6	REG/AUDIO BOARD
-SENSE	22	BS1	CG5	REG/AUDIO BOARD
+SENSE	21	BS2	CG6	REG/AUDIO BOARD
+5V REG.	B	BR5	CH2	REG/AUDIO BOARD
+5V. REG.	2	BV3	CH3	REG/AUDIO BOARD
-22VDC	3	BV2	CJ1	REG/AUDIO BOARD
-22VDC	4	BV1	CJ2	REG/AUDIO BOARD
+5V RETURN	1	BV4	CH5, AH3, AH6, AL3, AL6	REG/AUDIO BOARD
-10.3V UNREG.	E	BR2	BF6	REG/AUDIO BOARD
COIN LEFT	16	BT1	AS4	COIN SW. 1
COIN RIGHT	U	BN2	AT1	COIN SW. 2
STEP DIAG.	S	BN4	AK5	SW. 6
COIN COUNTER LEFT	H	BP6	AG4	1 ST GEAR
COIN COUNTER RIGHT	6	BU5	AG5	2 ND GEAR
START 1	M	BP2	AH2	SW. 1
START 2	11	BT6	AH5	SW. 2
PLAYER 1 LED	7	BU4	AU4	AUX LIGHT 1
PLAYER 2 LED	J	BP5	AU6	AUX. LIGHT 2
LOCKOUT	F	BR1	AV1	AUX. LIGHT 3
SELF TEST	T	BN3	AL2	SW. 7
SLAM	14	BT3	AL5	SW. 8
COIN ANALYSIS	15	BT2	AT4	START CREDIT SWITCH
SW. GND.	N	BP1	CJ5, AK6, AJ3, AL5	SW. GROUND
+5VDC	Y	BM4	AU5, AU3, AV2	AUX. LIGHT POWER
	17	BT5	AN3, AM6, AJ6,	SW. GROUND

GRANDPRAIRY CONTROL

TYPE 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION		TYPE 44 PIN CONN. DESCRIPTION
COIL TAIL	R	BN5		SW. 18
GEAR SELECT COMMON		AG3		COIN COUNTER
COIN COUNTER POWER		BG1		COIN COUNTER
AMP		BL4		SPEAKER OUT
AMP		BL5		SPEAKER OUT
AUDIO 1	J19	PIN 12		INPUT 1
AUDIO 2	J19	PIN 11		INPUT 2
AUDIO GND	J19	PIN M		GND
RED	J19	PIN 7	} TWISTED PAIR	PIN 1 OF MOLEX CONN. COLOR X-Y MONITOR
RED GND	J19	PIN H		PIN 4 OF MOLEX CONN. COLOR X-Y MONITOR
GREEN	J19	PIN 8	} TWISTED PAIR	PIN 2 OF MOLEX CONN. COLOR X-Y MONITOR
GREEN GND	J19	PIN J		PIN 5 OF MOLEX CONN. COLOR X-Y MONITOR
BLUE	J19	PIN 9	} TWISTED PAIR	PIN 3 OF MOLEX CONN. COLOR X-Y MONITOR
BLUE GND	J19	PIN K		PIN 6 OF MOLEX CONN. COLOR X-Y MONITOR
X OUT	J19	PIN A	} TWISTED PAIR	BJ3, PIN 7 OF MOLEX CONN. B/W & COLOR X-Y MONITOR
X GND	J19	PIN I		BH5, PIN 11 OF MOLEX CONN. B/W & COLOR X-Y MONITOR
Y OUT	J19	PIN B	} TWISTED PAIR	BJ4, PIN 8 OF MOLEX CONN. B/W & COLOR X-Y MONITOR
Y GND	J19	PIN 2		BH6, PIN 10 OF MOLEX CONN. B/W & COLOR X-Y MONITOR
Z OUT	J19	PIN 10	} TWISTED PAIR	BJ2 B/W X-Y MONITOR
Z GND	J19	PIN L		BJ1 B/W X-Y MONITOR
ROTATE LEFT 1 SELECT	J19	PIN E		SW. 15 PLAYER 1-2 CONTROL SELECT
ROTATE RIGHT 1 SELECT	J19	PIN 5		SW. 15 PLAYER 1-2 CONTROL SELECT
THRUST 1 SELECT	J19	PIN 6		SW. 15 PLAYER 1-2 CONTROL SELECT
FIRE 1 SELECT	J19	PIN 4		SW. 16 PLAYER 1-2 CONTROL SELECT
SHIELD 1				SW. 16 PLAYER 1-2 CONTROL

18" HARNESS TO COLOR MONITOR

50" HARNESS TO 24 PIN EDGE CONN.

VARIAC I

VARIAC II

NIGHT DRIVER SUPPLY

19.5

25 V

ON

BLUE SWITCH ON BOARD

SW 1 & 5 COIN SELECT

(BOTH OFF) 1 COIN 1 PLAY 1 ONLY 1 COIN 2 PLAY 5 ONLY 2 COINS 1 PLAY 1 & 5 ON 1 PLAY

SW 2 & 6 GAME SELECT

(BOTH OFF) RACCOON GAME 2 ONLY RACCOON GAME 6 ONLY WITCH HUNT GAME 2 & 6 ON BEAR GAME

SW 3 & 7 TIME SELECT

(BOTH OFF) SLOW 3 ONLY FAST 7 ONLY FASTER 3 & 7 ON FASTEST

SW 4 EXTENDED PLAY

(OFF) NO EXTENDED PLAY ON EXTENDED PLAY

SW 8 UNUSED

TO SET UP SWITCH S15 ON CONSOLE MUST BE UP SCREEN THEN READS AIM GUN (JS3).

TO UPPER LEFT AND DEPRESS S12 TRIGGER THEN AIM TO LOWER RIGHT AND DEPRESS S12 AGAIN, THEN SHOOT OUT LETTERS, THEN RETURN S15 TO DOWN POSITION. THIS STARTS GAME IN ATTRACT WITH LITE #1. ON THIS LITE WILL GO OUT WHEN COIN IS PUSHED AND GAME CAN NOW BE STARTED. (IF GUN WILL NOT SET GO TO H12 PIN 8 MOVE JS3 LEFT FO RIGHT SHOULD GO FROM 0 TO 5 V THEN GO TO H12 PIN 11 MOVE JS3 DOWN THEN UP SHOULD READ 5 V TO 10 V WITH MOVEMENT.

BEAR GAME STARTS AT 99 AND COUNTS DOWN ACCORDING TO TIME SWITCH SETTINGS.

LARGE BEAR WORTH 20 PTS.

SMALL BEAR WORTH 40 PTS.

EXT PLAY SET BY TIME SWITCHES

(1800) (1500) (1200) (800)

WITCH HUNT STARTS AT 99 AND COUNTS DOWN ACCORDING TO TIME SWITCH SETTINGS.

GHOST SORTH 20 PTS

WITCH WORTH 40 PTS

BAT WORTH 60 PTS

EXT PLAY SET BY TIME SWITCH

(5000) (4000) (3000) (1400)

RACCOON: STARTS AT (64) (48) (32) (16) DEPENDING ON TIME SETTINGS ONLY COUNTS DOWN WHEN EACH RACCOON REACHES THE TOP OF THE SCREEN

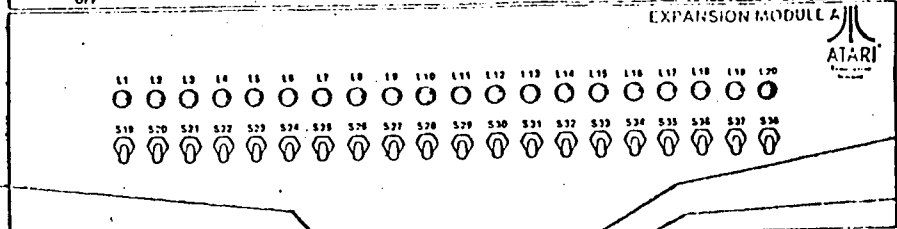
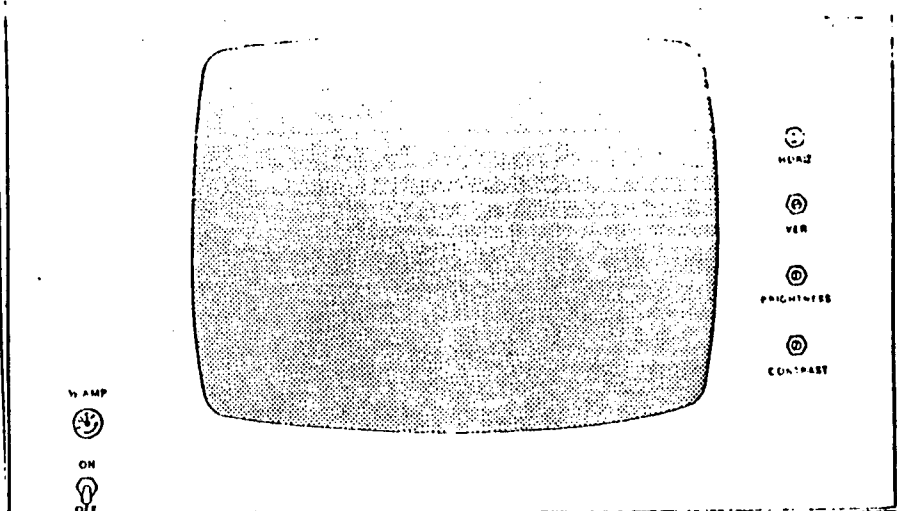
EXT PLAY SET BY TIME SWITCHES

(1800) (1500) (1200) (900)

JET FIGHTER

Variac 1 16.5
Variac 2 25

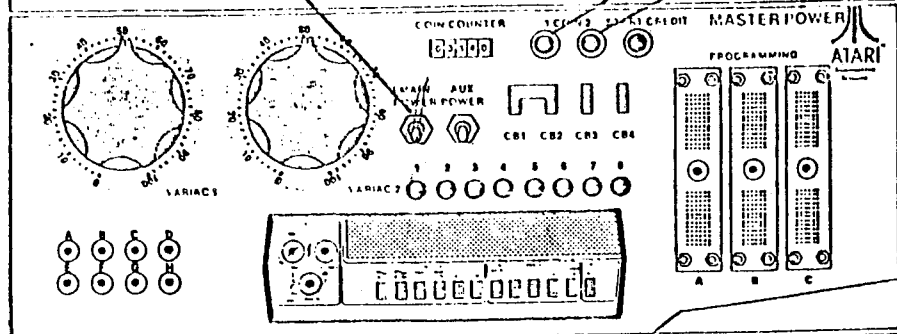
1. Check Switch Modes 50¢ & 25¢.
2. Check Acceleration & Deceleration For Increase And Decrease Of Audio Tones.
3. Maneuver Ability: Fast Left
 Slow Left
 Fast Right
 Slow Right
 Fast Forward
 Slow Forward
4. Make Sure Jets Score On Each Other When Hit.
5. Check Shot And Explosion Audio.
6. Make Sure Jets Spin When Hit.
7. Pulse Up Score Counter. White-B 5-P 16, Black-A 6-P 16.
8. Make Sure Score Flashes At End Of Game.
9. Check Static Mod.



Power on

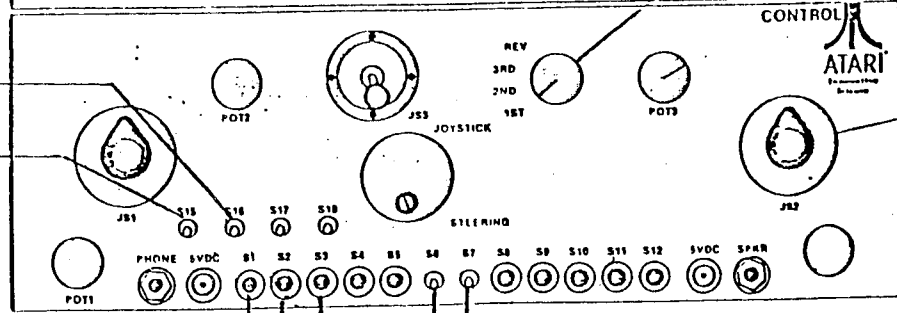
Coin SW 1

Coin SW 2



1st-L. Coin CT

2nd-R. Coin CT



Cocktail

Picture Reverse

Kangaroo Motion

Start 1
Start 2
Punch

Self Test
Footstep Audio Select

CTS-1
Kangaroo
Switch Locations

LINE # PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CONN. PIN #	CIS-1 DESTINATION	CIS-1 COMPONENT DESCRIPTION
TV RETURN	W	PM 6		J1 PIN H CH4	REG AUDIO BOARD
- SENSE	19	BS 4		CG 5	REG AUDIO BOARD
+ SENSE	21	BS 2		CG 6	REG AUDIO BOARD
+5 REG	Y	PM 4		CH 2	REG AUDIO BOARD
+12 VDC	Z	BM 3		J1 PIN K CJ 3	REG AUDIO BOARD
INVERT	D	BR 3		AX 2	SW 15
GND	V	EN 1		CH 5	GND
SPEAKER RETURN	T	BN 3		AR 1	AUDIO OUT
SPEAKER	15	BT 2		AP 6	AUDIO OUT
START 1	A	ER 6		AH 3	SW. 1
START 2	I	LV 4		AH 5	SW. 2
PUNCH	6	BU 5		AJ 2	SW. 3
LEFT	E	BR 2		AB 6	JOYSTICK JS2
DOWN	F	BR 1		AB 4	JOYSTICK JS2
RIGHT	4	BV 1		AC 4	JOYSTICK JS2
UP	5	BU 6		AC 2	JOYSTICK JS2
GND	U	BN 2		AJ 3, AC 3 AB 5, AB 3, AC 1	SW. COMMON
L. COIN	B	BR 5		AS 4	COIN SW. 1
R. COIN	2	BV 3		AT 1	COIN SW. 2
GND	17	BS 6		AH 2, AH 5, AS 6, AT 3, AL 3	GND
COIN CNTR. R	5	EN 4		AG 5	2ND. GEAR
COIN CNTR L	14	BT 3		AG 4	1ST GEAR
TEST	J	BP 5		AL 2	SW 7
+5 REG.		J1 PIN J		CH 3	
-5 V		J1 PIN L		CJ 4	

WIRING

COLOR GND

CTS-1 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION	
		AK 3		AS 2	GEAR SELECT COMMON	
COIN COUNTER POWER		BG 1		AS 3	COIN COUNTER	
FOOTSTEP AUDIO SELECT	C	BR 4		AK 6	SW. 6	
GND	18	BS 5		AX 3; AK 5	GND	
VIDEO GND		J1 PINE		BM 1	VIDEO GND	
BLUE		J1 PIN C				
GREEN		J1 PIN B				
RED		J1 PIN A			BL 6	VIDEO HOT
COMP SYNC		J1 PIN D				
					6' COLOR HARNESS	
VIDEO REVERSE	3	BV 2		AY 5	SW. 16	
GND	16	BT 1		AY 6	GND	

LIBERATOR SWITCH LIST

COIN L	COIN SW. 1
COIN R	COIN SW. 2
COIN AUX	START CREDIT SWITCH
COIN COUNTER L	1 ST GEAR
COIN COUNTER R	2 ND GEAR
START 1	SW. 1
START 1 LED	AUX LIGHT 1
START 2	SW. 2
START 2 LED	AUX LIGHT 2
SELF TEST	SW. 7
COCKTAIL	SW. 6
SLAM	SW. 8
HORIZ/VERT STEERING SELECT	} SW. 18
PLAYER 1/PLAYER 2 STEERING SELECT	} SW. 16 + 17 (DOWN - PLAYER 1 UP - PLAYER 2)
FIRE 1	SW. 4
SHIELD 1	SW. 3
FIRE 2	SW. 11
SHIELD 2	SW. 10

DESCRIPTION	BOARD	BOARD	CIS-1 COMPONENT	CIS-1 COMPONENT DESCRIPTION
EMD		74	CH4, AL2, AK5, AP5	R/A BOARD
- SENSE	22	BS1	CG5	R/A BOARD
+ SENSE	21	BS2	CG6	R/A BOARD
+5V REG.	2	BV3	CH2	R/A BOARD
+5V REG.	B	ER5	CH3	R/A BOARD
-22V	4	BV1	CJ2	R/A BOARD
+12V	C	BR4	CJ3	R/A BOARD
-5V	D	BR3	CJ4	R/A BOARD
GND	A	BR6	CH5, AS4, AT1, AT4, AL5	R/A BOARD
SLAM	J	BP5	AL6	SW. 8
+10:3V UNREG.	18	BS5	BF6	R/A BOARD
RT 1 LED	F	BR1	AU4	AUX LIGHT 1
START 2 LED	S	BU6	AU6	AUX LIGHT 2
START 1	N	BPI	AH3	SW. 1
START 2	11	BT6	AH6	SW. 2
FIRE 1	10	BU1	AJ6	SW. 4
SHIELD 1	L	BP3	AJ3	SW. 3
FIRE 2	9	BU2	AN3	SW. 11
SHIELD 2	M	BP2	AM6	SW. 10
+5V OUT	Y	BM4	AU3, AU5, AP2	AUX LIGHT POWER
GND	Z	BM3	AH2, AH5, AJ2, AJ5, AM5, AN2	SW. COMMON
COIN L	7	BU4	AS6	COIN SW. 1
COIN R	8	BU3	AT3	COIN SW. 2
COIN AUX	K	BP4	AT6	START CREDIT SWITCH
COIN CNTR L	6	BP6	AG4	1 ST GEAR

COMPONENT	PIN #	DESCRIPTION	CIS-1 IDENTIFICATION	CIS-1 COMPONENT DESCRIPTION
PLAYER R	H	BU3	AG5	2 ND GEAR
SELF TEST	13	BT4	AL3	SW. 7
COCKTAIL	P	BN6	AK6	SW. 6
GEAR SELECT COMMON		AG3	AS2	COIN COUNTER
COIN COUNTER POWER		BG1	AS3	COIN COUNTER
STEERING		AP4	AC2	} SW.18 HORIZ/VERT. SELECT SW. 17 PLAYER 1 PLAYER 2 SELECT SW. 16 PLAYER 1 PLAYER 2 SELECT
STEERING		AP3	AB5	
		AC1	AA2	
		AC3	AZ2	
		AB4	AY5	
		AB6	AA5	
HIZ. CLK. 1	J19	PIN M	AY4	
HORIZ. CLK. 2	J19	PIN 9	AY6	
VERT. CLK. 1	J19	PIN 12	AZ1	
VERT. CLK. 2	J19	PIN 10	AZ3	
HORIZ. DIR. 1	J19	PIN 11	AA1	
HORIZ. DIR. 2	J19	PIN K	AA3	
VERT. DIR. 1	J19	PIN N	AA4	
VERT. DIR. 2	J19	PIN L	AA6	
AMP		BL4	AP6	SPEAKER
AMP		BL5	AR2	SPEAKER
AUDIO 1	J19	PIN 5	BL1	R/A BOARD
AUDIO 2	J19	PIN 6	BL2	R/A BOARD
B/W VIDEO	J19	PIN 4	BL6	VIDEO HOT
VIDEO RETURN	J19	PIN D	BMI	VIDEO GND

PRELIMINARY LUNAR LANDER

Test Sequence

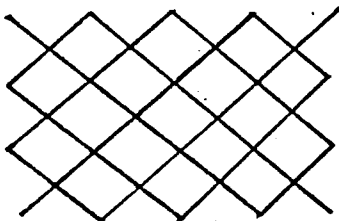
- ~~1. Set Variac II to 55%.~~
2. Adjust X and Y Gain and Zero pots on P.C.B. to midrange.
3. Turn on Main Power.
4. Turn on Circuit Breaker

A display will appear on monitor. This display will not be the correct size because the GAIN and ZERO X and Y potentiometers on the game board have not been set. These "pots" will be set during diagnostic checks later.

5. Throw S18 UP position. Diagnostics will begin. See attached Table I.

The diagnostics will cycle from 1 through 7 and the display that appears at diagnostic 3 will stay for the remainder of the diagnostics. When sequence arrives at diagnostic 7, push SW1, SW2, SW3, SW4, SW12 to simulate 5 LED switches in Table I. The number below FUEL UNITS is the coin credit multiple that is changed by DIP switches in Table II. The numbers 8, 9, 10, 11 will appear in English version where ROM OK appears on display. This happens when foreign language ROMs are not used.

6. Push S8 twice. A crosshatch pattern will appear on the monitor as shown.



Adjust the X and Y GAIN and ZERO pots on the game board to evenly fill the screen with the pattern.

NOTE: Q.A. Final will adjust ZERO X and Y using the test pattern above and centering the middle rhombus around a dot representing D.C. 0 volts. The X and Y pot wipers will then be "sealed" with a RTV epoxy.

7. Push S18 to DOWN position.

The display will now be in the ATTRACT mode showing:

SCORE	0000	ALTITUDE	0
TIME	0000	HORIZ. SPEED	0
FUEL	000	VERT. SPEEN	0

INSERT COINS (flashing) 450 FUEL UNITS PER COIN.

Lunar Lander vehicle will move from left to right across changing Lunar landscape and will not set down. Sequence of vehicle motion repeats.

8. Exercise option switch settings per Table II



Similar to the attract mode, actual game play begins with engine rumble and the lander drifting towards the bottom right corner of the screen. Horizontal and vertical speeds are constantly displayed, including two arrows to show horizontal and vertical directions of travel. Altitude is measured in distance above the surface of the mountain - not above "sea level". The screen also shows time in actual seconds, representing time elapsed in the current mission.

The scoring system gives 50 points for a good landing, plus 50 fuel units as a bonus. A hard landing earns only 15 points, and a crash earns 5 points. A crash happens when the vertical speed exceeds 15 and the horizontal speed exceeds 31. The number displayed after SCORE is cumulative of all landings made in the current game. The point scores for a good or hard landing can be greatly increased by landing on an area with a flashing multiplier, for example 2X or 5X. Thus, a good landing on the very narrow 5X site would give that player 250 points.

As already shown on Table II, the operator can select from four different settings for fuel units - 450, 600, 750 or 900 fuel units per coin (free play is also available). As the lander module flies over the landscape, it approaches the mountains and a landing site. At a certain point near the mountains, the game "zooms in" for a close-up view of everything on the screen.

If the player realizes the speed is too fast and the landing looks hopeless, he or she can press the ABORT button on the control panel. This will give the lander extra thrust and make it fly upwards at top speed. The abort feature does consume 120 to 180 fuel units, though, as a disincentive to overusing it. If the ABORT button is pressed too late, however, a crash cannot be avoided.

SWITCH	FUNCTION
1	ABORT (SHIP RIGHTS ITSELF AND RISES)
3	ROTATE LEFT
4	ROTATE RIGHT
POT 4	THRUST CONTROL

A low on fuel beep tone warns near end of game. Zero fuel is end of game.

Table I

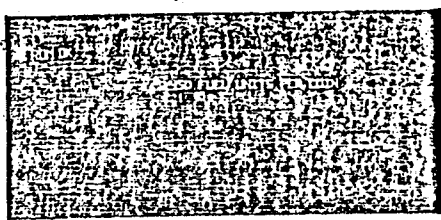
Name of Test/ Instructions	Result if Test Passes	Result if Test Fails
<p>1. Zero Page RAM Test</p>	<p>Select and Start switches light and stay lit. Screen is blank.</p> <p>Two short medium-high beeps are sounded (3000 Hz).</p>	<p>Screen stays blank and never displays any characters of Test 3.</p> <p>One or both beeps are very high pitch (6000 Hz); meaning bad RAM(s). 1st beep very high = bad RAM at location D2 on game PCB 2nd beep very high = bad RAM at location E2</p>
<p>2. Vector Generator (Screen) RAM Test</p>	<p>Four long medium-high beeps are sounded (3000 Hz).</p>	<p>One or more of the beeps are very high pitch (6000 Hz), meaning a bad vector generator RAM. 1st beep very high = bad RAM at M4 2nd beep very high = bad RAM at R4 3rd beep very high = bad RAM at N4 4th beep very high = bad RAM at P4</p>
<p>3. ROM Test</p>	<p>ROM OK appears in upper left corner of screen.</p> 	<p>☒ is displayed in upper left corner of screen, indicating bad or missing ROM at location N/P3 or PROMs at locations K4 and L4.</p> <p>OR</p> <p>One or more numbers 0 thru 27 will be displayed, indicating a bad ROM or PROM: see Identification of Faulty ROM Chips 1st on page 8</p>

TABLE III

Table I (cont'd)

Name of Test/ Instructions	Result if Test Passes	Result if Test Fails
<p>4. Option Display</p>	<p>Option settings are displayed in center of screen, as shown in photograph above.</p> <p>The first line shows one of 4 different numbers (see <i>Option Switch Settings</i> list on page 10) or an "X" to indicate free play setting. Message will be in one of four available languages.</p> <p>The second line shows the right coin mechanism factor — it will be 1, 4, 5, or 6.</p>	
<p>5. Thrust Control Test Push thrust control slowly towards rear of game.</p>	<p>The third line shows two characters: they should <i>increase</i>. "Flickering" numbers while control is at rest are unimportant and should be ignored.</p>	<p>Two characters don't change at all, or skip numbers, indicating a dirty potentiometer. <i>Decreasing</i> numbers as you push control means harness wires have been reversed. Thrust control at rest and numbers changing rapidly indicate harness wires are loose.</p>
<p>6. Lamp Audio, and LED Test</p>	<p>Four mission select lamps light sequentially from right to left. (<i>Instructions lamp is always lit.</i>)</p> <p>Engine thrust sound increases with each light from right to left. With <i>Training Mission</i> light on, you'll hear instead the crash sound. Now adjust volume for your location.</p> <p>Between the end and beginning of the four-light sequence, both <i>Select</i> and <i>Start</i> switches go on in unison for a moment.</p>	<p>One or more lights won't go on, indicating a defective light bulb.</p> <p>No engine thrust or crash sound means volume control too low, a defective speaker, loose speaker wires, or a problem in the audio circuitry.</p> <p>One or both of the <i>Select</i> and <i>Start</i> switches do not flash on, indicating bad LED switches or loose harness wires.</p>
<p>7. Switch Test Press each of these switches:</p> <ul style="list-style-type: none"> • 5 LED switches on control panel • 2 coin switch trip wires • slam switch on coin door 	<p>High beep is sounded for each change in switch state, i.e., a push and release should produce two beeps.</p>	<p>No beep indicates a defective switch or loose harness wires.</p>
<p>Slide the self-test switch towards the front of the game or off. Note that using the self-test will cause all the numbers at the top of the screen to reset to zeroes.</p>		

TABLE 11

Switch Settings on 8-Toggle DIP Switch (located at position P8 on the game PCB)								Results
8	7	6	5	4	3	2	1	
On On Off Off	On Off On Off	TOGGLE						450 fuel units per coin 600 fuel units per coin 750 fuel units per coin \$ 900 fuel units per coin
			Off On					
		UNUSED		Off Off On On	Off On Off On			* German instructions on screen * Spanish instructions on screen * French instructions on screen English instructions on screen \$
							On On Off Off	On Off On Off

9. Push Coin SW1 and Coin SW2.

Coin credits are registered as a multiple of the Fuel units per coin.

10. Push SW2.

This switch selects the relative degree of difficulty of game action.

LITE LEVEL ACTION

- | | | |
|---|----|---|
| 5 | 1. | Ship can be rotated 90 degrees right or left. Drag on ship represents low gravity for easy landing control. |
| 6 | 2. | Ship can be rotated 360 degrees right or left. |
| 7 | 3. | Stronger gravity. |
| 8 | 4. | Softer gravity and need counter thrust to stop rotation of ship. |

11. Play Game by Pushing Start.

Table III

Identification of Faulty ROM Chips

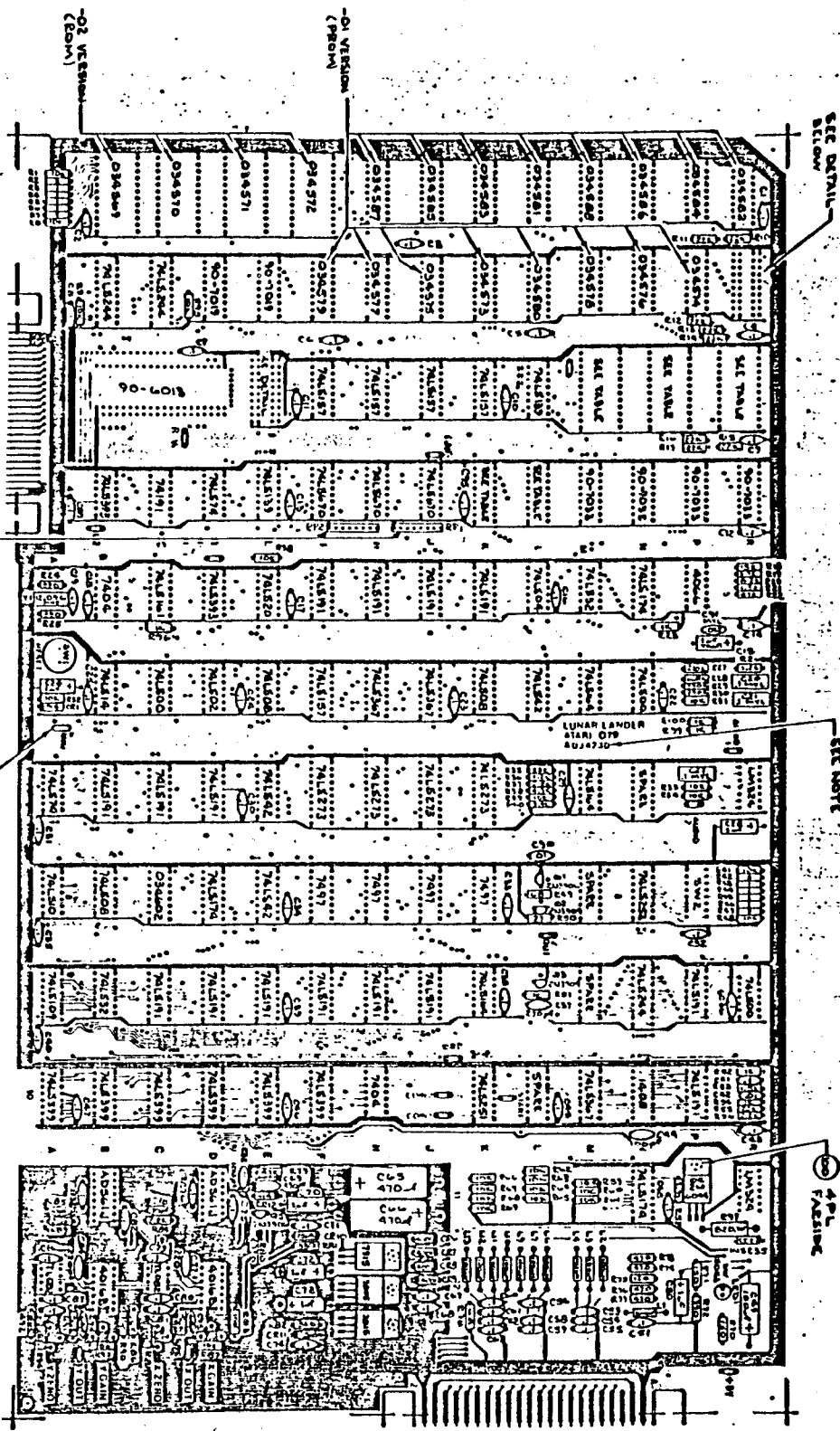
Display During Self-Test	-01 P.C. Boards (PROMs)	Alternate -01 P.C. Boards (PROMs)	-02 P.C. Boards (ROMs)
1 3 0 2		035176-01 K4	034599-01 R3
		035177-01 L4	
☒		035174-01 K4	034598-01 N/P3
		035175-01 L4	
9 11 8 10		034600-01 ¹ K4	034597-01 ¹ M3
		034601-01 ¹ L4	
13 15 12 14	034579-01 F2	034592-01 F2	034572-01 F1
	034580-01 L2	034596-01 H1	
	034587-01 H1		
	034588-01 M1		
17 19 16 18	034577-01 H2	034591-01 H2	034571-01 D/E1
	034578-01 M2	034595-01 J1	
	034585-01 J1		
	034586-01 N1		
21 23 20 22	034575-01 J2	034590-01 J2	034570-01 C1
	034576-01 N2	034594-01 K1	
	034583-01 K1		
	034584-01 P1		
No display at all	034573-01 K2 ²	034589-01 ² K2	034569-01 ² B1
	034574-01 P2 ²	034593-01 ² L1	
	034581-01 L1 ²		
	034582-01 R1 ²		

¹These chips contain only the French, German and Spanish messages. If the game is to be operated in the English language, you do not need to replace them. In fact, they may not even be supplied on a printed circuit board intended for use only in English-speaking areas. Thus in such a case you should ignore the 8 9 10 11 "bad" ROM message.

²ROM or PROMs must be in place for self-test to work.

NOTICE TO ALL PERSONS RECEIVING THIS DRAWING:
 COMPLETE REPRODUCTION OF THIS DRAWING FOR THE
 CORPORATION OF AMERICA, without the
 written permission of the Corporation, is prohibited.
 California. This drawing is only conditionally issued, and
 neither receipt nor possession thereof confers or transfers
 any right in, or license to use, the subject matter of the
 drawing or any design or technical information shown
 thereon, nor any right to reproduce this drawing or any part
 thereof, except for manufacture by vendors of parts, inco-
 porated and for manufacture under the Corporation's writ-
 ten permission. No right is granted by this drawing
 or any part thereof, in any patent or other intellectual
 property rights, in whole or in part, without the written
 permission of the Corporation.

NOTE:
 PERMANENT MARK -01 OR -02
 AFTER A034230 (-01 PGM, -02 BOM),



USE THIS TC POSITION
 IF INSTALLING 74LS545

USE THIS TC POSITION
 IF INSTALLING 74LS548

DETAIL
 FOR R1, R51

USE RESISTOR NETWORKS,
 ITEM 26, ONLY IF USING
 74LS170 IN P4, H4, J4.

100 10 PL

SEE NOTE

4 PL
 FASTEN

Figure 15 Lunar Lander PCB Assembly
 A034230-01 and -02 A

DESCRIPTION		PIN LOCATION	PIN #		DESCRIPTION
16.5 VCT GND	1	BV4		AH5, CH5, BJ5, AN5, AS4	
" "	A	BR6		BJ6, AT4, CH4, AJ2, AJ5	GND
POWER SOURCE	2	BV3		CH2, AV2	+5V
POWER SOURCE	B	BR5		CH3, AU6, AU4	+5V
		BV2			
		BR4			
		BV1			
AUDIO 2	D	BR3		BL2	INPUT 2
COIN COUNTER	5	BU6		AS2	DRIVER SIDE
AUDIO 1	E	BR2		BL1	INPUT 1
LAMP 2	6	BU5		AV5	LAMPS
POT IN	F	BR1		AG1	THRUST
START LED	7	BU4		AU5, AV1	LAMPS 2, 3
LAMP 4	H	BP6		AW3	LAMP 7
LAMP 3	8	BU3		AW1	LAMP 6
LAMP 5	J	BP5		AW5	LAMP 8
SELF TEST	9	BU2		Ab6	SWITCH 18
		BP4			
DIAG. STEP	10	BU1		AL6	SWITCH 8
SLAM	L	BP3		AN6	SWITCH 12
Z GROUND	11	BT6		BJ1, BN2, BN1, AT1	TO MOLEX (MON)
Z OUT	M	BP2		BJ2	" "
		BT5			
COIN 1	N	BP1		AS6	COIN SW. 1
START	13	BT4		AT6	START SW.
COIN 2	P	BN6		AT3	COIN SW. 2
AB	14	BT3		AH3	SWITCH 1
GAME SELECT	R	BN5		AH6	SWITCH 2
ROTATE LEFT	15	BT2		AJ3	SWITCH 3
ROTATE RIGHT	S	BN4		AJ6	SWITCH 4

MILLIPEDE SWITCH LIST

COIN L	COIN SW. 1
COIN R	COIN SW. 2
COIN AUX	START CREDIT SWITCH

COIN COUNTER L	1 ST GEAR
COIN COUNTER R	2 ND GEAR

SELF TEST	SW. 7
CABINET	SW. 15

START 1	SW. 1
START 2	SW. 2
START LED 1	AUX LIGHT 1
START LED 2	AUX LIGHT 2

FIRE 1	SW. 4
FIRE 2	SW. 5

UP 1	} JOYSTICK 1
DOWN 1	
LEFT 1	
RIGHT 1	

UP 2	} JOYSTICK 2
DOWN 2	
LEFT 2	
RIGHT 2	

PLAYER 1 / PLAYER 2	} SW. 16 + 17
STEERING SELECT	

HORIZ / VERT	} SW. 18
STEERING SELECT	

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4	CH4, AS6, AT3, AT6, AL3, AX3	REG/AUDIO BOARD
-SENSE	22	BS1	CG5	REG/AUDIO BOARD
+SENSE	21	BS2	CG6	REG/AUDIO BOARD
GND	A	BR6	CH5, AJ6, AK3, AP5, AH3, AH6	REG/AUDIO BOARD
+5V REG.	2	BV3	CH2	REG/AUDIO BOARD
+5V REG	B	BR5	CH3, AU3, AU5	REG/AUDIO BOARD
+22V	3	BV2	CJ1	REG/AUDIO BOARD
-22V	4	BV1	CJ2	REG/AUDIO BOARD
+10.3V UNREG	E	BR2	BF6	REG/AUDIO BOARD
COIN L	T	BN3	AS4	COIN SW. 1
COIN R	U	BN2	AT1	COIN SW. 2
COIN AUX	S	BN4	AT4	START CREDIT SWITCH
SELF TEST	17	BS6	AL2	SW. 7
+5V OUT	Y	BM4	AP2	STEERING BOARD. POWER
GND	Z	BM3	AA2, AA4, AA6, AB2, AB4, AB6, AC2, AC4	SW. COMMON
CABINET	16	BT1	AX2	SW. 15
START 1	14	BT3	AH2	SW. 1
START 2	P	BN6	AH5	SW. 2
FIRE 1	N	BP1	AJ5	SW. 4
FIRE 2	13	BT4	AK2	SW. 5
UP 1	11	BT6	AA5	JOYSTICK 1
DOWN 1	M	BP2	AA1	JOYSTICK 1
LEFT 1	9	BU2	AA3	JOYSTICK 1
RIGHT 1	10	BU1	AB1	JOYSTICK 1
UP 2	12	BT5	AB3	JOYSTICK 2

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION		CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
DOWN 2	J	BP5		AC1	JOYSTICK 2
LEFT 2	L	BP3		AC3	JOYSTICK 2
RIGHT 2	K	BP4		AB5	JOYSTICK 2
HORIZ. DIR. 1	5	BU6		AY4	STEERING 1
HORIZ. CLK. 1	C	BR4		AZ4	STEERING 1
VERT. DIR. 1	6	BU5		AZ1	STEERING 1
VERT. CLK. 1	D	BR3		A ^a 1	STEERING 1
HORIZ. DIR. 2	8	BU3		AY6	STEERING 2
HORIZ. CLK. 2	F	BR1		AZ6	STEERING 2
VERT. DIR. 2	7	BU4		AZ3	STEERING 2
VERT. CLK. 2	H	BP6		A ^a 3	STEERING 2
STEERING 1 STEERING 2 SELECT		A ^a 2		AC3	SW. 17
		AY5		A ^b 4	SW. 16
		AZ2		A ^b 6	SW. 16
		AZ5		AC1	SW. 16
		AP3		A ^b 5	SW. 18
HORIZ. VERT. STEERING SELECT		AP4		AC2	SW. 18
		AS2		AG3	GEAR SELECT COMMON
COIN COUNTER		AS3		BG1	COIN COUNTER POWER
SPEAKER OUT		BL4		AP6	AMP
SPEAKER OUT		BL5		AR2	AMP
START 1 LED	J19	PIN 3	30" HARNESS TO 24-POS. EDGE CONNECTOR	AU4	AUX LIGHT 1
START 2 LED	J19	PIN 4		AU6	AUX LIGHT 2
AUDIO 1	J19	PIN 2		BL1	INPUT 1
AUDIO 2	J19	PIN 1		BL2	INPUT 2

TEST SEQUENCE: MISSILE COMMAND

1. Switch to self-test mode.
 2. Verify that "1 Player Start" LED lights up, then "2 Player Start" LED lights up, then both light up.
 3. Verify that ROM OK, RAM OK, and MAP OK appear on screen.
 4. Verify that BAD CHIP does not appear.
 5. Press each pushbutton switch and verify that a sound is made and that the screen flashes:
 - a. 1 Player Start - SW1
 - b. 2 Player Start - SW2
 - c. alpha base (Player 1 and Player 2)-SW3
 - d. delta base (Player 1 and Player 2)-SW4
 - e. omega base (Player 1 and Player 2)-SW5
 - f. slam-SW8
 - g. left coin-SW10
 - h. middle coin-SW11
 - i. right coin-SW12
 6. (a) Move trackball (Player 1) up and down and left and right to verify that + moves on the screen.
(b) Press any Player 1 fire switch and verify that screen flips.
(c) Move Player 2 trackball and verify that + (cursor) moves in the same relative direction as the trackball.
(d) Press any Player 2 fire switch and verify that screen flips back to Player 1.
(e) Move steering select switch from A to B. Move trackball controls and verify proper movement of cursor as in 6 (a).
 7. Flip all option switches on bank at R10 on game board and verify that screen messages change.
- NOTE: Do not verify individual options, simply verify that messages on screen did change when switches were flipped.
8. Go into game play in 2 Player mode and defend one missile attack wave. Observe change to Player 2 at end of wave.
 9. Use scope probe to verify:
 - (a) COMP SYNC is present at J20-18
 - (b) HSYNC is present at J20-F
 - (c) VSYNC is present at J20-6
 10. END OF TEST



7/8/80

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4		CH4,AR1,AP5, BM1	
- SENSE	22	BS1		CG5	
+ SENSE	21	BS2		CG6	
+5V	2	BV3		CH2,AP2	
+5V	B	BR5		CH3	
AUDIO 2 OUT	5	BU6		BL2	
AUDIO 1 OUT	E	BR2		BL1	
+12V	20	BS3		CJ3	
-5V	19	BS4		CJ4	
GND	A	BR6		CH5, PIN 4	5 FEET CABLE
H SYNC	F	BR1		PIN 6	
V SYNC	6	BU5		PIN 5	
BLUE	L	BP3		PIN 3	
GREEN	M	BP2		PIN 2	
RED	10	BU1		PIN 1	
SW. COMMON	Z	BM3		AJ2,AJ5,AT1, AL5,Ab5,AH2	AH5,AK2,AT4, AS4, H.P19
+5V OUT	Y	BM4		AU3,AU5	
START LED 2	H	BP6		AU6	
START 2	13	BT4		AH6	SW. 2
START LED 1	P	BN6		AU4	
START 1	15	BT2		AH3	SW. 1
VTB DIR 1&2	T	BN3		AX3,P19-9	30"
VTB CK 1&2	16	BT1		AX6,P19-10	
HTB DIR 1&2	17	BS6		AX1,P19-K	
HTB CK 1&2	U	BN2		AX4,P19-L	

MONTE CARLO

COIN UP:

To coin up, press Sw.-10 and Coin 1 or Sw.-11 and Coin 2 or Sw.12 and Start Credit.

CONTROLS:

Sw.-1 Start Credit
Sw.-6 Track Select (easy, med., hard)
Sw.-15 Gas
Sw.-16 Slam (up for coin lockout)

LIGHTS:

Auxillary lights 1 and 2 are on only when the game is coined up.

TESTS:

Sw.-18 Diagnostic Test
Sw.-16 Step through enable
Sw.-1 Diagnostic Step through.

To step through Sw.-18 and Sw.-16 must be up, and Sw.-1 is pressed for each test.

Steps are from A to M.

- A. Background moves vertical, both cars in middle of picture.
- B. Background moves horizontal, to left and both cars in middle of picture.
- C. Background disappears slowly downward.
Player's car in middle moving in circles.
Drone car to lower right corner.
- D. Player's car in middle and Drone car moves horizontal to left.
- E. Player's car in middle and Drone car moves vertically.
- F. Player's car in middle and Drone car moves in circles in each corner.
- G. Audio bonus - loud beeps.
- H. Engine revs - slow to fast.
- I. Drone engine revs - slow to fast (not as loud).
- J. Engine sound idling.
- K. Screech audio.
- L. Crash audio loud to low idle.
- M. Color test.

MONTE CARLO

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION .	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
AUDIO 1	18	BS5		BL1	AUDIO REG. BD.
AUDIO 2	17	BS6		BL2	AUDIO REG. BD.
B/W VIDEO	13	BT4		BL6	MONITOR-CTS-1
H SYNC	L	BP3		PIN 6 CABLE	COLOR MONITOR
V SYNC	10	BU1		PIN 5 CABLE	COLOR MONITOR
VIDEO GND	R	BN5		BM1	MONITOR-CTS-1
BLUE	U	BN2		PIN 3 CABLE	COLOR MONITOR
GREEN	16	BT1		PIN 2 CABLE	COLOR MONITOR
RED	T	BN3		PIN 1 CABLE	COLOR MONITOR
1ST	M	BP2		AG4	ROTARY SWITCH
2ND	8	BU3		AG5	ROTARY SWITCH
3RD	11	BT6		AG6	ROTARY SWITCH
STEERING A	5	BU6		AP3	STEERING OUTPUT
STEERING B	E	BR2		AP4	STEERING OUTPUT
START LED.	9	BU2		AU3	AUX LITE 1
START SW.	12	BT5		AH3	SWITCH 1
TRACK SEL/LED	K	BP4		AU5	AUX LITE 2
TRACK SELECT	6	BU5		AK6	SWITCH 6
GAS SW.	F	BR1		AX2	SWITCH 15
L. COIN CTR	15	BT2		AM6	SWITCH 10
C. COIN CTR	S	BN4		AN3	SWITCH 11
R. COIN.CTR	14	BT3		AN6	SWITCH 12
LAM SW.	J	BP5		AY5	SWITCH 16
TEST SW.	P	BN6		Ab5	SWITCH 18
L. COIN	7	BU4		AS6	COIN SW. 1

NIGHT DRIVER

Variac #1: Not Used
Variac #2: 25.0

D.C. Power 9 VDC

Game Controls

Gears 1-4
Steering

S6 = Gas

S16 & S17 = Track Selection (3 options)

S15 = Diagnostic

Coin 1 and or Coin 2 & Start Credit = Game Start

PROGRAM PLUG WIRING DIAGRAM FOR UNIVERSAL TEST UNIT

GAME: NIGHT DRIVER

SET: VARIAC #1 @ NOT USED

SET: VARIAC #2 25 VA

CANNON DL - 156 CONNECTORS

NIGHT DRIVER PROGRAM PLUG

A CANNON

B CANNON

FUNCTION

T1	V1	COIN 2 C
S4	R3	COIN 1 C
P2, U1	U6	+5V STEER
G5	L6-R2	VIDEO HOT
G4	R1	2nd N.O.
Y2	M1-U4	VIDEO GROUND
Y3	P6	1st N.O.
G3	U3	TEST GROUND
G6	P5	TEST N.O.
p5, T5 Z5, a2, T4	U2	SHIFT C
R1	P4	3rd N.O.
P6	U1,	SWITCH GROUND
K6	P3	SPEAKER GROUND
T6	T6	SPEAKER
K5	P1	GAS GROUND C
Z6	T4	START N.O.
a3	N6	GAS N.O.
T2	T3	NOVICE TRACK
P3	N5	EXPERT TRACK
P4	T2	COIN 2 N.C.
S5	T1	STEER 1B
	N4	STEER 1A
	N3	COIN 1 N.C.
	B3-S2	25V AC C.T.
	B2-S4	25V AC
	B4-S3	25V AC
	V4-G4	16.5V CT GROUND
	R6-G5	16.5V CT GROUND
	V3-F6	+10V UNREG
	R5-G1	+10V UNREG
AU2	N2	LED START

NIGHT DRIVER

1. Turn + 5V Power Switch On. (Left Hand Side Of Video Display Monitor). SELF-TEST PROGRAM. S15, S16, S17, S18, S6, S7, All In Down Position, Gear In Reverse.

This Test Program Is Contained In The Regular Game Program, And Is Accessed By Throwing The "Test Switch": S15 To The "On" Position (Up). It Does Not Require That The Test Program And Buffer Board Be Plugged Into The Game Board (50 Pin Ribbon Cable Connector Does Not Have To Be Connected). The Video Display Should Be As Follows From Top Left Hand Side:

ABCDE----XYZ
 0123-----9
 Option 0 0 0 0
 Rom O.K.

1. (a) Option #, Display Will Depend On The Position Of Hex-Dec Switch (L10). With A Small Screwdriver Turn This Switch To Various Positions To Get Any Option Desired. Displays 0, 1, 2, --A, B, --F, One Character At A Time.
- (b) Switch M10 Setting Displayed Message. Game Set For Bonus Time Allowed (On SW #1)

#1-On/Off	1/0	Track Set (On SW #2)
#2-On/Off	1/0	Spare
#3-On/Off	1/0	
#4-On/Off	1/0	More Difficult Bonus (On SW. #4)

2. SWITCH TEST

Turn CB3 And CB4 On (Front Panel Of Video Display Monitor) Volt #2-25.0. This Test Verifies That The MPU Is Capable Of Recognizing A Switch Closure. This Portion Of The Test Automatically Follows Successful SELF-TEST-PROGRAM. Any Switch (Or Switches) Which Are Activated Will Cause The Screech Audio To Be Turned On. The Switches Examined In This Test Include:

GEAR 1st
 GEAR 2nd
 GEAR 3rd
 GAS S6
 NOVICE S16
 EXPERT S17
 COIN 1
 COIN 2
 START/CREDIT SWITCH

If All Of These Switches Are In Their "Unactivated" Position, There Should Be No Screech Audio. Test One Switch At A Time For Screech Audio.

3. STEERING CHECK

Move Steering Wheel Clockwise And Counter-Clockwise To Make Sure Other Displayed Objects On Screw Moves "Right" And

"Left". The Movement Should Be Smooth And Not Jerky.

3. (a) TO START GAME

The Following Table Gives Various "Coin" And "Players" Mode On Different Setting Of L10 (Hex-Dec SW).

<u>HEX-DEC SW POSITION</u>	<u>NO. OF PLAYS</u>	<u>COINS</u>	<u>GAME TIME</u>
0	2 Plays	25¢	50 Sec.
1	1 Play	25¢	50 Sec.
2	1 Play	25¢	50 Sec.
3	1 Play	50¢	50 Sec.
4	2 Plays	25¢	75 Sec.
5	1 Play	25¢	75 Sec.
6	1 Play	25¢	75 Sec.
7	1 Play	50¢	75 Sec.
8	2 Plays	25¢	100 Sec.
9	1 Play	25¢	100 Sec.
A	1 Play	25¢	100 Sec.
B	1 Play	50¢	100 Sec.
C	2 Plays	25¢	125 Sec.
D	1 Play	25¢	125 Sec.
E	1 Play	25¢	125 Sec.
F	1 Play	50¢	125 Sec.

(b) For Setting M10 Switch.

#1 Sw. On/Off	Bonus Time Allowed./No Bonus
#2 Sw. On/Off	Track Set/Track Set Off.
#3 Sw. Not Used	
#4 Sw. On	More Difficult Bonus

(c) Push Coin Switch As Required From Table (A) And Start . Credit Light Should Come In. Push Start Button And Game Should Be "On".

(d) MOTOR AUDIO
Use R17 (20k Pot) And R14 (100k Pot) To Adjust Motor Audio By Actual Hearing Test.

(e) Game Will Display: High Score ∅ ∅ ∅ Top Speed ∅ ∅ ∅
Your Score ∅ ∅ ∅ Top Speed ∅ ∅ ∅

(a) Second Row Displaying "Your Score" And "Top Speed" Are Current Player Score And Speed.

(b) First Row Display Of "High Score" And Top Speed: Are The Highest Score And Top Speed Of The Last Player.

(c) End Of Game Will Flash As "Game Over".

ORBIT

1. VOLTAGES REQUIRED:

- A. Variac 1 Not Used.
- B. Variac 2 25.0 51%.
- C. D.C. Preset Power Supply 10.0 D.V.C.

2. CREDIT LAMPS:

- A. Credit Lamp #1 LED 5 Volts 10 M.A.
- B. Credit Lamp #2 LED 5 Volts 10 M.A.
- C. Credit Lamp #3 LED 5 Volts 10 M.A.
- D. Credit Lamp #8 LED 5 Volts 10 M.A. (Check Polarity)

3. SWITCHES, CONTROLS & CIRCUIT BREAKERS:

- A. Master Power CB's 1, 2 & 4 - Not Used.
- B. Universal Expansion Module Toggle Switch.
- C. Coin 1 & 2.
- D. S-18 (Diag.).
- E. S-6 Audio.
- F. S-5 Slam.

4. SWITCH LOCATIONS & SETTINGS:

Program Option Switch At M-10, All On Will Read 00:30 (Thirty Seconds) PER COIN. INSERT COINS Goes From Thirty Seconds To Four Minutes. Switch #1, 2 & 3 For Time; 4 & 5 For Language, 6 For Free Play, 7 & 8 Not Used.

- 5. Program Switch At L-11. Switch #2 For (Diag.), #3 For Test.

6. POWER UP:

- A. Turn On CB's 1, 2 & 4 (3 Not Used).
- B. Turn On Toggle Switch Located On The Universal Expansion Module.
- C. Game Video Will Appear In "Attract Mode." Check For Glitching, Horizontal & Vertical Sync. Credit Lights 1, 2, 3 Blinking, 8 Stays On.

7. DIAGNOSTIC:

- A. Place Toggle Switch S-18 Up, H's On Screen. Two Beeps Followed By 8 More Beeps. Then Graphics Will Appear On Screen, Four Rows Of The Alphabet. The First Row Will Read Frontwards, The Second Row Backwards, The Third Row Frontwards, And The Fourth Row Backwards. There Are 4 Rows Of Numbers 0-9, Two Sets Of Four, One Small And One Large. The Letters OK Will Be At The Left Center Of The Screen And A Fat And A Skinny Z Sort Of Thing At The Bottom Center Of The Screen.
- B. Press S-1 On Control Box. A High Tone Will Sound And Letter A Will Appear Above The Word OK. Tone And Number 9 Above 0, S-38, S-47, S-56, S-65, S-74, S-83, S-92, S-101, S-110. Every Tone Will Change From High Tone To Low Tone With Each Switch. A Cricket Like Sound On S-12 Through S-22 Also On Coin I & II, S-5, S-6 Up Audio In Second Channel.
- C. Put Switch #2 On, P.C.B. Location L-11. Goes In Self Test Graphics At Top Of Screen. 16 Z's Horizontally Across Screen. Press And Hold S-8 On Master Control. Graphics Will Start Moving Vertically, Bottom Up. Release And Hold, Graphics Will Go Diagonally Across Screen, Release And Hold, Graphics Will Change To Broken Up Spaceships Changing All The Time. Press And Hold, Graphics Get Smaller And Only Small Bits Of Atari Spell Out. Press One More Time, Graphics Change Back To H's And Two Tones Are Followed By 8 Tones. Put Switch #2 Off At L-11, S-18 Down.

END TEST

CONTROL BOX FOR ORBIT

1. S-1 Game Reset (Select Game)
2. S-2 Fast Speed, No Space Stations, Stars And Floating Rocks, Medium Speed Rockets. Heavy Gravity Pull.
3. S-3 Same As S-2 (Strange Gravity Pull).
4. S-4 Same As 2 & 3, Less Gravity Pull.
5. S-5 Is A Slower Game Mode.
6. S-6 Faster Gunfire, Slower Gravity Pull.
7. S-7 Faster Gunfire, Slower Gravity Pull.
8. S-8 Medium Gunfire, Release Thrust Slows You.
9. S-9 Space Stations, Stars, Deathstar Fast Speed, Medium Gunfire.
10. S-10 Slower Speed Stops When Releasing Thrust, Medium Gunfire.
11. S-11 Same As S-10. Slower Gunfire.

All This Must Use S-1 First, Then Game Select.
S-2 Through S-11 (Start Credits)

OPTIONS DURING GAME MODE

1. S-5 For Stars
2. S-6 For Score & Fuel, Rockets
3. S-7 Space Stations
4. S-8 Visible Star & Invisible Star
5. S-9 No Gravity Pull
6. S-10 Gravity Pushes Away
7. S-11 Bouncing Walls

OUTLAWTEST FIXTURE REQUIRED:

1. CTS-1: Variac #1 At 16.5 VAC: Variac #2 At 25 VAC.
2. Two Cables Required (Test Fixture) (D & E).
3. Outlaw Gun/Light Fixture Harness.
4. Outlaw Gun.
5. Program Plug For Outlaw.

Turn The Game "On". The Video Display Consists Of White And Black Score. Gunfighter Should Run In, Stop And Turn, Draw And Fire. Depending Upon Switches (B5) Start The Game, By Coin And Start Button. Check For Gunfighter Running Audio. Turn Off Power And Connect Outlaw Gun As Shown In Harness Diagram. Perform The Following Test For Complete Digital P.C.B. Check Out.

NOTE: All Pots Set At 1/2; At Switch Open - "0", Closed - "1". All Switches To Open (B5).

STEPS FOR TEST PROCEDURE:

1. Close Switch #8 And #5.
2. Start Game, Check Gun Audio.
3. Pulse Up White Score To 20 Points - A1, Pin 14.
 Point Skill Level 6 - Dude
 12 - Green Horn
 16 - Top Gun
4. Pulse Up Black Score To 20 Points - C2, Pin 14.
5. Check Stat Mod - Q14.
6. Close Switch #3 (Replay At 12 Points).
 A. Restart Game Pulse White Score To 12 Points.
 B. Using Video Probe (Hooked Up To Coin Counter) Run Clock Out J8, Pin 6. No Replay Should Happen.
7. Close Switch #1, Repeat Step 6 (You Should Get A Replay). Push Start Button To See If Game Will Start, If So, Turn Game Off And Go To Step 8.
8. Open Switch #3.
9. Close Switch #4 (Replay At 16 Points).
 A. Restart Game, Pulse White Score To 16 Points - A1, Pin 14.
 B. Using Video Probe (Hooked Up To Coin Counter) Run Clock Out J8, Pin 6. No Replay Should Happen.
 C. Close Switch #4 (Replay At 16 Points).
10. Close Switch #2.
 A. Start Game And Pulse White Score To 16 Points.
 B. Holister Gun And Draw Before Gunfighter Stops Running (Coward's Draw).

- C. Run Timer Out With Video Probe - J8, Pin 6, (You Should NOT Get A Free Play).
11. Close Switch #7: *NOTE: Black Score Must Be At Zero. Repeat Step 10, Although You Should Now Get A Free Play When Timer Is Pulsed Down. Turn Game Off.
12. Open Switches #2 And #7.
- A. Restart Game. Check Modes (1) Slow, (2) Medium And (3) Fast As Follows:
- Slow: 1. Program Slow. Start Game With S5 & S8 (On CTS-1) Open (Not Pressed).
 2. Holster Gun.
 3. Gunfighter Should Run Out, Stop And Turn, Draw And Fire, Score 1 Point.
 4. Reholster Gun, When Gunfighter Runs Out, Shoot Him And Make Sure He Dies.
- Medium: 1. Program Medium. Start Game With S5 (On CTS-1) Pressed. Release S5 After Start.
 2. Gunfighter Should Draw Faster Than Slow Speed But Not As Fast As Fast Speed.
 3. *Check Draw Speed Pot, Set At 1/2.
- Fast: 1. Program Fast. Start Game With S8 (On CTS-1) Pressed. Release S8 After Start.
 2. Gunfighter Draws Very Fast (You Should Only Have About 1 Second To Draw And Shoot Him). Turn Game Off.
13. Open Switch #8.
- A. Start Game.
 B. Run Out Timer With Video Prob - J8, Pin 6. Game Should End And Go Into Track Mode But Credit Light Should Stay On.
 C. Push Start Button To See If Game Will Start.
 D. Run Out Timer With Video Probe - J8, Pin 6.
14. Open All Switches.
15. Close Switch #6.
- A. Start Game.
 B. Pulse Up White Score - A1, Pin 14.
 Point Skill Level 14 - Dude
 24 - Green Horn
 34 - Top Gun
- C. Turn Game Off.
16. Close Switch #5. (Now Both #5 And #6 Should Be Closed).
- A. Start Game.
 B. Pulse Up White Score - A1, Pin 14.
 Point Skill Level 16 - Dude
 26 - Green Horn
 36 - Top Gun
- C. Turn Game Off

POOL SHARKUniversal Test Fixture

Variac #1 (Auxiliary Power Supply)
 Variac #2 28.0 V
 JS3 Cue Ball Movement
 S18 UP-Self Test
 (See Self Test Instructions At The End Of Time Write-Up)
 S8 Start 2
 S15 DOWN-Player One
 UP-Player Two
 JS3 Cue Ball Movement: Cue Ball Will Be Stationary When The
 Joystick Is Centered And Will Move Symmetrically With The
 Joystick Up, Down Right, Left And Angle Directions.

Board Controls:

Dip Switch: (4 Position, Location H7)
 1 & 2 Off: One Coin Each
 1 On 2 Off: One Coin Two Games
 1 Off 2 On: One Coin One Game
 1 & 2 On: Two Coins Each
 3 & 4 Off: Two Racks
 3 Off 4 On: Three Racks
 4 Off 3 On: Four Racks
 3 & 4 On: Five Racks
 Volume Control: (In A & B 10 Circuit) Controls Audio Volume
 Reset Switch: A6 & A7 Resets Game To Attract Mode
 Pot 1-4 (D-10 Circuit): Cue Ball Movement Adjusts

Objects:

Cue Ball, White, Left Center Of The CRT. Rack Of Balls, 1-15 In
 Rack Formation Opposite The Cue Ball; 1-8 Solid, Q-15 Striped.

CUE BALL

		11
	7	
	4	12
2	8	
1	5	13
3	9	
	6	14
	10	
		15

Display:

Attract

Player 1

Player 2

0 0

0 0

RACK

TIME

GAME OVER ----- FLASHING

Selected By
Dip Switch

X Rack Game

Coin

Player

Player 1

Player 2

Game: 00 Rack
1

Time 00
30

FLASHING

Game Procedure:

Power On, Coin And Start As Per Dip Switch Selection And Video Instructions. Move The Cue Ball With JS3 To Break The Rack, Pursue The Numbered Balls With The Cue Ball As To Sink Them Into Any Of The Six Pockets Of The Table. Time Will Count Down At A Fixed Rate From 30 Upon "Scratching", The Cue Ball And The Rack Will Reset To The Original Position And The Rack Counter Will Increment Until The Number Selected Via The Dip Switch Has Been Attained, And The Game Will Go Into Attract.

Scoring:

One Point Per Ball Sunk (Regardless Of The Number Value On The Ball). The Score Will Continue Into The Succeeding Rack.

Audio:

"Click" When Either Cue Ball Hits Numbered Ball Or When The Balls Hit Themselves.
"Bump" Soft Tone When The Numbered Balls Into Any Rail.
"Scratch" When The Cue Ball Falls Into Any Pocket. Audio Is A Medium Tone Of Short Duration.
"Score Wail" When Any Numbered Ball Is Sunk, Like The Pull Of A Zipper Giving Low To High.

Self Test:

With Switch S18 And S15 Down, The CRT Will Display "Test Ok" (Memory Test) And Either "P1 Aligned" Or "Not Aligned". Adjust P1 On The Board For P1 Aligned (All Pot Adjustments Are Accompanied By An Audio Tone That Extinguishes Upon "Alignments" Display). Follow Display Instructions For P2 And Align As Above. With S15 Up Now, Adjust P3 And P4. Upon Successful Alignment Of P4, The Display Will Read "Test Complete", And Switch S18 Down. These Pots Are For Proper Cue Ball Movement.

TRECH TIP

from the ATARI FIELD SERVICE DEPARTMENT



April 14, 1983

POLE POSITIONTM

CTF-1 MOD

The following modification should be performed to any CTF-1 that has insufficient current capability to produce an adequate five volts.

Board: Audio/Regulator PCB

Procedure:

1. Find the 0.1-ohm, 7-watt resistor, R24, on the audio/reg. PCB and parallel another 0.1-ohm, 7-watt resistor across it.
2. Connect a 27,000 UF, 16-volt capacitor between the 10.6 volt and ground lines. Note: These are the same points that the big blue capacitor already on the CTF-1 is wired to.

Note: According to Engineering, the above 2 steps should suffice in fixing most 5-volt problems. If you are still having trouble, the following additional steps will help.

3. Change R3 from 33 ohms to 5.6 ohms ($\frac{1}{4}$ watt).
4. Change R1 from 270 ohms to 47 ohms ($\frac{1}{4}$ watt).
5. Replace R30 (10 ohms) with a 1N4001 Diode, Cathode to +5 volt RTN.

Note: Please see attached schematics.

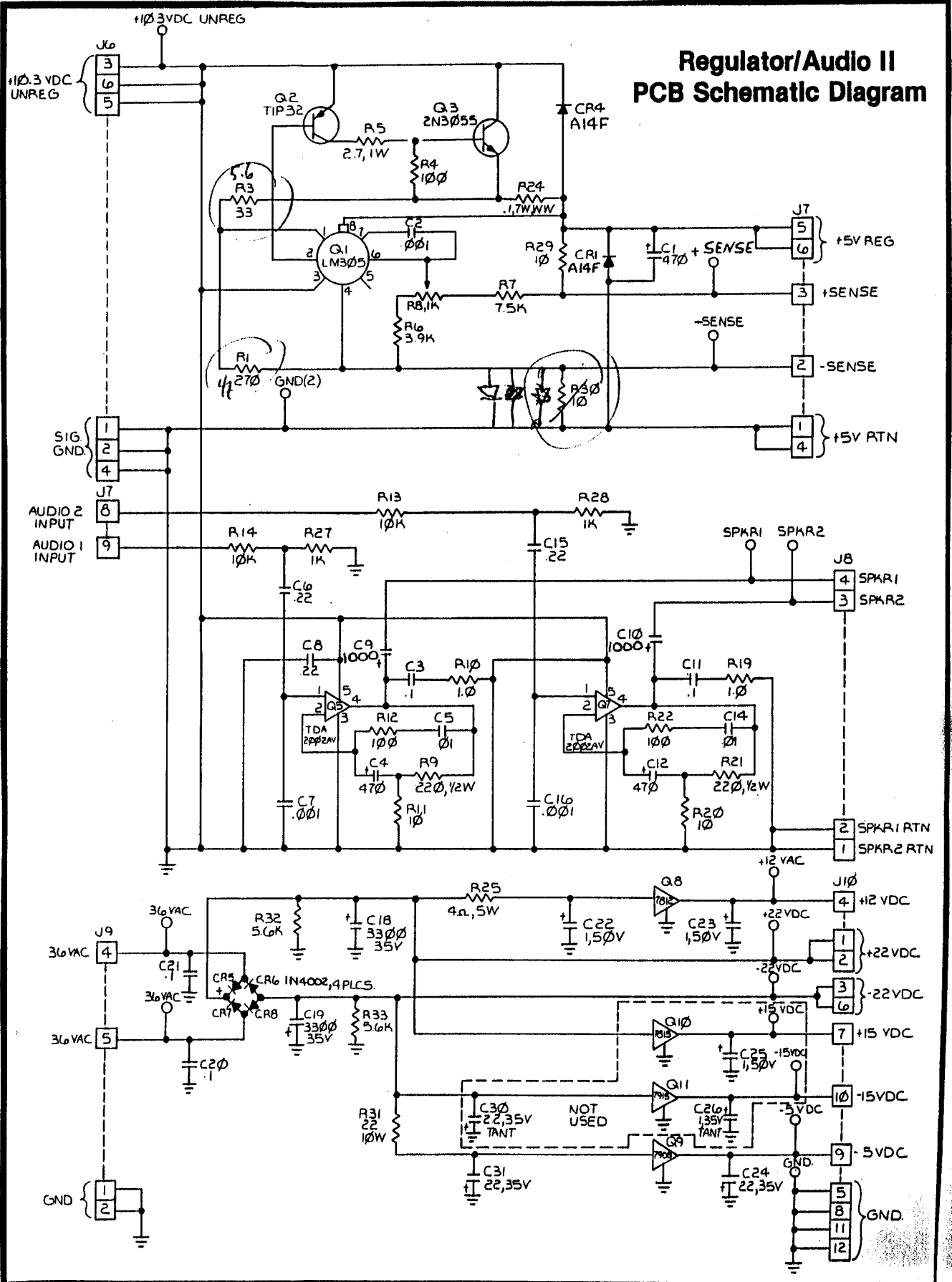
FOR FURTHER INFORMATION CALL:

(800) 538-1611
(408) 745-2900

15175 (3/83)



Regulator/Audio II PCB Schematic Diagram



POLE POSITION (DOMESTIC)

SWITCH LIST

COIN 1
COIN 2
COIN COUNTER L
COIN COUNTER R

COIN SW. 1
COIN SW. 2
1ST GEAR
2ND GEAR

TEST
SERVICE

SW. 7
SW. 6

SOUND 1
SOUND 3

SW. 15 DOWN
SW. 15 DOWN

SOUND 2
SOUND 4

SW. 15 UP
SW. 15 UP

STEERING 1
STEERING 2

STEERING BOARD
STEERING

SHIFTER
GAS
BRAKE

SW. 18
POT 3
SW. 5

44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION		CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4	30-PIN HARNESS TO 30-PIN EDGE CONNECTOR	CH4, J19 PIN 1	R/A BOARD
- SENSE	22	BS1		CG5, J19 PIN 15	R/A BOARD
+ SENSE	21	BS2		CG6, J19 PIN 14	R/A BOARD
GND	A	BR6		CH5, J19 PIN A	R/A BOARD
+5V REG.	2	BV3		CH2, J19 PIN 2	R/A BOARD
+5V REG.	B	BR5		CH3, J19 PIN B	R/A BOARD
SOUND 1 +	T	BN3			AX1
SOUND 3 +	18	BS5		AX4	SW. 15 DOWN
AUDIO GND	U	BN2		CJ5 ^{N.C.P.}	R/A BOARD
SOUND 2 +	15	BT2		AX3	SW. 15 UP
SOUND 4 +	16	BT1		AX6	SW. 15 UP
START \emptyset	7	BU4		BP2	START 1
GND	E	BR2		AK5, AL2	SW. COMMON
SERVICE	10	BU1		AK6	SW. 6
COIN 1	11	BT6		AS6	COIN SW. 1
COIN 2	L	BP3		AT3	COIN SW. 2
GND	D	BR3		AS4, AT1	SW. COMMON
COIN COUNTER L	9	BU2		AG4	1 ST GEAR
COIN COUNTER R	J	BP5		AG5	2 ND GEAR
TEST	K	BP4		AL3	SW. 7
STEERING 1	8	BU3		AP3	STEERING BD.
STEERING 2	H	BP6		AP4	STEERING. BD.
+5V OUT	Y	BM4		AP2	STEERING BD.
GND	Z	BM3		AP5	STEERING BD.
GEAR SELECT COMMON		AG3		AS2	COIN COUNTER

POLE POSITION (EUROPEAN)

POT 3 — GAS
SW. 5 — BRAKE
SW. 18 — SHIFTER
STEERING BD — STEERING
AUX LITE 3 — LOCKOUT

COIN 1 — COIN SW. 1
COIN 2 — COIN SW. 2

SERVICE — SW. 6

COIN COUNTER 1 — SW. 15 DOWN
COIN COUNTER 2 — SW. 15 UP

TEST — SW. 7

SPEAKER 1 — 1ST GEAR
SPEAKER 2 — 2ND GEAR
SPEAKER 3 — 3RD GEAR
SPEAKER 4 — REVERSE

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	J	BP5	CH4, AP5, AV1, A ^b 5	R/A BOARD
+ SENSE	15	BT2	CG6	R/A BOARD
- SENSE	V	BN1	CG5, P1 PIN 7	R/A BOARD
GND	P3	PIN 2	CH5, P2 PIN 2	R/A BOARD
+5V REG.	P3	PIN 3	CH2, P2 PIN 3	R/A BOARD
+10.3V UNREG.	P3	PIN 1	BF6, P2 PIN 1	R/A BOARD
VOL. VCC	14	BT3	AF5, AK2	BRAKE, GAS VCC
VOL. GND	12	BT5	AF3	POT 3 RETURN
BRAKE	13	BT4	AK3	SW. 5
GAS	P	BN6	AF4	POT 3 WIPER
START \emptyset	F	BR1	BU5	START 1
HIFTER	7	BU4	A ^b 6	SW. 18
STEERING DIR.	U	BN2	AP3	STEERING
STEERING CLK	17	BS6	AP4	STEERING
+5V OUT	S	BN4	AP2	STEERING BOARD POWER
LOCKOUT	B	BR5	AV2	AUX LIGHT 3
COIN 1	E	BR2	AS6	COIN SW. 1
COIN 2	5	BU6	AT3	COIN SW. 2
GND	18	BS5	AS4, AT1	SW. COMMON
SERVICE	D	BR3	AK6	SW. 6
COIN COUNTER 1	C	BR4	AX1	SW. 15 DOWN
COIN COUNTER 2	3	BV2	AX3	SW. 15 UP
SW. 15 COMMON		AX2	AS2	COIN COUNTER
COIN COUNTER POWER		BG1	AS3	COIN COUNTER
TEST	4	BV1	AL3	SW. 7

QUACK

- A. Power Up CB's 1,2,3,4
Set Voltages (VC 16.5 & 25.0)
- B. In Attract Mode: Duck Should Be Flying Randomly Across Screen At Full Size, And Slowly Fading. Audio Will Be On Until Laser Gun Is Plugged In (At L1).
- C. To Start Game: Push Coin 1 (Once), Start Credit Button Will Light. Push Start Credit To Start Game. (Button Will Stay Lit).
- D. To Adjust Laser Shot: Turn Pot A (Located On Component Side At K-2) Until Shot Fires Straight On Screen.
- E. To Adjust Quack Audio: Turn Pot B (Located At B-8) Component Side For Good Audio (Quacks Evenly Spaced).
- F. Three Shots Allowed Per Duck (Between Appearing And Fading). After Each Hit, Duck Will Nose Dive Towards Bottom Of Screen. Dog Will Appear And Travel Across Bottom Of Screen From Right To Left And Duck Image Should Appear On Screen (Top Left) For Each Duck Hit.

*To Check Score, Short Together Pin 1 & 2 Of F-8. Ducks Will Fall Constantly 12 Or 16 Ducks.

QUANTUM X-4 SWITCH LIST

COIN L	COIN SW. 1
COIN R	COIN SW. 2
COIN AUX	START CREDIT SW.
COIN COUNTER L	1 ST GEAR
COIN COUNTER R	2 ND GEAR

SELF TEST	SW. 7
-----------	-------

START 1	SW. 1
---------	-------

START 2	SW. 2
---------	-------

PLAYER 1 LED	AUX LIGHT 1
--------------	-------------

PLAYER 2 LED	AUX LIGHT 2
--------------	-------------

PLAYER 1 PLAYER 2 STEERING SELECT	} SW. 16 & SW. 17 (DOWN - PLAYER 1) (UP - PLAYER 2)
--	---

HORIZ/VERT. STEERING SELECT	SW. 18 (UP - VERT.) (DOWN - HORIZ.)
--------------------------------	---

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4	CH4	R/A BOARD
- SENSE	22	BS1	CG5	R/A BOARD.
+ SENSE	21	BS2	CG6	R/A BOARD
GND	A	BR6	CH5	R/A BOARD
+5V. REG.	2	BV3	CH2	R/A BOARD
+5V. REG.	B	BR5	CH3	R/A BOARD
+22V DC	3	BV2	CJ1	R/A BOARD
-22V DC	4	BV1	CJ2	R/A BOARD
+10.3V UNREG.	E	BR2	BF6	R/A BOARD
COIN L	J	BP5	AS6	COIN SW. 1
COIN R	9	BU2	AT3	COIN SW. 2
COIN AUX	L	BP3	AT6	START CREDIT SWITCH
COIN COUNTER L	15	BT2	AG4	1 ST GEAR
COIN COUNTER R	S	BN4	AG5	2 ND GEAR
GEAR SELECT COMMON		AG3	AS2	COIN COUNTER
COIN COUNTER POWER		BG1	AS3	COIN COUNTER
SELF TEST	10	BUI	AL3	SW. 7
SW. GND.	Z	BM3	AT4, AT1, AS4, AP5, AL2, AH5, AH2	SW. COMMON
START 1	11	BT6	AH3	SW. 1
START 2	M	BP2	AH6	SW. 2
PLAYER 1 LED	N	BP1	AU4	AUX. LIGHT 1
PLAYER 2 LED	14	BT3	AU6	AUX. LIGHT 2
+5V OUT	Y	BM4	AU5, AU3, AP2	STEERING BOARD, AUX LIGHT POWER
AUDIO 1	13	BT4	BL1	R/A BOARD
AUDIO 2	12	BT5	BL2	R/A BOARD

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
AMP		BL4	AP6	SPEAKER
AMP		BL5	AR2	SPEAKER
HORIZ. DIR. 1	H	BP6	AZ4	STEERING 1
HORIZ. CLK. 1	G	BU5	AY4	STEERING 1
VERT. DIR. 1	5	BU6	AZ1	STEERING 1
VERT. CLK. 1	F	BR1	A ^a 1	STEERING 1
HORIZ. DIR. 2	C	BR4	AY6	STEERING 2
HORIZ. CLK. 2	8	BU3	AZ6	STEERING 2
VERT. DIR. 2	D	BR3	A ^a 3	STEERING 2
VERT. CLK. 2	7	BU4	AZ3	STEERING 2
PLAYER 1	SW. 17	A ^a 2	A ^c 3	
PLAYER 2	SW. 16	AY5	A ^b 4	
STEERING	SW. 16	AZ2	A ^b 6	
SELECT	SW. 16	AZ5	A ^c 1	
HORIZ. / VERT.	SW. 18	A ^b 5	AP3	STEERING BOARD
STEERING SELECT	SW. 18	A ^c 2	AP4	STEERING BOARD
X OUT	19	BS4	BJ3	B/W X-Y MONITOR
Y OUT	20	BS3	BJ4	B/W X-Y MONITOR
BLUE	17	BS6	BN1, BN3, BJ2	COMP. Z OUT.
VIDEO RETURN	16	BT1	BJ1	B/W X-Y MONITOR

SKY DIVERI. TOOLS NEEDED:

- A. Program Plugs A, B & C For Sky Diver
- B. Edge Connector Harness (44 Pin)

II. POWER SETTINGS:

- A. Variac #1 Not Used
- B. Variac #2 25 VAC
- C. Master Power CB's 1 & 2 -9.5 VDC

III. VISUALLY INSPECT BOARD FOR ANY WORKMANSHIP DEFECT

IV. POWER UP:

- A. Turn On CB's 1, 2, & 4 On Master Power Panel
- B. Set Variac #2 For 25 VAC
- C. Insure Switches Inside Left Panel Of Test Fixture Are On

CAUTION: TOUCH ONLY THE SWITCHES. HIGH VOLTAGE IS PRESENT INSIDE CABINET.

V. TEST PROCEDURE:

A. Self Test:

1. Set Dip Switch F10 Position 3 And 6 Off. All Other Positions On. Set Dip Switch D12 Position 4 Off, 1-3 On.
2. S18 Should Be Up.
3. Pressing Following Switches Should Give An Audio Tone: Coin 1, Coin 2, S1, S2, S3, S4, S5, S8, S12, JS1, JS2, And All Switches On Dip Switch F10. (Remember To Set F10 As In Step 1 When Finished).
4. Auxiliary Lights In Pos. 1-5 On Upper Auxiliary Panel, And Lights 1-8 On Master Control Panel Should All Light Up. (L.E.D.'s Should Be Installed In Pos. 1, 2, 5, 6 On Master Control Panel).
5. Pos. 1 On Dip Switch D12 Is Used To Advance Diagnostics.

B. Game Play:

1. Auxiliary Lights 2, 3, 4, 5 On Upper Auxiliary Panel And 3, 4, 7, 8 On Master Control Panel Strobe In Game And Attract Mode.
2. The Screen Should Have A Picture Of Two Airplanes, Two Sky Divers And Two Targets. The Alphanumerics Indicate The Individual Score Of Each Sky Diver, High Score, Coin Per Player, And Credit, Number Of Misses Per Player And Extended Play.
3. Press Coin 1 And Lights 5 And 6 On Master Control Panel Flash. Press S1 (S1 Starts Black Plane) Light 2 On Master Control Panel Will Flash Until S3 Is Pressed And Sky Diver Will Fall. Press S5 And Parachute Will

SKY DIVER (Cont.)

Open. Use JS1 To Guide To Target.

4. Press Coin 2 And Lights 5 And 6 On Master Control Panel Flash. Press S2 (S2 Starts White Plane) Light 1 On Master Control Panel Will Flash Until S4 Is Pressed And Sky Diver Will Fall. Press S8 And Parachute Will Open. Use JS2 To Guide To Target.
5. Ambulance Will Appear If Parachute Fails To Open.

SKY RAIDERTEST FIXTURE SETTINGS:

Variac #1 Not Used.
 Variac #2 53% Or 25 Volts A.C.

D.C. Voltage 9.5 Volts D.C.

TOOLS NEEDED:

One Program Plug Sky Raider (A & B 2 Plugs).

CONTROLS USED: (CTS-1 Control Panel Test Fixture).

- a) CB 1, 2, & 4Variac 2 & D.C. Power (Master Power).
- b) Coin 1 & Coin 2 ..Coin Mechanisms & Counter.
- c) Start CreditGame Start.
- d) S8.....Rocket.
- e) S5.....Slam (Tilt).
- f) JS3.....Steering & Speed.
- g) S18.....Diagnostic Test.

SWITCH SETTINGS: (On Board)

8 Button Option Switch L9: 5 Off.
 16 Position Hexi Decimal Switch K10: Set On 1 Reset Button.
 H10 To Reset Game Reset Button.

OPTION SW 5 SHOULD ALWAYS BE OFF OR PLAYFIELD WILL ROLL

TEST #1: DIAGNOSTICS

Plug In Board . . Power Up CB1, 2, & 4 Game Video Should Come On In "Attract Mode." Set Switches On The Board In The Following Manner: Option Switch L9, 5 Off. The Black Hexi Decimal Switch K10 Should Be Set At #1. These Settings Should Give You 1 Coin Per Game. Bonus For 13,000 Points. Check For Bonus On Video Alternating With HI Score Video Under Game Over Video Blinking (Right Side Of Screen). Move Toggle Switch S18 (Diagnostics) To The Up Position. In Diagnostic Mode Credit Light #1 Will Stay On Extinguishing When S18 Is Off. Attrack Mode Video Should Stop And Video Should Be: Terrain Stopped, 4 Stacked Rocket Videos From Top Center To Middle Center Largest At Top Smallest At Bottom. To The Right Of Terrain There Should Be An Oil Refinery, Bridge, Jet, & Castle Shaped City. On The Lower Left Side Of The Screen Is Bonus, Bertical, & Horizontal With Two Diggits To The Right Of Them. These Should Count (Hexi Decimal) When The Joystick Is Moved Either Up, Down, Left, Or Right. On Lower Right Side Should Be Count 00 Top, Time 90 Middle, Coin 1 At Bottom. All Of These Graf-fics Should Be Inverted & Upside Down.

CONTROL PANEL SWITCH TEST: (Diagnostics)

Pressing Coins 1 & 2 Should Give You A Rocket Audio & Coin Counter Click & Count Video Graffics 00 Count (By Ones) On Screen Next To Count 01, Explosion Audio. S5 (Slam) & S8 (Rocket Fire) Should Give Rocket Audio. Move Joystick (JS3) Up And Down Making Sure That Horizontal & Vertical Counting On Video Can Be Seen. Switch S18 Off. Diagnostics Complete.

TEST #2: FUNCTIONAL CHECK

Credit Light #1 Should Blink On & Off Upon Receiving 1 Coin. Pressing Start Credit Will Make Credit Light #1 Stay On Until Game Is Over. If More Than 1 Coin Is Pushed Upon Finish Of Game Credit Light #1 Will Continue To Blink. Press Coin 1 & Start Credit, Make Sure Game Starts. Press Reset On Board (H10). Press Coin #2 & Start Credit Check Vertical & Horizontal Control With Joystick JS3 To Insure That Cross Hairs Move Left & Right About 50-60%. Up And Down Motion Of Joystick Should Give You Speed Control, Up Being Fast, Down, Slow. Firing Rockets Is Controlled By S8. When Pressing S8 Rocket Audio & Video Should Occur. Upon Hitting Target An Explosion (Boo) Audio, Video Will Show Value In Points And Place Them In Score Window Portion Of Video Adding As Score Increases. During Game Play A Hissing Jet-Like Audio Will Come On Anytime A Jet Is About To Appear On The Video 2 - 3 Seconds. Try To Hit All Targets At Least Once Making Sure That An Explosion Audio, Video, & Score Can Be Seen And Will Cease And Game Over Video Window Will Blink On And Off Over HI Score Window. On The Left Your Score Will Show Constant Video (Blink Not) HI Score Window Will Hold The Highest Scoring Game Points To Compare With Your Score At End Of Game. If You Scored Higher Than Previous High Game Score Your Score Will Be On Both HI Score & Score.

BONUS PLAY

Bonus Play Time Or Extended Play Will Trigger If 13,000 Pts. Or More Are Accumulated. When Time Runs Down, An Extra 50 Bits Of Time Will Appear In Time Window, Bonus Play Will Blink On & Off Above Time Window. On German Language Option, Bonus Time Will Appear On Playfield.

TARGET VALUES

Jet.....800 Pts.
 Oil Refinery.....450 Pts.
 Bridge.....450 Pts.
 City.....450 Pts.
 Oil Rig.....350 Pts.

SPACE DUEL PRE-PROD
SWITCH LIST

SELF TEST	SW. 7
DIAGNOSTIC STEP	SW. 6
SLAM	SW. 17
COCKTAIL	SW. 18
COIN LEFT	COIN SWITCH 1
COIN RIGHT	COIN SWITCH 2
COIN AUX.	START CREDIT SWITCH
COIN COUNTER LEFT	1st GEAR
COIN COUNTER RIGHT	2nd GEAR

PLAYER 1 CONTROLS

ROTATE LEFT	SW. 1
ROTATE RIGHT	SW. 2
SHIELDS	SW. 3
THRUST	SW. 4
FIRE	SW. 5

PLAYER 2 CONTROLS

ROTATE LEFT	SW. 8
ROTATE RIGHT	SW. 9
SHIELDS	SW. 10
THRUST	SW. 11
FIRE	SW. 12

SELECT	SW. 16
SELECT LED	AUX. LITE 2
START	SW. 15
START LED	AUX. LITE 1
LOCKOUT	AUX. LITE 3

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION.	EXTRA CONN. PIN #	CIS-1 DESTINATION	CIS-1 COMPONENT DESCRIPTION
+5V RETURN	A	BR6		CH4, AS6, AT3, AT6	REG/AUDIO BOARD
SENSE	22	BS1		CG5	REG/AUDIO BOARD
+SENSE	21	BS2		CG6	REG/AUDIO BOARD
+5V REG	B	BR5		CH2	REG/AUDIO BOARD
+5V REG	2	BV3		CH3	REG/AUDIO BOARD
+2.2VDC	3	BV2		CJ1	REG/AUDIO BOARD
-2.2VDC	4	BV1		C12	REG/AUDIO BOARD
+5V RETURN	1	BV4		CH5	REG/AUDIO BOARD
SW. GND	N	BP1		A3, AY6, AX3, AL3, AK6, A26	SW. COMMON
SLAM	14	BT3		A2	SW. 17
SHIELDS 2	9	BU2		AM5	SW. 10
LEFT 2	8	BU3		AL5	SW. 8
THRUST 2	M	BP2		AN2	SW. 11
SELECT LED	7	BU4		AU6	AUX LITE 2
SELECT	11	BT6		AY5	SW. 16
ROT. LEFT 1	K	BP4		AH2	SW. 1
THRUST 1	10	BUI		AJ5	SW. 4
SHIELDS 1	L	BP3		AJ2	SW. 3
START LED	J	BP5		AU4	AUX LITE 1
SW. GND	12	BT5		AH3, AJ3, AJ6, AH6, AK3	SW. COMMON
SW. GND	13	BT4		AM6, AL6, AN3, AN6, AM3	SW. COMMON
+5V	Y	BM4		AU3, AU5, AV1	AUX. LITE POWER
COIN R	U	BN2		AT1	COIN SW. 2
COIN L	16	BT1		AS4	COIN SW. 1
COIN AUX	S	BN4		AT4	START CREDIT SWITCH

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION.	INTERNAL CONN. PIN #	CIS-1 DESTINATION	CIS-1 COMPONENT DESCRIPTION
LOCKOUT	F	BRI		AV2	AUX LITE 3
COIN COUNTER L	H	BP6		AG4	1 ST GEAR
COIN COUNTER R	G	BU5		AG5	2 ND GEAR
SELF TEST	T	BN3		AL2	SWITCH 7
10.3V UNREG.	E	BR2		BF6	REG/AUDIO BOARD
		AG3		AS2	GEAR SELECT COMMON
AUDIO 2		J19 PIN 11		BL2	INPUT 2
AUDIO 1		J19 PIN 12		BL1	INPUT 1
ROTATE RIGHT 2		J19 PIN E		AM2	SWITCH 9
FIRE 2		J19 PIN 4		AN5	SWITCH 12
ROTATE RIGHT 1		J19 PIN 5		AH5	SWITCH 2
PAUSE 1		J19 PIN 3		AK2	SWITCH 5
START SWITCH		J19 PIN 6		AX2	SWITCH 15
Y GND		J19 PIN 2		BH6	} TWISTED PAIR B/W X-Y MONITOR
Y OUT		J19 PIN B		BJ4	
X GND		J19 PIN 1		BH5	} TWISTED PAIR B/W X-Y MONITOR
X OUT		J19 PIN A		BJ3	
Z GND		J19 PIN L		BJ1	} TWISTED PAIR B/W X-Y MONITOR
Z OUT		J19 PIN 10		BJ2	
AUDIO COMMON		J19 PIN M		BL3	REG/AUDIO BOARD
		A53		BG1	COIN COUNTER POWER
SPEAKER OUT		AP6		BL4	AMP
SPEAKER OUT		AR1		BL5	AMP
DIAGNOSTIC STEP	15	BT2		AK5	SWITCH 6
COCKTAIL	R	BN5		A ^b 5	SWITCH 18

SPRINT 1

DESCRIPTION	DESCRIPTION
GROUND	GAS SW. 15
AX2 AH2 Ab5 AR6 BV3 BM2 BR5 BS1 AP5 AS4 AT1	AX3 BP3
AG3 BU1 BA6 BC4 BB3 BR6	SELF TEST SW. 18
16.5 VAC	Ab6 BP1
BA5 BB1	START LP 1
25 VAC	AU3 BP4 AU4 BC3
BB2 BB4	AUDIO
COIN 1	AR2 AP6 BS2 AR1 BM3
AS6	COIN COUNTER
COIN 2	AS2 BN4 AS3 BU6
AT3	VIDEO
GEAR SHIFT	BU5 BL6 BV4 BM1
AG4 AG5 AG6	BT5 BP2 BT6
START SW.1	AH3
STEERING	BT4
AP2 AP3 AP4	BR2 BR1 BU4

SPRINT II

Variac #1 20.0
Variac #2 25.0

Game Controls

Steering

Gear Shift = 1-4

Black Car Gas = S16

White Car Gas = S15

S17 = TRACK SELECTION (12 Tracks)

S1 = 1 Player Start (white car only)

S8 = 2 player Start (both cars)

S18 = Diagnostic (RAM TEST)

S6 - select audio 1 or audio 2
(up) (down)

Coin 1 and or Coin 2

1 or 2 player mode

depends on amount of times coin buttons are pressed.

PROGRAM PLUG WIRING DIAGRAM FOR UNIVERSAL TEST UNIT

GAME: SPRINT II

SET: VARIAC #1 @ 19 VAC

SET: VARIAC #2

25VAC

CANNON DL - 156 CONNECTORS

A CANNON

⁴⁴
connectors B CANNON

C CANNON

COIN 1 - 2 = Sluggish common

S4-TI-P5

A - R6

V4-MI

V3-A6

R5-C4

V2-A5

V1-B1

S3

U6

P2

R2

U5-L6

P3

R1-U2

P4

U4-U3

T2 *COIN 2 N.C.*

H - P6 *COIN*

S5 *COIN 1 N.C.*

J - P5 *COIN*

U3

K - P4

X2-Y5-a2-b5-H2-L5-G3

10 - U1

b6

11 - T6

Y6

M - P2

X3

12 - T5

H3

P1

L6

T4

a3

N6

U5

N4

G6

T1-N3

G5

S6-N2

G4

S5-N1

S4-B2

S3-B4

after ← 56

L1

2k → S2 after 1 audio

K6

7 → M4 after 2 audio

L3-R1

2 → M3 after return 1 & 2

U4-U6

C3

P6-R2-K5

S6-T3-S2

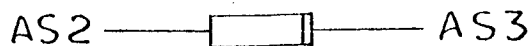
S1

R6

Add Diode S2, S3, (Neg Side)

L2

T3



1N 4001

c5
c6

TO START:

VOLT. #1-19.0
VOLT. #2-25.0

For one player - Push coin 1 (once) then S1 (Credit lites should stay lite)
For two players - Push coin 1 (twice) then S8

Choice of 12 tracks - S17 changes tracks, but only after coin is pushed and before S1 / S8 are pushed.

The harder the track the less points needed for "EXTENDED PLAY". Depending on game time the points needed will be different. (ie - if switch is set for 60 second game-points needed for "EXTENDED PLAY" are 40 pts. - easy track, 60 pts. - med. track, 100 pts. hard track.)

TO CHECK SPEAKERS S6 up = mtr 2 / down = mtr 1

TO CHECK GAS for black and white car - you must start a two player game - W (S15) / B (S16) switches and check black car.

Gray cars on screen always run by themselves and in 1 player mode black car runs like gray cars and white car is player. In 2 player mode black car is 2nd player.

You cannot pulse up score, so set switches for shipping. Pick track that needs only 40 points for "EXTENDED PLAY". Put sprint clip on H-6 (to disable barriers) drive car till you get 40 points, "EXTENDED PLAY" should flash at top of screen at end of game - should automatically start "EXTENDED PLAY" at 30 seconds. Take off chip clip - check skid audio; check oil slick audio.

SPRINT SWITCH & SETTING

8 SWITCH

1. Enables (+) or Disables (-) oil slick audio
2. Tracks will (-) or won't (+) cycle in attract mode
3. { 3 (-) 4 (-): Demo / 3 (-) 4 (+): 2 coins per player.
4. { 3 (+) 4 (-): 1 coin per player / 3 (+) 4 (-): 2 players per coin
5. Freeplay (+) or No Freeplay (-) game
6. Nothing
- 7.* { 7 (-) 8 (-): 60 second game / 7 (-) 8 (+): 90 second game
- 8.* { 7 (+) 8 (+): 150 second game / 7 (+) 8 (-): 120 second game

* = Game time will read 100 - but depending on time setting it will tick off at different rates.

Game time points for "EXTENDED PLAY"

	easy	med.	hard
60 seconds -	100	60	40
90 seconds -	150	90	60
120 seconds -	200	120	80
150 seconds -	250	150	100

4 switch

- 1.) nothing
- 2.) nothing
- 3.) nothing
- 4.) enables (-) or disables (+) video

TO SHIP

Setting for # 8 switch

- 1 +: oil slick on
- 2 -: track cycle in att. mode
- 3 +: 1 coin
- 4 +: per player
- 5 +: freeplay game
- 6 : doesn't matter
- 7 -: 60 seconds
- 8 -: game time

SPRINT II TESTING PROCEDURE

1. TROUBLE - SHOOT BASIC GAME CIRCUITS. (Do this step w/MPU and Program Proms removed, and O_0 switch in "ON" position. This switch shorts O_0 to O_2 and should only be used with the MPU removed from the game.) ^{Pos. Switch 4}
 Trouble - shoot power supplies and sync and video circuits. Legible alpha-numeric characters should be randomly displayed on screen. Verify that the O_0 and WRITE pulse circuits are functioning properly, as well as the NMI and RESET pulses to the MPU.

2. SELF - TEST PROGRAM.

This test program is contained in the regular game program, and is accessed by throwing the "SELF-TEST SWITCH" to the "on" position. It does not require that the test program and buffer board be plugged into the game board (50-pin ribbon cable connector does not need to be connected.) The MPU and Program Proms should be in and the O_0 switch should be in OFF position.

A. RAM TEST

The first portion of this test verifies that the MPU is capable of accessing and correctly writing to each of the 1K words of RAM (2102's). The MPU does this by addressing each word of the RAM memory and writing all possible combinations of data into it. The data is then read back by the MPU to verify that it was correctly stored in RAM. As the MPU stores various data codes into RAM, the visual effect of this test will be that as each different data combination is written into RAM, the character associated with that particular data code will be displayed on the screen. The entire screen will be filled with the character being addressed at that time, and will cycle through the complete set of alpha-nums. The RAM being tested also contains the rotation, horizontal, and vertical positions of the cars. Because of this, the cars will move across the screen and rotate as different combinations of data are written into each RAM location. The cars will first appear in the bottom right-hand corner of the screen, facing up. As the test progresses, they will move at a diagonal to the left-hand corner of the screen and rotate a complete 360° as they do so. The cars will appear as one, since they will be located "on top" of each other, due to identical horizontal and vertical position codes. If at any point in the test, data is incorrectly stored or read from a RAM position the test will "freeze" at that point, and the MPU will go into a tight loop, as it continually accesses that particular RAM word.

B. ROM TEST

This test verifies the data contained in the program PROMS (ROMS) by doing a check sum of all of the data bits. If an error is detected in any PROM (or ROM), the number of that PROM is displayed on the screen (0-7). Since the PROGRAM PROMS are 1K x 4, an error detection displayed on the screen could mean either or both of the PROMS associated with that 1K of addressing space is in error. (See chart below). An error indication means only that the check sum of bits in the indicated PROM does not match a comparable sum stored elsewhere in memory.* The indicated PROM is not necessarily bad, as it could be caused by erroneous address or data lines, etc.

TABLE 1

ERROR INDICATION	BAD PROMS	or	BAD ROM
#0	F0, F1		A0
#1	H0, J1		A0
#2	J0, J1		C0
#3	K0, K1		C0
#4	L0, L1		D0
#5	M0, M1		D0
#6	N0, N1		E0
#7	P0, P1		E0

* Check sum totals contained in #6.

C. SWITCH TEST

This test verifies that the MPU is capable of recognizing a switch closure. This portion of the test automatically follows a successful RAM test. Any switch (or switches) which are activated will cause the screech audio to be turned on. The switches examined in this test include:

1st (1)	1st (2)
2nd (1)	2nd (2)
3rd (1)	3rd (2)
GAS (1)	GAS (2)
COIN (1)	COIN (2)
START (1)	START (2)
TRAK SELECT	

If all of these switches are in their "unactivated" position, there should be no screech audio.

D. LAMP TEST

This test merely verifies that the MPU is capable of turning the lamps on. During the RAM test the 1 & 2 player start lamps should be off. After completion of the RAM test, these two lamps should come on and remain on for the remainder of the SELF - TEST. PROGRAM.

E. OPERATOR OPTIONS TEST

This test verifies that the MPU is capable of reading the 8 operator adjustable "option switches" located on dip - switch package J8½. It is also useful in setting up these options to the desired function, as the particular option (s) selected is written out on the screen. The following table contains the list of all possible operator options and message associated with them in this test program.

TABLE 2

SCREEN LAYOUT

- 1.) LENGTH OF GAME TIME OPTION
- 2.) NUMBER OF PLAYERS PER COIN OPTION
- 3.) EXTENDED PLAY OPTION
- 4.) CYCLING OF TRAKS IN ATTRACT MODE OPTION
- 5.) OIL SLICK OPTION

<u>SWITCH SETTING</u>	<u>DISPLAYED MESSAGE</u>
+ → ↑ ON #1 - ON	OIL
#1 - OFF	BLANK (NOTHING DISPLAYED IN THAT LOCATION)
#2 - ON	BLANK
#2 - OFF	CYCLE
#3 - ON } #4 - ON }	1 COIN PER PLAYER
#3 - ON } #4 - OFF }	2 PLAYERS PER COIN
#3 - OFF } #4 - ON }	2 COINS PER PLAYER
#3 - OFF } #4 - OFF }	DEMO

<u>SWITCH SETTING</u>	<u>DISPLAYED MESSAGE</u>
#5 - ON	EXTENDED PLAY
#5 - OFF	BLANK
#7 - ON	TIME 150
#8 - ON	
#7 - ON	TIME 120
#8 - OFF	
#7 - OFF	TIME 90
#8 - ON	
#7 - OFF	TIME 60
#8 - OFF	

Once these options and associated messages have all been verified, the SELF-TEST program is concluded. Turning the SELF-TEST switch off should cause the game to revert back to its normal ATTRACT mode if everything is functioning properly. If necessary, go on to the more detailed test described below.

3. TEST PROGRAM

Connect 50-PIN ribbon connector. Turn SELF - TEST switch "ON" and turn TEST switch "ON". (The TEST switch prevents the MPU from receiving its normal RESET and NMI signals, since these are ignored by the TEST PROGRAM). MPU and Program Proms should be in. To initialize program use RESET button. The toggle switch settings are given MSB (D5) to LSB (D0).

E.G. 000001 = D5 D4 D3 D2 D1 D0

PB6 = push button 6 (D6)

PB7 = push button 7 (D7)

A. SELF TEST (REPEAT)

Toggle switch setting = 000001; PB7 will start this test which is merely a repeat of the self test program previously described. To terminate this test, turn the SELF-TEST switch off, and leave off for the remainder of tests.

B. STEERING TEST

TOGGLE = 000010; PB7 starts this test. All four cars should be displayed on screen. Player 1 steering should cause all 4 cars to rotate in either direction; PB6 should cause Player 2 steering to now control the rotation of all four cars. Pushing PB7 should now prevent either steering 1 of 2 from controlling rotation. PB6 will terminate this test.

C. COLLISION TEST

TOGGLE = 000100; PB7 begins this test, which verifies that all possible types of collisions will be recognized by the MPU. If the collision circuit is functioning properly, the only visual affect will be a quick flash of video on the left-hand side of the screen. The test is self-terminating upon successful completion. If the MPU does not receive an indication of a collision between any of the designated objects, it will "freeze" on the collision not being recognized, with the two objects displayed on the screen "on top" of each other. The order in which the test is performed is as follows:

- 1.) CAR 1 & WHITE "A"
- 2.) CAR 1 & BLACK "A"
- 3.) CAR 1 & CAR 3
- 4.) CAR 1 & CAR 4
- 5.) CAR 1 & CAR 2
- 6.) CAR 2 & CAR 1
- 7.) CAR 2 & CAR 4
- 8.) CAR 2 & CAR 3
- 9.) CAR 2 & BLACK "A"
- 10.) CAR 2 & WHITE "A"

D. AUDIO TEST

TOGGLE = 001000; PB7 starts this test. Once started, toggle 0 through 3 will control the frequency of motor 1. E.G.: 001111 represents the highest frequency of MOTOR 1, 000000 represents the lowest frequency, etc. Pushing PB6 will cause the existing test to now apply to the frequency of MOTOR 2. Pushing PB7 will now start the screech & crash test. TOGGLE 0 through 3 now control the crash bits, with 0 being the LSB and 3 being the MSB. Toggle 4 turns Skid 1 on & off, and Toggle 5 turns Skid 2 on & off. Pushing PB6 terminates this test.

E. MISCELLANEOUS TEST

TOGGLE = 010000; PB7 starts this test. The first thing this test does is verify that the MPU can read the sync word (LINE, VBLANK*, & VRESET). If for some reason it cannot read any or all of these signals correctly, it will "freeze" in a tight loop, as it tries to read the signal. It will indicate to the operator that it is hung, by turning on the LED data lights, and leaving them on as long as it is in this loop. Upon successful reading of the sync word, this test will automatically continue to a test of the operator selectable switches (J8½ DIP switch). Turning any of the switches on will turn on the SKID audio. Turning all of them off should turn all audio off.

NOTE: When using diagnostic test board 005840 in testing of SPRINT II, use following assembly instructions.

B1 : 006430 82S115 PROM
C1 : 006431 " "
D1 : 006432 " "

I. Equipment Required

A. Universal Test Fixture

1. Sprint 8 program plug.
 2. 86 & 44 pin edge connector cable.
 3. Interface cable assembly.
- B. Fluke meter and test leads (normally installed in test fixture.)
C. External speaker plugged into "SPKR" on Control Panel.

II. Set-up Procedure

A. Universal Test Fixture

1. To test the Sprint 8, a total of three boards are needed:
 - a. Sprint 8 Main board
 - b. Sprint 8 Audio board
 - c. Sprint 8 Steering interface
2. The steering interface cable is connected to program plug C. This plug has three cables that can be reached by pulling the right hand side panel off the Universal Test Fixture. The steering interface cable is connected to the middle connector of program plug C.
3. The program plug for Sprint 8 should be installed next. Connect A, B & C program plugs to the respective sockets on the Master Power panel.
4. Turn power "on" to the Video Display Monitor.
5. Turn power "on" to CB1 & CB2 on the Master Power panel.
6. Install cable assembly on test fixture observing the plugs are oriented correctly. If the color circuit is going to be checked, connect cable to color monitor. The main board (the one with the CPU installed) is the only board which needs to have the color circuit checked, although an Audio & Interface board should be installed.
7. Install an interface board to mate with interface cable installed in II, A,2.
8. Install Audio board to the 44 pin edge connector. Observe polarity.
9. Install Main board to the 86 pin edge connector, again observing polarity.
10. With CB3 & VB4 turned on, adjust Variac 1 for 16.5 volts AC monitored at pins A & C of Master Power Panel.
11. Adjust Variac 2 for 25.0 VAX monitored at pins E & G on Master Power panel.

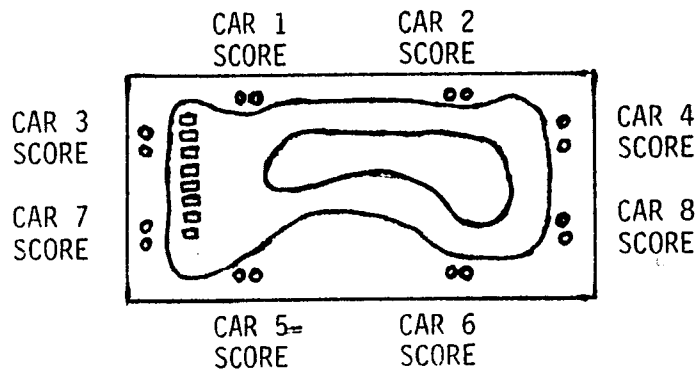
III. Test Procedure

A. Main Board

1. The RAM, ROM and CPU should be installed according to the following table. If not, shup power "off" to CB3 & CB4 of Master Power panel while installing chips.

<u>Location</u>	<u>Part Number</u>
C1	007313 ROM
E1	007314 ROM
N6	007315 ROM
J5	007316 ROM
M1	Motorola 6810 - Atari P/N 90-7002 RAM
P1	" " " " " " RAM
N3	Motorola 6800 - Atari P/N 90-6001 CPU

2. The display should look something like that in the figure below. Track configuration will change as the display cycles thru the 4 different tracks. The cars should be white before pushing coin.



3. Each car has it's own coin switch. The following is a list of the switches and cars.

COIN 1 on Power panel - Car 1	S3 on Control panel - Car 5
COIN 2 " " - Car 2	S4 " " " - Car 6
S1 Control panel - Car 3	S5 " " " - Car 7
S2 Control panel - Car 4	S8 " " " - Car 8

4. Each of the lights above the Fluke meter on the Master power panel should be on. They correspond with the cars whose numbers appear beneath the lights; 1 for Car 1, etc.
5. When a coin button is pushed, it's corresponding light should go out, the car on the black & white monitor should turn black, on the color monitor the car should turn to the color indicated below:

Car 1 - Red	Car 5 - Violet
Car 2 - Blue	Car 6 - Pink
Car 3 - Yellow	Car 7 - Light Blue
Car 4 - Green	Car 8 - White

III. Test Procedure Cont. on Main Board

6. The score associated with the car whose button was pushed should also be the color of the car. Unused cars' score will say TRAFFIC in white.
7. The track will stop cycling and a message will appear on the screen twice:

8 seconds till game play

The number of seconds should count down to 1 and then the game will start.

8. During count down the track can be changed by S7 on the Control panel. After the track has changed the count should start at 8 seconds.
9. The steering interface board will only handle steering for two cars. S15, S16, S17 and S18 control which pair of cars are getting steering control. Only one of these 4 switches should ever be 'on' (up) at a time.

S15 - controls cars 1 & 2
S16 - controls cars 3 & 4
S17 - controls cars 5 & 6
S18 - controls cars 7 & 8

The gas and shift are also on the interface and should also be checked for each car. S9 on the control panel is the gas for the odd numbered cars. S10 is gas for the even numbered cars. S11 is the shift for the odd cars, and S12 is the shift for the even numbered cars.

10. The motor sound, crash, and screech, should be checked. Four Speaker outputs are controlled by the position of the gear shift knob on the control panel.

1st - Audio cars 1 & 2
2nd - " cars 3 & 4
3rd - " cars 5 & 6
Rev - " cars 7 & 8

Each car should be checked.

11. Game time is controlled by the switch assembly located about F10 on the main board.

Switch one 'on'	Fastest Game
Switch two 'on'	Fast Game
Switch three 'on'	Medium Game
Switch four 'on'	Long Game

III. Test Procedure Con't. on Main Board

12. The reset switch located about A11 on the board, when pushed while a game is in progress, should terminate the game and revert the display to pre game status.
13. S6 on the Control panel is a self test program and should display the following message on the screen when it is on.

ROM OK

RAM OK

COIN OK

A number associated with the coin switch depressed will appear at the end of the message.

B. Audio Board

1. A know good main board should be used. The control output for each of the lockout lights above the Fluke meter is also on the Audio board. Check that each light is on at the beginning and can be shut off by depressing the coin switch with it.
2. Check that Audio can be obtained for each car by switching thru the gear position for each audio pair. Monitor for motor, crash, and screech.

C. Interface Board

1. The interface board contains the steering, gas and shift circuitry for two cars. Use a known good main board.
2. With S15 up, depress Coin 1 and Coin 2. Check that clockwise and counter clockwise steering is smooth for Cars 1 & 2.
3. Check that gas (S9 car 1, S10 car 2) works and also shift (S11 for car 1, S12 car 2) is functioning.

Switch and Function Summary:

Coin 1 on Power Panel	-	Coin Switch Car 1
Coin 2 on Power Panel	-	" " Car 2
S1 on Control Panel	-	" " Car 3
S2 " " "	-	" " Car 4
S3 " " "	-	" " Car 5
S4 " " "	-	" " Car 6
S5 " " "	-	" " Car 7
S8 " " "	-	" " Car 8
S6 " " "	-	Self Test Switch
S7 " " "	-	Track change
S9 " " "	-	Gas odd cars
S10 on Control Panel	-	Gas even cars
S11 " " "	-	Shift odd cars
S12 " " "	-	Shift even cars
S15 " " "	-	Steering cars 1 & 2
S16 " " "	-	Steering cars 3 & 4
S17 " " "	-	Steering cars 5 & 6
S18 " " "	-	Steering cars 7 & 8
1st " " "	-	Audio cars 1 & 2
2nd " " "	-	Audio cars 3 & 7
3rd " " "	-	Audio cars 5 & 6
Rev " " "	-	Audio cars 4 & 8

STARSHIP

GAME:

Starship

VARIAC SETTING:

#1 not used
#2 25 Vac check at E & G
DC supply

POTS USED:

JS3

CREDIT LIGHT:

#1 above multimeter

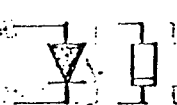
AUX LIGHT:

None

SWITCHES:

Coin 1, Coin 2, Start Credit
S1 - Photon torpedoes
S8 - Phasor
S18 - diagnostic

STARSHIP PROGRAM PLUG

<u>TO</u>	<u>FROM</u>	<u>DESCRIPTION</u>
AK3	BR2	SLAM NO SW. S5
BL6	BU5	VIDEO HOT
AC5	BU4	ROLL
AD2	BR1	PITCH
AT6	BU3	START N.O.
Ab6	BP5	TEST N.O. SW. S18
Aa3	BU2	SLOW N.O. SW. S17
AH3	BP4	PHOTON N.O. SW. S15
BP3	AC6, D3, K2	+5 VDC
AL6	BT6	PHASORS SW. S8
BM1	BP2	VIDEO GROUND
AT2	BT2	COIN 2 N.C.
AU3	BT1	LOCKOUT LITE #1
AS5	BS6	COIN #1 N.C.
BS5	AP6, R2	AUDIO
AR1	BN1	AUDIO
BB2	BS4, M6	25 VAC
BB4	BS3, M5	25 VAC
BB3	BS2, M4	25 V. C.T.
AS6	AT3, S2	COIN COUNTER
AS2	POSITIVE SIDE OF 4001 DIODE	
AS3	NEGATIVE SIDE OF 4001 DIODE	
BS1, M3	AA1, b5, T1, a2, H2, D1, D4, 4, 5, L5, T4, S4	GROUND
AS3, U4	BV2, F6, V3, G1, R5, G2, R4, G3	+10 VDC
BV4	BC4, R6, G5, V1, G6, R3, H1	GROUND
AR6	Cc6	
AS1	Cc5	

1. EQUIPMENT REQUIRED

- A. Universal test fixture.
- B. Starship program plug.
- C. 44-pin cable
- D. Speaker plugged into SPKR jack.

2. SET-UP

- A. Install Starship program plugs A, B & C into sockets A, B & C on master power panel.
- B. Connect 44-pin connector to board to be tested observing proper polarity of the plug.
- C. Be sure proper microprocessor is installed at C3 90-6010 (6502)
- D. Turn video display monitor on.
- E. Turn on CB1, CB2 and CB4, adjust variac #2 to 25 Volts AC measured between points E & G on the master power pane.
- F. Turn on power supply located on the inside left hand panel of the test system.

3. TEST PROCEDURE

- A. Test Mode.
- B. Turn S18 up on control panel.
- C. Press coin 1 or 2 on master power panel. A starship should appear in the upper right hand corner of the screen and slowly get larger until part of it disappeared from the right hand side of the screen. The forward part of the ship will still be on the left side of the screen. A sound will be heard coming from the speaker and by pressing start, S8 or S1 a tone will be super imposed with the tone coming from the speaker.
- D. While holding S1 down, put S17 in an up position, the tome should drop in frequency. Moving the joystick JS3 will cause the frequency to vary. Put S17 and S18 in their down position.
- E. Circle Adjustment.
- F. Turn on the four switches located at B8 on the P,C, board.
- G. Circle size can be adjusted by the D.C. off-set pot located on the board.
- H. By switching S1 on again and S3 off; the circle should go right with the screen and no bar should be present.
- I. Switch S1 on again and S3 off; the circle should go right with the screen, and no bar should be present.
- J. Switch S3 on; the circle should now be centered on the screen and should be circular, not oval. Switch S1 & S4 off.
- K. Game Operation
- L. The switches at K6 are arranged as follows:

	S2	S3	S4
3 PLAYS / COIN	OFF	OFF	OFF
2 PLAYS / COIN	ON	OFF	OFF
2 PLAYS / COIN	OFF	ON	OFF
2 PLAYS / COIN	ON	ON	OFF
1 PLAYS / COIN	OFF	OFF	ON
1 PLAYS / COIN	ON	OFF	ON
2 PLAYS / COIN	OFF	ON	ON
NOTHING	ON	ON	ON

B. ROM TEST

This test verifies the data contained in the program PROMS (ROMS) by doing a check sum of all of the data bits. If an error is detected in any PROM (or ROM), the number of that PROM is displayed on the screen (0-7). Since the Program PROMS are 1K x 4, and error detection displayed on the screen could mean either or both of the PROMS associated with that 1K of addressing space is in error. (See chart below). An error indication means only that the check sum of bits in the indicated PROM does not match a comparable sum stored elsewhere in memory.* The indicated PROM is not necessarily bad, as it could be caused by erroneous address or data lines, etc.

TABLE 1

ERROR INDICATION	BAD PROMS	or	BAD ROM
#0	F0, F1		A0
#1	H0, H1		A0
#2	J0, J1		C0
#3	K0, K1		C0
#4	L0, L1		D0
#5	M0, M1		D0
#6	N0, N1		E0
#7	P0, P1		E0

* Check sum totals contained in #6.

C. SWITCH TEST

This test verifies that the MPY is capable of recognizing a switch closure. This portion of the test automatically follows a successful RAM test. Any switch (or switches) which are activated will cause the screech audio to be turned on. The switches examined in this test include:

1st (1)	1st (2)
2nd (1)	1nd (2)
3rd (1)	3rd (2)
GAS (1)	GAS (2)
COIN (1)	COIN (2)
START (1)	START (2)
TRAK SELECT	

STARSHIP Q. C. PROCEDURE (CON'T)

If all of these switches are in their "unactivated" position, there should be no screech audio.

D. LAMP TEST

This test merely verifies that the MPU is capable of turning the lamps on. During the RAM test the 1 & 2 player start lamps should be off. After completion of the RAM test, these two lamps should come on and remain on for the remainder of the SELF TEST PROGRAM.

E. OPERATOR OPTIONS TEST:

This test verifies that the MPU is capable of reading the 8 operator adjustable "option switches" located on dip-switch package J8 $\frac{1}{2}$. It is also useful in setting up these options to the desired function, as the particular option (s) selected is written out on the screen. The following table contains the list of all possible operator options and the message associated with them in this test program.

TABLE 2

SCREEN LAYOUT

- 1.) LENGTH OF GAME TIME OPTION
- 2.) NUMBER OF PLAYERS PER COIN OPTION
- 3.) EXTENDED PLAY OPTION
- 4.) CYCLING OF TRAKS IN ATTRACT MODE OPTION
- 5.) OIL SLICK OPTION

SWITCH SETTINGDISPLAYED MESSAGE

#1 - ON	OIL
#1 - OFF	BLANK (NOTHING DISPLAYED IN THAT LOCATION.
#2 - ON	BLANK
#2 - OFF	CYCLE
#3 - ON	1 COIN PER PLAYER
#4 - ON	
#3 - ON	2 PLAYERS PER COIN
#4 - OFF	
#3 - OFF	2 COINS PER PLAYER
#4 - ON	
#3 - OFF	DEMO
#3 - OFF	

<u>SWITCH SETTING</u>	<u>DISPLAYED MESSAGE</u>
#5 - ON	EXTENDED PLAY
#5 - OFF	BLANK
#7 - ON	TIME 150
#8 - ON	
#7 - ON	TIME 120
#8 - OFF	
#7 - OFF	TIME 90
#8 - ON	
#7 - OFF	TIME 60
#8 - OFF	

Once these options and associated messages have all beeb verified, the SELF TEST program is concluded. Turning the SELF TEST switch off should cause the game to revert back to its normal ATTRACT mode if everything is functioning properly. If necessary, go on to the more detailed test described below.

III. TEST PROGRAM

Connect 50-PIN ribbon connector. Turn SELF TEST switch "ON" and turn TEST switch "ON". (The TEST switch prevents the MPU from receiving its normal RESET and NMI signals, since these are ignored by the TEST PROGRAM.) MPU and Program Proms should be in. To initialize program use REST button. The toggle switch settings are given MSB (D5) to LSB (D)).

E.G. 000001 = D5 D4 D3 D2 D1 D0

PB6 = push button 6 (D6)

PB7 = push button 7 (D7)

A. SELF TEST (REPEAT)

Toggle switch setting = 000001; PB7 will start this test which is merely a repeat of the self test program previously described. To terminate this test, turn the SELF TEST switch off, and leave off for the remainder of tests.

B. STEERING TEST

TOGGLE = 000010; PB7 starts this test. All four cars should be displayed on screen. Player 1 steering should cause all 4 cars to rotate in either direction; PB6 should cause Player 2 steering to now control the rotation of all four cars. Pushing PB7 should now prevent either steering 1 or 2 from controlling rotation. PB6 will terminate this test.

C. COLLISION TEST

TOGGLE = 000100; PB7 begins this test, which verifies that all possible types of collisions will be recognized by the MPU. If the collision circuit is functioning properly, the only visual affect will be a quick flash of video on the left-hand side of the screen. The test is self-terminating upon successful completion. If the MPU does not receive an indication of a collision between any of the designated objects, it will "freeze" on the collision not being recognized, with the two objects displayed on the screen "on top" of each other. The order in which the test is performed is as follows:

- 1.) CAR 1 & WHITE "A"
- 2.) CAR 1 & BLACK "A"
- 3.) CAR 1 & CAR 3
- 4.) CAR 1 & CAR 4
- 5.) CAR 1 & CAR 2
- 6.) CAR 2 & CAR 1
- 7.) CAR 2 & CAR 4
- 8.) CAR 2 & CAR 3
- 9.) CAR 2 & BLACK "A"
- 10.) CAR 2 & WHITE "A"

D. AUDIO TEST

TOGGLE = 001000; PB7 starts this test. Once started, toggle 0 through 3 will control the frequency of motor 1. E.G.: 001111 represents the highest frequency of MOTOR 1, 000000 represents the lowest frequency, etc. Pushing PB6 will cause the existing test to now apply to the frequency of MOTOR 2. Pushing PB7 will now start the screech & crash test. TOGGLE 0 through 3 now control the crash bits, with 0 being the LSB and # being the MSB. Toggle 4 turns Skid 1 on & off, and Toggle 5 turns Skid 2 on & off. Pushing PB6 terminates this test.

E. MISCELLANEOUS TEST

TOGGLE = 010000; PB7 starts this test. The first thing this test does is verify that the MPU can read the sync word (LINE, VBLAND *, & VRESET). If for some reason it cannot read any or all of these signals, correctly, it will "freeze" in a tight loop, as it tries to read the signal. It will indicate to the operator that it is hung, by turning on the LED data lights, and leaving them on as long as it is in this loop. Upon successful reading of the sync word, this test will automatically continue to a test of the operator selectable switches (J8½ DIP switch). Turning any of the switches

on will turn on the SKID audio. Turning all of them off should turn all audio off.

NOTE: When using diagnostic test board 005840 in testing of SPRINT II, use following assembly instructions.

B1 :	006430	82S115	PROM
C1 :	006431	"	"
D1 :	006432	"	"

DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
5 V C.T. GND	1	BV4		BG4, AK2, AJ2	
16.5 V C.T. GND	A	BR6		BG5, AL2, Ab5	
+ V UNREG	2	BV3		BF6, AS3	DC SUPPLY
+10 V UNREG	B	BR5		BG1	
	3	BV2			
	C	BR4			
	4	BV1			
	D	BR3			
+5 V	5	BU6		AU6, AP2	
+5 V	E	BR2		AU4	
VIDEO 1 GND	6	BU5		BM1	
COMP VIDEO 1	F	BR1		AX1	VIDEO 1
VIDEO 2 GND	7	BU4		BH1	
COMP VIDEO 2	H	BP6		AX3	VIDEO 2
STEER 2A	8	BU3		AY6	SW 16
STEER 1A	J	BP5		AY4	" "
STEER 1B	9	BU2		AZ1	" "
STEER 2B	K	BP4		AZ3	" "
COIN 1 RT	10	BU1		AS6	COIN SW 1
COIN 2 LFT	L	BP3		AT3	COIN SW 2
	11	BT6			
SLAM	M	BP2		AK3	SW 5
DIAG. HOLD	12	BT5		AL3	SW 7
DIAG. STEP	N	BP1		AL6	SW 8
START 1	13	BT4		AH3	SW 1
START 2	P	BN6		AH6	SW 2
FIRE 1	14	BT3		AJ3	SW 3
SELF TEST	R	BN5		Ab6	SW 18
FIRE TWO	15	BT2		AJ6	SW 4

WAVE 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CORN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
COIN COUNTER	S	BN4		AS2	COIN COUNTER
START LAMP 2	16	BT1		AU5	LITE 2
START LAMP 1	T	BN3		AU3	LITE 1
AUDIO 1	17	BS6		AL1	SW 6
AUDIO 1 GND	U	BN2		AR1	SPEAKER COMMON
AUDIO 2	18	BS5		AK6	SW 6
AUDIO 2 GND	V	BN1		BL3	SPEAKER COMMON
	19	BS4			
	W	BM6			
	20	BS3			
	X	BM5			
	21	BS2			
	Y	BM4			
GND	22	BS1		AP5, AS4, AT1, AJ5	
GND	Z	BM3		AL5, AH2, AH5	
		BL1		AK5	SW 6 COMMON
		BL4		AP6, AR2	LEFT & RIGHT SP.
25 VAC		BB2		BE1	VARIAC 2
25 VAC C.T.		BB3		BE2	" "
25 VAC		BB4		BE3	" "
		AX2		BL6	SW 15 (VIDEO)
		AY5		AP3	SW 16 COMMON
		AZ2		AP4	" " "

STEEPLECHASETOOLS NEEDED:

One Pulser.
 One Grounding Probe.
 One Grounding Lead.
 One Steeplechase Program.

TEST FIXTURE SETTINGS:

Variac #1 36% (16.5 VAC).
 Variac #2 56% (25.0 VAC).

CONTROLS USED:

CB 1, 2, 3, & 4.
 Coin 1 & Coin 2.
 Start Credit.
 Credit Light's 1 Through 6.
 Switches S3, S4, S5, S8, S9, S10.

BOARD SETTINGS:

Volume About 1/8 Open.
 Stat Mod Pot (Next To Q4) Set All The Way To Heat Sink.
 Mode Switch To "A".

TEST ONE:

1. Power Up Game (CB 3, 4, Then CB 1 & 2).
 2. Push "Coin 1" Once. Check The Following:
 Horn Should Sound.
 Crowd Audio Should Be Present.
 Credit Lights 1 Through 6 Should Light Up.
- *NOTE: If All The Credit Lights Don't Light Up, Check Mode Switch Set To "A" Switch Also May Be Dirty. Wiggle It Back And Forth A Few Times To Clean Contacts, And Start Again At Test One Step 2.
 Seven Horses & Riders Should Be Showing.
3. Push "Start Credit" Button. Check The Following:
 Gun Should Sound.
 Horses Should Start Running.
 Hoof Audio Should Be Present.
 There Should Be Intermittent Whistle Audio During Game.
 Steeples Have Both Close & Far Spacing.
 4. Push Switches S3, S4, S5, At The Same Time. First 3 Horses (Top) Should Jump.
 5. Jump The Steeple's With The First 3 Horses, Then On The Next

Steeple Let Them Trip. They Should Fall And Crash Audio Should Sound.

6. Push Switches S8, S9, S10, The Next 3 Horses Should Jump. Repeat Step 5 With These Horses. *NOTE: The 7th (Bottom) Horse Is The Lead Horse, He Should Jump All The Steeples All The Time.
7. Take Grounding Probe & Ground H-7 Pin 6, Horse #5 Will Start To Jump Automatically And Should Catch Up To The Lead Horse. Crowd Audio Should Get Louder As The Horse Moves Ahead, And Hoof Beat Audio Should Pick Up Speed. Steeples Should Move Faster. As Horse #5 Wins, It Should Flash And Game Should End.

TEST TWO:

1. Flip Mode Switch To 2/4/6 (On Older Boards It May Read "AP")
2. Push "Coin 1" Once. Check The Following:
Horn Should Sound.
Credit Lights 1 & 4 Should Light Up.
Horses 1 & 4 Should Show Up.
Lead Horse Should Be Present.
3. Push "Coin 2" Once. Check The Following:
Credit Lights 2 & 5 Should Light Up.
Horses 2 & 5 Should Show Up.
4. Push "Coin 1" Again. Check The Following:
Credit Lights 3 & 5 Should Light Up.
Last 2 Horses Should Show Up.

*NOTE: If The Above Test Doesn't Work Check The Following:
Mode Switch In 2/4/6?
Dirty Switch. See Note Test One Step 2.

5. Push "Start Credit". Check The Following:
Game Should Start.
Gun Should Sound.
Hoof Beat Present.
Horses Start Running.
6. With Grounding Probe, Pulse J-3 Pin 15 Until One Of The 6 (Six) Horses Starts Moving Ahead, Then Keep J-3 Pin 15 Grounded. Horse Will Trip At Steeples, But It Won't Fall Behind; It Should Catch And Pass The Lead Horse; Win Game And Flash.
7. Restart Game:
Push Coin 1 Once.
Push Start Credit.
8. Take Pulser (Not Grounding Probe) And Pulse Center Lead Of Stat Mod Pot, (Next To Q4) Game Should End.

INFORMATION SHEET

Q4 = Stat Mod

GROUNDING PROBE INFORMATION:

J-1 Pin 1 = Lead Horse Will Win Game Fast.

J-1 Pin 5 = No Steeples.

J-3 Pin 15 = One Of Six Horses Will Win.

H-7 Pin 6 = Horse #5 Jumps Automatically.

L-8 Pin 1 = Float Horse #1.

L-8 Pin 2 = Horses Run, But Don't Move Across Screen.

5th Hole Up From Heat Sink (Next To P-8) = Gunshot Audio.

(TEST FIXTURE SETTINGS, BOARD SETTINGS, AND TOOLS NEEDED)

TOOLS NEEDED:

1. One pulser
2. One length of wire with a 22 K resistor at one end, here-in called a "video probe".
3. One ground lead.
4. One Stunt Cycle programing block.

TEST FIXTURE SETTINGS:

1. Variac #1 = 36% (16 VAC)
2. Variac #2 = 56% (25 VAC)

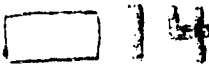
CONTROLS TO BE USED:

1. CB # 1, 2, 3, & 4.
2. Coin 1 and 2.
3. Start credit
4. Credit lights 1 and 2

BOARD SETTINGS & START SETTINGS:

1. Player mode switch to "1-P"
2. Free game switch to "F-6"
3. Rotart switches F-5 & F-7, set at "B"

STEP 1 - CHECK VIDEO DISPLAY

1. Plug in board.
2. Turn on Test Fixture (CB #1 & CB # 2).
3. Video should have following:
 - A. Three lines for cycle to drive on.
 - B. Cycle and rider
 - C. Launch and landing ramps
 - D. Bus
 - E. Score numbers and block beside number. EXAMPLE: 
 - F. Free play and end game block (top of screen).

STEP 2 - CHECK LANDING WINDOW

1. Using "video probe" (or a length of wire with a 22K resistor at one end), to from Pin 6 (six) of edge connector to A-5 Pin 8.
 - A. There should be a darker colored gray band from the bottom edge of the landing ramp to the right edge of screen.

* NOTE: If a light gray or a broken light gray band show's up at the far right edge of screen during the above test, reject the board.
 REASON: "Glitch in landing window".

STEP 3 - STARTING GAME

1. Set gas at idle (pot #2)
2. Put in one (1) coin; (push "coin 1" button) credit light #1 should light up.
3. Push "start credit" button, credit light #1 should go out.
4. Game should start.

A. Check the following:

1. Cycle starts on top line at far left.
2. Free play and end game blocks turn black.
3. Both scores reset to "8".
4. Only 8 bus (8) between launch and landing ramps.

B. Idle speed test:

1. At idle cycle should not jump past the 7th bus.
2. Check boing and crash audio as cycle hit's bus and crashes to ground.
3. Cycle should reset to top line left side after crash.
4. Pulse E-5 Pin 5* check crowd and whistle audio. *Note when E-5 Pin 5 is pulsed, cycle will score a point when it crashes; when it crashes, this is alright, proceed to Step 5.
5. As cycle reset's again, add gas and check for 2 stage wheelie.
6. Let cycle miss for the 3rd time.
7. Game should end. Turn power off (CB 1 & CB 2)

STEP 4 - SETTING FLIP POT

1. Set gas at $\frac{1}{2}$ (Pot #2)
2. Turn power on (CB 1 & CB 2)
3. Restart game. (Push coin button 1, once / push "start credit" button.
4. Adjust flip pot (next to Q15) until cycle flips over on top line, (with gas set a $\frac{1}{2}$) *Note you may have to repeat Step 3 a few times until you get the pot adjusted properly.
5. Listen to skid audio as cycle flips. Does it sound OK?
6. Turn power off (CB 1 & CB 2)

STEP 5 - GOOD JUMP TEST

1. Turn on power (CB 1 & CB 2)
2. Put in two (2) coins. "Coin 1" button, (credit light #1 should light on the first coin and credit light #2 should light on the second coin.
3. Start game by pushing "coin 2" button, (game should start and both credit lights should go out).
4. Game should start with white cycle in play.
5. Crash white cycle. Game should reset to black cycle.
6. Jump black cycle to a "good jump" (landing on landing ramp).
 - a. You should score a point for black only / get crowd and whistle audio.
 - b. Reset back to black cycle.
7. Crash black cycle, game should reset to white cycle.
8. Repeat Step 6 with white cycle (jumping to good jump etc).
9. Turn power off (CB 1 & CB 2)

STUNT CYCLE (CON'T)

STEP 6 - TWO PLAYER MODE

1. Set gas at idle.
2. Put player mode switch in "2P"
3. Turn on power (CB 1 & CB 2)
4. Push "coin 1" button once.
 - a. Credit light's 1 and 2 should light. *Note: If only one credit light light's up, the player switch may be dirty. Turn power off, (CB 1 & 2) and flip player mode switch from 2P to 1P a few times to clean the contacts's. Replace switch in 2P mode and start with Step 6 #3.
5. Start game by pushing "coin 2" button. Both credit light's should go out, game should start with white cycle in play.
6. Pulse white score to 23 (B8 Pin 5), free play block should turn white, credit light #1 should light up.
 - a. Before cycle crashes, pulse white score to 27, (Note: DO NOT pulse past 27). This should end the play for the white cycle and reset to black cycle.
7. Pulse black cycle score to 27 (B-9 Pin 5), this will end game.
 - a. Credit light #2 should light.
 - b. End game block should turn white.

STEP 7

1. Without adding coins (coin 1 button), push the "start credit" button.
 - a. Game should start with white cycle in play.
 - b. Credit light #2 should go out.
 - c. Credit light #1 should stay lit.
 - d. Game end block should turn black.
 - e. Free game block should stay white.
2. Pulse E-5 Pin 4
 - a. Game should end.
 - b. Game end block should turn white.
 - c. Free game block should turn black.
 - d. Credit light #1 should stay lit.
3. Push "start credit button"
 - a. Game should start.
 - b. End game block should turn black.
 - c. Free game block should stay black.
 - d. Credit light #1 should go out.
4. Pulse antenna input - Base of Q9 or Pin 17 of Main PCB Edge Connector.
 - a. Game should end.
 - b. End game block should turn white.
5. Turn off power (CB 1 & CB 2)

STUNT CYCLE (CON'T)

STEP 8

1. Place free game switch in "free game not" = \overline{FG}
2. Set gas at idle.
3. Push "coin 1" button once, only credit light should go out.
4. Push "coin 2" button to start game. Credit light should go out.
5. Pulse white score up to 23 (B8 Pin 5)
 - a. Free game block should stay black.
 - b. No credit light's should light up.

NOTE: If the free game block turns white or if a credit light light's up, the free play switch may be dirty. Turn power off (CB 1 & CB 2), and wiggle the free play switch back and forth a few times to clean the contacts.

Replace the switch back in F6 (free play not) mode and start again with Step 8 #3.

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
16.5V CT	1	BV4		B-A6, A-N5, A-H5	
.5V CT	A	BR6		B-G4, A-N2, A-U4	
+10V Unreg.	2	BV3		B-F6	
+10V Unreg.	B	BR5		B-G1	
16.5V AC	3	BV2		B-A5	
16.5V AC	C	BR4			
16.5V AC	4	BV1		B-B1	
16.5V AC	D	BR3			
	5	BU6			
Paddle	E	BR2		A-G1	POT 4 CT
	6	BU5			
	F	BR1			
	7	BU4			
Video Gnd.	H	BP6		B-M1	Video Gnd.
	8	BU3			
+5V	J	BP5		A-S3	
Paddle +5V	9	BU2		A-F6	POT 4 Left
Test	K	BP4		A-b6	SW 18
Slam	10	EU1		A-N6	SW 12
Start 2	L	BP3		A-H6	SW 2
Start 1	11	BT6		A-H3	SW 1
Coin 2	M	BP2		A-T2	Coin 2
Coin 1	12	BT5		A-S5	Coin 1
Video Hot	N	BP1		B-L6	Video Hot
Select	13	BT4		A-Y4	SW 16
Start 1	P	BN6		A-U3	Aux Lite 1
Coin Counter	14	BT3		A-S2	
Select	R	BN5		A-a3	SW 17
Serve	15	BT2		A-J3	SW 3
Serve LED	S	BN4		A-V1	Aux Lite 3

GAME:

SUPERBUG

VARIAC:

#1 NOT USED
#2 25 VAC (CHECK E & G)
D.C. SUPPLY

POTS USED:

NONE.

CREDIT LIGHTS:

#1 (ABOVE MULTIMETER)

AUXILIARY LIGHTS:

#2 TRACK SELECT
#3 COIN LOCK OUT

SWITCHES:

#1 HIGH SCORE RESET
#2 TRACK SELECT
#5 SLAM
#6 GAS
COIN #1
COIN #2
START CREDIT

CONTROLS:

STEERING BOARD CONTROL
GEARS 1ST, 2ND, 3RD, & REV. (4TH)

SUPERBUG

<u>TO</u>	<u>FROM</u>	<u>DESCRIPTION</u>
AR6	Cc6	DIAGONAL POWER
AS1	Cc5	DIAGONAL POWER
AV1	BF6, V3	+10 V UNREGULATED
BG1	BR5	+10 V UNREGULATED
BG4	BV4	10 V GROUND
BG5	BR6	10 V GROUND
BB2	BM6	25 VAC SEC
BB4	BM5	25 VAC SEC
BB3	BM4	25 VAC CT
BU4	AS5	COIN 1
BR1	AT2	COIN 2
BR2	AK3	SLAM
BP5	AT6	START
BP4	AG4	1ST
BU1	AG5	2ND
BU2	AG6	3RD
BP3	AK5	GAS
BP2	AU4	START LP
BN6	AU6	TRACK SEL LP
BC3	AU3, U5	6 VAC HOT
BS2	BC4	6 VAC COM
BT5	AV2	LOCKOUT LITE
BP1	AH6	TRACK SEL
BT4	AH3	HIGH SCORE RESET
BT6	Ab6	TEST
BS1	AS4, T1, K2, T4, G3, K6, H5, H2, b5 P5	GROUND
BS6	AP6, R2	SPEAKER
BM3	AR1	SPEAKER GROUND
BU5	AP2	+5 VDC
BP6	AP3	STEERING A
BU3	AP4	STEERING B
BU6	BL6	VIDEO
BV2	BM1	VIDEO GROUND

OPERATIONAL DESCRIPTION

S2 = TRACK SELECT
 S5 = SLAM
 S18 = TEST SWITCH
 LP2 = TRACK SEL LP

S6 = GAS
 S1 = HIGH SCORE RESET
 LP1 = START LP
 LP3 = LOCKOUT LITE

SUPER BREAKOUTI. TOOLS NEEDED:

- A. Program Plugs (1 Set).
- B. Edge Connector Harness (44 Pin).
- C. 1 Super Breakout RFI.

II. VOLTAGES REQUIRED:

- A. Variac #1 20.0 V.A.C. 41%.
- B. Variac #2 25.0 V.A.C. 51%.
- C. D.C. Preset Power Supply 10.0 V.D.C.

III. CREDIT LAMPS:

- (One Player Start) A. Credit Lamp #1 Incandescent 6.3 Volts 20 M.A.
- (Two Player Start) B. Credit Lamp #2 Incandescent 6.3 Volts 20 M.A.
- C. Serve Lamp #3 14 Volt L.E.D. (Check Polarity).

IV. SWITCHES, CONTROLS & CIRCUIT BREAKERS USED: (CTS-1)

- A. Master Power CB's 1, 2, 3, & 4.
- B. Universal Expansion Module Toggle Switch.
- C. S1 (One Player Start).
- D. S2 (Two Players Start).
- E. S12 (Slam).
- F. S16 (Game Select).
- G. S17 (Game Select).
- H. S18 (Diagnostic Self Test).
- I. Pot #4 (One & Two Players Control).

V. SWITCH LOCATIONS & SETTINGS P.C.B.:

- A. Program Option Switch Between J8 & 9.
Positions 3, 5 & 8 Off = 1 Coin Per Player/Game.
Three Serves Per Game & Bonus Game For 200 Points.
- B. Volume Pot (V1) Located Above Audio Amp.
5kΩ Set Arrow At A 3 O'Clock Angle.
- C. Reset Button B10.

VI. VISUAL INSPECTION:

- A. Check Component Side For Loose, Damaged Or Missing Components, Component Polarity And Overall Workmanship.
- B. Check Circuit Side For Solder Bridges, Lead Lengths, Damaged Or Burnt Traces, Pads, Etc.
- C. Check Fingers For Cleanliness, Solder Bridges, Contamination, Etc.
- D. Plug Main Board Into A "Known Good" Super Breakout RFI. This Is To Insure That The Main Board Is Capable Of Functioning All Required Switches, Controls, Audio And Coin Counter.

VII. POWER UP:

- A. Turn On CB's 1, 2, 3 & 4 Located On Master Power.
- B. Turn On Toggle Switch Located On The Universal Expansion Module.
- C. Game Video Will Appear In "Attract Mode".
Check For Glitching, Horizontal & Vertical Sync, Stability & No Audio.

VIII. DIAGNOSTIC SELF TEST:

- A. Place Toggle Switch S18 Up.
- B. Check Credit Lamps 1, 2 & 3.
- C. Listen For 4 Different Audio Beeps Going From High To Low.
- D. Press Coins 1 & 2, S1, 2, 3 & 12. Toggle Switches S16 & 17 Each One Of These Switches Should Give Audio Beeps High Or Low Depending On Switch Pressed.
- E. Rotate Pot #4 While Watching Video Alphanumeric Should Go From 00 To FF In A Smooth Hexidecimal Count.
- F. S18 Down, (Diagnostic Switch). Audio/Video And Control Tests Complete; Video Should Now Return To "Normal Attract Mode".

IX. FUNCTIONAL TEST: (SINGLE PLAYER MODE)

- A. Press Coin 1 Once While Watching Coin Counter For Rotation & Click.
- B. Check Video For Playfield & Bricks, BONUS FOR 200 1 COIN 1 PLAYER (Flashing) Paddle Or Paddles (Moveable With Control Pot #4) Score Windows "00" Two Locations.
- C. Check Credit Lamp #1 (Flashing On & Off).
- D. Press S1 (One Player Start) While Watching Credit Lamps Credit Lamp #1 Goes Out, #3 Will Flash In Unison With Score Window. 1 COIN 1 PLAYER Video Is Gone, Replaced By A #1 Signifying First Serve Is Ready.
- E. Press S3 (Serve) Credit Lamp #3 Should Go Out Coming On (Flashing) After A Miss.
- F. Check Video For Ball Stability & Complete Paddle Movement (Top To Bottom).
- G. Check Audio, Balls, Paddles, Walls, Bricks, Miss & Bonus. NOTE: Audio Frequency Increases With Ball Speed, Duration Of Volley And Depth Of Penetration Into The Wall (Paddle Audio Only).
- H. Check Score Window For Proper Score Tabulation.
- I. Check "Game Over" Video For:
 - 1. "Post Game Attract Video".
 - 2. HIGH SCORE/1 COIN 1 PLAYER Flashing Alternately While Balls Strike Bricks With No Penetration Until High Score Video Goes Off, Returning Video To "Normal Attract Mode".

X. BONUS GAME:

- A. Minimum Points For A Bonus Game Are Set With Option Switches #5, 6, 7 & 8 Located On P.C.B. Between J8 & 9. If During Game-play Minimum Points For Bonus Are Met Or Exceeded, A Bonus Audio Can Be Heard And Upon Completion Of Game, One Free Game Will Be Awarded To Player.

NOTE: Only One Free (Bonus Game) Per Coin.
This Means That If During Bonus Game-play The Bonus Score Is Met Or Exceeded, No Bonus Game Will Be Given.

XI. FUNCTIONAL TEST: (TWO PLAYER MODE)

- A. Press Coins 1 & 2 Once Each.
- B. Check Credit Lamps 1 & 2 Flashing.
- C. Check Video. No 1 COIN 1 PLAYER And No #1 (Serve) Tally Window.
- D. Press S2 (Two Player Start).
- E. Credit Lamps 1 & 2 Off, #3 Lamp Flashing.
- F. Check Video For (Serve) Tally Window #1 & 2 (Score) Tally Windows, Top Window #1 Player Flashing, Bottom Window #2 Player Steady.
- G. Player Rotation Occurs Only After A Miss.

SUPER BUG

I. Test Equipment Required:

A. Universal Test Fixture

1. Fluke Meter Installed.
2. External Speaker Plugged Into "SPKR" On Control Panel.

- B. 44 Pin Edge Connector.
- C. Super Bug Program Plug.

II. Set-Up Procedure:

A. Universal Test Fixture

1. Turn Power "On" To Video Display Monitor.
2. Turn On Circuit Breakers 1 & 2 On Master Power Panel.
3. Install Super Bug Program Plugs A,B & C Into The Respective Sockets On The Master Power Panel.
4. Connect The 44 Pin Edge Connector To The P.C. Board To Be Tested Observing TOP Designation On Connector Is Facing Up.
5. Insure 6800 (Atari P/N 90-6001) Chip Installed At C4.
6. Turn On CB4 And Adjust Variac #2 To 25 VAC Measured At Pins E & G.
7. Insure Switches Inside The Left Hand Panel Of The Test Fixture Are On.

CAUTION: TOUCH ONLY THE SWITCH. HIGH VOLTAGE IS PRESENT
INSIDE THE CABINET.

III. Test Procedure:

A. Self Test

1. S18 On The Control Panel Should Be Up. The Screen Will Display Alphanumerics On The Sides Of The Display. The Alphanumerics Will Then Switch From One Side To The Other. The Screen Will Display The Graphics, And The Graphics Will Change After A Period Of Time.
2. After Approximately 40 Seconds Motor Audio Will Be Heard. Actuating S1,S2,S5,S6,Coin 1,Coin2, Start Credit Will Also Cause Screech.
3. Turning Steering Clockwise Increases, And Counter Clockwise Decreases Motor Frequency.

B. Game Operation

1. Insure S18 Is Off. Depressing Coin 1 Or Coin 2 Causes Lamp Number 1 Above DVM To Flash. Depressing S2 Will Cause Lamp 2 Above DVM To Light. Depress Start Credit To Play Game. Turn S6 On And The Car Will Now Accelerate.
2. After S6 Is Turned On, Motor Frequency Will Increase. As Gears Are Shifted 1st Thru REV (4th) At Each Change,

Motor Frequency Will Drop And Increase Again. The Track Will Appear To Move Past The Bug Faster.

3. When The Car Passes Thru Oil Or Sand, A Screech Will Occur When The Car Hits The Wall, The Word Crunch Will Appear On The Screen And Crash Will Be Heard.
4. Located At Position B6 Is An Eight Position Switch. Setting One And Two Determine The Language.

<u>SW 1</u>	<u>SW 2</u>	<u>LANGUAGE</u>
OFF	OFF	GERMAN
ON	OFF	SPANISH
OFF	ON	FRENCH
ON	ON	ENGLISH

5. Switch #3 Determines Whether A Bonus Is Involved: Off Bonus, ON No Bonus.
6. Switch 4,5 And 6 Determine Point Count For Bonus.

<u>SW 4</u>	<u>SW 5</u>	<u>SW 6</u>	
OFF	OFF	OFF	Point Count 300
ON	OFF	OFF	" " 240
OFF	ON	OFF	" " 240
ON	ON	OFF	" " 190
OFF	OFF	ON	" " 180
ON	OFF	ON	" " 140
OFF	ON	ON	" " 120
ON	ON	ON	" " 90

7. Switch 7 And 8 Determine Number Of Coins Per Play As Follows:

<u>SW 7</u>	<u>SW 8</u>	
OFF	OFF	2 Coins Per Player
ON	OFF	1 Coin Per Player
OFF	ON	1 Coin Per 2 Players
ON	ON	Freeplay

C. Reset

1. During Game Operation, Depressing Reset (Located At P8,P9) Will Terminate The Game.
2. During Test, Depressing Reset Button Will Restart Test.

D. The Volume Control For The Audio Is Located At A8, & A9.

TANK 2

1. Set Voltage. Hook Cables To P.C. Board.

2. Set Scope At:

Volts/Div.-----2
 Channel-----1
 Trig. Mode-----Auto
 Horiz.-----A Lock Knobs
 Coupling (Both)---A C
 Source-----Norm.

3. Push Coin #1 To Start And Listen To Idle (May Be Adjusted By Turning Frequency Pots 8 & 9).
 Check Voltage With Scope By Probing Traces (By Pots 6 & 7) So Scope Reads 1 1/3.
4. Adjust Volume By Turning Pots 4 & 5.
5. Drive Tanks To Bottom Of Screen And Set Them Side By Side. Fire Missles At The Same Time And Check Range. Black Tank Range Is Not Adjustable, So If They Are Not Equal Adjust White Tanks Range By Turning Pot #10 (On #2 Board By I.C.), Until They Are Equal. To Adjust Both Tanks Boom Audio Turn Pot #1 By Q2. To Adjust Both Tanks Shot Audio Turn Pot #2 By Q1.
6. Turn Both Tanks In Toward Each Other And Fire, Both Should Score. Drive Each Tank To A Mine And The Opposite Tank Should Score. i.e.: If White Tank Hits A Mine The Black Tank Should Score A Point. Both Should Turn 360°.
7. Make Sure Score Flashes At The End Of Game. Start Again. Pulse I.C. 10 B Pin 3 And 11 D Pin 1, Should Count To 20.
- * When All Tests Are Completed. Solder Pins 1 And 4 On I.C. 9 A; To Enable Barriers. Check That Both Tanks Will Hit Barriers.
- * Do This On Post Burns ONLY.

TEMPEST MAIN BOARD TEST SEQUENCE

1. Turn on Power.
2. Verify proper sequence in Attract Mode.
3. Check LED'S on CTS-1 do not come on.
4. LEDS on Main and Aux. board are on.
5. Go into Status Mode by throwing S-7 up.
6. Rotate Steering control until FIRE AND ZAP FOR SELF TEST appears on display.
7. Press S-3 and S-4 to to into Self Test Mode.
8. LEDS on CTS-1 are on.
9. Display will go blank for a few seconds while memory on game is being checked.
10. Check to see there are no letters in upper half of display.
11. Check DIP switches on Main Board, locations 'L12' and N13.
12. Check game switches S-1,-2,-3,-4,-8,-9,-10,-15,-16.
13. Check hexadecimal for Steering Control.
14. Toggle S-6. A cros hatch pattern will appear.
15. Adjust potentiometers R147 and R167 for centering.
16. Adjust potentiometers R150 and R168 for size.
17. Adjust potentiometers R117 and R118 so that corners of squares rest on large rectangle edges.
18. Adjust potentiometers R165 and R169 for linearity.
19. Secure R117, R118, R165 and R169 with RTV or Loctite.
20. Toggle S-6. A cross will appear and 4 POKEY sounds will be heard.
21. Toggle S-6. Check for three groups of color.
22. Toggle S-6. Checkerboard pattern color will change with Steering Control.
23. Toggle S-6. There will be a rectangle displayed.
24. Push S-7 down to go into Attract Mode.
25. Coin up some credits. LED's on CTS will flash.
26. Start game and play for fifteen seconds or less.

END OF TEST

*This will become a part of the final
Tempest Procedure when it is released.*



9/10/81

TEMPEST AUXILIARY TEST SEQUENCE

1. Throw S-7 up and turn on Power.
2. Game will be in Self Test Mode and Leds on game are on. Leds on CTS will be on.
3. In the first display verify Math Box, Position/Control, Memory and Pokeys are good. Operate Game Switches.
4. Step S-6 to display a symmetrical cross. Listen for 4 sounds.
5. Go into Attract Mode by pushing S-7 down. Verify good video in Attract Mode.
6. Coin up some credits. Leds on CTS-1 will flash.
7. Go into game play and play for fifteen seconds or less.
8. Go into Status Mode by throwing S-7 up.
9. Rotate Steering Control until FIRE AND START 1 TO ZERO TIMES is displayed.
10. Press S-1 and S-3. Observe times being zeroed and word ERASING is flashing on display.
11. Rotate Steering Control until FIRE AND START 2 TO ZERO SCORES is displayed.
12. Press S-2 and S-3. Observe word ERASING is flashing.
13. Throw S-7 down and observe scores zeroed in Attract Mode.
14. Throw S-7 up. Rotate Steering Control until FIRE AND ZAP FOR SELF TEST is displayed.
15. Press S-3 and S-4. Game will go into SELF TEST MODE and Leds on CTS come on.

END OF TEST.



9/11/81
4:30 PM

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
+5V OUT	Y	BM4	30" AUX. HARNESS	J18 PIN 2	AUX HARNESS
+5V RETURN	Z	BM3		J18 PIN 15	AUX HARNESS
-22V	4	BV1		CJ2	REG/AUDIO BOARD
+22V	3	BV2		J18 PIN 4	AUX HARNESS
+5V RETURN	1	BV4		CJ1	REG/AUDIO BOARD
+5V RETURN	A	BR6		J18 PIN 3	AUX HARNESS
+10.6V	14	BT3		CH5, AS6, AT3, AT6,	REG/AUDIO BOARD
+5V REG	2	BV3		J18 PIN 1, AK6	AUX HARNESS
+5V REG	B	BR5		CH4, AX2, AL3, AL6	REG/AUDIO BOARD
+ SENSE	21	BS2		J18 PIN A	AUX HARNESS
- SENSE	22	BS1			
VIDEO RETURN	M	BP2		BG2	+10.3V UNREG
X OUT	T	BN3		CH2	REG/AUDIO BOARD
Y OUT	17	BS6		CH3	REG/AUDIO BOARD
X GND	16	BT1		CG6	REG/AUDIO BOARD
Y GND	U	BN2		CG5	REG/AUDIO BOARD
Z OUT	11	BT6		BJ1	B/W X-Y MONITOR
SELF TEST	7	BU4		BJ3	B/W X-Y MONITOR
DIAG. STEP	H	BP6		BJ4	B/W X-Y MONITOR
SLAM	5	BU6		BH5	B/W X-Y MONITOR
COIN L	6	BV5		BH6	B/W X-Y MONITOR
COIN C	F	BR1		BJ2	B/W X-Y MONITOR
COIN R	E	BR2		AL2	SW. 7
COIN CNTR L	12	BT5		AK5	SW. 6
COIN CNTR C	P	BN6		AL5	SW. 8
				AS4	COIN SW. 1
				AT1	COIN SW. 2
				AT4	START CREDIT SWITCH
				AG4	1 ST GEAR
				AG5	2 ND GEAR
					3 RD GEAR

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
RESET	V	BN1		J18 PIN F	AUX HARNESS SWITCH COMMON
+5V RETURN		J18 PIN S		AJ3, AJ6, AP5, AH3, AH6, AM3, AM6	
+5V OUT		J18 PIN R		AU4, AU6, AP2	
START LED 1		J18 PIN 12		AU3	AUX LITE 1
START LED 2		J18 PIN 13		AU5	AUX LITE 2
START 1		J18 PIN 11		AH2	SW. 1
START 2		J18 PIN M		AH5	SW. 2
FIRE 1		J18 PIN 9		AJ2	SW. 3
FIRE 2		J18 PIN K		AM2	SW. 9
ZAP 1		J18 PIN 10		AJ5	SW. 4
ZAP 2		J18 PIN L		AM5	SW. 10
B. DIR. 1	30" AUX. HARNESS	J18 PIN J		A ^b 4	SW. 18 PLAYER 1 PLAYER 2 STEERING SELECT
T.B. DIR. 2		J18 PIN 8		A ^b 6	
T.B. CLK. 1		J18 PIN H		A ^c 1	
T.B. CLK 2		J18 PIN 7		A ^c 3	
AUDIO (+)		J18 PIN 5		BL1	
AUDIO (-)		J18 PIN D		BL2	INPUT 2
COCKTAIL		J18 PIN C		AX3	SW. 15
		AG3		AS2	GEAR SELECT COMMON
		A ^b 5		AP4	STEERING
		A ^c 2		AP3	STEERING
SPEAKER OUT		AP6		BL4	AMP
SPEAKER OUT		AR1		BL5	AMP
OUT 3	J	BP5		BT2	X INV.
OUT 4	K	BP4		BN4	Y INV.
		BG1		AS3	COIN COUNTER

TOURNAMENT TABLEI. Tools Needed:

- A.) Program Plugs (A & B)
- B.) Paddle Control Box (4 Pots With 12 Plug Connector)
- C.) Edge Connector Harness (44 Pin)

II. Power Settings:

- A.) Variac 1 & 2 NOT USED
- B.) Master Power, CB's 1 & 2 = 9.5 Volts D.C.

III. Controls Used:

- A.) Paddle Control Box (Floating 4 Pot Unit)
- B.) Paddle Option Switches S9,10,11 & 12 (Control Panel, CTS-1)

IV. Diagnostic Test:

- A.) Switches Used: CTS-1 (Control & Master Power)
 - 1. Coin 1 & 2
 - 2. S1,2,3,5,S8,9,10,11,12
 - a.) All Switches Will Give Audio When Pressed
- B.) Credit Lights: 14. Volt L.E.D.'s
 - 1. Credit Lights 1,2,3,5 Will Remain On During Test
- C.) Video:
 - 1. At Top Of CRI In Capital Letters Will Be TEST
 - 2. Below "TEST" Video 7 Windows Will Be Stacked:
 - OK - ROM
 - OK - RAM
 - OK - RAM
 - B - Coin Mode
 - A - Bonus (Breakout Only)
 - 11 - Game Time & Points
 - 3 - # Of Balls
 - 3. Option Switches E6 & E7 (On Board) Set In The Following Manner Will Give You This Stacked Video Print/Out Above:
 - E6 1 & 8 OFF
 - C7 1 Thru 4 On
 - 4. Breakout Played With Switches Set This Way Will Give You:
 - 1 Coin Per Game/Player
 - 3 Balls Per Player
 - Bonus Game For 200 Points Or More

V. Functional Test:

- A.) Switches Used: (Control & Master Power) CTS-1
 - 1. CB's 1 & 2
 - 2. Coin 1 & 2
 - 3. S1,2,3,5,8,9,10,11 & 12
- B.) Controls Used: Control Panel (4 Pot Floating Unit)
- C.) Credit Lights: (Master Power Panel CTS-1)
- D.) Switches Used: (On Board)
 - 1. 8 Button Option Switch E6 = Coin Modes 1-4
 - 2. 4 Button Option Switch C7
 - 3. Reset Button

VI. Power Up - Start Game: (Breakout 1 Player Mode)

- A.) CB's 1 & 2 On
 - 1. Check Video: Game Over
Breakout
- B.) Press Coin 1 Or 2 Once Only On Master Power Panel
 - 1. Check Video: 1 Credit Credit Lights #1 & 5 ON
Breakout
- C.) Press S1
 - 1. Check Video: Score, Serve
Bricks, Walls, Paddle Movement Up & Down, &
No Credit Lights
- D.) Press S10
 - 1. Check Audio & Video, Stability Of Ball
 - 2. Play Game A Little To Insure That All Audios Are There
And That Score Counts Correctly. Also, Check Speed Up
And Vertical Mode Changes.
- E.) Bonus Game
 - 1. If You Exceed 200 Points At End Of Game, Check For:
 - a.) Credit Lights 1 & 5 ON
 - b.) Video Should Read: 1 Credit Breakout
 - c.) Repeat Serve & Play Test Breakout OK

- S1 Single Player Start Credit Breakout
- S2 Two Player Start (All Games)
- S3 4 Player Start (All Games)
- S5 Slam.
- S8 Game Selection
- S9 White Player - Pot #1 Forward Or / Option: Jump, Catch,
Top Whammy
- S10 Black Player - Pot #2 Forward Or "
Top
- S11 White Player - Pot #3 Rear Or "
Bottom
- S12 Black Player - Pot #4 Rear Or "
Bottom

Breakout Brick Value 60 Of Them

- 10 Tall 6 Deep
- 1st 2 Rows 3 Points Each
- 2nd 2 Rows 5 Points Each
- 3rd 2 Rows 7 Points Each

DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CONN. PIN #	CTS-1 DESTINATION	CTS-1 DESCRIPTION
16.5 VCT	1	BV4		BG4	
16 VCT	A	BR6		BG5, AP5	
+ 7 UNREG	2	BV3		BF6	DC SUPPLY
+ 10V UNREG	B	BR5		BG1, AS3	
LOCKOUT COIL	3	BV2		AW5	LIGHT 8
COIN COUNTER	C	BR4		AS2	COIN COUNTER
ANODE 6	4	BV1		CL3	
ANODE 7	D	BR3		CL4	
+ 5V	5	BU6		AW6, AP2	
CATHODE 1	E	BR2		CJ6	
CATHODE 2	6	BU5		CK1	
CATHODE 3	F	BR1		CK2	
ANODE 5	7	BU4		CL2	
CATHODE 4	H	BP6		CK3, AU3	
ANODE 3	8	BU3		CK6	
ANODE 4	J	BP5		CL1	
ANODE 8	9	BU2		CL5, AU4	START LAMP
ANODE 1	K	BP4		CK4	
VIDEO GND	10	BU1		BM1	
ANODE 2	L	BP3		CK5	
SPEAKER GND	11	BT6		AR1	
VIDEO	M	BP2		BL6	
	12	BT5			
SPEAKER	N	BP1		AP6, AR6	
PLUNGER 1	13	BT4		AP3	S15
PLUNGER 2	P	BN6		AP4	
	14	BT3			
JUDGE	R	BN5		AH5	SW2
TEST	15	BT2		AK5	SW6

ME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN. PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
	S	BN4			
START	16	BT1		AT4	START
SLAM	T	BN3		AL2	SLAM
COIN 2	17	BS6		AT1	COIN 2
COIN 1	U	BN2		AS4	COIN 1
RIGHT FLIPPER 2	18	BS5		AK2	S5
LEFT FLIPPER 1	V	BN1		AH2	S1
25 VAC	19	BS4		BB2	
25 VAC	W	BM6			
25 VAC	20	BS3		BB4	
25 VAC	X	BM5			
GND	21	BS2		AH3, AH6	
GND	Y	BM4		AK3, AS6	
25 VCT	22	BS1		BB3, AK6, AT3	
25 VCT	Z	BM3		AL3, AT6	
					S15 Com.
					S15 Com.

TRACK 10

1. Start Game:
 - A.) Press Coin One - Coin Counter Should Increment And Start Credit Light Should Come On.
 - B.) Press Start Credit Button. Car Should Reset To Starting Position.

2. To Drive Car:

S6 Down = Gas On
S7 Down = Brake On

To Eliminate Crash: Short C5 Pins 5 & 7 Together.

ADJUSTMENTS

3. Adjust Motor Audio:
 - A.) Eliminate Crash
 - B.) Turn On Gas; Allow Car To Reach Maximum Speed In Second Gear.
 - C.) Set Oscilloscope To .5 ms/div. Check E8 Pin 3, Adjust Pot Near E8 So One Complete Pulse Lasts 2.43 ms. (Roughly 5 div.)
 - D.) Check D8 Pin 3; Adjust It's Pot To 3.07 ms. (Roughly 6 div.)
 - E.) Set Scope To 2 ms/div.
 - F.) Check C8 Pin 3; Adjust For 13.7 ms/div. (Roughly 7 div.)
4. Adjust Speed Pulses (With Car At Max. Speed, 2nd Gear):
 - A.) Set Scope To 5 ms/div.
 - B.) Check B2 Pin 3. Adjust Speed Pulses Pot (Near 72030 Hybrid) To 35 ms. (7 div.)
5. Adjust Screech & Crash Audio:

This Is A Subjective Test Made While Adjusting Pot Near F9.

 - A.) Adjust Pot While Car Is In Motion And While Turning Brake Switch On And Off Until A "Good" Screech Sound Is Heard.
 - B.) After Attaining A Good Screech, Allow Car To Crash And Verify That Crash Sound Is Good. Screech/Crash Pot May Have To Be Readjusted To Reach An Acceptable Compromise.
6. Adjust Play Time:
 - A.) Set Scope At .2 sec/div. And Set Trig. Mode For Normal Triggering.
 - B.) Check B8 Pin 3 With Scope. Adjust Play Time Pot So That One Pulse Occurs Every 1.2 Seconds (6 Divisions); With Scope In Normal Trigger Mode, The Level Control On Scope Can Be Set Such That The First Pulse Of Every Trace Begins Consistently At The Beginning Of The Sweep.

TWIN RACER

NOTE: "L.E.D." Type Lamps Must Be Installed In The Place Of Auxiliary Lamps 1 And 2 Enable To Test 1 And 2 Player Credit.

1. Set Variac 1 To 12 VAC, Set Variac 2 To 25 VAC.
2. A. Engage Circuit Breakers No. 1 To 4.
B. Check For Proper Video Presentation.
3. A. Press Coin Switch 1 Check That Auxiliary "L.E.D." 1 Lights.
B. Press The Start Switch 1.
4. A. One Car Should Appear At The Start Line With The Score Reset.
B. Switch 15 Will Operate The Gas, Switch 6 Will Operate The Brakes.
C. Switch 18 Will Be Used To Switch The Audio From One Car To Another.
D. Check The Proper Operation Of These Switches And Of Steering And Gear Shift.
E. Check That The Game Scores Player Points And That Game Ends.
5. A. Press Coin Switch 1 Twice, Check That Auxiliary "L.E.D." 2 Lights.
B. Press The Start Switch 2 (Sw. 1).
6. A. Two Cars Should Appear At The Start Line With Both Scores Reset.
B. The Switches For Car 1 Will Be The Same.
C. Switch 16 Will Operate The Gas For Car 2, Switch 7 Will Operate The Brakes.
D. Repeat Steps 4C Thru 4E.
7. Check The Static Mode.

End Of Test

ULTRATANK

CS'D 2F37

FROM 3 030180 (NI) ~~3000~~
 307F 307F(5) 030181 (KI) (1000)
 2F37-PR0M 4 030182 (MI) ~~3800~~ (3000)
~~3122~~ 31DP 030183 (LI) (7800)
 (3800)

CS.
 344F Rom 1 030178
 4107 Rom 2 030179

RAM

SWATCH PAD
 VIDEO DISPLAY

0000-00FF
 0800-0BFF

SWITCH TEST	HEX ADDRESS	DATA LED
Start 1	(A) 2000	D7
Joy W	(A) 2001	D7
Start 2	(A) 2002	D7
Joy V	(A) 2003	D7
Fire A	(A) 2004	D7
Joy X	(A) 2005	D7
Fire B	(A) 2006	D7
Joy Z	(A) 2007	D7
Coin 1	(A) 2020	D7
Coin 2	(A) 2022	D7
Invisible	(A) 2024	D7
Rebound	(A) 2026	D7
Barrier Read	(A) 1800	D7
Test	(A) 1000	D6
V Blank	(A) 1000	D7
Lang 0	(A) 2060	D0
Lang 1	(A) 2060	D0
Credit 0	(A) 2061	D1
Credit 1	(A) 2061	D0
Time 0	(A) 2062	D1
Time 1	(A) 2062	D0
Spare	(A) 2063	D0
Spare	(A) 2063	D0
Collision Read	(A) 2043	D1
Slan	(A) 2044	D7
Slan	(A) 2046	D7
Collision 1 Reset	(A) 2020	D7
Collision 2 Reset	(A) 2022	D7
Collision 3 Reset	(A) 2024	D7
Collision 4 Reset	(A) 2026	D7
Write B/A latch	(A) 2040	D7
Write Explosion	(A) 2042	D7
Timer Reset	(A) 2044	D7

LATCH TEST

	HEX ADDRESS
Fire 1	(A) 206E
Fire 2	(A) 206C
Led 2	(A) 206A
Led 1	(A) 2068
Lockout	(A) 2066

All latches are activated
 by data switch zero.

30180 XX
 30183 (?)

XEVIOUS RASTER

SWITCH LIST

<u>SWITCH FUNCTION</u>	<u>CTS LOCATION</u>
COIN L	COIN SW. 1
COIN R	COIN SW. 2
COIN AUX.	START CREDIT SW.
COIN COUNTER L	1 ST GEAR
COIN COUNTER R	2 ND GEAR
START 1	SW. 1
START 2	SW. 2
START LED 1	AUX. LIGHT 1
START LED 2	AUX. LIGHT 2
TEST	SW. 7
UP	JOYSTICK 2
DOWN	JOYSTICK 2
LEFT	JOYSTICK 2
RIGHT	JOYSTICK 2
ZAPPER	SW. 3
BLASTER	SW. 5

GAME 44 PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	CIS-1 DESTINATION	CIS-1 COMPONENT DESCRIPTION
GND	1	BV4	CH4, J19 PIN 1, AB4 AB6, AC2, AC4	R/A BOARD
SENSE	22	BS1	CG5	R/A BOARD
+ SENSE	21	BS2	CG6	R/A BOARD
GND	A	BR6	CH5, J19 PIN A, AJ2, AK2	R/A BOARD
+5V. REG.	2	BV3	CH2, J19 PIN 2	R/A BOARD
+5V REG.	B	BR5	CH3, J19 PIN B	R/A BOARD
+10.3 V UNREG.	E	BR2	BF6	R/A BOARD
COIN L	K	BP4	AS6	COIN SW. 1
COIN R	9	BU2	AT3	COIN SW. 2
COIN AUX.	J	BP5	AT6	START CREDIT SWITCH
COIN COUNTER L	7	BU4	AG4	1 ST GEAR
COIN COUNTER R	H	BP6	AG5	2 ND GEAR
TEST	8	BU3	AL3	SW. 7
START 1	L	BP3	AH3	SW. 1
START 2	10	BU1	AH6	SW. 2
START LED 1	17	BS6	AU4	AUX. LIGHT 1
START LED 2	U	BN2	AU6	AUX. LIGHT 2
UP	S	BN4	AC1	JOYSTICK 2
DOWN	P	BN6	AB3	JOYSTICK 2
LEFT	N	BP1	AB5	JOYSTICK 2
RIGHT	R	BN5	AC3	JOYSTICK 2
ZAPPER	M	BP2	AJ3	SW. 3
MASTER	16	BT1	AK3	SW. 5
+5V OUT	Y	BM4	AU3, AU5	AUX LIGHT POWER
GND	Z	BM3	AS4, AT1, AT4, AL2, AH2, AH5	SW. COMMON

GAME # PIN CONN. DESCRIPTION	PIN #	B PROGRAM PIN LOCATION	EXTRA CONN PIN #	CTS-1 DESTINATION	CTS-1 COMPONENT DESCRIPTION
GND	1	BV4		CH4.A56 AT3.AT6	GND
-SENSE	22	BS1		CG5	-SENSE
SENSE	21	BS2		CG6	*SENSE
+5V	2	BV3		CH2	+5VREG
+5V	B	BR5		CH3	+5VREG
AUDIO 2	9	BU2		BL2	INPUT 2
AUDIO 1	10	BU1		BL1	INPUT 1
+22V	3	BV2		CJ1	+22V
+12V	20	BS3		CJ3	+12V
-5V	19	BS4		CJ4	-5V
GND	A	BR6		CH5.AE3.AEG AF3.AFG	+5V RETURN
GND	Z	BM3		AH3.AH6.AJ3 AK6.AL3 AL6.AX3	SW.COMMON
5V OUT	Y	BM4		AV3.AU3 AU5.AV1	START LED POWER
START 1	S	BN4		AH2	SW. 1
LED 1	6	BUS		AU4	START 1 LED
START 2	15	BT2		AH5	SW.2
LED 2	H	BPG		AU6	START 2 LED
START 3	T	BN3		AJ2	SW.3
LED 3	J	BPS		AV2	START 3 LED
START 4	16	BT1		AJ5	SW.4
LED 4	7	BU4		AV4	START 4 LED
TEST	13	BT4		AL2	SW.7
SLAM	17	BS6		AL5	SW.8
COIN L	R	BN5		AS4	COIN SW.1
COIN C	14	BT3		AT1	COIN SW.2

