



SERVICE MANUAL

CPU EXORCISOR MANUAL

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INTRODUCTION

The Exorciser Test Fixture is a diagnostic tool designed to be used in conjunction with a signature analyzer to trouble shoot the main logic board of a Cinematronics game.

A signature analyzer is a piece of test equipment which is used to monitor digital signals versus time, and which produces an alphanumeric readout which represents the signal's "signature". Any circuit can be tested by measuring the signatures of the desired signals and then comparing them to previously determined correct signatures.

The purpose of the Exorciser circuit is to provide a known set of reference inputs to the logic board. These reference inputs are designed to generate a known set of signatures which the signature analyzer can then measure. When the two dip headers in positions U14 and D8, containing the jumper wires are removed from the logic board, various signal paths are disconnected. Inserting the Exorciser cables into these sockets allows the Exorciser to inject its reference signals into the main logic board. The actual Exorciser circuit consists of a 16-bit counter chain whose outputs are then combined via a number of simple gating circuits to generate the input reference signals. There is also circuitry to produce the start/stop signal to the signature analyzer.

CONNECTING THE EXORCISER TO THE LOGIC BOARD

Connect a regulated +5V supply to the exerciser inputs and the logic board. Remove dip jumper U14 and insert the header of the center cable, J1. Remove jumper D8 and insert the header of cable J3. Attach "E-Z" hooks to ground pins of nearest IC.

Next attach the 3 chip clips at the end of Exorciser connector J2. Place the clip with the red dot facing the logic board on the IC at position T2. Attach the blue dotted clip to position R2 and

the yellow dotted clip to position N2. Ground the test point located to the left of U2. This must always be done when the clips are attached.

CONNECTING THE EXORCISER TO THE SIGNATURE ANALYZER

Connections from the signature analyzer to the Exorciser are straight forward. Both the start and stop leads on the signature analyzer connect to the test point labeled start/stop on the Exorciser front panel. Also connect the clock and ground leads from the analyzer to their respective test points on the Exorciser.

The spare clock terminal on the front panel should be connected to the clock test point on the logic board located between J4 and K4. This can easily be done with a cable terminated at both ends with E-Z hooks.

SIGNATURE ANALYZER OPERATING MODE

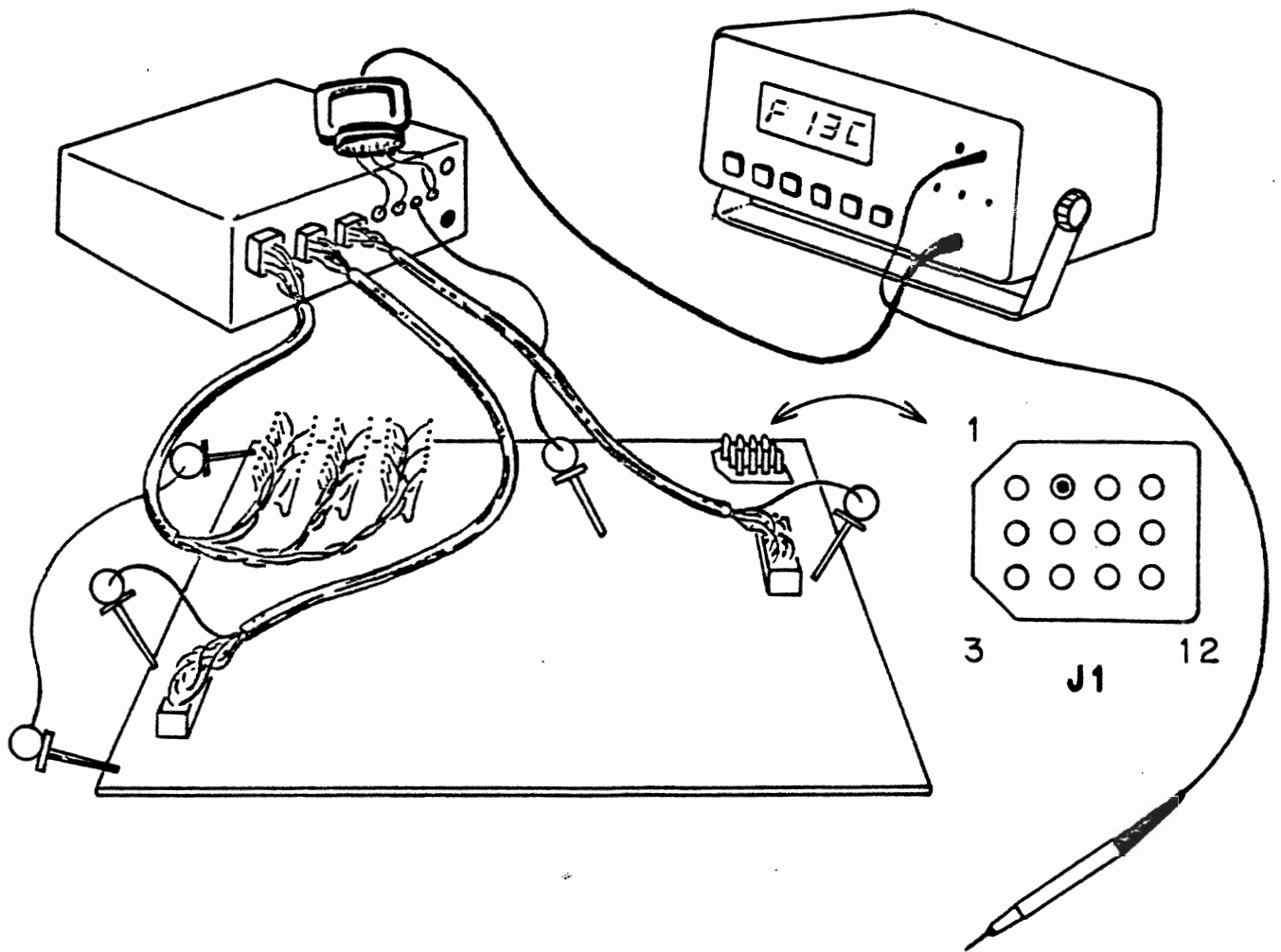
To achieve the proper signatures the signature analyzer must be set up to trigger on the proper pulse edge. Both the start and clock trigger on the trailing edge. The stop triggers on the leading edge.

NOTE: On Space Wars and Tailgunner a jumper wire must be installed from A8, Pin 8 to T2, Pin 4 on the main logic board. Once installed, leave it in place permanently as it will not affect Space Wars normal operation. Remove from Tailgunner after repair.

Also, a temporary jumper grounding TP8 which is located in the upper left corner above U2 should be installed. Remove this jumper after repair.

OPERATING INSTRUCTIONS

Once all the set up connections are made and power applied, check C8 Pin 12 for the signature U6HH. If this signature is unstable then recheck all the connections, especially the 3 16 pin clips. When stability is achieved, check the signatures at C8 Pins 5 and 6. They should be C32P. If they are not, recheck the connections at D-8. The header may have been installed improperly.

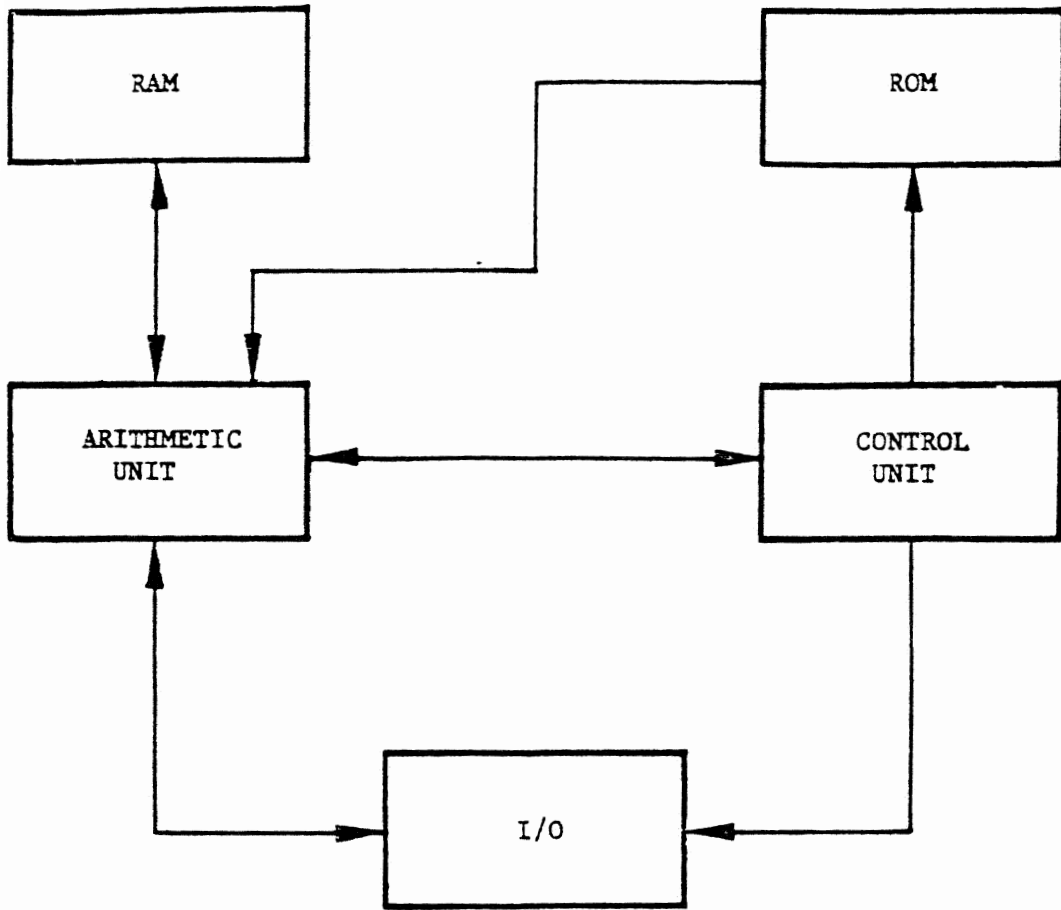


Trouble shooting the electronics on the main logic board with the Exorciser and signature analyzer should be done in the same manner as when using an oscilloscope. When a bad output is encountered, one should first investigate the control lines before assuming that the particular I.C. is bad. If one or more inputs are incorrect, continue back tracking until the problem is related to a bad output with good inputs. The problem should be confined to either the I.C. with the bad output or the board it connects to.

CPU TROUBLESHOOTING

This section describes the various checks on the main logic board and lists a few quick checks that should be performed. If a logic board pass these checks, very few other checks are required on the signature schematics are complete. The "patience" procedure - if a board is not signing nature somewhere.

The main logic board can be diagnosed as follows:



Functional Block Diagram

CPU QUICK & DIRTY TROUBLESHOOTING GUIDE

LOCATION	TYPE	PIN#	SIG.	PAGE		INSTRUCTION	IN/OUT	FROM/TO	
				A	F			A	F
F-14	74LS287	9	1846	4	5	$\overline{\text{LDR}}$	out	4	5
		10	FP05	4	5	$\overline{\text{LIR}}$	out	4	5
		11	8399	4	5	$\overline{\text{ACC}}$	out	4	5
		12	61C3	4	5	ADV	out	4	5
F-2	74LS259	1	PH07	1	1	D ₀	in	3	4
		2	29A9	1	1	D ₁	in	3	4
		3	80HP	1	1	D ₂	in	3	4
N-9	74LS85	5	A197	2	3	ACC	out	4	5
		6	237P	2	3	=ACC	out	4	5
L-4	74LS182	9	AH4H	2	3	$\overline{\text{Carry}}$	out	4	5
L-2	74LA10	4	F1CH	2	2	ACC	in	4	5
J-6	74LS10	8	F12C	2	2		out	2	2
C-6	74LS163	15	0109	5	6	Line Done	out	5	6
J-2	74LS32	3	9820	5	6	Intensity	out	7406	
		11	2873	5	6	Bright	out	7406	
H-8	74LS02	13	U97A	5	6	Initial Position	out	LF	
I-8	74LS04	2	204A	5	6	Line Drawing	out	LF	
A-12	74LS32	3	390P/2AF1	4	5	$\overline{\text{LPA}}$	out	3	4
H-14	74S02	10	HOU8/07U2	3	4	System/Ready	out	3	4
U-7	P_ROM	1	C443 4473	3	4	A ₇	in	3	4
		2	FC92 FA45	3	4	A ₆	in	3	4
		3	5PF4 FF86	3	4	A ₅	in	3	4
		4	A7U5 H162	3	4	A ₄	in	3	4
		5	UPAP 0A1F	3	4	A ₃	in	3	4
		6	HA00 UUF5	3	4	A ₂	in	3	4
		7	8066 1285	3	4	A ₁	in	3	4
		8	7211 U801	3	4	A ₀	in	3	4
		23	U62F 3124	3	4	A ₉	in	3	4
		22	0499 A8PF	3	4	A ₁₀	in	3	4
19	578F 4U1H	3	4	A ₁₁	in	3	4		
18	473U	3	4	PG ₉ Flop	in	3	4		
H-12	74LS194	15	7H33	2	3		out	2	3
		14	H255	2	3		out	2	3
		13	54CC	2	3	PG ₁	out	2	3
		12	OPH1	2	3	PG ₀	out	2	3
J-12	74LS298	10	AAP8	2	3	INDR	in	4	5
L-14	2102	20	4A50	2	3	R/W	in	4	5

LOCATION	TYPE	PIN#	SIG.	PAGE		INSTRUCTION	IN/OUT	FROM/TO	
				A	F			A	F
M-14	2102	20	4A50	2	3	R/W	in	4	5
N-14	2102	20	4A50	2	3	R/W	in	4	5
U-9	74LS75	4,13	H33C	3	4		in	3	4
U-11	74LS157	1	90AP	3	4		in	3	4
		15	C32P	3	4	Reset	in		

CONTROL SECTION (SHT 5 of 7)

This section decodes instructions (I0-I7) from memory to various control lines necessary for the rest of the computer.

Verify correct signatures at the following points:

<u>LOCATION</u>	<u>TYPE</u>	<u>PIN #</u>	<u>SIGNATURE</u>
F14	74LS287	9	1846
		10	FP05
		11	8399
		12	613C
E14	74LS288	1	OC45
		2	320U
		3	C530
		4	1PO2
		5	394A
		6	8PP6
		7	409C
D14	74LS288	9	07PU
		1	2H8F
		2	A76P
		3	41UC
		4	7P23
		5	9A6A
		6	5H61
		7	8ACC
		9	5AA5
C14	74LS288	1	9069
		2	7323
		3	CH9A
		4	96UA
		5	67AH
		6	2PFF
		7	32U4
		9	U100

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<u>LOCATION</u>	<u>TYPE</u>	<u>PIN#</u>	<u>SIGNATURE</u>
D10	74LS02	1	7341
B12	74LS10	6	077H
A10	74LS00	6	7890
		11	802H
		3	6PF3
C8	74LS107	5	C32P
B8	74LS107	2	4A50
A8	74LS107	2	49P2
B12	74LS10	12	FICH*
B6	74LS04	2	Logic High
A12	74LS32	3	390P/2AF1

*If bad, check F6-6 is 6598, F6-6 bad, see "Load Timer Loop" in following section.

ARITHMETIC SECTION (SHT 2 of 7, SHT 3 of 7)

Most mathematical manipulations are performed in this section. The "X" and "Y" accumulators, ALU's and scratchpad memory (RAM) are contained on these sheets.

<u>LOCATION</u>	<u>TYPE</u>	<u>PIN#</u>	<u>SIGNATURE</u>
L4	74S182	9	AH4H
L6	25LS181	9	9115
		10	61CA
		11	91CA
		13	6121
M6	25LS181	9	F43F
		10	5000
		11	34CP
		13	66UU
N6	25LS181	4	1C14
		10	8236
		11	304P
		13	FC6A
N9	74LS85	5	A197
		6	237P
L14	9101C	20	4A50
M14	9101C	20	4A50

(6)

<u>LOCATION</u>	<u>TYPE</u>	<u>PIN#</u>	<u>SIGNATURE</u>
N14	9101C	20	4A50
J12	74LS298	10	AAP8
*I12	74LS298	15	0038
	*GND pin 10 for this test	14	6034
		13	UCCC
		12	PF3C
*J12	*74LS298	15	PPC3
	GND pin 10 for this test	14	01F4
		13	4024
		12	F6C6
M4	74LS194	15	AC5H
		14	242C
		13	0841
		12	0U1F
P4	74LS194	15	725C
		14	FUC5
		13	30CC
		12	P38A
S4	74LS194	15	725C
		14	FUC5
		13	30CC
		12	P38A
N4	74LS194	15	C432
		14	166U
		13	67HU
		12	26PP
R4	74LS194	15	HAC9
		14	FPF2
		13	711H
		12	9172
T4	74LS194	15	F567
		14	651H
		13	UAC3
		12	HAFA

ROM (Game Memory)

Inside the ROM's are the instructions, data, and addresses for the particular game. Cinematronics games have an 8K memory capacity divided between an even 4K ROM and odd 4K ROM.

<u>LOCATION</u>	<u>TYPE</u>	<u>PIN #</u>	<u>SIGNATURE</u>
U7,R7,T7,P7	ROM	1	C443
		2	FC92
		3	5PF5
		4	A7U5
		5	UPAP
		6	HA00
		7	8066
		8	7211
		23	U62F
		22	0499
		19	578F
		18	473U (Logic High on s/w and S.H.)
U11			
T11			
U9	see No-Op test for particular game		
T9			
H14	74S02	10	07U2
		4	0000
			H33C * Reverse Clock Position
J14	74S288	1	H666
		2	FU3U
		3	P503
		4	C15P

I/O SECTION (SHTS 6 and 1)

These are the channels by which the computer receives information from the player controls and sends proper control signals to the monitor and audio board. (Note: It is best to measure output signals at the particular connector that they exit the board.

The pin number and connector designation is included in parenthesis).

<u>LOCATION</u>	<u>TYPE</u>	<u>PIN#</u>	<u>SIGNATURE</u>
M2	74LS377	9 (J2-1)	PP4F
		19 (J2-2)	LO
		2 (J2-3)	LO
		6 (J2-4)	C7P5
P2	74LS377	9 (J2-5)	C7P5
		19 (J2-6)	AA58
		2 (J2-7)	2ACF
		6 (J2-8)	1H2A
S2	74LS377	9 (J2-9)	U366
		19 (J2-10)	1H2A
		2 (J2-11)	3796
		6 (J2-13)	3796
M2	74LS377	16 (J2-21)	LO
		12 (J2-23)	8A2A
		15 (J2-25)	6P3U
		5 (J2-26)	8A2A
P2	74LS377	16 (J2-27)	6P3U
		12 (J2-28)	P415
		15 (J2-29)	LO
		5 (J2-30)	6P3U
S2	74LS377	16 (J2-31)	6P3U
		12 (J2-32)	8A2A
		15 (J2-33)	6P3U
		5 (J2-34)	6P3U
J2	74LS32	3 (J2-12)	9820
		11 (J2-14)	2873
H8	74LS32	13 (J2-18)	U97A
		11 (J2-19)	204A
A6	74LS02	10	9069
F2	74LS259	4	FH1H
		5	54P5
		6	8CAU
		7	2043