

Dragon's Lair Diagnostics

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The diagnostics package distributed by Cinematronics has multiple problems which make it essentially useless. The manual includes instructions for the construction of a test harness needed to perform the diagnostic tests, but there are errors in the design which make it impossible to successfully test your board. The test ROMs included are poorly named, have errors in them, and will always fail, even on known good boards.

The major errors are...

The pin numbers given for the player connection are backwards. There is no ground connection for the "counter" signal, causing it to never read low.

There is no power connection to the power supply. A required connection to pin-6 of the disc interface is not shown. Audio is only delivered to one amplifier, and there is no connection for speakers. ROMs U2-U5 are checksum tested, but not installed. The Interrupt test will fail on fast Rev-C boards.

But.. Once you have the diagnostics tools working correctly, they are extremely useful for quickly finding the problem areas of any Dragon's Lair or Space Ace main control board.

So let's get this fixed.

Building a Test Harness

Parts list

AC power cord with plug (essentially the cord and plug cut from an old lamp)

Power supply Molex (12-pin, 03-09-1122, and 6 - .093 male pins)

Wire cable with 3 conductors (a grounded power wire with black, white, & green)

Main board Molex (36-pin, 03-06-1362, and 20 - .062 female pins)

2K resistor

1 foot of 24 conductor ribbon cable

24 pin IDC dip-plug (jameco.com #42691)

Speaker connection (stereo plug and jack, or any 3 pin connector)

2 - full range speakers (about 10 Watts, 8 ohms, small)


There are four connectors:

C1 - the 12 pin power supply connector

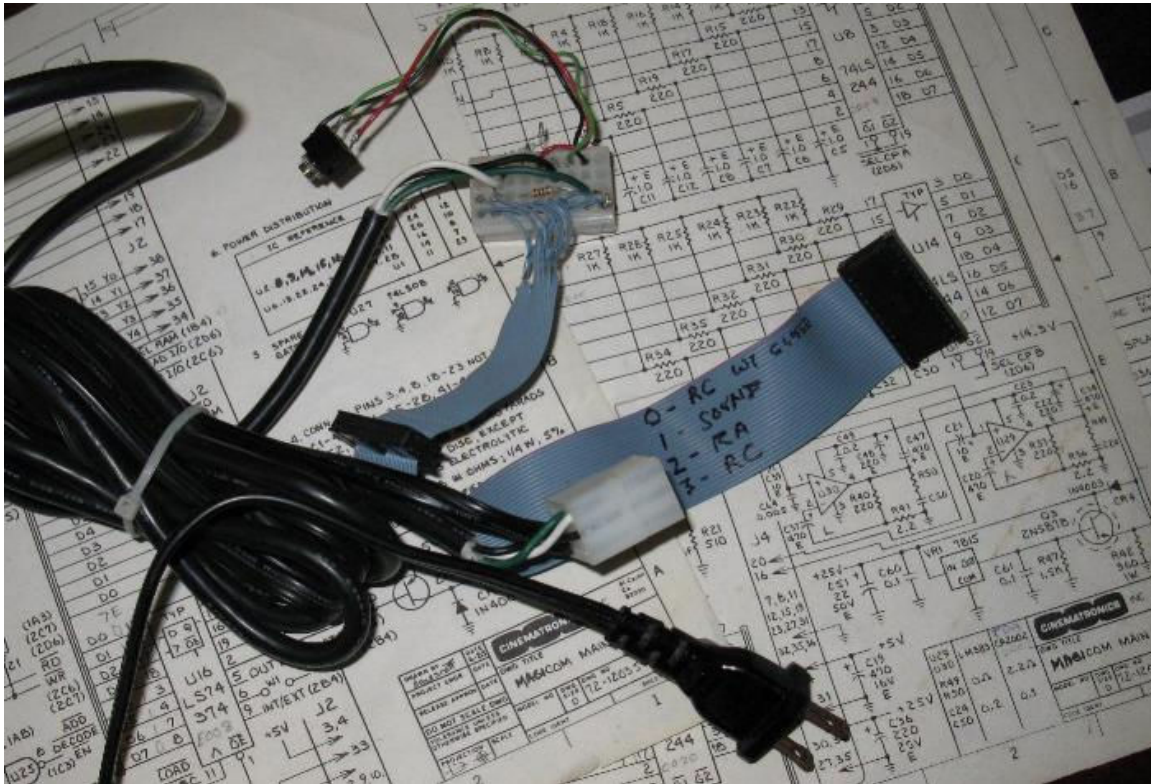
C2 - the 36 pin main board connector

C3 - the 24 pin dip-plug to the laserdisc connection

C4 - the 3 pin speaker connection

	C1	C2	C3	C4
<hr/>				
AC	<u>2</u>			
AC	<u>3</u>			
+25V	<u>7</u>	<u>30</u>		
+5V	<u>10</u>	<u>4</u>		
GND	<u>11</u>	<u>23</u>		
		<u>1</u>	<u>9</u>	
		<u>2</u>	<u>2</u>	
		<u>5</u>	<u>10</u>	
		<u>6</u>	<u>17</u>	
		<u>9</u>	<u>11</u>	
		<u>13</u>	<u>12</u>	
		<u>17</u>	<u>16</u>	
		<u>21</u>	<u>15</u>	
		<u>25</u>	<u>14</u>	
		<u>29</u>	<u>13</u>	
(2K resistor from 33 to 36)		<u>33</u>	<u>6</u>	
		<u>33</u>	<u>7</u>	
		<u>36</u>		
		16		
(jumper from 16 to 24)		24		
		<u>20</u>	<u>Left Speaker +</u>	
		<u>28</u>	<u>Right Speaker +</u>	
		<u>32</u>	<u>Speaker Common</u>	

The Harness:



The Software

Most of the files included in the diagnostics package are useless or not working correctly. Read "Files Explained.txt" for more detail.

For these diagnostics, you will need 1 - 27C128 EPROM to burn with the "DLdiag.bin" file.

Install this EPROM into a ROM board modified to work with the DL / SA combination ROMs at position U1.

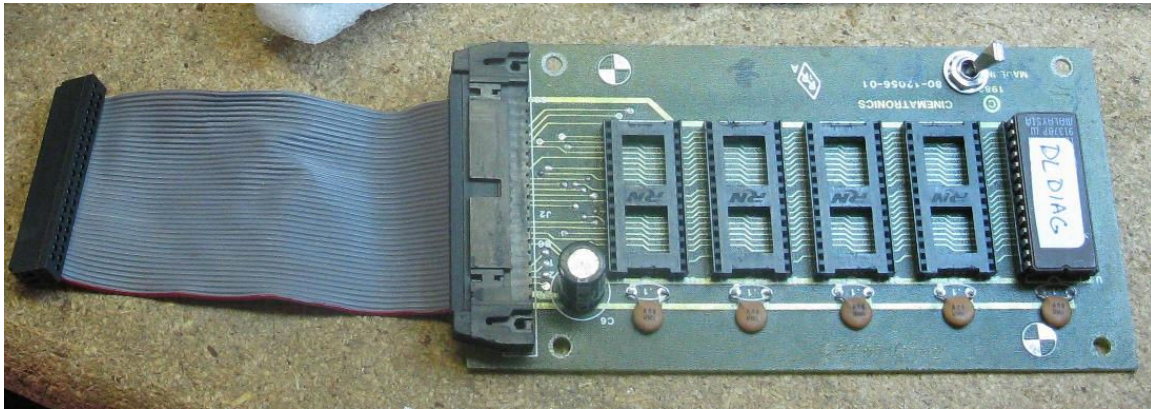
If you don't have a combination ROM board, then follow the instructions here... http://www.dragons-lair-project.com/tech/docs/dlsa_combo.asp
You just need to follow the hardware portion to install the toggle switch.

Your Toggle will select between...

System test: An overall test of the board

Disc I/O test: A detailed test of the laserdisc port J1

The ROM board:



Part 3 - Run the Tests

Connect your test harness to the board. Attach a **"known working"** power supply, scoreboard, and scoreboard ribbon cable.

The board type is selected via dip-switches. See the chart below...

Dip Switch settings for Board Type

A1	A0	TEST #	BOARD TYPE
0	0	0	GI Sound chip and amplifier test
0	1	1	Revision-A board (unmodified)
1	0	2	Revision-C board (or Rev-A fixed for V1000 use)
1	1	3	Rev-C board with the W1 jumper closed (Rev-C in PR-7820 mode)

Set your dip-switches for the type of board you are testing.

Set your Toggle to the System Test position.

Plug in the test harness to AC power.

The "Test #" will be displayed momentarily in the credits area of the scoreboard. If the displayed number does not match what you selected via dip-switches, then verify your switches for correct operation, or replace the GI Sound chip (AY-3-8910) at U19.

System Test:

The display will cycle through all possible numbers and characters (0-9,-,E,H,L,P, off) in every possible position. Remember, this is not a test of the scoreboard itself, it is a test of the main board's Address and Data busses, as well as U10 which selects the display.

Test 20 - RAM test (U3)

Test 30 - Interrupt test

Test 40 - Laserdisc I/O port

Test 50 - GI Sound chip (U19)

The above tests will complete successfully with a "P"ass in the LIVES display, or a fail will halt the tests and an error code will be displayed.

Test 60 - Dip Switches

If the above tests all pass successfully, the system tests will stop on "60" and wait for you to test each dip-switch.

Set all switches to the OFF position.

Turn on each switch, one at a time, and note the proper change on the scoreboard.

Tests complete. Unplug the AC power.

Error Codes:

02 - Failure of 16bit CPU registers - Replace Z80A (U1)

04 - Failure of 8bit CPU registers - Replace Z80A (U1)

20 - Data read from RAM did not match what was previously written.

Possible Faults: RAM, Z80A, U23, bus drivers U2, U9, U15

22 - Each RAM location is loaded with its own address. When read back, the address and location did not match.

Possible Faults: RAM, Z80A, U23, bus drivers U2, U9, U15

30 - No Interrupt, or Interrupt came too late.

Check for RTC signal at U26 pin-11. If not there, trace the signal back through U6 and U13. If Rev-A board, check for RTC at U7 pin-12 and perform the U7 bypass modification if needed.

If you have RTC at U26 pin-11, then possible faults are Z80A (U1), U23, U24, U25, U26.

40 - U20 failed to read FFh from inactive U21

Run Disc I/O test - Possible Faults: U21, U20

42 - Data read by U20 did not match output of U21

Run Disc I/O test - Possible Faults: U21, U20

44 - Signals read by U14 did not match output of U16
(counter, Enter, Int/Ext)

Run Disc I/O test - Possible Faults: U16, U14

46 - Data read by U8 did not match output of U21

Run Disc I/O test - Possible Faults: U21, U8

50 - GI sound registers not reading as programmed

Replace GI Sound chip (U19)

Disc I/O test:

This is a more detailed test of the Disc I/O (J1).

The signals being sent to the port are displayed in Player-1's score area.

The signals received are displayed in Player-2's score area.

Signals are displayed on the six digits as follows...

Int/Ext	Enter	Counter	D7, D6	D5,D4,D3	D2,D1,D0
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The left 3 signals will be displayed as '1' or '0'. Since a Rev-C board does not use the "Enter" signal, it will be masked out with a '-'

The Data signals in the right 3 digits will be combined into an Octal number.

Ex. If the binary number "10101011" is sent to the port, the 3 right digits will show "253"

Run the Test

Connect your test harness to the board. Attach a "**known working**" power supply, scoreboard, and scoreboard ribbon cable.

The board type is selected via dip-switches. See the chart below...

Dip Switch settings for Board Type

A1	A0	TEST #	BOARD TYPE
0	0	0	GI Sound chip and amplifier test
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1	1	3	Rev-C board with the W1 jumper closed (Rev-C in PR-7820 mode)

Set your dip-switches for the type of board you are testing.

Set your Toggle to the Disc I/O test position.

Plug in the test harness to AC power.

The "Test #" will be displayed momentarily in the credits area of the scoreboard. If the displayed number does not match what you selected via dip-switches, then verify your switches for correct operation, or replace the GI Sound chip (AY-3-8910) at U19.

The display will show the output signals in Player-1's score, and what was received in Player-2's score.

So long as all signal match, the test will cycle through all possible combinations of output signals.

Once all signals have successfully passed, a 'P' will display in LIVES, the loop count will be displayed in CREDITS, and the test will repeat forever.

Errors

In the event that the received signal does not match the output, the test will halt. The mismatched signal line can be identified by the score display.

Ex. Player-1 shows "0-0253"
Player-2 shows "0-0243"
then the error is in the D3 line.

Player-1 shows "0-0253"
Player-2 shows "1-0253"
then the error is in the "Int/Ext" line.

Also...

There are three different tests performed. In the event of an Error, the test that failed can be identified by what is displayed in the two LIVES digits...

E & 0 in LIVES means that U20 failed to read all high bits at the start of the test. U21 is disabled and U20 should be reading all high from the joystick pull-up resistors and U21 in a floating output condition.

E & L in LIVES means that the read of U20 did not match the output of U21.

E & E in LIVES means an the read of U8 and U14 did not match the output of U21 and U16 respectively. (note that U21 already passed an earlier test).

Test #0 - The GI Sound chip and Audio Amplifiers

This test repeatedly produces a rising sound effect from the GI sound chip.

You should hear it loud and clear from both test speakers.

If you get no sound at all, check the voltage at R42. It should be 14.3 Volts
If you have the right voltage, then replace the GI sound chip (U19).
If not, troubleshoot the power system.

If you have sound on only one speaker, then replace the associated amplifier (U29 or U30) and all of the 470uF capacitors. (note, the 220uF caps should also be replaced with 470uF caps). There are also a couple of 10uF caps in there. Replace them too.

This guide is just an overview. The possible faults listed above are just likely recommendations. Replacing integrated circuits is not a task for the inexperienced. Use at your own risk. Good Luck and Enjoy!

-Shaun