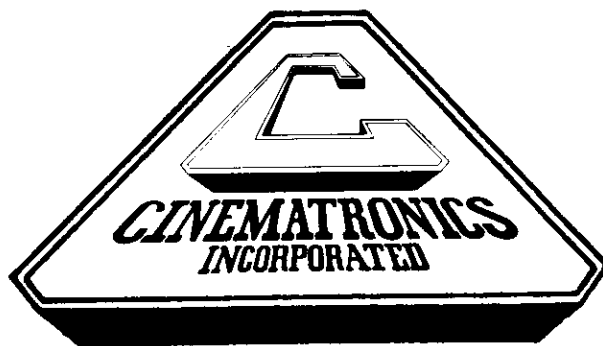


SPACE
ACE™



OPERATIONS/MAINTENANCE
MANUAL

DRAGON'S LAIR™



OPERATION AND MAINTENANCE
MANUAL FOR
CINEMATRONICS LASER DISC GAMES

CINEMATRONICS, INC.
1841 Friendship Drive
El Cajon, CA 92020
(619) 562-7000 or (800) 854-2666

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In order to provide the best possible service, the following procedures for ordering or returning parts must be followed:

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5. In all situations covered above, and in all other situations, the Warranty offered by Cinematronics, Inc. is applicable and should be fully understood.

6. Parts returned for service must be packaged so that no damage is incurred during shipment. Do not pack players in shredded paper. Note that both models of the videodisc player should be kept in a horizontal position. UNDER NO CIRCUMSTANCES should a player be shipped for any distance in a non-level position. If a cabinet must be shipped in a non-upright position, remove the player and ship it separately. Cartons without a prominently displayed RMA number will not be accepted. Full documentation, including a game serial number, part serial number, and reason for return, must accompany all parts. Ship parts prepaid to:

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CHAPTER 1

GENERAL INFORMATION FOR OPERATORS

Part I: GAME SET UP

A. WARNINGS:

For safety and reliability, Cinematronics does not recommend or authorize any substitute parts or modifications of Cinematronics equipment. Such alterations may adversely affect game play, cause injury, or void Warranty. Substitute parts, modifications and non-Cinematronics game "conversions" may also void FCC compliance.

Cinematronics' games are protected by Federal copyright, trademark, and patent laws. Therefore, non-Cinematronics game "conversions" or game modules may be illegal under Federal law.

Both models of the videodisc player should be kept in a horizontal position at all times. If tilting is required during transport or repair, keep the period of inclination to a minimum.

The monitor's picture tube encloses a high vacuum and, due to the large surface area, is subject to extreme force. Take care not to bump or scratch the picture tube as this may cause the tube to implode, resulting in personal injury and property damage.

To prevent fire or shock hazard, DO NOT EXPOSE THE MONITOR TO RAIN OR MOISTURE.

B. RF INTERFERENCE

Cable harness placements and ground strap routing on this game have been designed to keep RF radiation and conduction within levels accepted by FCC regulations. To maintain these levels, reposition harnesses and reconnect ground straps to their original placements if they should be disconnected during maintenance.

C. PRELIMINARY EXAMINATION

Each game should undergo a brief inspection upon arrival to ensure that no damages occurred during shipping. The following list may be used as an inspection guideline:

1. Inspect the outside of the shipping carton. Damage to the outside carton may indicate damage to the game cabinet.
2. Unlock and set aside the back panel to check the circuitry. Reconnect any loose connectors. The connectors are keyed--do not force them together. Prevent damage to the PC boards by taking care not to reverse connectors.
3. Make sure that all socketed integrated circuits are firmly seated.

4. Unwrap the power cord supplied with the game, and plug it into the receptacle found on the rear of the cabinet. DO NOT PLUG THE GAME INTO THE WALL AT THIS TIME.
5. Observe the major subassemblies: monitor, control panel, transformer board, and power supply. All should be securely mounted.
6. Open the drawer at the bottom of the cabinet by removing the wing nuts and screws on the sides of the cabinet. Make sure that the videodisc player is securely mounted.

Part II: GAME OPERATION

A. POWER REQUIREMENTS

CAUTION: To prevent shock hazard and ensure proper game operation, plug this game into a properly grounded outlet: unless otherwise specified, your game was shipped to operate at 115 VAC, 60 hz. Do not use a cheater plug or cut off the ground pin to defeat the ground through the line cord.

B. OPERATOR CONTROLS

1. **ON/OFF Switch:** This switch is mounted on the rear of the cabinet next to the AC input receptacle. Pull the switch out to turn on the game. **NOTE:** Some newer games have no on/off switch. In these games use the power cord.

2. **COIN COUNTER:** Mounted on the operator convenience panel behind the coin door, this mechanism is software controlled and will count coins for Space Ace and credits for Dragon's Lair. If, for example, one game costs fifty cents, the coin counter increments once for every two coins.

3. **VOLUME:** Two volume controls, one for the left channel and one for the right, adjust the game's stereo sound.

4. **RESET Switch:** Located on the right side of the Z80 Controller board near the amplifier heat sinks, the RESET switch forces the Z80 and other registers on the board into their proper initial states and prevents the generation of unwanted sounds. See the Theory of Operation chapter of this manual for a more thorough explanation of this switch.

5. **COVER-OPEN Switch:** The left-most switch on the front panel of the disc player, this switch opens the cover of the disc player. Power must be on and the laser disc in reject position before this switch can operate.

6. **DIPSWITCHES:** For an explanation of the dipswitch settings, see appropriate Appendix.

C. VIDEODISC PLAYER CARRIAGE MECHANISM

The carriage mechanism on either disc player must be locked in place during shipping or moving. An unlocked carriage may result in disc player alignment problems.

Pioneer PR-7820: (Brown Player Enclosure)

After the game is in the desired location, unlock the carriage mechanism on the disc player by inserting a small flathead screwdriver into the hole just below the cover on the front-left side of the disc player. Turn the screw counterclockwise until it releases. The carriage mechanism is now free; the disc player ready to operate.

Pioneer LDV-1000: (Black Player Enclosure)

The locking screw for the carriage is located inside this player. After the game is in the desired location, momentarily turn the power on and press the COVER-OPEN switch to open the disc player cover. Located on the right side of the disc cavity is a large 3/8" flathead screw. Remove this locking screw and its washer plate, and save them, along with the lens cap, in the bag on the back door of the game cabinet. The disc player is now ready to operate.

ALWAYS SECURE THE CARRIAGE MECHANISM PRIOR TO SHIPPING OR MOVING THE GAME.

D. LASER DISC INSTALLATION

Turn the power on momentarily and press the COVER-OPEN switch to open the disc player. The cover should open as soon as the disc is in reject position.

Pioneer PR-7820:

Now turn the power off. Data-side (reflective) up, set the laser disc on the spindle of the player. Press the "Lock" buttons on the spindle to hold the disc in place. Close the cover of the disc player.

Pioneer LDV-1000:

Turn the power off. Data-side down, set the laser disc onto the spindle of the player. Close the cover of the disc player to automatically lock the disc in place.

DO NOT OPERATE EITHER DISC PLAYER UNTIL THE DISC IS LOCKED ONTO THE SPINDLE.

E. POWER UP

When the carriage mechanism is unlocked and the laser disc installed, replace the back panel and plug in the game. Either pull out the ON/OFF switch or use power cord to turn the power on. Three tones should be heard, about fifteen seconds apart. The first indicates that the laser disc is in reject position; the second that the laser disc has begun to play. If any or all of the tones are not heard, return to the beginning of this GAME OPERATION section and start over. NOTE: In some instances the initial beep is absent, please wait 15 to 20 seconds for the sound. In another 15 to 20 seconds you should hear a tone, at which time the display will appear.

F. COIN OPERATION

One credit = one single player game. The number of coins required for one credit is operator programmable. (See appropriate Appendix for Game Setting Options). Two or more credits initiate a

two player game. Credits are displayed in the LED display above the CRT monitor.

G. GAME PLAY AND PLAYER CONTROLS

1. DRAGON'S LAIR

a. GAME PLAY: Dirk the Daring enters the enchanted castle of an evil wizard to rescue Princess Daphne. As Dirk fights his way through the monsters and traps the wizard has set for him, he must find the secret passages which lead to the caverns below the castle. There, in a deep dungeon, the princess is held captive in a magic cage guarded by a gigantic Dragon. Dirk must ultimately slay this Dragon to free the princess.

Because the monsters and traps to be overcome are so numerous and constantly changing, it is not possible to list the range of scores awarded for each one. Generally, as Dirk progresses deeper into the castle, he encounters more difficult obstacles and is accordingly awarded greater numbers of points for overcoming them.

b. SWORD/ACTION BUTTON: Causes Dirk to draw and use his sword.

c. JOYSTICK: Controls Dirk's movements. Dirk moves in the direction that the joystick is pointed. In some instances, moving Dirk to an object causes him to do something with that object.

2. SPACE ACE

a. GAME PLAY: "Space Ace" features a cast of loveable and laughable characters which make promotion easy, exciting and fun.

One gallant earthling stands between the inter-planetary invasion forces of the blue-skinned alien Commander Borf and their intended target, Earth: an earthling named Dexter. On Dexter's narrow shoulders ride the fate of Earth and the well-being of his lovely sidekick, Kimberly, who Borf has carried off into the cosmos.

Dexter sets off in hot pursuit of Lord Borf, battling monsters, machines and mechanisms as he fights his way across the galaxy. During his daring quest, Dexter relies on his wits, agility and quick reflexes to overcome the deadly predicaments and bizarre opponents Borf throws in his path; but when the peril grows too great for even cunning and courage to prevail, Dexter has a secret strength in reserve.

Exposure to mysterious cosmic rays has given Dexter a remarkable ability. Just when our hero seems doomed and all appears lost, he undergoes a startling transformation into his super-mighty, super-bold, super-self: SPACE ACE! - a broad-shouldered, good-natured

alter ego who evens out the odds as Dexter struggles to rescue Kimberly.

Pursued to his home planet by this resourceful and relentless adversary, Borf turns and faces Dexter in a final and climactic confrontation. Determined to prevail at all costs, Borf resorts to the ultimate weapon, a weapon capable of reducing even the mighty Space Ace into a helpless infant: the dreaded INFANTO-RAY! Only Space Ace can survive such a crisis, and Space Ace alone can save the Earth, save the girl, and save the day!

b. ACTION BUTTON: The action button functions in a variety of ways in a variety of situations. Most frequently the Action button fires weapons and energizes Dexter into Space Ace.

c. JOYSTICK: The joystick controls the direction of movement of the Dexter and Space Ace characters.

PART III: PERIODIC MAINTENANCE PROCEDURES

Because of its solid state electronic circuitry, this game should require very little maintenance and only occasional adjustments. Several measures should, however, be taken to ensure as few problems as possible.

LASER DISC: The laser disc should be cleaned weekly with a soft cloth and an ammonia-based cleaning solution, e.g. a non-aerosol window cleaner. Do not use any cleaner containing alcohol. To prevent fingerprints and smudges, hold the laser disc by its edges.

FILTER AND SCREEN: Routinely inspect and, when needed, clean or replace the filter on the back of the cabinet and/or fan guard.

VIDEO MONITOR: Though the video monitor is properly adjusted before shipping, occasional minor adjustments may be necessary. Adjustment controls are located at the rear of the monitor. Do not attempt to modify any circuit on the monitor. See Chapter 4 for additional information on the monitor.

POWER SUPPLY: The power supply is also adjusted before shipping. The computer boards in this game operate most efficiently and reliably when the power supply is set so that the voltage on the board is +5V. To check this, place a meter across +5V and ground on the logic board. If necessary, adjust the screwdriver control on the power supply until the meter reads between 4.9 and +5V.

The game should be serviced only by qualified technicians. For service information, contact:

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ALWAYS BE PREPARED TO GIVE THE SERIAL NUMBER OF THE GAME YOU ARE CALLING ABOUT.

CHAPTER 2
THEORY OF OPERATION
FOR THE SYSTEM CONTROLLER

A. Z80

The microprocessor used in this system is a 4 MHz Z80. All of the Z80's address, data, and control outputs are buffered by bus drivers: U2, U9, U15, and U23. These buffers are always enabled.

B. DATA BUS DIRECTION CONTROL

A high Read signal RD- at U15-1 allows the Z80 to write into the RAMs and other external devices. A low RD- signal allows the transfer of data from the RAMs, ROMs, and other external devices to the Z80.

The Z80 generates sixteen address lines. After buffering, these lines are referred to as A0 through A15. A0 is the least significant bit, A15 the most significant.

Similarly, after buffering by data bus driver U15, the eight data bus lines are referred to as D0 through D7.

U23 buffers the following four control signals generated by the Z80:

SIGNAL		OCCURRENCE
M1-	MACHINE CYCLE 1	During instruction fetches.
MREQ-	MEMORY REQUEST	When the Z80 reads or writes data from or to memory-mapped devices.
RD-	READ	When the Z80 reads data.
WT-	WRITE	When the Z80 writes data.

NOTE: Bus Acknowledge signal BUSAK- may be wired on some boards, but it is never used.

C. Z80 CONTROL LOGIC

This section describes the generation of three control inputs to the Z80: CLOCK+, RESET-, and WAIT-. The control input Bus Request (BUSRQ-) may be wired on some boards, but it is never used.

1. CLOCK CIRCUIT

The Clock Circuit provides the Z80 Controller Board with a stable 4.00 MHz signal. This signal may be derived in one of three ways:

- a. A TTL oscillator (U24,74LS04) producing 4 MHz directly.
- b. A TTL oscillator (U24,74S04) producing 16 MHz, which is divided by 4 (U31,74LS74) to produce 4 MHz.
- c. A transistor oscillator producing 8 MHz which is divided by 2 to produce 4 MHz.

The 4 MHz signal is used as the clock for the Z80 micro-processor. A 2 MHz clock for the GI sound chip is produced by dividing the 4 MHz system clock by 2 (U26,74LS74).

2. RESET CIRCUIT

The Reset Circuit forces the processor and other registers on the Z80 Board into their proper initial states and prevents the generation of unwanted sounds. The Reset Circuit is activated automatically at power up and manually by pressing the RESET button on the Z80 Controller Board.

The Power-up Reset Circuit is composed of C61, CR2, R43, R44 C62, Q1, U23, pins 11 and 9, U22, pins 1 through 3.

At power up, the positive side of C62 is very close to 0 volts. This causes Q1 to be turned on and the output of the circuit, U23-9, to be high. C62 now begins to charge; i.e., the voltage on its positive side goes from ground to +5V. When the positive side of C62 reaches a potential of approximately 1.4 volts, Q1 turns on, forcing U23-9 low. To provide a clean output pulse at U23-9, the pulse width at U23-9 should be in excess of 50 milliseconds.

A Schmidt-Trigger device, U23 has built-in hysteresis. U22, pins 1 through 3 provide an active low RESET at U22-3.

When the RESET button is depressed, C62 de-charges, initiating the RESET Circuit activity described above.

3. WAIT LOGIC

When reading or writing to GI Sound Chip U19, the Z80 must wait for one Time State, or T-State. For circuit simplicity, a signal generated by U25-6 determines when these states need to be inserted. Sometimes active for other reasons, this signal is always active low whenever the GI Sound Chip is addressed.

The Wait Circuit for the GI Sound Chip is composed of U28 and U25, pins 1 through 6. A T-State is generated as follows:

The signal at U25-6 is fed to U28-2. U28 is configured as a 2-Bit shift register. Normally, U25-6 remains high, causing U28, pins 5 and 9 to be held high and WAIT signal at U25-3 to be high/inactive. When the GI Sound Chip is addressed, U25-6 drops low, causing U28-6 to go high, while U28-9 remains high. The WAIT signal then drops low for 250 ns or one T-State.

D. Z80 ADDRESS DECODING

Address decoding is performed by U4, U11, and U10. U4 decodes address lines 13, 14, and 15. The outputs of U4 select five different banks of ROM, one bank of RAM, and two banks of memory-mapped I/O devices. Each of these banks is 4K long. Address decoding at U4 is enabled when Memory Request signal MREQ+ is active high at U25-10. It is disabled during Refresh Cycles (RFSH-) by a low at U25-9.

U10 decodes address lines 3, 4, and 5. Its outputs are used to generate Write Strokes to memory-mapped I/O devices. Also used to decode address lines 3, 4, and 5, U11 generates Read Strokes for memory-mapped I/O devices.

E. PROM MEMORY

Located on the PROM board, PROM Memory U1 through U5 contain the program for the game.

F. RAM MEMORY

RAM Memory U3 stores the variables for the Z80 Controller Board. U3 = one 2K block of memory.

G. REAL TIME CLOCK

Interrupts occurring at a rate of approximately 33 milliseconds are required to keep the Z80 in sync with the videodisc player. The signal RTC+ (REAL TIME CLOCK) at U26-11 is a square wave with a 33 millisecond period. In early models, this signal is generated by the 68705, U7-12. In later models, U6 and U13 are cascaded to form a 16-Bit binary counter. The output of this counter circuit, U6-6 is a 33 millisecond square wave.

In either case, U26-8 is forced low every 33 milliseconds, thereby generating an interrupt signal to the Z80. When the Z80 recognizes the interrupt signal, it forces both M1- and the IORQ- signals low simultaneously, causing CLR INT- (CLEAR INTERRUPT) to go low at U25-11, thus removing the interrupt generated at U26-8.

H. GI SOUND CHIP

GI Sound Chip U19 generates the boops and beeps for the coin drop and joystick feedback.

Both address words and data words are written by the Z80 to the GI Sound Chip. However, only data words are read from the Sound Chip. Two control inputs on the Sound Chip control all reading and writing between the Z80 and the Sound Chip. When an address word is written into U19, the Write Address signal generated at U10-13 falls low at U22, pins 4 and 10, forcing both control inputs, pins 18 and 20 on U19 high. In a similar fashion, the Write Data signal at U22-5, and the Read Data signal at U22-9 are encoded at U22 to control data transactions between the Z80 and U19.

The GI Sound Chip's input/output ports A and B are always programmed as inputs and are used to read option switches SW1 and SW2.

I. AUDIO AMPLIFIERS

There are two audio channels on the disc player. U29 amplifies the sounds on Channel 1, U30 the sounds on Channel 2 and the sounds generated by GI Sound Chip U19.

J. COLOR MONITOR

The monitor used in this system is a standard R.G.B. monitor with a N.T.S.C. Decoder Board. 115V from the power supply's Isolation Transformer reach the monitor through a 2-pin flying lead. Video signals travel through a COAX cable from the videodisc player to P103 of the monitor's NTSC decoder board.

See Chapter 4 for additional information on the monitor and the NTSC Decoder.

K. POWER SUPPLY

There are four versions of the power supply. All of the versions have outputs of +5V DC regulated and +25V unregulated power. The +25V is regulated down to +14V by the Z80 Controller for usage with audio amplifiers U29 and U30. All versions also output of 6.3V AC to the coin door lamps. Some version have -25V and other outputs that are not used.

NOTE: The first fuse on all versions (F1) should be a five-amp MDL, even if the white silkscreen markings on the PC board say otherwise. If a game appears to lose power, make sure that F1 is a five-amp MDL fuse.

L. AUDIO AMPLIFIER POWER SUPPLY

Composed of VR1, Q3, and other discrete components, the Audio Amplifier Power Supply circuit supplies approximately 14 volts to Audio Amplifiers U29 and U30. A 3-Terminal voltage regulator chip, VR1 is used to drive the base of Q3 with +15V. Q3 is configured as an emitter-follower. The output of the circuit is the emitter Q3. The voltage at the emitter of Q3 is normally 14.3V.

M. PLAYER INTERFACE

All player controls and the coin switches are read by the Z80 via input registers U8 and U14. All player control inputs are furnished with pull-up resistors and RC de-coupling networks.

N. DISC PLAYER INTERFACE

The disc player interface is composed of U20, U21, and U16. In games with Pioneer 7820 disc players, U16 feeds both the ENTER+ and the INT/EXT signals to the disc player. The signal OUT DISC DATA+ at U16-5 is fed to the output enable pin at U21-1. U21 is used to send control words to the disc player. U20 is not used with the 7820. Games with 7820 players should have board serial numbers below 6000.

In games with the Pioneer LDV-1000 player, the only signal sent to the player from the Z80 is the INT/EXT signal generated at U16-9. The ENTER+ signal is returned from the disc player and is fed to U14-6. U16-5, the output disc data signal, goes high, disabling U21, when the Z80 wishes to read data words from the disc player via U20. Games with LDV-1000 players should have board serial numbers above 6000.

O. COIN COUNTER

The mechanical coin counter is controlled by U16-2. When U16-2 is high or disabled, no base current is drawn thru Q2. (Q2 is the coin counter driver transistor). This keeps the coin counter de-energized. When the Z80 wishes to register a coin count, it will drop U16-2 low, thereby drawing base current through Q2, turning Q2 on, and bringing the collector of Q2 to approximately 4.7 volts. After a delay of at least 50 milliseconds, the Z80 will force U16-2 high.

To prevent false coin counts on power-up, U16-1 is connected to RESET+. This connection disables U16 until the program can start

running, forcing U16-2 high and de-energizing the coin counter.

P. LED DISPLAY BOARD

The LED display board is composed of two identical circuits. Each circuit has eight common anode displays and one multiplexer chip. The following is a description of one of these identical circuits.

The multiplexer chip has a memory of eight words, with four bits to each word. The Z80 writes into any location of this memory by setting appropriate highs and lows on address lines A0 through A2. The Z80 selects the character to be written into the memory by placing data on D0 through D3, thereby supplying a WRITE pulse to pin 8 of the multiplexer chip. Address lines A0 through A2 and data lines D0 through D3 are connected to the Z80's address and data bus by a 16-ribbon cable attached to the two boards. Display enable signals DEN 1 and DEN 2 are generated by address decoder U10, pins 7 and 9 on the Z80 Board.

CHAPTER 3

ON-BOARD DIAGNOSTICS

The on-board diagnostics are a series of tests performed on the system's hardware to verify whether or not the hardware is fully functional. Resident in the Z80A game program EPROM, the diagnostic software routines are initiated by appropriate option switch setting (see appropriate Appendix) when the game is powered up.

Once initiated, the diagnostic program cycles through the following tests. The results of these tests flash consecutively on the monitor display.

A. RAM TEST

Each RAM cell is loaded with 55H and read to insure that all of the cells retained the data. The RAM is then reloaded with 0AAH, which causes every bit in every cell to be inverted. The RAM is then read again to verify data retention. If all cells are operating properly, the diagnostics proceed to the EPROM Test. If a bad cell is found, the system displays "RAM test failed" on the monitor and halts until it receives a reset.

B. EPROM TEST

There are five 8K-byte EPROMs within the system. The Diagnostic program calculates each EPROM's checksum and compares it to pre-stored correct checksum values. If all of the checksums match, the program continues with the security device test. If an EPROM fails, the monitor displays the words "ROM test failed" and the address location of the bad EPROM. The correct address locations are listed in the following table:

Checksum no.	Address Location	EPROM Address
1	OFFF6H	0000H-1FFFH
2	OFFF8H	2000H-3FFFH
3	OFFFAH	4000H-5FFFH
4	OFFFCH	6000H-7FFFH
5	OFFFEH	8000H-9FFFH

C. SECURITY DEVICE TEST

May or may not be implemented. Please disregard.

D. SOUND TEST

The program outputs a tone scale to each of the three channels of the GI Sound Chip. Check the volume control while these sounds are playing. If no sound is heard, check the AY-3-8910 Sound Chip.

E. DISPLAY TEST

The seven segment Player 1 and Player 2 displays now cycle through all of their available digits; each display should progress through the numbers 0 through 9. No rating of PASS or FAIL appears on the monitor. Simply watch the displays themselves to ensure that they are operating properly.

F. KEYBOARD TEST

This test checks the operation of the player controls. During the fifteen-second period of the test, push all of the player control buttons and operate the joystick. One seven-segment display corresponds to each of the controls and to each direction of the joystick. Each time a control is operated, a zero should appear in its corresponding display. The monitor displays the diagram shown below, a table indicating which display corresponds to each control.

PLAYER 1 SCORE

	ACTION	RIGHT	LEFT	DOWN	UP
--	--------	-------	------	------	----

PLAYER 2 SCORE

P1	P2	COIN 1	COIN 2		
----	----	--------	--------	--	--

G. COLOR TEST

The program now displays the image of a dead Dirk or a color test pattern. Adjust the video monitor till the colors in this image are satisfactory. This image stays on the monitor until the diagnostic dipswitch is disabled.

H. SERVICE DIAGNOSTICS AND SIGNATURE ANALYSIS

A set of ten test EPROMs and documentation for their use in service diagnostics and signature analysis for the Z80 controller

board are available at an additional cost. The troubleshooting procedures using the test EPROMs assume a relatively advanced level of technical expertise and are, therefore, not included in this manual.

For information on purchasing a set of Diagnostic EPROMs, please contact Cinematronics' Customer Service Department.

CHAPTER 4

ELECTROHOME MONITOR AND NTSC DECODER BOARD SUPPLEMENT INFORMATION

NTSC DECODER BOARD ALIGNMENT PROCEDURE

PRELIMINARY

Set all six PCB controls to mechanical center except the sub-contrast (R107) which is set to the full clockwise position.

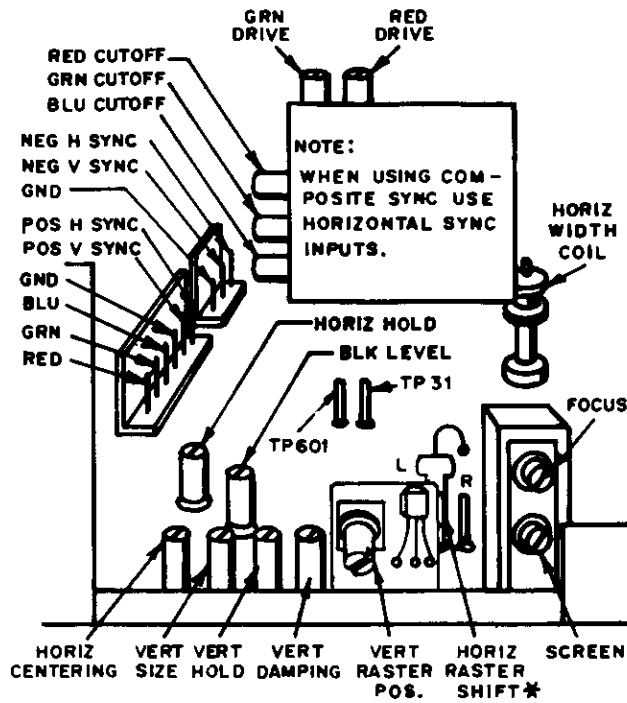
SET-UP:

1. Connect a composite video color bar signal at 1.0V pp to the PCB input at P101.
2. Adjust sub-contrast (R107) for maximum contrast with no overdrive. Overdrive appears as vertical white bars between the color bars, most noticeable between the yellow and cyan bars.
3. Adjust sub-brilliance (R130) until the black portion of the color bar pattern just turns black (raster just extinguished).
4. Critically adjust trimmer capacitor C124 to center of color lock-in range. It is a good idea to power PCB monitor off for a few seconds, then back on to ensure color lock.
5. Set chroma input level (R144) fully clockwise, then rotate slowly counterclockwise until color appears, then rotate counterclockwise another 30-40 degrees.
6. Connect scope at 10 microsec/div (AC couple) to blue output (P103-6). Adjust L101(3.58 MHz trap) for minimum of 3.58 MHz carrier riding on video signal.
7. With scope at blue output, adjust sub-brilliance (R130) and contrast pre-set (R106) for a black level of 0.5 volts and a peak white level of 4.0 volts respectively.
8. With scope at blue output, adjust sub-color (R139) so that the peak level for the grey bar and the peak level for the blue bar are equal.
9. Connect the scope to the green output (P103-5) and adjust the sub-tint so that the peak level for the cyan bar and the peak level for the green bar are equal.
10. If necessary, re-adjust the contrast pre-set (R106) for a peak white level of 4.0 volts (3.5V above black level).

4.2
1.9.84

NOTE: All of the preceding information is taken directly from ELECTROHOME ELECTRONICS' Service and Operation Manual: G07-19" R.G.B. Colour Monitor, January 1981, and from ELECTROHOME ELECTRONICS' Supplement Service Data: NTSC Decoder, July 1983.

69X1251-100



K4901	K4951
K4902	K4952
K4903	K4956
K4906	K4956R
K4911	K4961

1. HORIZONTAL FREQUENCY

With the monitor being driven from the game signal, connect a jumper between TP601 and TP31. Adjust the horizontal hold control until picture stops sliding horizontally, remove jumper. Do not use the horizontal hold control for horizontal centering. (See #3) NOTE: When game sync is composite, use horizontal sync input.

2. PICTURE SIZE

Adjust the vertical size control, and the horizontal width coil for desired picture size.

3. PICTURE CENTERING

If the video is off center vertically, turn the vertical raster position control to move the raster up or down. If the video is off center horizontally adjust the horizontal video position (Horiz. Centering) control to center the picture. If any additional horizontal positioning is required, move the horizontal raster position adjustment jumper (Horiz. Raster Shift) to the left or the right position.

4. VERTICAL DAMPING

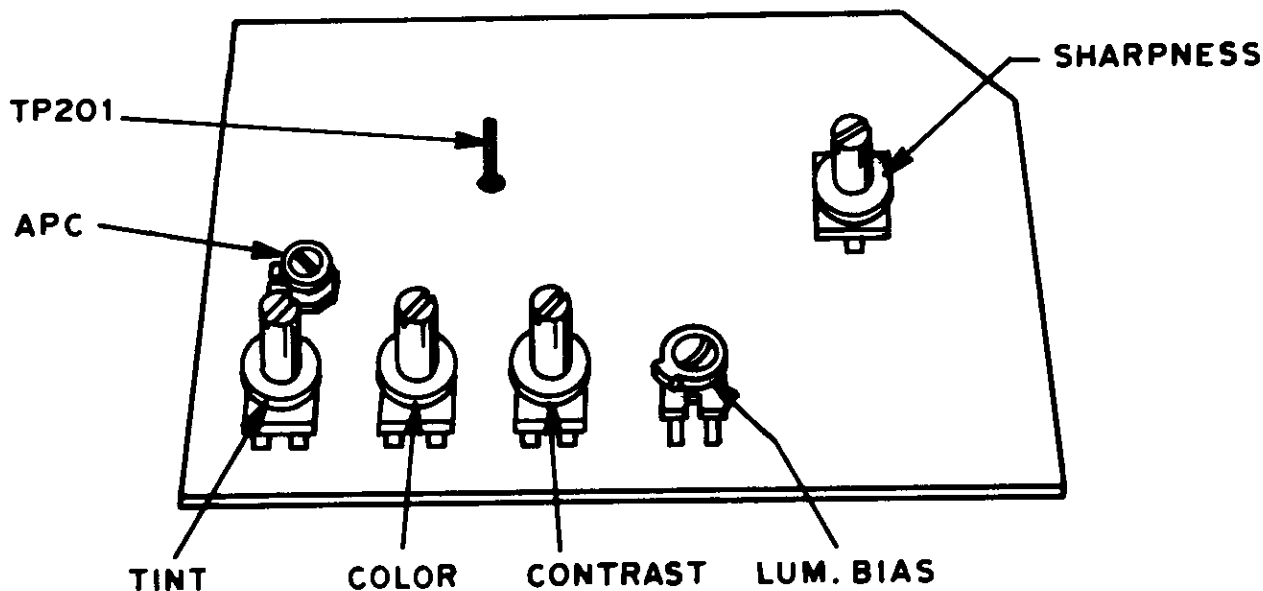
Adjustment of this control is required only if the monitor is being used with a game in which the top several raster lines are visible on the screen. Adjust the vertical damping control for uniform spacing of the top raster lines.

5. BLACK LEVEL

Adjust the black level control to obtain the proper black level (the black portion of the picture just extinguished). Do not use the screen control to set the black level.

6. FOCUS

Adjust the focus control for best overall definition and fine picture detail.



APC Adjustment

This adjustment should be made only when the Chroma IC (IC201), parts of the APC circuit have been replaced, or when the picture colors are unstable.

Procedures:

1. Apply a color bar signal to the Video Input Terminal.
2. Turn the Color Control fully clockwise and position the Tint Control at its mechanical center.
3. Connect a jumper between TP201 and ground.
4. Turn the APC Adj. Control VR201 until the color bars on the screen are synchronized.
5. Remove jumper.

Luminance Bias Adjustment

This is a factory adjusted control and should require no further attention. If however, it becomes necessary the procedure is as follows:

1. Connect a D.C. oscilloscope to one of the video outputs.
2. Turn the lum. bias control fully counter-clockwise.
3. Slowly turn the control in the clockwise direction until the black level is just at the sync tips. The sync appears just fully compressed.

APPENDIX A

PARTS LIST

Part numbers for the major assemblies (e.g. circuit board, control panel, etc.) are prefixed by 38-. The components used in making up an assembly are listed directly beneath that assembly.

For assistance or additional information, please call Cinematronics, Inc. (619)562-7000 or (800)854-2666.

<u>Part Number</u>	<u>Part Description</u>
38-12158-01	Laser Disc Player, LD-V1000
38-12127-01	Laser Disc Player, PR7820
25-12030-02	Shock Isolator
20-10868-12	Bracket, Drawer
01-11965-01	Air Filter
20-10873-01	Bracket, Air Filter
41-11926-01	Conn, 2 Cir Plug Molex #19-09-20
35-10614-01	Pin, Male, Molex
02-12092-01	Video Disc, Dragon's Lair
38-11863-01	Monitor, 19" NTSC Color
81-12057-01	NTSC Decoder Board, Electrohome
81-12057-02	NTSC Decoder Board, Wells-Gardner
81-12036-01	PCA, Display
44-12054-01	IC, ICM7218D
65-11533-01	LED, MAN8940
63-10784-01	Cap, .1MF 50V Disc 20%
63-11042-01	Cap, 470MF 35V Elec
41-10652-01	Conn, 16 Cir, M Header
80-12036-01	PCB, Display
36-11547-01	Socket, Dip 28Cir
38-12065-01	Assy, Cntl Panel, Dragon's Lair
20-11972-01	Cntrl Panel, Dragon's Lair
22-12066-01	Decal, Lexan, Dragon's Lair Control Panel
37-11192-01	Button, Short, White
37-11192-02	Button, Short, Red
37-11373-01	Switch, W/Plastic Mntg Brkt, Short
38-11396-01	Assy, Joystick, 8 Pos, Leafswitch
87-11679-11	Assy, Harness, Cntl Panel
38-12088-01	Assy, Circuit Panel, Magicom
81-12035-01	PCA, Main Board
44-11833-01	IC, Z80A (4 MHZ)
44-11486-01	IC, 74LS244
44-11487-01	IC, 74LS245
44-11890-01	IC, 4016(200NS)
44-11029-01	IC, 74LS138
44-12053-01	IC, AY-3-8910 (GI)

69-12064-01	Crystal, 4 MHZ, Fundamental
37-12050-01	Switch, Dip 8POS
37-11535-01	Switch, Pushbutton, 39-251-Red
44-11028-01	IC, 74LS74
44-10700-01	IC, 74S04
44-10677-01	IC, 74LS00
44-11492-01	IC, 74LS374
44-10697-01	IC, 74LS393
44-10680-01	IC, 74LS08
44-12055-01	IC, LM383 (NS)
20-10521-01	Heat Sink, Thermalloy 6072B
20-10520-01	Heat Sink, Thermalloy 6071B
44-10673-01	IC, 7815-C
66-10816-01	Transistor, NPN 2N3904
66-10817-01	Transistor, PNP 2N3906
66-10823-01	Transistor, NPN 2N5878
20-10537-01	Heatsink, Thermalloy 6060
65-10993-01	Diode, 1N914
65-10812-01	Diode, 1N4003, ENCPL
69-11898-01	Crystal, 16MHZ Fundamental
53-10743-01	Res, 4.7K OHM 1/4W 5% C.
53-10746-01	Res, 10K OHM 1/4W 5% C.
53-11123-01	Res, 0 OHM 5% C.
53-11684-01	Res, 220 OHM 1/4W 5% C.
53-10734-01	Res, 1K OHM 1/4W 5% C.
53-10731-01	Res, 330 OHM 1/4W 5% C.
53-10920-01	Res, 5.1K OHM 1/4W 5% C.
53-11044-01	Res, 510 OHM 1/4W 5% C.
53-12115-01	Res, 2.2 OHM 1/4W 5% C.
53-10771-01	Res, 360 OHM 1W 5% C.
53-10735-01	Res, 1.5K OHM 1/4W 5% C.
53-10730-01	Res, 300 OHM 1/4W 5% C.
63-11128-01	Cap, 22MF 50V Elec RAD
63-11042-01	Cap, 470MF 35V Elec
63-12129-01	Cap, 330PF 50V Disc 20%
63-11370-01	Cap, 10MF 50V Elec
63-12130-01	Cap, 0.2MF 50V Ceramic Disc, 20%
63-11127-01	Cap, 1.0MF 50V Elec RAD
63-10784-01	Cap, .1MF 50V Disc 20%
63-10944-01	Cap, 100MF 35V Elec RAD
63-10940-01	Cap, .001MF 50V Disc 20%
63-10781-01	Cap, 005MF 50V Disc 20%
41-10652-01	Conn, 16 Cir, M Header
41-11895-01	Conn, 40 Cir, M Header
36-10621-01	Socket, 24 Pin, I.C., Dip Solderta
36-11784-01	Socket, 40 Pin Diptail
41-12113-01	Conn, 36 Pin Body Molex
41-12114-01	Pins, Solder, Molex
80-12035-01	PCB, Main Logic
81-12056-01	PCA, ROM
02-12091-01	EPROM, 2764,250 NS,U1, Dragon's Lair
02-12091-02	EPROM, 2764,250 NS,U2, Dragon's Lair

02-12091-03	EPROM, 2764,250 NS,U3, Dragon's Lair
02-12091-04	EPROM, 2764,250 NS,U4, Dragon's Lair
02-12091-05	EPROM, 2764,250 NS,U5, Dragon's Lair
63-11042-01	Cap, 47OMF 35V Elec
63-10784-01	Cap, .1MF 50V Disc 20%
41-11895-01	Conn, 40 Cir, M Header
36-11547-01	Socket, Dip 28Cir
80-12056-01	PCB, ROM
20-12092-01	Plate, Circuit Mounting
87-12093-01	Assy, R. CBL. 40Cir 3"
05-12092-01	Set of Rev. C EPROMS (Speed Up Kit)
38-11701-01	Assy, Power Plate
20-11606-01	Plate, Mntg, P/S, Trans
38-11723-01	Assy, Trans ISOL Ravenswood
43-11704-01	Trans, ISOL Ravenswood 105P9
87-11767-01	Assy, Harn, Trans GND
82-10842-30	P/S, Data Power
82-10842-01	P/S, National
87-11688-01	Assy, Harn Trans/Mon JG
87-11768-01	Assy, Harn Trans/PS
38-12080-01	Assy, Operator Convenience Panel
20-12078-02	Brkt, Operator Convience Pnl
26-10589-01	Knob, Volume
29-11754-01	Meter, Coin 6 Volt
51-10722-01	POT, W.LK. Washer/Nut, 10K OHM
65-10812-01	Diode, 1N4003, ENCPL
87-12084-01	Assy, Harness Operator Convenience Panel
38-12081-01	Assy, AC Input Panel
20-12093-01	Plate, AC Input Panel
37-10893-01	Switch, Interlock
63-12131-01	Filter, AC Line, GCM3N1P (Genisco)
38-11704-01	Assy, Coin Door
20-10896-11	Coin Door W/Lamps
22-10899-01	Decal, "CINEMATRONICS"
87-11680-02	Assy, Harness, Coin Door
32-12100-03	Cabinet, Upright, DL, LD-V1000
38-12071-01	Assy, Marquee, Dragon's Lair
21-12069-01	Plexi, Marquee
22-12098-01	Decal, Lexan, Marquee, Dragon's Lair
20-12066-01	Retainer, Upper Marquee
20-12067-01	Retainer, Lower Marquee
21-10831-02	Bezel, CRT, Formed, DL
21-12138-01	Plexi, Rear, Score, Dragon's Lair
21-12139-01	Plexi, Monitor, Dragon's Lair
20-11382-01	Grill, Speaker
71-10834-01	Speaker
20-11420-01	Rail, CRT Mntg.
20-10862-01	Brkt, Coin Box Tong
20-10864-01	Handle, Coin Box
20-10871-01	Coin Box

20-10872-03	Cover, Coin Drawer
01-10505-01	Lamp, Fluorescent
26-10588-01	Fixture, Lamp, Fluorescent
87-12139-01	Assy, Main Harness
87-12140-01	Assy, Player Interface
87-12141-01	Assy, Cable, Display
87-12143-01	Power Cord
87-12142-01	Cable, BNC to BNC
01-11963-01	Fan, Muffin, 50 CFM
01-11964-01	Fan Guard, Muffin, Filter
22-12099-01	Decal, Side, Dragon's Lair
21-12140-01	Plexi, Film Smoked, 6 1/2 X 8 1/2

APPENDIX B

GAME SETTING OPTIONS - DRAGON'S LAIR

DIPSWITCH SPECIFICATION:

The following game options are controlled by Dipswitches 1 and 2 on the main CPU board:

- I. Attract Mode and Joystick Sound
- II. Number of Coins Required for One Credit
- III. Number of Dirks per Credit and Length of Play
- IV. Playtest and Diagnostic
- V. Difficulty Level
- VI. Pay-As-You-Go Play

Some options are controlled by individual switch settings, others by combinations of switch settings. Points B0 through B7, marked in white on the PC board, correspond to switches 1 through 8 respectively on Dipswitch 1. Points A0 through A7 correspond to switches 1 through 8 respectively on Dipswitch 2. BEFORE ADJUSTING SWITCHES, TURN POWER OFF AND UNPLUG POWER CORD.

A. ATTRACT MODE AND JOYSTICK SOUND

POINT	POSITION	FUNCTION
B0	OFF	Sound on every 8th attract mode sequence.
B1	OFF	No sound during attract mode sequences.
B3	OFF	Joystick feedback sound on.

B. NUMBER OF COINS REQUIRED FOR ONE CREDIT

NOTE: one credit = one game

SWITCH COMBINATION		NUMBER OF COINS REQUIRED FOR ONE CREDIT
A1	A0	
ON	ON	2
ON	OFF	3
OFF	ON	4
OFF	OFF	Not used

C. NUMBER OF DIRKS PER CREDIT AND LENGTH OF PLAY

POINT	POSITION	NUMBER OF DIRKS PER CREDIT
A5	ON	3
A5	OFF	5
B2	OFF	Unlimited Dirks for testing purposes.
A4	OFF	2 credits at all times/free play.

D. PLAYTEST AND DIAGNOSTIC

POINT	POSITION	FUNCTION
A3	OFF	Playtest Switch for engineering use.
A7	First ON, then OFF.	Diagnostics. To run diagnostics, set A7 to the ON position, and power up the game. Wait until you hear two beeps. The second beep indicates that the disc player has been initialized. After the second beep, turn A7 to OFF, and run diagnostics. To rerun diagnostics, press the RESET button, Sw 3 on the PC board.

E. GAME DIFFICULTY LEVELS

SWITCH COMBINATION			DIFFICULTY LEVEL
A2	B4	B7	
ON/OFF	ON/OFF	OFF	Easy
ON	OFF	ON	Difficulty is dependent upon player's ability. Easy at the onset of every game, play automatically increases in difficulty when a player survives 9 consecutive sequences of challenges.
ON	ON	ON	Difficulty is dependent upon player's ability. Easy at the onset of every game, play automatically increases in difficulty when a player survives 5 consecutive sequences of challenges.
OFF	ON	ON	Hard.

F. PAY-AS-YOU-GO PLAY OPTIONS

SWITCH COMBINATION

A0	A1	A6	B5	B6	OPTION
ON/OFF	ON/OFF	ON	ON/OFF	ON/OFF	Pay-as-you-go setting is off. A specific number of coins must be deposited before game play begins. Game then plays from start to finish without interruptions.
ON	ON	OFF	ON	ON	Game play stops once, 2/3 of the way to the dragon's lair. At this time, the player must deposit more money if he wishes to continue. After the required amount of money is deposited, play resumes from the the interruption point. If the player has less than three Dirks at the point of interruption, he receives one additional Dirk when play resumes. In this option, the game ends when the player finishes the dragon's lair sequence.
ON	ON	OFF	ON	OFF	Game play stops once, 2/3 of the way to the dragon's lair. At this time, the player must deposit more money if he wishes to continue. After the required amount of money is deposited, interruption point.

The player receives no additional Dirks in this option.

The game ends when the player finishes the dragon's lair sequence.

ON ON OFF OFF ON

Game play stops at three regular intervals. At each pause, the player must deposit more money if he wishes to continue. After the required amount of money is deposited, play resumes at the interruption point.

If the player has less than 3 Dirks at a point of interruption, he receives an additional Dirk when play resumes.

In this option, the game does not end after the dragon's lair sequence. Instead, after the dragon's lair sequence, the player may deposit additional coins to prolong play. Play begins again at the first sequence. (No extra Dirks are awarded after the dragon's lair sequence).

ON ON OFF OFF OFF

Game play stops at three regular intervals. At these times, the player must deposit more money if he wishes to continue. After the required amount of money is deposited, play resumes at the interruption point.

B.5
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In this option, the player receives no additional Dirks at any time. The game does not end after the dragon's lair sequence. Instead, after the dragon's lair sequence, the player may deposit additional coins to prolong play. Play begins again at the first sequence.

APPENDIX C

GAME SETTING OPTIONS - SPACE ACE

DIPSWITCH SPECIFICATIONS:
(As shown in white on PC Board)

A0	off = 2 coins/credit. on = 3 coins/credit.	
A1	off = 3 lives/credit. on = 5 lives/credit.	
A2	A3	DIFFICULTY SETTING
A2	off = Difficulty increases automatically after player goes through <u>five</u> consecutive episodes without losing a life. on = Difficulty increases automatically after player goes through <u>three</u> consecutive episodes without losing a life (harder setting).	
A3	off = Slow difficulty increase on = Fast difficulty increase (harder setting).	
A4	off = Attract mode audio on. on = Attract mode audio off.	
A5	off = Attract mode audio plays continuously. on = Attract mode audio plays only one out of eight times.	
A6	Not used.	
A7	Not used.	
B0	off = Pioneer model 7820 videodisc player. on = Pioneer model LD-V1000 videodisc player.	
B1	Not used.	
B2	Not used.	

- B3 Not used.
- B4 off = Default to setting of A1 and A2 (normal).
on = Free play (2 credits always).
- B5 off = Default to setting of A1 and A2 (normal).
on = Unlimited lives.
- B6 off = Normal.
on = Enable frame display.
- B7 off = Normal.
on = Diagnostics mode.

APPENDIX D
SCHEMATICS AND ASSEMBLY DRAWINGS

<u>ORDER OF APPEARANCE</u>	<u>NO. OF PAGES</u>
1. Z80 Controller Board Schematic Revisions	2
2. Z80 Controller Board Schematics Rev. E	2
3. Z80 Controller Board Assembly Rev. A	1
4. Z80 Controller Board Schematics Rev. K	2
5. Z80 Controller Board Assembly Rev. G	1
6. Magicom ROM Schematic	1
7. Magicom ROM Assembly	1
8. Magicom Display Schematic	1
9. Magicom Display Assembly	1
10. Condor Power Supply Schematic	1
11. Data Power Supply Schematic	1
12. National Power Supply Schematic (old)	1
13. National Power Supply Schematic (new)	1
14. Electrohome R.G.B. Monitor Schematic	1
15. Electrohome N.T.S.C. Decoder Schematic	1
16. Electrohome N.T.S.C. Decoder Specifications	1
17. Wells-Gardner R.G.B. Monitor Schematic	1
18. Wells-Gardner N.T.S.C. Decoder Schematic	1
19. Magicom Wiring Harness	2
20. Annunciator Board (Conversion Kit) Schematic	1
21. Annunciator Board (Conversion Kit) Assembly	1
22. Annunciator Board (with Lamps) - Schematic	1
23. Annunciator Board (with Lamps) - Assembly	1