

# The Lost Bit™



Volume 1 Number 1

October 1983

## Introducing The Lost Bit by Frank Becker, Field Service Manager

*The Lost Bit*—No it's not something from the master computer in Superman III—it's Atari's new technical newsletter, bringing you Customer and Field Service information to help you find that 'Lost Bit' of information you need to keep your game up and earning money.

At Atari, we realize that communication is the thread that weaves the operator, distributor, and manufacturer together. This newsletter is an attempt to communicate the bits and pieces that sometimes fall through the cracks without being communicated.

*The Lost Bit* is another example of Atari's commitment, from the president down through all levels of our corporation, to provide you with the best service department of any manufacturer.

For *The Lost Bit* to be an effective forum for communicating the problems we have in our games, you must first provide us with feedback. Therefore, I urge you to call either of our two service centers: New Jersey—(800) 526-3849 / (201) 469-5993 or California—(800) 538-1611 / (408) 943-1120 with any service problems you may have. To get on our mailing list call any of the above numbers. I can be reached by calling the California numbers. *The Lost Bit* is a bi-monthly newsletter (published six times a year) compiled and edited by Russell Gorr, to whom I owe many thanks for all the work he has done to produce this newsletter. I hope you find it useful.

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## CAT Box Checksums

In order to read checksums with the ATARI CAT Box, you must have a CAT Box modified with a checksum switch. For information on modifying your CAT Box, contact Atari Field Service. All checksums taken are in the two-byte additive mode (DATA position).

In this issue of the newsletter, we feature checksum information for the Star Wars<sup>1</sup> and Crystal Castles<sup>2</sup> games. Both of these games have read only memories (ROM) containing two separate pages of program.

**Star Wars Checksums.** ROM 0 of Star Wars is comprised of two pages of program data. To select page 1, momentarily ground the RESET test pins on the Main PCB. This makes MPAGE Low. To select page 2, use the CAT Box to write 80 (data) to 4684 (address). This makes MPAGE High. Before you take checksums, you must first either remove the microprocessor from the game printed-circuit board (PCB) or ground WDDIS and the HALT pin of the microprocessor. ROM 0 is a 16K device; VROM is a 4K device; all other ROMs are 8K devices.

Star Wars Checksum Table

ROM NO.	ADDRESS	CHECKSUM
ROM 0 (Page 1)	6000	BEE4 (MPAGE Low)
ROM 0 (Page 2)	6000	A736 (MPAGE High)
ROM 1	8000	571E
ROM 2	A000	73DD
ROM 3	C000	F839
ROM 4	E000	0210
VROM	3000	91D1

**Crystal Castles Checksums.** ROM 0 and ROM 1 are both comprised of two pages of program. To select the first page, you must first write data 00 to address 9E87. To select the second page, you must write data 01 to address 9E87. All ROMs in this game are 8K.

Crystal Castles Checksum Table

ROM	ADDRESS	CHECKSUM
ROM 0 (Page 1)	A000	5798
ROM 0 (Page 2)	A000	90E9
ROM 1 (Page 1)	C000	AAFF
ROM 1 (Page 2)	C000	A066
ROM 2	E000	554E

<sup>1</sup>Star Wars © 1983 Lucasfilm Ltd. and Atari, Inc. All Rights Reserved. Trademark of Lucasfilm Ltd. used by Atari, Inc. under license.

<sup>2</sup>Crystal Castles is trademarked by Atari, Inc. All rights reserved.

## Atari Introduces New Interfaces for the CAT Box

Now available from your Atari distributor are interfaces for your CAT Box. These interfaces allow the CAT Box to be used for troubleshooting game printed-circuit boards (PCB) that use microprocessors other than the 6502 or 6800. Currently available is a Z80 interface for any manufacturer's games using the Z80 microprocessor. Available soon will be interfaces for the Z8002, 6809, 6502, and 6800 microprocessors.

This will allow the CAT Box to test a wide variety of new 8-bit and 16-bit microprocessor games.

The CAT Box can be used to check a game board's RAM, ROM, address decoders, all input and output circuits, as well as special circuits such as vector generators, mathbox, and speech synthesis circuits. The CAT Box also features a built-in logic probe and provides signature analysis capability. The CAT Box is available from your Atari distributor.

# PAT 9000<sup>1</sup> Tester

The PAT 9000 can be used to test all black-and-white games, as well as color games. Internal circuitry converts both the X-Y and the raster displays of the PAT 9000 to black and white.

**Problem:** With the PAT 9000 Switch Pulsing Mode or down toggle position, the switches one and two will not always release when pressed.

**Solution:** On the Switch Interface I PCB in the PAT 9000, locate resistors R1-R6 (see pages 18 and 64 of TM-200). Replace these 1 k $\Omega$  resistors with 470  $\Omega$  resistors.

**Problem:** The PAT 9000 power breaker trips when testing some 2-PCB systems (such as Pole Position).

**Solution:** On the Regulator/Audio II PCB in the PAT 9000, locate the 0.1  $\Omega$  power resistor, R24, inside the heat sink (see page 88 of TM-200). Parallel this resistor with a 0.1  $\Omega$ , 7 W resistor.

**Problem:** The video picture is wavy when testing some games (such as Missile Command<sup>2</sup>).

**Solution:** Attach a ground wire between the power supply chassis and the card cage inside the PAT 9000 as shown in the following illustration.

**Problem:** The -5 volt power supply may trip when other test equipment near the PAT 9000 (such as the CAT Box, a soldering iron, or a heat gun) are powered up or down.

**Solution:** On the Power Trip PCB in the PAT 9000, locate the edge connector (see pages 18 and 82 of TM-200). Place a 0.1  $\mu$ F bypass capacitor from pin 19 of the edge connector to ground, and place another 0.1  $\mu$ F bypass capacitor from pin 3 of the edge connector to ground.

**Problem:** When testing black and white games (such as Sprint II<sup>3</sup> or Super Breakout<sup>4</sup>), the PAT 9000 may lose video SYNC.

**Solution:** On the Video Interface PCB in the PAT 9000, locate R7 (see pages 18 and 76 of TM-200). Obtain a 100 k $\Omega$  potentiometer. Short the center leg of the potentiometer to either end connection. Place the potentiometer in series with R7 by lifting one end of R7 and soldering one end of the potentiometer to the lifted end of R7. Sol-

der the other end of the potentiometer to the pad that R7 was lifted from. When testing older games, adjust the potentiometer to obtain stable SYNC.

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<sup>2</sup> Missile Command is trademarked by Atari, Inc. All rights reserved.

<sup>3</sup> Sprint II is trademarked by Atari, Inc. All rights reserved.

<sup>4</sup> Super Breakout is trademarked by Atari, Inc. All rights reserved.

## PAT 9000 Program Plugs

Program plugs for the PAT 9000 are easily made for just about any video game, not only those manufactured by Atari. Blank program plug kits are available from your Atari distributor. The kit contains enough material to make up three different plugs; order part number 08-0303045.

**Sprint II Program Plug.** The table given here is for use in making a program plug for the Sprint II game. When using the PAT 9000 and this program plug to test a Sprint II PCB, the PAT 9000 joystick will control the steering, the AUX 1 switch controls the track selection, the rotary switch simulates the gear shifter, and switch 9 simulates the gas switch. The following wiring is for one plug (A1).

Sprint II Program Plug Wiring

FROM	TO	COMMENTS
V5	S1	Ground
Z3	S2	Ground
V6	S3	Ground
Z4	S6	Ground
Z5	T1	+10 V Unregulated
W1	T3	+10 V Unregulated
Z6	T2	+10 V Unregulated
a1	R1	+5 V
W4	M6	Video Out
a2	E1	Steering 1A
W5	E3	Steering 1B
a3	G2	Coin 2
a4	G1	Coin 1
X1	E2	Steering 2A
W6	E4	Steering 2B
a5	L1	Start 1 Lamp
X2	S4	Ground
X3	H3	Self Test

b1	B6	Gas 2 (Switch 9)
X4	B5	Gas 1 (Switch 9)
b2	H5	Start 1
X5	H6	Start 2
b3	G5	Track Select (AUX 1)
Y1	J6	Track Select Lamp (L2)
b5	L2	Start 2 Lamp
Y2	D4	3rd 2 (Rotary Switch)
b6	D3	3rd 1
Y3	D2	2nd 2
c1	D1	2nd 1
Y4	C6	1st 2
c2	C5	1st 1
c3	U1	+22 Volts
Z1	L3	Audio 1
c5	L4	Audio 2
Z2	S5	Ground
c6	N3	Audio Ground
P1	N6	Switch Polarity

## Troubleshooting Guide Corrections

**Arabian\* Schematics, SP-241.** In the Troubleshooting Guide included in the schematic package under the heading "Troubleshooting With Checksums" on page 2, change the setting of the CAT Box BYTES switch in step 2 from 256 to 1024. Also, change the checksums given in Table 1 of the Troubleshooting Guide as follows:

Arabian Checksums

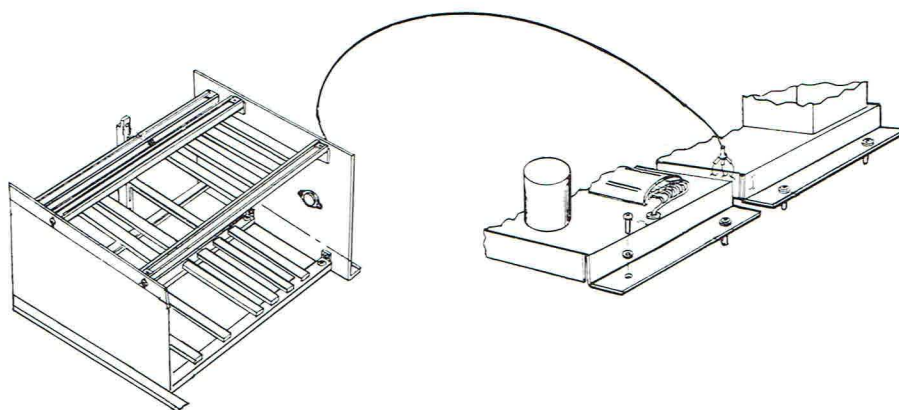
ROM TESTED	CHECKSUM
ROM 0	813F
ROM 1	AE35
ROM 2	86AD
ROM 3	F3F8

**Crystal Castles Schematics, SP-241.** Change the locators for the Audio I/O integrated circuits from 4D to 3D and from 4B to 3B. Also, in Table 3 of the Troubleshooting Guide included with the schematic package, only partial addresses were printed. The correct and complete addresses are given here.

Crystal Castles Custom Audio I/O Chips

ADDRESS	DATA
980F	00
980F	03
9800	55
9801	AF
9801	00
9802	55
9803	AF
9803	00
9A0F	00
9A0F	03
9A00	55
9A01	AF
9A01	00
9A02	55
9A03	AF
9A03	00

\*Arabian is manufactured under license from Sun Electronics Corporation.



# Star Wars Notes

**Problem:** The 3-D objects get funny looking, but everything checks out okay in self-test.

**Solution:** The problem may be AMD-type random-access memories (RAM) in locations 5F and 5H on the Main PCB. The defective RAM are AM9128-15 or AM9128-10. Do not use AMD RAM at locations 5F and 5H, connect a 180  $\Omega$ ,  $\pm 5\%$ ,  $\frac{1}{4}$  W, resistor from pin 2 of integrated circuit 9D to ground. You will find a convenient trace on the top of the Main PCB for connecting the resistor.

**Problem:** The game fails to keep credit or scorekeeping information.

**Solution:** The NOVRAM at location 1E on the Main PCB may be bad. When replacing the NOVRAM (X2212), be sure that capacitor C94 (4.7  $\mu$ F) is installed in the board.

**Problem:** Revision B and revision C boards may not power up on the PAT 9000 tester.

**Solution:** In the Clock circuit on the Main PCB, change R3 from a 220  $\Omega$  resistor to a 68  $\Omega$  resistor. Also change C3 from a 39 pF capacitor to a 100 pF capacitor. In addition, you must have the 0.1  $\Omega$  resistor modification done to the PAT 9000.

**Problem:** The option switches on the board are set; but, the game still doesn't have the correct options.

**Solution:** The option switches on the board are used only as a back-up in case the NOVRAM fails. The NOVRAM holds the option information normally used by the game. Use the self-test mode to set the option information into the NOVRAM.

**Problem:** Games with revision A and revision B Main PCB fail to work when powered up.

**Solution:** Change R3 in the Clock circuit of the Main PCB to a 68  $\Omega$  resistor.

**Problem:** I hear a series of beeps when performing the self-test. Which RAM and ROM do these beeps refer to?

**Solution:** The self-test gives off a continuous series of 16 beeps. If the beeps are high in tone, then the IC being checked is good; if the beeps are low in tone, then the IC is bad.

Star Wars Test

TONE NO.	IC LOCATION	DESCRIPTION
1	2F/H (Main PCB)	Program RAM
2	5F (Main PCB)	Matrix RAM 0
3	5H (Main PCB)	Matrix RAM 1
4	3L (AVG PCB)	VRAM 0
5	3M (AVG PCB)	VRAM 1
6	3P (AVG PCB)	VRAM 2
7	4L (AVG PCB)	VRAM 3
8	4M (AVG PCB)	VRAM 4
9	4P (AVG PCB)	VRAM 5
10	1E (Main PCB)	NOVRAM (RAM portion only)

11	1F (Main PCB)	ROM 0
12	1H/J (Main PCB)	ROM 1
13	1J/K (Main PCB)	ROM 2
14	1K/L (Main PCB)	ROM 3
15	1M (Main PCB)	ROM 4
16	1L (AVG PCB)	VROM

**Problem:** Possible cathode-ray tube damage while the game is in the freeze mode.

**Solution:** Switch 8 of the option switch at location 10E/F puts the game into a freeze mode. The game can be advanced through game play, frame by frame, by pressing the left trigger button. Care should be taken when operating the game in this manner to avoid leaving the screen on a frame using high intensity levels, such as when the Death Star explodes. If you leave the game screen in freeze mode with a high intensity frame displayed, you may burn the phosphor of the cathode-ray tube.

**Problem:** While in the Self-Test mode, a series of letters and numbers appears on the screen with a series of "N" and "F" letters after it.

**Solution:** The game has built-in diagnostics for use in troubleshooting. Refer to the Troubleshooting Guide included in the schematic package for details. This guide is available by ordering SP-225, 2nd printing. This Troubleshooting Guide explains how to use the diagnostics of the game when troubleshooting.

## Star Wars Display Problems

**Problem:** Failure of the 24-volt regulator in the display.

**Solution:** Check capacitors C3 and C4, on the output of the 24-volt regulator of the High-Voltage PCB, for an open circuit or for leakage. Change capacitors C3 and C4 from 100  $\mu$ F, 35 volts to 220  $\mu$ F, 35 volts. The replacement capacitors must have a low Equivalent Series Resistance (ESR). The Atari part no. for these replacement capacitors is 123009-227.

**Problem:** Failure of driver transistor type-2N3716 or type-2N3792 in the display.

**Solution:** Check diodes CR2 and CR11. The type-1N914 diodes may open up, causing fuses F1 and F2 to blow or causing driver-transistor failure. Change diodes CR2 and CR11 to a type-1N4148, part no. 131003-001, or to a type-1N4001, part no. 31-1N4001.

**Problem:** The schematic for the High-Voltage Cutoff circuit doesn't match the actual PCB.

**Solution:** These displays were manufactured with three different revisions of the PCB. To determine which revision of PCB is in your display, use the information in the following table.

Display Revision Indicators

PCB REVISION	R16	R18
Original	470 $\Omega$	27 k $\Omega$
1st Rev.	Zener	Missing or 27 k $\Omega$
2nd Rev.	470 $\Omega$	33 k $\Omega$

## Manual Corrections by Jo-An Torres

This column features parts ordering information and corrections to the technical game manuals and schematic packages.

**Control Panel Decals.** Control panel decals can be ordered from Atari and replaced in the field. If the manual states *not field replaceable* with regard to the control panel decal, this is an error.

**Side Panel Decals.** Side panel decals are only available for Cabaret games or retrofit games such as Black Widow<sup>†</sup>.

**Food Fight<sup>‡</sup> Manual, TM-229.** On Figure 3-1, Cabinet-Mounted Assemblies US-Built Game, change the Display Shield part no. from 037412-01 to part no. 039752-01. On Figure 3-14, Food Fight Game PCB Assembly, change the Main PCB part no. from A039445-21 to part no. A039945-21.

**Millipede<sup>§</sup> Manual, TM-217.** Under Figure 3-16, in the Printed-Circuit Board Mounting Hardware Parts List, change the EMI Shield PCB part no. from A039490-01 to part no. A039430-01.

**Pole Position<sup>¶</sup> Manual, TM-218.** On Figure 3-2, Cabinet-Mounted Assemblies Sit-Down Cabinet, the arrow for the Display Shield, part no. 039148-01, should point to the video display above the steering wheel. On Figure 3-9, Foot-Pedal Control Assembly: change the Extension Spring part no. from 178026-006 to part no. 039704-01; change the Cable Spring part no. from 178026-005 to part no. 039703-01; change the Compression Spring part no. from 000592-01 to part no. 040028-01. The new part numbers for the Extension Spring, Cable Spring, and Compression Spring are for new and improved springs for the Foot-Pedal Control.

**Star Wars Schematics, SP-225.** Schematic error on sheet 11A, in the "Matrix Processor Address Selector" circuit, on the pins of IC at location 6E, pin 1 is signal IP7, which connects to pin 11 of IC 7K. Pin 2 of 6E connects to pin 6 of IC 5E.

**Warlords<sup>§</sup> Manual, TM-175.** On Figure 16, Cabinet-Mounted Assemblies, the part numbers for the attraction panel and monitor shield are reversed. The attraction panel part no. is 037208-01; the monitor shield part no. is 037207-01.

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<sup>‡</sup>Food Fight is trademarked by Atari, Inc. All rights reserved.

<sup>§</sup>Millipede is trademarked by Atari, Inc. All rights reserved.

<sup>¶</sup>Pole Position is engineered and designed by Namco, Ltd. Manufactured under license by Atari, Inc. Trademark and © Namco 1982.

<sup>§</sup>Warlords is trademarked by Atari, Inc. All rights reserved.

# Atari Questions and Answers

**Question:** What type of lamp is used in the coin return buttons of the newer coin doors?

**Answer:** A 6.3 volt, 0.25 A, wedge-base lamp. The common lamp number is CM259, manufactured by Chicago Miniature and other lamp manufacturers. The Atari part no. is 170000-001.

**Question:** In the high-voltage assembly of the Wells-Gardner color X-Y display used in Tempest<sup>1</sup>, is a diode marked D901. What is the part number of this diode?

**Answer:** The diode is a Motorola MR1600. The Atari part no. is 99-130448.

**Question:** The Wells-Gardner displays use a TPS98 transistor. Is there any other type that can be used in its place?

**Answer:** You can use a Texas Instruments TIS98 transistor; however, the lead basing on this device is reversed from that of the TPS98.

**Question:** What does the "p" stand for on the schematics?

**Answer:** The "p" means that the pin of the integrated circuit (IC) is connected to a pull-up resistor. Quite often the "p" is followed by a comma and a resistor number, which tells you to what resistor the pin is connected.

**Question:** I have an Asteroids<sup>2</sup> game that is "locked up." How can I easily narrow down where the problem might be on the logic board?

**Answer:** Two circuits on the logic board might lock up the game. One circuit is the Vector Generator and the other is the Program circuit. You should first check the RESET line of the microprocessor (pin 40 of the 6502 microprocessor) to see if it is

pulsing. If it is, then temporarily connect a small jumper wire between the HALT pin and +5 volts. Check the RESET line again. If the RESET line is still pulsing, your problem is probably in the Program circuit. If the RESET line is not pulsing, then the problem is in the Vector Generator. Remove the jumper after performing this test. This quick test works on other X-Y games also.

**Question:** How do I tell which revision of a printed circuit board is in my game?

**Answer:** The revision level of the printed-circuit board (PCB) is indicated by a letter given at the end of the assembly number. The assembly number with revision indicator are placed on the component side of the PCB in close proximity to the Atari copyright. These are usually found near the edge of the PCB.

<sup>1</sup> Tempest is trademarked by Atari, Inc. All rights reserved.

<sup>2</sup> Asteroids is trademarked by Atari, Inc. All rights reserved.

# QUANTUM\* Quickie

**Problem:** The left coin mechanism gives 4 credits/coin and the right coin mechanism gives 12 credits/coin.

**Solution:** This problem is due to a timing error by the Custom Audio I/O integrated circuit at location 2/3D when it reads the option switches. Change the following ROM:

At Location	Replace Part	With New Part
2E	136016-101	136016-201
2H/J	136016-103	136016-203
3E	136016-106	136016-206
3H/J	136016-108	136016-208

\*Quantum is trademarked by Atari, Inc. All rights reserved.

# CENTIPEDE\* Quickie

**Problem:** The Trak Ball™ intermittently loses control of the shooter.

**Solution:** If you have a game with PCB revision A-C, replace R130-R133 with 3.3 kΩ, ¼ W resistors. If you have a cocktail game with PCB revision A-C, you must also replace R83-R86 with 3.3 kΩ, ¼ W, resistors. If you have a game with PCB revision D-F, replace R151-R154 with 3.3 kΩ, ¼ W, resistors. If you have a cocktail game with PCB revision D-F, you must also replace R143-R146 with 3.3 kΩ, ¼ W, resistors. For games with PCB revision G-J, these modifications have already been made.

**Problem:** Intermittent fire buttons and coin switches.

**Solution:** To fix the fire buttons, change R115 and R117 from 1 kΩ resistors to 470 Ω resistors. To fix the coin switches, change R119, R120, and R123 from 1 kΩ resistors to 470 Ω resistors.

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# CAUTION

Modifications described in this newsletter should *only* be performed by those who are experienced in troubleshooting digital circuits and in solid-state circuit soldering and rework techniques. Those without this experience who attempt to modify printed-circuit boards *may damage the board*, both physically and electrically. This may result in extra repair charges by your distributor and, in extreme cases, may render the board unrepairable.

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