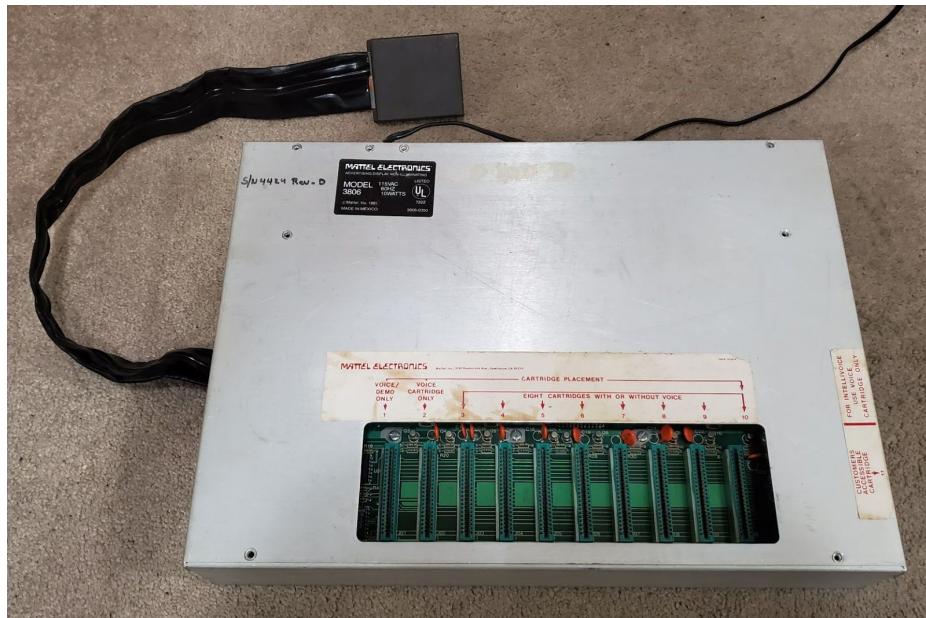


# Mattel Kiosk Multiplexer Reverse

## Engineering Notes

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version 2020-03-11



### What is it?

Mattel® designed several in-store kiosks for stores to show off the Intellivision® to potential customers. Two types of kiosks are known to exist from the Mattel Electronics 1982 catalog (seen at right). One was called the “deluxe in-store display module” and the other was called the “smaller unit”. These kiosks were displays of plastic, metal, and cardboard that allowed customers to choose from 1 of up to 10 games to play for a limited time, they had a simple built-in attract mode, and they used a demonstration cartridge as an advanced attract mode. The larger deluxe kiosk is confirmed to be able to play up to 10 games. However, the smaller kiosk did not have the same ability since Italian 1983 Mattel Electronic catalog states that only the larger unit had the “special demonstration box” (presumably the Kiosk Multiplexer). Also, both catalogs only show photos of the smaller unit



with normal Mattel cartridges plugged directly into it.

The "Kiosk Multiplexer" is the electronic component of the in-store kiosks and is the main focus of this document. It is what housed the 10 playable game cartridges, the 1 demo cartridge, and the ROM code that provided both game selection and the simple attract mode. It is a large aluminum box with:

- 1 ribbon cable connected to a cartridge-like end that plugs into the Intellivision Master Component
- 10 slots for cartridges on the main face. These are referred to as slots 1 thru 10 since the circuit board labels them as J1 thru J10.
  - 1 is for a demo cartridge and is Intellivoice compatible
  - 1 is Intellivoice compatible (Rev B and Rev D boards differ on which slot this is)
  - 8 are for non-Intellivoice games only.
- 1 slot on the side for a game cartridge and is Intellivoice compatible (installed upside down!). This slot is referred to as slot 11 since the circuit board labels it at J11. This slot is intended to be customer accessible.
- 1 edge-card connector with 44 pins labeled as J14. It was originally called the "mystery connector", but has been determined to be an expansion slot to add more cartridge slots.
- Note: "Intellivoice compatible" only means that Intellivoice ROM expansion signals can be used. No game is known to ever use these signals. However, many non-Intellivoice games ground these signals. As a result, if both non-Intellivoice games and Intellivoice games are plugged into the Intellivoice slots, then the Intellivoice audio will not function correctly (ex: it can say "Mattel Electronics Presents" and nothing more). However, the following scenarios function correctly:
  - Plugging only Intellivoice games into the Intellivoice slots and non-Intellivoice games into the normal slots.
  - Plugging non-Intellivoice games into any slots if no Intellivoice games are being used.



It's Mattel part number is 3806.

According to official Mattel internal documentation from "Papa Intellivision", there are 2 major versions known to exist: pre-1982 model and post-1982 model. The pre-1982 model has its ROM at address \$7000-\$77FF while post-1982 is documented to have its ROM start at \$4800. Further, pre-1982 is confirmed to come in Rev B and Rev D variants. Rev A and Rev C variants are suspected to exist but unknown if these shipped outside of Mattel and it is unknown if Rev E or later ever existed. While Rev D is called pre-1982, the chips inside it have manufacture dates as late as the 37th week of 1982. No known post-1982 models are known to exist. If they were released, it is unknown if they shipped in late 1982 or in 1983. It is unknown if post-1982 Kiosk Multiplexers use the same part number of 3806.

At least with the pre-1982 model, most games are compatible with it but there a good number of games that are not.

### **Are these common?**

No. At present, there are only 5 known to exist.

<u>Serial #</u>	<u>Rev</u>	<u>Notes</u>
2043	A or B	"Old eBay unit"
2819	B	Other WA state unit
4424	D	Lathe26's (me)
4766	D	"Mattel Intellivision Kiosk Demonstration" YouTube video. This unit may have been donated

5209

D?

to a retro museum in California  
decle found this photo, unknown source

### **Has the ROM been dumped?**

Yes, but it was difficult. The first dump was attempted with a Rev B model that was loaned for a day. In preparation, several different memory dumping programs were created and loaded onto an LTO Flash, Cuttle Cart 3, and Intellicart.

All multicarts were incompatible.

As a last attempt, an AtariMax Maxflash USB Programmer was connected to the cartridge-like end of the Kiosk Multiplexer. This downloaded a 2K word ROM image but it was ~97% full of read failures (i.e. it read \$FFFF from most addresses) and read only a handful of memory locations. More dumps were attempted but these produced similar results. However, it was noticed that the few successful reads in each dump were at different address locations. 100 dumps were performed. Afterwards, a utility called MergePartialDumps.exe was created to merge the 100 dumps together, find the valid reads, confirm there were no conflicts at the same address location, and was able to successfully generate a valid ROM dump.

To imagine what this was like, consider receiving a Confidential CIA or FBI document where everything on the page was blacked out except for 3 words, then get another copy of the same page but with 3 different words being readable, and so on until you had enough copies of the same page to piece together all the words into a single readable page.

### **Top-Level Findings**

- Slot 1 is closest to the ribbon cable while slot 10 is closest to slot 11 (the side slot).
- The user can select a game in any slot **except** slot 1. Tap the disc to select the next populated slot. Press Enter to start a game. A brief tune plays before the game starts.
- The user has 10 seconds to tap the disc or select a game (time measured by the kiosk code counting interrupts). If the timeout occurs, then:
  - If a demo cartridge (or game) is in slot 1, it will start playing and will play forever.
  - If no cartridge is in slot 1, the kiosk ROM's simple attract mode will play. When the simple attract mode is done, it resets and returns to letting the user select a game. While the simple attract mode is executing, it does not respond to input from the controllers.
  - In neither case does the brief tune play.
- The user can play a game in slot 2 thru 11 for 5-10 minutes until the 556 timer pulls ~RESET. Note that the 556 circuitry is disabled for slot 1 and this was confirmed by a 33 minute continuous test and observing that the 556\_2TRIG signal continuously toggles

which inhibits the ~RESET. Three different 556 timeouts have been measured on Lathe's Rev D unit for the other slots:

- 1st timeout after power has been applied to the Kiosk Multiplexer is 5:42 to 7:34
- Typical timeout is 8:00 ( $\pm 5$  seconds)
- Occasional truncated timeout 4:45 when there is a spurious signal on 556\_2TRIG



*Image: One 1st timeout (0 to 5:20), one typical timeout (5:20 to 13:45), and one truncated timeout (13:45 to just off the screen).*

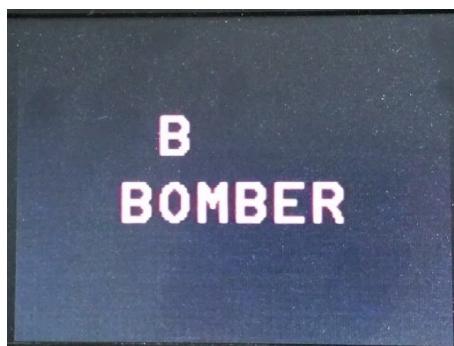
*~RESET is asserted on falling edges of 556\_1Q.*

- The simple attract mode built into the ROM displays a series of screens using green GROM text on a black background. This mode detects a Mattel Intellivision versus a Sears Intellivision. Both Mattel and Sears share the 3rd and last screen.
  - Mattel screens:
    - screen 1 "Welcome to INTELLIVISION"
    - screen 2 "The World's Most Exciting Video Game System"
    - screen 3 "Experience the thrill of REAL-LIFE Video Action"
  - Sears screens:
    - screen 1 "This is the SUPER VIDEO ARCADE"
    - screen 2 "Our Most Advanced Video Game System"
    - screen 3 "Experience the thrill of REAL-LIFE Video Action"
- There are 4 empty screw holes on the underside of the aluminum case. It is presumed that these were for mounting the Kiosk Multiplexer somewhere inside or behind the in-store kiosk display.
- The cartridge-like end of the ribbon cable contains a simple circuit board designed for the Kiosk Multiplexer (i.e. no chips and it is labelled with the 3806 part number). However, the plastic casing for the connector is internally stamped with the Keyboard Component's 1149 part number.

## Deeper Findings

- Only 8K decle games in the \$5000-\$6FFF range are supported
- The Kiosk Multiplexer's ROM is 2K decles at \$7000-\$77FF.
- The mystery connector on the side is to add expansion hardware for more cartridge slots (referred now as the “expansion port”).
- The kiosk ROM uses writes to address locations \$7400-\$74FA as registers (data in the write is ignored). These are used to select which slot is active.

- ROM code theoretically supports up to 121 slots (including the 11 built)
- Circuitry supports up to 59 slots (including the 11 built in, with the other 48 through the expansion port)
- Circuitry decodes most of the address for writes. Specifically, it looks at bits 15-12, 10, and 7-0 (it ignores bits are 11, 9, and 8). Thus, a write to other addresses like \$7C00 or \$7700 would be the same as \$7400.
- Address \$7400 is used to deselect the built-in slots, while \$7410-\$741A select slots 1-11.
- Writes to \$7420-\$747F go out to the expansion port.
- Note: the "59 slots" above comes from 11 built-in slots + 48 slots for the 96 external addresses written to (assuming similar circuitry for the 4-to-16 decoder which needs to use 1/2 of the 96 addresses to indicate 'no slot selected').
- The algorithm for finding what slots have cartridges is:
  - i. Write to \$7400. This turns off the power to the active slot. Intellivoice slots also have their ground turned off.
  - ii. Increment the VAR8\_CART\_COUNTER variable. If it is  $\geq 235$ , set VAR8\_CART\_COUNTER to 0 and goto step i above
  - iii. Write to \$7410 + value of VAR8\_CART\_COUNTER to turn on power (and possibly ground) for the requested slot.
    - \$7410 thru \$741A correspond to built-in slots 1 thru 11.
    - \$741B thru \$741F are ignored.
    - \$7420 thru \$747F go to the expansion port.
    - \$7480 thru \$74FA are ignored.
  - iv. Read value address \$5000
  - v. If greater than or equal to \$0400, goto step i above
  - vi. Game found in the selected cartridge
- The special, custom font displays the game's title. Each letter uses 4 tiles (2 x 2).
  - Only upper case letters are supported by the font
  - Lower case letters are displayed as upper case
  - Numbers and symbols are displayed as blanks. For example, "B-17 BOMBER" is displayed as "B BOMBER".

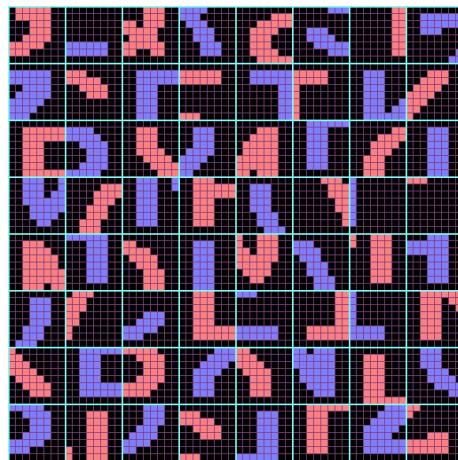


- Game titles are line wrapped up to 4 lines of text.

- The phrase "Sphinx of Quartz Judge My Black Vow" shows all 26 letters.

**SPHINX OF  
QUARTZ  
JUDGE MY  
BLACK VOW**

- Below is an image of the tiles as they are arranged in GRAM



- If a game title is the empty string, then it defaults to "MATH FUN". The string "MATH FUN" is built into the ROM.
- 2 sections of dead code found in the ROM
  - Code for randomly selecting a slot: this code does not appear fully developed. It is suspected that randomly selecting a slot would simply lead to most games sitting at the green Mattel title screen, which is rather boring for customers and would likely burn the title screen into the TV (a pain for the store).
  - Code for an unused sound effect. This has already been extracted and sounds like a cross between "ding" and "shwing". It is suspected that this sound effect might have been intended to play whenever the user pressed the disc to advance to the next game title. It is further suspected that it was removed because some kids would just rapid-fire press the disc so they could hear the sound effect, which could be annoying for store employees and parents who'd then avoid buying the console.
- 2 Easter Eggs found
  - Type in "81657" or "16121" and ENTER results in "JOHN WAS HERE" is displayed as game title text. Note that 16121 is just 81657 after 16-bit overflow.
  - Type in "21059" and ENTER results in "JOHN LOVES LUCY" is displayed as game title text
  - If you flub the typing, you can press CLEAR to start over.
  - Tap the disc to buy more time to type in the numbers.

- It is presently unknown who John is but some of the candidates are
  - i. John Sohl
  - ii. John Brooks
  - iii. John Tomlinson



*Image: the two Easter Eggs being displayed*

- The ROM checks for code at \$8000 on startup. If it finds code, it jumps to \$8000, otherwise it continues executing.
  - Since the MC can't read \$8000 through the cartridge slots or the expansion port, my suspicion is that \$8000 was possibly for one of the following:
    - i. A device sat between the MC and the Kiosk Multiplexer at address \$8000, perhaps for debugging (ex: a bus splitter and a T-card at \$8000).
    - ii. Maybe \$8000 was readable in earlier Kiosk Multiplexer hardware (a prototype or unrealized design for Kiosk ROM upgrades?)
- Cartridges are selected/deselected by applying/cutting Vcc through a transistor. The 3 Intellivoice slots also have ground applied/cut through a transistor.
- The power supply for the Kiosk Multiplexer is a slightly modified Intellivision I power supply. The J3 5-pin socket is changed to a 4-pin post connector (pin 5, -3.3V, is omitted).
- The ROM contains only 1 direct mode instruction, though interestingly it has no observable effect. See the "Maybe ROM Bugs or Just Odd" section below.

## Cartridge Compatibility

This list is mostly determined from looking at CFG files to see that 1) the game is 8K decles or less and 2) is only in the supported address range of \$5000-\$6FFF. No checking was done for whether the title strings in games are compatible. Only some of the games were actually tested with the physical hardware. Examples of games that are listed as compatible and *were* physically tested *but* also showed strange behavior are:

1. Sewer Sam and Donkey Kong Junior worked but they displayed no title text
2. Happy Trails worked but displayed garbage GROM text.
3. Empire Strikes Back displayed as MATH FUN and is theoretically compatible (counted as such below) but didn't work in the 1 Kiosk Multiplexer tested.

4. All Intellivoice games were tested. Only Space Spartans worked, as expected since it is the only Intellivoice game that fits in the 8K decle memory range (other games are larger). The failed games show the title screen, say "Mattel Electronics presents", and then stop working before the name of the game is said.
5. All demo carts were tested. The earlier 1978 (blue) and 1979 (red) carts work properly but the later 1983 (green) and International (INT'L, 1982) carts crash because they exceed the 8K decle size limit. Further, when plugged into slots 1, 2, or 11, the earlier two demo carts prevent the Intellivoice from functioning (ex: can say "Mattel Electronics presents" but not the game's name) but the later two demo carts don't interfere with the Intellivoice.

Originals:	84 of 125
Intellivoice:	1 of 4
ECS:	0 of 6 (since the ECS is not compatible)
Demo carts:	2 of 4
Test carts:	3 of 7 will go directly to embedded game, none run test code

Note: the Kiosk Multiplexer is not compatible with the KC or ECS hardware because of ROM conflicts at address \$7000.

## Kiosk ROM

There "KioskPre1982" files have been created: the \*.asm, \*.bin, and \*.cfg files. The \*.asm file is disassembly generated from the \*.bin/\*.cfg. It has been fully commented with (hopefully) sensible labels and variable names.

While this ROM is designed to run on the real hardware, it *can* be run in an emulator. Further, if it is merged with a compatible game ROM, it will be tricked into thinking that 1 game cartridge is plugged in (or more accurately, the same game is plugged into every slot). However, there are 1 or 2 work-arounds required for the ROM to work properly:

- The command-line option --rand-mem must be provided to a recent release of jzintv. Alternatively, at address \$72F8, change the BEQ instruction to NOPP (\$0208) if --rand-mem jzintv option is not available (ex: jzintv4droid on Android or old versions of jzintv). This is because of a bug mentioned below. This hack means that game title colors may repeat when the disk is pressed.
- At address \$7088, change the BNC instruction to NOPP (\$0208) so that the game does not appear as slot 0. This enables the simple built-in attract mode to be used after 10 seconds, rather than using the game ROM. This hack causes the check for whether a cartridge is detected in slot 0 to always be treated as 'false'.

## **Sphinx of Quartz Judge My Black Vow**

This is a test 'game' created to:

- Show all 26 letters on the screen in the Kiosk Multiplexer's font
- Play the extracted tune (press 1) and the unused sound effect (press 2)

The file "SphinxOfQuartz.rom" is just the stand-alone game and requires no modification to play in an emulator or real Intellivision hardware.

The phrase "Sphinx of Quartz Judge My Black Vow" was used because the kiosk ROM's line-wrapping code puts this as 4 lines of text while the more common "Sphinx of Black Quartz Judge My Vow" phrase line wraps to 5 lines and then causes issues (see below).

The 2 files "Kiosk Pre1982 With SphinxOfQuartz - No Slot 0" \*.bin/\*.cfg is the same game above merged with the Kiosk Multiplexer ROM. This shows the full Kiosk Multiplexer experience of a game plugged into any non-demo slot of the real hardware (including the Easter Eggs). This ROM will work on real Intellivision hardware and will work in jzintv but requires the --rand-mem command-line option (apply the \$72F8 hack for use with jzintv4droid, out-of-date jzintv versions, or other emulators). Note that the 10 minute game timeout reset won't occur as that is performed by kiosk hardware (the 556 timer).

## **Circuit Board**

Here are images of Rev B and Rev D circuit boards. There is a separate PDF that is a schematic of a Rev D board.

Roughly speaking, the main circuit board is divided into 3 major zones:

- The bottom ½ is for game cartridges and supports address ranges \$5000-\$6FFF.
- The middle ¼ responds to the address range of \$5000-\$7FFF and has the kiosk's ROM chip(s) and the expansion port.
- The top ¼ handle address decoding, bus phase decoding, game timeout (556 chip), and other miscellaneous duties.

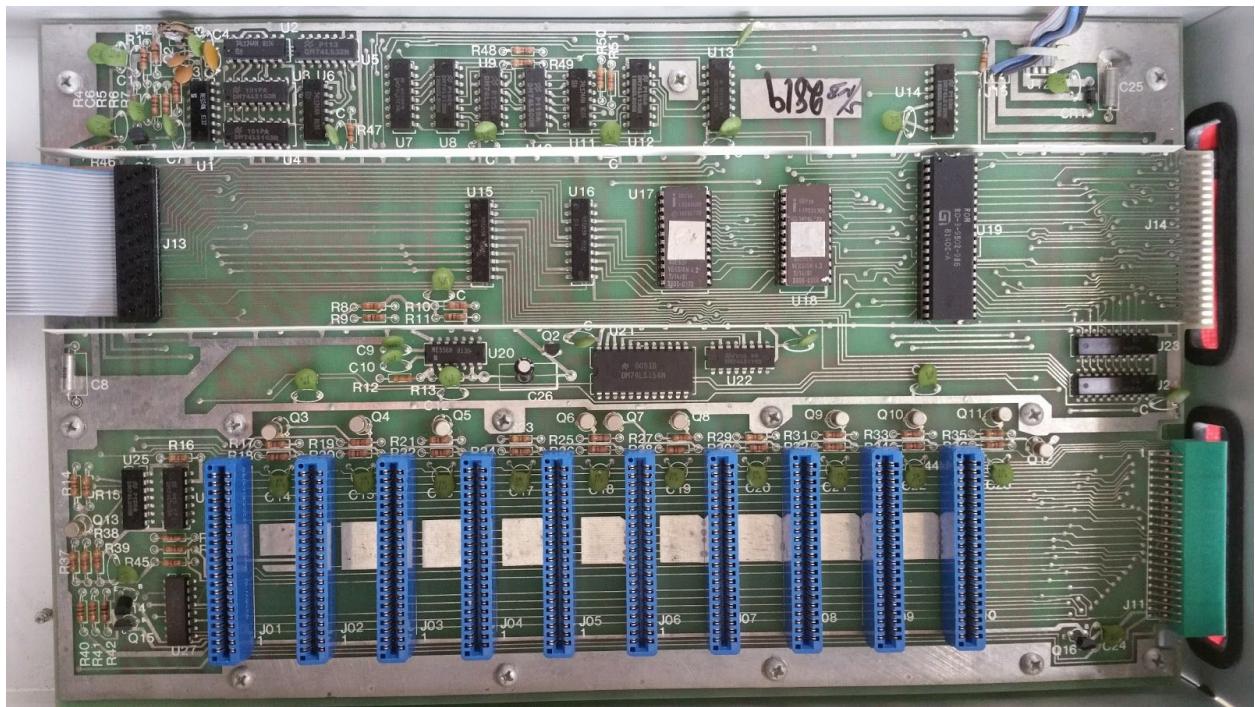


Image: top side of Rev B circuit board

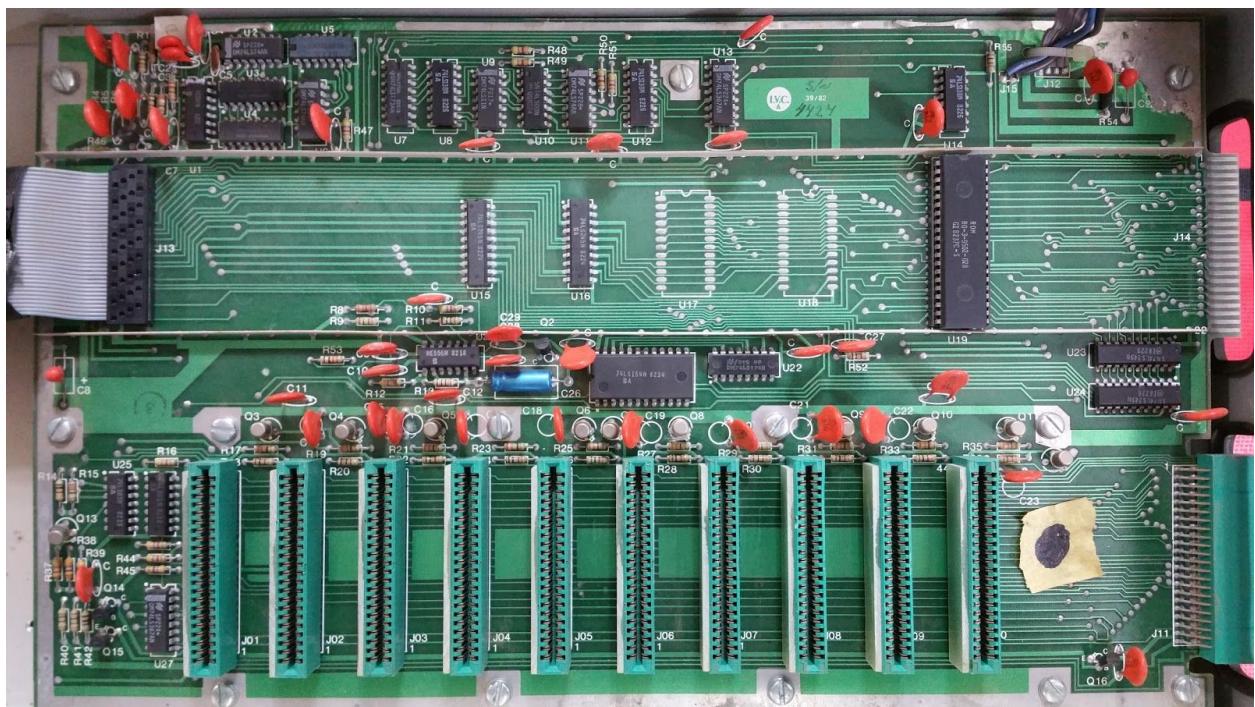
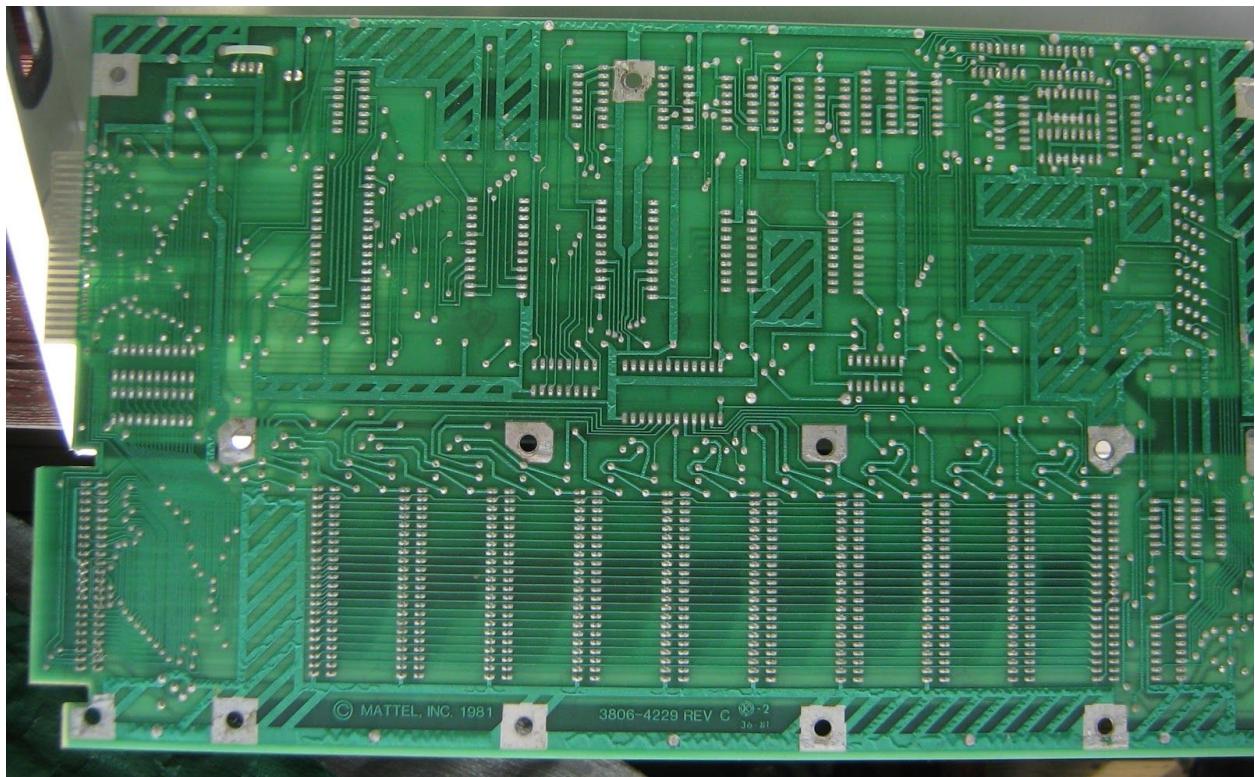
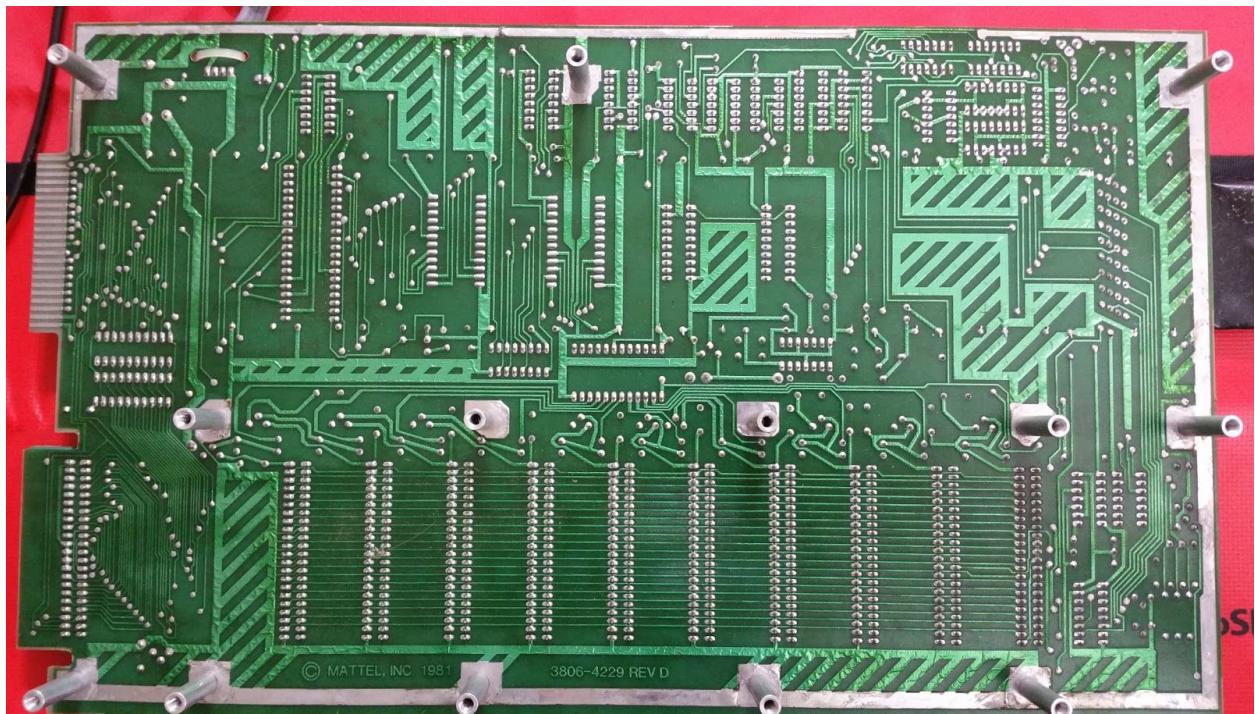


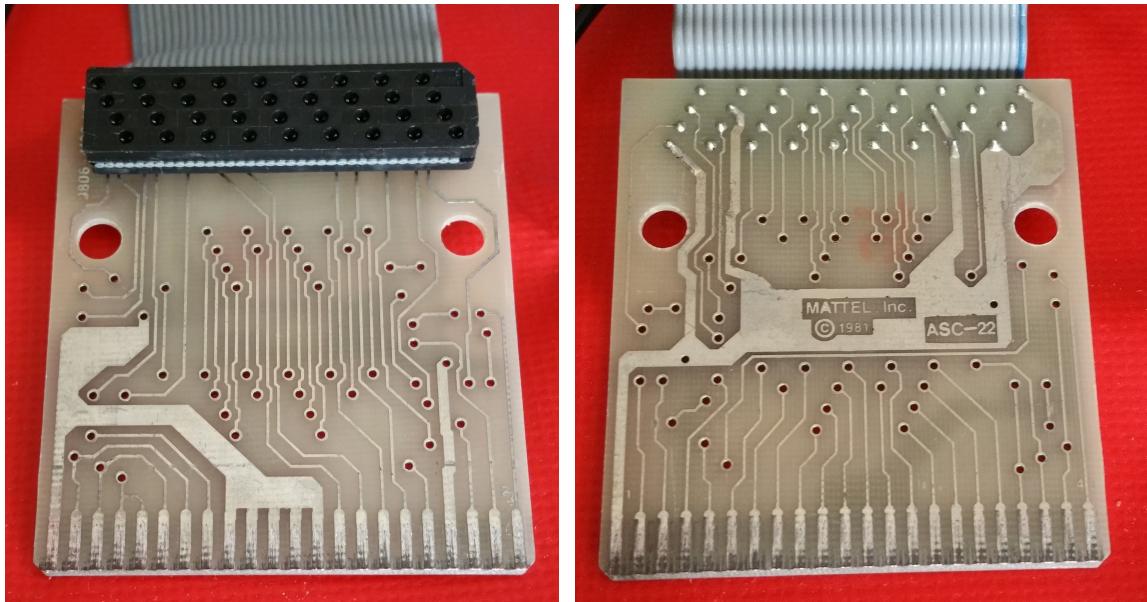
Image: top side of Rev D circuit board



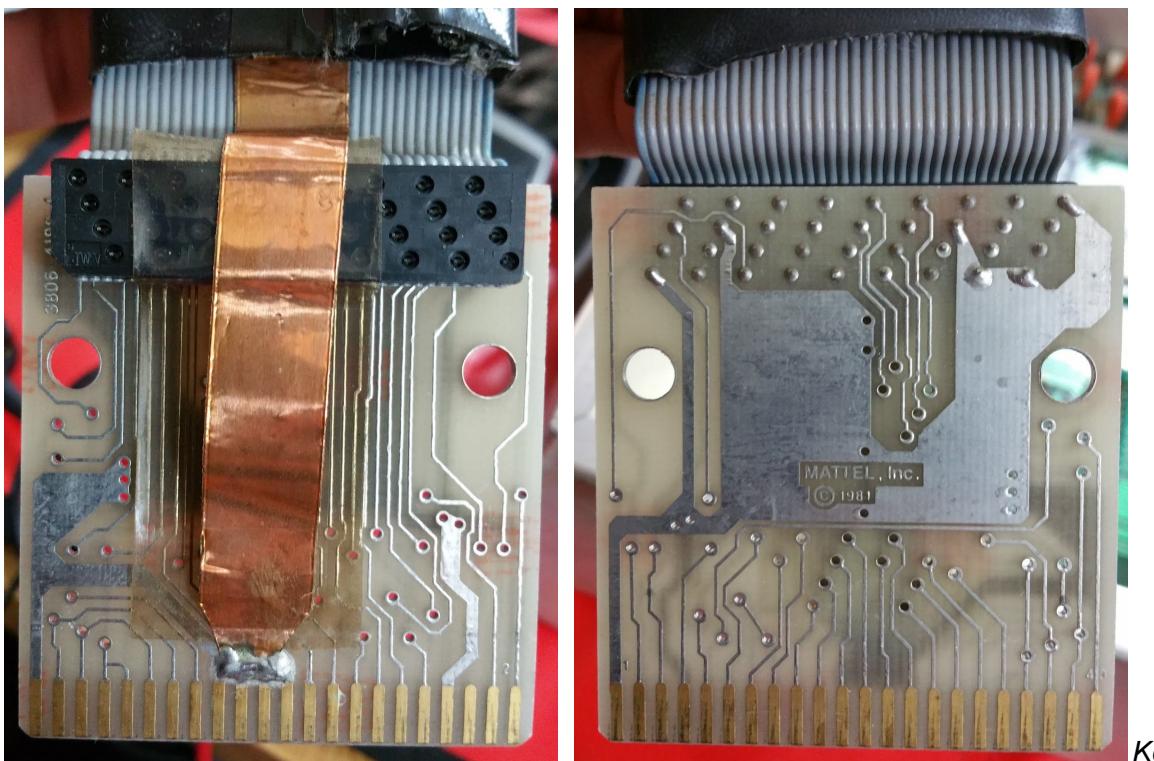
*Image: bottom side of Rev B circuit board*



*Image: bottom side of Rev D circuit board*



*Images: top and bottom sides of Rev B cartridge-like connector*



*Images: top and bottom sides of Rev D cartridge-like connector*

*Koi*

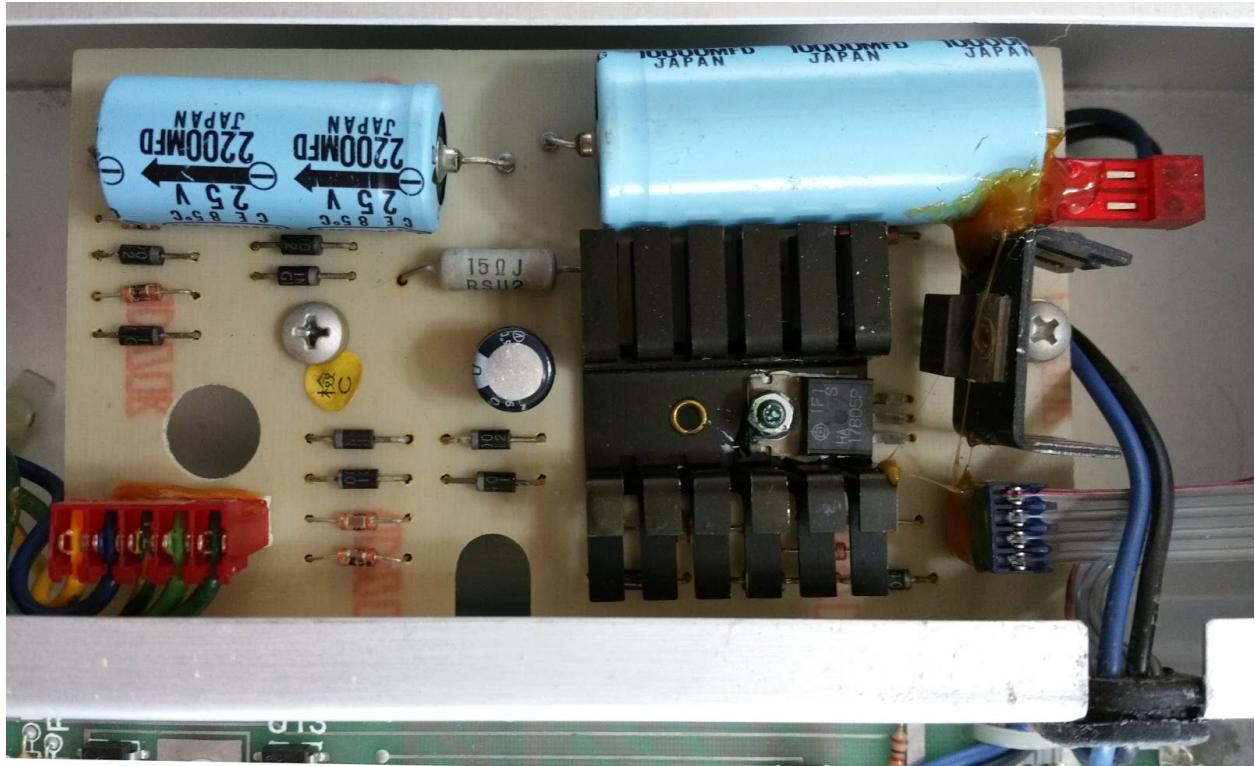


Image: power supply for Rev B (note that J3 has 4 wires, not 5)

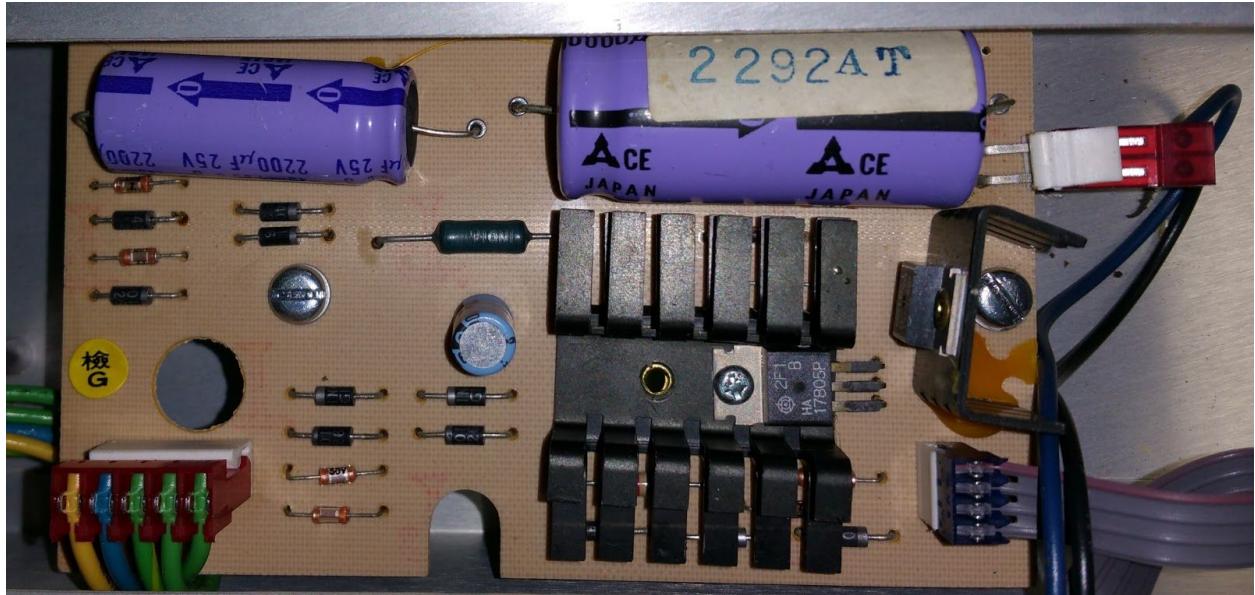


Image: power supply for Rev D (note that J3 has 4 wires, not 5)

The chips on the board are:

	Rev B Part	Rev D Part	Description
<b>U1</b>	NE654N	NE564N	Phase Lock Loop. Rev B chip is mis-printed

<b>U2</b>	74LS74	74LS74	2x D-type Flip-Flop, Preset & Clear
<b>U3</b>	74LS163	74LS163	4-bit Binary Counter, Sync Reset
<b>U4</b>	74LS163	74LS163	4-bit Binary Counter, Sync Reset
<b>U5</b>	74LS32	74LS32	4x 2-input OR gates
<b>U6</b>	74LS74	74LS74	2x D-type Flip-Flop, Preset & Clear
<b>U7</b>	74LS173	74LS173	4x D-type Flip-Flop, Tri-State, Reset
<b>U8</b>	74LS138	74LS138	3-to-8 Decoded, 3 enables
<b>U9</b>	74LS11	74LS11	3x 3-input AND gates
<b>U10</b>	74LS00	74LS00	4x 2-input NAND gates
<b>U11</b>	74LS74	74LS74	2x D-type Flip-Flop, Preset & Clear
<b>U12</b>	74LS138	74LS138	3-to-8 Decoded, 3 enables
<b>U13</b>	74LS367	74LS367	6x Tri-State Drivers (2x / 4x enable)
<b>U14</b>	74LS138	74LS138	3-to-8 Decoded, 3 enables
<b>U15</b>	74LS245	74LS245	8x Tri-State Transceiver
<b>U16</b>	74LS245	74LS245	8x Tri-State Transceiver
<b>U17</b>	D2716	not populated	2Kx8 UV EPROM
<b>U18</b>	D2716	not populated	2Kx8 UV EPROM
<b>U19</b>	RO-3-9502-986	RO-3-9502-028	2Kx10 ROM with 2K latched address bus. Note Rev B vs Rev D have differing suffixes.
<b>U20</b>	556	556	2x 555 Timers
<b>U21</b>	74LS154	74LS154	4-to-16 Decoder, 2 enables
<b>U22</b>	74LS174	74LS174	6x D-type Flip-Flop, 1 CLK & CLR
<b>U23</b>	74LS245	74LS245	8x Tri-State Transceiver
<b>U24</b>	74LS245	74LS245	8x Tri-State Transceiver
<b>U25</b>	74LS05	74LS05	6x Inverters with Open Collector outputs
<b>U26</b>	74LS05	74LS05	6x Inverters with Open Collector outputs

<b>U27</b>	74LS367	74LS367	6x Tri-State Drivers (2x / 4x enable )
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### **Rev B vs Rev D**

The Rev D variant of the pre-1982 model was fully analyzed while the Rev B variant of the pre-1982 model was only partially analyzed (ROM dumped but circuit only minimally investigated). Most differences are noted in the separate "Kiosk Multiplexer Schematic" PDF with photos. Some other differences:

- It is unknown how the Kiosk Multiplexer was mounted inside of the in-store kiosk display. However, if it is assumed that the Kiosk Multiplexer was mounted with the labels facing up and the ribbon cable coming out the left side, then the Rev D has its label placed right-side up while the Rev B label is upside down (slot 1 is still closest to the ribbon cable).
- While both units label slot 1 and 11 as Intellivoice compatible, they differ on which slot is the 3rd slot that is Intellivoice compatible. The Rev D's slot 2 is Intellivoice compatible (2nd closest to ribbon cable) while Rev B's slot 10 (closest to side slot 11) is labeled as such.
- While both the Rev B and Rev D ROM dumps using the AtariMax Maxflash USB Programmer had the same "some valid data and some failed read addresses", there were significant differences in the success rate of the dumps. On the Rev B, the vast majority of each dump was filled with failed read address locations (~100 dumps needed to create a complete ROM). On the Rev D, only a small minority of each dump contained failed read address locations (~6 dumps needed to create a complete ROM). However, both the Rev B and Rev D contain the same ROM data. It is presumed that the higher failure rate in the Rev B is due to the ROM being stored in separate UV erasable EPROMs (more chips to electrically drive or more AtariMax-related timing interaction issues) while the Rev D does not have these 2 EPROM chips. Alternatively, since the circuit expects MCLK to be driven and the Maxflash is known to not do that, the PLL timing recovery portion of the circuit is not functioning as designed.
- The oldest date code on Rev B is for the 40th week of 1981. The oldest date code on Rev D is for the 37th week of 1982.

At present, only Rev B and Rev D variants of the pre-1982 model are known to exist. Others are assumed to exist, but this is not confirmed.



*Images: a Rev B (left) and a Rev D (right) Kiosk Multiplexer, both oriented with the ribbon cable on the left side, power cable on the top, and the side “Customer Accessible” slot 11 on the right side. Note that the Rev B label appears as upside down in this orientation and that slot 10, not slot 2, is for Intellivoice games.*

## ROM Bugs

- The Intellivision II is treated the same as the Sears console for the simple built-in attract mode. This is because the ROM code checks to see if address \$1FFC is zero. If it is non-zero, then it assumes that it is connected to the Sears console. Thus, the Sears attract mode is used instead of the correct Mattel one.
- The ROM does not handle more than 4 lines of game title text. Random behavior occurs from simply not seeing the 5th line of text to crashing.
- If a word in a line of text is too long, it wraps around the screen, with letters overwriting top/bottom half of other letters. See below example of Championship Tennis
- If the very first random number from X\_RAND1 returns a zero, it keeps returning zero, resulting in an infinite loop in the Kiosk Multiplexer that is trying to select a different game title color from the previous title. It displays a black screen and is non-functional.
  - Thus --rand-mem is required when running the code under jzintv (or the above \$72F8 hack). This is a bug in the multiplexer's ROM, not jzintv.
  - Rare in real-world hardware but can still happen.



*Image: Championship Tennis where “Championship” has 12 letters being displayed where there is only width for 10 letters*

### Maybe ROM Bugs or Just Odd

- If no cartridge is installed, the Kiosk Multiplexer is stuck in an infinite loop trying to find a cartridge. It displays a black screen. Maybe this is a feature.
- The Mattel attract mode erases the whole BACKTAB and then writes a \$00F0 (a black '>') to 1st BACKTAB location using the only direct-mode instruction in the ROM, a MVO instruction. This does not happen for Sears attract mode. Since a black character on a black background is not visible to the user, its purpose is unclear. One hypothesis is that this might have been for testing that the hardware handled the ADAR bus phase correctly. Another hypothesis is that the ROM might have been developed on earlier hardware that didn't support direct-mode instructions.
- The call to install the HANDTAB passes \$5000 in R1 even though only the low byte of \$00 is used.

### Revision History

Date	Notes
2019-07-29	Initial document
2019-08-01	Responded to feedback and corrections. Corrected that there is 1 direct-mode instruction and it is used to write a black '>' on a cleared BACKTAB. Clarified that Intellivoice and non-Intellivoice games shouldn't be mixed in the Intellivoice slots. Added that PLL & MCLK might be why dumping the ROM was difficult.

	<p>Clarified how Sears vs Mattel consoles are detected, and why the Intellivision II is misidentified as a Sears console.</p> <p>Expanded on the slot selection algorithm.</p> <p>Correct address range of \$7420-\$746F to \$7420-\$747F</p>
2019-08-13	Included measurements on the various game timeouts controlled by the 556 timer chip.
2019-10-24	Added names of John Sohl, John Brooks, and John Tomlinson as the potential “John” in the Easter Eggs.
2020-03-07	Updated that the “smaller unit” kiosk display did not use the Kiosk Multiplexer hardware, based on the Italian 1983 Mattel Electronics catalog.
2020-03-11	Explicitly listed which demo carts work and which crash as well as which interfere with the Intellivoice and which don’t.