Atari 800/5200 FPGA Core Manual

REVISION HISTORY

NUMBER	DATE	DESCRIPTION	NAME
1.0	November 26, 2014	Initial release.	DN
1.0.1	December 2, 2014	Corrected MCC-216/MCC-TV SD Card structure.	DN
1.0.2	December 15, 2014	Added Atari 5200 files to MCC-216/MCC-TV SD Card structure.	DN

Contents

1 Introduction

The **Atari 800 FPGA core** and **Atari 5200 FPGA core** provide highly accurate hardware re-implementations of the Atari 8-bit series of computers.

1.1 Features

- Atari 800/XL/XE computer support
- Atari 5200 console support
- Passes all Acid800 tests
- Runs 99% of Atari 8-bit software
- Drive emulation including write support
- Turbo Freezer cartridge support
- Supports both PAL and NTSC
- Supports VGA and S-Video output

1.2 Supported FPGA Platforms

- Altera DE1
- Chameleon
- FPGA Arcade Replay
- MIST
- MCC-216
- MCC-TV

1.3 Platform Feature Matrix

Table 1: Hardware Platform Feature Matrix

Platform	Joystick ports?	USB?	Spare I/O?	SIO2PC?	Video Outputs
Altera DE1			X	X	VGA
Chameleon	X				VGA
FPGA Arcade Replay	X		X	X	DVI (Composite, S-Video)
MIST	X	X			VGA
MCC-216	X	X			S-Video, VGA
MCC_TV		X			Composite

Note
Altera DE1 SIO2PC support requires some additional work. See Appendix A for more information.

Note
FPGA Arcade Replay only has Composite and S-Video on some models.

Note
Chameleon can either use the two joystick ports on a real Commodore 64 or use two of the four ports on the Chameleon docking station.

1.4 Core Versions

The latest pre-built core files are available from http://www.scrameta.net/autobuild. The core source code is available from http://www.scrameta.net/atarixlfpga_svn/trunk/.

Note that there are separate cores for Atari 8-bit computer (`atari800core`) and Atari 5200 (`atari5200core`).

On most platforms, there are multiple versions of the core supporting different video display devices. It's important to choose the correct version for your display.

Table 2: Core Versions

Core Type	Description
NTSC_RGB	15 kHz
NTSC_SVIDEO	
NTSC_VGA	Scan doubled (separate hsync/vsync)
NTSC_VGA_CS	Scan doubled (composite sync)
PAL_RGB	15 kHz
PAL_SVIDEO	
PAL_VGA	Scan doubled (separate hsync/vsync)
PAL_VGA_CS	Scan doubled (composite sync)

2 Getting Started

In order to use the core, you will need the following:

1. A supported hardware platform
2. An SD card supported by that platform
3. The FPGA core file that supports the appropriate video mode
4. Atari system ROM files
5. Software images you want to run

2.1 System ROMs

Atari system ROMs are required for the cores to function and can be found fairly easily via an Internet search. You will need the following:

Table 3: Atari Computer System ROM Files

ROM Filename	Description
ATARIBAS.ROM	Atari BASIC
ATARIOSB.ROM	Atari 400/800 OS
ATARIXL.ROM	Atari XL/XE OS

Table 4: Atari 5200 System ROM Files

ROM Filename	Description
5200.ROM	Atari 5200 ROM

2.2 Software Image Formats

The cores currently support a number of different software image formats.

Table 5: Atari Computer Core Supported Software Image Formats

File Extension	Description
ATR	Atari computer floppy disk image
CAR	Atari computer cartridge ROM image
XFD	Atari computer floppy disk image
XEX	Atari computer binary executable

Table 6: Atari 5200 Core Supported Software Image Formats

File Extension	Description
A52	Atari 5200 cartridge ROM image (raw)
BIN	Atari 5200 cartridge ROM image (raw)
CAR	Atari 5200 cartridge ROM image

Important
Note that a CAR file is different from other cartridge files such as A52, BIN and ROM. The latter files are usually raw dumps of the original cartridge. A CAR file is also a raw dump of the cartridge but includes a 16-byte header containing details about the cartridge (e.g. bank switching scheme). The Atari 5200 core supports both raw and CAR files. However, the Atari 800/XL/XE core only supports CAR files.

Tip
You can use the Atari800Win program to convert raw cartridge files to CAR files.

2.3 SD Card Layout

The SD card requires a specific directory structure in order to work correctly.

SD Card Structure #1 (Altera DE1, Chameleon, FPGA Arcade Replay, MIST)

```
|---atari800 ❶
|   \---rom
|   |   \---ataribas.rom
|   |   |---atariosb.rom
|   |   |---atarixl.rom
|   |   |---freezer.rom ❷
|   \---user ❸
\---atar5200 ❹
|   \---rom
|   |   \---5200.rom
|   \---user ❺
```

❶ Atari computer related files

❷ If Freezer support is desired (optional)

❸ Directory where all Atari computer software images should be copied

❹ Atari 5200 related files (currently only supported by DE1 & MIST)

❺ Directory where all Atari 5200 software images should be copied

Important
On all platforms but the Chameleon, copying the core file(s) onto the SD card is sufficient. The Chameleon requires flashing both the NTSC_VGA and PAL_VGA versions of `atari800core.rbf` using ChaCo. See the Chameleon User Manual for more information.

Tip
On the MIST, putting the core file at the root of the SD card and naming it `core.rbf` will cause it to start by default when the device is booted.

SD Card Structure #3 (MCC-216, MCC-TV)

```
+---System
|   \---Core
|   |  \---Atari800
|   |  |   \---atari800core.arg ❶
|   |  |---Atar5200
|   |      \---atar5200core.arg ❷
|   \---Rom
|      \---Atari800
|      |   \---ataribas.rom
|      |   |---atariosb.rom
|      |   |---atarixl.rom
|      |   |---freezer.rom ❸
|      \---Atar5200
|          \---5200.rom
|---Atari800
|   \---User ❹
|---Atar5200
|   \---User ❺
```

1. The Atari 800 FPGA core file
2. The Atari 5200 FPGA core file
3. If Freezer support is desired (optional)
4. Directory where all Atari computer software images should be copied
5. Directory where all Atari 5200 software images should be copied

3 Usage

If your SD card has been formatted and laid out properly, booting your FPGA hardware should result in one of the two following screens:

Figure 1: Atari Computer Startup (400/800 mode)

Figure 2: Atari Computer Startup (XL/XE mode)

Important
When the Atari computer is running in XL/XE mode, it will boot into BASIC by default (indicated by the `READY` prompt). This will cause problems when trying to run machine language software. In order to disable BASIC, hold down OPTION (F8) when booting the machine.

Figure 3: Atari 5200 Startup

3.1 Keyboard Layout

The below figure shows how the Atari keys map to a standard PC keyboard.

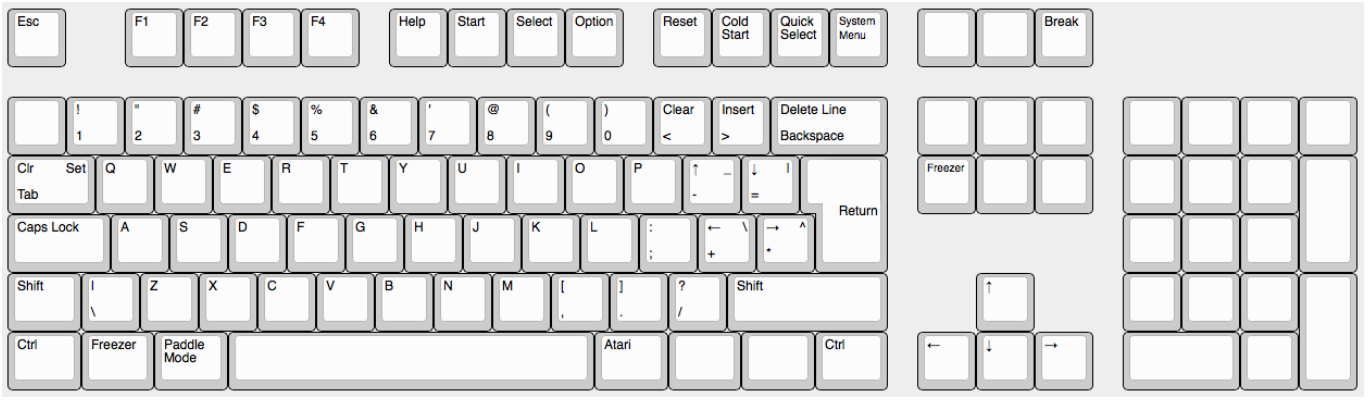

Figure 4: Atari Computer Keyboard Mappings (European)

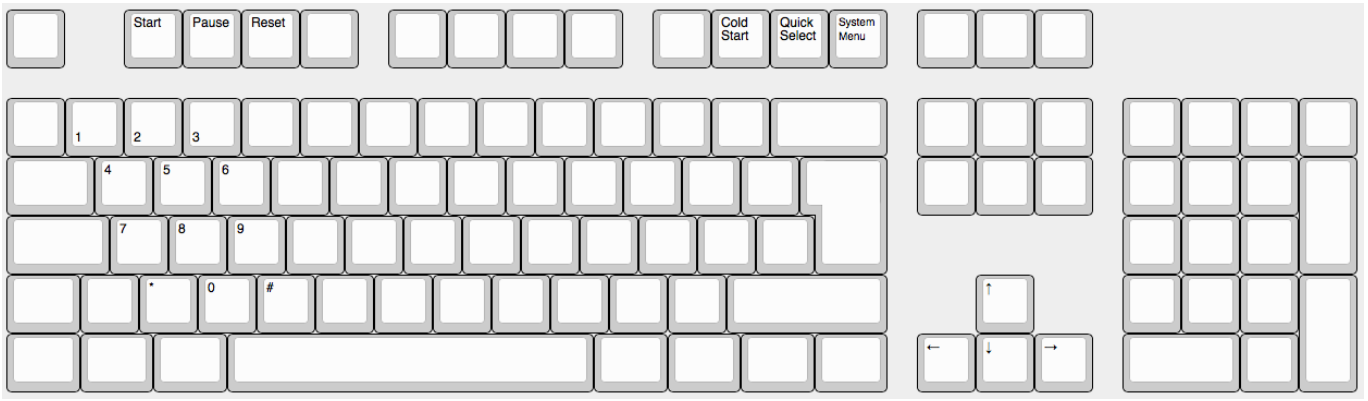

Figure 5: Atari 5200 Keyboard Mappings (European)

Note
Quick select will allow you to select a Drive 1 disk image (800/XL/XE) or cartridge ROM (5200) and immediately reboot.

3.2 The System Menu

The **system menu** provides a way to configure and control the Atari hardware. It can be navigated using either the joystick or keyboard.

3.2.1 Atari 800/XL/XE

In Atari 800/XL/XE computer mode, when the system menu is activated you will see the following screen:

Figure 6: Atari Computer Settings Menu

Table 7: Atari 800/XL/XE Settings

Name	Value	Description
Turbo	`1x`, `2x`, `4x`, `8x`, `16x`	Runs the computer at a multiple of its original 1.79MHz speed (1x = 1.79MHz)
Ram	`64K`	Runs computer with 64Kb of RAM (similar to original 800XL)
	`128K`	Runs computer with 128Kb on RAM (similar to original 130XE)
	`320K(Compy)`	Runs computer with a 320Kb Compyshop-compatible RAM expansion
	`320K(Rambo)`	Runs computer with a 320Kb Rambo-compatible RAM expansion
	`576K(Compy)`	Runs computer with a 576Kb Compyshop-compatible RAM expansion
	`576K(Rambo)`	Runs computer with 576Kb Rambo-compatible RAM expansion
	`1MB`	Runs computer with a 1MB RAM expansion
	`4MB`	Runs computer with a 4MB RAM expansion
Rom	`ATARIOSB.ROM`	Atari 400/800 OS ROM
	`ATARIXL.ROM`	Atari XL/XE OS ROM
Disk 1-4	Indicates the currently mounted disk image for the drive number	
Cart	Indicates the currently mounted cartridge image	

3.2.2 Atari 5200

In Atari 5200 mode, when the system menu is activated you will see the following screen:

Figure 7: Atari 5200 Settings Menu

Table 8: Atari 5200 Settings

Name	Value	Description
Turbo	`1x`, `2x`, `4x`, `8x`, `16x`	Runs the console at a multiple of its original 1.79MHz speed (1x = 1.79MHz)
Ram	`16K`	Run console with 16Kb of RAM
Rom	`5200.ROM`	Atari 5200 OS ROM
Cart	Indicates the currently mounted cartridge image	

3.3 Controllers

The core features support for both real Atari controllers as well as standard PC-compatible USB controllers.

3.3.1 Joysticks

Atari-compatible Joysticks

On platforms that have joystick ports (see Feature Matrix table above), you can simply plug in Atari-compatible joysticks and use them.

On platforms that have USB ports, you can connect Atari-compatible joysticks via the 2600dapter adaptor.

The Altera DE1 can support the use of Atari-compatible joysticks with some additional work. See Appendix A for more information.

USB Joysticks and Gamepads

On platforms that have a USB port, you can use PC-compatible USB joysticks and gamepads as Atari controllers.

3.3.2 Paddles

On platforms that have a USB port, you can connect real Atari paddle controllers using the 2600dapter adaptor. You can also simulate paddle controllers using an analog PC joystick.

Important
The "Windows logo" key on the keyboard toggles "Paddle Mode". The core must be in Paddle mode for the paddle controller buttons to work. This will render the arrow keys for the system menu inoperable, so be sure to turn off Paddle mode when finished with a game that uses them.

3.4 Freezer Mode

Turbo Freezer support is available if the `freezer.rom` file is properly placed on the SD card. Pressing the Delete or Scroll Lock keys while the computer is running will activate it.

More information is available on the Turbo Freezer website.

A Altera DE1 Information

A.1 Dip Switch Settings

Table 9: Altirra DE1 Dip Switch Settings

	SW9	**SW8**	**SW7**	**SW6**	**SW5**	**SW4**
ON	Force SDRAM only	PAL	Scan double	Composite on HSYNC	Scanlines	PBI Enable
OFF		NTSC			No scanlines	PBI Disable

A.2 Joystick Support

The DE1 can use Atari-compatible joysticks through the use of the Minimig adapter as shown in the figure below.

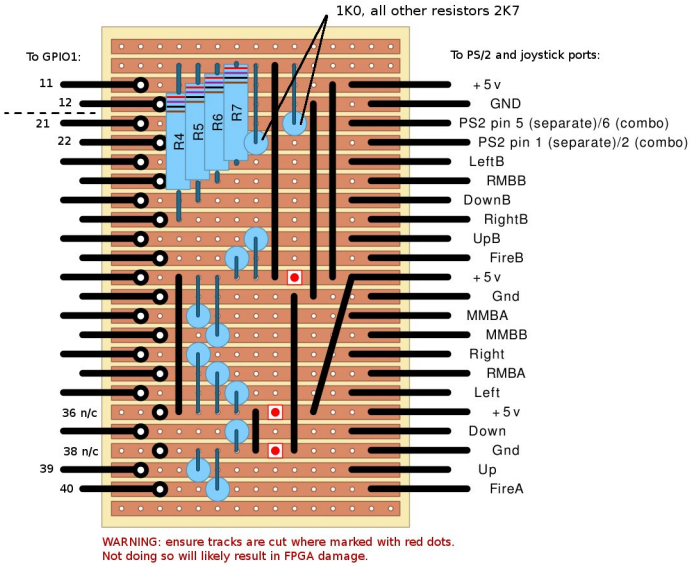

Figure 8: Minimig Joystick Adapter

A.3 SIO2PC

In order for the Altera DE1 to work with an SIO2PC drive emulation device (such as AspeQt), two wires need to be soldered. These will connect the GPIO pin used for the Atari command line to either the CTS or RI line on the serial port. You will need to make sure your SIO2PC software is configured to use CTS or RI appropriately.

Below is an example of how to wire for CTS.

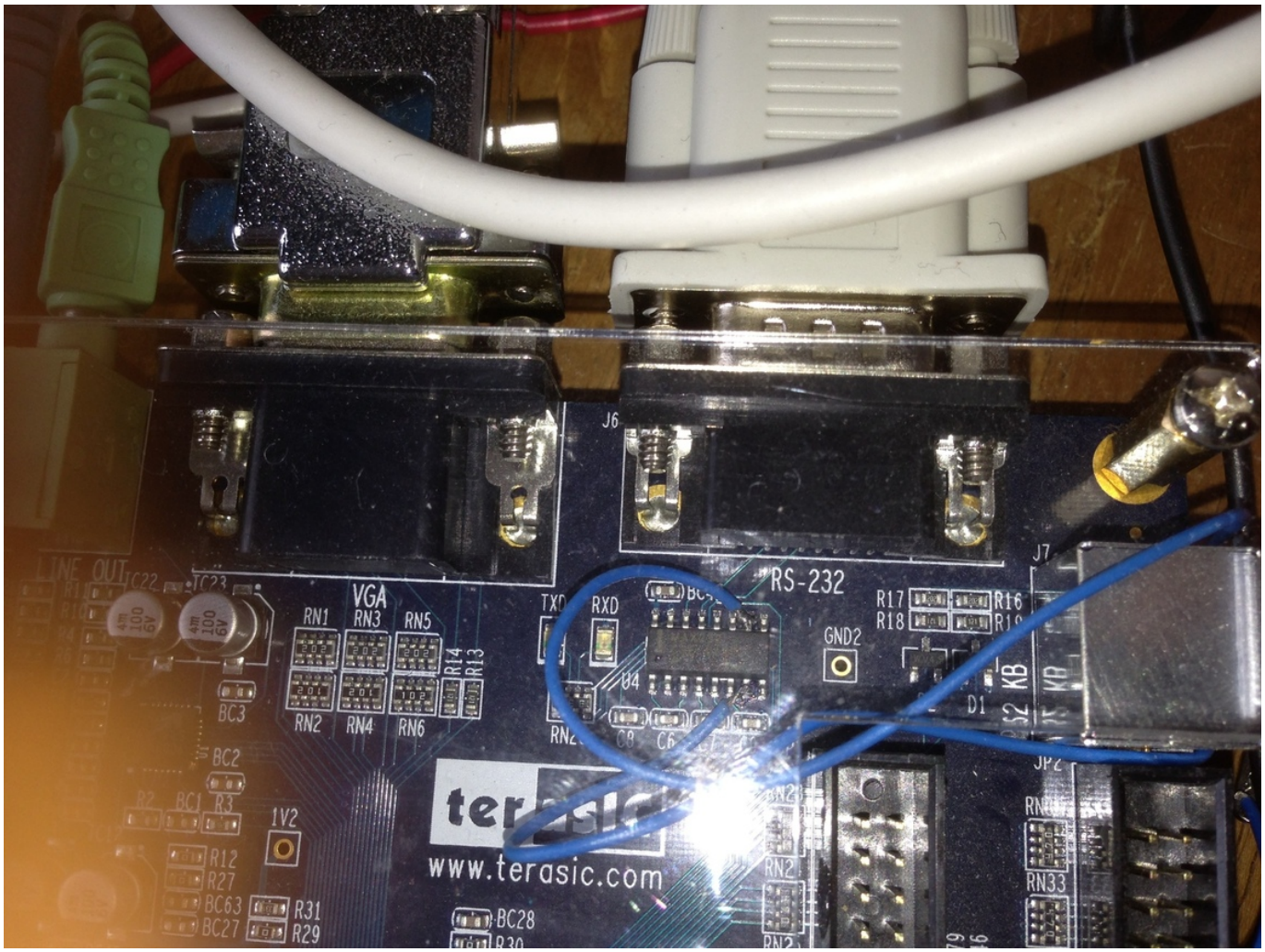

Figure 9: DE1 SIO2PC (CTS) Top View

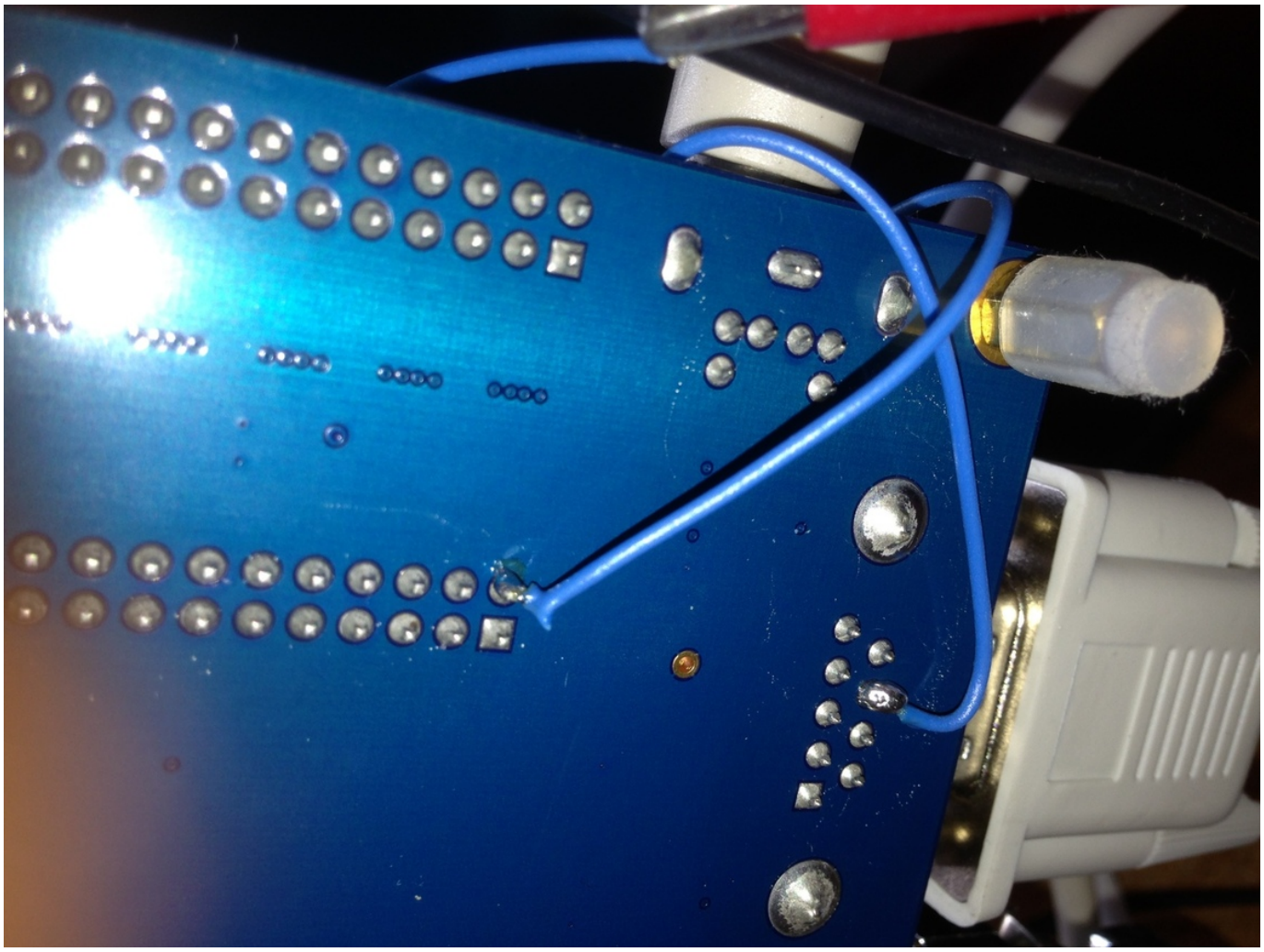

Figure 10: DE1 SIO2PC (CTS) Bottom View