



**FASTCHIP II<sup>TM</sup>e**

**User's Guide**



# **Table of Contents**

Description .....	4
FASTChip //e features .....	5
Contents of Package .....	5
FASTChip //e Installation .....	6
Anti Static Warning .....	6
FASTChip //e Orientation.....	7
FASTChip //e Control Panel.....	10
Accessing the Control Panel.....	10
SET Speed .....	11
Slot Configuration .....	12
Miscellaneous .....	13
Startup Graphics .....	13
Startup Delay.....	13
Sound Mode:.....	13
Joystick Delay .....	14
RamFactor .....	14
RamFactor Slot.....	14
RamWorks.....	15
Backlight.....	15
Additional FASTChip //e LED indicators.....	17
System Test .....	17
Save Configuration .....	18
About FASTChip //e .....	18
Quit FASTChip //e .....	19
FASTChip //e External Control panel .....	19
Display Messages .....	21
FASTChip //e Programmer's Reference .....	22
Programming Hints .....	24
FASTChip Demos and Reviews .....	26
Frequently Asked Questions .....	26
Where to find further help.....	27
About a2heaven.com.....	27
Warranty .....	27
Some other a2heaven products.....	28

## Description

The heart of the Apple //e™ is the 6502/65C02 microprocessor. It is responsible for running all programs including the operating system. This it does at a speed of 1 MHz. Whilst an acceptable speed in the late 1970s and early 1980s, creative manufacturers found ways to increase the speed of the Apple //e to speeds up to 8-10 times faster. Products like the ZIP Chip and Rocket Chip, were quite reliable but these days are extremely rare and expensive to purchase. Other speed enhancement boards were complex, very power hungry and at times unreliable due to the way they interfaced with the Apple //e. Jump forward some 30+ years and enter the FASTChip //e. Much like speed enhancement boards of yesteryear, the FASTChip //e replaces the original 6502/65C02 microprocessor with a modern 65C02/65C816 microprocessor that makes your Apple //e run up to sixteen times faster.

The FASTChip //e accelerates the Apple //e™ by replacing the on-board microprocessor with a much faster one. Because the memory on the Apple //e™ can only run at a 1 MHz speed maximum, faster memory (SRAM) must be provided to increase performance and allow the 65C02/65C816 CPU to run at full speed. To do this, the FASTChip //e contains 512KB/1024KB of fast SRAM memory. The clever design allows the acceleration of programs running in both main and auxiliary memory. The additional FASTChip //e memory can emulate both 192/448 KB fast RamWorks compatible RAM and 256/512 KB fast RamFactor (slinky) compatible RAM.

FASTChip //e consists of a 65C02/65C816 CPU, a 512/1024K SRAM and a Complex Programmable Logic Device (CPLD) plus some very clever and complex programming of the CPLD.

When the program is in fast SRAM memory, FASTChip //e can run it at the selected speed, i.e. up to 16.6Mhz. When the program is in the Apple //e 64K on-board memory, the FASTChip //e processor must slow down and access it at 1 MHz.

### **Steve Wozniak Quote:**

*If I designed a computer with 200 chips, I tried to design it with 150. And then I would try to design it with 100. I just tried to find every trick I could in life to design things real tiny.*

### Programmers' Note

If you are an assembly language programmer and are interested in writing programs that directly access the FASTChip //e, check the FASTChip //e Programmer's Reference information found later in this manual.

## FASTChip //e features

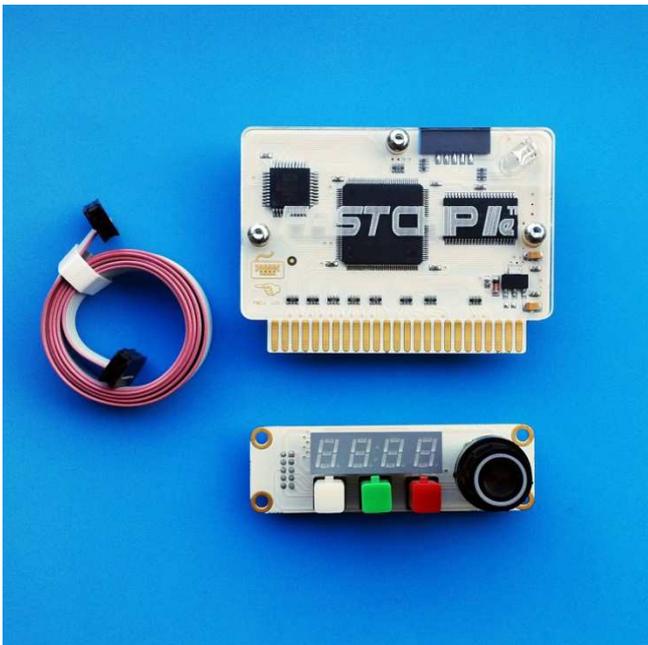
- Easy to install card, installable in slot 1-7 of the Apple //e™, or Enhanced //e.
- Does not mechanically interfere with the 80 column card in slot 3.
- 65C02/65C816 microprocessor running at a clock rate of more than 16 MHz .
- External Hardware Control Panel with controls and LED display.
- CPU frequency can be changed real-time via rotary knob (0.2Mhz to 16.6Mhz).
- Stop/Pause and Status buttons for easy control.
- 4 digits x 7 segment LED display.
- Built in 192/448 KB fast RamWorks compatible RAM.
- Built in 256/512 KB fast RamFactor (Slinky) compatible RAM.
- Low power design for cool operation.
- Acceleration of programs running in both main and auxiliary memory.
- Compatible with most interface and expansion cards for the Apple II/IIE.
- Transparent operation with all Apple II software.
- An easily accessed built-in software control panel lets you control processor speed, memory, joystick, speaker sound quality and many other options.

## Contents of Package

1 x FASTChip //e – Board

1 x Extension cable to connect the Hardware Control Panel

1 x Hardware Control Panel



# **FASTChip //e Installation**

## **Anti Static Warning**

FASTChip //e is an expansion card for the Apple //e computer. To install it requires opening of your Apple //e computer and installing the FASTChip //e in a free expansion slot. Many of you would have done this before, but for clarity I will outline anti-static precautions that you should take. The bane of modern electronics is static electricity. It's that 'zap' or 'crackle' you get on a dry day when getting out of your car or touching the door handle having walked on nylon carpet. This 'zap' is static electricity and can amount to many thousands of volts. The discharge of this voltage to ground is often heard as a 'zap' and in the dark can be seen as sparks. Try taking off a nylon jumper in the dark on a dry summer's day. You will be amazed at the flashes of electricity. This is typically 10,000-20,000 volts. What has this to do with modern electronics I hear you ask?

As electronic chip technology advances we are able to reduce the transistor size and pack more functionality onto a piece of silicon typically 5mm x 5mm square or smaller. In the case of the SRAM used in FASTChip //e (512K x 8, [4Mbit]) the transistor size is typically measured in  $\mu\text{m}$ ; a millionth of a metre. A rule of thumb is a 10KV static charge will jump a 3-4mm gap. A static charge directed to a CMOS integrated circuit can typically destroy internal gates and transistors, either destroying the chip completely, or damaging it such that it might fail in the foreseeable future.

I still don't understand?

Basically when handling any modern electronics where the circuitry is exposed, you should never touch the gold or silver edge connector and always take basic antistatic precautions. I typically switch off the computer but leave it plugged in. This way the chassis and power supply are earthed via the Mains power cable. Before handling any chips or boards I touch the metal case of the power supply with my hand to discharge any residual static electricity in my body. I then handle the board by its edges only. Once you follow these simple steps, you can safely handle precious Apple //e peripheral boards like the FASTChip //e.

Don't believe me? Google it; the science and proof is sound.

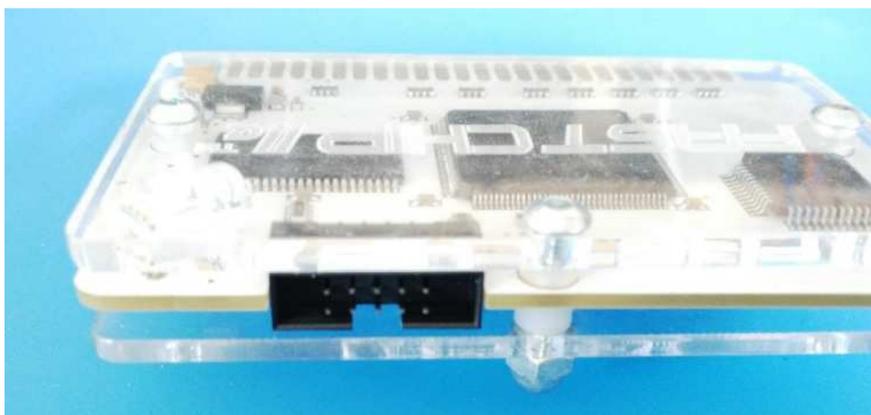
## FASTChip //e Orientation

**WARNING: It is possible to install FASTChip //e incorrectly.**



The board should be plugged into any one of the 7 peripheral slots (not the AUX memory slot). The FASTChip //e logo should be facing the RHS of the Apple //e as you look towards the rear of the //e computer. IE with the Apple //e keyboard closest to you.

With the FASTChip //e main board installed it is time to connect the extension cable and Hardware Control Panel. Once again, with the Apple //e in the same orientation as before, plug one end of the extension cable into the main FASTChip //e board with the cable to the left. The picture below shows the keyway, match the cable end to the keyway and press into place.



FASTChip //e board showing the keyway which locates the extension cable with the correct orientation.

The installed extension cable should look like the following picture.



The final step is to plug the other end of the extension cable into the Hardware Control Panel. See the image below to get the correct orientation. The extension cable sockets on the main FASTChip //e board and the Hardware Control Panel are keyed, so it should be impossible to insert the cables incorrectly. As the extension cable is a straight through cable, the ends are interchangeable between the main FASTChip //e board and the Hardware Control Panel.



In the image above; the keyway is towards the bottom, the unconnected/free end of the extension cable should easily plug into this socket. The hardware (FastChip //e, extension cable and Hardware Control Panel) should now be fully installed. Double check your work and you should be ready to start preliminary testing. Switch on your Apple //e and it should boot up as normal. If not, switch it off and recheck your installation.

## FASTChip //e Control Panel

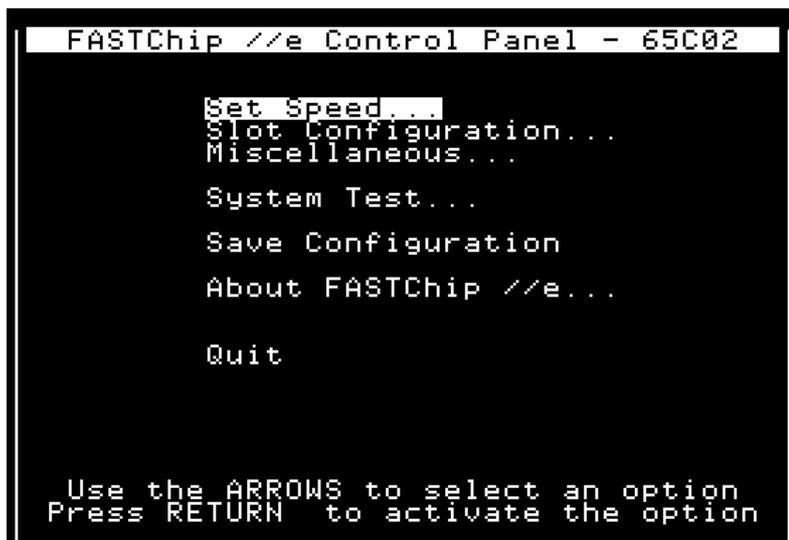
### About the Control Panel

In order to fully understand and take advantage of FASTChip //e features, read through this chapter and display the menus on your screen as they're being described.

The Software Control Panel (herein called the Control Panel) allows you to control the speed of the FASTChip //e, makes changes to its configuration and test its operation.

## Accessing the Control Panel

Access the Control Panel menu by pressing the <Esc> key when power up your Apple //e™. This is best achieved by holding your finger on the <Esc> key and switching on the Apple //e. You should be greeted with the following screen.

A screenshot of a terminal window titled "FASTChip //e Control Panel - 65C02". The menu options are: "Set Speed...", "Slot Configuration...", "Miscellaneous...", "System Test...", "Save Configuration", "About FASTChip //e...", and "Quit". At the bottom, instructions read: "Use the ARROWS to select an option" and "Press RETURN to activate the option".

```
FASTChip //e Control Panel - 65C02

Set Speed...
Slot Configuration...
Miscellaneous...

System Test...

Save Configuration

About FASTChip //e...

Quit

Use the ARROWS to select an option
Press RETURN to activate the option
```

Use the arrow keys <UP>, <DOWN>, <LEFT> and <RIGHT> to navigate the menus. Specific instructions are shown at the bottom of each screen. Navigate to the option you wish to alter, then press <Return> to change it.

## SET Speed

FASTChip //e Speed Menu

```
FASTChip //e Control Panel - 65C02
Set Speed

Speed: 5.0 Mhz

Use SPACE or <--> to change settings
Press RETURN or ESC to Exit
```

Press the <**SPACEBAR**> or use <**LEFT**> and <**RIGHT**> arrow to change the FASTChip //e speed between **Off** and a speed between 0.20 Mhz and 16.6 Mhz. Setting the speed will set the default speed each time the Apple //e is switched on. You can always override the default speed using the knob on the Hardware Control Panel.

Off and 1 Mhz are both the normal Apple //e™ speed. The difference is, when set to “**Off**”, the FASTChip //e board is disabled and the Apple //e™ uses the original 6502/65C02 CPU and clock speed on the Apple //e™ motherboard. Use the “**Off**” setting when using another DMA device. When set to 1 Mhz or another speed up to 16.6 Mhz, the speed is determined by the FASTChip //e. If you are having a problem running a particular program, try turning the speed “**Off**” to determine if the program is having a compatibility issue with the FASTChip //e.

## Slot Configuration

FASTChip //e Slot configuration menu

```
FASTChip //e Control Panel - 65C02
Slot Configuration

Slot 1: Fast
Slot 2: Normal
Slot 3: Fast
Slot 4: Normal
Slot 5: Normal
Slot 6: Normal
Slot 7: Fast

Use the ARROWS to select an option
Use SPACE or <--> to change settings
Press RETURN or ESC to Exit
```

The **Slot Configuration** option allows you to define the FASTChip //e speed setting for each slot. This way you can fine tune your system for maximum speed and compatibility with your other peripheral boards. If you have a peripheral board that cannot run at the accelerated speed, select the slot that that card occupies and press the spacebar to set the FASTChip //e to "**Normal**" for that slot. The available options are Normal or Fast.

*Sample Configuration:*

- Slot 1 **Fast** Parallel Printer Interface Card
- Slot 2 **Normal** Serial Interface Card
- Slot 3 **Fast** FASTChip //e
- Slot 4 **Normal** Clock Card
- Slot 5 **Fast** Slot 1-7 Memory Card
- Slot 6 **Normal** Floppy Disk Controller
- Slot 7 **Fast** Empty

## Miscellaneous

FASTChip //e Miscellaneous Menu



### Startup Graphics

If you don't want the FASTChip //e logo to appear each time you boot your computer, toggle the graphics off by highlighting Startup Graphics and pressing the spacebar to set the option to **Off**. Pressing it a second time will toggle it back **On**. You will notice a slight decrease in boot time with the graphics turned off. As with all changes you make to the FASTChip //e configuration, you must use the "**Save Configuration**" option to keep this change whenever the system is booted up.

### Startup Delay

Here you can set the amount of time the FASTChip //e logo appears on the screen before the boot process continues. The value can be from 1 to 20 seconds. Pressing any key during the logo display will stop the delay and the apple //e will continue booting.

### Sound Mode:

As the Apple default sound generation is controlled by a timing loop in the Apple //e, it is dependent upon the processor speed. This option attempts to correct distortion caused by a fast processor such as the FASTChip //e.

Your choices are DISTORTED, FAST, NORMAL, MUSIC and HIFI.

With the "DISTORTED" setting, the sound will be dependent upon the FASTChip //e speed.

In "FAST" mode a 1 ms delay is added to the timing loop.

"NORMAL" is the standard settings for the Sound Mode.

Some music programs require that the sound be slowed down a bit. If your music program doesn't sound right try setting the Sound Mode to the "MUSIC" or "HIFI" setting.

"HIFI" is required by a few music programs. Try this setting if the sound is still too accelerated at "NORMAL" or "MUSIC" setting. Note: these settings will slow down the FASTChip //e and you not get the maximum speed. As there is such a wide variety of software written by a plethora of authors, there is no rhyme or reason to which settings will work for you. You will need to test the settings with each piece of software to achieve maximum compatibility.

## **Joystick Delay**

The choices here are NONE, SHORT and LONG .

Leave the Joystick Delay option set to "**LONG**" in most cases. Many games that use joysticks are timing sensitive. Both the "**SHORT**" or "**LONG**" setting will work, however, some programs will work with the "**SHORT**" setting and may run faster with the "**NONE**" setting. Once again this is program dependent and linked to program loops and software timing delays.

## **RamFactor**

As mentioned previously, the FASTChip //e contains additional SRAM to allow the 65C02/65C816 microprocessor to run at full speed. Some of this RAM can be allocated to emulate 256/512 KB Fast RamFactor (Slinky type) RAM. The emulation supports all software than can use the RamFactor memory. If you want RamFactor RAM you simply enable this option. Options are [256]/[512] or OFF.

## **RamFactor Slot**

This option allows you to specify the slot the RamFactor card/emulation is located in. This option will only be available if the RamFactor option is ON.

N.B. If you have an actual RamFactor board in your system, you can make use of its RAM and also the RAM on the RamFactor emulation on the FASTChip //e. As you have to tell the Apple //e which slot the actual RamFactor board is located in, you can simply tell the FASTChip //e that the RamFactor Slot on the FASTChip //e is in a

different slot. This way you can effectively have 2 RamFactor boards installed. You should specify a slot for the FASTChip //e RamFactor emulation which is NOT occupied by another peripheral board, otherwise you run the risk of a hardware conflict.

## **RamWorks**

### 192/448 KB RamWorks Emulation

If you are running software that cannot use the additional RAM as RamFactor RAM, but can make use of RamWorks RAM, then you should enable this option. FASTChip //e contains built in emulation of a 192/448 KB Fast RamWorks RAM card. The options are either ON or OFF.

Note: you can use both RamFactor and RamWorks emulation at the same time. The only other options is NO extended RAM emulation. This is achieved by turning OFF both the RamFactor RAM and RamWorks RAM emulations.

N.B If you have an actual RamWorks board in your system and enable the emulation on the FASTChip //e board it will clash with the actual RamWorks board, effectively disabling it. Hence you should not enable the RamWorks emulation n the FASTChip //e if you have a physical RamWorks board installed in your system.

## **Backlight**

As a tribute to modern technology, the FASTChip //e board uses programmable LEDs for lighting. There are 6 modes of operation. "DISABLED", "FADE", "SPEED", "RED", "GREEN", and "BLUE" modes.

**DISABLED:** Use this option to turn OFF any LED animations on the FASTChip //e.

**FADE:** With this option enabled, the FASTChip //e will cycle between colors, fading in between. This gives a really cool color effect. The color cycling is NOT dependent upon the FASTChip //e speed.

**SPEED:** Selecting this option will cause the color LEDs to change color based on the currently selected speed. For example, GREEN is low speed. As you increase the speed, the color changes to YELLOW (midrange speed) through RED for high speed.

**RED:** This will make the FASTChip //e light up RED only, there is no fading or intensity change. However this may change in a later/production version of the FASTChip //e board.

**GREEN:** This will make the FASTChip //e light up GREEN only, there is no fading or intensity change. However this may change in a later/production version of the FASTChip //e board.

**BLUE:** This will make the FASTChip //e light up BLUE only, there is no fading or intensity change. However this may change in a later/production version of the FASTChip //e board.

## Additional FASTChip //e LED indicators

In addition, there is a 4 x 7 segment LED display that shows Speed, Extended Memory options and Soft Switch settings. See appropriate sections later in this manual.

## System Test

FASTChip //e System Test menu

This runs a confidence test on the FASTChip //e board. It tests the CPU, memory, speaker (sound) and Video. Pressing <Esc> at any time will abort the System Tests. It is a good idea to run these tests once you have completed the installation of your FASTChip //e, to ensure it is stable and working correctly.

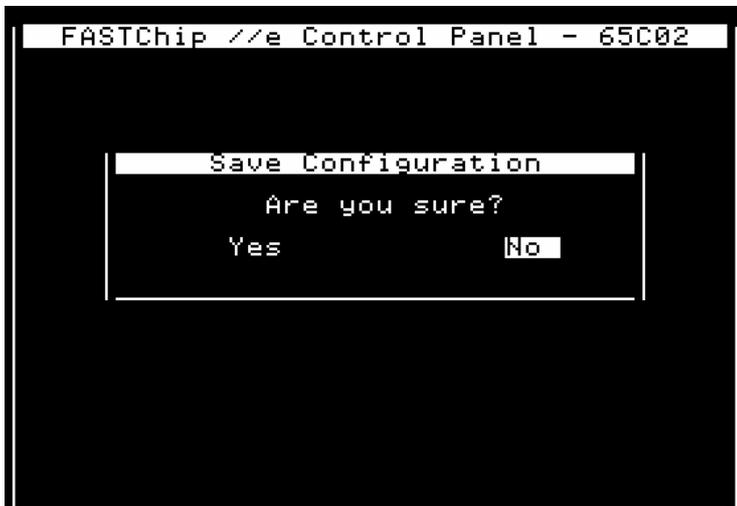
```
FASTChip //e Control Panel - 65C02
System Test

CPU Test : Finish
MEMORY Test : Testing
SPEAKER Test : .....
VIDEO Test : .....

press ESC to skip TEST
```

## Save Configuration

After you make any changes to your configuration, you **must** save the configuration otherwise it will forget your changes next time to restart the system. Saving the configuration, writes the settings to non-volatile memory.



## About FASTChip //e ...

This screen gives credit to the masterminds behind the FASTChip //e. It also lists A2Heaven address and phone numbers for Sales and Technical Support.



## Quit FASTChip //e

When you're finished selecting your options **and** you have saved your configuration, choose Quit. This will force a REBOOT of your Apple //e™.



## FASTChip //e External Control panel

FASTChip //e has an external, hardware control panel. This unique feature is not present in any other known Apple //™ accelerator. The external hardware control panel allows quick and easy use of most FASTChip //e features.

The control panel includes a control knob, three buttons and a 4 x 7 segment LED display. The buttons and knob are used to change speed and some functions on the fly. The 4x7 segment LED display shows speed and status of the FASTChip //e accelerator.

FASTChip //e Hardware Control Panel:



- By pressing the **left** button you can change between the current speed and standard 1Mhz CPU speed.
- By pressing the **center** button you can pause/stop CPU, press a second time to resume.
- By pressing **right** button you can choose which function is be displayed on the 7 segment LED display.
- Turning the rotary knob will change working frequency from 0.20Mhz-16.6Mhz, there are 40 available speeds plus Off.

## Display Messages

When the FASTChip //e is active the following messages can be displayed on the 4x7 segment LED display.



FASTChip //e is disabled.



FASTChip //e current speed in Mhz.



FASTChip //e is in normal, 1Mhz non-accelerated mode.



FASTChip //e is in PAUSE/STOP mode.



Show current RamFactor (slinky) page when RamFactor is enabled.



RamFactor (slinky) emulation is disabled.



Show current RamWorks page if RamWorks is enabled.



RamWorks emulation is disabled.



Shows the state of some soft-switches (see table below)

Digit	Soft SW	Function of soft switch
Segments	-	UP - <b>1</b> DOWN - <b>0</b>
1	ALTZP	Alternate Zero Page (on/off)
2	STORE80	Use PAGE2 for Aux Memory
3	RAMWRT	Status of Main/Aux RAM Writing
4	RAMRD	Status of Main/Aux RAM Reading

## FASTChip //e Programmer's Reference

Control of the FASTChip //e via software is through soft-switch registers inside the chip. Extreme care must be used when changing the contents of these registers because improper use can make FASTChip //e functionally unstable. Each register may perform a number of related or unrelated functions. The table below shows the FASTChip //e registers, how they are accessed and what each bit of the register does. An in-depth discussion of each register follows this table.

Register Address	How Accessed	Function
\$C06A	Write	\$A6 Locks FASTChip //e. 4 consecutive \$6A writes unlock FASTChip //e. While unlocked, any write other than \$A6 or \$6A will initiate an indefinite synchronous sequence.
\$C06B	Write	Any hex byte written will enable FASTChip //e
\$C06B	Read	7 - bit returns the FASTChip //e status .
\$C06C	Read/Write	Slot Speed / Set and Read 0 - Set slot Normal 1 - Set slot Fast  bit 0 - none      bit 4 - Slot 4 bit 1 - Slot 1    bit 5 - Slot 5 bit 2 - Slot 2    bit 6 - Slot 6 bit 3 - Slot 3    bit 7 - Slot 7
\$C06D	Read/Write	Set/Read FASTChip //e Speed (see table below)
\$C06E	Read/Write	Configuration Register
\$C06F	Read/Write	Data Register

## FASTChip //e - Speed Register

Value / HEX	Speed / Mhz	Value	Speed / Mhz
0 / \$00	Disabled	21 / \$15	2.20
1 / \$01	0.20	22 / \$16	2.30
2 / \$02	0.30	23 / \$17	2.50
3 / \$03	0.40	24 / \$18	2.60
4 / \$04	0.50	25 / \$19	2.70
5 / \$05	0.60	26 / \$1A	2.90
6 / \$06	0.70	27 / \$1B	3.10
7 / \$07	0.80	28 / \$1C	3.30
8 / \$08	0.90	29 / \$1D	3.50
9 / \$09	1.00	30 / \$1E	3.80
10 / \$0A	1.10	31 / \$1F	4.10
11 / \$0B	1.20	32 / \$20	4.55
12 / \$0C	1.30	33 / \$21	5.00
13 / \$0D	1.40	34 / \$22	5.50
14 / \$0E	1.50	35 / \$23	6.20
15 / \$0F	1.60	36 / \$24	7.10
16 / \$10	1.70	37 / \$25	8.30
17 / \$11	1.80	38 / \$26	10.00
18 / \$12	1.90	39 / \$27	12.50
19 / \$13	2.00	40 / \$28	16.60
20 / \$14	2.10		

By using the Configuration register you can Read or Change options of the FASTChip //e.

Configuration Address	How Accessed	Function
\$00	Read/Write	<b>FASTChip //e Speed</b> (same as \$C06D)
\$01	Read/Write	<b>Slot Speed</b> (same as \$C06C)
\$02	Read/Write	<b>Speaker Delay</b> \$00 - NONE \$01 - FAST \$02 - NORMAL \$03 - MUSIC \$04 - HIFI
\$03	Read/Write	<b>Joystick Delay</b> \$00 - NONE \$01 - SHORT \$02 - LONG
\$04	Read/Write	<b>RamFactor (Slinky Card) Memory size</b> \$00 - Disabled \$01 - 256 KB
\$05	Read/Write	<b>RamFactor (Slinky Card) Slot</b> \$00 - UNDEFINED (Do not set !!!) \$01 - Slot 1 \$02 - Slot 2

		\$03 - Slot 3 \$04 - Slot 4 \$05 - Slot 5 \$06 - Slot 6 \$07 - Slot 7
\$06	Read/Write	<b>RamWorks Memory size</b> \$00 - DISABLED \$01 - 192 KB
\$07	Read/Write	<b>Backlight</b> \$00 - Disabled \$01 - FADE \$02 - SPEED \$03 - RED \$04 - GREEN \$05 - BLUE

## Programming Hints

Programmers are encouraged to use the features of FASTChip //e in their code. To assist in this the following code samples are provided.

This outline is recommended for opening and altering the FASTChip //e soft-switch registers:

---

### ENABLE\_FASTCHIP\_IIE

```
LDY # $6A      ; Load Unlock Value
STY $C06A     ; Send 6Ah to FASTChip //e, 4X to unlock
STY $C06A     ;2
STY $C06A     ;3
STY $C06A     ;4
STY $C06B     ; Enable FASTChip //e
LDY $C06B     ; Is FASTChip //e enabled?
BMI  EXIST    ; Jmp if FASTChip //e is installed
```

---

### DISABLE\_FASTCHIP\_IIE

```
LDY # $A6     ; Load Lock value
STY $C06A    ; Save to FASTChip //e
RTS
```

---

## SET\_SPEED

```
JSR  ENABLE_FASTCHIP_IIE ; Before we set the speed we need to enable FASTChip //e
LDA  SPEED                ; Load Speed value to A (See table above)
STA  $C06D                ; Save Speed
RTS
```

---

## SET\_SPEED\_ALT

```
JSR  ENABLE_FASTCHIP_IIE ; Before we set the speed we need to enable FASTChip //e
LDA  #$00                 ; Store SPEED index (See table above)
STA  $C06E                ; Save to Configuration Register
LDA  SPEED                ; Load Speed value to A
STA  $C06F                ; Save Speed to Data register
RTS
```

---

## READ\_SPEED

```
JSR  ENABLE_FASTCHIP_IIE ; Before we set the speed we need to enable FASTChip //e
LDA  $C06D                ; Read FASTChip //e Speed value to A
RTS
```

---

## READ \_SPEED\_ALT

```
JSR  ENABLE_FASTCHIP_IIE ; Before we set the speed we need to enable FASTChip //e
LDA  #$00                 ; Save SPEED index (See table above)
STA  $C06E                ; Save to Configuration Register
LDA  $C06F                ; Read Speed value to A
RTS
```

---

## SET\_BACKLIGHT

```
JSR  ENABLE_FASTCHIP_IIE ; Before we set the speed we need to enable FASTChip //e
LDA  #$07                 ; Save BACKLIGHT index (See table above)
STA  $C06E                ; Save to Configuration Register
LDA  BACKLIGHT            ; Load Backlight value to A
STA  $C06F                ; Save Data to Data Register
RTS
```

## **FASTChip Demos and Reviews**

### **Demos:**

Xevious Demo: <https://www.youtube.com/watch?v=J6x7UmMbTs8>

The Jet Demo: <https://www.youtube.com/watch?v=DImR-TI3aCU>

Alien Downpour Demo: [https://www.youtube.com/watch?v=o4wdP\\_dlpZE](https://www.youtube.com/watch?v=o4wdP_dlpZE)

Ultima V Demo: <https://www.youtube.com/watch?v=X2rLzT5oLI4>

### **Reviews:**

Javier A. Rivera's review: <http://www.callapple.org/uncategorized/fast-chip-iie-first-look/>

Jorma Honkanen's review: <http://finapple.hho.fi/finapple/index.php/2017/06/15/im-going-fast-with-fastchip-e/>

## **Frequently Asked Questions**

**Q.** Who makes the FASTChip //e?

**A.** The adapter was designed and built by Plamen Vaysilov from a2heaven.com. This includes the software (VHDL design)/firmware, circuit design and the PCB.

**Q.** Can I use FASTChip //e on other computers?

**A.** Almost certainly no, you can use FASTChip //e only on Apple //e™, Enhanced //e or compatible clones. FASTChip //e has been tested in the Apple II/II+ range of computers but no guarantee stable work you can use on own rusk. At this point compatibility with the Apple II/II+ is not guaranteed. This may change in a later version or a new Apple II/II+ specific version may be released.

**Q.** How much does the FASTChip //e adapter cost?

**A.** At the time of writing this document (July 2017), the price was US\$150.00 which includes shipping to anywhere on the planet.

**Q.** I Want more than 512KB of Fast RAM, is this is possible?

**A.** Yes, FC have 1024 KB extended RAM version, contact A2Heaven for more info.

## **Where to find further help**

**Phone:** +359 888 810 993

**Email:** info@a2heaven.com

**Facebook:** <https://www.facebook.com/a2heaven/>

## **About a2heaven.com**

A2Heaven is a small company that implements new technology for use on vintage computer hardware.

## **About this User Guide**

This User Guide was written by Plamen Vaysilov and Martin Crockett, using technical information from the TransWarp II User Manual from Applied Engineering.

Version 0.06, 18<sup>th</sup> July 2017, 1<sup>st</sup> public release, KFest 2017.

## **Warranty**

A2Heaven.com warranties the FASTChip //e adapter for 6 months or 180 days, from the date of purchase. This warranty assumes the FASTChip //e adapter has not been tampered with in any way.

## Some other a2heaven products

**Apple SAM (Semi Automatic Mouth):** A high quality speech synthesizer.

**Mockingboard-T:** A sound card for all Apple II computers, no speech chip.

**ALF MC1 Clone:** A music synthesizer that allows you to program music into your apple using standard musical notation.

**Ramworks III Clone:** Comes with 64k, expandable to 1M or 3M with 2M expander board. For apple IIe only.

**Ramworks III VGA adapter:** Option board for the Ramworks III Clone. Generates VGA compatible video, only for NTSC, 60Hz Apple IIe.

**dClock:** Clock option for Ram Express or Apple IIc Memory Expansion card.

**Senior PROM IIe:** Add debugging commands to your Apple IIe, such as entry to System monitor at any time, copy memory to and from auxiliary memory, plus much more.

**Trak Star II:** Gives constant digital read of any 5.25" Apple II drive, great for seeing what that pesky protection scheme is up to. Supports full, half and quarter track movement.

**SDFloppy II:** Store up to 36 "DSK" images on an SD card, replaces 5.15" floppy drive.

**RamWorks8M :** RAM memory Add 8MB RAM to Apple IIe .

**RamFactor8M :** RAM memory Add 8MB RAM to Apple II+ .

For more products visit [www.a2heaven.com](http://www.a2heaven.com)