

Mockingboard emulation issues on SD Music card

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Guide for software developers

Dear APPLE II software developers,

I'm a developer of SD Music Deluxe and SD Music(+) card
I made this guide for programmers who like to play music on
mockingboard and SD Music card. And if you are experiencing
some issues with the SD Music card, Please refer to this
document.

I saw several nice programs which are working fine on general
Mockingboard but, not SD Music Deluxe. We knew there are
many differences between OPL3 with PSG chips but,
malfunctioning issues don't come from it. Please refer to the
following pages and hope to be helpful in your music playing
program.

Differences Mockingboard with SD Music

- SD Music card has an internal mockingboard translation function to produce sound as the mockingboard. Due to the differences OPL3 sound chip with PSG(AY3-891x) chip and SD Music doing real-time interpreting of all signals but it has some H/W differences as the under.

First, It only has **one 65c22** chip.

It means you can have only one interrupt source IRQ only no NMI supported. We know, the mockingboard have two 6522 and controlling 2 AY3-891x chips,

How it works as it have two 6522?

In principle, on classic mockingboard control way, Program used only one 6522 for IRQ for timer interrupt and output port and other 6522 didn't use the NMI interrupts(I didn't see the software which is used NMI) but used for out port to control 2nd AY3-891x So, it would be a problem if you want to use NMI on your program but, I believe you could make nice sound playing program without NMI.

Second, SD Music deluxe has an optimized design with higher functions.

Port control ports are divided into two sections the same as mockingboard, One is **C40x** area Another section is **C48x** area but, both are mirrored.

The first \$c40x area is first mockingboard 6522 address and the second \$C48x is used by 2nd 6522.

SD Music card doesn't have 2nd 6522 but, it also accepts data from \$C48x with device number so, it knows where they come from.

Classic way of Ports Initialization

- In the classic way, to control mockingboard, In my research, It has port configuration and IRQ configuration. The port configuration was simply done as below

** This code makes 6522 port to data port to all Output and Control lower 3 lines only.

```
LDA #$FF
STA $C403 'Set PORTA all Output
LDA #$07
STA $C402 'Set PORTB Output only lower 3bits
```

....

I take this information from Mockingboard testing program and the SD Music card following this way and mockingboard program works fine and I used the left other 6522 PORTB pins for extended commands such as change instruments, add instruments so on for SD Music Deluxe. But, it became an issue in recently made programs. Please read the followings.

Some issues on initialization

It has appeared recently with some wrong guides exist. Maybe to make it a simpler way to initialize 6522 ports.

Here is a non-compatible example of simple initialization on two 6522s.

```
LDA #$FF
STA $C403 'Set 1st AY3-891x PORTA to all Output
STA $C402 ←Set 2nd AY3-891x PORTB to all Output
STA $C483 'Set 2nd AY3-891x PORTA to all Output
STA $C482 ←'Set 2nd AY3-891x PORTB all Output
```

I know it doesn't be a problem on Mockigboard. But, on SD Music deluxe cases, some more PORTB lines are used for extended commands so it should not set it all output on PORTB.

To avoid problems, I suggested the below codes for PORTs initialization

```
LDA #$FF
STA $C403 'Set 1st AY3-891x PORTA to all Output
STA $C483 'Set 2nd AY3-891x PORTA to all Output
LDA #$07 '0000 0111'
STA $C402 'Set 1st AY3-891x PORTB to Output (Lower 3bits)
STA $C482 'Set 2nd AY3-891x PORTB to Output(Lower 3bits)
```

AY3-891x Control protocols

Mockingboard has this control way for AY3 891x. When I research it, it really had a strange design but, I realize the problem at that time Due to Ay3-891x doesn't work well on APPLE II timing. To control AY3-8912 on mockingboard, It is using this protocol way.

To send data

Ex) Send data #\$10 to Register #1 on 1st AY3-891x

```
LDA #$1 'Get Reg#'  
STA #$C401 'Send Register# to 6522 PORTA  
LDA #$07  
STA #$C400  
LDA #$04  
STA #$C401
```



Register Latch process

```
LDA #$10 'Get Data'  
STA #$C401 'Send Data to 6522 PORTA  
LDA #$06  
STA #$C400  
LDA #$04  
STA #$C401
```



Data Latch process

Then control 2nd AY3-891x of C48x (Please **separate** between C40x with C48x)

Thank you very much

Thank you very much Now we could have sound on both mockingboard and SD Music deluxe card.

Your efforts for APPLE II enthusiasts would be much appreciated.

I'm developing hardware cards, and I wish to have more software that supports mockingboard sounds.

Also, I wish to provide my card for game/new sound software developers.

Please let me know if you are interested,

I will provide a very low price for Software developers but, you have to provide your own software such as Games or music players etc.. sorry about it but, I don't have any company list where is developing games or who is the developers.

If you have any questions, please let me know.

Thanks again and Best regards

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