INSTALLATION OF AN IDE FLASH CARD DRIVE IN THE YAMAHA EX5R SYNTHESIZER

Prepared on December 1, 2004
(By Dr. F.)

DISCLAIMER: Every installation that is not performed by Yamaha qualified technicians may cause serious damage to your equipment and put your life in danger if you are not cautious while working with electricity. Always wear eye-protective equipment when power tools are used. If you damage your EX5R it's your fault. I offer all of the following advice in this document as a guide to people that like to take a challenge and experiment with their equipment.

A. Introduction

A few months ago I published on EX5Tech a document about an internal hard drive (HD) u p-grade. It was a good upgrade but there was no fast and easy way to load data to the HD. After that I discussed (on the same forum) how to replace the floppy drive (FD) with a SCSI Zip100 drive (ZP) and use the Iomega® Guest software in order to do fast transfers through a SCSI cable and a personal computer (Mac or PC). In the mean time I tried some schemes with a flash card adapter that did not work (details about this later). After many tries I succeeded in two different ways in using an IDE flash card drive (IFD) combined with a SCSI-to-IDE bridge. The principal concerns of the upgrade were the following:
1) no serious alterations should take place inside the synthesizer,
2) it had to be relatively economical,
3) the space that was intended for the installation of other upgrade modules should be kept available for the future.
The only requirement for this upgrade is that you must have the ASIB1 option installed in your EX5R for SCSI hard disks, zip drives and/or CD-ROMs to be connected to the synthesizer.
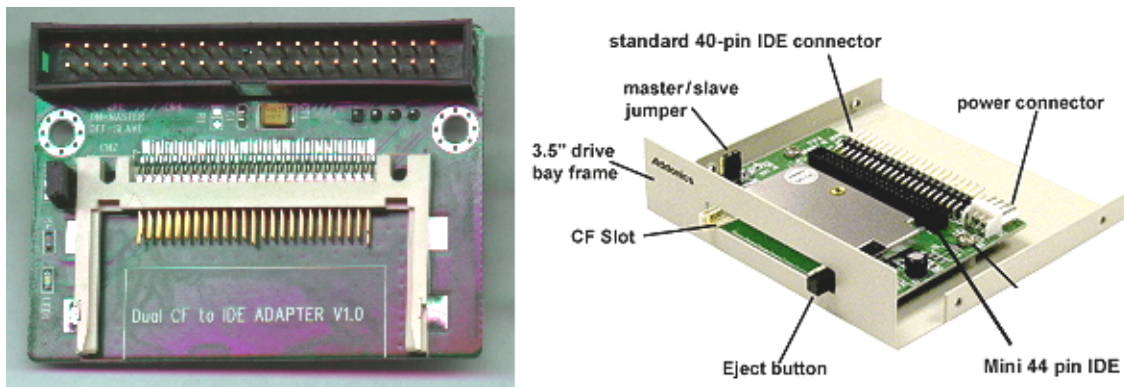

Figure 1. These adapters will NOT WORK with the proposed upgrades.

B. Bill of materials

The installation of an internal IDE flash card reader is not difficult but it does take time. Unless you feel comfortable working with computer peripherals, cables, adapters, etc you should not attempt any modifications. The lists of parts and materials required for the upgrades follow.

Option (A)
1) One Addonics IDE Ultra Digidrive (note 1)
2) One PCMCIA to CF1/CF2/SM/MS/SD/MMC/MD/XD adapter
3) One 21 cm (8 inches) long 40-conductor IDE-to-IDE adapter (note 2)
4) One ACARD AEC-7720U SCSI-to-IDE Bridge (note 3)
5) One 38 cm (15 inches) long 50-conductor SCSI cable with two 50-pin connectors (note 4)
6) One power-cable adapter (note 5)
7) Anti-static wrist strap to ground yourself
8) Philips screwdriver to open the EX5R (a power tool is optional but not necessary)

Option (B)
1) One Addonics IDE Ultra Digidrive (note 1)
2) One PCMCIA to CF1/CF2/SM/MS/SD/MMC/MD/XD adapter
3) One Storigen ACHIP ARC760-B SCSI-to-IDE Bridge (note 6)
4) One SCA 80-pin Female to 50-pin Male Internal SCSI Adapter
5) One 38 cm (15 inches) long 50-conductor SCSI cable with two 50-pin connectors (note 4)
6) One power-cable adapter (note 5)
7) Anti-static wrist strap to ground yourself
8) Philips screwdriver to open the EX5R (a power tool is optional but not necessary)

Option (A) is the modern but difficult one due to item (3) of the list. Option (B) is easier but item (3) of this modification is difficult to find. Most of the main components for both modifications can be found on Ebay from time to time for a reduced price.

Notes

(1) The Addonics IDE Ultra Digidrive is shown in Figure 2. It comes with two faceplates and if you don't like the white you can use the black one to match the original drive in your EX5R. The Ultra Digidrive requires a PCMCIA adapter to read/write on CF-1, CF-2, SM, MS, SD, MMC, MD and XD cards. The original box contains just a drive with instructions, two face-plates and no adapters or memory cards of any kind. Its maximum transfer rate is 128 Mbits/sec. Addonics makes another IDE Digidrive that functions with all of the above cards except the XD one. That drive has a maximum transfer rate of 40 Mbits/sec and features four memory-card slots on its faceplate. However **it will not work with the proposed up-grades** because it does not have removable-drive bios support as the Ultra Digidrive does.
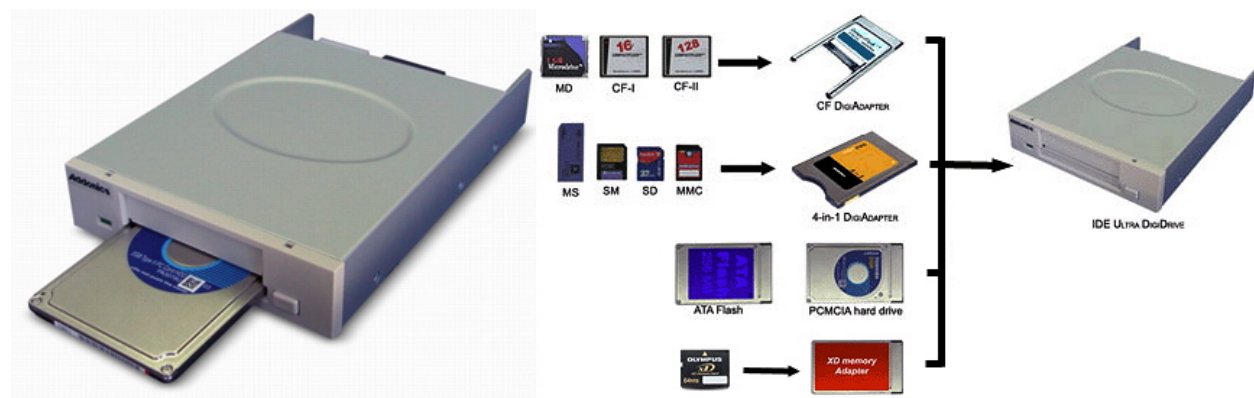

Figure 2. The Addonics IDE Ultra Digidrive.

(2) The IDE-to-IDE adapter is shown in Figure 3. The side that connects to the Ultra Digidrive must have its wires twisted as shown. This means that wire No 1 (with the stripe) must become wire No 2, wire No 2 must become No 1, wire No 3 must become No 4, wire No 4 must become No 3, etc. This goes for all 40 of them. This side of the adapter features a female 40-pin connector. The other side that connects to the SCSI-to-IDE adapter must be a male 40-pin connector. Since I did not have one available I used 40 headers in a dual raw format as you can see in the insert of Figure 3.

Note that one of the 40 headers (or pin if you use a male connector) must be removed in order to fit this adapter to the SCSI-to-IDE bridge. Counting from the top of the picture to the bottom of it the first 9 pins stay as they are on the inner side but the next one shown with the arrow must be removed. The remaining 10 pins of that inner side stay in place. The outer side must have all of its 20 pins left in place. In addition the notches of the two 40-pin connectors should be as shown in the picture, all of them on the outer side of the connectors.
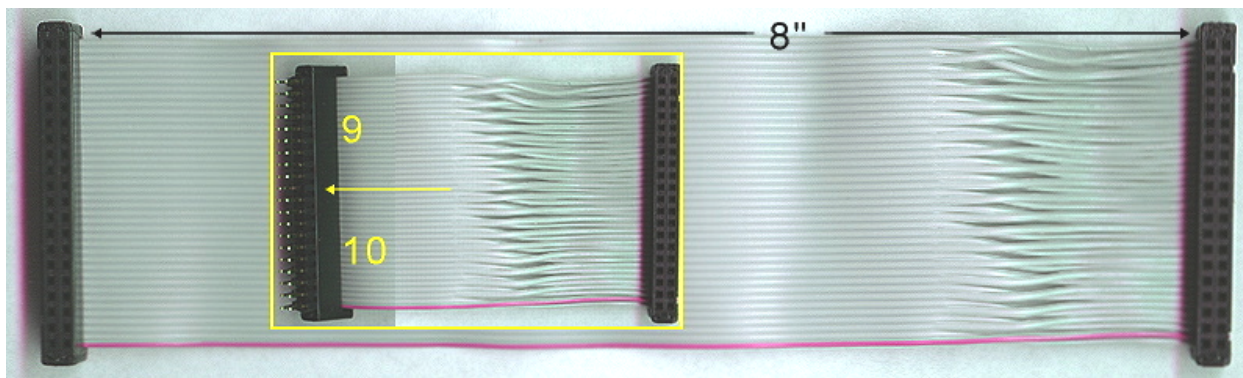

Figure 3. The special IDE-to-IDE adapter required for Option (A).

(3) The ACARD AEC-7720U SCSI-to-IDE Bridge is a device that allows you to use an IDE drive in a SCSI chain. It requires no drivers because it has all the needed software on its flash ROM that can be upgraded in the future. As they say however, if it works for you do not perform any flash upgrades on this bridge. I bought mine brand new for $45 some time ago, but these days it sells for a minimum price of $70 and as high as $100 in some stores. It is too tall to fit inside the EX5R behind the Ultra Digidrive and that's the reason that the IDE-to-IDE adapter is required. Inside the box you will find a special Y-type power adapter that powers this bridge and the Ultra Digidrive from a regular 4-pin computer power connector.
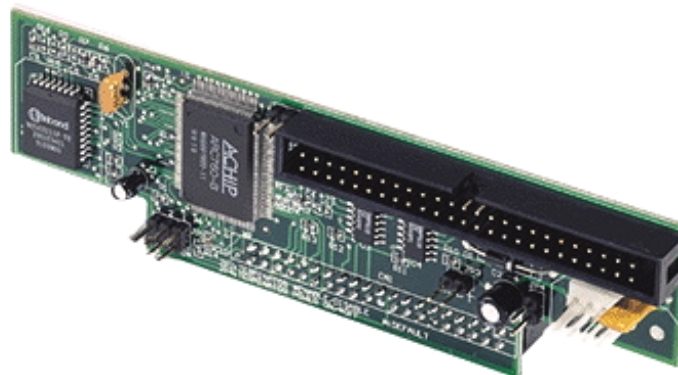

Figure 4. The ACARD AEC-7720U SCSI-to-IDE Bridge required for Option (A).

(4) The SCSI cable that was used in this project came out of an older Macintosh computer. It has three connectors but only two are needed. The two connectors should be notched in order to avoid problems with the proper pin orientation.

(5) The adapter can be made or it can be found in older PCs. Details follow later in this text.

(6) The Storigen SCSI-to-IDE Bridge works in the same way that the ACARD Bridge does mainly because it features the same ARC760-B controller chip. The only problem with this device is that its SCSI connector is a male SCA 80-pin and your EX5R needs a regular SCSI 50-pin. That's where item (4) of the list of option (B) is required. You can find the 80/50 adapter in many computer-upgrade stores or Ebay for about $5 plus shipping. A slim version (15/16") is **strongly** recommended. The TPR and ID0 jumpers must be ON.
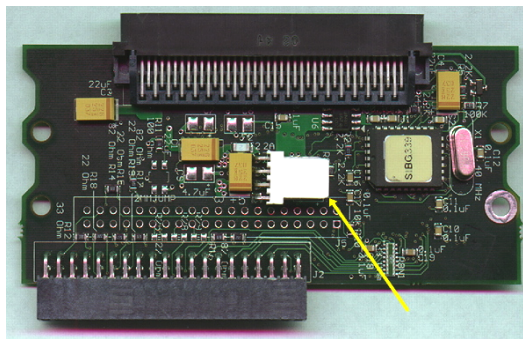

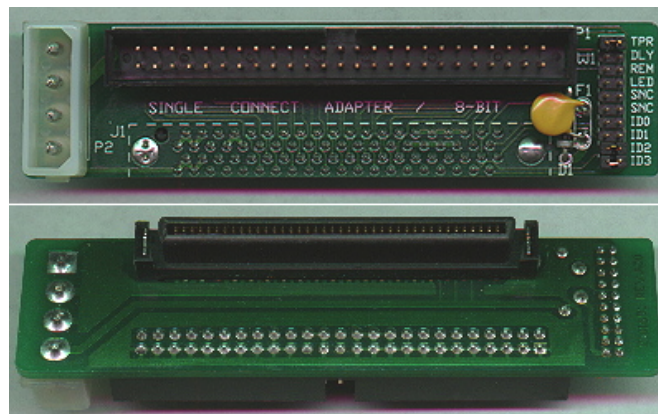Figure 5. The Storigen SCSI-to-IDE Bridge required for Option (B).

Figure 6. The SCA 80/50 SCSI adapter for option (B).

C. Installation

The only reason that this upgrade works is because the EX5R firmware offers support for a SCSI removable-type drive (like a zip drive). The Ultra Digidrive offers similar support in its bios that makes it look as an ATAPI removable-type drive to the host machine. Thus the next logical step would be to find a "bridge" between the SCSI bus of the EX5R and the IDE bus of the Ultra Digidrive. That bridge must also have all the required drivers in its firmware and the ARC760-B

chip does exactly that. The installation procedure starts in the same way for both options and then splits in two different directions. The final testing is the same for both options.

1) **Set the SCSI ID of the EX5R to "0"** and then turn it off. Remove the screws of the synth cover. I counted 17 of them and this is where the power screwdriver comes handy.

2) Plug your EX5R in a grounded outlet but **do not** turn it on.

3) Have the anti-static wrist strap on your hand all the time and connect it to the metal case of the EX5R every time that you need to touch something inside the synthesizer. DO NOT SKIP THIS STEP. You can damage your beloved synth forever if something goes wrong with static electricity. Make sure that you clip the wrist strap to the metal case (the sides are better, so that you don't scratch the faceplate or the rear side).

4) Remove the floppy drive mounting bracket. There are four screws that must be removed in the EX5R, two on the side and two on the inside. You will notice a bunch of wires coming out along with the bracket. Do not pull them hard. Just leave them in place and wrap the floppy drive power connector along with them.

5) Replace the floppy drive with the Ultra Digidrive and choose the proper faceplate (see Figure 7). The Digidrive mounts on the bracket with four screws. You can use the included ones or those from the floppy drive. Then mount the bracket back inside the EX5R.

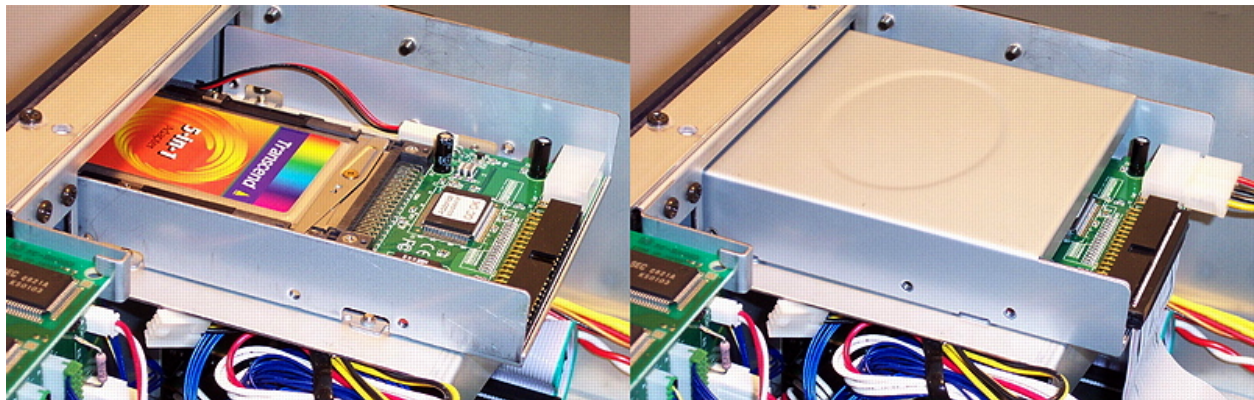Figure 7. External view of the Digidrive with a functioning 512MB SD card.

Figure 8. The Ultra Digidrive inside the EX5R with and without cover.

6) The power adapter consists of a regular 4-pin **hard drive** power connector which is connected to a 4-pin flat connector that is in turn connected to the small 4-pin EX5R power connector with metal pins (check arrows in Figure 9). The red wire of the small EX5R connector carries 12 Vdc and needs to be connected to the yellow cable of the HD power connector. The two white cables next to the red cable (EX5R side) are the ground wires and they must be connected to the black wires of the HD power connector. Finally the last white wire is connected to the red wire of the HD power connector. It's the 5 Vdc line for the logic circuits.
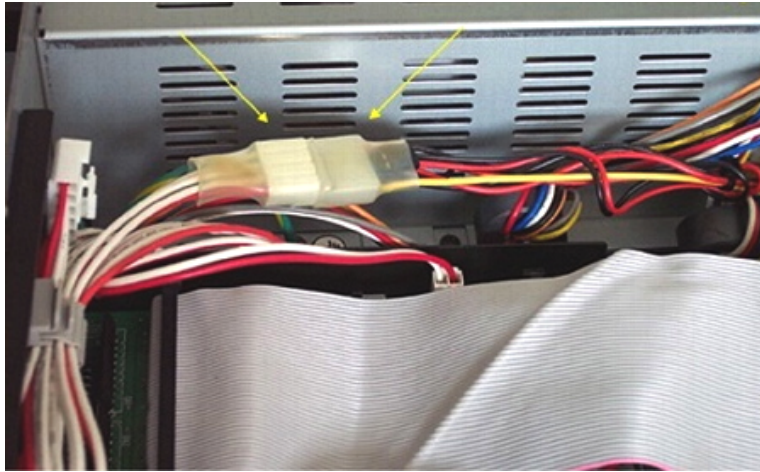

Figure 9. The power connector that is required for both options.

7) When everything has been put in place, put some heat-shrink tubing around the coupling connectors and heat it. This will hold the two connectors securely together. Alternatively remove a hard drive power connector with 30 cm (12 inches) of cable from an old PC. Strip 0.8 cm of the four wires and cover the stripped part with solder. Plug them in the EX5R power connector, put a cable tie around them and then use the heat-shrink tubing as before. Some cable ties may be used to keep the wires inside the synthesizer in good order.

Option (A) installation procedure

8) The jumpers of the AEC-7720U must be set as follows: **JP2 is ON, JP4 is ON and on the JP1 (4) and (2) are ON while (1) is OFF**. This transforms the IDE drive to a SCSI drive with an ID of "6" and its terminator power (TP) and terminator enable (TE) in the active position.

9) Use the SCSI cable and connect the AEC-7720U to the ASIB1 board. Use the IDE-to-IDE adapter and connect the Ultra Digidrive to the AEC-7720U bridge (notches on top). Finally, use the **included** Y-type power adapter and connect the small female floppy-type connector to the AEC-7720U and the big female HD-type connector to the Ultra Digidrive. The male connector of the power adapter must be connected to the female power connector from step (7) above. This procedure supplies power from the EX5R to the bridge and the IDE drive.

10) Secure the AEC-7720U with some cable ties around the white plastic base inside the EX5R and check all the previous steps to insure that no mistakes took place during the installation. The AEC-7720U has a plastic insulating layer on one side. It should not be removed otherwise some **serious damage** to your synth will occur. Your EX5R should look as in Figure 11 when the upgrade is completed. Continue to step (11) if you chose this option.
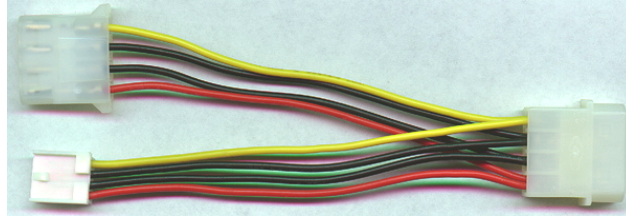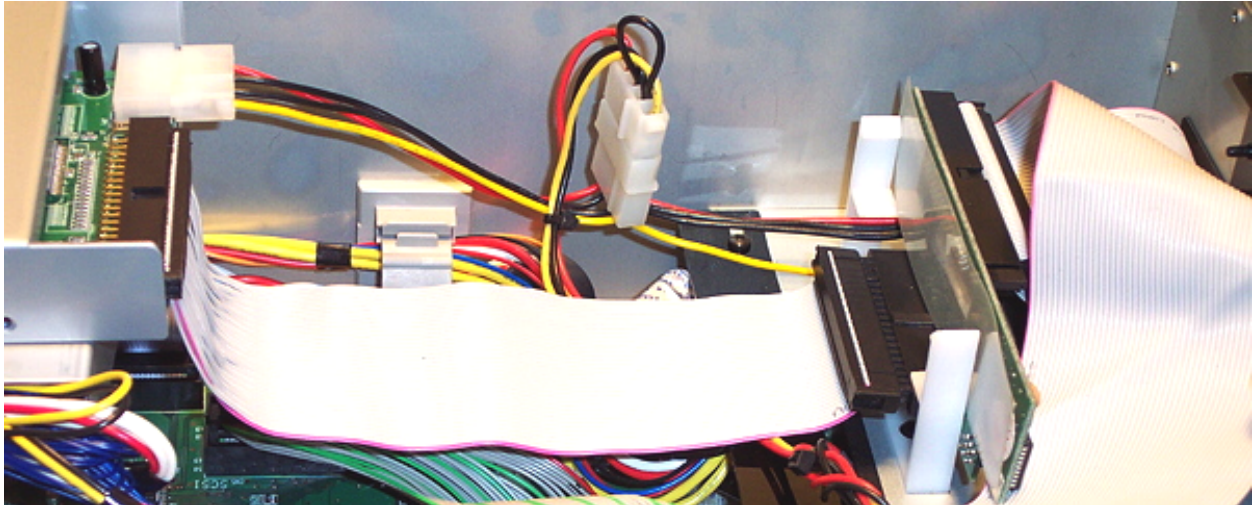
Figure 10. The power adapter used in step 9(A).

Figure 11. View of option (A) when completed.

Option (B) installation procedure

8) The Storigen ARC760-B has no setup jumpers and turns any IDE HD into an SCA 80-pin HD with 16 possible SCSI IDs instead of the usual 8. You must carefully remove the plastic frame of the white power connector that is shown with a yellow arrow in Figure 6 making sure to put minimal stress to the four pins so that you do not damage them. Then you plug in the 4-inch long power adapter that is shown in Figure 12. It can be found in older computers or in computer hardware stores. The two notches (and in some cases a locking pin) of the small floppy-type power connector must face you, not the board.
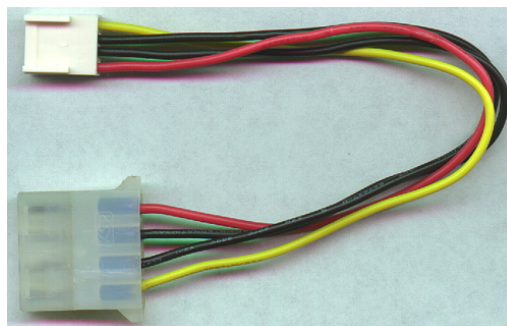

Figure 12. The power adapter used in step 9(B).

The big female HD-type power connector features a long notch in one side that must be removed with a sharp utility knife. When this is done plug the Storigen board behind the Ultra Digidrive with the power connector side facing the bottom of the EX5R. Then plug the big female power connector to the Digidrive and press gently. If you did not remove the notch of the power connector the Storigen board will not fit in well (if at all). **Any mistakes during this step will cause serious damage to the EX5R.**

(7) The SCA 80/50 SCSI adapter that is shown in Figure 6 must be plugged behind the Storigen board. If it is higher than 15/16" it will force the EX5R cover to put stress on it and this will create problems. Thus, make sure that you order a slim version of the SCA adapter. **The TPR and ID0 jumpers must be ON** giving the Digidrive a SCSI ID of "1". Finally plug in the power connector from step (7) in the SCA adapter and press everything firmly in place.

9) Use the SCSI cable and connect the Storigen adapter to the ASIB1 board. Your EX5R should look as in Figure 13 when the upgrade is completed.
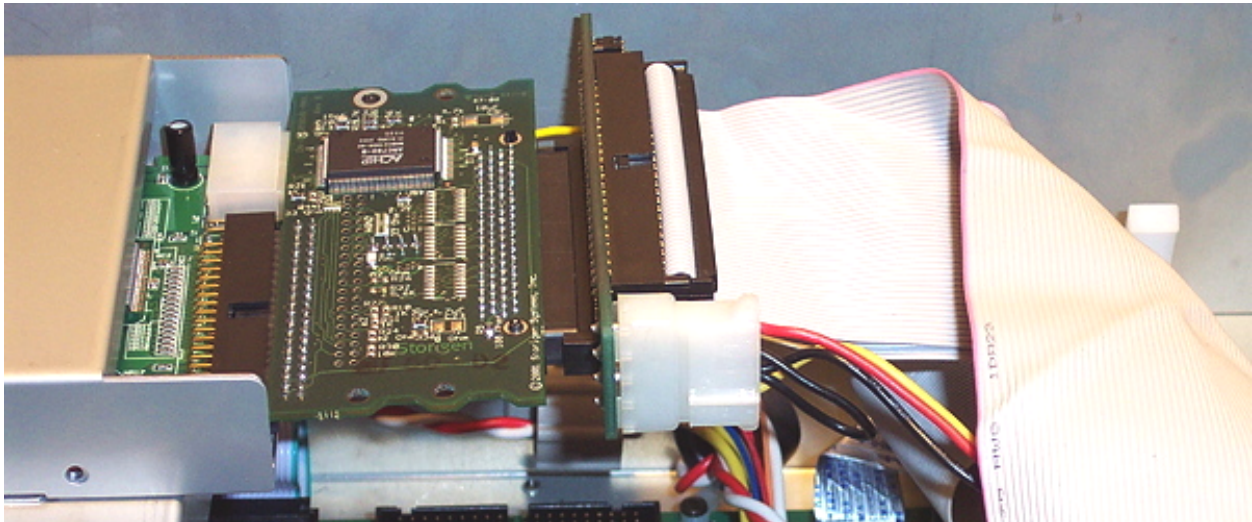

Figure 13. View of option (B) when completed.

11) Remove the wrist strap and power on the EX5R. If everything is OK you will see your greeting message. **If you see nothing on the display turn off the synthesizer immediately.** Do the same if the buttons do not respond properly or at all. Try to locate errors. Unplug the SCSI connector, the power connector, etc, until you locate the problem.

12) Assuming that all went well you must format the flash card. Plug it in the PCMCIA adapter and place that adapter in the Ultra Digidrive. Press "DISK" and then "DEV" (or F7). Your display should show "MO0" instead of the usual "HD0" for hard drive or "ZP0" for a zip drive. Then press "FORM" (or F6) and sooner or later (depending on the size of the flash card) you will receive a "format completed" confirmation. You will also read the available IFD space on your screen. During the format operation the LED on the Ultra Digidrive will blink rapidly, just like in a regular floppy or hard drive. This procedure took a few seconds in my EX5R with a 512 MB secure digital card from Kingston® Technologies and even less with a 32 MB compact flash type I card from Kodak®. Always format the card on the EX5R not on the Mac or the PC.
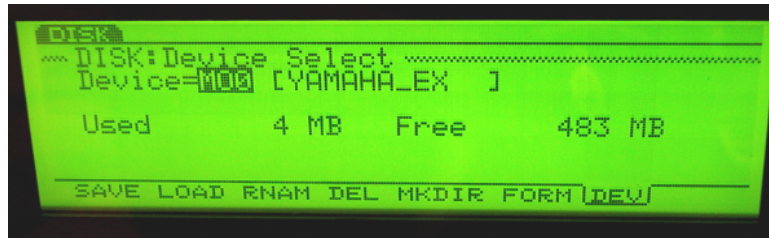
Figure 14. Screen capture after the installation was completed.

13) Now you can put the cover back (turn off the power first) and enjoy your upgraded and very beloved synth. You can also connect an external CDROM if you wish and start copying files from the CD to your IFD. Or you can plug the flash card to an USB reader and just drop some samples and midi files in there with a Mac or PC. Just make sure that each of the SCSI devices (EX5R included) has a different SCSI ID and that the last one in the external chain is terminated.

D. Desktop mounting

Despite the fact that a flash card allows for easy data transfer between a computer and the EX5R someone may still ask for desktop mounting. As far it concerns this procedure for a PC I have no instructions on how to do it or if it can be done. I use a Mac and I was able to mount the flash card on the desktop through a SCSI connection between my MDD PowerMac and the EX5R. I am running OSX but for the mounting I used OS9.2 and the only piece of software that seems to work, Hard Disk SpeedTools by Intech Software Corporation, version 3.1.1.

Turn on the EX5R, run the software and it will automatically detect that you have a Yamaha EX5R synthesizer and a Flash Card in your SCSI chain, each with a different ID. Select the "flash card drive", hit the "mount" button and the card will appear as an icon on your desktop. From there you can erase, drag and drop any files you wish from one device to the other. To unmount the card, drag it to the trash and immediately turn the EX5R off or it will mount again on the desktop automatically. Then remove the SCSI cable and turn the EX5R back on. In case that you can do this procedure with some other software let me know. The software that I use is the only one that can mount PC formatted SCSI drives on a Mac computer and it is a commercial package (not free).

E. Epilogue

One thing will not change despite the upgrade: internal or external the EX5R SCSI interface is slow and there is nothing you can do about it. It does load faster than the floppy and I do like to have a lot of songs, samples and data around without having to switch floppies. Not to mention that the noise of floppy/zip/hard drive motors is gone forever!!! This is always a good thing and it's worth spending one afternoon to complete the upgrade. Depending on the available hardware that exists in your closet and the option that you choose, your cost will be from as little as $60 to as much as $120 and beyond. I do believe that the EX5R is worth it. The speed of loading files depends on the type of flash card that you will use. Secure digital and compact flash type I did not differ during my tests. Compact flash type II is the fastest and most expensive one.

At this point I think that there is nothing more that I can do to improve the EX5R in a different area. Thus I will not be posting any additional modifications for this or any older Yamaha syn-

thesizer. The two options of this upgrade can be used with any Yamaha music-making device that has a SCSI or IDE interface but no flash card access. I do hope that my contribution to the Yamaha synthesizer fans will make a difference and for some time I will be around to help with any questions you might have. But don't ask me to make the special IDE-to-IDE adapter for you. Find someone who can help you on this.

Happy musical creations fellow EX5R users !!!

Dr. F.
qs3000@yahoo.com

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