CALIFORNIA SOFTWARE SYSTEMS
COMPUTER SYSTEMS FOR MANUFACTURING PRINTED CIRCUIT BOARDS

Installation Manual – Revision 2
December 1, 2014

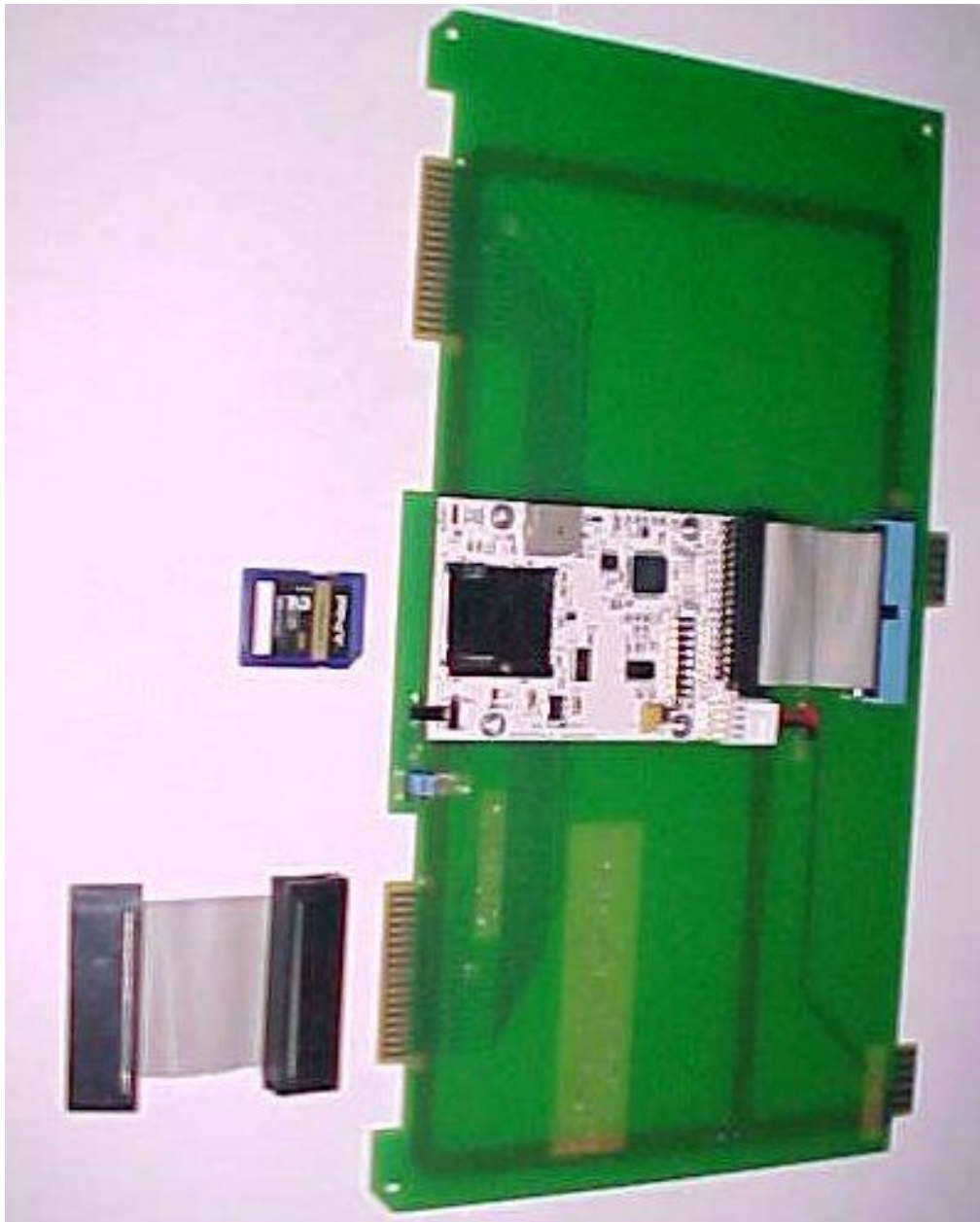## EMU-1 Solid State Floppy Disk Emulator

For

Excellon CNC-6 Machine Controller

These instructions assume you are familiar with setting up and maintaining Excellon machines.   In particular, you should have a good working knowledge of Excellon ZOS commands including @BACKUP. For assistance please contact our stocking distributor, Enterprise Technologies, or California Software Systems.

Enterprise Technologies, Inc.	970 667-0060
California Software Systems:	831 477-6843

EMU-1 Solid State Floppy Disk Emulator For CNC-6 Controller

Introduction

The EMU-1 Solid State Floppy Disk Emulator can replace the floppy disk drives in any Excellon CNC-6 controller. No mechanical modifications are necessary. You simply plug the Emulator board into any open slot in the CNC-6 card cage.. It doesn't matter whether the floppy disk drives are "high" or "low" capacity, single or double sided, or 5.25 or 3.5 inch diameter. The same Emulator and setup procedure works for all versions of the CNC-6. There is also no need to change the floppy disk controller board. The EMU-1 Emulator automatically adjusts to the parameters of all the types of floppy disk controllers used in the CNC-6.
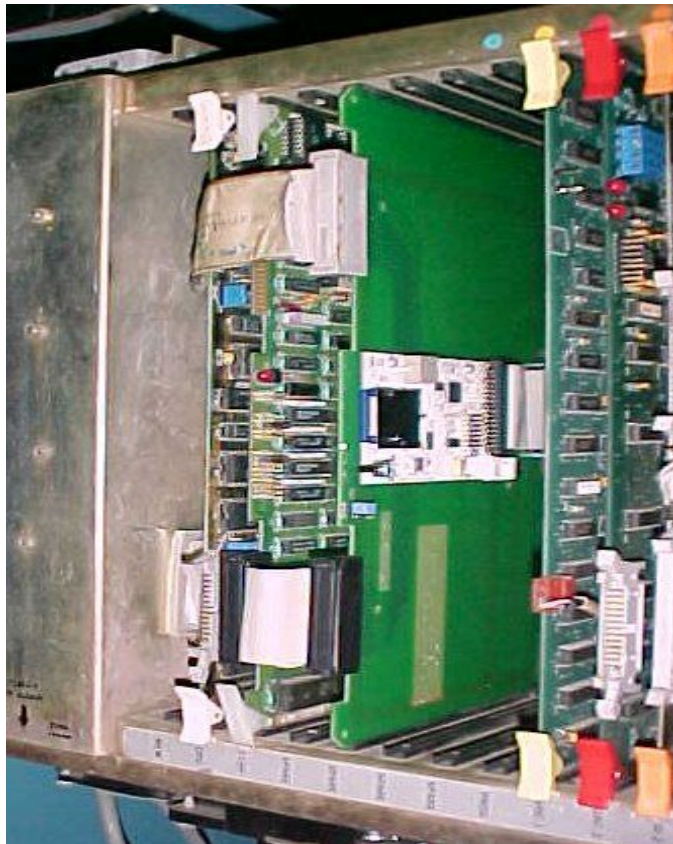
Rear View of CNC-6 with EMU-1 Installed

Note: USB readers for SD cards are inexpensive and readily available almost any place where computer hardware or digital cameras are sold.

The correct, full name, of the solid state digital storage device used in the EMU-1 is a type SDHC card (Secure Digital High Capacity). However, most people refer to it as simply an "SD Card". The principal use for SD cards in the world today is for storing photographs taken with modern digital cameras.

Typical USB Adapter For SDHC Card

The files stored on an SD card can be accessed using a USB adapter which plugs into any modern computer. You can then read/write files to and from the SD card to the computers hard disk, a network file server, CD/DVD, or any other digital media accessible to the computer running any modern version of Microsoft Windows.

Installation In CNC-6

Warning - Do not erase the files or re-format the SD card in a new EMU-1 before installation in a machine!

Outline - Installation Procedure

1. Turn OFF the machine

2. Move the two jumpers on the EMU-1 to the "SETUP" position

3. Insert EMU-1 in CNC-6 card cage

4. Turn ON machine and boot from the original Excellon system software floppy disk.

5. Run "@BACKUP" to copy all files on System Disk to SD Card.

6. Turn OFF the machine and move the two jumpers on EMU-1 to the "RUN" position.

7. Turn ON the machine. It should boot normally - from the SD card.

Detailed Installation Procedure

1. Move both jumpers on Emulator to "SETUP" position (1-3, 2-4).

2. Turn OFF the Main Power to the machine

3. Insert Emulator board into any empty slot in the CNC-6 card cage

4. Unplug data cable from floppy disk controller P3 and connect to P4 on Emulator board (top connector).

5. Connect P3 (bottom connector) on Emulator to P3 on floppy disk controller (New cable provided with EMU-1).

6. Turn ON power and let Machine boot from original Excellon system floppy disk

7. Type @BACKUP on keyboard. Then press RETURN

Excellon Screen - @BACKUP Procedure

```
This will allow you to make copies of floppy disks
  (Including Software disks)
Please note that a "FILE NOT FOUND" message will be
displayed if the disk to be copied has no file on it.
This message should be ignored.

Is this a two-sided disk being copied (Y/N)?            Y

Do you want the new disk verified (Y/N)?               N

Has the disk being CREATED been
initialized yet (Y/N)?                                 N

Place the disk to be INITIALIZED in the PART-PROGRAM
disk drive (D2).

Press (RETURN) when ready>                             RETURN

--Warning! Destroys ALL data on ENTIRE Drive -- Password?:  YES
--Warning! Destroys ALL data on ENTIRE Drive -- Password?:  YES

Place disk being CREATED in the PART-PROGRAM
disk drive (D2).

Place original disk (disk being COPIED) in the SYSTEM
SOFTWARE disk drive (D1). You may now remove the SYSTEM
SOFTWARE disk from it's drive.

Press (RETURN) when ready>                             RETURN
BACK,D1:*,D2:*
BACK,D3:*,D4:*
Do you want to re-run '@BACKUP' (Y/N)?         Turn Off Machine
```

8. Move jumpers on Emulator board to "RUN" position (3-5, 4-6)

9. Turn ON the machine and it will automatically reboot from SD card in Emulator

Note: You may have to press the green "RESET" button in the upper right, rear corner of CNC-6 card cage to initiate the Boot process in some machines.

Everything Works Exactly The Same

The machine will now operate normally. All files, including those needed by the Tool Management Systems, will be read from and written to the SD card in the Emulator. The "parts" program floppy disk drive on the right will still operate exactly as it did before the Emulator was installed. Every ZOS command which works from a floppy disk will work identically with the Emulator.

Files on SD Card

File Name	Function
CNC6FE.CFG	Configuration file for EMU-1 (Don't modify !)
CNC6SYS1HFE	Copy of CNC-6 system (boot) disk for this machine
CNC6SYS2.HFE	Low Capacity Maintenance Disk: Mnt/AE/02.8
EMU-1MANUAL.PDF	This manual

Maintenance Programs - High Capacity Drives

CNC-6 controllers with high capacity disk drives, both 5.25" and 3.5", have the System software and Maintenance programs included on a single "System" floppy disk. A separate Maintenance Disk is not required. Therefore, once the EMU-1 Emulator is installed using the @BACKUP command, the Maintenance Programs have also been copied to the SD card and are available just as they were from the original Excellon System floppy disk.

Maintenance Programs - Low Capacity Drives

All machines with low capacity floppy disk drives originally came with a "System" (boot) disk and a second, separate, "Maintenance" disk. The Maintenance (Diagnostic) disk for System Software Release 2.8 is included in the file CNC6SYS2.HFE on the SD card shipped with the EMU-1. These Maintenance files are not modified during the Installation of the Emulator. Only the file CNC6SYS1.HFE is over-written with the System files for the particular machine in which the Emulator is being installed.

There is a small pushbutton switch protruding out the back of the printed circuit board near the SD card and LED. This switch selects either the System files or the Maintenance files on the SD Card. To access the low capacity Maintenance Disk, after the machine has booted from the SD card, press the small pushbutton switch once. This will step the EMU-1 from CNC6SYS1.HFE to CNC6SYS2.HFE which is a complete copy of the original, low capacity, Maintenance disk. Pressing the switch again will return you to the System files in CNC6SYS1.HFE.

If the machine requires a different Maintenance disk from software release 2.8 the CNC6SYS2.HFE file should be over-written with the correct data. The entire contents of a different Maintenance disk can be copied to CNC6SYS2.HFE using the @BACKUP command.

Warning: First make sure you have a good, backup copy of all the files on the SD card.

1. Make sure jumpers on Emulator are in "Setup" position.

2. Boot the CNC-6 from a floppy "System" disk.

3. Enter @BACKUP on the keyboard.

4. Do not remove the System Disk yet. Follow the instructions on screen.

5. When you're instructed to "Place original – (disk being COPIED) – in – drive D1", remove the System disk and insert the Maintenance floppy disk in the System drive.

6. Press the button on the Emulator once, quickly, to switch from CNC6SYS1.HFE to CNC6SYS2.HFE. Then follow the instructions on the screen of the CNC6 to copy all Maintenance Files from the original floppy disk to the SD Card.

When you are finished copying the Maintenance disk, press the button on the Emulator once again and hold for about 2 seconds. The EMU-1 will return to System files stored in CNC6SYS1.HFE.

Each time you press the button on the Emulator it will switch back and forth between the copies of the System disk and the Maintenance disk. If you're not sure which disk image is selected either use the ZOS directory command (DIR,D1:) to view the contents or simply press and hold the button for a few seconds to reset the Emulator.

Another alternative is to completely "power down" the entire machine and then turn it back on. The Emulator will always come up ready to load the Excellon operating system from CNC6SYS1.HFE if the machine has been turned completely "Off".
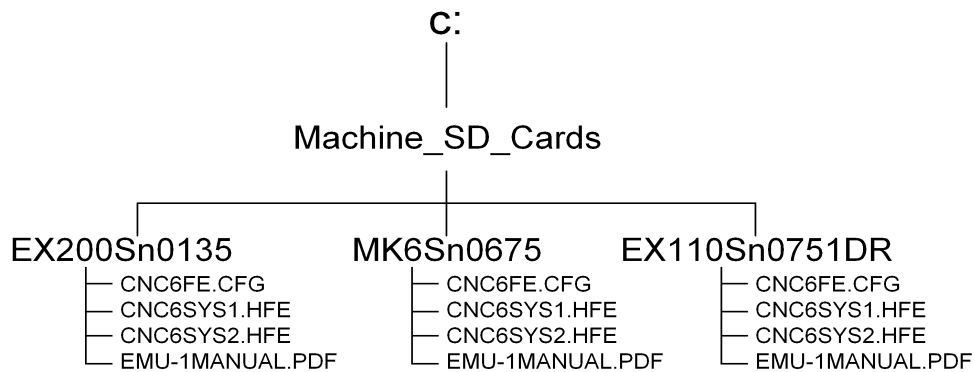
SD Card Size

The amount of data which can be stored on even the smallest available SD card is far beyond the needs of the CNC-6. The smallest SD card you can buy today is probably 2 GB. There is no need for anything larger. However, if necessary, you can use any size SD or SDHC card available - provided that it works correctly and can be formatted FAT-32.

Backup The SD Card

Once you have the machine functioning correctly and all the system files copied to the SD card, it is very important that you backup the entire content of the Emulator. This can be done on any modern PC running Microsoft Windows. If the computer does not already have a slot for SD cards you can use an USB to SD adapter. These devices are readily available at most stores that sell computers including WalMart, Target, and Radio Shack, for less than $25.00.

If the drill room file server computer is accessible, it is generally one of the best places to create and save your backups for each machine.

1. Create a subdirectory named "Machine_SD_Cards"

2. Then, under this subdirectory create separate folders for each machine. We recommend the folder names indicate the model of the machine and its' serial number.

3. Lastly copy the entire contents of the SD card for each machine to its' appropriate folder. There should be four files for each SD card.

```
                               c:
                                │
                        Machine_SD_Cards
             ┌──────────────────┼──────────────────┐
      EX200Sn0135          MK6Sn0675          EX110Sn0751DR
        ├── CNC6FE.CFG        ├── CNC6FE.CFG       ├── CNC6FE.CFG
        ├── CNC6SYS1.HFE      ├── CNC6SYS1.HFE     ├── CNC6SYS1.HFE
        ├── CNC6SYS2.HFE      ├── CNC6SYS2.HFE     ├── CNC6SYS2.HFE
        └── EMU-1MANUAL.PDF   └── EMU-1MANUAL.PDF  └── EMU-1MANUAL.PDF
```

It is also a very good idea for your I.T. department to make another backup of this critical machine software somewhere else. If you lose it, it could be difficult, time consuming, and expensive to re-create your Excellon software.

Trouble Shooting Tips

Four files are provided on the SD card included with each new EMU-1 Emulator. The first, CNC6FE.CFG, is a configuration file which automatically sets up the Emulator for the Excellon CNC-6 controller. Never attempt to modify this file.

Once the Emulator has been installed and the ZOS @BACKUP command executed, the file CNC6SYS1.HFE always contains a complete copy of the original Excellon system floppy disk used to boot and run the machine.

After the machine has been booted from the SD card, you can use the ZOS DIR command to see the individual files contained in CNC6SYS1.HFE. You can also edit these files with the CNC-6 keyboard, just as you normally do when the machine is booted from a floppy disk rather than the Emulator.

While viewing the contents of CNC6SYS1.HFE on the CNC-6 you can display and edit the individual Excellon files which were on both sides of the original floppy disk. However, when you remove the SD card from the Emulator and view the files on a Windows computer, you cannot access the separate files contained in CNC6SYS1.HFE. You can only read and write the entire file in the Windows environment. However, you can manipulate the files any way you choose on a Microsoft network including creating new, fully functional, SD cards for the Emulator and transmitting the files over the internet around the world.

If The Floppy Disk Drive is Bad - Use A Different Machine To Setup The Emulator

To copy the Excellon system software to the SD card you must have both a working floppy disk drive in the CNC-6 (system drive – on the left) and a good, bootable, "System" floppy disk. If you suspect the floppy disk drive in the first machine is bad, but the floppy disk is OK, you can use another machine with the same type and size of floppy disk drives to setup the EMU-1 Emulator. Then remove the Emulator and SD card from the 2nd machine and insert it into the first machine. Unless there are other problems, the first machine should boot up and operate properly.

1. Move the jumpers on the EMU-1 to the "Setup" position

2. Install the Emulator in a 2nd, different, machine which has the same type of floppy disk drives as the 1st machine you are working on.

3. Boot the 2nd machine from the System Floppy Disk for the 1st machine. The 2nd machine probably will not run from the system software for the 1st machine. However, it should boot up to the point where you can use the @BACKUP command.

4. Use @BACKUP to copy all the files on the system disk for the 1st machine to the SD card in the emulator which is temporarily installed in the 2nd machine.

5. Remove the Emulator from the 2nd machine.

6. Move the jumpers on the EMU-1 to the "RUN" position.

7. Insert the Emulator in the 1st machine and boot from the SD card.

The 1st machine should now be up and running correctly.

Editing The System Software

It is not unusual to discover that the files on a working, bootable, System floppy disk need to be edited, copied, or even deleted to make the machine run correctly. You should be able to do this by reading and writing to the floppy disk using the keyboard commands and editor included in the Excellon operating system. The problem has always been that if you try to make corrections and the floppy disk or the disk drive is not working correctly, you may very well end up making matters worse – even though you did everything right ! Now there's a better way.

1. Copy the entire floppy disk, problems and all, to the SD card in the EMU-1 Emulator (@BACKUP).

2. Move the jumpers and boot the machine from the Emulator with the SD card.

3. Then modify the files on the SD card using exactly the same technique as you did in the past for floppy disks.

You will find that everything works better and the results are much more reliable using the Emulator and SD card.

Creating A Bootable Floppy Disk From the SD Card

If you need a good, clean, copy on an Excellon format floppy disk, you can use the @BACKUP command to write from the SD card to the parts program floppy disk drive in the CNC-6 - provided the disk drive is still good. If not, there is no practical way to create a new floppy disk on this machine. However, you could move the Emulator temporarily to a different machine with a good drive and then make your copies.