
Vcc
2010
A Tandy Color Computer 3 Emulator for Windows
Cause we're still preoccupied
with 1985

Welcome to VCC

(Virtual Color Computer)

The Color Computer 3 was the last of a line of micro-computers designed by, and distributed through Radio Shack stores, released in 1986, it developed a rather large and loyal following that continues to this day. Some of the system's specs are as follows.

- 64k system memory, 128K via bank switching.
- 512K upgrade available from Radio Shack as well as 1, 2. & 8 meg memory upgrades from 3rdparty vendors.
- 32, 40, and 80 column hardware text modes.
- Hi-res graphics resolutions up to 320x225 at 16 colors and 640 x 225 at 4 colors.
- Clock speeds of 0.89 and 1.78 MHz. Software selectable.
- Super Extended Color Basic ROM.
- Color Computer 2 compatibility mode.

Unfortunately in 1991 Tandy decided to discontinue the line.

Strangely lack of support didn't seem to deter the fans. Third party vendors stepped in to fill the void. New products were and are still being developed. Today you can buy 512k memory cards, IDE and SCSI hard disk interfaces and faster, more powerful CPUs in the HD63B09E. There is even a free user supported Multi-tasking Multi-User OS (NitrOS9) available for this poor little 2 decade old 8 bit machine.

VCC is a Tandy © Color Computer 3 emulator that runs on the Windows© operating system (Windows XP or greater). It attempts to simulate the hardware that comprised this system. As such it allows software written for this 20+ year old computer to run on modern hardware. Please take a moment to read this guide to discover some of the features and yes shortcomings of this emulator.

If you have ever used an emulator before you should have no trouble understanding most of VCC's functions, however there are some differences that you should be aware of. VCC not only attempts to emulate the hardware of the coco3 but also its organization. As such VCC only emulates the Coco 3 with no peripherals. Expansion is possible via a system of run-time loadable plug-ins that emulate the various add-in card that were/are available. Sort of an Emulator within an Emulator. See the section on Loadable Modules for an explanation of this.

Joseph Forgeone

Copyrights

All code that comprises this emulator was written by Joseph Forgeone and is under the “GPL3” license with the following exceptions:

The RGB to composite color conversion algorithm, Floppy disk CRC algorithm and the 32x16 font set were stole…. umm borrowed! from M.E.S.S. The MESS source was also a valuable source of technical information, without which, this emulator would not be as good as it is today.

The “Becker Port” implementation was patched by Aaron Wolfe and David Ladd, giving “VCC 1.4.3b” the ability to communicate to the host PC via the DriveWire4 protocol and since then, in VCC 2.0.1, the Becker Port was moved to a cartridge emulation “becker.dll” and must be loaded into the MPI.

The “MS Visual Studio 2015 Community” port of the old “MS Visual C++ 6” sources was done by Gary Coulborne (Thanks Gary!) and is allowing VCC to now move forward on the more “modern” versions of Windows.

Various bugs cropped up in the move from VS6 to VS2015, and Wes Gale stepp in to lend a hand at getting the code usable.

The HD6309 code was unfinished and incomplkete and was finally put in place by Walter Zambotti

VCC is maintained by the VCCE Open Source Project Team:
Joe Forgeone
Gary Coulborne
Wes Gale
Bill Pierce

The home of “VCC 2.0.1c” is:
https://github.com/VCCE/VCC/releases

Where you will find the latest binary downloads as well as the sources for VCC.

Forward

VCC version 1.4.2 was originally written by Joseph Forgeone. In or about 2012, several of the Coco Community had contacted Joseph about VCC since he hadn't updated the software in several years. Joseph informed us that he would like to release the VCC source files to the public as an "Open Source Project" so that it could be enhanced by others. His desire was to remove the Tandy ROMs (for copyright reasons) and make small changes in his copyrights before releasing the sources. He told us he should have it ready for release in a couple of months. As a "token of good faith", he offered to send us the sources to "play with" until he made his release. After that, Joseph seemed to disappear from the map. He had not replied to many emails nor could any posts be found on any of the forums as he was a regular on some Coco forums. He seemed to have disappeared into thin air.

As the events above describe, several of us ended up with sources to VCC. No, we could not release these sources without Joseph's permission. But in frustration of the situation, holders of the sources started "playing" with them as Joseph had suggested. The main goal being to add support for the Becker Port system developed by Gary Becker as well as to fix a few minor known bugs. Since Joseph could no longer be contacted, the decision was made to release some changes to VCC only in "binary" form in executable packages therefore keeping the sources from public view. Thus VCC 1.4.3b Beta w/Becker Port was born.

As the "Becker Port" patch eventually started causing a few *internal* problems in VCC, the Becker Port developers decided to move the port to an external "cartridge port" as a "Rom Cart", therefore removing all *internal* influences of the Becker Port to VCC. So now, to use the Becker Port, you must load the "becker.dll" into either VCC's cartridge slot or a slot in VCC's MPI. I find this new implementation of the Becker Port to be much more stable than the original version.

ENTER JOESEPH FORGEONE...

Several of the Coco community decided that after a couple of years of not hearing from Joseph (VCC author), that they would follow his intentions and release the VCC sources as an "Open Source Project". In doing so, we decided to make a public announcement in advance to allow anyone having claims to the copyrights of VCC to step up. Amazingly, the first person to reply was Joseph Forgeone!!
Not only did we get the "VCC Open Source Project" started, but we did so with Joseph on board and contributing to the project. We have now moved the VCC sources from the old "MS Visual Studio 6" programming environment into the "MS Visual Studio 2015 Community" programming suite which is a free download from the Microsoft website. The VCC sources can now be compiled in Windows 7, 8, & 10.

Needless to say, we now have a new release of "VCC 2.0.1" which should be much more compatible with modern versions of Windows. Hopefully in the future, there will be new enhancements, bug fixes and there are plans to port the code to Linux and Mac operating systems.... The future is bright for VCC!!

VCC 2.0.1 consists of a new "Becker Port" program cart emulation which allows the cart to be used as a gateway to the outside world. The main goal of this was to have a way to send serial data to the "DriveWire4" file server system on the host PC. This allows VCC access to the host PC file system to utilize the use of virtual floppy disks and virtual hard drives as well as the many new functions of DriveWire4 such as Virtual Printers, Remote Terminals & DriveWire4 MIDI. It is beyond the scope of this document to explain DriveWire4. The documentation for DriveWire4 can be found at "https://sites.google.com/site/drivewire4"

Note: All references to "DriveWire" refer to "DriveWire4" and *not* "DriveWire3" by Cloud9. DriveWire3 does not support communication through a TCP port connection and therefore cannot be used with VCC 2.0.1 and the Becker Port interface.

This document is meant to be an enhanced version of Joseph's original VCC User's Manual with expanded content that was never added to the original manual as well as documentation on setting up VCC for using the Becker Port with DriveWire4. Hopefully, it will cover a larger amount of information than Joseph's original document with more information on the operation of VCC 2.0.1. It is my goal to make VCC 2.0.1 as easy to use

as possible so that everyone can enjoy this package as much as I have, as I am an avid user of VCC 2.0.1 as well as the “real” Color Computer 1, 2, & 3 hardware. As new developements are made on VCC, I hope to expand this manual as needed.

As one last note: VCC 2.0.1 is *still* in a BETA state and by no means is a finished product. As of this release (v2.0.1c), very few things have been changed from the original. The largest change being the move from the “Microsoft Visual Studio 6” programming environment to “Microsoft Visual Studio 2015 Community”. This change alone opens doors for newer programming techniques and a more *modern* programming environment. There are still many bugs to be worked out and enhancements to be added. It is this very reason the VCC Color Computer 3 emulator has been released as an open source project in hopes that outside contributors and/or programmers will get involved and help this become the best Color Computer 3 emulator available!

Enjoy ☺
Bill Pierce

Introduction

VCC 2.0.1 w/Becker Port support is a small move forward in the Color Computer 3 emulation. The emulator covers many aspects of the Color Computer 3 hardware. The author has tried to keep the "look and feel" of the real machine while maintaining a sense of a newer and better machine. There may be a few bugs lurking in the remenants of the old C code, but for the most part, the emulation is still one of the best Coco 3 emulations available. Currently, work is underway to convert VCC to *multi-platform* software, enabling VCC to be run on Windows, Mac, Linux and possibly even Mobile Devices. If this is accomplished, we will have a Coco 3 emulator available for most *modern* systems.

System Requirements

Currently, VCC 2.0.1 runs only under Microsoft Windows but has been successfully be installed on Linux systems using the Wine Windows emulation package for Linux as well as "Winebottle" on Mac. I do not know too much about these installations, but I am told they work well.

The Windows requirements are:

1. Microsoft Windows XP SP2 or greater (Windows Vista, 7, 8, & 10 are supported).
2. A Hard Drive large enough for the Windows OS and the VCC installation as well as space for any Coco ".dsk" (virtual floppy disk images) and ".vhd" (virtual hard drive images) files you plan to be using. Also you will need space for DriveWire4 if you are planning to use this system as well. Today's *modern* computers have no problem with storage space with their large capacity storage systems.
3. On older Windows systems (XP), I suggest at least 512 meg of memory. On newer systems (Vista and greater), I suggest at least 1 gigabyte or memory, and 4 gigs for heavy users, especially if using DriveWire4.
4. DirectX 9 or greater. Most Windows PC graphics systems will work well with VCC. (some newer versions of Windows may need the "DirectX 9 runtime" dll).
5. If you are using VCC 2.0.1 with DriveWire4, an internet connection is also desirable (but not mandatory). We'll get into this later.

VCC Installation

VCC 2.0.1 is distributed in a self-installing executable package. Just “double click” the “VCC 2.0.1 setup.exe” and follow the prompts. Windows will install all components and provide a Desktop icon for starting VCC.

If you want to install VCC in a different location than the default, choose the “Custom” option when installing, otherwise, VCC will normally install to “C:\Program Files (x86)” on your hard drive.

Setting up and Configuring VCC

VCC allows several setup configurations with RGB or Composite monitor emulation, 6809 or 6309 CPU, from 128k to 8 megabytes of memory, and many others. In these next sections I will try to step through each option and explain its function.

NOTE: On most *modern* Windows systems (7, 8, & 10), you may need to give VCC Administrator’s permission for VCC’s internal system to maintain its “vcc.ini” file. This is due to VCC storing the “vcc.ini” file in the app folder. Most recent versions of Windows do not like you modifying files in the Programs folders and will only do so when the program is run with administrator’s permissions. To get around this, once VCC is installed, *right-click* on VCC’s icon on your desktop and select “Properties”. In the “Properties” dialog under the “Compatibility” tab, check the “Run as Administrator” checkbox, then click “Apply” and close the dialog box. VCC should then have no problems maintaining its “vcc.ini” file. We hope to fix this inconvenience in a future release of VCC.

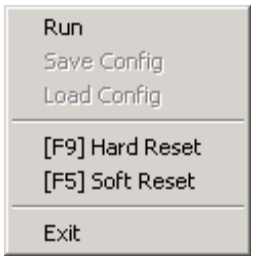
The MenuBar

The MenuBar resides across the top of the VCC window. Here you'll find the various functions of the VCC emulator. All of VCC's options start here. No *command line* parameters are needed (or wanted).
The Menu choices and their options are:

File, Configuration, Cartridge, & Help

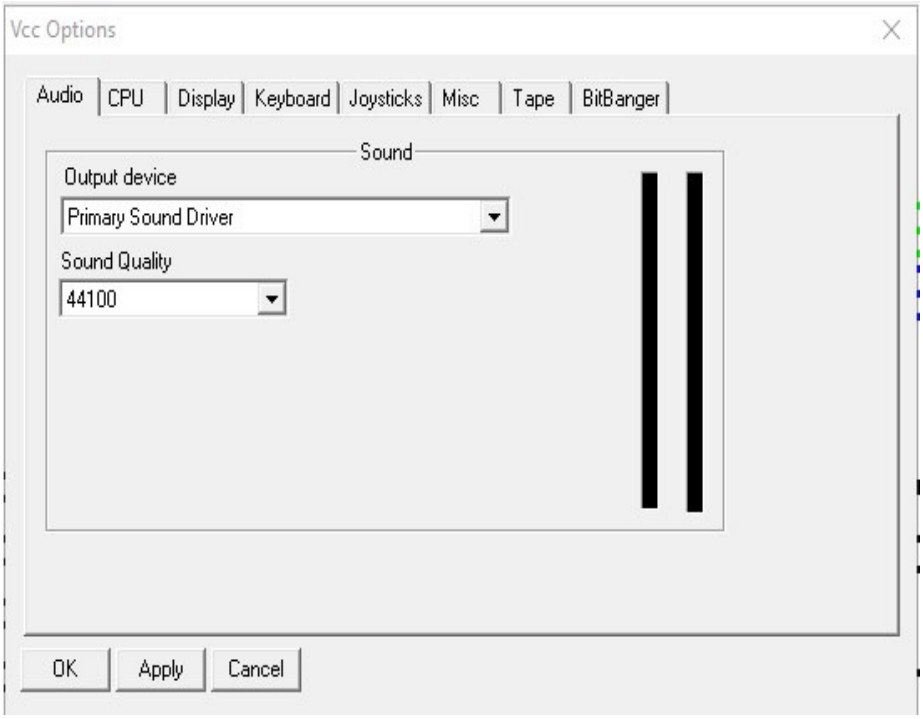
I will now break down these menus into their various components and attempt to explain their functions.

- **File** – These options are the basic operating functions of VCC



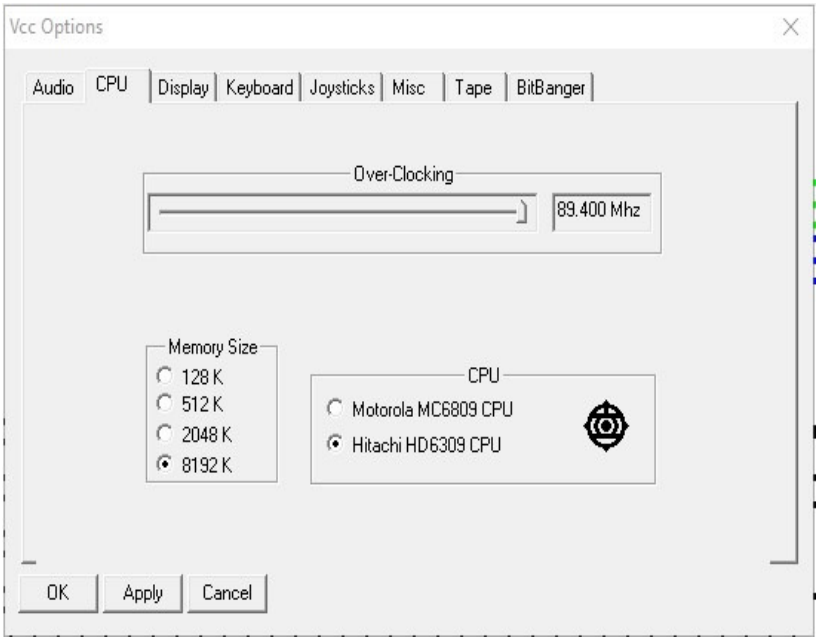
  - **Run** – If the "Configuration/Config/Misc/AutoStart Emulation" box is unchecked, this selection will start the Coco 3 emulation. If the box is checked, emulation will start when VCC starts and this selection does nothing. Consider it a "Power Button" of sorts. This is also invoked by the "F9" function key.
  - Save Config – Disabled (VCC actually auto saves the config file). Originally, Joseph was going to allow you to save and load different Coco 3 configurations. But alas, the feature was never finished.
  - Load Config – Disabled (VCC actually auto loads the config file)
  - **[F9] Hard Reset** – Hitting [F9] twice simulates switching the power to the Coco "Off" then "On" again. You must hit [F9] two times to complete the cycle. Anything in memory will be lost.
  - **[F5] Soft Reset** – Hitting [F5] simulates pressing the "Reset" button on a real Coco 3. The results are the same as a real Coco. Anything in memory will be preserved.
  - **Exit** – This ends the VCC emulation and returns you to Windows. Any unsaved data and or programs will be lost as the program ends with no prompts and control returns to the Windows OS.

- **Configuration** – This menu tab contains only one item, but most "configuration" items reside here.
    - **Config** – This sub-menu contains a tabbed panel with most of the config items. On each of these panels, you must click "Apply" for your changes to take place. Clicking "OK" will also finalize your choices, but also exits the "Config" menu.
        - **Audio** – This controls VCC's audio emulation.



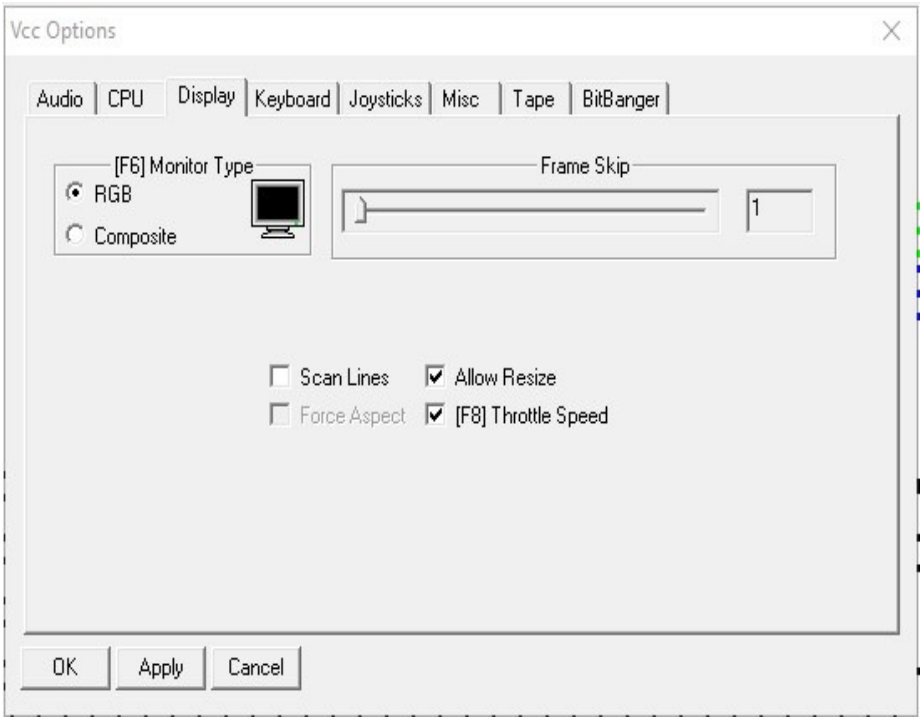
        - **Sound** – VCC's sound controls
            - **Output Device** – A pull down menu to select the Windows sound device for VCC to use for the Coco's 6-bit DAC and Orchestra 90 sound.
            - **Sound Quality** – Select the frequency resolution for your PC's soundcard (normally 44100).
            - **VU Meters** (vertical bars to the right) – These meters are a visual representation of the sound volume in VCC

- **CPU** – This tab is where you select the CPU type used in VCC and the memory size of your Coco 3 emulation.



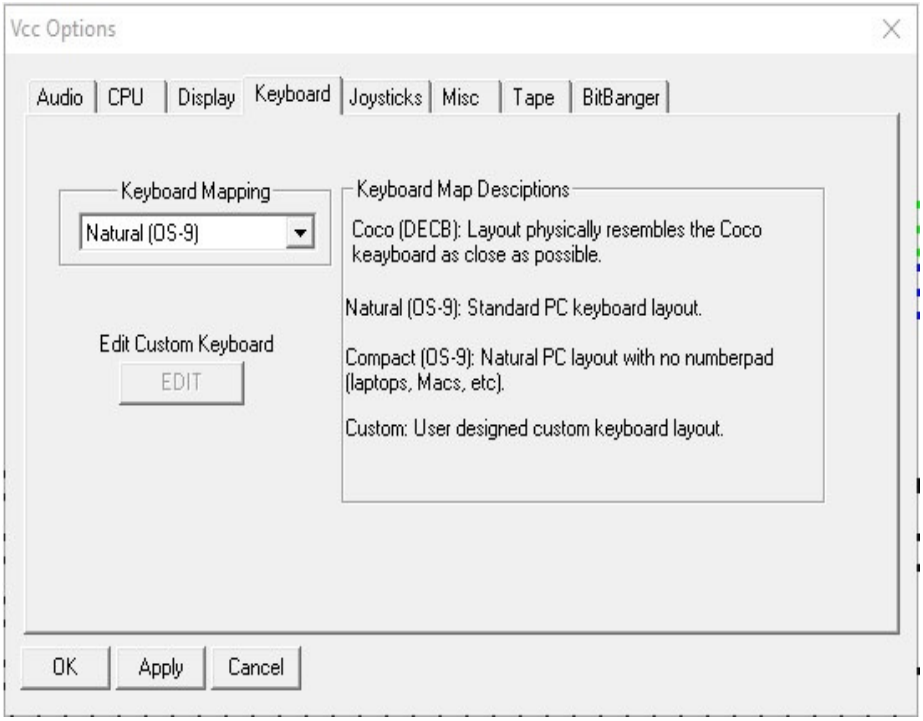
  - **Over-Clocking** – Speeds up the CPU cycle speed but does not affect the internal clock speed. This can speed up text scrolling and graphics functions as well as some aspects of disk access. The slider can be adjusted from 1.78 MHZ (normal Coco 3 speed) to 89.400 MHZ which is ridiculously fast. Over-clocking the CPU to extremely high speeds may not work well on older PCs. Use with caution.
  - **Memory Size** – Select the memory size for your Coco 3 emulation
    - **128 K** – The stock Coco 3 memory size.
    - **512 K** – Emulates a Coco with the 512k upgrade
    - **2048 K** – Emulates Disto's 2 meg memory board
    - **8192 K** – Emulates Paul T. Barton's 8 meg memory board
  - **CPU** – This option allows CPU selection for your Coco 3
    - **Motorola MC6809** – The standard Color Computer 6809 CPU
    - **Hitachi HD6309** – Emulates use of Hitachi's HD68B09 CPU. Slightly faster than the 6809 with an enhanced instruction set. This CPU was a popular mod for Coco users in the early 1990s.

- **Display** – Here you set the display type of your Coco 3 emulation.



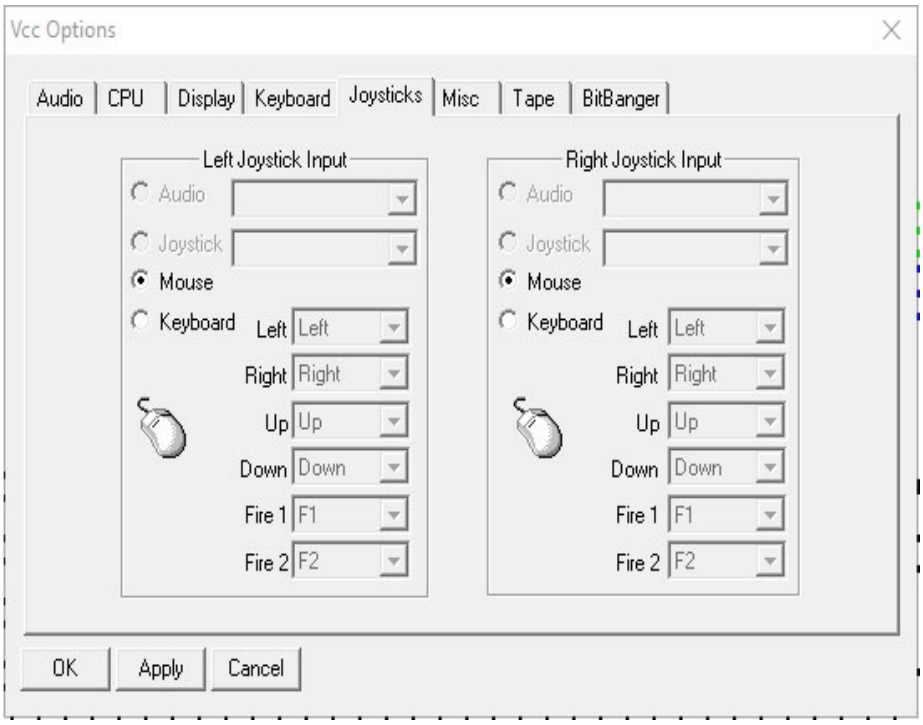
  - **[F6] Monitor Type** – Select the monitor type you want to emulate.
    - **RGB** – Emulates the use of the Tandy CM-8 RGB monitor
    - **Composite** – Emulates the use of a composite monitor or TV. Mostly used when "artifact colors" are desired.
  - **Frame Skip** – Selects how many frames to skip in the video scans. Mostly used for older, slower PCs with cheap graphics cards.
  - **Scan Lines** – used to simulate the scan lines seen in a TV display.
  - **Allow Resize** – Checking this option allows you to resize the VCC window, not checked will result in the default window size only. This needs to be checked to allow VCC to be run in a "maximized" window.
  - **Force Aspect** – Disabled at the moment, but we hope to have this feature operational soon.
  - **[F8] Throttle Speed** – Un-checking this box allows VCC to run at the full speed of the host PC. This is *not* desirable in most situations, but does have its uses. In most cases, un-checking this will cause *double* & *triple* keystrokes.

- **Keyboard** – Only one selection resides in this tab



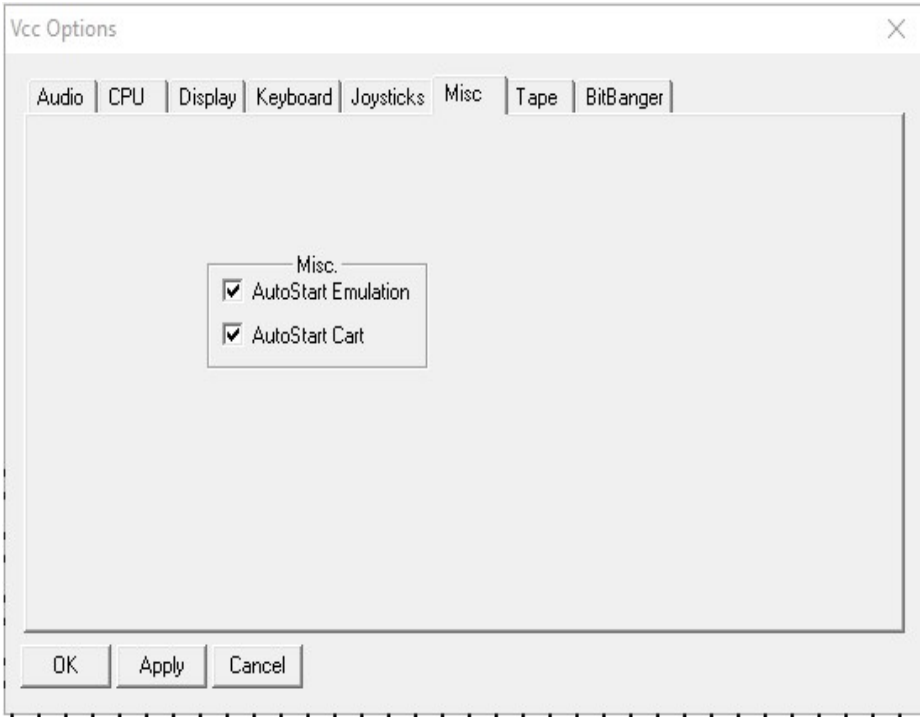
  - **Keyboard Mapping** – Here you select "Basic" or "OS-9" keyboard emulation.
    - **Coco (DECB)** your PC's keyboard is mapped in a layout similar to an actual Coco 3 keyboard.
    - **Natural (OS-9)** your PC's keyboard is in its "normal" state with the exception of a few special keys (later).
    - **Compact (OS-9)** same as above (PC), but with a few keys altered to compensate for missing keys on laptops and hopefully in the future... IPads and Android devices.
    - **Custom** – Disabled at the moment, but soon to be activated. This feature will load a user created custom keyboard layout.
  - **Edit Custom Keyboard –** Also disabled but soon it will allow you to edit the keyboard layout to your liking. You will beable to create multiple custome layouts.

- **Joysticks** – This tab contains controls for using the mouse or keyboard as Coco joysticks.



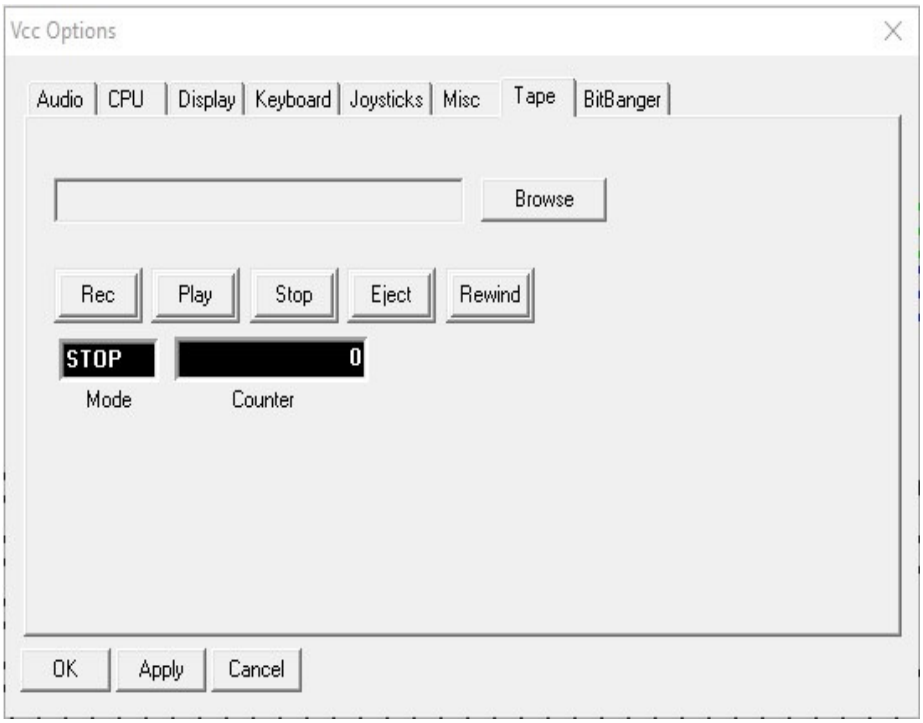
  - **Left Joystick Input** – Set's the left joystick emulation.
    - Audio – Disabled. In the future, this is hoped to be used as on the real Color Computer 3 as an *audio input* for recording digital 6 bit audio just as on the real machine.
    - **Joystick** – This option will only be available if you have a real PC type joystick plugged into your PC. Your Joystick should available through the pull down menu.
    - **Mouse** – Allows use of the PC's mouse as the left Coco 3 joystick.
    - **Keyboard** – Allows the user to select custom keyboard keys as the various joystick directional controls.
  - **Right Joystick Input** – Same as above but for the right Coco 3 joystick port.

- **Misc** – Set the cartridge emulation type.



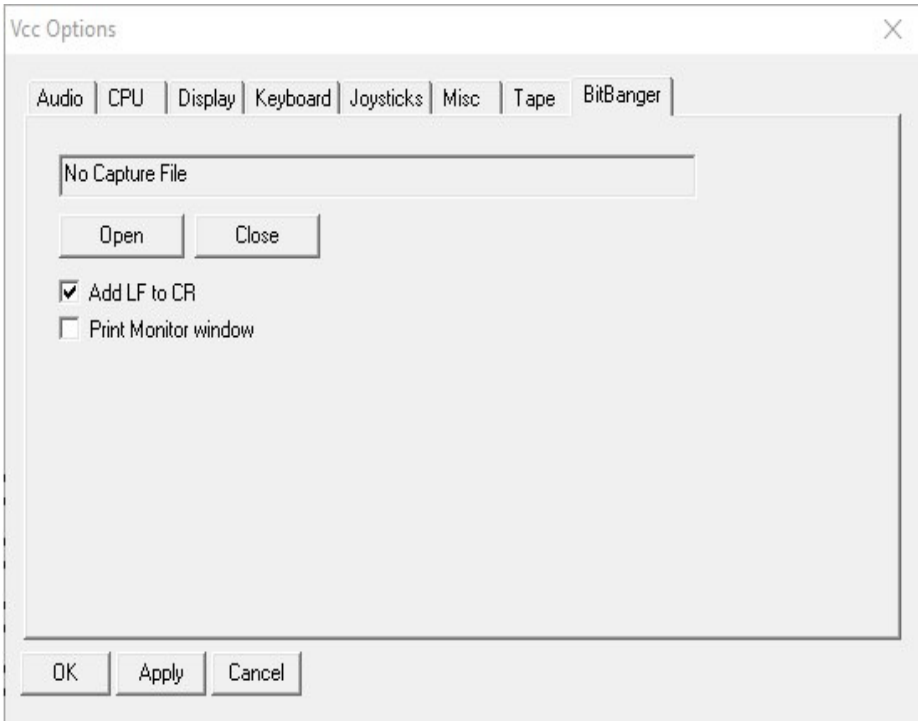
  - Misc
    - **AutoStart Emulation** – Unchecked starts VCC in an "Off" state. You must press "F9" to turn the emulation on. Checked, VCC will start with the power "On".
    - **AutoStart Cart** – Unchecked, program paks will not "autostart". This simulates "taping" the cartridge detect pin on a cart. This is useful for using the Orchestra90 cart emulation for stereo sound. I did this same thing on my real Coco to use Orch90 for sound output back in the 80s. Checked, all carts will autostart as normal. When using the MPI (MultiPak Interface) module, the carts will only autostart when the MPI slot switch is set to the slot in which the cart is inserted.

- **Tape** – This tab is for the cassette tape emulation in VCC. As a note, the BASIC commands "MOTOR ON/OFF" and "AUDIO ON/OFF" do not affect the VCC tape recorder as on a real Coco.



  - **Browse** – this button allows you to *browse* your PC for ".cas" or ".wav" files of recorded cassette tape format programs. The 2 types differ in their formats as follows:
    wav - An 8 bit, 44.199 khz audio recording of the actual cassette file. The file MUST be 8 bit & 44.199 khz (see blow).
    cas - A specially encoded, digital representation of the program data. This format is much more compact than wav and loads much faster.
    WARNING: If you use ".wav" files, be warned, if the ".wav" file is *not* recorded in "8-bit, 44,100 khz", VCC will mangle the file just by loading it, you don't even have to "play" it. Most "standard" wave files are in 16-bit, 44,199 khz. These will not work in VCC and even if you just browse to them and select them into the tape interface, VCC will try to convert them to 8-bit and ruin the file. This issue is being looked into. You were warned.
  - **Record** – Sets the tape emulation to record. The tape will stay on "pause" until you issue a "CSAVE" or "CSAVEM" command from basic.
  - **Play** – Sets the tape player to "play" and as above, stays on pause until a "CLOAD" or "CLOADM" command is issued fro BASIC.
  - **Stop** – This will stop the recorder just as on a real tape deck. It will not respond to any BASIC commands while stopped. The current "cas" or "wav" file remains in the buffer.
  - **Eject** – This button closes then "unloads" the tape file from VCC. You will no longer have access to this file until it's loaded again.
  - **Rewind** – This will rewind the "tape" file to the beginning of the tape.

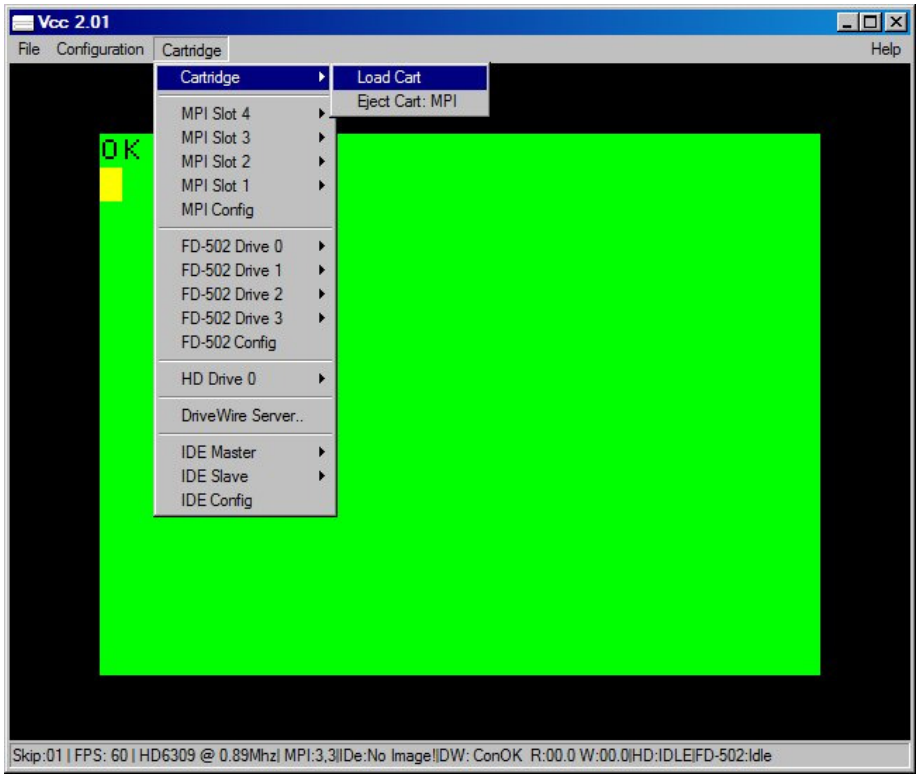
- **BitBanger** – This tab is the emulated "serial" port on the VCC Coco 3.



  - **Open** – This button "opens" a selected capture file. Any data sent to the serial port will be sent to this file in raw ASCII format.
  - **Close** – This closes the serial capture file.
  - **Add LF to CR** – Checking this item will cause VCC to add a Line Feed character to every Carriage Return VCC encounters while sending data to the capture file. PC text files use CR/LF as a standard where the Coco uses CR alone.
  - **Print Monitor Window** – Opens an extra window panel on your Windows desktop that will display any data sent to the bitbanger port.

NOTE: The "DriveWire4" server features that were available here in "VCC 1.43b" have now been moved to the "Becker.dll" rom cart emulation. To access the DW4/Becker Port features , you must insert the Becker cart into the cartridge slot or a slot in the MPI (Multi Pak Interface).

- **Cartridge** - The "Cartridge" selection is an emulation of the Coco's cartridge slot in that here, you will insert ROM images or special (included) cartridge dll files emulating various Coco controller carts, such as, the Multipak Interface, Orchestra 90, the FD-502 disk controller, several HD controllers, and the Becker Port cart. Each cart emulation may or may not add items to the "Cartridge" menu. I will try to list these additions below. The full description of each cart emulation can be found in the "Loadable Modules" section:



Inserting the mpi.dll module into the emulator cartridge slot results in the following menu:

- **mpi.dll** - Tandy Multipak Interface. Allows insertion of up to 4 cart dlls
  - **MPI Slot 4** - Slot 4 of the MPI (duh!)
  - **MPI Slot 3** - Slot 3 of the MPI
  - **MPI Slot 2** - Slot 2 of the MPI
  - **MPI Slot 1** - Slot 1 of the MPI
  - **MPI Config** - Configures the MPI settings

Inserting these cart images into the MPI slots or the Cartridge slot results in the following menu additions:

- **fd502.dll** - Tandy FD-502 Disk controller
  - **FD-502 Drive 0** - Insert virtual disk images (.dsk) into the drive slots
  - **FD-502 Drive 1 - "**
  - **FD-502 Drive 2 - "**
  - **FD-502 Drive 3 - "**
  - **FD-502 Config** - Configuration utilities for the FD-502 controller

- **harddisk.dll** - Hard drive emulation
  - **Hard Drive 0** - Insert hard drive images (.vhd) here
- **SuperIDE.dll** - Glenside IDE / SuperIDE emulation for using CF card images
  - **IDE Master** - Insert CF (master) card image here (.img)
  - **IDE Slave -** Insert 2nd (slave) CF card image here
  - **IDE Config -** IDE interface configuration settings
- **orch90.dll** - Orchestra 90 Music cart
  - **NONE**
- **becker.dll** - Becker Port emulation for DriveWire4 and TCP communication
  - **DriveWire Server** - Becker Port configuration for DW4

- **Help** - This menu selection has only one choice:

  - **About -** Displays the VCC "About Box" which contains the "Function Key" list and Copyright information.

This concludes the "MenuBar" selections and their uses. I hope my explanations are helpful to the new VCC user.

Function Keys

- **F1 & F2** - By default these are mapped to the F1 and F2 keys on the standard coco keyboard. Alternatively they are the default Fire 1 and Fire 2 when using the keyboard to emulate joystick input in OS-9's "MouseKey" mode.
- **F5** - Soft Reset. Same as pressing the reset button on a real machine.
- **F6** - RGB/Composite toggle. Has the same effect as the Display Dialog setting except that unlike the configuration dialog option, changing this will not save its state to the ini file.
- **F8** - Throttle Toggle. Normally the emulator will try to run at the original 60 frames per second that the real hardware runs at regardless of the speed of the host CPU. This is known as "throttling". Alternatively the emulation can be allowed to run as fast as possible. This key is used to toggle between these two modes. It's useful during long loading or processing tasks to shorten the wait time. Note that unlike the configuration dialog option, changing this will not save its state to the ini file.
- **F9** - Hard reset. Same as pressing the Power button on a real machine. Press once for "Off" and again for "On"
- **F10** - Only used in Full screen mode. In windowed mode there is a status bar at the bottom of program window. In Full screen mode this information is displayed in a band at the top of the screen. This is used to toggle that band on and off.
- **F11** - Switches between Full screen and Windowed mode.

NOTE: Holding "F1" and pressing "F9" twice will reverse the color artifacting in VCC. If you are getting the wrong colors in Composite mode, then this should help.

VCC Keyboard Layout

When the keyboard layout is set to “Coco (DECB)”, the PC keyboard is reconfigured to that of the Coco 3 as close as possible. The “Natural (OS-9)” mode is meant to be the full PC keyboard with a few slight modifications. The “Compact (OS-9)” mode is similar to the Natural mode, but configured for laptop computers with limited keys. The layout looks something like this:

PC Keyboard:

```
[Esc]  [F1][F2][F3][F4][F5][F6][F7][F8][F9][F10][F11][F12]    [Prnt][Scr][Paus]

[`][1!][2@][3#][4$][5%][6^][7&][8*][9(][0)][-_][=+][BkSpc]    [Inst][Hom][PgUp]
[ Tab][Qq][Ww][Ee][Rr][Tt][Yy][Uu][Ii][Oo][Pp][{[][]}][\|]    [Dlet][End][PgDn]
[ Caps][Aa][Ss][Dd][Ff][Gg][Hh][Jj][Kk][Ll][;:]['"][Enter]
[ Shift ][Zz][Xx][Cc][Vv][Bb][Nn][Mm][,<][.>][/?][ Shift ]          [UpA]
[Cntl][Win][Alt][       Space       ][Alt][Win][Prp][Cntl]    [LftA][DnA][RgtA]
```

VCC Coco (DECB) Keyboard:

```
[  ][F1][F2][  ][  ][Rst][RGB][  ][Thr][Pwr][StB][FSc][  ]    [    ][   ][    ]

[ ][1!][2”][3#][4$][5%][6&][7’][8(][9)][0 ][:*][-=][BkSpc]    [    ][Clr][    ]
[    ][Qq][Ww][Ee][Rr][Tt][Yy][Uu][Ii][Oo][Pp][{[][]}][\|]    [    ][Brk][    ]
[ Caps][Aa][Ss][Dd][Ff][Gg][Hh][Jj][Kk][Ll][;:]['"][Enter]
[ Shift ][Zz][Xx][Cc][Vv][Bb][Nn][Mm][,<][.>][/?][ Shift ]          [UpA]
[Cntl][   ][Alt][       Space       ][Alt][   ][   ][Cntl]    [LftA][DnA][RgtA]
```

VCC Natural (OS-9) Keyboard **

```
[BRK][F1][F2][  ][  ][Rst][RGB][  ][Thr][Pwr][StB][FSc][  ]    [    ][   ][    ]

[`][1!][2@][3#][4$][5%][6^][7&][8*][9(][0)][-_][=+][BkSpc]    [INST][Clr][PgUp]
[ Tab][Qq][Ww][Ee][Rr][Tt][Yy][Uu][Ii][Oo][Pp][{[][]}][\|]    [DEL ][EOL][PgDn]
[ Caps][Aa][Ss][Dd][Ff][Gg][Hh][Jj][Kk][Ll][;:]['"][Enter]
[ Shift ][Zz][Xx][Cc][Vv][Bb][Nn][Mm][,<][.>][/?][ Shift ]          [UpA]
[Cntl][   ][Alt][       Space       ][Alt][   ][   ][Cntl]    [LftA][DnA][RgtA]
```

VCC Compact (OS-9) Keyboard

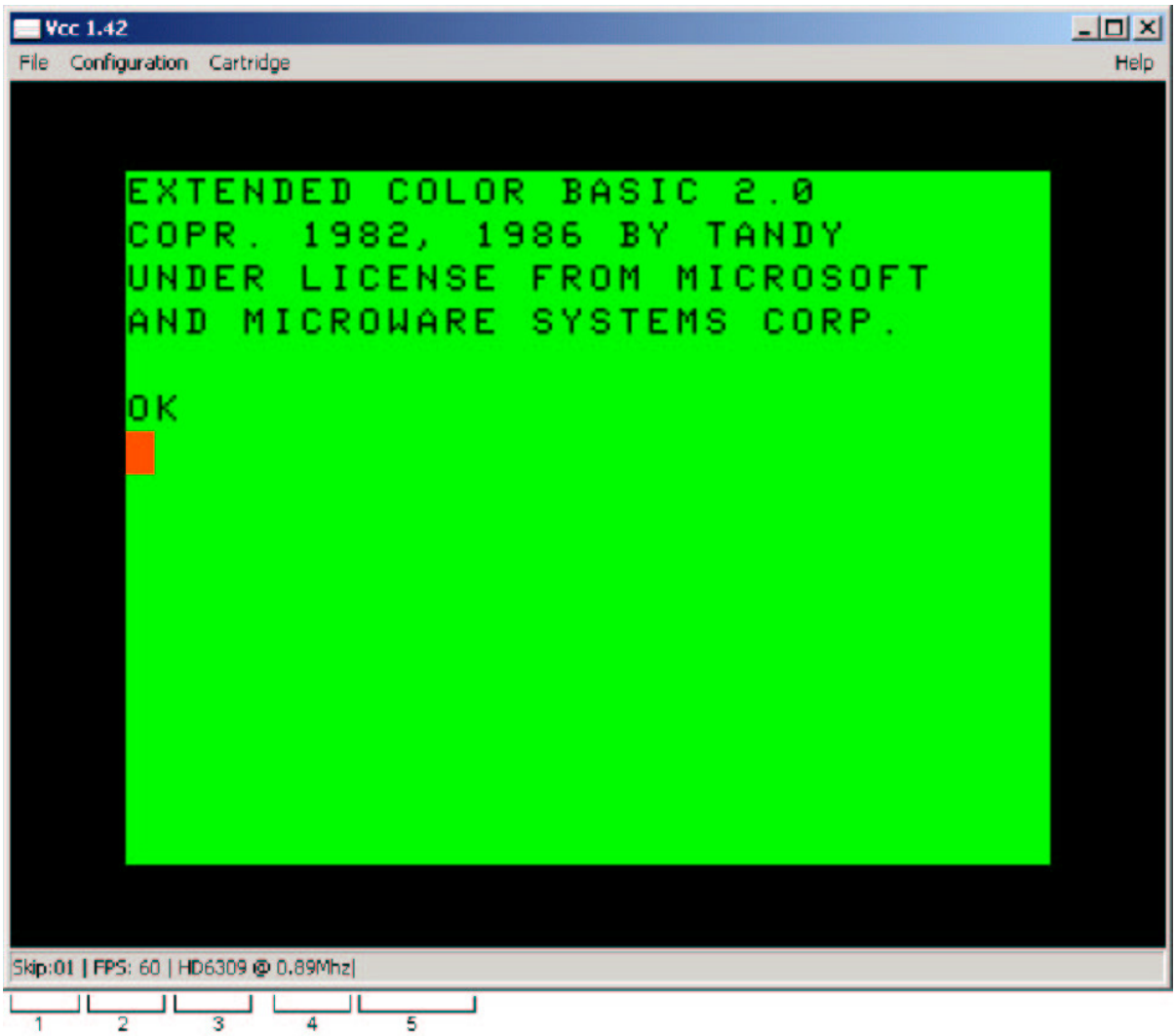
```
[  ][F1][F2][  ][  ][Rst][RGB][  ][Thr][Pwr][StB][FSc][  ]    [    ][   ][    ]

[BRK~][1!][2@][3#][4$][5%][6^][7&][8*][9(][0)][-_][=+][BkSpc][    ][   ][    ]
[ CLR][Qq][Ww][Ee][Rr][Tt][Yy][Uu][Ii][Oo][Pp][{[][]}][\|]    [    ][   ][    ]
[ Caps][Aa][Ss][Dd][Ff][Gg][Hh][Jj][Kk][Ll][;:]['"][Enter]
[ Shift ][Zz][Xx][Cc][Vv][Bb][Nn][Mm][,<][.>][/?][ Shift ]          [UpA]
[Cntl][   ][Alt][       Space       ][   ][   ][   ][Cntl]    [LftA][DnA][RgtA]
```

** Some changes have been made to the “Natural (OS-9)” keyboard layout to better faciliate it’s use in NitrOS9 and some text editors. These changes are:

- <END> has been changed from <BRK> to <SHIFT><RIGHT ARROW> to faciliate the “End Of Line” sequence in NitrOS9 and ShellPlus. Also, in the “Ed 3.1” text editor, this key will now produce a true <TAB>.
- <ESC> is now mapped as <BRK>
- <INSERT> has been mapped to <CTRL><RIGHT ARROW>
- <DELETE> has been mapped to <CTRL><LEFT ARROW>
- <PAGE UP> has been mapped to <SHIFT><UP ARROW>
- <PAGE DOWN> has been mapped to <SHIFT><DOWN ARROW>

The Status Line

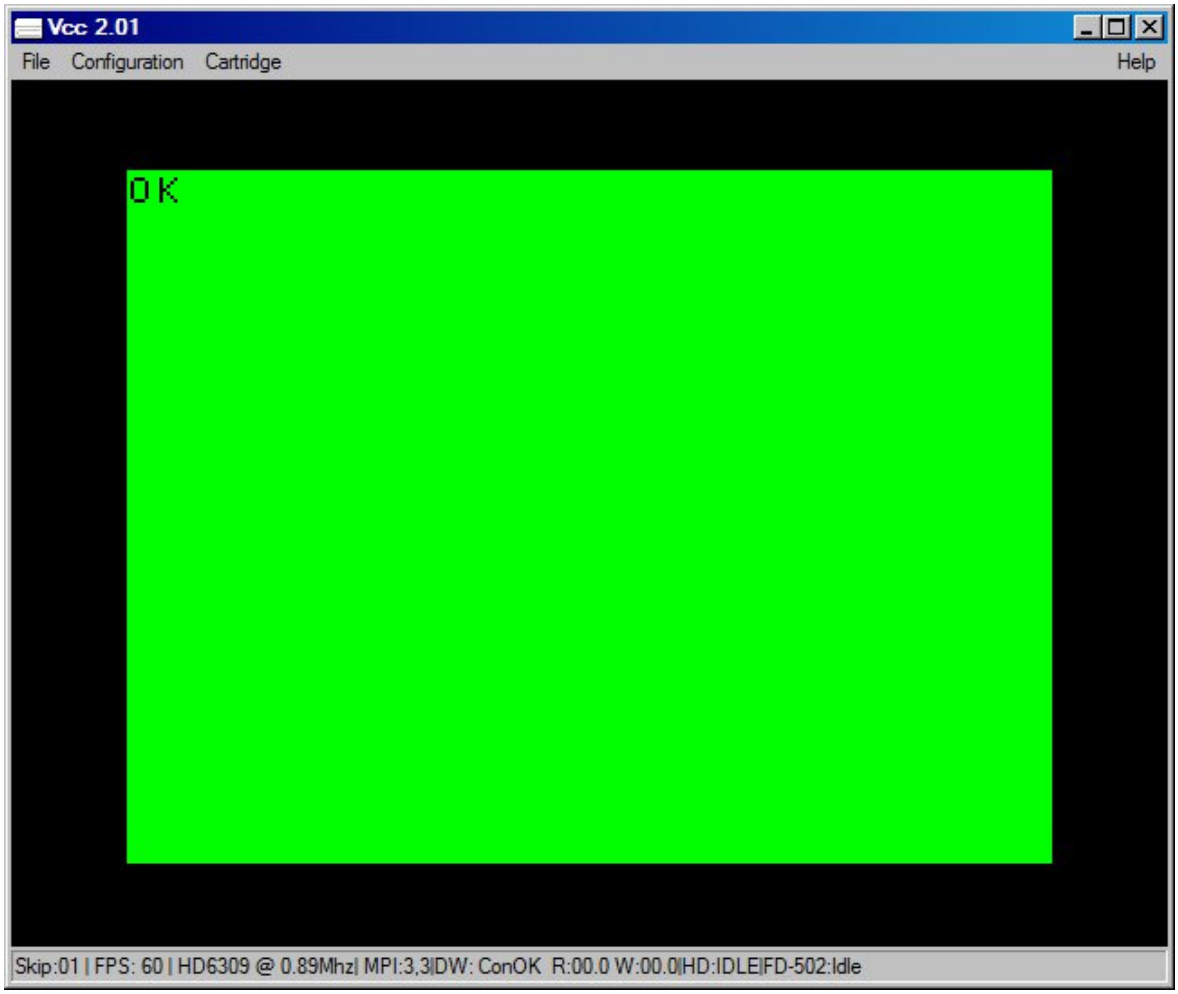
This is a view of the original VCC 1.4.2 screen showing the “status line”.



The status line contains useful information about the status of the emulation.

1. Current frame skip setting. It means draw every nth frame. So 1 is every frame , 2 is every other frame etc.
2. Average frames per second. Should always read 60. If it consistently reads lower try selecting a higher frame skip or turning on scan lines. See the configuration dialogs section.
3. CPU Type currently being emulated. MC6809 or HD6309.
4. Clock speed. .89 and 1.79 MHz are stock. Over-clocking up to 90 MHz is supported.
5. Cartridge data field. Some pluggable carts will also display information on the status line. More on this later.

This is a view of the *new* VCC 2.0.1c screen showing the “status line”.



The status line contains useful information about the status of the emulation.

1. Current frame skip setting. It means draw every nth frame. So 1 is every frame , 2 is every other frame etc.
2. Average frames per second. Should always read 60. if it consistently reads lower try selecting a higher frame skip or turning on scan lines. See the configuration dialogs section.
3. CPU Type currently being emulated. MC6809 or HD6309and clock speed. .89 and 1.79 MHz are stock. Over-clocking up to 89 MHz is supported.
4. Cartridge data field. Some pluggable carts will also display information on the status line. More on this later.
5. DriveWire4 info field. Displays “ConOK” if there is a DW4 connection. The “R” & “W” fields display data as DW4 is accessed (only displays when the “becker.dll” cart is inserted)
6. Hard Drive info is only displayed if the “harddisk.dll” cart is loaded
7. FD-502 info is only displayed if the “fd502.dll” is loaded

Configuring VCC

This section will try to explain the options to configure VCC for normal use.

Setting up VCC 2.0.1 should be as easy as double clicking the VCC setup file icon and following the onscreen prompts. I have tried to make the *default* as close to a "stock" Tandy Color Computer 3, just as you would have bought it in 1986.

Here are the default settings for VCC 2.0.1.

VCC 2.0.1 Defaults:

Configuration/Config

- Audio – Primary Sound Driver. This should default to what ever your PC is using.
- CPU/CPU – Motorola MC6809
- CPU/Memory – 128k (up to 8 meg).
- CPU/Overclocking – 1.788 MHz (stock Coco 3 speed). VCC will actually start at .89MHz with 1.788MHz available through software POKEs.
- Display/Monitor Type – RGB
- Display/Frame Skip – 1
- Display/Scan Lines – Unchecked
- Display/Allow Resize – Checked
- Display/Throttle Speed – Checked
- Keyboard/Keyboard Mapping – Coco (DECB), emulates the Coco 3 keyboard
- Joysticks/Left Joystick - Mouse
- Joysticks/Right Joystick - Mouse
- Misc/AutoStart Emulation – Checked
- Misc/AutoStart Cart – Checked
- BitBanger/Add LF to CR – Checked
- BitBanger/Print Monitor Window – Unchecked

Cartridge

- Cartridge – Empty

This about covers the VCC default settings. You can change most of these settings to suite your needs. The CPU overclocking is particularly handy when running an assembler or compiling "C" code in OS-9. Overclocking also speeds up screen scrolling in text editors as well, but I would not advise using overclocking while running games. It may speed up the emulator enough to make the game unplayable.

Setting Up A "Custom" VCC to Suit Your Needs

Here I will try to explain some of the setup possiblities with VCC. The emulator can be configured many ways and emulate some of the more unique Color Computer 3 settups.
VCC will remember any settings you make and these settings become the "default" fo running VCC in the future.

Using the Multipack Interface

Included with VCC is an emulation of the Tandy Multipack Interface (MPI). To use the MPI, Click the "Cartridge" menu selection at the top of the emulator window. Select "Cartridge" (actually, the only choice initially). Select "Load Cart". If the navigation panel does not start in your VCC installation folder, you must navigate to this folder, usually "C:\Program Files (x86)\VCC 2.01c" (or whereever you installed it). Select the "mpi.dll" and click "Open". On some more *modern* versions of Windows (Vista, 7, 8 & 10), the ".dll" extension may be hidden from view. If this is the case, just select "mpi".

Once you have loaded the MPI, you will notice now that the "Cartridge" menu has expanded. You will see 4 "Cartridge Slots" and an "MPI Config" selection. These "slots" are where you insert the custom "ROM carts" included with the VCC installation or most any of the "ROM carts" you can find and download from any of the Color Computer archive websites. To use a ROM cart, you must *select* the proper slot in the "MPI Config". Just move the "Slot Select" slider to the slot in which you have inserted the cart.

VCC comes with several *custom* ROM carts:

- FD-502 Disk Controller (fd502.dll) - Standard Tandy FD-502 Disk controller with an DECB ROM installed.
- Hard Drive Controller (harddisk.dll) - An emulation of the a typrical MFM HD controller.
- SuperIDE Hard Drive Controller (SuperIDE.dll) - An emulation of Cloud9's "SuperIDE" HD w/CF cards.
- Becker Port Cart - A custom designed cart of the "Becker Port" for use with DriveWire4.
- Orchestra90cc (orch90.dll) - An emulation of the Tandy Orchestra90cc cart.
- RamDisk (ramdisk,dll) – An emulation of a 512k RAM card similar to those made by Disto.

Several of these carts require an external ROM image to run (included). The ROMs should *autoload* when the modules are inserted into the MPI slot. These carts & ROMS are:

- fd502.dll - disk11.rom, rgbdos.rom, or one of the hdbdos ROMs (explained in the "Loadable Modules" section of this manual).
- orch90.dll - orch90.rom

The "becker.dll", "harddisk.dll", and "SuperIDE.dll" are dependant on whatever ROM image is loaded by the "fd502.dll". This is handled in the "FD502 Config" menu under the "Cartridge" menu.
The "hdbdos" and "rgbdos" ROM uses are best explained in the "HDBDOS User's Manual" available on the Cloud9 website and the "RGB-DOS User's Guid" found in "The Color Computer Archives".
The ROMs included in this installation are specifically written for use with emulators.

Loadable Modules

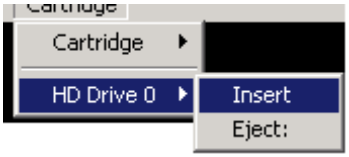
As stated before the VCC emulator does not know anything about the various peripherals that were available. It depends entirely on runtime loadable DLL files or Modules.
Modules (DLL) or program packs (ROM) images are loaded via the Cartridge menu option. After a module is loaded it will, if needed, add its own options to the Cartridge Menu and status line. There are currently 7 modules included. They are:
“mpi.dll”, “orch90.dll”, “harddisk.dll”, “Superide.dll”, “fd502.dll”, “becker.dll” and “ramdisk.dll”. These are installed in VCC's home directory "C:\Program Files\VCC 2.01" by default.
Any “ROMs” needed by these cart emulations are loaded externally and are included in the installation. The roms are stored in the same folder as the VCC executable and DLL files, usually “C:/Program Files/VCC 2.01”

orch90.dll

This is the simplest module. It emulates the Orchestra-90 program pack. It has no menu options and returns no status. The sound from the Orchestra-90 pak will play in full stereo through your PC’s speakers. To use the Orchestra-90 as the original, you must have the Orchestra-90 rom in the VCC installation folder along with the other roms. The “Autostart Cart” checkbox must be checked in the “Config/Misc” menu and if using the MPI, the MPI selector switch must be set to the same slot as the Orch90 pak. Hit “F5” to reset the emulator and start the cart.

harddisk.dll

This is an implementation of the "emulator hard disk" that is supported in many Coco emulators. It adds a single menu item used to Insert/Eject a virtual hard disk image (VHD). It uses an image of the RGB-DOS rom. This is a version of DOS that has been modified by Robert Gault for use with this type of emulation. It also contains an implementation of the Dallas DS1315 real time clock as used by Cloud-9. This can be used under OS9/Nitros9 with the appropriate driver.

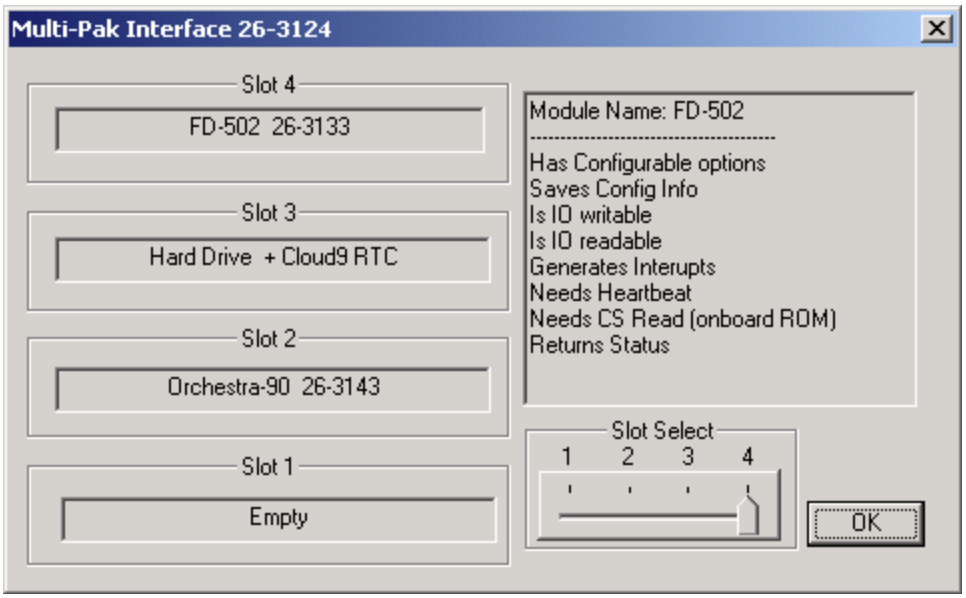


HD: [STATUS] will be added to the status bar and will change during the following events:
No Image!, Indicates that no VHD image has been selected.
Idle, VHD image is loaded but not being accessed.
RD: ###### or WR: ###### a sector is being read or written.

mpi.dll

The MPI module emulates the standard Tandy Multi-Pack interface. It adds 5 menu options. The first four allow Inserting/Ejecting carts from the Multi-pack. Any loaded modules will also add there own options to the menu. As with the main emulator, each slot will accept either a Module DLL or a Program ROM pack with the following exceptions. Don't try to insert the mpi.dll module into an MPI slot. Windows does not support recursive library loading. Also don't try to insert the same module into more than one slot. This is a limitation of the way the dynamic menu system currently works and will be fixed in a future version.

The MPI Config option is mostly informational. The Slot Select Slider picks the slot the MPI will use on startup. Displayed on the left are the names of all loaded modules. On the right is a list of API interfaces the currently selected module needs.



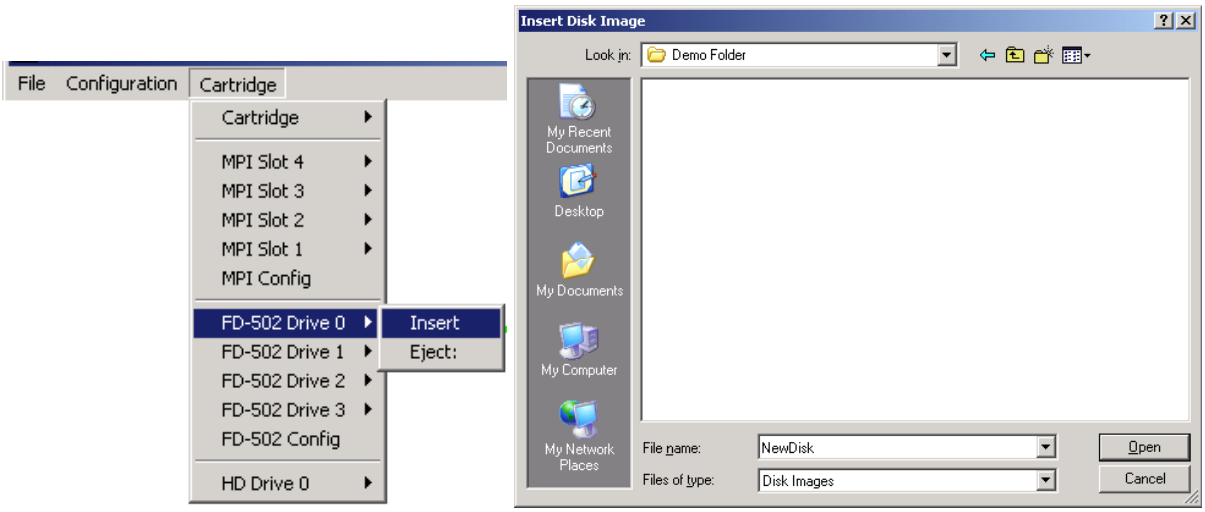
This module will add an MPI item to the status line. Following this are two numbers. The first is the slot the Chip select signal is routed to, The second is the destination of the Spare Select line. Following this is any status info returned from loaded modules. In the example above the MPI is set for slot 4 (internally slots are numbered 0 to 3) and the harddisk and fd502 modules are also loaded.

fd502.dll

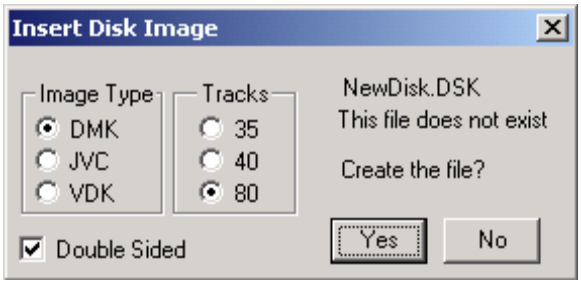
This module emulates the Tandy FD-502 Floppy disk controller with 4 Double Sided/ Double density disk drives attached. It adds 5 options to the Menu. The first 4 are simply to Insert / Eject Virtual disk images.
Most image types are supported including DMK, OS9, JVC and VDK. To insert a virtual Disk simply select the drive you wish to put it in and select insert. Note: Only the first side of Drive 3 can be accessed.

If you wish to have the disk "write protected" simply set the "read only" attribute from windows. This can be done by right-clicking the file, selecting Properties and checking the "read-only" box under Attributes. This will work for all image types. The DMK format uses a byte in the header to indicate "write protect". This will be respected if present but there is currently no way to change it from within this emulator.

Creating a new blank disk will be similar to inserting an existing image. Simple click Insert, and instead of picking an existing image type the name of the new disk image you wish to create (with the extension “.dsk”).

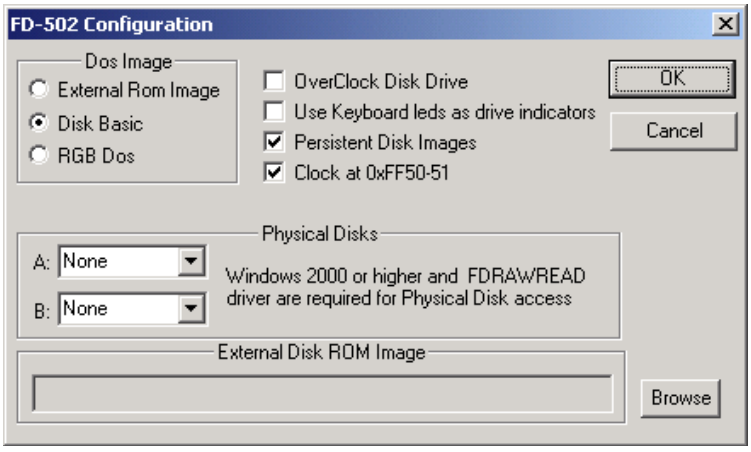


The following dialog will appear.



Just select the parameters for the new image and click yes. The image will be created, Zero filled and mounted in the drive you've selected. Note that unlike most other emulators the act of creating a new **disk will NOT format it**. Just as you would with a real disk you must either DSKINI (DOS) or format (OS9 et al) the image before it can be used.
For most disk use, you will want to use the JVC as it is the format most emulators use. The DMK and VDK formats are not fully implemented and in some cases, cause problems.

The configuration dialog:



Dos Image:
There are two built in DOS ROMS to choose from. Disk Basic is the standard DOS 1.1 that shipped with the FD-502 controller. RGB Dos is a version of DOS modified by Robert Gault to take advantage of the virtual hard disk emulation described elsewhere in the document. External Rom Image is just that. If you have a dump of a custom

version of DOS (ADOS3 or HDB-DOS for example) simply click "Browse" and select it. then check the "External Rom Image" radio button. It is recommended that you keep this image in the same directory that VCC is installed to, but it's not required. To use the Becker Port cart and DW4, you will need to use this feature to mount the “hdbdw3bck.rom” image, and check “External Rom Image”.

OverClock Disk Drive” Sounds more sophisticated than it is. By default I attempt to emulate the time it would take a real disk to move the read/write head. Clicking this will reduce that time to almost nothing. If you are using the CPU over-clocking option and experience I/O errors try turning this on.

Use Keyboard LEDs as drive indicators: lights are mapped as follows:
Drive 0 = Num Lock
Drive 1 = Caps Lock
Drive 2 = Scroll Lock
Drive 3 = None. Ran out of LEDs.
Note that this will really change the state of these keys. I.E. if you have Caps Lock on and Drive 1 is accessed. When the Emulator shuts off drive 1 and the light, Caps lock will now be off. Still Working on this.

Persistent Disk Images:
When checked any Disk images mounted when the emulator is shut down will be remounted when it’s started back up. Un-checking this will cause the emulator to start with empty Floppy disk drives. This is also true with any hard drive controller modules and VHD files.

Clock at 0xFF50-51: Selected whether the Disto RTC will be enabled or not.

Physical Disks:
This is also experimental code. Please only use backup disks as I can't guarantee everything works 100% yet. Currently only "standard format" 18 sector per track disks are supported. I'm hoping get "protected" disk formats working In a later version.

To use this option 3 requirements must be met. The drop downs will be grayed otherwise.
1) The host computer must be running Windows 2000,XP or Vista. Note I have only tested this on XP so far.
2) The host computer must have a supported Floppy disk controller chip, (µPD765a or equiv.). A USB floppy drive will NOT do.
3) The FDRAWCMD driver must be loaded. These drivers were written by Simon Owen and can be downloaded from his website here: http://simonowen.com/fdrawcmd/

Download and run the fdinstall.exe file.
There are two drop downs. One for each Physical disk drive you may have. Simply select the Virtual disk drive from the dropdown next to the Physical disk Letter. For Example: To Map Virtual disk 1 to real Drive A:, Select "Drive 1" from the dropdown next to A:.
To un-map a disk either select None from the dropdown or select Eject *Floppy ?? from the menu, where *Floppy?? Is either A or B.

DISCLAIMER

*** We have no association with either the Glenside computer club or Cloud-9.**
They do not endorse or support this program in any way. If you experience any issues with this software please DO NOT bother either of these entities. J.F.

SuperIDE.dll:

This is simulation of the Glenside IDE and Cloud9’s SuperIDE controller with the Dallas DS1315 RTC. It provides no more functionality than RGB-DOS and the hard disk module that are included with VCC. Its primary

purpose is to allow owners of the Glenside IDE or Cloud-9 Super-IDE Controller to mount and run a backup of their CF card under VCC without any driver modifications. As such it is compatible the both HDB-DOS and the Super-Driver currently in the Toolshed and NitrOS9 repositories. It adds three menu items used to Insert/Eject backup images (.IMG files) created by my sideutil program and to set the base address of the virtual controller. Also note that currently the sideutil program only allows dumping of removable CF cards, Hard disks are not currently supported for safety reasons.

Base Address:

This must be set to match the address of the real hardware the CF card image was taken from.
FF40 Do not use this address with the FD-502 module loaded as it uses part of this range as does the becker.dll.
FF50 Default base address. If selected verify the RTC in the FD-502 module is disabled as it uses part of this range.
FF60
FF70 Also used by the Modules RTC, Selecting this base will disable the internal RTC.

Clock at 0xFF70:

Enables the DS1315 RTC at this address. It will be unavailable if the IDE base address is set to 0xFF70.

Clock is Read-Only:

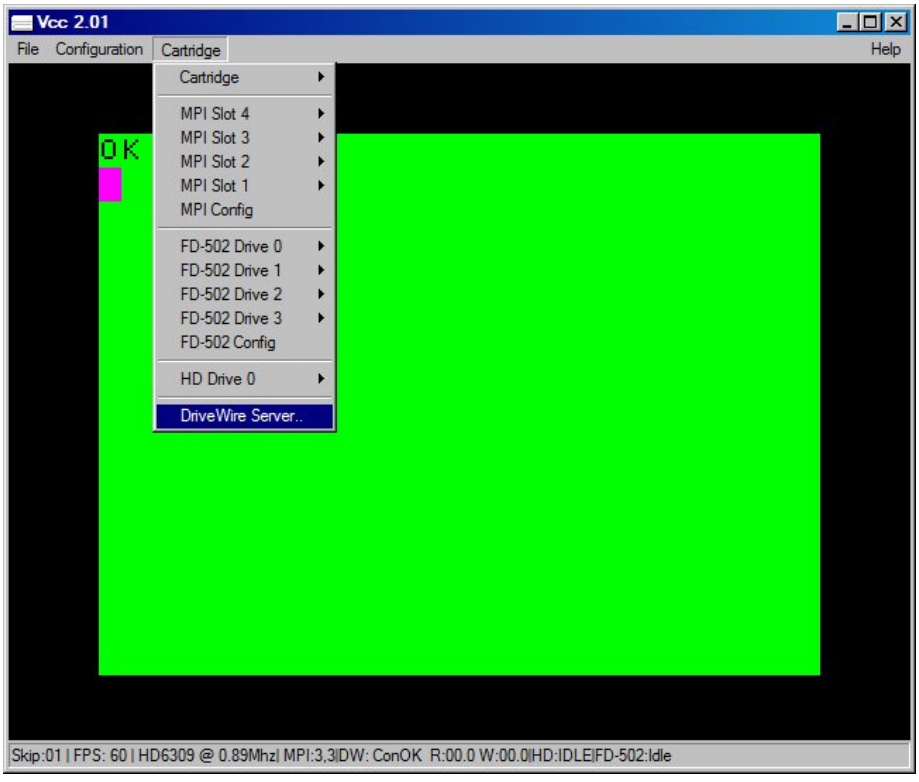
If this option is not selected changing the time in the emulator will affect the time of the host computer.

becker.dll

The “Becker Port” cart emulation has been added to allow the user to utilize the features of the DriveWire4 file server. DriveWire4 can be used for multiple dsk/vhd access, TelNet, modem emulation (through telnet), internet FTP access, DriveWire MIDI through the PC host’s soundcard, virtual printing, and much, much more!

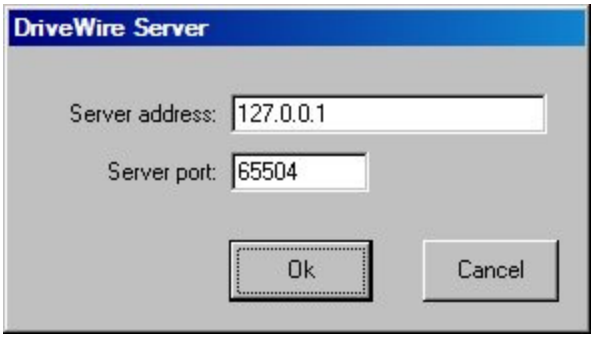
DriveWire4 (DW4) has opened the doors to the outside world to the Coco and now it’s available for VCC 2.0.1. To use DW4 with VCC 2.0.1c, you must insert the “becker.dll” into one of the MPI slots, but DO NOT SELECT THE SLOT. You will need to use the “External ROM” feature of the FD-502 controller to load the becker version of HDBDOS.

The becker.dll cart will add another menu option to the “Cartridge” menu:



This menu option allows the setting for the Becker port to be changed to fit the user's needs. In most cases, the default settings are what is needed and it should not have to be changed.

The default settings are:



These settings should be sufficient for most DriveWire4 uses. In the DriveWire4 server "Simple Config Wizard" utility, you will use the "Emulator or other TCP/IP" selection and use the default settings from there.

To use DW4 from BASIC, you must have the "Cartridge/FD502 Config/External Rom" selected and the browse to your HDBDOS rom in the "Browse" box. This rom is also used when "auto booting" NitrOS9 from an HDBDOS virtual floppy drive using Robert Gault's RGBDOS menu system. If you are using "multi-partitioned" VHD images with NitrOS9 and HDBDOS images on one VHD, then you will have to use an "offset" in HDBDOS to reflect the size of the NitrOS9 partition to get to the HDBDOS partition. An explanation to this offset can be found on Robert Gault's website @ http://aaronwolfe.com/robert.gault/Coco/Downloads/Downloads.htm.
Scroll to the bottom of the page for RGBDOS. Almost all that applies to RGBDOS will also apply to HDBDOS (in most cases).

ramdisk.dll

This cart image emulates a 512k. RAM cart. It's very simple to use and can give you 512k of extra data storage. To use the RamDisk cart, you use a 24 bit addressing mode (3 bytes) and read/write single bytes of data to/from the cart.
To set the address in the cart of the data byte you want to read or write, just poke your 24 bit address variable like this:

The address range of the cart is $000000 - $80000 or 0 – 524,288

To read/write to/from address $6F4972 you would poke:
POKE &HFF40,&H72 = lswlsb of address
POKE &HFF41,&H49 = lswmsb of addresses
POKE &HFF42,&H6F = mswlsb of address

To read the above address once set:
AA=PEEK(&HFF43)

To write &H55 to the above address: (overwrites any existing data at that address)
POKE &HFF43,&H55

A NitrOS9 driver for this cart would be a very simple project.

System ROMs:

This installation of "VCC 2.0.1" comes with the following ROM images installed in the VCC installation folder along with the emulator and it's supporting software:

"coco3.rom" - A combined copy of the original Tandy "Color BASIC", "Extended Color BASIC", and "Super Extended Color BASIC" ROMs installed in the Color Computer 3. This ROM was compiled from the "ToolShed" repository sources and not "ripped" from a real Color Computer 3.

"disk11.rom" - A copy of the "Disk Extended Color BASIC" ROM (v1.1) supplied with the Tandy "FD-502" disk controller. This ROM was compiled from the "ToolShed" repository sources and not "ripped" from a real FD-502 disk controller.

"rgbdos.rom" - A copy of the RGBDOS ROM by Robert Gault and downloaded from his website. This ROM has "offsets" for dual partitioned VHD images with NitrOS9 and RSDOS partitions. The offsets are set at "$5A000" for *standard* VHD images that use a 90 megabyte OS-9 partition and and RSDOS partition with 256 virtual drives. To change this ROM for use with *single partition* VHD images, (in RSDOS) use:

```
POKE&HD938,0:POKE&HD939,0:POKE&HD93A,0
```

Or in a Windows hex editor, you can change the values permanently by changing the ROM image values directly at locations $1938, $1939, and $193A, all to $00.

"hdbdw3bc3.rom" - Standard "Becker Port" HDBDOS ROM. Compiled from the HDBDOS sources at the ToolShed repository. Not to be used with *dual partitioned* VHD images.

"hdbdw3bc3 w-offset 5A000.rom" - Standard "Becker Port" HDBDOS ROM. Compiled from the HDBDOS sources at the ToolShed repository, but modified for using dual partitioned VHD images for OS-9 and RSDOS. The offsets are set at "$5A000" for *standard* VHD images that use a 90 megabyte OS-9 partition and and RSDOS partition with 256 virtual drives.

"hdbdw3bck.rom" - "Becker Port" HDBDOS ROM without the *speedup* (2 mhz) poke installed. This ROM allows time critical Games and Apps that do not run well (or run too fast) with the speedup poke. Compiled from the HDBDOS sources at the ToolShed repository. Not to be used with *dual partitioned* VHD images.

"hdbdw3bck w-offset 5A000.rom" - "Becker Port" HDBDOS ROM without the *speedup* (2 mhz) poke installed. This ROM allows time critical Games and Apps that do not run well (or run too fast) with the speedup poke. Compiled from the HDBDOS sources at the ToolShed repository, but modified for using dual partitioned VHD images for OS-9 and RSDOS. The offsets are set at "$5A000" for *standard* VHD images that use a 90 megabyte OS-9 partition and and RSDOS partition with 256 virtual drives.

The RGBDOS and HDBDOS ROMs offsets can be changed to match any size VHD images with any size partitions using the methods used above for the RGBDOS ROM. The same ROM addresses apply to HDBDOS. To calculate the proper offset for your VHD partition, I suggest using Robert Gault's "SPECS.BAS" program found on "RGBDOS Tools Disk image" found on his website (listed above). This program will calculate the size of your OS-9 partition (which must come first) and give you the proper offset to the RSDOS partition. The SPECS.BAS program can be found on the "Tools.dsk" in the RGBDOS zip available for download on his site.

Credits:

First and foremost, I would like to thank Joseph Forgeone, the original author of the VCC Color Computer 3 emulator. Without all his hard work, this wonderful emulator would have never come about.

I would like to thank Robert Gault for his contribution of the “RGBDOS” implementation and all the testing and suggestions during Joseph’s development of VCC. Robert has contributed more to the Coco Community than anyone could know.

I would like to thank Aaron Wolfe and David Ladd for the addition of the “Becker Port” for using VCC with DriveWire4. This has allowed VCC to communicate to the outside world and has opened many doors that were closed before.

I would like to thank Gary Colbourn for his work in converting Joseph’s Visual Studio 6 C++ code to compile in Visual Studio 2015 Community Edition.

I would like to thank Wes Gale for his bug hunting and squashing during the initial release of VCC to open source.

I would like to thank Walter Zambotti for his contribution in fixing the HD6309 CPU to funtion properly and adding in the missing instructions.

Last but not least, I would like to thank everyone in the Coco Community as the help and support of the Coco Community is what has kept the interest in the Color Computer going strong and made VCC possible in the first place!

Let’s make VCC the BEST Color Computer 3 emulator ever!
Bill Pierce 10/01/2015