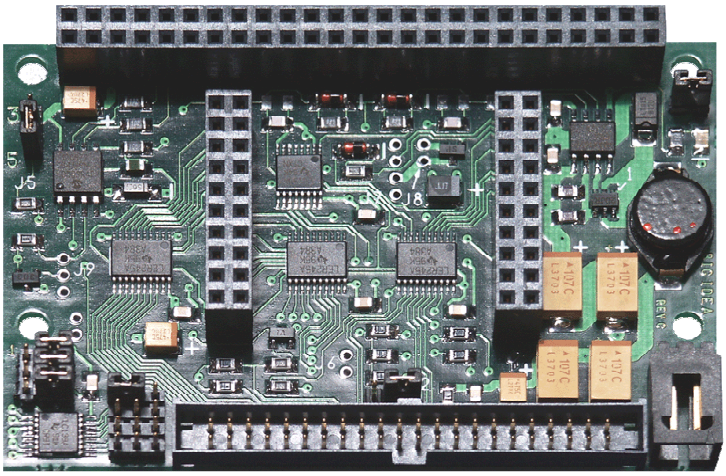
PERSISTOR®

BigIDEA User's Manual



Revision 1.1 - April 2002

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Trademark Notice

Introduction

The Persistor BigIDEA is a 2"x3" IDE adapter for use with a Persistor CF2. The BigIDEA sandwiches between a CF2 and either a CF2 RecipeCard, a CF2 SandwichCard adapter, or your custom CF2 electronics. The BigIDEA allows the CF2 to control 2.5" hard drives (2GB to 48GB), 1.8" Type II or III PCMCIA hard drives (2GB to 10GB), or single/dual stack PCMCIA TrueIDE flash cards.

2GB Limit Note: *PicoDOS is currently limited to accessing just 2GB from up to a maximum of four partitions for a total of usable capacity of 8GB. Until PicoDOS adds support for FAT32 partitions, low level sector reads and writes are the only way to access greater than GB from a single drive.*

The BigIDEA's power-switched electronics keeps its share of the current drain below 15uA while you collect and buffer data into RAM or the CF2's CompactFlash cards. When these fill up, you spin up the power hungry hard drive, spool off the buffered data, then quickly shut it back off.

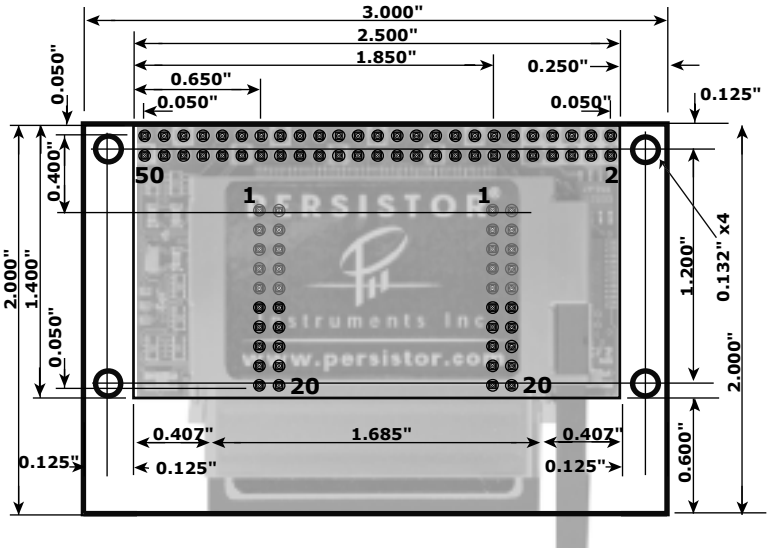
Each BigIDEA adds about 0.48" of height to a CF2 system and you can stack several (see section on Installing Disk Arrays with Multiple BigIDEAs). All BigIDEAs in the system share the same SandwichCard chip select and memory space. This leaves your system with up to 31 additional SandwichCard chip selects for other expansion options.

Drives and Cards connected to the BigIDEA get to use the CF2's PicoDOS file system so they're directly compatible with DOS/Windows PCs. The flash cards and PCMCIA hard disk plug into standard PC Card slots and automatically mount as logical drives (E:, F:, etc.) for extremely fast and easy data recovery.

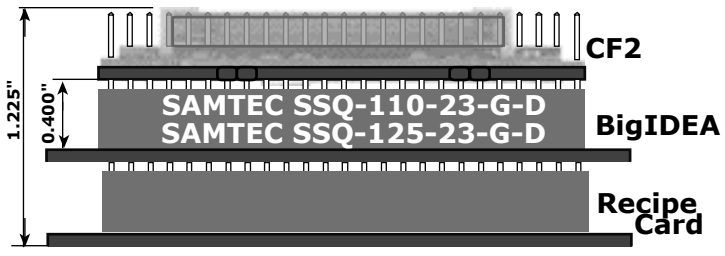
The BigIDEA driver software lets you access the file system through standard C function calls (fopen, fread, fprintf, fwrite, fseek, fclose, etc.). If you're willing to trade file name/size flexibility for the most efficient power utilization you use the included recorder library routines to squeeze every last milliwatt out of your batteries.

Mechanics

The BigIDEA sandwiches between your CF2 and other electronics ala PC104 and adds about a half inch to the height of the system. The drawing at right shows that the BigIDEA circuit board is larger than the CF2. The BigIDEA juts out just far enough in front to preclude front panel access to the CompactFlash. In BigIDEA systems, the CF card is typically just used as buffer storage so hopefully this will not be a problem.



The BigIDEA mounting hole pattern is a standard for CF2 RecipeCards, and the front two holes (CF side) line up with the mounting holes on the PicoDAQ RecipeCard and many other RecipeCards.



Not Quite Plug & Play

It's unlikely that the IDE drive controller in your PC came with a user's manual. Most PCs today do not have a users manual for the IDE controller either. PC's can do this because:

1. Their drives are usually factory installed into convenient drive bays and card cages and the controllers are usually integrated into the motherboard.

2. The PC BIOS and OS were pre-configured for the installed drive and controller at the factory.

3. PCs don't much care about power or startup time, so they can interrogate hardware peripherals with no negative consequences.

Though we've tried to make the CF2 mimic the simplicity of a PC, the BigIDEA and hard drives pose special challenges because:

1. There's no standard mechanical mounting arrangement, so they can't ship pre-configured even if ordered together.

2. The vast majority of CF2s will never see an add-on drive, so PicoDOS doesn't expect to find one.

3. PicoDOS can't poke around and look for off board peripherals without incurring startup delays, and in the case of hard drives, significant power expenditures.

What all this means is that you have to learn enough about the BigIDEA and various drive options to correctly install the hardware and setup the software. Since you've chosen a CF2 and BigIDEA, you probably care very much about power utilization and will want to learn everything you can about the tradeoffs between convenience and simplicity versus maximum battery life.

What's in the User's Guide

The remainder of this manual explains how to install, configure, and properly use your BigIDEA and cards/drive. It is broken up into these major sections:

Setting Up the BigIDEA - Describes how to properly setup the board's jumper options for your particular requirements.

Installing the BigIDEA – Explains how to connect the BigIDEA between your CF2 and other peripheral electronics.

Installing Cards and Drives – Describes the cabling from the BigIDEA to your 2.5" drive, PCMCIA adapter or how to install a Disk Array with multiple BigIDEAs.

Preparing the Drive – This section explains partitioning and formatting of your hard drive.

BigIDEA Software – This section describes the various example programs you can use as a foundation for your applications.

Packing List

Your BigIDEA ships with the following items:

1	BigIDEA SandwichCard Adapter
6	2mm configuration jumpers on the BigIDEA with standard default setting
1	8" 3 connector IDE-44 ribbon cable
1	18" power cable, tinned leads to 2-pin Molex C-Grid plug
1	User's Manual (this document)
1	Example files (on the PicoDEV CD or a separate diskette)
1	(possibly) Release Notes

Setting up the BigIDEA

BigIDEAs are installed sandwich-like between a something and something else. Those something else's can be a CF2, a RecipeCard, your custom instrument electronics, some other SandwichCard peripheral, or even more BigIDEAs. Typically, it's a CF2 on top, a BigIDEA in the middle, and a RecipeCard or your board on the bottom. In multiple SandwichCard systems, the stacking order makes no difference. The remainder of the installation and setup instructions will assume a simple three board system with a CF2, BigIDEA, and PicoDAQ RecipeCard - though what's described applies similarly to more complex systems.

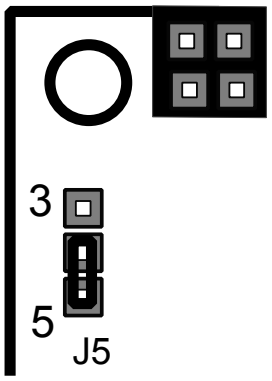
Jumpers

Before you plug your CF2 into the BigIDEA, you should make sure that the three groups of configuration jumpers are properly installed for your CF2 system. These jumpers select:

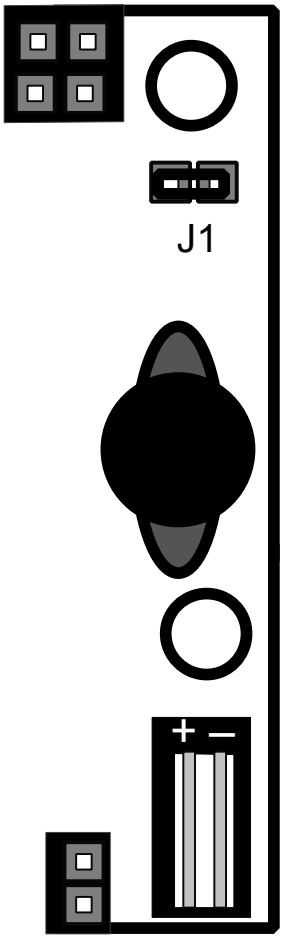
- 3.3V or 5V IDE voltage
- Power Source
- Memory Slot

All of these jumpers are accessible when a CF2 is plugged into the BigIDEA, but most other full-sized SandwichCards will obscure all or some these when they plug into a BigIDEA.

3.3V/5V



The 3.3V/5V jumper J5 comes from the factory preset to the 5 volt position, and that's where it has to be for most hard disk drives, and generally where you want it to be for flash cards. Some flash cards write about 20% faster when operating at 5 volts, but they pull about 30% less current when you writing at 3.3 volts. However, most systems don't spend much of their time actually writing, so the savings may not be all that significant.

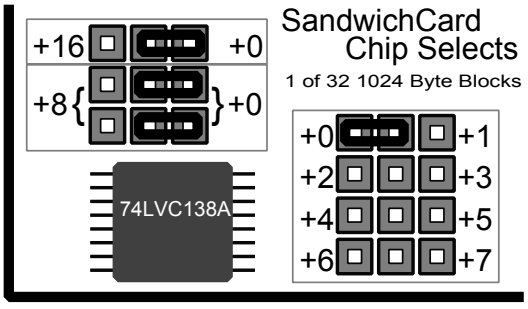


Power Source

The power source jumper also comes from the factory installed to let the BigIDEA use the CF2's VBAT (pin 13) as its voltage source to the switching regulator for the IDE drives. This is convenient since a single power source and cable works for everything. It also means that if the drive turns on and tries to gulp more power than what's left in your batteries, the CF2 will die when the voltage drops below about 4 volts. To preclude this possibility, remove the power source jumper and run a separate supply to connector J1 on the bottom right of the board.

WARNING: Never connect a separate supply while J1 is jumpered!

Memory Slot



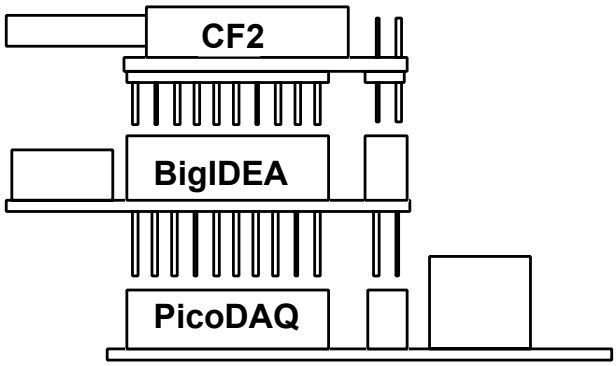
The SandwichCard memory slot jumper block comes pre-configured for slot 0 as shown in the drawing at right. If you're constructing a complex SandwichCard system, refer to the appendix for details on setting up multiple SandwichCards, otherwise, just make sure your BigIDEA looks like the drawing.

The appendix contains much more detail on SandwichCard memory addressing. This is not required reading for working with the BigIDEA but if you are going to use other types of Sandwich cards, you may want to look at it.

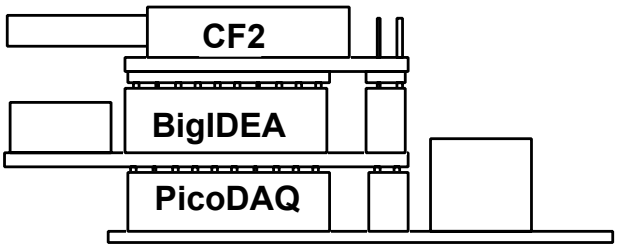
Installing the BigIDEA

Plug in the CF2

Before plugging the CF2 into the BigIDEA SandwichCard, lets also make sure we've got a working system as a reference point. Hookup your CF2 and RecipeCard (or whatever) to a power supply and terminal. Make sure that Motocross is running and that you have it configured for an available COM port on the PC. Also, make sure that the communications cable from your Recipe Card (or whatever) is connected to the same COM port that Motocross is using. Turn the power supply on and verify that you can get to the PicoDOS prompt (Motocross will display the startup message and PicoDOS prompt).



Next, disconnect the power while we install the BigIDEA. Begin by unplugging the CF2 from the RecipeCard (or whatever). Now, plug the backside of the CF2 (the side without the CF header, but with all 90 pins in a π pattern) into the topside (component side with sockets) of the BigIDEA.



It is possible (we've done it) to misalign the pins and damage both boards if powered that way (we've proved it). Even the most cursory visual side-view inspection will reveal the mistake before any damage can be done. So, make sure to look at the pins after you insert everything. The drawing at right shows a side view of a CF2/BigIDEA/RecipeCard system before and after insertion.

Plug in the RecipeCard

Having plugged the CF2 into the BigIDEA, there's only one way to connect the BigIDEA back into the RecipeCard - its pins go into the RecipeCard's sockets. We learned our lesson by frying a CF2/BigIDEA with powered misalignment so we know how much harm can be done by not paying attention. Hopefully you will examine the installation and not have to call us for a damage assessment.

Powering the BigIDEA

Whether powered from the CF2 VBAT or the Molex connector, the upper range of the supply must be limited to 16.5 volts (NO HIGHER), and the lower range must be 0.5 volts above the operating voltage selected by J5. One more reminder: Never attach a separate supply to the Molex connector while J1 is jumpered! There are no fuses, no diode isolation, and nothing else to protect the two supplies from trying to equalize each other - probably catastrophically!

Quick Checkout

Before going on, let's confirm that what we've done so far is working. Reconnect power and everything should work exactly as it did in the pre-installation quick test i.e. you should get the PicoDOS prompt. This doesn't prove the BigIDEA is working, but it does tell us that nothing is seriously wrong with the hookup.

Installing Cards and Drives

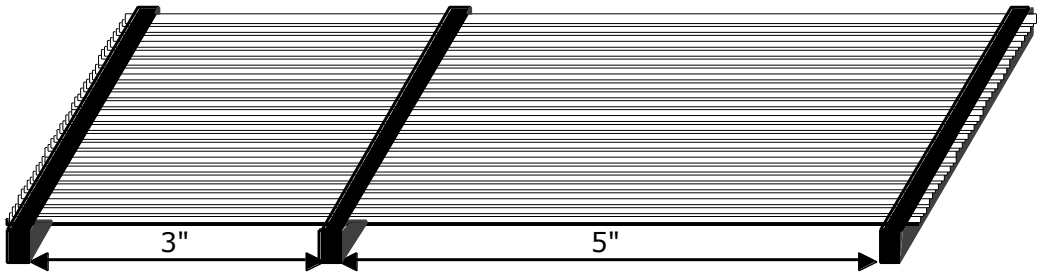
Important Notice about Hard Drives

While there are many hard disk options available today, selecting one that suits your needs can be difficult. Persistor Instruments does not regularly test the BigIDEA with the rapidly changing selection of hard disk offerings. Disk drive models change too rapidly for anyone to keep up.

When you choose a hard disk make sure that you test it before you deploy a system with it. Changes in hard disks even with the same manufacturer can introduce differences that may affect your application. It is up to YOU, the user, to test the hard disk that you choose.

Connecting

Cards and drives connect to the BigIDEA using 44-pin 2mm connectors and 1mm ribbon cables that can be any length up to twelve inches. The BigIDEA comes with a single eight-inch cable with connectors at both ends, and with one additional connector three inches away from one of the ends. This one cable actually has many uses. It can be used as an eight-inch cable and you can get rid of the annoying bump in the middle by prying apart and removing the center IDC connector. You can also make it into either a five inch or three inch cable using just a pair of scissors. You can also use it to connect two separate single slot PCMCIA adapter boards to the BigIDEA.



The BigIDEA's IDE header is shrouded, but not polarized, and 44-pin IDE cable connectors come in a variety of widths, so the shroud does not always guarantee proper pin alignment (it does however with the included cable). Drive headers are neither shrouded nor polarized, so it's very easy to hook them up backwards (goodbye expensive electronics) or misaligned by one set of pins (poof goes the drive). You must take care to connect pin 1 of the BigIDEA header to pin 1 of the drive or adapter. You do this by always assigning the striped side of the cable to pin 1.

Pin 1 for the drive header on the BigIDEA is located on the end of the header which is closest to the J3 jumper block. Unfortunately, most hard drives give no indication of which side has pin 1. The 44-pin headers on both the BigIDEA and 2.5" hard drives are not symmetrical along the center of the devices, and in the field, you can figure out which way to hook them together by centering the BigIDEA board with the drive and noting that only one orientation gives a straight line connection between the headers.

Bad Vibrations

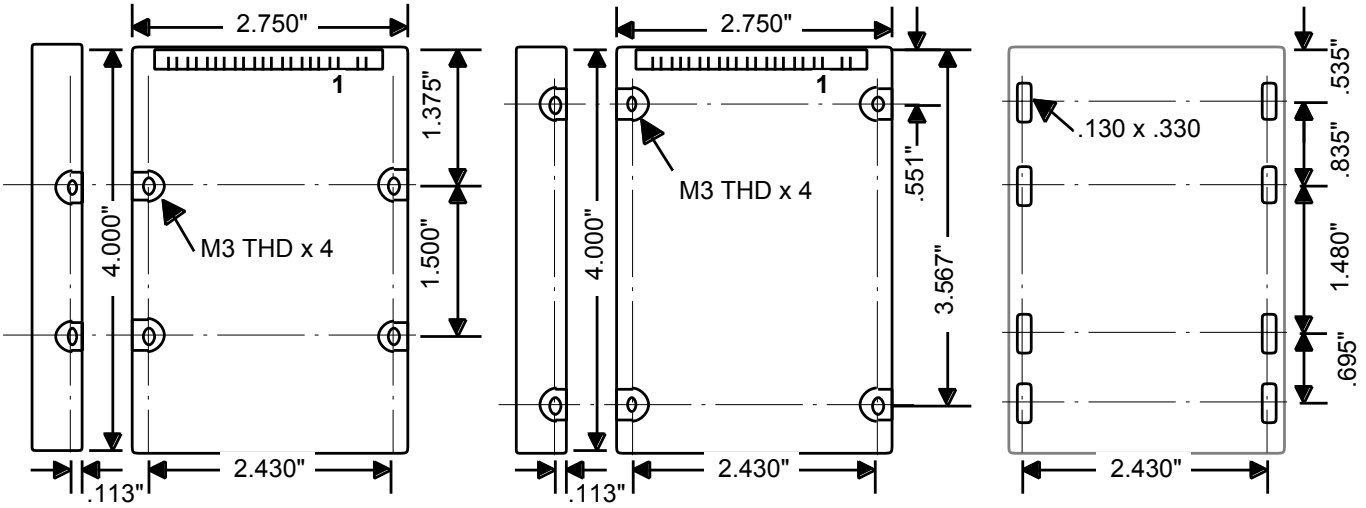
Neither the BigIDEA nor the hard drives have locking mechanisms for the ribbon cable connectors and rely on the relatively high extraction force of 44 connections to hold the assembly in place. This works well for desktop, and even laptop computer environments, but it may not be sufficient to survive high vibration applications. We do not have a generic solution to this potential problem, but if you suspect your system will operate in a fashion where the cable could be shaken off, you'll need to do something to keep it attached (wire ties, tak-pak, clamps, etc.).

Installing a 2.5" Hard Drive

The BigIDEA makes no provision for physically mounting your 2.5" hard drive other than by offering a flexible cabling connection. Most modern drives can be installed and operated in any orientation, but you may need to check with the drive manufacturer for recommendations if you're pushing the technology limits. Various drives have different limitations on vibration and shock and these too should be considered when you design the mounting. Hard disk drives self heat when running (Toshiba MK2104 calls out 15°C maximum rise) so you should also provide for ventilation if you'll be running at ambient temperatures where that rise could have the drive working beyond specified limits.

You should also be aware that even though many of the 2.5" drives have similar top or side mounting holes, these are not standard, or guaranteed to remain the same from one generation of hard drives to another - even from the same manufacturer. About all you can count on mechanically is that 2.5" drives will be 2.75" x 4.0" but that the height may vary from less than 0.2" to over 0.8".

For top mounting drives, we recommend slots instead of holes as shown in the drawing below, far right. On the left side of the drawing are the mounting hole dimensions for two different 2.5" drives we've actually worked with. For our own use, we've attached to the drives with M3.0 x 0.5 thd metric screws with a length appropriate to get about 0.1" to 0.2" of the screw into threaded holes after accounting for board thickness and spacers.



These drawings are meant to provide some guidance, but you must confirm these against a drive in hand or the drive manufacturer's specifications before beginning your mechanical design.

2.5" Drive Connections

Some 2.5" drives have a separate power connector, but you do not need this with the BigIDEA. Power for the drives is brought over in the 1mm ribbon cable. Instead of a 44-pin header, most 2.5" drives have a 50-pin header with two pins missing to make one 44-pin header, and one 2x2-pin jumper block for drive options (discussed ahead). Most drives also provide little or no markings to help you properly connect the cable. The dimension drawing above shows how to identify pin 1 on the drive, and that pin is where you should always connect the striped side of the ribbon cable.

To save yourself some future catastrophes, this would be an excellent time to make some very clear markings on the drive where pin 1 is, and where you want the cable stripe to be so that at some future time, you or your technician will be able to confidently reattach the drive without this long-lost BigIDEA manual.

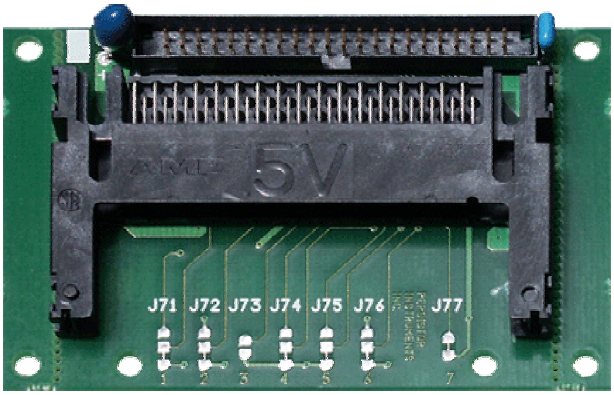
2.5" Master/Slave Options Pins

Most 2.5" drives have another four pins separated from the main group of 44 IDE pins for drive options. The option pins exist for multiple-drive (Master/Slave) configurations that are not supported by the BigIDEA. Though this might sound like a cheap and easy way to double your capacity, the protocol only works by having the two drives up and running, so it's twice the spinup surge current, and only a bit less than twice the operating current while filling each drive - probably not a goal for you CF2 based system. If you need more capacity, consider multiple BigIDEAs - each powering it's drive independently.

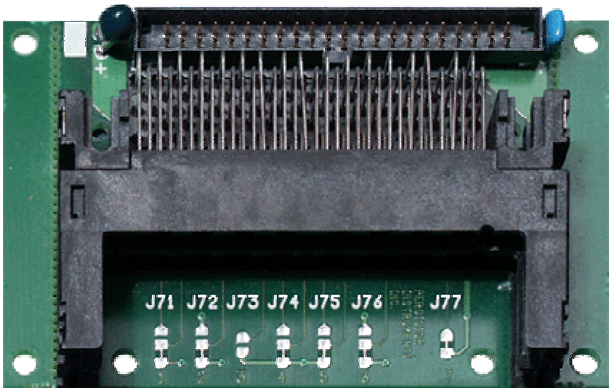
Generally, “no jumpers” is the correct option for the BigIDEA. If your drive came with jumpers installed, find out why before running it with the BigIDEA.

Installing a PCMCIA Adapter Card

To work the BigIDEA with PCMCIA hard disks or flash cards (including CompactFlash in a PCMCIA adapter), you need a single or dual PCMCIA to 44-pin adapter board. These are actually made from the same printed circuit board, but the single has one PCMCIA header which can work with Type I, II, or III PCMCIA cards, while the dual has a double-height header that can take a Type I or II card in the lower (slave) socket and a Type I, II, or III card in the upper (master) socket. The appendix shows the schematic for the PCMCIA adapter board.



BIAPFC1 Single PCMCIA Adapter



BIAPFC2 Dual PCMCIA Adapter

Electrically, the single adapter and the upper socket of the dual adapter are identical. The single has the advantage of lower height (0.34") versus the taller (0.62") height of the dual, and the single sells for a little bit less. Dual operation really only makes sense when using only flash memory cards. The BigIDEA can only power switch the dual adapter in pairs, so either both are on, or both are off at any given time.

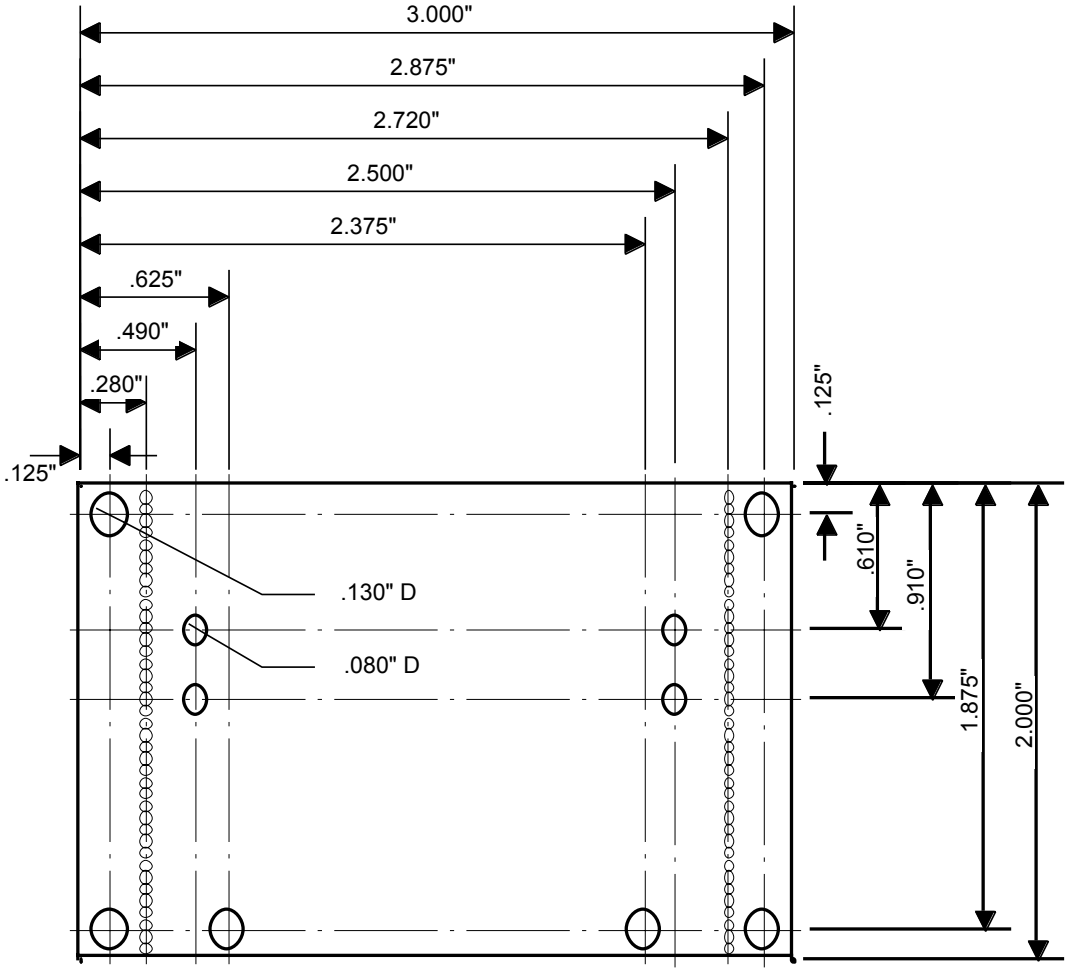
For flash card pairs, that's a small initial startup pulse of current to charge up capacitors and wake the cards processor, but each settles down to less than 500uA automatically. For hard drive pairs, it is instead a huge spinup surge current and twice the already onerous operating current. The combination of a flash card and hard drive in a dual adapter is also unwise since the relatively slow flash write operations will incur the full penalty of carrying the hard drive power burden over a long period of time.

Flash memory cards do not care at all about operating orientation, nor do the 512MB and 1GB Calluna 1.8" drives that we've worked with. If you're using something different, check the manufacturer's data sheets for any restrictions on mounting. Various drives have different limitations on vibration and shock and these too should be considered when you design the mounting. Hard disk drives self heat when running so you should also provide for ventilation if you'll be running at ambient temperatures where that rise in temperature could have the drive working beyond specified limits.

The PCMCIA adapters have a shrouded 44-pin header that is not polarized. You must take care to make sure that the striped side of the cable connects to pin 1 of the adapter (which is marked with the big white square).

PCMCIA Adapter Dimensions

The BigIDEA makes no provision for physically mounting the PCMCIA adapter board other than to provide a variety of mounting holes and breakaway panels with additional mounting holes as shown below.



Installing Disk Arrays with Multiple BigIDEAs

Your CF2 can control a number (limited by our ability to test them) of BigIDEAs. Each adds only microamps to the idle current and each powers up its drive independently of other attached drives. However, only one BigIDEA can be active at any given time.

Note: It is possible, under software control, to spin up a second drive while powering another as long as you do not try to mount the second drive before dismounting the first.

To install multiple BigIDEAs, simply follow the instructions for installing a single drive/adapter for each BigIDEA in the system. You do not need to modify the chip select jumper settings for each BigIDEA. In fact, all of the BigIDEAs should have the same chip select. At startup, the CF2 interrogates its attached SandwichCards and discovers the unique serial numbers which will be used to select individual BigIDEAs. The lowest serial number becomes the default BigIDEA for programs that do not explicitly request a specific unit.

Important Notice Regarding Multiple Hard Drive Stacks

We test BigIDEAs in stacks of 4. Some of our customers have used stacks of 6 BigIDEAs. As with any complex system, you should test your system carefully before deployment. Even if you have sucessfuly-deployed systems with the same drive types and part numbers, you should retest each new system.

For instance, in early 2002 one customer repurchased IBM Travelstar drives and discovered a change to their interface electronics. This change introduced impedance problems with the bus signals for the BigIDEA. The problems were not detectable until the 5th drive was added to the stack. To get around this problem, a special board had to be added with termination resistors to eliminate the reflection problems by controlling the impedance of the bus. We can provide details on how to build such a board if necessary.

This new problem highlights the difficulty of tracking changes to hard disks. When you choose a hard disk make sure that you test it and be sure you fully test an entire stack of drives before deployment. It is up to YOU the user to test the hard disk(s) that you choose for use with the BigIDEA.

Mounting Multiple BigIDEAs

The 'MOUNT' command is used to turn on and spin-up a hard disk using the BigIDEA. The syntax of the mount command is:

MOUNT [V:] [DEV[-n]] [/D] [/Pnnn] [/Nmmm]

V:	Specifies the first drive letter to use: none for first available
DEV[-n]	Specifies the driver name "CF", "BIHD", "BI25", "BI18", "BFCM", "BFCS" -n specifies the BigIDEA index
/D	Dismount
/Pnnn	Specify first DOS partition index (zero based)
/Nmmm	Specify number of DOS partitions to mount (ALL is default)
/V	Verbose mode
/Q	Quite mode

After the device drive name (DEV there is a '-n' parameter. This is the BigIDEA index. The indexes start with 0 and climb up. If this is not specified when using the mount command it is assumed to be zero. This is fine if you are using one BigIDEA, but what if you are using two? To mount the second hard drive (I'll assume a 2.5 inch drive as my example) use:

```
MOUNT BI25-1↵
```

If the other BigIDEA is already mounted, the CF2 will power down and dismount the first BigIDEA automatically and then mount the second one.

Preparing the Drive

In order to use the BigIDEA, you must first prepare the drive. This involves using commands to break the hard disk connected to the BigIDEA into separate distinct volumes or partitions. The current version of the PicoDOS operating system supports FAT16 only. This limits the maximum allowable partition for any volume to 2 GB. It is possible to have up to four partitions for a single drive/BigIDEA combination for a total of 8 GB. Partitioning a drive is necessary until FAT32 becomes available for the BigIDEA.

A Note about Partitions

The maximum number of partitions possible for a single BigIDEA is four. This means that the largest fully usable hard disk is 8 GB (4 * 2GB = 8 GB). NOTE: For those who are willing to deal with some low-level, somewhat detailed programming, it is possible to go beyond 8 GB even before the availability of FAT32. To do this requires writing to the drives without a file system. You perform low-level access and write to actual physical sectors on the hard disk. For long-term logging of data, this may be a good alternative to multiple stacks of BigIDEAs but be warned: it is not for the faint of heart.

Partitioning

To partition a hard disk for the BigIDEA, make sure that you have your BigIDEA and hard drive connected as described in the previous sections. Apply power. When you see the PicoDOS prompt, you are ready to start.

Begin by mounting the BigIDEA. The command options for this will vary from drive to drive. For this example, we are using 3 GB IBM 2.5 inch drive. We will type the following:

```
MOUNT BI25↵
```

When the drive has mounted we will see the following message:

```
Turning on BI25-0 ...
Mounting D: E:
```

The easiest way to partition a drive is to have the FDISK do it automatically. The only interaction with the user is to enter the name of the driver for the volume to partition from a list that FDISK generates.

Begin partitioning by typing the following:

```
FDISK /S /P↵
```

The /S option by itself will force FDISK to search for devices and drivers. The /P option by itself will force partitions to be equal to the largest value possible based on available space. Using these options for a 2.5" 3GB drive, FDISK would partition the drive into first a 2GB partition and then a 1GB partition for a total of 3GB. Here is what the sequence would look like:

```
C:\>FDISK /S /P↵
Known storage device names:

  "CF"
          CF:0     256.9 MB   dos40pri  mounted as C:
  "BI25"                                          // BI25 is the storage device name
         BI25:0    2146.4 MB   fat16LBA  mounted as D:
         BI25:1    1107.0 MB   fat16LBA  mounted as E:

Which named device (CTRL-C to exit) ? BI25↵     // We enter BI25 for the hard disk
Current Partition Table:
  #  Stat  StHd  StSct  Ptyp  EHd  ESct  SctOfs    NumScts
  0  00    00    0101   0E    FE   013F  0000003F  003FF800
  1  00    00    0101   0E    FE   013F  003FF83F  0020FDC1
  2  00    00    0000   00    00   0000  00000000  00000000
  3  00    00    0000   00    00   0000  00000000  00000000

Proposed Partition Table:
  #  Stat  StHd  StSct  Ptyp  EHd  ESct  SctOfs    NumScts
  0  00    00    0101   0E    FE   013F  0000003F  003FF800
  1  00    00    0101   0E    FE   013F  003FF83F  0020FDC1

Overwrite the current partition table [Y] ? ↵   // Enter to accept the overwrite
Dismounting D ... Ok (0)
Dismounting E ... Ok (0)
Partition(s) installed/updated

Ok to reset (necessary for changes to take effect) [Y] ? ↵   // Yes, reset!
```

We are now back at the PicoDOS prompt. We must now format the drive before we can use it.

Formatting

The next step is to format the partitions that we created above. FDISK created two partitions so we will need to format two partitions.

Begin by mounting the BigIDEA again. Type the following:

```
MOUNT BI25↵
```

After the mount completes type the following:

```
FORMAT D: /Q↵
```

This will format the D: partition and the /Q will force PicoDOS not to prompt us to confirm the format. You will now need to enter this same format command for each of the other partitions. For our example, we only need to format the D: and E: partition. If you are using a larger hard disk, you may need to format partitions D: through G:.

That's it. Now that the hard disk is prepared, you are ready to use your BigIDEA.

BigIDEA Software

Getting Started with BigIDEA Software

Everything you need to develop for the BigIDEA is included when you install the PicoDEV following the Metrowerks installation. The directory structure for the BigIDEA looks like this:

C:\Program Files\Persistor\Motocross Support\CFX\

\Examples\GigaPicoDOS	Demonstration of using ToPico stationery with the BigIDEA. We add several commands to show turning the BigIDEA on and off. We also demonstrate using LPSTOP to turn all the power off to put the CF2 in its lowest power mode.
\Examples\BigIDEA_LPAD	This is a simple example of using the BigIDEA as a storage medium for data logging. The application will log data to Ram at a specified rate. Data will be written to the Compact Flash from RAM. When the Compact Flash is full, the application will stop the logging operation. It will then spin up the hard drive attached to the BigIDEA. After spinning up the drive it will write the data from the file on the Compact Flash to the hard disk. When completed the application will power down the BigIDEA and resume logging to a new file on the Compact Flash.
\Examples\BigIDEADataLogger	This is a complex example that uses the Compact Flash as a buffer for data. The data is only written to the BigIDEA when the card is half full. This example is a great example of low power long term data logging and the BigIDEA. Be warned: This software is designed with a very specific purpose in mind. It may break if you modify the software without first understanding how it works.
\Docs \BigIDEA\	This is where you will find any Release Notes and where you will also find an electronic copy of this manual.

GigaPicoDOS Example

GigaPicoDOS.mcp in the BigIDEA\Examples directory is a good place to start to familiarize yourself with the BigIDEA. GigaPicoDOS is based on the "ToPico" stationery. The ToPico stationery is a 'starter' project that provides a way to program a custom version of PicoDOS. The custom version of PicoDOS that is created is BigIDEA "aware". It includes all of the standard PicoDOS commands plus three new commands (ON, OFF, LPSTOP) just for the BigIDEA. It's main() function sets up your CF2 system to automatically mount a BigIDEA flash card or hard disk as drive "D", after which you perform all of the normal PicoDOS operations like DIR, COPY, CHDIR, and so on.

The SetupBigIDEA() helper function shows you what you'll need to do to integrate the BigIDEA into your own programs, and you can pretty much copy and paste this into your application. The ON and OFF commands let you power the card/drive on and off, and the LPSTOP command shows you what to expect when the card/drive is off and the CF2 is in its lowest non-SUSPEND operating mode. GigaPicoDOS demonstrates the BigIDEA operations however, its services are not available when you exit and return to normal PicoDOS.

BigIDEA_LPAD

BigIDEA_LPAD is similar to the LPFiledAD.c example. Data is collected from the A/D converter and written to a file on the Compact Flash card. BigIDEA_LPAD copies the CompactFlash data file to a hard disk when the CF card fills up. This simple mechanism necessitates a pause in the acquisition, but that's the price of the simplicity. You can extend the functionality by providing two files and 'ping-ponging' between them. Another option is to use the methods demonstrated in the much more complex BigIDEADataLogger example.

BigIDEADataLogger

This builds a low-power, high-capacity data acquisition program for a Persistor CF2 mated to a BigIDEA hard drive adapters and a single Persistor PRCPDAQ PicoDAQ RecipeCard for the analog to digital converter and I/O connections. The basic operations and features of the system are:

- Continuous recording of 1 to 8 channels of unipolar analog data in the range or 0-2.5V.
- Sample rates from 50Hz to 1kHz (400sps to 8000sps aggregate).
- 8-bit (high or low byte) or 16-bit (12 bit resolution) samples.
- DOS compatible file system on hard drive for simplified data recovery
- Automatic startup and relaunch in the event of a system failure (100 second watchdog).
- Three stage data buffering - A-D to RAM, RAM to CompactFlash card, CF to hard drive.
- 1mA (50Hz/1Ch) to 10mA (1kHz/8Ch) average current drain during acquisition
- Password protection to change settings or erase files

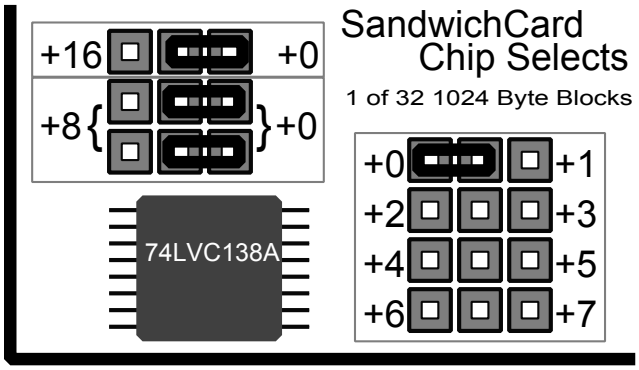
This is a much more complex example, and additional documentation can be found in the directory containing the project file.

Appendix A - Using SandwichCards in your CF2 system

Your new BigIDEA add-on for the Persistor CF2 complies with guidelines for standard SandwichCard peripherals that should make installation and setup a fairly simple and straightforward process. If the BigIDEA is the only SandwichCard add-on in your CF2 system, or if the BigIDEA is the only IDE controller SandwichCard add-on, you should be able to safely skip the rest of this section. If not, you may want to familiarize yourself with some simple SandwichCard concepts to help you hurdle any installation difficulties.

Your CF2 system can support up to 32 SandwichCards and generally most Persistor Instruments and third party SandwichCards will be pre-configured to automatically work in your system using default jumper configurations and default initialization specifiers for their respective software drivers. This means you usually need to just follow the instructions to copy the associated library and header files into the proper directories and merge them into your CF2 projects. However, some very complex CF2 systems may be built with SandwichCard components that compete for system resources and you will need to manually reconfigure some boards and make minor accommodations in driver initialization calls to get everything working.

The diagram below shows the pattern and placement of the recommended 2mm chip select jumper blocks for SandwichCards. Inevitably, some board designs will face physical constraints that make some other scheme compelling enough to veer from the standard. Electrically however, the effect will be the same.



The CF2 has just two chip selects to provide for system expansion. Without something like the SandwichCard chip select circuitry, that would limit you to two add-on devices. With it, you can have up to 32 devices, but at the expense of a large memory space. However, with the exception of RAM or Flash, almost all I/O devices need only a tiny block of addresses for full functionality.

Each expanded SandwichCard chip select corresponds to a unique block of memory addresses, but since the C language and supplied drivers means you will almost never need to be cognizant of these physical addresses, we refer to each expanded chip select by a reference number between 0 and 31. The numerical markings surrounding the jumper blocks combine to yield that value based on the installed jumpers.

In the diagram above, the top three pins of the jumper block J4 (the upper left group of jumpers in the diagram) chooses which chip select controls the board. If you jumper the right pin as shown, the

system uses CS8 (which you don't really need to know) and the chip select reference number begins with zero. If the left pin was jumpered between the center pin and +16, the system would use CS10 and the reference number would start with sixteen.

The lower six pins select the high or low bank of eight addresses. These jumpers must always be moved in pairs (admittedly awkward, but it saves much circuitry). Keep the pair to the right as shown for the low address bank with zero added to the chip select reference. Move the pair to the left for the upper bank and eight added to the reference number.

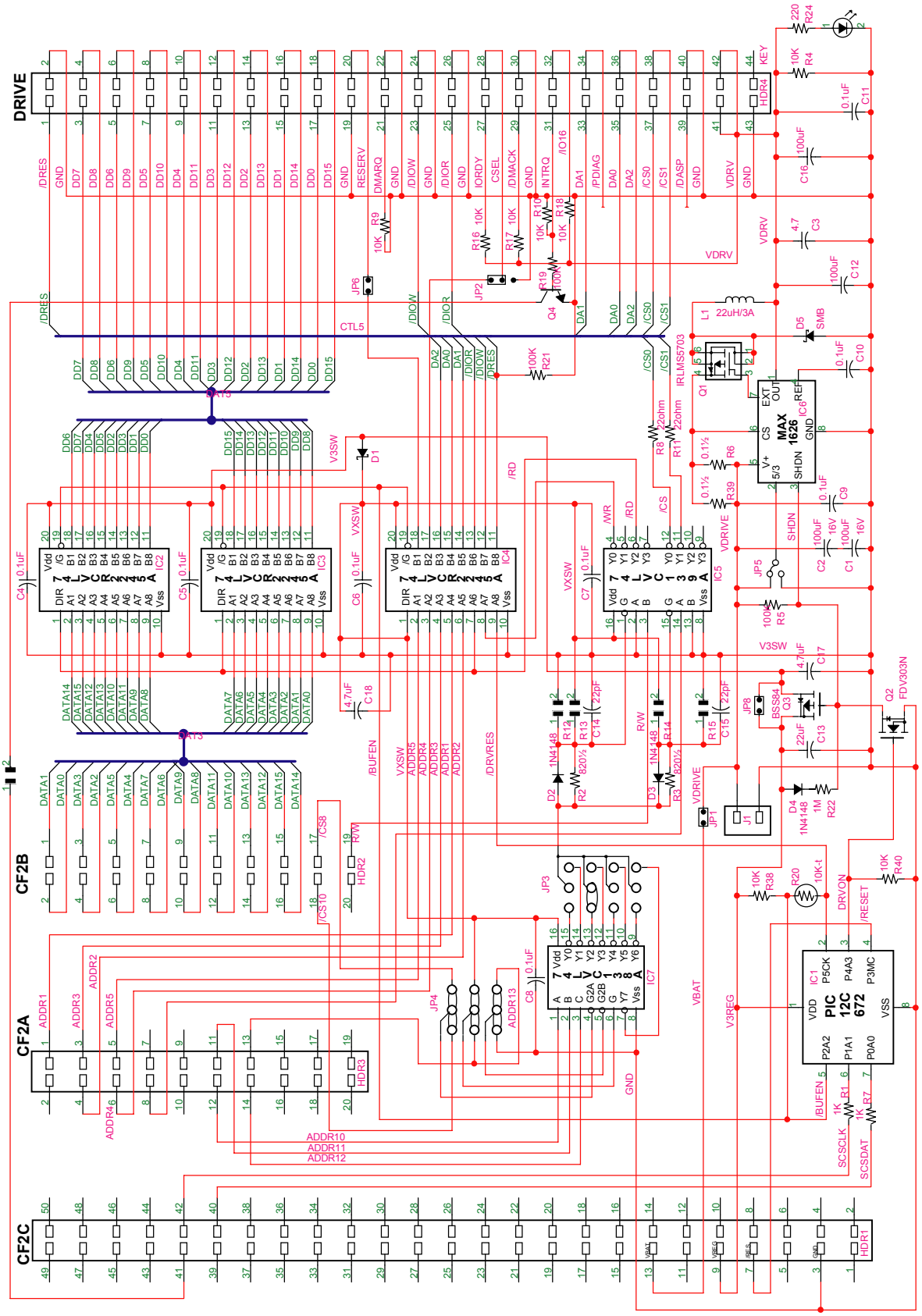
Finally, the jumper block in the lower right selects one of eight possible slots from the memory bank. One jumper connects from a center pin to any of the peripheral pins to complete the selection, and the corresponding number gets added to the reference number to complete its selection.

Fortunately, most SandwichCards manufacturers will supply their cards pre-configured to conform to the Persistor Instruments guidelines to simplify installation and setup. The table below details these selections.

SC#	Device Class	Base+	Size	CS	Default
0	BigIDEA IDE adapter	0000	1024	/CS8	FFFF8000
1	other IDE adapter	0400	1024	/CS8	FFFF8400
2	ATA Flash Card adapter	0800	1024	/CS8	FFFF8800
3	SCSI adapter	0C00	1024	/CS8	FFFF8C00
4	PCMCIA adapter	1000	1024	/CS8	FFFF9000
5	Quad UART	1400	1024	/CS8	FFFF9400
6	other UART	1800	1024	/CS8	FFFF9800
7	Ethernet controller	1C00	1024	/CS8	FFFF9C00
8	CAN controller	2000	1024	/CS8	FFFFA000
9	USB controller	2400	1024	/CS8	FFFFA400
10	IEEE488 Interface	2800	1024	/CS8	FFFFA800
11	68k bus to ISA adapter	2C00	1024	/CS8	FFFFAC00
12	LCD Display	3000	1024	/CS8	FFFFB000
13	undefined	3400	1024	/CS8	FFFFB400
14	undefined	3800	1024	/CS8	FFFFB800
15	user circuitry	3C00	1024	/CS8	FFFFBC00
16	parallel I/O	0000	1024	/CS10	FFFF0000
17	parallel A-D 1	0400	1024	/CS10	FFFF0400
18	parallel A-D 2	0800	1024	/CS10	FFFF0800
19	parallel D-A	0C00	1024	/CS10	FFFF0C00
20	counter/timer	1000	1024	/CS10	FFFF1000
21	Bank-switched RAM	1400	1024	/CS10	FFFF1400
22	Precision clock	1800	1024	/CS10	FFFF1800
23	undefined	1C00	1024	/CS10	FFFF1C00
24	}	2000	1024	/CS10	FFFF2000
25	}	2400	1024	/CS10	FFFF2400
26	}	2800	1024	/CS10	FFFF2800
27	} reserved for user	2C00	1024	/CS10	FFFF2C00
28	} custom circuitry	3000	1024	/CS10	FFFF3000
29	}	3400	1024	/CS10	FFFF3400
30	}	3800	1024	/CS10	FFFF3800
31	}	3C00	1024	/CS10	FFFF3C00

Keep in mind that these are merely guidelines and implementation considerations may persuade board designers to adopt different strategies. Check the vendors documentation as they will likely clearly state if you need to be on guard for potential collisions.

Appendix B: BigIDEA Schematic Rev: C2



Appendix C: 1-2-Punch PCMCIA Adapter Schematic