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# OPERATIONS MANUAL
# PCM-SSD

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**REVISION HISTORY**

**P/N 403-0171-000**

| ECO Number | Date Code | Rev Level |
|---|---|---|
| ORIGINATED | 921216 | B |
| 95-71 | 950803 | B1 |
| 95-92 | 951018 | B2 |

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# ADDENDUM

May 15, 1996

An anomoly has been identified when using the PCM-SSD with hybrid 512K X 8 Static RAMSs when the battery backup option is not enabled which results in premature battery failure.

**Solutions :**

1. Be sure the socket has been selected for battery backup prior to installing the SRAM.

2. If extended storage of the board is required, either store with the SRAMs removed, or place the J10 jumper in position 2-3 which is the master battery disable position. These steps will conserve battery capacity during storage.

**Technical Explanation**

When hybrid (multiple surface mount parts mounted on a substrate) are used, and not selected for battery backup, a leakage current into the SRAM's /CE input is present of up to 5mA. This leakage current will typically drain the battery in a matter of hours. This is a charatceristic of the 512K X 8 SRAMs (The leakage is into the decoder on the hybrid SRAM) and does not occur with the monolithic 512K X 8 parts.

**NOTE :** WinSystems part number 900-0025-100 512K X 8 SRAM could be either a hybrid or monolithic device dependent upon availability. WinSystems cannot gaurantee that monolithic parts may now, or in the future, be available. If you have specific questions or concerns please contact your WinSystems Applications Engineer or contact the WinSystems Technical Support department.



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# REVISION NOTICE

ECO 95-92 10-18-1995

Due to the inability to obtain the PEEL253 PLD device used as the memory mapping device U10, the memory maps have been altered by switching to a more limited PLD device. This change, simply stated, reduces the number of memory maps available by reducing the number of boards that may be daisy-chained to form a single disk. The current limitations are :

MAP 0 - 128K X 8 devices. Only two boards may be daisy-chained instead of the 8 previously supported.

MAP 1 - 256K X 8 devices. Only two boards may be daisy-chained instead of the 8 previously supported.

MAP 2 - 512K X 8 devices. Only four boards may be daisy-chained instead of the 8 previously supported.

If this change effects any customer currently using the deleted mapping options WinSystems will provide a custom PLD device to replace the missing map required. Contact your WinSystems Applications Engineer to discuss any concerns regarding this revision

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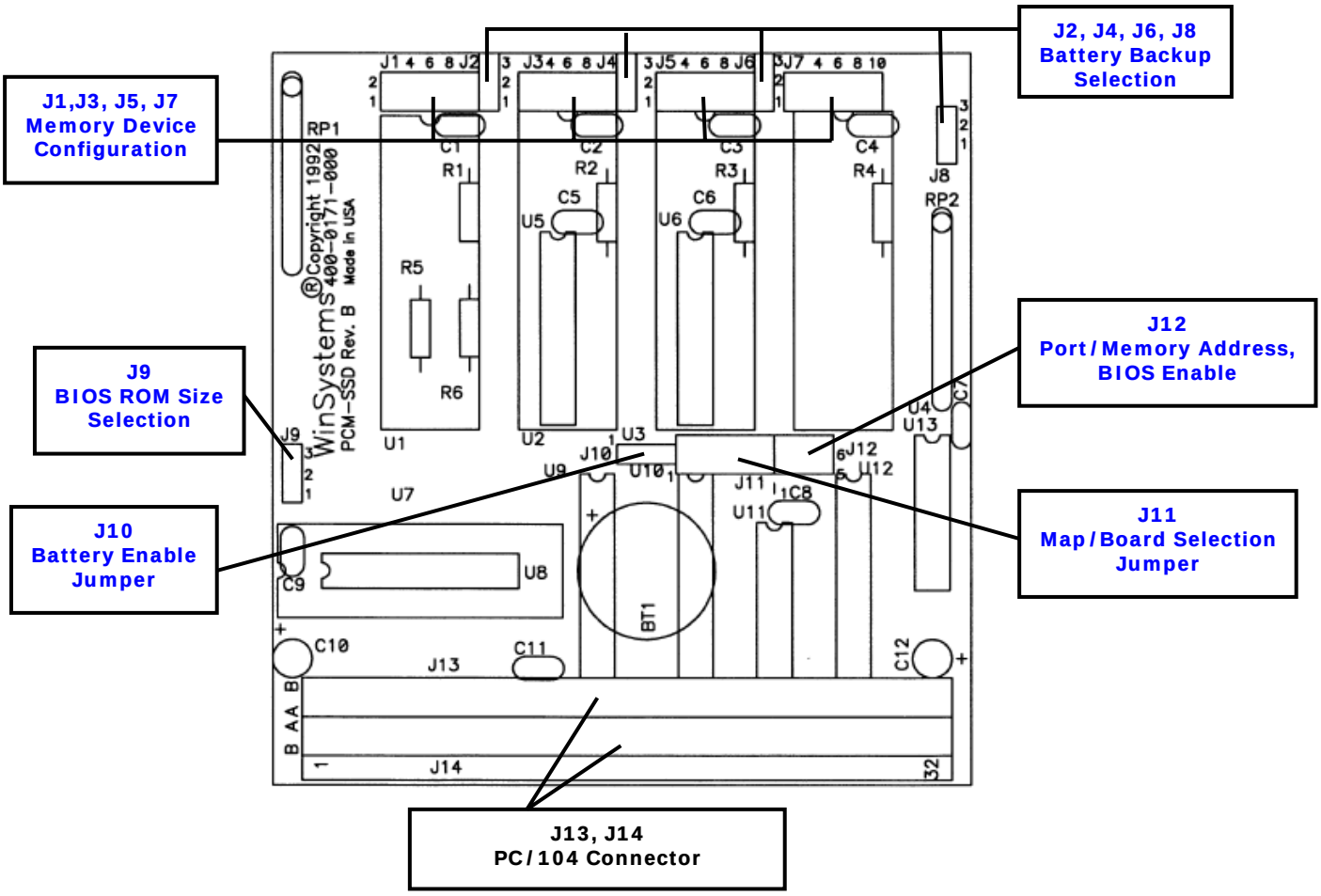
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# Visual Index – Quick Reference

For the convenience of the user, a copy of the Visual Index has been provided with direct links to connector and jumper configuration data.






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# 1 GENERAL INFORMATION

## 1.1 FEATURES

- 2MB per board "Solid State Disk"
- 8MB per disk capability (4 Boards)
- Uses NO memory address space (except BIOS extension)
- I/O Mapped to only 4 consecutive I/O Ports
- Hardware Address counter for Fast sector Transfers
- Power Fail/brownout/Battery Switching RAM protection circuit
- Software Controlled "Write Protect"
- BIOS Extension for "Bootable" RAM/ROM Disks
- Installable device driver for MS-DOS, ROM-DOS
- MKDISK utility for Creating ROM disks
- Supports SRAM, EPROM, and PEROM (ATMEL 5V only Flash)
- On Board battery for SRAM protection
- +5V only operation

## 1.2 GENERAL DESCRIPTION

The PCM-SSD is an I/O mapped Solid State Disk card for the PC/104 Bus. It is user populated with up to 2 megabytes of SRAM, EPROM, or PEROM. The PCM-SSD is primarily designed to allow the replacement of rotational media in DOS applications where temperature, shock, vibration, or other environmental factors may limit or prohibit the use of conventional disk devices. The PCM-SSD contains four 32-pin sockets which will accommodate JEDEC standard devices of RAM,ROM or PEROM. Up to 4 PCM-SSD boards may be daisy-chained to allow a maximum single drive capacity of 8 Mbytes. Up to two of these 8 Mbyte disks may be present in a system. A BIOS extension ROM allows for "bootable" Solid State disks in the form of either RAM or ROM. A diskette imaging program "MKDISK" is provided to simplify the creation of a bootable ROMdisk made from a floppy diskette.



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# 1.3 SPECIFICATIONS

## 1.3.1 Electrical

Bus Interface : PC/104 8-bit

VCC : +5V +-5% @ Tbd mA no memory devices installed

## 1.3.2 Memory

Addressing : Single 28-Pin BIOS extension socket for 32K or 64K EPROM.

## 1.3.3 Mechanical

Dimensions : 3.6 X 3.8 X 0.6 inches

PC-Board : FR-4 epoxy glass with 2 signal layers and 2 power planes with screened component legend, and plated through holes.

Jumpers : 0.025" square posts on 0.10" centers

## 1.3.4 Environmental

Operating Temperature : 0° to 70° C

Non Condensing Humidity : 5 to 95%



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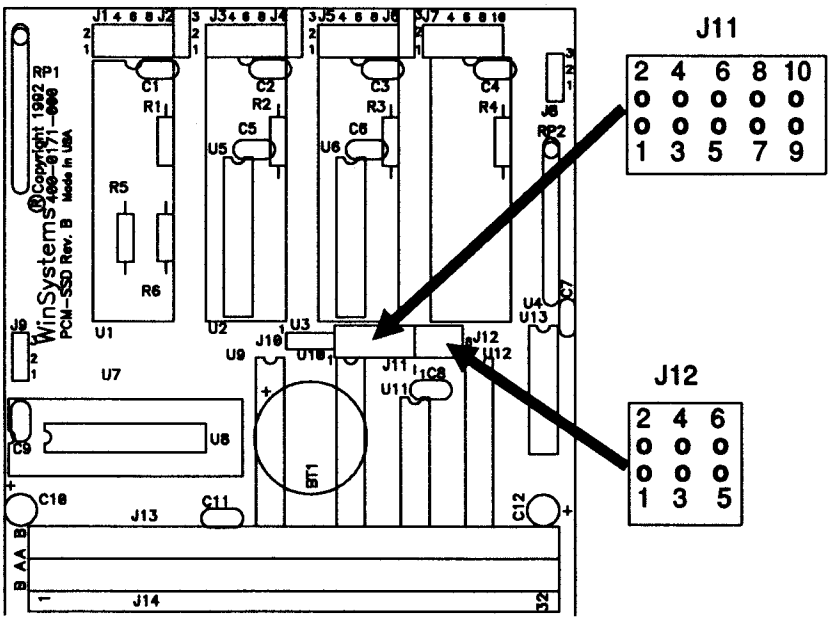
# 2 PCM-SSD Technical Reference

## 2.1 Introduction

The PCM-SSD was designed specifically for providing Solid State Disk support in the highest density consistent with parts available at the time. Up to four 512K X 8 EPROMS or SRAMS may be populated onto a single board for 2 Mbytes of non-volatile storage. A daisy chaining feature allows four boards to be joined into a single huge disk of up to 8 Mbytes. This section of the manual provides the necessary information to configure the board for the mode and the devices to be used.

## 2.2 Theory of operation

The PCM-SSD board uses an unconventional approach to providing the large memory array needed for Silicon disk drives. Rather than directly mapping or even paging the memory into the processor's address space, the PCM-SSD, I/O maps the memory into only 4 I/O port addresses allowing it's use in even the tightest of memory mapped systems. The four I/O registers allow the writing of the ram array addresses, the data access, and the write protect function. Each of the registers will be described in detail in a later section. The memory is actually accessed through a single I/O address which through hardware counters, automatically adjusts the address to the next location so that high speed string move instructions can be utilized for reading or writing blocks of data. These data blocks are 256 bytes in length. After each block transfer a new 16 bit address is written to the Address registers and the board is ready to block transfer another 256 bytes.




Configuration Jumpers
J11 and J12

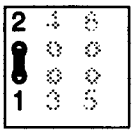


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## 2.3 I/O Port Selection

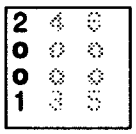
Jumper Block J12, pins 1 and 2 control the Base I/O port to which the board responds. When a jumper is installed the base address is 210H, when not installed the base address is 218H.

J12




BASE ADDRESS 210H

J12




BASE ADDRESS 218H

## 2.4 I/O Registers

There are four I/O registers on the PCM-SSD that are used for accessing the memory array. The register definition and usage is defined below:

### OFFSET 0 - MSB Address Register

D7 - A23 of access address
D6 - A22 of access address
D5 - A21 of access address
D4 - A20 of access address
D3 - A19 of access address
D2 - A18 of access address
D1 - A17 of access address
D0 - A16 of access address

This register is write only and holds the upper 8 bits of the 24 bit address used to access the 16 Mbyte range.

### OFFSET 1 - NSB Address Register

D7 - A15 of access address
D6 - A14 of access address
D5 - A13 of access address
D4 - A12 of access address
D3 - A11 of access address
D2 - A10 of access address
D1 - A9 of access address
D0 - A8 of access address

This register is write only and holds the middle 8 bits of the 24 bit address used to access the 16 Mbyte memory array. Writing this register also clears the LSB address counter to 0.



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### OFFSET 2 - Data access register A

D7 - D7 of memory data
D6 - D6 of memory data
D5 - D5 of memory data
D4 - D4 of memory data
D3 - D3 of memory data
D2 - D2 of memory data
D1 - D1 of memory data
D0 - D0 of memory data

This read/write register is the primary window to the memory array a value written to this port will be written to the address in the memory array specified by the MSB register the NSB register and the current LSB counter address. In like fashion, a read from this I/O address will result in the current Memory array data at the address specified by the MSB register, the NSB register and the LSB address counter. In either case, read or write, an access to this register results in the LSB address counter being incremented immediately following the access so that the next access will be at the next sequential address in the array. This incrementing process does NOT carry into the NSB or MSB register which must be rewritten every 256 bytes.

### OFFSET 3 - Data access register B

D7 - D7 of memory data
D6 - D6 of memory data
D5 - D5 of memory data
D4 - D4 of memory data
D3 - D3 of memory data
D2 - D2 of memory data
D1 - D1 of memory data
D0 - D0 of memory data

This read/write register is used to access the memory array when post incrementing of the LSB counter is not desired. The byte written or read will still be specified by the 24 bit combination of the MSB register the NSB register and the LSB counter, but the LSB counter will NOT be altered following the access. This mode is useful for EEPROM or PEROM (Flash) memories where data polling of a page must be verified for write completion before proceeding on to the next address. It would then be necessary to do one more read from Data Access Register A in order to bump the address to the next byte.



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### OFFSET 4 - Write Protect Register

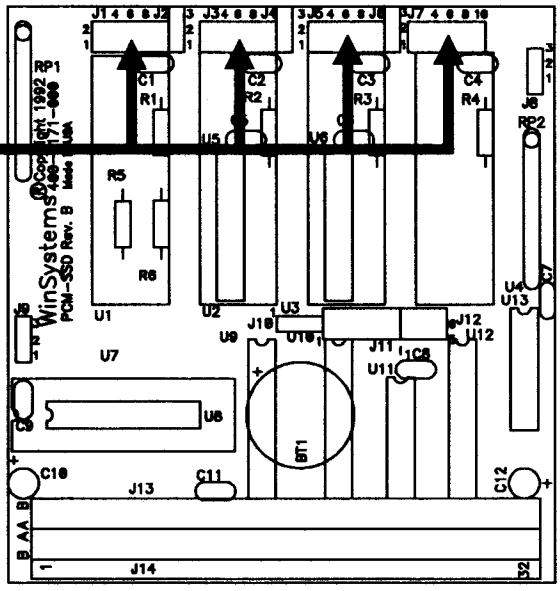
D7 - D6 - Reserved
D0 - Write Protect Bit, 0 = Protected, 1 = Writeable

This write only register controls the write protect function of the PCM-SSD board. On powerup the write protect bit is cleared (disabling writes) and must be explicitly enabled by writing a 1 to the I/O port at the BASE address + 4. To reenable the write protection write a 0 this register. The USSD.SYS device driver as well as the USSD BIOS extension will both enable writing only during that time that a sector is being transferred which contributes greatly to data safety and integrity.

DEVICE CONFIG

| 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|
| o | o | o | o | o |
| o | o | o | o | o |
| 1 | 3 | 5 | 7 | 9 |

Memory Device Configuration
Jumpers
J1, J3, J5, J7




## 2.5 Device Type Configuration

The PCM-SSD board supports 9 basic device types ranging from 128K X 8 to 512K X 8 bytes each. The standard memory maps require that the devices used must ALL be of the same SIZE configuration i.e. all 128K X 8 devices or all 512K X 8 devices. It is allowed to mix ROM and RAM but not sizes. Each memory socket has a configuration jumper immediately above the socket. Each device size/type has a specific jumpering which must be accomplished for proper operation. The device type/size configuration table is shown on the following page.

When SRAM type devices are selected they may be Battery Backed-Up by placing the battery configuration jumper for the device on pins 2-3, for ANY other device types, the jumper must be placed on pins 1-2. The Jumpers J2, J4, J6, and J8 control battery backup control for U1, U2, U3 and U4 respectively. Jumper block J10 is used for the master battery enable, when J10 is jumpered 1-2, the battery is enabled. If no battery is installed or it is desired to disable the battery J10 should be jumpered pins 2-3.



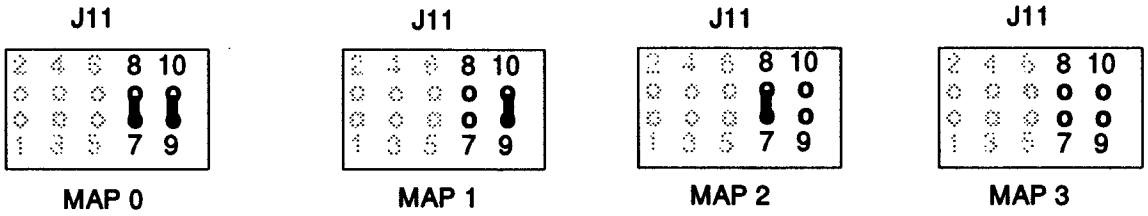
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| | SRAM | EPROM | EEPROM | PEROM |
|---|---|---|---|---|
| **128K X 8** | 1-2 3-5<br>4-6 | 1-3 2-4 | 1-3 2-4<br>5-6 | 1-3 2-4<br>5-6 |
| **256K X 8** | 1-2 3-5<br>4-6 7-8<br>9-10 | 1-3 2-4<br>9-10 | | |
| **512K X 8** | 1-2 3-5<br>4-6 7-8<br>9-10 | 1-3 2-4<br>5-7 9-10 | | 1-3, 2-4<br>5-6, 7-8, 9-10 |

## 2.6 Memory Map Selection

The MCM-SSD supports up to 4 distinct mappings of the 4 array sockets to provide maximum flexibility. J11 pins 7-8, 9-10, control the map number. The map jumpering and devices supported are shown below.

| | |
|---|---|
| MAP 0 | 4 128K X 8 devices. (Two board maximum) |
| MAP 1 | 4 256K X 8 devices (Two board maximum) |
| MAP2 | 4 512K X 8 devices (Four board maximum) |
| MAP3 | Reserved |




## 2.7 Board Number Selection

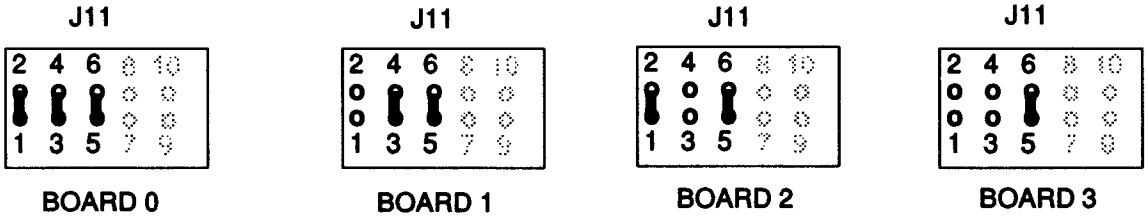
Each memory map selected by pins 7-8, 9-10 on J11 must also be matched by a board number. A board number specifies a board number 0 through 3. Up to 4 boards may be used in any particular map (See limits above). All boards in a particular set must

1. Use the Same BASE I/O port
2. Use the same SIZE devices
3. Use the same Map number
4. Have sequential Board Numbers starting with 0.

Board numbers are controlled by pins 1 through 6. The board number jumperings are shown on the following page.



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## 2.8 BIOS Configuration

The PCM-SSD board contains a fifth memory socket in which may be installed a BIOS extension ROM. This ROM when enabled, can allow the PCM-SSD to become a "bootable" disk containing either RAMS or ROMS. The BIOS ROM is installed into socket U7 and it's size is selected via J9. When J9 is jumpered pins 1-2 a 32K (27C256) BIOS is selected (default) or when J9 pins 2-3 are jumpered a 64K (27C512) BIOS is selected. Once the proper type has been selected the BIOS may be enabled or disabled by placing a jumper on J12 Pins 5-6 to enable or removed to disable. A final configuration option for the BIOS is the base address at which the BIOS will appear. If J12 pins 3-4 are jumpered the BIOS image will appear at C800:0000H otherwise the BIOS image will appear at D000:0000H.

## 2.9 JUMPER SUMMARY

| Jumper No. | Description | Page Reference |
|---|---|---|
| J1 | U1 Device Configuration | 2-4, 2-5 |
| J2 | U1 Battery Backup Select | 2-4, 2-5 |
| J3 | U2 Device Configuration | 2-4, 2-5 |
| J4 | U2 Battery Backup Select | 2-4, 2-5 |
| J5 | U3 Device Configuration | 2-4, 2-5 |
| J6 | U3 Battery Backup Select | 2-4, 2-5 |
| J7 | U4 Device Configuration | 2-4, 2-5 |
| J8 | U4 Battery Backup Select | 2-4, 2-5 |
| J9 | BIOS ROM Size Select | 2-6 |
| J10 | Battery Enable Jumper | 2-4 |
| J11 | Map/Board Select jumper | 2-5, 2-6 |
| J12 | Port/Memory Address, BIOS enable | 2-2, 2-8 |
| J13 | PC/104 Connector | N/A |
| J14 | PC/104 Connector | N/A |



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# 3 ROMDISK & RAMDISK USAGE

## 3.1 MKDISK Utility

The bootable ROMDISKS for the PCM-SSD board use a disk imaging technique to allow maximum versatility and compatibility. Since the bootable ROMDISK is an exact image of a bootable floppy diskette, all testing and debugging can be accomplished using a floppy drive. Once the application is ready for ROM, it's a simple matter to use the MKDISK utility to create the EPROMS necessary for a bootable ROMDISK equivalent of the functioning floppy.

MKDISK is a menu driven utility for creating the ROM images duplicating the desired floppy diskette. MKDISK is invoked at the MS-DOS command line with :

**MKDISK**

```
MKDISK - Solid-State RomDisk Creation Utility V3.00
(C) Copyright 1988-1992, WinSystems Inc.

SELECT SSD TYPE

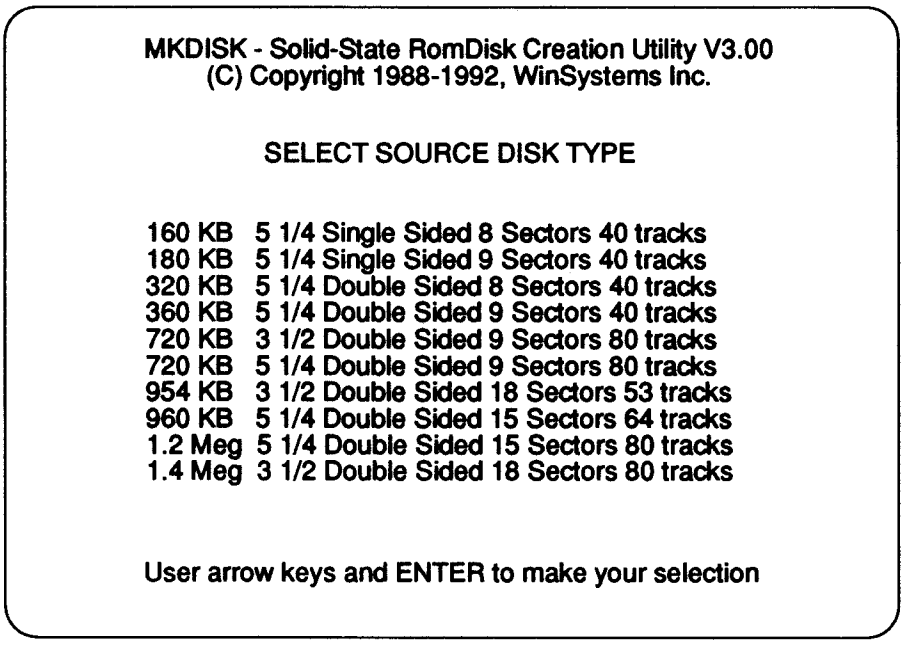
Paged Memory Mode (SSD-XT)
Extended Memory Mode (SSD-AT)
V53 Expanded Memory Mode
USSD Board Mode

User arrow keys and ENTER to make your selection
```

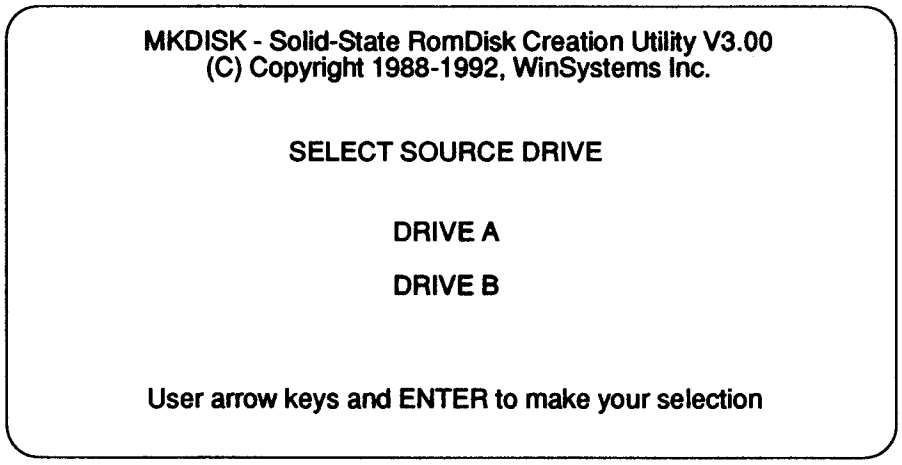
Select the USSD mode from menu number 1. The other menu options are used for other WinSystem's Silicon Disk systems and are NOT compatible with the PCM-SSD board.



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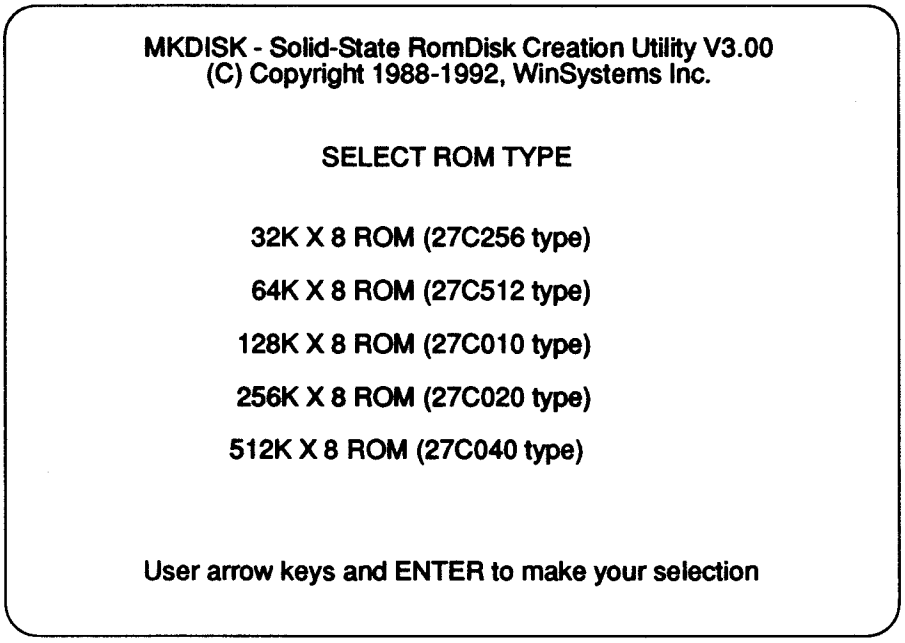

From menu number 2 select the diskette type from which the ROMDISK is to be imaged.



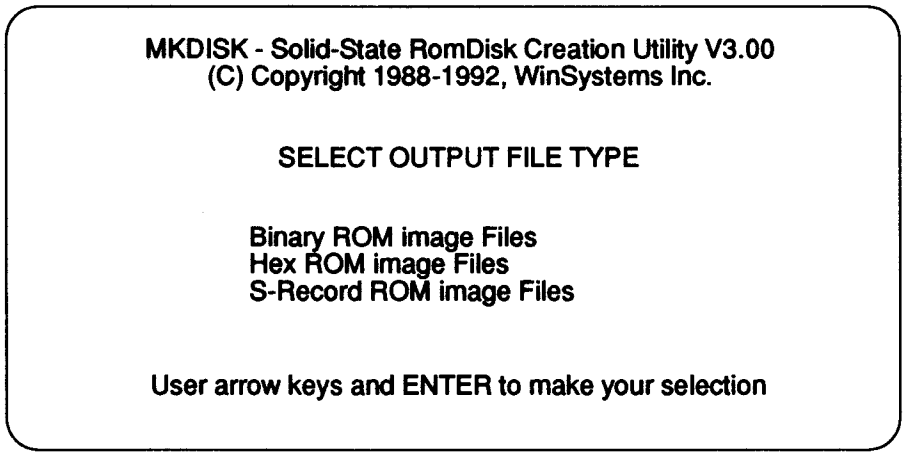

Select either DRIVE A or DRIVE B from the source drive selection menu.



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From menu number 4 select the appropriate EPROM size for the ROMDISK. Note that EPROM sizes below 128K are NOT usable with the USSD board but are provided as choices for other Silicon Disk modes.




From menu number 5 select the appropriate ROM image file format that your EPROM programmer accepts. Selecting the BINARY ROM image file format will result in the smallest files. MKDISK will then read the specified floppy diskette and create a number of ROM files in the format specified. These files will be named ROMx.BIN, ROMx.HEX, or ROMx.S19 where the x is the ROM number in the sequence (starting with 1) and the extension (.BIN, .HEX, .S19) depends upon the output file format specified. After programming the ROM image files, install the ROMS into the PCM-SSD board with ROM1 in U1, ROM2 in U2 etc. Refer to the technical reference section of this manual to properly jumper each of the ROM sockets, to choose the correct map for the devices chosen and to enable the BIOS ROM for booting.



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If everything has been carefully prepared, at the next powerup the system will boot from the ROMDISK just as if it were the floppy disk from which it was imaged. The actual floppy drive, if present may still be accessed but as DRIVE B. The ROMDISK boot can NOT be overridden by inserting a diskette into the floppy drive. Only by removing the board, removing ROMS or disabling the BIOS extension will the ROMDISK boot be disabled.

## 3.2 RAMDISKS

The PCM-SSD board with it's onboard BIOS extension may also be used to create a "bootable" RAMDISK. This may be especially helpful during development or testing before committing to ROMS, or may be an acceptable solution where program or data changes dictate a more flexible medium. The first decision that must be made is to the type and number of SRAM chips to be used for the RAMDISK. The simplest method is to choose a number of parts that will contain storage equal to or greater than one of the standard floppy diskette formats. A list of floppy disk formats as well as a possible RAM complement is shown below.

| Disk Size | 128K RAMS | 256K RAMS | 512K RAMS |
|---|---|---|---|
| 160K | 2 | 1 | 1 |
| 180K | 2 | 1 | 1 |
| 320K | 3 | 2 | 1 |
| 360K | 3 | 2 | 1 |
| 720K | 6 | 3 | 2 |
| 1.2M | 10 | 5 | 3 |
| 1.44M | 12 | 6 | 3 |
| 2.88M | 24 | 12 | 6 |

After having installed the parts starting with U1 and continuing on to secondary boards if required, jumper the device type, map option and board numbers appropriately and enable the BIOS extension. Boot up the system from floppy or hard disk and format the RAMDISK which, if previously unformatted, will be DRIVE B. The method used to format the drive for the desired size varies slightly with MS-DOS versions but is simplified greatly with MS-DOS Version 5.0's format command which will take as an argument the media type to format. An example line for each of the above disk sizes are shown here :

**160K**

**format b: /f:160 /s /u**

**180K**

**format b: /f:180 /s /u**



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**320K**

**format b: /f:320 /s /u**

**360K**

**format b: /f:360 /s /u**

**720K**

**format b: /f:720 /s /u**

**1.2M**

**format b: /f:1.2 /s /u**

**1.44**

**format b: /f:1.44 /s /u**

**2.88**

**format b: /f:2.88 /s /u**

Depending upon the particular system and it's BIOS some of these formatting commands may not be allowed or recognized. In these cases the problem can usually be overcome by using the MS-DOS configuration command DRIVPARM in the boot drive's CONFIG.SYS file to define the drive type correctly. Another approach is to use the BIOS SETUP menu to enable DRIVE B to be a size equal to or greater than that desired for formatting. Careful use of DRIVPARM and/or DRIVER.SYS can allow the creation of even nonstandard sized bootable disks eliminating the wasted RAM when device size totals are greater than the disk storage size. We have not been able however, to create "bootable" RAMDISKS in sizes much larger than 2.88M. If larger disks are needed, boot from either a small ROMDISK or RAMDISK and use the USSD device driver to create and access a secondary RAMDISK of up to 16Mbytes in size.

**NOTE :** SRAM disks in order to retain the information during powerdown must have each RAM chip in the array battery backed up. Refer to the technical reference section on selecting battery backup.



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# 4 USSD Device Driver Reference

## 4.1 USSD Device driver options

The USSD.SYS device driver allows the USSD board to be used with MS-DOS and ROM-DOS with disk sizes up to 16Mbytes. This device driver is used for a variety of silicon disk applications and has a myriad of command line switches to control it's modes of operation. The basic invocation of USSD.SYS in the CONFIG.SYS file on the boot media is :

**DEVICE = USSD.SYS [options]**

where the following options are available. Note that the following option list is complete for the driver and most of these options are NOT applicable to use with the USSD board. Refer to the examples that follow the option list for specific USSD board usages.

**/DBLFAT** This switch creates a duplicat FAT table (Normally not needed)

**/NOINIT** This switch tells USSD not to auto-initialize the drive but will still allow writes.

**/VLSI** Sets the mode to support the VLSI 82C315 internal PCMCIA registers for disk access.

**/V53** This switch is used only used with the V53 processor when V53 expanded memory is being used as the ROMDISK or RAMDISK. This switch is used in place of the /MOD switch.

**/SEG:XXX** where the XXX is a HEX value specifying the segment for the disk, the disk page or the expanded memory access address.

**/MOD:P** This switch places the driver into paged mode which sets a small page (Size specified by /PSZ:) at an address below 1 meg. (specified by /PAD:) into which memory for the disk is paged.

**/MOD:L** This switch places the driver into linear mode where memory below 1 Meg is used as the disk and then the /SEG: switch specifies where in RAM the disk begins.

**/MOD:E** This switch places the driver into extended mode where memory above the 1Meg. boundary is used for the disk. A protected mode capable processor (286,386,486) is required for using this mode.

**/MOD:U** This switch places the driver into USSD board mode which allows access to the disk through 4 I/O ports specified by /PAD:.

**/PAD:XXX** where the XXX is a hex value specifying the port I/O address used in either the USSD or for paged memory maps controlled by an I/O port.

**/PSZ:XXX** where xxx specifies the page size in decimal of a single page. Usually 64 or 128 for paged mode and 16 for V53 mode.



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**/DSZ:XXX** where XXX is the desired disk size in decimal Kbytes. This parameter is used in determining whether the disk needs to be initialized (formatted) or not and to what size.

**/EPT:XX** where xx specifies the PEROM/EEPROM internal page size. Atmel 29C010 parts use a page size of 128. Atmel 29C040/29C040A parts use a page size of 256.

**/SPG:XXX** where xxx is the hex value that specifies the starting page number. For /V53 mode this value specifies the upper 10 bits of the 24 bit absolute address for the start of the disk.

**/INC:XXX** where xxx specifies a hex value that is added to the /SPG: value for each subsequent page.

**/ROM** This switch signals the driver not to initialize the disk but to treat is as if it was ROM, this includes not allowing any writes to the disk.

**/SND** This switch will allow PC compatible systems to produce a sound from the speaker during disk activity.

**/VERIFY** Turns on full read after write verify.

### 4.1.1 PCM-SSD Board examples

Following are several examples using the USSD board and the USSD.SYS driver for accessing some or all of the memory on board.

**EXAMPLE 1**

8 PCM-SSD Boards, each populated with 4 pieces of 512K X 8 SRAM for a desired disk size of 16M bytes. The CONFIG.SYS line would read:

**DEVICE = USSD.SYS /MOD:U /PAD:210 /DSZ:16384**

**EXAMPLE 2**

A single PCM-SSD board populated with 2 pieces 512K X 8 ROM which are configured as a bootable ROMDISK along with 2 pieces 512K X 8 SRAM for a 1Meg RAMDISK. The ROMDISK handling would be taken care of by the BIOS extension, to access the RAMDISK the following CONFIG.SYS entry would be necessary.

**DEVICE = USSD.SYS /MOD:U /PAD:210 /SPG:1000 /DSZ:1024**

Notice that the /SPG:1000 argument was added to indicate that the RAMDISK was not in the first socket but was offset by 1.0M (1000).



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**EXAMPLE 3**

A single PCM-SSD board contains 2 pieces 128K X 8 ROM and 2 pieces 128K X 8 PEROM for 256K or Bootable Romdisk and 256K of PEROM RAMDISK. Again, the BIOS extension would handle the "Boot Drive" and an entry must be made in the CONFIG.SYS file to access the PEROM drive. The entry would be :

**DEVICE = USSD.SYS /MOD:U /PAD:210 /SPG:400 /DSZ:256 /EPT:128**

Notice that both the 256K offset (/SPG:400) and a PEROM page size (/EPT:128) were necessary in this example.

**EXAMPLE 4**

Two PCM-SSD boards with 5 pieces 256K X 8 ROM and 3 pieces 256K X 8 RAM for a 1.2M ROMDISK and a 768K RAMDISK. As before, the BIOS handles the bootable ROMDISK and we specify the size and starting location for the RAMDISK with a CONFIG.SYS entry of :

**DEVICE = USSD.SYS /MOD:U /PAD:210 /SPG:1400 /DSZ:768**

**EXAMPLE 5**

A single PCM-SSD board populated with 2 pieces 512K X 8 ROM which are configured as a bootable ROMDISK along with 2 pieces 512K X 8 PEROM (29C040/29C040A 5 Volt Flash) for a 1Meg FLASH DISK. The ROMDISK handling would be taken care of by the BIOS extension, to access the FLASH DISK the following CONFIG.SYS entry would be necessary.

**DEVICE = USSD.SYS /MOD:U /PAD:210 /SPG:1000 /DSZ:1024 /EPT:256**

Notice that the /SPG:1000 argument was added to indicate that the FLASH DISK was not in the first socket but was offset by 1.0M (1000).



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## 4.1.2 CALCULATING STARTING PAGE VALUES

To help calculate the /SPG value the following constants are added together for each device.

128K X 8 devices add 200H
256K X 8 devices add 400H
512K X 8 devices add 800H

Count the number of parts preceding the RAMDISK you wish to specify and after starting with zero, add the value shown above for each part. In EXAMPLE 2 above, there were three 512K X 8 devices preceding the start of the RAMDISK we therefore add together the constant for 512K devices three times to arrive at the correct /SPG value.

```
  800H
 +800H
 +800H
------
 1800H
```

Remember that this is hexadecimal arithmetic and the 8 + 8 = 10 and not 16. One more illustration might help. In Example 4 above 5 pieces of 256K parts preceded the RAMDISK area. The constant for 256K parts is 400H. We must add the constant 400H together 5 times to arrive at the correct SPG value.

```
  400H
 +400H
 +400H
 +400H
 +400H
------
 1400H
```

which is what we had used earlier in the example. Again remember it's hex math.

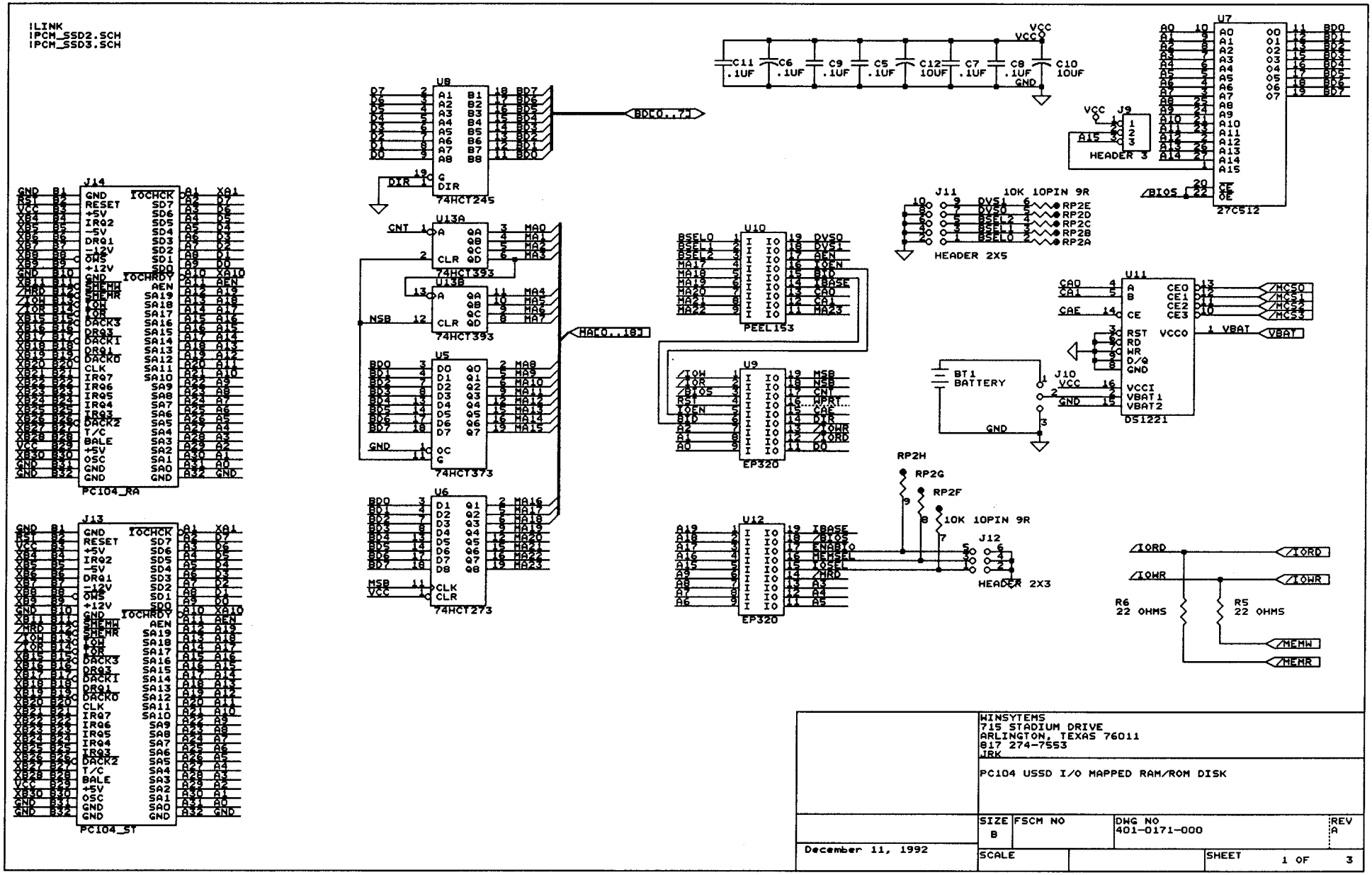


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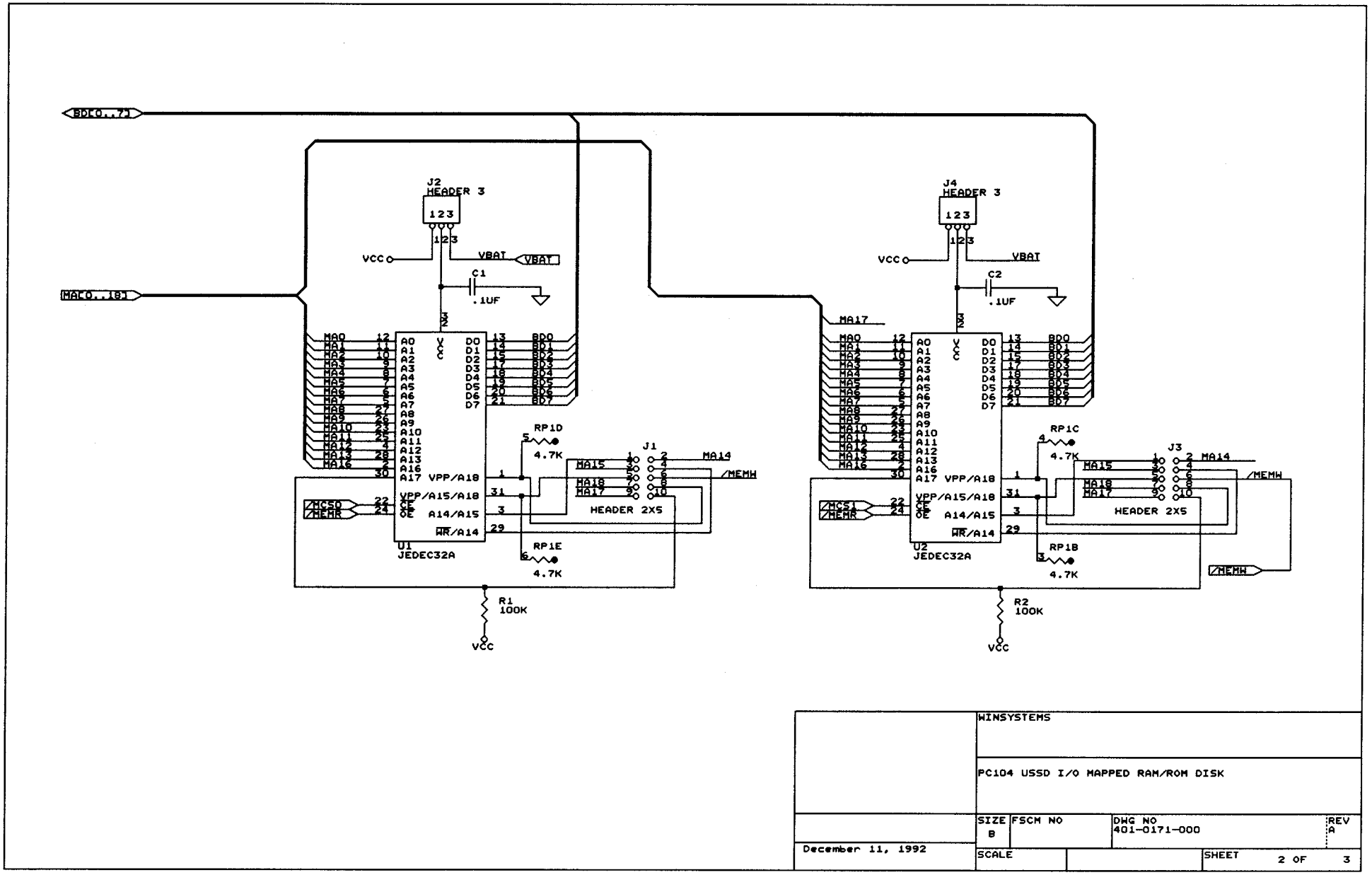
# APPENDIX A

## PCM-SSD Schematic Diagram

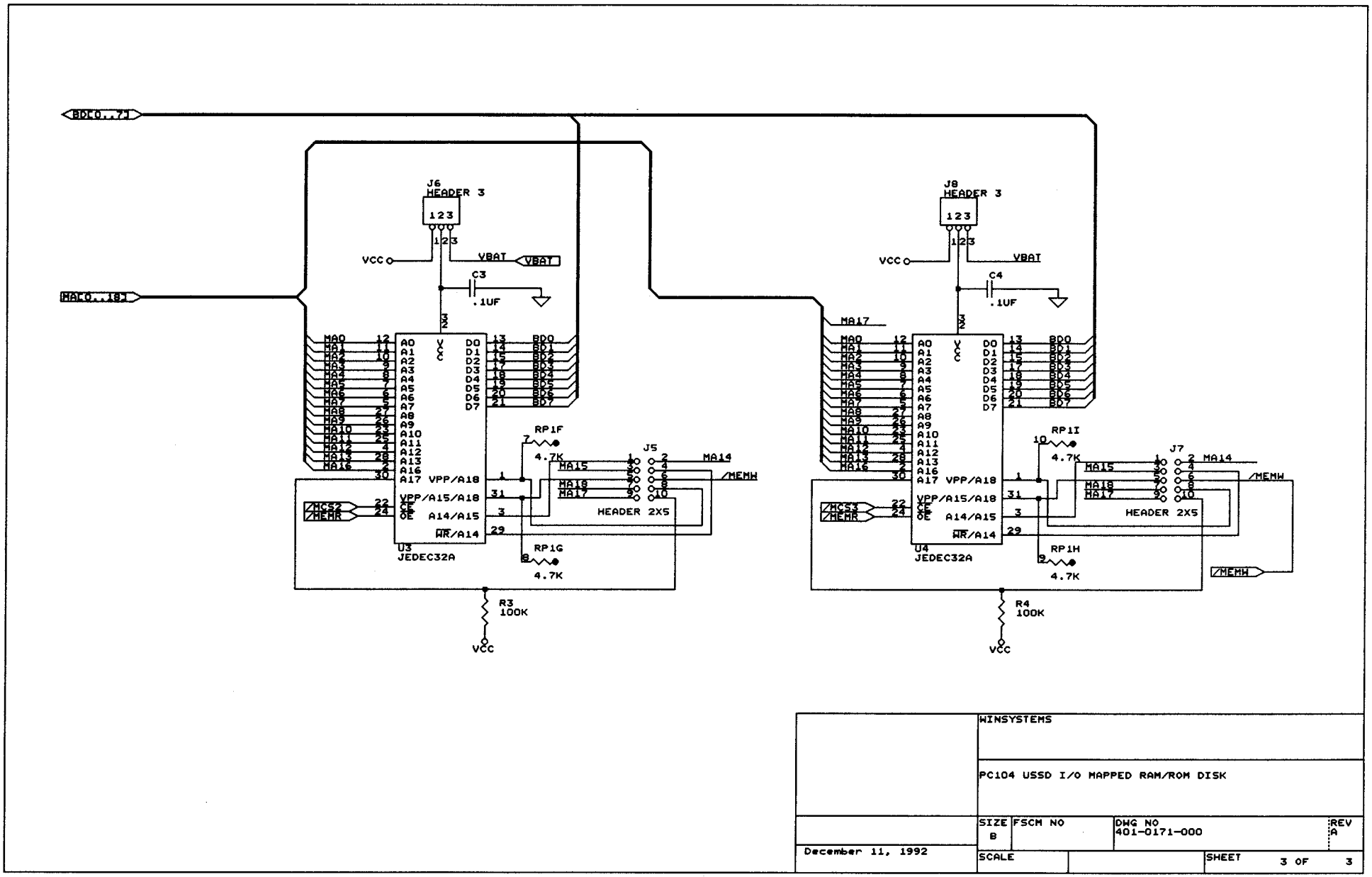
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|---|---|---|---|---|
| | WINSYSTEMS | | | |
| | PC104 USSD I/O MAPPED RAM/ROM DISK | | | |
| | SIZE B | FSCM NO | DWG NO 401-0171-000 | REV A |
| December 11, 1992 | SCALE | | SHEET 3 OF 3 | |

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