PCM-4330

PC/104 486 CPU Module
with Flat Panel/CRT Interface

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Packing list

Before you begin installing your card, please make sure that the following materials have been shipped:

- 1 PCM-4330 CPU card
- 1 SVGA adapter (10-pin to 15-pin)
- 1 Power supply adapter (8-pin to 4-pin)
- 2 Com port adapter (10-pin to 9-pin)
- 1 Universal-LCD adapter (40-pin to 44-pin)
- 1 System interface connector (10-pin)
- 2 hard disk drive (IDE) interface cable (40-pin for 1.8"/2.5" or 3.5" HDD)
- 1 floppy disk drive interface cable (34-pin)
- 1 parallel port adapter (26-pin to 25-pin)
- 1 utility disk)Flash BIOS program, Watchdog for Windows Librarym and Demo Program)
- 2 utility disks with SVGA utility programs
- PC/104 module mounting supports

If any of these items are missing or damaged, contact your distributor or sales representative immediately.

PCM-4330 Features

PC/104-Board-Computer with 486SX, 486DX2, or 486DX4

- High MTBF
- PC/104 standard size
- High frequency mains shielded between GND and VCC layer
- Flash-Memory for BIOS and customer specific extensions
- SVGA, LC-display, keyboard, IDE-/AT-bus and floppy disk interface, one parallel and two serial ports on-board
- Silicon disk for fast loading and booting of operating system optional
- Loudspeaker control
- Watchdog function

SIS-85C471-AT-Controller

- Includes components, which are compatible to: 82C37A-DMA,
- 82C54-Timer, 82C59-Interrupt-Controller, 82288-Bus-Controller, and 82284-Clock-Generator
- Supports 70 ns DRAM modules providing a total of 1 MB, 4 MB and 16MB system memory on-board
- Memory controller with Page Mode
- Supports shadow RAM between 768 kB and 1 MB
- Memory remap of 256 kB to segments D000h and E000h with more than 1 MB memory installed and shadow disabled
- Supports synchronous and asynchronous bus timing

SMC-FDC37C92x-Ultra-I/O-Controller

- SuperCell™ technology
- Licenced CMOS 765B-Floppy-Controller
- IDE hard disk interface
- Two NS16550-compatible serial ports with 230k baud and full modern support
- ChiProtect™ protected parallel port can operate in standard mode, enhanced mode, as an enhanced parallel port (EPP), or extended
- capabilities port (ECP)

Award-Modular-BIOS

- Modular BIOS
- Testing and initialization of all PCM-4330 hardware components
- Supports all IBM-AT03-compatible traps

WD90C24-Controller

- 32 bit memory interface
- 1 MB display memory
- Hardware drag of lines under MS-Windows (Strip Line)
- Hardware pane of screen segments under MS-Windows (BitBLT)
- Character set loading into display memory for screen segments outside visible area
- CRT connector with integrated RAMDAC
- Monochrome STN-LCD connector with 64 shades of gray
- Color D STN or TFT-LCD connector
- Plasma-display connector

WD-VGA-BIOS

- Version 7.22A
- All IBM VGA standard modes and all VESA Super VGA modes
- Extended CRT mode with 132 columns
- 48 kB Video BIOS
- All VGA traps are supported
- Simultaneous display on CRT and LC-display possible

Table of Contents

1 Introduction

This manual describes the PCM-4330 PC/104 board computer with 486SX, 486DX2, or 486DX4 CPU as a PC/104 module.

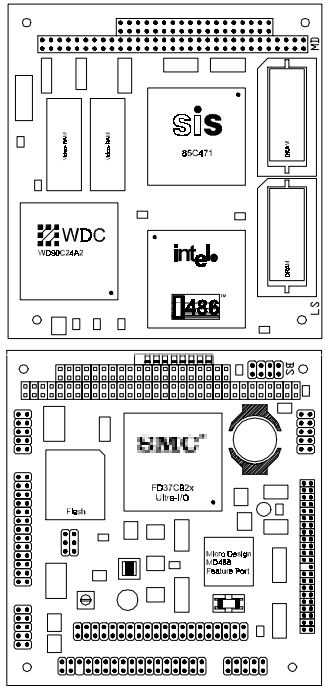


Figure 1, PCM-4330 with 486SX, 486DX2, or 486DX4-CPU (Top and Bottom View)

Several notes in the text refer to product documentation not included in this manual. If you need more comprehensive and detailed information, please refer to data sheets and documents listed under chapter 1.3.

1.1 Product Introduction

The PCM-4330 serves as a processor board in a PC/104 environment and provides for a fully ISA-compatible computer system.

The system is built using the SIS-85C47i. This chip contains on a single VLSI component the main elements of an ISA system by implementing DMA, memory,bus, interrupt controller, memory mapper, and timer.

For addressing peripheral devices, a chip from Standard Microsystem Corporation (SMC) is used on the board. The FDC37C92x-Ultra-I/O-Controller, built in SuperCel™ technology, includes IDE-/AT-bus, floppy disk, keyboard, serial, and parallel port controllers, as well as a real-time clock.

The WD90C24 controller, addressing 1 MB of video memory via a 32 bit wide data bus, is used to control video output. The controller accelerates the screen display of window systems like MS-Windows by hardware support of CPU intensive screen operations. The graphics board supports all VGA, SVGA and Paradise enhanced video modes.

Design

The PCM-4330 board is AT-compatible including all interfaces. All software written for Intel 8086, 80286, 80386, 80486, and compatible processors runs on this board. It is built and fired in double-sided SMD technology requiring minimum space for a maximum of functions.

Processor

The 486SX, 486DX2, and 486DX4 CPUs offer virtual addressing capabilities, integrated MMU, 4-level memory protection in multi-user-mode (Protected Virtual Address Mode). 1 MB physical memory can be addressed in Real-Address-Mode and 4 GB in Protected Mode. Maximum virtual memory in Protected Mode is 64 TB.

Co-processor

All DX-CPUs used for the PowerDwarf feature on-chip math co-processors.

Cache

Presently available CPUs from the i486 family include 8 kB 4-way-on-chip-cache used for data and code caching by the CPU.

Main Memory

With respect to the 486SX, 486DX2, and 486DX4 CPU capabilities, main memory is addressed with an access width of 32 bit. RAM memory is parity checked. Two DRAM modules with access times of 70 ns are used in sockets providing 1 MB with/without parity (256K x 16 or 256K x 18), 4MB with/without parity (1M x16 or 1M x 18), or 16MB (4M x 16) on-board system memory.

Silicon Disk

The PCM-4330 board can optionally be fitted with a 28F016SV (2MB) or 28F032SV (4 MB) flash module to provide a silicon disk, Data, programs, or operating software can be permanently stored on this disk. Data is accessed in16 kB banks that are paged into the address space of the processor.128 kB from the available memory space of the flash module is used for the System-BIOS.

Video Controller

The Western Digital WD90C24 video controller can address various monochrome or fiat panel displays directly, as well as all SVGA monitors. Depending on the LCD display connected, an additional CRT display may be used simultaneously. The WD90C24 offers accelerated display of windows via integrated hardware functions (such as Bit Block Transfer). Frame buffers and font-caching are also supported.

Video Memory

The 1 MB video memory on the VGA controller is addressed directly via a 32 bit wide interface from the video controller. The size of the video memory allows for a resolution of 1024 x 768 pixels (256 colors) on LED and CRT displays.

ROM-BIOS

A 64 kB segment at address F000h is reserved for the Award ROM-B IO S. All AT03-compatible traps are included in this address space.

The Western Digital VGA-BIOS for the WD90C24 video controller uses 48 kB in the physical address space of the computer, starting at segment C000h. All VGA-, SVGA- and VESA-compatible video traps are supported by the BIOS.

The memory area is fitted with a 29F010 (128 kB), 29F020 (256 kB), or 29F040 (512 kB) Flash-Memory. Alternatively, the board can be equipped with a28F0xGSV (1 MB) or 28F032SV (4 MB) module to provide memory space for the BIOS and a silicon disk.

Interfaces

The PCM-4330 board includes the most important interfaces on-board. Two serial and one parallel port, keyboard, floppy disk and an IDE hard disk controller are included and can be configured by software. A SVGA connector is available, as well as a connector for monochrome or color LC-display. The PCM-4330 single board computer features an expansion slot according to the PC/104 norm.

1.2 Compatibility

The board is fully XT/AT-compatible. All available expansion cards complying with the PC/104 norm can be used with the PCM-4330.

1.3 Reference Documents

[1]ISA-Bus-Spezifikation S2636I-XXX-X-*-59 (allgemein)
[2]Intel-Microprocessors: Volume II
[3]Data-Manual SIS-85C471 Green PC ISA-VESA Single Chip
[4]Data-Manual FDC37C92x-Ultra-I/O-Controller (SMC)
[5]Data-Manual Intel Flash Memory: Volume I
[6]Data-Sheet WD90C24 (Western Digital)
[7]WD90C24 Windows Accelerated High Resolution VGA LCD Controller for Low Power Applications (Western Digital)
[8]WD90C24 VGA Controller BIOS Specification (Western Digital)

2 PCM-4330-Installation

Before installing the PCM-4330 PC/104 board computer please read the following notes very carefully. You must adhere to these rules to avoid damaging components:

- Before touching the board or any other component, discharge your body by touching a grounded object such as the metal chassis of the computer.
- Tools used to install the board must be free of static charges.
- Always remove the power cord from the system before installing or removing components.
- Handle the board carefully, holding it by its edges only.
- Do not touch components on the board, connecting pins, or exposed circuits on the board.

2.1 Hardware Installation

The PCM-4330 is installed in a PC/104 system taking over all functions of a modern ISA-compatible computer system.

Please observe all notes listed above before installing the module.

If the system does not operate as anticipated after installation, please refer to Appendix A: Troubleshooting.

2.1.1 Jumper JPI: Panel Off Signal

Jumper JP1 sets the polarity for the LC-display panel off signal. Please refer to figure 9. for the exact location of jumper JP1

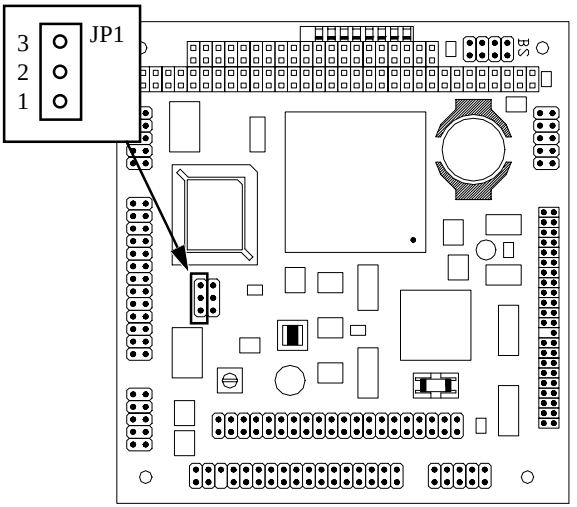


Figure 2, Jumper JP1

Jumper JP1: Panel Off Signal	
1 - 2 closed: Panel off at high (1) 3 2 1	2 - 3 Closed: Panel off at low (0) 3 2 1

Table 1, Jumper JP1

2.1.2 Jumper JP2: Contrast Voltage

Jumper JP2 on the PCM-4330 board selects the contrast voltage polarity (positive or negative) for LC-displays. Use the onboard contrast control to set the maximum contrast voltage. The corresponding value in the setup menu must be set to “o”. After adjustment, software can only select contrast voltage to less than the maximum set.

Check with the display documentation prior to any adjustment to ensure that the connected LC-display is capable of supporting the selected voltage. Unsupported values might damage the display.

See figure 3 for the exact location of jumper JP2:

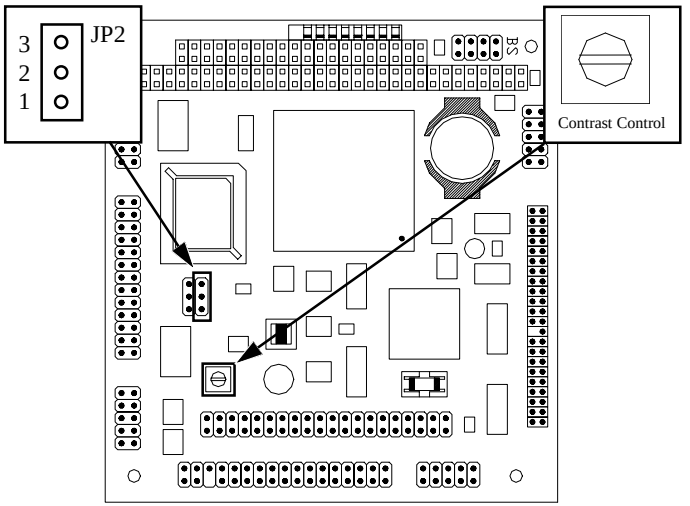


Figure 3, Jumper JP2

Jumper JP2: Contrast Voltage	
1 - 2 closed: Negative contrast voltage 3 2 1	2 - 3 Closed: Positive contrast voltage 3 2 1

Table 2, Jumper JP2

2.1.3 LC-Display Configuration Switches

The PCM-4330 single board computer features a DIL-switch with 8 keys for easy configuration of a connected LC-display. See Appendix B: LC-Displays for a selection of displays and the corresponding settings of switches SW.1 to Sw.8. See figure 4 for the location of the configuration switches.

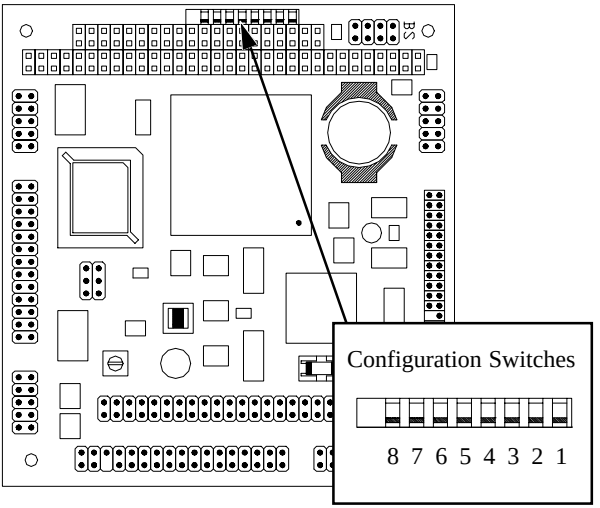


Figure4 Configuration Switches

Configuration Switches	
Key	**Setting**
SW.1	reserved
SW.2	on: CRT, off: CRT and LCD simultaneous
SW.3	Display type 0
SW.4	Display type 1
SW.5	Display configuration 0
SW.6	Display configuration 1
SW.7	Display configuration 2
SW.8	Display configuration 3

Table 3, Configuration Switches

2.1.4 Installing the PC/104-Module

The PCM-4330 is installed in a PC/104 system and takes over the function of the CPU. Please observe the following guidelines for the installation of the module:

Check that jumpers Jp1 and Jp2 and all configuration switches are set correctly before installation.

- Switch off the computer system.
- Remove the power cord.
- Remove the cover or housing of the computer system
- If a PC/104-CPU-board, VGA graphics adapter, IDE-hard disk or floppy disk controller is installed in the system, remove it. The PCM-4330 comprises all functions of these boards.
- Carefully install the PCM-4330 in the PC/104 system. The board features four holes for safe fastening and a connector for the installation on a PC/ 104 bus.
- Connect all cables and connectors with the appropriate interfaces (system,LPT1, COM1, COM2, VGA/LCD, IDE hard disk, floppy disk, and power). See chapter 4.
- Replace the housing cover and plug in the power cord.
- Switch on the computer system.
- Call the Setup-Menu.

2.2 Setup

The PCM-4330 board features an integrated setup program to easily select and adapt the system configuration, such as number and type of floppy disk or hard disk drives installed. Configuration details are stored in a battery-buffered RAM area retaining all information even when the system is switched off.

Tne following messages are displayed during system boot:

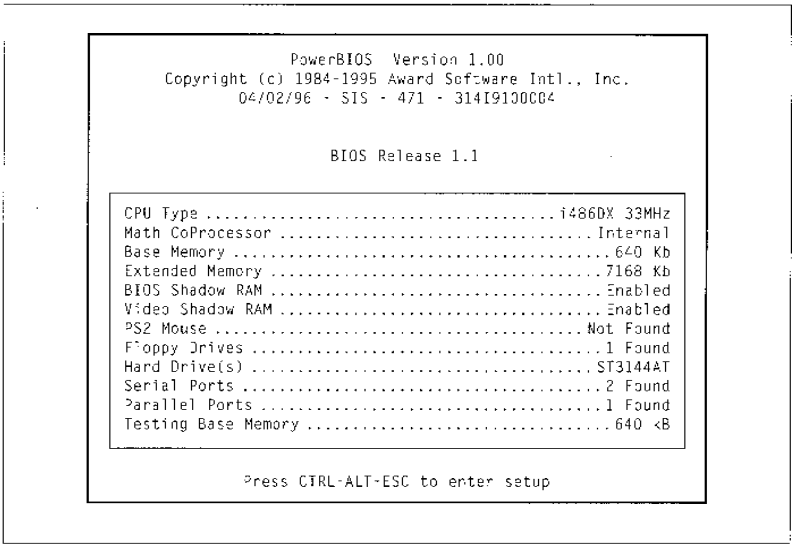


Figure 5, Setup Main Menu

After pressing the CTRL-ALT-ESC keys, the following menu is displayed:

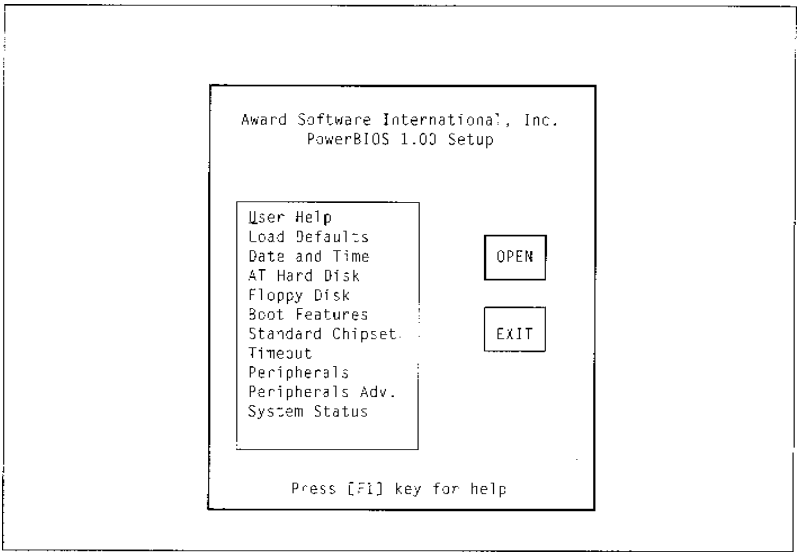


Figure 6, Setup Menu

The following selections are available in the setup menu:

User Help

This selection displays a screen with help message and instructions on how to use list boxes and radio buttons.

Load Defaults

Use this option to reset current settings to factory default values.

Time and Date

Use this selection to set time and date.

AT Hard Disk

This selection offers automatic detection and manual drive parameter configuration of IDE-/AT-Bus hard disk drives connected to the primary (on-board) and secondary IDE-Controller. If using the BIOS automatic detection, several drive types may be available. Extended modes for IDE hard disk with a capacity of more than 528 MB are supported by the BIOS.

Floppy Disk

Select type of floppy disk drives installed.

Boot Features

Additional configuration features for system boot.

Standard Chipset

Settings for Cache and Shadow.

Timeout

Select to switch off screen or spin down IDE hard disk drives after specified time of inactivity.

Peripherals

Setup settings for serial ports, parallel port, IDE-/AT-Bus-Controller, Floppy Disk Controller and PS/2-Mouse.

Peripherals Adv.

Sehup settings for feature controller, silicon disk and LC display.

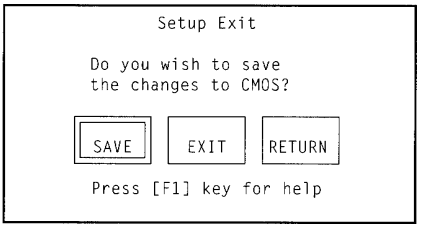
System Status

Information on temperature and voltage (read only).

Use the arrow keys to navigate between menu selections and press RETURN to enter the chosen dialog box. Use the TAB keys to jump between list boxes and buttons.

To return to the setup menu or leave the setup program, hit ESC (or press the EXIT or CANCEL button).

Before leaving the setup program, a confirmation box appears. Press SAVE to save all settings and leave the setup program, press EXIT the button or hit the ESC key to discard all changes and leave the setup program without saving, or press RETURN to return to the setup menu:



2.2.1 Time and Date

After selecting Time and Date the following dialog box appears:

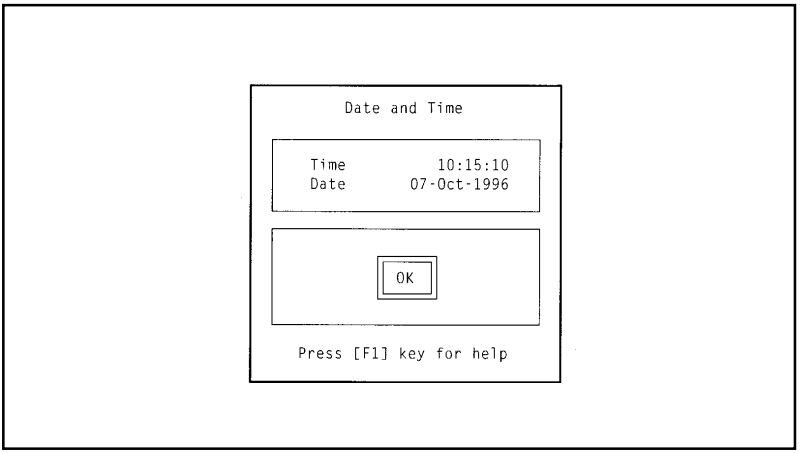


Figure 7, Date and Time Setup

The following parameters can be set (Use the TAB keys to jump between selections):

Date

Enter the current date in the form tt-MM-JJJJ

Time

Enter current system time in the format hh:mm:ss

2.2.2 AT Hard Disk

After selecting AT Hard Disk the following dialog box is displayed:

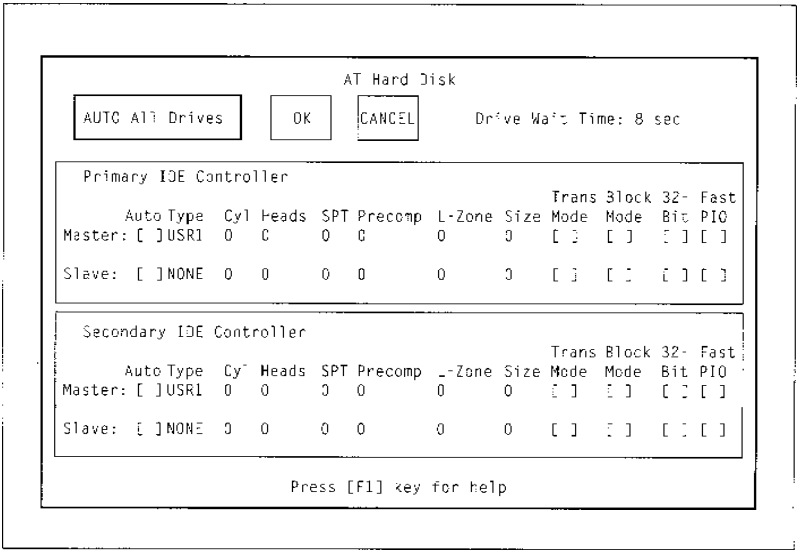


Figure 8, "AT Herd Disk" Setup

Use the arrow keys to navigate to the appropriate hard disk drives settings or jump between buttons using the TAB keys. Press the AUTO All Drives button to configured drive parameters automatically or enter the applicable values. Use the AUTO checkmark to automatically detect the drive type during system boot and set the appropriate period of time the system is to wait for the drive to spin up (drive wait time).

2.2.3 Floppy Disk

After selecting Floppy Disk the following dialog box appears:

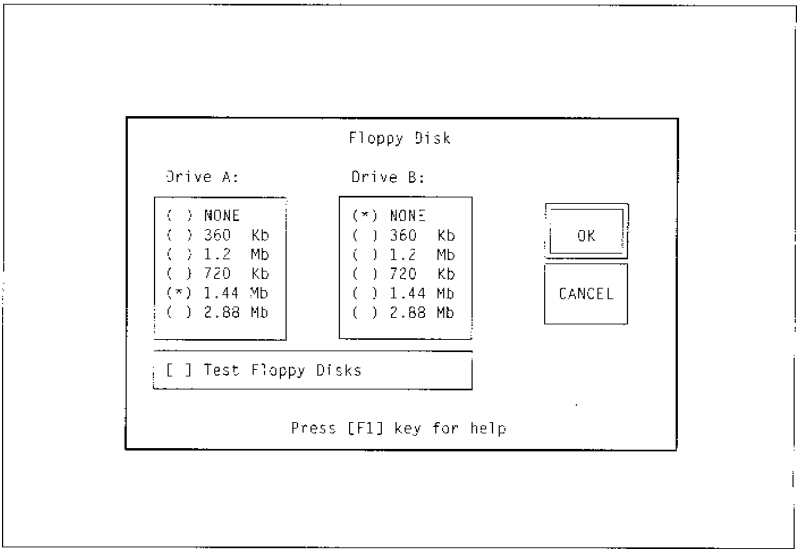


Figure 9, "Floppy Disk" Setup

The following parameters can be set (Use the TAB keys to jump between items and select an highlighted option by pressing the space bar):

Drive A:, Drive B:

Select type of floppy disk drive installed

- No floppy disk drive installed — None
- 360 kB, 51/4 — 360Kb
- 1.2 MB, 51/4 — 1.2Mb
- 720 kB, 31/2 — 720Kb
- I.44 MB, 31/2 — 1.44MB
- 2.88 MB, 31/2 — 2.88MB

Test Floppy Disks

Activate/deactivate floppy disk drive testing at start-up

2.2.4 Boot Features

After selecting Boot Features the following dialog box is displayed:

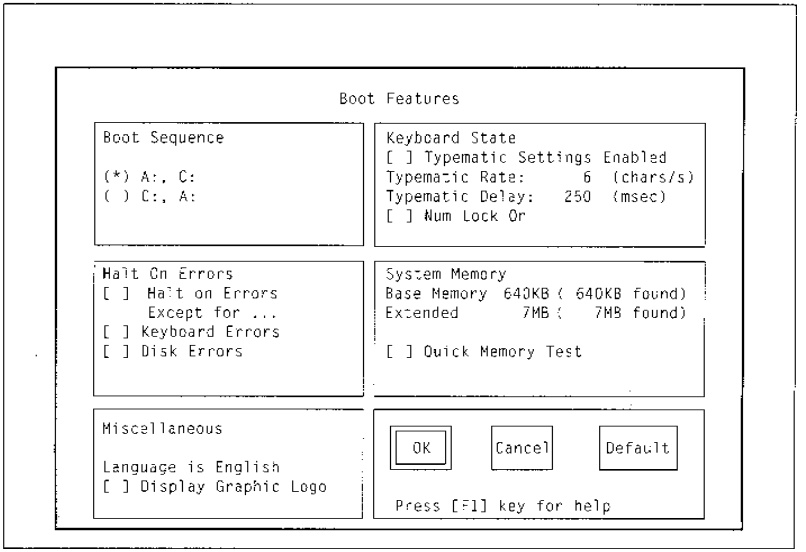


Figure 10, Boot Features Setup

The following parameters can be set (Use the TAB keys to jump between items and select/deselect an highlighted option by pressing the space bar):

Boot Sequence

Secluence for boot attempts

- Drive A:, Drive C: (Default) A:, C:
- Drive C:, Drive A: C:, A:

Typematic Settings Enabled

Enable this option if the typematic settings have to be programmed into the keyboard.

Typematic Rate

Select the keyboard repeat rate in characters per second (use cursor up/down keys)

Typematic Delay

Select the delay before first repeat (use cursor up/down keys)

Num Lock On

Activate/deactivate numeric key lock

Halt On Errors

Halt boot on errors. Select which errors not to halt boot on:

- Keyboard error
- Disk errors

Base Memory

Base memory size

Extended Memory

Extended memory size

Quick Memory Test

Activate/deactivate quick memory testing

Language Is

Select language for POST and error messages (see also Figure 5 on page 16). Use the arrow up and down keys to navigate to select a desired language.

■ English boot messages (Default)	English
■ German boot messages	German
■ French boot messages	French

Display Graphic Logo

Activate/deactivate graphic logo display during system boot

2.2.5 Standard Chipset

After selecting Standard Chipset the following dialog box appears:

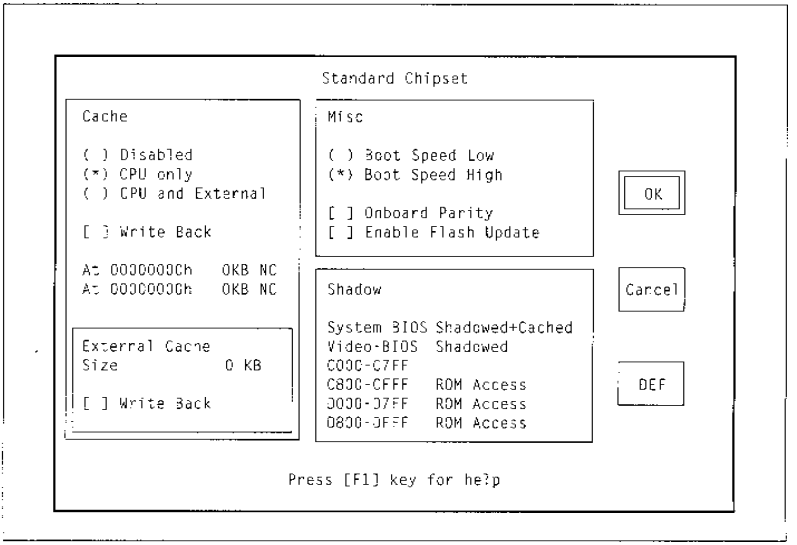


Figure 11,"Standard Chipset" Setup

The following parameters can be set (Use the TAB keys to jump between items and select/deselect an highlighted option by pressing the space bar):

Cache

Activate/Deactivate system cache. If an external cache is not available, this option can not be selected.

- Cache off — Disable
- CPU cache only — CPU only
- Cache on — CPU and External

Cache Write Back

Select writeback cache fiunction for CPU cache. This option can only be selected if supported by the CPU installed.

External Cache Write Back

Select writeback cache function for external (level z) cache. This option can only be selected if second level cache is installed on the board.

Boot Speed

Define bootup system speed

- Full operation speed — High
- Reduced CPU speed for bootup — Low

Onboard Parity

Enable onboard parity checking if parity RAM is installed

Enable Flash Update

Enable System-ROM update (i.e. disable flash module write protection). After checking this option, the System-ROM Flash module will be unprotected at next power on and automatically be cleared again at the following power on. If option is not checked, the System-ROM is write protected.

Shadow

Activate/deactivate shadowing for memory area

2.2.6 Timeout

After selecting Timeout the following dialog box is displayed:

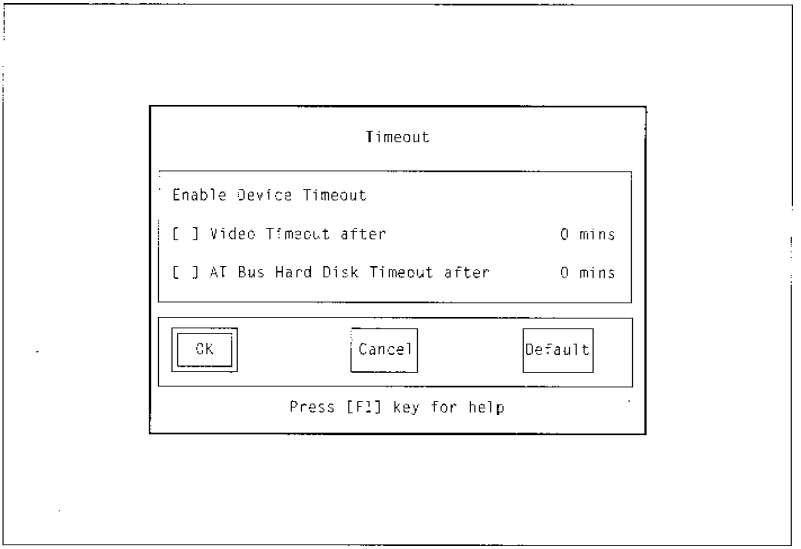


Figure 12, "Timeout" Setup

Tne following parameters can be set (Use the TAB keys to jump between items and select an highlighted option by pressing the space bar):

Video Timeout

Select this option to switch off screen after specified time of keyboard inactivity. DPMS mode is used if supported by the video system. Select the time to wait before screen is switched off.

AT Bus Hard Disk Timeout

Select this option to spin down IDE drivel(s) after a specified time of drive inactivity. Select the time to wait before timeout.

2.2.7 Peripherals

After selecting Peripherals the following dialog box appears:

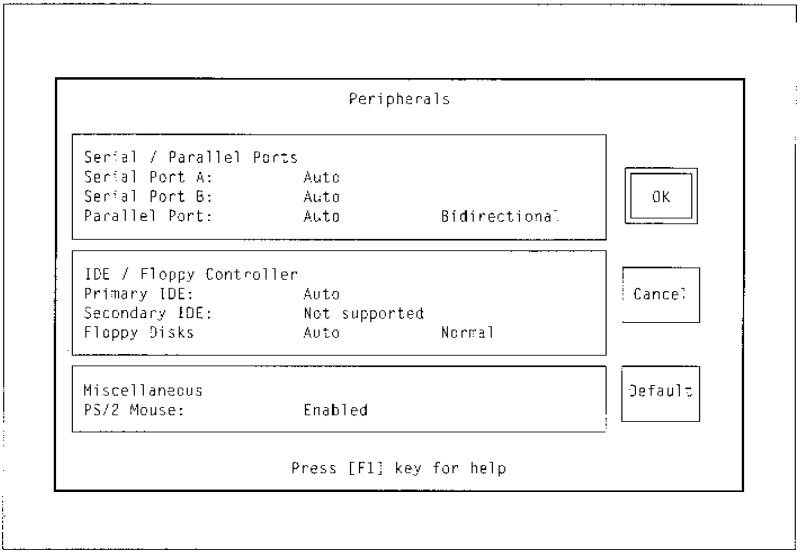


Figure 13, Peripherals Setup

The following parameters can be set (Use the TAB keys to jump between items and select/deselect an highlighted option by pressing the space bar):

Serial Port A

Select base address for serial port I

- Automatic assignment at start-up — Auto
- Select address and interrupt — 3F8h, IRQ4. 2F8h, IRQ3 3E8h, IRQ4 2E8h, IRQ3
- Not active — Disable

Serial Port B

Select base address for serial port 2

- Automatic assignment at start-up — Auto
- Select address and interrupt — 3F8h, IRQ4 2F8h, IRQ3 3E8h, IRQ4 2E8h, IRQ3
- Not active — Disable

Parallel Port

Select base address for parallel port

■ Automatic assignment at start-up	Auto
■ Address and interrupt	3BCh, IRQ7 378h, IRQ7 278h, IRQ5
■ Not active	Disable

Select mode for active parallel port

- ■ Bidirectional
- ■ EPP
- ■ ECP
- ■ EPP+ECP

Primary IDE

Activate/deactivate primary (on-board) IDE-Controller and IDE-/AT-Bus interface

■ Automatic detection at start-up	Auto
■ IDE-Controller off	Disable
■ IDE-Controller on	Enabled

Floppy Disk

Activate/deactivate on-board Floppy Disk Controller and floppy disk interface

■ Automatic detection at start-up	Auto
■ FDC-Controller off	Disable
■ FDC-Controller on	Enabled

Select mode for floppy disk drives

■ Standard assignment	Normal
■ Swap drive letter assignment	Swap A:/B:

PS/2 Mouse

Enable/disable onboard PS/2-mouse port.
Please note: This function is not supported on the PCM-4330 platform.

2.2.8 Peripherals (Advanced)

After selecting Peripherals (Advanced) the following dialog box appears:

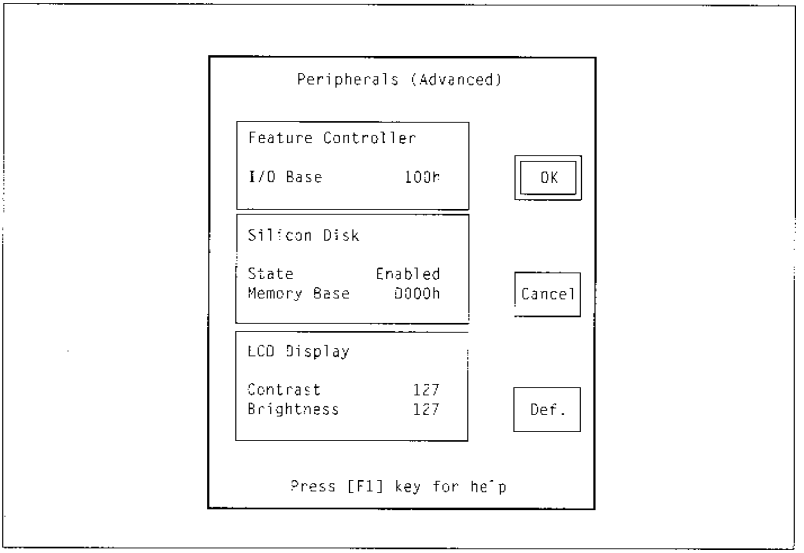


Figure 14, Peripherrls (Advanced)" Setup

The following parameters can be set (Use the TAB keys to jump between items and select values using the arrow up and down keys):

Feature Controller I/O Base

Select the I/O base for Feature Port access. The Feature Port interface uses two consecutive addresses, which should not conflict with any other system device. The new base address will be used after reboot.

- Base address 100h - 7FFh

Silicon Disk State

Onboard silicon disk support. If this option is enabled the option ROM is mapped to the CPU address space, while no resources are needed if this function is disabled.

- Onboard silicon disk on Enabled
- Onboard silicon disk off Disabled

Silicon Disk Memory Base

Define the 16 kB memory window within the CPU address space to be used for silicon disk access.

- Memory Base — D000h/D400h/D800h/ DC00h/CC00h

LCD Display Contrast

Select LC display bootup value for contrast. As visual feedback, the new value will be programmed immediately.

- Contrast value — 0 - 255

LCD Display Brightness

Select LC display boohup value for brightness. As visual feedback, the new value will be programmed immediately.

- Brightness value — 0 - 255

2.3 MS-DOS SVGA Software

Special SVGA software (drivers and programs) is included with the PCM-4330 single board computer to use the extended functions under MS-DOS. Operation of the SVGA adapter is also possible without this SVGA software.

The SVGA software for use with MS-DOS is found on the disk labeled DOS Install Disk. The following files are included on this disk:

Text

- README.TXT — Lists all drivers and programs on the disk
- README.1ST — (If included on the disk) Contains last-minute information and change remarks

Drivers

- ACAD.LIF — AutoCAD 386, AutoShade and 3D Studio display driver
- CADVANCE.LIF — Cadvance display driver
- GENERIC.LIF — Generic CADD display driver
- LOTUS.LIF — Lotus 1-2-3 and Lotus Symphony display driver
- PCAD.LIF — PCAD display driver
- WORD.LIF — Microsoft Word for MS-DOS display driver
- WP.LIF — WordPerfect display driver
- UTILITY. LIF — ANSI.SYS driver for extended VGA mode (Paradise Mode)

Programs

- INSTALL. COM — Menu controlled installation program
- CHIPTST. EXE — (used by INSTALL.COM)
- KDINSTAL. EXE — (used by INSTALL.COM)
- READID.EXE — (used by INSTALL.COM)
- VGAMODE.EXE — (used by INSTALL.COM)

If the system does not operate as anticipated after the installation of a MS-DOS device driver, please refer to Appendix A:Troubleshooting.

2.3.1 Driver Installation

To use the extended features of the WD90C24 controller under MS-DOS special SVGA software (programs and drivers) must be installed. The disk DOS-Install Disk contains the menu-controlled program INSTALL.COM.

- Make a backup copy of the disk DOS-Install Disk and store the original at a secure place.
- Check whether the PCM-4330 single board computer is correctly installed in the system and that all jumpers and switches are set properly.
- Load the utility program INSTALL.COM from your backup copy of the installation disk from dis

The following start-up page of the installation utility appears on the screen. It contains the version number and copyright information:

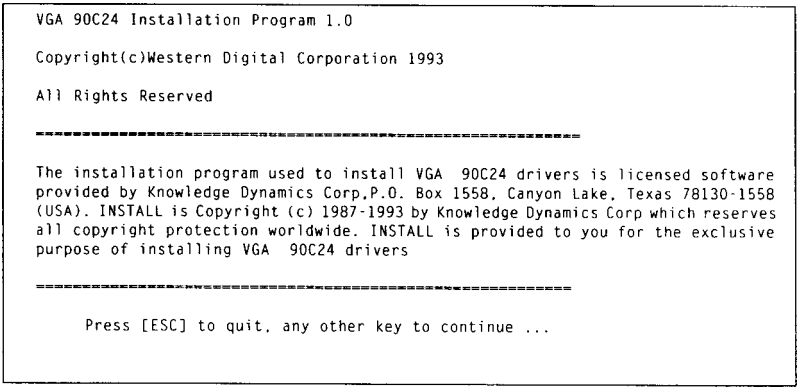
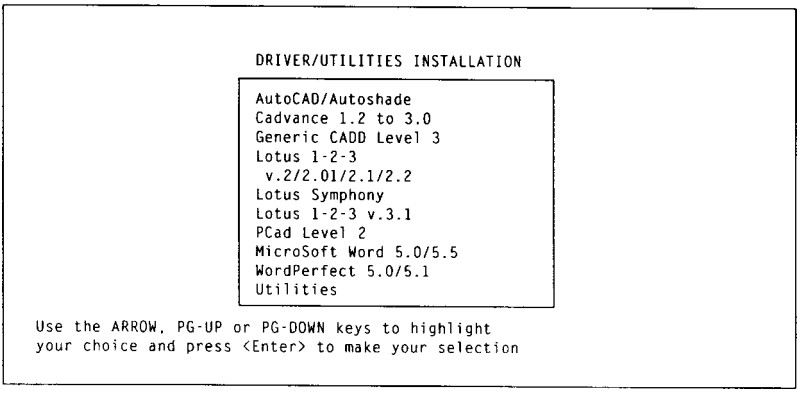


Figure 15, (Install.com) Start-up Screen

- Press the < E S C > key to quit the I N STALL.COM installation utility or press any other key to display the following menu:



Rgure 16, (Install.com) Selection Screen for Program Groups

- Use the cursor keys to select the program group for which you want to install a driver and press < ENTER > .

Depending on your selection in the program selection screen (see figure 16), the following drivers and driver configurations may be selected:.

Cadvance 1.2 to 3.0			
Product	**Version**	**Resolution**	**Driver Name**
Cadvance	3	640x480x256 800x600x16 1024x768x16	gsvga.drv gs800.drv gs102416.drv

Table 4, Cadvance Drivers

Generic-CADD Level3			
Product	**Version**	**Resolution**	**Driver Name**
Generic-CADD	Level3	640x400x256 640x480x256 800x600x16 800x600x256 1024x768x16 1024x768x16	p640x400.vgd p640x480.vgd para800.vgd p800x600.vgd p1024x16.vgd p1024xff.vgd

Table 5, Generic-CADD Drivers

Lotus 1-2-3 v.2/2.01/2.1/2.2			
Product	**Version**	**Resolution**	**Driver Name**
Lotus 1-2-3	2,2.1,2.01,2.2	640x480x16 800x600x16 1024x768x16 123Columns	sp1_480s.drv sp1_600s.drv sib2vga.drv(8x9font) sib3vga.drv(9x13font) s0_25s.drv(132x25) sp0_44s.drv(132x44)

Table 6, Lotus 1-2-3 Drives

Lotus Symphony			
Product	**Version**	**Resolution**	**Driver Name**
Lotus Symphony	1.1,1.2,2.0	640x480x16 800x600x16 1024x768x16 123Columns	sp1_480s.drv sp1_600s.drv sib2vga.drv(8x9font) sib3vga.drv(9x13font) s0_25s.drv(132x25) sp0_44s.drv(132x44)

Table 7, Lotus Symphony Drives

Lotus 1-2-3 v.3.1			
Product	**Version**	**Resolution**	**Driver Name**
Lotus 1-2-3	3.1	800x600x16 1024x768x16	l13v600.dld l13v768.dld

Table 8, Lotus 1-2-3 v.3.1 Drivers

PCad Level2			
Product	**Version**	**Resolution**	**Driver Name**
PCAD	Level2	800x600x16 1024x768x16	dwdpvga.drv dpvga1k.drv

Table 9, PCad Drivers

Microsoft Word 5.0/5.5			
Product	**Version**	**Resolution**	**Driver Name**
WORD	v5.5	800x600x16	vga.gsd

Table 10, Microsoft Word 5.0/5.5 Drivers

WordPerfect 5.0/5.1			
Product	**Version**	**Resolution**	**Driver Name**
WordPerfect	v5.0	800x600x16 1024x768x16	wdpvga1.wpd wdpvga2.wpd
WordPerfect	v5.1	1024x768x16	wdpvga3.vrs

Table 11, WordPerfect 5.0/5.1 Drivers

AutoCAD/Autoshade			
Product	**Version**	**Resolution**	**Driver Name**
AutoCAD 386 Non D.L. Auto Shade 386 3D Studio	Release 11 Version 2	640x480x256 640x480x256 / 32k 640x480x256 / 32k	11p6168.exp 11p6168.exp 11p6168.exp
AutoCAD 386 Non D.L. Auto Shade 386 3D Studio	Release 11 Version 2	800x600x256 / 32k 800x600x256 / 32k 800x600x256 / 32k	11p8188.exp 11p8188.exp 11p8188.exp
AutoCAD 386 Non D.L. Auto Shade 386	Release 11 Version 2	640x480x256 640x480x256	11pshv68.exp 11pshv68.exp
AutoCAD 386 Non D.L. Auto Shade 386	Release 11 Version 2	800x600x256 800x600x256	11pshv88.exp 11pshv88.exp
AutoCAD 386 Non D.L. Auto Shade 386	Release 11 Version 2	1024x768x256 1024x768x256	11pshv18.exp 11pshv18.exp
AutoCAD 386	Release 11	800x600x16 800x600x256 1024x768x16 1024x768x256	11pdlv84.exp 11pdlv88.exp 11pdlv14.exp 11pdlv18.exp
Auto Shade	Version 1	640x400x256 640x480x256 800x600x256 1024x768x256	rd400.exe rd480.exe rd800.exe rd1024.exe

Table 12, AutoCAD Drivers

Utilities	
Driver	**Description**
WDANSI.SYS	ANSI.SYS driver for extended VGA mode

Table 13, #Utilities

- After selecting a driver and display resolution, the installation utility requests the target drive and the name of the destination directory to receive the driver software.
  The following example installs the driver into the directory that contains the Lotus1-2-3 software.
- Use the cursor keys to select a drive letter from the list of avafiable drives and press <ENTER>.

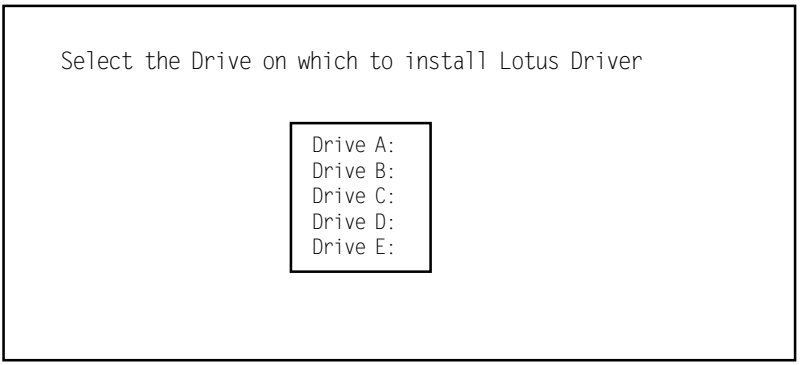


Figure 17, (Install.com)Destination Drive

- Enter the subdirectory and press <ENTER>.

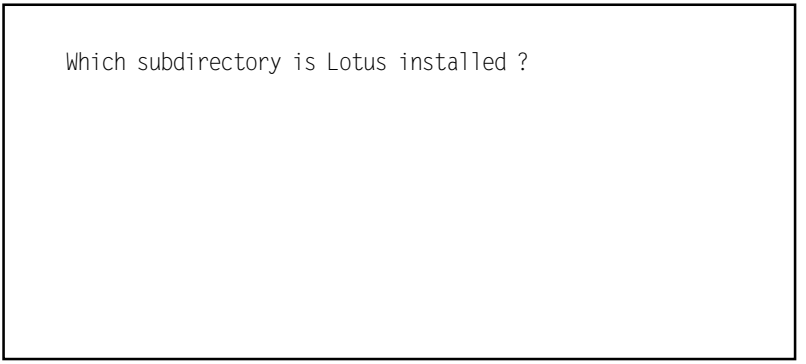


Figure 18,(Install.com)Destination Subdirectory

- Please read all instructions carefully as the actual input parameters may vary according to the driver selected.

2.4 MS-Windows SVGA Software

Special SVGA software (programs and drivers) is included with the PCM-4330 to use extended functions of the video controller under MS-Windows. Operation of the SVGA adapter is also possible without this special SVGA software.

The SVGA software for use with MS-Windows is found on the disk labeled *Windolvs-Install-Disk*. The following files are found on this disk:

Drivers

- vga .dr_ Windows 3.1 driver(standard VGA)
- wd24_8 .dr_ Windows 3.1 driver
- wd24ik_4.dr_ Windows 3.1 driver
- wd2464__4.dr_ Windows 3.1 driver
- wd2464_h.dr_ Windows 3.1 driver
- wd2480_4.dr_ Windows 3.1 driver
- wddci.dr_ Windows 3.1 driver

Character Sets

- 8514fix.fo_ Windows 3.1 character set
- 8514oem.fo_ Windows 3.1 character set
- 85x4sys.fo_ Windows 3.1 character set
- cga4owoa.fo_ Windows 3.1 character set
- cga8owoa.fo_ Windows 3.1 character set
- coure.fo_ Windows 3.1 character set
- courf. fo_ Windows 3.1 character set
- dosapp.fo_ Windows 3.1 character set
- ega4owoa.fo_ Windows 3.1 character set
- ega8owoa.fo_ Windows 3.1 character set
- serife.fo_ Windows 3.1 character set
- seriff. fo_ Windows 3.1 character set
- smalle.fo_ Windows 3.1 character set
- smallf. fo_ Windows 3.1 character set
- sserife.fo_ Windows 3.1 character set
- sseriff. fo_ Windows 3.1 character set
- symbole.fo_ Windows 3.1 character set
- symbolf. fo_ Windows 3.1 character set

vgaoem.fo_	Windows 3 .1 character set
vgasys .fo_	Windows 3 .1 character set
vgafix.fo_	Windows 3 .1 character set

SetupPrograms

setup.exe	Windows 3 .1 setup file
setup.inf	Windows 3 .1 setup file
setup.lst	Windows 3 .1 setup file
setup.rest	Windows 3 .1 setup file
setupapi.inc	Windows 3 .1 setup file
dciman.dl_	Windows 3 .1 setup file
mscomstf. dll	Windows 3 .1 setup file
mscuisff. dll	Windows 3 .1 setup file
msdetsff. dll	Windows 3 .1 setup file
msinssff. dll	Windows 3 .1 setup file
msshlstf. dll	Windows 3 .1 setup file
msuilsff. dll	Windows 3 .1 setup file
oemsetup.inf	Windows 3 .1 setup file
pvga.gr_	Windows 3 .1 setup file
v7vga.3g	Windows 3 .1 setup file
vddpvga.38-	Windows 3 .1 setup file
ver.dll	Windows 3 .1 setup file
vgalogo.lg_	Windows 3 .1 setup file
vgalogo .fi_	Windows 3 .1 setup file
vidchg.ex_	Windows 3 .1 setup file
vidchg.hl_	Windows 3 .1 setup file
_mssetup.exe	Windows 3 .1 setup file
_mstest.exe	Windows 3 .1 setup file

If the system does not operate as anticipated after the installation of a MS-Windows device driver, please refer to Appendix A: Trouble-shooting.

2.4.1 Driver Installation

To use extended features of the SVGA controllers on the PCM-4330 single board computer under MS-Windows special SVGA drivers must be installed.

The Windows-Install-Disk contains a special installation program to install SVGA video drivers and change video settings under MS-Windows. Use the MS-Windows File Manager or Program Manager to start the installation. On-line-Help is available at every stage.

Figure 19, Western Digital Video Changer

Please check with your monitor specifications to ensure that the monitor is capable of supporting the particular option, to prevent damage to the display.

Resolution

Select a resolution for the video driver

640 x 480 This resolution supports the following color settings: 16,25,32k and 64k colors

800 x 600 This resolution supports 16 and 256 colors. The screen refresh rate may also be set: 56 Hz, 60 Hz and 72 Hz, non-interlaced, are sup ported.

1024 x 768 This resolution also supports 16 or 256 colors. Screen refresh rate can be set to 60 Hz interlaced or non-interlaced.

Refresh Rate

Choose a screen refresh rate for the selected resolution

640 x 480	No refresh rate can be set for this resolution.
800 x 600	Select between non-interlaced 56 Hz, 60 Hz and 72 Hz.
1024 x768	Choose between 60 Hz interlaced or non-interlaced.

The higher the refresh rate, the better the display quality. Also, non-interlaced mode has a better display quality than interlaced mode.

Color

Choose a color option for the selected resolution

640 x 480	Color options are: 16,256, 32k or 64k colors
800 x 600	Color options are 16 and 256 colors
1024 x768	Color options are 16 and 256 colors

When 256 color is selected for all resolutions, the following options are available:

Font Size

Select font size for the display

■ Large display font	Large Font
■ Small display font	Small Font

Font Caching

Enable font caching to increase performance

Enable font cache	Font cache off
Disable font cache	Font cache on

Cursor

Select cursor type

■ Normal cursor	Normal
■ Inverted cursor	Invert

You do not have to restart Windows for this option to take effect.

Virtual Screen

Enable virtual screen

■ Enable virtual screen	On
■ Disable virtual screen	Off

3 Layout and Functions

This chapter describes the technical layout and functions of the PCM-4330 single board computer.

3.1 Block Circuit Diagram

Figure 14 illustrates the schematic layout of the PCM-4330 in form of a circuit diagram:

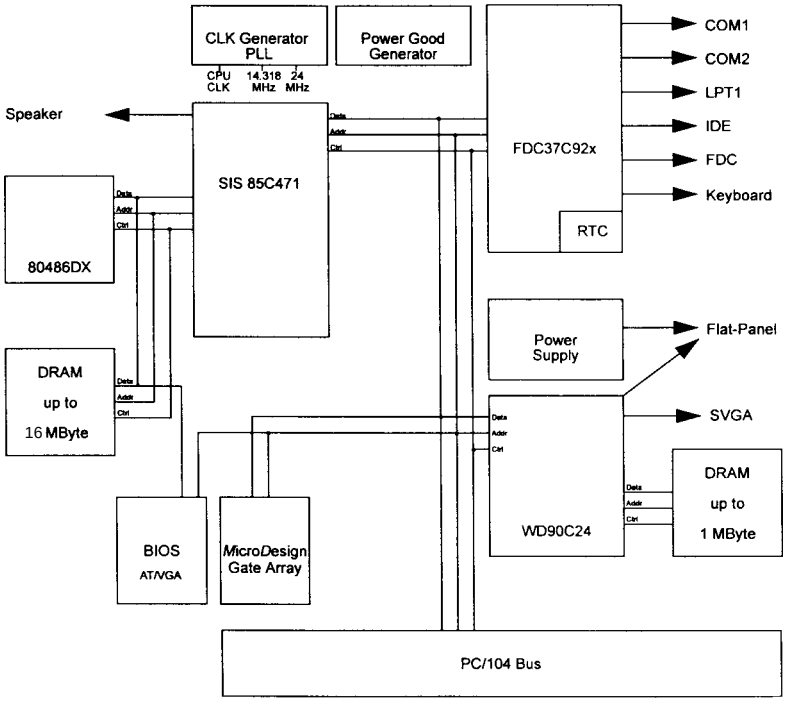


Figure 20, PCM-4330 486SX-,486DX2-,and 486DS4-ISA-System

3.2 General Layout

The following sections describe the individual components of the PCM-4330 single board computer.

3.2.1 Processor (CPU)

A 32-bit CPU from the Intel i486 family is used. The PCM-4330 may be fitted with a 486SX, 486DX2, or 486DX4 processor.

All these processors feature:
Separate address and data bus
Extensive instruction set, downward compatible to the 8086 set
Integrated memory management (MM U)
Memory protection on 4 levels
Address space of 1 MB in Real Mode
Physical addressable address space of up to 4 GB in Protected Mode

The processor can be operated in Real Address Mode or Protected Virtual Mode. After a reset, the processor resumes operation in Real Mode.

3.2.2 Memory

Memory on the PCM-4330 consists of ROM and RAM area depending on the board configuration, ROM memory size is 128 kB to 4 MB. 128 kB are located below the 1 MB and 4 GB address boundary. It is therefore available twice (mirrored). A socket is used for ROM memory modules with a 8-bit word width containing a 29F010 (128 kB), 29F020 (256 kB), or 29F040 (512 kB) Flash-Memory. Alternatively, a 28F016SV (I MB) or 28F032SV (4 MB) module can be used, which also offers silicon disk capabilities. The BIOS software can be reprogrammed by an auxiliary program during operation.

RAM is build up by two dynamic memory modules in sockets to offer 1 MB, 4MB or 16 MB on-board. These RAM modules support an access width of 32 bit and may be parity checked bitwise (optional).

Specific attributes can be assigned to certain regions of RAM memory:

- Enable/Disable Shadow
- RAM

16MB		
1024kB	BIOS 128kB	enable/disable RAM
896kB	CHANNEL-I/O 128kB	enable/Disable RAM
768kB	Video-Buffer 128kB	enable/disable RAM
640kB	DOS-area	

Table 14, RAM Area Attributes

Accessing the silicon disk is performed via 16 kB banks, that are paged into the address space of the processor. I/O port may be assigned for paging and individual banks may be designated for paging. Read operations can be performed on bytes, words or double-words. Special software must be used to write to the silicon disk, removing the write protection before write operations.

3.2.3 Cache

The i486 family of processors all feature 8 kB on-chip cache and cache controller.

3.2.4 DMA Controller

The DMA controller of the SIS-85C471-AT-Controller offers the ISA functionality of two 82C37-DMA controllers with seven independent channels.

3.2.5 Interrupt Controller

Two 82C59-compatible interrupt controllers are implemented. They are cascaded and offer 2 external interrupt channels.

3.2.6 Timer

A 82C54-compatible timer is also included. It comprises three independent channels which can be programmed in six different modes.

3.2.7 Real-time Clock (RTC)

The RTC is included in the MC146818A-compatible cell of the FDC37C92x-Ultra-I/O-Controller. It is extended by 128 bytes via two 64 byte CMOS RAM pages in address space 40h - 7Fh of the RTC.

The RTC manages system time, date, and offers alarm functions. 14 of 192 bytes of internal memory are used to control the clock functions, the remaining 178 bytes of CMOS RAM are used to store BIOS setup information.

3.2.8 Keyboard Controller

The keyboard interface is implemented as a megacell in the SMC FDC37C92x-Ultra-I/O-Controller. In addition to the serial keyboard port, two ports for system status and control functions are available.

The keyboard controller manages:

- Keyboard lock
- Color/monochrome toggling
- Address line A20 (1 MB limit)
- Keyboard reset
- Keyboard interrupt request IRQ1

3.2.9 Loudspeaker

The tone signal for the speaker is generated by Timer 2 (in the SIS-85C471-AT-Controller). The timer is programmed as a square-wave generator. The generator is controlled by the System-Control-Registers in Port B. An additional bit of the System-Control-Registers is combined with output of Timer 2 by a logical and. Theresulting signal controls the internal or external speaker (using the system interface; c.f. Figure 23 on page 54).

3.2.10 Reset Logic

A system reset may be initiated by the power supply, shutdown, keyboard reset or via I/O port 92h (Bit 0) and the SIS-85C471-AT-Controller.

3.2.11 A20 Logic

The CPU line mask-A20 can be controlled as in AT-systems through the key-board controller. Additionally, the PS/2®-compatible port 92h (Bit 1) is available.

3.2.12 Port B and NMI Logic

The status and control port B (061h) consists of the integrated System-Control-Register and the System-Status-Buffer. Parity checking may be enabled/disabled via the System-Control-Register. The System-Status-Buffer informs on queued memory parity errors.

3.2.13 Video Controller

The Western Digital WD90C24 video controller can address various monochrome or color flat panel displays directly, as well as regular SVGA monitors. A 2-row 10-pin connector for SVGA displays and a 2-row 40-pin universal LCD-onnector arelocated on the board.

3.2.14 Floppy Disk Controller

The FDC37C92x-Ultra-I/O-Controller from SMC with a licensed 765B-compatible SuperCell™ is used for floppy disk control. Data is exchanged over DMA channel2, interrupts are initiated via IRQ6. Up to two floppy disk drives ($3^{1/2}$ or $5^{1/4}$) are supported.

3.2.15 IDE-/AT-Bus

The FDC37C92x peripheral unit also includes an interface for IDE-/AT-bus hard disks.

3.2.16 Parallel Port LPT1

The parallel port LPT1 is also integrated into the FDC37C92x-Ultra-I/O-ontroller. In addition to the PC/AT standard it can be operated in bi- as wall as in uni-directional mode. This interface is equipped with a ChiProtect™ circuit protecting it from power surges at power-on of the printer device. I/O addresses are selectable in the setup menu. LPT1 is a 26-pin 2-row male connector on the board and can be extended to the exterior with an extension cable.

3.2.17 Serial Ports COM1 and COM2

Interfaces COM1 and COM2 are included in the FDC37C92x-Ultra-I/O-ontroller as a NS16550-compatible SuperCelL™. I/O addresses are selectable in the set-up menu; interrupts (IRQn) are pre-assigned and can not be selected by the user. COM1 and COM2 are located as 2-row 10-pin connectors on the PCM-4330 single board computer.

4 Hardware Interfaces

All interfaces required for an AT-compatible PC are included on-board. Figure 21 illustrates the location of interfaces and connectors on the PCM-4330 PC/104 single board computer.

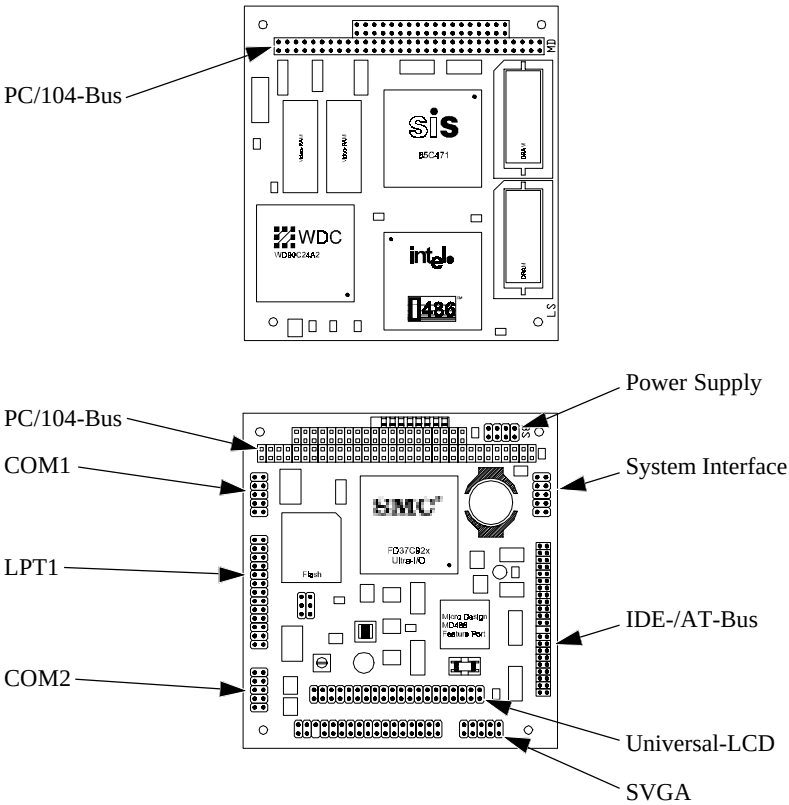


Figure 21, Location of on-board Interfaces

The following sections describe individual interfaces of the PCM-4330 in detail.

PC/104-Bus

The PC/104-Bus is a multimaster bus featuring:

- 24-bit addressing for CPU, DMA and busmaster
- 8-bit or 16-bit data
- Multimaster capability
- 11 interrupt channels, flank triggered
- 7 DMA channels (four 8-bit, three 16-bit)
- Waitstate control
- Refresh control

PC/104-Bus Pin Assignment

The PCM-4330 features a PC/104-Bus. Please refer to table 16 for the pin assignment on the PC/104-Bus.

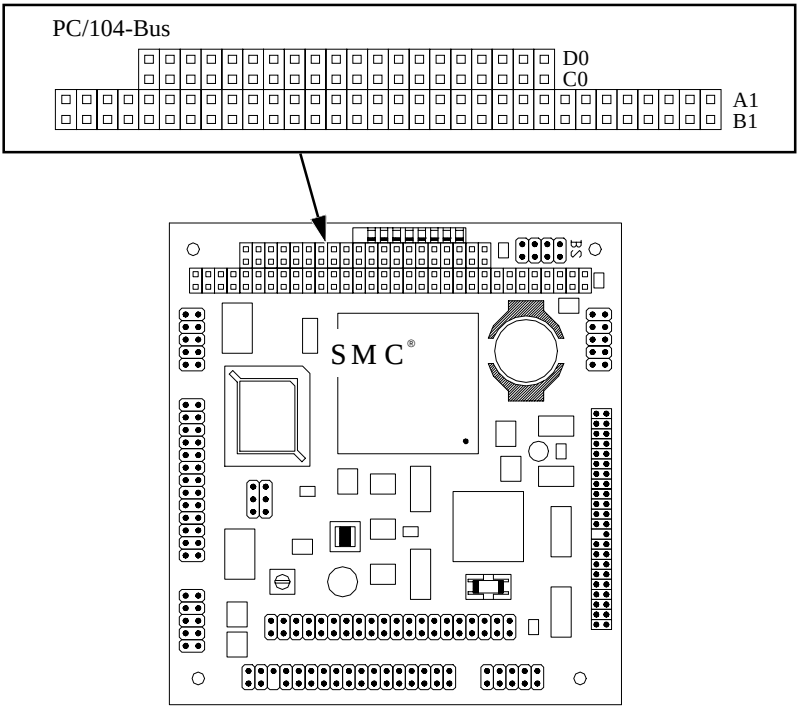


Figure 22, PC/104-Bus

Table 15 lists the PC/104-Bus pin assignments. Signals with# symbol are low active.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
B1	GND	A1	IOCHK#	C0	GND	D0	GND
B2	RSTDRV	A2	D7	C1	SBHE#	D1	MEMCS16#
B3	VCC	A3	D6	C2	LA23	D2	IOCS16#
B4	IRQ9	A4	D5	C3	LA22	D3	IRQ10
B5	-5V	A5	D4	C4	LA21	D4	IRQ11
B6	DRQ2	A6	D3	C5	LA20	D5	IRQ12
B7	-12V	A7	D2	C6	LA19	D6	IRQ15
B8	WSO#	A8	D1	C7	LA18	D7	IRQ14
B9	+12V	A9	D0	C8	LA17	D8	DACK0#
B10	GND	A10	IOCHRDY	C9	MEMR#	D9	DRQ0
B11	SMEMW#	A11	AEN	C10	MEMW#	D10	DACK5#
B12	SMEMR#	A12	SA19	C11	D8	D11	DRQ5
B13	IOW#	A13	SA18	C12	D9	D12	DACK6#
B14	IOR#	A14	SA17	C13	D10	D13	DRQ6
B15	DACK3#	A15	SA16	C14	D11	D14	DACK7#
B16	DRQ3	A16	SA15	C15	D12	D15	DRQ7
B17	DACK1#	A17	SA14	C16	D13	D16	VCC
B18	DRQ1	A18	SA13	C17	D14	D17	MASTER#
B19	REFRESH#	A19	SA12	C18	D15	D18	GND
B20	SYSCLK	A20	SA11	C19	N. C.	D19	GND
B21	IRQ7	A21	SA10				
B22	IRQ6	A22	SA9				
B23	IRQ5	A23	SA8				
B24	IRQ4	A24	SA7				
B25	IRQ3	A25	SA6				
B26	DACK2#	A26	SA5				
B27	TC	A27	SA4				
B28	BALE	A28	SA3				
B29	VCC	A29	SA2				
B30	OSC	A30	SA1				
B31	GND	A31	SA0				
B32	GND	A32	GND				

Table 15, PC/104-Bus Pin Assignment

4.1.2 Signal Description

The following section describes the meaning and specific attributes of individual signal. Signals with # symbol are *low* active.

SD0 - SD15

Data is transferred on these lines between CPU / DMA, memory and I/O. 8-bit boards must use lines SD0 - SD7 while 16-bit boards use lines SD0 - SD15. A 16-bit processor access to an 8-bit board automatically results in the generation of two 8-bit accesses. More significant data is shifted by a swap buffer to D0 - D7 with *High-Byte-Access.*

LA17 - LA23

LA17- LA23 represent the unlatched address bus. Together with lines SA0 - SA19 of the ISA Bus, they address a memory area of up to 16 MB. Lines must be latched by a BALE signal. Output signals are generated by the CPU or a busmaster, input signals must be generated by a busmaster.

SA0 - SA19

These lines are used on the ISA-bus to address memory and I/O devices. They are stable during *Command Phase* and need not be latched. They are generated as output signals by the CPU or the DMA controller. Input signals must be generated by a busmaster. During a refresh cycle — indicated by a REFRESH# signal — lines SA0 - SA9 carry the dynamic memory's refresh address.

SBHE#

This low active signal indicates data transfer on data lines SD8 - SD15. It may only be used for control of data bus drivers and write signals on the ISA-bus with 16-bit boards.

AEN

This low active signal specifies the I/O address space. AEN is the result of a logical and of signals HOLDA and MASTER# and indicates that a DMA controller or the refresh logic has taken control of the bus. It must always be used for I/O address coding for expansion cards.

SYSCLK

This signal is a synchronous signal to the system cycle on the AT-bus with a frequency of 8.25 MHz and a cycle proportion of 1:1(50%).

BALE

This signal is the result of a logical or of signals ALE and HOLDA. Addresses LA17- LA23 must be latched with this signal. It is not generated for the second cycle of a 16-bit access to an 8-bit board and may thus not be evaluated as the beginning of a cycle. Due to the or operation, signal BALE is *high* during DMA or refresh cycles.

SMEMR#,SMEMW#

Signal SMEMR# indicates a read cycle, SMEMW# a write cycle within the first MB of the ISA memory area (000000H-0FFFFFH). These signals are generated by the CPU or DMA controllers, signal SMEM R# is also generated by the refresh logic during refresh cycles with lines SA0 - SA9 indicating the refresh address. SA10- SA16 are in state high-impedance! SA17 - SA19 and LA17 - LA23 are kept on low by the page register. Signal REFFRESH# indicates that this is a refresh cycle in contrast to a normal read.

MEMR#,MEMW#

Signal MEMR# indicates a read, signal MEMW# a write cycle within the 16 MB ISA address space. Output signals are generated by the CPU or by DMA controllers. For signal MEMW#, the refresh cycle operates analog to the SMEMR# signal. Input signals must be driven by a busmaster.

IOR#, IOW#

Signal IOR# indicates a read, signal IOW# a write cycle on an I/O device if signal AEN is active at the same time. Output signals are generated by the CPU or the DMA controllers. Input signals must be forced by a busmaster. Since the Slot-CPU does not support full address decoding of I/O addresses, only a limited address space of 000h - 3FFh is available for expansion cards. Therefore, lines SA10 - SA15 need not be coded for I/O devices.

IOCHRDY

This asynchronous signal is used to prolong the standard access times preset on the Slot-CPU for memory and port access. Slow boards generate this signal from the board address and the read/write signal. The CPU, DMA controller or refresh logic insert waitstates while this signal is set to low (NOT-READY). This signal should only be used if an access time of 500 ns for 8-bit or 220 ns for 16-bit ISA boards is insufficient. It must not be held by a ISA slave board for longer than 2.1 μs to avoid loss of data due to an overdue refresh cycle.

WSO#

The synchronous ready signal WS0# notifies the buslogic that the peripheral inserted into the expansion slot does not require wait states. In order to satisfy the setup and hold times of the peripheral, this signal must be logically combined with the processor synchronous signals: IOR#, IOW#, SMEMR#, SMEMW#, MEMR#, MEMW# and SYSCLK. To allow 16-bit memory access to a peripheral to proceed without waitstates (access time 100 ns), WS0# must be generated by combining the address and the read/write signal. If an 8-bit bus cycle with a minimum of 2 wait states is to occur, WS0# must be asserted (combined with the address coding) one clock cycle after the READ or WRITE signal is asserted. The signal must be asserted by an open collector or tri-state driver.

MEMCS16#

The low active signal MEMCS16# indicates that the data transfer is a 16-bit access to memory. It must be generated by i6-bit memory units from addresses LAI7 - LA23. These memory accesses require one wait state with an access time of 220 ns. If this is not sufficient, additional wait states must be inserted by asserting CHRDY. The signal must be asserted by an open collector or tri-state driver.

IOCS16#

This active low signal indicates that the current data transfer is a 16-bit I/O transfer. It must be generated by 16-bit I/O units from addresses SA1 - SA15. These transfers require one wait state with an access time of 220 ns. If this is not sufficient, additional wait states must be inserted by asserting CHRDY. The signal must be asserted by an open collector or tri-state driver.

DRQO -DRQ3, DRQ5- DRQ7

An expansion component can request an I/O → memory or memory → I/O transfer or an ISA busmaster can request use of the bus by asserting the asynchronous DMA request lines. DRQ0 has the highest priority. The request is asserted by a high signal that must be maintained until the DMA controller responds with a DACK# signal. DRQ0 - DRQ3 can only be used to request byte (8-bit) transfers while DRQ5 - DRQ7 can only be used to request word (16-bit) transfers at even addresses (SBHE=0, A0=0). A DMA request can also be used to allow an expansion card to become a busmaster if the DMA channel is programmed in Cascade Mode and if the expansion card generates a MASTER# signal after receiving a DACK# signal.

DACKO# - DACK3#, DACK5# - DACK7#

The DACK# signals indicate that a DMA request is acknowledged by the DMA controller and that the DMA transfer can occur. These signals are used by the expansion cards as I/O select signals for the selected data register. An expansion card that wants to become bus master will generate a MASTER# signal in response to receiving a DACK# signal.

TC

This signal is bi-directional depending on the mode in which the DMA controller was programmed. In output mode, the TC signal indicates that a DMA transmission is finished. In input mode, a DMA slave may cancel a DMA transmission with this signal.

MASTER#

This signal, together with an DRQn / DACKn# pair, lets an expansion card become busmaster. The DMA channel must be programmed in Cascade Mode. After receiving the DACK# signal, the expansion card sets the MASTER# signal to low. One system cycle later (I25 ns) it may assume control of the address and data bus, another cycle later of the read and write lines. If a busmaster wants to retain control of the bus longer than 50 μs, it must refresh the memory every 15 μs to avoid loss of data. Signal MASTER# must be asserted by an open collector or tri-state driver.

REFRESH#

Signal REFRESH# indicates a memory refresh cycle. It is generated as an output signal by the refresh control. As an input signal, it must be generated by a busmaster (open collector or tri-state driver) every 15 μs if the busmaster uses the bus for more than 10 μs. During a refresh, the refresh address is on lines SA0 - SA15.

OSC

This signal provides a frequency of 14.31818 MHz that can be used e.g. to generate the color signal of a CRT controller. It may also be used as a timer cycle. It is asynchronous to the system cycle and has a cycle ratio of 1:1.

RSTDRV

This signal is used to reset the control logic on ISA expansion boards. RETDRV is set by the Reset-Controller on power-up of the computer and after a bus time-out.

IRQ3 - IRQ7, IRQ9 - IRQ12, IRQ14, IRQ15

The interrupt signals are used to interrupt program currently executed by the processor and indicates that an I/O device needs to be attended by the CPU. Their priority is 9, 10, 11, 12, 14, 15, 3, 4, 5, 6, 7 (in descending order). A CPU interrupt is initiated either by a flank or a level. The interrupt signal must be held until the processor has executed the appropriate INTA cycles. Since that can not be detected on the bus (no INTACK line), an Interrupt-Hold-Flip-Flop must be present for every interrupt signal. The flip-flop must be reset by an I/O command, which acknowledges the interrupt.

IOCHK#

An expansion board can indicate an error via this signal to the processor (e.g. a parity error), if IOCHK# was enabled prior by writing bit 3 to the port address 61h. In that case, a NMI can be created, if it is enabled via bit 7 (=0) on the I/O-address 70h.

4.2 System Interface

The keyboard, a loudspeaker (to VCC), a hard-disk-LED (to VCC), a keylock (to GND)and a reset-button (to GND) are connected to the 10-pin system interface (see figure17). An external battery can also be connected. Please refer to table 16 for the coding of individual pins.

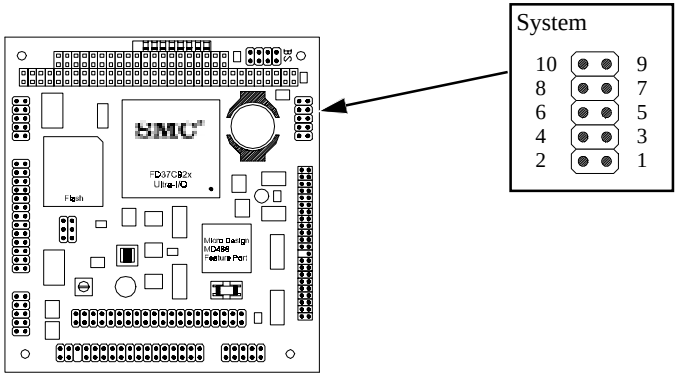


Figure 23, System Interface

Pin	Signal	Pin	Signal
1	Speaker	2	GND
3	Reset	4	Keylock
5	Keyboard data	6	Keyboard clock
7	GND	8	VCC
9	VBAT	10	Hard-disk-buxy-LED

Table 16, System Interface Pin Assignment

4.3 Power Supply

Power is supplied to the PCM-4330 through a 8-pin male connector on the board.

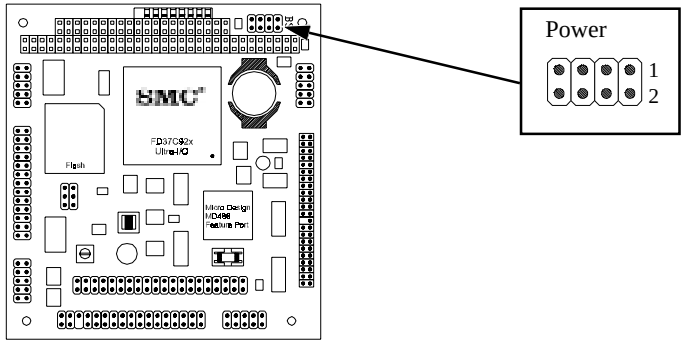


Figure 24, Power Supply

Pin	Signal	Pin	Signal
1	GND	2	VCC
3	N.C.	4	+12 Volt
5	-5 Volt	6	-12 Volt
7	GND	8	VCC

Table 17, Power Supply Pin Assignment

4.4 Floppy Disk Interface

The floppy disk interface is a coded 34-pin, 2-row male connector. Two ($3^{1/2}$ or $5^{1/4}$) floppy disk drives can be connected via a 34-wire flat cable. The odd pins connect the shielded wires to GND. Signals with # symbol are low active.

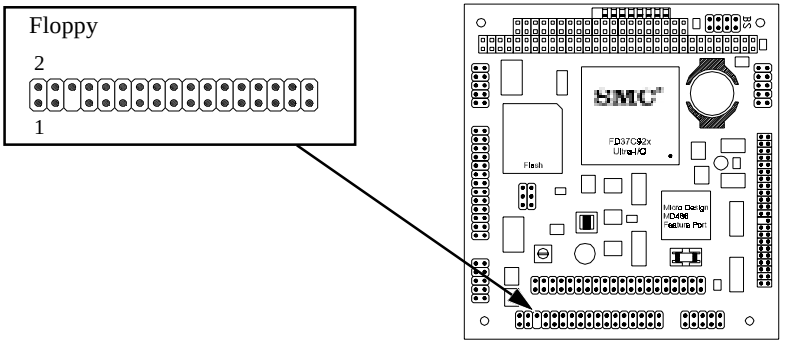


Figure 25,Floppy Disk Interface

Pin	Signal	I/O	Function
2	HDS#	O	High Density Select
4	N.C.	-	
6	N.C.	-	
8	INDEX#	I	Index Hole
10	MO1#	O	Motor 1 On
12	DS2#	O	Drive 2 Select
14	DS1#	O	Drive 1 Select
16	MO2#	O	Motor 2 On
18	DIRC#	O	Direction
20	STEP#	O	Step Impulse
22	WD#	O	Write Data
24	WE#	O	Write Enable
26	TRK0#	I	Track 0
28	WP#	I	Write Protection
30	RDD#	I	Read Data
32	HS#	O	Head Select
34	DISKCHG#	I	Disk Change

Table 18, Floppy Disk Interface Pin Assignment

4.5 IDE-/AT-Bus Interface

This is a coded 2-row 44-pin male connector on the board. Up to two IDE-/AT-Bus hard disk drives and/or IDE-/AT-bus CD-ROM drives can be connected via a flat ribbon cable. Signals with # symbol are low active.

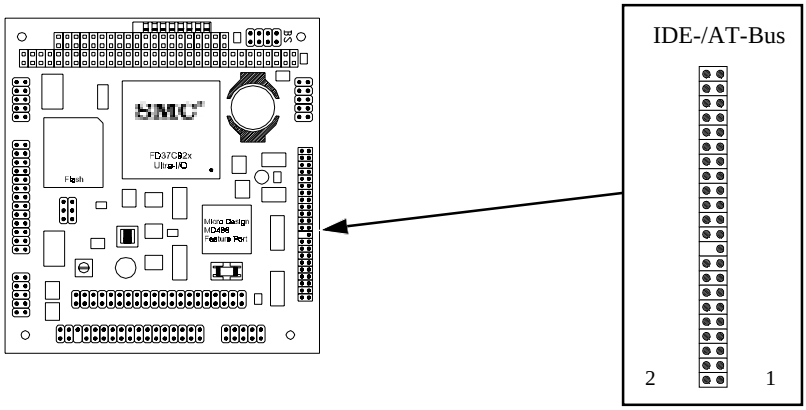


Figure 26 , IDE-/AT-Bus

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	RESET#	2	GND	23	IOW#	24	GND
3	D7	4	D8	25	IOR#	26	GND
5	D6	6	D9	27	N.C./IOCHRDY	28	BALE
7	D5	8	D10	29	N.C.	30	GND
9	D4	10	D11	31	IDINIT	32	IOCS16
11	D3	12	D12	33	SA1	34	N.C./MEMCS16#
13	D2	14	D13	35	SA0	36	SA2
15	D1	16	D14	37	CS#	38	HCS1#
17	D0	18	D15	39	HDLED	40	N.C.
19	GND	20	(coded)	41	VCC	42	VCC
21	N.C.	22	GND	43	GND	44	N.C.

Table 19, IDE-/AT-Bus Pin Assignment

4.6 SVGA Display Connector

A SVGA display can be connected to the 10-pin 2-row connector on the PCM-4330 board.

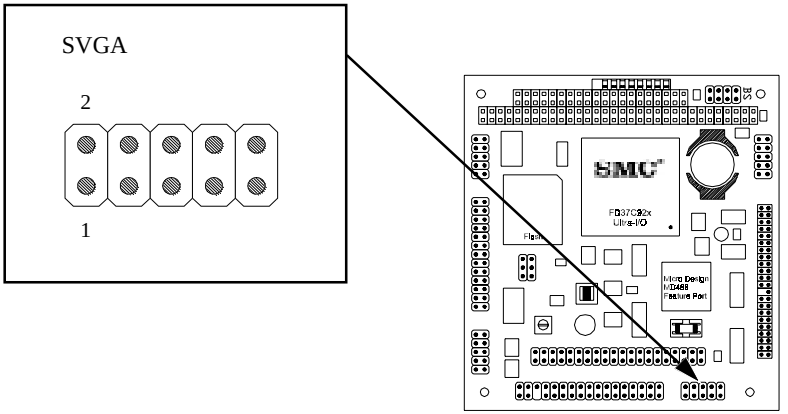


Figure 27 , SVGA Connector

Pin	Signal	Pin	Signal
1	Video signal red	2	Ground red
3	Video signal green	4	Ground green
5	Video signal blue	6	Ground blue
7	Horizontal synchronization	8	Ground horizontal synchronization
9	Vertical synchronization	10	Ground vertical synchronization

Table 20, SVGA Connector Pin Assignment

4.7 Universal LCD Connector

The Universal LCD connector is a 2-row 40-pin male connector for monochrome or color LC-displays. Pin 21 and 22 provide adjustable output voltages (0 to 5 V) for optional contrast and brightness control. Signals with#symbol are low active.

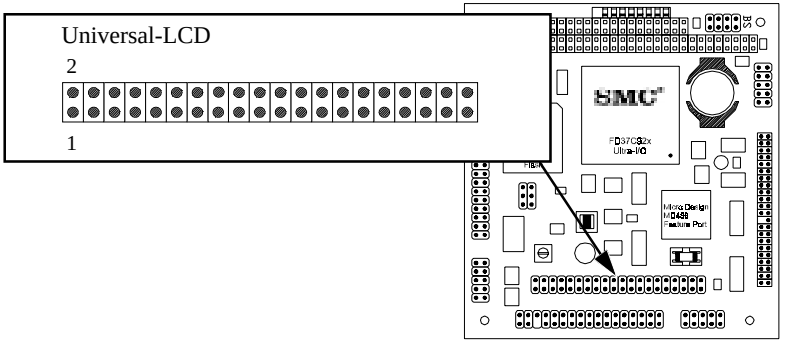


Figure 28, Universal LCD Connector

Pin	Signal	Pin	Signal
1	Clock	2	GND
3	RGB-Data 12	4	RGB-Data 13
5	RGB-Data 14	6	GND
7	RGB-Data 6	8	RGB-Data 7
9	RGB-Data 8	10	GND
11	RGB-Data 0	12	RGB-Data 1
13	RGB-Data 2	14	GND
15	Line Pulse, HSync	16	GND
17	Frame Pulse, VSync	18	5 Volt (saveguarded)
19	GND	20	12 Volt (switched, safeguarded)
21	DA VCC / Contrast Voltage(0 to 5 volt)	22	DA out / Brighness(0 to 5 Volt)
23	RGB-Data 3	24	RGB-Data 4
25	RGB-Data 5	26	RGB-Data 9
27	RGB-Data 10	28	RGB-Data 11
29	RGB-Data 15	30	RGB-Data 16
31	RGB-Data 17	32	Pixel-Clock of RAMDAC
33	Negative contrast voltage	34	Frame Rate, Blank#
35	Positive contrast voltage	36	12 Volt (safeguarded)
37	LCD enable	38	Panel-OFF (see JP1 for Polarity)
39	GND	40	5 Volt (saveguarded)

Table 21, Universal LCD Connector Pin Assignment

4.8 Parallel Port (Centronics)

The parallel port (LPT1) is a 2-row 26-pin male connector. Signals with# symbol are low active.

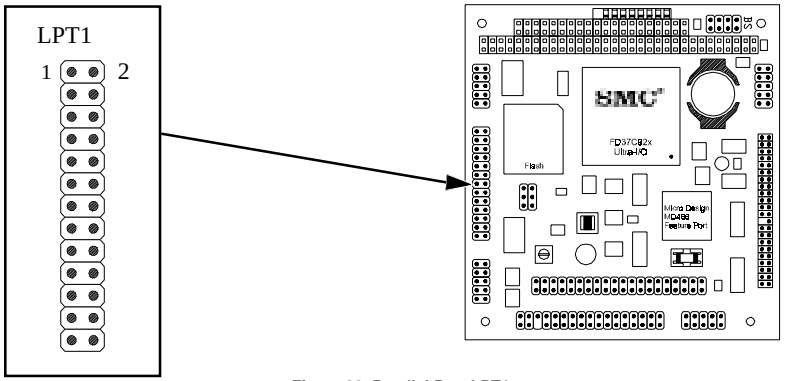


Figure 29, Parallel Port LPT1

Pin	Signal	I/O	Function
1	STB#	O	Strobe
2	PD0	I/O	Data bit 0
3	PD1	I/O	Data bit 1
4	PD2	I/O	Data bit 2
5	PD3	I/O	Data bit 3
6	PD4	I/O	Data bit 4
7	PD5	I/O	Data bit 5
8	PD6	I/O	Data bit 6
9	PD7	I/O	Data bit 7
10	ACK#	I	Acknowledge
11	BUSY	I	Device busy
12	PE	I	Paper empty
13	SLCT	I	Device selected
14	AFD#	O	Auto line feed
15	ERROR#	I	Error condition
16	INIT#	O	Initialization (Reset)
17	SLIN#	O	Select In
18-25	GND	-	Ground
26	VCC	O	+5 Volt

Table 22, Parallet Port LPT1 Pin Assignment

4.9 Serial Ports

Two serial RS-232-C interfaces (COM1 and COM2) are located on the PCM-4330 PC/104 board computer as 2-row 10-pin male connectors.

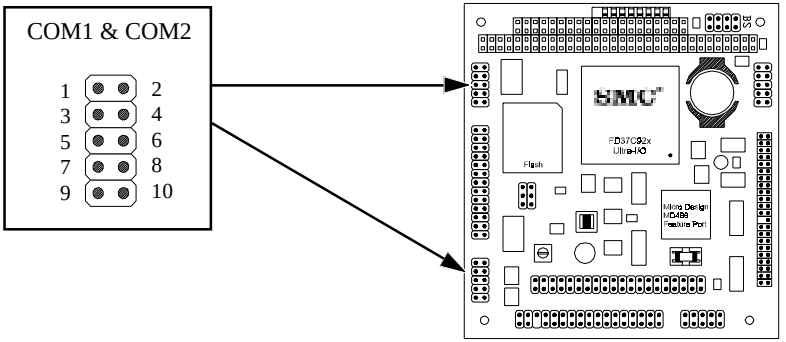


Figure 30, Serial Ports (COM1 and COM2)

Pin	Signal	Function	Pin	Signal	Function
1	DCD#	Data Carrier Detect	2	DSR#	Data Set Ready
3	RxD	Receive Data	4	RTS#	Request to Send
5	TxD	Transmit Data	6	CTS#	Clear to Send
7	DTR#	Data Terminal Ready	8	RI#	Ring Indicator
9	GND	Ground	10	N.C.	-

Table 23, Serial Ports (COM1 and COM2) Pin Assignment

5 Software Interfaces

This chapter describes the software interface of the PCM-4330 PC/104 board computer.

5.1 Address Summary of System Memory

A 1 MB address space is available in Real Mode and up to 4 MB physical memory on-board in Protected *Virtual Mode.*
After a system reset the CPU resumes operation in Real Address Mode. Code at address FFFFF0h is executed next. Therefore, the BIOS area must be paged into the upper 64 kB segment of the 4 MB address space. From there a far jump into segment F000h is performed.

HEX Address	Name	Function
00000000h - 0009FFFFh	640 kB User RAM	DOS application programs
000A0000h - 000BFFFFh	128 kB Video RAM	Display refresh memory
000C0000h - 000CBFFFh	40 kB VGA BIOS	40 kB Flash-Filings 8kB
000CC000h - 000EFFFFh	144 kB Extemsion ROM	Extended BIOS area
000F0000h - 000FFFFFh	64 kB BIOS on-board	BIOS area
00100000h - 003FFFFFh	On-board RAM 4 MB	Extended Memory in Protected Mode only
00000000h - 00FFFFFFh	Off-board RAM 16 MB	On expansion boards (if enabled in setup menu)
FFFF0000h - FFFFFFFFh	64 kB BIOS on-board	BIOS area after reset

Table 24, Address Summary of System Memory

5.2 Interrupt Channels

16 system interrupt channels are provided by the NMI of the CPU and two 8259 interrupt controllers in the SIS-85C471-AT-Controller. All interrupts may be masked. Interrupts are sorted by priority, starting with the highest priority. Table 16 lists all available interrupts:

Interrupt Level		Function
NMi		Parity or I/O error
Master	Slave	
IRQ 0		Timer Output 0
IRQ 1		Keyboard
IRQ 2		Cascading for slave controller
	IRQ 8	Real-time clock (RTC)
	IRQ 9	Software redirect to INT 0Ah
	IRQ 10	available
	IRQ 11	available
	IRQ 12	available
	IRQ 13	Co-processor
	IRQ 14	Hard disk controller
	IRQ 15	available
IRQ 3		COM2
IRQ 4		COM1
IRQ 5		available (LPT2)
IRQ 6		Floppy disk controller
IRQ 7		LPT1

Table 25, System Interrupt Levels

5.3 DMA Channels

The PCM-4330 single board computer provides a total of seven DMA channels. Two 82c37-compatible DMA controllers in the SIS-85C471-AT-Controller are AT-compatibly cascaded as MASTER and SLAVE.

5.3.1 DMA Channel Assignment

Channel 0 of the Master-*Controller* (= DMA channel 4) is used to cascade input for the *Slave-Controller*.
Channels 0 to 3 (Slave) support 8-bit DMA data transfer between an 8-bit I/O unit and the 8/16-bit main memory. Channels 5 to 7 (Master 1 to 3) support 16-bit DMA data transfer between a 16-bit I/O component and the 16-bit main memory.
Channels 5 to 7 can only address data on even byte boundaries.

5.3.2 DMA Address Generation

The limited addressing capability (16 address lines = 64 kB memory) of the 8237-DMA controller is extended to 16 MB by the *Low-Page-Registers.*
The address is constituted by the contents of the *Low-Page-Register* and the DMA controller address in the current address register.

5.4 Port A

The SIS-85C471-AT-Controller. supports port A (I/O address 92h) of the PS/2® system family. This offers a fast alternative to the PC/AT standard for controlling CPU resets and A20 control.

Port 92h	**Data Port Description**							
PS/2	RES	RES	RES	RES	RES	RES	A20	RST
	x	x	x	x	x	x	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	**Name**	**Function**
7- 2	RES	Reserved bits, always read “1”
1	A20	Fast A20 shift
		0 = A20-line always low
		1 = A20 under CPU control
0	RST	Fast CPU reset
		0 = no reset initiated
		1 = initiate reset

5.5 Port B

Port B (I/O address 61h) supports the following settings. Bits 0 to 3 are read/write, bits 4 to 7 are read-only

Port 61h	Data Port Description							
KEYB	PRNMI	INOMI	SP	SF	IOCHK	PR	SPON	SPCOU
	r	r	r	r	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	PRNMI	parity error occurred
		0 = no NMI from parity error
		1 = parity active, NMI requested
6	IONMI	I/O error occurrend
		0 = no NMI from IOCHK
		1 = IOCHK active, NMI requested
5	SP	Loudspesker counter signal
4	RF	Refresh detection,changing with the refresh cycle (15 μs)
3	IOCHK	I/O channel check
		0 = enabled
		1 = disabled and erased
2	PR	Parity checking on systom board
		0 = enabled
		1 = disabled and erased
1	SPON	Direct speaker control
		0 = speaker off
		1 = speaker on
0	SPCOU	Loudspeaker counter gate
		0 = counter disabled
		1 = counter disabled

5.6 AAEON Feature Port

This port was introduced by AAEON to realize special functions of thePCM-4330 single board computer.

Feature port functions are also available through BIOS calls. These calls provide a save and convenient method to use AAEON feature port features. You should use these BIOS calls whenever possible.

Incorrect arguments for direct port calls might lead to unexpected behavior, system crashes or halts, render the system inoperative or even damage components. Please study this section closely and observe all notes as well as programming guidelines set fourth in the component data sheets and documentation.

5.6.1 Setting the Base Address

To write to or read from the data on index port, the base address must be set first. Setting the base address is done by a Word-OUT to port address 90h. Programming can also be done with Byte-OUTs.

Port 90h	Data Port Description							
LOWARD	SA7	SA6	SA5	SA4	SA3	SA2	SA1	REGEN
PWR	0	0	0	0	0	0	0	0
	w	w	w	w	w	w	w	w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 1	SA7 - SA1	Address bits SA7 - SA1 of base address
0	REGEN	Enable AAEON Feature Port
		0 = AAEON Feature Port off
		2 = AAEON Feature Port on

Port 91h	Data Port Description							
HIGHADR	RES	RES	RES	RES	RES	RES	SA9	SA8
PWR	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	w	w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Font
7 - 2	RES	(reserved)
1 - 0	SA9 - SA8	Address bits SA9 - SA8 of base address

5.6.2 Feature Port Register Description

Data Port xxxxxxxxx0b

This port is used to write or read the data of the register set by the index port. The address of the register and description of bits are found in the following table.

Index Port xxxxxxxxx1b

The index port is used to address the corresponding data register through which the data port is to be accessed.

MISCSET Register 0

Index: 0	Data Port Description							
MISCSET 0	ID3	ID2	ID1	ID0	VPPEN	RES	WDEN	RES
PWR	0	0	0	1	1	x	0	x
	r	r	r	r	r/w	x	r/w	x
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7-4	ID3-ID0	Identification code 4h in High-Nibble for AIO486
3	VPPEN	Activate programming voltage (12 Volt) This bit also removes the write protection for all Flash and SRAM modules. 0 = Programming voltage on 1 = Programming voltage off (reserved)
2	RES	Enable watchdog timer
1	WDEN	0 = Watchdog off 1 = Watchdog on (reserved)
0	RES	

MISCSET Register 1

Index: 1	Data Port Description							
MISCSET 1	RES	ROM	CC	V48K	VGADIS	VGARS	RES	RES
PWR	x	0	0	0	0	0	x	x
	r	r/w	r/w	r/w	r/w	r/w	x	x
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	RES	(reserved)
6	ROM	Disable VGA-ROM at address C0000h 0 = VGA-ROM on 1 = VGA-ROM off
5	CC	Disable VGA-ROM at address C0000h 0 = VGA-ROM on 1 = VGA-ROM off
4	V48K	Select VGA-ROM size 0 = 48 kB 1 = 32 kB
3	VGADIS	Disable on-board VGA controller 0 = WD90C24A on 1 = WD90C24A off
2	VGARIS	Disable on-board VGA controller 0 = WD90C24A on 1 = WD90C24A off
1 - 0	RES	(reserved)

Watchdog Retrigger

Index: 2	Data Port Description							
WDTRIG	x	x	x	x	x	x	x	x
PWR	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x	x
	D7	D6	D5	D4	D3	D2	D1	D0

The watchdog timer is reset by a write operation to this register.

DA Converter for LCD Contrast Control

Index: 5	Data Port Description							
DACTRL	RES	RES	RES	RES	RES	RES	LOAD	DATA
PWR	x	x	x	x	x	x	x	0
	x	x	x	x	x	x	w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Funtion
1	LOAD	Load impulse for DA converter
0	DATA	Data for DA converter

The DA converter used on-board is a 12-bit converter from Linear Technology (LTC1451). To avoid damaging the display, always check that the desired value is supported by the connected display.

AD Converter and Temperature Sensor

Index: 6	Data Port Description							
ADCTRL	RES	RES	RES	RES	RES	RES	CS	DATA
PWR	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
1	CS	Chip select for multiplexer and AD converter
0	DATA	Data for multiplexer and from AD converter

A 10-bit AD converter from Linear Technology (LTC1392) is used on-board. This component also contains a temperature sensor. The 5 V supply voltage is measured internally by a multiplexer of the LTC1392. Before the LTC1392. chip, an eight channel multiplexer is put in line. This multiplexer measures several voltages on the board. Please refer to the following table for the analog multiplexer input signals:

Channel 1	Programming voltage (12 Volt)
Channel 2	12 Volt
Channel 3	5 Volt (switched) voltage for LC-display
Channel 4	12 Volt (switched) voltage for LC-display
Channel 5	Keyboard voltage (5 Volt)
Channel 6	Positive contrast voltage (max. 30 Volt)
Channel 7	Negative contrast voltage (max. 30 Volt)
Channel 8	Battery voltage (3 volt)

Before programming the LTC1390 or LTC1392. converters, please refer to the component data sheets.

MISCSET Register 2

Index: D	Data Port Description							
MISCSET 2	US05	US15	US012	US112	S5VEN	S12VEN	COMM1	COMM0
PWR	1	0	1	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	US05	Enable 5 Volt supply voltage for display through LCDEN pin of the WD90C24 chip 0 = Enable through LCDEN off 1 = Enable through LCDEN on
6	US15	Enable 5 Volt supply voltage for display through PNLOFF pin of WD90C24 chip 0 = Enable through PNLOFF off 1 = Enable through PNLOFF on
5	US012	Enable 12 Volt supply voltage and contrast voltage for display through delayed LCDEN signal of the WD90C24 chip 0 = Enable through delayed LCDEN off 1 = Enable through delayed LCDEN on
4	US112	Enable 12 Volt supply voltage and contrast voltage for display through PNLOFF signal of the WD90C24 chip 0 = Enable through PNLOFF off 1 = Enable through PNLOFF on
3	S5VEN	Enable 5 Volt supply voltage for display 0 = 5 Volt off 1 = 5 Volt on
2	S12VEN	Enable 12 Volt supply voltage and contrast voltage for display 0 = 12 Volt off 1 = 12 Volt on
1	COMM1	Select mode for COMB 0 = RS232 mode 1 = RS485 / RS422 mode
0	COMM0	Select mode for COMA 0 = RS232 mode 1 = RS485 / RS422 mode

MISCSET Register 3

Index: E	Data Port Description							
MISCSET 3	PROG	RES	RES	IRQ12	COM	RES	SOUND	NET
PWR	PROG	x	x	0	0	x	0	1
	r/w	x	x	r/w	r/w	x	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

BIT	Name	Function
7	PROG	Select on-board/external BIOS on ISA-bus 0 = External BIOS 1 = On-board BIOS
6 - 5	RES	(reserved)
4	IRQ12	Enable PS/2 mouse interrupt on IRQ12 0 = IRQ12 disabled for PS/2 mouse 1 = IRQ12 enabled for PS/2 mouse Please note: This function is not supported on the PCM-4330 platform!
3	COM	Enable serial interface driver 0 = Interface driver off 1 = Interface driver on
2	RES	(reserved)
1	SOUND	Enable sound chip 0 = Sound chip off 1 = Sound chip on Please note: This function is not supported on the PCM-4330 platform!
0	NET	Enable ethernet chip 0 = Ethernet chip off 1 = Ethernet chip on Please note: This function is not supported on the PCM-4330 platform!

Controller Revision

Index: F	Data Port Description							
REVISION	ID3	ID2	ID1	ID0	REV3	REV2	REV1	REV0
PWR	0	0	0	1	x	x	x	x
	r	r	r	r	r	r	r	r
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	ID3 - ID0	Identification code 4h in High-Nibble for AIO486
3 - 0	REV3 - REV0	Revision number for controller, currently 2h

Flash Page

Index: 10	Data Port Description							
DEPAGE	EC	E8	E4	E0	DC	D8	D4	D0
PWR	0	0	0	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	EC	Enable 16 kB page m segment EC00h - EFFFh
6	E8	Enable 16 kB page m segment E800h - EBFFh
5	E4	Enable 16 kB page m segment E400h - E7FFh
4	E0	Enable 16 kB page in segment E000h - E3FFh
3	DC	Enable 16 kB page in segment DC00h - DFFFh
2	D8	Enable 16 kB page in segment D800h - DBFFh
1	D4	Enable 16 kB page in segment D400h - D7FFh
0	D0	Enable 16 kB page in segment D000h - D3FFh

Memory-Page 0

Index: 30	Data Port Description							
PAGE0LO	A21	A20	A19	A18	A17	A16	A15	A14
PWR	0	0	0	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 0	A21 - A14	Address for active page of memory module (16 KB)

Index: 31	Data Port Description							
PAGE0HI	CARD0	A28	RES	RES	RES	A24	A23	A22
PWR	0	0	x	x	x	0	0	0
	r/w	r/w	x	x	x	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	CARD0	Enable first 16 kB memory page 0 = Page disabled 1 = Page enabled
6	A28	Address for active page of memory module (16 kB). This address determines, whether the on-board flash disk This address determines, whether the on-board flash disk width) is used. 0 = SIMM64/Flash/SRAM module (16 bit) 1 = On-board flash disk (8 bit) Please note: Off-board modules are not supported on the PCM-4330 platform.
5 - 3	RES	(reserved)
2 - 0	A24 - A22	Address for active page of memory module (16 KB)

Memory-Page 1

Index: 32	Data Port Description							
PAGE1LO	A21	A20	A19	A18	A17	A16	A15	A14
PWR	0	0	0	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 0	A21 - A14	Address for active page of memory module (16 KB)

Index: 33	Data Port Description							
PAGE1HI	CARD1	A28	RES	RES	RES	A24	A23	A22
PWR	0	0	x	x	x	0	0	0
	r/w	r/w	x	x	x	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	CARD1	Enable second 16 kB memory page 0 = Page disabled 1 = Page enabled
6	A28	Address for active page of memory module (16 kB). This address determines, whether the on-board flash disk or an off-board SIMM64/Flash/SRAM module (8 or 16 bit width) is used. 0 = SIMM64/Flash/SRAM module (16 bit) 1 = On-board flash disk (8 bit) Please note: Off-board modules are not supported on the PCM-4330 platform.
5 - 3	RES	(reserved)
2 - 0	A24 - A22	Address for active page of memory module (16 KB)

Memory-Page 2

Index: 34	Data Port Description							
PAGE2LO	A21	A20	A19	A18	A17	A16	A15	A14
PWR	0	0	0	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 0	A21 - A14	Address for active page of memory module (16 KB)

Index: 35	Data Port Description							
PAGE1HI	CARD2	A28	RES	RES	RES	A24	A23	A22
PWR	0	0	x	x	x	0	0	0
	r/w	r/w	x	x	x	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	CARD2	Enable third 16 kB memory page 0 = Page disabled 1 = Page enabled
6	A28	Address for active page of memory module (16 kB). This address determines, whether the on-board flash disk or an off-board SIMM64/Flash/SRAM module (8 or 16 bit width) is used. 0 = SIMM64/FIash/SRAM module (16 bit) 1 = On-board flash disk (8 bit) Please note: Off-board modules are not supported on the PCM-4330 platform.
5 - 3	RES	(reserved)
2 - 0	A24 - A22	Address for active page of memory module(16 KB)

Memory-page 3

Index: 36	Data Port Description							
PAGE3LO	A21	A20	A19	A18	A17	A16	A15	A14
PWR	0	0	0	0	0	0	0	0
	r/w	r/w	r/w	r/w	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 0	A21 - A14	Address for active page of memory module(16kB)

Index: 37	Data Port Description							
PAGE3HI	CARD3	A28	RES	RES	RES	A24	A23	A22
PWR	0	0	x	x	x	0	0	0
	r/w	r/w	x	x	x	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7	CARD3	Enable fourth 16 kB memory page 0 = Page disabled 1 = Page enabled
6	A28	Address for active page of memory module (16 kB). This address determines. whether the on-board flash disk or an off-board SIMM64/Flash/SRAM module (8 or 16 bit width) is used. 0 = SIMM64/Flash/SRAM module (16 bit) 1 = On-board flash disk (8 bit) Please note: Off-board modules are not supported on the PCM-4330 platform.
5 - 3	RES	(reserved)
2 - 0	A24 - A22	Address for active page of memory module (16 KB)

Memory Address Space for Flash-/SRAM-Module

Index: 38	Data Port Description							
PCPAGE0	RES	RES	RES	RES	SA17	SA16	SA15	SA14
PWR	x	x	x	x	0	0	0	0
	x	x	x	x	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	RES	(reserved)
3 - 0	SA17- SA14	AT address space of first 16 kB window SA19 and SA18 are assigned as logically high.Address space may be set in 16 kB increments.

Index: 39	Data Port Description							
PCPAGE1	RES	RES	RES	RES	SA17	SA16	SA15	SA14
PWR	x	x	x	x	0	0	0	0
	x	x	x	x	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	RES	(reserved)
3 - 0	SA17 - SA14	AT address space of second 16 kB window. SA19 and SA18 are assigned as logically high. Address space may be set in 16 kB increments.

Index: 3A	Data Port Description							
PCPAGE2	RES	RES	RES	RES	SA17	SA16	SA15	SA14
PWR	x	x	x	x	0	0	0	0
	x	x	x	x	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	RES	(reserved)
3 - 0	SA17 - SA14	AT address space of third 16 kB window. SA19 and SA18 are assigned as logically high. Address space may be set in 16 kB increments.

Index: 3B	Data Port Description							
PCPAGE3	RES	RES	RES	RES	SA17	SA16	SA15	SA14
PWR	x	x	x	x	0	0	0	0
	x	x	x	x	r/w	r/w	r/w	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	RES	(reserved)
3 - 0	SA17 - SA14	AT address space of fourth 16 kB window. SA19 and SA18 are assigned as logically high. Address space may be set in 16 kB increments.

PCM-4330 Register 0

Index: 40	Data Port Description							
PWRDWN0	RES	RES	RES	RES	COM	ESS	SMC	VGA
PWR	x	x	x	x	0	x	x	0
	x	x	x	x	r/w	x	x	r/w
	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Name	Function
7 - 4	RES	(reserved)
3	COM	PCM-4330 for LTC1334 through SMOUT 3 of SIS85C471 0 = PCM-4330 off 1 = PCM-4330 on
2	ESS	PCM-4330 for ESSI788 through SMOUT 3 of SIS85C471 0 = PCM-4330 off 1 = PCM-4330 on Please note: This function is not supported on the PCM-4330 platform!
1	SMC	PCM-4330 for SMC9IC92 through SMOUT 3 of SIS85C471 0 = PCM-4330 off 1 = PCM-4330 on Please note: This function is not supported on the PCM-4330 platform!
0	VGA	PCM-4330 for WD90C24 through SMOUT 0 of SIS85C471 0 = PCM-4330 off 1 = PCM-4330 on

5.7 Real-Time Clock/CMOS-RAM

A MC146818A compatible, battery-buffered real-time clock (RTC) is included in the DC37C92x-Ultra-I/O-controller. It provides data for time, alarm, control and status information. The remaining RAM is used by the BIOS to store system configuration data.

5.7.1 RTC/CMOS-RAM Address Assignment

Table26 illustrates the internal RTC port addresses

To the programmer the RTC apears as a 128 byte RAM area that can be addressed via two I/O addresses. 192 bytes RAM are in this address-area. Two RAM pages are in area 40h to 3Fh which may be paged in/out alternatively.

Address	Description	
00h	Second	0-59
01h	Seconds-Alarm	0-59
02h	Minutes	0-59
03h	Minutes-Alarm	0-59
04h	Hours	1-12(24)
05h	Hours-Alarm	0-23
06h	Day of Week	1-7
07h	Day of Month	1-31
08h	Month	1-12
09h	Year	0-99
0Ah	Status Register A	
0Bh	Status Register B	
0Ch	Status Register C	
0Dh	Status Register D	
0Eh-3Fh	50 bytes used by BIOS	
40h-7Fh	2*64 bytes used by BIOS	

Table 26, RTC Address Assignment

5.7.2 RTC/CMOS-RAM Operations

Writing into the RTC requires two steps:
[1] Address output (OUT) at port70h
[2] Data output (OUT) at port 71h

Note to programmers: Accessing port 70h, databit 7 determines the status of the NMI controller:
Bit 7 = 1, NMI disabled
Bit 7 = 0, NMI enabled
The desired control status for the NMI must be set for every application program accessing the RTC!

5.8 System Timer

The system timer in the SIS-85C471-AT-Controller includes all 82C54 timer functions. It contains three AT-compatible, independently running and programmable counters for software controlled generation of precise time intervals (counter 0, 1 and 2)

Counter 0 is connected to the interrupt request 0 of the Master-Interrupt-Controller. It has the highest priority of all maskable interrupts. Counter 0 has to interrupt the CPU every 50 ms to provide necessary time-updates. It is always active.

Counter 1 works in mode 2, programmed to update the memory refresh logic every 15 μs. Counter 1 is always active.

Counter 2 operates in mode 3, programmed as a square-wave generator to control the speaker. It is controlled by gate 2 via System-Control-Latch-Bit 0 (I/O port 61h). The output of counter 2 is combined by a logical and with bit 1 of the Port-B-Register to generate output signals for the speaker.

5.8.1 Timer Programming

The timer is addressed as a 8-bit peripheral at I/O address 40h to 43h.

Counters are programmed by writing the control word and then the initial counter state into the memory location of the counter. Please refer to the SIS-85C471 product documentation (Lit. [3]) for detailed information.

IO-Port	Register Description
040h	Timer 1, System Timer (Counter 0)
041h	Timer 1, Refresh Request (Counter 1)
042h	Timer 1, Speaker Tone (counter 2)
043h	Timer 1, Control Word Register

Table 28, Timer Register

5.9 NMI Logic

After a Power-On-Reset the AT-NMI is disabled. By writing to I/O address 70h the AT-NMI can be enabled or disabled. Bit 7 can not be read.

- Bit 7 = 1: AT-NMI disabled
- Bit 7 = 0: AT-NMI enabled

The AT-NMI can be triggered by:

- a parity error in the main memory
- the ISA-bus signal IOCHCK of an expansion card

Bits ENRAM and ENIOCK control the NMI sources via Port B.
After a Power-On-Reset both NMI sources are enabled. Bits ENRAM and ENIOCK can be read via Port B even if the AT-NMI is disabled. If an enabled parity error or I/O channel error occurs, the corresponding ENRAM or ENIOCK bit must be disabled and then enabled again to reset the logic.

5.10 Keyboard Interface

For the function of the keyboard interface, the controller is programmed to translate the codes received from the keyboard (Scan Codes) into system codes, which can be interpreted by the BIOS. The keyboard controller receives serial data from the keyboard, checks parity, translates key codes and sends the data to the system as data byte into its output buffer. As soon as data is present in the buffer, an interrupt request (IRQ1) is asserted.
Commands can be sent to the keyboard by writing into the buffer. The data byte is sent to the keyboard as serial data with the uneven parity bit being inserted automatically. All data transmission to the keyboard must be acknowledged. No data may be sent to the keyboard until the previous byte is acknowledged.

5.11 Floppy Disk Controller

A 765B-compatible SuperCell™ in the FDC37C92x-Ultra-I/O-controller from S MC (c.f. Lit. [4]) is used as floppy disk controller (FDC). Data is transferred over DMA channel 2. Interrupts are triggered by IRQ6. Two floppy disk drives (3½ or 5¼) are supported.

Floppy disks must be formatted according to their capacity. Failure to do so may result in read/write errors.

5.12 Parallel Port

The parallel centronics port is programmable (see Lit. [4]). It may operate in uni-directional mode (AT standard) or bi-directional mode. It contains the following registers:

- Bi-directional parallel port for data transfer
- Status register for requests of the printer status
- Readback control register

5.13 Serial Port

Both serial RS-232-C ports are programmable via the FDC37C92x chip. This highly integrated chip features two independent channels for the AT-compatible 16550 port. Each channel controls its own send/receive channel, has its own data register and interrupts. Modem control signals are provided for each channel.

Programmable features are:

- Serial data transmission with 5, 6, 7 or 8-bit characters
- Generation/detection of even, odd or no parity
- Generation of 1,1.5 or 2 Stop-Bits
- Baud rate generator to divide the 1.8432 MHz clock frequency

6 Firmware

This chapter describes the Award PowerBIOS functions of the PowerDwarf single board computer.

6.1 POST (Power On Self Test)

After a (soft- or hardware) reset of the computer, a self-test and initializing of all hardware components is performed. This test is referred to as POST (Power On Self Test) .

After a hardware reset, on-screen messages identiftr which component is currently being tested. If any errors occur during POST, a corresponding message is displayed on the screen. An error may occur due to hardware failure, i.e. an defective component, or if the setup configuration is incorrect (e.g. setup information contains entries for two floppy disk drives while only one drive is actually installed in the system).

Errors, that occur before the primary display adapter has been initialized, are indicated by the BIOS through a series of signals tones (beeps). Please refer to chapter G.I.I for the description of possible signals tones and their meaning. After the display adapter initialization all errors are reported through on-screen error messages. A description of error messages is found in chapter 6.I.2 on page 86.

During POST, diagnostic codes are also written to I/O Port 80h. Chapter 6·I*3 on page 89 lists possible diagnostic codes.

6.1.1 Signal Tone Error Messages

- 1 Beep: Refresh error
  Check that the SIMM module is installed properly. If the error still occurs, replace the memory chip.
- 2 Beeps: Parity error
  Check that the SIMM module is installed properly. If the error still occurs, replace the memory chip.
- 3 Beeps: Error in the first 64 kB memory area
  Check that the SIMM module is installed properly. If the error still occurs, replace the memory chip.
- 4 Beeps: as above, or the timer does not work The board must be replaced.
- 5 Beeps: CPU error
  The board must be replaced.
- 6 Beeps: Gate Azo error
  Check the keyboard controller and supply. Ifnecessary, replace the keyboard controller.
- 7 Beeps: CPU asserted unnecessary interrupt
  The board must be replaced.

- 8 Beeps: Video adapter error

Replace the video adapter or video adapter display memory RAM.

- 9 Beeps: ROM-checksum error

The BIOS will probably have to be replaced.

- Io Beeps: CMOS-RAM register error

The board must be replaced

- 11 Beeps: Cache error

Check the cache memory on the board.

6.1.2 On-screen Error Messages

if an error occurs during POST one or more of the following messages may appear on the display:

```
ERROR Message Line 1
ERROR Message Line 2
Press <F1> to  continue
```

The program stops, if the setup option Halt On Ewors is set to All ewors.

Alternatively, the program might prompt you to run the setup utility program to correct settings. The following message would be displayed on-screen:

```
RUN SETUP UTILITY
```

The following section describes error messages, provides explanations and suggests work-arounds. Further POST messages and problem work-arounds can be found in the reference documents.

```
8042 Gate-A20 Error
```

The keyboard controller gate Azo does not work properly. Replace the keyboard controller.

```
Address Line Short!
```

Address coding error.

```
C:  Drive Error
```

Drive C: does not respond. Use the diagnostic utility program AM~Diag Hard Disk Utility to test the drive and check that all hard disk drive parameters and hard disk setup settings are correct.

```
C:  Drive Failure
```

Drive C: does not respond. Replace the hard disk drive.

```
Cache Memory bad. Do Not enable Cache!
```

The cache memory is corrupt. Run the AMIDiag diagnostic utility program.

```
CH-2 Timer Error
```

Timer 2 error.

CMOS Battery State Low
The CMOS-RAM is (almost) empty.

CMOS Checksum Failure CMOS-RAM
The checksum does not contain a valid value. Use the setup program to calculate a valid checksum.

CMOS System Options Not Set
CMOS-RAM values are false or non-existent. Use the setup program to identiftr and correct the problem.

CMOS Display Type Mismatch
The CMOS-RAM video adapter type setting does not correspond to the display adapter installed. Run the setup utility program to correct the problem.

CMOS Memory Size Mismatch
The size of memory installed does not correspond to the CMOS-RAM setting. Run the setup utility program to check settings.

CMOS Time and Date Not Set
Run the setup utility program to enter new time and date values.

D: Drive Error
Drive D: does not respond. Use the diagnostic utility program AM~Diag Hard Disk Utility to test the drive and check that all hard disk drive parameters and hard disk setup settings are correct.

D: Drive Failure
Drive D: does not respond. Replace the hard disk drive.

Diskette Boot Failure
The disk in drive A: is not a boot disk. Insert a boot disk and following directions on the screen.

Display Switch Not Proper
Some computer system use display type switches to set the display type to mono-chrome or color. Check the stting off this switch or jumper.

DMA Error
DMA controller error.

DMA 1 Error or DMA 2 Error
DMA channel error.

FDD Controller Failure
BIOS could not address the floppy disk controller. Check that all cables are properly connected.

HDD Controller Failure
BIOS could not address the hard disk controller. Check that all cables are connected properly.

INTR 1 Error orINTR 2 Error
Interrupt channel error.

Invalid Boot Diskette
BIOS could read the disk but could not boot the system from the disk. Insert another boot disk and follow directions on the screen.

Keyboard Is Locked...Unlock It
The keyboard is locked (keyswitch).

Keyboard Error
The keyboard obviously has timing problems.

KB/Interface Error
The keyboard is not connected properly.

No ROM BASIC
BIOS could not find a free sector on drive A: or on the hard disk for the boot operation.

Off Board Parity Error
A memory parity error has occurred on an adapter board.

On Board Parity Error
A memory parity error has occurred on the board.

Parity Error ????
A memory parity error has occurred at an unidentified location.

6.1.3 POST-Codes

During the Power On SeEfTest, POST codes are sent to I/O port 80h. Each routine number (hexadecimal) is sent to the post Port before the routine is called. The following table lists all possible POST codes:

Code	Function	Description
00h	(None)	Hook for Cpu type detection (CPU extension)
01h	Timer Reset	Initializes the timer
02h	DMA Reset	Initializes the DMA controller
03h	IRQ POST	Initializes the interrupt controller
04h	RTC Reset	Initializes RTC control registers
05h	KBD Reset	Initializes the keyboard Error codes: BAh...BFh
06h	Video Blank	Clears screen (if 684~ present)
07h	NVS Checksum	Calculates CMOS checksum
08h	NVS Default	Initializes CMOS if checksum bad
09h	ROM Checksum	Calculates ROM checksum, system halted if checksum bad
10h	Memory Sizing	Checks memory presence, saves size in CMOS
11h	POST Setup	Initializes memory, sets interrupt vectors
12h	Setup Option ROM	Initializes option ROM table
15h	Timer Test	Enables timer IRQ (INT8)
16h	NCP POST	Detects co-processor
17h	KBD Setup	Set up keyboard variables (in data area), enables keyboard IRQ (INT9)
18h	Video POST	Initializes ISA video if presen
19h	Option POST	Detects non-video option ROMs, stores r in option ROM table
1Ah	Display POST	Set up POST window, displays early results
25h	(None)	PS/2 mouse init hooks here if PS2M extension is present
26h	Floppy POST	Detection and initialization of floppy disk drives
27h	(None)	IDE hard disk init hooks here if FIXED extension is present
28h	Serial POST	Detection and initialization of serial ports
29h	Parallel POST	Detection and initialization of parallel ports

Table 28, POST - Code

Code	Function	Description
2Ah	Game Port POST	Detection of game port
2Bh	RTC POST	Copies current RTC time in BIOS data area (BDA)
2Dh	RAM POST	Memory test
40h	Checksum	Recalculates CMOS checksum
41h	Option ROM Init	Initializes all non-video ISA option ROMs stored in option ROM table
4Fh	Boot POST	Attempt to boot
50h	(None)	Restart
DEh	(None)	Power-on or hardware reset
6xh	POST Shutdown	Restart caused by software, x indicates shutdown type
51h	POST Shutdown	Invalid shutdown type detected, system halted
CFh	POST Begin	Early init, begin execution of POST routines

Table 28, POST - Codes

6.2 SVGA-BIOS Calls (INT l0h)

The following sections describe the Standard-VGA-, Extended- and VESA-Super-VGA BIOS calls.

6.2.1 Standard IBM VGA-compatible BIOS Calls (INT 10h)

These calls are IBM VGA-BIOS compatible functions.
The following lists all functions supported by the WD-BIOS with call and return codes.

AH = 00h set video mode

AL= Hex	Type	Colors	Text	Resolution	Font	Clock MHz	HSync KHz	VSync Hz	Min. memo	Brffer Start	Pages
0,1	A/N	16/256k	40x25	320x200	8x8	25.175	31.55	70.3	256K	B8000	8
0,1*	A/N	16/256k	40x25	320x350	8x14	25.175	31.55	70.3	256K	B8000	8
0,1+	A/N	16/256k	40x25	360x400	9x16	28.322	31.34	69.8	256K	B8000	8
2,3	A/N	16/256k	80x25	640x200	8x8	25.175	31.55	70.3	256K	B8000	8
2,3*	A/N	16/256k	80x25	640x350	8x14	25.175	31.55	70.3	256K	B8000	8
2,3+	A/N	16/256k	80x25	720x400	9x16	28.322	31.34	69.8	256K	B8000	8
4,5	A/N	4/256k	40x25	320x200	8x8	25.175	31.55	70.3	256K	B8000	1
6	A/N	2/256k	80x25	640x200	8x8	25.175	31.55	70.3	256K	B8000	1
7	A/N	Mono	80x25	720x350	9x14	28.322	31.34	69.8	256K	B8000	8
7+,	A/N	Mono	80x25	720x400	9x16	28.322	31.34	69.8	256K	B8000	8
D	APA	16/256k	40x25	320x200	8x8	25.175	31.55	70.3	256K	A0000	8
E	APA	16/256k	80x25	640x200	8x8	25.175	31.55	70.3	256K	A0000	4
F	APA	Mono	80x25	640x350	8x14	25.175	31.55	70.3	256K	A0000	2
10	APA	16/256k	80x25	640x350	8x14	25.175	31.55	70.3	256K	A0000	2
11	APA	2/256k	80x30	640x480	8x16	25.175	31.55	60.1	256K	A0000	1
12	APA	16/256k	80x30	640x480	8x16	25.175	31.55	60.1	256K	A0000	1
13	APA	256/256k	40x25	320x200	8x8	25.175	31.55	70.3	256K	A0000	1

Table 30, Supported VGA Video Modes

AH = 01h set cursor type

CH=	Bit 0..4	start line or cursor
	Bit 5..6	blinking attributes
CL=	Bit 0..4	end line of cursors

AH = 02h set cursor position
- DH = line
- DL = rowscreen page number
- BH = 0 in graphics mode
  0..3 in mode 2/3
  0..7 in mode 0/1

AH = 03h read cursor position
- BH = screen page number
  0 in graphics mode
  0..3 in mode 2/3
  0..7 in mode 0/1
- DH: = line
- DL: = row
- CH: = start line of cursor
- CL: = end line of cursor

AH = 05h select active screen page number
- AL = screen page number
  0..3 in mode 2/3
  0..7 in mode 0/1

AH = 06h scroll up sector of active screen
- AL = number of lines to scroll (0 for all lines of screen)
- BH = attribute for lines to delete
- CH = line of upper left corner of the sector
- CL = row of upper left comer of the sector
- DH = line of lower right comer of the sector
  DL = row of lower right comer of the sector

AH = 07h scroll down sector of active screen
- AL = number of lines to scroll (0 for all lines of screen)
- BH = attribute for lines to delete
- CH = line of upper left corner of the sector
- CL = row of upper left comer of the sector
- DH = line of lower right comer of the sector
- DL = row of lower right comer of the sector

AH = 08h read character and attribute at cursor position
- BH = screen page number
- AL: = character at cursor position
- AH: = attribute of character at cursor position

AH = 09h write character and attribute at cursor position
- AL = character
- BL = attributes
- BH = screen page number
- CX = number of characters/attributes to write

AH = 0Ah write character at cursor position
- BH = screen page number
- CX = number of characters to write
- AL = characters

AH = 0Bh set color palette
- BH = color palette
- BL = color values used with color palette

AH = 0Ch set single pixel
- AL = color value for pixel
- BH = screen page number (if more than one page)
- DX = line of pixel
- CX = row of pixel

AH = 0Dh read single pixel
- BH = screen page number (if more than one page)
- DX = line of pixel
- CX = row of pixel
- AL = color value of pixel

AH = 0Eh write character at cursor position (TTY Write)
- AL = character
- BL = foreground color in graphics mode
- BH = screen page number (if more than one page)

AH = 0Fh read current screen status
- AL = character
- AH = current screen page number
- BH = current screen page number

AX = 1000h set a palette register
- BL = number or palette register
- BH = color for palette register

AX = 1001h set overscan register
- BH = color value for overscan register

AX = 1002 h set all palette registers and overscan register
- ES:DX = address for 17 byte for the registers

AX= 1003h switch background intensity and blinking bit
BL = 0: switches background intensity
BL = 1: switches blinking bit

AX = 1007h read palette register
BL = number of palette register
BH = color of register

AX = 1008h read overscan register
BH = color values of register

AX = 1009h read all palette registers and overscan register
ES:DX = address of the 17 byte for the registers

AX = 1010h set one color register (DAC)
BX = number of color register
CH = new value for color green (0..63)
CL = new value for color blue (0..63)
DH = new value for color red (0..63)

AX = 1012h set number of color registers (DAC)
BX = number of first color register
CX = number of color registers
ES:DX = address for values of the registers

AX = 1013h select video DAC color page
BL = 0: select page mode:
BH = 0: selects 4 blocks out of 64
BH = 1: selects 16 blocks out of 16
BL = 1: select color page
BH = selected color page

AX = 1015h read one color register (DAC)
BX = number of color register
CH = current value for color green
CL = current value for color blue
DH = current value for color red

AX = 1017h read number ofcolor registers (DAC)
BX = number of first color register
CX = number of registers
ES:DX = address of the values for the registers
CX = number of color register triples read

AX = 1018h set pixel mask
BL = screen mask

AX= 1019h read screen mask
BL = screen mask

AX= 101Ah read current video DAC color page
BL = 0: read page mode:
BH = 0: 4 blocks out of 64
BH = 1: 16 blocks out of 16
BL = 1: read color page
BH = color page

AX= 101Bh convert color values into shades of gray
BX = number of first palette register
CX = number of registers

AX = 1100h load user defined character set for text mode
ES:BP = address of character set
CX = number of characters to load
DX = character offset in second block
BL = block to load into map 2
DH = number of bytes per character

AX = 1101h load 8 x 14 monochrome ROM character set
BL = block to load

AX = 1102h load 8 x 8 (twin pixels) ROM character set
BL = block to load

AX = 1103h set parameters of block
BL = parameters of the block

AX = 1104h load 8 x 16 ROM character set

AX = 1110h load user defined character set for text mode
(see AX = 1100h)

AX = 1111h load 8 x 14 monochrome ROM character set
(see AX = 1101h)

AX = 1112h load 8 x 8 (twin pixels) ROM character set
(see AX = 1102h)

AX = 1113h set parameters for block
(see AX = 41103h)

AX = 1114h load 8 x 16 ROM character set
(see AX = 1104h)

AX = 1120h	load user defined 8 x 8 graphic character set (INT 1Fh)	
	ES:BP=	address of character set
	load user definedcharacter set	
AX = 1121h	ES:BP=	address of character set
	CX=	number of bytes per character
	BL=	information about the number of lines on the screen page
		0: DL defines number of lines
		1:14 lines
		2:25 lines
		3:43 lines
AX = 1122h	load 8 x 14 ROM graphics character set	
	BL=	information about number of lines
AX = 1123h	load 8 x 8 (twin pixels) ROM graphics character set	
BL=	information about number of lines	
AX = 1124h	load 8 x 16 ROM graphics character set	
	BL=	information about number of lines
AX = 1130h	return information on current character set	
	ES:BP=	address of pointer to character set
	CX=	number of bytes per character in character set
	DL=	number of lines on the screen page
AH = 12h	BL=10h	return video information
	BH=	color or monochrome mode (0: color mode)
	BL=	size of screen memory in 64 byte steps
	CL=	switch setting
AH = 12h	BL=20h	switch to alternative functions for screen print
AH = 12h	BL=30h	set vertical screen resolution
	AL=	number of vertical lines
		0:200 lines
		1:350 lines
		2:400 lines
	AL=	12h (since function is supported)
AH = 12h	BL=31h	load standard values for palette registers
	AL=	enable/disable loading of standard values for palette registers
	AL=	12h (since function is supported)
AH = 12h	BL=32h	enable/disable video addressing
	AL=	enable/disable video addressing
	AL=	12h (since function is supported)

AH = 12h	BL=33h	conversion color to grayscale
	AL=	enable/disable conversion of color values to grayscale
	AL=	12h (since function is supported)
AH = 12h	BL=34h	cursor emulation
	AL=	enable/disable cursor emulation
	AL=	12h (since function is supported)
AH = 12hBL=35h		monitor switching
	AL=	type of switching
	ES:DX=	128 byte array to store old video values
	AL =	12h (since function is supported)
AH = 12h	BL=36h	monitor on/off
AH = 13h	write text	
	AL=	Mode (move cursor / additional attributes for text)
	BL=	attribute (if not included in the text)
	BH=	screen page number
	DH=	write text in line
	DL=	write text in column
	CX=	length of text
	ES:BP=	address of text
AX = 1A00h	read video codes	
	BL=	current video code
	BH=	alternate video code
	AL=	1Ah (since function is supported)
AX = 1A01h	write video code	
	BL=	current video code
	BH=	alternate video code
	AL=	1Ah (since function is supported)
AH = 1BhA	read status information	
	BX=	type (0000h)
	ES:DI=	64 byte buffer for status information
	AL=	1Bh (since function is supported)
X = 1C00h	read size of buffer for video status	
	CX=	which video status
	BX=	size of buffer in 64 byte blocks
	AL=	1Ch (since function is supported)

AX = 1C01h	save video state	
	CX=	which video state
	ES:BX =	buffer to save video state in
	AL =	1Ch (since function is supported)

AX = 1C02 h	restore video state	
	CX=	which video state
	ES:BX=	buffer from which to restore video state
	AL=	1Ch (since function is supported)

6.2.2 Extended BIOS Calls (INT 10h)

These calls are spedtic to the WD-BIOS.
The following lists functions that are supported by the WD-BIOS with call and return codes.

AX = 7F7Fh	BH = 00h	set non-VGA mode
AX = 7F7Fh	BH = 01h	set VGA mode
AX = 7F7Fh	BH = 02h	read spedtic status information
	CH=	number of available 64 KB blocks of screen memory
	CL=	number of used blocks
AX = 7F7Fh	BH = 03h	disable current VGA mode
	BL=	enable/disable current VGA mode
AX = 7F7Fh	BH = 04h	set non-VGA MDA (monochrome) mode
AX = 7F7Fh	BH = 05h	set non-VGA CGA (color) mode
AX = 7F7Fh	BH = 06h	set VGA monochrome mode
AX = 7F7Fh	BH = 07h	set VGA color mode
AX = 7F7Fh	BH = 08h	disable RAMDAC
	BL=	enable/disable RAMDAC
AX = 7F7Fh	BH = 22h	read BitBLT scroll status information
	BL=	hardware BitBLT or software scroll-function 0: hardware BitBLT scroll-function 1: software scroll-function
AX = 7F7Fh	BH = 23h	set BitBLT scroll-function
	BL=	0: hardware BitBLT scroll-function 1: software scroll-function
AX = 7F7Fh	BX = 4100h	enable LCD- and CRT-monitor
AX = 7F7Fh	BX = 4101h	enable or disable auto-centering This function is not available if vertical expansion is actived.
AX = 7F7Fh	BX = 4102h	toggle vertical expansion This function is available for video modes 3+ and 7+ only.

AX = 7F7Fh BX = 4104h toggle display
Toggle between LCD, CRT or simultaneous display on LC and CRT. For high resolution video modes which are not sup ported by the LC-display. simul-aneous display cannot be selected.

AX = 7F7Fh BX = 4105h enable CRT-monitor

AX = 7F7Fh BX = 4106h enable LCD-monitor

AX = 7F7Fh BX = 4107h switch between LCD- and CRT-monitor

AX = 7F7Fh BX = 4108h toggle simultaneous/non-simultaneous display

AX = 7F7Fh BX = 410Ah switch between normal/inverted text display

AX = 7F7Fh BX = 410Bh switch between normal/inverted graphics display

AX = 7F7Fh BX = 410Dh switch to simultaneous display

AX = 7F7Fh BX = 4200h return extended status information
BX= status information

Bit	Description
0,1	(reserved)
2	0: CRT display 1: LCD display
3	0: autocentering on 1: artocentering off
5,4	00: normal graphics and inverted text 01: normal graphics and mormal text 10: inverted graphics and text 11: (reserved)
6	0: vertical expansion on 1: vertical expansion off
9,8	00: 800x600 pixel at 56 Hz 01: 800x600 Pixel at 60 Hz 10: 800x600 pixel at 72 Hz 11: 800x600 pixel (16 colors) at 72 Hz and 800x600 pixel (256 colors) at 60 Hz
11,10	00: 1024x768 pixel (16 colors) interlaced 01: 1024x768 pixel (16 colors) at 60 Hz
13,12	00: 1024x768 pixel (256 colors) interlaced 01: 1024x768 pixel (256 colors) at 60 Hz
14	0: no simultaneous display on CRT / LCD 1: simultaneous display on CRT and LCD
15	(reserved)

Table 30, INT 10h AX= 7F7Fh / BX = 4200h, Return Extended Status Information

AX= 7F7Fh BX = 4201h set extended status information
CX= status information

Bit	Description
0,1	(reserved)
2	0: CRT display 1: LCD display
3	0: autocentering on 1: artocentering off
5,4	00: normal graphics and inverted text 01: normal graphics and mormal text 10: inverted graphics and text 11: (reserved)
6	0: vertical expansion on 1: vertical expansion off
9,8	00: 800x600 pixel at 56 Hz 01: 800x600 Pixel at 60 Hz 10: 800x600 pixel at 72 Hz 11: 800x600 pixel (16 colors) at 72 Hz and 800x600 pixel (256 colors) at 60 Hz
11,10	00: 1024x768 pixel (16 colors) interlaced 01: 1024x768 pixel (16 colors) at 60 Hz
13,12	00: 1024x768 pixel (256 colors) interlaced 01: 1024x768 pixel (256 colors) at 60 Hz
14	0: no simultaneous display on CRT / LCD 1: simultaneous display on CRT and LCD
15	(reserved)

Table 31, INT 10h AX= 7F7Fh / BX = 4201 h, Set Extended Status Information

AX = 7F7Fh BX=4300h set power-on condition
CX= value for INT 15h call (CMOS-value)

AX = 7F7Fh BX=4400h return power-on condition
BL= value of power-on condition

AX = 7F7Fh BX=4500h return version numbers of VGA BIOS
BL= 1. digit of version number
CH= 2. digit of version number
CL= 3. digit of version number

AX = 7F7Fh BX=4700h return type of connected monitor (dynamic)
BX= status information
CX= status information

6.2.3 VESA SuperVGA 8105 Calls (INT 10h)

These calls are VESA SuperVGA-BIOS specific.
The following lists functions that are supported by the WD-BIOS with call and return codes.

AH = 00h set video mode

AL= HEX	WD Modus	Type	Colors	Text	Resolution	Font	Min. Memory	Buffer Start	Pages
100	5E	APA	256/256K	80x25	640x400	8x16	512K	A0000	1
101	5F	APA	256/256K	80x30	640x480	8x16	512K	A0000	1
102	58/6A	APA	16/256K	100x75	800x600	8x8	256K	A0000	1
103	5C	APA	256/256K	100x75	800x600	8x8	512K	A0000	1
104	5D	APA	16/256K	128x48	1024x768	8x16	512K	A0000	1
105	60	APA	256/256K	128x48	1024x768	8x16	1M	A0000	1
109	55	APA	16/256K	132x25	1056x400	8x16	256K	B8000	4
10A	54	APA	16/256K	132x43	1056x344	9x9	256K	B8000	2
10D	68	APA	32768	40x25	320x200	8x8	256K	A0000	1
10E	78	APA	65536	40x25	320x200	8x8	256K	A0000	1
110	62	APA	32768	80x30	640x480	8x16	1M	A0000	1
111	72	APA	65536	80x30	640x480	8x16	1M	A0000	1

Table 32, Supported VESA Super VGA Video Modes

AX = 4F00h return SuperVGA information
ES:DI =256 Byte buffer for SuperVGA information
AL= 00h: 4 Byte text string "VESA"
AH= 004h: Word VESA version number
006h: DWord pointer to OEM-name
00Ah: 4 Byte properties
00Eh: DWord pointer to supported VESA and OEM
12h: display modes
(reserved from here)
4Fh (since function is supported)
00h:OK (buffer filled with Super VGA information)
01h:error

AX = 4F01h return SuperVGA mode information
CX = SuperVGA screen mode
ES:DI= 256 Byte buffer for SuperVGA mode information
AL= 4Fh (since function is supported)
AH= 00h: OK (buffer filled with SuperVGA mode information)
01h: error

AX = 4F02h	set SuperVGA screen mode	
	BX =	SuperVGA screen mode
		100h: 640 x 400 x 256
		101h: 640 x 480 x 256
		102h: 800 x 600 x 16
		103h: 800 x 600 x 256
		104h: 1024 x 768 x 16
		105h: 1024 x 768 x 256
		106h: 1280 x 1024 x 16
		107h: 1280 x 1024 x 256
	AL =	4Fh (since function is supported)
	AH =	00h: OK (SuperVGA screen mode is set)
AX = 4F03h	return SuperVGA screen mode	
	AL =	4Fh (since function is supported)
	AH =	00h: OK (SuperVGA screen mode is set)
		01h: error
	BX =	SuperVGA screen mode
		100h: 640 x 400 x 256
		101h: 640 x 480 x 256
		102h: 800 x 600 x 16
		103h: 800 x 600 x 256
		104h: 1024 x 768 x 16
		105h: 1024 x 768 x 256
		106h: 1280 x 1024 x 16
		107h: 1280 x 1024 x 256
AX = 4F04h	DL= 00h	read size of buffer for screen status
	CX=	Bit 0: Video-Hardware status
		Bit 1: Video-BIOS status
		Bit 2: Video-DAC status
		Bit 3: SuperVGA status
	AL=	4Fh (since function is supported)
	AH=	00h: OK
		01h: error
	BX=	number of 64 Byte blocks (size of buffer)
AX = 4F04h	DL=01h	save status
	CX=	Bit 0: Video-Hardware status
		Bit 1: Video-BIOS status
		Bit 2: Video-DAC status
		Bit 3: SuperVGA status
	ES:BX=	buffer for status
	AL=	4Fh (since function is supported)
	AH=	00h: OK
		01h: error

AX = 4F04h	DL = 02h	load saved status
	CX=	Bit 0: Video-Hardware status
		Bit 1: Video-BIOS status
		Bit 2: Video-DAC status
		Bit 3: SuperVGA status
	ES:BX=	buffer where status is saved
	AL=	4Fh (as function is supported)
	AH=	00h: OK
		00h: OK
		01h: error
AX = 4F05h	BH=00h	select memory screen window
	BL=	00h: window A
		01h: window B
		address of window in screen memory (units)
	DX=	4Fh (since function is supported)
	AL=	00h: OK
	AH=	01h: error
AX = 4F05h	BH=01h	return memory screen window
	BL=	00h: window A
		01h: window B
		address of window in screen memory (units)
	DX=	4Fh (since function is supported)
	AL=	00h: OK
	AH=	01h: error

7 Technical Specifications

This chapter contains electrical and environmental specifications for the operation and storage of PCM-4330 boards and a dimension sketch.

7.1 Electrical Specifications

The PCM-4330 PC/104 board computer is supplied with +5V (±5%) at typ. 1.0 A. Actual power consumption depends on the type of CPU installed, maximum consumption is 1.4 A.

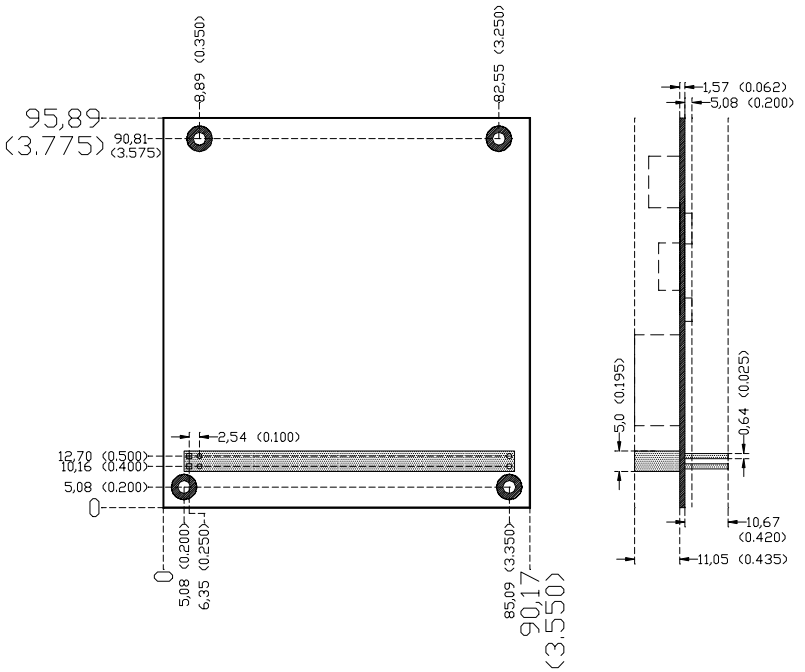
In power-off condition, power is supplied to the CMOS real-time clock by an onboard 3 V/280 mAh lithium battery. At a typical power consumption, this battery lasts for a minimum of 5 years.

7.2 Environment Conditions

The PCM-4330 PC/104 board computer complies to conditions under climate class 2:

	Operating Conditions	Storage Conditions	Shipping Conditions for Packaged Boards
Temperature	+5 to +50 41 to 122 F	0 to +55 32 to 131F	-40 to +70 -40 to +158 F
Relative Humidity	5 to 85%	5 to 95%	5 to 100% (no condensation)
Altitude	-50 to +3,000 m -492 to 9,842 ft	-50 to +3,000 m -492 to 6+9,842 ft	-50 to +3,000 m -492 to +42,650 ft
Max. Change in Temperature	0.5 per min. max. 7.5 in 30 min.	0.5 per min.	1 per min.
Impact	150 m/s 6 ms	400 m/s 6 ms	400 m/s 6 ms
Vibration	10 to 58 Hz 0.075 mm amplitude 58 to 500 Hz IO m/s velocity	5 to 9 Hz 2.5 mm amplitude 9 to 500 Hz 10 m/s velocity	5 to 9 Hz 3.5mm amplitude 9 to 500 Hz 10 m/s velocity

7.3 Dimension Sketch



Controlling dimensions: millimeters. Dimensions in inches (in brackets) are for reference only and not necessarily accurate. Drawing not to scale.

Appendix A: Troubleshooting

The following notes might help you when encountering problems after the installation of the PCM-4330 single board computer or software.
If you can not solve the problem after referring to this section, please contact your dealer who will need the following information together with your problem report:

- Description of the problem.
- Have you tried workarounds? Which?
- Serial number of your PCM-4330.
- Type and model of your computer system.
- Type and model of expansion cards installed in the system.
- Name and version of installed software and drivers.
- Error messages by POST, operating software or application software (if any)
- Hardcopy of the files AUTOEXEC.BAT, CONFIG.SYS, SYSTEM.INI and WIN.INI (MS-DOS and MS-Windows only).

Problem

It seems as if the system is performing system checks and booting file operating system but there is no output on the screen.

Answer

Please check the following:

- Is the PCM-4330PC/104 board computer installed properly?
- Check power supply of computer system and monitor. If the display has its own power switch, make sure it is set to the on position.
- If an additional graphics adapter is installed in the system, remove the secondary adapter and check whether the system operates properly with only one graphics adapter installed.
- Check settings of the switches and jumpers on the PCM-4330 board.
- Check settings of DIL-switches SW.3 to SW.8 of the LC display configuration switches. Check the LCD connector and cabling between the display and the PCM-4330 board (proper connectors, polarity).

Problem

(Graphics) application software does not display correctly on the CRT or LCD display.

Answer

- Return to DOS and reboot the system and reload the operating software.
- Check the installation instructions of the application software; select a video mode and resolution that is supported the monitor or LCD display.
- Restart the (graphics) application software.

Problem

After installation of a new display driver under MS-Windows the monitor or LC-display does not operate properly.

Answer

- Return to DOS and reboot the system.
- Change into the MS-Windows directory.
- Start the MS-Windows Setup-Program and select the standard VGA display driver for your system.
- Quit the Setup-program.
- Install a display driver for the PCM-4330 board (see section 2.4.1 on page 35) that uses a video mode and resolution that is supported by your monitor or LC-Display (see Appendix B: LC-Displays).

Problem

You have selected a higher display resolution under MS-Windows using the Western Digital Display Changer. However, the display resolution is still unchanged.

Answer

- Please check the settings of the configuration switches.
- If you are using a CRT display only, make sure that switch SW.2 of the configuration switches is set to on.
- If you are using a simultaneous display on a CRT and LC display, the settings of switches SW.3 to SW.8 limit the maximum display resolution possible. You can not select a higher resolution than selected for the display.

Appendix B: LC-Displays

The following section contains an excerpt of supported LC-displays with reference tables assigning individual pins of the universal LCD connector on the PCM-4330 board to signal lines of several LC-displays and indicating proper configuration switch settings.
Please contact your PCM-4330 dealer if you cannot find your LC-display in the following lists and ask for the LCD-Connector manual, which contains constantly updated lists of all supported displays and further configuration details and notes.

Configuration Switches

A row of configuration switches (DIL-switches) on the PCM-4330 board is used to select the connected LC-display. The individual keys of the configuration switches are assigned the following function:

SW.1	(reserved)
SW.2	Toggle between CRT and CRT/LCD simultaneous operation on: CRT only off: CRT and LCD simultaneously
SW.3	Panel Technology 0
SW.4	Panel Technology 1
SW.5	Display Configuration 0
SW.6	Display Configuration 1
SW.7	Display Configuration 2
SW.8	Display Configuration 3

Please refer to figure 4 on page 14 for the location of these switches.

Display	BIOS-Code	SW.3	SW.4	SW.5	SW.6	SW.7	SW.8
Mono Dual-Scan Display 8 Bit	00	on	on				
reserved	01	on	on	on			
Color Dual-Scan Display 16 Bit	02	on	on		on		
Color Dual-Scan Display 16 Bit	03	on	on	on	on		
reserved	04	on	on			on	
reserved	05	on	on	on		on	
reserved	06	on	on		on	on	
reserved	07	on	on	on	on	on	
reserved	08	on					
reserved	09	on		on			

Display	BIOS-Code	SW.3	SW.4	SW.5	SW.6	SW.7	SW.8
reserved	0A	on			on		
reserved	0B	on		on	on		
reserved	0C	on				on	
reserved	0D	on		on		on	
reserved	0E	on			on	on	
reserved	0F	on		on	on	on	
EL Display (Sharp) Pixel	10		on				
EL Display 1 Pixel	11		on	on			
EL Display 2 Pixel	12		on		on		
Mono TFT Display	13		on	on	on		
EL Display (640x400) 1 Pixel (no grayscale)	14		on			on	on
EL Display (640x400) 1 Pixel (no grayscale)	15		on	on		on	on
reserved	16		on		on	on	
reserved	17		on	on	on	on	
9 Bit Color TFT Display	18						
9 Bit Color TFT Display	19			on			
9 Bit Color TFT Display	1A				on		
9 Bit Color TFT Display	1B			on	on		
Color Single-Scan Display 8 Bit	1C					on	
Color Single-Scan Display 8 Bit	1D			on		on	
Color Single-Scan Display 8 Bit	1E				on	on	
reserved	1F			on	on	on	

EL Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Planar EL640.400-C2	1 Pixel no grayscale (640x400)	4,7,8	no contrast voltage required
Planar EL640.400-CD3	1 Pixel no grayscale (640x400)	4,7,8	no contrast voltage required
Planar EL640.400-CE1	1 Pixel no grayscale (640x480)	4,5,7,8	no contrast voltage required
Planar EL640.480-A4	1 Pixel no grayscale	4,5	no contrast voltage required
Planar EL640.480-AA1	1 Pixel no grayscale	4,5	no contrast voltage required
Fujitsu FPF8050Hrud-001	1 Pixel no grayscale (640x400)	4,6,7,8	no contrast voltage required
Sharp LJ64ZU49	2 Pixel 16 grayscale (640x400)	4,8	no contrast voltage required

Monochrome Dual-Scan Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Hosiden HLM8619	Monochrome Dual-Scan	3,4	-24 Volt (to GND)
Sanyo LCM-5494-24NTR	Monochrome Dual-Scan	3,4	-26 Volt (to GND)
Sanyo LMC-5505-32NTK	Monochrome Dual-Scan	3,4	(no data available)
Torisan LM-KE55-32NTK	Monochrome Dual-Scan	3,4	-24 Volt (to GND)
Sharp LM 64P10	Monochrome Dual-Scan	3,4	-24 Volt (to GND)
Sharp LM 64P89	Monochrome Dual-Scan	3,4	-22 Volt (to GND)
Sharp LM 64P831	Monochrome Dual-Scan	3,4	-22 Volt (to GND)

Monochrome Dual-Scan Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Sharp LM64P839	Monochrome Dual-Scan	3,4	-22 Volt (to GND)
Hitachi LMG5160XUFC-3	Monochrome Dual-Scan	3,4	-22 Volt (to GND)
Hitachi LMG5161XUFC-C	Monochrome Dual-Scan	3,4	-21 Volt (to GND)
Hitachi LMG5168XUFC-C	Monochrome Dual-Scan	3,4	-21 Volt (to GND)
Hitachi LMG6911RPBC	Monochrome Dual-Scan	3,4	-22 Volt (to GND)

Color Dual-Scan Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Hosiden HLM6678-015211	Color Dual-Scan 1	3,4,6	35 Volt (to GND)
Kyocera KCS6448CSTT	Color Dual-Scan 1	3,4,6	36 Volt (to GND)
Sanyo LCM-5331-22NTK	Color Dual-Scan 1	3,4,6	30 Volt (to GND)
Sanyo LCM-5334-22NTK	Color Dual-Scan 1	3,4,6	28 Volt (to GND)
Sanyo LCM-CC53-22NTK	Color Dual-Scan 1	3,4,6	30 Volt (to GND)
Torisan LM-CA53-22NTK	Color Dual-Scan 1	3,4,6	30 Volt (to GND)
Torisan LM-CD53-22NTK	Color Dual-Scan 1	3,4,6	28 Volt (to GND)
Torisan LM-CF53-22NTK	Color Dual-Scan 1	3,4,6	30 Volt (to GND)
Torisan LM-DC53-22NTK	Color Dual-Scan 1	3,4,6	28 Volt (to GND)
Torisan LM-HB53-22NTK	Color Dual-Scan 1	3,4,6	-24 Volt (to GND)
Sharp LM64C08P	Color Dual-Scan 1	3,4,6	32.6 Volt (to GND)
Sharp LM64C35P	Color Dual-Scan 1	3,4,6	25.5 Volt (to GND)
Sharp LM64C152	Color Dual-Scan 1	3,4,6	25.5 Volt (to GND)
Hitachi LMG9460XUCC	Color Dual-Scan 1	3,4,6	6 Volt (to GND)
Hitachi LMG9520RPCC	Color Dual-Scan 1	3,4,6	23 Volt (to GND)
Hitachi LMG9822XUCC-A1	Color Dual-Scan 1	3,4,6	32 Volt (to GND)
Orion OEM-6448C-2	Color Dual-Scan 1	3,4,6	35 Volt (to GND)

TFT Color Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Seiko Epson EG9013F-NZ	Monochrome Single-Scan 1	6,7	35 Volt (to GND)

TFT Color Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
Toshiba LTM09C016K	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Toshiba LTM10C015K	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Toshiba LTM10C025K	18 Bit Color TFT	5,6	no contrast voltage required
Toshiba LTM10C040K	18 Bit Color TFT	5,6	no contrast voltage required
Toshiba LTM10C042	18 Bit Color TFT	5,6	no contrast voltage required
Toshiba LTM10C209(A)	18 Bit Color TFT	5,6	no contrast voltage required
Sharp LQ9D011	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Sharp LQ10D011	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Sharp LQ10D11	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Sharp LQ10D15	9 Bit Color TFT	(all switches set to "off")	no contrast voltage required
Sharp LQ10D021	9 Bit Color TFT	5,6	no contrast voltage required
Sharp LQ14D311	18 Bit Color TFT	5,6	no contrast voltage required
Sharp LQ10D131	12 Bit Color TFT	6	no contrast voltage required
Sharp LQ64D131	12 Bit Color TFT	6	no contrast voltage required
Sharp LQ10D321	18 Bit Color TFT	5,6	no contrast voltage required
NEC NL6448AC20-10	12 Bit Color TFT	6	no contrast voltage required
NEC NL6448AC20-02	12 Bit Color TFT	6	no contrast voltage required

TFT Color Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
NEC NL6448AC30-06	12 Bit Color TFT	6	no contrast voltage required
NEC NL6448AC30-10	12 Bit Color TFT	6	no contrast voltage required
NEC NL6448AC32-01	18 Bit Color TFT	5,6	no contrast voltage required
NEC NL6448AC33-10	12 Bit Color TFT	6	no contrast voltage required
NEC NL6448AC30-15	12 Bit Color TFT	6	no contrast voltage required
NEC NL8060AC24-01	special setting: (800x600) 18 Bit-TFT	6,7	no contrast voltage required
NEC NL8060AC26-02	special setting: (800x600) 18 Bit-TFT	6,7	no contrast voltage required
Hitachi TX26D60VC1CAB	18 Bit Color TFT	5,6	no contrast voltage required

TFD Color Displays			
Display	**Display Type**	**Configuration Switches set to "on"**	**Max. Contrast Voltage**
FPD LDH102T-10	18 Bit Color TFD	5	no contrast voltage required
FPD LDH102T-20	18 Bit Color TFD	5	no contrast voltage required

LCD-Enable-Signal

The LCD-Enable-Signal (Panel Off Signal) is used to control the LC-displays and can be set to low or high. Use the appropriate jumper to select the polarity of this signal.

Cabling

The following tables contain pin assignments for a range of standard LC-displays to the pins of the universal LCD connector on the PCM-4330 board. If you can not find a suitable display type in one of the tables and the examples are insufficient to produce a custom cable, please contact your PCM-4330 dealer.

Universal-LCD		Monochrome Single-Scan Display 8 Bit 640x480	Monochrome Single-Scan Display 8 Bit 640x480	Color Single-Scan Display 8 Bit 640x480
Pin	Function			
1	XSCLK		Clock	
2	GND			
3	RGB12	Data4	UpperData3	Data4
4	RGB13	Data5	UpperData2	Data5
5	RGB14	Data6	UpperData1	Data6
6	GND			
7	RGB6	Data0	LowerData3	Data0
8	RGB7	Data1	LowerData2	Data1
9	RGB8	Data2	LowerData1	Data2
10	GND			
11	RGB0			
12	RGB1			
13	RGB2			
14	GND			
15	LP	Line Pulse	Line Pulse	Line Pulse
16	GND			
17	FP	FramePulse	FramePulse	FramePulse
18	5V			
19	GND			
20	12V			
21	CONTR 0-5V			
22	BRGHT 05-V			
23	RGB3			
24	RGB4			
25	RGB5	Clock	Clock	Clock
26	RGB9	Data3	LowerData0	Data3
27	RGB10			
28	RGB11			
29	RGB15	Data7	UpperData0	Data7
30	RGB16			
31	RGB17			
32	PCLK			
33	LCD-			
34	FR	Frame	Frame	Frame
35	LCD+			
36	12V			
37	LCDEN#			
38	Panel On			
39	GND			
40	5V			

Universal-LCD		Color Single-Scan Display 16 Bit 640x480	Color Single-Scan Display 16 Bit 640x480	EL Display 16GS 1 Pixel 640x480
Pin	Function			
1	XSCLK		Clock	
2	GND			
3	RGB12	Data4	UpperData4	Data0
4	RGB13	Data5	UpperData5	Data1
5	RGB14	Data6	UpperData6	Data2
6	GND			
7	RGB6	Data0	LowerData0	
8	RGB7	Data1	LowerData1	
9	RGB8	Data2	LowerData2	
10	GND			
11	RGB0	Data12	UpperData4	
12	RGB1	Data13	UpperData5	
13	RGB2	Data14	UpperData6	
14	GND			
15	LP	Line Pulse	Line Pulse	HSync
16	GND			
17	FP	FramePulse	FramePulse	VSync
18	5V			
19	GND			
20	12V			
21	CONTR 0-5V			
22	BRGHT 05-V			
23	RGB3	Data15	UpperData7	
24	RGB4			
25	RGB5	Clock	Clock	
26	RGB9	Data3	LowerData3	
27	RGB10	Data10	UpperData2	
28	RGB11	Data11	UpperData3	
29	RGB15	Data7	UpperData7	Data3
30	RGB16	Data8	UpperData0	
31	RGB17	Data9	UpperData1	
32	PCLK			
33	LCD-			
34	FR	Frame	Frame	Blank
35	LCD+			
36	12V			
37	LCDEN#			
38	Panel On			
39	GND			
40	5V			

Universal-LCD		EL Display 16GS 2 Pixel 640x480	EL Display 16GS 1 Pixel 640x480	EL Display 16GS 1 Pixel 640x480
Pin	Function			
1	XSCLK	Clock	Clock	Clock
2	GND			
3	RGB12	Data0	Data0	Data0
4	RGB13	Data1	Data1	
5	RGB14	Data2	Data2	
6	GND			
7	RGB6	Data0		
8	RGB7	Data1		
9	RGB8	Data2		
10	GND			
11	RGB0			
12	RGB1			
13	RGB2			
14	GND			
15	LP	HSync	HSync	HSync
16	GND			
17	FP	VSync	VSync	VSync
18	5V			
19	GND			
20	12V			
21	CONTR 0-5V			
22	BRGHT 05-V			
23	RGB3			
24	RGB4			
25	RGB5			
26	RGB9	Data13		
27	RGB10			
28	RGB11			
29	RGB15	Data03	Data3	
30	RGB16			
31	RGB17			
32	PCLK			
33	LCD-			
34	FR	Blank	Blank	Blank
35	LCD+			
36	12V			
37	LCDEN#			
38	Panel On			
39	GND			
40	5V			

Universal-LCD		TFT 9 Bit Color 640x480	TFT 12 Bit Color 640x480	TFT 18 Bit Color 640x480	TFD 18 Bit Color 640x480
Pin	Function				
1	XSCLK	Clock	Clock	Clock	Clock
2	GND				
3	RGB12	Red0	Red0	Red0	Red0
4	RGB13	Red1	Red1	Red1	Red1
5	RGB14	Red2	Red2	Red2	Red2
6	GND				
7	RGB6	Green0	Green0	Green0	Green0
8	RGB7	Green1	Green1	Green1	Green1
9	RGB8	Green2	Green2	Green2	Green2
10	GND				
11	RGB0	Blue0	Blue0	Blue0	Blue0
12	RGB1	Blue1	Blue1	Blue1	Blue1
13	RGB2	Blue2	Blue2	Blue2	Blue2
14	GND				
15	LP	HSync	HSync	HSync	HSync
16	GND				
17	FP	VSync	VSync	VSync	VSync
18	5V				
19	GND				
20	12V				
21	CONTR 0-5V				
22	BRGHT 05-V				
23	RGB3		Blue3	Blue3	Blue3
24	RGB4			Blue4	Blue4
25	RGB5			Blue5	Blue5
26	RGB9		Green3	Green3	Green3
27	RGB10			Green4	Green4
28	RGB11			Green5	Green5
29	RGB15		Red3	Red3	Red3
30	RGB16			Red4	Red4
31	RGB17			Red5	Red5
32	PCLK				
33	LCD-				
34	FR	DataEnable	DataEnable	DataEnable	DataEnable
35	LCD+				
36	12V				
37	LCDEN#				
38	Panel On				
39	GND				
40	5V				

Appendix C: Silicon Disk

To use the on-board flash module on the PCM-4330 board to emulate a hard disk drive (silicon disk) follow these steps:

BIOS-Requirements and CMOS-Settings

- The BIOS version on the PCM-4330 board must be 1.0c or higher to support the memory module.
- To emulate a silicon disk, the 8105 extension requires that the memory area in which the extension is started is available as Shadow-RAM.
- The ROM extension is started in area CC00 — CFFF. Therefore, this segment must be set to *Shadow RAM* in the setup menu (see page 23).
- The emulation uses area D0000— D3FFF as a window to the memory module. Consequently, no other program or driver may use this area. Additionally, Shadow-RAM needs to be disabled for this segment.
- To disable loading the 8105 extension, simply set the CMOS-RAM date to the year 2099. If the year is set to 2098, only a part of the extension is loaded. The modifications for INT 13 will not be loaded.

BIOS Extension Setup

To set up the 8105 extension, enter the following command at a DOS prompt:

```
flashcl -v = FlashBIOS.<ver>
<ver> indicates the current version of the 8105 extension.
```

Do not cancel the program with a reset. This might otherwise render the computer inoperative since the 8105 may be deleted.

Low Level Formatting

Before using the silicon disk it must first be initialized with the memcform program. A signature and further parameters enable the 8105 extension to identify and access the disk. A drive number needs to be assigned to the disk before the formatting process:

- Select values “0” to “9” for drive numbers 0x80 to 0x89 or values “A” to “F” for drive numbers 0xFA to 0xFF.
- If a drive number is selected which is smaller or equal to a number of an existing hard disk drive, the number of the hard disk drive is raised for INT 53.
- Choose any drive number if no hard disk drive is installed in the system.
- If value “0” (corresponding to drive number 0x80) is selected for the silicon disk in a system with a hard disk drive, drive letter C: is assigned to the silicon disk and letter D: to the hard disk. Value “F” swaps drive letter assignments (letter C: for the hard disk drive and letter D: for the silicon disk).

Enter the following command at a DOS prompt to start low level formatting:
`memcform <param1><param2>`

Enter "S" for *param*1 to format a SRAM-Module or "F" for a Flash-Memory. Entering "Z" for *param*2 will start the formatting without any further user input (if possible).
After low level formatting the computer must be rebooted for the changes to take effect.

GetMem Device Driver

The BIOS extension requires the *getmem* driver which provides BIOS expansion memory (about 600 bytes). Add the following line to your config.sys file:

```
device=getmem.exe
```

DOS Formatting

The silicon disk can now be prepared for use with the *fdisk* and *format* DOS programs. If a hard disk drive is installed in the system, make sure that *fdisk* is pointing to the appropriate disk (option "5").

The silicon disk is not entered into the CMOS-RAM. No additional controller(such as an IDE-Controller) is required to use the silicon disk.

Reorganization

If the silicon disk is predominately used for read operations, access times can possibly (depending on the disk size) be improved by reorganizing sector ordering.
Use the memcform program to start the reorganization process:
`memcform rs`

Do not use any other method but the ESC key to stop a running reorganization process. CTRL- C or a system reset may result in data loss.
After stopping the reorganization using the ESC key, the current segment and possibly one more segment are processed before the program stops. This might take up to 2 seconds. The program can then be restarted to resume the reorganization.

Additional Considerations

The segment D0000 — D3FFFF is used by the BIOS extension as a window to the memory module. Therefore this segment needs to be protected from accesses by any other program. This segment range should therefore be excluded when installing a memory manager such as *emm*386.

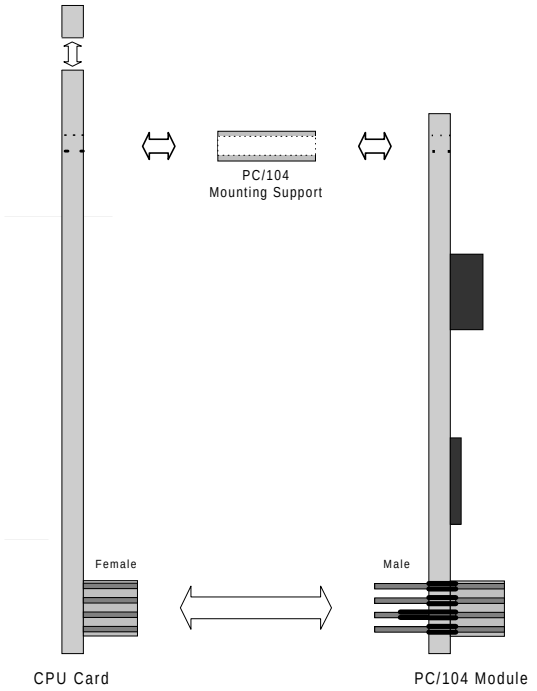
Installing PC/104 modules

The CPU card's PC/104 connectors give you the flexibility to attach PC/104 expansion modules. These modules perform the functions of traditional plug-in expansion cards, but save space and valuable slots. Modules include:

- **PCM-4330** 486 CPU Module with Flat Panel/CRT Interface
- **PCM-3335** 386 CPU Module w/ Flat Panel/CRT Interface
- **PCM-3600** FAX/Modem Module
- **PCM-3420** Fast SCSI-2 Module
- **PCM-3200** Sound Module
- **PCM-3810** Solid State Disk Module
- **PCM-3820** High Density Flash Disk Module
- **PCM-3115** PCMCIA Module (two slots)
- **PCM-3610** Isolated RS-232 and RS-422/485 Module
- **PCM-3660** Ethernet Module
- **PCM-3718** 30 KHz A/D Module
- **PCM-3724** 48-Channel DIO Module
- **PCM-3910** Breadboard Module

Installing these modules on the CPU card is quick and simple. The following steps show how to mount the PC/104 modules:

1. Remove the CPU card from your system paying particular attention to the safety instructions already mentioned.
2. Make any jumper or link changes required to the CPU card now. Once the PC/104 module is mounted you may have difficulty in accessing these.
3. Normal PC/104 modules have male connectors and mount directly onto the main card. However, to ensure better bus matching, the connectors on the CPU card and the PC/104 module are both female. For this reason, you may need to use the "male-male" adapter included with the CPU card in order to properly connect your PC/104 module. (Refer to the diagram on the following page.)
4. Mount the PC/104 module onto the CPU card by pressing the module firmly but carefully onto the mounting connectors.
5. Secure the PC/104 module onto the CPU card using the four mounting spacers and srews.



PC/104 Module Mounting Diagram