



MOPS/lcd4

Technical Manual

Rev. 1.3

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Table of Contents

TABLE OF CONTENTS.....	2
USER INFORMATION.....	4
TRADEMARKS.....	4
GENERAL	4
WARRANTY.....	5
INTRODUCTION.....	5
FEATURES	6
I/O MAP	7
MEMORY MAP FOR BIOS, SSD AND JRC SUPPORT.....	8
ONBOARD SSD (DOS-COMPATIBLE).....	9
BLOCK DIAGRAM	10
CONNECTOR ARRANGEMENT	11
BIOS-DESCRIPTION.....	12
RTC-CMOS SETUP MENU	12
MAIN MENU	12
STANDARD CMOS SETUP.....	12
ADVANCED CMOS SETUP	14
POWER MANAGEMENT SETUP.....	16
PERIPHERAL SETUP.....	17
AUTO-DETECT HARD DISKS.....	18
CHANGE USER PASSWORD	18
CHANGE SUPERVISOR PASSWORD	18
AUTO CONFIGURATION WITH OPTIMAL SETTINGS	18
AUTO CONFIGURATION WITH FAIL SAFE SETTINGS	18
SAVE SETTINGS AND EXIT	18
EXIT WITHOUT SAVING	18
AMIBIOS CONFIGURATION SCREEN	20
HARDWARE DESCRIPTION.....	21
ALI-CHIPSET FEATURES	21
MEMORY CONFIGURATION	21
INTERRUPTS	22
DMA	22
ONBOARD C&T VGA.....	23
THE JIDA STANDARD	25
WATCHDOG EXTENSION.....	28
NETWORK OPERATION.....	29
OVERVIEW.....	29
SPECIFICATIONS	30
MECHANICAL SPECIFICATIONS	30
ELECTRICAL SPECIFICATIONS	30
ENVIRONMENTAL SPECIFICATIONS.....	30
PERIPHERAL INTERFACE.....	31
KEYBOARD, RESET, BATTERY, SPEAKER	31
SERIAL PORT COM A, B RS232C	32

PARALLEL PORT LPT 1.....	33
FLOPPY CONNECTOR.....	33
IDE CONNECTOR FOR 2,5" HARD DISK.....	34
ETHERNET CONNECTOR.....	34
FEATURE CONNECTOR.....	34
CRT CONNECTOR.....	35
POWER CONNECTOR	35
PC/104-CONNECTOR	36
LITERATUR, STANDARDS, LINKS	37
PC/104-BUS	37
ISA-Bus, STANDARD PS/2 - CONNECTORS.....	37
RS232C	37
DOCUMENT REVISION HISTORY	38

User Information

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General

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Warranty

Each board is tested carefully and thoroughly before being shipped. If, however, problems should occur during the operation, please check your user specific settings of all boards included in your system. This is often the source of the fault. If a board is defective, it can be sent to your supplier for repair. Please take care of the following steps:

1. The board returned should have the factory default settings since a test is only possible with these settings.
2. In order to repair your board as fast as possible we require some additional information from you. Please fill out the attached Repair Form and include it with the defective board.
3. If possible the board will be upgraded to the latest version without additional cost.
4. Upon receipt of the board please be aware that your user specific settings were changed during the test.

Within the warranty period the repair is free of charge as long as the warranty conditions are observed. Because of the high test expenditure you will be charged with the test cost if no fault is found. Repair after the warranty period will be charged.

This **JUMPtac®** product is warranted against defects in material and workmanship for the warranty period from the date of shipment. During the warranty period **JUMPtac®** will at its option either repair or replace defective products.

For warranty service or repair the product must be returned to a service facility designated by **JUMPtac®**.

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance or handling by buyer, unauthorized modification or misuse, operation outside of the product's environmental specifications or improper installation or maintenance.

JUMPtac® will not be responsible for any defects or damages to other products not supplied by **JUMPtac®** that are caused by a faulty **JUMPtac®** product.

Introduction

The **MOPSIcd4** integrates the complete functionality of an 80486 motherboard with CPU, System-BIOS, 8 Mbyte to 32 MByte DRAM, keyboard-controller, real time clock, onboard high-performance PCI-SVGA with LCD interface and additional peripheral functions like COM1, COM2, LPT1, Floppy-interface, EIDE-harddisk-interface, watchdog and Ethernet access. The system runs with CPU clock speed 133MHz.

Features

- **Processor**
AMD Am5x86® with 133 MHz internal Clock and 16 kByte write-back-Cache
- **Chipset**
ALI 1489/1487 PCI Chipset
- **Power Supply**
5V only supply
- **Memory**
4 MB onboard and 4/8/16/32MB 5V-DIMM module DRAM with Fast Page Mode or EDO DRAM on the lower SO-DIMM-Connector
- **Ethernet 10BaseT (Twisted Pair)**
- **Two serial ports, (COM1 and COM2)**
standard RS232C serial ports with FIFO, 16550 compatible
- **Parallel port, LPT1**
With ECP/EPP-support
- **Floppy-interface**
- **EIDE-PCI-hard disk-interface**
PCI Bus Master IDE port (up to 2 IDE Devices)
supports PIO Mode 3,4 IDE & ATAPI CD-ROM
supports JUMPtac CHIPdisk
- **Watchdog**
- **128 KByte FLASH-BIOS (AMI) and 1,6 Mbyte onboard SSD (DOS-compatible)**
- **Real Time Clock**
With external Battery-support
- **Keyboard Controller**
- **Onboard C&T-VGA**
 - C&T 69000 LCD-VGA-Controller with PCI-Bus interface incl. Burst Mode support
 - VGA-CRT and LCD Controller with integral 2 MByte Video RAM
 - Resolution up to 1280x1024 on panel and CRT
 - Color depths up to 16 millions of colors
 - Simultaneous display on CRT and panel
 - True 64-Bit Graphics engine and accelerator
 - Powerful drivers for Win3.11, Win95, NT3.51, NT4.0, OS/2....
 - plug and play panel interfacing on the upper SO-DIMM-Connector supports almost any type of LCD

I/O Map

The I/O-port addresses of the processor module **MOPSlcd4** are functionally identical with a standard PC/AT.

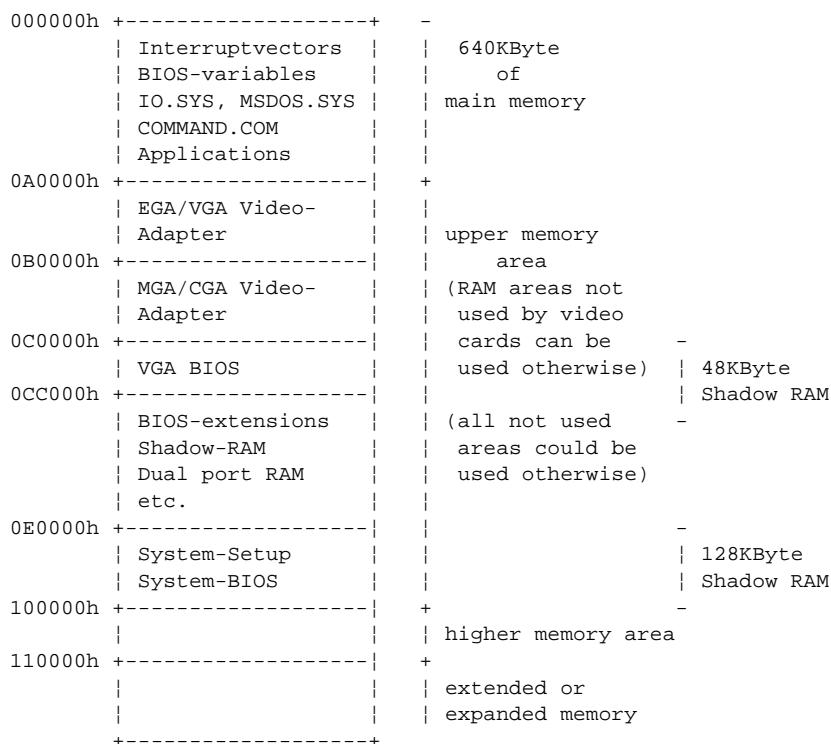
I/O Addresses	MOPSlcd4 - onboard	Function
0000 - 001F	X	DMA-Controller 1
0020 - 003F	X	Interrupt-Controller 1
0040 - 0043	X	Timer
0050 - 005F		Onboard Control Registers
0060 - 0064	X	Keyboard-controller
0061	X	Port B Register
0070	X	NMI Enable Register
0070 - 0071	X	Real Time Clock
0080 - 008F	X	DMA Page Register 74LS612
0092	X	Port A Register (Fast A20 Gate)
00A0 - 00BF	X	Interrupt-Controller 2
00C0 - 00DF	X	DMA-Controller 2
00F0 - 00FF	X	Math-Coprocessor
0100 - 10F	X	Onboard Control Registers
01F0 - 01F8	X	Fixed Disk
0200 - 0207		Game I/O
020C-020D		Reserved
021F		Reserved
0274		Control Register 1 External SSD (Board 0 - 3)
0275		Control Register 1 External SSD (Board 4 - 7)
0278 - 027F		Parallel Port 2
02B0 - 02DF		Alternate Enhanced Graphics Adapter
02E1		GPIB (adapter 0)
02E2 - 02E3		Data acquisition (Adapter 0)
02E8 - 02EF		Serial Port 4
02F8 - 02FF	X	Serial Port 2
0300 - 030F	X	Onboard Network (default configuration)
0310 - 031F		Prototype Card
0360 - 0363		PC Network (low Address)
0364 - 0367		Reserved
0368 - 036B		PC Network (high Address)
036C - 036F		Reserved
0370 - 0377		Config. Space for second SMC Controller
0378 - 037F	X	Parallel Port 1
0380 - 038F		SDLC, Bisynchronous 2
0390 - 0393		Cluster
03A0 - 03AF		Bisynchronous 1
03B0 - 03BF	X	Monochrom Disp. and Printer Adap.
03C0 - 03CF	X	Enhanced Graphic Adapter
03D0 - 03DF	X	Color/Graphic Monitor Adapter
03E8 - 03EF		Serial Port 3
03F0 - 03F7	X	Diskette Controller
03F8 - 03FF	X	Serial Port 1

Memory Map for BIOS, SSD and JRC Support

The BIOS includes two special extensions to support the onboard silicon state disk and Jumptec Remote Control. If the SSD is enabled in setup or the JRC client finds a host the code of the bios extension will be copied into shadow ram. The location where the biosextension is placed is automatically determined by the system bios . The user can not influence this! So care must be taken, when a **Extended Memory Manager** is used. To avoid memory conflicts **exclude the area E0000h-EFFFFh and do'nt include the area C0000h-DFFFFh !**

DOS allows to address 1MByte directly. The memory area above 1MByte (high memory, extended memory) is accessed under DOS via special drivers like HIMEM.SYS, EMM386.EXE etc. Other operating systems (OS/2, Windows-NT) allow to address the full memory area directly.

Standard Memory Map



Expanded Memory Map

The user can convert (up to 20Mbytes) Extended Memory into Expanded Memory (EMS). The selected Expanded Memory is divided into 16KByte pages, of which four can be mapped into the EMS-frame. The EMS-frame is located within the first 1MByte address space and has a length of 64KByte. The start address of the EMS-page can be selected between CC000h and E0000h in steps of 16KBytes. Most Expanded Memory Managers are choosing their frame address location by themselves if it is not explicit set..

```

000000h +-----+ - 640KByte
| Interruptvectors | | of
| BIOS-variables | | main memory
| IO.SYS, MSDOS.SYS | |
| COMMAND.COM | |
| HIMEM, EMM386 | |
| Applications | |
0A0000h +-----+ +
| EGA/VGA Video- | |
| Adapter | | upper memory
0B0000h +-----+ area
| MGA/CGA Video- | (RAM areas not
| Adapter | | used by video
0C0000h +-----+ cards can be -|
| VGA BIOS | | used otherwise) | 48KByte
0CC000h +-----+ | | Shadow RAM
| BIOS-extensions | |
| Shadow-RAM | |
| Dual port RAM | |
| EMS-Pages | |
| etc. | |
0E0000h +-----+ - 128KByte
| System-Setup | | |
| System-BIOS | | | Shadow RAM
100000h +-----+ - higher memory area
110000h +-----+ + extended or
| | | expanded memory
+-----+

```

To be able to work with Expanded Memory under MS-DOS, you have to add the following drivers to your CONFIG.SYS:

HIMEM.SYS and EMM386.EXE

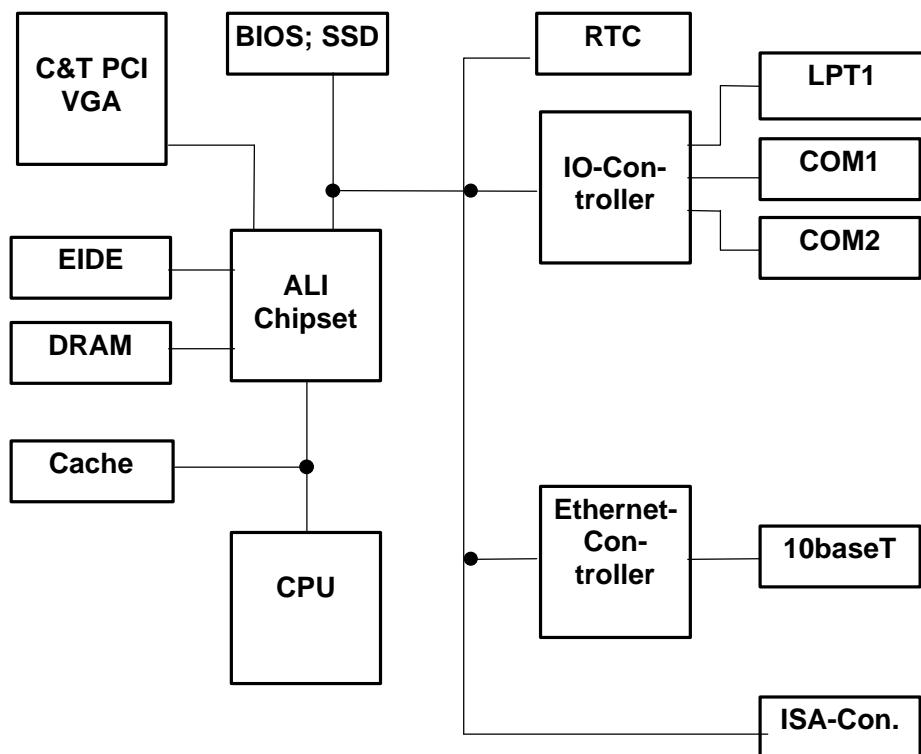
The *MOPSIcd4* uses a 32KByte extension BIOS (many other boards do this, too) which is mapped to a configurable memory area. Some other kind of boards have no extension BIOS, but are using drivers which communicate with their corresponding devices via memory mapped I/O. All these boards have one thing in common, they have to share the upper memory area with the Expanded Memory Manager. This is often the reason for several problems in the system. Make sure you excluded all areas in the upper memory, which are used by extension BIOSes and memory mapped I/O. Your instruction in the CONFIG.SYS concerning the Expanded Memory Manager should look like this: (questionmarks for location of extension BIOS)

DEVICE=EMM386.EXE X=E000-EFFF

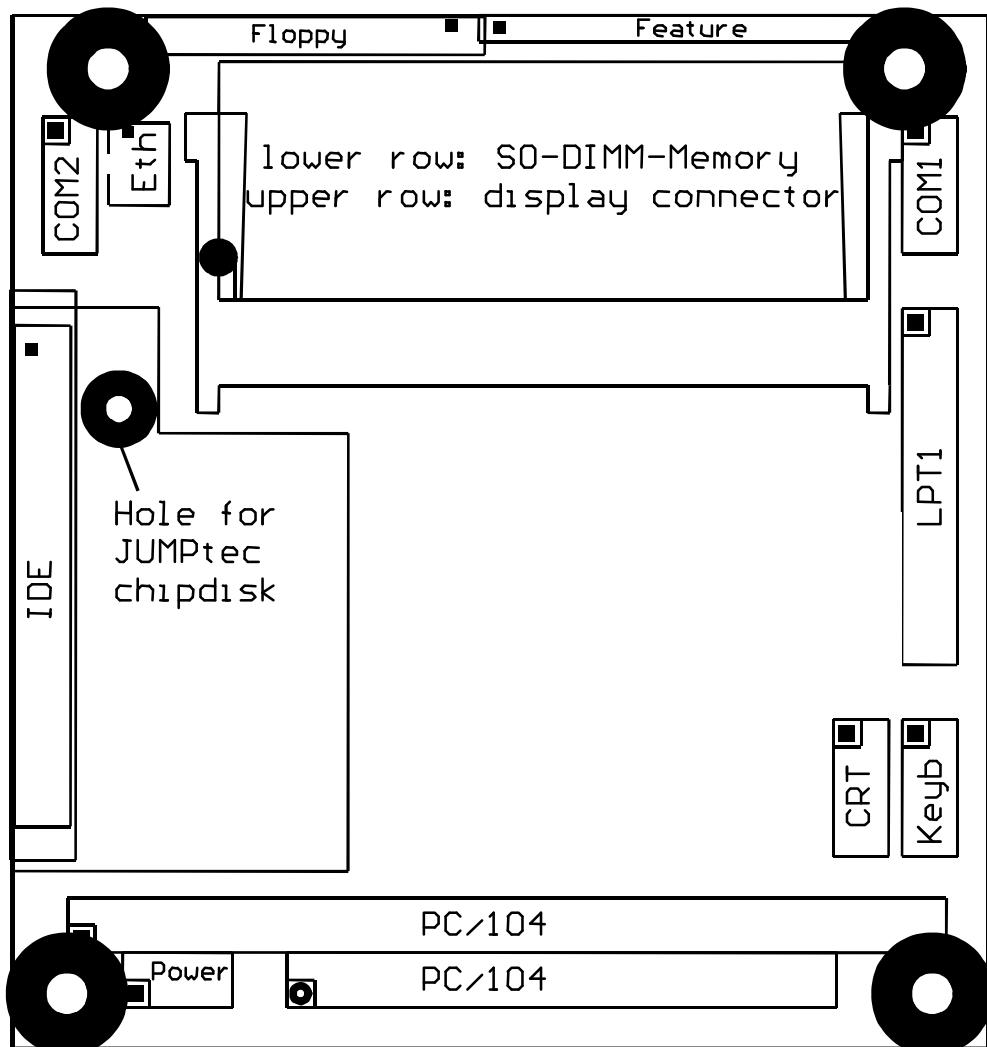
Onboard SSD (DOS-compatible)

The onboard Solid State Disk (SSD) won't work under any protected mode operating system, like WINDOWS 3.1, WINDOWS FOR WORKGROUPS 3.11, WINDOWS NT, OS/2 etc.
For SSD-Setup look to Peripheral Setup on page 17.

Block Diagram



Connector Arrangement



BIOS-Description

The Standard AMI-BIOS is located in the Flash EPROM onboard. This device has 8 bit wide access. 16 bit access is enabled by the shadow RAM feature (Standard).

RTC-CMOS setup menu

During boot sequence the CMOS setup can be entered by pressing the -key while the memory test is in progress.

Main Menu

- Standard CMOS Setup
- Advanced CMOS Setup
- Power Management Setup
- Peripheral Setup
- Auto-Detect Hard Disks
- Change User Password
- Change Supervisor Password
- Auto Configuration with Optimal Settings
- Auto Configuration with Fail Safe Settings
- Save Settings and Exit
- Exit Without Saving

Standard CMOS Setup

Date/Time

Select the Date/Time option to change the date or time. The current date and time are displayed.

Floppy Drive A, B

Choose the Floppy Drive A or B to specify the floppy drive type. The settings are Not Installed, 360 KB 5½", 1.2 MB 5½", 720 KB 3½", 1.44 MB 3½", or 2.88 MB 3½".

Pri Master, Pri Slave, Sec Master, Sec Slave

Enter the correct settings for the attached mass storage drive. Possible settings are *Not Installed*, 1-46 (predefined types), *User*, *AUTO*, *CDROM*.

Configuring an MFM Drive: If configuring an old MFM hard disk drive, you must know the drive parameters (number of heads, number of cylinders, number of sectors, the starting write precompensation cylinder, and drive capacity). Choose Type and choose the appropriate hard disk drive type (1 - 46). The old MFM hard drive types are listed on page 13. If the drive parameters of your MFM drive do not match any drive type listed on page 13, select *User* in the Type field and enter the drive parameters on the screen that appears.

User-Defined Drive: If you are configuring a SCSI drive or an MFM, RLL, ARLL, or ESDI drive with drive parameters that do not match drive types 1-46, you can select the *User* in the Type field. You must then enter the drive parameters on the screen that appears. The drive parameters include:

- Size (drive capacity, calculated automatically)
- Cyln (number of cylinders),
- Head (number of heads),

- WPcom (starting write precompensation cylinder)
- Sec (number of sectors)

Parameter	Description
Type	The number for a drive with certain identification parameters.
Cylinders	The number of cylinders in the disk drive.
Heads	The number of heads.
Write Precompensation	The size of a sector gets progressively smaller as the track diameter diminishes. Yet each sector must still hold 512 bytes. Write precompensation circuitry on the hard disk compensates for the physical difference in sector size by boosting the write current for sectors on inner tracks. This parameter is the track number where write precompensation begins.
Landing Zone	This number is the cylinder location where the heads will normally park when the system is shut down.
Sectors	The number of sectors per track. MFM drives have 17 sectors per track. RLL drives have 26 sectors per track. ESDI drives have 34 sectors per track. SCSI and IDE drives have more sectors per track.
Size	The formatted capacity of the drive is (Number of heads) x (Number of cylinders) x (Number of sectors per track) x (512 bytes per sector)

Configuring IDE Drives: If the hard disk drive to be configured is an IDE drive, select the option *AUTO* and press <ENTER> to detect all drive parameters automatically.

AMIBIOS automatically detects the IDE drive parameters (including ATAPI CD-ROM drives) and displays them. You can set the parameters manually if you are absolutely certain that you know the correct IDE drive parameters.

Set *LBA Mode* to *On* to enable support for IDE drives with capacities greater than 528 MB.

Set *Blk Mode* to *On* to support IDE drives that use Block Mode.

Choose *P/I/O Mode* to select the IDE Programmed I/O mode. PIO programming also works with ATAPI CD-ROM drives. The settings are *Auto*, *0*, *1*, *2*, *3*, *4*, or *5*. Use *Auto* to allow AMIBIOS to automatically find the PIO mode that the IDE drive being configured uses. If you select *0-5* you must make absolutely certain that you are selecting the PIO mode supported by the IDE drive being configured.

Set *32Bit Mode* to *On* to support IDE drives that permit 32-bit accesses.

Configuring a CD-ROM Drive: Select the appropriate drive (Pri Master, Pri Slave, Sec Master, or Sec Slave). Choose the Type parameter and select CDROM. You can boot the computer from a CD-ROM drive. You can also choose *Auto* and let AMIBIOS automatically set the correct drive parameters.

Hard Disk Drive Types

Please look for Setup-Screen.

Boot Sector Virus Protection

If enabled, any write access to the hard disks boot sector will be trapped and reported on the screen. The user himself decides if the access accomplishes. The Optimal and Fail Safe default settings are *Disabled*.

Advanced CMOS Setup

Quick Boot

Set this option to *Enabled* to instruct AMIBIOS to boot quickly when the computer is powered on. This option replaces the former **Above 1 MB Memory Test** Advanced Setup option. The settings are:

Setting	Description
Disabled	AMIBIOS tests all system memory. AMIBIOS waits up to 40 seconds for a READY signal from the IDE hard disk drive. AMIBIOS waits for 0.5 seconds after sending a RESET signal to the IDE drive to allow the IDE drive time to get ready again. AMIBIOS checks for a key press and runs Setup if the key has been pressed.
Enabled	AMIBIOS does not test system memory above 1 MB. AMIBIOS does not wait up to 40 seconds for a READY signal from the IDE hard disk drive. If a READY signal is not received immediately from the IDE drive, AMIBIOS does not configure that drive. AMIBIOS does not wait for 0.5 seconds after sending a RESET signal to the IDE drive to allow the IDE drive time to get ready again.

The Optimal default setting is *Enabled*. The Fail Safe default setting is *Disabled*.

BootUp Sequence

Choose the type of the boot device and the order to boot from. Possible settings are „C:,A:,CDROM“, „A:, C:, CDROM“ and „CDROM, A:, C:“.

BootUp Num-Lock

Set this option to *Off* to turn the Num Lock key off when the computer is booted so you can use the arrow keys on both the numeric keypad and the keyboard. The settings are *On* or *Off*. The Optimal and Fail Safe default settings are *On*.

Floppy Drive Swap

Set this option to *Enabled* to permit drives A: and B: to be swapped. The settings are *Enabled* or *Disabled*. The Optimal and Fail Safe default settings are *Disabled*.

System Keyboard

This option specifies that a keyboard is attached to the computer. The settings are *Present* or *Absent*. The Optimal and Fail Safe default settings are *Absent*.

Primary Display

This option specifies the type of display monitor and adapter in the computer. The settings are *Mono*, *CGA40x25*, *CGA80x25*, *VGA/EGA*, or *Absent*. The Optimal and Fail Safe default settings are *Absent*.

Password Check

This option enables password checking every time the computer is powered on or every time Setup is executed. If *Always* is chosen, a user password prompt appears every time the computer is turned on. If *Setup* is chosen, the password prompt appears if Setup is executed. The Optimal and Fail Safe default settings are *Setup*.

OS/2 Compatible Mode

Set this option to *Enabled* to permit AMIBIOS to run with IBM OS/2. This is only necessary if more than 64MB of system dram is present. The settings are *Enabled* or *Disabled*. The Optimal and Fail Safe default settings are *Disabled*.

Wait For 'F1' if Error

If this option is *Enabled* the system will wait on power up for the user to press the *<F1>* key on any occurring error. The Optimal and Fail Safe default settings are *Disabled*.

Hit 'Del' Message Display

If this option is *Enabled* the system will display the String „Hit DEL if you want to run Setup“ on the screen while accepting the DEL key to enter setup. If the option is set to *Disabled* the string want be displayed.

Internal Cache

This option specifies the caching algorithm used for L1 internal cache memory. The settings are:

Setting	Description
<i>Disabled</i>	The L1 internal cache memory on the CPU is disabled
<i>WriteBack</i> (Optimal and Fail Save default)	Use the write-back caching algorithm

Shadow Region Cacheability

When this option is set to *Enabled*, the contents of the shadow region can be read from or written to cache memory. System BIOS, Video BIOS and Bioextensions are mostly copied from the BIOS ROM to system RAM for faster execution. The settings are *Enabled* or *Disabled*. The Optimal default setting is *Enabled*. The Fail Safe default setting is *Disabled*.

C000,16k Shadow, C400,16k Shadow, C800,16K Shadow, CC00,16K Shadow, D000,16K Shadow; D400,16K Shadow; D800,16K Shadow; DC00, 16K Shadow

These options control the location of the contents of the 16KB of ROM beginning at the specified memory location. If no adaptor ROM is using the named ROM area, this area is made available to the local bus. The settings are:

Setting	Description
<i>Disabled</i>	The ROM is not copied to RAM. The contents of the ROM cannot be read from or written to cache memory
<i>Enabled</i>	The ROM contents are written to the same address in system memory (RAM) for faster execution

NOTE: If an onboard video controller is present, the BIOS automatically copies the video bios into shadow ram blocks C000, C400 and C800. In that case these options are grayed and not accessible in setup!

Watchdog Mode

With these settings, the type of watchdog is specified. Possible settings are *Disabled*, *Reset*, *NMI*. The Optimal and Fail Safe default settings are *Disabled*.

Watchdog Delay (available only if **Watchdog Mode** is not *Disabled*)

Time delay before the watchdog timer is set. Used for example, to let the system boot without the need to trigger the watchdog. Possible time settings are *1 Sec*, *5 Sec*, *10 Sec*, *30 Sec*, *1 Min*, *5 Min*, *10 Min*, *30 Min*.

Watchdog Timeout (available only if **Watchdog Mode** is not *Disabled*)

The watchdog must be triggered (reset) within this span of time. Possible time settings are *0.4 Sec*, *1 Sec*, *5 Sec*, *10 Sec*, *30 Sec*, *1 Min*, *5 Min*, *10 Min*.

Power Management Setup

Power Management/APM

If this option is *Disabled*, none of the below listed options are available, the system doesn't provide you with power save features. The Optimal and Fail Safe default settings are *Disabled*.

Instant On Support

Instant On is a Power Management Software for Windows 95. Must be *Enabled* to support this Software. The Optimal and Fail Safe default settings are *Disabled*.

Green PC Monitor Power State

This option specifies the power management state that the Green PC-compliant video monitor enters after the specified period of display inactivity has expired. The settings are *Stand By*, *Suspend*, *Off*.

Video Power Down Mode

This option specifies the power management state that the video subsystem enters after the specified period of display inactivity has expired. The settings are *Disabled*, *Standby*, or *Suspend*.

Hard Disk Power Down Mode

This option specifies the power management state that the hard disk drive enters after the specified period of HDD inactivity has expired. The settings are *Disabled*, *Standby*, or *Suspend*.

Hard Disk Time Out (Minute)

After this period, the hard disk drive is entering its power down mode. Possible settings are *Disabled*, 1, 2, 3, 4, 5....14.

Standby Time Out (Minute)

After this period, the specified devices are entering the standby mode. In Standby mode, some power use is curtailed. Possible settings are *Disabled*, 1, 2, 3, 4, 5....14.

Suspend Time Out (Minute)

After this period, the specified devices are entering the suspend mode. In Suspend mode, nearly all power use is curtailed. Possible settings are *Disabled*, 1, 2, 3, 4, 5....14.

Display Activity, IRQ3, IRQ4, IRQ5, IRQ7, IRQ9, IRQ10, IRQ11, IRQ12, IRQ13, IRQ14, IRQ15

These options enable event monitoring. When the computer is in a power saving mode, activity on the named interrupt request line is monitored by AMIBIOS. When any activity occurs, the computer enters Full On mode. Each of these options can be set to *Monitor* or *Ignore*. The Fail Safe default setting is *Ignore*.

Peripheral Setup

Onboard IDE

This option enables the onboard IDE controller. The settings are *Disabled* and *Enabled*. The Optimal and Fail Safe default settings are *Enabled*.

Onboard FDC

This option enables the floppy drive controller on the motherboard. The settings are *Enabled* or *Disabled*. The Optimal and Fail Safe default settings are *Enabled*.

Onboard Serial Port1

This option enables serial port 1 on the motherboard and specifies the base I/O port address for serial port 1. The settings are *Disabled*, *3F8*, *2F8*, *3E8*, *2F8*. The Optimal and Fail Safe default settings are *3F8*.

Onboard Serial Port2

This option enables serial port 2 on the motherboard and specifies the base I/O port address for serial port 2. The settings are *Disabled*, *3F8*, *2F8*, *3E8*, *2F8*. The Optimal and Fail Safe default settings are *2F8*.

Onboard Parallel Port

This option enables the parallel port on the motherboard and specifies the parallel port base I/O port address. The settings are *Disabled*, *378*, *278*, *3BC*. The Optimal and Fail Safe default settings are *378*.

Parallel Port Mode

This option specifies the parallel port mode. EPP and ECP are bidirectional data transfer schemes that adhere to the IEEE P1284 specifications. The settings are:

Setting	Description
<i>Normal</i>	The normal parallel port mode is used. This is the default setting.
<i>BI-DIR</i>	The bidirectional parallel port mode is used.
<i>EPP 1.7</i>	The parallel port can be used with devices that adhere to the Enhanced Parallel Port (EPP) specification version 1.7. EPP uses the existing parallel port signals to provide asymmetric bidirectional data transfer driven by the host device.
<i>EPP 1.9</i>	The parallel port can be used with devices that adhere to the Enhanced Parallel Port (EPP) specification version 1.9.
<i>ECP</i>	The parallel port can be used with devices that adhere to the Enhanced Capabilities Port (ECP) specification.

Parallel Port IRQ (available only if **Onboard Parallel Port** is not set to *Auto*)

This option specifies the IRQ line for the parallel port. The settings are *5*, *7*. The Optimal and Fail Safe default settings are *7*.

Note: If Parallel Port Mode is ECP DMA channel 3 is used!

SSD INT13h Drive Mapping

This option enables the silicon state disk as either drive 80h, 81h, 82h, or 83h (C, D, E or F). The settings are *Disabled*, *80h*, *81h*, *82h*, *83h*. The Optimal and Fail Safe default settings are *Disabled*.

SSD Write Protect

This option allows to write protect the silicon state disk. The settings are *Disabled* and *Enabled*. The Optimal and Fail Safe default settings are *Disabled*.

SSD Erase On Next Boot

If this option is set to *Enabled*, the silicon state disk will be erased on the next boot. The settings are *Disabled* and *Enabled*. The Optimal and Fail Safe default settings are *Disabled*.

Auto-Detect Hard Disks

This useful option helps to identify the drive parameters of IDE hard disks. The BIOS shows the Standard CMOS setup and enters the detected HDD parameters automatically.

Change User Password

Use this option to enter the password for system or setup protection. It is available after the **Supervisor Password** is defined. Refer also to option *Password Check* of the *Advanced CMOS Setup Screen*.

Change Supervisor Password

Use this option to enter the password for system or setup protection. After this password is set, the **User Password** can be defined. To change the **Supervisor Password** first erase the **User Password**. Refer also to option *Password Check* of the *Advanced CMOS Setup Screen*.

Auto Configuration with Optimal Settings

Use this option to configure the system with highspeed settings for increasing the system performance.

Auto Configuration with Fail Safe Settings

Use this option to configure the system with fail safe settings for increasing the system stability.

Save Settings and Exit

Use this option to save all setup changes to the NV-EEPROM. This option is also available in the **Main Menu** by pressing <F10>.

Exit Without Saving

Use this option to discard all setup changes. This option is also available in the **Main Menu** by pressing <ESC>.

AMIBIOS Configuration Screen

AMIBIOS System Configuration (C) 1985-1996, American Megatrends Inc.,			
Main Processor	:	Am5x86 (X5)	Base Memory Size : 640KB
Math Processor	:	Built-In	Ext. Memory Size : 3072KB
Floppy Drive A:	:	1.44 MB 3½"	Display Type : VGA/EGA
Floppy Drive B:	:	None	Serial Port(s) : 3F8,2F8
AMIBIOS Date	:	07/15/95	Parallel Port(s) : 378
Processor Clock	:	133MHz	Power Management : Disabled
Hard Disks(s)	Cyl	Head	Sector
Primary Master	1010	6	55
			Size
			163MB
			LBA
			Mode
			32Bit
			Mode
			Block
			Mode
			PIO
			Mode

Example screen for a P488

board equipped with an AMD5x86 133MHz, 4MB RAM, booting from a 163 MB hard disk.

Hardware Description

ALI-Chipset Features

The **MOPSlcd4** Board operates with the chipset ALI 1489/87, which provides following features:

- 32 bit PCI Interface
- integrated DRAM controller
- integrated PMU controller
- integrated PCI to ISA bridge (fully compliant to PCI 2.0)
- enhanced DMA functions
- build-in two 8259A interrupt controllers
- fast PCI IDE Master Controller for ATA PIO mode 4 harddisks

Memory configuration

One memory bank for DRAM extension is located at the bottom of the **MOPSlcd4** board. The following memory configurations are available:

total memory	technology
64 MB	single sided
32 MB	double sided
16 MB	single sided
8 MB	single sided
8 MB	double sided
4 MB	single sided
1 MB	single sided

The chipset support FPM- and EDO-Memory.

For highest memory performance, it is recommended to use EDO-Memory-modules.

Interrupts

IRQ0	System Timer
IRQ1	Keyboard
IRQ2	Cascade
IRQ3	COM 2
IRQ4	COM 1
IRQ5	Ethernet (default)
IRQ6	Floppy
IRQ7	LPT 1
IRQ8	Clock/Calendar
IRQ9	Available
IRQ10	COM 3
IRQ11	COM 4
IRQ12	Available
IRQ13	Numeric-processor
IRQ14	EIDE Channel 1
IRQ15	Available

Notes:

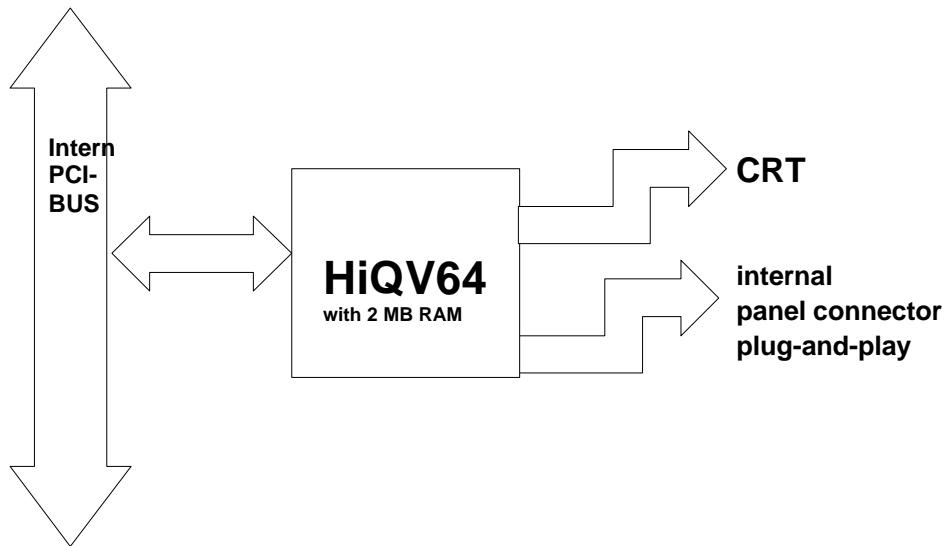
(1) if serial ports are disabled via system bios, these interrupts are available for other devices.
(2) possible settings for Ethernet controller, IRQ5 is the factory default.

DMA

DMA 0	Available
DMA 1	Available
DMA 2	Floppy
DMA 3	Available
DMA 4	Cascade
DMA 5	Available
DMA 6	Available
DMA 7	Available

Onboard C&T VGA

Block Diagram



Supported Display Types

The **MOPSlcd4** supports a vast variety of panels all configured by a dedicated cable for each panel. There is no jumper setting or software setup required. Since practically all LCD's have different connectors, pinout or LCD voltages, this is the easiest and safest way to configure different panels.

The **MOPSlcd4** BIOS supports different panel types, which are identified via the video BIOS by reading the configuration on internal panel connector.

Power Supply

The on board 3.3V-circuitry and low-voltage panels are powered by their own separated voltage regulators, the one for the LCD is mounted on the adapter cable. If the used backlight converter needs +12V, supply system also with +12V.

The LC-Display Interface

Connecting a Display

Many different panel adapters for a wide spread variety of displays are available through **JUMPTec®**. If you use one of those adapters supplied by **JUMPTec®**, configuration is very easy:

1. Check, whether you have the correct adapter and cable for the panel you plan to use. Inspect the cable for damages.
2. Disconnect power from your System.
3. Connect the panel adapter to the internal LCD connector (X6) on **MOPSlcd4**.
4. Connect the other end of the cable to your display.
5. Connect the backlight converter.
6. Supply power to your system
7. If no picture appears on your display, you should connect a CRT monitor to the CRT-connector (X5).

If you still don't see any improvement, you may consider contacting the dealer for technical support.

Current panel information from the JUMPTec®-Website

To find out whether your panel is supported, you should check the **JUMPTec®** support pages on the Internet for actual panel lists. We regularly update the list of panels that have been tested with the **MOPSlcd4**.

Available Video Modes

Video Mode	Display Mode	Characters/Pixels	Colors/Gray val.	Refresh Rate
00h/01h	Text	40x25	16	70
02h/03h	Text	80x25	16	70
04h/05h	Graphics	320x200	4	70
06h	Graphics	640x200	2	70
07h	Text	80x25	Mono	70
0Dh	Graphics	320x200	16	70
0Eh	Graphics	640x200	16	70
0Fh	Graphics	640x350	Mono	70
10h	Graphics	640x350	16	70
11h	Graphics	640x480	2	60
12h	Graphics	640x480	16	60
13h	Graphics	320x200	256	70
14h	Graphics	320x200	256	70
15h	Graphics	320x200	64k	70
16h	Graphics	320x200	16M	70
17h	Graphics	320x240	256	60
18h	Graphics	320x240	64k	60
19h	Graphics	320x240	16M	60
1Ah	Graphics	400x300	256	60
1Bh	Graphics	400x300	64k	60
1Ch	Graphics	400x300	16M	60
1Dh	Graphics	512x384	256	60
1Eh	Graphics	512x384	64k	60
1Fh	Graphics	512x384	16M	60
20h	Graphics	640x480	16	85
22h	Graphics	800x600	16	85
24h	Graphics	1024x768	16	85
28h	Graphics	1280x1024	16	60
30h	Graphics	640x480	256	85
31h	Graphics	640x400	256	70
32h	Graphics	800x600	256	85
34h	Graphics	1024x768	256	85
38h	Graphics	1280x1024	256	60
40h	Graphics	640x480	32k	85
41h	Graphics	640x480	64k	85
42h	Graphics	800x600	32k	85
43h	Graphics	800x600	64k	85
44h	Graphics	1024x768	32k	85
45h	Graphics	1024x768	64k	85
50h	Graphics	640x480	16M	85
52h	Graphics	800x600	16M	85
62h	Graphics	640x400	64k	70
63h	Graphics	640x400	16M	70
64h	Graphics	1024x768	16	85
68h	Graphics	1280x1024	16	60
6Ah	Graphics	800x600	16	85
70h	Graphics	640x480	256	85
71	Graphics	640x400	256	70
72	Graphics	800x600	256	85
74	Graphics	1024x768	256	85
78	Graphics	1280x1024	256	60

The JIDA Standard

JIDA is the abbreviation for JUMPtec® Intelligent Device Architecture.

Every board with onboard BIOS extension shall support the following function calls, which supply information about the board. JIDA functions are called via Interrupt 15h with AH=EAh, AL=function number, DX=4648h (security word), CL=board number (starting with 1).

The interrupt will return with CL#0, if a board with the number specified in CL does not exist. CL will be equal to 0 if the board number exists. In this case, the content of DX is used to determine, if operation was successful. DX=6B6Fh indicates successful operation, any other value indicates an error.

To get information about the installed boards following the JIDA standard, the following procedure is recommended:

Call "Get Device ID" with CL=1. The name of the first device installed will be returned. If result was "Board exists" (CL=0), increment CL and call "Get Device ID" again. Repeat until result is "Board not present" (CL#0). You now know the names of all boards within your system that follow the JIDA standard. More information about a specific board may then be obtained by calling the appropriate inquiry function with the board's number in CL.

WARNING: Association between board and board number may change due to configuration changes. **Do not rely on any association between board and board number.** Instead, always use the procedure described in the preceding paragraph first, to determine the association between board and board number.

The source of a Turbo-Pascal™ unit called JIDA_ACC.PAS showing JIDA access is included on the support disk.

Get Manufacturer ID		Int 15h
Input:	AX = EA00h CL = Board number (1=first board a.s.o.) ES:BX = Pointer to destination data area	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present	DX=6B6Fh: Function successful DX≠6B6Fh: Error
Description:	If CL=0 and DX=6B6Fh, then 4 Byte manufacturer ID were copied to the area pointed to by ES:BX By default, the result will be "JUMP". Note: There is no ending zero byte. Function must be implemented on every device supporting the JIDA.	

Get Device ID		Int 15h
Input:	AX = EA01h CL = Board number ES:BX = Pointer to destination data area	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present	DX=6B6Fh: Function successful DX≠6B6Fh: Error
Description:	If CL=0 and DX=6B6Fh, then 7 Byte device ID were copied to area pointed to by ES:BX By default, the result will be " " Note: There is no ending zero byte. Function must be implemented on every device supporting the JIDA.	

Get Manufacturing Date	Int 15h	
Input:	AX = EA02h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BX = Manufacturing date	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Description	<p>If CL=0 and DX=6B6Fh, then BX=Manufacturing date. Date format is the same as used for DOS files:</p> <p>Bit0..4: Day Bit5..8: Month Bit9..15: Years since 1980</p>	
Get Serial Number	Int 15h	
Input:	AX = EA03h CL = Board number ES:BX = Pointer to destination data area	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Description:	<p>If CL=0 and DX=6B6Fh, then 10 Byte serial number were copied to area pointed to by ES:BX</p> <p>The result is different for each single P488.</p> <p>Note: There is no ending zero byte.</p>	
Get Hardware Revision	Int 15h	
Input:	AX = EA04h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BH=Major revision number BL=Minor revision number	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Get Firmware Revision	Int 15h	
Input:	AX = EA05h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BH=Major revision number BL=Minor revision number	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Get Last Repair Date	Int 15h	
Input:	AX = EA06h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BX = Last repair date.	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Description:	<p>If CL=0 and DX=6B6Fh, then BX=Last repair date. For date format see function "Get Manufacturing Date".</p> <p>If board was never repaired, result will be equal to manufacturing date.</p>	

Read Running Time Meter	Int 15h	
Input:	AX = EA07h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BX=Running time (hours) CH=Overflow counter	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
ReadBoot Counter		Int 15h
Input:	AX = EA08h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BX = Boot counter	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Get JIDA Revision Level		Int 15h
Input:	AX = EA09h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BH = Major revision number (currently 2) BL = Minor revision number (currently 4)	DX=6B6Fh: Function successful DX≠6B6Fh: Fn. not implemented
Read User Byte from EEPROM		Int 15h
Input:	AX = EA40h CL = Board number BH = Number of byte to read (0..15 allowed)	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BL = Value read	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Write User Byte to EEPROM		Int 15h
Input:	AX = EA41h CL = Board number BH = Number of byte to write (0..15 allowed) BL = Value to write	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Get Number of User Bytes available in EEPROM		Int 15h
Input:	AX = EA42h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present BL=Number of Bytes available Note: BL=0 means 256 Bytes	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented

Watchdog Extension

With the aid of a special Interrupt 15h function, the watchdog on a JUMPtec board can be controlled very easily.

The respective functions have the following calling conventions:

Watchdog init	Int 15h	00h
Input:	AH = E0h AL = 00h BX = timeout in 0.2sec increments CX = delay in 0.2sec increments DX = watchdog action (0 = reset, 1 = NMI)	
Output:	None	
Description:	This function is a public JUMPtec INT15h extension used to init the watchdog on JUMPtec boards.	

Watchdog trigger	Int 15h	01h
Input:	AH = E0h AL = 01h	
Output:	None	
Description:	This function is a public JUMPtec INT15h extension used to trigger the watchdog on JUMPtec boards.	

Detailed description of the watchdog function:

Programming:

The function *Init watchdog* must be called only once. The three parameters *delay time*, *timeout time* and *trigger event* must be set. After initialisation the watchdog will be active only after the delay time has expired. The watchdog must be reset during the *timeout time* with the *trigger watchdog function*. Otherwise a RESET or NMI will occur depending on *trigger event*.

The trigger- and the delay time can be set in steps of 0.2 sec.

The trigger and the delay
The maximum values are:

The system BIOS makes it very easy to use the watchdog via software interrupt 15h. Two ways are possible to access the watchdog: The simplest way is to use AH=0E0h to init or trigger the watchdog. The second way is to use the functions "Write I²C" and "Read I²C" with AH=0E1h and handling the I²C bus protocol.

A) Simple with AH = E0h

Init Watchdog (Int 15h, AH=E0h)

Called with	AX	E000h
	BX	timeout time
		BX = 0 \Rightarrow watchdog off. BX _{max} = 0FFFFh
	CX	delay time
		CX = 0 \Rightarrow no delay. CX _{max} = 07FFFh
	DX	trigger event
		DX = 0 \Rightarrow RESET, DX = 1 \Rightarrow IOCHCHK

Returns Example	no
	<pre> mov ax,0E000h ; Watchdog set mov bx,5 ; 5*0,2s = 1s Timeout mov cx,5 ; 5*0,2s = 1s Delay mov dx,0 ; after Timeout and Delay generate RESET int 15h</pre>

Network Operation

Overview

The Crystal LAN™ CS8900 ISA Ethernet Adapter from Crystal Semiconductor follows IEEE 802.3 standards and supports half- or full-duplex operation in ISA bus computers on 10 Mbps Ethernet networks.

The driver can be download from the webpage:

<http://www.jump.de/jumpdata/software/ETHERNET.EXE>

For further information read the readme-File or contact the technical support.

Specifications

Mechanical Specifications

PC/104 Bus connector: 2 pieces of 2*32 pin male and 2*20 pin male connector
Module-dimensions: length * width 95 mm * 90 mm (3,7" * 3,5 ")

Electrical Specifications

Supply voltage: 5V DC +/- 5%
Supply voltage ripple: 100 mV peak to peak 0 - 20 MHz
Supply current (maximal): 1,8 A + current DRAM + current Processor
(Σ max. current all Parts)
Processor maximal current (AMD-data-sheet): 931 mA
DRAM maximal current (MICRON data sheet): 4 Meg x 32 0,80 A
4 Meg x 32 0,82 A
Supply current (typical, DOS-Prompt):
with 4 MB DRAM 2,40 A
external RTC battery voltage 2,4 – 4,0 V
external RTC battery quiescent current max. 4,5 μ A

Environmental Specifications

Temperature: operating 0 to +60 C ((*)with appropriate airflow))
non operating: -10 to +85 °C
Humidity: operating: 10% to 90% (non-condensing)
non operating: 5% to 95% (non-condensing)

(*) The maximum operating temperature is the maximum measurable temperature on any spot on the modules's surface. It is the user's responsibility to maintain this temperature within the above specification.

Peripheral Interface

Keyboard, Reset, Battery, Speaker

Pin	Signal name	Function	5-pin diode keyboard adapter	6-pin minidin keyboard adapter (PS2)
1	SPKR	speaker output		
2	GND	ground		
3	POWERGOOD	reset input		
4	/KLOCK	keyboard lock		
5	KDATA	keyboard data	2	1
6	KCLK	keyboard clock	1	5
7	GND	ground	4	3
8	VCC	+5V	5	4
9	VBAT	VBAT input (3,6V)		
10	POWERGOOD	reset input		

/KLOCK (keyboard lock)

input on CPU modules
output on any other module
input to the keyboard controller input port 1 bit 7 .

POWERGOOD (reset input)

input on CPU modules
open collector output on all other module
When power good goes high, it starts the reset generator on the CPU module to pull the onboard reset line high after a valid reset period. This pin can also be used as a low active hardware reset for modules.

SPKR (speaker output)

open collector output on modules which can drive a loudspeaker.
input on modules which connect a 8 Ohm loudspeaker to this pin
An 8 Ohm loudspeaker is connected between SPEAKER and GND. Only one loudspeaker should be connected to this pin. Usually only the CPU drives this pin, however other modules can also use this signal to drive the system loudspeaker.

KDATA (keyboard data)

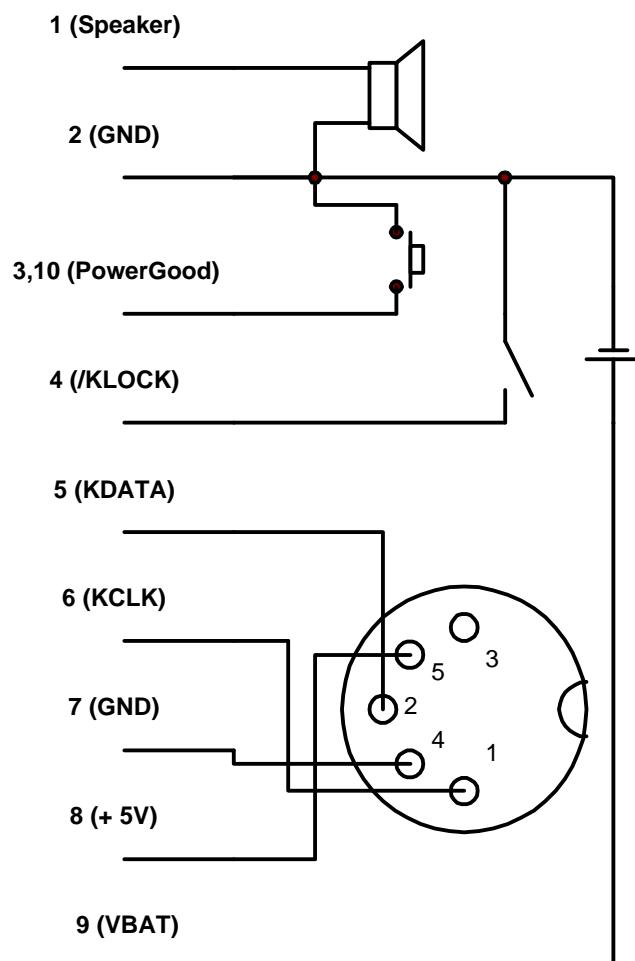
bi-directional I/O pin on CPU modules
Keyboard data signal.

KCLK (keyboard clock)

bi-directional I/O pin on CPU modules
Keyboard clock signal.

VBAT (system battery connection)

This pin connects a system battery to all modules.
The battery voltage has to be higher than 3.0V and lower than 4.0V. Either a 3V or 3.6V battery is recommended.
Note, that there is no battery needed to hold the CMOS-setup data. Your configuration concerning hard disks, floppy drives etc. is automatically saved in an onboard FRAM. Nevertheless the battery is necessary to serve the CMOS date and time while power consumption is turned off.



Serial Port COM A, B RS232C

Pin	Signalname	In / Out	DSUB-25 (need Adapter)	DSUB-9 (need Adapter)
1	DCD	In	8	1
2	DSR	In	6	6
3	RxD	In	3	2
4	RTS	Out	4	7
5	TxD	Out	2	3
6	CTS	In	5	8
7	DTR	Out	20	4
8	RI	In	22	9
9	GND	--	7	5
10	+5V	--	--	--

For signal description please refer additional literatur.

The four serial input/output interfaces can be set to any I/O-address on the peripheral setup. The serial ports are completely compatible with the serial port implementation used on the IBM Serial Adapter. Their interrupts are mapped to IRQ4, IRQ3, IRQ10, IRQ11.

Parallel Port LPT 1

Pin	Signalname	Function	In / Out	DSUB-25 (need Adapter)
1	/Strobe		Out	1
3	Data 0		I/O	2
5	Data 1		I/O	3
7	Data 2		I/O	4
9	Data 3		I/O	5
11	Data 4		I/O	6
13	Data 5		I/O	7
15	Data 6		I/O	8
17	Data 7		I/O	9
19	/ACK		in	10
21	BUSY		in	11
23	PAPER out		in	12
25	SEL out		in	13
2	/AUTOFD		out	14
4	/ERROR		in	15
6	/INIT		out	16
8	SEL in		out	17
26	Vcc	+ 5 V	--	NC
10,12	GND	Signal Ground	--	18 - 25
14,16	GND	Signal Ground	--	18 - 25
18,20	GND	Signal Ground	--	18 - 25
22,24	GND	Signal Ground	--	18 - 25

For signal description please refer additional literatur.

The Centronics printer interface can be programmed via the system setup menu. Refer the peripheral setup for more informations. The parallel port is completely compatible with the parallel port implementation used in the IBM PS-II-Parallel Adapter.

Floppy Connector

Pin	Signal	Function	Pin	Signal	Function
1	VCC	+ 5V	2	IDX	index
3	VCC	+ 5V	4	DS0	drive select 0
5	VCC	+ 5V	6	/DCHNG	disk change
7	NC	-	8	NC	-
9	NC	-	10	Mo0	motor on
11	NC	-	12	DIR	direction select
13	NC	-	14	STEP	step
15	GND	ground	16	WD	write data
17	GND	ground	18	WG	write gate
19	GND	ground	20	TR00	track 00
21	GND	ground	22	WP	write protect
23	GND	ground	24	RD	read data
25	GND	ground	26	SIDE	side one select

For signal description please refer additional literatur.

IDE Connector for 2,5" Hard Disk

Pin	Signal	Pin	Signal
1	/RESET	2	GND
3	D7	4	D8
5	D6	6	D9
7	D5	8	D10
9	D4	10	D11
11	D3	12	D12
13	D2	14	D13
15	D1	16	D14
17	D0	18	D15
19	GND	20	NC
21	NC	22	GND
23	/IOW	24	GND
25	/IOR	26	GND
27	NC	28	BALE
29	NC	30	GND
31	IRQ14	32	/IOCS16
33	SA1	34	NC
35	SA 0	36	SA2
37	/CS0	38	/CS1
39	/HDLED	40	GND
41	VCC	42	VCC
43	GND	44	NC

For signal description please refer additional literatur.

Ethernet Connector

Pin	Signalname	Function	In/Out
1	TXD+	10BASE-T Transmit	differential Output
2	TXD-	10BASE-T Transmit	differential Output
3	RXD+	10BASE-T Receive	differential Input
4	NC	unused Pin	
5	NC	unused Pin	
6	RXD-	10BASE-T Receive	differential Input
7	LNLED	LED	Output
8	LKLED	LED	Output

TXD+, TXD-

Differential output pair drives 10 Mb/s Manchester encoded data to the 10BASE-T transmit lines.

RXD+, RXD-

Differential input pair receives 10 Mb/s Manchester encoded data from the 10BASE-T receive lines.

LKLED, LNLED

Connect with Cathode of Ethernet-LED's.

Feature Connector

Only for manufacture, not for use by customer

CRT Connector

Pin	Signal name	Function	DSUB15 (need adapter)
1	RED	analog video red	1
2	GND	signal ground	5
3	GREEN	analog video green	2
4	GND	signal ground	6
5	BLUE	analog video blue	3
6	GND	signal ground	7
7	VSYNC	vertical sync	14
8	GND	signal ground	8
9	HSYNC	horizontal sync	13
10	GND	signal ground	10

Power Connector

Pin	Pin function
1	GND
2	+5V
3	keypin
4	+12V
5	-5V
6	-12V
7	GND
8	+5V

Power Pins

The MOPSlcd4 is a +5 V only module. Nevertheless the power connector offers the possibility to supply with the additional voltages +12V, -12V and -5V which may be needed by other boards in the PC/104 system. The power consumption of all available power pins on the MOPSlcd4 is limited to 5A in total (1A per pin, with 2 pins on the power connector, 2 pins on the XT-bus and 1 pin on the AT-bus) and at GND up to 8A. Systems consuming more than 2A shouldn't be served over the power connector only. Systems consuming more than 5A must provide power supply through an additional connector on another board.

Keypin

The keypin avoids wrong insertion of the 8 pin power connector offered by JUMPTEC.

PC/104-Connector

Specification XT Bus

Pin	Signal Name	Pin	Signal Name
A1	/IOCHK	B1	GND
A2	SD7	B2	RESETDRV
A3	SD6	B3	+5V
A4	SD5	B4	IRQ9
A5	SD4	B5	-5V
A6	SD3	B6	DRQ2
A7	SD2	B7	-12V
A8	SD1	B8	/0WS
A9	SD0	B9	+12V
A10	IOCHRDY	B10	GND (*)
A11	AEN	B11	/SMEMW
A12	SA19	B12	/SMEMR
A13	SA18	B13	/IOW
A14	SA17	B14	/IOR
A15	SA16	B15	/DACK3
A16	SA15	B16	DRQ3
A17	SA14	B17	/DACK1
A18	SA13	B18	DRQ1
A19	SA12	B19	/REFRESH
A20	SA11	B20	SYSCLK
A21	SA10	B21	IRQ7
A22	SA9	B22	IRQ6
A23	SA8	B23	IRQ5
A24	SA7	B24	IRQ4
A25	SA6	B25	IRQ3
A26	SA5	B26	/DACK2
A27	SA4	B27	TC
A28	SA3	B28	BALE
A29	SA2	B29	+5V
A30	SA1	B30	OSC
A31	SA0	B31	GND
A32	GND	B32	GND

Specification AT Bus X2, C0 - C19

Pin	Signal Name	Pin	Signal Name
C0	GND	D0	GND
C1	/SBHE	D1	/MEMCS16
C2	LA23	D2	/IOCS16
C3	LA22	D3	IRQ10
C4	LA21	D4	IRQ11
C5	LA20	D5	IRQ12
C6	LA19	D6	IRQ15
C7	LA18	D7	IRQ14
C8	LA17	D8	/DACK0
C9	/MEMR	D9	DRQ0
C10	/MEMW	D10	/DACK5
C11	SD8	D11	DRQ5
C12	SD9	D12	/DACK6
C13	SD10	D13	DRQ6
C14	SD11	D14	/DACK7
C15	SD12	D15	DRQ7
C16	SD13	D16	+5V
C17	SD14	D17	/MASTER
C18	SD15	D18	GND
C19	GND (*)	D19	GND

(*) Key pin for PC/104; GND for PC/104+ - specification

For signal description and peripheral driver current refer the PC/104 Specification.
Any signals are open collector for multiple sources and can not drive by TTL.

Literatur, Standards, Links

PC/104-Bus

- **PC/104 Specification Version 2.3 June 1996**
PC/104 Consortium; www.pc104.org
- **Embedded PCs** Markt&Technik GmbH, ISBN 3-8272-5314-4 (german)

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- **ISA System Architecture** Addison-Wesley Publishing Company
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- **AT IBM Technical Reference Vol 1&2**, 1985
- **ISA Bus Specifications and Application Notes**, January 30, 1990, Intel
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RS232C

- EIA-232-E Interface between data terminal equipment and date circuit-terminating equipment employing serial binary data interchange (ANSI/IEA-232-D)

National Semiconductor's Interface Data Book includes any applications notes. These notes are also available online at <http://www.national.com/>. A search engine is provided to search the text of the available application notes. Entering „232“ as search criteria to get a current list of related application notes.

Document Revision History

Filename	Date	Edited by	Alteration to preceding revision
P488D110.DOC	08.09.98	KW	Created
P488D111.DOC	16.09.98	KW	Add SSD
P488D112.DOC	19.09.98	KW	Remove BL-Conn., onboard-DRAM, red. Videomode
P488D113.DOC	10.01.99	KW	Add L1-cache