*super*MOPS*pro*

Technical Manual

Rev. 2.2

JUMP*tec*®
Industrielle Computertechnik AG
Brunnwiesenstraße 16
94469 Deggendorf/ Germany

PN of Manual: 96035-0003-00-0
Manual Rev.: 2.2
File: P487m222.DOC

Table of Contents

User Information

In this document **JUMP*tec*** Industrielle Computertechnik GmbH will also be referred to by the short form "**JUMP*tec***".

The information in this document has been carefully checked and is believed to be accurate and reliable. However, no responsibility is assumed for inaccuracies. Furthermore, **JUMP*tec*** reserves the right to make changes to any portion of this manual to improve reliability, function or design. **JUMP*tec*** does not assume any liability for any product or circuit described herein.

Trademarks

AT and IBM are trademarks of International Business Machines
XT, AT, PS/2 and Personal System/2 are trademarks of International Business Machines Corporation.
Microsoft is a registered trademark of Microsoft Corporation.
Intel is a registered trademark of Intel Corporation.
All other products and trademarks mentioned in this manual are trademarks of their respective owners.

General

For the circuits, descriptions and tables indicated no responsibility is assumed as far as patents or other rights of third parties are concerned.
The information in the Technical Descriptions describes the type of the boards and shall not be considered as assured characteristics.

Warranty

Each board is carefully and thoroughly tested 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 correspond to the factory default settings since a test is only possible under this settings.

2. Upon receipt of the board, please be aware that your user specific settings could have been changed during the repair and tests.

Within the guarantee, the repair is free as long as the guarantee conditions were kept. If no fault has been found, you will be charged with the test cost due to the high test expenditure. Repairs outside the guarantee period will be charged.

This **JUMP*tec*** product is warranted against defects in material and workmanship for our guaranteed warranty period from the date of shipment. During the warranty period, **JUMP*tec*** will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, the product must be returned to a service facility designated by **JUMP*tec***.

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

JUMP*tec* will not be responsible for any defects or damages due to a faulty **JUMP*tec*** product other than the products supplied by **JUMP*tec***.

Introduction

*super*MOPS*pro*

The *super*MOPS*pro* integrates the complete functionality of an 80486 SX/DX motherboard with CPU, System-BIOS, 4 Mbyte to 20MByte DRAM, keyboard-controller, real time clock and additional peripheral functions like COM1, COM2, LPT1, floppy-interface, IDE-harddisk-interface, watchdog, silicon disk and Ethernet access. The system runs with CPU clock speeds from 33MHz to 133MHz (" DX5"). The *super*MOPS*pro* incorporates the following features:

Features

Supported Processors

Type	Internal Clock	Notes
80486SX,	*33 MHz*	*many 486 processor types are or*
80486DX	*33 MHz*	*will be not be available anymore*
80486DX2-66	*66 MHz*	*in the future*
80486DX4-100	*100 MHz*	
80486DX5-133	*133 MHz*	

Memory Configurations, onboard and additional S.O.DIMM

Onboard	S.O.DIMM	Total
4 MB	**-**	*4 MB*
4 MB	*4 MB*	*8 MB*
4 MB	*16 MB*	*20 MB*

for self-upgrade only use modules with:

support of fast page mode, no EDO-DRAM

one page mode (no 8 MB modules)

DRAMs with support of CAS only refresh

5V-modules (no 3.3V types)

(refer also to JUMPtec specification X00560.DOC)

Silicon Disk as a BIOS Compatible Bootable Hard Disk

Onboard	SDISK-DIMM	Total
0.9 MB	**-**	*0.9 MB*
0.9 MB	*1 MB*	*1.9 MB*
0.9 MB	*2 MB*	*2.9 MB*
0.9 MB	*4 MB*	*4.9 MB*
0.9 MB	*8 MB*	*8.9 MB*

Serial Ports, COMA and COMB (user configurable)

Base Adresses	Port Definition
220h	*user*
228h	*user*
238h	*user*
2E0h	*user*
2E8h	*COM4*
2F8	*COM2*
338	*user*
3E8	*COM3*
3F8	*COM1*

Parallel Port, LPT uni- or bi-directional (user configurable)

Base Adresses	Port Definition
278	
378	
3BC	

Floppy-Interface

via a flat foil connector

Standard IDE-Hard Disk-Interface

via a 2mm 44 pin 2.5" hard disk connector

Watchdog

implemented in the extended BIOS

FLASH-BIOS (AMI)

Real Time Clock

Keyboard-Controller

EEPROM for CMOS-SETUP

IRDA-Support

I²C-Bus Interface

Ethernet 10BaseT (Twisted Pair)

RS485 prepared

PC/104-Format

*90 * 95 mm (4,5" x 3,7") with the PC/104 Bus*

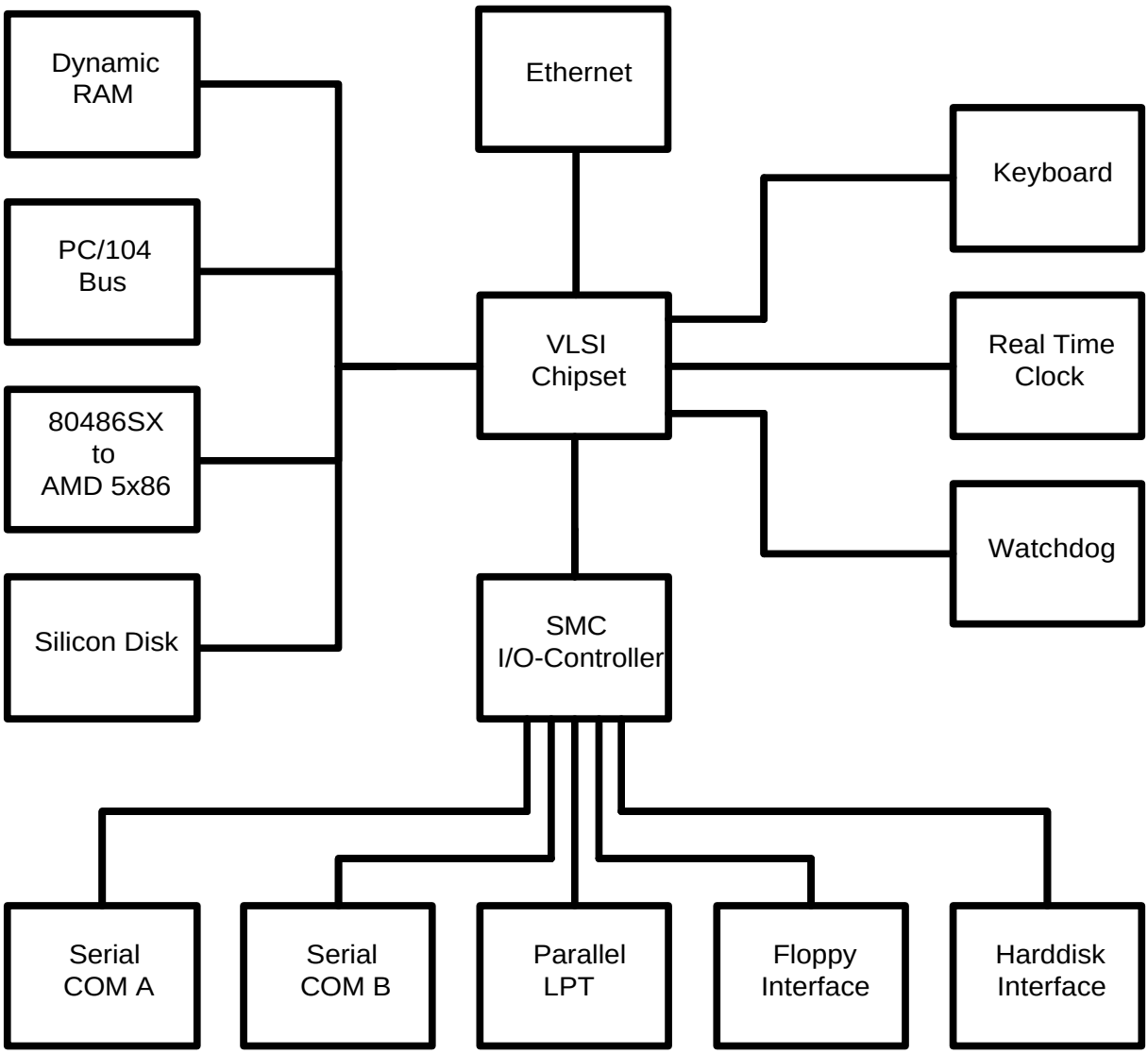
5V only power supply

Full ISA electrical characteristics like timing and DC-characteristics

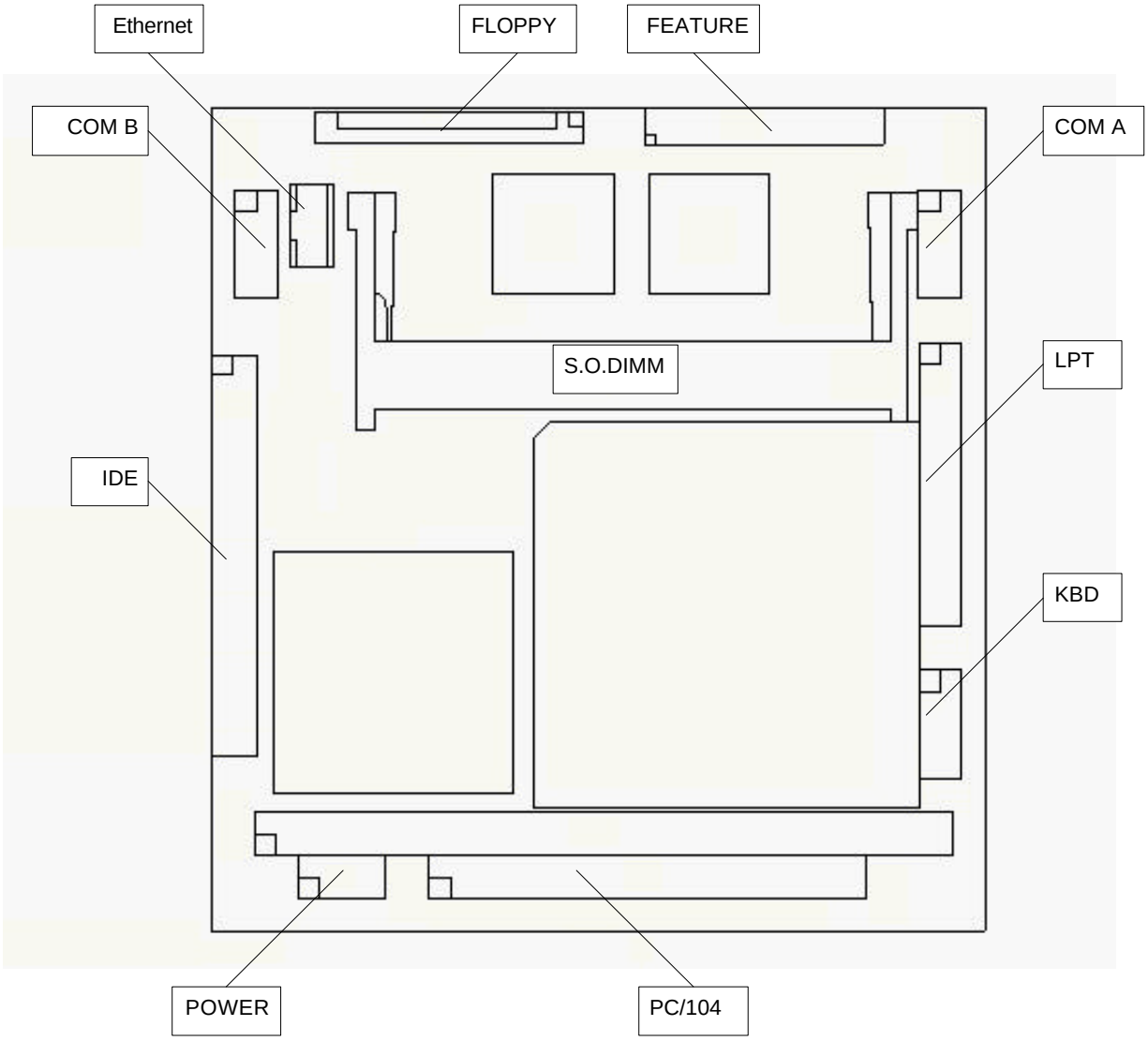
Low power CMOS technology with 12mA driver capacity (=half of ISA-bus)

Connector Overview

Block Diagram



Connector Arrangement



The pin 1 of any connector is marked with a rectangular pad at the bottom side of the board and with a mark of the same kind in this drawing (showing the top view of the board).

The S.O.DIMM socket for memory and BIOS compatible flash disk consists of two ”slots”. The lower one is for upgrade of memory. The upper one is only for flash disk usage.

Connector Tables

Pin	(A) PC/104	(B) PC/104	(C) PC/104	(D) PC/104	Power	IDE	Floppy	LPT	COMA	COMB	Key	Feature	Network
0			GND	GND									
1	/IOCHCK	GND	/SBHE	/MEMCS16	GND	/RESET	VCC	/STB	RLSD1	RLSD2	SPKR	ISPDEV	TXD+
2	SD7	RESETDRV	LA23	/IOCS16	VCC	GND	IDX	/AFD	DSR1	DSR2	GND	RAMWI	TXD-
3	SD6	VCC	LA22	IRQ10	keypin	IDE D7	VCC	PD0	SIN1	SIN2	POWERGOOD	/HDLED	RXD+
4	SD5	IRQ9	LA21	IRQ11	+12V	IDE D8	DS0	/ERR	RTS1	RTS2	/KLOCK	VCC	NC
5	SD4	-5V	LA20	IRQ12	-5V	IDE D6	VCC	PD1	SOUT1	SOUT2	KDATA	MDATA	NC
6	SD3	DRQ2	LA19	IRQ15	-12V	IDE D9	/DCHNG	/INIT	CTS1	CTS2	KCLK	VCC	RXD-
7	SD2	-12V	LA18	IRQ14	GND	IDE D5	NC	PD2	DTR1	DTR2	GND	MCLK	NC
8	SD1	/0WS	LA17	/DACK0	VCC	IDE D10	NC	/SLIN	RI1	RI2	VCC	GND	NC
9	SD0	+12V	/MEMR	DRQ0		IDE D4	NC	PD3	GND	GND	VBAT	/RLSDB	
10	IOCHRDY	GND[1)]	/MEMW	/DACK5		IDE D11	Mo0	GND	VCC	VCC	POWERGOOD	/DSRB	
11	AEN	/SMEMW	SD8	DRQ5		IDE D3	NC	PD4				SINB	
12	SA19	/SMEMR	SD9	/DACK6		IDE D12	DIR	GND				/RTSB	
13	SA18	/IOW	SD10	DRQ6		IDE D2	NC	PD5				SOUTB	
14	SA17	/IOR	SD11	/DACK7		IDE D13	STEP	GND				/CTSB	
15	SA16	/DACK3	SD12	DRQ7		IDE D1	GND	PD6				/DTRB	
16	SA15	DRQ3	SD13	VCC		IDE D14	WD	GND				/RIB	
17	SA14	/DACK1	SD14	/MASTER		IDE D0	GND	PD7				GND	
18	SA13	DRQ1	SD15	GND		IDE D15	WG	GND				LKLED	
19	SA12	/REFRESH	GND	GND[1)]		GND	GND	/ACK				/EN	
20	SA11	SYSCLK				NC	TR00	GND				VCC	
21	SA10	IRQ7				NC	GND	BUSY				I2DAT	
22	SA9	IRQ6				GND	WP	GND				VCC	
23	SA8	IRQ5				/IOW	GND	PE				I2CLK	
24	SA7	IRQ4				GND	RD	GND				GND	
25	SA6	IRQ3				/IOR	GND	SLCT				Powergood	
26	SA5	/DACK2				GND	SIDE	VCC				LNLED	
27	SA4	T/C				NC							
28	SA3	BALE				BALE							
29	SA2	VCC				NC							
30	SA1	OSC				GND							
31	SA0	GND				IRQ14							
32	GND	GND				/IOCS16							
33						SA1							
34						NC							
35						SA0							
36						SA2							
37						/IDE CS0							
38						/IDE CS1							
39						/HDLED							
40						GND							
41						VCC							
42						VCC							
43						GND							
44						NC							

1) these pins are connected to GND, while in PC/104 specification they are keypins.

The *super*MOPS*pro* is designed in the standard PC/104 format.
The PC/104 bus consist of 2 different connectors with 104 pins in total.
- XT bus connector (64 pins)
- AT bus connector (40 pins) (Optional for 16 bit data bus system)

The pinout of the PC/104 bus connectors correspond to the pinout of the ISA bus connectors with some added ground lines. Therefore the two PC systems with different form factor are electrically compatible.

The XT bus connector is labeled X1 with row A and B.
The corresponding 64 pin stackthrough header (ISA bus = 62 pins) has two added ground pins at the end of the connector (pin A32 and pin B32). Therefore the pinout between PC/104 bus and XT ISA bus is identical between A1 - A31 and B1 - B31.

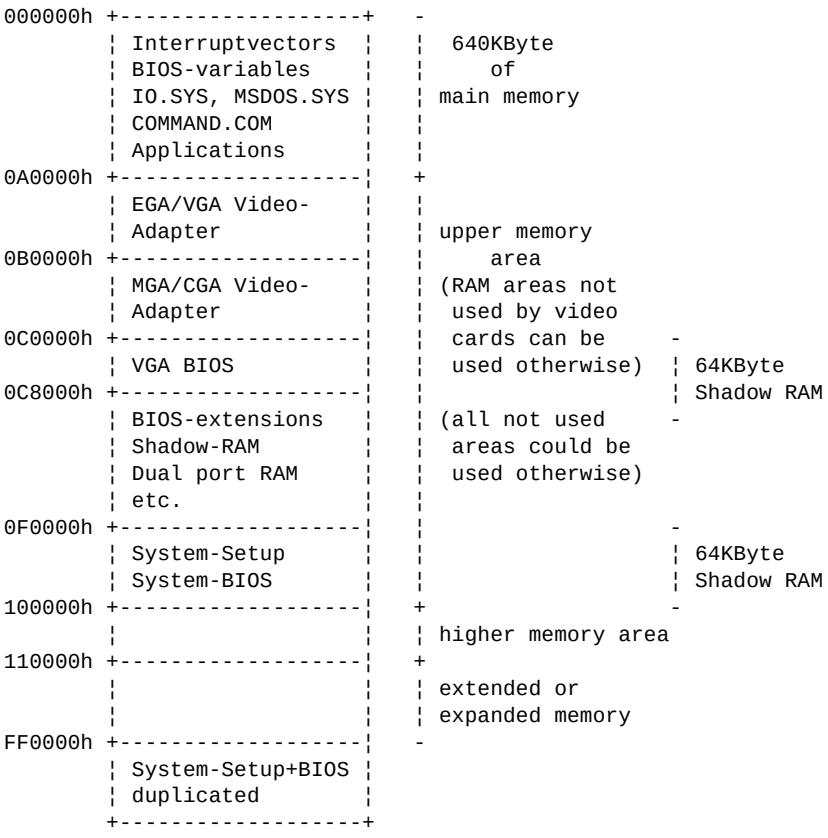
The AT bus extension connector is labeled X2 with row C and D.
The corresponding 40 pin stackthrough header (ISA bus = 36 pins) has four added ground pins, two on each side of the connector. In order to avoid any confusion the first two pins are defined as pin C0 and pin D0. The additional ground pins at the end of the connector are defined as C19 and D19. Therefore the pinout between PC/104 bus and AT ISA bus is again identical between C1 - C18 and D1 - D18.

Memory and I/O Information

Memory Map

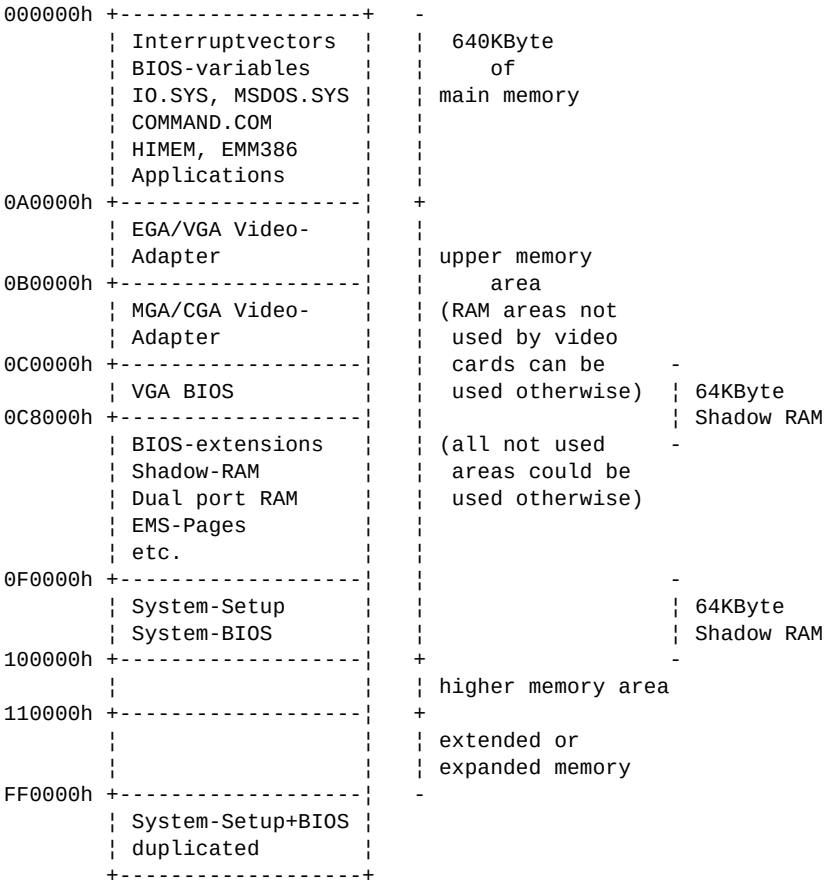
The 24 address lines of the *super*MOPS*pro* processor module can address up to 32MByte of memory. Onboard DRAM can be up to 32MByte, too (end address 01FFFFFFh). The first 640KByte of DRAM are used as main memory.
DOS allows to address 1MByte directly. The memory area above 1MByte (high memory, extended 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 devided 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 C8000h and E0000h in steps of 16KBytes. Most Expanded Memory Managers are choosing their frame address location by themselves if it is not explicit set..



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

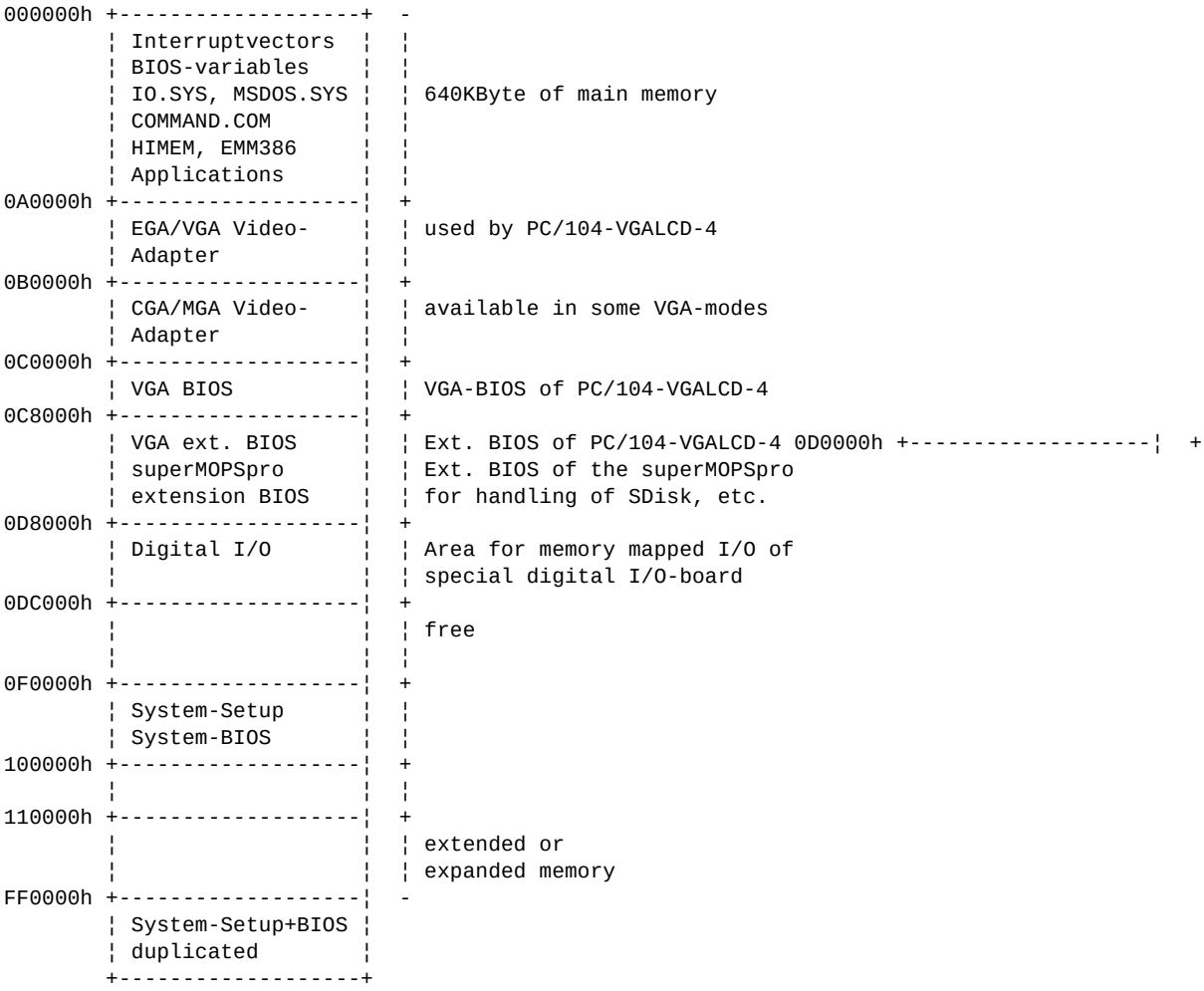
HIMEM.SYS and EMM386.EXE

The *superMOPSpro* 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=*????-????* X=F000-FFFF

Example for Memory Map

Assume you've got a system consisting of a *superMOPSpro*, a graphic module PC/104-VGALCD-4 and a special digital I/O-board. The graphic-module PC/104-VGALCD-4 is a product of **JUMP*tec*** and has an extension BIOS located at C800h to CBFFh while the digital I/O-board uses a memory window from D800h to DC00h for memory mapped I/O. To avoid any BIOS conflict you have to choose a location for the *superMOPSpro* extension BIOS (32KByte) at either D000h or above of D800h. Assume your decision was D000h. The special systems memory map would look like this:



If you want to use the EMM386.EXE with this configuration, your CONFIG.SYS would have to hold the following instruction:

```
DEVICE=EMM386.EXE X=C800-CC00 X=D000-D800 X=D800-DC00 X=F000-FFFF
```

or in a shorter way:

```
DEVICE=EMM386.EXE X=C800-DC00 X=F000-FFFF
```

The EMM386.EXE will after a reboot choose a frame above DC000h for his own purposes and leave the excluded areas untouched.

Note, that while booting up your system with this configuration the exclusion of area F000 to FFFF will cause the following or a similar warning : "Bereiche überlappen sich...".
We asked MICROSOFT about this EMM386 warning and got the information, that this message will always appear, when the F000-segment lies in the shadow RAM. This is a bug of the EMM386 and not of the *superMOPSpro*.

I/O Map

The I/O port addresses of the processor modules superMOPSpro are functionally identical with a standard PC/AT.
An additional I/O-port is the GPCS, which has the standard location 0050h. This port is decoded only with 10 bits, therefore some adresses of the I/O-address space can´t be used because of mirroring. The mirroring will occur every 400h starting at 450h, 850h etc.

I/O addresses	*super*MOPS*pro*-used	function
0000 - 000F	fixed	DMA-controller 1
0020 - 003F	fixed	interrupt-controller 1
0040 - 0043	fixed	counter/timer
0050 - 005F	fixed	GPCS-Port
0060 - 0064	fixed	keyboard-controller
0070 - 0071	fixed	real time clock
0080 - 008F	fixed	DMA page register 74LS612
0092	fixed	port A register (Fast A20 Gate)
00A0 - 00BF	fixed	interrupt-controller 2
00C0 - 00DE	fixed	DMA-controller 2
00EC - 00EF	fixed	configuration registers
00F0 - 00FF	fixed	math-co-processor
01F0 - 01F8	fixed	fixed disk
0220 - 0227	if configured instead other serial	user specific serial port
0228 - 022F	if configured instead other serial	user specific serial port
0238 - 023F	if configured instead other serial	user specific serial port
02E0 - 02E7	if configured instead other serial	user specific serial port
0278 - 027F	if configured instead parallel 1	parallel port 2
02E8 - 2EF	if configured instead other serial	user specific serial port (COM4)
02F8 - 02FF	default	serial port 2
0300 - 031F	default if equipped with Ethernet	Ethernet Controller
0378 - 037F	default	parallel port 1
03E8 - 3EF	if configured instead other serial	user specific serial port (COM3)
03F0 - 03F7	x	diskette controller
03F8 - 03FF	default	serial port 1
0450 - 045F , 0850 - 085F 0C50 - 0C5F , 1050 - 105F 1450 - 145F , etc.	x	mirroring of GPCS port over the whole I/O address space (every 400h)

Interrupts

IRQ0	system timer
IRQ1	keyboard
IRQ2	cascade
IRQ3	COM 2
IRQ4	COM 1
IRQ5	available
IRQ6	floppy
IRQ7	LPT 1
IRQ8	clock/ calendar
IRQ9	available
IRQ10	available
IRQ11	available
IRQ12	available
IRQ13	numeric-processor
IRQ14	hard disk
IRQ15	available

Please note that **JUMP*tec*** PC/104 devices are designed following the P996 Specification for ISA-Systems. Due to this fact shareable interrupts are not supported. Some PC/104 manufacturers are not following the P996 Specification and allow shareable interrupts. If you want to use such a PC/104 board with **JUMP*tec*** devices, contact the manufacturer of the board and ask for a possibility to switch of interrupt sharing.

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

Working with the *super*MOPS*pro*

Introduction

Before you can work with your *super*MOPS*pro* you have to configure your system. All the features of the *super*MOPS*pro* are fully software configurable, so you don't have to place any Jumpers and it is possible to simply plug this board into your system and turn power on. Nevertheless the software configuration has to be taken with care to avoid malfunction.

With power up or keyboard reset the system starts up with the POST (Power On Self Test) and at least the following reports will appear on the screen:

VGA-BIOS Report

This report depends of the video controller you use in your system. Some video controllers even display no reports or have the possibility to suppress their own messages. Check the manual of your graphic controller board which message should be displayed.

*super*MOPS*pro* System BIOS Report

The superMOPSpro has a system BIOS based on a source code from American Megatrend Inc. which will give you a report similar to the following text.

AMIBIOS (C) 1992 American Megatrends Inc.,
SuperMOPS Pro V*?.?* (with *?.?* holding the system BIOS revision)

Wait .....

Before the WAIT message is displayed a memory test may be conducted when the system boots up after a hardware reset. Note that the system BIOS may give you the option do disable the memory test on every boot up.

While the WAIT message is displayed the user has the possibility to press the <DEL> key to enter the RTC - CMOS setup.

*Super*MOPS*pro* Extension BIOS Report

The Extension BIOS of the superMOPSpro is necessary to control the extended features of processor board. It will display the following lines on the monitor.

Hostmode ...

SuperMOPS Pro Extension BIOS V*?.?* **from** *zz/zz/zz*
Checking o.K.
(with *?.?* holding extension BIOS revision and *zz/zz/zz* showing revision date)

SuperMOPSpro Setup

While this message of the extension BIOS is displayed the user has the possibility to press the key combination <ALT><F1> to enter the extended setup.

Further Reports

A system consisting of additional boards with own BIOSes may display more messages, before the last report occurs. This AMIBIOS report gives you some information about your system configuration.

```
+-------------------------------------------------------------------------+
|   AMIBIOS System Configuration - (C)1985-1992, American Megatrends Inc. |
|-------------------------------------------------------------------------|
|                                                                         |
|          Main Processor: 486DX or 487SX  Base Memory Size: 640 KB       |
|       Numeric Processor: Present         Ext. Memory Size: 3072 KB      |
|          Floppy Drive A: 1.44 MB, 3½"         Hard Disk C  Type: 47     |
|          Floppy Drive B: None                 Hard Disk D  Type: None   |
|            Display Type: VGA/PGA/EGA       Serial Port(s): 3F8, 2F8     |
|            AMIBIOS Date: 11/11/92        Parallel Port(s): 278          |
|                                                                         |
+-------------------------------------------------------------------------+
```

Description of the RTC - CMOS-Setup Menu

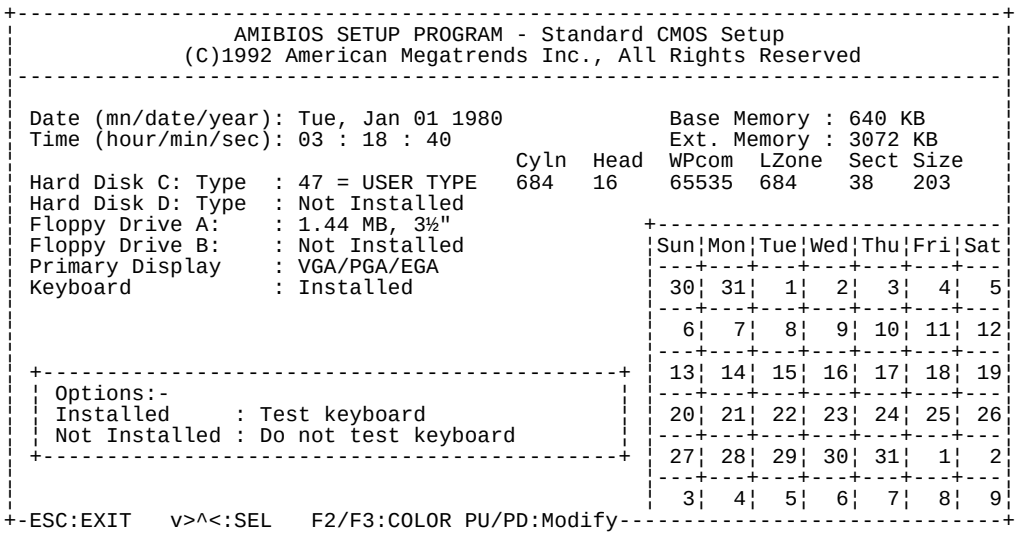
The Standard AMI-BIOS is located in a Flash EPROM onboard the *super*MOPS. Because this device has an eight bit wide data access, **JUMP*tec*** enabled the shadow RAM feature for this memory area to allow a much faster 16 bit access.

During boot sequence while WAIT will be displayed the <DEL> key allows to switch to the CMOS setup.
The first menu that will appear is the main menu, which offers several further entries. Every of these entries can be selected by cursor keys and additional return. The next screen that will appear is always similar and gives some more information as well as a warning about the consequences of inexperienced changes. It can be left by <ESC> (back to main menu) or any other key to go on.

Main Menu

```
+-------------------------------------------------------------------------+
|                 AMIBIOS SETUP PROGRAM - BIOS SETUP UTILITIES             |
|             (C)1992 American Megatrends Inc., All Rights Reserved       |
|-------------------------------------------------------------------------|
|                                                                         |
|                              STANDARD CMOS SETUP                        |
|                              ADVANCED CMOS SETUP                        |
|                           ADVANCED CHIPSET SETUP                        |
|                    AUTO CONFIGURATION WITH BIOS DEFAULTS                |
|                            AUTO DETECT HARD DISK                        |
|                              HARD DISK UTILITY                          |
|                           WRITE TO CMOS AND EXIT                        |
|                        DO NOT WRITE TO CMOS AND EXIT                    |
|                                                                         |
|                                                                         |
|                                                                         |
|                                                                         |
|-------------------------------------------------------------------------|
|                                                                         |
|       Standard CMOS Setup for Changing Time, Date, Hard Disk Type, etc. |
+--------------ESC:EXIT   v>^<:SEL   F2/F3:COLOR   F10:SAVE & EXIT-------+
```

Menu Item 1



Entry	Function /Meaning	additional note
Date	*set the actual CMOS date*	
Time	*set the actual CMOS time*	
Base Memory	*base memory size*	*1)*
Ext. Memory	*extended memory size*	
Hard Disk C	*configure the first hard disk*	*2), 3), 4)*
Hard Disk D	*configure the second hard disk*	
Floppy Drive A	*configure the first floppy drive*	
Floppy Drive B	*configure the second floppy drive*	
Primary Display	*configure primary display*	*5)*
Keyboard	*enable/disable keyboard test*	*6)*

notes:

1) the memory sizes should match with the installed RAM

2) don't try to configure the onboard silicon disk here, this is part of the extension setup

3) most hard disks don't have to be configured manually here, try the "Auto Detect Hard Disk" feature first

4) the *superMOPSpro* is only capable to handle hard disks with up to 504MB; bigger ones can only be supported with special handlers, which are available on the free market

5) not necessary to be set

6) this function has no effect, because the system will boot even if keyboard is enabled and no keyboard is connected

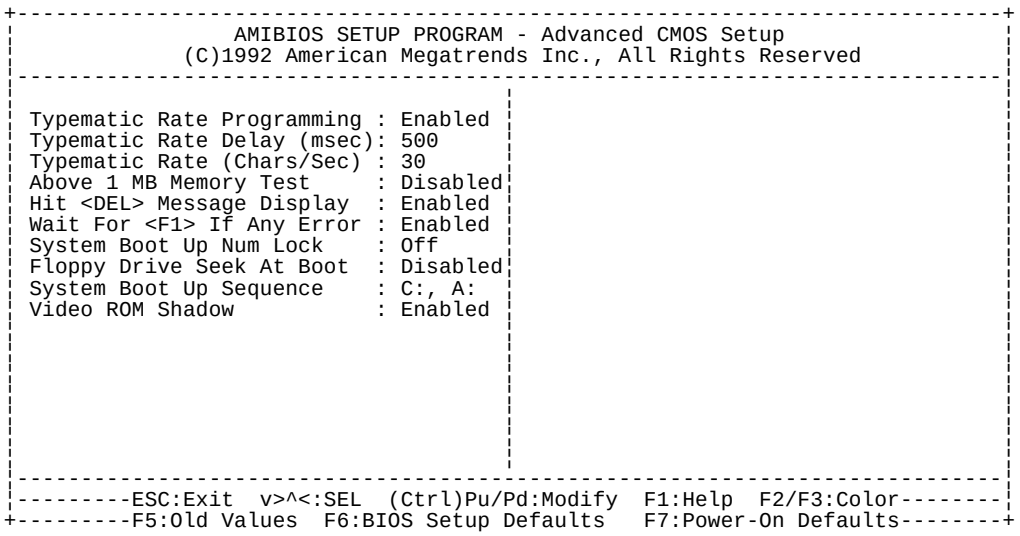
Hard Disk Types

For the hard disk type either a set of parameters can be chosen from a list of 46 different standard disk drives (see below) or by selecting type 47 a user defined set of parameters can be installed.

FIXED DISK CONFIGURATION

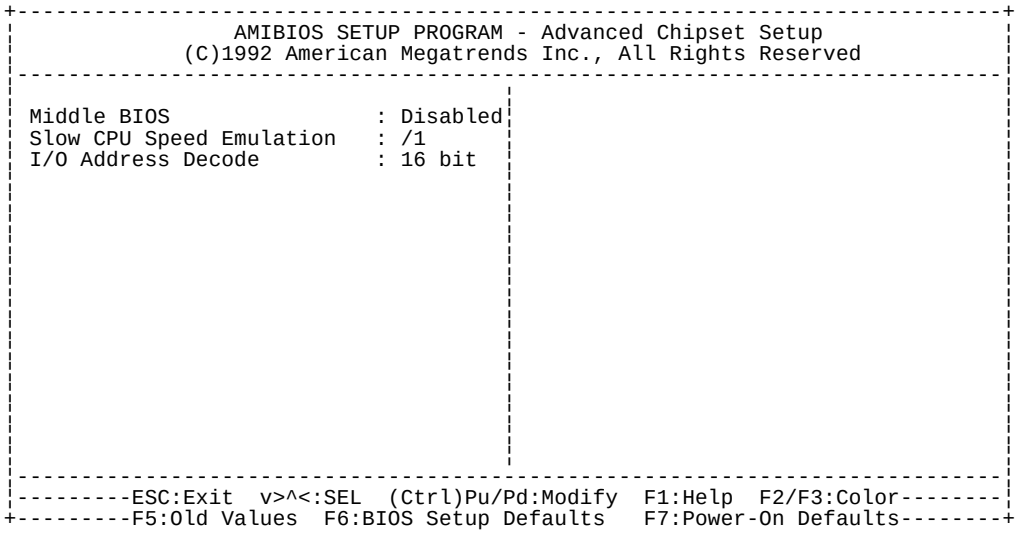
Type	Cyls	Heads	WPcom	Ctrl Byte	LZone	Secs	Size
1	306	4	128	0	305	17	10 MB
2	615	4	300	0	615	17	20 MB
3	615	6	300	0	615	17	31 MB
4	940	8	512	0	940	17	62 MB
5	940	6	512	0	940	17	47 MB
6	615	4	65535	0	615	17	20 MB
7	462	8	256	0	511	17	31 MB
8	733	5	65535	0	733	17	30 MB
9	900	15	65535	8	901	17	112 MB
10	820	3	65535	0	820	17	20 MB
11	855	5	65535	0	855	17	35 MB
12	855	7	65535	0	855	17	50 MB
13	306	8	128	0	319	17	20 MB
14	733	7	65535	0	733	17	43 MB
15	0	0	0	0	0	0	0 MB
16	612	4	0	0	663	17	20 MB
17	977	5	300	0	977	17	41 MB
18	977	7	65535	0	977	17	57 MB
19	1024	7	512	0	1023	17	60 MB
20	733	5	300	0	732	17	30 MB
21	733	7	300	0	732	17	43 MB
22	733	5	300	0	733	17	30 MB
23	306	4	0	0	336	17	10 MB
24	925	7	0	0	925	17	54 MB
25	925	9	65535	8	925	17	69 MB
26	754	7	754	0	754	17	44 MB
27	754	11	65535	8	754	17	69 MB
28	699	7	256	0	699	17	41 MB
29	823	10	65535	8	823	17	68 MB
30	918	7	918	0	918	17	53 MB
31	1024	11	65535	8	1024	17	94 MB
32	1024	15	65535	8	1024	17	128 MB
33	1024	5	1024	0	1024	17	43 MB
34	612	2	128	0	612	17	10 MB
35	1024	9	65535	8	1024	17	77 MB
36	1024	8	512	0	1024	17	68 MB
37	615	8	128	0	615	17	41 MB
38	987	3	987	0	987	17	25 MB
39	987	7	987	0	987	17	57 MB
40	820	6	820	0	820	17	41 MB
41	977	5	977	0	977	17	41 MB
42	981	5	981	0	981	17	41 MB
43	830	7	512	0	830	17	48 MB
44	830	10	65535	8	830	17	69 MB
45	917	15	65535	8	918	17	114 MB
46	1224	15	65535	8	1223	17	152 MB
47	x	x	x	x	x	x	

Menu Item 2



Entry	Function /Meaning	note
Typematic Rate Progr.	*enable/disable changing typematic rate*	
Typematic Rate Delay	*sets time after which repetition of a keystroke will start with typematic rate*	
Typematic Rate	*sets the speed at which a keystroke is repeated*	
Above 1 MB Memory Test	*enable/disable memory test above 1 MB during boot up*	
Hit <DEL> Message Display	*enable/disable this message during boot up*	
Wait for <F1> If Any Error	*enable/disable this message which appears with a POST error during boot up*	
System Boot Up Num Lock	*enable/disable Num Lock Key*	
Floppy Drive Seek At Boot	*enable/disable a seek on floppy drive during boot up*	
System Boot Up Sequence	*sets the boot up sequence to floppy or hard disk as first device*	
Video ROM Shadow	*enable/disable shadowing of video ROM into faster RAM*	

Menu Item 3



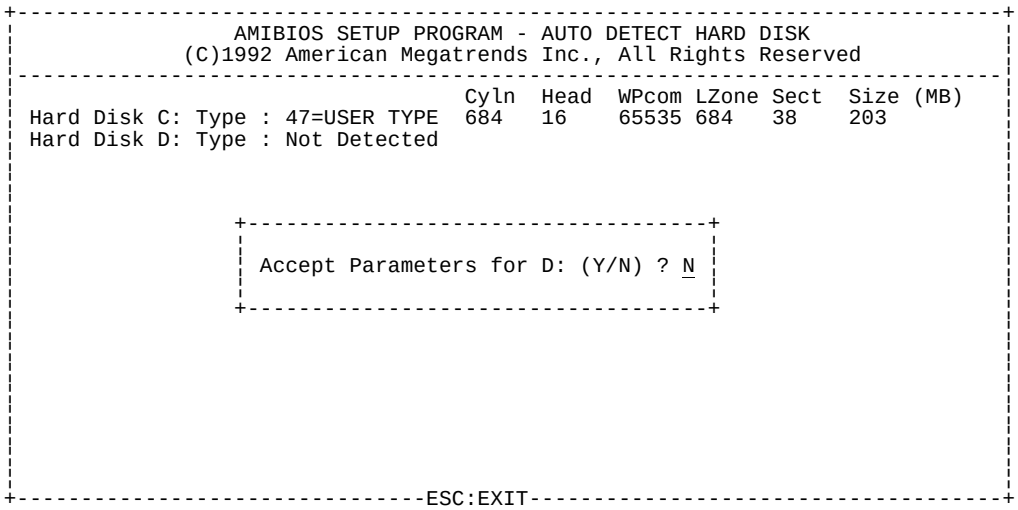
Entry	Function /Meaning	note
Middle BIOS.	*enable/disable mirroring of system BIOS at E000h-EFFFh*	*1)*
Slow CPU Speed Emulation	*without function on the superMOPSpro*	
I/O AddressDecode	*sets the speed at which a keystroke is repeated*	

notes: 1) should be left to disabled

Menu Item 4

"Auto Configuration with BIOS Defaults" will load default values from the ROM table. This is allways a very save configuration and may help with some BIOS problems.

Menu Item 5



This menu item allows an autodetection of most hard disk types, however some older disks don't support autodetection and have to be configured manually in menu item 1.
Autodetection won't configure the optional onboard silicon disk, this drive has to be configured in the extension setup described later in this manual.

Menu Item 6

"Hard Disk Utility" will only be described in a short way, because this menu item is only useful with old hard disk types. This feature makes a low level format and is not needed with today's hard disks. **JUMP*tec*** gives the advice not to use this item except you're sure about the consequences.

Menu Item 7

"Write To CMOS And Exit" leaves the AMIBIOS-SETUP and saves the actual settings in the flash EPROM.

Menu Item 8

"Do Not Write To CMOS And Exit" leaves the AMIBIOS-SETUP without saving the actual settings. Old settings will stay active.

Description of *super*MOPS*pro* Extended Setup

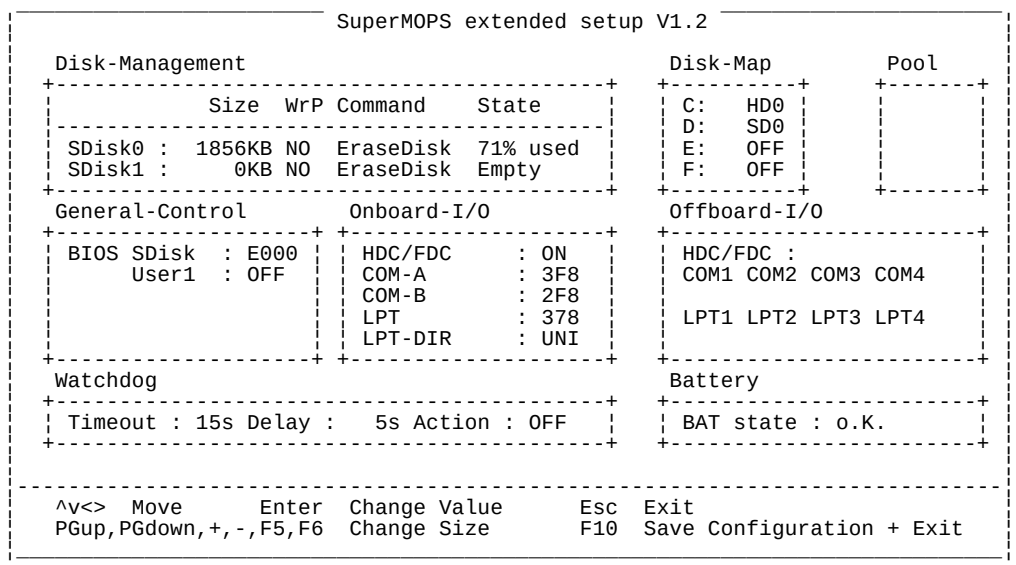
Supported functions

- ❑ Disk-management and disk-map of solid state disk
- ❑ Setup of onboard super-I/O-chip
- ❑ Setup of watchdog feature
- ❑ Battery voltage state
- ❑ Setup of extension- and user-BIOS

Entering and Configuering *super*MOPS*pro* Setup

During boot up immediately after checking the Solid State Disk the message "SuperMOPS Pro-Setup" appears for 0,5s . While this moment the extended setup can be entered by pressing the buttons <ALT><F1> simultaneously**.**

After entering Setup the following or similar screen will be displayed:



This screen shows several windows, five single framed and three double framed. Values in single framed windows can be changed, while double framed windows only give information. Changeable values can be selected with<F5>, <F6>, <↑>,<↓>**.** To save and exit press <F10>, to exit without saving press <ESC>.

Disk-Management

This window gives the user the possibility to configure the optional silicon disk. If your *superMOPSpro* is equipped with a silicon disk (sometimes called flash disk or solid state disk SSD) you'll find the last configuration of this disk here. The silicon disk may be splitted in two disks called SDisk0 and SDisk1, with some additional information displayed.

Item	Function
Size	Shows and allows to enter the capacity of the SDisks. The flash memory module size may be splitted in two disks by 64KB steps. Note, that the usable size of the plugged in flash module is decreased by 192KB, which means of for example 2MB = 2048KB only 1856KB can be used. It is only possible to change the sizes of the silicon disks, when they are physically deleted.
WrP	Enables or disables software-depending-write protect, which means that BIOS function INT13, AH=3 (Write sectors) will be suppressed.
Command	Using this item will physically delete all data on the chosen Sdisk. All files and data will be lost.
State	If the SDisk contains no data state shows "Empty" .If any data has been written to the SDisk, this value describes the used space on it in percent. A SDisk that has allready a partition (e.g. made with FDISK.EXE) will show state "2% used".

Disk-Map

In the "Disk-Map" - window hard disks and SDisks can be associated to a drive specifier. The available drives, which are not yet associated can be found in the "Pool"-window. Note, that all disks appearing in the "Pool"-window can't be accessed until they are linked to a drive specifier.

If you are using hard disk drives you nevertheless have to configure them in the CMOS setup as drives C: and D: first. The extension BIOS adds them and the SDisks to the Pool window . The "Disk-Map" makes a remap of the hard disks configured in the CMOS setup and the available SDisks.

Pool

This window shows all drives, which aren't associated yet. (Exception: Value "OFF").

General-Control

The Extension-BIOS (32KB) which handles the SDisks and holds this setup menu too, is loaded by default in memory segment E000-, just as the User1 BIOS (32KB if present) will be loaded in memory segment E800. The Extension-BIOS shadows both to the memory segment entered at this position. Possible addresses are B000, B800, C000, C800, D000, D800, E000 and E800.

The User1 BIOS should only be activated, if there is a User BIOS available in the system. This will only be the case if a customer of **JUMP*tec*** is using a special BIOS version with an allready implemented BIOS code. Extension BIOS and User BIOS addresses have to be different.

If you are using expanded memory managers like EMM386, QEMM, etc. refer to the chapter "Memory and I/O information" to avoid malfunction.

Onboard-I/O

This window allows to configure the onboard I/O components. Hard disk, floppy interface, serial- and parallel ports can be activated or turned off. Addresses of serial ports COM-A/COM-B and parallel port LPT can be chosen. LPT can be used as uni- and bidirectional port.

Item	Function
HDC/FDC	Switches hard disk and floppy controller to on/off
COM-A	assignes a port to first serial or turns it off
COM-B	assignes a port to second serial or turns it off
LPT	assignes a port to parallel or turns it off
LPT-DIR	chooses parallel direction uni- or bi-directional

Port	Possible Addresses
COM :	3F8, 3E8, 338, 2E8, 2E0, 238, 228, 220
LPT :	3BC, 378,278

Offboard-I/O

To prevent address conflicts with any other I/O ports in the system (if present), addresses of all offboard I/O ports will be shown.

Watchdog

The watchdog is a useful supervising feature, which allows the user to check, whether his software is still running correctly. The watchdog will be active after "Delay" time and cause an "Action" after "Timeout" is elapsed. If you have enabled the watchdog feature by setting "Action" e.g. to RESET, you have to make sure, that the watchdog is triggered within the duration of "Timeout", otherwise your system will reboot after "Timeout" is elapsed. The watchdog feature can also be controlled out of a user's software (refer to the chapter "Watchdog User Interface").

Item	Function
Timeout	Duration, within user has to trigger the Watchdog using INT15h, AX=E001.
Delay	Capability of entering a delay for watchdog. After delay time is elapsed, the timeout starts counting.
Action	If "Timeout" has elapsed, the entered "Action" will be caused (RESET or IOCHK). RESET will pull down the POWERGOOD signal and cause the system to reboot. IOCHK pulls down the /IOCHCHK signal line for about 2 µs and causes a NMI to the processor. If turned to "OFF", watchdog will be inactive.

Battery

Shows the state of the battery voltage. If no battery is connected to the system or battery voltage (VBAT) falls below 2,6V a blinking "LOW" appears. If battery voltage is higher then threshold, "O.K": is indicated.

Up-/Downgrading a SDisk DIMM Module

If you want to change the SDisk DIMM module configuration for upgrade or downgrade reasons the new configuration has to be "recognized" and initialized by the *super*MOPS*pro*.

If you make a upgrade or downgrade of the SDisk, you have to note, that all your data stored on the old configuration is not accessable anymore, because the new configuration must be initialized and formated afterwards.

For upgrade or downgrade execute the following steps:

1 Power up your system with the old SDisk configuration and enter the extension BIOS setup mask with <ALT> + <F1>.

2 Write down the current settings of the following items for the extension BIOS on a piece of paper
.

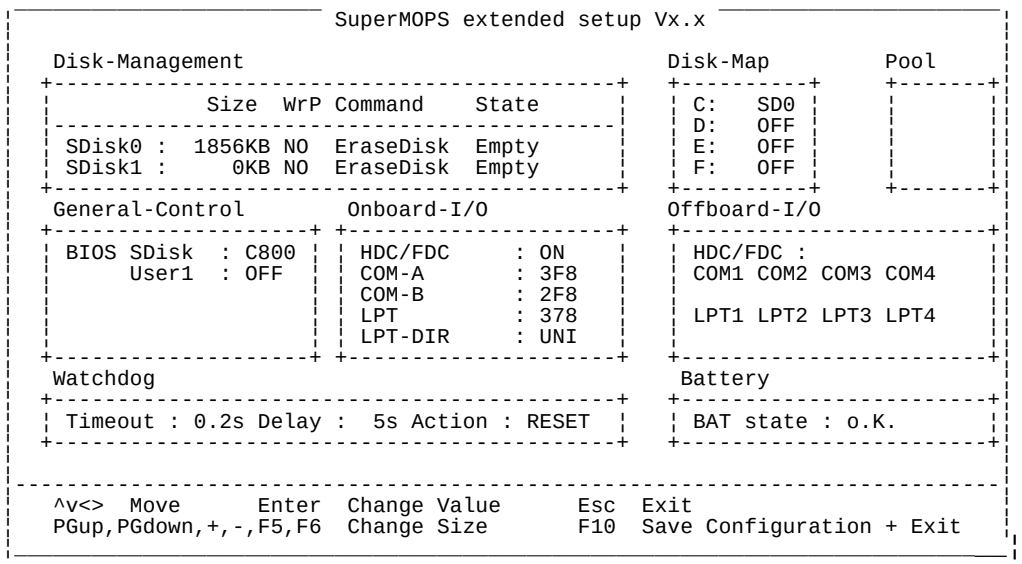
Disk-Map, General-Control, Watchdog.

3 Leave the extension BIOS with <ESC> key and switch the power off.

4 Plug your new SDisk configuration into the corresponding socket and switch power on.

5 While the message "*SuperMOPSpro Setup"* is displayed, press the <INS> key. This will cause the extended BIOS to check the installed SDisk in your system and set the other configuration to defined values.

6 The extension BIOS setup mask will be displayed.
Note, that the standard BIOS values are now inserted. The screen should look like this:



7 Change the settings to your original values you wrote down under 2), especially the settings for *BIOS SDisk* and *Watchdog Action*!

8 Press <F10> to save the settings, the system should reboot.

9 Now you have to make a new partition on the SDisk. Use the available partitioning program of your operating system (e.g. FDISK for DOS)

10 The last step to do is formating your Sdisk with the corresponding utility of your operating system (e.g. FORMAT for DOS)

Restrictions of SDisk Usage

The optional SDisk won't work under any protected mode operating system, like WINDOWS 3.1, WINDOWS FOR WORKGROUPS 3.11, WINDOWS NT, OS/2 etc. The reason for this restriction is the onboard PIC-controller placed between keyboard and keyboard controller. One of the PIC´s purposes is controlling the SDisk access. The above mentioned operating systems emulate the keyboard and therefore suppress most kind of SDisk accesses.

Watchdog User Interface

The watchdog user interface is implemented in the SDisk BIOS and will only be active when the "BIOS SDisk" option in the extended setup is set to a BIOS location. If this Option is set to OFF the watchdog can not be accessed via the user interface.

The watchdog can either be handled via the extension setup (described above) or by the user's own software. There are two functions available for the programmer. One is the initialization the other the triggering of the internal *super*MOPS*pro* watchdog, with both functions handled by the software interrupt 15hex.

Watchdog Control Functions

Watchdog Init	Int 15h	
Input:	AX = E000h	BX = 0h to 0FFFFh Timeout in 0,2s steps 0 = watchdog off
	CX = 0h to 07FFFh Delay in 0,2s steps	DX = 0h or 1h Event: 0 for RESET 1 for IOCHK

Watchdog Trigger	Int 15h	
Input:	AX = E001h	

Programming Example

```
Start:    MOV AX,0E000h    set watchdog
          MOV BX,96h       150 * 0.2s = 30s timeout
          MOV CX,32h       50 * 0.2s = 10s delay
          MOV DX,0h        RESET as event
          INT 15h

Trigger:  MOV AX,0E001h    trigger watchdog
          INT 15h
```

The part of the programming example marked with "start" has to be executed once to initialize the watchdog, while the "trigger" part has to be run cyclic at least once before timeout is elapsed.

Peripheral Interfaces

DC Power Connector (X3)

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

Power Pins

The *super*MOPS*pro* 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 *super*MOPS*pro* 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 then 2A shouldn't be served over the power connector only. Systems consuming more then 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.

Keyboard, Reset, Battery, Speaker (X9)

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)

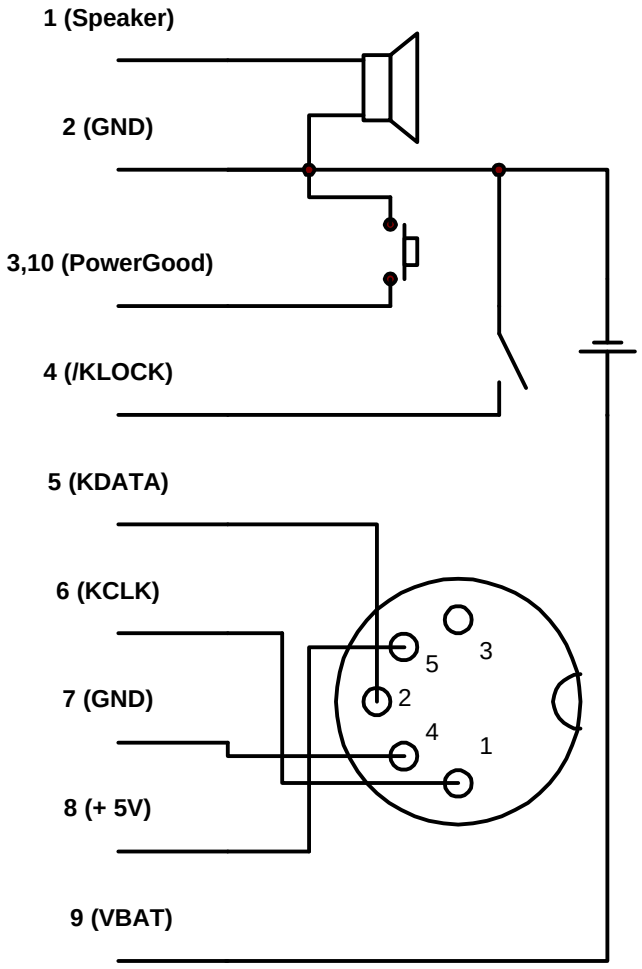
bi-directional I/O pin on CPU modules
Keyboard data signal.

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.



Parallel Port (X6)

Pin	Signal name	Function	In / Out	DSUB25
1	/STB	data valid	out	1
2	/AFD	after CR LF	out	14
3	PD0	data bit 0	I/O	2
4	/ERR	error	in	15
5	PD1	data bit 1	I/O	3
6	/INIT	initialization	out	16
7	PD2	data bit 2	I/O	4
8	/SLIN	select in	out	17
9	PD3	data bit 3	I/O	5
10,12	GND	signal ground	--	18 - 25
11	PD4	data bit 4	I/O	6
13	PD5	data bit 5	I/O	7
14,16	GND	signal ground	--	18 - 25
15	PD6	data bit 6	I/O	8
17	PD7	data bit 7	I/O	9
18,20	GND	signal ground	--	18 - 25
19	/ACK	acknowledge	in	10
21	BUSY	printer busy	in	11
22,24	GND	signal ground	--	18 - 25
23	PE	no paper	in	12
25	SLCT	selected	in	13
26	VCC	+ 5 V	--	NC

The centronics printer interface on the *super*MOPSpro can be programmed by the extended setup. The user can define the base I/O-addresses 378h, 3BCh, 278h or disable the interface. The parallel port is completely compatible with the parallel port implementation used in the IBM PS-II-parallel adapter.

Register-description

offset	read	write
0h	centronics-port	centronics-port
1h	status-register	not used
2h	control-register	control-register
3h	not used	not used

Since the parallel port is bidirectional (set by an special bit in the control-register), the centronics-port allows the microprocessor to read the information on the parallel bus. The status register allows the microprocessor to read the status of the printer in the five most significant bits. The status bits are Printer Busy (BUSY), Acknowledge (ACK) which is a handshake function, Paper Out (PE), Printer Selected (SLCT), and Error (ERR). The control register (xxAh) is a read/write register. The control bits are found in the six least significant bits of this register. They are Interrupt Enable (IRQ ENB), Select In (SLIN), Initialize the Printer (INIT), Autofeed the Paper (AFD), Strobe (STB) and Direction (DIR), which informs the printer of the presence of valid data on the parallel bus.

register	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
centronics-Port	PD7	PD6	PD5	PD4	PD3	PD2	PD1	PD0
status-register	BUSY	ACK	PE	SLCT	ERR	1	1	1
control-register	1	1	DIR	IRQ ENB	SLIN	INIT	AFD	STB

Serial Ports (X7,X8)

Serial Port COM A (X8)

Pin	Signal name	Function	In / Out	DSUB25	DSUB9
1	RLSD1	data carrier detect	In	8	1
2	DSR1	data set ready	In	6	6
3	SIN1	receive data	In	3	2
4	RTS1	request to send	Out	4	7
5	SOUT1	transmit data	Out	2	3
6	CTS1	clear to send	In	5	8
7	DTR1	data terminal ready	Out	20	4
8	RI1	ring indicator	In	22	9
9	GND	signal ground	--	7	5
10	VCC	+5V	--	--	--

Serial Port COM B (X7)

Pin	Signal name	Function	In/Out	DSUB25	DSUB9
1	RLSD2	data carrier detect	In	8	1
2	DSR2	data set ready	In	6	6
3	SIN2	receive data	In	3	2
4	RTS2	request to send	Out	4	7
5	SOUT2	transmit data	Out	2	3
6	CTS2	clear to send	In	5	8
7	DTR2	data terminal ready	Out	20	4
8	RI2	ring indicator	In	22	9
9	GND	signal ground	--	7	5
10	VCC	+5V	--	--	--

The two serial input/output interfaces can be programmed at the base I/O-addresses 3F8h - 2F8h, 3E8h - 2E8h, 238h - 338h, 220h - 228h or switched to disabled. The serial ports are completely compatible with the serial port implementation used on the IBM serial adapter. All the base I/O-addresses are changeable in the *superMOPSpro* extended setup.

Register Description

offset	read	write
0h	TX buffer / divisor latch LSB(*)	RX buffer / divisor latch LSB(*)
1h	interrupt-enable-register / divisor latch MSB(*)	interrupt-enable-register / divisor latch MSB(*)
2h	interrupt-ID-register	FIFO control register
3h	line control register	line control register
4h	modem control register	modem control register
5h	line status register	line status register
6h	modem status register	modem status register
7h	Scratch register	Scratch register

(*) If bit7 of the line control registers is 1

If the line control register bit7 is 0, data will be written to the TX- buffer. A read command from this port transfers data from RX-buffer.
If the line control register bit7 is 1, the divisor latch enabled on I/O- address x0 for LSB and x1 for MSB.

Baudrate Table

baud rate	baud rate-latch MSB	baud rate-latch LSB
50	9	0
75	6	0
150	3	0
300	1	80
600	0	C0
1200	0	60
2400	0	30
4800	0	18
9600	0	0C
19200	0	6
115200	0	1

Line Control Register

The line control register has two functions, if bit 7 = 0 the least significant seven bits used to control the format of the data character. The contents are word length, stop bits, parity and break. If bit 7 = 1 it's possible to setup the baud rate in register x0 and x1

bit number									
7	6	5	4	3	2	1	0	function	possible value
X								divisor-latch-bit	1 = baud rate-register
	X							break-control	1 = break enable 0 = break disable
		X						parity	1 = parity on
			X					parity type	0 = odd, 1 = even
				X				stick parity	0 = disabled, 1 = enabled
					X			stop-bits	0 = 1 stop bit 1 = 1,5 (if bit0,1=0) o. 2
						X	X	word length	00 = 5 bit 01 = 6 bit 10 = 7 bit 11 = 8 bit

After reset all bits are zero.

Line Status Register

The line-status register is used to control the state of the transmit /receive - register and the received data.

bit number									
7	6	5	4	3	2	1	0	function	possible value
X								-	
	X							transmitter empty	1 = empty, 0 = not empty
		X						TX-hold-reg. empty	1 = empty, 0 = not empty
			X					break-interrupt	1 = break, 0 = no break
				X				framing - error	1 = framing - error
					X			parity - error	1 = parity - error
						X		overrun - error	1 = overrun - error
							X	data ready	1 = ready

After reset the register value is 60h.

Scratch Register

The Scratch register is an 8-bit read/write register that has no effect on any channel in the I/O controller. It is intended as a scratchpad register used by the programmer to hold data temporarily.

Modem Control Register

The modem control register is used to control the interface with the modem or data set.

bit number									
7	6	5	4	3	2	1	0	function	possible value
X	X	X						-	
			X					loop-testmode	0 = loop off, 1 = loop on
				X				interrupt enable	0 = disabled, 1 = enabled
					X			-	
						X		RTS-output	0 = low, 1 = high
							X	DTR-output	0 = low, 1 = high

After reset all bits are zero.

Modem Status Register

The modem-status register is used to control the state and the change of the modem input lines.

bit number									
7	6	5	4	3	2	1	0	function	possible value
X								RLSD complement	0/1
	X							RI complement	0/1
		X						DSR complement	0/1
			X					CTS complement	0/1
				X				delta RLSD	1 = changed
					X			TERI	1 = RI changed to off
						X		delta DSR	1 = changed
							X	delta CTS	1 = changed

After reset the four least significant bits are 0, the most significant bits have the state of their correspondended pin.

Interrupt ID Register

The interrupt-ID-register is used to identify communication interrupts.

bit number									
7	6	5	4	3	2	1	0	function	possible value
X	X	X	X	X				-	
					X	X		interrupt-ID	1 = modem-status 1 = TX hold register empty 1 = receive data ready 1 = RX-line status
							X	interrupt pending	1 = interrupt pending 0 = no interrupt pending

After reset the value of the register is 01h.

Interrupt Enable Register

The interrupt-enable-registers are used to enable independently the four serial channel interrupts which activates the interrupt output. To enable the interrupt output, bit3 of the modem-control-register must be set. If bit7 of the line-control-register is set, the MSB of the baud rate-register is enabled instead of the interrupt-enable-register .

bit number									
7	6	5	4	3	2	1	0	function	possible value
X	X	X	X					-	
				X				modem status	1 = interrupt enabled
					X			receiver-line status	1 = interrupt enabled
						X		TX-hold-reg. empty	1 = interrupt enabled
							X	data ready	1 = interrupt enabled

After reset all bits are zero.

FIFO Control Register

The FIFO control register is a write only register at the same location as the interrupt ID register. This register is used to enable and clear the FIFOs, set the receiver FIFO trigger level.

bit number									
7	6	5	4	3	2	1	0	function	possible value
X	X							trigger level of the receiver FIFO	00 = 1 byte 01 = 4 bytes 10 = 8 bytes 11 = 14 bytes
		X	X	X				-	-
					X			clear transmit FIFO	1 = clear
						X		clear receive FIFO	1 = clear
							X	enable disable FIFOs	1 = eanable FIFOs 0 = disable FIFOs

If bit 0 = 0 clears all bytes in the transmit and receive FIFO, it must be 1 to write to other bits in this register. Bits 1 and 2 are self-clearing.

Floppy Connector (X4)

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

IDE Connector for 2,5" Hard Disk (X10)

Pin	Signal	Function	Pin	Signal	Function
1	/RESET	reset	2	GND	ground
3	D7	data 7	4	D8	data 8
5	D6	data 6	6	D9	data 9
7	D5	data 5	8	D10	data 10
9	D4	data 4	10	D11	data 11
11	D3	data 3	12	D12	data 12
13	D2	data 2	14	D13	data 13
15	D1	data 1	16	D14	data 14
17	D0	data 0	18	D15	data 15
19	GND	ground	20	NC	keypin
21	NC		22	GND	ground
23	/IOW	I/O write	24	GND	ground
25	/IOR	I/O read	26	GND	ground
27	NC		28	BALE	reserved
29	NC		30	GND	ground
31	IRQ14	interrupt 14	32	/IOCS16	I/O CS 16
33	SA1	address 1	34	NC	
35	SA 0	address 0	36	SA2	address 2
37	/CS0	IDE CS 0	38	/CS1	IDE CS 1
39	/HDLED	active	40	GND	ground
41	VCC	+5V (Logic)	42	VCC	+5V (Motor)
43	GND	ground	44	NC	

Feature Connector (X5)

Pin	Signals	Function	Pin	Signals	Function
1	ISPDEV	reserved	2	RAMWI	reserved
3	/HDLED	HD active	4	VCC	+ 5V
5	MDATA	PS2 mouse data	6	VCC	+ 5V
7	MCLK	PS2 mouse clock	8	GND	ground
9	/RLSDB	RS485 DCD	10	/DSRB	RS485 DSR
11	SINB	RS485 RXD	12	/RTSB	RS485 RTS
13	SOUTB	RS485 TXD	14	/CTSB	RS485 CTS
15	/DTRB	RS485 DTR	16	/RIB	RS485 RI
17	GND	ground	18	LKLED	Link LED
19	/EN	enable RS485	20	VCC	+ 5V
21	I2DAT	I2C bus data	22	VCC	+ 5V
23	I2CLK	I2C bus clock	24	GND	ground
25	PowerGood	reset	26	LNLED	Line LED

ISPDEV, RAMWI

Signals, which are used during manufacturing **do not use !**

/HDLED

Signal, which indicates access to HDD

MDATA, MCLK

Signals for connecting PS2-Mouse.
Note, that PS2-Mouse support is not enabled by the BIOS.

/RLSDB, /DSRB, SINB, /RTSB, SOUTB, /CTSB, /CTRB, /RIB

These signals based on TTL-Level and corresponds with the V24-level signals of serial port 2. They are used to provide IRDA or RS485 support.
Attention: It is necessary to disable the V24-driver of serial port 2 if any of that signals are used.

/EN

A low-level on Signal /EN disables the V24-driver of serial port 2.

POWERGOOD

When POWERGOOD goes high, it starts the reset generator on a CPU module to pull the onboard reset high after a valid reset period. This pin can also be used as a low active hardware reset for modules.

I2DAT, I2CLK

output on I^2C-bus devices
see I^2C-bus chapter for more detailed information

LNLED

Active-low output indicating transmission or reception of frames or detection of a collision. May be connected to external LED.

LKLED

Active-low output indicating valid 10BASE-T link pulses. May be connected to external LED.

Ethernet Connector (X11)

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	NC	unused Pin	
8	NC	unused Pin	

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.

RS485 Option

The TTL-Signals of COM 2 are available on the feature connector X5. Therefore it is optionally possible to connect an RS485 Converter to X5. Before these signals can be used, the COM2 V24 drivers must be disabled by pulling the /EN signal low.

IRDA interface

Alternatively an IRDA-transceiver can be connected to the TTL signals of COM2 at connector X5 to allow for bidirectional wireless data transfer at speeds up to 115 kbaud. (No BIOS- or software support is provided for this feature.).

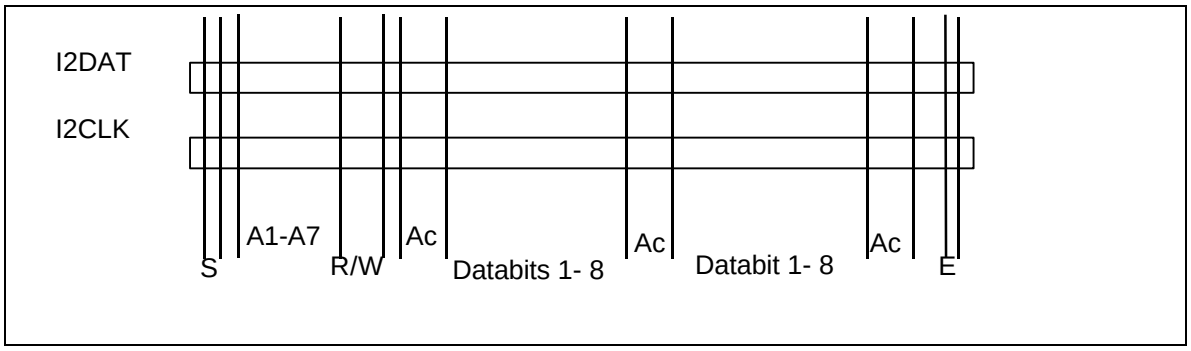
NOTE: IRDA (named after the standardizing group "InfraRed Data Association") defines a standard for High Speed infrared data transfer (over distances of about 1 metre). It is supported by many suppliers at chip, module or device level.

I^2C-Bus

Introduction to I^2C-Bus

The inter-IC bus (I^2C) is a two-wired serial bus and provides a sort of small area network between the circuits of one system and between different systems. Any device with build-in I^2C bus interface can be connected to the system by simply clipping it to the I^2C bus. It consists of two bidirectional lines for serial data (I2DAT) and serial clock (I2CLK). Every device connected can be master or slave, so there is no central master. A device addressed as a slave during one data transfer could possibly be the master for the next data transfer. Devices are also free to transmit or receive data during a transfer. The inherent synchronization process in connection with the wired AND technique allows fast devices to communicate with slower ones.

For each data bit transferred, one clock pulse has to be generated. The data on the I2DAT line must be stable during the high period of the clock. The data lines state can only change during I2CLK line is low. Data transfer is entered by a start- and ended by a stop-condition. A high to low transition of the I2DAT line while the I2CLK is high signals the start condition and a low to high transition while I2CLK is high indicates the stop condition. Data transfer follows the format below:



After the start condition (S) the slave address byte is sent. This byte consists of seven address bits (A1-A7) and one direction bit (R/W) with low level indicating a transmission (WRITE) and high level indicating a request for data (READ).

After the addressing of a slave device the masters next clock pulse is used for acknowledgment (Ac). During this acknowledge pulse the I2DAT line has to be pulled down to low by the receiving device. A data transfer is always terminated by a stop condition (E) generated by the master. However, if the master wants to communicate with another device on the bus, it generates another start condition to address another slave without the necessity of first generating a stop condition.

This was only a short summary concerning the I^2C bus. For detailed information (e.g. timing problems, characteristics of devices) join I^2C bus specifications, data books and specialized textbooks.

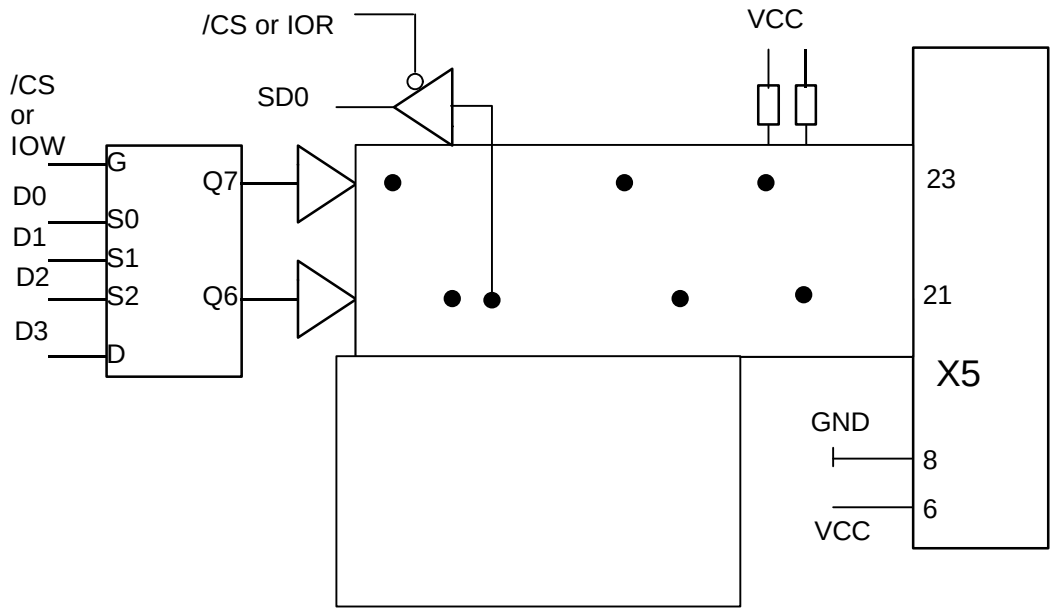
I²C Bus on JUMP*tec* Boards

The I²C bus interface on **JUMP*tec*** boards has to be realized by the customer via software which drives the two lines I2DAT and I2CLK following the I²C bus specifications. The basic hardware to design the software interface is standard on this device. This kind of interface does not support external masters.

On different kinds of **JUMP*tec*** boards the two I²C bus lines are not offered on identical connectors. Join your manual, if you're not sure using the right connector or pins for your I²C application.

The following drawing show the bus interface and the onboard devices connected to the I²C bus on the **JUMP*tec*** boards.

I²C Bus on *super*MOPS/486DX-1 and *super*MOPS/586DX-1



I/O address to generate /CS : 50h

Device address of EEPROM : 1010000
Device address of PIC16C84 : 1011000

<u>Attention:</u> These devices are for BIOS-access only, reading from or writing to them may cause data corruption and system failure.

Example: Guess you're writing a software utility and want the I2DAT line to be pulled HIGH. You have to use I/O-port 50h and set the data lines D0 to D3, with D3=1 holding the output level for I2DAT and D2 to D0=110 choosing the right output line Q6.

The corresponding OUT instruction would be : OUT 50h,0Eh

Several OUTs and INs will be necessary to address one I²C bus device and write or read a byte, because the start and stop conditions and every single bit have to be set separately as well as the I2CLK line.

The JIDA (JUMP*tec* Intelligent Device Architecture) Standard

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 procedrue 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 systen 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, alway 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.

et Manufacturer ID	Int 15h
Input:	AX = EA00h DX = 4648h CL = Board number (1=first board a.s.o.) ES:BX = Pointer to destination data area
Output:	CL=0: Board present DX=6B6Fh: Function successful CL≠0: Board not present 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 DX = 4648h CL = Board number ES:BX = Pointer to destination data area
Output:	CL=0: Board present DX=6B6Fh: Function successful CL≠0: Board not present 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 "SMOPSP ". 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 DX = 4648h CL = Board number
Output:	CL=0: Board present DX=6B6Fh: Function successful CL≠0: Board not present DX≠6B6Fh: Fn.not implemented BX = Manufacturing date
Description	If CL=0 and DX=6B6Fh, then BX=Manufacturing date. Date format is the same as used for DOS files: Bit0..4: Day Bit5..8: Month Bit9..15: Years since 1980

Get Serial Number	Int 15h
Input:	AX = EA03h DX = 4648h CL = Board number ES:BX = Pointer to destination data area
Output:	CL=0: Board present DX=6B6Fh: Function successful CL≠0: Board not present DX≠6B6Fh: Fn.not implemented
Description:	If CL=0 and DX=6B6Fh, then 10 Byte serial number were copied to area pointed to by ES:BX The result is different for each single *super*MOPS*pro*. Note: There is no ending zero byte.

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:	If CL=0 and DX=6B6Fh, then BX=Last repair date. For date format see function "Get Manufacturing Date". If board was never repaired, result will be equal to manufacturing date.	

Read Running Time Meter	Int 15h	(not implemented with MULTI-4)
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	(not implemented with MULTI-4)
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 Contrast setting	Int 15h	
Input:	AX = EA20h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present CH = Actual contrast value (range 0..63)	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented

not supported on *super*MOPS*pro*

Set Contrast	Int 15h	
Input:	AX = EA21h	DX = 4648h
	CL = Board number	
	CH = New contrast value	
Output:	CL=0: Board present	DX=6B6Fh: Function successful
	CL≠0: Board not present	DX≠6B6Fh: Fn.not implemented
Description:	Valid range for contrast is 0..63. Other values will be ignored.	

not supported on *super*MOPS*pro*

Disable DC/DC Converter	Int 15h	
Input:	AX = EA22h	DX = 4648h
	CL = Board number	
Output:	CL=0: Board present	DX=6B6Fh: Function successful
	CL≠0: Board not present	DX≠6B6Fh: Fn.not implemented

not supported on *super*MOPS*pro*

Enable DC/DC Converter	Int 15h	
Input:	AX = EA23h	DX = 4648h
	CL = Board number	
Output:	CL=0: Board present	DX=6B6Fh: Function successful
	CL≠0: Board not present	DX≠6B6Fh: Fn.not implemented

not supported on *super*MOPS*pro*

Get Matrix Translation Table	Int 15h	
Input:	AX = EA30h	DX = 4648h
	CL = Board number	
	ES:BX = Pointer to destination data area	
Output:	CL=0: Board present	DX=6B6Fh: Function successful
	CL≠0: Board not present	DX≠6B6Fh: Fn.not implemented
Description:	72 Byte matrix keyboard translation table will be copied to area pointed to by ES:BX	

not supported on *super*MOPS*pro*

Set Matrix Translation Table	Int 15h	
Input:	AX = EA31h	DX = 4648h
	CL = Board number	
	ES:BX = Pointer to new translation table	
Output:	CL=0: Board present	DX=6B6Fh: Function successful
	CL≠0: Board not present	DX≠6B6Fh: Fn.not implemented
Description:	New matrix keyboard translation table will be copied from area pointed to by ES:BX	

not supported on *super*MOPS*pro*

Get Matrix Translation Entry	Int 15h		
Input:	AX	= EA32h	DX = 4648h
	CL	= Board number	
	BH	= Matrix line (0..7 allowed)	
	BL	= Matrix row (0..8 allowed)	
Output:	CL=0: Board present		DX=6B6Fh: Function successful
	CL≠0: Board not present		DX≠6B6Fh: Fn.not implemented
	CH = Table entry (undefined if BH or BL are invalid)		

not supported on *super*MOPS*pro*

Set Matrix Translation Entry	Int 15h		
Input:	AX	= EA33h	DX = 4648h
	CL	= Board number	
	BH	= Matrix line (0..7 allowed)	
	BL	= Matrix row (0..8 allowed)	
	CH	= New Entry	
Output:	CL=0: Board present		DX=6B6Fh: Function successful
	CL≠0: Board not present		DX≠6B6Fh: Fn.not implemented

not supported on *super*MOPS*pro*

Read User Byte from EEPROM	Int 15h		
Input:	AX	= EA40h	DX = 4648h
	CL	= Board number	
	BH	= Number of byte to read (0..15 allowed)	
Output:	CL=0: Board present		DX=6B6Fh: Function successful
	CL≠0: Board not present		DX≠6B6Fh: Fn.not implemented
	BL = Value read		

Write User Byte to EEPROM	Int 15h		
Input:	AX	= EA41h	DX = 4648h
	CL	= Board number	
	BH	= Number of byte to write (0..15 allowed)	
	BL	= Value to write	
Output:	CL=0: Board present		DX=6B6Fh: Function successful
	CL≠0: Board not present		DX≠6B6Fh: Fn.not implemented

Read OC Output State	Int 15h	
Input:	AX = EA50h CL = Board number	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present CH = Actual output state	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Description:	Data format: CH = xxxxxxba, where b = OC1, a = OC0	

Switch OC Outputs	Int 15h	
Input:	AX = EA51h CL = Board number CH = New output state	DX = 4648h
Output:	CL=0: Board present CL≠0: Board not present	DX=6B6Fh: Function successful DX≠6B6Fh: Fn.not implemented
Description:	Data format: CH = xxxxxxba, where b = OC1, a = OC0	

Network Operation

Overview

The Crystal LAN(tm) CS8900 ISA Ethernet Adapter from Crystal Semiconductor follows IEEE 802.3 standards and support half- or full-duplex operation in ISA bus computers on 10 Mbps Ethernet networks. The adapter is designed for operation in 16-bit ISA or EISA bus expansion slots and is available in 10BaseT-only or 3-media configurations (10BaseT, 10Base2, and AUI for 10Base-5 or fibre networks).

SYSTEM REQUIREMENTS

The following hardware is required:

- Crystal LAN(tm) CS8900 ISA Ethernet Adapter
- IBM or IBM-compatible PC with:
- An 80386 or higher processor
- 16 bytes of contiguous I/O space between 210h - 370h
- One available IRQ (5,10,11,or 12 for the CS8900)
- Appropriate cable with 8-positions RJ45 connector (connector for AUI, 10BASE-2) for your network topology.

The following software is required:

- CS8900 Setup and Device Driver Software diskette.
- Installation diskettes or CD-ROM for your client and/or network operating system.

FILES ON THE SETUP AND DEVICE DRIVER DISK

```
\
|
|  SETUP.EXE ..............  CS89XX Setup and Diagnostic Utility
|  README.EXE .............  This application
|  DISK1 ..................          Installation file
|  OEMSETUP.INF ...........  Driver installation file for WFWG
|  OEMSETNT.INF ...........  Driver installation file for Win NT
|  NETCSC.INF .............  Driver installation file for WIN 95
|  ENDS3ISA.VXD ...........  NDIS 3.0 driver (Windows 95)
|  ENDS3ISA.SYS ...........  NDIS 3.0 driver (Windows NT)
|  ENDS3ISA.386 ...........  NDIS 3.0 driver (Win for Workgroups)
|  !CS89XX.CFG ............  EISA configuration file
|
+--DMI
|   CS89DMI.MIF ..........  CS89XX MIF file
|   CS89DMI.DLL ..........  DMI Component Interface for OS/2
|   CS89DMI.OVL ..........  DMI Component Interface for DOS
|
+--BOOTPROM
|   RBOOT.ROM ............  BootPROM image for RIPL
|
+--MSLANMAN.DOS
|  +-DRIVERS
|     +-ETHERNET
|     |  +-ENDS2ISA
|     |     ENDS2ISA.DOS ..  NDIS 2.0.1 DOS driver
|     |     PROTOCOL.INI ..  Sample PROTOCOL.INI file
|     |
|     +-NIF
|        ENDS2ISA.NIF ....  Used by LAN Manager setup utility
|
+--MSLANMAN.OS2
|  +-DRIVERS
|     +-ETHERNET
|     |  +-ENDS2ISA
|     |     ENDS2ISA.OS2 ..  NDIS 2.0.1 OS/2 driver
|     |     PROTOCOL.INI ..  Sample PROTOCOL.INI file
|     |
|     +-NIF
|        ENDS2ISA.NIF ....  Used by LAN Manager setup utility
|
+--NETWARE
|   EODIISA.COM ..........  Netware 3.12, 4.X server driver
|   EODIISA.LDI ..........  Server driver installation file
|
+--DOS
|   ENDS2ISA.DOS .........  NDIS 2.0.1 DOS driver
|   ENDS2ISA.NIF .........  NDIS 2.0.1 installation file
|   PROTOCOL.INI .........  NDIS 2.0.1 configuration file
|   EODIISA.COM ..........  NetWare ODI DOS client driver
|   EODIISA.INS ..........  NetWare DOS client installation file
|   NET.CFG ..............  NetWare DOS client configuration file
|
+--OS/2
|   ENDS2ISA.OS2 .........  NDIS 2.0.1 OS/2 driver
|   ENDS2ISA.NIF .........  NDIS 2.0.1 installation file
|   PROTOCOL.INI .........  NDIS 2.0.1 configuration file
|   EODIISA.SYS ..........  NetWare OS/2 ODI client driver
|   NDS.MSG ..............  LANTRAN message file
|   NET.CFG ..............  NetWare OS/2 client configuration file
|
+--PCKTDRVR
    EPKTISA.COM ..........  Packet driver for DOS workstations
    SOURCE.ZIP ...........  Source files for packet driver
```

DESKTOP MANAGEMENT INTERFACE (DMI) INTERFACE

DMTF Desktop Management Interface (DMI) support for the CS8900 adapter is provided through the ODI client (DOS and OS/2) and NDIS 2.0.1 (DOS and OS/2) device drivers. The three files required to implement this interface are provided in the \DMI directory of the "CS8900 Setup and Device Driver Software" diskette:

- CS89DMI.MIF -- Management Information Format (MIF) file describing the charctersitics of the CS8900 based adapters.
- CS89DMI.DLL -- Component Interface for the OS/2 operating system (supports both the OS/2 ODI and NDIS 2.0.1 device drivers).
- CS89DMI.OVL -- Component Interface for the DOS operating system (supports both the DOS ODI and NDIS 2.0.1 device drivers).

Installation procedures are specific to a particular management application. Refer to your management application's documentation for the installation of the required DMI support files.

Installation

INSTALLATION OVERVIEW

Perform the following steps to install and configure you CS8900 ISA Ethernet Adapter:

1. Install the adapter in an available ISA or EISA slot. (On JUMP*tec* products the controller is mounted directly on board, therefore this step is not necessary.)
2. Connect your network cable.
3. Configure the adapter. Configuration is not required if installing a CS8900-based adapter and the default configuration is acceptable.
4. Install the device driver and support files.
5. Perform diagnostic tests if needed.

ADAPTER INSTALLATION

- Turn off the computer and remove its cover if necessary
- Connect your network cable. The cable must be connected before loading the driver. If your adapter supports multiple cable types (twisted-pair, thin coax, and AUI connection), connect only one type of cable to the adapter at a time.
- Continue with the section on Adapter Configuration.

CS8900-BASED ADAPTER CONFIGURATION

CS8900-based adapters shipped from Crystal Semiconductor are configured with the following "default" settings:

Operation Mode:	Memory Mode
IRQ:	10
Base I/O Address:	300
Memory Base Address:	D0000
Optimization:	DOS Client
Transmission Mode:	Half-duplex
BootProm:	None
Media Type:	Autodetect (3-media cards) or 10BASE-T (10BASE-T only adapter)

You should only change the default configuration settings if conflicts with another adapter exist. (See the section on resolving I/O-conflicts in Testing and Troubleshooting.) To change the adapter's configuration run the CS8900 SetupUtility after the adapter is installed.

WINDOWS FOR WORKGROUPS - NDIS 3.0 DRIVER INSTALLATION

Use the NDIS 3.0 driver (ENDS3ISA.386) in a Windows for Workgroups Network environment or to connect a Windows for Workgroups client to a Windows NT server.

1) Start Windows. From the Program Manager double click on the "Network" group Icon.

2) Double click on the "Network Setup" icon to start the Network Setup utility.

3) Click on the "Networks" button.

4) Select the "Install Microsoft Windows Network" option and click on the "OK" button.

5) Select the "Drivers..." button at the bottom of the dialog box.

6) From the "Network Drivers" panel select "Add Adapter".

7) Select the "Unlisted or Updated Network Adapter" from the Network Adapters list and click "OK".

8) When prompted, insert the "CS8900 Setup and Device Driver Software" diskette in drive A: and click "OK" to accept the default path (A:\).

9) The next dialog box lists adapter drivers. Select "Crystal (CS8900)" and click "OK".

10) You will be returned to the "Network Drivers" window. Click the "Close" button.

11) On the "Network Setup" panel, click "OK"'.

12) Respond "Yes" to any update messages. Insert the Windows for Workgroups system disk(s) as prompted.

13) When the installation process is complete, exit and restart Windows for Workgroups for the changes to take effect.

WINDOWS FOR WORKGROUPS - DOS ODI CLIENT DRIVER INSTALLATION

Use the DOS ODI driver (EODIISA.COM) to connect a Windows for Workgroups client to a Novell NetWare 3.12 or 4.X server. Perform the installation using Novell's "NetWare Client for DOS/WINDOWS" Installation package.

1) From a DOS prompt start the Novell installation program from the NetWare WSDOS_1 diskette (NetWare Client for DOS/WIN, Disk 1).

2) At the NetWare Client Installation panel set the destination directory to where you want to store your NetWare files. The directory will be created if it does not exist.

3) Make sure you have answered "Yes" to the question about modifying your AUTOEXEC.BAT and CONFIG.SYS files. If you wish to use Windows as a NetWare client answer "Yes" to install support for Windows and specify the path to your Windows directory.

4) Highlight the option to select the driver and press <ENTER>.

5) From the "Network Board" dialog page to the end of the list and select the "Other Drivers" option.

6) Insert the drivers diskette. Press <ENTER> to accept the default path.

7) Choose "Crystal ISA Ethernet Adapter EODIISA" as the driver.

8) When the "Settings" panel is displayed enter selections for the desired Frame Type(s). Valid frame types are:

   Ethernet_802.2 (default)
   Ethernet_802.3
   Ethernet_II
   Ethernet_SNAP

   Up to a maximum of four frame types are supported.

   NOTE: The first frame type you specify must be one used by the IPX protocol on the NetWare server to which you wish to connect. Ethernet_802.2 is the default frame type for NetWare 3.12 and 4.X servers. (Contact your Network Administrator to determine the frame types supported by your server.)

   An optional Node Address can be assigned if desired. Only assign a local Node Address in accordance with IEEE 802.2 specifications. A universally administered address is assigned at the factory and is used by default.

9) Return to the NetWare Client Install panel, select the "Highlight here and press <Enter> to install" option and press <ENTER>.

10) Exchange disks as prompted.

11) When the installation process is complete, reboot the system.

12) The installation process will automatically configure Windows for Workgroups as a NetWare client. Be sure to login to the file server from the DOS prompt each time before you start Windows.

WINDOWS 95 - INSTALLATION FOR CS8900-BASED ADAPTERS

1) Install the adapter and boot Windows 95.

2) If required to log on do so as Administrator or as a user with Administrator's privileges.

3) After Windows 95 has finished booting select the "Start" button on the Task Bar.

4) Select "Settings" and then "Control Panel" from the "Start" menu.

5) Double-click on the "Network" icon in the Control Panel window.

6) Click on the "Add" button.

7) From the "Select Network Component Type" window select "Adapter" and click on the "Add" button.

8) From the "Select Network Adapters" window click the "Have Disk" button.

9) When prompted insert the "CS8900 Setup and Device Driver Software" diskette in drive A:

10) Click on "OK" to accept the default path (A:\) in the "Copy manufacturer's files from:"list box.

11) Select "Crystal LAN(tm) CS8900 Ethernet Adapter" and click on "OK".

12) From the "Network" Control Panel window, select the "Crystal LAN(tm) CS8900 Ethernet Adapter" and click on the "Properties" button.

13) Click on the "Resources" tab. Set the configuration type to "Basic Configuration 0" and set the resources to those you assigned to the adapter during during configuration with the CS8900 Setup Utility. If using the adapter's default configuration, enter:

    I/O address range = 300-30F
    Interrupt (IRQ) = 10
    Memory address = disabled (ignore this setting)

    NOTE: Resources already in use are marked with an asterisk "*". If the adapter's default configuration is in conflict with resources used by other devices in the system, you must exit Windows 95 and run the CS8900 Setup Utility to reconfigure the CS8900 adapter.

14) Click the "OK" button to return to the "Network" Control Panel.

15) Add protocol support as appropriate for your network environment by using the "Add" button and selecting "protocol" as the network component to install.

16) Click the "Network" control panel's "OK" button.

17) Shut down and restart Windows 95 for all changes to take effect.

WINDOWS 95 - ADVANCED CONFIGURATION

This procedure assumes the Crystal LAN CS8900 adpapter and device drivers have been installed as described in ”Installation for CS8900-based Adapter”. If not, do so now.

1) Start Windows 95 and log on as Administrator or as a user with Administrator's privileges.

2) Go to the "Network" control panel window. Select the "Crystal LAN(tm) CS8900 Ethernet Adapter" and click on the "Properties" button.

3) Click on the "Advanced" tab. You will be presented with settings for:

   a) Cable Type
   Select the type of cable you have connected to the adapter. Use the default "Auto Detect" if you want the driver to automatically determine the type of cable connected to the adapter each time the driver loads.

   b) Duplex Mode
   Select the transmission mode you want the adapter to use. It is strongly recommened you use the default "half-duplex" for CS8900-based adapters unless you are sure of the transmission mode capabilities of the network equipment to which you will be connecting.

   WARNING: Setting a transmission mode that is incompatible with the other equipment on your network will prevent the adapter from working properly and can adversely affect your entire network's performance.

   c) LoadWithoutCable
   Specify the driver's behavior when loading without a cable connected to the adapter. The default "No" will cause the driver to report an error and unload if a cable is not connected to the Crystal LAN(tm) adapter. Selecting "Yes" will allow the driver to load without a cable connected.

   NOTE: This setting is ignored if the driver is configured to "Auto Detect" the cable type. You must specify the cable type before the driver will load without a cable.

   d) NetworkAddress
   If you want to override the adapter's assigned Ethernet Address, enter the 12 hex-digit locally administered address in the "NetworkAddress" field. Otherwise, leave this field blank.

   NOTE: Only assign a local Ethernet Address in accordance with IEEE 802.2 specifications. A universally administered Ethernet Address is assigned at the factory and is used by default.

   e) SerialNumber
   If you are installing more than one Crystal ISA Ethernet Adapter in the same PC, you must specify the serial number for each adapter. If you are installing a single adapter in this PC, this field is optional (leave blank).

4) Set each property to the desired value and click "OK".

5) Click the "OK" button on the "Network" control panel window to update the required files.

6) Shut down and restart Windows 95 for all changes to take effect.

WINDOWS NT

1) Install the adapter and boot Windows NT.

2) If required to log on, do so as Administrator or as a user with Administrator's privileges.

3) After Windows NT has finished booting, open the "Main" window from the Program Manager.

4) Open the "Control Panel" window and double-click on the "Network" icon in the Control Panel window.

5) If the message: ”Windows NT Networking is not installed. Install it now?” is displayed, reply ”Yes”, otherwise continue with step 6.

   When prompted, choose ”Do Not Detect” network adapter and then ”Continue”. Continue the installation with step 7.

6) Continue with the "Network Settings" dialog by clicking the "Add Adapter" button.

7) From the "Add Network Adapter" dialog, click the down arrow on the "Network Adapter Card" list box. Select "<Other> Requires disk from manufacturer" at the end of the adapter list. Click the "Continue" button.

8) When prompted, insert the "CS8900 Setup and Device Driver Software" diskette in drive A: and click on "OK" to accept the default path of A:\.

9) Select "Crystal LAN(tm) Family Ethernet Adapter" and click on "OK".

10) If you are installing more than one Crystal ISA Ethernet Adapter in the same PC, enter the serial number for the adapter you are installing when prompted. If you are only installing a single adapter in this PC you may leave this field blank. Click on the "Continue" button when finished.

11) If you want to override the adapter's assigned Ethernet Address, enter the 12 hex-digit locally administered address in the "NetworkAddr" field. Otherwise, leave this field blank. Click on "Continue" when finished.

    NOTE: Only assign a local Ethernet Address in accordance with IEEE 802.2 specifications. A universally administered Ethernet Address is assigned at the factory and is used by default.

12) Select the type of cable you have connected to the adapter. Use the default "Auto Detect" if you want the driver to automatically determine the cable type connected to the adapter each time the driver loads.

13) Select the transmission mode you want the adapter to use. It is strongly recommened you use the default "half-duplex" for CS8900-based adapters unless you are sure of the transmission mode capabilities of the network equipment to which you will be connecting.

    WARNING: Setting a transmission mode that is incompatible with the other equipement on your network will prevent the adapter from working properly and can adversely affect your entire network's performance.

14) Specify the driver's behavior when loading without a cable connected to the adapter. The default "No" will cause the driver to report an error and unload if a cable is not connected to the Crystal LAN(tm) adapter. Selecting "Yes" will allow the driver to load without a cable connected.

    NOTE: This setting is ignored if the driver is configured to "Auto Detect" the cable type. You must specify the cable type before the driver will load without a cable.

15) Accept the default "Bus Type" and "Bus Number" from the "Bus Location" dialog and click the "OK" button. Windows NT will copy the required driver files to your hard drive and return you to the "Network Settings" Control Panel.

16) The next step is to select the appropriate protocols to bind to the adapter for your network environment. When prompted, install the protocol options and and utilities required for your network. (If not prompted, use the "Add Software" and then the "Bindings" option from the "Network Settings" dialog.)

17) Restart Windows NT when prompted for all changes to take effect.

MS LAN MANAGER DOS AND OS/2

This procedure assumes that MS LAN Manager 2.X is already installed on the target system. If not, do so now. Refer to the "Microsoft LAN Manager Installation and Configuration Guide" for instructions.

1) Start the LAN Manager Setup program and select "Configuration".

2) Select "Network Drivers".

3) Select the installed configuration you want to update. If the configuration list is empty, select "Add New Config".

4) From the "Network Adapter Drivers" window, select "Other Driver".

5) When prompted, insert the "CS8900 Setup and Device Driver Software" diskette in the diskette drive and press <Enter>. You do not need to enter path information. The diskette is configured to enable the Setup utility to find the required files.

6) Select "Crystal LAN(tm) CS8900 Ethernet Adapter" and then "OK".

7) From the "Network Protocols" window, select the appropriate protocol(s) for you network environment. Typically, this will be the NetBEUI driver (required for NetBIOS support).

8) Follow the instructions in the window to complete the configuration. Your AUTOEXEC.BAT, CONFIG.SYS, and PROTOCOL.INI files will be updated.

9) Restart the computer to load the NDIS 2.0.1 and protocol drivers.

DOS ODI CLIENT - USING NOVELL'S INSTALLATION UTILITY

Use this procedure to install the NetWare DOS Client software if you have the Novell NetWare DOS Client Installation utility and you are configuring the PC as a NetWare client for the first time. If the PC has been previously configured as a DOS client using a network adapter from another vendor, go to the section on Manual Driver Installation.

NOTE: If the Novell NetWare DOS Client Installation utility is distributed as part of the NetWare Server Installation on CD-ROM, you must make diskette images for the DOS Client Installation utility from the NetWare Server Installation program. You cannot run the DOS Client Installation utility from CD-ROM.

1) Start the Novell installation program from the NetWare WSDOS_1 diskette (NetWare Client for DOS/WIN, Disk 1).

2) At the NetWare Client Installation panel, set the destination directory to where you want to store your NetWare files. The directory will be created if it does not exist.

3) Make sure you have answered "Yes" to the question about modifying your AUTOEXEC.BAT and CONFIG.SYS files. If you wish to use Windows as a NetWare client, answer "Yes" to install support for Windows and specify the path to your Windows directory.

4) Highlight the option to select the driver and press <ENTER>.

5) From the 'Network Board' dialog, page to the end of the list and select the "Other Drivers" option.

6) Insert the drivers diskette. Press <ENTER> to accept the default path.

7) Choose "Crystal ISA Ethernet Adapter EODIISA" as the driver.

8) When the "Settings" panel is displayed, enter selections for the desired Frame Type(s). Valid frame types are:

   Ethernet_802.2 (default)
   Ethernet_802.3
   Ethernet_II
   Ethernet_SNAP

   Up to a maximum of four frame types are supported.
   NOTE: The first frame type you specify must be one used by the IPX protocol on the NetWare server to which you wish to connect. Ethernet_802.2 is the default frame type for NetWare 3.12 and 4.X servers. (Contact your Network Administrator to determine the frame types supported by your server.)

   DO NOT enter selections for memory address, port address, DMA, or IRQ.

   An optional Node Address can be assigned if desired. Only assign a local Node Address in accordance with IEEE 802.2 specifications. A universally administered address is assigned at the factory and is used by default.

9) Return to the NetWare Client Install panel, select the "Highlight here and press <Enter> to install" option and press <ENTER>.

10) Exchange disks as prompted.

11) When the installation process is complete, reboot the system.

DOS ODI CLIENT - MANUAL DRIVER INSTALLATION

Use this procedure to install the NetWare DOS Client software if the PC has been previously configured as a DOS client using the NetWare DOS Requester (VLM.EXE) or NetWare DOS ODI Shell (NETX.EXE). You can also use this procedure if you have the NetWare DOS ODI Client support files but do not have access to the Novell DOS Client Installation package.

1) Move to the target directory on the hard disk where the existing NetWare DOS Client files are installed (e.g. C:\NWCLIENT). Create a new directory if this is a new installation.

2) Copy EODIISA.COM from the A:\DOS directory of the driver diskette to the target directory.

   Also copy LSL.COM, IPXODI.COM and the VLMs (VLM.EXE and related files) to the target directory if this is new installation. Note:The DOS ODI Client support files are not provided with the driver diskette.

3) Add the target directory to the end of the path statement in your AUTOEXEC.BAT file. For example, PATH=C:\;C:\DOS;C:\NWCLIENT

4) If you are using the NetWare DOS Requester (VLM.EXE), make sure the CONFIG.SYS file contains the statement:

   LASTDRIVE=Z

5) Use an ASCII text editor to edit (or create) the NET.CFG file in the target directory. If you are editing an existing NET.CFG file, change only the LINK DRIVER statement to LINK DRIVER EODIISA and remove any configuration statements such as PORT, IRQ, MEMORY, etc. The only keywords supported under the LINK DRIVER statement for the EODIISA driver are FRAME and NODE ADDRESS.

   Following is a sample NET.CFG suitable for most NetWare 3.12 and 4.X networks. Lines preceded by a semicolon are comments and are ignored by the driver. Note: Statements in the NET.CFG file are position sensitive. Indent as shown below.

   ```
   ; SAMPLE NET.CFG File for EODIISA.COM Driver

   Link Driver EODIISA
         Frame ETHERNET_802.2
   ;     Node Address 200000000200 (Optional Node Address)

   NetWare DOS Requester
         FIRST NETWORK DRIVE = F

   ;--- End of file ----
   ```

   Up to a maximum of four frame types are supported. The four valid frame types are:

   ```
   Ethernet_802.2 (default)
   Ethernet_802.3
   Ethernet_II
   Ethernet_SNAP
   ```

   NOTE: If multiple frame types are specified, the first frame type must be one used by the IPX protocol on the NetWare server to which you wish to connect. Ethernet_802.2 is the default frame type used by NetWare 3.12 and 4.X servers. (Contact your Network Administrator to determine the frame types supported by your server.)
   An optional Node Address can be assigned if desired. Only assign a local Node Address in accordance with IEEE 802.2 specifications. A universally administered address is assigned at the factory and is used by default.

6) Reboot the system.

7) At a DOS prompt, change to the target directory and load the driver and support file manually in the order shown.

   Example: (assumes target directory is \NWCLIENT)

   CD C:\NWCLIENT <ENTER>
   LSL <Enter>
   EODIISA <Enter>
   IPXODI <Enter>
   VLM <Enter>

8) If no errors are reported, you may create a batch file (or place the commands in you AUTOEXEC.BAT file) to execute the above commands and load the driver automatically.

   NOTE: If the PC was previously configured as a NetWare DOS Client using another adapter, check the AUTOEXEC.BAT file and make sure you remove any existing commands that load drivers for other network adapters.

DOS ODI CLIENT - CONSIDERATIONS WHEN USING EMM386

If you are using EMM386 (or other similar DOS memory managers) make sure that you exclude the area (RAM and ROM) used by the adapter. As an example (assumes using EMM386), to exclude a 4K range of shared memory used by the adapter starting at memory address D000:0000, change the EMM386 line in CONFIG.SYS to:

Device=C:\DOS\EMM386.EXE NOEMS X=D000-D0FF

Remember to reboot your machine after changing CONFIG.SYS.

DOS ODI CLIENT - DRIVER SIGN-ON MESSAGES

The sign-on messages reported by the driver and the ODI client support files when loaded can be helpful in diagnosing problems. Load the driver and support files manually, one at a time, noting the messages displayed as they load. (If the files are loaded automatically from a batch file, the may scroll by too fast to read.) Following are some things to look for as you load the driver and support files.

- LSL.COM - When loading, it displays the message:

  The configuration file used is "C:\NWCLIENT\NET.CFG

  giving the full path to the NET.CFG file it used (C:\NWCLIENT\NET.CFG is used as an example. This may be different on your system.) Take note to ensure it is using the NET.CFG file you intended. (Multiple NET.CFG files may exist on the system.)

- EODIISA.COM - When loading, it displays the cable type in use, operation mode (IO/Memory Mode) Transmission Mode (half/full duplex), the IRQ used, I/O-port used, Memory Address (if Memory mode used), the Node Address, and Frame Type used by the adapter. Make sure the resources reported are what you expect. In particular note the operation mode (IO/Memory) and frame type. If you have configured the adapter to run in memory mode but the driver reports it is using I/O mode, this is an indication of a memory address conflict. (The driver defaults to I/O mode operation if it detects a memory address conflict.) If the frame type listed for "Board 1" is not as expected, check the NET.CFG file and make sure the desired frame type is listed and that it is the first frame type listed in the LINK DRIVER section.

- VLM.EXE - When the DOS Requester is loaded (VLM.EXE) it should report the following message:

  The VLM.EXE file is pre-initializing the VLMs
  You are attached to server XXXXX

  where XXXXX is the name of your file server. If you do not see this message or the system hangs, it is a good indication the client is not connecting to the server. Check to ensure a cable fault does not exist and that you are using the correct frame type. (Check with you Network Administrator to determine the frame type(s) supported by the target NetWare server.)

NOVELL NETWARE NETWORKS - WORKSTATION FOR OS/2 REQUESTER

1) Install the adapter and reboot OS/2

2) You must have the 6 NetWare Client Installation diskettes available to install the NetWare Client software. If you create the installation diskettes from the NetWare Server CD-ROM, be sure each diskette is labeled with the correct volume label as shown below. If not, use the DOS "label" command to label them correctly.

Diskette Name	Volume Label
WS0S2_1 (Disk 1)	WSOS2_1
WSOS2_2 (Disk 2)	WSOS2_2
WSOS2_3 (Disk 3)	WSOS2_3
OSUTIL1 (Disk 4)	OSUTIL1
OS2DOC1 (Disk 5)	OS2DOC1
WSDRV_1 (Disk 6)	WSDRV_1

3) Copy the EODIISA.SYS driver (located in the \0S2 directory) from the "CS8900 Setup and Device Driver Software" diskette to the \OS2 directory of the WSDRV_1 installation diskette.

4) Open an OS/2 command window or full screen session.

5) Insert the WSOS2_1 diskette into drive A: and type INSTALL.

6) Select the "Requester on Workstation" from the "Installation" menu.

7) Set the target directory for file installation (typically C:\NETWARE).

8) In the "Requester Installation" dialog select "Edit CONFIG.SYS and Copy All Files...". Click "OK".

9) The "Choose the ODI LAN Driver" dialog appears. Enter "EODIISA.SYS" and click "Continue".

10) Next, specify whether or not you need NetWare Support for DOS and Windows. Click on "Help" for more information on setting up support for DOS and Windows applications.

11) From the "Suggested Default Settings to AUTOEXEC.BAT" dialog, select the support options appropriate for your configuration and click on the "Save" button. Make sure the path specified point to your existing AUTOEXEC.BAT file.

12) The installation message appears asking if you want to save settings to another batch file. Select "No" and continue.

13) If an installation message appears stating that you need to set "DOS_LASTDRIVE=" in your DOS settings, click "OK" to continue. Enter this setting in the OS/2 "DOS settings" for the DOS command prompt once installation is complete.

14) From the "Choose Optional Protocols" dialog, select the protocol support appropriate for your network environment, then click "Save".

15) Save changes to your CONFIG.SYS when prompted by clicking "Ok".

16) The "Copy Requester Files" dialog opens. Click "Copy" to copy the driver files to your hard disk.

17) Follow the screen prompts to copy the required files from the remaining diskettes and complete the NetWare Client for OS/2 installation.

18) Shut down the system and reboot OS/2 for all changes to take effect.

NETWARE 3.12 and 4.X SERVER - NOVELL'S INSTALLATION UTILITY (4.X Only)

Use this procedure if you want to install the driver using Novell's INSTALL.NLM utility and you are installing ONLY ONE CS8900 ISA Ethernet adapter. If you are using NetWare 3.12 or are installing multiple CS8900 Ethernet adapters in the same server, perform a manual installation. (See section on Manual Driver Installation.) This procedure assumes that NetWare 4.X is already installed on your system. If not, install it now.

1) Load the Novell Installation utility (type LOAD INSTALL at the console s command prompt) and select "Driver options".

2) From the "Driver Options" menu, select "Configure network drivers".

3) From the "Additional Driver Actions" menu, choose "Select a driver".

4) If the EODIISA.LAN driver is listed, select it. Otherwise press the INSERT key to "Install an unlisted driver".

5) When prompted, insert the "CS8900 Setup and Device Driver Software" diskette and press ENTER. The installation utility will scan the diskette for the NetWare EODIISA.LAN driver.

6) When the EODIISA.LAN driver appears in the list, highlight it and press ENTER.

7) When prompted, respond "Yes" to copy the EODIISA.LAN driver from the driver diskette to the server's SYS:SYSTEM directory.

8) If prompted to save old copies of EODIISA.LAN, MSM.NLM, or ETHERTSM.NLM, respond "No". If an error message appears stating MSM.NLM or ETHERTSM.NLM are not found on the driver diskette, ignore the message and press ENTER to "Continue copying the next file".

9) Once copying is completed, use the arrow key to move the cursor to the "Protocols" input box on the screen.
   Press the F3 key to "Manually set IPX frame types".
   The driver supports loading of up to 4 frame types. You can load instances of the driver for any or all of the frame types. However, Novell recommends using only ETHERNET_802.2 for best performance. The valid frame types are:

   ETHERNET_802.2 (default for NetWare 3.12 and 4.X)
   ETHERNET_802.3 (required for NetWare 3.11 and earlier)
   ETHERNET_II (used for TCP/IP support)
   ETHERNET_SNAP

   Highlight the frame type(s) you want to use and press ENTER to select it. When finished selecting the frame type(s) you want, press the ESC key to return to the main dialog.

10) Highlight the "Save parameters and load driver" option and press ENTER. The driver will load and you will be prompted for a network identification number. Enter an eight-digit hexadecimal number or press ENTER to accept the number presented. Do this for each frame type you selected in the step above.

11) Load additional drivers for adapters from other manufacturers, or use the ESC key to move to the main menu of the Installation utility.

12) To ensure that the drivers are loaded correctly, exit Install and do the following:

Type MODULES at the console's command prompt. You should see the following modules listed:

MSM.NLM_,
ETHERTSM.NLM_, and
EODIISA.LAN_

Others may be listed also. EODIISA.LAN will only be listed once even if you loaded it again for additional frame types.

Load the MONITOR NLM (type _LOAD MONITOR_ at the console's command prompt). Select "LAN/WAN Information" and press return. You should see EODIISA listed for each frame type you loaded.

The LEDs on the adapter indicate normal operation. (See the section on using the adapter's LEDs in Testing and Troubleshooting)

You can log on from a workstation and communicate with the server.

NETWARE 3.12 and 4.X SERVER - MANUAL DRIVER INSTALLATION

Use this procedure if you are using NetWare 3.12, installing multiple CS8900 Ethernet adapters in the same server, or if you prefer not to use the NetWare 4.X INSTALL.NLM. This procedure assumes that NetWare 3.12 or 4.X is already installed on your system. If not, install it now. If you will be installing multiple CS8900 Ethernet adapters, be sure you have recorded the serial number for each card. The serial number is printed on the front of the adapter. (See the section "Installing Multiple CS8900 Adapters".)

1) Boot DOS (or down the server and exit to DOS) and move to the target directory on the server. This directory should be the directory used by NetWare for the SERVER.EXE file, for this example: C:\NETWARE.

2) Copy the EODIISA.LAN driver from the A:\NETWARE directory of the "CS8900 Setup and Device Driver Software" diskette to the target directory.

3) Start NetWare. When the server completes the boot process, mount the SYS: volume if it is not already mounted. (Type MOUNT ALL at the console command prompt.)

4) Load the LAN driver and bind IPX to the CS8900 ISA Ethernet Adapter. The following illustrates how to load the driver for a single adapter and bind it to IPX using the default Ethernet_802.2 frame type. Enter the following at the console's command prompt:

LOAD C:\NETWARE\EODIISA
BIND IPX to EODIISA NET=[unique hex network number]

A unique hexadecimal number (8 digits max.) must be assigned to each LAN. (Do not type the brackets.)

5) To create an additional logical network, load another instance of the driver and bind it to another frame type. The following example shows how you would load the driver for two frame types; the first uses the default ETHERNET_802.2 frame type with the second using ETHERNET_II.

LOAD C:\NETWARE\EODIISA
BIND IPX to EODIISA NET=[unique hex network number]
LOAD C:\NETWARE\EODIISA FRAME=ETHERNET_802.3
BIND IPX to EODIISA NET=[2nd unique hex network number]

The driver supports loading of up to 4 frame types. You can load instances of the driver for any or all of the frame types. However, Novell recommends using only ETHERNET_802.2 for best performance. The valid frame types are:

ETHERNET_802.2 (default for NetWare 3.12 and 4.X)
ETHERNET_802.3 (required for NetWare 3.11 and earlier)
ETHERNET_II (used for TCP/IP support)
ETHERNET_SNAP

If installing multiple adapters, use the adapter's serial number (S/N) to specify the adapter for which you are loading the driver. The following example loads the driver for two CS8900 Ethernet adapters. The first uses the default ETHERNET_802.2 frame type with the second using ETHERNET_II.

LOAD C:\NETWARE\EODIISA SERIAL=[1st S/N]
BIND IPX to EODIISA NET=[unique hex network number]
LOAD C:\NETWARE\EODIISA FRAME=ETHERNET_II SERIAL=[2nd S/N]
BIND IPX to EODIISA NET=[2nd unique hex network number]

6) To ensure that the drivers are loaded correctly, exit Install and do the following:

Type MODULES at the console’s command prompt. You should see the following modules listed:

MSM.NLM,
ETHERTSM.NLM, and
EODIISA.LAN

Others may be listed also. EODIISA.LAN will only be listed once even if you loaded it again for additional frame types.

Load the MONITOR NLM (type LOAD MONITOR at the console's command prompt). Select "LAN/WAN Information" and press return. You should see EODIISA listed for each frame type you loaded.

The LEDs on the adapter indicate normal operation. (See the section on using the adapter's LEDs in Testing and Troubleshooting).

You can log on from a workstation and communicate with the server.

NETWARE 3.12 and 4.X SERVER - INSTALLING MULTIPLE CS8900 ADAPTERS

Record the serial number for each adapter before installing. (The serial number is printed on the front of the adapter card.)

1) Record the serial number of the first adapter, install it in the PC, and reboot. Install only the first adapter.

2) Start the CS8900 Setup Utility and configure the adapter using any available I/O base address other than 300-30Fh. (This is the default I/O address the CS8900 Setup Utility will use to communicate with a new CS8900 adapter.)

3) Turn off the PC. Record the serial number of the next CS8900-based adapter and install it in the system.

4) Reboot the system and run the CS8900 Setup Utility and configure the next adapter, taking care to use an I/O-port different from those used by the previously installed adapters.

5) Repeat steps 3 and 4 for any additional adapters. (A maximum of four CS8900-based adapters can be installed in the same system.)

6) When loading the driver for multiple adapters, use the adapter's serial number (S/N) to specify the adapter for which you are loading the driver. The following example loads the driver for two CS8900 Ethernet adapters. The first adapter will use the default ETHERNET_802.2 frame type with the second using ETHERNET_II.

   Example:

   ```
   LOAD C:\NETWARE\EODIISA SERIAL=[1st S/N]
   BIND IPX to EODIISA NET=[unique hex network number]
   LOAD C:\NETWARE\EODIISA FRAME=ETHERNET_II SERIAL=[2nd S/N]
   BIND IPX to EODIISA NET=[second unique hex network number]
   ```

NOVELL NETWARE NETWORKS - IF UNABLE TO CONNECT TO THE FILE SERVER

When the DOS Requester is loaded (VLM.EXE) it should report the following message:

"The VLM.EXE file is pre-initializing the VLMs...."
"You are attached to server XXXXX"

where XXXXX is the name of your file server. If you do not see this message or the system hangs, it is a good indication the client is not connecting to the server. Check to ensure a cable fault does not exist and that you are using the correct frame type. (Check with your Network Administrator to determine the frame type(s) supported by the target NetWare server.) Edit the NET.CFG file to change the frame type used by the adapter if needed.

IBM OS/2 NETWORKS - OS/2 CLIENT, PEER-PEER, and LAN SERVER

The following procedure assumes either OS/2 LAN Server, OS/2 Warp, or Warp Connect have been installed on the system. If not, do so now. Also it is assumed that you have installed LAPS (IBM's LAN Adapter and Protocol Support program) or MPTS (OS/2 Warp).

1) Install the adapter and reboot OS/2.

2) Select the LAPS or MPTS program icon from the OS/2 desktop. If you cannot find the icon, you can start the program from an OS/2 command prompt as \IBMCOM\LAPS.EXE or \IBMCOM\MPTS.EXE.

3) Select "Install" from the LAPS or MPTS window. Enter a User ID and Password if prompted.

4) Insert the CS8900 Setup and Device Driver Software diskette in drive A: and enter the path \OS2. Select "OK".

5) When the dialog appears stating the CS8900 ISA Ethernet Adapter driver has been installed, select "OK".

6) Select "Configure" in the next window. Make sure the "LAN adapter and protocols" button is selected. Click on "Configure".

7) The "LAPS CONFIGURATION" panel appears next (for both LAPS and MPTS installations). Select the "Crystal LAN(tm) CS8900 Ethernet Adapter" and click on "Add".

8) In the "Protocols" list box, select the protocols you need for your network and click on "Add" after each one you select. (Usually you will select "NetBIOS" for OS/2 networks and "IEEE 802.2" for NetWare networks.)

9) Click on "OK" and then "Close" in the LAPS Configuration panel when you have finished configuring your adapter.

10) Exit the LAPS or MPTS program. Select "OK" for update windows for the CONFIG.SYS, STARTUP.CMD, and PROTOCOL.INI files.

11) Shut down and restart OS/2 for all changes to take effect.

IBM OS/2 NETWORKS - D0S CLIENTS FOR LAN SERVER NETWORKS

The NDIS 2.0.1 DOS driver (ENDS2ISA.DOS) is required to run a DOS workstation in an IBM LAN Server environment. IBM LAN Support Program (LSP) version 1.33 or higher is also required.

1) Start the LSP installation program by inserting the LSP installation diskette in the A: drive. Type DXMAID and press <Enter>.

2) Follow the instructions displayed by the DXMAID installation program. Respond to questions concerning your particular setup as appropriate.

3) When prompted, insert the "CS8900 Setup and Device Driver Software" diskette in drive A:, enter the search path as _A:\DOS_ and press <Enter>. You can press <F1> if you need additional help on any DXMAID installation dialog.

4) From the "Primary Adapter and Alternate Adapter" dialog, verify the Crystal LAN(tm) CS8900 Ethernet Adapter driver is listed as the "Adapter Driver".

5) Verify the list of "Protocol Drivers" to ensure the appropriate protocols are supported for your network environment. All protocol drivers listed will be installed. If you want to change the Protocol Drivers list, select a protocol driver in the list and press <F6> to display the list of options.

6) Press <F4> to copy the NDIS DOS driver and protocol driver(s) to the appropriate directory. The installation program will also make the necessary modifications to your AUTOEXEC.BAT, CONFIG.SYS, and PROTOCOL.INI files.

7) After installation is complete, restart the computer to load the NDIS 2.0.1 driver (ENDS2ISA.DOS) and LSP protocol drivers.

PACKET DRIVER

The packet driver provides an interface between the CS8900 ISA Ethernet Adapters and a TCP/IP protocol stack (or packet driver utility) written in accordance with the PC/TCP Version 1.09 Packet Driver Specification. It is used in a DOS or MS Windows 3.1X environment.

The "CS8900 Setup and Device Driver Software" diskette contains the following files located in the \PCKTDRVR directory:

EPKTISA.COM	Packet driver for DOS workstations
SOURCE.ZIP	Source files for packet driver

INSTALLATION

1) Install the adapter and boot DOS. DOS 3.3 or greater is required. If you are running Windows, version 3.1 or greater is required. The packet driver must be loaded before starting Windows.

2) Copy the packet driver (EPKTISA.COM) to the target directory on your hard drive or boot floppy.

3) Change directories to the target directory and load the packet driver. The syntax of the packet driver load command is:

   epktisa [options] 0xINT [OxIO_ADDR] [0xIRQ] [E_ADDR]

   INT is the packet software interrupt number (in hexadecimal) and is the only required parameter. (The most frequently used packet software interrupt number is 0x60.) The other parameters are optional and will be taken from the adapter's EEPROM by default. See the table below for an explanation of all available options and parameters.

4) Install and/or load the TCP/IP protocol or packet driver utilities you want to use. Be sure to use the same packet software interrupt number (OxINT) that you used when you loaded the packet driver.

   (TCP/IP protocols and packet driver utilities must be obtained from third party sources -- they are not provided on the "CS8900 Setup and Device Driver Software" diskette).

PACKET DRIVER PARAMETERS

INT	Packet software interrupt number (in hex). Prefix the INT number by "Ox".
IO_ADDR	I/O base address of the adapter (in hex). Prefix the IO_ADDR number by "Ox".
IRQ	Hardware IRQ used by the adapter (in hex). Prefix the IRQ number by "Ox".
E_ADDR	12-digit hexadecimal locally administered address in canonical format. Do not use the "0x" prefix. Example: 020011223344

OPTIONS:

-i	Force driver to report itself as IEEE 802.3 instead of Ethernet II
-d	Delayed initialization. Used for diskless booting
-n	NetWare conversion. Converts 802.3 packets into 8137 packets
-w	Windows hack, obsoleted by winpkt
-p	Promiscuous mode disable
-u	Uninstall
-s	Scan I/O space for adapter even if a plug and play card found

EXAMPLES

1. To load the driver using a software interrupt number of 96 (60 hex), an I/O base address of 300 (hex), an IRQ of 10, a locally administered address of 060011223344, and disable promiscuous mode, you would type

```
epktisa -p 0x60 0x300 0xB 060011223344
```

2. To unload the driver, type

```
epktisa -u
```

3. Typing epktisa without any arguments (including the packet software interrupt number) will cause a usage message listing all options to be displayed.

SCO UNIX DRIVER INFORMATION

A CS8900 ISA Ethernet driver is available for SCO Unix 3.2 version 4.X. It is not included on the CS8900 Setup and Device Driver Software diskette. It is available on a separate diskette, or, it may be downloaded from Crystal's BBS free of charge. See the sections on Crystal's BBS service and technical support for more information on how to contact Crystal Semiconductor to obtain the SCO Unix CS8900 ISA Ethernet devicedriver.

LINUX DRIVER INFORMATION

A CS8900 ISA Ethernet driver is available for the Linux operating system. It is not included on the "CS8900 Setup and Device Driver Software" diskette. However, source code for the driver may be downloaded from Crystal's BBS free of charge. The source code may then be compiled into your Linux kernel or compiled into a dynamically loadable module suited for version of the Linux kernel you are using. See the sections on Crystal's BBS service and technical support for more information on how to contact Crystal Semiconductor to obtain the source code for the CS8900 ISA Ethernet device driver for Linux.

Diagnostics Overview

Once the adapter has been installed and configured, the diagnostic option of the CS8900 Setup Utility can be used to test the functionality of the adapter and its network connection. Use the diagnostic's Self Test option to test the functionality of the adapter with the hardware configuration you have assigned. You can use the diagnostic's Network Test to test the ability of the adapter to communicate across the Ethernet with another PC equipped with a CS8900 adapter card (it must also be running the CS8900 Setup Utility).

NOTE: The Setup Utility's diagnostics are designed to run in a DOS-only operating system environment. DO NOT run the diagnostics from a DOS or command prompt session under Windows 95, Windows NT, OS/2, or other operating system.

To run the diagnostics tests on the CS8900 adapter:

1) Boot the PC. If the PC is already running and network device drivers are loaded, restart the PC without loading the network device drivers.

2) From the CS8900 Setup and Device Driver Software diskette, run the CS8900 Setup Utility.

3) The adapter's current configuration is displayed. Hit the ENTER key to get to the main menu.

4) Select Diagnostics (ALT-G) from the main menu.

   - Select Self-Test to test the adapter's basic functionality.

   - Select Network Test to test the network connection and cabling.

DIAGNOSTIC SELF-TEST

The diagnostic _Self-Test_ checks the adapter's basic functionality, as well as its ability to communicate across the ISA bus, based on the system resources assigned during hardware configuration. The following tests are performed:

- I/O Register Read/Write Test
  The IO Register Read/Write test ensures that the CS8900 can be accessed in I/O mode and that the I/O base address is correct.

- Shared Memory Test
  The Shared Memory test ensures the CS8900 can be accessed in memory mode and that the range of memory addresses assigned does not conflict with other devices in the system.

- Interrupt Test
  The Interrupt test ensures there are no conflicts with the assigned IRQ signal.

- EEPROM Test
  The EEPROM test ensures the EEPROM can be read.

- Chip RAM Test
  The Chip RAM test ensures the 4K of memory internal to the CS8900 is working properly.

- Internal Loop-back Test
  The Internal Loop Back test ensures the adapter's transmitter and receiver are operating properly. If this test fails, make sure the adapter's cable is connected to the network (check for Link LED activity for example).

- Boot PROM Test
  The Boot PROM test ensures the Boot PROM is present, and can be read. Failure indicates the Boot PROM was not successfully read due to a hardware problem or due to a conflicts on the Boot PROM address assignment. (Test only applies if the adapter is configured to use the Boot PROM option.)

Failure of a test item indicates a possible system resource conflict with another device on the ISA bus. In this case, you should use the _Manual Setup_ option to reconfigure the adapter by selecting a different value for the system resource that failed. (See the section _Resolving I/O Conflicts_.)

DIAGNOSTIC NETWORK TEST

The diagnostic Network Test verifies a working network connection by transferring data between two CS8900 adapters installed in different PCs on the same network. (Note: the diagnostic network test should not be run between two nodes across a router.)

This test requires that each of the two PCs have a CS8900-based adapter installed and have the CS8900 Setup Utility running. The first PC is configured as a "Responder" and the other PC is configured as an "Initiator". Once the Initiator is started, it sends data frames to the Responder which returns the frames to the Initiator.

The total number of frames received and transmitted are displayed on the Initiator's display, along with a count of the number of frames received and transmitted OK or in error. The test can be terminated anytime by the user at either PC.

To setup the diagnostic Network Test:

1) Select a PC with a CS8900-based adapter and a known working network connection to act as the Responder. Run the CS8900 Setup Utility and from the main menu, select

   Diagnostics
   -> Network Test
   -> Responder

   Hit ENTER to start the Responder.

2) Return to the PC with the CS8900-based adapter you want to test and start the CS8900 Setup Utility.

3) From the main menu, select

   Diagnostics
   -> Network Test
   -> Initiator

   Hit ENTER to start the test.

   You may stop the test on the Initiator at any time while allowing the Responder to continue running. In this manner, you can move to additional PCs and test them by starting the Initiator on another PC without having to stop/start the Responder.

USING THE ADAPTER's LEDs

The CS8900-based two and three-media adapters have two LEDs visible on the back end of the board located near the 10Base-T connector.

Link Integrity LED: A "steady" ON of the green LED indicates a valid 10Base-T connection. (Only applies to 10Base-T. The green LED has no significance for a 10Base-2 or AUI connection.)

TX/RX LED: The yellow LED lights briefly each time the adapter transmits or receives data. (The yellow LED will appear to "flicker" on a typical network.)

DRIVER SIGN-ON MESSAGES

The sign-on messages reported by the driver and protocol support files when loaded can be helpful in diagnosing problems. If possible, load the driver and support files manually, one at a time, noting the messages displayed as they load. (If the files are loaded automatically from a batch or configuration file, they may scroll by too fast to read.)

RESOLVING I/O-CONFLICTS

An I/O-conflict occurs when two or more adapters use the same ISA resource (I/O address, memory address, or IRQ). You can usually detect an I/O conflict in one of four ways after installing and or configuring the CS8900-based adapter:

1) The system does not boot properly (or at all).

2) The driver cannot communicate with the adapter, reporting an "Adapter not found" error message.

3) You cannot connect to the network or the driver will not load.

4) If you have configured the adapter to run in memory mode but the driver reports it is using I/O-mode when loading, this is an indication of a memory address conflict.

Another common source of install problems is conflicts between EMM386 and the RAM and ROM areas assigned to the adapter. Please ensure that you exclude the area (RAM and ROM) used by the adapter from use by EMM386.

If an I/O-conflict occurs, run the CS8900 Setup Utility and perform a diagnostic self-test. Normally, the ISA resource in conflict will fail the self-test. If so, reconfigure the adapter selecting another choice for the resource in conflict.Run the diagnostics again to check for further I/O conflicts.

When manually configuring the adapter, keep in mind the typical ISA system resource usage as indicated in the tables below.

I/O Address	Device
200-20F	Game I/O adapter
230-23F	Bus Mouse
270-27F	LPT3: 3rd parallel port
2F0-2FF	COM2: 2nd serial port
320-32F	Hard disk controller

IRQ	Device
3	COM2, Bus Mouse
4	COM1
5	LPT2
6	Floppy controller
7	LPT1
8	Real-time Clock
9	EGA/VGA adapter
12	Mouse (PS/2)
13	Math Coprocessor
14	Hard Disk controller

Memory Addr	Device
A000-BFFF	EGA Graphics Adapter
A000-C7FF	VGA Graphics Adapter
B000-BFFF	Mono Graphics Adapter
B800-BFFF	Color Graphics Adapter
E000-FFFF	AT BIOS

Technical Support

For technical support please contact JUMP*tec*.
Technical help, troubleshooting and dirver support is provided through JUMPTEC.
You may also contact Crystal's Technical Application Supprot.

Crystal's CS8900 Technical Application Support can be reached at:

Telephone: (800) 888-5016 (from inside U.S. and Canada)
(512) 442-7555 (from outside the U.S. and Canada)
Fax: (512) 912-3871
Email: ethernet@crystal.cirrus.com

BEFORE CONTACTING TECHNICAL SUPPORT

Before contacting Crystal for technical support, be prepared to provide as much of the following information as possible.

1) Adapter type (CDB8900, etc.)

2) Adapter configuration

3) - I/O Base, Memory Base, I/O or memory mode enabled, IRQ, and DMA channel

   - Configured for media auto-detect or specific media type (which type).

4) (Record this information from the driver's sign-on message if possible.)

5) Computer System's Configuration

   - BIOS (make and version)
   - System make and model
   - CPU (type and speed)
   - System RAM

6) Software

   - CS8900 driver and version
   - Your network operating system and version
   - Your system's OS make/version (MS-DOS, Novell's DOS, Win95, WFWG, etc.)
   - Version of all protocol support files
   - Frame types supported by you server

7) Contents of your configuration files

   - CONFIG.SYS
   - AUTOEXEC.BAT file
   - PROTOCOL.INI file
   - NET.CFG FILE
   - WINDOW'S SYSTEM.INI (if using Windows client)
   - AUTOEXEC.NCF file

8) Any Error Message displayed.

CRYSTAL'S BBS SERVICE

You can obtain the latest CS89XX drivers and support software from Crystal's BBS. Access to the BBS is available 24 hours a day, seven days a week. Baud rates from 300K to 14.4K are supported as well as
most common file transfer protocols.

To access the BBS, set your terminal software to use 8 data bits, 1 stop bit, and no parity. Dial _(512) 441-3265_ and press _ENTER_ after connection is made. Login using your account name and password. (If you do not have an account, you may login as "GUEST". No password is required for the Guest account.)

From the main system menu, select the "Enter Public File Area" menuoption. From the Public File Area menu, select the "LAN (Local Area Network)" file area. A list of the latest drivers and support utilities available for the CS89XX ISA Ethernet adapter will be presented along with the option to download the file(s).

Setup Utility

Installation procedure

- Place the DOS setup and installation utility into drive A: (or B:)
- From a DOS prompt type: A:\SETUP (or B:\SETUP).
- The current configuration of the adapter will be displayed. Click on OK or press the Enter key to proceed.
- Use the adapter/auto configuration screen to accept, as a group, all of the recommended configuration settings. If any of these setting as not appropriate, then go to the next step.
- Use the adapter/manual configuration options to manually override any of the recommended configurations setting shown by the Auto-configuration screen.
- Use diagnostics/self test to test the functionality of the card.
- Use the diagnostics/network Test screen to test the abiltity of the card to communicate across the Ethernet with another CS8900-based card which is also running the DOS setup and Installation utility.

Adapter / auto configuration screen

This screen shows the current configuration settings for the card. For a brief description of the configuration parameters see the next section.
The user must determine if the displayed settings are appropriate for the system, and whether these settings will cause conflicts with any other components on the PC. If all of these settings are appropriate, then the user selects the "CONFIG" option which willl save these settings into the EEPROM. The user can then exit the screen. If any of these settings are not appropriate, then the user should exit this screen without selecting CONFIG and then open the manual configuration screen.

Adapter / manual configuration screen

This function allows the user to manually assign system resources and other CS8900 features. The user is required to know what system resources can be used without conflicts to other devices.
The current values for the parameters appear on the screen the first time this screen is selected. The settings can then be modified.

- I/O-port address describes the base address and range used on the PC/104 bus to access the CS8900-chip.
- Interrupt request (IRQ) identifies the interrupt used by the CS8900 to communicate with the system software over the bus.
- Shared memory describes the memory base address used if memory mode is selected. In memory mode, memory reads/writes are being utilized to transfer data between the system and the CS8900. A 4K block of memory needs to be assigned.

NOTE: If memory mode is selected, then the user must manually exclude use of that block by the system. This is accomplished by editing the CONFIG.SYS file. For example, if the contoller uses memory in the address range D000h to D0FFh, you would exclude this range from Windows by adding the following line to the CONFIG.SYS file:

device=c:\windows\emm386.exe x=d000-d0ff

- Boot PROM describes the memory base address of the boot PROM, if present.

- Connector type describes the type of Ethernet media
- OS optimization describes the performance option selected:
  - DOS - maximize ethernet throughput, with no attempt to minimize CPU utilization or number of interrupts.
  - Windows / server - Selects a configuration which minimizes the number of interrupts generated by the CS8900, with no attempt to maximize ethernet throughput.

Diagnostics / Self test screen

This function tests the adapter based on the settings that the user has assigned, either from auto configuration or manual configuration screen. System resources availability can be ckecked by running this test. Adjustment to the setup should be manually made it the diagnostics fail.
Failure upon test items such as I/O, IRQ, DMA and MEM indicate the conflict with other devices on the bus. In this case, the user is prompted to use manual configuration screen to eliminate those conflicts.
The tests are run once when the function is entered. The user can then chose to repeat the test by selecting REPEAT.
The I/O register read/write test insures that the CS8900 can be accessed in I/O mode, and that the I/O base address is correct. If this test fails, the I/O base address should be changed.
The EEPROM test insures that the EEPROM can be read. If the EEPROM can not be read, then the controller should be checked exactly on the system.
The chip RAM test insures that the 4K byte memory internal to the CS8900 is working properly. If both this test, and the shared memory test fail, then the memory base address should be modified and this test run again. If this test fails but the shared memory test passes, then the board must be repaired or replaced.
The shared memory test insures the memory base address doesn´t conflict with other memory assignments in the system. If this test fails, the memory base address must be changed.
The internal loop back test insures that the controller is operating properly. If this test fails, make sure the PC is properly attached to the network (check for LED activity for example). If network attachment is confirmed, the card must be repaired or replaced.
The Interrupt test insures that there are no conflicts on the IRQ assignment. If this test fails the IRQ assignment must be changed.
The DMA channel test insures that there are no conflicts on the DMA assignment. If this test fails the DMA assignment must be changed.
The boot PROM test insures that the Boot PROM is present, and can be read. If this test fails, the boot PROM was not successfully read due to a hardware problem, or due to a conflict on the boot PROM base address assignment.

Diagnostics/Network Test Screen

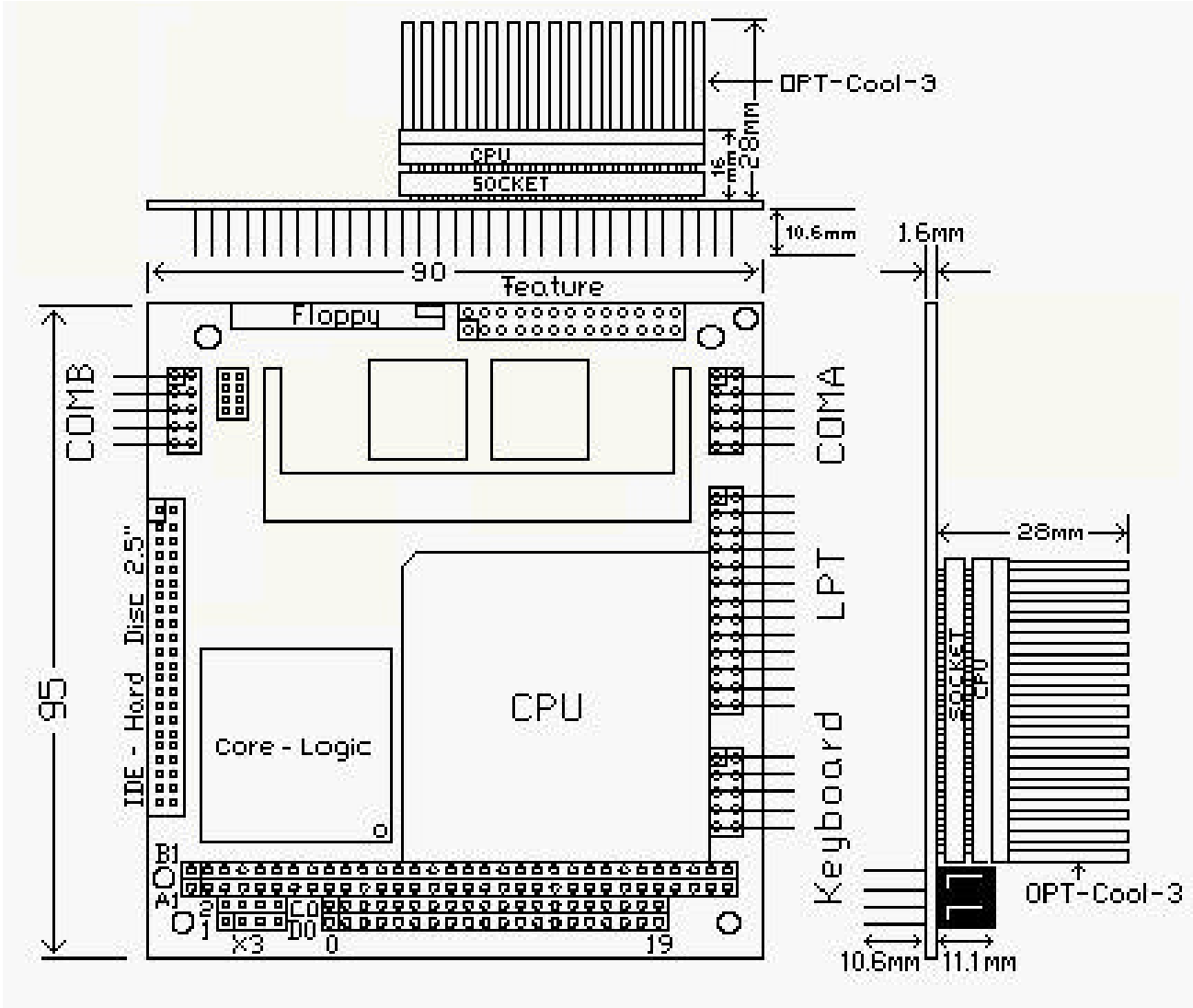
This function lets the user further verify the network connection by transferring data between two PC´s. This test requires that each of two stations have a CS8900 controller installed and have diagnostics/network Test program running. The user first sets one station to run responder, and then sets the orther station to run initiator.
The responder stays in a loop to wait for a frame to arrive, and then sends back the same frame if the frame was received OK. The initiator also stay in a loop that keeps feeding frames to the network and at the same time receiving frames back from the responder. The total number of frames received and transmitted are displayed on the screen, along with a count of the number received/transmitted OK and the number received/transmitted in error. The test can be terminated anytime by the user at either side.

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 ")
Height:	43,2 mm measured the highest devices (CPU-cooler))
Weight:	120 g (with processor, without cooler, RAM and Flash);

Physical Dimensions



Electrical Specifications

Supply voltage:	5V DC +/- 5%	
Supply voltage ripple:	100 mV peak to peak 0 - 20 MHz	
Supply current (typical):	with AMD 486DX2-66-3V	0.80A (4MB) to 0.90A (20MB)
	with AMD 486DX4-100-3V	1.03A (4MB) to 1.09A (20MB)
	with AMD 5x86P75-133-3V	1.13A (4MB) to 1.24A (20MB)
	supply current may vary with CPU- and memory-devices of different manufacturers.	
	(measurements without keyboard, hard disk, floppy etc.)	

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.

PC/104-Bus Specification of *super*MOPS

Specification XT Bus X1, A1 - A32

Pin	Signal Name	Function	CPU Module					I/O Modules				
			Type	Pullup	Iol	Ioh	C	Type	Pullup	Iol	Ioh	C
A1	/IOCHCK	I/O Channel Check	I	1K				OC		12mA		120pF
A2	SD7	Data Bit 7	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A3	SD6	Data Bit 6	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A4	SD5	Data Bit 5	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A5	SD4	Data Bit 4	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A6	SD3	Data Bit 3	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A7	SD2	Data Bit 2	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A8	SD1	Data Bit 4	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A9	SD0	Data Bit 3	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
A10	IOCHRDY	I/O Channel Ready	I	1K				OC		12mA		120pF
A11	AEN	Address Enable	O		12mA	6mA	120pF	I				
A12	SA19	Address Bit 19	O		12mA	6mA	120pF	I				
A13	SA18	Address Bit 18	O		12mA	6mA	120pF	I				
A14	SA17	Address Bit 17	O		12mA	6mA	120pF	I				
A15	SA16	Address Bit 16	O		12mA	6mA	120pF	I				
A16	SA15	Address Bit 15	O		12mA	6mA	120pF	I				
A17	SA14	Address Bit 14	O		12mA	6mA	120pF	I				
A18	SA13	Address Bit 13	O		12mA	6mA	120pF	I				
A19	SA12	Address Bit 12	O		12mA	6mA	120pF	I				
A20	SA11	Address Bit 11	O		12mA	6mA	120pF	I				
A21	SA10	Address Bit 10	O		12mA	6mA	120pF	I				
A22	SA9	Address Bit 9	O		12mA	6mA	120pF	I				
A23	SA8	Address Bit 8	O		12mA	6mA	120pF	I				
A24	SA7	Address Bit 7	O		12mA	6mA	120pF	I				
A25	SA6	Address Bit 6	O		12mA	6mA	120pF	I				
A26	SA5	Address Bit 5	O		12mA	6mA	120pF	I				
A27	SA4	Address Bit 4	O		12mA	6mA	120pF	I				
A28	SA3	Address Bit 3	O		12mA	6mA	120pF	I				
A29	SA2	Address Bit 2	O		12mA	6mA	120pF	I				
A30	SA1	Address Bit 1	O		12mA	6mA	120pF	I				
A31	SA0	Address Bit 0	O		12mA	6mA	120pF	I				
A32	GND	(Added) Ground										

I = input O = output I/O = bidirectional signal OC = open collector output

[1)] = the pullups on these signal lines have lower values then specified by the PC/104-consortium
the changes have been made to improve timing characteristics for certain bus architectures

Specification XT Bus X1, B1 - B32

Pin	Signal Name	Function	CPU Module					I/O Modules				
			Type	Pullup	Iol	Ioh	C	Type	Pullup	Iol	Ioh	C
B1	GND	Ground										
B2	RESETDRV	Reset System Signal	O		12mA	6mA	120pF	I				
B3	+5V	+5V										
B4	IRQ9	Interrupt Request 9	I	4K7[1)]				O		4mA	1mA	50pF
B5	-5V	-5V (to X1 pin 5)										
B6	DRQ2	DMA Request 2	I	10K				O		12mA	6mA	120pF
B7	-12V	-12V (to X1 pin 6)										
B8	/0WS	Zero Wait State	I	300[1)]				OC		12mA		120pF
B9	+12V	+12V (to X1 pin 4)										
B10	GND	Ground										
B11	/SMEMW	Mem. Write (1MB)	O	1K[1)]	12mA	6mA	120pF	I				
B12	/SMEMR	Mem. Read (1MB)	O	1K[1)]	12mA	6mA	120pF	I				
B13	/IOW	I/O Write	O	1K[1)]	12mA	6mA	120pF	I				
B14	/IOR	I/O Read	O	1K[1)]	12mA	6mA	120pF	I				
B15	/DACK3	DMA Acknowledge 3	O		4mA	1mA	50pF	I	10K			
B16	DRQ3	DMA Request 3	I	10K				O		12mA	6mA	120pF
B17	/DACK1	DMA Acknowledge 1	O		4mA	1mA	50pF	I	10K			
B18	DRQ1	DMA Request 1	I	10K				O		12mA	6mA	120pF
B19	/REFRESH	Memory Refresh	O	330[1)]	12mA	6mA	120pF	I				
B20	SYSCLK	8 MHz	O		12mA	6mA	120pF	I				
B21	IRQ7	Interrupt Request 7	I	4K7[1)]				O		4mA	1mA	50pF
B22	IRQ6	Interrupt Request 6	I	4K7[1)]				O		4mA	1mA	50pF
B23	IRQ5	Interrupt Request 5	I	4K7[1)]				O		4mA	1mA	50pF
B24	IRQ4	Interrupt Request 4	I	4K7[1)]				O		4mA	1mA	50pF
B25	IRQ3	Interrupt Request 3	I	4K7[1)]				O		4mA	1mA	50pF
B26	/DACK2	DMA Acknowledge 2	O		4mA	1mA	50pF	I	10K			
B27	TC	DMA Terminal Count	O		4mA	1mA	50pF	I	10K			
B28	BALE	Address Latch Enable	O		12mA	6mA	120pF	I				
B29	+5V	+5V										
B30	OSC	OSC (14.3MHz Clock)	O		12mA	6mA	120pF	I				
B31	GND	Ground										
B32	GND	(Added) Ground										

I = input O = output I/O = bidirectional signal OC = open collector output

[1)] = the pullups on these signal lines have lower values then specified by the PC/104-consortium
the changes have been made to improve timing characteristics for certain bus architectures

Specification AT Bus X2, C0 - C19

Pin	Signal Name	Function	CPU Module					I/O Modules				
			Type	Pullup	Iol	Ioh	C	Type	Pullup	Iol	Ioh	C
C0	GND	(Added) Ground										
C1	/SBHE	Bus High Enable	O		12mA	6mA	120pF	I				
C2	LA23	Latch Address 23	O		12mA	6mA	120pF	I				
C3	LA22	Latch Address 22	O		12mA	6mA	120pF	I				
C4	LA21	Latch Address 21	O		12mA	6mA	120pF	I				
C5	LA20	Latch Address 20	O		12mA	6mA	120pF	I				
C6	LA19	Latch Address 19	O		12mA	6mA	120pF	I				
C7	LA18	Latch Address 18	O		12mA	6mA	120pF	I				
C8	LA17	Latch Address 17	O		12mA	6mA	120pF	I				
C9	/MEMR	Mem.Read High 1M	O	1K[1)]	12mA	6mA	120pF	I				
C10	/MEMW	Mem.Write High 1M	O	1K[1)]	12mA	6mA	120pF	I				
C11	SD8	Data Bit 8	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C12	SD9	Data Bit 9	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C13	SD10	Data Bit 10	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C14	SD11	Data Bit 11	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C15	SD12	Data Bit 12	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C16	SD13	Data Bit 13	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C17	SD14	Data Bit 14	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C18	SD15	Data Bit 15	I/O	4K7[1)]	12mA	6mA	120pF	I/O		12mA	6mA	120pF
C19	GND	(Added) Ground										

I = input O = output I/O = bidirectional signal OC = open collector output

[1)] = the pullups on these signal lines have lower values then specified by the PC/104-consortium
the changes have been made to improve timing characteristics for certain bus architectures

Specification AT Bus X2, D0 - D19

Pin	Signal Name	Function	CPU Module					I/O Modules				
			Type	Pullup	Iol	Ioh	C	Type	Pullup	Iol	Ioh	C
D0	GND	(Added) Ground										
D1	/MEMCS16	16 Bit Mem.access	I	300[1)]				OC		12mA		120pF
D2	/IOCS16	16 Bit I/O access	I	300[1)]				OC		12mA		120pF
D3	IRQ10	Interrupt Request 10	I	4K7[1)]				O		4mA	1mA	50pF
D4	IRQ11	Interrupt Request 11	I	4K7[1)]				O		4mA	1mA	50pF
D5	IRQ12	Interrupt Request 12	I	4K7[1)]				O		4mA	1mA	50pF
D6	IRQ15	Interrupt Request 13	I	4K7[1)]				O		4mA	1mA	50pF
D7	IRQ14	Interrupt Request 14	I	4K7[1)]				O		4mA	1mA	50pF
D8	/DACK0	DMA Acknowledge 0	O		4mA	1mA	50pF	I	10K			
D9	DRQ0	DMA Request 0	I	10K				O		12mA	6mA	120pF
D10	/DACK5	DMA Acknowledge 5	O		4mA	1mA	50pF	I	10K			
D11	DRQ5	DMA Request 5	I	10K				O		12mA	6mA	120pF
D12	/DACK6	DMA Acknowledge 6	O		4mA	1mA	50pF	I	10K			
D13	DRQ6	DMA Request 6	I	10K				O		12mA	6mA	120pF
D14	/DACK7	DMA Acknowledge 7	O		4mA	1mA	50pF	I	10K			
D15	DRQ7	DMA Request 6	I	10K				O		12mA	6mA	120pF
D16	+5V	+5V										
D17	/MASTER	Bus Master Assert	I	300[1)]				OC		12mA		120pF
D18	GND	Ground										
D19	GND	(Added) Ground										

I = input O = output I/O = bidirectional signal OC = open Collector output

[1)] = the pullups on these signal lines have lower values then specified by the PC/104-consortium
the changes have been made to improve timing characteristics for certain bus architectures

Signal Description

PC/104 Overview

Notation

Throughout the specification of the *PC/104* interface the following convention is used for signal notation. An "/" in front of a signal name indicates that the signal is active when it is at a low voltage level. A signal name without the beginning of a "/ " indicates that the signal is active when it is at a high voltage level.

General

The *PC/104*- bus is a stackable implementation of the industry standard (ISA) PC bus according to IEEE P996 specification. The PC/104 bus has additional signals and different mechanics than P996. The driver capability of the PC/104- Bus (6mA) is a quarter of a standard (ISA) PC bus (24mA). The *super*MOPS/486DX-1 is developed with 12mA driver so it is the double of the PC/104 spec. Four PC/104 modules are useful to stack.

The included Features:

- full implementation of the industry standard (ISA) bus on signal level.
- stackable bus for low cost and high reliable piggy back connections without backplane.
- additional signals for improved control include:
  battery connection, Reset input, XT/AT sense signal, and general purpose I/O pins.
- keyboard and Mouse interface.
- speed and sleep control signals.
- serial control interface.
- small footprint for embedded control applications.

Address / Data Signal Group

SD<0..15> (System Data Bus)

bidirectional I/O pins

These signals provide data bus bits 0 to 15 for the peripheral devices. All 8-bit devices use SD0 <0..7> for data transfers. The 16-bit devices will use SD<0..15>. To support 8-bit devices, the data on SD<8..15> will be gated to SD<0..7> during 8-bit transfers to these devices. 16-bit CPU cycles will be converted to two 8-bit cycles for 8-bit peripheral automatically.

SA<19..0> (System Address)

output on CPU modules

input on all other modules

Address bits 0 through 15 are used to address I/O devices and address bits 0 through 19 are used to address memory within the system. These 20 address lines, in addition to LA<17..23> allow access of up to 16MB of memory. SA<0..19> are gated on the PC/104-bus when BALE is high and latched on falling edge of BALE.

LA<17..23> (Latchable Address Bus)

output on CPU modules
input on any other module
These signals (unlatched) are used to address memory up to 16 MB.

/SBHE (System Bus High Enable)

output on CPU modules
input on all other module
Bus High Enable indicates a transfer of data on the upper byte of the data bus (SD<8..15>). 16 bit I/O devices use SBHE to condition data bus buffers tied to SD<8..15>.

BALE (Bus Address Latch Enable)

output from CPU modules
input on any other module
Bale is an active high pulse which is generated at the beginning of any bus cycle initiated by a CPU module. It indicates when the SA<0..19>, LA<17..23>, AEN, and /SBHE signals are valid.

AEN (Address Enable)

output from CPU modules
input on any other module
AEN is an active high output that indicates a DMA transfer cycle, only resources with a active /DACK signal should respond to the command lines when AEN is high.

Control Signal Group

/MEMR (Memory Read)

output from CPU modules
input on any other module
/MEMR instructs memory devices to drive data onto the data bus. /MEMR is active on all memory read cycles.

/SMEMR (System Memory Read)

output from CPU modules
input on any other module
/SMEMR instructs memory devices to drive data onto the data bus. /SMEMR is active on memory read cycles to addresses below 1MB.

/MEMW (Memory Write)

output from CPU modules
input on any other module
/MEMW instructs memory devices to store the data present on the data bus. /MEMW is active on all memory write cycles.

/SMEMW (System Memory Write)

output from CPU modules
input on any other module
/SMEMW instructs memory devices to store the data present on the data bus. /SMEMW is active on all memory write cycles to address below 1MB.

/IOR (I/O Read)

output from CPU modules
input on any other module
I/O read instructs an I/O device to drive its data onto the data bus. It may be driven by the CPU or DMA controller. /IOR is inactive (high) during refresh cycles.

/IOW (I/O Write)

output from CPU modules
input on any other module
I/O write instructs an I/O device to store the data present on the data bus. It may be driven by the CPU or DMA controller. /IOW is inactive (high) during refresh cycles.

/IOCHCK (I/O Channel Check)

input to CPU modules
open collector output on any other module
/IOCHCK is an active low input signal which indicates that an error has taken place on the module bus. If I/O checking is enabled on the CPU module, an /IOCHCK assertion by a peripheral device generates an NMI to the processor.

IOCHRDY (I/O Channel Ready)

input to CPU modules
open collector output on any other module
The I/O channel ready is pulled low in order to extend the read or write cycles of any bus access when required. The cycle can be initiated by the CPU, DMA controllers or refresh controller. The default number of wait states for cycles initiated by the CPU are 4 wait states for 8 bit peripherals and 1 wait state for 16 bit peripherals. One wait state is inserted as a default for all DMA cycles. Any peripheral that cannot present read data or strobe in write data in this amount of time use IOCHRDY to extend these cycles.
This signal should not be held low for more than 2,5 us for normal operation. Any extension to more than 2,5 us does not guarantee proper DRAM memory contents because memory refresh is stopped while IOCHRDY is low.
The IOCRDY signal is monitored on CPU modules, and if low (invalid) for more than 1,5 seconds, the CPU module is resetted and booted like in a power up situation. This gives the user the possibility to use this signal also as an external reset pin.

/MEMCS16 (16 Bit Memory Chip Select)

input to CPU modules
open collector output on any other module
The /MEMCS16 signal determines when a 16 bit to 8 bit conversion is needed for memory bus cycles. A conversion is done any time the CPU module is requesting a 16 bit memory cycle and the /MEMCS16 line is high. If /MEMCS16 is high, 16 bit CPU cycles are converted into two 8 bit cycles on the bus automatically. If /MEMCS16 is low, an access to peripherals is done 16 bit wide.

/IOCS16 (16 Bit I/O Chip Select)

input to CPU modules
open collector output on any other module
The /IOCS16 signal determines when a 16 bit to 8 bit conversion is needed for I/O bus cycles. A conversion is done any time the CPU module is requesting a 16 bit I/O cycle and the /IOCS16 line is high. If /IOCS16 is high, 16 bit CPU cycles are converted into two 8 bit cycles on the bus automatically. If /IOCS16 is low, an access to peripherals is done 16 bit wide.

/REFRESH (Memory Refresh)

output to CPU modules
input on any other module
/REFRESH is pulled low whenever a refresh cycle is initiated. A refresh cycle is activated every 15,6 us to prevent loss of DRAM data.

/OWS (0 Wait States)

input to CPU modules
output on any other module
The Zero wait state signal tells the CPU to complete the current bus cycle without inserting the default wait states. By default the CPU inserts 4 wait states for 8 bit transfers and 1 wait state for 16 bit transfers.

Special Function Signal Group

/MASTER (MASTER bus request)

input to CPU modules
open collector output on any other module
This signal is used with a DRQ line to gain control of the system bus. A processor or DMA controller on the I/O channel may issue a DRQ to a DMA channel in cascade mode and receive a /DACK. Upon receiving the /DACK, a bus master may pull /MASTER low, which will allow it to control the system address, data and control lines. After /MASTER is low, the bus master must wait one system clock period before driving the address and data lines, and two clock periods before issuing a read or write command. If this signal is held low for more than 15 us, system memory may be lost because of lack of refresh.

SYSCLK (SYStem CLocK)

output from a CPU module
input on any other module
SYSCLK is supplied by the CPU module and has a nominal frequency of about 8 MHz with 40-60 % duty cycle. Slower and higher frequencies may be supplied by different CPU modules. This signal is supplied at all times, except when the CPU module is in sleep mode.

OSC (Oscillator frequency)

output on CPU modules
input on any other module
OSC is supplied by CPU modules. It has a nominal frequency of 14,31818 MHz and a duty cycle of 40-60 %. This signal is supplied at all times, except when the CPU module is in sleep mode.

RESETDRV (Bus RESET)

output on CPU modules
input on any other module
This active high output is system reset generated from CPU modules to reset external devices.

DRQ<0..3, 5..7> (DMA Request)

input to CPU modules
output on any other module
The asynchronous DMA request inputs are used by external devices to indicate when they need service from the CPU modules DAM controllers. DRQ<0..3> are used for transfers between 8 bit I/O adapters and system memory. DRQ<5..7> are used for transfers between 16 bit I/O adapters and system memory. DRQ4 is not available externally. All DRQ pins have pullups on CPU modules.

/DACK<0..3, 5..7> (DMA Acknowledge)

output on CPU modules
input on any other module
DMA acknowledge 0..5 and 5..7 are used to acknowledge DMA requests. They are low active.

T/C (Terminal Count))

output on CPU modules
input to all other module
The active high output TC indicates that one of the DMA channels has transferred al data.

IRQ<3..7, 9..12, 14,15> (Interrupt Requests)

input to CPU modules
output on any other module
These are the asynchronous interrupt request lines. IRQ0, 1, 2, 8 and 13 are not available as external interrupts because they are used internally to CPU modules. All IRQ signals are active high. The interrupt requests are prioritized, with IRQ9 through IRQ12 and IRQ14 through IRQ15 having the highest priority (IRQ9 is the highest) and IRQ3 through IRQ7 having the lowest priority (IRQ7 is the lowest). An interrupt request is generated when an IRQ line is raised from low to high. The line must be held high until the CPU acknowledges the interrupt request (interrupt service routine).

Data Conversion and Swapping

Data Conversion

16 - bit transfers by the main CPU via the *PC/104* - bus are converted into two 8 - bit transfers (low and high Byte) if the control signals MEMCS16* or IOCS16* are not asserted. The higher Byte - Data (SD<15..8>) is directed to SD <7..0> with SA0 =H during write cycles and from SD <7..0> to SD <15..0 > with SA0 =H during read cycles. This operation is transparent to the software .

Data Swapping

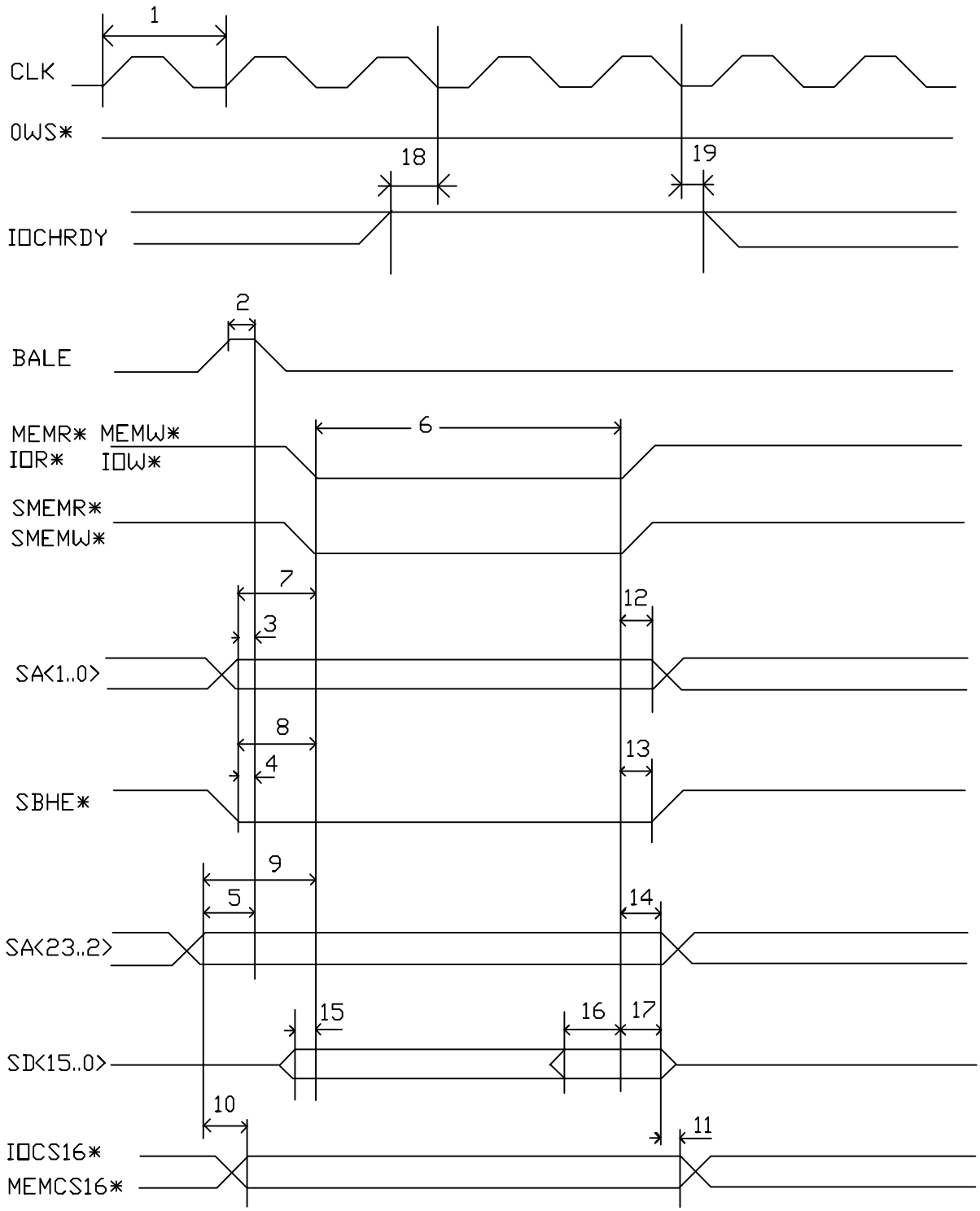
Data are swapped between SD <15..8 > and SD <7..0 > on the main CPU for odd Byte transfers (SA0 =H) with 8 - bit devices on the *PC/104* - bus. Swapping occurs also during DMA cycles (SA0 =H) if the devices on the *PC/104* - bus is a 16 - bit memory device and an 8 - bit DMA channel is used for the transfer.

No.	Description	Min	Typ	Max	Note
1	Clock period (Tclk)	125			
2	BALE high width		54		
3	SA<1..0> setup to BALE low			8	
4	SBHE* setup to BALE low		20		
5	SA<23..2> setup to BALE low		130		
6a	Command width 16 bit cycles (zero wait states)		125		2)
6b	Command with 8 bit cycles (with 2 wait states)		325		3)
7	SA<1..0> setup to command zero cmd delay	8			1)
8	SBHE* setup to command zero cmd delay		20		1)
9	SA<23..2> setup to command zero cmd delay	130			1)
10	MEMCS16* , IOCS16* delay from SA<23..2>			80	
11	MEMCS16* , IOCS16* hold after SA<23..2	0			
12a	SA<1..0> hold after command	23			
12b	SA<1..0> hold after SMEMR* or SMEMW*		18		
13a	SBHE* hold after command	23			
13b	SBHE* hold after SMEMR* or SMEMW*	18			
14a	SA<23..2> hold after command	30			
14b	SA<23..2> hold after SMEMR* or SMEMW*	25			
15	Write Data setup to command active		6		
16	Read Data setup to command inactive	65			1)
17a	Write Data hold after command	45			
17b	Read Data hold after command	0			
18	IOCHRDY setup to CLK	34			
19	IOCHRDY hold after CLK	2			
20	0WS* setup to CLK	20			
21	0WS* hold after CLK	0			

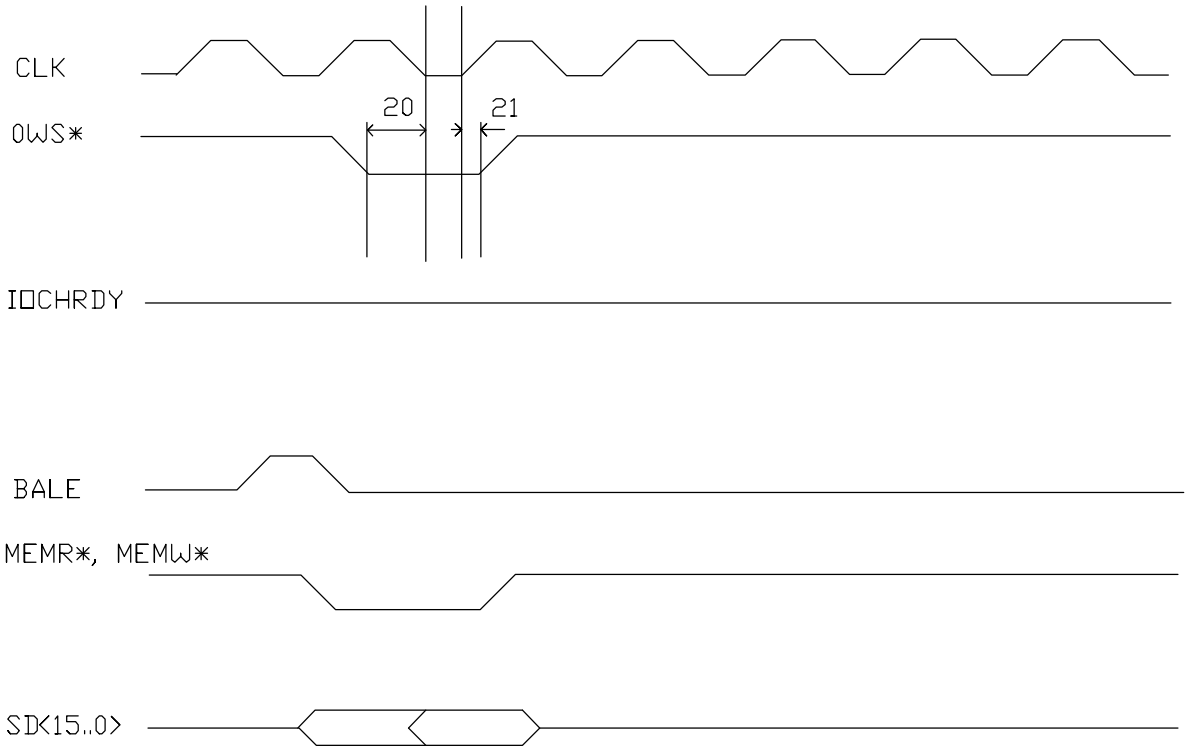
Notes:

1) Command delay programmable between 0 and 3 CLK/2 cycles seperately for 16 bit memory , 8 - bit memory and I/O cycles
2) Command width depends on the number of wait states (programmable from 0 to 3 CLK cycles) and command delay (note 1)
3) Command width depends on the number of wait states (programmable from 2 to 5 CLK cycles) and command delay (note 1)

CPU Bus Cycle Timing



Zero Wait State Operation



DMA Timing Specification

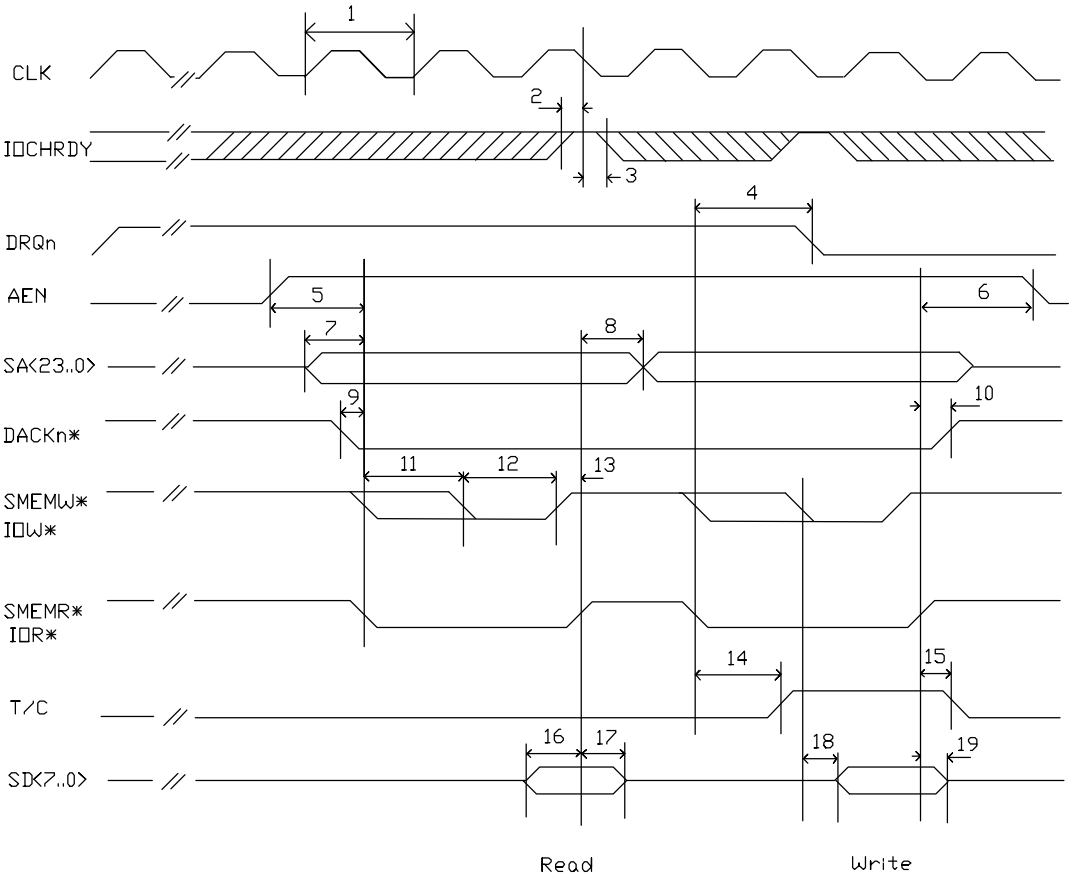
This section specifies the timing for Direct Memory Access cycles (all time in ns):

No.	Description	MIN.	TYP.	MAX.	Note
1	Clock period (Tclk)	125			
2	IOCHRDY setup to CLK	35			
3	IOCHRDY hold from CLK	20			
4	DRQ inactive delay from command			55	
5	AEN setup to command	80			
6	AEN hold from command	10			
7	SA<23..0> setup to command	50			
8	SA<23..0> hold from command	50			
9	DACK setup to command	0			
10	DACK hold from command		0		
11	Extended Write delay	122		128	
12	Write command width	80			1)
	(Extended Write , 0 Waitstates)				
13	Read inactive delay from Write	20			
14	T/C delay from command			165	
15	T/C hold from command	0			
16	Read data setup	110			
17	Read data hold	0			
18	Write data delay after command			80	2)
19	Write data hold	15			

Notes:

1) with programmable wait states from 1 to 4 CLK cycles
2) Note that this time cannot be extended by insertion of wait states

DMA - Timing

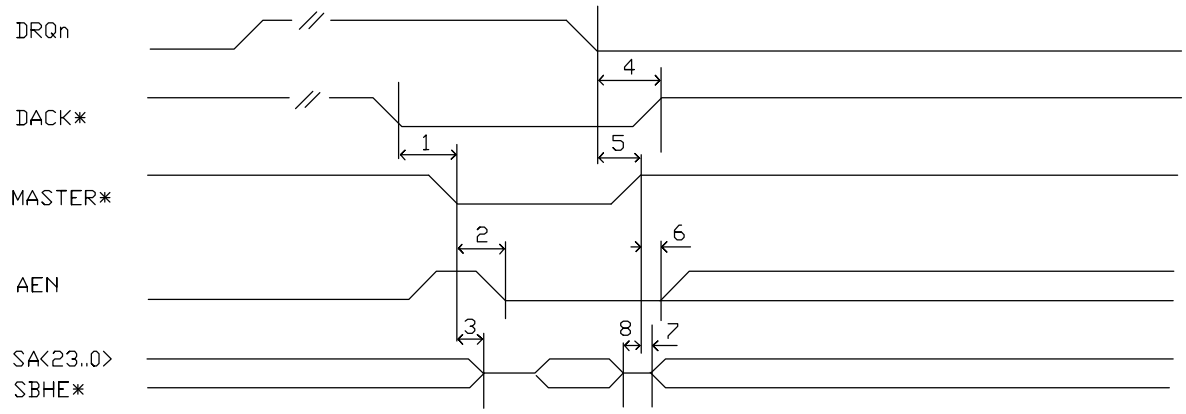


Bus-Master Exchange Operation

This section specifies the timing for exchange of bus ownership between the CPU and a secondary Busmaster (all times in ns) :

No.	Description	MIN.	TYP.	MAX.	Note
1	MASTER* delay after DACKn	0			
2	AEN inactive after MASTER* active			45	
3	CPU tristates bus signals			45	
4	DACKn* inactive from DRQn inactive	0			
5	MASTER* delay from DRQn inactive			100	
6	AEN delay after MASTER* inactive	0		45	
7	CPU drives bus signals	0			
8	Secondary Master tristates bus signals	0			

BUS Master Exchange Operation

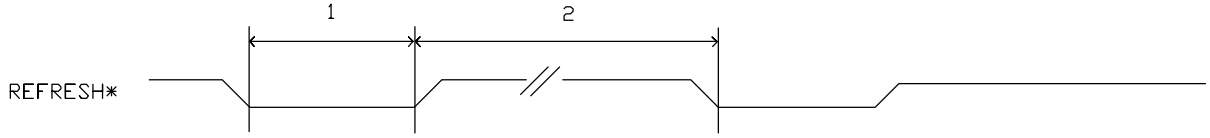


REFRESH* Signal Timing

This section specifies the timing of the REFRESH* signal

No.	Description	MIN	TYP	MAX	Note
1	REFRESH* pulse width	750ns			
2	REFRESH* inactive time	15,6µS			

REFRESH* Signal Timing

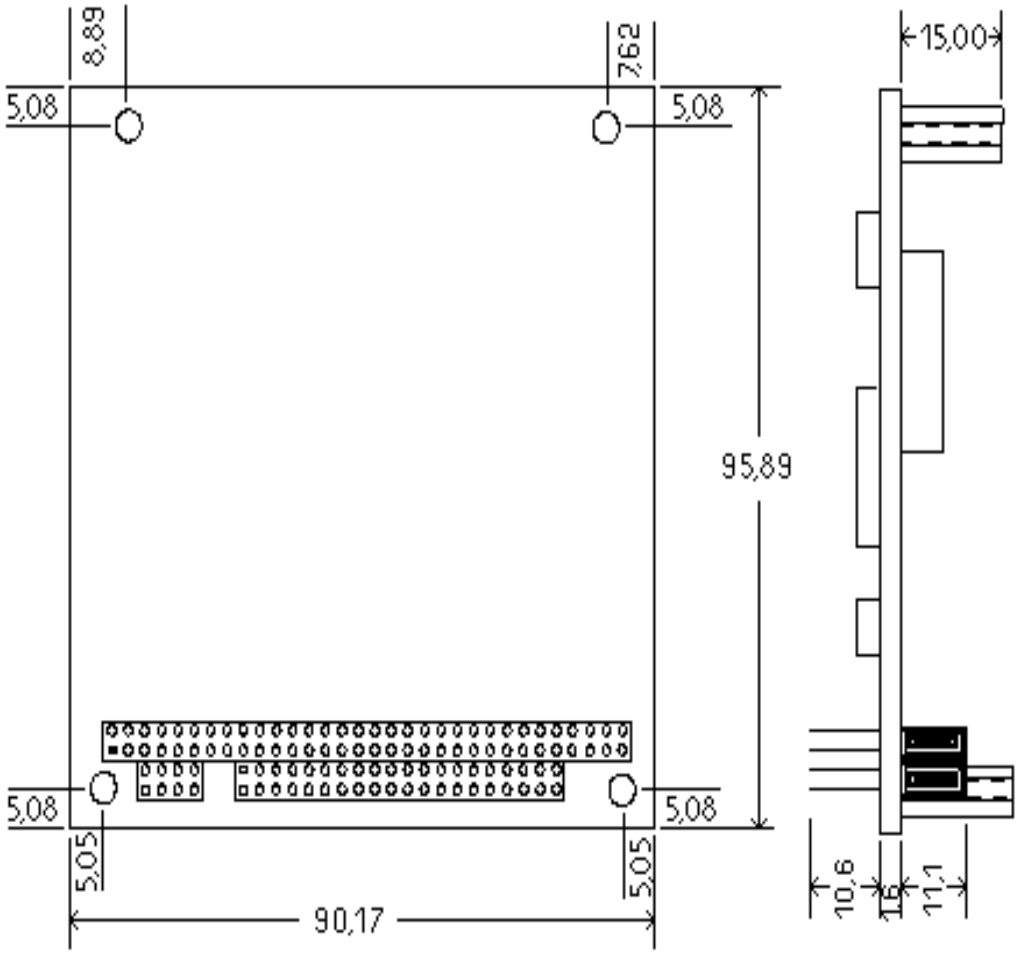


PC/104 Stack Characteristics

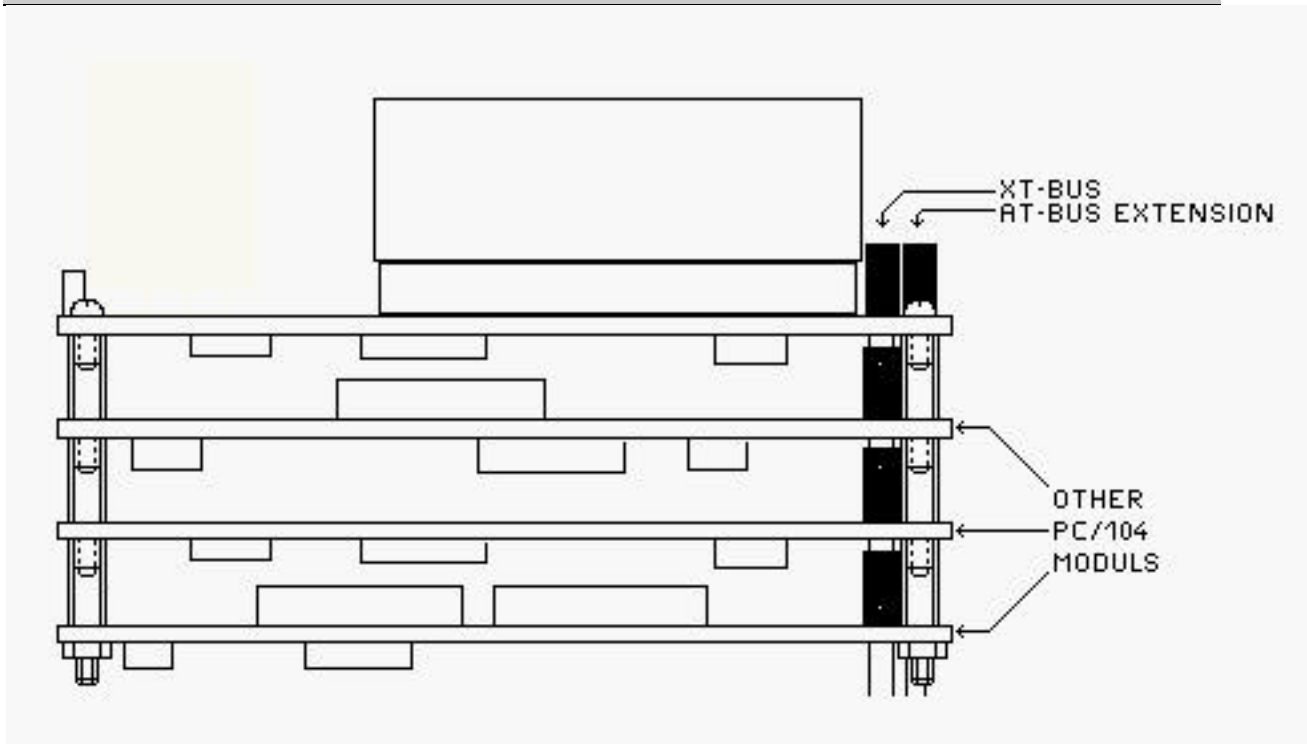
The interconnection between two boards PC/104-bus will be done with a 104 pin female/male stacked connector. There are drillings in every modules corner to hold four bolts, which give the stack the required stability in industrial applications.
The *superMOPSpro* is a PC/104 stack top module, which means, it can only be placed as upper module in a PC/104 stack. The only chance to use the *superMOPSpro* in the middle of a PC/104 stack is to lengthen the PC/104-bus with additional connectors.

All measurements of the following drawings are in mm.

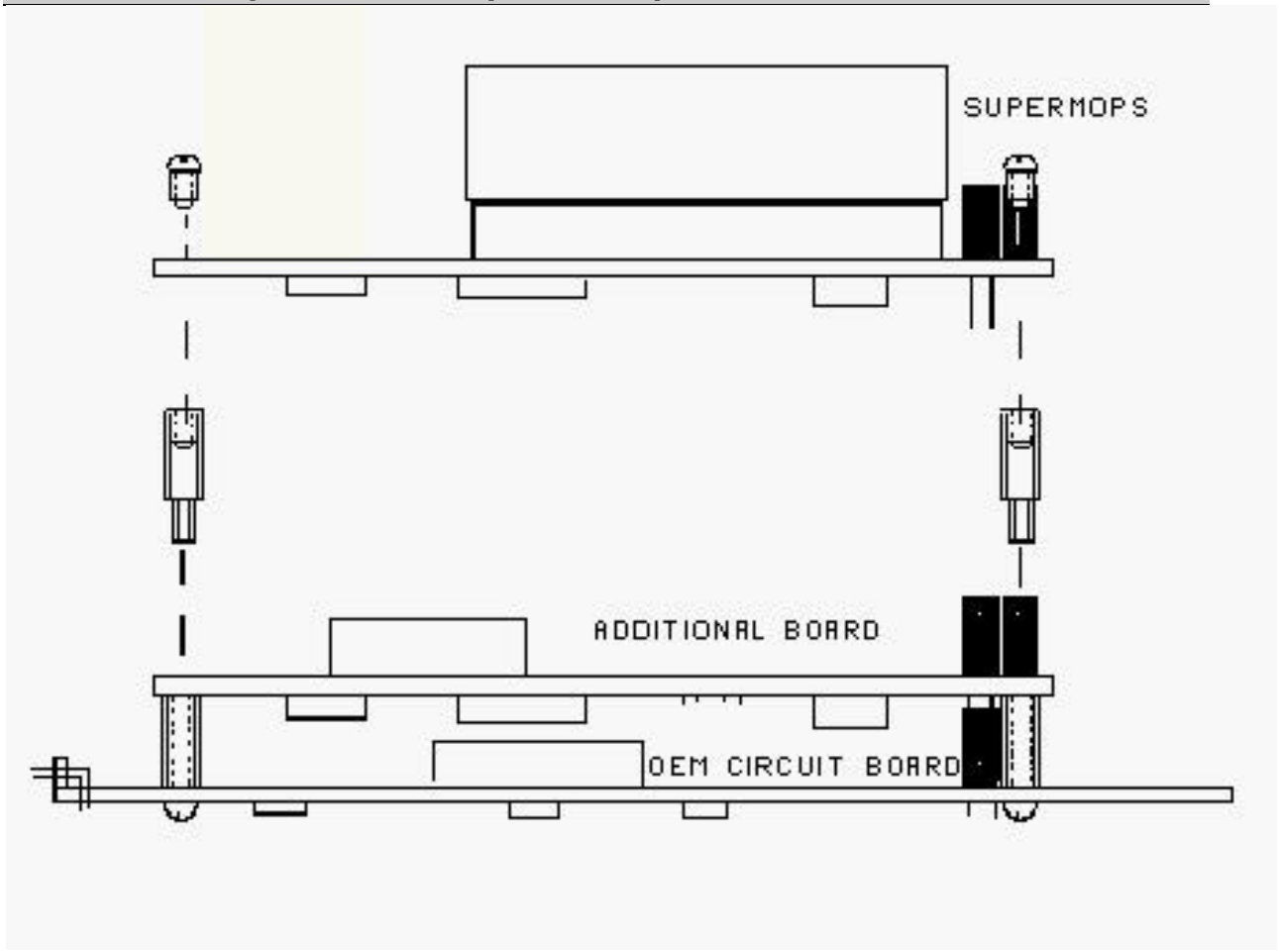
Mechanical dimensions of standard PC/104 modules



Self stacking system (Standard) with *super*MOPS*pro*



Customized System with *super*MOPS*pro*



History

Filename	Date	Edited by	Alteration to preceding revision
P487D112.DOC		M. Schanz	Created
P487D212.DOC	6.2.96	H. Iglhaut	Formatted
P487_neu.DOC	22.11.96	M. Huber	Ethernet added, graphics changed
P487D312.DOC	2.2.97	E.Eras	Text revised, IRDA added
P487D210.DOC	14.10.97	H.Bruhn	Changed file name to regular JUMP standard, Manual completely revised
P487D220.DOC	15.10.97	H.Bruhn	Changed to JUMPtec
P487D221.DOC	12.01.1998	SG	Changed to Brunnwiesenstr.
P487m222.DOC	09.02.98	J. Hagn	Layout revised and filename corrected