

ICOP-6053H

**Embedded 386SX PC/104 All-in-One CPU Module
with 2S/ LAN/ DOC/ 4M RAM onboard**

User's Manual

(Version 1.0)

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Chapter 0

Startup

0.1 Packing List

Product Name	Function	Package
ICOP-6053H	Embedded 386SX PC/104 All-in-One CPU Module	<ul style="list-style-type: none">● ICOP-6053H Embedded 386SX PC/104 All-in-One CPU Module● CD for User's Manual & Driver x1● FDD cable x 1● HDD cable x 1● RS232 cable x 2● Printer cable with bracket x 1● AT KB/ PS2 Mouse Y-cable x 1

0.2 Specifications

Features	ICOP-6053H
Chipset	DM&P(ALi) M6117D
Processor	386SX-40 on-die
Multi I/O Chip	ALi 5113
BIOS	AMI BIOS
Watchdog Timer	From 30.5 μ s to 512 seconds
Bus Interface	PC/104 standard compliant
RAM	4MB onboard
Display	X
Enhanced IDE Port	1
Floppy Connector	1
Flash Disk / DiskOnChip Socket	1
Network chipset	ASIX AX88796L Fast Ethernet Controller
Network interface	RJ45
Serial Port	RS232 X 1, RS232/485 X 1
Parallel Port	1
Power Requirement	+5V @450mA
Board Weight	76g
Board Size	90mm x 96mm

Chapter 1

Introduction

1.1 Features

- PC/104 (96x90 mm) Embedded CPU Module
- PC/104 connector
- DM&P (ALi) M6117D Embedded CPU, compatible with 386SX-40 CPU
- 4MB EDO RAM onboard
- Enhanced IDE devices and FDD interface
- One Bi-directional Parallel Port
- RS-232 interface
- RS-232/485 interface
- Watchdog timer
- Socket for Flash Disk or DiskOnChip
- Onboard Keyboard, Mouse header
- Onboard Ethernet, compatible with NE2000
- Single voltage +5 V power connector
- Operating temperature from -20~+70 °C

1.2 Specifications

- **Embedded CPU:** DM&P(ALi) M6117D 386SX-40MHZ
- **BIOS:** Y2K compliant AMI system BIOS
- **DRAM Memory:** 4MB EDO DRAM onboard
- **Bus Interface:** PC/104
- **Data Bus:** 16-bit
- **Bus Speeds:** PC/104 - 8 MHz

(Above values are defaults, bus speeds are programmable up to 16 MHz)

- **DMA Channels:** 7
- **Interrupt Levels:** 15
- **Enhanced IDE:** supports one port and up to two hard drives or Enhanced IDE devices of PIO mode 4. BIOS enabled/disabled
- **Watchdog Timer:** generates either a RESET, NMI or an IRQ when your application loses control over the system. Optionally the watchdog can trigger a user specified interrupt. The watchdog is configurable from 30.5 μ s to 512 seconds (in 30.5 μ s segments)
- **Real-time Clock:** included in M6117D with onboard lithium battery backup for 10 years of data retention. CMOS data backup of BIOS setup and BIOS default.

- **Keyboard and Mouse Connectors:**

External 6 pin Mini DIN for AT-keyboard, PS/2 Mouse

Internal 5-pin header for AT-keyboard

High Speed Multi I/O

- **Chipset:** ALi M5113
- **Serial ports:** one high speed RS-232 port, one high speed RS-232/485 port (jumper selectable). Both with 16C550 UART and 16 byte FIFO. BIOS enabled/ disabled
- **Floppy Disk Drive Interface:** supports up to two floppy drives, 5¼" (360 KB or 1.2 MB) and 3½ " (720 KB, 1.44 MB). BIOS enabled / disabled
- **Bi-directional Parallel Port:** supports SPP, EPP and ECP mode. BIOS

enabled/disabled

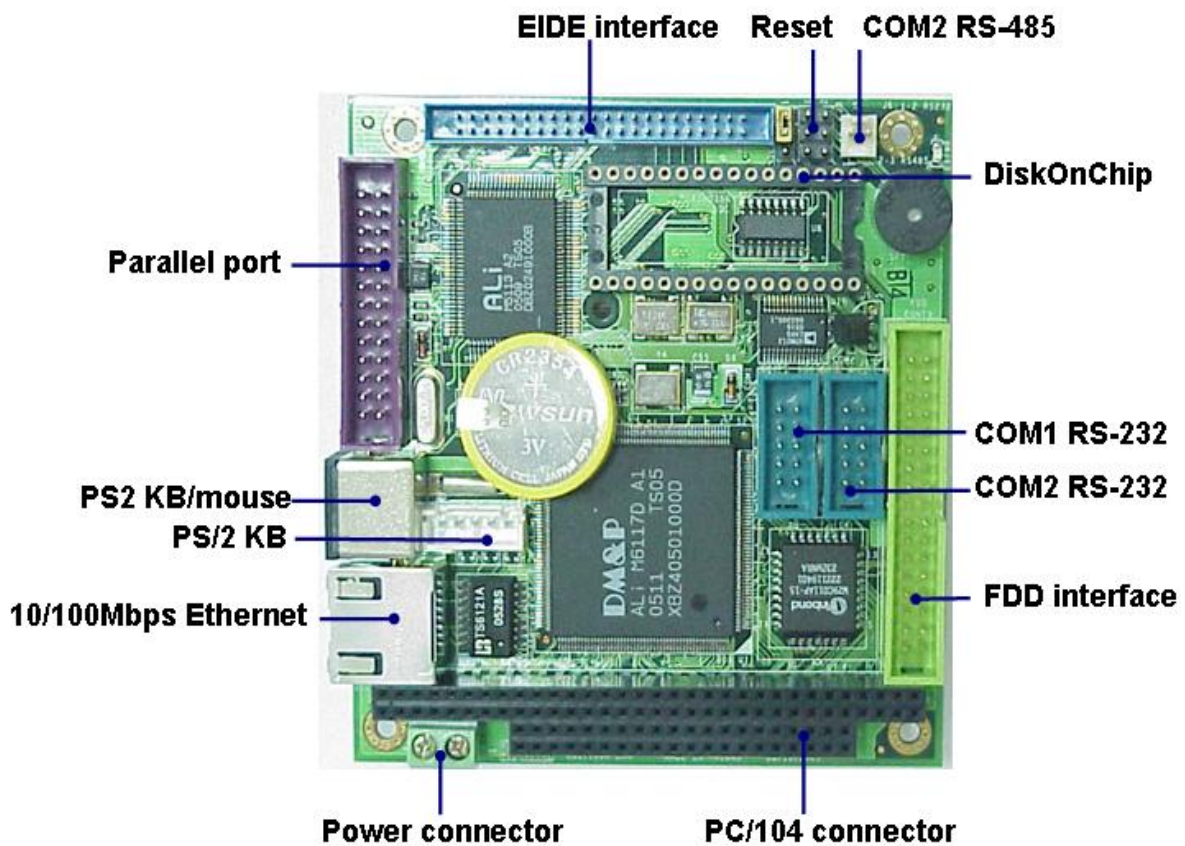
Environmental and Power

- **Power Requirements:** Single voltage +5 V
- **Board Dimensions:** 90 (L) x 96 (W) mm.
- **Board Weight:** 76 g
- **Extended Operating Temperature:** -20~+70 °C

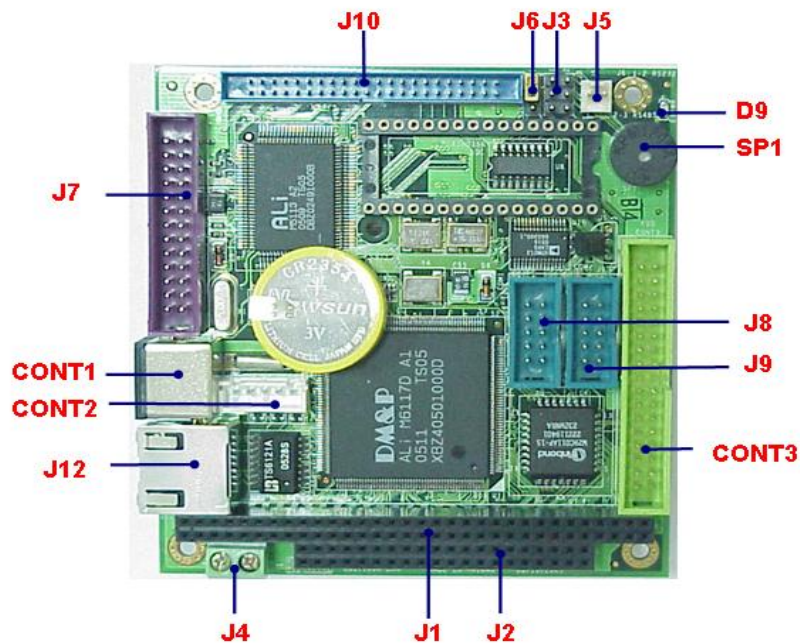
Chapter 2

Installation

2.1 Board Outline



2.2 Connectors & Jumpers Location



Nbr	Description
J1	PC/104, 64pin
J2	PC/104, 40pin
J3	IDE LED
	Power LED
	Reset Switch
J4	Power input
J5	COM 2 , RS485
J6	Jumper for COM 2 RS232/RS485
J7	Parallel Port
J8	COM 1, RS232
J9	COM 2, RS232
J10	IDE Port
J12	RJ45
SP1	Buzzer
CONT1.	MiNi Din Keyboard/Mouse
CONT2.	Keyboard
CONT3.	Floppy
D9	Power LED

2.3 DiskOnChip/EPROM/Flash ROM Disk

2.3.1 Setup a DiskOnChip[®] 2000 Flash Disk

Installation Instructions

1. Make sure the ICOP-605X is powered OFF
2. Plug the DiskOnChip 2000 device(s) into its socket. Verify the direction is correct (pin 1 of the DiskOnChip 2000 is aligned with pin 1 of the socket)
3. Set address for both DiskOnChip and Flash Disk devices as below instructions:

Step1: Enter to AMI BIOS Setup Utility while system power on

Step2: Enter to "Advanced Chipset Setup"

Step3: Select "GPCS Function" to "Enable"

(For DiskOnChip)

Step4: Select "GPCS0 Command" to "MEMR/W 8bit"

Step5: Select "GPCS0 Start Address" to "0C8000 HEX"

Step6: Select "GPCS0 Size" to "8 KBYTE" (goto Step 10)

(For Flash Disk)

Step4: Select "GPCS0 Command" to "MEMR/W 8bit"

Step5: Select "GPCS0 Start Address" to "0E0000 HEX"

Step6: Select "GPCS0 Size" to "64 KBYTE"

Step7: Select "GPCS1 Command" to "IOW 8bit"

Step8: Select "GPCS1 Start Address" to "000100 HEX"

Step9: Select "GPCS1 Size" to "2 BYTE"

Step10: Save changed and exit.

4. Power up the system
5. During power up you may observe the messages displayed by the DiskOnChip 2000 when its drivers are automatically loaded into system's memory
6. At this stage the DiskOnChip 2000 can be accessed as any disk in the system
7. If the DiskOnChip 2000 is the only disk in the system, it will appear as the first disk (drive C: in DOS)
8. If there are more disks besides the DiskOnChip 2000, the DiskOnChip 2000 will appear by default as the last drive, unless it was programmed as first drive. (Please refer to the DiskOnChip 2000 utilities user manual)

9. If you want the DiskOnChip 2000 to be bootable: a - copy the operating system files into the DiskOnChip by using the standard DOS command (for example: sys d :) b - The DiskOnChip should be the only disk in the systems or should be configured as the first disk in the system (c:) using the DUPDATE utility

For more information on DiskOnChip2000 technology, visit M-Systems Web site [http:// www.m-sys.com](http://www.m-sys.com) where you can find Utilities Manual, Data Sheets and Application Notes. In addition, you can find the latest DiskOnChip 2000 S/W Utilities.

2.3.2 Setting up a Flash Disk

Before you can use the ICOP-605X's Flash disk you will have to initialize it using a software utility called "PC104.EXE". This program can be found on the utility disk in the subdirectory "A:\FLASH"

- Connect a keyboard and floppy disk ICOP-605X to the PC/104 bus and boot-up your system.

- run PC104.EXE (this is a DOS command line utility)

```
ICOP-605X FLASH disk initialize program V1.0
```

```
FLASH manufacturer: (1) ATMEL (2) SST
```

```
Input manufacturer number (1,2) : 1
```

```
Input quantity of FLASH (1,2) : 2
```

```
Simulation disk:
```

```
(1)DISK-A (2)DISK-B (3)DISK-C (4)DISK-D
```

```
Input manufacturer number (1,2,3,4) : 1
```

```
FLASH-DISK initializes finish.
```

(Text in bold should be entered by user)

- After running the PC104.EXE configuration program reboot the system, while holding down the left "Ctrl" key. This will bring you to the "Flash Disk Utility"

- "CHANGE CURRENT DISK NUMBER" lets you select the drive you want to assign to the disk, either A, B, C or D

- "CHANGE FLASH DISK SIZE" lets you select the amount of Flash EPROM chips that are onboard.

- make selections and reboot the system after closing the program

Your disk can now be formatted and setup with normal DOS commands such as

FORMAT, FDISK, COPY, SYS etc.

Note: when assigning the solid state disk as either C or D, you first have to run FDISK before formatting the drive!

2.4 Watchdog Timer

The watchdog timer uses a 32.768 KHz frequency source with a 24-bit counter. Its time range stretches from 30.5 ms to 512 sec. with a resolution of 30.5 ms. When the watchdog times out a System RESET, NMI or IRQ can be invoked. Watchdog timer control and the 24-bit counter itself occupy 6 consecutive 8-bit address locations.

When functioning properly the system resets the watchdog timer periodically to prohibit that it times out. If the watchdog timer times out, it will RESET the system, or generate and NMI or IRQ, depending on its configuration.

Watchdog or System Timer

Another great application is to generate a periodic IRQ signal. Under DOS environment, the 8254, system timer 0, will generate IRQ0 every 54.9 ms. The watchdog is like system timer 0. It can be programmed to periodically generate a configurable IRQ. It may be clear that the selected IRQ, will be no longer available to the system.

Configuring the Watchdog Timer in the BIOS

The M6117D watchdog configuration register can be controlled by software or can be setup in the BIOS. To do so go to BIOS Setup's "Advanced Chipset Setup"

Watchdog Function = Enable/Disable

Watchdog Signal = RESET, NMI or IRQ 3/4/5/6/7/9/10/11/12/14/15

Watchdog Timer = 1/2/4/8/16/32/64/128/256/512 Seconds

The BIOS setup only offers a limited amount of time-out values. More a higher resolution of timeout values refer to the next paragraph "Configuring the Watchdog Timer by Software" Note that in case of using the BIOS setup, the watchdog starts counting the moment it passes the BIOS setup. This means that if you set the time-out period to 1 second, the system will keep rebooting before being able to load operating system or software!

After you have finished configuring you watchdog timer read "Timeout Status & Reset - INDEX 3CH" on page 12 and look at the example on page 15 to find out how to periodically resetting the timeout status to prevent the watchdog timer from invoking a RESET, NMI or IRQ.

Configuring the Watchdog Timer by Software

Chipset configuration registers

The M6117D configuration register INDEX 37H, 38H, 39H, 3AH, 3BH, 3Ch

are used to control the watchdog functions and/or display its current status.

Enable/Disable watchdog - INDEX 37H

Bit	Value	Action
7	reserved	Do not modify the value of these bits!
6	0	Disable watchdog timer
	1	Enable watchdog timer
5-0	Other function	Do not modify the value of these bits!

Watchdog time out action - INDEX 38H

Bit	Value	Action
7-4	0000	No output signal
	0001	IRQ3
	0010	IRQ4
	0011	IRQ5
	0100	IRQ6
	0101	IRQ7
	0110	IRQ9
	0111	IRQ10
	1000	IRQ11
	1001	IRQ12
	1010	IRQ14
	1011	IRQ15
	1100	NMI
	1101	System RESET
	1110	No output signal
	1111	No output signal
3-0	Other function	Do not modify the value of these bits!

Watchdog timer - INDEX 39H, 3AH, 3BH

Index	3Bh	3Ah	39h
Bits	D7.....D0	D7.....D0	D7.....D0
counter	[VSB.....LSB]

For example

Index	3Bh	3Ah	39h	Time out
	00h	00h	01h	30.5µs
	00h	00h	02h	61µs
	00h	01h	00h	7.8 ms
	00h	02h	00h	15.6 ms
	01h	00h	00h	2 s
	02h	00h	00h	4 s
	FFh	FFh	FFh	512 s

Timeout Status & Reset - INDEX 3CH

Bit	Value	Action
7	0	Timeout has not occurred
	1	Timeout has occurred
6	1	Reset timer
	0	Has no meaning
5-0		Other function, do not modify these bits

Programming the watchdog

To perform any operation on the M6117D configuration registers you always have to unlock first and lock the registers afterwards

Unlock configuration register

```
mov al, 013h
out 22h, al
nop
nop
```

Lock configuration register

```
mov al, 013h
out 22h, al
nop
nop
```

```

mov al, 0c5h                mov al, 000h
out 23h, al                 out 23h, al
nop                          nop
nop                          nop

```

Read the value of a configuration register

For example, read INDEX 3Ch :

Unlock configuration register

```

mov al, 03ch
out 22h, al
nop
nop
in al, 23h
nop
nop
push ax

```

Lock configuration register

```

pop ax ;AL - result

```

Write data to configuration register

For example, write 0FFh to INDEX 3Bh :

Unlock configuration register

```

mov al, 03bh
out 22h, al
nop
nop
mov al, 0ffh
out 23h, al
nop
nop

```

Lock configuration register

Watchdog Program Example

We use the following sequence to initialize the watchdog timer:

- (1) Unlock configuration register.
- (2) Disable watchdog timer by setting INDEX 37H Bit 6 to '0'.
- (3) Set the expected counter value to INDEX 3BH, 3AH, 39H.
- (4) Select timeout action from INDEX 38H Bit 7-4.
- (5) Enable watchdog timer by setting INDEX 37H Bit 6 to '1'.
- (6) Lock configuration register.

Example: Set timeout to 128 sec to generate a system RESET.

; Please use MASM to compiler the following program

; Execute under DOS environment

```
dosseg
```

```
. model small
```

```
. stack 100h
```

```
.code
```

```
main proc
```

```
    mov ax, 0c513h ; Unlock config. register
```

```
    call writechip
```

```
    mov ax, 03737h ; Disable watchdog timer
```

```
    call readchip
```

```
    and al, 10111111b
```

```
    xchg ah, al
```

```
    call writechip
```

```
    mov ax, 0403bh ; Set the expected counter
```

```
                ; value
```

```
    call writechip ; to [400000h]
```

```
    mov ax, 0003ah ; 30.5*sec*400000h= 128 sec
```

```
    call writechip
```

```

mov ax, 00039h
call writechip
mov ax, 03838h ; Select "system reset" as
                ; timeout action
call readchip
and al, 00001111b
or al, 11010000b
xchg ah, al
call writechip
mov ax, 03737h ; Enable watchdog timer
call readchip
or al, 01000000b
xchg ah, al
call writechip
mov ax, 00013h ; Lock config. register
call writechip
mov ax, 04c00h
int 21h
main endp

readchip proc
    out 22h, al
    nop
    nop
    in al, 23h
    nop
    nop
    ret
readchip endp

```

```

writechip proc
    out 22h, al
    nop
    nop
    xchg ah, al
    out 23h, al
    nop
    nop
    xchg ah, al
    ret

```

```
writechip endp
```

```
end main
```

Reset watchdog timer

Resets the watchdog timer periodically to prevent timeout.

```

    mov ax, 0c513h ; Unlock configuration
                    ; register
    call writechip
    mov ax, 03C3Ch ; Reset watchdog timer
                    ; counter
    call readchip
    or al, 01000000 ; The counter is reset at
    xchg ah, al ; out 23h, al
    call writechip
    mov ax, 00013h ; Lock configuration
                    ; register
    call writechip

```

(The above code uses readchip and writechip procedures)

Chapter 3

Network Interface

3.1 Introduction

The AX88796 Fast Ethernet Controller is a high performance and highly integrated local CPU bus Ethernet Controller with embedded 10/100Mbps PHY/Transceiver and 8K*16 bit SRAM. The AX88796 implements both 10Mbps and 100Mbps Ethernet function based on IEEE802.3 / IEEE802.3u LAN standard.

3.2 Software Support

ICOP (DM&P Group) provides the DSocket, DOS TCP/IP Socket Library, for programmers to use TCP/IP easily under DOS real mode.

To use DSocket with AX88796, please follow the instruction below to load the packet driver.

```
C:\DSOCK\DEMO\EXE>796pkt 0x62 5 0x320
```

```
C:\DSOCK\DEMO\EXE>pktdrv3 (Load packet driver for AX88796)
```

```
C:\DSOCK\DEMO\EXE>ftpd (Run any DSocket example program)
```

For more detail information and download the DSocket, please refer to <http://www.dmp.com.tw/tech/dmp-lib/dsocket/>

As for the Linux driver, please always contact inf@icop.com.tw to get the most update version.

Appendix

Pin Assignments

Summary

Nbr	Description
J1	PC/104, 64pin
J2	PC/104, 40pin
J3	IDE LED
	Power LED
	Reset SW
J4	Power input
J5	COM 2 , RS485
J6	Jumper for COM 2 RS232/RS485
J7	Parallel Port
J8	COM 1, RS232
J9	COM 2, RS232
J10	IDE Port
J12	RJ45
SP1	Buzzer
CONT1.	MiNi Din Keyboard/Mouse
CONT2.	Keyboard
CONT3.	Floppy
D9	Power LED

J1: PC104 Connector – 64pin

Pin #	Signal Name	Pin #	Signal Name
1	IOCHCHK *	2	GND
3	SD7	4	RESETDRV
5	SD6	6	+5V
7	SD5	8	IRQ9
9	SD4	10	-5V
11	SD3	12	DRQ2
13	SD2	14	-12V
15	SD1	16	ENDXFR *
17	SD0	18	+12V
19	IOCHRDY	20	(KEY)
21	AEN	22	SMEMW *
23	SA19	24	SMEMR *
25	SA18	26	IOW *
27	SA17	28	IOR *
29	SA16	30	DACK3 *
31	SA15	32	DRQ3
33	SA14	34	DACK1 *
35	SA13	36	DRQ1
37	SA12	38	REFRESH *
39	SA11	40	SYSCLK
41	SA10	42	IRQ7
43	SA9	44	IRQ6
45	SA8	46	IRQ5
47	SA7	48	IRQ4
49	SA6	50	IRQ3
51	SA5	52	DACK2 *
53	SA4	54	TC
55	SA3	56	SALE
57	SA2	58	+5V
59	SA1	60	OSC
61	SA0	62	GND
63	GND	64	GND

J2: PC104 Connector – 40pin

Pin #	Signal Name	Pin #	Signal Name
1	GND	2	GND
3	MEMCS16 *	4	SBHE *
5	IOCS16 *	6	LA23
7	IRQ10	8	LA22
9	IRQ11	10	LA21
11	IRQ12	12	LA20
13	IRQ15	14	LA19
15	IRQ14	16	LA18
17	DACK0 *	18	LA17
19	DRQ0	20	MEMR *
21	DACK5 *	22	MEMW *
23	DRQ5	24	SD8
25	DACK6 *	26	SD9
27	DRQ6	28	SD10
29	DACK7 *	30	SD11
31	DRQ7	32	SD12
33	+5V	34	SD13
35	MASTER *	36	SD14
37	GND	38	SD15
39	GND	40	(KEY)

J3: Reset SW / Power LED / IDE LED

Pin #	Signal Name	Pin #	Signal Name
1-2	Reset_SW	3-4	Power LED
5-6	IDE_LED		

J4: Power Input

Pin #	Signal Name
1	+5V
2	GND

J5: RS485

Pin #	Signal Name
1	RS485+
2	RS485-

J6: Jumper for COM2, RS232/RS485 Select

Pin #	Signal Name
1-2	RS232
2-3	RS485

J7: Parallel port

Pin #	Signal Name	Pin #	Signal Name
1	STB-	2	PD0
3	PD1	4	PD2
5	PD3	6	PD4
7	PD5	8	PD6
9	PD7	10	ACK-
11	BUSY	12	PE
13	SLCT	14	AFD-
15	ERR-	16	PRINIT-
17	SLIN-	18	GND

19	GND	20	GND
21	GND	22	GND
23	GND	24	GND
25	GND	--	--

J8: COM1

Pin #	Signal Name	Pin #	Signal Name
1	DCD1	2	RXD1
3	TXD1	4	DTR1
5	GND	6	DSR1
7	RTS1	8	CTS1
9	RI1	10	VCC

J9: COM2

Pin #	Signal Name	Pin #	Signal Name
1	DCD2	2	RXD2
3	TXD2	4	DTR2
5	GND	6	DSR2
7	RTS2	8	CTS2
9	RI2	10	VCC

J10: IDE port

Pin #	Signal Name	Pin #	Signal Name
1	IDERST-	2	GND
3	IDED7	4	IDED8
5	IDED6	6	IDED9
7	IDED5	8	IDED10
9	IDED4	10	IDED11
11	IDED3	12	IDED12
13	IDED2	14	IDED13
15	IDED1	16	IDED14
17	IDED0	18	IDED15
19	GND	20	NC
21	IDEREQ	22	GND
23	IDEIOW-	24	GND
25	IDEIOR-	26	GND
27	ICHRDY	28	GND
29	IDACK-	30	GND
31	IDEIRQ	32	NC
33	IDESA1	34	CBLID
35	IDESA0	36	IDESA2
37	IDECS-0	38	IDECS-1
39	DASP	40	GND
41	VCC	42	VCC
43	GND	44	NC

J12: RJ45

Pin #	Signal Name	Pin #	Signal Name
1	TX+	2	TX-
3	RX+	4	ACT
5	ACT+	6	RX-
7	LINK+	8	LINK

CONT1.MiNi Din

Pin #	Signal Name	Pin #	Signal Name
1	KBCLK	2	MCLK
3	GND	4	KBDAT
5	IRQ12	6	VCC

CONT2.KBD

Pin #	Signal Name	Pin #	Signal Name
1	KBCLK	2	KBDAT
3	NC	4	GND
5	VCC		

CONT3.Floppy

Pin	Description	Pin	Description
1	GND	2	Drive Enable Select
3	GND	4	N/C
5	GND	6	N/C
7	GND	8	Index #
9	GND	10	Drive select 0
11	GND	12	Drive select 1
13	GND	14	Drive select 2
15	GND	16	Motor enable
17	GND	18	Direction #
19	GND	20	STEP #
21	GND	22	Write data #
23	GND	24	Write gate #
25	GND	26	Track 0 #
27	GND	28	Write protect #
29	GND	30	Read data #
31	GND	32	Side 1 select #
33	GND	34	Disk change #

IRQ Mapping

IRQ#	Usage
IRQ0	System Timer
IRQ1	Keyboard Controller
IRQ2	Cascade for IRQ8 - 15
IRQ3	Serial Port
IRQ4	Serial Port
IRQ5	LAN Card #1
IRQ6	Floppy Disk Controller
IRQ7	Parallel Port
IRQ8	Real Time Clock
IRQ9	Unassigned
IRQ10	Unassigned
IRQ11	Unassigned
IRQ12	Unassigned
IRQ13	Math Coprocessor
IRQ14	Hard Disk Controller
IRQ15	Unassigned

Warranty

This product is warranted to be in good working order for a period of one year from the date of purchase. Should this product fail to be in good working order at any time during this period, we will, at our option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster. Vendor assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Vendor will not be liable for any claim made by another related party. Return authorization must be obtained from the vendor before returned merchandise will be accepted. Authorization can be obtained by calling or faxing the vendor and requesting a Return Merchandise Authorization (RMA) number. Returned goods should always be accompanied by a clear problem description.