

# **ICOP-6050M**

**Embedded 386SX PC/104 CPU Module  
with 4S/ DOC/ GPIO/ 8M RAM onboard/  
User's Manual**

**(Version 1.1)**

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# Chapter 0

## Startup

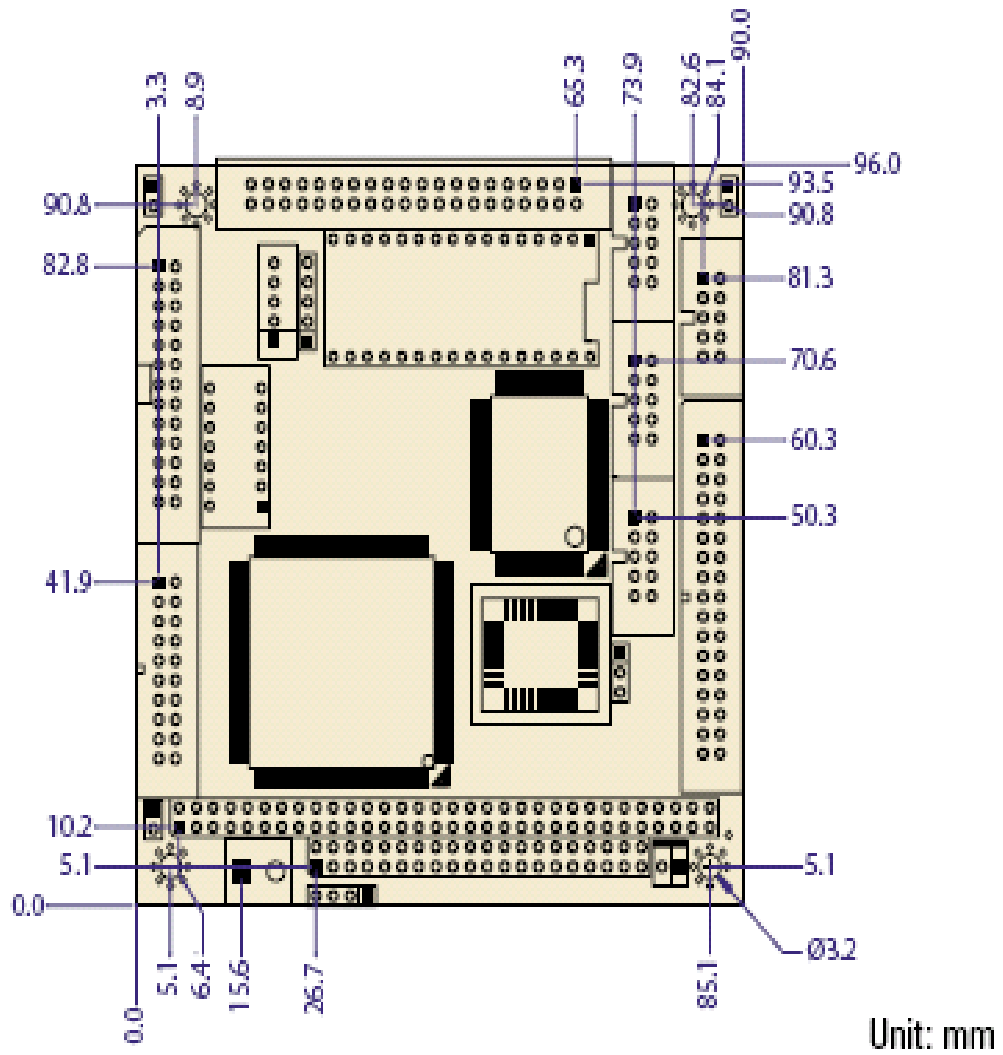
### 0.1 Packing List

Product Name	Function	Package
ICOP-6050M	Embedded 386SX PC/104 All-in-One CPU Module	<ul style="list-style-type: none"><li>● ICOP-6050M Embedded 386SX PC/104 CPU Module x 1</li><li>● CD for User's manual &amp; Driver x 1</li><li>● FDD cable x 1</li><li>● HDD cable x 1</li><li>● RS232 cable x 4</li><li>● Printer cable with bracket x 1</li><li>● GPIO cable x 1</li><li>● PS2 KB white x 1</li><li>● Screw Kit x 1</li></ul>

## 0.2 Specifications

Features	ICOP-6050M
Chipset	DM&P(ALi) M6117D
Processor	386SX-40 on-die
Multi I/O Chip	ALi 5113
BIOS	AMI BIOS
Watchdog Timer	From 30.5 $\mu$ s to 512 seconds
Bus Interface	PC/104 standard compliant
RAM	8MB onboard
Display	X
Enhanced IDE Port	1
Floppy Connector	1
Flash Disk / DiskOnChip Socket	1
Flash Disk / EPROM Socket	X
Serial Port	RS232 X 4
Parallel Port	1
Power Requirement	+5V @420mA
Board Weight	100g
Board Size	90mm x 96mm

## 0.3 Board Dimension



# Chapter 1

## Introduction

### 1.1 Features

- PC/104 (96x90 mm) Embedded CPU Module
- PC/104 connector
- DM&P (ALi) M6117D Embedded CPU, 100% compatible with 386SX-40 MHz CPU
- 8MB EDO RAM onboard
- Enhanced IDE devices and FDD interface
- One Bi-directional Parallel Port
- RS-232 interface
- RS-232/485 interface
- 16 bit GPIO (General Purpose Input / Output)
- Watchdog timer
- Support EmbedDisk
- Onboard Keyboard, Mouse header
- Onboard Dual Ethernet, compatible with NE2000, 10Mbps
- Single voltage +5 V power connector
- Operating temperature from -40~+80 °C



## 1.2 Specifications

- **Embedded CPU:** DM&P(ALi) M6117D 386SX-40MHz
- **BIOS:** Y2K compliant AMI system BIOS
- **DRAM Memory:** 8MB 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 30.5µs to 512 seconds (in 30.5µs 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:**

Internal 5-pin header for AT-keyboard

Internal 5-pin header for PS/2-mouse

### High Speed Multi I/O

- **Chipset:** ALi 5113
- **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@420mA

- **Board Dimensions:** 90 (L) x 96 (W) mm.

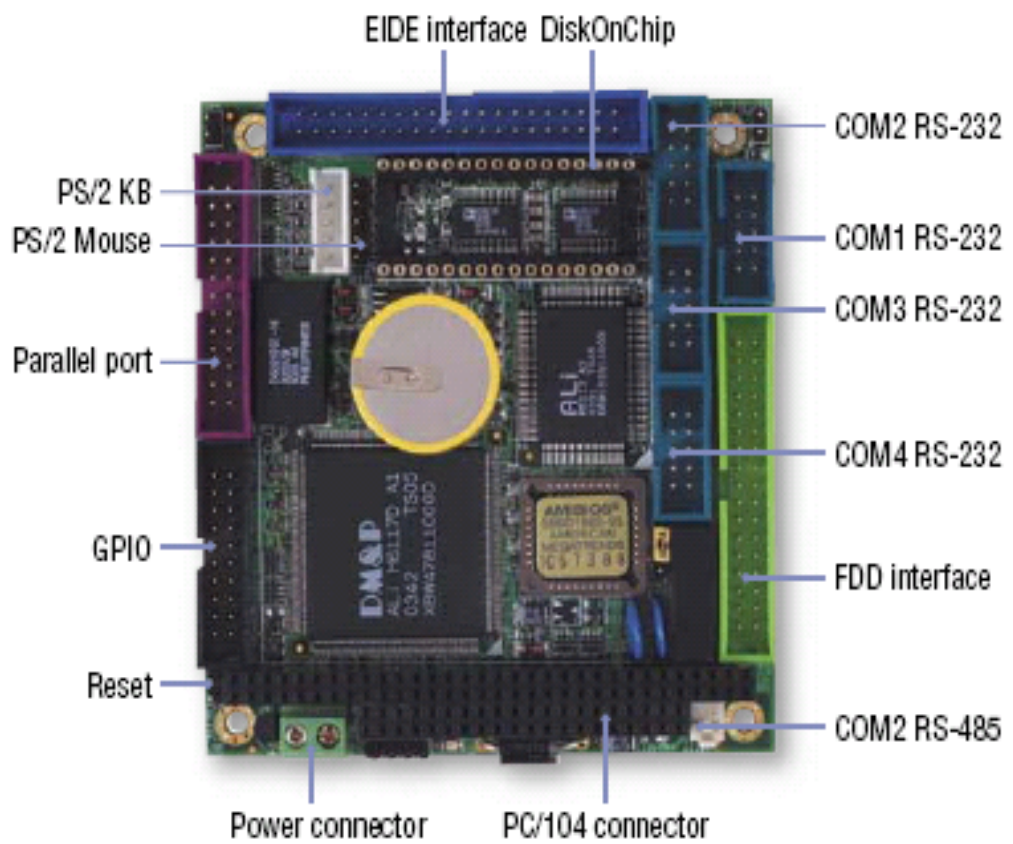
- **Board Weight:** 100 g

- **Extended Operating Temperature:** -40~+80 °C

# Chapter 2

## Installation

### 2.1 Board Outline



## 2.3 DiskOnChip/Flash ROM Disk

### 2.3.1 Setup a DiskOnChip ® 2000 Flash Disk

#### Installation Instructions

1. Make sure the ICOP-6050M 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 initialize 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**



<b>Index</b>	<b>3Bh</b>	<b>3Ah</b>	<b>39h</b>
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)

# Appendix

## Pin Assignments

### Summary

Nbr	Description
J1	Keyboard
J2	PC/104, 64pin
J3	PC/104, 40pin
J4	Power input
J5	Power source (Note 1)
J6	Mouse
J7	Speaker
J8	Reset
J9	Parallel Port
J10	Floppy Port
J11	RS485
J12	GPIO
J13	COM 1, RS232
J14	COM 2, RS232
J15	IDE LED
J16	Jumper for COM 2 RS232/RS485
J17	IDE Port
J18	COM3, RS-232
J19	COM4, RS-232
D10	Power LED , Red

**Note 1:** For +12V,-12V and -5V, interlink to PC/104 bus.  
Need only when your add-on PC/104 Module need the +12,-12V or -5V power input.

## J1: Keyboard

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

## J2: 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

### J3: 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)



## J4: Power Connector

Pin #	Signal Name
1	+5V
2	GND

## J5: Power Source

Pin #	Signal Name
1	+12V
2	-12V
3	-5V
4	GND

## J6: Mouse

Pin #	Signal Name	Pin #	Signal Name
1	PMCLK	2	PMDAT
3	NC	4	GND
5	+5V		

## J8: RESET

Pin #	Signal Name	Pin #	Signal Name
1	PWG	2	GND

## J9: 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	--	--

## J10: FDD port

Pin #	Signal Name	Pin #	Signal Name
34	DSKCHG\	33	GDN
32	HDSEL\	31	GDN
30	RD\	29	GDN
28	WP\	27	GDN
26	TR0\	25	GDN
24	WG\	23	GDN
22	WD\	21	GDN
20	STEP\	19	GDN
18	DIR\	17	GDN
16	MTR1\	15	GDN
14	DS0\	13	GDN
12	DS1\	11	GDN
10	MTR0\	9	GDN
8	INDEX\	7	GDN
6	NC	5	GDN
4	NC	3	GDN
2	DENSEL	1	GDN

## J11: RS485

Pin #	Signal Name
1	RS485+
2	RS485-

## J12: GPIO

Pin #	Signal Name	Pin #	Signal Name
1	GND	2	VCC-
3	GP0	4	GP8
5	GP1	6	GP9
7	GP2	8	GP10
9	GP3	10	GP11
11	GP4	12	GP12
13	GP5	14	GP13
15	GP6	16	GP14
17	GP7	18	GP15
19	VCC	20	GND

## J13: 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

### J14: COM2

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

### J15: IDE LED

Pin #	Signal Name
1	VCC
2	GND

## J16: Jumper for COM2, RS232/RS485 Select

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

## J17: IDE port

Pin	Description	Pin	Description
1	Reset	2	GND
3	Data 7	4	Data 8
5	Data 6	6	Data 9
7	Data 5	8	Data 10
9	Data 4	10	Data 11
11	Data 3	12	Data 12
13	Data 2	14	Data 13
15	Data 1	16	Data 14
17	Data 0	18	Data 16
19	GND	20	N/C
21	N/C	22	GND
23	IOW #	24	GND
25	IOR #	26	GND
27	N/C	28	BALE-Default
29	N/C	30	GND-Default
31	Interrupt	32	IOCS16-Default
33	SA1	34	N/C
35	SA0	36	SA2
37	HDC CS0	38	HDC CSI #
39	HDD Active	40	GND

### J18: COM3

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

### J19: COM4

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

## IRQ Mapping

IRQ#	Usage
IRQ0	System Timer
IRQ1	Keyboard Controller
IRQ2	Cascade for IRQ8 - 15
IRQ3	Serial Port
IRQ4	Serial Port
IRQ5	Unassigned
IRQ6	Floppy Disk Controller
IRQ7	Parallel Port
IRQ8	Real Time Clock
IRQ9	Unassigned
IRQ10	Serial Port
IRQ11	Serial Port
IRQ12	Mouse (if exist)
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 any other 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.