AX10402

PC/104 Embedded CPU Module

User's Manual

Disclaimers

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ESD Precautions

Integrated circuits on computer boards are sensitive to static electricity. To avoid damaging chips from electrostatic discharge, observe the following precautions:

- Do not remove boards or integrated circuits from their anti-static packaging until you are ready to install them.
- Before handling a board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. This helps to discharge any static electricity on your body.
- Wear a wrist-grounding strap, available from most electronic component stores, when handling boards and components.

Trademarks Acknowledgments

Unpacking

After unpacking the PC/104 module, check and see if the following items are included and in good condition. If any of the items is missing or damaged, notify your dealer immediately.

- AX10402 PC/104 Embedded CPU module ..... x 1
- HDD, COM port cables ..... x 1
- Printer extension cables with bracket ..... x 1
- Floppy flat cable ..... x 1
- PS/2 mouse cable ..... x 1
- Keyboard adapter ..... x 1
- Screws (3mm) ..... x 4
- Bronze stick (6mm) ..... x 4
- User's Manual with Warranty Card ..... x 1

Make sure that all of the items listed above are present.

What To Do If There Is A Problem

If there are damaged or missing parts, contact your supplier and/or dealer immediately. Do not attempt to apply power to the board if there is damage to any of its components.

Table of Contents

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Chapter 1
Introduction

1.1 General Description

The AX10402 is a PC/104 plug-in CPU module using 80386SX 40-MHz. Its 6-layer printed circuit board combines features with noise-tolerant and low power consumption. CMOS technology applied on the board makes AX10402 withstand and adapt harsh industrial environments very well.

Additional AX10402 onboard features include two RS-232 serial ports, one bi-directional parallel port, keyboard connector, an EIDE (AT bus) hard disk drive interface, a floppy disk drive controller and a watchdog timer.

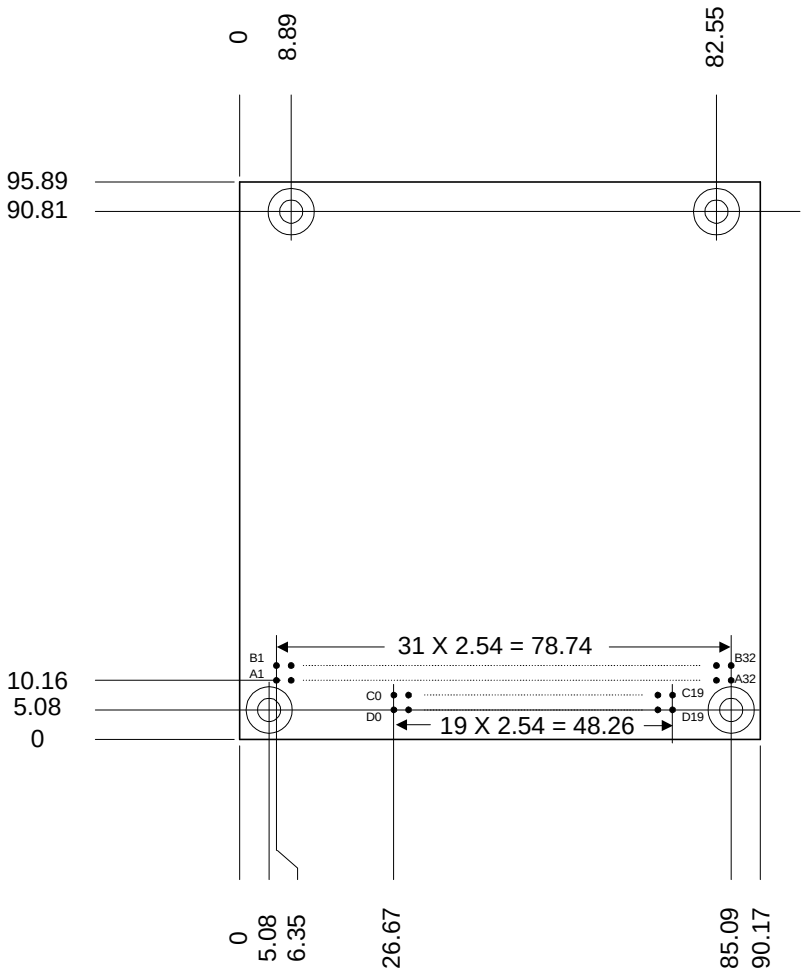
1.2 Features

- Fully PC/AT compatible 40MHz 80386SX CPU
- ALI M6117C single chip built-in 386SX CPU core
- Compact form factor meets the PC/104 standard
- Fully hardware and software compatibility with the popular PC bus standard.
- AMI BIOS
- Onboard 2 RS-232 serial ports support FIFO mode
- Onboard 1 parallel port support SPP/ECP/EPP modes
- Build-in EIDE hard disk driver interface
- Build-in floppy disk controller
- DRAM expandable from 2MB to 4MB
- External K/B connector
- Supports PS/2 mouse
- 16-level watchdog timer selected via CMOS setup

1.3 Specifications

- **Dimensions (LxW):** 3.74" (95mm) x 3.54" (90mm)
- **Weight:** 120g
- **Operating Temperature:** 0°C (32°F) to 60°C (140°F)
- **Power Consumption:** +5V_{DC} @ 2A

1.4 Board Dimensions



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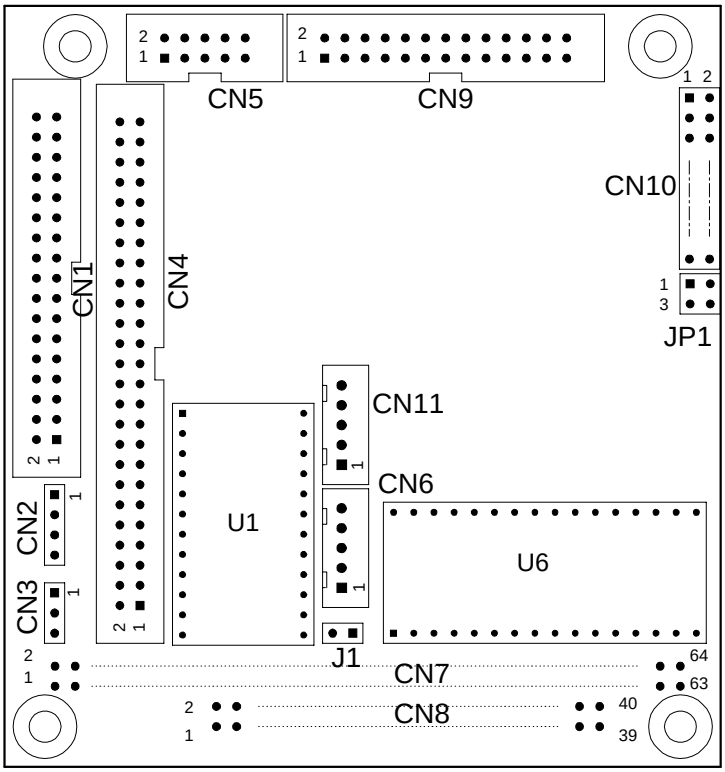
Chapter 2
Configuration

2.1 Placement



2.2 Inspection

Please read carefully the details explained in Chapter 3 "Hardware Description" before installing the AX10402 into your system. Pay careful attention to the proper cabling, jumper and switch settings.

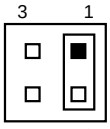
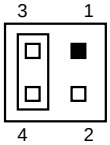
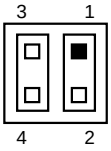
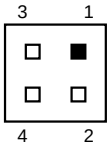
Follow the reminders listed below during installation:

1. Read Chapter 3 "Hardware Description" of this manual.
2. Configure the proper jumper settings.
3. Make sure the power is OFF.
4. Plug the board into a PCI/104 interface connector and fix it with a screw.
5. Connect the cables. Make sure the connections of the FDC, HDC, parallel port, serial port and K/B PS/2 mouse cables are correct.
6. Turn ON the power.
7. If the board does not work, turn OFF the power. Read the "Hardware Description" chapter carefully and install the board again.
8. If the board still does not perform as defined in this manual; consult with your dealer if the unit requires service.

2.3 Jumpers

The AX10402 has 2 onboard jumpers that configure the DiskOnChip™ BIOS Expansion Address and Real-time Clock setting. Refer the following sections for the available options and settings of both jumpers.

2.3.1 DiskOnChip™ BIOS Expansion Address Select: JP1

JP1	Address	JP1	Address
	D2000-D3FFF		D4000-D5FFF
	D0000-D1FFF (default)		D6000-D7FFF

2.3.2 Clear CMOS Jumper: J1

J1	Setting	Function
	Pin 1-2 Short/Closed	Clear CMOS Content
	Pin 1-2 Open	Normal Operation

2.4 Connectors

The following table lists the connectors and their respective functions onboard the AX10402.

Connector	Function
CN1	Floppy Connector
CN2	External Power Connector #1
CN3	External Power Connector #2
CN4	Multi-function Connector of HDD and Serial Port 2
CN5	Serial Port 1 Connector
CN6	Keyboard Connector
CN9	Parallel Port Connector
CN10	Multi-function Connector
CN11	PS/2 Mouse Connector

CN1: Floppy Connector

PIN	Description	PIN	Description
1	Ground	2	Reduce Write Current
3	Ground	4	N/C
5	Ground	6	N/C
7	Ground	8	Index #
9	Ground	10	Motor Enable A #
11	Ground	12	Drive Select B #
13	Ground	14	Drive Select A #
15	Ground	16	Motor Enable B #
17	Ground	18	Direction #
19	Ground	20	STEP #
21	Ground	22	Write Data #
23	Ground	24	Write Gate #
25	Ground	26	Track 0 #
27	Ground	28	Write Protect #
29	Ground	30	Read Data #
31	Ground	32	Side 1 Select #
33	Ground	34	Disk Change #

CN2: External Power Connector #1

1	2	3	4
5V	GND	GND	+12V

CN3: External Power Connector #2

1	2	3
-12V	GND	-5V

CN4: Multi-Function Connector of HDD and Serial Port 2

PIN	Description	PIN	Description
1	Reset #	2	Ground
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	Ground	20	N/C
21	N/C	22	Ground
23	IOW #	24	Ground
25	IOR #	26	Ground
27	IOCHRDY	28	N/C
29	N/C	30	Ground-Default
31	Interrupt	32	N/C
33	SA1	34	N/C
35	SA0	36	SA2
37	HDC CS0 #	38	HDC CSI #
39	HDD Active #	40	Ground
41	Data Carrier Detect	42	Data Set Ready
43	Receive Data	44	Request to Send
45	Transmit Data	46	Clear to Send
47	Data Terminal Ready	48	Ring Indicator
49	Ground	50	Ground

CN5: Serial Port 1 Connector

PIN	Description
1	Data Carrier Detect (DCD)
2	Data Set Ready (DSR)
3	Receive Data (RXD)
4	Request To Send (RTS)
5	Transmit Data (TXD)
6	Clear To Send (CTS)
7	Data Terminal Ready (DTR)
8	Ring Indicator (RI)
9	Ground (GND)
10	Ground (GND)

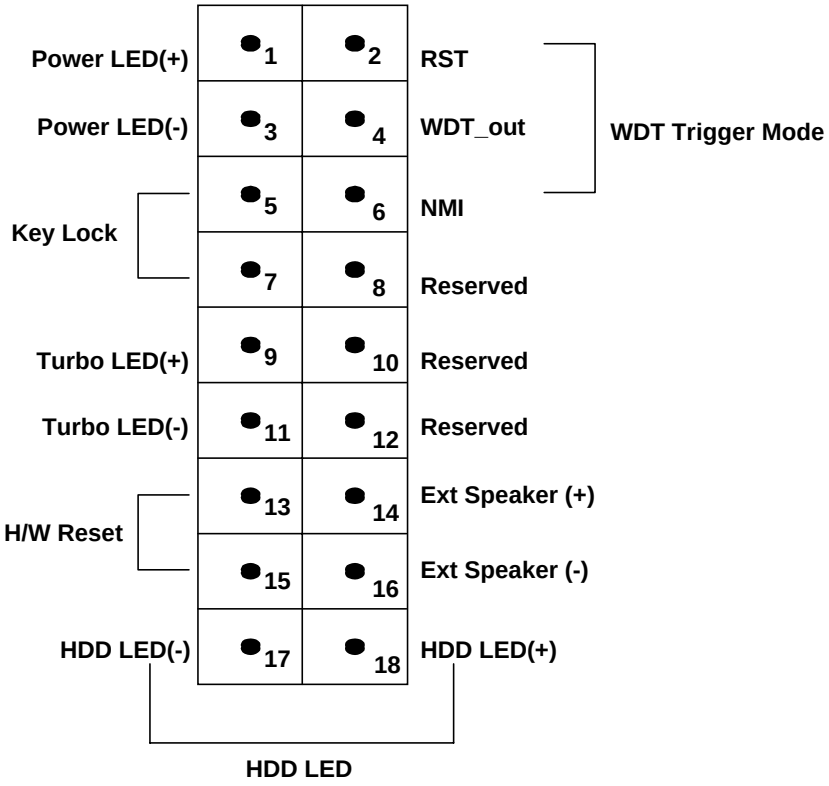
CN6: K/B Connector

PIN	Description
1	Keyboard Clock
2	Keyboard Data
3	N/C
4	Keyboard Ground
5	Keyboard VCC

CN9: Parallel Port Connector

PIN	Description	PIN	Description
1	Strobe #	2	Auto Form Feed #
3	Data 0	4	Error #
5	Data 1	6	Initialize #
7	Data 2	8	Printer Select In #
9	Data 3	10	Ground
11	Data 4	12	Ground
13	Data 5	14	Ground
15	Data 6	16	Ground
17	Data 7	18	Ground
19	Acknowledge #	20	Ground
21	Busy	22	Ground
23	Paper Empty #	24	Ground
25	Printer Select	26	Ground

CN10: Multi-Function Connector



CN11: PS/2 Mouse Connector

PIN	Description
1	Mouse Clock
2	Mouse Data
3	N/C
4	Mouse Ground
5	Mouse VCC

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Chapter 3
Hardware Description

3.1 Chipset

The M6117C is designed to perform like Intel's 386SX system with deep green features. Aside from the 386SX core, it contains:

- PS2/AT keyboard controller and mouse
- Integrated System Peripheral to serve the peripheral requests
- DRAM Controller for four banks memory module supporting EDO and Fast page mode with page interleave and up to 64MB space.

3.2 CPU

The M6117C is an implementation of Intel™ 386SX compatible microprocessor. The M6117C compatible with 386/286 and 8086 microprocessor.

3.3 CPU CLK

The AX10402 CPU speed is 40MHz.

3.4 BIOS

The board supports a single 1MB Flash EPROM that contains the system BIOS residing at the upper 64KB of address space of the first megabyte.

3.5 Timer

The board has three channels of timer/counter in the AX10402 that are Intel 8254 compatible. The function of each channel is listed on the following table.

Channel	Function
0	System Timer - This timer generates the time base for the system timer. Its output is tried to IRQ0.
1	Memory Refresh Request - This timer is used to generate memory refresh requests. It triggers the memory refresh cycle.
2	Tone Generator for Speaker - This timer provides the speaker tone. Programming the timer can generate various sounds.

3.6 Memory Address Map

The AX10402 supports 4MB EDO DRAM. The first megabyte is divided into four blocks with each block dedicated to a specific function.

Memory	Address	Description
0KB	000000H--09FFFFH	Conventional RAM
640KB	0A0000H--0BFFFFH	128KB of Video RAM
768KB	0C0000H--0EFFFFH	192KB of I/O Expansion ROM
960KB	0F0000H--0FFFFFH	64KB of System BIOS ROM

3.7 I/O Port Address Map

The 80386SX CPU communicates via I/O ports. It has a total of 1KB port addresses that can be assigned to other devices via I/O expansion cards.

Address	Devices
000 - 01F	DMA Controller #1
020 - 03F	Interrupt Controller #1
040 - 05F	Timer
060 - 06F	Keyboard Controller
070 - 07F	Real Time Clock, NMI
080 - 09F	DMA Page Register
0A0 - 0BF	Interrupt Controller #2
0C0 - 0DF	DMA Controller #2
0F0	Clear Math Coprocessor Busy Signal

Continued . . . . .

Address	Devices
0F1	Reset Math Coprocessor
0F8 - 0FF	Math Processor
120	Disable WDT
121	Trigger WDT
1F0 - 1F8	Fixed Disk Controller
278 - 27F	Parallel Port #2
278 - 2FF	Serial Port #2
300 - 31F	Prototype Card
360 - 36F	Reserved
378 - 3FF	Parallel Port #1
380 - 38F	SDLC #2

3.8 DMA Channels

The board contains an equivalent of two 8237A DMA controllers inside the M6117C. The M6117C provides the user with two DMA controllers and four channels of DMA (DMA#1) for 8-bit transfers and three channels of DMA (DMA#2) for 16 bit transfers. (The first 16-bit DMA channel is used for cascading)

DMA channel 0	Reserved
DMA channel 1	SDLC
DMA channel 2	Floppy Disk Controller
DMA channel 3	Reserved
DMA channel 4	Cascade for DMA #1
DMA channel 5	Reserved
DMA channel 6	Reserved
DMA channel 7	Reserved

3.9 Interrupt Controller

There are two Intel 8259A compatible interrupt controllers in the M6117C. Sixteen channels are partitioned into the cascaded controllers (INTC1, INTC2) with 8 inputs each. Of these 16 channels, three are connected internally to various devices allowing 13 user definable channels of interrupt. Any or all of these interrupts can be masked.

NMI	Parity check error
IRQ0	System timer output
IRQ1	Keyboard
IRQ2	Interrupt rerouting from IRQ8 through IRQ15
IRQ3	Serial Port #2
IRQ4	Serial Port #1
IRQ5	Reserved
IRQ6	Floppy Disk Controller
IRQ7	Parallel Port #1
IRQ8	Real Time Clock
IRQ9	Software redirected to INT OAH (IRQ2)
IRQ10	Reserved
IRQ11	Reserved
IRQ12	PS/2 Mouse
IRQ13	Math Coprocessor 80387SX
IRQ14	Hard Disk Controller
IRQ15	Reserved

3.10 Parallel Port Interface

The onboard built-in a is multi-mode parallel port support:

- **Standard mode:** IBM PC/XT, PC/AT and PS/2™ compatible bi-directional parallel port
- **Enhanced mode:** Enhance parallel port (EPP) compatible EPP 1.7 and EPP 1.9 (IEEE 1284 compliant)
- **High speed mode:** Microsoft and Hewlett Packard extended capabilities port (ECP) IEEE 1284 compliant

3.11 Serial Port Interface

There are two onboard standard RS232A serial ports (NS16C550 compatible) with 16 bytes of FIFOS. The serial port can be individually configured as COM1 (3F8H), COM2 (2F8H), COM3 (3E8H), COM4 (2E8H) or disable, with each serial port's address selected via the BIOS COMS setup.

3.12 Floppy Disk Controller

The board provides a 34-pin header type connector, **CN4** that supports up to two floppy drives. The floppy drives may be any one of the following types: 5.25" 360KB/1.22MB and 3.5" 720KB/1.44MB/2.88MB.

3.13 IDE Controller

The AX10402 has a built-in 1 channel, 2 IDE drivers, AT bus IDE controller compatible with IBM PC/XT and PC/AT Embedded Hard Disk Drivers.

3.14 PS/2 Mouse

The ALIM6117C chip includes a built-in PS2/AT keyboard controller device that also supports mouse. Therefore there is no need for an external keyboard controller. If the user does not use the internal keyboard controller for something else, then it can be disabled via hardware setting.

3.15 DiskOnChip™ Flash Disk

The DiskOnChip™ Flash Disk (DOC) is produced by M-Systems. Since DOC is 100% compatible to hard disk and DOS, customer doesn't need any extra software utility. It is simply a "plug and play" component that is easily installed and reliable. The DOCs currently available range from 2MB to 72MB.

3.16 Watchdog Function

The trigger sources for watchdog timer during system failure. The system failure may be caused by thunder, power glitch, radio interference, and program bug. To detect such failure symptoms, users have to put some program code into their system running loops.

The program code should be similar to the following:

```
    :
    :
Loop:
      input (0x121)              ;enable and trigger WDT
        :
      if (END) GOTO END;         ;must be smaller than time-out
      GOTO Loop                  ;period
END:
      input (0x120)              ;disable WDT
```

The time-out period, selected from the BIOS setup, ranges from 0.5 second to 1000 seconds.

3.17 PC/104 Expansion Bus

CN7: PC/104 Bus Signal Assignments

PIN No.	PIN Name	PIN No.	PIN Name
1	IOCHCHK*	2	0V
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*

Continued . . . . .

PIN No.	PIN Name	PIN No.	PIN Name
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	0V
63	0V	64	0V

CN8: PC/104 Bus Signal Assignments

PIN No.	PIN Name	PIN No.	PIN Name
2	0V	1	0V
4	SBHE*	3	MEMCS16*
6	LA23	5	IOCS16*
8	LA22	7	IRQ10
10	LA21	9	IRQ11
12	LA20	11	IRQ12
14	LA19	13	IRQ15
16	LA18	15	IRQ14
18	LA17	17	DACK0*
20	MEMR*	19	DRQ0

Continued . . . . .

PIN No.	PIN Name	PIN No.	PIN Name
22	MEMW*	21	DACK5*
24	SD8	23	DRQ5
26	SD9	25	DACK6*
28	SD10	27	DRQ6
30	SD11	29	DACK7*
32	SD12	31	DRQ7
34	SD13	33	+5V
36	SD14	35	MASTER*
38	SD15	37	0V
40	(KEY)	39	0V

NOTE: *1. CN7 is not used on 8-bit modules.*
2. CN8 Pin 20 and Pin 40 are key locations.