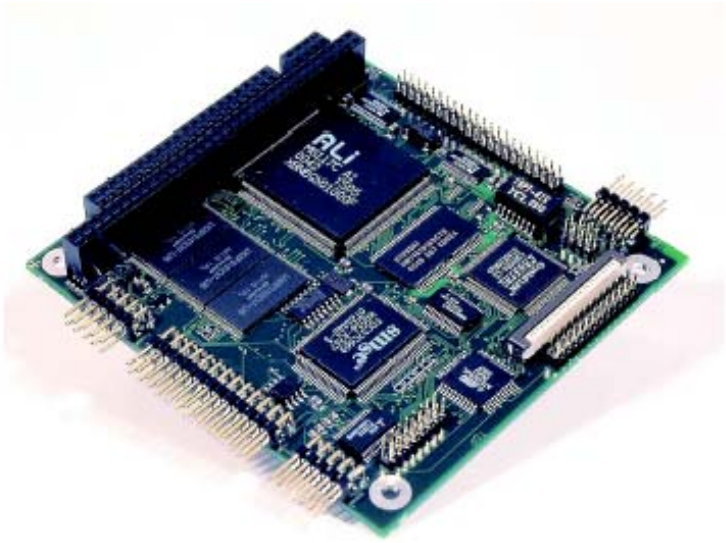


MOPS/386A

User's Guide

Document Revision 1.4

kontron

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1. USER INFORMATION

1.1 About This Manual

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1.4 Standards

Kontron Embedded Modules is certified to ISO 9000 standards.

1.5 Warranty

This Kontron Embedded Modules product is warranted against defects in material and workmanship for the warranty period from the date of shipment. During the warranty period, Kontron Embedded Modules will at its discretion decide to repair or replace defective products.

Within the warranty period, the repair of products is free of charge as long as warranty conditions are observed.

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

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1.6 Technical Support

Technicians and engineers from Kontron Embedded Modules and/or its subsidiaries and official distributors are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Before contacting Kontron Embedded Modules technical support, please contact your local representative or consult our Web site for the latest product documentation, utilities, and drivers. If the information does not help to solve the problem, contact us by telephone.

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2. INTRODUCTION

2.1 MOPS/386A

The MOPS/386A integrates the complete functionality of an 80386 SX motherboard with a CPU, system BIOS, minimum 2MB DRAM, keyboard controller, real-time clock and additional peripheral functions such as serial and parallel ports, floppy interface, IDE hard-disk interface, character-LCD interface, matrix-keyboard interface, watchdog timer, and a silicon disk. The system runs at a CPU clock speed of up to 40MHz.

The MOPS/386A is not equipped with a graphics controller and requires an external graphics-controller board on the PC/104 bus to provide output to a CRT monitor.

2.2 The MOPS Family

MOPS (**M**inimized **O**pen **P**C **S**ystem) PC/104 products represent the "Proven PC Platform for Instant Solutions." Each MOPS module is characterized by the same pinout for the keyboard, COM1 and COM2, 44-pin IDE, LPT, and 1st LAN. These homogeneous features facilitate easy upgrades within the Kontron Embedded Modules GmbH MOPS PC/104 product family.

Whenever a LCD panel is required in an application, MOPS products that have onboard graphics controllers serve as the right choice. Display connections are simplified when using these units, which come with a JUMPtec Intelligent LVDS Interface (JILI) and a JUMPtec Intelligent Panel Adapter (JIPA) interface. The two interfaces can recognize which display is connected and then independently set all video parameters. These interfaces are not available on all MOPS products.

All MOPS-PC/104 are plug-and-work enabled to further reduce time-to-market.

As part of the standard features package, all MOPS PC/104 modules come with a JUMPtec Intelligent Device Architecture (JIDA) interface, which is integrated into the BIOS of the PC/104 modules. This interface enables hardware independent access to the MOPS-PC/104 features that cannot be accessed via standard APIs. Functions such as watchdog timer, brightness and contrast of LCD backlight and user bytes in the EEPROM can be configured with ease by taking advantage of this standard MOPS PC/104 module feature.

All MOPS PC/104 products can be remote controlled by using JRC software feature. This allows you to change, update, and maintain the MOPS products from a host computer via a serial connection.

2.3 PC/104 an Embedded PC Standard

Over the past decade, the PC architecture has become an accepted platform for far more than desktop applications. Dedicated and embedded applications for PCs are beginning to appear everywhere.

By standardizing hardware and software around the broadly supported PC architecture, embedded system designers can substantially reduce development costs, risks, and time-to-market.

For these reasons, companies that embed microcomputers as controllers within their products seek ways to reap the benefits of using the PC architecture. However, the standard form factor of a PC bus (12.4" x 4.8") and its associated card cages and backplanes are too bulky and expensive for most embedded control applications.

The only practical way to embed the PC architecture in space-and power-sensitive applications has been to design a PC chip by chip directly into the product. But this runs counter to growing trend away from "reinventing the wheel." Whenever possible, top management now encourages outsourcing of components and technologies to reduce development costs and accelerate product design cycles.

A need has arisen for a more compact implementation of the PC bus, satisfying the reduced space and power constraints of embedded control applications. PC/104 was developed in response to this need. It offers full architecture, hardware and software compatibility with the PC bus but in ultra-compact (3.6" x 3.8") stackable modules. PC/104 is ideally suited to the unique requirements of embedded control applications.

Although configuration and application possibilities with PC/104 modules are practically limitless, there are two ways to use them in embedded system designs:

- ***Standalone module stacks***
  PC/104 modules are self-stacking. The modules are used like ultra-compact bus boards but without a need for backplanes or card cages. Stacked modules are spaced 0.6 inches apart. (The three-module stack measures 3.6 by 3.8 by 2 inches.) Companies using PC/104 module stacks within their products frequently create one or more of their own application-specific PC/104 modules.

- ***Component-line applications***
  In this configuration, the modules function as highly integrated components, plugged into custom carrier boards that contain application-specific interfaces and logic. The modules' self-stacking bus can be useful to install multiple modules in one location. This facilitates product upgrades or options and allows temporary addition of modules during system debug or test.

3. GETTING STARTED

The easiest way to get the MOPS/386A board running is to use a starter kit from Kontron Embedded Modules GmbH. Take the following steps:

1. Turn off the power supply (part of the starter kit).
2. Connect the power supply to the starter kit baseboard (part of the starter kit).
3. Plug a graphics-controller board to the PC/104 bus or the ISA bus slots on the starter kit. (There are starter kits available with and without PC/104 graphics boards included.)
4. Connect the CRT monitor to the graphics controller board.
5. Plug the MOPS/386A to the PC/104 bus stack on the starter kit baseboard.
6. Make all necessary connections from the MOPS/386A to the starter kit board. (Cables come with the starter kit). The starter kit board offers various interfaces on standard connectors.
7. Plug a keyboard to the starter kit's keyboard connector.
8. Connect the floppy drive (part of the starter kit) with the data cable (part of the starter kit) to the MOPS/386A floppy interface.
9. Connect the power supply to the floppy's power connector.
10. Plug a hard-drive data cable to the MOPS/386A hard-disk interface. Attach the hard disk to the connector at the opposite end of the cable.
11. If necessary, connect the power supply to the hard disk's power connector.
12. Make sure all your connections have been done correctly.
13. Turn on the power.
14. Enter the BIOS by pressing the F2 key during bootup. Make all necessary changes in the BIOS setup. See the BIOS chapter of this manual for details.

4. SPECIFICATIONS

4.1 *Functional Specifications*

- **Processor**
  - 386 SX compatible (40MHz) embedded in an Ali M6117C microprocessor
  - BIOS setting for slower MHz frequencies
- **Onboard memory**
  - 2MB (8MB possible as a special version upon request)
- **Super I/O controller**
  - SMsC FDC37C669
  - with Floppy disk controller, 2 UARTs 16C550, multimode parallel port, IDE controller
- **Silicon disk as a bootable Flash hard disk (DOS compatible)**
  - 1.8MB or 3.8MB (5.8MB possible as a special version upon request)
- **Two serial port interfaces: COM1 and COM2**
  - RS232 compatible, 16550 compatible
- **One parallel port interface (LPT1)**
  - SPP, EPP or ECP, IEEE 1284 compliant
- **Ethernet 10BaseT (twisted pair)**
  - Crystal CS8900A Ethernet Controller with BIOS LAN Boot support
- **Floppy and IDE hard-disk interface**
- **Watchdog timer**
- **Real-time clock**
- **Keyboard controller**
- **EEPROM for CMOS setup**
- **Matrix keyboard controller**
- **Alphanumeric LCD interface**
- **PC/104-Format 96 * 90 mm (3.8" x 3.6") with PC/104 ISA bus**
- **5V-only power supply**
- **Full ISA electrical characteristics such as timing and DC characteristics**

4.2 *Mechanical Specifications*

4.2.1. PC/104 Bus Connector

- One 2 X 32 pin stackthrough and one 2 X 20 pin stackthrough connector

4.2.2. PCB Dimensions

- 96 x 90 mm (3.8" x 3.6") without exceeding peripheral connectors

4.2.3. Height

- 23.5 mm max (including PC/104 connector pins)

4.2.4. Weight

- 80 g

4.3 *Electrical Specifications*

4.3.1. Supply Voltage

- 5V DC +/- 5%

4.3.2. Supply Voltage Ripple

- 100 mV peak to peak 0 - 20 MHz

4.3.3. Supply Current (Typical)

- 620mA (at 40MHz CPU clock) / 340mA (at 4MHz CPU clock)

4.3.4. Supply Current (Maximum)

- 1.95A

(calculated theoretical value from all components maximum supply currents)

4.3.5. Supply Current from Battery (Max.)

- < 10µA @ 3V battery, 0..70°C, no system power
- < 1µA with system power on

4.4 MTBF

The following MTBF (Mean Time Between Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and a Bellcore calculation for the remaining parts. The Bellcore calculation used is "Method 1 Case 1". In that particular method the components are assumed to be operating at a 50 % stress level in a 40° C ambient environment and the system is assumed to have not been burned in. Manufacturer's data has been used wherever possible. The manufacturer's data, when used, is specified at 50° C, so in that sense the following results are slightly conservative. The MTBF values shown below are for a 40° C office or telecommunications environment. Higher temperatures and other environmental stresses (extreme altitude, vibration, salt water exposure, etc.) will lower the MTBF values.

- System MTBF (hours) : 389.993 for full feature version

Notes: Fans usually shipped with Kontron Embedded Modules GmbH products have 50,000-hour typical operating life. The above estimates assume no fan, but a passive heat sinking arrangement.
Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and need to be considered for separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.

4.5 Environmental Specifications

4.5.1. Temperature

- **Operating: 0 to +70 C (*) (with appropriate airflow)**
- **Nonoperating: -10 to +85 °C (noncondensing)**

Note: The maximum operating temperature is the maximum measurable temperature on any spot on the module's surface. You must maintain the temperature according to the above specification.

4.5.2. Humidity

- **Operating: 10% to 90% (noncondensing)**
- **Nonoperating: 5% to 95% (noncondensing)**

5. CPU, CHIPSET AND SUPER I/O CONTROLLER

5.1 CPU and Chipset

The MOPS/386A features an ALi M6117C single chip that includes a highly integrated, low voltage implementation of Intel's™ 386SX compatible microprocessor (40MHz), plus Ali's M1217B chipset.

The M6117C provides the following functions:

- Static Intel™ 386SX Core
- ISA interface
- Peripheral interface
  - Two cascaded 8237 DMA controllers
  - 74612 memory mapper
  - Two cascaded 8259 interrupt controllers
  - 8254 programming counter
- Built-in RTC
- Built-in PS2/AT keyboard controller
- Built-in watchdog timer

5.2 CPU Configuration

See the Advanced Chipset Control Submenu section of the Appendix B: BIOS chapter for information on setting the MHz speed of the CPU.

5.3 Super I/O Controller

A super I/O Controller (SMsC FDC37C669) is connected to the ISA interface of the chipset. This controller offers the following features:

- 2.88MB Super I/O Floppy Disk Controller
- Two high-speed NS16C550 compatible UARTs with 16Byte send/receive FIFOs
- Multimode parallel port supporting standard, bi-directional, EPP and ECP mode
- IDE interface

5.4 Super I/O Controller Configuration

See the I/O Device Configuration Submenu section of the Appendix B: BIOS chapter for information on settings of the features included in the SMsC FDC37C669 controller.

Note: The Super I/O Controller is connected to the ISA address lines A0 to A10. Therefore, the I/O port addresses of the SMsC FDC37C669 will be mirrored every 800hex in the I/O address apace.

6. SYSTEM MEMORY

The *MOPS/386A* comes with onboard soldered 2MB of DRAM (EDO). The memory is not upgradeable by the customer. Upon request, Kontron can equip the board with 8MB of DRAM (EDO) instead of 2MB. Eight MB versions are not a standard product.

7. PC/104 BUS

The design of the MOPS/386A follows the standard PC/104 format.

The PC/104 bus consists of two connectors that use 104 pins in total.

- XT bus connector (64 pins)
- AT bus connector (40 pins, which is optional for 16 bit-data bus system)

The pinout of the PC/104 bus connectors corresponds to the pinout of the ISA bus connectors with some added ground pins. The two PC systems with different form factors are electrically compatible.

The **XT bus connector**, Row A and B.

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

The **AT bus extension connector**, 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. To avoid 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. The pinout between PC/104 bus and AT ISA bus is identical between C1 - C18 and D1 - D18.

The MOPS/386A features both – XT bus and AT bus extension – on two, dual-row socket connector with 2.54mm x 2.54mm grid (0.1" x 0.1").

7.1 Connectors

The PC-104 bus is available through the X1A and X1B connectors.

A detailed description of the signals including electrical characteristics and timings is beyond the scope of this document. Please refer to the official ISA bus and PC/104 specifications for more details.

7.2 Configuration

When using add-on boards on the PC/104 bus, make sure that there are no resource conflicts in the system. Carefully choose hardware interrupts, DMA channels, memory and I/O address ranges to avoid resource conflicts, which are often the reason for a board or a feature not functioning correctly. See the Appendix B: System Resource Allocation for information about the resources already used by the MOPS/386A.

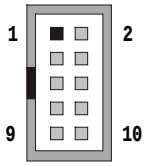
8. SERIAL-COMMUNICATION INTERFACE

Two fully functional serial ports (COMA and COMB) provide asynchronous serial communications. The serial ports support RS-232 operation modes and are compatible with the implementation used on the IBM Serial Adapter. They are 16550 high-speed UART compatible and support 16-byte FIFO buffers for transfer rates from 50baud to 115.2Kbaud.

8.1 *Connector*

COMA is available through the X10 connector (10 pins) and COMB through the X13 connector (10 pins). To have the signals available on the standard serial interface connectors DSUB9 or DSUB25, an adapter cable is required. A 9-pin DSUB cable is available from Kontron (KAB-DSUB9-2, Part Number 96017-0000-00-0).

The following table shows the pinouts for COMA and COMB as well as necessary connections for the DSUB adapters.

Header	Pin	Signal Name	Function	In / Out	DSUB-25	DSUB-9
	1	/DCD	Data Carrier Detect	In	8	1
	2	/DSR	Data Set Ready	In	6	6
	3	RxD	Receive Data	In	3	2
	4	/RTS	Request to Send	Out	4	7
	5	TxD	Transmit Data	Out	2	3
	6	/CTS	Clear to Send	In	5	8
	7	/DTR	Data Terminal Ready	Out	20	4
	8	/RI	Ring Indicator	In	22	9
	9	GND	Signal Ground	--	7	5
	10	VCC *	+5V	--	--	--

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of the serial ports on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

8.2 *Configuration*

You can set the two serial input/output interfaces to base I/O-address 3F8h, 2F8h, 3E8h, 2E8h, AUTO or disabled. You can set their interrupts to IRQ3 or IRQ4. Refer to the I/O Device Configuration submenu in the Appendix B: BIOS Operation chapter for information on configuration.

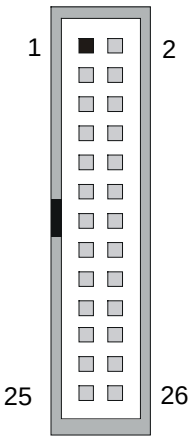
9. PARALLEL-COMMUNICATION INTERFACE

The MOPS/386A incorporates an IBM XT/AT compatible parallel port. The bi-directional functions are compatible with those of an IBM PS/2 style parallel port.

9.1 *Connector*

The parallel port is available through the X7 connector (26 pins). To have the signals available on a standard, parallel-interface connector DSUB-25, an adapter cable is required, which is available from Kontron (KAB-DSUB25-1, Part Number 96015-0000-00-0).

The following table shows the pinout as well as necessary connections for a DSUB-25 adapter.

Header	Pin	Signal Name	Function	In / Out	DSUB-25
	1	/STB	Strobe	Out	1
	3	D0	Data 0	I/O	2
	5	D1	Data 1	I/O	3
	7	D2	Data 2	I/O	4
	9	D3	Data 3	I/O	5
	11	D4	Data 4	I/O	6
	13	D5	Data 5	I/O	7
	15	D6	Data 6	I/O	8
	17	D7	Data 7	I/O	9
	19	/ACK	Acknowledge	In	10
	21	/BUSY	Busy	In	11
	23	PE	Paper out	In	12
	25	/SLCT	Select out	In	13
	2	/AFD	Autofeed	Out	14
	4	/ERR	Error	In	15
	6	/INIT	Init	Out	16
	8	/SLIN	Select in	Out	17
	26	VCC *	+ 5 V	--	NC
	10,12	GND	Signal Ground	--	18 - 25
	14,16	GND	Signal Ground	--	18 - 25
	18,20	GND	Signal Ground	--	18 - 25
	22,24	GND	Signal Ground	--	18 - 25

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of the parallel port on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

9.2 Configuration

The parallel-port mode, I/O addresses, and IRQs are changeable in the MOPS/386A BIOS Setup Utility. You can program the base I/O-address 378h, 3BCh, 278h, disable the interface or set it to AUTO. You can choose IRQ5 or IRQ7 as the parallel-port interrupt. You can set the mode to bi-directional EPP and ECP.

Refer to the I/O Device Configuration Submenu in the Appendix B: BIOS Operation chapter for additional information on configuration.

10. KEYBOARD AND FEATURE INTERFACE

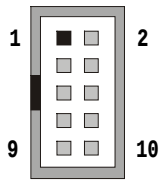
The keyboard and feature connector of the MOPS/386A offers five functions. The interface connects the following:

- System keyboard
- Keyboard lock switch
- Speaker
- Battery
- Reset button

10.1 *Connector*

The keyboard and feature connector is available through Connector X4 (10 pins). An adapter cable is required to connect a standard keyboard to this interface. There are two adapter cables available from Kontron. One can be used for AT-keyboard (KAB-KB-1, Part Number 96023-0000-00-0), the other for PS/2-keyboard (KAB-KB-PS2, Part Number 96060-0000-00-0). The adapter cables do not know the other functions on this interface.

The following table shows the pinout as well as necessary connections for adapters.

Header	Pin	Signal Name	Function	5-pin Din (Diode)	6-pin MiniDin (PS2)
	1	Speaker	Speaker output		
	2	GND	Ground		
	3	/RESIN	Reset input		
	4	/KBLOCK	Keyboard lock		
	5	KBDAT	Keyboard data	2	1
	6	KBCLK	Keyboard clock	1	5
	7	GND	Ground	4	3
	8	VCC *	+5V	5	4
	9	BATT	Battery in (3,6V)		
	10	PWRGOOD	Powergood		

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of the keyboard and feature connector on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

10.2 Signal Descriptions

/KBLOCK (Keyboard Lock)

- Input on CPU modules
- Output on any other module
- Input to the keyboard controller input Port 1, Bit 7

/RESIN and PWRGOOD (Reset Inputs)

- Input on CPU modules
- When POWERGOOD goes high, it starts the reset generator on the CPU module to pull the onboard reset line high after a valid reset period. You also can use this pin as a low active hardware reset for modules.

Speaker

- TTL output on modules that can drive a loudspeaker.
- An 8-Ohm loudspeaker can be connected between SPEAKER and GND. Connect only one loudspeaker to this pin. Usually, only the CPU drives this pin. However, other modules can use this signal to drive the system loudspeaker.

KBDAT (Keyboard Data)

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

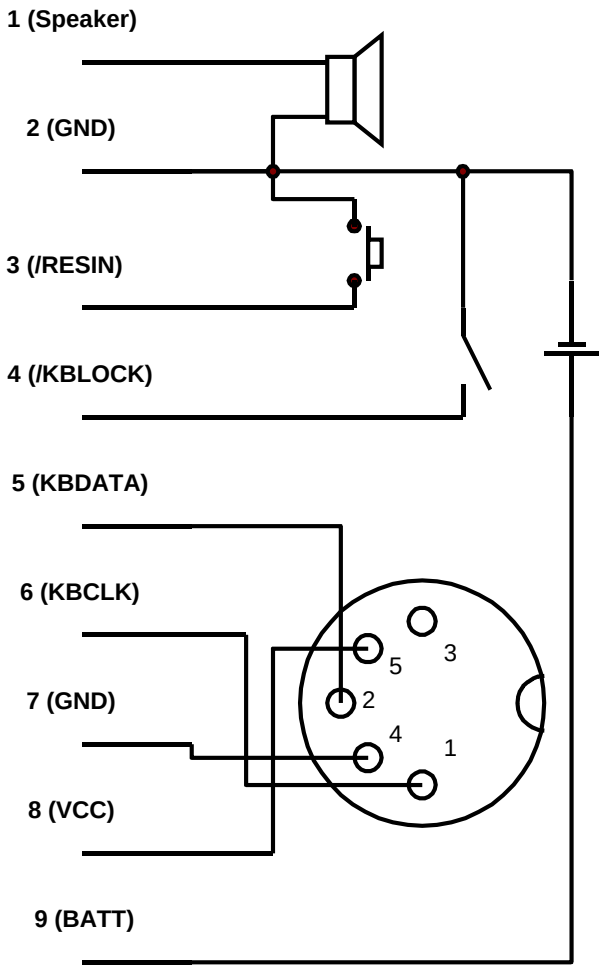
KBCLK (Keyboard Clock)

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

BATT (System Battery Connection)

- This pin connects a system battery to all modules. The battery voltage must be higher than 3.0V and lower than 4.0V. A 3.6V battery is recommended.
- Because a capacitor supplies the RTC chip, you can disconnect the battery for at least several seconds without losing time and setup information.
- An external battery on this pin is only required for the update of the RTC. The CMOS setup configuration data is stored in an onboard EEPROM and will not get lost, even without a battery connected.

10.2.1. Example Connection AT-keyboard and Other Functions



10.3 *Configuration*

Refer to the Keyboard Features submenu in the Appendix B: BIOS chapter for information on configuration.

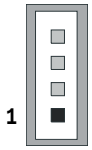
11. PS/2 MOUSE INTERFACE (OPTIONAL)

The chipset of the MOPS/386A can support a PS/2 mouse. However, the standard MOPS/386A is not equipped with this feature. A special version of this board can support the PS/2 mouse feature. Such a version is only available upon request.

11.1 *Connector*

A PS/2 mouse interface is available on Connector X9 (4 pins), if the board supports the feature. An adapter cable is required to connect a standard PS/2 mouse. The cable is available from Kontron (KAB-MOUSE-PS2, Part Number 96062-0000-00-0).

The following table shows the pinout and connections for a PS/2 mouse adapter.

Header	Pin	Signal Name	Function	6-pin MiniDin (PS2)
	1	MSDAT	Mouse data	1
	2	VCC *	+5V	4
	3	GND	Ground	3
	4	MSCLK	Mouse clock	5

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of the PS/2 mouse connector on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

11.2 *Configuration*

You can set the PS/2 mouse to enabled, disabled or autodetect from the BIOS Setup. If you enable the mouse, the IRQ12 is used as the interrupt and is no longer available for other devices. Please refer to the Advanced Menu in the Appendix B: BIOS chapter for additional information on configuration.

Note: If the PS/2 mouse is enabled, the signal IRQ12 on the PC/104 bus connector is connected to MSDAT. When enabling the PS/2 mouse, make sure that no external device uses IRQ12.

12. FLOPPY-DRIVE INTERFACE

The floppy-drive interface of the MOPS/386A uses a 2.88MB super I/O floppy-disk controller and can support one floppy disk drive with densities that range from 360kB to 2.88MB. The controller is 100% IBM compatible.

12.1 *Connector*

The floppy disk interface is available on the flat-foil Connector X6 (26 pins). This type of connector is often internally used in notebooks to connect a slim-line floppy drive. There are different accessories available for this interface from Kontron. To connect a standard 3.5" floppy drive, use an adapter cable (ADA-FLOPPY-2, Part Number 96001-0000-00-0). If you have a slim-line 3.5" floppy drive, you may need a flat foil cable (KAB-FLOPPY/MOPS-1, Part Number 96019-0000-00-0). It also is possible to get a slim line 3.5" floppy drive with cable from Kontron (FLOPPY-MOPS-1, Part Number 96010-0000-00-0).

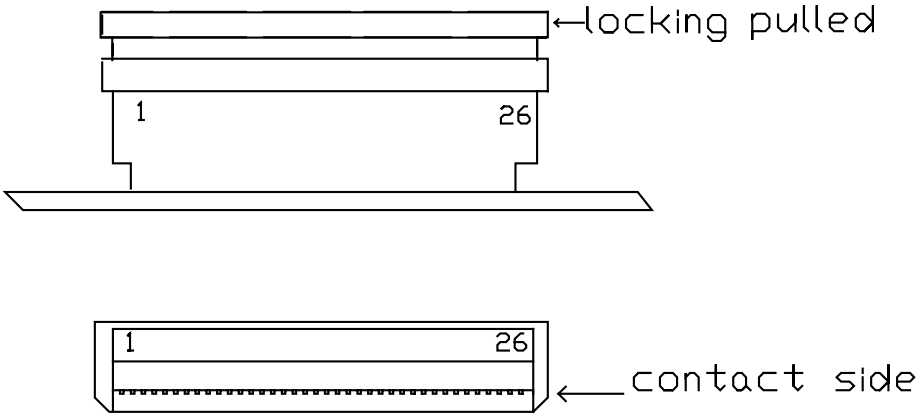
The following table shows the connector pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	VCC *	+5V	2	/IDX	Index
	3	VCC *	+5V	4	/DS0	Drive Select 0
	5	VCC *	+5V	6	DCHNG	Disk Change
	7	NC	Not connected	8	NC	Not connected
	9	NC	Not connected	10	/MTR0	Motor on 0
	11	NC	Not connected	12	/DIR	Direction Select
	13	NC	Not connected	14	/Step	Step
	15	GND	Ground	16	/WDATA	Write Data
	17	GND	Ground	18	/WGATE	Write Gate
	19	GND	Ground	20	/TRK0	Track 00
	21	GND	Ground	22	/WRPRT	Write Protect
	23	GND	Ground	24	/RDATA	Read Data
	25	GND	Ground	26	/CHDSEL	Side One Select

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of floppy-drive interface on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

12.1.1. Connector Diagram



12.2 *Configuration*

You can configure the floppy disk interface in the BIOS Setup Utility. You can choose the 3.5" (common) or 5.25" drive types with densities of 360kB, 720kB, 1.2MB, 1.25MB, 1.44MB or 2.88MB. Refer to the Main Menu section of the Appendix B: BIOS Operation chapter for more information on configuring the floppy drive.

You also can disable the floppy-disk interface in the I/O Device Configuration Submenu.

13. IDE INTERFACE

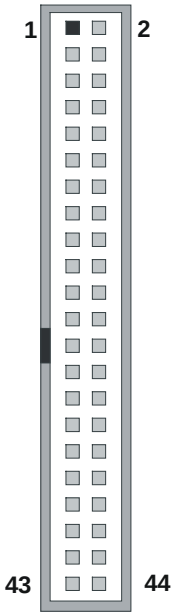
The MOPS/386A features an IDE controller interface with on-chip decode and select logic compatible with IBM PC/XT and PC/AT embedded hard-disk drives. The board can support up to two IDE drives such as hard disks and CD-ROM in a master/slave configuration. If only one drive is in the system, you must set it as the master.

13.1 *Connector*

The IDE interface is available through Connector X5 (44 pins). This interface is designed in 2mm grid for optimal connectivity to a 2.5" hard disk. There are several accessories available for IDE connectivity. You can use two cables to directly connect a hard disk in a 2.5" form factor (KAB-IDE-2MM, Part Number 96021-0000-00-0) or a 3.5" form factor (KAB-IDE-25, Part Number 96020-0000-00-0).

You can plug a Kontron chipDISK, which is an IDE hard disk that uses Flash technology, into the IDE interface and mechanically mount it by using a mini spacer on the chipDISK hole. You also can use a chipDISK adapter (chipDISK-ADA1, Part Number 96004-0000-00-0) or compact Flash adapter (CFC-ADA1, Part Number 96004-0000-00-2) for more disk support.

The following table shows the pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	/RSTDRV	Reset	2	GND	Ground
	3	HDD7	Data 7	4	HDD8	Data 8
	5	HDD6	Data 6	6	HDD9	Data 9
	7	HDD5	Data 5	8	HDD10	Data 10
	9	HDD4	Data 4	10	HDD11	Data 11
	11	HDD3	Data 3	12	HDD12	Data 12
	13	HDD2	Data 2	14	HDD13	Data 13
	15	HDD1	Data 1	16	HDD14	Data 14
	17	HDD0	Data 0	18	HDD15	Data 15
	19	GND	Ground	20	Key (NC)	Key pin
	21	NC	Not connected	22	GND	Ground
	23	/IWT	I/O write	24	GND	Ground
	25	/IRT	I/O read	26	GND	Ground
	27	IOCHRDY	channel ready	28	BALE	Reserved
	29	NC	Not connected	30	GND	Ground
	31	IRQ14	Interrupt	32	/IOCS16	16bit I/O
	33	S1T	Addr 1	34	NC	Not connected
	35	S0T	Addr 0	36	S2T	Addr 2
	37	/IDECS0	Chip select 0	38	/IDECS1	Chip select 1
	39	NC	Not connected	40	GND	Ground
	41	VCC *	+5V	42	VCC (Motor) *	+5V
	43	GND	Ground	44	NC	Not connected

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of IDE-controller interface on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

13.2 *Configuration*

The IDE interface offers several configuration settings. Refer to the Main Menu and I/O Device Configuration Submenu in the Appendix B: BIOS Operation chapter for additional information on configuration.

14. SILICON-DISK

The MOPS/386A comes with a silicon disk, which works as bootable Flash hard disk and which mounts on the board. The size of the disk on standard boards can either be 1.8MB or 3.8MB. You can request a disk size of 5.8MB, too, as a special board version. The customer cannot extend the silicon disk size.

The silicon disk is controlled by a Kontron BIOS extension, which is basically software interrupt INT13hex BIOS interface. You only can use this disk with DOS in real mode. There is no support for operating systems that run in protected mode or real-time environment. Use a Kontron chipDISK as an add-on module on the IDE interface if you require a Flash disk for other operating systems. Set the silicon disk to disabled when not used.

However, if you use the silicon disk using DOS, it is totally transparent to the user and can be accessed like any other hard disk in the system. When using the silicon disk under DOS with Expanded Memory Managers (EMM), configure the EMM drivers with care. (See Appendix A: Memory Map chapter for more details.)

14.1 *Configuration*

You can configure the silicon disk from the system's BIOS setup. You can set the disk to disabled or configure it as Drive 80 up to Drive 83. Under DOS, Drive 80 corresponds to drive-specifier C:, Drive 81 to drive-specifier D:, etc. If there is another hard disk in the system connected to the IDE interface, it is automatically rerouted to the first free drive specifier. Make sure that you can find the bootable drive as C:.

The silicon disk can be write-protected and erased on the next system boot, if required.

Please refer to the Flash Disk submenu in the Appendix B: BIOS Operation chapter for additional information on configuration.

14.2 Initialization

The silicon disk is optimized for the DOS FAT file system with eight sectors per cluster. The disk requires a special initialization to function properly. After cleaning the Flash disk with 'Erase On Next Boot' option in the BIOS setup screen, you must run the SSDINIT.EXE utility to create a DOS partition. The SSDINIT.EXE utility, which you can download from the Kontron Web site, is self-explanatory.

Note: Do not use FDISK or other disk-partitioning tools to create partitions on the Flash disk. There is a potential risk for data damage or loss.

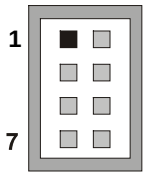
15. ETHERNET INTERFACE

The MOPS/386A can be equipped with a 10BaseT Ethernet controller from Crystal Semiconductor. The Crystal LAN™ CS8900(A) ISA Ethernet Adapter follows IEEE 802.3 standards and supports half- or full-duplex operation in ISA bus computers on 10Mbps Ethernet networks. You can enable an onboard LAN RPL ROM to support the boot up of the system via Ethernet and an Etherboot server.

15.1 *Connector*

The Ethernet interface is available through Connector X12 (8 pins). To have the signals of the Ethernet connection available on a standard RJ45 connector, you need an adapter cable, which is offered by Kontron (KAB-MOPS-ETN1, Part Number 96048-0000-00-0).

The following table shows the pinout.

Header	Pin	Signal Name	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	
	5	NC	Unused	
	6	RXD-	10BASE-T Receive	Differential Input
	7	LNLED	LAN LED	Output
	8	LKLED	Link LED	Output

To find the location of the Ethernet controller on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

15.2 Signal Descriptions

TXD+, TXD-

- Differential output pair drives 10 Mbps Manchester encoded data to the 10base-T transmit lines.

RXD+, RXD-

- Differential input pair receives 10 Mbps Manchester encoded data from the 10base-T receive lines.

LKLED, LNLED

- Connect with Cathode of Ethernet LEDs. Connect Anode of Ethernet LEDs with +5V. The onboard serial resistor is 330 Ohm.

15.3 Configuration

A setup utility, which is part of the driver package, can configure the Ethernet controller. You can download the driver from the Kontron Web site. For further information read the read-me file or contact technical support.

15.4 Ethernet Technical Support

If any problems occur, you can solve some of them by using the latest drivers for the Crystal LAN™ CS8900(A) ISA Ethernet Adapter. Kontron provides you with the latest in house- tested drivers, which can differ from newer ones. For further technical support, contact either Kontron or get support information and downloadable software updates from Crystal Semiconductor.

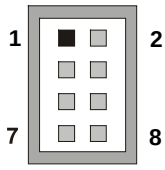
16. POWER CONNECTION

In some applications, the MOPS/386A is intended for use as a stand-alone module without a backplane. You need to have a power connector available on the board for direct power supply. The MOPS/386A is a +5V-only board. Peripherals can obtain additional voltage from the power connector next to the PC/104 bus. The additional voltages (+12V, -5V and -12V) are not generated onboard the MOPS/386A.

16.1 *Connector*

The power connector is available as X1C (8 pins).

The following table shows the pinout.

Header	Pin	Signal Name	Function
	1	GND	Ground
	2	VCC	+5V
	3	BATT	Battery
	4	+12V	+12V
	5	-5V	-5V
	6	-12V	-12V
	7	GND	Ground
	8	VCC	+5V

To find the location of the power connector on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

16.2 Power Pins

Every power pin on the power connector as well as on the PC/104 bus connectors is limited to a maximum current of 1A per pin.

If a system using a MOPS/386A is only supplied from the power connector, the following limitations apply:

Power	Number of Pins	Max. Current
VCC (+5V)	2	2A
+12V	1	1A
-12V	1	1A
-5V	1	1A
GND	2	2A

A system using the MOPS/386A also can be supplied from the PC/104 bus connectors. If only those supply voltages pins are used, the following limitations apply:

Power	Number of pins	Max. Current
VCC (+5V)	4	4A
+12V	2	2A
-12V	2	2A
-5V	2	2A
GND	8	8A

Modules on the PC/104 bus consuming a higher supply current must provide power supply through an additional connector.

Note: The MOPS/386A is not a replacement for a backplane. Use all power pins on the power connector and on the PC/104 connector for power supply to the MOPS/386A, and also use all additional power connectors on additional I/O cards, if your system exceeds the above limitations. It is not acceptable to use only the power pins of the PC/104 connector for power supply of the full PC/104 stack.

16.3 External Battery

You can connect an external battery to Pin 3 (BATT) of the power connector instead of Pin 9 of the KBD connector.

Note: The two battery inputs are not protected against each other directly connected and should only be used exclusively.

17. LCD DOT-MATRIX INTERFACE

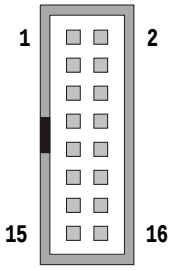
To connect a LCD dot-matrix display, the MOPS/386A offers an interface with 16 signals. This interface can support character LCDs for up to 40 columns and four rows, which are equipped with a Hitachi HD44780 controller or a compatible one. A BIOS extension of the MOPS/386A controls the outputs to the display via software interrupt INT10hex. You can only use this feature with DOS.

Note: The LCD dot-matrix interface uses the signals of the onboard parallel port. In most cases, this will cause problems if you use the parallel port with a device parallel to the LCD.

17.1 *Connector*

The LCD dot-matrix interface is available through Connector X8 (16 pins). To find the location of the LCD connector on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

The following table shows the pinout.

Header	Pin	Signal Name	Function
	1	GND	Ground
	2	VCC	+5V
	3	VEE	Output voltage from DC/DC converter for adjusting contrast.
	4	RS	Select different registers on the LCD.
	5	R/W	Read / Write
	6	Enable	Signal for data assumption.
	7	DB0	Data signals.
	8	DB1	Data signals.
	9	DB2	Data signals.
	10	DB3	Data signals.
	11	DB4	Data signals.
	12	DB5	Data signals.
	13	DB6	Data signals.
	14	DB7	Data signals.
	15	Backlight +	Positive supply voltage for backlight (+5V).
	16	Backlight -	Negative supply voltage for backlight (GND).

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

17.2 Backlight

A series resistor (4Ω) connects Pin 15 with VCC (+5V). You can plug in a LED backlight directly on Pin 15 and Pin 16.

17.3 Configuration

Because the LCD dot-matrix display is driven by parallel-port signals and needs to exchange data with the MOPS/386A BIOS extension, the parallel port must be set to bi-directional mode. We recommend using the EPP mode. Please refer to the I/O Device Configuration Submenu in the Appendix B: BIOS Operation chapter for additional information on configuration of the parallel port.

You can configure the Dot Matrix extension BIOS by using the ALCDINIT.EXE utility program, which you can download from the Kontron Web site.

Call the ALCDINIT utility from the DOS-prompt with suitable parameters:

```
alcdinit <mode> <columns> <lines> <la1> <la2> <la3> <la4>

      mode  = ON        the display interface will be prepared
                        for direct mode

            = COPY      the display interface will be prepared
                        for copy mode

      lin         number of LCD lines (normally 2 or 4)

      columns     number of LCD columns (normally 16, 20 or 40)

      la?         starting address of LCD lines; refer to the
                  datasheet for your display
```

Note: The ”copy to display” mode works slowly on the LPT interface. Using the BIOS Setup Utility, set the parallel port mode to EPP. Choose “mode” in the I/O Device Configuration submenu to make the EPP selection

17.4 LCD Dot-Matrix Display Technical Support

Additional information about this feature, especially programming and detailed configuration and connectivity information is available in Application Note DotMatrixPC104_E???.PDF. The three question marks represent the document revision number. You can download the application note from the Kontron Web site or request it from technical support.

18. MATRIX KEYBOARD INTERFACE

18.1 *Matrix Keyboard Controller*

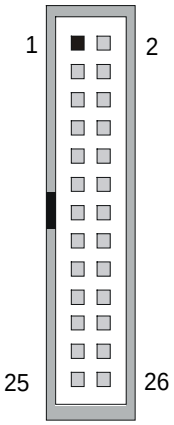
The MOPS/386A comes with a matrix keyboard controller, which can control an 8*10 (80 keys) matrix keyboard or matrix touch screen that fully parallels a standard keyboard. You do not need additional driver software to support this feature because the matrix support is fully integrated in the onboard BIOS.

Note: The matrix keyboard controller can only work with DOS.

18.2 Connector

The matrix keyboard interface is available through Connector X11 (26 pins).

The following table shows the pinout.

Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	GND	Ground	2	Y0	Scan outputs.
	3	RA0	Scan inputs.	4	Y1	Scan outputs.
	5	RA1	Scan inputs.	6	Y2	Scan outputs.
	7	RA2	Scan inputs.	8	Y3	Scan outputs.
	9	RA3	Scan inputs.	10	Y4	Scan outputs.
	11	RA4	Scan inputs.	12	Y5	Scan outputs.
	13	RB0	Scan inputs.	14	Y6	Scan outputs.
	15	RB1	Scan inputs.	16	Y7	Scan outputs.
	17	RB2	Scan inputs.	18	/MCLR	Reserved for factory testing. Do not connect anything.
	19	RB3	Scan inputs.	20	ENPBLT	Enable external backlight power.
	21	RB4	Scan inputs.	22	NC	
	23	I2CLK/RB5	Reserved. Do not connect anything.	24	RB7	Reserved. Do not connect anything.
	25	I2DAT/RB6	Reserved. Do not connect anything.	26	VCC *	+5V

Notes:
(*)To protect the external power lines of peripheral devices, make sure that:
-- the wires have the right diameter to withstand the maximum available current
-- the enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

To find the location of the matrix keyboard connector on the MOPS/386A board, please see the Appendix E: Connector Layout chapter.

18.3 Standard Matrix Keyboard

You can connect a matrix keyboard with formats up to 8*10 crossings directly to a MOPS/386A. Pins Y0 to Y7 serve as outputs (active low), while RA0 to RA4 and RB0 to RB4 serve as inputs.

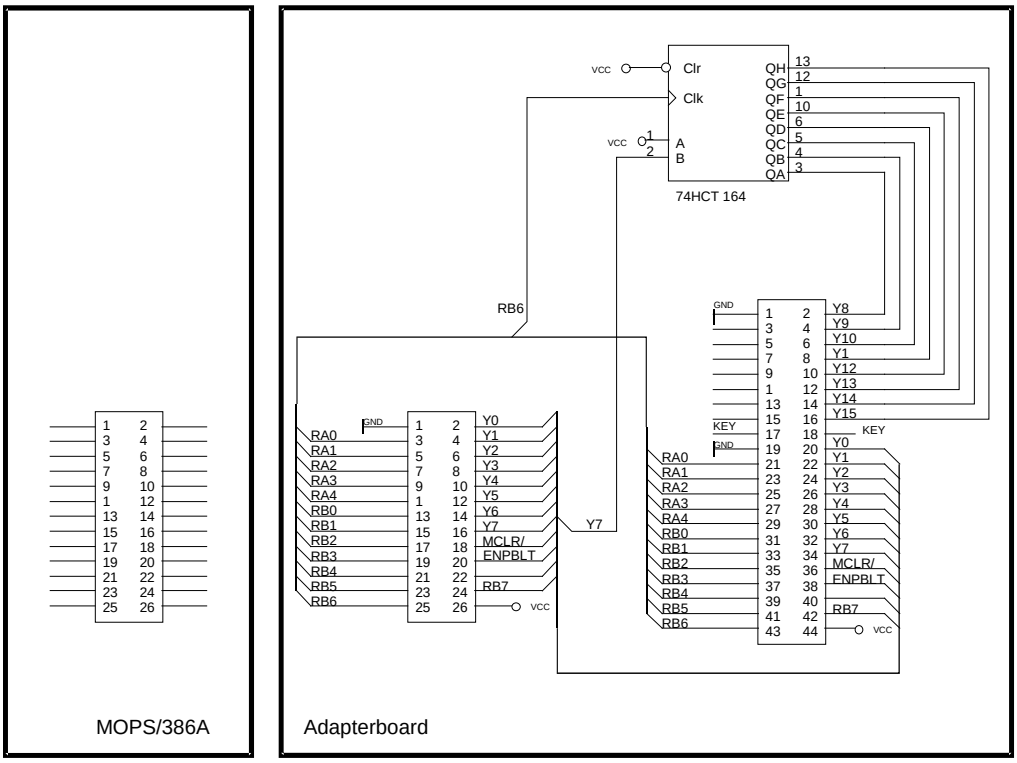
To connect a matrix keyboard, wire outputs Y0-Y7 with matrix lines and inputs RA0-RA4, RB0-RB4 with matrix columns.

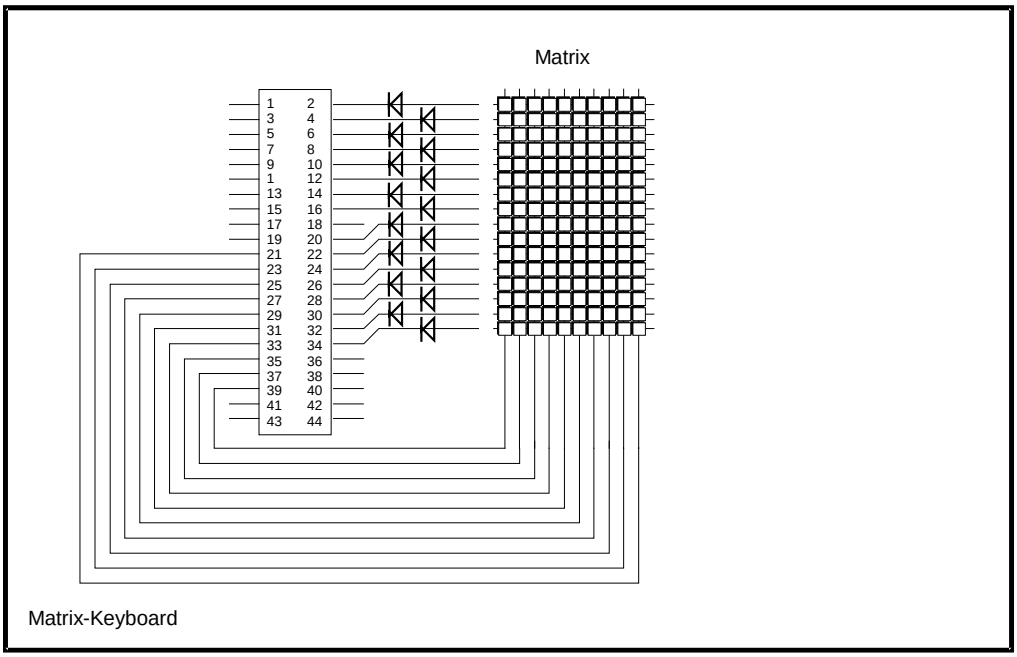
The matrix controller of the MOPS/386A has a cyclic output of a low level on the Y0 to Y7 lines. Whenever a connection (shortcut) on the matrix keyboard is made, an input line will go low. Input lines are pulled up by 47KOhm resistors and are high as long as a connection (shortcut) is not made by the matrix keyboard. This allows the matrix controller to recognize a key press of the matrix keyboard by a low level on the corresponding line. The matrix keyboard controller can only recognize a single key press; keys simultaneously pressed (such as <CTRL><ALT><DEL>) cannot be recognized.

The matrix controller uses hardware interrupt IRQ9 to tell the MOPS/386A a key has been pressed. A BIOS handler takes care of IRQ9. Each connection (shortcut) between a line and a column generates an internal scan code that is transferred to the system by IRQ9. The BIOS converts this internal scan code to a keyboard scan code using the matrix decoder table, which is located in the onboard EEPROM.

18.4 *Enhanced Matrix Keyboard*

If you need a larger matrix, you can enhance the matrix to 16*10 crossings. To achieve this, you will need external circuitry, which is shown in the following diagram.





18.5 Configuration

You can disable or enable the matrix keyboard controller from the BIOS setup. Please refer to the I/O Device Configuration Submenu in the Appendix B: BIOS Operation chapter for additional configuration information.

18.6 Matrix Keyboard Scan Code Setup

The matrix decoder table, which is accessed by the BIOS to convert the internal scan code to a keyboard scan code, can be configured for a special layout of the matrix keyboard. This configuration is done with the P389MTX.EXE utility program, which you can download from the Kontron Web site. This program allows you to assign a scan code or extended scan codes to any crosspoint on the matrix.

The syntax is: **P389MTX <command> <filename>**

18.6.1. Defining Scan Codes

Defining a matrix decoder table for the MOPS/386A is done using the following three steps:

1. Read the matrix decoder table from the onboard EEPROM with the P389MTX utility.

   ```
   P389MTX read mymatrix.mtx
   ```

2. Modify the matrix decoder table with a standard editor and save the new table.

3. Write the new matrix decoder table back to the onboard EEPROM.

   ```
   P389MTX write mymatrix.mtx
   ```

To define the scan code that should be generated when RA3 is connected with Y1, you must fill in the fourth column in Line two. The numbers, which are entered in hexadecimal form, are the scan codes, not the ASCII codes of the corresponding key.

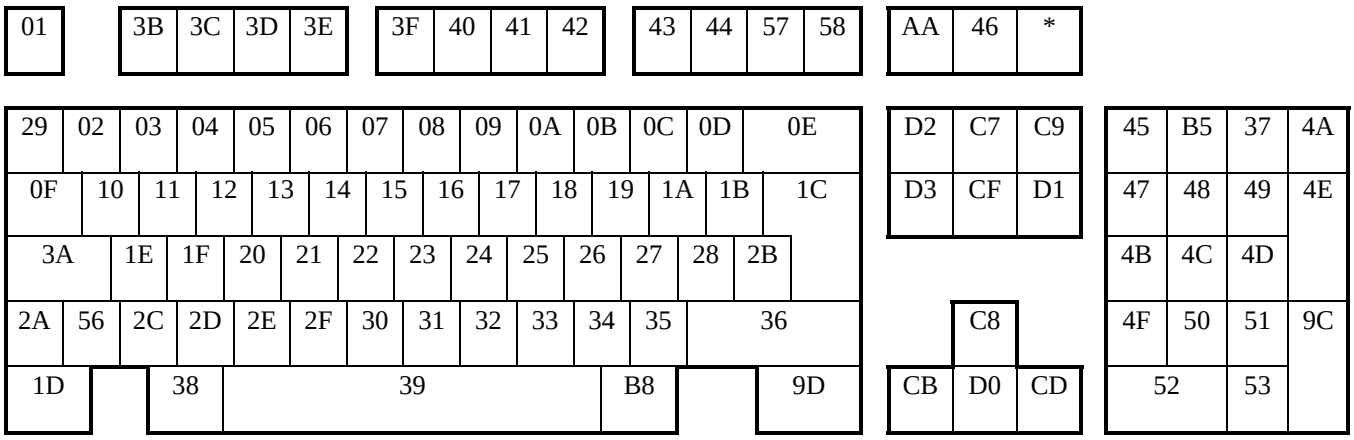
Scan codes are individual numbers for every key on your keyboard. For example, the scan code of the [Esc] key is 01, the [A] key has scan code 1Eh, while the left [Shift] key is associated with scan code 2Ah. You can find a listing of scan codes below for the MF-II keyboard below.

Some keys on MF-II keyboards generate extended scan codes. When the key is pressed, the scan code is transmitted to the keyboard, but the scan code is preceded by a "precode" with value 0Eh. If you want the matrix keyboard to generate an extended scan code, add 80h to the scan code.

As an example, entry 1Ch will result in scan code 1Ch (associated to the [Return] key). Entry 9Ch (added 80h) will generate scan codes 0Eh 1Ch, designating the [Enter] key on the numeric keypad.

18.6.2. Scan Codes of a MF2 Keyboard

The following scan codes are in hex.



Note: (*) This key cannot be used on a matrix keyboard

19. WATCHDOG TIMER

The watchdog timer is integrated in the chipset of the MOPS/386A and can issue a reset to the system or generate a nonmaskable interrupt (NMI). The watchdog timer circuit has to be triggered within a specified time by the application software. If the watchdog is not triggered because proper software execution fails or a hardware malfunction occurs, it will reset the system or generate the NMI.

19.1 *Configuration*

You can set the watchdog timer to disabled, reset or NMI mode. You can specify the timeout (trigger period) from 0.4 seconds up to 8.5 minutes. You can make the initialization settings in the BIOS setup. Refer to the Watchdog Settings Submenu in the Appendix B: BIOS Operation chapter for information on configuration.

19.2 *Programming*

19.2.1. Initialization

You can initialize the watchdog timer from the BIOS setup or the application software, using low-level programming or with help of the JIDA (Jumptec Intelligent Device Architecture) programmer's interface.

19.2.2. Trigger

The watchdog needs to be triggered out of the application software within the specified timeout period. You can only do this in the application software by using low-level programming or with help of the JIDA (Jumptec Intelligent Device Architecture) programmer's interface.

For information about low-level programming for the watchdog timer, refer to Application Note WdogP38x_E???.DOC, which you can request from Kontron technical support.

For information about the JIDA programmer's interface refer to the JIDA BIOS extension section in the Appendix B: BIOS chapter and separate documents available in the JIDA software packages on the Kontron Web site.

20. APPENDIX A: SYSTEM-RESOURCE ALLOCATIONS

20.1 *Interrupt Request (IRQ) Lines*

Please note that Kontron PC/104 devices were designed after the draft of P996 Specification for ISA systems. Because of this, shareable interrupts are not supported. Some PC/104 add-on board manufacturers do not follow the P996 Specification and allow shareable interrupts. If you want to use such PC/104 boards with Kontron devices, contact the manufacturer of the add-on board and ask about switching to non interrupt sharing.

IRQ #	Use	Available	Comment
0	Timer0	No	
1	Keyboard	No	
2	Slave PIC	No	
3	COM2	No	Note (1)
4	COM1	No	Note (1)
5	Ethernet	No	Note (2) Note (3)
6	FDC	No	Note (1)
7	LPT1	No	Note (1) Note (3)
8	RTC	No	
9	Matrix Keyboard	No	Note (1)
10		Yes	
11		Yes	
12	PS/2 Mouse	No	Note (1) Note (4)
13	FPU	No	
14	IDE0	No	Note (1)
15		Yes	

Notes:
(1) If the Used For device is disabled in setup, the corresponding interrupt is available for other devices.
(2) You can configure the Ethernet controller for another IRQ by using the setup tool; however, you cannot disable the Ethernet controller.
(3) You can assign LPT1 IRQ5, but avoid a conflict with the Ethernet IRQ assignment by first changing its interrupt.
(4) If PS/2 mouse is enabled in setup the signal IRQ12 on the PC/104 bus becomes MSDAT.

20.2 Direct Memory Access (DMA) Channels

DMA #	Use	Available	Comment
0		Yes	
1		Yes	
2	FDC	No	Note (1)
3	LPT1	No	Note (2)
4	Cascade	No	
5		Yes	
6		Yes	
7		Yes	

Notes:
(1) If the Used For device is disabled in setup, the corresponding DMA channel is available for other devices.
(2) The DMA channel is only used in ECP mode; it is free in other modes.

20.3 Memory Map

The MOPS/386A processor module can come with up to 8MB of memory. The first 640KB of DRAM are used as main memory.

Using DOS, you can address 1MB of memory directly. Memory area above 1MB (high memory, extended memory) is accessed under DOS via special drivers such as HIMEM.SYS and EMM386.EXE, which are part of the operating system. Please refer to the operating system documentation or special textbooks for information about HIMEM.SYS and EMM386.EXE.

Other operating systems (OS/2, Windows NT) allow you to address the full memory area directly.

Upper Memory	Use	Available	Comment
C0000h – C8000h		Yes	Free for ISA bus or shadow RAM in standard configuration, mainly used by ISA VGA cards.
C8000h – DFFFFh		Yes	Free for ISA bus or shadow RAM in standard configuration. If onboard LAN-RPL ROM is enabled, onboard SSD is enabled, the matrix keyboard or JRC is used; a 32K block is shadowed for BIOS extensions, starting with first free area at D8000h or D0000h or C8000h or C0000h. (BIOS extensions do not use the whole shadow block.)
E0000h – EFFFFh	SSD Flash pages and tables	No	If the onboard SSD is disabled in setup, the area is free for other devices to use (ISA bus only, no shadow RAM).
F0000h – FFFFFh	System BIOS	No	

20.3.1. Using Expanded Memory Managers

MOPS/386A extension BIOSes are mapped to an upper memory area. (See the previous table.) There also is a memory mapped I/O area for SSD pages and SAT tables, if the onboard silicon disk is enabled. Some add-on boards also have optional ROMs or use drivers that communicate with their corresponding devices via memory mapped I/O such as dual-ported RAM. These boards have to share the upper memory area with the Expanded Memory Manager's EMS frame. This often causes several problems in the system.

Most EMMs scan the upper memory area for extension BIOSes (optional ROMs) and choose a free memory area for their frame if it is not explicitly set. Normally, they are not always capable of detecting special memory-mapped I/O areas. You need to tell the EMM which memory areas are not available for the EMS frames, which is most of the time done by using special exclusion parameters.

When using the MOPS/386A with the onboard silicon disk enabled, an EMM has to be loaded in the CONFIG.SYS, the memory area E0000h to EFFFFh has to be excluded.

MS-DOS Example:

```
DEVICE=EMM386.EXE X=E000-EFFF
```

If the Expanded Memory Manager you use cannot detect extension BIOSes (optional ROMs), make sure you excluded all areas in the upper memory, which are used by extension BIOSes, too. Your instruction in the CONFIG.SYS concerning the Expanded Memory Manager should look like this: (questionmarks for location of extension BIOS).

MS-DOS Example:

```
DEVICE=EMM386.EXE X=????-???? X=E000-FFFF
```

Note: When booting up your system using this configuration under MS-DOS, the exclusion of area F000 to FFFF causes a warning. Microsoft reports that this message will always appear when the F000 segment lies in the shadow RAM. This is a bug of EMM386, not of the MOPS/386A.

Please carefully read the technical manuals of add-on cards used with the MOPS/386A for the memory areas they use. If necessary, also exclude their memory locations to avoid a conflict with the EMM.

20.4 I/O Address Map

The I/O-port addresses of the processor module MOPS/386A are functionally identical to a standard PC/AT. All addresses not mentioned in this table should be available. We recommend that you do not use I/O addresses below 0110hex with additional hardware for compatibility reasons, even if they are available on the MOPS/386A.

I/O Addresses	Use	Available	Comment
0000-000Fh	DMA Controller 1	No	Fixed
0020-003Fh	Interrupt Controller 1	No	Fixed
0040-0043h	Counter/timer	No	Fixed
0050-005Fh	Onboard control registers	No	Fixed
0060-0064h	Keyboard controller	No	Fixed
0070-0071h	Real-time clock	No	Fixed
0080-008Fh	DMA page register 74LS612	No	Fixed
0092h	Port A register (Fast A20 Gate)	No	Fixed
00A0-00BFh	Interrupt Controller 2	No	Fixed
00C0-00DEh	DMA Controller 2	No	Fixed
00EC-00EFh	Configuration registers	No	Fixed
00F0-00FFh	Math coprocessor	No	Fixed
01F0-01F8h	Fixed disk	No	Fixed
0278-027Fh	Parallel Port 2	Yes	Free in standard configuration, but possible address of LPT.
02E8-02EFh	User specific Serial Port (COM4)	Yes	Free in standard configuration, but possible address of COM.
02F8-02FFh	Serial Port 2	No	Default for COM B, free with different configuration.
0300-030Fh	Onboard Ethernet	No	The Ethernet controller can be configured to another I/O port address with the setup tool; it cannot be disabled.
0370-0377h	Configuration Port	No	Configuration address for SMC-controller.
0378-037Fh	Parallel Port 1	No	Default for LPT 1; free with different configuration.
03BC-03C4h	User-specific Parallel Port	Yes	Free in standard configuration but possible address of LPT.
03E8-03Efh	User-specific Serial Port (COM3)	Yes	Free in standard configuration, but possible address of COM.
03F0-03F7h	Diskette controller	No	Fixed.
03F8-02FFh	Serial Port 1	No	Default for COM A; free if different configuration used.

Note: The Super I/O Controller is connected to ISA address lines A0 to A10. The I/O port addresses of the SMsC FDC37C669 will be mirrored every 800hex in the I/O address space.

21. APPENDIX B: BIOS OPERATION

The MOPS/386A comes with a Phoenix BIOS, which is located in an onboard Flash EEPROM in compressed form. The device has 8-bit access. Faster access (16 bit) is provided by the shadow RAM feature. The onboard Flash EEPROM also holds some special Kontron BIOS extensions, which are loaded during boot up if the corresponding feature is enabled.

You can update the BIOS using a Flash utility.

21.1 *Determining the BIOS Version*

To determine the BIOS version of the MOPS/386A, immediately press the <**Pause/Break**> key on your keyboard as soon as you see the following text display in the upper left corner of your screen:

```
PhoenixBIOS 4.0 Release 6.0
Copyright 1985-2001 Phoenix Technology Ltd.
All Rights Reserved
JUMPtec(R) BIOS Version <P389R112>
(C)Copyright 2001 JUMPtec(R) Industrielle Computertechnik AG
```

Whenever you contact technical support about BIOS issues, providing a BIOS version <P389R???> is especially helpful.

The system BIOS provides additional information about the board's serial number, CPU, and memory information by displaying information similar to the following:

```
S/N: AD215125

CPU = ALi M6117C
640K System RAM Passed
1M Extended RAM Passed
System BIOS shadowed
Video BIOS shadowed
UMB upper limit segment address: F25D
```

The board's serial number has value to technical support. MOPS/386A serial numbers always start with AD and are followed by 6 or 7 digits. The first digit represents the year of manufacturing, the next two digits stand for the lot of that year, and the last 3 or 4 digits are the number of the board in that lot.

In the example above, the board with the serial number AD215125 was manufactured in year 2002, lot number 15 and it is the board number 125 of that lot.

21.2 *Setup Guide*

The Phoenix BIOS Setup Utility changes system behavior by modifying the BIOS configuration. The setup program uses a number of menus to make changes and turn features on or off.

The BIOS setup menus documented in this section represent those found in most models of the *MOPS/386A.* The BIOS setup for specific models can differ slightly.

Note: Selecting incorrect values may cause system boot failure. Load setup-default values to recover by pressing <F9>.

21.2.1. Start Phoenix BIOS Setup Utility

To start the Phoenix BIOS Setup Utility, press the **<F2>** key when the following string appears during boot up.

```
Press <F2> to enter Setup
```

The Main Menu then appears.

21.2.2. General Information

The **Setup Screen** is composed of several sections:

Setup Screen	Location	Function
Menu Bar	Top	Lists and selects all top-level menus.
Legend Bar	Bottom	Lists setup navigation keys.
Item Specific Help Window	Right	Help for selected item.
Menu Window	Left Center	Selection fields for current menu.
General Help Window	Overlay (center)	Help for selected menu.

Menu Bar

The menu bar at the top of the window lists different menus. Use the left/right arrow keys to make a selection.

Legend Bar

Use the keys listed in the legend bar on the bottom to make your selections or exit the current menu. The table below describes the legend keys and their alternates.

Key	Function
<F1> or <Alt-H>	General Help window.
<Esc>	Exit menu.
← or → Arrow key	Select a menu.
↑ or ↓ Arrow key	Select fields in current menu.
<Tab> or <Shift-Tab>	Cycle cursor up and down.
<Home> or <End>	Move cursor to top or bottom of current window.
<PgUp> or <PgDn>	Move cursor to next or previous page.
<F5> or <->	Select previous value for the current field.
<F6> or <+> or <Space>	Select next value for the current field.
<F9>	Load the default configuration values for this menu.
<F10>	Save and exit.
<Enter>	Execute command or select submenu.
<Alt-R>	Refresh screen.

Selecting an Item

Use the ↑ or ↓ key to move the cursor to the field you want. Then use the + and - keys to select a value for that field. The **Save Value** commands in the **Exit** menu save the values displayed in all the menus.

Displaying Submenus

Use the ← or → key to move the cursor to the submenu you want. Then press <Enter>. A pointer (▸) marks all submenus.

Item Specific Help Window

The Help window on the right side of each menu displays the Help text for the selected item. It updates as you move the cursor to each field.

General Help Window

Pressing **<F1>** or **<ALT-F1>** on a menu brings up the General Help window that describes the legend keys and their alternates. Press **<Esc>** to exit the General Help window.

21.3 Main Menu

Feature	Option	Description
System Time	HH:MM:SS	Set system time. Press <Enter> to move to MM or SS.
System Date	MM/DD/YYYY	Set system date. Press <Enter> to move to DD or YYYY.
Legacy Diskette A	360 kB, 5 ¼" 1.2 MB, 5 ¼" 720 kB, 3 ½" **1.44/1.25 MB**, 3 ½" 2.88 MB, 3 ½" Not installed Disabled	Select type of installed floppy disk drive.
Legacy Diskette B	See above **Disabled**	See above.
‣ Primary Master	Autodetected drive	Displays results of PM autotyping.
‣ Primary Slave	Autodetected drive	Displays results of PS autotyping.
‣ Secondary Master	Autodetected drive	Displays results of SM autotyping.
‣ Secondary Slave	Autodetected drive	Displays results of SS autotyping.
‣ JUMP*tec* Flash Disk	Submenu	Opens Flash Disk submenu.
‣ Memory Shadow	Submenu	Opens Memory Shadow submenu.
System Memory	N/A	Displays amount of conventional memory detected during bootup.
Extended Memory	N/A	Displays amount of extended memory detected during bootup.

Note: In the Option column, bold shows default settings.

21.4 Master or Slave Submenus

Feature	Option	Description
Type	None User **Auto** CD-ROM	None = Autotyping is not able to supply the drive type or end user has selected None, disabling any drive that may be installed. User = End user supplies the hdd information. Auto = Autotyping, the drive itself supplies the information. CD-ROM = CD-ROM drive.
Cylinders	1 to 65,536	Number of cylinders in CHS format.
Heads	1 to 256	Number of read/write heads in CHS format.
Sectors	1 to 63	Number of sectors per track in CHS format.
Maximum Capacity	N/A	Displays the calculated size of the drive using CHS format.
Total Sectors	N/A	Total number of sectors in LBA mode as reported by the drive during autotyping.
Maximum Capacity	N/A	Displays the calculated size of the drive by using the LBA format.
Multi-Sector Transfers	Disabled Standard 2 sectors 4 sectors 8 sectors **16 sectors**	Any selection except Disabled determines the number of sectors transferred per block. The standard is 1 sector per block.
LBA Mode Control	Disabled **Enabled**	Enabling LBA uses Logical Block Addressing instead of CHS.
32-Bit I/O	**Disabled** Enabled	Enables 32-bit communication between CPU and IDE card. Requires PCI or local bus.

Note: In the Option column, bold shows default settings.

21.4.1. JUMPtec Flash Disk Submenu

Feature	Option	Description
INT 13h Drive Mapping	**Disabled** Drive 80 Drive 81 Drive 82 Drive 83	Disables the Flash disk or specifies the drive number used to access the Flash disk via the INT 13h disk I/O interrupt.
Write Protect	**Disabled** Enabled	Inhibits INT 13h Flash disk-write access.
Erase On Next Boot	**Disabled** Enabled	Causes the Flash disk BIOS extension to erase the complete Flash disk volume during the next boot process.

Note: In the Option column, bold shows default settings.

21.4.2. Memory Shadow Submenu

Feature	Option	Description
System Shadow	Enabled	The system BIOS area F000-FFFF is always shadowed to improve performance.
Video Shadow	Disabled **Enabled**	Accesses to the video BIOS area C000-C7FF go to the ISA bus if Disabled or to local memory if Enabled.
C800 – CFFF	**Disabled** Enabled	Accesses to this upper memory region go to the ISA bus if Disabled or to local memory if Enabled.
D000 – D7FF	**Disabled** Enabled	See above.
D800 - DFFF	**Disabled** Enabled	See above.

Note: In the Option column, bold shows default settings.

21.5 Advanced Menu

Feature	Option	Description
▸ Advanced Chipset Control	Submenu	Opens Advanced Chipset Control submenu.
▸ PNP ISA UMB Region Exclusion	Submenu	Opens PNP ISA UMB Region Exclusion submenu.
PS/2 Mouse	Autodetect Enabled **Disabled**	Selecting Disabled prevents installed PS/2 mouse from functioning, but frees up IRQ12. Selecting Autodetect frees IRQ12 if a mouse is not detected.
▸ Keyboard Features	Submenu	Opens Keyboard Features submenu.
▸ I/O Device Configuration	Submenu	Opens I/O Device Configuration submenu.
Large Disk Access Mode	**DOS** Other	Select DOS if you have DOS. Select Other if you use an OS such as UNIX. A large disk is one that has more than 1024 cylinders, more than 16 heads or more than 63 sectors per track.
Halt On Errors	Yes **No**	Determines if post errors cause the system to halt.

Note: In the Option column, bold shows default settings.

21.5.1. Advanced Chipset Control Submenu

Feature	Option	Description
CPU Clock [MHz]	33, 30, 25, 16, 12, 10, 4, **40**	Selects CPU speed in MHz.

Note: In the Option column, bold shows default settings.

Kontron recommends using a CPU with a clock speed of 25MHz, 33MHz or 40MHz when using the MOPS/386A with additional add-on boards. With lower CPU clocks, the MOPS/386A performance operates too slowly for proper operation of peripherals.

21.5.2. PNP ISA UMB Region Exclusion Submenu

Feature	Option	Description
C800 - CFFF	**Available** Reserved	Reserves the specified block of upper memory for use by legacy ISA devices.
D000 – D7FF	See above.	See above.
D800 - DFFF	See above.	See above.

Note: In the Option column, bold shows default settings.

21.5.3. Keyboard Features Submenu

Feature	Option	Description
Numlock	**Auto** On Off	On or Off turns NumLock on or off at bootup. Auto turns NumLock on if it finds a numeric keypad.
Key Click	**Disabled** Enabled	Turns audible key click on.
Keyboard auto-repeat rate	**30/sec** 26.7/sec 21.8/sec 18.5/sec 13.3/sec 10/sec 6/sec 2/sec	Sets the number of times to repeat a keystroke per second if you hold the key down.
Keyboard auto-repeat delay	¼ sec **½ sec** ¾ sec 1 sec	Sets delay time after the key is pressed before it begins to repeat the keystroke.

Note: In the Option column, bold shows default settings.

21.5.4. I/O Device Configuration Submenu

Feature	Option	Description
Hard disk controller	Disabled **Enabled**	Enables onboard IDE controller.
Floppy disk controller	Disabled **Enabled**	Enables onboard FDC controller.
Serial Port A Serial Port B	Disabled Enabled **Auto**	Disabled turns off port. Enabled requires a base I/O address and IRQ. Auto makes BIOS configure the port.
Base I/O address	**3F8h** **2F8h** 3E8h 2E8h	Select I/O base of serial port.
Interrupt	**IRQ 3** **IRQ 4**	Select IRQ of serial port.
Parallel Port	Disabled Enabled **Auto**	Disabled turns off port. Enabled requires a base I/O address and IRQ. Auto makes the BIOS configure the port.
Mode	Output only **Bi-directional** ECP EPP	Set the mode for the parallel port.
Base I/O address	**378h** 278h 3BCh	Select I/O base of parallel port. 3BCh cannot be selected in EPP mode.
IRQ	IRQ 5 **IRQ 7**	Select the IRQ of parallel port.
DMA	**DMA3**	DMA Channel 3 can be used for ECP mode only.
▸ Watchdog Settings	Submenu	Opens Watchdog Settings submenu.
Keyboard Matrix	**Disabled** Enabled	Enables the onboard keyboard matrix controller.

Note: In the Option column, bold shows default settings.

21.5.5. Watchdog Settings Submenu

Feature	Option	Description
Mode	**Disabled** Reset NMI	Select watchdog operation mode.
Timeout	0.4s, 1s, 5s, 10s, **30s**, 1min, 5min, 10min	Maximum trigger period.

Note: In the Option column, bold shows default settings.

21.6 *Security Menu*

Feature	Option	Description
Supervisor Password Is: *	**Clear** Set	Displays if a supervisor password is set or not.
User Password Is: *	**Clear** Set	Displays if a user password is set or not.
Set Supervisor Password	Up to seven alphanumeric characters	Pressing <Enter> displays the dialog box for entering the supervisor password. In related systems, this password gives full access to setup.
Set User Password	Up to seven alphanumeric characters	Pressing <Enter> displays the dialog box for entering the user password. In related systems, this password gives restricted access to setup.
Password on boot	**Disabled** Enabled	Enabled requires a password on boot. Requires prior setting of the supervisor password. If supervisor password is set and this option is disabled, BIOS assumes user is booting.
Fixed disk boot sector	**Normal** Write protected	Write protect the boot sector on the hard disk for virus protection. Requires a password to format or Fdisk the hard disk.
Diskette access	User **Supervisor**	Enabled requires supervisor password to access the floppy disk.
Virus check reminder System backup reminder	**Disabled** Daily Weekly Monthly	Displays a message during bootup asking (Y/N) if you backed up the system or scanned for viruses. Message returns on each boot until you respond with "Y." Daily displays the message on the first boot of the day, Weekly on the first boot after Sunday, and Monthly on the first boot of the month.

Notes: In the Option column, bold shows default settings.
(*) Enabling Supervisor Password requires a password for entering Setup.
Passwords are not case-sensitive.
User and Supervisor passwords are related.
You can only create a user password if a supervisor password exists.

21.7 Boot Menu

Feature	Option	Description
Floppy check	**Disabled** Enabled	Enabled verifies floppy type on boot; disabled speeds boot.
Summary screen	**Disabled** Enabled	Enabled creates a summary screen to let you see system configuration.
QuickBoot Mode	Disabled **Enabled**	Allows system to skip certain tests while booting. This decreases time needed to boot the system.
Dark Boot *	**Disabled** Enabled	If enabled, system comes up with a blank screen instead of the diagnostic screen during bootup.
Boot sequence	A: then C: **C: then A:** C: only	Defines device sequence from which the system boots.
Onboard LAN RPL ROM	**Disabled** Enabled	Enables Remote Program Load ROM of the LAN controller.

Notes: In the Option column, bold shows default settings.
(*) If you enable dark boot, the screen stays blank until the OS loads unless:
a) You press <Escape> to display the POST screen.
b) You press <F2> to enter setup.
c) POST issues an error message.
d) The BIOS or an option ROM requests keyboard input.

21.8 *Exit Menu*

The following sections describe the five options in **Exit Menu**. Pressing **<Esc>** does not exit this menu. You must select an item from the menu to exit.

Exit Saving Changes

Saves all selections and exits setup. Upon reboot, the BIOS configures the system according to the Setup selection stored in CMOS.

Exit Discarding Changes

Exits Setup without storing new selections in CMOS. Previous selections remain in effect.

Load Setup Defaults

Select to display default values for all Setup menus.

Discard Changes

Discards changes made during a Setup session and reverts to values previously saved in CMOS.

Save Changes

Saves all selections without exiting Setup.

21.9 Kontron BIOS Extensions

Besides the Phoenix System BIOS, the MOPS/386A comes with a few BIOS extensions that support special features. All extensions are located in the onboard flash EEPROM. Some extensions are permanently available; some are loaded if required during boot up. Supported features include:

- JIDA standard
- Remote Control feature (JRC)
- Silicon disk extension
- Onboard LAN RPL ROM
- DOT-matrix LCD
- Matrix-keyboard

All enabled BIOS extensions require shadow RAM. They will be loaded into the same 32K shadowed memory block, if possible. However, if the system memory cannot find free memory space because all the memory is already used for add-on peripherals, the BIOS extensions do not load.

21.9.1. JIDA BIOS extension

The JUMPtec Intelligent Device Architecture (JIDA) BIOS extension is not a true extension BIOS. It is part of the system BIOS and is located in the F-segment after boot up. It is permanently available and supports the JIDA 16-bit standard. It is a software interrupt 15hex driven programmers interface and offers lots of board information functions. For detailed information about programming, refer to the JIDA specification and a source code example (JIDAI???.ZIP), which you can find at the Kontron Web site. The three question marks represent the revision number of the file. You also can contact technical support for this file.

For other operating systems, special drivers (JIDAIA??.ZIP) are available. You can download the zip file from the Kontron Web site.

21.9.2. Remote Control Client Extension

You can remotely control the MOPS/386A using software available from Kontron (JRC-1, Part Number 96047-0000-00-0). This software tool can communicate with the board via one of the serial ports. During boot up of the MOPS/386A, the system BIOS scans the serial ports for an available JRC connection. If detected, it loads the JRC client BIOS extension into the memory. With the JRC client loaded into the first detected free memory location between C0000hex and D8000hex, a 32K block is shadowed.

For more information on the Remote Control usage, refer to the JRC-1 technical manual or Application Note JRCUsage_E???.PDF, which you can find on the Kontron Web site.

21.9.3. Silicon Disk BIOS extension

The system BIOS setup of the MOPS/386A allows you to enable the onboard silicon disk as a bootable Flash disk. When the Interrupt 13h drive mapping is enabled, the Silicon Disk BIOS extension loads during boot up. The Flash Disk is a BIOS INT 13h compatible implementation of a solid-state disk. It is a DOS-compatible disk and cannot be used under protected mode or real-time operating systems.

The BIOS extension is loaded into the first free memory area between C0000hex and D8000hex, a 32K block of memory is shadowed. This feature also needs the memory area E0000h to EFFFFh to access the flashes. Also, you can refer to the Silicon Disk chapter of this user's guide for more information.

21.9.4. LAN RPL ROM

If the onboard LAN RPL ROM is enabled in the system BIOS setup, a special optional ROM for the Ethernet controller loads into memory during boot up. This optional ROM allows you to boot the MOPS/386A over an Ethernet connection. A server with Etherboot support is required on the other side of the Ethernet connection. The setup and configuration of the server, including Etherboot support, is not the responsibility of Kontron.

The RPL ROM extension is loaded into the first free memory area between C0000hex and D8000hex and a 32K block of memory is shadowed.

21.9.5. DOT-Matrix LCD BIOS extension

If the DOT-matrix LCD interface is set up by using software tool ALCDINIT.EXE, the BIOS extension that supports this feature will load during boot up. Refer to the LCD DOT-matrix Interface chapter for more details.

The BIOS extension for the DOT-matrix LCD loads into the first free memory area between C0000hex and D8000hex; a 32K block of memory is shadowed. However, if the system memory cannot find free memory space because all the memory is already used for add-on peripherals, the BIOS extension will not load.

21.9.6. Matrix Keyboard BIOS extension

You can enable the Matrix keyboard feature from the system BIOS setup. Refer to the Matrix Keyboard Interface chapter for more details.

This feature enables results in a load of the Matrix Keyboard BIOS extension into the first free memory area between C0000hex and D8000hex; a 32K block of memory is shadowed.

21.10 Updating or Restoring BIOS

If your MOPS/386A board requires a newer BIOS version or the BIOS is damaged, you may need to update or restore the BIOS.

Phoenix PHLASH allows you to update or restore the BIOS with a newer version or restore a corrupt BIOS by using a floppy disk without having to install a new ROM chip.

1) Download Phoenix Phlash as a compressed file, CRD?P389.ZIP, from the Kontron Web site. It contains the following files:

File	Purpose
MAKEBOOT.EXE	Creates the custom boot sector on the Crisis Recovery Diskette.
CRISBOOT.BIN	Serves as the Crisis Recovery boot sector code.
MINIDOS.SYS	Allows the system to boot in Crisis Recovery Mode.
PHLASH.EXE	Programs the Flash ROM.
WINCRISIS.EXE	Creates the Crisis Recovery Diskette from Windows.
WINCRISIS.HLP	Serves as the help file of WINCRISES.EXE.
PLATFORM.BIN	Performs platform-dependent functions.
BIOS.ROM	Serves as the actual BIOS image to be programmed into Flash ROM.

2) To install Phoenix Phlash on a hard disk, unzip the content of CRD?P389.ZIP into a local directory such as C:\PHLASH.

3) To create a Crisis Recovery Diskette, insert a blank diskette into Drive A: or B: and execute WINCRISIS.EXE. This copies four files onto the Crisis Recovery Diskette:

File	Purpose
MINIDOS.SYS	Allows the system to boot in Crisis Recovery Mode.
PHLASH.EXE	Programs the Flash ROM.
PLATFORM.BIN	Performs platform-dependent functions.
BIOS.ROM	Serves as the BIOS image to be programmed into Flash ROM.

4) If the BIOS image (BIOS.ROM) changes because of an update or bug fix, copy the new BIOS.ROM image onto the diskette.

5) Phlash can fail if the system uses memory managers. If this occurs, the utility displays the following message:

```
Cannot flash when memory managers are present.
```

6) If you see this message after you execute Phlash, disable the memory manager.

21.11 Preventing Problems When Updating or Restoring BIOS

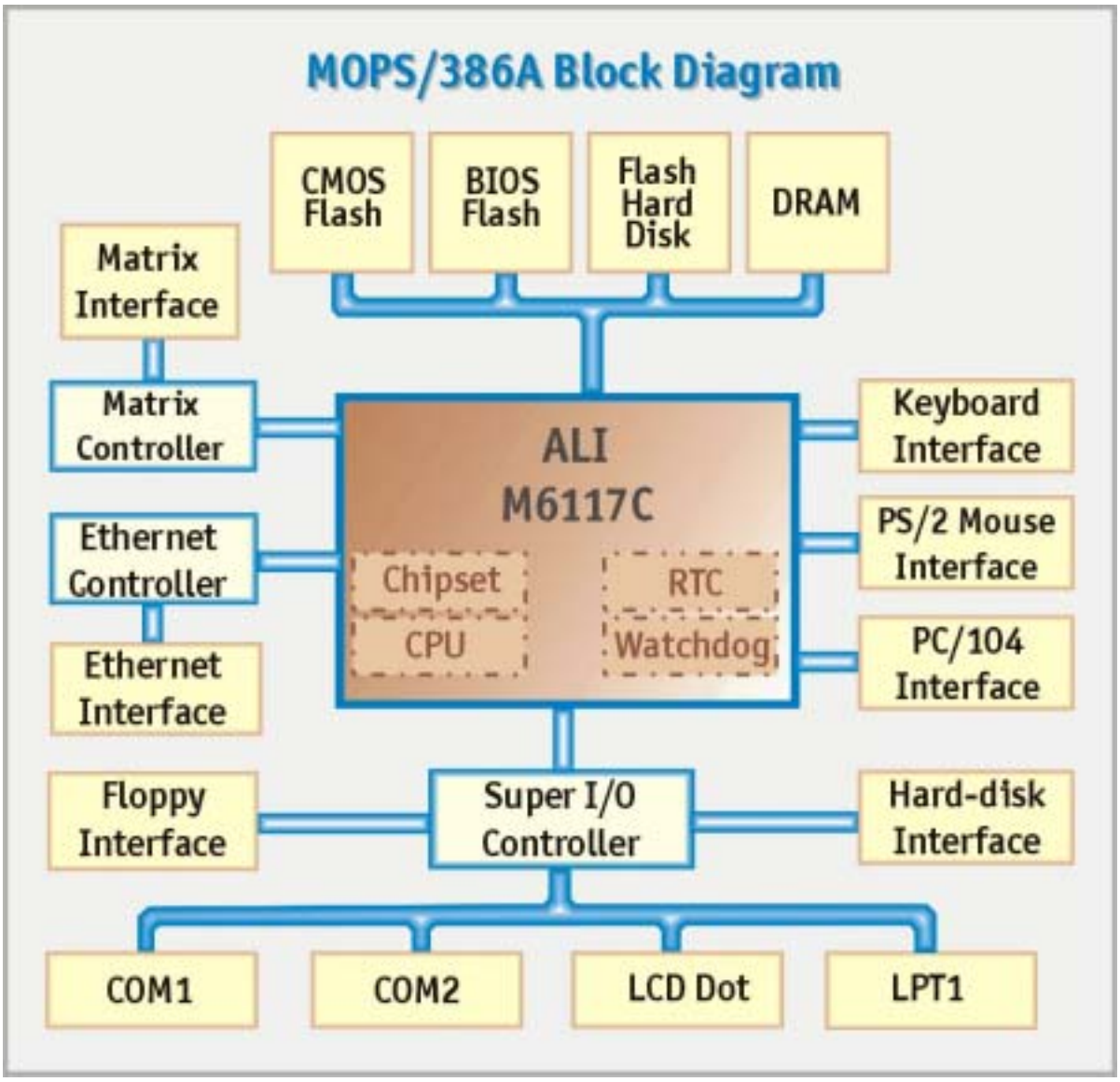
Updating the BIOS represents a potential hazard. Power failures or fluctuations that can occur during updating the Flash ROM can damage the BIOS code, making the system unbootable.

To prevent this potential hazard, many systems come with a boot-block Flash ROM. The boot-block region contains a fail-safe recovery routine. If the boot-block code finds a corrupted BIOS (checksum fails), it boots into the crisis recovery mode and loads a BIOS image from a crisis diskette (see above).

Additionally, the end user can insert an update key into the serial port (COM1 only) to force initiating the recovery routine for the boot block.

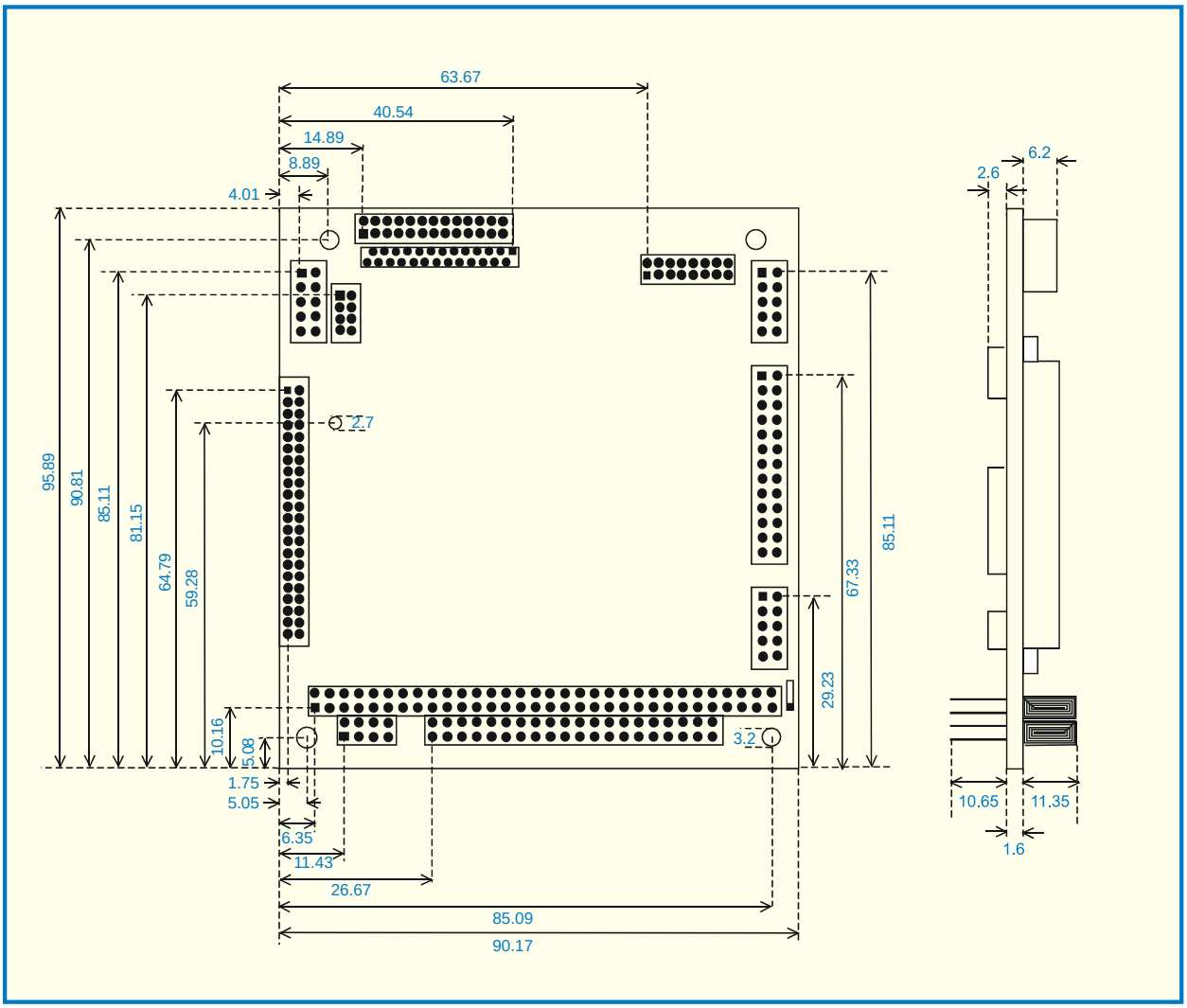
For further information on the update key and the crisis diskette, see a special application note (PHLASH_SC_E???.PDF), which is available from the Kontron Web site. (The three question marks indicate the revision number of the document.)

22. APPENDIX C: BLOCK DIAGRAM



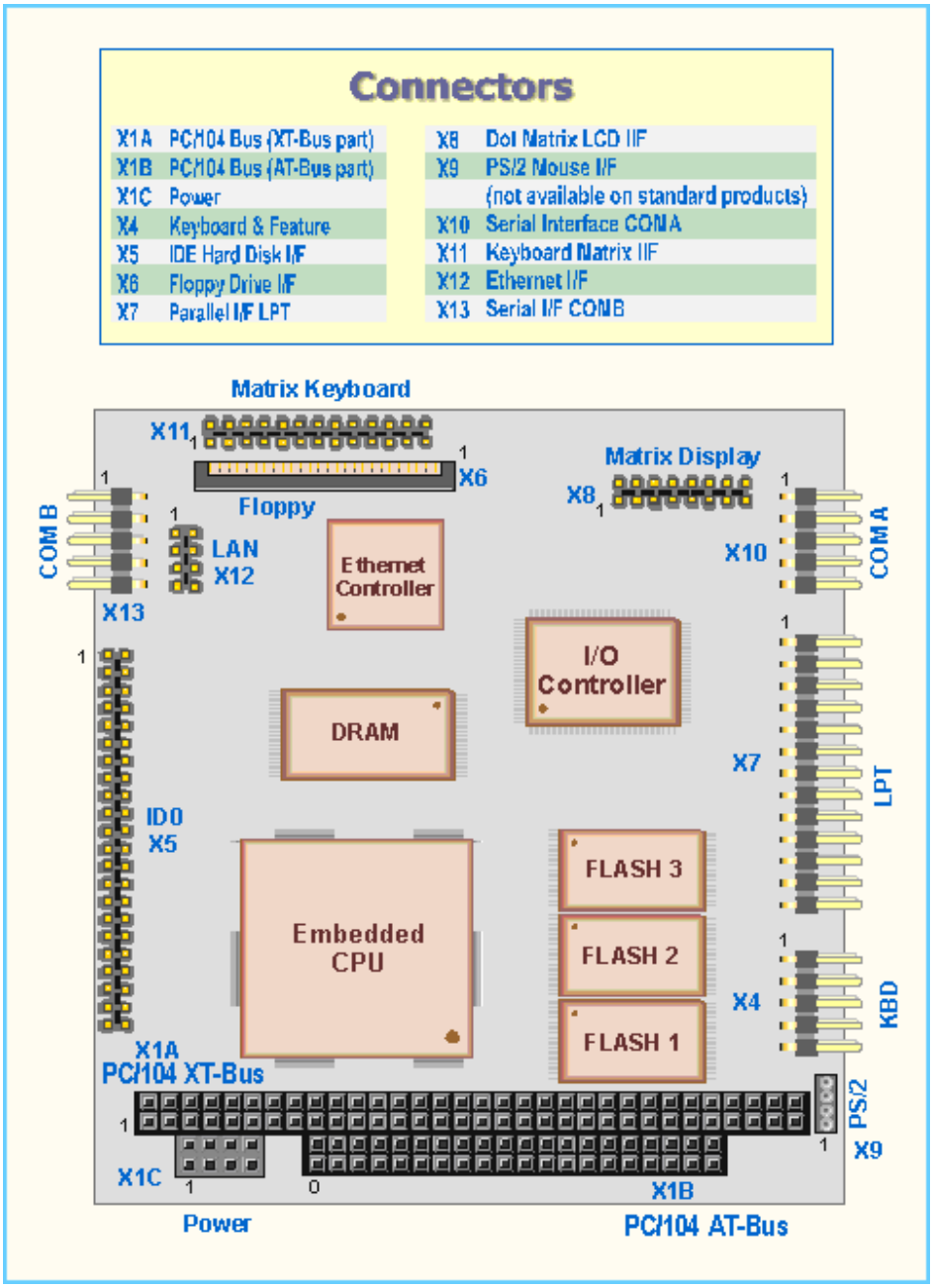
23. APPENDIX D: MECHANICAL DIMENSIONS

You can use a pair of 104-pin male and female stacking connectors to connect two PC/104 bus boards. (All dimensions below are in mm.)



24. APPENDIX E: CONNECTOR LAYOUT

24.1 Connector Locations



Pin 1 of any connector is marked with a rectangular pad at the bottom side of the board.

24.2 Connector Functions and Interface Cables

The table notes connector functions, as well as mating connectors and available cables.

Connector	Function	Mating Connector	Available Cable	Cable Description
X1A	PC/104 Bus (XT-Bus part)	2.54mm 64 pos. (EPT 962-60323-12 or compatible for board to board connection)		
X1B	PC/104 Bus (AT-Bus part)	2.54mm 40 pos. (EPT 962-60203-12 or compatible for board to board connection)		
X1C	Power Connector	2.54mm 8 pos. (EPT 962-60043-12 or compatible for board to board connection)		
X4	Keyboard and Feature Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-KB-1 (PN 96023-0000-00-0) or KAB-KB-PS2 (PN 96060-0000-00-0)	For AT-keyboard or PS/2 keyboard.
X5	IDE Hard Disk Interface Connector	2mm 44 pos. (Berg 89361-144 or compatible)	KAB-IDE-25 (PN 96020-0000-00-0) or KAB-IDE-2MM (PN 96021-0000-00-0)	For 3.5” HDD Or 2.5” HDD
X6	Floppy Drive Interface Connector		ADA-FLOPPY-2 (PN 96001-0000-00-0) or KAB-FLOPPY/MOPS-1 (PN 96019-0000-00-0)	For 3.5” floppy or Slim-line floppy.
X7	Parallel Interface LPT Connector	2.54mm 26 pos. (AMP 2-215882-6 or compatible)	KAB-DSUB25-1 (PN 96015-0000-00-0)	For DSUB 25 adaptation.
X8	DOT-Matrix LCD Interface Connector	2mm 16 pos.		
X9	PS/2 Mouse Interface Connector (not available on standard products)	1.25mm 4 pos. (Molex 51021-0400 or compatible)	KAB-MOUSE-PS2 (PN 96062-0000-00-0)	For PS/2 Mouse
X10	Serial Interface COM A Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-DSUB9-2 (PN 96017-0000-00-0)	For DSUB 9 adaptation.
X11	Keyboard Matrix Interface Connector	2mm 26 pos.		
X12	Ethernet Interface Connector	2mm 8 pos. (Berg 90311-008 or compatible)	KAB-MOPS-ETN1 (PN 96048-0000-00-0)	For RJ45 adaptation.
X13	Serial Interface COM B Connector	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-DSUB9-2 (PN 96017-0000-00-0)	For DSUB 9 adaptation.

24.3 Pinout Table

Pin	PC104 (A)	PC104 (B)	PC104 (C)	PC104 (D)	Power	IDE	Floppy	LPT
0			GND	GND				
1	/IOCHCK	GND	/SBHE	/MEMCS16	GND	/RSTDRV	VCC	/STB
2	SD7	RESETDRV	LA23	/IOCS16	VCC	GND	/IDX	/AFD
3	SD6	VCC	LA22	IRQ10	BATT	HDD7	VCC	PD0
4	SD5	IRQ9	LA21	IRQ11	+12V	HDD8	/DS0	/ERR
5	SD4	-5V	LA20	IRQ12	-5V	HDD6	VCC	PD1
6	SD3	DRQ2	LA19	IRQ15	-12V	HDD9	DSKCHG	/INIT
7	SD2	-12V	LA18	IRQ14	GND	HDD5	NC	PD2
8	SD1	/0WS	LA17	/DACK0	VCC	HDD10	NC	/SLIN
9	SD0	+12V	/MEMR	DRQ0		HDD4	NC	PD3
10	IOCHRDY	GND	/MEMW	/DACK5		HDD11	/MTR0	GND
11	AEN	/SMEMW	SD8	DRQ5		HDD3	NC	PD4
12	SA19	/SMEMR	SD9	/DACK6		HDD12	/DIR	GND
13	SA18	/IOW	SD10	DRQ6		HDD2	NC	PD5
14	SA17	/IOR	SD11	/DACK7		HDD13	/STEP	GND
15	SA16	/DACK3	SD12	DRQ7		HDD1	GND	PD6
16	SA15	DRQ3	SD13	VCC		HDD14	/WDATA	GND
17	SA14	/DACK1	SD14	/MASTER		HDD0	GND	PD7
18	SA13	DRQ1	SD15	GND		HDD15	/WGATE	GND
19	SA12	/REFRESH	GND	GND		GND	GND	/ACK
20	SA11	SYSCLK				NC	/TRK0	GND
21	SA10	IRQ7				NC	GND	/BUSY
22	SA9	IRQ6				GND	/WRPRT	GND
23	SA8	IRQ5				/IWT	GND	PE
24	SA7	IRQ4				GND	/RDATA	GND
25	SA6	IRQ3				/IRT	GND	/SLCT
26	SA5	/DACK2				GND	/HDSEL	VCC
27	SA4	T/C				IOCHRDY		
28	SA3	BALE				BALE		
29	SA2	VCC				NC		
30	SA1	OSC				GND		
31	SA0	GND				IRQ14		
32	GND	GND				/IOCS16		
33						S1T		
34						NC		
35						S0T		
36						S2T		
37						/IDECS0		
38						/IDECS1		
39						NC		
40						GND		
41						VCC		
42						VCC		
43						GND		
44						NC		

Note: LPT Pin 26 is connected to VCC.

Pin	COM A	COM B	LAN	KBD	PS/2 Mouse (option)	Matrix Display	Matrix Keybrd
0							
1	/DCD1	/DCD2	TXD+	SPKR	MSDAT	GND	GND
2	/DSR1	/DSR2	TXD-	GND	VCC	VCC	Y0
3	RXD1	RXD2	RXD+	/RESIN	GND	VEE	RA0
4	/RTS1	/RTS2	NC	/KBLOCK	MSCLK	RS	Y1
5	TXD1	TXD2	NC	KBDAT		R/W	RA1
6	/CTS1	/CTS2	RXD-	KBCLK		Enable	Y2
7	/DTR1	/DTR2	LNLED	GND		DB0	RA2
8	/RI1	/RI2	LKLED	VCC		DB1	Y3
9	GND	GND		BATT		DB2	RA3
10	VCC	VCC		PWRGOOD		DB3	Y4
11						DB4	RA4
12						DB5	Y5
13						DB6	RB0
14						DB7	Y6
15						Backlight +	RB1
16						Backlight -	Y7
17							RB2
18							/MCLR
19							RB3
20							ENPBLT
21							RB4
22							NC
23							I2CLK/RB5
24							RB7
25							I2DAT/RB6
26							VCC

Note: COMA and COMB PIN10 are connected to VCC.

25. APPENDIX F: PC ARCHITECTURE INFORMATION

The following sources of information can help you better understand PC architecture.

25.1 *Buses*

25.1.1. ISA, Standard PS/2 - Connectors

- AT Bus Design: Eight and Sixteen-Bit ISA, E-ISA and EISA Design, Edward Solari, Annabooks, 1990, ISBN 0-929392-08-6
- AT IBM Technical Reference Vol 1&2, 1985
- ISA & EISA Theory and Operation, Edward Solari, Annabooks, 1992, ISBN 0929392159
- ISA Bus Specifications and Application Notes, Jan. 30, 1990, Intel
- ISA System Architecture, Third Edition, Tom Shanley and Don Anderson, Addison-Wesley Publishing Company, 1995, ISBN 0-201-40996-8
- Personal Computer Bus Standard P996, Draft D2.00, Jan. 18, 1990, IEEE Inc
- Technical Reference Guide, Extended Industry Standard Architecture Expansion Bus, Compaq 1989

25.1.2. PC/104, PCI - Information

- Embedded PC 104 Consortium
  The consortium provides information about PC/104 and PC/104-Plus technology. You can search for information about the consortium on the Web.
- PCI SIG
  The PCI-SIG provides a forum for its ~900 member companies, who develop PCI products based on the specifications that are created by the PCI-SIG. You can search for information about the SIG on the Web.
- *PCI & PCI-X Hardware and Software Architecture & Design*, Fifth Edition, Edward Solari and George Willse, Annabooks, 2001, ISBN 0-929392-63-9.
- *PCI System Architecture*, Tom Shanley and Don Anderson, Addison-Wesley, 2000, ISBN 0-201-30974-2.

25.2 General PC Architecture

- *Embedded PCs*, Markt&Technik GmbH, ISBN 3-8272-5314-4 (German)
- *Hardware Bible*, Winn L. Rosch, SAMS, 1997, 0-672-30954-8
- *Interfacing to the IBM Personal Computer*, Second Edition, Lewis C. Eggebrecht, SAMS, 1990, ISBN 0-672-22722-3
- *The Indispensable PC Hardware Book*, Hans-Peter Messmer, Addison-Wesley, 1994, ISBN 0-201-62424-9
- *The PC Handbook: For Engineers, Programmers, and Other Serious PC Users, Sixth Edition*, John P. Choisser and John O. Foster, Annabooks, 1997, ISBN 0-929392-36-1

25.3 Ports

25.3.1. RS-232 Serial

- EIA-232-E standard

The EIA-232-E standard specifies the interface between (for example) a modem and a computer so that they can exchange data. The computer can then send data to the modem, which then sends the data over a telephone line. The data that the modem receives from the telephone line can then be sent to the computer. You can search for information about the standard on the Web.

- *RS-232 Made Easy: Connecting Computers, Printers, Terminals, and Modems*, Martin D. Seyer, Prentice Hall, 1991, ISBN 0-13-749854-3
- National Semiconductor

The Interface Data Book includes application notes. Type “232” as a search criteria to obtain a list of application notes. You can search for information about the data book on National Semiconductor’s Web site.

25.3.2. ATA

AT Attachment (ATA) Working Group
This X3T10 standard defines an integrated bus interface between disk drives and host processors. It provides a common point of attachment for systems manufacturers and the system. You can search for information about the working group on the Web.
We recommend you also search the Web for information on *4.2 I/O cable*, if you use hard disks in a DMA3 or PIO4 mode.

25.3.3. USB

USB Specification
USB Implementers Forum, Inc. is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement and adoption of Universal Serial Bus technology. You can search for information about the standard on the Web.

25.4 *Programming*

- *C Programmer's Guide to Serial Communications*, Second Edition, Joe Campbell, SAMS, 1987, ISBN 0-672-22584-0
- *Programmer's Guide to the EGA, VGA, and Super VGA Cards*, Third Edition, Richard Ferraro, Addison-Wesley, 1990, ISBN 0-201-57025-4
- *The Programmer's PC Sourcebook*, Second Edition, Thom Hogan, Microsoft Press, 1991, ISBN 1-55615-321-X
- *Undocumented PC, A Programmer's Guide to I/O, CPUs, and Fixed Memory Areas*, Frank van Gilluwe, Second Edition, Addison-Wesley, 1997, ISBN 0-201-47950-8

26. APPENDIX G: DOCUMENT-REVISION HISTORY

Revision	Date	Edited by	Changes
P389M110	14.12.2001	WKA	Created manual.
P389M111	30.06.2003	JL/BHO	Updated manual with technical information and Kontron name change throughout the manual.
P389M112	18.11.2003	BHO	Corrected POWERGOOD information, minor corrections
P389M113	15.03.2004	BHO	Added MTBF, corrected connector layout drawing, added watchdog JIDA information, minor corrections
P389M114	12.10.2004	BHO	Updated technical support addresses, added protection notes for connectors, minor changes