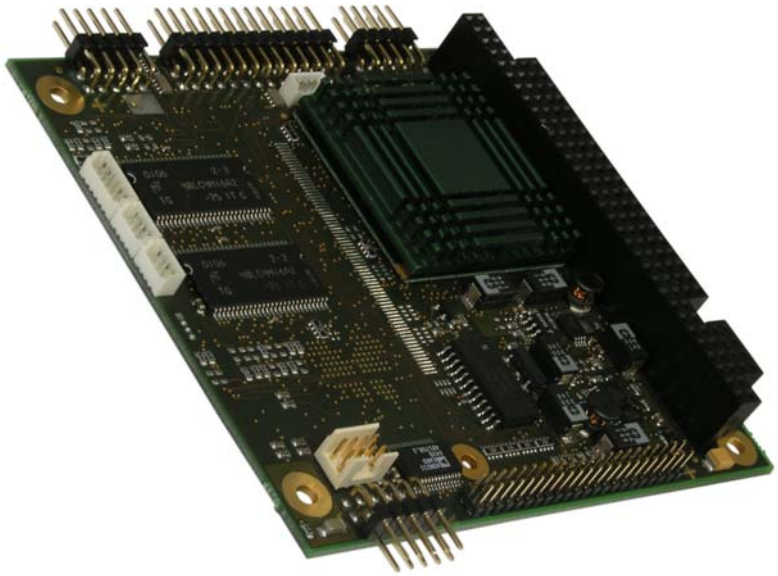
Kontron User's Guide



T-MOPSlcdSA

Document Revision 1.13

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1 User Information

1.1 About This Document

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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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Technicians and engineers from Kontron Embedded Modules GmbH and/or its subsidiaries 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 GmbH technical support, please consult our Web site at http://www.kontron-emea.com/emd for the latest product documentation, utilities, and drivers. If the information does not help solve the problem, contact us by telephone or email.

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2 Introduction

2.1 T-MOPSlcdSA

The **T-MOPSlcdSA** comes with a STMicroelectronics STPC® Atlas embedded microcontroller. The ATLAS processor runs with an internal clock speed of 120MHz and is fully compatible with standard x86 processors. The processor is combined with a powerful chipset to provide a general purpose PC-compatible subsystem on a single chip. The CPU/chipset does not require a cooler or a fan.

The T-MOPSlcdSA is equipped with 32MB SDRAM soldered onboard (64MB as option upon request), which makes this PC/104 processor board especially suitable for use in rugged environments.

However, the standard product available on stock comes with 32MB of SDRAM.

Every T-MOPSlcdSA comes with the PC/104 standard interface (full 16bit ISA signals).

The T-MOPSlcdSA is a highly integrated CPU board that features many standard interfaces, including a watchdog timer and a real-time clock. The board integrates the complete functionality of an 80486 motherboard and includes the following features:

- CPU / chipset (single chip)
- System BIOS
- SDRAM controller, which supports up to 64MB SDRAM
- Interrupt controller and DMA controller
- EIDE controller

The following features are provided via the onboard PCI bus (PCI 2.1 compliant):

- 32-bit PCI Ethernet controller

Additional peripheral functions include:

- Keyboard controller and PS/2 mouse support
- Real-time clock
- Watchdog timer (WDT)
- Two serial ports (Both RS-232)
- Parallel port (SPP/EPP/ECP modes)
- USB 1.1 compatible OHCI 1.0 controller

T-MOPSlcdSA online: http://www.kontron.com

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 pin out 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, MOPS products with 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.

T-MOPSlcdSA provides a CRT output only but it can easily connect to a TFT by i.e. CRTtoLCD-5. More information can be obtained under the following product link to Kontron website:

http://emea.kontron.com/index.php?id=226&cat=78&productid=1145.

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 controlled remotely by using JRC software through a serial port. The software allows you to change, update, and maintain the MOPS products from a host computer via a serial connection.

General MOPS information is obtained here:

http://www.kontron.com/mops

You can find MOPS PC/104 accessories information here:

http://emea.kontron.com/index.php?id=82&cat=56

You can find MOPS PC/104 Starterkit information here:

http://emea.kontron.com/index.php?id=82&cat=57

2.3 PC/104 an Embedded PC Standard

Over the past decade, 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 T-MOPSlcdSA 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. Connect a CRT monitor to the CRT interface by using the corresponding adapter cable.
4. Plug the T-MOPSlcdSA to the PC/104 bus stack on the starter kit baseboard.
5. Make all necessary connections from the T-MOPSlcdSA to the starter kit board. (Cables come with the starter kit). The starter kit board offers various interfaces on standard connectors.
6. Plug a keyboard to the starter kit's keyboard connector.
7. Plug a hard-drive data cable to the T-MOPSlcdSA hard-disk interface. Attach the hard disk to the connector at the opposite end of the cable.
8. If necessary, connect the power supply to the hard disk's power connector.
9. Make sure all your connections have been made correctly.
10. Turn on the power.
11. Enter the BIOS by pressing the **<DEL>** key during boot-up. Make all changes in the BIOS setup. See the BIOS chapter of this manual for details.

4 Specifications

4.1 Functional Specifications

Processor

- STMicroelectronics STPC® Atlas with 120 MHz internal clock and 8KB unified instruction and data cache (fanless)

Chipset

- Integrated PCI North / South Bridge controller

Power Supply

- 5V supply

Memory

- Onboard soldered 32MB or 64MB SDRAM (60Mhz clock speed)

Ethernet: Intel® 82551IT Network Controller

- 32-bit Fast Ethernet
- Integrated IEEE 802.3 10BASE-T and 100BASE-TX compatible PHY
- Backward compatible software to 82559ER controller
- works according to the common criteria of the embedded technology market segment

Two Serial Ports, (COM1 and COM2)

- Standard RS232C serial ports with 16-bit FIFO
- 15540 compatible

Parallel Port (LPT)

- All IEEE Standard 1284 protocols supported: Compatibility, Nibble, Byte, EPP and ECP modes

Integrated USB Controller

- Two USB OHCI 1.0 compliant ports
- USB 1.1 compatible

EIDE Hard-disk Interface

- Support for PIO mode 3 & 4
- Supports up to two devices
- Individual drive timing for all two devices

- Backward compatibility with IDE (ATA-1)
- Supports Kontron chipDISK

Watchdog Timer

256KB Flash BIOS (AMI)

Real-time Clock

- External battery support

Keyboard Controller

Internal Graphics Controller

- VGA and SVGA CRT Controller
- 135MHz RAMDAC
- Enhanced 2D Graphics engine
- The frame buffer can occupy a space up to 4 Mbytes anywhere in the physical main memory

PC/104 Extension Bus

4.2 Mechanical Specifications

4.2.1 PC/104 Bus Connector (ISA part)

- One 2 X 32 pin stack-through and one 2 X 20 pin stack-through connector

4.2.2 Module Dimensions

- 95 x 90 mm (3.7" x 3.5")

4.2.3 Height

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

4.2.4 Weight

- 85 g (full feature version)

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 DOS prompt)

➤ T-MOPSlcdSA with 32MB SDRAM:

Power Mode	Power Consumption
Full on	850 mA
1.5625 %	832 mA
3.125 %	825 mA
6.25 %	819 mA
12.5 %	809 mA
25 %	789 mA
50 %	748 mA
Stop CPU Clock	660 mA

Notes: The T-MOPSlcdSA does not have real standby and suspend modes. It can be configured for different clock throttling modes from 1.5625% up to 50%. It can also be set to stop clock mode. Every of the available modes can be assigned to the standby and suspend timers.

4.3.4 Supply Current (Maximum)

➤ 1.45A (full featured maximum performance version) (calculated theoretical values from all components maximum supply currents)

4.3.5 External RTC Battery

➤ External RTC battery voltage: 2.8 V to 4.0 V (3.0 V recommended)

➤ External RTC battery quiescent current: 0.5 µA (typical)

4.4 MTBF

The following Mean Time Between Failure (MTBF) values were calculated using a combination of manufacturer's test data and a Bellcore calculation for the remaining parts. The Bellcore calculation used is "Method 1 Case 1." In that particular method, 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. The manufacturer's data, when used, is specified at 50° C, which means that 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 such as extreme altitude, vibration, or salt-water exposure can lower MTBF values.

- System MTBF (hours): 371990

Notes: Fans shipped with Kontron Embedded Modules GmbH products have a typical operating life of 50,000 hours. The system MTBF above assumes no fan, but a passive heat-sink arrangement.
Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and needs to be considered separately. Battery life depends on 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: -40 to +85°C (*) (with appropriate airflow.)
- Non-operating: -40 to +85C (non-condensing)

Notes: (*) 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% (non-condensing)
- Non-operating: 5% to 95% (non-condensing)

5 CPU, Chipset and Super-I/O

5.1 CPU and Chipset

The T-MOPSlcdSA comes with a STMicroelectronics STPC® ATLAS, which operates with a 120MHz CPU. The processor and chipset provide a general purpose PC-compatible subsystem on a single chip. It integrates a standard 5th generation x86 core along with a powerful UMA graphics/video chipset, support logic including PCI, ISA, Local Bus, USB, EIDE controllers and combines them with standard I/O interfaces to provide a single PC compatible subsystem on a single device.

The chipset integrated in the STPC® ATLAS microcontroller features:

Integrated PCI North / South Bridge controller

SDRAM controller (64 bit, 60MHz)

PCI controller (PCI 2.1 compatible)

- Integrated PCI arbitration interface
- PCI-to-ISA translation cycles
- Translation of ISA master initiated cycles to PCI

ISA / Master / Slave / DMA

- ISA master / slave supports flash ROM
- ISA hidden refresh
- 16bit I/O decoding

EIDE controller (ATA-1 compatible)

DMA controller (2x8237/AT compatible)

Interrupt controller (2x8259/AT compatible)

Timer/counters (8254 compatible)

Power Management Unit

5.2 CPU and Chipset Configuration

See the Chipset Menu section of the Appendix B: BIOS Operation chapter for information on possible settings.

5.3 Super I/O Controller

The T-MOPSlcdSA uses the integrated I/O Controller of the STPC® ATLAS CPU that provides peripheral functions such as:

PC/AT+ compatible Keyboard Interface

PS/2 compatible Mouse Interface

Two Serial Communication Ports (UARTs)

- 15540 compatible with 16-byte FIFOs
- 16-bit programmable baud rate generator

Parallel Port

- All IEEE Standard 1284 protocols supported: Compatibility, Nibble, Byte, EPP and ECP modes
- 16 bytes FIFO for ECP

Watchdog Timer

5.4 Super I/O Controller Configuration

See the STPC Integrated IO Device Configuration Submenu and the Watchdog Submenu section of the Appendix B: BIOS Operation chapter for information on possible settings of the features included in the I/O controller.

Additional information about the watchdog feature can be found in the section Watchdog Timer.

6 System Memory

The T-MOPSlcdSA is available with different memory configurations. The module can be equipped with onboard soldered 32 or 64 of SDRAM. Customers cannot upgrade the memory. However, the standard T-MOPSlcdSA available from stock will come with 32MB SDRAM.

The total amount of memory available on the SDRAM module is used for main memory and graphics memory on the T-MOPSlcdSA. The Unified Memory Architecture (UMA) manages how the system shares memory between the graphics controller and the processor. The full system memory size is not available for software applications. Up to 4MB of system memory is used for graphics memory.

6.1 Configuration

There are lots of settings available for timing and memory usage in the BIOS setup utility. See the Chipset Menu section of the Appendix B: BIOS Operation chapter for details on the memory configuration settings.

7 ISA and PC/104 Bus Expansion

The design of the T-MOPSlcdSA follows the standard PC/104 form factor and offers ISA bus signals for standard PC/104 adapter cards.

7.1 PC/104 Bus (ISA part)

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 systems)

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

XT bus connector, Rows A and B.

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

The AT bus extension connector, Rows C and D.

The corresponding 40-pin stack through 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 pin-out between PC/104 bus and AT ISA bus is identical between C1 - C18 and D1 - D18.

The T-MOPSlcdSA features both – XT bus and AT bus extension – on two, dual-row socket connectors with 2.54mm x 2.54mm grid (0.1" x 0.1").

7.1.1 PC/104 Connectors

The PC/104 XT bus is available through the J9A connector. The PC/104 AT bus is available through the J9B connector. To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

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

7.1.2 PC/104 Configuration

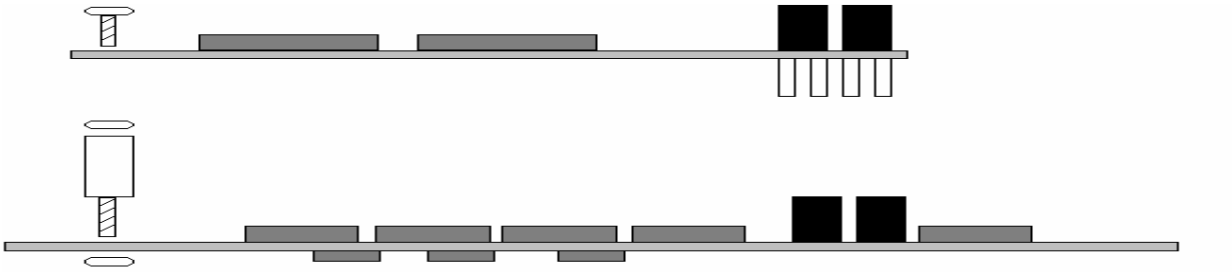
When using add-on boards on the PC/104 bus, make sure that there are no resource conflicts in the system. Carefully choose hardware interrupts, DMA channels, memory and I/O address ranges to avoid resource conflicts, which are often the reason why a board or a feature does not function correctly. See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

You can configure different features for the PC/104 bus in the BIOS setup utility. Please refer to the ISA Bus Configuration Submenu, the PCI PnP Menu and the Cache & Shadow Configuration Submenu section in the Appendix B: BIOS Operation chapter.

7.2 PC/104 Stack

PC/104 adapter cards are mounted in a stack-through manner. Adapter cards are designed with plugs on their undersides that mate with the PC/104 socket connectors of T-MOPSlcdSA. PC/104 adapters can support the socket connector version on their topside and allow additional stacking of adapters.

Whenever possible, use the T-MOPSlcdSA as the top module of the PC/104 stack because the CPU board usually has higher heat-dissipation requirements.



8 Graphics Interface

8.1 Graphics Controller

The T-MOPSlcdSA comes with a in the STPC ATLAS integrated onchip SVGA controller. The CRT monitor display is generated by the 2D graphics display engine.

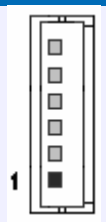
The frame buffer can occupy a space up to 4 Mbytes anywhere in the physical main memory. The maximum graphics resolution supported is 1280 x 1024 in 16 Million colors at 75 Hz refresh rate and is VGA and SVGA compatible.

8.2 CRT Connector

The CRT monitor is available through the X2 connector (6 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

To have the signals available on a standard DSUB-15 CRT monitor connector, an adapter cable is required. For adapter cable information see the section Connector Functions and Interface Cables.

The following table shows the pin-out as well as necessary connections for a DSUB adapter:

Header	Pin	Signal Name	Function	DSUB-25
	1	RED	Analog video red	1
	2	GRN	Analog video green	2
	3	BLU	Analog video blue	3
	4	GND	Signal ground	7
	5	VSYNC	Vertical sync	14
	6	HSYNC	Horizontal sync	13

8.3 Configuration

You can download available drivers for the integrated ATLAS graphic from the Kontron Web site. For further information read the read-me or help files or contact technical support.

8.4 Graphics Technical Support

If problems occur, you can solve some of them by using the latest drivers for the Atlas graphics controller. Kontron provides you with the latest tested drivers, which can differ from newer ones. For further technical support, contact either Kontron, or obtain support information and downloadable software updates from STMicroelectronics.

8.5 Available Video Modes

The following list shows the video modes supported by the video BIOS.

Mode	Type	Page	BPP	X	Y	Offset	C-Height
0000h	MDTYPE-CTEXT	8	4	40	25	80	16
0001h	MDTYPE-CTEXT	8	4	40	25	80	16
0002h	MDTYPE-CTEXT	8	4	80	25	160	16
0003h	MDTYPE-CTEXT	8	4	80	25	160	16
0004h	MDTYPE-CGA	1	2	320	200	80	8
0005h	MDTYPE-CGA	1	2	320	200	80	8
0006h	MDTYPE-CGA	1	1	640	200	80	8
0007h	MDTYPE-MTEXT	8	0	80	25	160	16
000Dh	MDTYPE-4BPP	8	4	320	200	40	8
000Eh	MDTYPE-4BPP	4	4	640	200	80	8
000Fh	MDTYPE-MGRAF	2	1	640	350	80	14
0010h	MDTYPE-4BPP	2	4	640	350	80	14
0011h	MDTYPE-1BPP	1	1	640	480	80	16
0012h	MDTYPE-4BPP	1	4	640	480	80	16
0013h	MDTYPE-8BPP	1	8	320	200	320	8
010Ah	MDTYPE-CTEXT	2	4	132	43	264	8
0109h	MDTYPE-CTEXT	2	4	132	25	264	16
0102h	MDTYPE-4BPP	1	4	800	600	100	16
0106h	MDTYPE-4BPP	1	4	1280	1024	160	16
0100h	MDTYPE-8BPP	1	8	640	400	640	16
0103h	MDTYPE-8BPP	1	8	800	600	800	16
0104h	MDTYPE-4BPP	1	4	1024	768	128	16
0105h	MDTYPE-8BPP	1	8	1024	768	1024	16
0101h	MDTYPE-8BPP	1	8	640	480	640	16
010Ch	MDTYPE-CTEXT	2	4	132	60	264	8
010Bh	MDTYPE-CTEXT	2	4	132	50	264	8
0108h	MDTYPE-CTEXT	6	4	80	60	160	8
0112h	MDTYPE-24BPP	1	24	640	480	2048	16
0107h	MDTYPE-8BPP	1	8	1280	1024	1280	16
0111h	MDTYPE-16BPP	1	16	640	480	1280	16
0114h	MDTYPE-16BPP	1	16	800	600	1600	16
0115h	MDTYPE-24BPP	1	24	800	600	3272	16
0117h	MDTYPE-16BPP	1	16	1024	768	2048	16
010Eh	MDTYPE-16BPP	1	16	320	200	640	8
010Fh	MDTYPE-24BPP	1	24	320	200	1024	8

Notes: The BIOS support for all nonstandard IBM compatible VGA Modes consists only of the ability to set the mode. Other BIOS calls such as write character, scrolling, and write pixel are not supported. The BIOS is used to set modes, not to install or run software applications and drivers.

9 Serial-Communication Interfaces

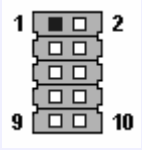
Two fully functional serial ports (COMA and COMB) provide asynchronous serial communications. COMA and COMB support RS-232 operation modes and are compatible with the serial-port implementation used on the IBM Serial Adapter. They are 15540 high-speed, UART-compatible and support 16-byte FIFO buffers for transfer rates from 50 baud to 115.2K baud.

9.1 Connectors

COMA is available through the J3 connector (10 pins). COMB is available through the J5 connector (10 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

An adaptor cable is required to have the signals available on standard serial-interface connectors DSUB9 or DSUB25. For adapter cable information see the section Connector Functions and Interface Cables.

The following table shows the pin-outs for COMA and COMB, as well as connections for 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.

9.2 Configuration

You can set the two serial input/output interfaces to a variety of I/O addresses and IRQ configurations. Settings are changeable from the T-MOPSlcdSA BIOS setup utility. Refer to the STPC Integrated IO Device Configuration Submenu section in the Appendix B: BIOS Operation chapter for configuration information.

Notes: Most operating systems detect the serial port with the I/O address 3F8h as COM1 and 2F8h as COM2.

10 Parallel-Communication Interface

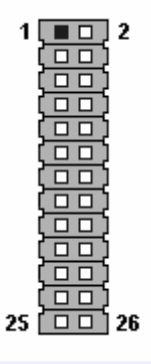
The T-MOPSlcdSA incorporates an IBM XT/AT compatible parallel port. It can be set to bi-directional and supports EPP and ECP operating modes. The bi-directional functions are compatible with those of an IBM PS/2 style parallel port. This functionality is always available and does not conflict with printer use.

10.1 Connector

The parallel port is available through the X1 connector (26 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

To have the signals available on a standard, parallel-interface connector DSUB-25, an adapter cable is required. For adapter cable information see the section Connector Functions and Interface Cables.

Pin-out table and necessary connections for a DSUB-25 adapter:



Header	Pin	Signal Name	Function	In / Out	DSUB-25
	1	/STB	Strobe	Out	1
	3	PD0	Data 0	I/O	2
	5	PD1	Data 1	I/O	3
	7	PD2	Data 2	I/O	4
	9	PD3	Data 3	I/O	5
	11	PD4	Data 4	I/O	6
	13	PD5	Data 5	I/O	7
	15	PD6	Data 6	I/O	8
	17	PD7	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.

10.2 Configuration

The parallel-port mode, I/O addresses, and IRQs are changeable in the T-MOPSlcdSA BIOS Setup Utility. You can program the base I/O-address 378h, 3BCh and 278h or disable the interface. You can choose IRQ5 or IRQ7 as the parallel-port interrupt. In ECP mode, you can choose DMA 1 to DMA 3.

Refer to the STPC Integrated IO Device Configuration Submenu section in the Appendix B: BIOS Operation chapter for configuration information.

11 Keyboard and Feature Interface

The keyboard and feature connector of the T-MOPSlcdSA offers four functions. The interface connects the following:

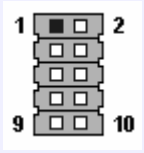
- Keyboard
- Speaker
- Battery
- Reset Button

11.1 Connector

The keyboard and feature connector is available through Connector J4 (10 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

An adapter cable is required to connect a standard keyboard to this interface. For adapter cable information see the section Connector Functions and Interface Cables. The adapter cables do not know the other functions on this interface.

Pin-out table:

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	NC	Not connected		
	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 (3,0V)		
	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.

11.2 Configuration

There are no BIOS configuration entries available for this interface.

11.3 Known Issues

A problem occurs when the SHIFT, NUMLOCK, ROLL or CAPSLOCK key is pressed, which will update the keyboard LED's via command EDh. The STPC does not acknowledge this and will send a beep to the speaker output.

The keyboard controller also sends several beeps when booting a DOS operating system without a PS/2 keyboard connected to the system.

11.4 Signal Descriptions

11.4.1 /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.

11.4.2 Speaker

- Open collector output on modules that drive a piezo electronic speaker.
- Input on modules that connects a 5V piezo electronic speaker to this pin.
- An 8-Ohm loudspeaker also can be connected between SPEAKER and GND, but because of current limitation, the volume will be low.
- Connect only one speaker to this pin. The CPU usually drives this pin. However, other modules also can use this signal to drive the system speaker.

11.4.3 KBDAT (Keyboard Data)

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

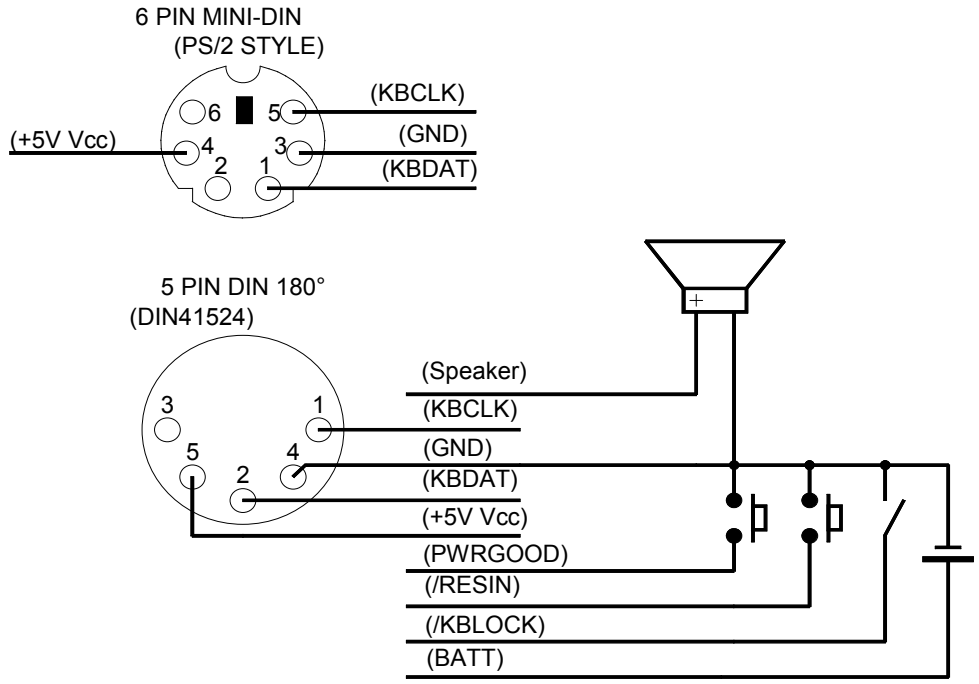
11.4.4 KBCLK (Keyboard Clock)

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

11.4.5 BATT (System Battery Connection)

- This pin connects a system battery to all modules.
- The battery voltage has to be higher than 2.2 V and lower than 3.5 V. A 3 V battery is recommended.
- A battery is not needed to hold CMOS setup data. Your configurations for hard disks, floppy drives, and other peripherals are saved in an onboard DRAM. However, you need a battery to save the CMOS date and time when power supply is turned off.

11.4.6 Example Connection AT-keyboard and Other Functions



12 PS/2 Mouse Interface

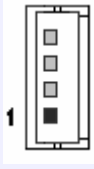
The super I/O controller of the T-MOPSlcdSA supports a PS/2 mouse.

12.1 Connector

The PS/2 mouse interface is available on connector J6 (4 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

An adapter cable is required to connect a standard PS/2 mouse. For adapter cable information see the section Connector Functions and Interface Cables.

Pin-out table:

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.

12.2 Configuration

You can set the PS/2 mouse support to enabled, disabled or auto from the BIOS Setup. Be aware that no matter you enable or disable the mouse IRQ12 is never free for other devices in the system. Please refer to the Boot Settings Configuration Submenu section in the Appendix B: BIOS Operation chapter for information on configuration.

13 USB Interface

The T-MOPSlcdSA is equipped with a USB controller integrated in the STPC ATLAS chipset. It comes with two USB ports, which follow the OHCI 1.0 specification and are USB-1.1 compliant.

You can expand the amount of USB connections by adding external hubs. You can connect up to 127 USB peripherals to each hub. When using USB hubs on these interfaces they have to be self-powered.

13.1 Connector

The USB ports are available through the J1 and the J2 connectors (each 4 pins). To find the location of these connectors on the T-MOPSlcdSA board, please see the chapter Connector Locations.

To have the signals available on the standard USB interface connectors, an adapter cable is required. For adapter cable information see the section Connector Functions and Interface Cables.

Pin-out table:

Header	Pin	Signal Name	Function
	1	VCC (*)	+5V
	2	USB0	USB-
	3	USB1	USB+
	4	GND	Ground

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.

Warning: ***The power contacts for USB devices on Pin 1 and Pin 4 are not protected. They are suitable to supply connected USB devices with a maximum of 500mA power dissipation. Do not supply external USB devices with higher power dissipation through these pins. Always use a fuse for power on external USB connectors, as a defective USB device may damage the T-MOPSlcdSA. Kontron recommends using a resetable fuse, which follows the USB 1.1 specification, for power on external USB connectors.***

13.2 Configuration

Legacy USB support can be enabled or disabled in the T-MOPSlcdSA BIOS Setup Utility. For detected mass storage devices there are several configuration options.

Refer to the USB Configuration Submenu and the Boot Menu section in the Appendix B: BIOS Operation chapter for information on configuration.

13.3 Limitations

In order to guaranty correct detection of plugged devices and to avoid electrical problems which may lead to unreliable data, you have to ensure that no cables exceeding 1 meter cable length are used to connect the USB devices.

Some USB floppy disk drives and sticks make trouble by formatting. The following floppy devices are known to fail:

- Mitsumi D353GUE
- Sony MPF88E–U1
- Y-E USB-FDU

If you have problems to boot from an USB stick, set its “emulation type” in the BIOS setup to Hard Disk. See the chapter USB Mass Storage Device Configuration Submenu for details.

An USB-Mouse will not work under DOS even if USB legacy support is enabled.

14 IDE Interface

The T-MOPSlcdSA features one EIDE interface (Ultra DMA 33 mode) that can drive two hard disks. When two devices share a single adapter, they are connected in a master/slave, daisy-chain configuration. If only one drive is in the system, you must set it as the master.

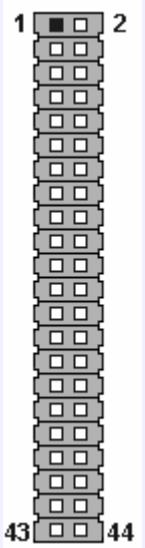
14.1 Connector

The IDE interface is available through Connector J8 (44 pins). This interface is designed in 2mm grid for optimal connectivity to a 2.5" hard disk. To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

There are several accessories available for IDE connectivity. For adapter cable information see the section Connector Functions and Interface Cables.

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.

Pin-out table:



Header	Pin	Signal Name	Function	Pin	Signal Name	Function
	1	/RESET	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	DRQ	IDE DMA Request	22	GND	Ground
	23	/IOW	I/O write	24	GND	Ground
	25	/IOR	I/O read	26	GND	Ground
	27	IOCHRDY	I/O channel ready	28	CSEL	Cable Select
	29	/AKJ	Acknowledge	30	GND	Ground
	31	PIRQ	Interrupt	32	NC	Not connected
	33	SA1	Addr 1	34	NC	Not connected
	35	SA0	Addr 0	36	SA2	Addr 2
	37	/CS0	Chip select 0	38	/CS1	Chip select 1
	39	NC	Not connected	40	GND	Ground
	41	VCC (*)	+5V	42	VCC (*)	+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.

14.2 Configuration

The IDE interface offers several configuration settings. Refer to the IDE Configuration Submenu and the Boot Menu section in the Appendix B: BIOS Operation chapter for additional information on configuration.

15 Ethernet Interface

The Ethernet interface of the T-MOPSlcdSA is realized with the 82551IT from Intel®, a fully integrated 10BASE-T/100BASE-TX LAN solution. The 82551IT consists of both the Media Access Controller (MAC) and the physical layer (PHY) interface combined into a single component solution. The 32-bit PCI controller provides enhanced scatter-gather bus mastering capabilities and enables the 82551IT to perform high-speed data transfers over the PCI bus. Two large transmit and receive FIFOs of 3 Kbytes each help prevent data underruns and overruns while waiting for bus accesses.

The 82551IT can operate in either full duplex or half duplex mode. In full duplex mode, the 82551IT adheres with the IEEE 802.3x Flow Control specification. Half-duplex performance is enhanced by a proprietary, collision-reduction mechanism. The 82551IT also includes an interface to a serial (4-pin) EEPROM. The EEPROM provides power-on initialization for hardware and software configuration parameters.

The 82551IT provides the following features:

- Integrated IEEE 802.3 10BASE-T and 100BASE-TX compatible PHY
- Glueless 32-bit PCI master interface
- Improved dynamic transmit chaining with multiple priorities transmit queues
- Full Duplex support at both 10 and 100Mbps
- IEEE 802.3u Auto-Negotiation support
- 3 KB transmit and 3 KB receive FIFOs
- Fast back-to-back transmission support with minimum interframe spacing
- IEEE 802.3x 100BASE-TX Flow Control support
- Adaptive Technology
- TCP/UDP checksum offload capabilities
- Low power 3.3 V device
- Clock run protocol support

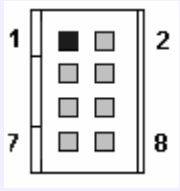
Notes: The Ethernet interface works according to the common criteria of the embedded technology market segment.

15.1 Connector

The Ethernet interface is available through Connector J7 (8 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

To have the signals of the Ethernet connection available on a standard RJ45 connector, you need an adapter cable. For adapter cable information see the section Connector Functions and Interface Cables.

Pin-out table:

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	SHLDGND	Shield Ground	
	5	SHLDGND	Shield Ground	
	6	RXD- (**)	10BASE-T Receive	Differential Input
	7	SPEEDLED (***)	Speed LED	Output
	8	LILED (***)	Link LED	Output

Notes: *(*) TXD+, TXD- differential-output pair drives 10- and 100-megabits-per second Manchester- encoded data to 100/10BASE-T transmit lines.*
(**) RXD+, RXD- differential-input pair receives 10- and 100-megabits per second Mancheste-encoded data from 100/10BASE-T receive lines.
(***) SPEEDLED and LILED have an onboard 470Ohm serial resistor and can directly be connected to a LED's cathode. Connect anode to VCC.

15.2 Configuration

You can download available drivers and setup utilities from the Kontron Web site. Please refer to the corresponding readme and setup/install files. For further information contact your local technical support.

You can enable/disable the Ethernet controller from the Advanced Menu in the BIOS setup utility or enable the Onboard LAN PXE ROM to boot the system via Ethernet connection from a PXE server. See the Boot Menu section in the Appendix B: BIOS Operation chapter for more information.

15.3 Ethernet Technical Support

If problems occur, you can solve some of them by using the latest drivers for the INTEL® 82551IT controller. 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 Intel®.

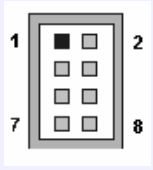
16 Power Connection

In some applications, the T-MOPSlcdSA 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 T-MOPSlcdSA is a +5V-only board. Peripherals can obtain additional voltage from the power connector that is located next to the PC/104 bus. The additional voltages (+12V, -5V and -12V) are not generated onboard the T-MOPSlcdSA.

16.1 Connector

The power connector is available as J9C (8 pins). To find the location of this connector on the T-MOPSlcdSA board, please see the chapter Connector Locations.

The following table shows the pin-out:

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

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 T-MOPSlcdSA 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 T-MOPSlcdSA 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 on ISA Part	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.

Warning: ***The T-MOPSlcdSA does not replace a backplane. Use all power pins on the power connector and on the PC/104 connectors to supply power to the T-MOPSlcdSA, 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 to supply power to 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 Keyboard connector. For more information refer to the Keyboard and Feature Interface section.

Notes: *The two battery inputs are protected against each other by diodes.*

16.4 Configuration

The T-MOPSlcdSA is equipped with an Advanced Power Management system (APM). You can configure lots of options for power-saving states such as doze/sleep, standby, and suspend state. You can specify wake-up events that bring the system back to full-on state. Please refer to the Power Menu section in the Appendix B: BIOS Operation chapter.

17 Watchdog Timer

The watchdog timer is integrated in the ATLAS CPU of the T-MOPSlcdSA and can generate a NMI or a reset to the system. The watchdog timer circuit has to be triggered within a specified time by application software. If the watchdog timer is not triggered because proper software execution fails or a hardware malfunction occurs, it generates a NMI or resets the system.

17.1 Configuration

You can set the watchdog timer to enabled or disabled. You can specify the delay time and timeout (trigger period) from 15 seconds up to 30:15 minutes. The delay time is the time after first initialization before the trigger period starts. The timeout is the time the watchdog has to be triggered within. If the watchdog timer is not triggered within the timeout period, the board will be reset or a NMI is generated. You can make the initialization settings in the BIOS setup utility. Refer to the Watchdog Submenu section in the Appendix B: BIOS Operation chapter for information on configuration.

17.2 Programming

17.2.1 Initialization

You can initialize the watchdog timer from the BIOS setup and out of the application software with help of the JUMPtec Intelligent Device Architecture (JIDA) programmer's interface. For BIOS setup options refer to the Watchdog Submenu section of the Appendix B: BIOS Operation chapter.

17.2.2 Trigger

The watchdog timer needs to be triggered out of the application software within the specified timeout period. You can only do this in the application software with help of the JIDA programmer's interface.

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.

18 Appendix A: System Resource Allocations

18.1 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 #	Used for	Available	Comment
0	Timer0	No	
1	Keyboard	No	
2	Cascade	No	
3	COM B	No	
4	COM A	No	
5		Yes	
6		Yes	
7	LPT	No	
8	RTC	No	
9		Yes	
10		Yes	
11		Yes	
12	PS/2 Mouse	No	
13	Numeric processor	No	
14	EIDE Channel 1	No	Note (1)
15		Yes	

Notes: (1) If the "used for" device is disabled in setup, the corresponding interrupt is available for other devices.

18.2 Direct Memory Access (DMA) Channels

DMA #	Used for	Available	Comment
0		Yes	
1	LPT	No	Note (1), (2)
2		No	
3		Yes	Note (3)
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 of LPT; in other modes it is available.

(3) Possible alternative setting of LPT in ECP mode for used DMA channel.

18.3 I/O Address Map

I/O port addresses of the processor module T-MOPSlcdSA are functionally identical to a standard PC/AT. All addresses not mentioned in this table should be available. Kontron recommends that you do not use I/O addresses below 0110hex with additional hardware for compatibility reasons, even if available.

I/O Address (h)	Use	Available	Comment
0000-000F	DMA Controller 1	No	
0020-002F	Interrupt Controller 1	No	
0022-0024	System Control	No	
0030	System Control	No	
0040-0044	Timer	No	
0060-006F	Keyboard Controller, Flags	No	
0061	Port B Register	No	
0070	NMI Enable Register	No	
0070-0071	Real-time Clock	No	
0072	CMOS Register	No	
0080-008F	DMA Page Register	No	
0092	Port A Register (Fast A20 Gate)	No	
0094	Graphic Motherboard Enable	No	
00A0-00A1	Interrupt Controller 2	No	
00C0-00DF	DMA Controller 2	No	
00E0-00EF	System Control	No	
00F0-00FF	Math Coprocessor	No	
0100-010F	System Control	No	Kontron Control Port
01F0-01F7	Fixed Disk	No	This I/O space is mirrored every 400hex
0278-027Fh		Yes	Free in standard configuration but possible address of LPT.
02E8-02EF		Yes	Free in standard configuration but possible address of COM.
02F8-02FF	Serial Port 2	No	Free when serial port is disabled in setup or configured for different port address.
0330-033F	STPC	No	
0378-037A	Super I/O Configuration	No	This I/O space is mirrored every 800hex
0378-037F	Parallel Port 1	No	Free when parallel port is disabled in setup.
03B0-03BB	Video Subsystem	No	
03BC-03C4h		Yes	Free in standard configuration but possible address of LPT
03C0-03Df	Video Subsystem	No	
03E0-03E1	STPC	No	
03E8-03EFh		Yes	Free in standard configuration but possible address of COM.
03F6	IDE Controller	No	This I/O space is mirrored every 400hex
03F8-03FF	Serial Port 1	No	Free when serial port is disabled in setup or configured for different port address.
0400-041F	IRQ Routing Control	No	
0420-042F	DRQ Routing Control	No	
04D0-04D1	STPC	No	
0CF8-0CFF	PCI Configuration	No	
EF00-EF3F	Ethernet Controller	No	Flexible
FFA0-FFAF	IDE Controller	No	

18.4 Memory Map

The T-MOPSlcdSA processor module can support up to 32MB 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 textbooks for information about HIMEM.SYS and EMM386.EXE.

Other operating systems (Linux or Windows versions) allow you to address the full memory area directly.

Upper Memory	Use	Available	Comment
A0000h – BFFFFh	VGA Memory	No	Mainly used by graphic adapter cards. If a PCI graphics card is in the system, this memory area is mapped to the PCI bus.
C0000h – C8FFFh	VGA BIOS	No	
CC000h – EFFFFh		Yes	Free for ISA bus or shadow RAM in standard configurations. If onboard LAN RPL ROM is enabled, JRC is used, or LCD-matrix support is enabled, a 16K block is shadowed for BIOS extensions, starting with first free area at C8000h, CC000h, D0000h, D4000h, D8000h, DC000h, E0000h, E4000h, E8000h or EC000h. (BIOS extensions do not use the whole shadow block.)
F0000h – FFFFFh	System BIOS	No	

18.4.1 Using Expanded Memory Managers

T-MOPSlcdSA extension BIOSes may be mapped to an upper memory area. (See the previous table.) 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 EMS frame of the Expanded Memory Manager (EMM). 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 usually done by using special exclusion parameters.

If the EMM 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: (question marks for location of extension BIOS).

MS-DOS Example

```
DEVICE=EMM386.EXE X=????-???? X=F000-FFFF
```

Notes: 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 T-MOPSlcdSA.

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

19 Appendix B: BIOS Operation

The T-MOPSlcdSA comes with the modular AMIBIOS8 of American Megatrends Inc. The BIOS is located in an onboard Flash EEPROM in compressed form. American Megatrends refers to the BIOS setup utility as ezPORT. The device has 8-bit access. The shadow RAM feature provides faster access (16 bits). The onboard Flash EEPROM also holds Kontron BIOS extensions, which are loaded during boot-up if the corresponding feature is enabled.

You can update the BIOS using a Flash utility.

19.1 Determining BIOS Version

To determine the BIOS version of the T-MOPSlcdSA , 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:

```
AMIBIOS (C) 2003 American Megatrends, Inc.
BIOS Date: 22/08/05 17:59:22 Ver: 08.00.09
Kontron(R) BIOS Version <PEXTR113>
Copyright 2002-2005 Kontron Embedded Modules GmbH
```

Whenever you contact technical support about BIOS issues, providing a BIOS version <PEXTR???> 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: ETA090080
CPU : SGS Thompson 486DX2
Speed : 120MHz

Press DEL to run Setup (F4 on Remote Keyboard)
Press F11 for BBS POPUP (F3 on remote Keyboard)
Checking NVRAM..
Initializing USB Controllers .. Done.
28MB OK
```

The board's serial number has value to technical support. T-MOPSlcdSA serial numbers always start with ET and are followed by up to seven characters and digits. The first three positions represent the lot number and the last three or four digits are the number of the board in that lot.

In the example above, the T-MOPSlcdSA with the serial number ETA090080 is board number 80 from the lot A09.

19.2 Setup Guide (ezPORT)

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

The ezPORT setup menus documented in this section represent those found in most models of the T-MOPSlcdSA. The BIOS setup for specific models can differ slightly.

Notes: Selecting incorrect values may cause system boot failure. Load setup failsafe defaults <F8> or optimal defaults <F9> to recover the system.

19.2.1 Start ezPORT BIOS Setup Utility

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

```
Press DEL to run Setup
```

The Main Menu then appears. It is the first screen that you can navigate.

19.2.2 General Information

The ezPORT Setup Screen is composed of four sections:

Section	Location	Function
Menu Bar	Top	Lists and selects all top-level menus.
Information Bar	Bottom	Shows version and copyright information.
Menu Window	Left Center	Selection fields for current menu.
Help Window	Right Center	Help for selected menu.

Menu Bar

The menu bar at the top of the window lists different top-level menus. Use the ← and → arrow keys to make a selection.

Information Bar

Here you can see general information about the version of the BIOS as well as copyright information.

Menu Window

The menu window frame on the left center side of the screen displays all the options of the currently selected top-level menu that can be configured. These configurable options are shown in blue. “Grayed-out” options cannot be configured. Use the ↑ or ↓ Arrow key to select an item.

Help Window

The right center frame is the help window and displays the key legend as well as item specific text messages. When an option is selected in the menu window, it is highlighted in white. Often a text message accompanies it.

Hot Keys

The ezPORT setup utility uses a key-based navigation system called hot keys. Most ezPORT BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, **<F10>**, **<Enter>**, and **<ESC>**.

Hot Keys	Function
<F1>	General Help window.
<Esc>	Discard Changes and Exit window.
<F10>	Save Configuration and Exit window.
← or → Arrow key	Select a top-level menu.
↑ or ↓ Arrow key	Select items in current menu.
<Tab>	Select an items setup field.
<Home> or <End>	Move cursor to top or bottom of current screen.
<PgUp> or <PgDn>	Move cursor to next or previous page.
<+> or <->	Select next or previous value for the current field.
<F7>	Discard changes.
<F8>	Load the failsafe default configuration.
<F9>	Load the optimal default configuration.
<Enter>	Execute command or select submenu.
<F2>/<F3>	Change colors.

Selecting an Item

Use the ↑ or ↓ key to move the cursor to the item you want. Then use the **<+>** and **<->** keys to select a value for that field. Changes you made for the single items keep the new configuration for all the BIOS session, but they are only saved to the CMOS and EEPROM, when the <F10> key is pressed, and the setup is finished.

Displaying Submenus

A pointer (►) marks all submenus that are available in your current top-level menu. Use the ↑ or ↓ key to move the cursor to the submenu you want. Then press **<Enter>**.

General Help Window

Pressing **<F1>** on any menu brings up the General Help window that describes the hot keys and their functions. Press **<Enter>** to exit the General Help window.

Save Configuration and Exit Window

Pressing the **<F10>** key brings up a window with the question “Save configuration and exit now?”. Choose **[OK]** when you want to do this or **[Cancel]** when you want to return to the previous screen. You can select one of the two options by using the arrow keys.

Discard Changes and Exit Window

Pressing the **<ESC>** key brings up a window with the question "Discard changes and exit now?" Choose **[OK]** when you want to do this or **[Cancel]** when you want to return to the previous screen. You can select one of the two options by using the arrow keys. If your choice was **[OK]**, your setup changes will not be saved.

19.3 Main Menu

Feature	Option	Description
System Overview		
AMIBIOS		
Version		Displays the AMIBIOS version code in format XX.XX.XX.
Build Date		Displays the build date of the BIOS in format MM.DD.YY.
ID		Displays Kontron BIOS revision in format PEXTR??? (??? Is the revision number).
Processor		
Type		Displays system processor, normally SGS Thompson 486DX2.
Speed		Displays processor's internal clock rate in format, normally 120MHz.
Count	1	Displays amount of processors recognized by the BIOS. The count is always 1, this is not a multi-processor system.
System Memory		
Size		Displays the amount of system's extended memory, normally 28MB or 60MB. (4MB of memory module are used for UMA graphic frame buffer)
System Time	HH:MM:SS	Set system time. Press <Enter> to move to MM or SS.
System Date	DOW MM/DD/YYYY	Set system date. Press <Enter> to move to DD or YYYY.

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

19.4 Advanced Menu

All entries in this part of the BIOS setup utility are vital to your system. Change settings only if you are sure of what you are doing. Some changes may not be suitable for your complete system and may lead to unwanted system behavior.

Feature	Option	Description
Advanced Settings		
▸ IDE Configuration	Submenu	Opens IDE Configuration submenu, which allows you to configure IDE devices.
▸ Watchdog	Submenu	Opens Watchdog submenu, which allows you to configure the watchdog timer.
▸ Remote Access Configuration	Submenu	Opens Remote Access Configuration submenu, which allows you to configure the AMIBIOS remote system. (This is not the Kontron JRC feature!)
▸ USB Configuration	Submenu	Opens USB Configuration submenu, which allows you to configure the OHCI controller and USB devices.

Onboard Ethernet	**Enabled** Disabled	Enables/Disables the onboard Davicom DM9102A Ethernet controller.

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

19.4.1 IDE Configuration Submenu

Feature	Option	Description
IDE Configuration		
OnBoard PCI IDE Controller	**Primary** Disabled	Disabled: disables the integrated IDE controller Primary: enables the integrated IDE controller
▸ Primary IDE Master	Submenu	Opens Primary IDE Master submenu.
▸ Primary IDE Slave	Submenu	Opens Primary IDE Slave submenu.
Hard Disk Write Protect	**Disabled** Enabled	Write accesses through the BIOS can be enabled/disabled here; accesses overriding the BIOS are not affected.
IDE Detect Time Out (Sec)	0 to 35	Enter the timeout value for the detection of ATA/ATAPI devices here. Smaller values can speed up the boot process but increase the risk that a connected device will not be detected. When Type in the Master/slave submenus is set to Auto, set this item to 35.

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

19.4.2 Master or Slave Submenus

Feature	Option	Description
Primary IDE Master/Slave		
Device		Displays the detected type of IDE drive or “Not detected.”
Vendor		Displays drive’s vendor information.
Size		Displays drive’s capacity.
LBA Mode		Displays LBA Mode information of drive. In LBA mode, the maximum capacity is 137GB.
Block Mode		Displays Block Mode information of the drive. With Block Mode capability up to 64KB, data transfer per interrupt is possible.
PIO Mode		Displays highest PIO Mode supported by the drive. The higher the PIO Mode, the less the cycle time.
Async DMA		Displays highest asynchronous DMA mode supported by drive.
Ultra DMA		Displays highest synchronous DMA mode supported by drive.
S.M.A.R.T.		Displays whether drive supports SMART monitoring.
Type	Not Installed **Auto** CDROM ARMD	Selects the type of device connected to the system. Not installed: prevents BIOS from searching a device. Auto: allows BIOS to detect device. CDROM: specifies that a CDROM is attached. ARMD: specifies an ATAPI removable device is attached.
LBA/Large Mode	Disabled **Auto**	Selects the LBA mode capability of the device. Disabled: prevents BIOS from using LBA. Auto: allows BIOS to detect LBA capability.

Block (Multi Sector Transfer)	Disabled **Auto**	Selects multisector transfer capability of the device. Disabled: prevents BIOS from using multisector transfer. Auto: allows BIOS to detect multisector transfer capability.
PIO Mode	**Auto,** 0, 1, 2, 3, 4	Selects the PIO Mode capability of the drive. Auto: allows BIOS to detect the supported PIO mode. 0, 1, 2, 3, 4: sets the PIO mode.
DMA Mode	Auto SWDMA0 SWDMA1 SWDMA2 MWDMA0 MWDMA1 MWDMA2 UDMA0 UDMA1 UDMA2	Selects the DMA Mode capability of the drive. Auto: allows BIOS to detect DMA capability. SWDMA0,1,2: sets single word DMA mode. MWDMA0,1,2: sets multiword DMA mode. UDMA0,1,2: sets ultra DMA mode.
S.M.A.R.T.	**Auto** Disabled Enabled	Selects drive's SMART monitoring capability. Auto: allows the BIOS to detect SMART capability. Disabled/Enabled: switch off or on SMART feature.
32Bit Data Transfer	**Disabled** Enabled	Selects 32Bit data transfer option. Disabled/Enabled: switch off or on 32-bit data transfer.

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

19.4.3 Watchdog Submenu

Feature	Option	Description
Configure Watchdog Parameters		
Mode	**Disabled** Reset NMI	Disabled: Switches watchdog timer off. Reset: Resets the system when the timeout time is reached. NMI: Generates an NMI when the timeout period is reached.
Timeout (*)	**15s** to 30:15m	Selects the timeout time for the watchdog in a range of 15 seconds up to 30:15 minutes. The timeout time is the time the watchdog has been triggered within.

Notes: In the Option column, bold shows default settings.
(*) This is not visible if Mode is disabled.

19.4.4 Remote Access Configuration

This remote access system is an AMIBIOS feature and has nothing to do with the Kontron JRC Remote Control Extension BIOS. The following information describes the differences:

- The AMIBIOS Remote Access feature always sends output data to the specified serial port when enabled. It is not possible to use the port for other devices during the time this feature is enabled. On the other side of the serial connection, a system with terminal software can be used to display the BIOS output information, enter setup,

and configure BIOS settings. Terminal software settings and the remote-access configuration setting have to match to establish a working connection between the host and slave. See the configuration settings in the table below.

➤ The Kontron JRC Remote Control software only becomes active when a JRC connection is detected during the first steps of the boot process. This allows users to have other devices connected to the same serial port instead of the JRC connection - without output affecting them. On the other side of the serial connection a DOS- or Windows- based system running the JRC host software is required. For configuration settings and functional description read the technical manual of the JRC software.

Feature	Option	Description
Configure Remote Access Type and Parameters		
Remote Access	**Disabled** Enabled	Disabled/Enabled: Switches remote-access feature off or on.
Serial Port Number (*)	**COM1** COM2	Sets the serial port used for remote access to COM1 or COM2. Enable the selected port in the Super I/O Configuration submenu.
Serial Port Mode (*)	**115200 8,n,1** 57600 8,n,1 19200 8,n,1	Sets serial port mode for remote access to 115200, 57600 or 19200 Baud. 8-bit data, no parity bit, and one stop bit is used.
Flow Control (*)	**None** Hardware Software	Select flow control. None: No flow control used. Hardware: Hardware handshake used. Software: Software handshake used.
Redirection after BIOS POST (*)	**Disabled** Boot Loader Always (**)	Select redirection after POST. Disabled: Turns off redirection after POST. Boot Loader: Turns on redirection during POST and boot loader. Always: Redirection is always on.
Terminal Type (*)	**ANSI** VT100 VT-UTF8	Selects target-terminal type. ANSI, VT100, or VT-UTF8.
VT-UTF8 Combo Key Support (***)	**Disabled** Enabled	Enable/Disable: Switches off or on VT-UTF8 combination-key support for ANSI and VT100 terminals.

Notes: In the Option column, bold shows default settings.
(*) This is visible only if Remote Access is enabled.
(**) Some operating systems may not work correctly if this is set to always.
(***) This is visible only when Terminal Type is set to ANSI or VT100.

19.4.5 USB Configuration Submenu

Feature	Option	Description
USB Configuration		
Module Version		Displays version information about the used USB module.
USB Devices Enabled		Displays all attached and configured USB devices.
Legacy USB Support	Disabled **Enabled** Auto	Disabled/enabled: switches onboard USB controller legacy support off or on. Auto: USB controller is of when no USB devices connected.
▸ USB Mass Storage Device Configuration(*)	Submenu	Opens USB Mass Storage Device Configuration submenu.

Notes: In the Option column, bold shows default settings.
(*) This is visible only if a Mass Storage Device is connected.

19.4.6 USB Mass Storage Device Configuration Submenu

Feature	Option	Description
USB Mass Storage Device Configuration		
USB Mass Storage Reset Delay	10, **20**, 30, 40 Sec	Number of seconds POST waits for the USB mass storage device after the start unit command. If an attached device cannot be detected try a longer delay.
Device #		Displays the device names by their available vendor code.
Emulation Type	**Auto** Floppy Forced FDD Hard Disk CDROM	Select emulation of the device. Auto: Devices less than 530MB will be emulated as floppy, remaining as hard drive. Floppy: Device will be emulated as floppy. Forced FDD: HDD formatted device will be emulated as FDD. Hard Disk: Device will be emulated as HDD CDROM: Device is emulated as CDROM
USB Mass Storage Reset Delay	10, **20**, 30, 40 Sec	Number of seconds POST waits for the USB mass storage device after the start unit command.

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

19.5 PCI PnP Menu

All entries in this part of the BIOS setup utility are vital to your system. Change settings only if you are sure of what you are doing. Some changes may not be suitable for your complete system and may lead to unwanted system behavior.

Feature	Option	Description
Advanced PCI/PnP Settings		
Plug & Play OS(*)	**No** Yes	Selects a Plug & Play operating system: No: Lets the BIOS configure all the devices in the system. Yes: Lets the operating system configure plug & play devices.
PCI Latency Timer	32, **64**, 96, 128, 160, 192, 224, 248	Sets value of latency-timer register for the PCI device (in units of PCI clocks).
Palette Snooping	Disabled Enabled	Disabled/Enabled: Switches palette snooping feature off or on. When enabled, the PCI graphic adapter is informed about an ISA or a none PnP-PCI graphic adapter. Always check graphic adapter card manual before setting this feature.
PCI IDE BusMaster	Disabled Enabled	Selects PCI IDE bus mastering feature: Disabled: Prevents PCI IDE bus mastering. Enabled: Allows PCI IDE bus mastering.
IRQ 5(**)	Reserved **Available**	Selects the use of the IRQ resource: Available: this IRQ is available for PCI/PnP devices. Reserved: this IRQ is reserved for use of legacy ISA devices.
IRQ9	Reserved **Available**	See above.
IRQ10	Reserved **Available**	See above.
IRQ11	Reserved **Available**	See above.
IRQ14	Reserved **Available**	See above.
IRQ15	Reserved **Available**	See above.

Notes: In the Option column, bold shows default settings.
(*) Set this parameter to "no" if you are not sure whether the OS you use meets the PnP specification.
(**) Up to BIOS version PEXTR112 the default setting was Reserved.

Feature	Option	Description
DMA Channel 0	Reserved **Available**	Selects the use of the DMA resource: Available: this DMA is available for PCI/PnP devices. Reserved: this DMA is reserved for use of legacy ISA devices.
DMA Channel 1	Reserved **Available**	See above.
DMA Channel 3	Reserved Available	See above.
DMA Channel 5	Reserved **Available**	See above.
DMA Channel 6	Reserved **Available**	See above.
DMA Channel 7	Reserved **Available**	See above.
Reserved Memory Size (*)	**Disabled** 16, 32, 64k	Disabled: No memory block for legacy ISA devices reserved. 16, 32, 64k: specifies the size of memory block reserved for legacy ISA devices.
Reserved Memory Address (**)	C0000, C4000, **C8000**, . DC000	Selects the base address of the memory block reserved for legacy ISA devices. The memory addresses C0000 and C4000 are usually used by the onboard graphic device. Your graphic output will fail if using these areas. These settings only make sense if you are working in a system without graphic output.

Notes: In the Option column, bold shows default settings.
(*) If a legacy ISA device of your system requires an UMB area, this needs to be reserved.
(**) This is visible only if a Reserved Memory Size is set.

19.6 Boot Menu

Feature	Option	Description
Boot Settings		
▸ Boot Settings Configuration	Submenu	Opens the boot settings configuration submenu. You can configure options for the boot process.
1st Boot Device (*)	Disabled N/A	Selects the boot sequence from the available devices. Disabled: this device will not be used to boot from. All others: devices are listed by their available vendor code.
2nd Boot Device (*)	Disabled N/A	See above.
3rd Boot Device (*)	Disabled N/A	See above.
4th Boot Device (*)	Disabled N/A	See above.
Onboard LAN PXE ROM (**)	**Disabled** Enabled	Disabled/Enabled: Switches the remote boot BIOS extension for the onboard LAN controller off or on.

Notes: *In the Option column, bold shows default settings.*
(*) The availability of these entries depends upon how many boot devices exist in the system. The list of devices is dynamically arranged (none to four devices visible).
(**) When this feature is enabled, boot-up the system again, configure the PXE ROM BIOS settings, and re-enter the ezPORT utility to set boot sequence.

19.6.1 Boot Settings Configuration Submenu

Feature	Option	Description
Boot Settings Configuration		
Quick Boot	Disabled **Enabled**	Disabled/Enabled: Switches the quick boot mode off or on. Enabling quick boot skips certain tests while booting and decreases boot time.
Quiet Boot	**Disabled** Enabled	Selects what is displayed during boot-up. Disabled: displays normal POST messages during boot-up. Enabled: displays dark screen instead of POST messages.
AddOn ROM Display Mode	**Force BIOS** Keep Current	Selects display mode for option ROM.
Bootup Num-Lock	**On** Off	Selects Power-on state for Numlock. On: Numlock for alphanumeric keypad is on. Off: Numlock for alphanumeric keypad is off.
PS/2 Mouse Support	**Auto** Disable Enabled	Selects the way PS/2 Mouse support is handled. Auto: BIOS auto-detects if a PS/2 Mouse is connected. Disabled: PS/2 Mouse support is off. Enabled: PS/2 Mouse support is on.
Wait for 'F1' If Error	Disabled **Enabled**	Disabled/Enabled: switches the wait function off or on. If enabled, the boot process stops when detecting an error; the user has to press <F1> to continue.
Hit 'DEL' Message Display	Disabled **Enabled**	Disabled/Enabled: switches the Hit DEL message off or on.
Interrupt 19 Capture	Disabled **Enabled**	Disabled/Enabled: Switches the interrupt 19hex capturing off or on. When this feature is enabled, option ROMs are allowed to trap the interrupt 19hex.

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

19.7 Security Menu

Feature	Option	Description
Security Settings		
Supervisor Password		Displays “Installed” or “Not Installed,” depending on whether a password has been set.
User Password		Displays “Installed” or “Not Installed,” depending on whether a password has been set.
Change Supervisor Password		Opens a password dialog in which the new supervisor password has to be entered and confirmed.
User Access Level (*)	No Access View Only Limited **Full Access**	Selects access rights of a user: No Access: prevents user access to the setup utility. View Only: allows views of the setup utility but blocks changes. Limited: allows limited access (such as date and time). Full Access: allows all changes by the user.
Change User Password		Opens a password dialog in which a new user password has to be entered and confirmed.
Clear User Password		Clears user password.
Password Check	**Setup** Always	Selects which condition requires a password: Setup: password is required to enter the setup. Always: password is required to enter setup on every boot.
Boot Sector Virus Protection	Disabled Enabled	Disabled/Enabled: Switches the BIOS protection of the boot sector off or on.

Notes: In the Option column, bold shows default settings.
(*) This is visible only if a Supervisor Pathword is set.

19.8 Chipset Menu

All entries in this part of the BIOS setup utility are vital to your system. Change settings only if you are sure of what you are doing. Some changes may not be suitable for your complete system and may lead to unwanted system behavior.

Feature	Option	Description
▸ STPC Integrated IO Device Configuration	Submenu	Opens a submenu to configure IO devices integrated in the chipset.
▸ Cache & Shadow Configuration	Submenu	Opens Cache & Shadow Configuration submenu. Users can configure cache and shadow memory areas.
▸ North Bridge Configuration	Submenu	Opens North Bridge Configuration submenu for configuration of the PCI bridge and the memory controller.
▸ ISA Bus Configuration	Submenu	Opens ISA Bus Configuration submenu for configuration the ISA bridge and optimize the ISA bus performance.

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

19.8.1 STPC Integrated IO Device Configuration Submenu

Feature	Option	Description
STPC Serial Port A	Auto **3F8/IRQ4** 2F8/IRQ4 3E8/IRQ4 2E8/IRQ4	Selects address and IRQ of the physical COM A. Auto: BIOS selects the address and IRQ. 3F8/IRQ4: set to logical COM 1. 2F8/IRQ4: set to logical COM 2. 3E8/IRQ4: set to logical COM 3. 2E8/IRQ4: set to logical COM 4.
STPC Serial Port B	Auto **3F8/IRQ3** 2F8/IRQ3 3E8/IRQ3 2E8/IRQ3	Selects address and IRQ of the physical COM B. Auto: BIOS selects the address and IRQ. 3F8/IRQ3: set to logical COM 1. 2F8/IRQ3: set to logical COM 2. 3E8/IRQ3: set to logical COM 3. 2E8/IRQ3: set to logical COM 4.
STPC Parallel Port Base Address (*)	Auto Disabled **378 (LPT1)** 278 (LPT2) 3BC (LPT3)	Select address of physical LPT port. Auto: BIOS selects the address. Disabled: switches the port off. 378: set to logical LPT 1. 278: set to logical LPT 2. 3BC: set to user LPT port.
STPC Parallel Port Mode	Normal Mode **Bidirectional Mode** EPP Mode ECP Mode	Selects parallel port mode. Normal Mode: set to unidirectional printer mode. Bidirectional Mode: set to bidirectional printer mode EPP Mode: set to extended mode EPP ECP: set to extended mode ECP with DMA
STPC Parallel Port DMA Channel (**)	**DMA1** DMA3	Selects the DMA 1 or 3 channel used in ECP mode.

Notes: In the Option column, bold shows default settings.
(*) Even if this item is set to disabled, the IRQ7 used for this device will not be available.
(**) This is visible only if a parallel port mode is ECP.

19.8.2 Cache & Shadow Configuration Submenu

Feature	Option	Description
Internal Cache(*)	Write-Through **Write-Back**	Selects the mode of the internal processor cache: Write-Through: Writes are sent to main memory at once. Write Back: Writes are only sent to main memory until necessary.
Cache Video BIOS	Disabled **Enabled**	Disabled/Enabled: switches caching of video BIOS off or on.
C000, 16K Shadow (**)	Disabled **Enabled**	Disabled/Enabled: switches a 16K memory block shadowing off or on. When shadowing is enabled, all accesses go to the main memory shadow region. When shadowing is disabled, the same accesses would go to the ISA bus addresses.
C400, 16K Shadow(**)	Disabled **Enabled**	See above.
C800, 16K Shadow	**Disabled** Enabled	See above.
For every 16K block		
E800, 16K Shadow	**Disabled** Enabled	See above.
EC00, 16K Shadow	**Disabled** Enabled	See above.

Notes: In the Option column, bold shows default settings.
(*) Don't set Internal Cache to Write Through, this may cause system failures. Therefore this Setup entry was removed with BIOS version PEXTR113 and later. The cache was always set to Write Back.
(**) These Setup entries are not available since BIOS version PEXTR113 because Cache Video BIOS already takes care of these UMB areas.

19.8.3 North Bridge Configuration Submenu

Feature	Option	Description
Refresh Cycle Time	0, 1, 2, 3, 4, 5, 6, 7, **8**, 9, 10, 11, 12, 13, 14, 15	Sets the refresh cycle time for SDRAM. Kontron recommends using the default value of 8.
RActive to Read/Write	0, 1, 2, **3**, 4, 5, 6, 7	Sets the RAS active to read/write time for SDRAM accesses. Kontron recommends using the default value of 3.
Precharge To Row Active	0, 1, 2, **3**	Sets the precharge to row active delay time for SDRAM accesses. Kontron recommends using the default value of 3.
CAS Latency	**2**, 3	Sets the CAS latency time for SDRAM accesses. Kontron recommends using the default value of 2.
MEM16_OE	**8mA** 16mA	Sets driver current for SDRAM interface. Kontron recommends using the default value of 8mA.
Read Clock Delay Programming	0, 1, 2, 3, 4, 5, 6, 7, **8**, 9, 10, 11, 12, 13, 14, 15	Sets the refresh cycle time for SDRAM. Kontron recommends using the default value of 8.
PCI Standard	PCI 2.0 **PCI 2.1**	Sets the PCI Bus compatibility to standard 2.0 or 2.1. PCI 2.1 is recommended; however, users may need to set some none PCI 2.1 add-on cards to PCI 2.0.
PCI to Host Read Prefetch	Disabled **Enabled**	Disabled/Enabled: Switches read buffering for PCI to Host accesses off or on.

PCI to Host Write Posting	Disabled **Enabled**	Disabled/Enabled: Switches write buffering for PCI to Host accesses off or on.

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

19.8.4 ISA Bus Configuration Submenu

Feature	Option	Description
ISA Write Posting	Disabled **Enabled**	Disabled/Enabled. Switches the PCI to ISA write buffering off or on. Kontron recommends using the default value of Enabled.
ISA Read Buffer	Disabled **Enabled**	Disabled/Enabled. Switches PCI to ISA read buffering off or on. Kontron recommends using the default value of Enabled.
ISA Extra Wait States	**Disabled** Enabled	Disabled/Enabled. Switches additional ISA wait states off or on. Users can enable this feature with slow ISA extension cards
DMA Clock	ISACLK / 2 **ISACLK**	Sets clock of ISA DMA operation. ISACLK is set in this table under feature ISA Clock. Kontron recommends using the default value of ISACLK.
DMA MEMR#-IOW# Delay	**Disabled** Enabled	Disabled/Enabled. Switches the extra delay for DMA accesses off or on. Kontron recommends using the default value of Disabled.
16-bit DMA Wait States	**1**, 2, 3, 4	Sets wait states for 16-bit ISA DMA accesses.
8-bit DMA Wait States	**1**, 2, 3, 4	Sets wait states for 8-bit ISA DMA accesses.

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

19.9 Power Menu

Feature	Option	Description
APM Configuration		
Power Management/APM (*)	**Disabled**, Enabled	Disabled/Enabled. Switches power management system off or on.
Doze/Sleep Timeout	**Disabled**, 50ms, 100ms, 500ms, Reserved, 4s, 8s, 16s	Sets timeout value for the period after which the system goes into doze/sleep state.
Doze Stop Clock Ratio	**Disabled**, 50%, 25%	Selects CPU clock throttle into doze state.
Standby Timeout	Disabled, Reserved, **2m**, 4m, 6m, 8m, 12m, 16m	Sets timeout value for the period after which goes into standby state.
Standby Stop Clock Ratio	Disabled, 50%, 25%, **12.5%**, 6.25%, 3,125%, 1.5625%, Stop CPU Clock	Selects CPU clock throttle in standby state.
Suspend Timeout	Disabled, **4m**, 8m, 12m, 16m, 32m, 48m, 64m	Sets timeout value for the period after which the system goes to suspend state.
Suspend Stop Clock Ratio	Disabled, 50%, 25%, 12.5%, 6.25%, 3,125%, 1.5625%, **Stop CPU Clock**	Selects CPU clock throttle in standby state.
DMA Request Monitor	**Ignore**, Monitor	Selects whether the system monitors this event for wake up or ignores this event and stays in the APM state.
PCI Master Monitor	**Ignore**, Monitor	See above.
Parallel Port Monitor	**Ignore,** Monitor	See above.
Serial Port Monitor	**Ignore**, Monitor	See above.
Keyboard Monitor	Ignore, **Monitor**	See above.
Floppy Disk Monitor	**Ignore**, Monitor	See above.
Hard Disk Monitor	**Ignore**, Monitor	See above.
Display Activity	**Ignore**, Monitor	See above.
IRQ15 Thru 1 Monitor	Ignore, **Monitor**	See above.
IRQ0 Monitor	**Ignore**, Monitor	See above.
NMI Monitor	**Ignore**, Monitor	See above.
Video Power Down Mode	Disabled, **Standby**, Suspend	Selects whether the video is powered down in suspend or standby state, or if it is not powered down.
Green PC Monitor State	Standby, **Suspend,** Mechanical Off	Selects Green PC Monitor State.
Hard Disk Power Down Mode	Disabled, Standby, **Suspend**	Selects whether hard disk is powered down in suspend or standby state, or if it is not powered down.
Hard Disk Timeout (Minute)	**Disabled**, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	Sets timeout value for the period after which the hard disk goes to power-saving state.

Notes: In the Option column, bold shows default settings.
(*) All other options are only visible when this feature is enabled.

19.10 Exit Menu

Feature	Option	Description
Exit Options		
Save Changes and Exit	**Ok** Cancel	Opens Save Configuration and Exit window. Pressing the <F10> key does the same. Choose [OK] to do so or [Cancel] to return to previous setup screen.
Discard Changes and Exit	**Ok** Cancel	Opens Discard Changes and Exit window. Pressing the <ESC> key does the same. Choose [OK] to do so or [Cancel] to return to previous setup screen.
Discard Changes	**Ok** Cancel	Opens Discard Changes window. Pressing the <F7> key does the same. Choose [OK] to do so or [Cancel] to return to previous setup screen.
Load Optimal Defaults	**Ok** Cancel	Opens Load Optimal Defaults window. Pressing the <F9> key does the same. Choose [OK] to do so or [Cancel] to return to previous setup screen.
Load Failsafe Defaults	**Ok** Cancel	Opens Load Failsafe Defaults window. Pressing the <F8> key does the same. Choose [OK] to do so or [Cancel] to return to previous setup screen.

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

19.11 Kontron BIOS Extensions

Besides the AMIBIOS, the T-MOPSlcdSA comes with a few BIOS extensions that support additional 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)
- Onboard LAN RPL ROM
- DOT-matrix LCD

All enabled BIOS extensions require shadow RAM. They will be loaded into the same 16K 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.

19.11.1 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 system BIOS segments after boot-up. It is permanently available and supports the JIDA 16-bit standard and the JISA 32-bit standard. The JIDA 16-bit standard is a software interrupt 15hex driven programmer 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 on 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.

19.11.2 Remote Control Client Extension

You can remotely control the T-MOPSlcdSA 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 T-MOPSlcdSA , 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 D0000hex and EC000hex, a 16K 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.

19.11.3 LAN RPL ROM

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

The RPL ROM extension is loaded into the first free memory area between D0000hex and EC000hex. A 16K block is shadowed.

19.11.4 DOT-Matrix LCD BIOS Extension

The T-MOPSlcdSA can drive an LCD-DOT matrix display on the parallel port. It 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 T-MOPSlcdSA controls the outputs to the display via software interrupt INT10hex. You only can use this feature with DOS.

If the DOT-matrix LCD interface is set up by using software tool ALCDINIT.EXE, the BIOS extension that supports this feature loads during boot-up.

The BIOS extension for the DOT-matrix LCD loads into the first free memory area between D0000hex and EC000hex; a 16K 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.

Users can download the software tool ALCDINIT.EXE and a related application note from the Kontron Web site. Programming, detailed configuration, and connectivity information is available in Application Note DotMatrixPC104_E???.PDF. The three question marks represent the document revision number. Users can download the application note from the Kontron Web site, or request it from technical support.

19.12 Updating or Restoring BIOS

If your T-MOPSlcdSA board requires a newer BIOS version or the BIOS is damaged, you may need to update or restore the BIOS.

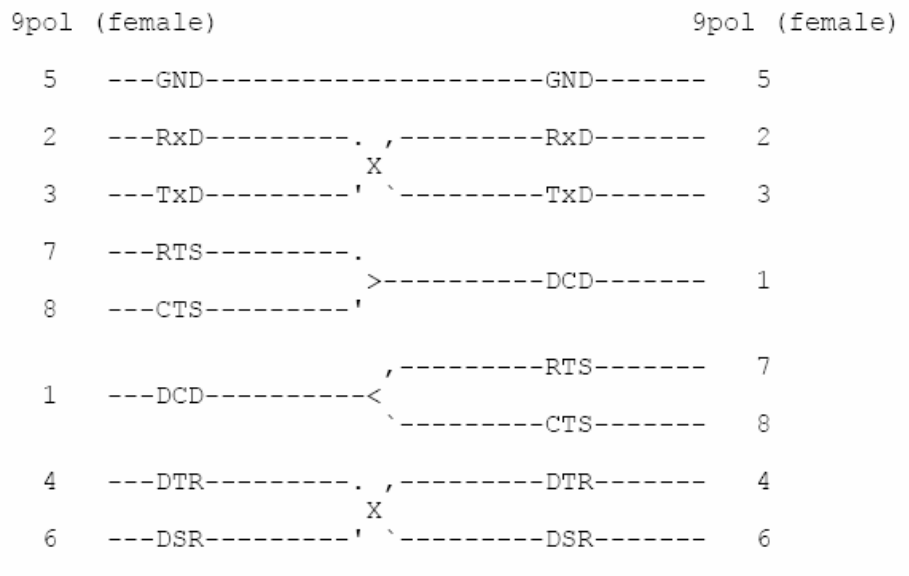
AMIBIOS allows you to update or restore the BIOS by using a serial port connection without having to install a new ROM chip (AMIBIOS8 Serial Flash).

To use the AMIBIOS8 Serial Flash feature the following requirements have to be fulfilled:

- A "Host" system with serial port running terminal program that supports XMODEM transfer protocol (HyperTerminal for Microsoft Windows, minicom for Linux/FreeBSD, etc.)
- Null modem cable

19.12.1 Null modem cable

A standard null modem cable with DSUB-9 connectors on both sides integrates the following connections:



If you decide to make your own cable for direct connection to the 10 pin header of the T-MOPSlcdSA, please refer to the Serial-Communication Interfaces chapter for pin-out information.

19.12.2 BIOS Update or Recovery Step-by-Step

For a BIOS update or recovery please do the following:

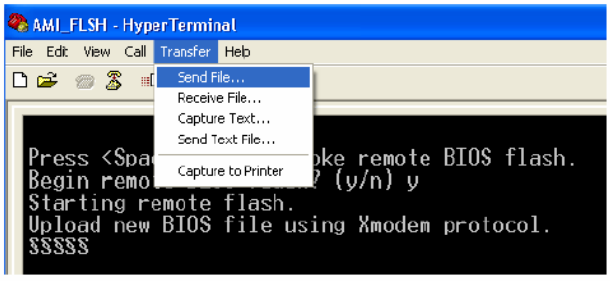
1. Attach a null modem cable to the serial port of the system that requires an update ("target"). Attach the other end of the null modem cable to a system running the terminal program ("host").
2. Make sure the new BIOS image file is accessible from the host system.

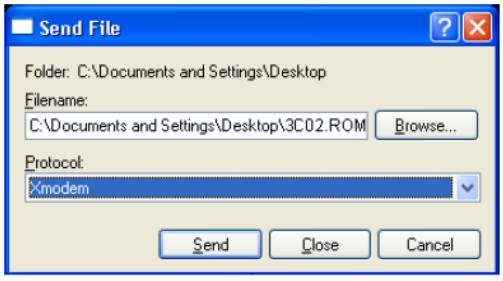
3. Start the terminal program on the host and open a new session. The session should use the following communication parameters:
   - Bits per second: 115200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
4. Start the target system. The terminal on the host should display the following message: "Press **<SpaceBar>** to invoke remote BIOS flash" (*). Immediately press the SpaceBar on the host to confirm. If the SpaceBar is not pressed within a few seconds, the system will skip the flash update and perform a normal boot procedure.
5. A second string will appear on the host terminal: "Begin remote BIOS flash? [y/n]". Press the **<Y>**' key on the host to continue. If the **<N>** is pressed, the system will skip the flash update and perform a normal boot procedure.
6. You will be prompted to upload the new BIOS file using the XMODEM protocol. Use the host terminal program to select the proper BIOS image and transfer it to the target.
7. If the transfer from host to target is successful, the target will update the BIOS and indicate success. Restart the system by switching the main power supply off and on. The system will then reboot using the new BIOS image.

Notes: (*) If the target system has multiple serial ports, only one will be enabled for Serial Flash. COM1 is the default port. A system that does not display the 'Press <SpaceBar> to invoke remote BIOS flash' string over the serial port does not have support for the Serial Flash feature.

19.12.3 Terminal Programs

HyperTerminal (**) for Microsoft Windows is the most common terminal program available today. XMODEM transfers can be initiated using the 'Send File' dialog under the 'Transfer' menu.



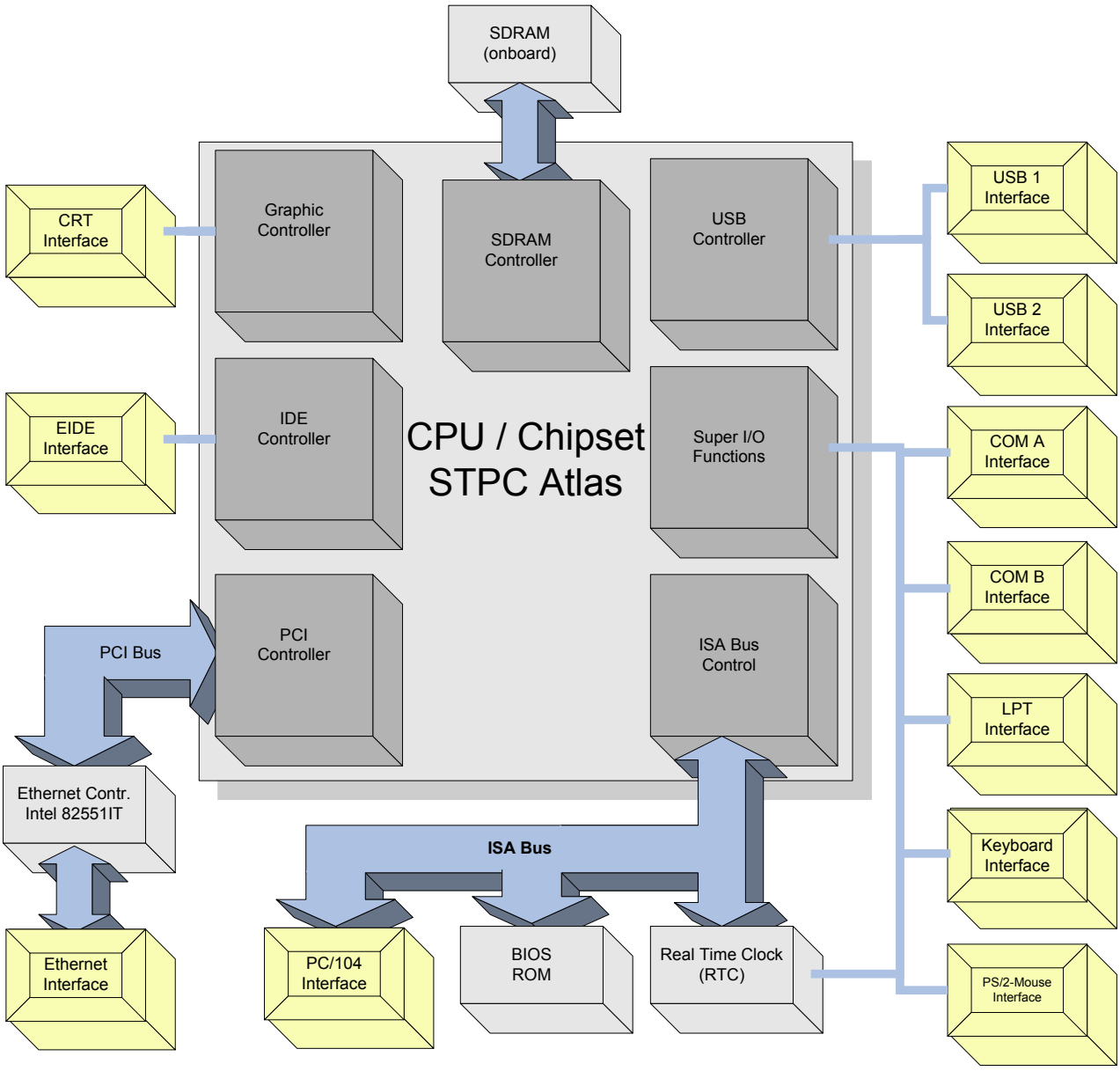


AMIBIOS8 Serial Flash will work with any terminal communications program that supports VT-100 and XMODEM protocols. This includes products designed for GNU/LINUX & BSD operating systems, such as

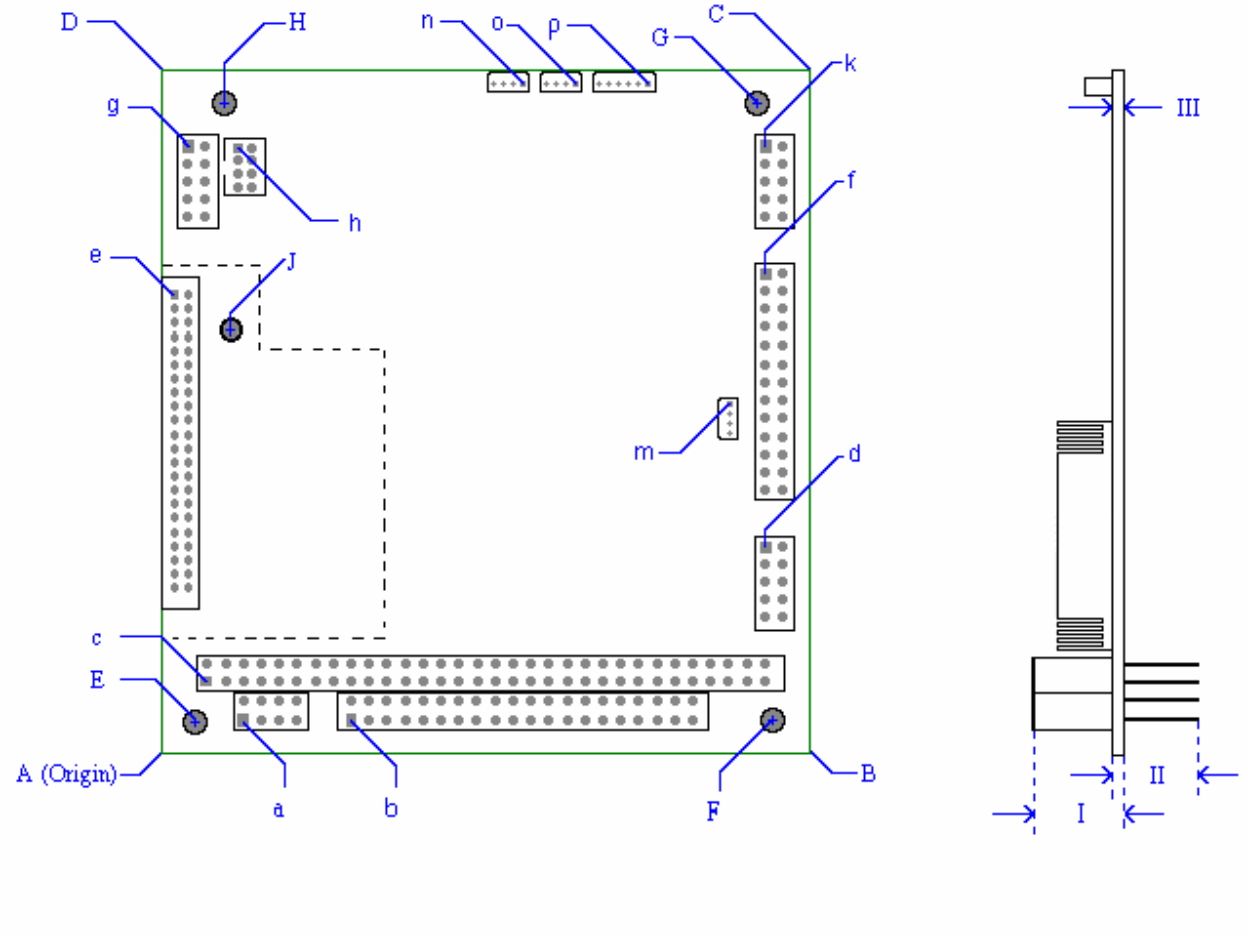
minicom. It is recommended that the terminal program be configured to use the 'CR/LF' style of line termination.

Notes: (**) There is a known issue with AMIBIOS8 Serial Flash, AMIBIOS8 Serial Console Redirection and the version of HyperTerminal that ships with some installations of Windows 2000. Please make sure you are using the most updated version of HyperTerminal to avoid problems.

20 Appendix C: block Diagram



21 Appendix D: Mechanical Dimensions



All dimensions in the tables below are relative to the origin location A.

Location	Horizontal (mm)	Vertical (mm)	Horizontal (mil)	Vertical (mil)
PCB Dimensions				
A (Origin)	0	0	0	0
B	90.17	0	3550	0
C	90.17	95.89	3550	3775
D	0	95.89	0	3775
Mounting Holes				
E	5.08	5.08	200	200
F	85.09	5.08	3350	200
G	82.55	90.81	3250	3575
H	8.89	90.81	350	3575
J	9.88	59.28	389	2333.84

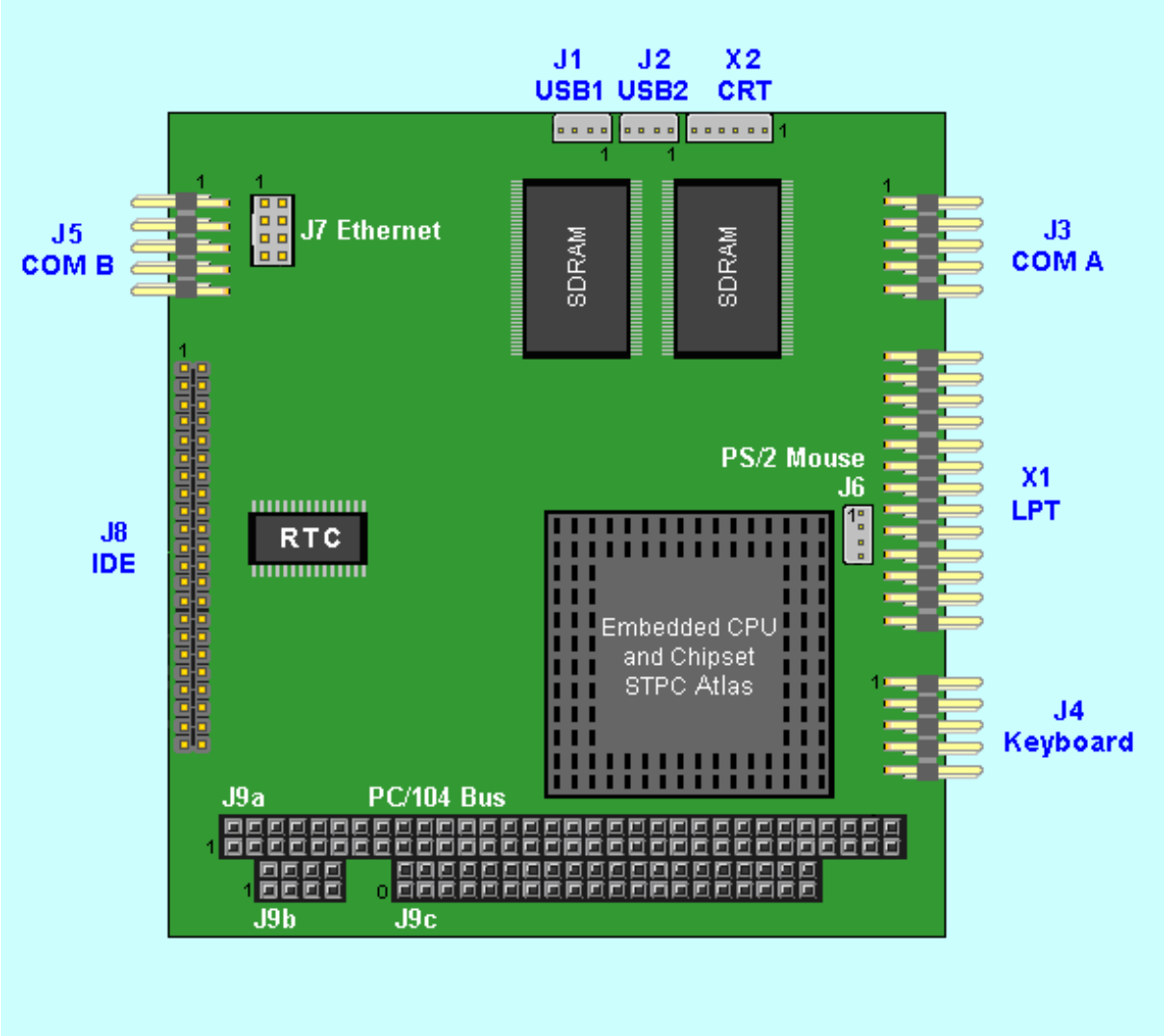
Location	Horizontal (mm)	Vertical (mm)	Horizontal (mil)	Vertical (mil)
Interface Connectors				
a	11.43	5.08	450	200
b	26.67	5.08	1050	200
c	6.35	10.16	250	400
d	83.54	29.24	3289	1151
e	1.75	64.80	69	2551
f	83.54	67.34	3289	2651
g	4.04	85.12	159	3351
h	10.69	84.99	421	3346
k	83.54	85.12	3289	3351
m	80.52	48.01	3170	1890
n	49.58	93.73	1952	3690
o	56.69	93.73	2232	3690
p	66.27	93.73	2609	3690

Height	Dimension (mm)	Dimension (mil)
I	13.10	515
II	10.60	417
III	1.60	63

22 Appendix E: Connector Layout

22.1 Connector Locations

Pin 1 of any connector is marked with “1” in this drawing and with a rectangular pad at the bottom side of the board’s PCB.



22.2 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
J1, J2	USB interface Connectors	1.25mm 4 pos. (Molex 51021-0400 or compatible)	KAB-USB-1 (PN 96054-0000-00-0)	For standard USB adaptation.
J3, J5	Serial Interfaces COM A and COM B Connectors	2.54mm 10 pos. (AMP 1-215882-0 or compatible)	KAB-DSUB9-2 (PN 96017-0000-00-0)	For DSUB 9 adaptation.
J4	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.
J6	PS/2 Mouse Interface Connector	1.25mm 4 pos. (Molex 51021-0400 or compatible)	KAB-MOUSE-PS2 (PN 96062-0000-00-0)	For PS/2 mouse.
J7	Ethernet Interface Connector	2mm 8 pos. (Berg 90311-008 or compatible)	KAB-MOPS-ETN1 (PN 96048-0000-00-0)	For RJ45 adaptation.
J8	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.
J9a	PC/104 Bus (XT-Bus part)	2.54mm 64 pos. (EPT 962-60323-12 or compatible for board to board connection)		
J9b	Power Connector	2.54mm 8 pos. (EPT 962-60043-12 or compatible for board to board connection)		
J9c	PC/104 Bus (AT-Bus part)	2.54mm 40 pos. (EPT 962-60203-12 or compatible for board to board connection)		
X1	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.
X2	CRT Monitor	1.25mm 6 pos. (Molex 51021-0600 or compatible)	KAB-VGA-2 (PN 96053-0000-00-0)	For DSUB 15 adaptation.

22.3 Pin-out Table

Pin	PC104 (A) J9a	PC104 (B) J9a	PC104 (C) J9c	PC104 (D) J9c
0			GND	GND
1	/IOCHCK	GND	/SBHE	/MEMCS16
2	SD7	RESETDRV	LA23	/IOCS16
3	SD6	VCC (***)	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-5V	LA20	IRQ12 (**)
6	SD3	DRQ2	LA19	IRQ15
7	SD2	-12V	LA18	IRQ14
8	SD1	/0WS	LA17	/DACK0
9	SD0	+12V	/MEMR	DRQ0
10	IOCHRDY	GND (*)	/MEMW	/DACK5
11	AEN	/SMEMW	SD8	DRQ5
12	SA19	/SMEMR	SD9	/DACK6
13	SA18	/IOW	SD10	DRQ6
14	SA17	/IOR	SD11	/DACK7
15	SA16	/DACK3	SD12	DRQ7
16	SA15	DRQ3	SD13	VCC (***)
17	SA14	/DACK1	SD14	/MASTER
18	SA13	DRQ1	SD15	GND
19	SA12	/REFRESH	GND	GND
20	SA11	SYSCLK		
21	SA10	IRQ7 (**)		
22	SA9	IRQ6		
23	SA8	IRQ5		
24	SA7	IRQ4 (**		
25	SA6	IRQ3 (**)		
26	SA5	/DACK2		
27	SA4	T/C		
28	SA3	BALE		
29	SA2	VCC (***)		
30	SA1	OSC		
31	SA0	GND		
32	GND	GND		

Notes: *(*) Key pin for PC/104; GND for PC/104+ specification.*
(**) These signals are internally used by the STPC Atlas and are not available on the ISA bus for other devices.
(***) 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.

Pin	IDE J8	LPT X1	Power J9b	COM A J3	COM B J5
1	/RESET	/STB	GND	/DCD1	/DCD2
2	GND	/AFD	VCC (***)	/DSR1	/DSR2
3	HDD7	PD0	BATT	RXD1	RXD2
4	HDD8	/ERR	+12V	/RTS1	/RTS2
5	HDD6	PD1	-5V	TXD1	TXD2
6	HDD9	/INIT	-12V	/CTS1	/CTS2
7	HDD5	PD2	GND	/DTR1	/DTR2
8	HDD10	/SLIN	VCC (***)	/RI1	/RI2
9	HDD4	PD3		GND	GND
10	HDD11	GND		VCC (***)	VCC (***)
11	HDD3	PD4			
12	HDD12	GND			
13	HDD2	PD5			
14	HDD13	GND			
15	HDD1	PD6			
16	HDD14	GND			
17	HDD0	PD7			
18	HDD15	GND			
19	GND	/ACK			
20	KEY (NC)	GND			
21	DRQ	BUSY			
22	GND	GND			
23	/IOW	PE			
24	GND	GND			
25	/IOR	SLCT			
26	GND	VCC (***)			
27	IOCHRDY				
28	CSEL				
29	/AKJ				
30	GND				
31	SIRQ				
32	NC				
33	SA1				
34	NC				
35	SA0				
36	SA2				
37	/CS1				
38	/CS3				
39	NC				
40	GND				
41	VCC (***)				
42	VCC (***)				
43	GND				
44	NC				

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.

Pin	KBD J4	LAN J7	CRT X2	PS/2 Mouse J6	USB 1 J1	USB 2 J2
1	SPEAKER	TXD+	RED	MSDAT	VCC (***)	VCC (***)
2	GND	TXD-	GRN	VCC (***)	USB00	USB10
3	/RESIN	RXD+	BLU	GND	USB01	USB11
4	/KBLOCK	SHLDGND	GND	MSCLK	GND	GND
5	KBDAT	SHLDGND	VSYNC			
6	KBCLK	RXD-	HSYNC			
7	GND	SPEEDLED				
8	VCC (***)	LILED				
9	BATT					
10	PWRGOOD					

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.

Warning: ***The power contacts for USB devices on Pin 1 and Pin 4 are not protected. They are suitable to supply connected USB devices with a maximum of 500mA power dissipation. Do not supply external USB devices with higher power dissipation through these pins. Always use a fuse for power on external USB connectors, as a defective USB device may damage the T-MOPSlcdSA. Kontron recommends using a resetable fuse, which follows the USB 1.1 specification, for power on external USB connectors.***

23 Appendix F: Limitations and Hints

23.1 Unavailable ISA Signals

Due to the STPC Atlas microcontroller architecture, the following signals are not available on the PC/104 bus (ISA):

IRQ3, IRQ4, IRQ7, IRQ12

23.2 USB Ports

The power contacts for USB devices on Pin 1 and Pin 4 are not protected. They are suitable to supply connected USB devices with a maximum of 500mA power dissipation. Do not supply external USB devices with higher power dissipation through these pins. Always use a fuse for power on external USB connectors; otherwise a defective USB device may damage the T-MOPSlcdSA. Kontron recommends using a reset able fuse, which follows the USB 1.1 specification, for power on external USB connectors.

23.3 USB Devices

Some USB floppy disk drives and sticks make trouble by formatting. The following floppy devices are known to fail:

- Mitsumi D353GUE
- Sony MPF88E–U1
- Y-E USB-FDU

If you have problems to boot from an USB stick, set its “emulation type” in the BIOS setup to Hard Disk. See the chapter USB Mass Storage Device Configuration Submenu for details.

An USB-Mouse will not work under DOS even if USB legacy support is enabled.

23.4 Windows® 98 Support

The Win9x OS is not a targeted operating system of STPC. One known issue is that standby is not supported under Windows 98.

23.5 Keyboard Controller

A Problem occurs when the SHIFT, NUMLOCK, ROLL or CAPSLOCK is pressed, which will update the keyboard LED's via command EDh. The STPC does not acknowledge this and sends a beep on the speaker.

Only the standard US 101key keyboard is supported.

When there is no PS/2 keyboard connected, several beeps ring out when booting DOS.

If you are using an USB keyboard in the system and you want to get into the BIOS Setup or get the boot menu loaded, press **<DEL>** or **<F11>** once and keep it pressed until you are in the Setup / boot menu. Don't press any other keys or the mentioned keys more often during POST.

24 Appendix F: PC Architecture Information

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

24.1 Buses

24.1.1 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

24.1.2 PC/104, PCI - Information

- Embedded PC 104 Consortium: Provides information about PC/104 and PC/104-Plus technology. You can search for information about the consortium on the Web.
- PCI SIG: Provides a forum for its ~900 member companies, which 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.

24.2 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

24.3 Ports

24.3.1 RS-232 Serial

- 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.

24.3.2 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 system. You can search for information about the working group on the Web.

24.3.3 USB

- USB Specification: The USB Implementers Forum (USB-IF) is a nonprofit corporation founded by the group of companies that developed the Universal Serial Bus specification. USB-IF provides a support organization and forum to advance and adopt Universal Serial Bus technology. You can search for information about the standard on the Web.

24.4 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

25 APPENDIX G: DOCUMENT-REVISION HISTORY

Revision	Date	Edited by	Changes
PEXTM101	30.03.2005	KFR	First preliminary version.
PEXTM110	19.08.2005	SMA	Reworked and added all BIOS relevant issues.
PEXTM111	21.11.2006	BHO	Manual completely reworked, new format, added more technical details.
PEXTM112	23.01.2007	BHO	Corrected MTBF value, minor changes
PEXTM113	16.11.2007 29.02.2008	GUL ZDA	Updated to current Kontron Layout Released for web