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»Kontron User's Guide«

AdvancedMC™



AM4220

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Revision History

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1.0	First Release	June 2008
1.1	Rework on all chapter	March 2009
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Kontron reserves the right to make changes without notice in product or component design as warranted by evolution in user needs or progress in engineering or manufacturing technology. Changes that affect the operation of the unit will be documented in the next revision of this user's guide.

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Safety Instructions

Before You Begin

Before handling the board, read the instructions and safety guidelines on the following pages to prevent damage to the product and to ensure your own personal safety. Refer to the "Advisory Convention" section in the Preface for advisory conventions used in this user's guide, including the distinction between Warnings, Cautions, Important Notes, and Notes.

- Always use caution when handling/operating the computer. Only qualified, experienced, authorized electronics service personnel should access the interior of the computer. The power supplies produce high voltages and energy hazards, which can cause bodily harm.
- Use extreme caution when installing or removing components. Refer to the installation instructions in this user's guide for precautions and procedures. If you have any questions, please contact Kontron Technical Support

WARNING



High voltages are present inside the chassis when the unit's power cord is plugged into an electrical outlet. Turn off system power, turn off the power supply, and then disconnect the power cord from its source before removing the chassis cover. Turning off the system power switch does not remove power to components.



Preventing Electrostatic Discharge

Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedure to reduce the risk of damage to components. Kontron strongly encourages you to follow proper ESD procedure, which can include wrist straps and smocks, when servicing equipment.

Take the following steps to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component's antistatic packing material until you are ready to install the component in a computer. Just before unwrapping the antistatic packaging, be sure you are at an ESD workstation or grounded. This will discharge any static electricity that may have built up in your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components at an ESD workstation. If possible, use antistatic floor pads and workbench pads.
- Handle components and boards with care. Don't touch the components or contacts on a board. Hold a board by its edges.
- Do not handle or store system boards near strong electrostatic, electromagnetic, magnetic, or radioactive fields.

Safety Requirements

The following safety precautions must be observed when installing or operating the AM4220. Kontron assumes no responsibility for any damage resulting from failure to comply with these requirements.

WARNING

Due care should be exercised when handling the board due to the fact that the heat sink can get very hot. Do not touch the heat sink when installing or removing the board.
In addition, the board should not be placed on any surface or in any form of storage container until such time as the board and heat sink have cooled down to room temperature.



ESD Equipment

This AMC board contains electrostatically sensitive devices. Please observe the necessary precautions to avoid damage to your board:

- Discharge your clothing before touching the assembly. Tools must be discharged before use.
- Do not touch components, connector-pins or traces.
- If working at an anti-static workbench with professional discharging equipment, please do not omit to use it.

WARNING

This product has gold conductive fingers which are susceptible to contamination. Take care not to touch the gold conductive fingers of the AMC Card-edge connector when handling the board.
Failure to comply with the instruction above may cause damage to the board or result in improper system operation.

CAUTION

Laser light from fiber-optic transmission cables and components can damage your eyes. The laser components plugged into the switch are Class 1 laser components. Class 1 laser is considered incapable of producing damaging radiation levels during normal operation or maintenance.
To avoid damaging your eyes and to continue safe operation in case of abnormal circumstances:

- Never look directly into the outlets of fiber-optic transmission components or fiber-optic cables with unprotected eyes.
- Never allow fiber-optic transmission path to operate until all the connections have been made.

Always fit protective plugs to any unused ports of the switch.

WARNING

Be careful when inserting or removing the AM4220. The SFP+ cage has sharp edges which might lead to injuries.

Preface

How to Use This Guide

This user's guide is designed to be used as step-by-step instructions for installation, and as a reference for operation, troubleshooting, and upgrades.

For the circuits, descriptions and tables indicated, Kontron assumes no responsibility as far as patents or other rights of third parties are concerned.

The following is a summary of chapter contents:

- Chapter 1, Product Description
- Chapter 2, Board Features
- Chapter 3, Installing the board
- Chapter 4, Thermal
- Chapter 5, Software Setup
- Appendix A, Connector Pinout
- Appendix B, Getting Help
- Appendix C, Glossary

Customer Comments

If you have any difficulties using this user's guide, discover an error, or just want to provide some feedback, please send a message to: Tech.Writer@ca.kontron.com. Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user's guide on our Web site. Thank you.

Advisory Conventions

Seven types of advisories are used throughout the user guides to provide helpful information or to alert you to the potential for hardware damage or personal injury. They are Note, Signal Paths, Jumpers Settings, BIOS Settings, Software Usage, Cautions, and Warnings. The following is an example of each type of advisory. Use caution when servicing electrical components.



Note:
Indicates information that is important for you to know.



Signal Path:
Indicates the places where you can find the signal on the board.



Jumper Settings:
Indicate the jumpers that are related to this sections.



BIOS Settings:
Indicates where you can set this option in the BIOS.



Software Usage:
Indicates how you can access this feature through software.



CAUTION
Indicates potential damage to hardware and tells you how to avoid the problem.





WARNING
Indicates potential for bodily harm and tells you how to avoid the problem.





ESD Sensitive Device:
This symbol and title inform that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.
Please read also the section "Special Handling and Unpacking Instructions".



CE Conformity:
This symbol indicates that the product described in this manual is in compliance with all applied CE standards. Please refer also to the section "Regulatory Compliance Statements" in this manual.

Disclaimer: We have tried to identify all situations that may pose a warning or a caution condition in this user's guide. However, Kontron does not claim to have covered all situations that might require the use of a Caution or a Warning.

Unpacking

Follow these recommendations while unpacking:

- Remove all items from the box. If any items listed on the purchase order are missing, notify Kontron customer service immediately.
- Inspect the product for damage. If there is damage, notify Kontron customer service immediately.
- Save the box and packing material for possible future shipment.

Regulatory Compliance Statements

FCC Compliance Statement for Class B Devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generated, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experience radio/TV technician for help.

WARNING



This is a Class B product. If not installed in a properly shielded enclosure and used in accordance with this User's Guide, this product may cause radio interference in which case users may need to take additional measures at their own expense.



Safety Certification

All Kontron equipment meets or exceeds safety requirements based on the IEC/EN/UL/CSA 60950-1 family of standards entitled, "Safety of information technology equipment." All components are chosen to reduce fire hazards and provide insulation and protection where necessary. Testing and reports when required are performed under the international IECEE CB Scheme. Please consult the "Kontron Safety Conformity Policy Guide" for more information.

CE Certification

The product(s) described in this user's guide complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques. Although Kontron offers accessories, the customer must ensure that these products are installed with proper shielding to maintain CE compliance. Kontron does not offer engineering services for designing cabling systems. In addition, Kontron will not retest or recertify systems or components that have been reconfigured by customers.

Limited Warranty

Kontron grants the original purchaser of Kontron's products a TWO YEAR LIMITED HARDWARE WARRANTY as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of Kontron are valid unless the consumer has the express written consent of Kontron.

Kontron warrants their own products, excluding software, to be free from manufacturing and material defects for a period of 24 consecutive months from the date of purchase. This warranty is not transferable nor extendible to cover any other users or long- term storage of the product. It does not cover products which have been modified, altered or repaired by any other party than Kontron or their authorized agents. Furthermore, any product which has been, or is suspected of being damaged as a result of negligence, improper use, incorrect handling, servicing or maintenance, or which has been damaged as a result of excessive current/voltage or temperature, or which has had its serial number(s), any other markings or parts thereof altered, defaced or removed will also be excluded from this warranty.

If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation.

Kontron provides for repair or replacement of any part, assembly or sub-assembly at their own discretion, or to refund the original cost of purchase, if appropriate. In the event of repair, refunding or replacement of any part, the ownership of the removed or replaced parts reverts to Kontron, and the remaining part of the original guarantee, or any new guarantee to cover the repaired or replaced items, will be transferred to cover the new or repaired items. Any extensions to the original guarantee are considered gestures of goodwill, and will be defined in the "Repair Report" issued by Kontron with the repaired or replaced item.

Kontron will not accept liability for any further claims resulting directly or indirectly from any warranty claim, other than the above specified repair, replacement or refunding. In particular, all claims for damage to any system or process in which the product was employed, or any loss incurred as a result of the product not functioning at any given time, are excluded. The extent of Kontron liability to the customer shall not exceed the original purchase price of the item for which the claim exists.

Kontron issues no warranty or representation, either explicit or implicit, with respect to its products reliability, fitness, quality, marketability or ability to fulfil any particular application or purpose. As a result, the products are sold "as is," and the responsibility to ensure their suitability for any given task remains that of the purchaser. In no event will Kontron be liable for direct, indirect or consequential damages resulting from the use of our hardware or software products, or documentation, even if Kontron were advised of the possibility of such claims prior to the purchase of the product or during any period since the date of its purchase.

Please remember that no Kontron employee, dealer or agent is authorized to make any modification or addition to the above specified terms, either verbally or in any other form, written or electronically transmitted, without the company's consent.

Chapter 1

Product Description

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1. Product Description

1.1 Product Overview

The AM4220 is an Advanced Mezzanine Card (AMC) from Kontron supporting both multi-core processor and 10GbE technologies enabling intelligent network services. The AM4220 AMC is cost competitive with other AdvancedMC cards, optimized for layer 4 to 7 data and security processing, targeting access and service providers with 3G/4G BTS, RNC, xGSN and Media Gateways.

The AM4220 provides 2x 10GbE ports to the front and x4 PCIe to the fabric side. AMC GbE on Ports 0 and 1 are connected to the processor for boot support and management.

1.2 What's Included

This board is shipped with the following items:

- One AM4220 AMC board
- One DB9 to RJ45 adaptor
- One Documentation & Drivers disk

If any item is missing or damaged, contact the supplier.

1.3 Board Specifications

Table 1-1: Board Specifications

Features	Description
Multicore Processor Unit	• Cavium Octeon Plus CN5650-600 BG1217-NSP-G • Socketless
Memory	• 2 or 4 Gigabyte DDR2 Memory support with ECC (2GB standard) • 18 JEDEC standard 60ball FBGA (x8) DDR2 SRAM Devices • 800MHz data rate • Socketless
Flash Memory	• 128MB Flash Memory • Boot sector protection
USB SSD Flash Module	• NAND flash memory. • Single Port USB 2.0 interface • Capacities: 4GB and 16GB • Package: Low Profile Package

Features	Description
Dual Gigabit Ethernet Controller	• Dual Gigabit Ethernet Controller Intel 82571EB • PCIe x4 interface to processor • 2 1000Base-BX (Serdes) interfaces to AMC connector • Serial-over-LAN Support via SMB
IPMI	• IPMI 1.5 compliant • Voltage and Temperature Sensors • ATCA LED control • FRU data storage for AMC • Firmware Update handling for field upgrades, rollbacks and watchdog functions
I/O Interfaces	• Front: 2 SFP+ cages to support multi-rate fiber SFP+ modules • Front: RJ45 for RS232 access to Processor • AMC TCLKA support • AMC FCLKA input with 100MHZ without SSC • AMC Port 0 and Port 1: 1000Base-BX • AMC Port 4 to Port 7: Configurable x4 PCIe Root Complex or target mode • AMC Port 15: RS232 (proprietary mapping)
Standards Compliance	This board is compatible to the following standards: • AMC.0 R2.0 Advance Mezzanine Card Base Specification • AMC.1 R2.0 PCI Express and Advance Switching • AMC.1 Type 4 • IPMI v1.5. • IEEE 802.3 • The AM4220 is RoHS compliant.
Mechanical Characteristics	• 4HP single Mid-size AMC Module • Board is compliant with AMC.0 R2.0
Operating Voltages	• Management: 3.3V +/-0.3V • Payload: 10VDC to 14VDC
Operation Power	• Management: 500mW max., 400mW typ. • Payload: 38.4W max., 31W typ.
Temperature	• This board is designed for operation from 5°C to 70°C ambient air temperature with forced convection. • Operating @ 10 CFM: 5°C to 45°C • Operating @ 15 CFM: 5°C to 65°C • Short term operating @ 25 CFM: -5°C to 75°C • Non-Operating: -40°C to 70°C
Humidity	• The board is designed to meet Bellcore GR63, Section 4.1 • Operating: 15%-90% (non-condensing) at 55°C • Non-Operating: 5%-95% (non-condensing) at 40°C
Altitude	• The board is designed to meet the following requirements according to Belcore GR-63, section 4.1.3: • Operating: 4000 m (13123 ft) (GR63 4.1.3), may require additional cooling above 1800m (5905ft) • Non-Operating: 15000 m (49212 ft)

Features	Description

Vibration	• The board is designed to meet the following requirements according to EN 300 019, Telcore GR-63 and IEC 60068:
	• Operating:
	  • 5 Hz to 200Hz 0.2G, 5mm/s (sinusoidal)
	  • 5 Hz to 100Hz: 0.1G @ 0.1 Octave/minute (sinusoidal)
	  • 5 Hz to 100Hz: 1G @0.1 Octave/minute (sinusoidal)
	  • 0,02 m^2/s^3 ASD, 5-10Hz +12dB/oct, 10-50Hz 0dB/oct, 50-100Hz -12dB/oct (random)
	• Non-Operating (packaged enclosure):
	  • 5 Hz to 200Hz 2G, 5mm/s (sinusoidal)
	  • 0,02 m^2/s^3 ASD, 5-10Hz +12dB/oct, 10-50Hz 0dB/oct, 50-100Hz -12dB/oct (random)
	  • 5 Hz to 20 Hz: 0.01g^2/Hz (random)
	  • 20 Hz to 200 Hz: -3dB/octave (random)

Shock	• The board is designed to meet the following requirements according to EN 300 019, Telcore GR-63 and IEC 60068: • Operating: • 3G, 11ms Shock • Non-Operating • 18G, 6ms Shock • 1000mm/all edges and corners Free Fall (packaged) • 100mm/all edges and corners Free Fall (unpackaged)
Safety	• CB report to IEC 60950-1, complies with EN/CSA/ UL 60950-1. • The board is designed to meet the following flammability requirement (as specified in Telcordia GR-63-CORE): • UL 94V-0/1 with Oxygen index of 28% or greater material
Electromagnetic Compatibility	• The board is designed to meet or exceed of the following specifications/requirements (assuming an adequate carrier/chassis): • FCC 47 CFR Part 15, (USA) • EMC Directive 89/336/EEC (Europe) • EN55022 (Europe) • EN55024 (Europe) • CISPR22 • VCCI (Voluntary Japan Electromagnetic Compatibility requirement) • EN 300 386, Electro-Magnetic Compatibility (EMC) Requirements for Public Telecommunication Network Equipment; Electromagnetic Compatibility (EMC) Requirements • Telcordia GR-1098
ETSI/NEBS requirements	• This board is designed to meet NEBS Level 3, Earthquake Zone 4

1.4 Hot Swap Capability

The AMC supports Full Hot Swap capability as required by AMC.0 R2.0. It can be removed from or installed in the system while it is on (without powering-down the system). Please refer to the AMC.0 R2.0 specification for additional details.

1.5 Software Support

The following table contains information related to software supported by the AM4220.

Table 1-2: AM4220 Software Specification

	Specifications
General	• The system supports IPMI version 1.5 for board level management (AMC.0). • Support for accessing serial interfaces of Octeon with Serial Over LAN (SOL) as per IPMI version 2.0 • Support for IPMI over LAN (IoL) on e1000 Ethernet port • Support for onboard IPMI event log (SEL) • Reliable field upgrades for all software components, including boot loader and IPMI firmware • Optional Dual boot images with roll-back capability. • Software development kit based on Cavium cnusers SDK • Offline Diagnostic software for running diagnostics tests
Bootloader	U-Boot • Power On Self Test • multi image support • loadable bootimage via e1000 and Octeon Ethernet ports (bootp/tftp) • loadable boot image via PCI Express (boot from RAM) • loadable boot image from onboard flash and flash disk connected via USB (boot from flash, boot from filesystem) • reliable field upgradable • KCS interface to MMC • serial console support
Operation System	• Linux Operating system on Octeon processor • Wind River Platform for Network Equipment 2.0 (PNE 2.0) Linux Edition board support package

Chapter 2

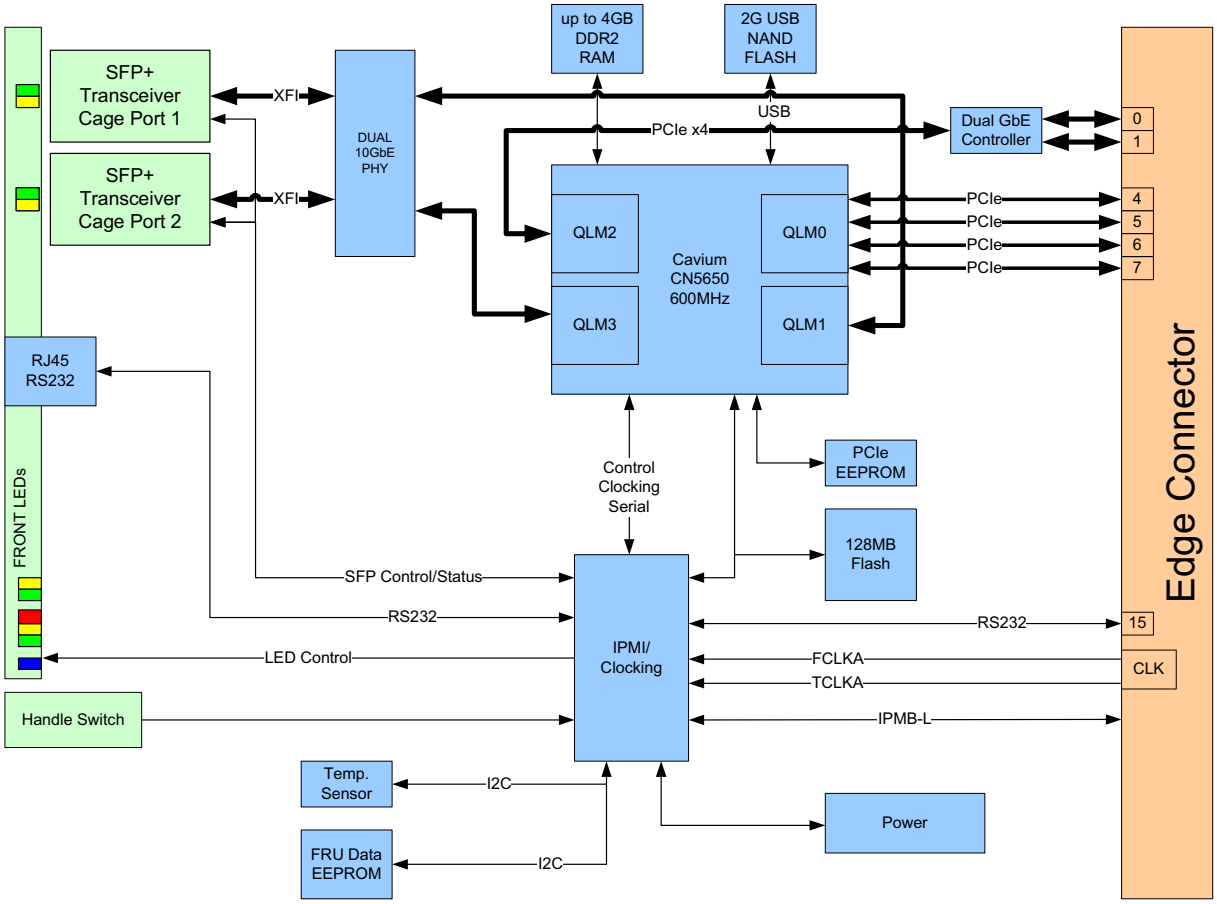
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2. Board Features

2.1 Block Diagram

Figure 2-1: Block Diagram



2.2 System Core

2.2.1 Cavium OCTEON Plus 5650

- 12x MIPS64 R2 Cores; 600Mhz
- Up to 14.4 Billion MIPS64 instructions per second • 16 high-speed SERDES, flexibly configured in blocks of 4
- Flexible combinations of PCI Express x4, x8, XAUI (10GE), SGMII (GbE/2GbE)
- Integrated coprocessors for application acceleration, including: Packet I/O processing, QoS, TCP Acceleration; Support for IPsec, SSL, SRTP, WLAN and 3G/UMB/LTE security (includes DES, 3DES, AES-GCM, AES up to 256, SHA1, SHA-2 up to SHA-512, RSA up to 8192, DH, KASUMI); and Compression/ Decompression with up to 10Gbps throughput and highest compression ratios.

2.3 USB Flash Module

The AM4220 supports Solid State Drive. It is a NAND flash disk module with a USB 2.0 interface. The module is socketed on a 2x5 header attached to the AM4220 PCB. Here are the main features:

- Many available sizes
- Mean-Time Between Failures (MTBF) of 5 millions hours
- 5 Years Useful Life under specific conditions
- Read throughput of 28MB/second
- Write throughput of 20MB/second
- I/O Operations per second of 100 (4KB random 2 Read + 1 Write)
- 5V operating voltage
- 0 to 70 Celsius operating temperature



Signal Path:
USB Flash Module Connector is located into the heatsink.

2.4 SFP+ Front IO

The two front SFP+ cage support multi-rate fiber SFP+ modules. The ports are numbered on the front panel overlay

Table 2-1: SFP Connections

SFP+	Connection
1	10 GbE xaui0
2	10 Gbe xaui1

SFP+ modules are not provided with the AM4220 and have to be obtained separately. The SFP+ uplink ports are compliant to the Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module “SFP+” MultiSource Agreement (MSA), February 16th 2007, and the Improved Pluggable Formfactor MSA, February 26th 2007. An application note with a list of SFP+ modules successfully operated by Kontron in the AM4220 is available upon request..

CAUTION LASER LIGHT!

Do not look into the laser beam!
The SFP+ modules are fitted with a class 1 or 1M laser. To avoid possible exposure to hazardous levels of invisible laser radiation, do not exceed maximum ratings.

Each SFP+ port has a bi-color green/amber LED with the following signification:

Table 2-2: SFP+ LED Significations

LED	Signification
Green on	Link 10Gbit
Green blink	Activity 10Gbit
Amber on	Link 1Gbit
Amber blink	Activity 1Gbit

2.5 Dual Gigabit Ethernet Controller

A dual Gigabit Ethernet controller is connected to PCIe port 2 of the Octeon Processor. The two GbE lines are connected to ports 0 and 1 of the AMC connector.

Signal Path:

The two GbE lines are connected to ports 0 and 1 of the AMC connector.

2.6 RS232 Management Interface

The RS232 interface of the Octeon is connected to the front panel RJ45 connector and to the AMC port 15 (RTM connection). If a terminal is connected to the front port, the RTM connection is disabled.

External connection is established with a straight through Ethernet cable and a RJ45 (female) to SubD (female) adapter if required. The adapter is described in the Appendix A.



Signal Path:
The serial port is available through the AMC faceplate.

2.7 IPMI

The AM4220 supports an intelligent hardware management system based on the Intelligent Platform Management Interface (IPMI) Specification 1.5. It provides the ability to manage the power, cooling and interconnect needs of intelligent devices, to monitor events and to log events to a central repository.

The MMC ("Module Management Controller") controls all hotswap and E-Keying processes required by ATCA. It activates the board power supply and enables communication with the AMC carrier and the RTM. The MMC manages the Ethernet switch E-Keying and the baseboard ATCA feature. The controller is connected to the IPMC of the ATCA carrier board via IPMB-L bus.

All voltages and currents on the base board are monitored by the MMC, including the management and AMC supply. Three temperature sensors on the board make sure that thermal conditions are met:

- Temp CPU (Cavium Internal Sensor)
- Temp Dual GE (i82571EB Ethernet Controller Internal Sensor)
- Temp Outlet

For more information on the thermal design and management, consult the "Thermal Consideration" section.

2.8 Power Supply

- Payload input voltage range from 10V to 14V
- Management input voltage range from 3.3V +/- 0.3V
- PoL converter 5.0V, 3.3V early, 3.3V, 1.8V, VTT, 1.2V, 1.1V, 1.0V
- Power up/down sequence controlled by CPLD

2.9 AMC Connector

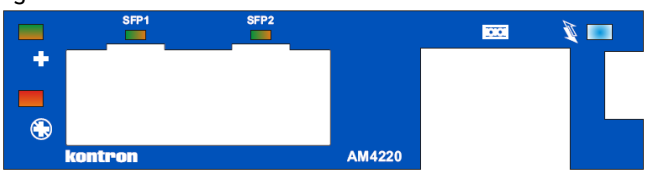
Table 2-3: AMC Connector

Port	Region	Connection
0	GbE	GbE eth0
1	GbE	GbE eth1
2	Storage	-
3	Storage	-
4	Fat Pipe	PCIe Port 0 (Lane 0)
5	Fat Pipe	PCIe Port 0 (Lane 1)
6	Fat Pipe	PCIe Port 0 (Lane 2)
7	Fat Pipe	PCIe Port 0 (Lane 3)
8	Fat Pipe	-
9	Fat Pipe	-
10	Fat Pipe	-
11	Fat Pipe	-
12	Extended	-
13	Extended	-
14	Extended	-
15	Extended	RS232
17	Extended	-
18	Extended	-
19	Extended	-
20	Extended	-
TCLKA	Clock	From Backplane
TCLKB	Clock	-
TCLKC	Clock	-
TCLKD	Clock	-
FCLKA	Clock	PCIe Reference Clock

Note:
The GbE interfaces on ports 8 to 11 are named eth2 to eth5 in the operating system and octeth0 to octeth3 in the bootloader.

2.10 Front Panel LEDs

Figure 2-2: Front Panel of AM4220



2.10.1 Hot Swap LED (Blue LED)

The AM4220 board supports a blue Hot Swap LED mounted on the front panel. This LED indicates when it is safe to remove the Module. The on-board MMC drives this LED to indicate the hot swap state but is controlled by the carriers IPMC or the MicroTCA carrier manager. The following states are possible:

Table 2-4: Hot Swap LED

LED state	Description
OFF	Module is in M3 or M4 state, normal state when module is in operation.
ON	Module is ready for hot swap
Short blink	Module is in M5 state (Deactivation Request) or in M6 state (Deactivation in progress)
Long blink	Activation in progress.

2.10.2 Out-Of-Service (OOS) LED (LED1)

Table 2-5: Red LED

LED state	Description
ON	1) The bootup handshake between FUM and MMC is not finished or failed 2) The firmware update is in progress and the new MMC firmware image is copied to the FUM 3) power denied from ShMgr
Blinking	The FUM is programming the MMC due to a firmware update or a rollback
OFF	The MMC is operational

2.10.3 Health LED (LED2)

Table 2-6: Amber/Green LED

LED state	Description
OFF	Payload power down
Green	Health OK
Amber	Health Error (Critical)
Application Defined	May be controlled by application using PICMG API

2.10.4 SFP+ LED

Table 2-7: Amber/Green LED

LED state	Description
Green On	Link 10 GBit
Green Blinks	Activity 10 Gbit
Amber On	Link 1 Gbit
Amber Blink	Activity 1 Gbit

Chapter 3

Installing the Board

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3. Installing the Board

3.1 Hot Swap Insertion Procedures

The AM4220 is designed for hot swap operation. Hot swapping allows the coordinated insertion and extraction of modules without disrupting other operational elements within the system. This allows for identified faulty elements to be removed and replaced without taking the carrier card out of service that will typically be hosting others modules.

The following procedures are applicable when inserting the AM4220 in a running system.

1 Ensure that the safety requirements are observed.

WARNING



Failure to comply with the instruction below may cause damage to the board or result in improper system operation.



2 Ensure that the board is properly configured for operation in accordance with application requirements before installing.

WARNING



Care must be taken when applying the procedures below to ensure that neither the AM4220 nor other system boards are physically damaged by the application of these procedures.



3 To install the AM4220 perform the following:

1 Carefully insert the board into the slot designated by the application requirements for the board until it makes contact with the AMC Card-edge connector located on the carrier or backplane.

2 Connect all external interfacing cables to the board as required.

3 Using the handle on the front panel, engage the board with the carrier or backplane. When the handle is locked, the board is engaged and the following steps occur:

1 The BLUE HS LED turns on.

If the carrier recognizes that the AM4220 is fully seated, the carrier then enables the management power for the AM4220 and the BLUE HS LED turns on.

2 Long blinks of the BLUE HS LED.

If the carrier IPMI controller detects the AM4220, it sends a command to the AM4220 to perform long blinks of the BLUE HS LED.

3 The BLUE HS LED turns off.

The Intelligent Platform Management Controller on the carrier reads the Module Current Requirements record and the AMC Point-to-Point Connectivity record. If the Module FRU information is valid and the carrier can provide the necessary payload power, the BLUE HS

LED will be turned off. If the module FRU information is invalid or the carrier cannot provide the necessary payload power, the insertion process is stopped and the BLUE HS LED keeps blinking. Should this problem occur, please contact Kontron's Technical Support.

4 Short blinks of the Module Management LEDs and the User-Specific LEDs.

The carrier enables the payload power for the AM4220, and the Module Management LEDs and the User-Specific LEDs emit a short blink.

5 Ensure that the board and all required interfacing cables are properly secured.

4 The AM4220 is now ready for operation. For operation of the AM4220, refer to appropriate AM4220-specific software, application, and system documentation.

3.2 Hot Swap Extraction Procedures

To extract the board proceed as follows:

1 Ensure that the safety requirements indicated in section 3.1 are observed. Particular attention must be paid to the warning regarding the heat sink!

2 Pull the handle on the AM4220's front panel initiating the deactivation. This changes the state of the handle to open. Now, the following steps occur:

1 Short blinks of the BLUE HS LED

- When the carrier IPMI controller receives the handle opened event, the carrier sends a command to the MMC with a request to perform short blinks of the BLUE HS LED. This indicates to the operator that the AM4220 is waiting to be deactivated.
- Now the AM4220 waits for a permission from higher level management (Shelf Manager or System Manager) to proceed with its deactivation.
- Once the AM4220 receives the permission to continue the deactivation, all used ports are disabled.
- The Intelligent Platform Management Controller on the Carrier disables the AM4220's Payload Power.

2 The BLUE HS LED turns on

Now the AM4220 is ready to be safely extracted.

3 Disconnect any interfacing cables that may be connected to the AM4220.

4 Pull the AM4220 out of the slot. Now the carrier disables the management power for the AM4220.

WARNING

Due care should be exercised when handling the board due to the fact that the heat sink can get very hot. Do not touch the heat sink when changing the board.

3.3 Software

The AM4220 comes as a pre-installed system with all necessary OS, Filesystem, drivers and applications factory-installed with default configurations.

Updating the Software with new Operating System or applications or new versions is provided by a dedicated update mechanism, which is described in “Firmware Administration”.

3.4 System access

This section gives instructions for accessing the AM4220 using either

- Serial port via front plate connector
- Serial port over an appropriate ATCA carrier board and RTM
- Telnet over Ethernet using the front plate SFP+ connector or AMC port 0
- SoL (Serial over LAN)

3.4.1 Front port serial connection

The Octeon processor’s serial console can be accessed directly via the front port connector with the appropriate cabling. The corresponding procedure is described in the following.

1 Connect to serial port on AM4220 front plate using the RS232 adapter, see “RS232 Management Interface”.

  Port settings are:

  - 115200 bps
  - 8 bit, no parity, 1 stop bit (8N1)
  - no flow control

2 Ensure that the boards are powered up.

3 Wait for boot process to complete. Login is not required by default:

```
BusyBox v1.2.1 (2008.09.15-08:10+0000) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

~ #
```

3.4.2 RTM serial connection

The serial console of the AM4220 can be accessed via RTM. The RTM to be used depends on the carrier board. Refer to the corresponding Kontron front board documentation to find information on the appropriate RTM.

As an example, the procedure for connecting to an AM4220 used in AMC slot B1 of an AT8404 via the RTM8030 is described in the following.

1 Connect to the RTM serial port as described in the RTM8030 manual (using a RJ45 straight cable).

Port settings are:

- 115200 bps
- 8 bit, no parity, 1 stop bit (8N1)
- no flow control

2 Enable serial connection of the AT8404 for usage with an RTM8030.

Access the AT8404 carrier shell (type “CTRL-v” from the CLI prompt and then “!”, enter root password “root” (default) and use the command “serialcfg” to route the RTM‘s serial port to the AMC slot which hosts the AM4220.

```
(AT8404 Ethernet Fabric) #
Disconnected from Base Fabric console

b - connect Base Fabric console
c - connect Custom Application console
! - shell escape
r - reset system

Starting shell
Give root password for system maintenance
(or type Control-D for normal startup):
System Maintenance Mode


BusyBox v1.4.1 (2009-07-23 18:10:23 CEST) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

# serialcfg

usage: serialcfg fru1/fru2/fru3/fru4
       Enable T5516 serial line for FRU1-4, i.e. AMCB1-B4
usage: serialcfg FILENAME
       Enable serial line with portstate config file FILENAME

# serialcfg fru1
Serial AMCB1 to RTM rotary switch channel 4
Enabling ports for FRU 1
```

3 Set the RTM’s rotary switch as indicated by the serialcfg tool output (in this example switch channel 4).

4 Close AM4220 handle or power up.

5 Wait for boot process to complete. Login is not required by default:

```
BusyBox v1.2.1 (2008.09.15-08:10+0000) Built-in shell (ash)
```

```
Enter 'help' for a list of built-in commands.

~ #
```

3.4.3 Access over Ethernet Interface

The AM4220 can be accessed by using the Ethernet Interface AMC port 0 (eth0).

By default, DHCP is configured for this Interface.

There is also a possibility to access the AM4220 using one of the SFP+ on the front plate. Both interfaces are not configured by default and must be setup accordingly by editing the file /mnt/etc/rc.local.

3.4.4 Using SoL over AMC Port 0 on AM4220

3.4.4.1 Requirements

- AM4220
- ATCA carrier or uTCA System providing access to AMC connector port 0
- Linux host with Ethernet interface
- SFP+ module for Ethernet connection to the Linux host
- ipmitool v1.8.9 (http://ipmitool.sourceforge.net/)

3.4.4.2 Configure IOL (IPMI over LAN)

In preparation for configuring SOL, the IOL interface has to be configured first. This is done by establishing a telnet connection via SFP1.

The interface SFP1 has a fixed configured IP address: 192.168.0.100

The Ethernet interface of the Linux host must be configured for accessing the IP address 192.168.0.100. An IP connection from the Linux host to SFP 1 of the AM4220 must be possible.

Connect to the AM4220 via telnet

Check board information (optional)

```
~ # /mnt/bin/ipmitool mc info
Device ID                 : 6
Device Revision           : 0
Firmware Revision         : 5.24
IPMI Version              : 1.5
Manufacturer ID           : 15000
Manufacturer Name         : Kontron
Product ID                : 5516 (0x158c)
Device Available          : yes
Provides Device SDRs      : yes
```

```
Additional Device Support :
    Sensor Device
    FRU Inventory Device
    IPMB Event Receiver
    IPMB Event Generator
    Chassis Device
Aux Firmware Rev Info     :
    0x00
    0x00
    0x00
    0x00
~ #
```

Check LAN settings on the Ethernet interface to be configured for IOL (optional). At this time, this can only be the eth0 (which is connected to AMC port 0). Default settings are shown below:

```
~ # /mnt/bin/ipmitool lan print 1
Set in Progress         : Set Complete
Auth Type Support       : NONE PASSWORD
Auth Type Enable        : Callback :
                        : User     : NONE PASSWORD
                        : Operator : PASSWORD
                        : Admin    : PASSWORD
                        : OEM      :
IP Address Source       : Static Address
IP Address              : 0.0.0.0
Subnet Mask             : 0.0.0.0
MAC Address             : 00:a0:a5:5d:23:9e
IP Header               : TTL=0x40 Flags=0x40 Precedence=0x00 TOS=0x10
BMC ARP Control         : ARP Responses Enabled, Gratuitous ARP Enabled
Gratituous ARP Intrvl   : 8.0 seconds
Default Gateway IP      : 0.0.0.0
Default Gateway MAC     : 00:00:00:00:00:00
RMCP+ Cipher Suites     : 0,1,2,3
Cipher Suite Priv Max   : uaaaXXXXXXXXXX
                        :     X=Cipher Suite Unused
                        :     c=CALLBACK
                        :     u=USER
                        :     o=OPERATOR
                        :     a=ADMIN
                        :     O=OEM
~ #
```

Configure LAN IOL IP parameters of the Ethernet interface eth0. The address given below is an example. The actual address must fit the existing network configuration:

```
~ # /mnt/bin/ipmitool lan set 1 ipaddr 10.0.1.145
Setting LAN IP Address to 10.0.1.145
~ #
~ # /mnt/bin/ipmitool lan set 1 netmask 255.255.255.0
Setting LAN Subnet Mask to 255.255.255.0
```

Configure LAN IOL gateway parameters of eth0. They describe the gateway connected to AMC port 0. The IP and MAC addresses given below are examples and must be replaced by the actual values:

```
~ # /mnt/bin/ipmitool lan set 1 defgw ipaddr 10.0.1.1
Setting LAN Default Gateway IP to 10.0.1.1
~ #
~ # /mnt/bin/ipmitool lan set 1 defgw macaddr 00:15:C5:60:74:AE
Setting LAN Default Gateway MAC to 00:15:c5:60:74:ae
```

Enable IOL interface on eth0:

```
~ # /mnt/bin/ipmitool lan set 1 access on
~ #
```

Now all configuration required for IOL connection from an external host via eth0 is done.

3.4.4.3 Configure SoL

The Linux host must now be configured to connect to eth0 (AMC port 0) of the AM4220. This is dependant on the actual network topology.

Ipmitool executed on the external Linux host to check connectivity to AM4220 via the previously configured IOL interface (optional). Following parameters have to be provided:

- -H <IoL IP address as configured above>
- -U <username>

  default: admin
- -P <password>

  default: admin

```
[root@router01 ipmitool-1.8.9]# ipmitool -I lanplus -H 10.0.1.145 -U admin -P admin mc info
Device ID                 : 6
Device Revision           : 0
Firmware Revision         : 5.24
IPMI Version              : 1.5
Manufacturer ID           : 15000
Manufacturer Name         : Kontron
Product ID                : 5516 (0x158c)
Device Available          : yes
Provides Device SDRs      : yes
Additional Device Support :
    Sensor Device
    FRU Inventory Device
    IPMB Event Receiver
    IPMB Event Generator
    Chassis Device
Aux Firmware Rev Info     :
    0x00
    0x00
    0x00
    0x00
```

Show SoL settings (optional):

```
[root@router01 ipmitool-1.8.9]# src/ipmitool -I lanplus -H 10.0.1.145 -U admin -P admin sol
info
Set in progress                 : set-complete
Enabled                         : true
Force Encryption                : false
Force Authentication            : false
Privilege Level                 : USER
Character Accumulate Level (ms) : 50
Character Send Threshold        : 30
Retry Count                     : 0
Retry Interval (ms)             : 100
```

```
Volatile Bit Rate (kbps)        : 19.2
Non-Volatile Bit Rate (kbps)    : 19.2
Payload Channel                 : 1 (0x01)
Payload Port                    : 623
```

Adjust serial baud-rate to 115.2 kBaud (required):

```
[root@router01 ipmitool-1.8.9]# src/ipmitool -I lanplus -H 10.0.1.145 -U admin -P admin sol
set non-volatile-bit-rate 115.2
```

Connect to AM4220 serial interface via SOL:

```
[root@router01 ipmitool-1.8.9]# src/ipmitool -I lanplus -H 10.0.1.145 -U admin -P admin sol
activate
[SOL Session operational.  Use ~? for help]

~ #
```

Check board information (optional).:

```
~ #  /mnt/bin/ipmitool fru
FRU Device Description : Builtin FRU Device (ID 0)
 Board Mfg             : Kontron
 Board Product         : AM4220
 Board Serial          : 1000749470
 Board Part Number     : T5516AB##
 Board Extra           : MAC=00:A0:A5:5D:23:9E/10
 Product Manufacturer  : Kontron
 Product Name          : AM4220
 Product Part Number   : T5516AB##
 Product Version       : 00
 Product Serial        : 1000749470
 Product Asset Tag     : 0000000000

~ #
```

The following example shows parts of a serial output of the boot process:

```
~ #
~ # reboot
The system is going down NOW !!
Jan  1 00:30:36 (none) daemon.info init: The system is going down NOW !!
Sending SIGTERM to all processes.
Jan  1 00:30:36 (none) daemon.info init: Sending SIGTERM to all processes.
Jan  1 00:30:36 (none) syslog.info System log daemon exiting.
Requesting system reboot.
128)
Restarting system.


U-Boot 1.1.1 (Development build) (Build time: Jun  5 2008 - 17:05:55)

Measured DDR clock 399.96 MHz
CUST_KONTRON_T5516 board revision major:0, minor:0, serial #:
OCTEON CN5750-SSP pass 1.1, Core clock: 600 MHz, DDR clock: 400 MHz (800 Mhz data rate)
PLD version: 4 Board Type: 0 Board Option: 2 Board Revision: 0
Performing MMC handshake ...done
Reset Type: 00 warm reset, Source: 08 Software Initiated
DRAM:  2048 MB
Flash: 128 MB

[...]
```

```
/sbin/rc starting
Updating module dependencies
Loading IPv6 module
Mounting file systems
Setting up loopback
Starting syslogd
Jan  1 00:00:06 (none) syslog.info syslogd started: BusyBox v1.2.1
Starting telnetd
Mounting /dev/mtd4 to /mnt
Execute /mnt/etc/rc.local
cavium-ethernet: Cavium Networks Octeon SDK version 1.8.1, build 244
Interface 0 has 4 ports (SGMII)
Interface 1 has 4 ports (SGMII)
Interface 3 has 4 ports (LOOP)
Configure eth6 / SFP0 for IP 192.168.0.100/24
Start DHCP client on eth0 / AMC Port 0
udhcpc (v1.2.1) started

[...]

adding dns 192.168.50.2
/sbin/rc Jan  1 00:00:09 (none) daemon.info init: Starting pid 904, console /dev/ttyS0: '/
bin/sh'


BusyBox v1.2.1 (2008.06.05-14:58+0000) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

~ #
```

The connection is terminated by pressing the escape character sequence "~." (without quotes).



Note:
SoL over AMC port 0 (Intel 82571EB) will only work with AT8050, AT8030, AT8404, AT8402 and AT890xM, using an AT8010 or AT8020 it will not work, since there is no GbE on Port 0 available.

3.5 Using the cfgtool

A tool to configure the CPU settings will be provided. This tool shall configure the strapping options, apply the changes to the MMC and update the E-keying information in the Multi-Record section of the FRU data. The MMC is responsible for saving and restoring these settings.

- The cfgtool allows to configure the PCIe settings.
- The cfgtool allows to configure the QLM 1 and QLM 3 settings.
- The cfgtool allows to perform a validly check before setting the new configuration.
- The cfgtool allows to update the e-keying information related to the performed changes.
- The cfgtool allows to update the e-keying information to meat the "multi flavor" settings.
- The cfgtool allows to change the multirecord area when updating the e-keying information.
- The cfgtool allows to configure PCIe clock source.

3.5.1 Usage

```
cfgtool  [--help|-h][--status|-t][--interface|-i][--pcie|-p][--clock|-k][--set|-s][--cycle|-
c][--nofru|-n][--debug|-d]
```

The following options are recognized:

```
-h       show possible settings available for this board
-t       show current running configuration
-i <num> Interface setting
-p <num> PCIe setting
-k <num> clock setting
-s       set configuration (change HW setting and update ekeying info)
-c       perform power cycle of payload power to activate settings
-n       no FRU data modification
-d       debug flag
```

Detailed description of these options:

- -h | --help

  This option shows a list of possible settings.

- -t | --status

  This option shows the present configuration stored in NV ram of the MMC. This setting will take affect after invoking a “Chassis Control Power cycle” command or after a complete hotswap cycle with remove and reinsertion of the module.

- -I | --interface <INTF>

  This option checks if the setting <INTF> is possible for this board. To set this setting the [–s|--set] options has to be appended.

- -p | --pcie <PCIE>

  This option checks if the setting <PCIE> is possible for this board. To set this setting the [–s|--set] options has to be appended.

- -k | --clock <CLOCK>

  This option checks if the setting <CLOCK> is possible for this board. To set this setting the [-s|--set] options has to be appended.

- -s | --set

  This option set the configuration in the MMCs NV ram, updates the FRU data multirecord and performs a MMC reset (IPMI Cold Reset).

- -c | --cycle

  This option send the IPMI command “Chassis control Power cycle” to the MMC to perform a payload power cycle. During the power cycle the configuration will be enabled. This option is allowed without any other options or when a valid PCIe or Interface setting is configured and activated with the [–s|--set] option.

- -n | --nofru

  This option prevent FRU data update when changing an interface, pcie, or clock setting (obsolete)

- -d | --debug

  This option sets the debug level. If this option is used twice the debug level is increased.

In case there is no possibility to boot over PCIe, the customer should check settings before doing a power cycle to avoid boot problems:

```
cfgtool -s -p 2
```

Verify with :

```
cfgtool -t
```

and if OK:

```
cfgtool -c
```

Chapter 4

Thermal Considerations

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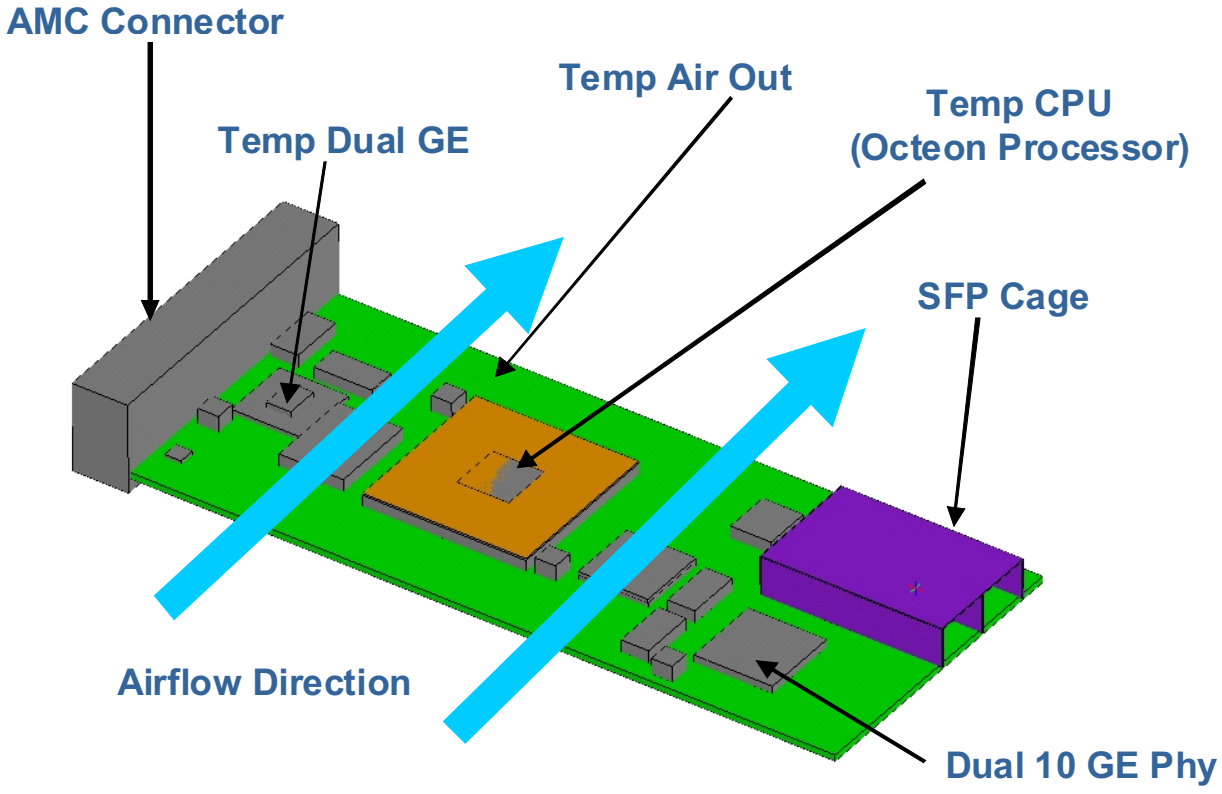
4. Thermal Considerations

4.1 Thermal Monitoring

To ensure optimal operation and long-term reliability of the AM4220, all onboard components must remain within the maximum temperature specifications. The most critical components on the AM4220 are the processor and the Dual GE Phy. Operating the AM4220 above the maximum operating limits will result in permanent damage to the board. To ensure functionality at the maximum temperature, the Module Management Controller supports several temperature monitoring and control features.

The AM4220 includes three temperature sensors that are accessible via the Module Management Controller. Although temperature sensing information is made available to the MMC, the AM4220 itself does not provide any active means of temperature regulation.

Figure 4-1:Temperature Sensor Locations (AM4220 Top View, heat sinks not shown)



The Temp CPU and the Temp Dual GE sensors are on-chip sensors which measure the die temperature of the Octeon Processor and the Dual GE PHY. The Temp Air Out sensor is a separate sensor measuring the temperature in the slipstream of the processor. This is the spot with the highest outlet air temperature. The Dual 10 GE Phy does not have a sensor. Simulations show that its temperature remains uncritical under operating conditions compared to the processor. The separate heat sink on the 10 GE Phy ensures thermal decoupling from the processor.

The following table shows the temperature thresholds of all three sensors.

Table 4-1:MMC Temperature Sensors Thresholds

Sensor	Lower Non Recoverable	Lower Critical	Lower Non Critical	Upper Non Critical	Upper Critical	Upper Non Recoverable
Temp Air Out	- 10°C	- 5°C	+ 0°C	+ 85°C	+ 90°C	+ 95°C
Temp CPU	- 10°C	- 5°C	+ 0°C	+ 105 °C	+ 110°C	+ 115°C
Temp Dual GE	- 10°C	- 5°C	+ 0°C	+ 105 °C	+ 110°C	+ 115°C

Temperature values are measured with an accuracy of 1°C.

4.2 External Thermal Regulation

The external thermal regulation of the AM4220 is realized using a dedicated heat sink design in conjunction with a system chassis that provides thermal supervision, controlled system airflow and thermal protection, such as increased airflow, reduced ambient air temperature, or power removal.

The heat sink provided on the AM4220 has been specifically designed to ensure the best possible basis for operational stability and long-term reliability. The physical size, shape, and construction of the heat sink ensure the lowest possible thermal resistance. In addition, it has been specifically designed to efficiently support forced airflow concepts as found in modern AMC carriers and MicroTCA systems.

4.2.1 Forced Airflow

When developing applications using the AM4220, the system integrator must be aware of the overall system thermal requirements. All system chassis requirements must be provided to make sure they satisfy these requirements. As an aid to the system integrator, characteristics graphs are provided for the AM4220.

WARNING

As Kontron assumes no responsibility for any damage to the AM4220 or other equipment resulting from overheating any of the components, it is highly recommended that system integrators as well as end users confirm that the operational environment of the AM4220 complies with the thermal considerations set forth in this document.

4.2.2 Thermal Characteristic Graphs

The thermal characteristic graph shown on the following pages illustrates the maximum ambient air temperature as a function of the linear airflow rate for the power consumption indicated. The diagram is intended to serve as guidance for reconciling board and system considering the thermal aspect. When operating below the indicated curves, the AMC runs steadily without any intervention of thermal supervision. When operated above the indicated curves, various thermal protection mechanisms may take effect eventually resulting in an emergency stop in order to protect the AMC from thermal destruction. In real applications this means that the board can be operated temporarily at a higher ambient temperature or at a reduced flow rate and still provide some margin for temporarily requested peak performance before thermal protection will be activated.

4.2.2.1 How to read the diagram

The diagram contains one curve for 80% thermal load and one for 100%. Full thermal load is not expected to be reached under real operating conditions. For a given flow rate there is a maximum airflow input temperature (= ambient temperature) provided. Below this operating point, a safe operation is guaranteed. Above this operating point, the chassis thermal management must become active and take the necessary steps to protect the AMC from thermal destruction.

4.2.2.2 Airflow

At a given cross-sectional area and a required flow rate, an average, homogeneous airflow speed can be calculated using the following formula:

Airflow = Volumetric flow rate / area.

The airflow is specified in m/s = meter-per-second or in LFM = linear-feet-per-minute, respectively.

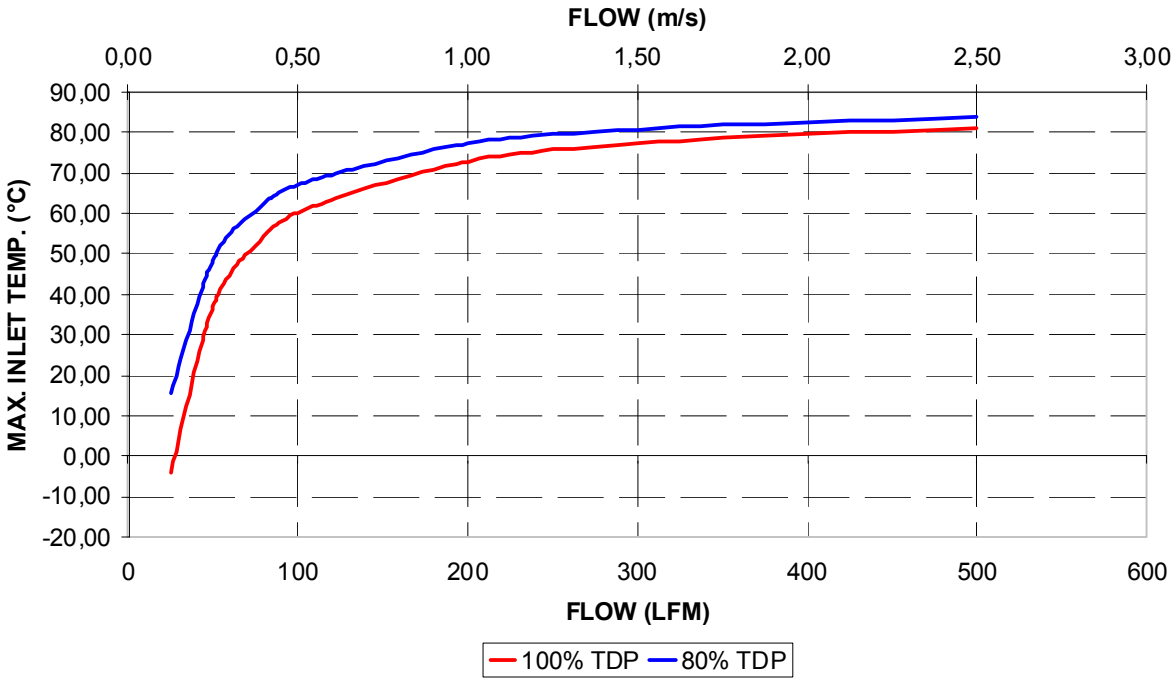
Conversion: 1 LFM = 0.00508 m/s; 1 m/s = 196.85 LFM

The following figure illustrates the operational limits of the AM4220 taking into consideration power consumption vs. ambient air temperature vs. airflow rate. The values are based on simulation data taking into account the actual power values of all components.

WARNING

In all situations, the maximum specified case temperature of the components must be kept below the maximum allowable temperature.

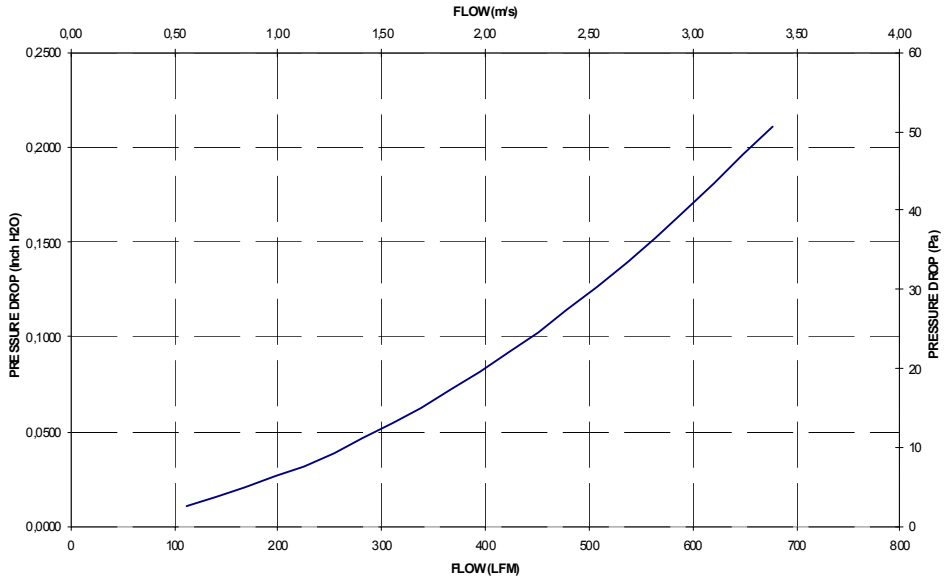
Figure 4-2:Operational Limits for the AM4220



4.2.3 Airflow Impedance

In order to determine the cooling requirements of the AM4220, the airflow impedance of the module has been determined via simulation. No card guides or struts have been used for the simulations because the resulting airflow impedance depends on individual configuration of the AMC carrier or MicroTCA system.

Figure 4-3:AM4220 Impedance Curve



4.2.4 Airflow Paths

The area between the front panel and the AMC Card-edge connector is divided into five zones, one I/O zone and four uniform thermal zones, A, B, C, and D. The PICMG AMC.0 Specification states that the uniformity of the airflow paths' resistance should provide an impedance on the A, B, C, and D zones that is within ± 25% of the average value of the four thermal zones.

Figure 4-4:Thermal Zones of the AM4220

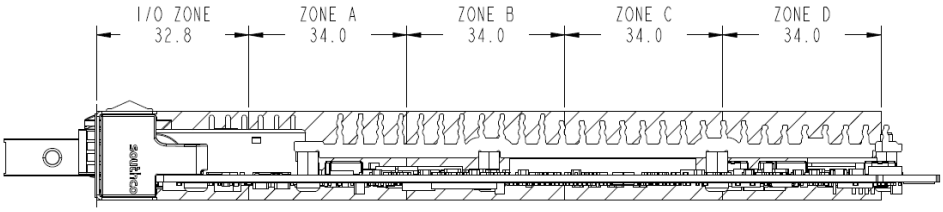


Table 4-2:Deviation of the Airflow Rate on the AM4220

Inlet Velocity			Deviation (%)			
CFM	m/s	LFM	ZONE A	ZONE B	ZONE C	ZONE D
5	0.57	112.8	-11.71	8.25	6.16	-2.70
10	1.15	225.7	-9.46	6.64	5.03	-2.21
15	1.72	338.5	-8.85	5.63	5.09	-1.88
20	2.29	451.4	-8.14	5.13	4.72	-1.71
25	2.87	564.2	-7.72	4.82	4.50	-1.61
30	3.44	677.1	-7.17	4.62	4.35	-1.81



Note:
The Mid-size AM4220 module has an airflow rate deviation of max. ± 11.7% of the average value of the four thermal zones (max. ± 25% is allowed).
Positive deviation means increased airflow.
Negative deviation means decreased airflow.

Chapter 5

Software Setup

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5. Software Setup

Software on the AM4220 includes the following parts:

- Bootloader
- OS (rootFS, kernel)
- MMC FW

5.1 MMC Firmware

The Module Management Controller (MMC) is a crucial component of any AMC module. Besides acting as a regular IPMI management controller (sensor monitoring, event generation, etc.), it also provides an interface to all necessary data related to module power requirements and implemented interfaces (E-Keying). Further, it plays an active role in the module hot swap state management. The carrier IPMI Controller (IPMC) communicates with the MMC using the local IPMB (IPMB-L) bus. In an ATCA/AMC environment, it is the IPMC that actually turns on/off module (payload) power. However, before the IPMC enables the module payload power, various criteria must be satisfied by both the carrier and the module, including handle switch state, power requirements and capabilities, matching interfaces, current module hot swap state, and any other special conditions as specified by the Shelf Manager policy.

5.1.1 Related Documentation

IPMI specifications: (http://www.intel.com/design/servers/ipmi/spec.htm)

- IPMI-Intelligent Platform Management Interface Specification. Second Generation v2.0, February 12, 2004 (part)
- IPMI- Platform Management FRU Information Storage Definition v1.0, Document Revision 1.1, September 1999

PICMG specifications: http://www.picmg.org

- PICMG® AMC.0 R2.0 - Advanced Mezzanine Card Base Specification
- PICMG® AMC.1 R1.0 - PCI Express and Advanced Switching on AdvancedMC
- PICMG® AMC.2 R1.0 – AMC Gigabit Ethernet/10 Gigabit XAUI Ethernet

Open tools documentation

- Ipmitool documentation: http://ipmitool.sourceforge.net
- OpenIPMI documentation: http://www.openipmi.sourceforge.net

The AM4220 is built in accordance to the AMC.0 R2.0 specification, and is also AMC.1 and AMC.2 compliant and is easily managed via IPMI v1.5/v2.0.

5.1.2 IPMI Sensors

The MMC includes many sensors for voltage or temperature monitoring and various others for pass/fail type signal monitoring.

Every sensor is associated with a Sensor Data Record (SDR). Sensor Data Records contain information about the sensors identification such as sensor type, sensor name and sensor unit. SDRs also contain the configuration of a specific sensor such as threshold/hystheresis, event generation capabilities that specifies sensor behavior. Some field of the sensor SDR are configurable through IPMI v1.5 command and are set to built-in initial values. Finally one field which is the sensor owner must reflect the module addresses that allow the AMC Carrier to identify the owner of the SDR when it is scanned from the module management controller and merged within the AMC Carrier Device SDR repository.

From an IPMI perspective, the MMC is set up as a satellite management controller (SMC). It does support sensor devices, and uses the IPMI static sensor population feature of IPMI v1.5. All SDRs can be queried using Device SDR commands to the MMC.

The sensor name in its SDR has a name prefix which after module insertion is automatically adapted to the physical position of the module in a carrier or in a µTCA chassis. The format of this prefix is:

- in AMC bay 1...8 or µTCA slot 1...8: 'A1:', 'A2:', 'A3:', 'A4:', 'B1:', 'B2:', 'B3:', 'B4:'.
- in µTCA slot 9...12: 'C1:', 'C2:', 'C3:', 'C4:'.

Please note that in the case that the module is installed elsewhere, then the IPMB-L address of the module is unknown and the interface is off.

Module sensors that have been implemented are listed in the sensor list below.

Table 5-1:Sensor list

SDR ID	Name	Sensor Type Code	Reading Type Code	Description	Event Offset
1	B1:IPMI Info-1	C0h (OEM Kontron)	6Fh (Sensor Specific)	Firmware Debug sensor	
2	B1:IPMI Info-2	C0h (OEM Kontron)	6Fh (Sensor Specific)	Firmware Debug sensor	
3	B1:FRU Agent	C5h (OEM Kontron FRU Info Agent State)	0Ah (Discrete)	For additional information, refer to section Kontron FRU Info Agent	Offset 6: transition to Degraded Offset 8: Install Error
4	B1:ModuleHotSwap	F2h (Module Hot Swap)	6Fh (Sensor Specific)	Refer to AMC.0 specification.	Offset 0: Module Handle Closed Offset 1: Module Handle Opened Offset 2: Quiesced Offset 3: Backend Power Failure Offset 4: Backend Power Shutdown Refer to AMC.0 R2.0 Section 3.6.6 Module Hot Swap Sensor.

SDR ID	Name	Sensor Type Code	Reading Type Code	Description	Event Offset
5	B1:IPMBL State	C3h (OEM Kontron)	6Fh (Sensor Specific)	For additional information, refer to section Kontron IPMB-L Link	Offset 0: IPMB-L disabled Offset 1: IPMB-L enabled Offset 2: IPMB-L disabled Offset 3: IPMB-L enabled
6	B1:MMC Stor Err	28h (Management Subsystem Health)	6Fh (Sensor Specific)	Generates an event when a local EEPROM storage error is detected.	See IPMI v1.5 table 36.3, Sensor type code 28h for sensor definition
7	B1:MMC Reboot	24h (Platform Alert)	03h (Generic Discrete)	Generates an event when MMC reboot is detected.	Offset 0: State Deasserted Offset 1: State Asserted
8	B1:MMC FwUp	CAh (OEM Kontron External Component Firmware Upgrade Status)	6Fh (Sensor Specific)	Generates event after IPMI Firmware upgrade process is finished.	Offset 0: Firmware upgrade in progress (no event) Offset 1: Firmware upgrade succeeded Offset 2: Firmware upgrade failed
9	B1:Ver change	2Bh (Version Change)	6Fh (Sensor Specific)	Generates an event when the IPMI FW changes	Offset 1: IPMI Firmware changed
10	B1:IPMI Watchdog	23h (Watchdog 2)	6Fh (Sensor Specific)	Generates event when IPMI watchdog bites. For closer information refer to IPMI v1.5 specification.	See IPMI v1.5 table 36.3, Sensor type code 23h (Watchdog 2) for sensor definition and event trigger Event Data 1: [7:6] – 11b sensor specific ext. code in byte 2 [5:4] – 00b unspecified [3:0] – Offset 0h 1h 2h 4-7h 8h Event Data 2: [7:4] – interrupt type [3:0] – timer use at expiration 0h – reserved 1h – BIOS/FRB2 2h – BIOS/POST 3h – OS Load 4h – SMS/OS 5h - OEM Event Data 3: always FFh
11	B1:CPU Reset	CFh (OEM Kontron Reset)	03h (Sensor Specific)	Generates an event when CPU is released from reset. The reset type and reset source is encode in the event data.	For additional information, refer to section Kontron Reset

SDR ID	Name	Sensor Type Code	Reading Type Code	Description	Event Offset
12	B1:Temp Air Out	01h (Temperature)	01h (Threshold Based)	Temperature Sensor of the outlet region	Sensor is only readable when Payload Power is on
13	B1:Temp CPU	01h (Temperature)	01h (Threshold Based)	Temperature Sensor of the CPU	Sensor is only readable when Payload Power is on
14	B1:Temp Dual GE	01h (Temperature)	01h (Threshold Based)	Temperature Sensor of the dual GE device (i82571EB Ethernet Controller)	Sensor is only readable when Payload Power is on.
15	B1:Vcc 1.0V	02h (Voltage)	01h (Threshold Based)	Voltage on 1.0v board power supply	Sensor is only readable when Payload Power is on.
16	B1:Vcc 1.0V BCM	02h (Voltage)	01h (Threshold Based)	Voltage on 1.0v board power supply	Sensor is only readable when Payload Power is on. (only valid for AM4220)
17	B1:Vcc 1.1V	02h (Voltage)	01h (Threshold Based)	Voltage on 1.1v board power supply	Sensor is only readable when Payload Power is on.
18	B1:Vcc 1.2V	02h (Voltage)	01h (Threshold Based)	Voltage on 1.2v board power supply	Sensor is only readable when Payload Power is on.
19	B1:Vcc 1.8V	02h (Voltage)	01h (Threshold Based)	Voltage on 1.8v board power supply	Sensor is only readable when Payload Power is on.
20	B1:Vcc 3.3V	02h (Voltage)	01h (Threshold Based)	Voltage on 3.3v board power supply	Sensor is only readable when Payload Power is on.
21	B1:Vcc 3.3V SUS	02h (Voltage)	01h (Threshold Based)	Voltage on 3.3v suspend (management) power supply	Sensor is only readable when Payload Power is on. (only valid for AM4204)
23	B1:Vcc 12V	02h (Voltage)	01h (Threshold Based)	Voltage on 12v board power supply	Sensor is only readable when Payload Power is on.
24	B1:Health Error	24h (Platform Alert)	03h (Generic Discrete)	The sensor is an aggregation of analog sensors and shows the healthy state of the module. If the sensor is asserted, the health LED lit on amber	Offset 0: no critical sensors asserted Offset 1: one or multiple critical sensors are asserted See table: Health Sensor list for details.
25	B1:Pres SFP-1	25h (Entity Present)	6Fh (Sensor specific)	The sensor shows presents or absents of SFP. No event is generated.	Offset 0: Entity Present Offset 1: Entity Absent Offset 2: Entity Disabled Sensor is only readable when Payload Power is on. (available for AM42xx)
26	B1:Pres SFP-2	25h (Entity Present)	6Fh (Sensor specific)	The sensor shows presents or absents of SFP. No event is generated.	Offset 0: Entity Present Offset 1: Entity Absent Offset 2: Entity Disabled Sensor is only readable when Payload Power is on. (only available for AM4204 and AM4220)

SDR ID	Name	Sensor Type Code	Reading Type Code	Description	Event Offset
27	B1:Pres SFP-3	25h (Entity Present)	6Fh (Sensor specific)	The sensor shows presents or absents of SFP. No event is generated.	Offset 0: Entity Present Offset 1: Entity Absent Offset 2: Entity Disabled Sensor is only readable when Payload Power is on. (only available for AM4204)
28	B1:Pres SFP-4	25h (Entity Present)	6Fh (Sensor specific)	The sensor shows presents or absents of SFP. No event is generated.	Offset 0: Entity Present Offset 1: Entity Absent Offset 2: Entity Disabled Sensor is only readable when Payload Power is on. (only available for AM4204)
29	B1:Post Value	C6h (OEM Kontron Post Value)	6Fh (Sensor specific)	When bootloader postvalue is not 0 the sensor shows the result value code.	Offset 14: Event Data 2: <POST Value> Event Data 3: 00h undef
30	B1:Post Error	0Fh (System Firmware Progress)	6Fh (Sensor specific)	Generates an event when a POST error occurred	Offset 0: event data 2: 00h (unspecified): event trigger, A Boot monitor POST failure
31	B1:Boot Error	1Eh (Boot Error)	6Fh (Sensor specific)	Generates an event when an system boot error is detected	Offset 0: Offset 3:
32	B1:Diag Status	C9h (OEM Kontron)	6Fh (Sensor specific)	Generates an event when Diagnostic is finished.	Offset 0: Diagnostic Started Offset 1: Diagnostic PASS Offset 2: Diagnostic FAIL
33	B1:Fwupg Status	CAh (OEM Kontron External Component Firmware Upgrade Status)	6Fh (Sensor specific)	Generates event in case of passed or failed User SW upgrade process.	Offset 0: Firmware upgrade in progress (no event) Offset 1: Firmware upgrade succeeded Offset 2: Firmware upgrade failed

5.1.2.1 OEM sensor description

5.1.2.1.1 Kontron FRU Info Agent

Table 5-2:Kontron FRU info agent sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
0Ah	C5h OEM Kontron FRU Info Agent	06h	Transition to degraded Event Data 2 is used a bit flag error Bit 7: unspecifiedError Bit 6: notPresentError Bit 5: multirecHeaderError Bit 4: multirecDataError Bit 3: timeout error Bit 2: ipmcError Bit 1: fruDataError Bit 0: commonHeaderError Event Data 3 is used a bit flag error Bit 7: reserved Bit 6: reserved Bit 5: SetPortState Not Supported Bit 4: SetPortState Error Bit 3: reserved Bit 2: reserved Bit 1: reserved Bit 0: Match Error, Not in single link matches
		08h	Install Error Event Data 2 is used a bit flag error Bit 7: unspecifiedError Bit 6: notPresentError Bit 5: multirecHeaderError Bit 4: multirecDataError Bit 3: timeout error Bit 2: ipmcError Bit 1: fruDataError Bit 0: commonHeaderError Event Data 3 is used a bit flag error Bit 7: SetClockState Not Supported Bit 6: SetClockState Error Bit 5: SetPortState Not Supported Bit 4: SetPortState Error Bit 3: Clock Internal Mismatch Bit 2: Clock Match Error, Not a single clock matches Bit 1: Internal mismatch Bit 0: Match Error, Not in single link matches

5.1.2.1.2 Kontron IPMB-L Link

Table 5-3:Kontron IPMB-L Link sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
6Fh	C3h OEM Kontron IPMB-L Link	02h	IPMB-L Disable Event Data 2: always 0 Event Data 3: bit[7:3]: always 0 bit [2:0]: 0h = no failure 1h = Unable to drive clock HI 2h = Unable to drive data HI 3h = Unable to drive clock LO 4h = Unable to drive data LO 5h = clock low timeout 6h = Under test (the IPM Controller is attempting to determine who is causing a bus hang) 7h = Undiagnosed Communication Failure
		03h	IPMB-L Enable Event Data 2: always 0 Event Data 3: bit[7:3]: always 0 bit [2:0]: 0h = no failure 1h = Unable to drive clock HI 2h = Unable to drive data HI 3h = Unable to drive clock LO 4h = Unable to drive data LO 5h = clock low timeout 6h = Under test (the IPM Controller is attempting to determine who is causing a bus hang) 7h = Undiagnosed Communication Failure

5.1.2.1.3 Kontron MMC Firmware Upgrade Status

Table 5-4:Kontron MMC FW upgrade status sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
6Fh	CAh OEM Kontron External Component Firmware Upgrade Status	00h	Firmware Upgrade in Progress (no event)
		01h	Firmware upgrade succeeded
		02h	Firmware upgrade failed

5.1.2.1.4 Kontron Reset

Table 5-5:Kontron reset sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
03h	CFh OEM Kontron RESET	00h 01h State Asserted / State Deasserted	Event Data 2: Reset Type 00h: Warm reset 01h: Cold reset 02h: Forced Cold [Warm reset reverted to Cold] 03h: Soft reset [Software jump] Event Data 3: Reset Source 00h: IPMI Watchdog [cold, warm or forced cold] (IPMI Watchdog2 sensors gives dditional details) 01h: IPMI commands cold, warm or forced cold] (chassis control, fru control) 02h: Processor internal checkstop 03h: Processor internal reset request 04h: Reset button [warm or forced cold] 05h: Power up [cold] 06h: Legacy Initial Watchdog / Warm Reset Loop Detection * [cold reset] 07h: Legacy Programmable Watchdog [cold, warm or forced cold] 08h: Software Initiated [soft, cold, warm of forced cold] 09h: Setup Reset [Software Initiated Cold] FFh: Unknown

5.1.2.1.5 Kontron POST Code Value

Table 5-6:Kontron POST code value sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
6Fh	C6h OEM Kontron POST Code Value	14h	POST Code Error Event Trigger Event Data 2: POST Low Event Data 3: POST High (always 00h)

5.1.2.1.6 Kontron Diagnostic Status

Figure 5-1:Kontron diagnostic status sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
6Fh	C9h OEM Kontron Diagnostic Status	00h	Diagnostic Started
		01h	Diagnostic PASS
		02h	Diagnostic FAIL

5.1.2.1.7 Kontron User SW upgradeStatus

Table 5-7:Kontron user SW upgrade status sensor

Event/Reading type code	Sensor type	Sensor specific offset	Event trigger
6Fh	CAh OEM Kontron External Component Firmware Upgrade Status	00h	Firmware Upgrade in Progress (no event)
		01h	Firmware upgrade succeeded
		02h	Firmware upgrade failed

5.1.2.2 Sensor Thresholds

Following table shows sensor thresholds for voltages

Table 5-8:Voltage sensor thresholds

SENSOR Number / ID string	Lower Non-Recoverable	Lower critical	Lower non critical	Upper non critical	Upper critical	Upper Non-Recoverable
ID=15: Vcc 1.0V	na	1.01 V	1.03 V	1.18 V	1.294 V	na
ID=16: Vcc 1.0V BCM (AM4220 and AM4210 only)	na	0.88 V	0.93 V	1.08 V	1.465 V	na
ID=17: Vcc 1.1V	na	1.01 V	1.02 V	1.18 V	1.67 V	na
ID=18: Vcc 1.2V	na	1.10 V	1.13 V	1.28 V	1.29 V	na
ID=19: Vcc 1.8V	na	1.65 V	1.68 V	1.92 V	2.06 V	na
ID=20: Vcc 3.3v	na	3.05 V	3.06 V	3.55 V	3.56 V	na
ID=21: Vcc 3.3V SUS	na	2.92 V	2.93 V	3.69 V	3.70 V	na
ID=23: Vcc 12v	na	8.36 V	9.7 V	14.45 V	15.52 V	na

5.1.2.3 Health Error

The Health Error is asserted if one of the sensors mentioned in Table 5-8 on page 40 (Voltage sensor thresholds) exceeds UC, UNR, LC or LNR or one of the sensors mentioned in Table 4-1 (Temperature Sensor Thresholds) in Chapter 4.1 exceeds UC or UNR.

5.1.3 OEM commands

5.1.3.1 OEM Get Firmware SysUpTime

Command Name	LUN	NetFn	Command Number
OEM Get Firmware SysUpTime	3	0x3E	0x03

	Byte Num	Data Field / Byte Raw
Request Data	1...4	0xBA 0x90 0x91 0x8B
Response Data	1	Completion Code
	2...5	System Up-Time in Seconds

5.1.3.2 OEM Get Serial Configuration

Command Name	LUN	NetFn	Command Number
OemApGetSerialconfig	3	0x30	0x05

	Byte Num	Data Field / Byte Raw
Request Data	1...5	0xAB 0xCA 0xCA 0xCE 0xC9
Response Data	1	Completion Code
	2	MUX setting
	3	UART0 config
	4	UART1 config
	5	MMC SPI config
	6	Reserved

Setting	[reg.config] – UART0	[reg.config] – UART1	[reg.config] – MMC
0	[3/4] – CableDetect/SOL	[0] – not connected	-
1	[0] – not connected	[3/4] – CableDetect/SOL	-
2	[3] – CableDetect	[4] – SOL	-
3	[4] – SOL	[3] – CableDetect	-
4	[1] – Front	[2/4] – Rear/SOL (AM4220 only)	-
5	[2/4] – Rear/SOL	[1] – Front (AM4220 only)	-
6	[1/4] – Front/SOL	[2] – Rear (AM4220 only)	-
7	[2] – Rear	[1/4] – Front/SOL (AM4220 only)	-
8	[4] – SOL	[0] – not connected	[2] – Rear
9	[4] – SOL	[0] – not connected	[1] – Front

Example: Using onboard

```
ipmitool -l 3 raw 0x30 0x5 0xab 0xca 0xca 0xce 0xc9
```

5.1.3.3 OEM Set Serial Configuration

Command Name	LUN	NetFn	Command Number
OemApSetSerialconfig	3	0x30	0x06

	Byte Num	Data Field / Byte Raw
Request Data	1...5	0xAB 0xCA 0xCA 0xCE 0xC9
	6	MUX setting
Response Data	1	Completion Code

Example: Using onboard

```
ipmitool -l 3 raw 0x30 0x06 0xab 0xca 0xca 0xce 0xc9 <setting>
```

5.1.3.4 OEM Set Control State

- The MMC shall support the following Control Ids
- The MMC shall save and restore these settings.
- The MMC shall immediately restart the payload of the module on change of the “interface settings”.

Command Name	LUN	NetFn	Command Number
CmdSetControlState	0	0x3E	0x20h

	Byte Num	Data Field
Request Data	1	Control ID 0 – Boot Image Selection 1 – Interface Settings 2 – PCIe Settings 3 – Image Swap Reset Threshold
	2	Control State Control Number 0: Boot Image Selection 0 – Image0 1 – Image1 Control Number 1: Interface Settings 0 – AM4204 front x4 GE, p8..11 x4 GE 1 – AM4204 front x4 GE, p8..11 x1 XAUI 2 – AM4220 front x2 XAUI 3 – AM4220 front x2 1GE 4 – AM4210 front x1 XAUI, p8..11 x4 GE 5 – AM4210 front x1 XAUI, p8..11 x1 XAUI 6 – AM4210 front x1 GE, p8..11 x4 GE 7 – AM4210 front x1 GE, p8..11 x1 XAUI Control Number 2: PCIe Settings 0 – PCIe disabled (default) 1 – PCIe Host Mode 2 – PCIe Target Mode (Boot from Bootbus/onboard Flash) 3 – PCIe Target Mode (Boot from PCIe) Control Number 3: Image Swap Reset Threshold N – count of detected resets before image swap 0,1 = invalid values (will be rejected) 255 = disable logic Control Number 4: 0 – local PCIe clock enabled 1 – FCLKA support enabled
Response Data	1	Completion Code

Example: Using onboard

```
# ipmitool raw 0x3e 0x20 <ID> <STATE>
```

Example: Using ipmitool on Kontron AMC carrier (e.g. AT8404):

```
# ipmitool -t 0x80 -b 7 raw 0x3e 0x20 <ID> <STATE>
```

Example: Using Kontron carrier manager (AM4904/AM4910):

```
# clicm Kontron boot set <FRUID> <ID> <STATE>
```

Example: Using PigeonPoint ShMC:

```
# clia sendamc 9a 80 0x3e 0x20 <ID> <STATE>
```

Note:
When changing settings with this command a power cycle is required to allow changes take effect!

5.1.3.5 OEM Get Control State

Command Name	LUN	NetFn	Command Number
CmdGetControlState	0	0x3E	0x21

	Byte Num	Data Field
Request Data	1	Control Number 0 – Boot Image Selection 1 – Interface Settings 2 – PCIe Settings
	6	MUX setting
Response Data	1	Completion Code
	2	See "OEM Set Control State" command

Example:

```
ipmitool -l 0 raw 0x3e 0x21 0x00
```

5.1.4 Field Replaceable Unit (FRU) Information

This FRU information contains the IPMI defined Board and Product Information areas that hold the part number and serial number of the board and the Multirecord Information Area that contains the PICMG defined Module Current Requirement Record, the AMC Point-to-Point Connectivity Record and the Clock Configuration Record.

The Internal Use Area is pre-allocated to 384 bytes and is free for customer use.

This FRU information responds to FRU ID #0, which is the ID for the MMC.

5.1.5 E-Keying

E-Keying has been defined in the AMC.0 Specification to prevent board damage, prevent wrong operation, and verify fabric compatibility. The FRU data contains the AMC Point-to-Point Connectivity record as described in Section 3.9 of the AMC.0 R2.0 specification.

When the Module is inserted in an ATCA AMC carrier or MicroTCA system, the carrier manager reads in the AMC Point-to-Point Connectivity record from FRU and determines whether the Board can enable the ports to the AMC connector. Set/Get AMC Port State IPMI commands defined by the AMC.0 specification are used for either granting or rejecting the E-keys.

5.1.6 Watchdog

The complete startup and execution process is guarded using external watchdog timers implemented by the hardware management subsystem IPMC. There are 4 distinct watchdog timers running during

- boot initialization and early boot monitor execution
- boot monitor execution and preparation for OS loading
- OS execution and initialization

The watchdog timers will trigger a specific action when expired. The action is dependent on previous resets and on watchdog type.

The standard IPMI watchdog as implemented by the Wind River Linux IPMI driver supports different actions on watchdog timer expiry and a configurable watchdog pre-timeout.

This pre-timeout period is configurable from 1 second up. The pre-timeout allows application software to take actions just before the watchdog bites and causes a reset or error-halt-state. The pre-timeout action can either be configured to trigger a Linux kernel panic, where appropriate panic-handlers can collect data, or to inform a user-space application of the pre-timeout event.

The watchdog can be disabled for debug reasons by an appropriate jumper setting (consult the Quick Reference Sheet).

5.1.7 MMC Firmware Code

MMC firmware code is organized into boot code and operational code, both of which are stored in a flash module. Upon an MMC reset, the MMC executes the boot code and performs the following:

- Self test to verify the status of its hardware and memory.
- Calculates a checksum of the operational code.

Upon successful verification of the operational code checksum, the firmware will jump to the operational code.

5.1.8 Updating MMC Firmware

Updating the MMC is possible in 4 different ways depending on the operating system running on the module. Those are:

- using ipmitool from the Linux shell
- using kex-flashimage from the Linux shell
- using an IPMI over LAN (IOL) session
- using the ‘download ipmifw’ command from a AT8404 carrier

5.1.8.1 MMC Firmware Update using ipmitool

Prerequisites: a working TFTP server, DHCP server and network connectivity to the DHCP and TFTP server. WindRiver Linux BSP or Cavium Linux BSP must be running on the board.

The MMC Firmware is updated using the following commands:

```
# tftp -r am42xx-fw-mmc-GA-2.01.hpm -g 10.0.114.1
#
#
#
# ipmitool hpm check am42xx-fw-mmc-GA-2.01.hpm
PICMG HPM.1 Upgrade Agent 1.0.2:
Validating firmware image integrity...OK
Performing preparation stage...OK
Comparing Target & Image File version
-----------------------------------------
|ID | Name      |        Versions       |
|   |           | Active| Backup| File  |
-----------------------------------------
| 1 |MMC        |  5.24 |  5.24 |  5.24 |
-----------------------------------------
# ipmitool hpm upgrade am42xx-fw-mmc-GA-2.01.hpm all activate

PICMG HPM.1 Upgrade Agent 1.0.2:

Validating firmware image integrity...OK
Performing preparation stage...OK

Performing upgrade stage:

--------------------------------------------------------------------------------
|ID | Name      |    Versions           |    Upload Progress  | Upload| Image |
|   |           | Active| Backup| File  |0%       50%     100%| Time  | Size  |
|---|-----------|-------|-------|-------||----+----+----+----||-------|-------|
| 1 |MMC        |  5.24 |  5.24 |  5.24 ||.................|| 01.17 | 30f02 |
--------------------------------------------------------------------------------
Performing activation stage:
    Waiting firmware activation...OK
```



Note:

1. It is necessary to repeat the upgrade command above to ensure that both firmware images of the MMC are updated. Otherwise, the MMC will fall back to its old firmware in case of a rollback condition.
2. The MMC firmware image is stored in the flash file system and should be deleted after the update procedure has finished successfully

5.1.9 MMC Firmware Update using kex-flashimage

Updating the MMC firmware using the kex-flashimage tool is done as part of the WindRiver BSP update described in chapter 5.3.4.2. This is only possible in case that the WindRiver BSP is installed.

5.1.9.1 MMC Firmware Update using IOL Session

To setup an IOL session, please refer to chapter 3.4.3.2. The update will be done using ipmitool or kex-flashimage as described in chapter 5.1.8.1 and chapter 5.1.9.

5.1.9.2 MMC Firmware Update from AT8404 Carrier

Prerequisites: a working TFTP server, DHCP server and network connectivity to the DHCP and TFTP server. The board must be located in an AT8404 carrier with firmware GA 2.04 or higher. It is not required, that Linux is running on the board.

A HPM.1 compliant MMC firmware image file must be available on the TFTP server. Given the board is plugged into slot AMC B4 of the carrier, the MMC firmware can be downloaded using the following command:

```
(Ethernet Fabric) # download ipmifw tftp://10.0.111.1/tftpboot/am42xx-fw-mmc-GA-2.05 amcb4
```

5.2 Bootloader

On the AM4220 Advanced Mezzanine Card (AMC), the bootloader 'u-boot' (universal bootloader) is used. The bootloader initializes the main components of the board like CPU, DDR2 RAM, serial lines etc. for operation and performs a power on self test (POST). After these steps have been finished, Linux kernel and application are started from flash.

5.2.1 Power On Self Test

Upon power on or system reset, the bootloader performs the following power on self tests (POST):

Table 5-9:Power On Self Tests

Test	Description
Cavium BIST	Several CPU checks as defined in lib_mips/lib_octeon.c file
DDR RAM (fast)	Simple memory write/read test. Testing a 1MB memory chunk every 16 MB.
DDR RAM (full)	Simple memory write/read test allover the full memory area.

In the case that a POST fails, a POST error code is written into the postcode register of the onboard CPLD. The postcode register is also accessible by the MMC which can report error codes to a separate management instance.

The following table shows the POST code values written into the CPLDs postcode register in case of a POST error.

Table 5-10:Bootloader POST Code values

POST Code Value	Description
0x00	All POST were successful
0x10	Cavium BIST failed
0x20	Memory data line POST failed
0x40	Memory address line POST failed
0x80	Memory device cells POST failed

5.2.2 Bootloader shell and options

The boot process can be interrupted by entering the bootstopkey phrase “stop”. This will open a bootloader command line interface.

Entering “?” provides a list of possible built-in commands, “printenv” provides a list of current environment settings. The bootloader shell can be used to customize boot options and system startup by changing some of its environment variables. A list of available environment variables and its description can be seen in the table below.

Table 5-11: Bootloader environment variables

Name	Type	Description
boardmacaddr	Var	Contains the default base MAC address for the Octeon plus Ethernet interfaces. This variable is automatically set by the bootloader when the MAC address was read from the MMC/KCS interfaces. This should only be set manually when disable_kcs=yes or ignore_kcserr=yes to provide a “fallback” MAC address, when the KCS/MMC interface is not available or fails
bootcmd	Script	This variable defines a command string that is automatically executed when the initial countdown is not interrupted. This command is only executed when the variable bootdelay is also defined!
bootcmddata0a	Script	Contains the standard startup script for loading OS image from flash partition mtd4, which is a raw partition. The image is started using bootoctlinux command.
bootcmddata0b	Script	Contains the standard startup script for loading OS image from flash partition mtd5, which is a JFFS2 partition by default. The image is started using a combination of fsload/bootoctlinux command.
bootcmdnet	Script	Contains the standard startup script for loading OS image from network
bootcmdprd	Script	Contains the standard startup script for use during board production
bootdelay	Var	After reset, U-Boot will wait this number of seconds before it executes the contents of the *bootcmd* variable. If the bootstopkey phrase is typed during this time, the bootloader command line interface is entered. Set this variable to *0* boots without delay. Be careful: depending on the contents of your *bootcmd* variable, this can prevent you from entering interactive commands again forever! Set this variable to *-1* to disable autoboot. default: 5 for flash based bootloader, -1 for RAM resident bootloader
bootsource	Var	When the standard boot sequence is used, contains the boot source, either data0a, data0b, net, prd to select the respective boot sequence to activate. It is only used when bootcmd contains the default startup script, which may be overridden by the user. default: data0a

Name	Type	Description
dataXa_flash_update	Script	Command script to flash a binary image transferred with tftpboot to the active image flash partition data0a
dataXb_flash_update	Script	Command script to flash a binary image transferred with tftpboot to the active image flash partition data0b
dataXa_backup_flash_update	Script	Command script to flash a binary image transferred with tftpboot to the backup image flash partition data1a
dataXb_backup_flash_update	Script	Command script to flash a binary image transferred with tftpboot to the backup image flash partition data1b
disable_kcs	Var	yes – completely disable all IPMI KCS access from bootloader <not set> - use KCS interface to retrieve MAC address and program watchdog et al (default)
disable_pci	Var	yes – disable any PCI Express initialization in bootloader (default) <not set> - initialize and enumerate PCI Express port 1 (connected to onboard e1000 dual GbE MAC)
ethact	Var	Default network interface used by network commands (bootp, tftpboot et al) default: e1000_eth0
ignore_kcserr	Var	yes – do not retry KCS accesses from bootloader indefinitely. This may lead to a situation where the MAC address of the board is not correctly setup <not set> - retry KCS access for getting MAC address et al forever (default)
linuxcores	Var	Contains the number of CPU cores to allocate to the Linux kernel booted by the default boot commands default: 12
linuxmem	Var	Contains the amount of RAM in MB to allocate for the Linux kernel booted by the default boot comands default: 2048 (with a 2 Gig) 4096 (with a 4 Gig)
loadaddr	Var	Default load address for network transfers. This is used as a temporary storage for netbooting and firmware updates. default: 0x20000000
netretry	Var	<not set> – retry a failed netboot command infinitely with the interface defined by 'ethact' environment variable. no – do not retry failed net boot commands (bootp, tftpboot et al) using all available interfaces (default) yes – retry a failed netboot command by iterating through all available interfaces rotate – retry a failed netboot command by iterating through all interfaces defined by 'net_retry_if' variable. This setting is done automatically if 'net_retry_if' or 'net_retry_vlan' have been defined. locked – a BOOTP/DHCP request has been completed successfully. Subsequent commands use the VLAN and interface settings of the successful request. This setting is done automatically if 'net_retry_if' or 'net_retry_vlan' have been defined.
net_retry_vlan	Var	Defines a comma-separated list of possible VLAN IDs. Up to 8 VLAN IDs can be used. <not set> – the VLAN ID used is defined only by the 'vlan' environment variable. N1,N2,N3... – the VLAN IDs N1, N2, N3 are used in turn when using the boot commands (bootp, tftpboot). Frames will be sent and accepted with IEEE 802.1Q VLAN tag only, except for special VLAN ID 0, which means untagged. This variable will implicitly set the 'vlan' and 'netretry' variables on each iteration
net_retry_if	Var	Defines a comma-separated list of possible interfaces for network commands. A maximum of 128 characters is allowed for the complete list. <not set> – if 'net_retry_vlan' is not set, retry is defined by the setting of the 'netretry' variable. E1,E2,E3 – do retry only E1 E2 and E3 interfaces in turn when using the boot commands. This variable will implicitly set the 'netretry' variable on each iteration

Name	Type	Description
nuke_data0a	Script	Command script to erase in the active image the onboard flash partition data0a
nuke_data0b	Script	Command script to erase in the active image the onboard flash partition data0b
nuke_env	Script	Command script (use with “run nuke_cmd”) that erases the U-Boot environment for the active image
nuke_env_backup	Script	Command script to erase the U-Boot environment for the backup bootloader
pci_console_active	Var	When set, enables the Octeon PCI console instead of serial console in U-Boot (default: not set for flash based bootloader, set for RAM resident bootloader)
pci_console_count	Var	Number of PCI consoles to set up. default: 1
pci_console_size	Var	Size of PCI console buffer in bytes, minimum 128. default: 1024
serial_rtscts	Var	yes – use hardware flow control when transmitting serial data through UART0/ UART1 in bootloader and simple executive applications (default) <not set> - do not use hardware flow control
uboot_backup_flash_update	Script	Command script to flash a U-Boot binary image transferred with tftpboot to the backup image bootloader
uboot_flash_update	Script	Command script to flash a U-Boot binary image transferred with tftpboot to the active image bootloader
vlan	Var	<not set> - send and accept only untagged frames N – sent all frames as IEEE 802.1Q tagged frames using VLAN ID N and default priority. Also accept IEEE 802.1Q tagged frames when they match VLAN ID N
watchdogboot	Var	0 – disable boot monitor watchdog (default) 5...n – timeout in seconds before boot monitor watchdog fires Note: This is the pBMWD watchdog
watchdogos	Var	0 – disable OS load watchdog (default) 15...n – timeout in seconds before load OS watchdog fires Note: This is the pOSWD watchdog
ignoreposterr	Var	0 – stop boot process if power on self test errors are detected 1 – continue boot in the presence of power on self test errors (default)
postresult	Var	Contains the power on self tests results: 0 - POST successful (default), 1 - POST failed
memtest	Var	0 = no DRAM test during POST 1 - quick DRAM test (default) 2 - full DRAM test
bootstopkey	Var	string to wait for during startup. If this string is entered, U-Boot will interrupt the boot process, stop the watchdog and will start its internal command line interface. default: “stop”
dhcp_client_id	Var	0 – do not include DHCP option 61 client identifier (default) 1 – do include DHCP option 61 client identifier variant 1
e1000_flu	Var	1 - forces E1000 link up, using this setting fixes autonegotiation problems with some 'bootp' and 'tftpboot' hosts All others: standard behaviour as originally implemented in driver

There are 3 different types of bootloader environment variables:

- **Script:** The variable is a set of consecutive (more simple) bootloader commands to perform a specific task. A command script is invoked using the ‘run <script>’ syntax. E.g. the ‘run clear_env’ command would erase the bootloader environment sectors causing the bootloader to use its default environment upon next restart.

- **Var**: The variable controls a specific behavior of the bootloader startup sequence. E.g. the 'bootdelay' variable controls the time u-boot waits before execution of the bootcmd which normally loads and starts the Linux kernel.
- **Auto**: The variable is automatically set during bootloader startup sequence. E.g. the 'postresult' variable stores the result of the POST.

It is possible to modify environment variables and start the pre-defined scripts from the bootloader shell. It is strongly recommended not to modify the pre-defined script variables. However, definition and execution of user-defined script variables can be done.

CAUTION

Changing bootloader environment variables must be taken very carefully. It will change system behavior and can lead to a non-booting system

For additional information about u-boot, refer to http://sourceforge.net/projects/u-boot/

Modification of bootloader environment variables is done using the 'setenv' and 'saveenv' bootloader CLI commands. In the following example, first, the new environment script variable 'bootcmdmyscript' is defined. After that, the 'bootsource' is set to <myscript> causing the bootloader to execute <bootcmdmyscript> upon next restart. In addition, bootdelay is increased to 10. Finally, all changes are stored into flash environment sector.

```
T5516# setenv bootcmdmyscript 'bootp; tftpboot ${loadaddr} myimg.multi; bootm ${loadaddr}'
T5516# setenv bootsource myscript
T5516# setenv bootdelay 10
T5516# saveenv
```

Environment changes are stored in one of the redundant bootloader environment sectors. In case of failure (e.g. power loss), the settings of the redundant sector are still available. However, the fabric default setting is running with environment sectors erased. In this case the following startup message is displayed:

```
Using default environment
```

Any changes of the environment can be cleared using the 'nuke_env' script (provided that 'nuke_env' itself was not changed):

```
T5516# run nuke_env
```

5.2.3 Bootloader Update

To update the bootloader, the new U-boot binary is transferred to the board using TFTP. After that, this binary is written into the onboard flash. The onboard E1000 NIC is used for network connection.

Prerequisites: a working TFTP server, DHCP server and network connectivity to the DHCP and TFTP server. The new bootloader image has to be stored on the TFTP server. No jumper settings are required on the AM4220.

There are 2 possible ways to update Image 0 and image 1 bootloaders:

- Using the predefined update scripts from the bootloader CLI
- Using the kex-flashimage tool which is provided with the Kontron WindRiver BSP.

5.2.3.1 Update from Bootloader CLI

The following procedure defines the update of the image 0 bootloader:

- Start system and connect to serial console
- Connect to bootloader shell by entering the bootloader bootstop phrase ‘stop’

```
U-Boot 1.1.1 FIXES 2.04 (Build time: Feb 10 2010 - 04:27:51)

OCTEON CN5650-NSP pass 2.1, Core clock: 600 MHz, DDR clock: 400 MHz (800 Mhz data rate)
CUST_KONTRON_T5516 PLD version: 12 Board Type: 1 Option: 3 Revision: 1
Reset Type: 01 cold reset, Source: 08 Software Initiated
DRAM:  2048 MB
Flash: 128 MB
Calculating bootloader CRC checksum.....finished
Testing DRAM (fast), testpattern 5555555555555555
             (fast), testpattern aaaaaaaaaaaaaaaa
2048MB - ok
Clearing DRAM........ done
Using default environment
KCS: Reading boot image number : Image 0
KCS: Reading interface settings: Front x2 XAUI
KCS: Reading PCIe settings     : Disabled
KCS: Reading PCIe clock source : local
KCS: Reading ethaddr           : 00:a0:a5:63:22:e2
KCS: Reading serial#           : 9010004184
BIST check passed.
Starting PCIE
PCIe: Waiting for port 1 link
PCIe: Port 1 link active, 4 lanes
PCIe: port=1, first_bus=0, last_bus=0
Net:   e1000: 00:a0:a5:63:22:e2
e1000: 00:a0:a5:63:22:e2
e1000_eth0, e1000_eth1, octeth0, octeth1, octeth2, octeth3, octeth4, octeth5, octeth6, octeth7
autoboot in 5 seconds...
press 'bootstopkey' phrase to abort <==== Enter ‘stop’ now
MMC watchdog stopped
Kontron T5516#
```

- Get proper network settings

```
Kontron T5516# bootp
```

- Set the TFTP server IP

```
Kontron T5516# setenv serverip <IP_addr>
```

- Download the bootloader image from the TFTP server

```
Kontron T5516# tftpboot $loadaddr <bootloader.bin>
```

- Execute the predefined update script

```
Kontron T5516# run uboot_flash_update
```

To update the backup bootloader image, the predefined script uboot_backup_flash_update is used instead.

5.2.3.2 Update from WindRiver Linux Shell

To update the boardloader along with the Linux kernel BSP using the kex-flashimage tool the sequence described in chapter 5.3.4.2:

5.3 Board Firmware

The system is delivered with a bootloader and Linux OS preinstalled on the on-board 128MB NOR flash. The system will boot by default from this flash, which is directly connected to the bootbus of the Cavium Octeon CPU. In addition to the on-board flash the board supports a mounted USB flash drive that can be used for application data. This USB flash drive is not used for booting in the default configuration.

The on-board flash is logically divided into two 64MB sections each consisting of 512 flash sectors. They are referred to as image0 and image1. The table 5-13 shows the physical addresses and associated flash sectors for each image once the board has booted on image 0.

Table 5-12:Fabric Default Flash Sector to Image Association

Physical Address Range	Linux MTD Partitions	Flash Sectors	Logical Image
0x17C00000 – 0x1BBFFFFF	mtd0 – mtd4	0 – 511	Image0
0x1BC00000 – 0x1FBFFFFF	mtd5 – mtd9	512 – 1023	Image1

Image0 and image1 can be swapped by a simple IPMI command. Physically, the uppermost address line of the flash device is inverted in this case. Flash sector to logical image association remains the same; however physical address to logical image association will be swapped as shown below

Table 5-13:Swapped Flash Sector to Image Association

Physical Address Range	Linux MTD Partitions	Flash Sectors	Logical Image
0x17C00000 – 0x1BBFFFFF	mtd0 – mtd4	512 – 1023	Image1
0x1BC00000 – 0x1FBFFFFF	mtd5 – mtd9	0 – 511	Image0

As the Octeon CPU always starts booting from the first physical address in the flash, image0 system is started in the first case and image1 in the second.

After Linux startup, the flash is divided into 10 partitions (mtd0-mtd9) associated to the physical addresses as shown in the AM4220 partition scheme below. Note that association of MTD partitions to image depends on the started image as shown above.

Table 5-14:On-board 128 MB NOR Flash layout

Physical address	Offset in flash	Size	Linux partition	Designation	Description
0x17C00000	0	512KiB	mtd0	uboot0	Active bootloader image
0x17C80000	0x80000	128KiB	mtd1	env0a	Redundant bootloader environment
0x17CA0000	0xA0000	128KiB	mtd2	env0b	Redundant bootloader environment
0x17CC0000	0xC0000	32384KiB	mtd3	data0a	First data partition (typically read-only OS)

Physical address	Offset in flash	Size	Linux partition	Designation	Description
0x19C60000	0x2060000	32384KiB	mtd4	data0b	Second data partition (typically writable data), configured as JFFS2 partition in bootloader
0x1BC00000	0x4000000	512KiB	mtd5	uboot1	Secondary bootloader image
0x1BC80000	0x4080000	128KiB	mtd6	env1a	Secondary Redundant bootloader environment
0x1BCA0000	0x40A0000	128KiB	mtd7	env1b	Secondary Redundant bootloader environment
0x1BCC0000	0x40C0000	32384KiB	mtd8	data1a	Secondary First data partition (typically read-only OS)
0x1DC60000	0x6060000	32384KiB	mtd9	data1b	Second data partition (typically writable data), configured as JFFS2 partition in bootloader

When shipped from factory, image0 and image1 contain identical bootloader and firmware images and image0 system is booted by default. Image1 serves as a backup system which is started in case that image0 fails for some reason. It is recommended to always boot and work from image0 and leave image1 firmware untouched. This allows easy activation of the original firmware in case of any errors or corruption in the active image.

5.3.1 Switching between Firmware Images

The IPMI command used for image swap can be executed either from the bootloader shell with a predefined script command or with a specific 'ipmitool' command either from the board itself, from an ATCA carrier or from an external server.

5.3.1.1 Image swap using bootloader predefined commands

The current firmware image is displayed during startup. It can be changed from the bootloader. Below are the available commands to change boot image. Those commands can be used in the U-Boot.

- Change to image 0

```
Kontron T5516# run activate_image0
```

- Change to image 1

```
Kontron T5516# run activate_image1
```

Using one of these commands, the board will immediately boot the selected image.

5.3.1.2 *Image swap using ipmitool*

Image swap can also be achieved using the ipmitool from the Linux shell of the board. The following command syntax must be used (IMAGE: 0 or 1):

```
~ # ipmitool raw 0x3e 0x20 0x00 <IMAGE>
```

It is possible to invoke the ipmitool with the same parameters from the AMC carrier that holds the AM4220 or even from external server provided that the ipmitool installed supports the Kontron OEM extensions. However, the command must be invoked with appropriate bridging parameters set. E.g. on an AT8404 carrier with the AM4220 inside Bay 4, the syntax would be:

```
# ipmitool -b 7 -t 0x80 kontron boot set 0 0
```



Note:
In case that no ipmitool is available on a carrier or host server and image 0 has been corrupted, the board will perform an image swap automatically triggered by the system watchdog. Image swap is performed every 2nd power cycle by the MMC if no watchdog is triggered.

5.3.2 Updating Firmware

Updating firmware includes updating bootloader, system software (Linux kernel and root FS) and MMC firmware. It is recommended to always update firmware of the active image. In case of a failure, it is possible to restore the board using the still unchanged redundant image. After the updated firmware is running properly, the redundant image can be updated to the same version, only if it is required.

Under WindRiver BSP, there are several ways to update the different parts of the board firmware. Update can be done with the predefined bootloader update commands as well as using the kex-flashimage tool from the Linux shell. For a Cavium Linux BSP, only updating from the bootloader CLI is possible.

Please refer to the following chapters for information and procedures on how to update the different parts of the System:

- See “Bootloader Update” on page 51. for the bootloader update
- See “Updating MMC Firmware” on page 45. for the MMC firmware update
- See “Updating Cavium Linux BSP” on page 57. for Cavium Linux update
- See “Updating WindRiver Linux BSP” on page 60. for WindRiver Linux

5.3.3 Cavium Linux BSP

5.3.3.1 Rebuilding the Cavium Linux BSP

Cavium Networks provides a SDK that includes Linux kernel and root file system along with the necessary toolchain, library and extensions for the Octeon CPUs. Kontron has added some patches for the SDK to support the AM4220 AMC module properly. These patches are supplied with each software release and areavailable for different versions of the SDK. Thus, the user can add his own extensions and rebuild the Cavium Networks Linux for the AM4220 easily.

Prerequisites: Either the CNUSERS SDK or the Cavium Networks SDK from Cavium Networks must be installed. The CNUSERS SDK allows rebuild of kernel and root file system, the Cavium Networks SDK has additional support for simple executive application development.

The patches supplied in uniformed diff format. A “series” file specifies the names and order of the patch set. The optional tool ‘quilt’ may be used to apply the patches. Thus it is recommended to install ‘quilt’ on the build host. For additional information about quilt, see http://savannah.nongnu.org/projects/quilt.

Installation of the patches described below can be done with quilt with one single command.

However it is also possible to apply the patches one after another using the ‘patch’ tool. In addition the ‘fakeroot’ RPM must be installed. This is necessary to build the target root filesystem with proper root permissions.



Note:
In case the CNUSERS SDK is used, the user has to delete the ‘examples-passthrough’ entry from the series file after unpacking the patches. Otherwise, applying the patches will break because the examples directory will not be found.

Rebuilding the Cavium Linux BSP for the AM4220 can be done with the following procedure:

- Install the SDK delivered from Cavium Networks

  ```
  # rpm --prefix /usr/local/cavium/ -iv OCTEON-SDK-1.8.1-294.i386.rpm
  ```

- Install the Linux package delivered from Cavium Networks

  ```
  # rpm --prefix /usr/local/cavium/sdk-1.8.1 -iv OCTEON-LINUX-1.8.1.i386.rpm
  ```

- Make a local copy of the SDK on your home directory

  ```
  # cp -rp /usr/local/cavium/sdk-1.8.1/OCTEON-SDK /home/<username>
  ```

- Unpack the patches provided by Kontron into your home directory

  ```
  # tar xzf am42xx-patches-OCTEON-SDK-1.8.1-GA-2.05.tar.gz -C OCTEON-SDK
  ```

- Apply the patches to your local copy of the Cavium Networks SDK

  ```
  # cd OCTEON-SDK
  # quilt push -a
  ```

In case ‘quilt’ is not installed, use ‘patch’ instead:

```
# for i in `cat patches/series`; do patch -p 1 < patches/$i; done
```

Please note, the last line in the “series”-file (# pcinic-pcie.patch) must be changed, depending on whether pci host driver package is installed or not.

- Setup the SDK environment

```
# source ./env-setup --runtime-model OCTEON_CN56XX_PASS2
```

- Build the Linux kernel

```
# make –C linux kernel
```

This will build the Linux kernel and root file system including all necessary libraries. Using ‘make –C linux kernel-deb’ builds only the kernel without the root file system. After building has finished, a kernel and rootfs image ‘linux/kernel_2.6/linux/vmlinux.64’ will be made. Before using it with the ‘bootoctlinux’ command, the file should be stripped.

Please refer to the online documentation provided with the Cavium Networks SDK for more detail.

5.3.3.2 Updating Cavium Linux BSP



Note:
The following description assumes that image 0 is activated either using the ‘activate_image0’ bootloader command or the appropriate ipmitool command as described above. If image1 would be active, the upper and lower halves of the flash address space are swapped. In this case, the ‘data1a_backup_flash_update’ command would not update image1 kernel and root FS partition as intended but image0 instead.

A new Cavium Linux BSP, either rebuilt as described above or delivered as part of an AM4220 software release, is installed from the bootloader CLI. The BSP is stored in Linux MTD partitions mtd3 (image 0) and mtd8 (image 1). Generally, the active image (image0) is updated first. If the update worked and the board started successfully, image1 can also be updated.

Prerequisites: a working TFTP server, DHCP server and network connectivity to the DHCP and TFTP server.

- Start system and connect to serial console
- Stop boot process at the bootloader command line

```
U-Boot 1.1.1 GA 2.04 (Build time: Dec  9 2009 - 13:59:54)

OCTEON CN5650-NSP pass 2.1, Core clock: 600 MHz, DDR clock: 400 MHz (800 Mhz data rate)
CUST_KONTRON_T5516 PLD version: 12 Board Type: 2 Option: 10 Revision: 0
Reset Type: 01 cold reset, Source: 08 Software Initiated
DRAM:  2048 MB
Flash: 128 MB
Calculating bootloader CRC checksum.....finished
Testing DRAM (fast), testpattern 5555555555555555
             (fast), testpattern aaaaaaaaaaaaaaaa
2048MB - ok
Clearing DRAM........ done
Using default environment
```

```
KCS: Reading boot image number : Image 0
KCS: Reading interface settings: front x1 XAUI, p8..11 x4 GE
KCS: Reading PCIe settings     : Disabled
KCS: Reading PCIe clock source : local
KCS: Reading ethaddr           : 00:a0:a5:63:d4:0a
KCS: Reading serial#           : 9010006140
BIST check passed.
Starting PCIE
PCIe: Waiting for port 1 link
PCIe: Port 1 link active, 4 lanes
PCIe: port=1, first_bus=0, last_bus=0
Net:   e1000_eth0, e1000_eth1, octeth0, octeth1, octeth2, octeth3, octeth4
autoboot in 5 seconds...
press 'bootstopkey' phrase to abort   ß Enter 'stop' here
MMC watchdog stopped
Kontron T5516#
```

- Get proper network settings

```
Kontron T5516# bootp
```

- Set the TFTP server IP

```
Kontron T5516# setenv serverip <IP_addr>
```

- Unprotect flash memory

```
Kontron T5516# protect off all
Un-Protect Flash Bank # 1
Kontron T5516#
```

- Flash new Linux kernel/rootfs binary

```
Kontron T5516# run data1a_flash_update

.....................................................................................
.....................................................................................
.................................................................... done
Erased 253 sectors
Copy to Flash... done
Kontron T5516#
```

- Check the updated image

```
Kontron T5516# run activate_image0
```

In case the updated image boots properly, image1 can be updated as described above using the same image file with the following commands:

- run data1a_backup_flash_update
- run activate_image1



Note:
The data1a_backup_flash_update command will update image0 when image1 has been booted!

5.3.3.3 Updating JFFS2 partition



Note:
The following description assumes that image 0 is activated either using the 'activate_image0' bootloader command or the appropriate ipmitool command as described above. If image1 would be active, the upper and lower halves of the flash address space are swapped. In this case, the 'data1b_backup_flash_update' command would not update image1 JFFS2 partition as intended but image0 instead.

There are two Linux MTD partitions (mtd4 for image 0 and mtd9 for image 1) available that allow customers to generate their own specific Linux environments. The JFFS2 flash file system is installed on these partitions allowing mounting them on the Linux shell to /mnt. These partitions include a Linux kernel and some tools as well as simple executive example applications, but do not include a root filesystem. The bootloader can be configured to boot the kernel stored here. To get this working, a root filesystem must be installed additionally.

The two JFFS2 partitions can also be updated. The update procedure is described in the previous section. Generally, the image0 JFFS2 partition is updated first. After the updated JFFS2 partition can be mounted properly by the Linux kernel, image1 JFFS2 partition mtd9 is also updated.

5.3.4 WindRiver Linux BSP

5.3.4.1 Rebuilding the WindRiver Linux BSP

In addition to the Cavium Linux BSP, Kontron also provides a WindRiver Linux BSP for the AM4220. The BSP itself is available with each software release, however modification and rebuilding of the WindRiver BSP requires obtaining a development license from WindRiver. In this case the BSP for the AM4220 can be rebuilt on an x86 host with the following steps:

- Unpack the patches provided by Kontron into your WindRiver working directory

  ```
  # tar xzf bsp-kontron_t5516-wrlinux-2.0-GA-2.05.tar.gz
  ```

- Configure the WindRiver system to build the Kontron AM4220 BSP

  ```
  # /opt/WindRiver/wrlinux-2.0/wrlinux/configure --with-layer=kontron_t5516 --enable-board=kontron_t5516 --enable-rootfs=glibc_small --enable-kernel=standard+squashfs
  ```

- Build WindRiver kernel and root file system

  ```
  # make build-all
  ```

Note that depending on your build host, building the system completely can take quite a long time (a few hours).

After the build process has been finished, the (stripped) kernel image is stored in the export directory 'kontron_t5516-vmlinux-stripped-WR2.0ap_standard'

- Install root file system into bootable image

```
# make boot-image-create BOOTIMAGE_FSTYPE=squashfs BOOTIMAGE_TYPE=flash BOOTIMAGE_ARGS=-be BOOTIMAGE_RAMOSIZE=64000
```

- Create bootloader multi image

```
# /opt/WindRiver/wrlinux-2.0/wrlinux/host-tools/bin/mkimage -A mips -O linux -T multi -C none -a 0 -e 0 -n "kontron_t5516" -d export/kontron_t5516-vmlinux-stripped-WR2.0ap_standard:export/kontron_t5516-squashfs kontron_t5516.multi
```

This command takes kernel and root file system images created before and stores them in the 'kontron_t5516.multi' file along with an appropriate u-boot header.

The final image may be downloaded via tftp and started using the 'bootoctlinux' command as defined in the 'bootcmdprd' environment script. It can also be copied into flash and started from here.

Please refer to the documentation provided with the appropriate WindRiver PNE distribution for more details how to build and modify the kernel and/or the root file system.

5.3.4.2 Updating WindRiver Linux BSP



Note:
The following description assumes that image 0 is activated either using the 'activate_image0' bootloader command or the appropriate ipmitool command as described above. If image1 would be active, the upper and lower halves of the flash address space are swapped. In this case, the 'data1a_backup_flash_update' command would not update image1 kernel and root FS partition as intended but image0 instead.

A WindRiver Linux BSP installed on the AM4220 module is updated using the kex-flashimage tool which is part of the WindRiver Linux BSP installation.

A new WindRiver Linux BSP, either rebuilt as described above or delivered as part of an AM4220 software release, is installed from the bootloader CLI. The BSP is stored in Linux MTD partitions mtd3 (image 0) and mtd9 (image 1). Generally, the backup image (image1) is updated first. When the backup image has been updated and started successfully, image0 will also be updated.

Prerequisites: a working NFS server, which can provide the update package file to the AM4220 module.

- Boot to WindRiver Linux prompt and mount NFS file system to AM4220 directory tree

```
# portmap
# mkdir /mnt/nfs
# mount <server_ip>:<exported_fs> /mnt/nfs
```

- Install update package to image1 (backup image)

```
# kex-flashimage --verify --update --image backup --file /mnt/nfs/am42xx-wr-GA-2.05.pkg
```

This will update flash image1 firmware, MMC firmware and FRU data in case that the old version is GA 2.04 or higher. Please refer to 5.3.4.3 for updating from GA 2.03 or earlier versions.

- Activate image1 and reboot to WindRiver Linux prompt

```
# ipmitool raw 0x3e 0x20 0 1
# reboot
```

- Mount NFS file system to AM4220 directory tree

```
# portmap
# mkdir /mnt/nfs
# mount <server_ip>:<exported_fs> /mnt/nfs
```

- Install update package to image0

```
# kex-flashimage --verify --update --image backup --file /mnt/nfs/am42xx-wr-GA-2.05.pkg
```

Note that this is the same command which has been used to update image1 before. The reason is that an image swap was performed before reboot. Thus, image1 is now active and image0 is the backup image which is updated using the same command.

- Activate image0 and reboot to WindRiver Linux prompt

```
# ipmitool raw 0x3e 0x20 0 0
# reboot
```

Now, flash image0 and image1 firmware, MMC firmware and FRU data are updated to the new release. The image0 and image1 JFFS2 config partitions are deleted and will be re-initialized upon next restart of the respective image.

5.3.4.3 Updating older versions

The kex-flashimage tool installed on GA 2.03 or lower is not capable to update MMC firmware and the boards FRU data. Thus an additional installation step is necessary before following the update procedure described in chapter 5.3.4.2.

Contradictory to the standard update procedure, updating older versions starts from image1 (backup image) prompt.

- Activate image1 and reboot to WindRiver Linux prompt

```
# ipmitool raw 0x3e 0x20 0 1
# reboot
```

- Boot to WindRiver Linux prompt and mount NFS file system to AM4220 directory tree

```
# portmap
# mkdir /mnt/nfs
# mount <server_ip>:<exported_fs> /mnt/nfs
```

- Install update package to image0 (backup image now)

```
# kex-flashimage --verify --update --image backup --file /mnt/nfs/am42xx-wr-GA-2.05.pkg
```

This will update flash image0 firmware to GA 2.05, but not MMC firmware and FRU data of the board. However, after rebooting to image0, the update procedure is continued with all the steps described for the standard update procedure and the new kex-flashimage tool installed in the previous step will also update MMC firmware and FRU data.

- Activate image0 and reboot to WindRiver Linux prompt

```
# ipmitool raw 0x3e 0x20 0 0
# reboot
```

- Proceed with the update procedure as described in chapter 5.3.4.2.

5.3.5 Simple executive applications

Building simple executive applications requires the availability of the Cavium Networks SDK which must be obtained from Cavium Networks directly. The CNUSERS SDK which can be downloaded at http://www.cnuser.org does not include support for SE application development.

The Cavium Networks SDK includes Octeon Executive Library as well as documentation and examples for Octeon simple executive development. The Octeon Executive Library provides runtime support, hardware abstraction, memory management, and synchronization routines for the Octeon processor. It is composed of the libcvmx.a library as well as header files that provide a lot of functionality with inline functions. The Executive is designed to provide an efficient environment for developing data plane code for Octeon. It supports a single thread of execution per cnMIPS core.

Simple executive applications can be used without the support of an OS, however, memory TLBs for each core must have been set up correctly before starting a SE. This is done by the bootloader 'bootoct' command which is part of the Octeon u-boot port.

Please refer to the online documentation provided with the Cavium Networks SDK for more detail.

Refer to section 5.3.3.1 for the procedure to install the SDK.

- Build the 'passthrough' sample application

```
# make –C examples/passthrough
```

5.3.6 Using the NFS Root FS

For development purposes, a NFS mounted root filesystem is often more convenient than a flash or ramdisk based one. Changes can be applied quickly on the development host and tested on the target. Below the setup necessary to use a NFS root file system is described.

Prerequisites: Development host with DHCP and TFTP protocols enabled and a NFS exported tree including the root file system to mount.

- Rebuild the Cavium Linux or WindRiver Linux BSP including kernel and root filesystem as described above

- Copy the kernel built in step 1 into the tftpboot directory of the development host. E.g. the kernel for the WindRiver Linux BSP is located in the build/export directory of the WindRiver Linux BSP (kontron_t5516-vmlinux-stripped-WR2.0ap_standard).
- Copy the root file system built in step 1 into the NFS exported file tree. E.g. the root file system for the WindRiver Linux BSP is located in the build/export/dist directory of the WindRiver Linux BSP. In the following, it is assumed that the root filesystem has been copied into /export/T5516/nfsroot on the development host.
- Reset the AM4220 and enter the bootloader CLI using the bootstop phrase 'stop'
- Setup the bootloader environment variables for booting a NFS root filesystem.

```
Kontron T5516# setenv rootpath '/export/T5516/nfsroot'
Kontron T5516# setenv bootargsnfs 'setenv bootargs root=/dev/nfs rw nfsroot=${serverip}:${rootpath} ip=${ipad-
dr}:${serverip}:${gatewayip}:${netmask}:${hostname}::off'
Kontron T5516# setenv bootcmdnfs 'run bootargsnfs ; bootp && tftpboot ${loadaddr} ${bootfile} && bootoctlinux
${loadaddr} numcores=${linuxcores} mem=${linuxmem} console=ttyS0,${baudrate}n8r ${mtdparts} ${bootargs}'
Kontron T5516# setenv bootfile t5516-vmlinux-stripped-WR2.0ap_standard
Kontron T5516# save
```

- Boot the Linux kernel from the bootloader CLI

```
Kontron T5516# run bootcmdnfs
```

The kernel is loaded via tftp and mounts its root filesystem via NFS. Note that the standard kernel delivered by Kontron mounts an overlay JFFS2 file system located in the mtd4 flash partition to /. All files available on the NFS server are still available on the AM4220 system. However, if a file is changed from the target, the changes are stored in the local JFFS2 partition and cannot be seen from the development host. This allows providing one single root filesystem exported via NFS on the development host for several AM4220 target boards. Changes for a specific target system are stored only on the targets JFFS2 partition and apply not for other targets. This allows to setup different targets in a different way without the need to provide more root filesystem trees on the development host.

A. Connectors Pinouts

A.1 USB SSD Flash Module

Signal	Pin Number	Signal	Pin Number
V_5V	1	NC	2
USB DATA (-)	3	NC	4
USB DATA (+)	5	NC	6
GND	7	NC	8
NC (KEY)	9	NC	10

A.2 SFP+ Front IO

Pin Number	Signal	Pin Number	Signal
20	VeeT	1	VeeT
19	TD-	2	Tx Fault
18	TD+	3	Tx Disable
17	VeeT	4	SDA
16	VccT	5	SCL
15	VccR	6	MODABS
14	VeeR	7	Rate Select 0
13	RD+	8	LOS
12	RD-	9	Rate Select 1
11	VeeR	10	VeeR

A.3 Serial Port Pinout

Signal	Pin
RTS	1
DTR	2
TXD	3
GND	4
GND	5
RXD	6
DSR	7
CTS	8

A.4 Serial console terminal cable interface: RJ45 Female to DB9 Female

RJ45 Pin Number	Signal	Connected	Description	DB9 Pin Number
1	RTS	Y	Request To Send	8
2	DTR	Y	Data Terminal Ready	6
3	TXD	Y	Transmit	2
4	GND	N	Ground	-
5	GND	Y	Ground	5
6	RXD	Y	Receive	3
7	DSR	Y	Data Set Ready	4
8	CTS	N	Clear To Send	7
-	RI	N	Ring Indicator (Not Used)	9
-	CD	N	Carrier Detect (Not Used)	1

B. Getting Help

If, at any time, you encounter difficulties with your application or with any of our products, or if you simply need guidance on system setups and capabilities, contact our Technical Support at:

North America	EMEA
Tel.: (450) 437-5682	Tel.: +49 (0) 8341 803 333
Fax: (450) 437-8053	Fax: +49 (0) 8341 803 339

If you have any questions about Kontron, our products, or services, visit our Web site at: www.kontron.com

You also can contact us by E-mail at:

North America: support@ca.kontron.com

EMEA: support-kom@kontron.com

Or at the following address:

North America	EMEA
Kontron Canada, Inc.	Kontron Modular Computers GmbH
4555, Ambroise-Lafortune	Sudetenstrasse 7
Boisbriand, Québec	87600 Kaufbeuren
J7H 0A4 Canada	Germany

B.1 Returning Defective Merchandise

Before returning any merchandise please do one of the following:

- Call

    1 Call our Technical Support department in North America at (450) 437-5682 and in EMEA at +49 (0) 8341 803 333. Make sure you have the following on hand: our Invoice #, your Purchase Order #, and the Serial Number of the defective unit.

    2 Provide the serial number found on the back of the unit and explain the nature of your problem to a service technician.

    3 The technician will instruct you on the return procedure if the problem cannot be solved over the telephone.

    4 Make sure you receive an RMA # from our Technical Support before returning any merchandise.

- E-mail

    1 Send us an e-mail at: RMA@ca.kontron.com in North America and at: orderprocessing@kontron-modular.com in EMEA. In the e-mail, you must include your name, your company name, your address, your city, your postal/zip code, your phone number, and your e-mail. You must also include the serial number of the defective product and a description of the problem.

B.2 When Returning a Unit

- In the box, you must include the name and telephone number of a contact person, in case further explanations are required. Where applicable, always include all duty papers and invoice(s) associated with the item(s) in question.
- Ensure that the unit is properly packed. Pack it in a rigid cardboard box.
- Clearly write or mark the RMA number on the outside of the package you are returning.
- Ship prepaid. We take care of insuring incoming units.

North America	EMEA
Kontron Canada, Inc.	Kontron Modular Computers GmbH
4555, Ambroise-Lafortune	Sudetenstrasse 7
Boisbriand, Québec	87600 Kaufbeuren
J7H 0A4 Canada	Germany

C. Glossary

Acronyms	Descriptions
ACL	Access Control List. IP Access Control List.
ACPI	Advanced Configuration & Power Interface
AdvancedMC	(Same as AMC). Advanced Mezzanine Card.
AMC	(Same as AdvancedMC). Advanced Mezzanine Card.
AMC.0	Advanced Mezzanine Card Base Specification.
AMC.1	PCI Express and Advanced Switching on AdvancedMC. A subsidiary specification to the Advanced Mezzanine Card Base Specification (AMC.0).
AMC.2	Ethernet Advanced Mezzanine Card Specification. A subsidiary specification to the Advanced Mezzanine Card Base Specification (AMC.0).
AMC.3	Advanced Mezzanine Card Specification for Storage. A subsidiary specification to the Advanced Mezzanine Card Base Specification (AMC.0).
API	Application Programming Interface
APIC	Advanced Programmable Interrupt Controller
APM	Advanced Power Management
ARMD	ATAPI Removable Media Device
ARP	Address Resolution Protocol
ASCII	American Standard Code for Information Interchange. ASCII codes represent text in computers, communications equipment, and other devices that work with text.
ASF	Alert Standard Format. A standard for how alerting and remote-control capabilities on network controllers work.
ATCA	Advanced Telecommunications Computing Architecture
BCD	Binary-Coded Decimal
BER	Bit Error Ratio
BI	Base Interface. Backplane connectivity defined by the ATCA.
BMC	Base Management Controller
BT	Block Transfer. An optional IPMI system management interface.
CB	Certification Body
CCB	Core Complex Bus (Inside PowerQuicc III CPU)
CFM	Cubic Foot per Minute
CLI	Command-Line Interface
CLK1	AdvancedTCA bused resource Synch clock group 1
CLK1A	AdvancedTCA bused resource Synch clock group 1, bus A
CLK1B	AdvancedTCA bused resource Synch clock group 1, bus A
CLK2	AdvancedTCA bused resource Synch clock group 2
CLK2A	AdvancedTCA bused resource Synch clock group 2, bus A
CLK2B	AdvancedTCA bused resource Synch clock group 2, bus B
CLK3	AdvancedTCA bused resource Synch clock group 3
CLK3A	AdvancedTCA bused resource Synch clock group 3 , bus A
CLK3B	AdvancedTCA bused resource Synch clock group 3 , bus B
CPLD	Complex Programmable Logic Device
CP-TA	Communications Platforms Trade Association

Acronyms	Descriptions
CRC	Cyclic Redundancy Check
CS1	Components Side 1 as describes in PICMG3.0.
CS2	Components Side 2 as describes in PICMG3.0.
CTCA	Compact Telecom Computing Architecture
CTS	Clear To Send
DDR2	(Same as DDR-II). DDR2 SDRAM or Double-Data-Rate two (2) Synchronous Dynamic Random Access Memory.
DHCP	Dynamic Host Configuration Protocol
DIMM	Dual In-line Memory Module
DIN	Deutsches Institut für Normung. German Institute for Standardization.
DMA	Direct Memory Access
DMI	Desktop Management Interface
DPLL	Digital Phase-Locked Loop
DRAM	Dynamic Random Access Memory
DTC	Data Transfer Controller
DTR	Data Terminal Ready
DTS	Digital Thermal Sensor in IA32 processors.
ECC	Error Checking and Correction
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFI	Extensible Firmware Interface
EFT	Electric Fast Transient
EHCI	Enhanced Host Controller Interface. Specification for Universal Serial Bus specification, revision 2.0.
EIA	Electronic Industries Alliance
EISA	Extended Industry Standard Architecture. Superset of ISA, 32-bit bus architecture.
EIST	(Same as SpeedStep). Enhanced Intel SpeedStep Technology
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMTTM	Turbo mode and enhanced Multi Threaded Thermal Management
ERM	Electromagnetic compatibility and Radio spectrum Matters
ESD	ElectroStatic Discharge
ESI	Enterprise South bridge Interface. Interface to the I/O legacy bridge component of the Intel ICHx.
ETH	Same as Ethernet.
ETSI	European Telecommunications Standards Institute
FADT	Fixed ACPI Description Table
FC	Fibre Channel
FC-AL	Fibre Channel-Arbitrated Loop
FI	Fabric Interface. Backplane connectivity defined by the ATCA.
FML	Fast Management Link
FPGA	Field-Programmable Gate Array
FPL	FPGA-to-PLD Link. FPL is a 20 MHz serial link that exchange 32-bit of data in each direction between the FPGA and a companion PLD. Comes from Kontron Canada.

Acronyms	Descriptions
FRBx	Fault-Resilient Booting level [1-3]. A term used to describe system features and algorithms that improve the likelihood of the detection of, and recovery from, processor failures in a multiprocessor system.
FRB2	Fault-Resilient Booting, Level 2.
FRT	Free-Running Timer
FRU	Field Replaceable Unit. Any entity that can be replaced by a user in the field. Not all FRUs are hot swappable.
FTP	File Transfer Protocol
FW	FirmWare
FWH	FirmWare Hub. Boot flash connected to the LPC bus containing BIOS FW.
GARP	Generic Attribute Registration Protocol
Gb	Gigabit
GB	(Same as GByte) GigaByte.
GByte	(Same as GB) GigaByte.
GbE	Gigabit Ethernet
GHz	GigaHertz
GMRP	GARP Multicast Registration Protocol
GND	GrouND
GPCM	General-Purpose Chip select Machine
GPI	General Purpose Input
GPIO	General Purpose Input Output
GPO	General Purpose Output
GRUB	GRand Unified Bootloader
GUID	Globally Unique Identifier
GVRP	GARP VLAN Registration Protocol
HFM	High Frequency Mode. The highest operating speed for the processor.
HMS	Hardware Management System
HPM	PICMG Hardware Platform Management specification family
HPM.1	Hardware Platform Management IPM Controller Firmware Upgrade Specification
HW	HardWare
I2C	Inter Integrated Circuit bus
IICH	Integrated I/O Controller Hub. Sub-part of the MICH chipset.
INT	INTerrupt
IMCH	Integrated Memory Controller Hub. Sub-part of the MICH chipset.
IMVP-6	Intel Mobile Voltage Positioning. The Intel Mobile Voltage Positioning specification for the Intel® Core™ Duo Processor. It is a DC-DC converter module that supplies the required voltage and current to a single processor.
IO	(Same as I/O). Input Output
IOAPIC	(Same as IO-APIC). IO Advanced Programmable Interrupt Controller
IOH	I/O Hub
IO-APIC	(Same as IOAPIC). IO Advanced Programmable Interrupt Controller
IOL	IPMI-Over-LAN
IP	Internet Protocol

Acronyms	Descriptions
IPM	Intelligent Platform Management
IPMB	Intelligent Platform Management Bus
IPMB-0	Intelligent Platform Management Bus Channel 0, the logical aggregation of IPMB-A and IPMB-B.
IPMB-A	Intelligent Platform Management Bus A
IPMB-B	Intelligent Platform Management Bus B
IPMB-L	Intelligent Platform Management Bus Local
IPMC	Intelligent Platform Management Controller
IPMI	Intelligent Platform Management Interface
IPMIFWU	Intelligent Platform Management Interface FirmWare Update
IPv6	Internet Protocol version 6
IRQ	Interrupt ReQuest
ISA	Industry Standard Architecture. 16-bit (XT) bus architecture.
ISE	Xilinx electronic design automation (EDA) tools for use with its devices.
ISO	International Organization for Standardization
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication standardization sector. ITU is International Telecommunication Union.
JTAG	Joint Test Action Group
KB	KiloByte
KHz	KiloHertz
LAN	Local Area Network
LBA	Logical Block Addressing
LBC	Local Bus Controller (On PowerQuicc III CPU)
LED	Light-Emitting Diode
LFM	Low Frequency Mode. The lowest operating speed for the processor.
LIP	Loop Initialization Primitive. Related to FC arbitrated loop topology (an initial message needed for learning the loop addresses and acquiring one).
LSB	Least Significant Byte
LUN	Logical Unit Number
LV	Low Voltage
LVCMOS	Low-Voltage Complementary Metal Oxide Semiconductor
LVDS	Low-Voltage Differential Signaling
MAC	Media Access Controller address of a computer networking device.
MB	MegaByte
MC	Management Controller
MCH	Memory Controller Hub
MemBIST	(same as MBIST). Memory Built-In Selft-Test. Chipset feature for out-of-band memory testing and intialization.
MDn	Message Digest algorithm (n=2, 5)
MDI	Medium Dependent Interface. MDI port or uplink port.
MHz	MegaHertz
MMC	Module Management Controller. MMCs are linked to the IPMC.
MMIO	Memory-Mapped IO

Acronyms	Descriptions
MP	MultiProcessor
MPS	MultiProcessor Specification
MRC	Memory Reference Code. Chipset specific code provided by the manufacturer and integrated into the BIOS to test and intialize the system memory.
MSB	Most Significant Byte
MSI	Message Signaled Interrupts
MSR	Model Specific Register inside IA32 processors.
MTBF	Mean Time Between Failures
MTRR	Memory Type Range Register. CPU cache control registers.
NAND	Type of Flash Memory, used for mass storage.
NC	Not Connected
NDA	Non-Disclosure Agreement
NEBS	Network Equipment-Building System
NEDS	Network Equipment Development Standard
NMI	Non-Maskable Interrupt
O&M	(Same as OAM/OA&M). Operations and Maintenance
OAM	(Same as OA&M/O&M). Operations, Administration and Maintenance
OA&M	(Same as OAM/O&M). Operations, Administration and Maintenance
OEM	Original Equipment Manufacturer
OMU	Operations and maintenance Unit
OOS	Out Of Service
OS	Operating System
OSI	Open Source Initiative
PCB	Printed Circuit Board
PCIe	(Same as PCI-E). PCI-Express. Next generation I/O standard
PCI-E	(Same as PCIe). PCI-Express. Next generation I/O standard.
PERR	Parity ERRor. A signal on the PCI bus that indicates a parity error on the bus.
PHY	PHYsical layer. Generic electronics term referring to a special electronic integrated circuit or functional block of a circuit that takes care of encoding and decoding between a pure digital domain (on-off) and a modulation in the analog domain.
PICMG	PCI Industrial Computer Manufacturers Group
PICMG®	PCI Industrial Computer Manufacturers Group
PIR	Product Issue Report
PIU	Plug-In Unit
PLCC	Plastic Leaded Chip Carrier
PLD	Programmable Logic Device
PLL	Phase Lock Loop
PMM	POST Memory Manager
PNE	Platform for Network Equipment. A Carrier Grade Linux (4.0) platform.
POR	Power-On Reset
POST	Power-On Self-Test
PXE	Preboot eXecution Environment
RAM	Random Access Memory

Acronyms	Descriptions
RHEL	Red Hat Enterprise Linux
RMS	Root Mean Square
RoHS	Restriction of the Use of Certain Hazardous Substances
ROM	Read Only Memory. Also refers to option ROM or expansion ROM code used during POST to provide services for specific controllers, such as boot capabilities.
RS-232	(Same as RS232). Recommended Standard 232.
RS232	(Same as RS-232). Recommended Standard 232.
RTC	Real Time Clock
RTM	Rear Transition Module
RTS	Request To Send
S0	ACPI OS System State 0. Indicates fully on operating state.
S5	ACPI OS System State 5. Indicates Soft Off operating state.
SBC	Single Board Computer
SBE	Single Bit Error
SCI	System Control Interrupt
SCL	Serial CLock
SDR	Sensor Data Record
SDRAM	Synchronous Dynamic Random Access Memory
SEC	Single-bit Error Correct
SEEPROM	Serial EEPROM
SEL	System Event Log
SERDES	SERializer/DESerializer. Pair of functional blocks commonly used in high speed communications. These blocks convert data between serial data and parallel interfaces in each direction.
SERIRQ	Serial IRQ
SERR	System ERRor. A signal on the PCI bus that indicates a 'fatal' error on the bus.
SGMII	Serial Gigabit Media Independent Interface. Standard interface used to connect a Gigabit Ethernet MAC-block to a PHY.
ShMC	Shelf Management Controller
SMB	(Same as SMBus/SMBUS). System Management Bus.
SMBIOS	System Management BIOS
SMBUS	(Same as SMB/SMBus). System Management Bus.
SMBus	(Same as SMB/SMBUS). System Management Bus.
SMI	System Management Interrupt
SMM	System Management Mode
SMP	Symmetric MultiProcessing. SMP systems allow any processor to work on any task no matter where the data for that task are located in memory; with proper operating system support, SMP systems can easily move tasks between processors to balance the workload efficiently.
SOL	Serial Over LAN
SONET	Synchronous Optical NETworking
SPD	Serial Presence Detect. A standardized way to automatically access information about a computer memory module.
SPI	Serial Peripheral Interface
SSE2	Streaming SIMD Extension 2. SIMD is "Single Instruction, Multiple Data".
SSE3	Streaming SIMD Extension 3. SIMD is "Single Instruction, Multiple Data".

Acronyms	Descriptions
SSH	Secure SHell. A network protocol that allows data to be exchanged over a secure channel between two computers.
TCLKA	Telecom CLocK A. AMC Clock Interface.
TCLKB	Telecom CLocK B. AMC Clock Interface.
TCLKC	Telecom CLocK C. AMC Clock Interface.
TCLKD	Telecom CLocK D. AMC Clock Interface.
TPM	Trusted Platform Module
TX	Transmit
TXD	Transmit
UART	Universal Asynchronous Receiver Transmitter
UL	Underwriters Laboratories inc
USB	Universal Serial Bus
VLAN	Virtual Local Area Network
WD	WatchDog
WDT	WatchDog Timer
XAUI	X (meaning ten) Attachement Unit Interface. A standard for connecting 10 Gigabit Ethernet (10GbE) ports.
XDP	eXtended Debug Port