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PPC7A Product Manual

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Contents

Chapter 1 - Introduction 1-1

Build Levels 1-1
Communications 1-1
Standards 1-1
Objectives of this Manual 1-2
Documentation Audience 1-2
Scope of this Manual 1-2
Structure of this Manual 1-3
Safety Notices 1-4
Safety Summary 1-4
Ground the Equipment 1-4
Do Not Operate in an Explosive Atmosphere 1-4
Keep Away From Live Circuits 1-4
Do Not Service or Adjust Alone 1-4
Do Not Substitute Parts or Modify Equipment 1-4
Conventions Used in this Manual 1-6
Associated Documents 1-7
World Wide Web Sites 1-8

Chapter 2 - General Description 2-1

Introduction 2-1
Features 2-2
Functional Overview 2-3
PowerPC Platform 2-3
Processor 2-4
PCI 2-5
Memory 2-6
VMEbus Interface 2-7
Utility I/O and Auxiliary Function Bus 2-7
Input/Output 2-7
Software Support 2-8
Boot Firmware 2-8
Built In Test 2-8
Background Condition Screening 2-8
Operating System Support 2-8
Build Styles 2-9
Level 1 2-9
Level 2 2-10
Level 3 2-10
Level 4 2-10
Level 5 2-10

Chapter 3 - Inspection 3-1

Product Identification 3-1
Inspection 3-2

Chapter 4 - Configuration 4-1

Default Link Settings 4-2
RTC Standby Supply Voltage Link (E1) 4-2
FLASH Write Enable Links (E3 and E9) 4-3
VME Boot Link (E4) 4-3
Overall FLASH Write Enable Links (E5) 4-3

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ECC Enable Link (E6) 4-4
FLASH Boot Image Select Link (E7 & E8) 4-4
On-board SCSI Terminator Enable Link (E13) 4-4
Enable Front Panel Reset Switch Link (E14) 4-5
Geographical Addressing/Board ID Links (E11, E2, E12 and E10) 4-5
VME Slave Address Configuration 4-6
VMEbus Interface Configuration 4-6

Chapter 5 - Connectors 5-1

P1 (VMEbus) Connector Pinout 5-2
P2 Connector Standard Pinout 5-3
P2 Connector Pinout (when J24 is fitted) 5-4
Alternate P2 Pinout for GPIO Pins 5-5
VMEbus Signal Descriptions 5-6
P2 I/O Signal Descriptions 5-7
P0 Connector Pinout 5-9
Type B (95-way) 5-9
Type A (80-way) 5-10
P0 I/O Signal Descriptions 5-11
PMC Connector Pinouts 5-12
J11 and J21 5-12
J12 and J22 5-13
J13 and J23 5-14
PMC Signal Descriptions 5-15
J14 PMC I/O 5-16
J24 PMC I/O and Partial P2 Option 5-17
P10 PLD Connector Pinout 5-18
P8 RISCWatch Connector Pinout 5-18
P8 Signal Descriptions 5-19
EST Emulator Connection 5-19

Chapter 6 - Front Panel 6-1

Air-cooled Versions 6-1
PMC Slots 6-1
LEDs 6-1
Switches 6-1
Conduction-cooled Versions 6-1
PMC Slots 6-1
LEDs 6-1
Switches 6-1

Chapter 7 - Installation and Power-up 7-1

PMC Installation 7-1
PMCPCI Expansion Card Installation 7-1
Board Installation 7-2
System Configuration Suggestions 7-3
Power-up 7-4
Power-up Routine 7-5

Chapter 8 - Functional Description 8-1

PowerPC Processor 8-2
MPC7455 8-2
L3 Cache 8-2
MPC7410 8-3
L2 Cache 8-3
Resetting the PPC7A 8-4

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Hard Reset 8-4
Soft Reset 8-5
VMEbus Remote Reset 8-5
Watchdog Reset 8-5
Memory 8-6
Controller 8-6
Maps 8-6
SDRAM 8-6
FLASH 8-7
VME Programming Option 8-8
JTAG 8-9
JTAG Clock Frequencies 8-10
JTAG and PMC 8-10
PCI Buses 8-11
Memory/PCI Bridge 8-11
Ethernet Controller 8-12
SCSI Scripts Processor 8-12
VGA graphics Processor 8-12
Universe II 8-12
South Bridge 8-13
PMC Sites 8-13
South Bridge Peripheral Components 8-13
Floppy Disk Controller 8-13
Serial I/O 8-13
Parallel I/O 8-13
Keyboard and Mouse Controller 8-14
VMEbus Interface 8-14
VMEbus Master Access 8-14
VMEbus Slave Access 8-15
Indivisible Cycles on VME 8-15
VMEbus Arbitration 8-15
VMEbus Master Block Transfers 8-15
VMEbus Slave Block Transfers 8-15
Mailboxes 8-15
Semaphore Register 8-16
VMEbus Location Monitor 8-16
VMEbus Interrupts 8-16
VME Bus Errors 8-16
VMEbus Retries 8-17
VMEbus Reset Options 8-17
Watchdog Timers 8-17
Software Programmable LEDs 8-18
Control and Status Registers 8-19
Memory Configuration Register (Port 0x0804) 8-20
Memory Configuration Extend Register (Port 0x0806) 8-21
SCSI Activity LED Register (Port 0x0808) 8-22
Equipment Present Register 1 (Port 0x080C) 8-22
Equipment Present Register 2 (Port 0x080E) 8-23
Equipment Present Register 3 (Port 0x0810) 8-24
Key Lock Register (Port 0x0818) 8-24
LED Register (Port 0x0820) 8-25
COMs Register (Port 0x0824) 8-26
RTS Register (Port 0x0826) 8-27
Watchdog Register (Port 0x0828) 8-27
Watchdog Trig (Port 0x082C) 8-28
Board Revision Register (Port 0x0854) 8-28

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Extended ID Register (Port 0x0858) 8-28
ID Link Register (Port 0x0864) 8-29
Motherboard Type Register (Port 0x0866) 8-30
FLASH Write Protection (Port 0x0868) 8-31
FLASH Control Register (Port 0x086E) 8-32
Control and Status Registers on CS0 8-33
Board ID (Port 0x0) 8-33
Last Reset Source (Port 0x2) 8-33
Reset Register (Port 0x3) 8-34
Board ID String (Port 0x4 to 0x7) 8-34
Status Registers on CS1 8-34
Checker Board 1 (Port 0x0 to 0x3) 8-34
Checker Board 2 (Port 0x4 to 0x7) 8-34
Interrupts and Error Reporting 8-35
System Resets 8-35
Machine Check Exception 8-35
System Management Interrupt (SMI~) 8-35
External Interrupt (INT~) 8-36
PCI Interrupts 8-36
PCI Configuration 8-37
Keylock 8-37

Chapter 9 - Technical Assistance 9-1

Radstone Contact Information 9-1
Troubleshooting 9-2

Appendix A - Specifications A-1

VMEbus Compliance A-2
Local Resources A-3
EMC Regulatory Compliance and Safety A-4
Power Requirements A-4
Reliability (MTBF) A-5
Environmental Specifications A-5
Mechanical Construction A-6
Weight A-6
Dimensions A-6
Ordering Information A-7
PMCs A-8
Operating Systems A-9
P2 I/O Module A-9

Glossary

Index

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Chapter 1 - Introduction

Radstone's PPC7A, with associated peripherals and software, is the latest addition to Radstone's PPC family of VME-based PowerX boards. Designed for users who require scaleable, high performance processors, sophisticated I/O subsystems and high levels of on-board integration, the PPC7A offers a cost-effective solution to a wide range of application requirements. The PPC7A is designed to be as much as possible a plug-in upgrade/replacement for the Radstone PPC range of boards, embracing those features that have made the PPC range of cards such a popular VME card.

Build Levels

Like all Radstone's VME products, the PPC7A is available in a range of build styles, form Level 1 (Standard), suitable for a benign office-like environment, right through to Level 5 (Rugged Conduction-cooled), capable of withstanding the harshest of environments. All products are COTS/NDI and make maximum use of low cost plastic packaged integrated circuits to ensure the most cost effective solution, whatever the market.

Communications

Local connection of Ultra-SCSI, Video graphics and VME64 uses PCI, as do the two IEEE P1386.1 PMC sites. PMCs available directly from Radstone include high performance graphics, MIL-STD-1553, serial, ATM, FLASH memory, Solid State Hard Disk, fast Ethernet and other communications. The PPC7A is the latest of Radstone's VME products to use 5-row connectors for P1 (VME), P2 (I/O) and P0 (PMC I/O).

Standards

Radstone is a key member of the VITA standards committee. In line with their recommendations, one of the two PMC sites has the PMC I/O connected to P0, allowing direct backplane connection to all I/O. The other site has its PMC I/O connected to P2, allowing direct backplane connection to I/O. The PPC7A can also use the PMCPCI bridge product, which can be used to extend the board's PCIbus out via the P0 connector.

This flexibility, together with operating system support including VxWorks/Tornado, LynxOS and RTEMS are factors in making the PPC7A an ideal vehicle for applications such as communications, simulation, multi-media, real-time acquisition, terrain mapping, C^4, image processing and high performance graphics.

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Objectives of this Manual

- To guide the reader through configuration, installation and power-up
- To provide the user with sufficient information to understand the operation of the PPC7A hardware

Note: **The on-board firmware and other firmware (e.g. drivers, BSPs, ESPs etc.) are described in separate manuals.**

Documentation Audience

This manual is written to cover, as far as possible, the range of people who will handle or use the PPC7A including (but not limited to):

- Inspectors
- Installation technicians
- Hardware and software engineers
- System managers

While every effort has been made to keep the description of configuration, installation and power-up as simple and user-friendly as possible, a certain amount of background knowledge on these subjects is assumed.

In the Functional Description chapter, a higher degree of background knowledge is assumed on subjects including:

- Single board computer architecture
- Peripherals
- The VMEbus
- Communications

There is a glossary provided at the back of this manual that explains some of the terms used and expands abbreviations.

Scope of this Manual

This manual describes:

- All build standards of the PPC7A
- All variants of the PPC7A

This manual mentions, but does not describe in detail:

- PMCs, including the PMCPCI bridge product
- Carrier cards
- PPC7A on-board firmware
- Other firmware such as drivers, BSPs, ESPs etc.
- Application software

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Structure of this Manual

This manual is structured in a way that will reflect the sequence of operations from receipt of the PPC7A up to getting it working in your system. Each topic is covered in a separate chapter and each chapter begins with a brief introduction that tells you what the chapter contains. In this way, you can skip any chapters that are not applicable or with which you are already familiar.

The chapters are:

Chapter 1 (this chapter) - gives a brief introduction, this manual's objectives, audience, scope, structure and conventions, safety notices and associated documentation.

Chapter 2 - is a slightly more detailed, but still general product description.

Chapter 3 - contains inspection instructions and describes product identification.

Chapter 4 - describes board configuration.

Chapter 5 - describes the PPC7A's connectors and signals used.

Chapter 6 - describes the PPC7A's front panel.

Chapter 7 - describes installation of the PPC7A in a system and power-up.

Chapter 8 - is a functional description.

Chapter 9 - gives troubleshooting guidelines.

Appendix A - is a board specification.

There is also a glossary and an index provided.

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Safety Notices

Safety Summary

Observe the following general safety precautions during operation, service and repair of this equipment. Failure to comply with these precautions or with specific Warnings and/or Cautions elsewhere in this manual violates safety standards of design, manufacture and intended use of the equipment. Radstone Limited trading as Radstone Technology assumes no liability for the user's failure to comply with these requirements.

The safety precautions listed below represent warnings of certain dangers of which Radstone is aware. Take note of these warnings and take all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Ground the Equipment

To minimise shock hazard, connect the equipment chassis and rack/enclosure to an electrical ground. If AC power is supplied to the rack/enclosure, the power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.

Do Not Operate in an Explosive Atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

If lethal voltages are present in the equipment, do not remove equipment covers. In these circumstances, only Factory Authorised Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly or component replacement, or any internal adjustment. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them

Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person capable of rendering first aid and resuscitation is present.

Do Not Substitute Parts or Modify Equipment

Due to the danger of introducing additional hazards, do not install substitute parts or carry out any unauthorised modification of the equipment. Contact your local Radstone representative for service and repair to ensure that safety features are maintained.

⚠ WARNING

Do not exceed the maximum rated input voltages or apply reversed bias to the assembly.

If such conditions occur, toxic fumes may be produced due to the destruction of components.

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⚠ WARNING

Power supply problems to be dealt with only by qualified personnel.

All Radstone circuit boards are manufactured by UL-recognised manufacturers and have a flammability rating of 94V-0.

⚠ CAUTION

This equipment generates, uses and can radiate electromagnetic energy. It may cause or be susceptible to electromagnetic interference (EMI) if not installed and used in a cabinet with adequate EMI protection.

European Notice: Board products with the CE marking comply with the EMC Directive (89/336/EEC). Compliance with this directive implies conformity to the following European Norms:

EN55022 (CISPR 22) Radio Frequency Interference.

EN50082-1 (IEC80-2, IEC801-3, IEC801-4) Electromagnetic Immunity.

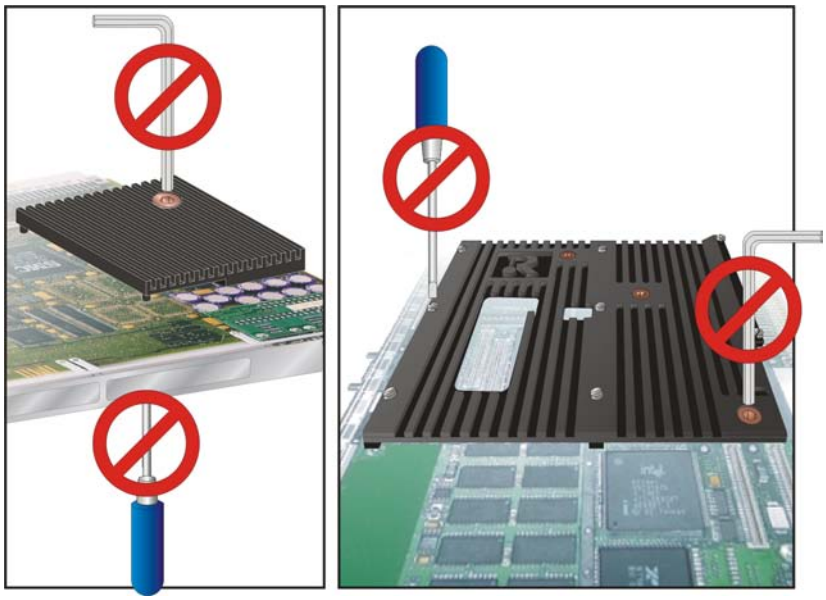
The product also fulfils EN60950 (product safety), which is essentially the requirement for the Low Voltage Directive (73/23/EEC).

The board product was tested in a representative system to show compliance with the above mentioned requirements. A proper installation in a CE-marked system will maintain the required EMC/safety performance.

⚠ CAUTION

Only use the PPC7A in backplanes that supply power on both the J1 and J2 connectors.

Do not remove the heatsink(s).



There are ***no*** PROMs or other user-alterable components underneath the heatsink, so users should have no reason to remove it.

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Users should ***not*** attempt reattachment of the heatsink, as this requires precise torque on the screws attaching the heatsink to the PCB. Over-tightening the screws may cause the heatsink to damage components beneath it (e.g. the main PowerPC processor). **Radstone should only carry out removal and re-attachment of the heatsink.**



CAUTION

When using a conduction-cooled board in a commercial backplane, ensure that the wedgelocks do not interfere with any backplane connection points, such as the ground or Vcc points near the P1 and P2 connectors.

Conventions Used in this Manual

All numbers are expressed in decimal, except addresses and memory or register data, which are expressed in hexadecimal. Where confusion may occur, decimal numbers have a 'D' subscript and binary numbers have a 'b' subscript. The prefix '0x' shows a hexadecimal number, following the 'C' programming language convention. Thus:

One dozen = 12_D = 0x0C = 1100_b

The multipliers 'k', 'M' and 'G' have their conventional scientific and engineering meanings of $*10^3$, $*10^6$ and $*10^9$ respectively. The only exception to this is in the description of the size of memory areas, when 'K', 'M' and 'G' mean $*2^{10}$, $*2^{20}$ and $*2^{30}$ respectively.

Note: When describing transfer rates, 'k' 'M' and 'G' mean $*10^3$, $*10^6$ and $*10^9$ *not* $*2^{10}$, $*2^{20}$ and $*2^{30}$.

In PowerX terminology, multiple bit fields are numbered from 0 to n, where 0 is the MSB and n is the LSB. PCI and VMEbus terminology follows the more familiar convention that bit 0 is the LSB and bit n is the MSB.

Signal names ending in with a tilde (~) denote active low signals; all other signals are active high.

This manual uses three types of notice: notes, cautions and warnings. Shown as follows:

Notes, which take the form '**Note:**', call attention to important features or instructions.

Cautions, which take the following form, alert you to system danger or loss of data.

CAUTION

This is the form a caution takes.

Warnings, which take the following form, alert you to the risk of sever personal injury.

WARNING

This is the form a warning takes

Les avertissements vous préviennent qu'il existe un risque de blessure grave.

Warnhinweise sollen Sie auf mögliche schwere Körperverletzungen aufmerksam machen.

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Associated Documents

Due to the complexity of some of the parts used on the PPC7A, it is not possible to include all the detailed data on all such devices in this manual. The following is a list of the specifications and data sheets that provide any additional information required:

VME64 Specification ANSI/VITA 1-1994 April 1995. VMEbus International Trade Association AZ 85253 USA.

VME64 Extensions Specification. Not Yet Published. VMEbus International Trade Association AZ 85253 USA.

PCI Local Bus Specification, Revision 2.1, June 1 1995. *PCI Special Interest Group OR 98214 USA.*

PCI System Design Guide.

IEEE P1386 Draft Standard for a Common Mezzanine Card Family.

IEEE P1386.1 Draft Standard Physical and Environmental Layers for PCI Mezzanine Cards.

IEEE Std 802.3 Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) - (ETHERNET) (1985) *The Institute of Electronic and Electrical Engineers Inc., NY 10017 USA.*

ANSI X3.131-1986 - Small Computer System Interface (SCSI), *American National Standards Institute NY10036, USA.*

ANSI X3.131-1994 : Information Systems - Small Computer Systems Interface-2 (SCSI-2) *American National Standards Institute NY10036, USA.*

ANSI/EIA/TIA-232-E - Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange (December 1991) *Electronic Industries Association, DC20006 USA.*

ANSI/EIA/TIA-422-B, Electrical Characteristics of Balanced Voltage Digital Interface Circuits (December 1978). *Electronic Industries Association, DC20006 USA.*

PowerPC Microprocessor Family: The Programming Environments, 1994. *IBM VT 05452-4299 or Motorola AZ 85036 USA.*

The PowerPC Architecture: A Specification for a New Family of RISC Processors, Second Edition. *Morgan Kaufmann publishers Inc. San Francisco, California USA.*

PowerPC 745x RISC Microprocessor User's Manual. *Motorola AZ 85036 USA.*

GT64260 System Controller for PowerPC Processors *Galileo Technology, CA 95131 USA.*

NCR53C875 PCI-SCSI I/O Processor Data Manual. *NCR Microelectronic Products Division. CO 80916. USA.*

M1535 South Bridge with integrated Super IO controller. *Acer Labs, Taiwan.*

69000 PCI to VGA device. Asiliant Technologies, CA95112.

Universe II User Manual. Tundra Microsystems ON K2K 2M5 Canada.

FLASH Memory, Volume 1 1995. *Intel corporation IL 60056-7641 USA.*

Radstone PPC Boot Firmware Manual, publication number RT5078.

Radstone PMC9100 Manual, publication number RT5062.

Radstone PMC2-9100 Manual, publication number RT30144.

Radstone BIT on PPCx User Guide, publication number RT5107.

Radstone PMCPCI Manual, publication number PMCPCI-0HH.

Radstone P0CC1 Manual, publication number P0CC1-0HH.

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Radstone PMC Installation Note, publication number HN4/3-99.

Radstone PPC BIT Release Notes, publication number RT5111.

VxWorks BSP for PPCx Release Notes, publication number RT5080.

World Wide Web Sites

Manufacturers of many of the devices used on the PPC7A maintain FTP or world-wide-web sites. Some useful sites are:

Motorola PowerX data is available through this site.

http://e-www.motorola.com/

IBM PowerX data is available through this site.

http://www.chips.ibm.com

Universe II chip information, including the user manuals as Adobe Acrobat .PDF files, is available through this site.

http://www.tundra.com

Graphics adapter information.

http://www.asiliant.com

Radstone on the world-wide-web is available at:

http://www.radstone.co.uk or http://www.radstone.com

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Chapter 2 - General Description

This chapter contains a general description of the PPC7A. Chapter 8 describes the board in more detail.

Introduction

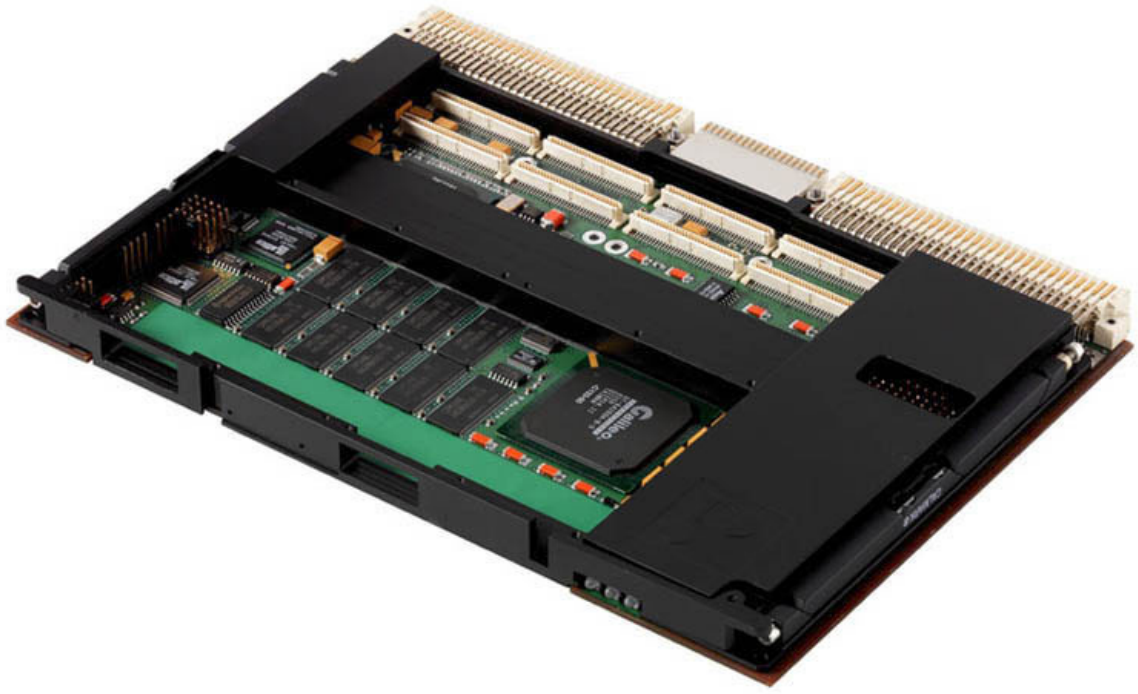
The PPC7A is a highly integrated, VMEbus processor using the PowerPC 745x RISC CPU with integrated L2 cache and a private L3 cache bus or the PowerPC 7410/755 RISC CPU with a private L2 cache bus. The product offers an extensive range of standard functions including processors clocked at 933 MHz and above, 2 Mbytes of L2 (or L3 if 745x fitted) cache, user SDRAM up to 512 Mbytes on-board with ECC, on-board serial, parallel, and two channels of 10/100 base Ethernet, up to 256 Mbytes of FLASH memory, an Ultra-SCSI peripheral interface controller, a 64-bit VMEbus interface, and direct connection for a keyboard and mouse.

Expansion capabilities are provided by two 64-bit/66 MHz PCI interface slots. PCI (IEEE P1386.1) provides an industry-standard, high-speed (528 Mbytes/second) local expansion bus, designed for graphics, high-speed communications (e.g. ATM, FDDI, ISDN, etc.), multi-media and user-defined custom functions. PCI has established itself as the leading local interconnect standard, and the wide availability of compatible devices, coupled with its adoption on an array of platforms, ensures that PCI-based modules are both high-performance and low cost.

The highly integrated nature of the PPC7A makes it a true single board computer. In many ways, the PPC7A resembles a high performance PC motherboard, although in a more rugged, lower profile and more compact form factor.

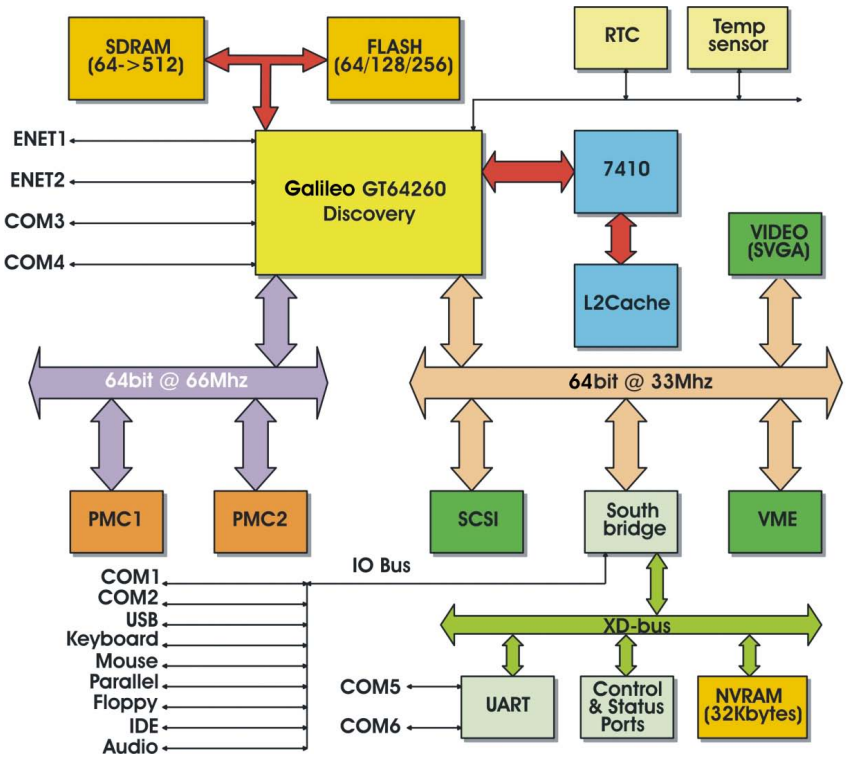
The PPC7A has been designed to be a plug in upgrade/replacement of the PPC range of PowerX boards. To enhance the connection capabilities, the PPC7A uses 5-row P1 and P2 connectors, but still retains the PPC basic pinout.

Figure 2.1 - PPC7A General View



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Figure 2.2 - PPC7A Block Diagram



Features

- Various PowerPC processor options including the PowerPC 7455 CPU at 933 MHz and above (**contact your nearest Sales office for details of speed grades**) gives low power, low cost, high performance PowerPC RISC CPU and system interfaces all on one device as main system resource
- Up to 512 Mbytes of SDRAM with optional ECC for memory intensive applications
- Two 64-bit/66 MHz PCI expansion slots on-board give system expansion using IEEE P1386.1 standard single or double width PMCs
- Optional PCI expansion bridge (on a short PMC card) and PMC carrier cards future proof your system design by enabling PCI sub-system expansion to add new, low cost interface capability as required
- Two on-board Ethernet controllers giving 10/100BaseT
- Radstone COTS software support includes BIT, Boot firmware, BSPs and ESPs (with BCS) for LynxOS/LynxOS HA, VxWorks/Tornado and RTEMS
- Wide range of shrink-wrapped application software available
- 2 Mbytes of cache memory on a private cache bus
- 256 Mbytes of FLASH ROM
- 32 Kbytes of NOVRAM
- Real Time Clock (TOD/calendar) with battery backup using VME standby supply
- Temperature Sensor
- Ultra-SCSI I/O processor

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- 4 off RS232 serial I/O channels up to 115.2 kbaud
- 2 off RS485/422/232 software selectable serial I/O channels up to 1 Mbaud
- Parallel printer port
- 16 bit wide IO interface
- Keyboard/mouse interface
- Floppy disk controller
- VME64 interface using Tundra Universe II VMEbus interface chip
- High-resolution VGA graphics
- Single slot 6U VME form factor for reduced system cost and slot count
- Range of 3U rear-mounting I/O modules
- ANSI/VITA 1-1994 VME64 and VME64 extensions (5 row P1 and P2) compatible
- Five build standards
- Optional software maintenance giving automatic software revision updates and technical support
- Optional hardware and on-board firmware configuration management service giving a unique part number requiring customer authorisation for changes in product revision status

Functional Overview

PowerPC Platform

The PowerPC Platform is an example implementation of a philosophy designed to allow software compatibility across different platforms based on the PowerPC processor. Aiming to achieve an open standard, the PowerPC Platform encourages the use of industry standard components and buses, and a wide range of operating systems.

As well as providing a detailed hardware design specification, the PowerPC Platform also embodies a software mechanism that allows the hardware to be isolated from the application by abstraction layers. It is these abstraction layers (in effect very low-level system drivers) that are the key to differentiation, scalability and future-proofing. Operating systems, applications and drivers can ‘sit’ on these layers without needing to be aware of the underlying hardware (other than general functionality). This is fundamentally different from PCs, which use a BIOS that ultimately constrains operating systems and applications alike.

The major purpose of the PowerPC Platform architecture “... is to give direction to system designers, while still enabling differentiation in areas where real value can be added, thus allowing the PowerPC microprocessor industry to build a reusable body of OS and application software...”. The knowledge that both OS and application programs will run on any host that complies with the PowerPC Platform architecture provides security for today’s valuable software investments, as well as expansion capabilities for the future.

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Processor

The PowerPC has become the most widely used of the new generation of RISC processors. Its pedigree is unequalled - jointly developed by world-leading computer companies and backed by long-term commitments from major OEMs.

PowerPC 7455

The PowerPC 7455 is a 32-bit superscalar RISC processor, clocked at 933 MHz and above, with the following features:

- 64-bit external data bus
- On-chip 32 Kbyte instruction and data caches
- On-chip 256 Kbyte of L2 Cache
- Enhanced branch prediction capabilities
- MMU and integral FPU
- On-chip L3 cache controller that connects to a private L3 cache bus operating at up to 200 MHz

The PowerPC 7455 implements a fully static architecture and offers sophisticated power management capabilities. As a result, its maximum power consumption is less than 20 Watts at 933 MHz.

PowerPC CPU	CPU Frequency (MHz)	SPECINT95	SPECFP95
7455	733	32.1	23.9

PowerPC 7410

The PowerPC 7410 is a 32-bit superscalar RISC processor, clocked at 500 MHz and above, with the following features:

- 64-bit external data bus
- On-chip 32 Kbyte instruction and data caches
- Enhanced branch prediction capabilities
- MMU and integral FPU
- On-chip L2 cache controller that connects to a private L2 cache bus operating at up to 200 MHz

The PowerPC 7410 implements a fully static architecture and offers sophisticated power management capabilities. As a result, its maximum power consumption is less than 12 Watts at 500 MHz.

PowerPC CPU	CPU Frequency (MHz)	SPECINT95	SPECFP95
7410	500	22.8	17

Note: **The above estimated values are supplied by Motorola Semiconductor, and illustrate the performance and power dissipation of the CPU. Radstone PowerX SBCs are designed to take the processor, providing a balanced general-purpose platform. The actual performance and power dissipation may vary depending on the application being run and resource usage of the configured system.**

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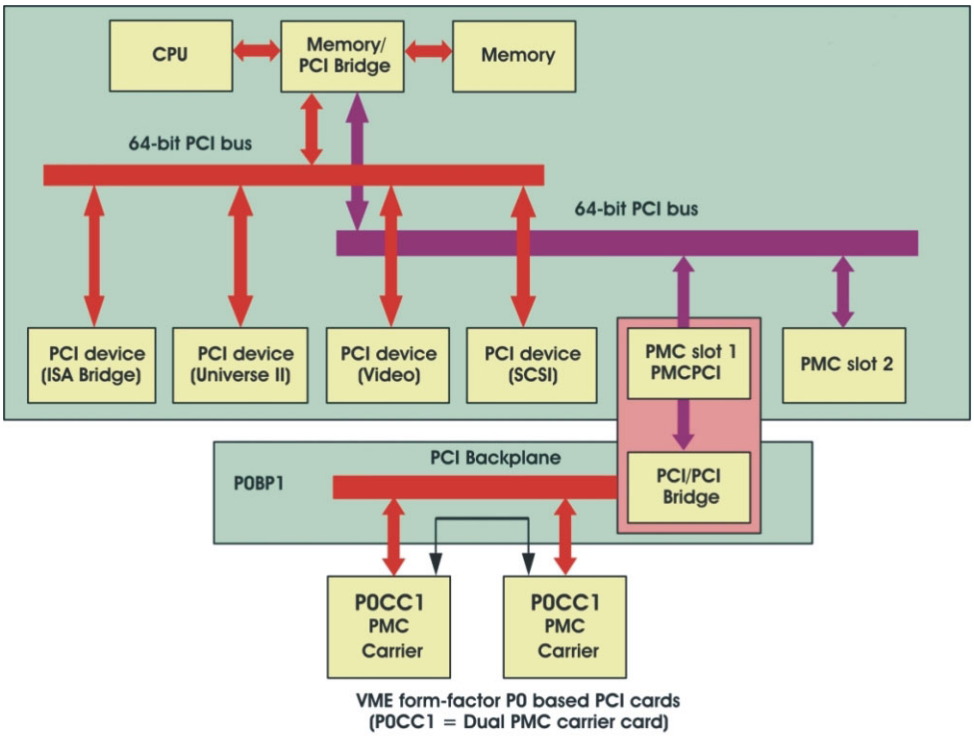
PCI

PCI has become a highly desirable local interface bus, due to its high bandwidth, glueless interface and low cost. PCI provides a synchronous 32 or 64-bit multiplexed address and data bus at speeds of 33 or 66 MHz, allowing burst data transfers to 528 Mbytes/second. The PPC7A uses PCI to provide a high-speed backbone for local interconnection of on-board devices (processor, VGA, Ultra-SCSI, South bridge and VME64, all of which have direct PCI connectivity). The Tundra Universe II chip provides full PCI to VME bridge capability.

As well as local interconnection of on-board devices, PCI also allows communication with optional mezzanine expansion modules (PMCs). The PCI mezzanine format also provides 64 I/O pins for user definition. A range of PMCs are available from Radstone, including high-performance graphics, MIL-STD-1553, asynchronous serial, Fast Ethernet, FLASH memory, Fibre Channel and ATM, all fully compliant with the IEEE P1386.1 standard.

Using the PCI to PCI bridge device on the PMCPCI bridge card (see overleaf), the PPC7A can maintain concurrent bus operation. This allows applications using PMCs for routing and communications to operate efficiently and in parallel without being blocked.

Figure 2.3 - PCI Interconnections



PCI Bridge and Memory Controller

The Galileo GT-64260 Discovery provides the CPU to Memory-PCI bridge. This interfaces the processor to the SDRAM, FLASH and the two PCI buses.

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PCI Expansion Bus

Two PMC slots are provided as standard on the PPC7A. These PCI slots are 64 bits wide and run at 66 MHz. If a PCI card is fitted that is not capable of running at 66 MHz, then the PPC7A will reduce the frequency to 33 MHz for both PCI slots.

For those configurations requiring additional PCI functionality, the PMC to PCI Bridge card (PMCPCI) bridges the on-board PCI bus out via the P0 connector, allowing use of a range of P0 PMC carriers, or interfacing the PPC7A directly to Radstone's range of SHARC-based DSP boards.

To connect the PPC7A to P0-based carrier cards such as the P0CC1, a series of P0 add-on backplanes are available. These are PCBs for attaching to a system backplane that has J0 connectors fitted. The following variants are available:

Variant	PCI Backplane Slots	Master Slots	P0CC1 Slots
P0BP1-502	2	1	1
P0BP1-503	3	1	2
P0BP1-504	4	1	3
P0BP1-505	5	1	4

The P0BP1 backplane must be soldered onto the J0 system backplane, and can be used with either type A or type B J0. These backplanes are intended to have a host SBC with PMCPCI card plugged into the master slot, which is the left-most slot of the P0 PCI backplane. For further information about P0 backplanes, please contact Radstone directly or talk to your nearest Sales Office.

Memory

System RAM

Between 64 and 512 Mbytes (using 256 Mbit devices) of system memory is available. The SDRAM is configured as two banks, with the GT64260 directly controlling both. The GT64260 data protection is by two methods:

- Error Correction Coding - capable of detecting all single bit, double bit and nibble errors, and correcting single bit errors
- Parity - aids the detection of errors, but offers no correction

System FLASH

Up to 8 Mbytes of System FLASH is provided. This holds initialisation and operating system boot routines. The System FLASH is configured as a 32-bit wide device.

User FLASH

Between 24 and 248 Mbytes of User FLASH may be fitted. The data width is configured as a 32-bit wide device.

NOVRAM

For maintenance of general system parameters, such as boot options, Ethernet addresses and VME configuration, 32 Kbytes of on-board NOVRAM provides a convenient non-volatile storage area.

Level 2 or 3 Cache

The PPC7A provides 2 Mbytes of L2 or L3 (with PowerPC 745x) cache, connected to a separate cache bus. By using this private cache bus, the cache traffic does not consume memory bus bandwidth. The

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amount of cache that can be fitted depends on the CPU that is fitted to the PPC7A, for example the MPC7455 limits the external cache to 2 Mbytes.

VMEbus Interface

The Tundra Universe II chip provides a full master/slave VMEbus interface. Features include:

- Full slot 1 (system controller) functionality
- Interrupt handling
- Interrupt generation
- DMA control
- VME64 support

VMEbus slave address decoding is software configurable.

Utility I/O and Auxiliary Function Bus

To take full advantage of low-cost, industry standard components, general purpose I/O and auxiliary functions are implemented through an South bridge bus interface. Facilities provided include:

- Parallel/printer port
- Four PC-compatible serial interfaces
- Floppy disk controller
- Real-time clock
- Keyboard/mouse interface
- USB

Input/Output

The PPC7A has a wide variety of possible I/O connectivity, including the following ports:

- Ultra-SCSI
- Ethernet
- Serial
- Mouse/keyboard
- Parallel/printer
- USB
- VGA-Graphics

To maximise the flexibility of connecting to these ports, a range of I/O modules are available, attached by a VME P2 transition module. Using rear I/O minimises the effort needed to remove boards from a rack, so improving maintainability and reliability.

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Software Support

Radstone's software strategy for PPC boards allows fully integrated system-level solutions to be realised easily and with confidence. Off-the-shelf, layered software modules deliver the most from low-level hardware features while exploiting the best high level debug and run-time functionality of popular COTS operating systems and communications modules.

The software products described below build on those available for previous generations of the PPCx family, so providing a common look, feel and interface for technology inserts.

Radstone has invested more than 50 man-years of engineering talent into the PowerX architecture so that customers can develop market-leading products using the O/S and development environment best suited to their long term program requirements.

Boot Firmware

Developed as an integral part of the Radstone PowerX strategy, the Boot firmware provides a foundation layer to interface between the raw Radstone board hardware, with its highly programmable device set-ups and flexibility, and the supported Operating Systems, which require a straight-forward booting and device interface model.

The PPC Boot Firmware includes comprehensive configuration facilities, interactive or auto-boot sequencing from a range of device types, automatic PCI resource allocation at initialisation, PCI display/interrogation utilities and other valuable features for system integrators.

Memory or other speed and feature enhancements are seamlessly absorbed by the Boot firmware, giving the same look and feel to the O/S and the user application as the Radstone hardware models advance. This allows the constant use of latest technology in required areas without system impact. Where particular operating systems define the use of alternate boot methods (e.g. VxWorks bootroms), the Boot firmware technology is absorbed into such boot methodology.

Built In Test

PPC BIT probes from the lowest level of discrete on-board hardware up to Line Replaceable Unit level within a system, ensuring the highest degree of confidence in system integrity. BIT includes comprehensive configuration facilities, allowing automatic initialisation tests to be defined for the desired mix of system functionality and options. Further tests can be invoked interactively, giving BIT a valuable role as a field service tool. Both object and source code products are available.

Background Condition Screening

BCS supplements the BIT initialisation test coverage with further health screening that can co-exist with a standard COTS Operating System.

In contrast to a traditional BIT-style test, the intensity and coverage of which makes it destructive to operating systems, the configurable BCS package allows functions such as periodic check-summing, memory scrubbing, and others to be tailored for operation alongside the application in on-line conditions. Results are stored in FLASH in the same format as BIT results. Code is available for reading out BIT/BCS results under LynxOS and VxWorks.

Operating System Support

In-house porting expertise for PowerX based boards is focused on key operating systems, including Wind River Systems' VxWorks/Tornado and LynuxWorks' LynxOS. Other operating system ports, drivers for third party hardware and layered products are provided through strategic partnerships with dedicated third party vendors, able to offer high quality products and services complementary to the Radstone range. In this way, state of the art development environments and debug tools that are part of the above software products are made available for use on Radstone's flexible hardware architectures.

Please contact Radstone for availability of other operating systems in addition to the standard VxWorks and LynxOS offerings.

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VxWorks/Tornado

Wind River Systems' VxWorks/Tornado distributed real-time operating system includes integrated networking facilities and a complete software development environment for UNIX hosts. It features a fast, multitasking kernel with pre-emptive scheduling, inter-task communications, multiprocessor support, symbolic and source-level debugging, performance monitoring and an I/O file system.

The full range of facilities are supported by BSPs for all Radstone CPU types, which have been validated by both Radstone and Wind River for the greatest confidence and ease of use. To complement the BSPs, many of Radstone's I/O and graphics products are also supported by libraries and drivers.

LynxOS

Created by LynuxWorks, LynxOS is compatible with UNIX V.3. It is POSIX compliant and supports X.11 (X-Windows), Motif, NFS and TCP/IP. Unlike conventional UNIX, it is fully pre-emptive to ensure that application tasks can be rescheduled if a higher priority task is ready.

BSPs and ESPs

Board Support Packages provide 'standard' support for the above operating systems, as defined by the operating system vendors. Radstone also provide Enhanced Support Packages for comprehensive hardware support in addition to that defined by the operating system vendors. This approach allows users to implement a verifiable BSP standard and yet not be locked out of using valuable extra features, which will adapt the BSP but shorten development times. ESP features may be added or removed as desired during development.

Typical features include VME DMA for VxWorks (not included in WindRiver's BSP definition) and VME enhancements like dynamic windowing and interrupt generation for LynxOS (not included in LynuxWorks' BSP definition. BCS is also part of the ESP.

Build Styles

The PPC7A is available in five electrically compatible build styles. These have two basic mechanical configurations: convection-cooled in accordance with ANSI/VITA 1-1994 spec., and conduction-cooled in accordance with IEEE Std 1101.2-1992.

Convection-cooled boards include:

- Level 1
- Level 2
- Level 3

Conduction-cooled boards include:

- Level 4
- Level 5

A brief description of each build style follows:

Level 1

Intended for use in benign environments, Level 1 also provides the ideal cost effective method of omplete system development. The Level 1 assembly comprises a double-Eurocard size printed wiring board with high quality commercial (plastic encapsulated) components. As software compatibility throughout the build styles is absolute, a system intended for final implementation in a severe tactical environment can be developed and debugged at low cost, switching over to target style only in the final stages of system integration.

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Level 2

As Level 1, but conformally coated and 100% tested in manufacture to provide an extended operating range.

Level 3

Level 3 boards are intended for applications that have extended temperature, shock and vibration requirements, but can be served by conventional, forced-air-cooled, racking systems. These rugged boards comprise a double-Eurocard size printed wiring board fitted with wide temperature range, industrial grade components and are conformally coated as standard.

Level 4

Designed primarily for use in sealed ATR chassis and other conduction-cooled environments the Level 4 board features wide temperature range, industrial grade devices, an integral thermal management layer and incorporates a central stiffening bar for additional strength. Cooling is achieved through conduction of heat from the thermal management layer to the cold wall of the rack to which the boards are secured by screw driven wedgelocks. Level 4 boards are 100% temperature characterized and conformally coated during manufacture. Level 4 is mechanically compliant with IEEE Std. 1101.2- 1992.

Level 5

As Level 4, but 100% tested in manufacture to provide an extended operating range. All five styles fully support the power and versatility of the VMEbus, so no matter how large or diversified your project, absolute compatibility is assured at all stages of development.

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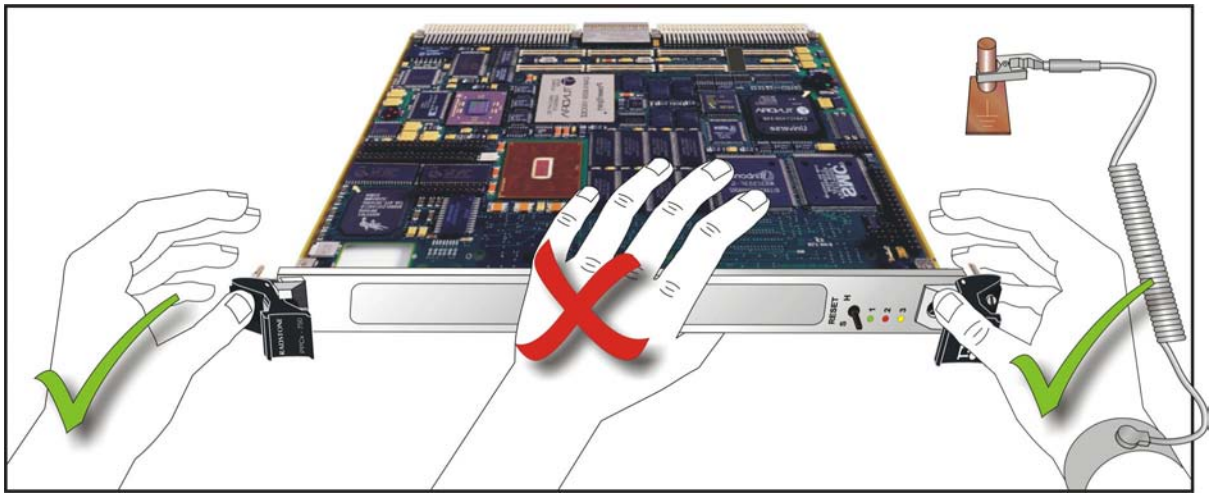
Chapter 3 - Inspection

This chapter gives guidelines on inspecting the PPC7A.

⚠ CAUTION

Observe antistatic precautions (wear an antistatic wrist strap connected to an Earth point and work at an approved antistatic work station) when handling the board.

Figure 3.1 – Board Handling



Product Identification

Radstone hardware products are identified by labels at strategic positions. You can cross-check these against the Advice Note provided as a separate note with your delivery.

On the outside of the shipping box, and the antistatic bag, there is a label similar to the following:



On the card within the antistatic bag, there is an identifying label, similar to the following, attached to the printed wiring board. This is fitted in the most suitable location, which may include the reverse of the board.

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The label gives customer details, that is the board's order number (see Appendix A for more details), serial number and revision.

MADE IN UK	PPC7A-7410-1C10BB3	Base Rev
10233351	Rev	Rev-

If the product features Ethernet capability, a label giving the board's Ethernet number is also attached to the printed wiring board. The Ethernet number has the form XX-XX-XX-XX-XX-XX, for instance:

00-80-8E-
00-50-93

Inspection

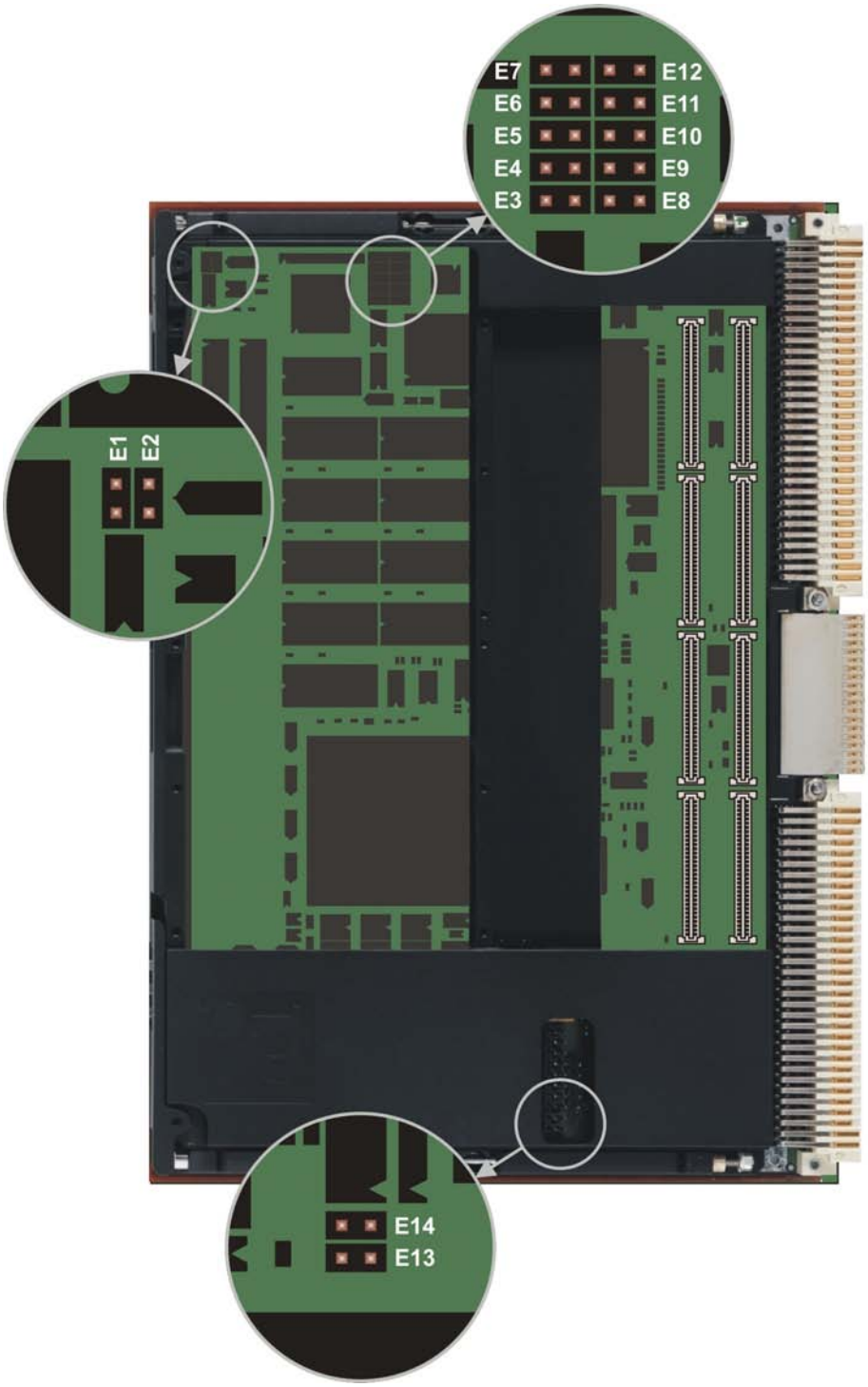
1. Visually inspect the board for any damage and loose or dislodged components.
2. Report any defects you detect to Radstone.
3. Referring to Chapter 4 – Configuration, visually inspect the board to ensure that the default configuration is correct and that there are no loose or missing jumpers:

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Chapter 4 - Configuration

This chapter describes the configuration of links on the PPC7A. The board is delivered with push-on jumper links, but for more rugged or military applications, link pins must be connected using wire wraps.

Figure 4-1. Link Locations



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Default Link Settings

The following table shows the factory default link settings:

LINK	SETTING	ACTION
E1	Out	Standby supply voltage is 5 volts
E3	Out	User FLASH Write Protected
E4	Out	Boot from System FLASH
E5	Out	FLASH Write Protected
E6	Out	ECC Disabled
E7	Out	Select main Boot Image
E8	Out	Boot from System FLASH
E9	Out	System FLASH Write Protected
E13	Out	On-board SCSI terminators disabled
E14	Out	Reset Switch enable
E2, E10, E11,E12	Out	ID links (board ID = 15)

If you wish to change any of these linkable options, refer to the appropriate section(s) in the following pages.

Note: **If you are about to install your board and power-up for the first time, leaving your board in the default configuration (as above), will enable board operation to be proved prior to tackling any more configuration issues.**

RTC Standby Supply Voltage Link (E1)

This link selects the voltage of the standby supply to the I²C RTC (DS1337). As the normal VME standby voltage is 5 Volts, the link should not normally be fitted. However, the PPC7A can be linked to use a backup supply of 3.3 Volts.

Note: **If the link is fitted the Backup supply should never be allowed to go above 3.5 Volts otherwise damage to the DS1337 device might result.**

SETTING	FUNCTION
In	3.3 Volt standby
Out (default)	5 Volt standby

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FLASH Write Enable Links (E3 and E9)

Each link enables or disables erasure/reprogramming of a section of the FLASH. E3 controls the User FLASH and E9 controls the System FLASH. See Chapter 8 for details of FLASH operation.

SETTING	FUNCTION
In	Enables erasure/reprogramming of the section of FLASH
Out (default)	Disables erasure/reprogramming of the section of FLASH

Note: **Regardless of any link settings for the FLASH write protection the Boot Recovery can't be write enabled and also the Boot data area can't be write protected. See Chapter 8 for more details of these FLASH areas.**

VME Boot Link (E4)

This link holds the CPU in reset to allow a VME master to program boot code to the FLASH devices. To program the boot code into the FLASH devices the VME master will need to program up both the Universe and also the GT-64260 to allow a window from VME into the FLASH devices.

SETTING	FUNCTION
In	VME programming mode
Out (default)	Normal boot mode

Use of this link relies on the default Universe II configuration (see the VMEbus Interface Configuration section).

Overall FLASH Write Enable Links (E5)

This link enables or disables erasure/reprogramming of a both sections of the FLASH.

SETTING	FUNCTION
In	Enables erasure/reprogramming of the FLASH
Out (default)	Disables erasure/reprogramming of the FLASH

Note: **To give more flexibility to the system builder, the FLASH can also be write enabled by linking pin A2 of the P0 connector to Ground or Z1 of the P2 connector.**

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ECC Enable Link (E6)

This link enables or disables ECC on the SDRAM, as follows:

SETTING	FUNCTION
In	Enables ECC
Out (default)	Disables ECC

FLASH Boot Image Select Link (E7 & E8)

The System FLASH is divided into four sections, with all sections accessible all the time. Using these links, the four sections can be swapped around in the memory map. This allows for two (three if the data area is not required) boot images to be blown into the FLASH, a Factory blown Boot recovery image, with the links selecting which image is used at boot time. The state of the links is reflected in the Memory Configuration Register (Port 0x0804) - see Chapter 8. Normally, these links are not fitted and the PPC7A boots from the default boot area from FLASH (see Chapter 8 for details of FLASH operation). However, when either of the links are fitted, the PPC7A boots from the alternate boot image. After boot time, the link setting can be software-overridden to select the different images.

E7	E8	FUNCTION
Out (default)	Out (default)	Normal FLASH boot image operation
Out	In	Alternate FLASH boot image
In	Out	Recovery Boot image
In	In	2nd Alternate FLASH boot image (Data area)

On-board SCSI Terminator Enable Link (E13)

This link enables or disables the on-board SCSI terminators, as follows:

SETTING	FUNCTION
In	Enable on-board SCSI terminators
Out (default)	Disable on-board SCSI terminators

If you are using the SCSI bus, you are recommended to locate the PPC7A at one end and enable the terminator by fitting link E13. If you want to use the PPC7A somewhere other than at the end of the SCSI bus, ensure that E13 is not fitted.

Note: **Fitting E13 when the PPC7A is not located at the end of a SCSI bus may cause erroneous SCSI operation.**
This link can be overridden by a control register.

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Enable Front Panel Reset Switch Link (E14)

This link enables or disables the front panel reset/abort switch, as follows:

SETTING	FUNCTION
In	Disable reset switch
Out (default)	Enable reset switch

Note: **The function of this link is the opposite of most other Radstone PPC cards.**

Geographical Addressing/Board ID Links (E11, E2, E12 and E10)

These links form a 4-bit board ID that may be read from the ID Link register (see Chapter 8). The links are decoded as follows:

BOARD ID	E10	E12	E2	E11
15 (default)	Out	Out	Out	Out
14	Out	Out	Out	In
13	Out	Out	In	Out
12	Out	Out	In	In
11	Out	In	Out	Out
10	Out	In	Out	In
9	Out	In	In	Out
8	Out	In	In	In
7	In	Out	Out	Out
6	In	Out	Out	In
5	In	Out	In	Out
4	In	Out	In	In
3	In	In	Out	Out
2	In	In	Out	In
1	In	In	In	Out
0	In	In	In	In

Links E11, E2, E12 and E10 are also connected to the VME64 GA0~ to GA3~ signals respectively on P1 row D (see the P1 connector description in Chapter 5). If you wish to read the status of the Geographical Address signals, do not fit these links, as they connect the signals to 0 Volts.

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VME Slave Address Configuration

The board ID should be set up according to the system slot into which the board is inserted, as shown in the following table. The board ID also sets the board's VME slave addresses, as shown, so take care to avoid an address clash with other boards in the system.

Slot	Slot 1 Functions	Board ID	A32 Address	A24 Address
1	Yes	0	0x0000 0000	0x00 0000
2	No	1	0x1000 0000	0x40 0000
3	No	2	0x2000 0000	0x80 0000
4	No	3	0x3000 0000	0xC0 0000
5	No	4	0x4000 0000	None
6	No	5	0x5000 0000	None
7	No	6	0x6000 0000	None
8	No	7	0x7000 0000	None
9	No	8	0x8000 0000	None
10	No	9	0x9000 0000	None
11	No	A	0xA000 0000	None
12	No	B	0xB000 0000	None
13	No	C	0xC000 0000	None
14	No	D	0xD000 0000	None
15	No	E	0xE000 0000	None
16	No	F	0xF000 0000	None

Note: Any change to the Board ID links will require the hardware registers to be 'relearned' if BIT is not to fail.

VMEbus Interface Configuration

Several operating features of the Universe II VME interface are set at power-up or reset by surface mount jumper links. All of these, except local register access, may be overridden by software. The default settings are:

Operating Feature	Setting
Register access slave image from vmebus	Enabled in A32 space at 0x8000 0000
Vme cr/csr slave image	Disabled
Pci slave image 0	Enabled in PCI memory space at 0xF000 0000 to 0xFFFF FFFF
Local register access	PCI I/O space
Auto-id scheme	Disabled

Changing the default power-up options requires surface-mount rework tools and would normally only be done at the factory. Further details are available from technical support at Radstone.

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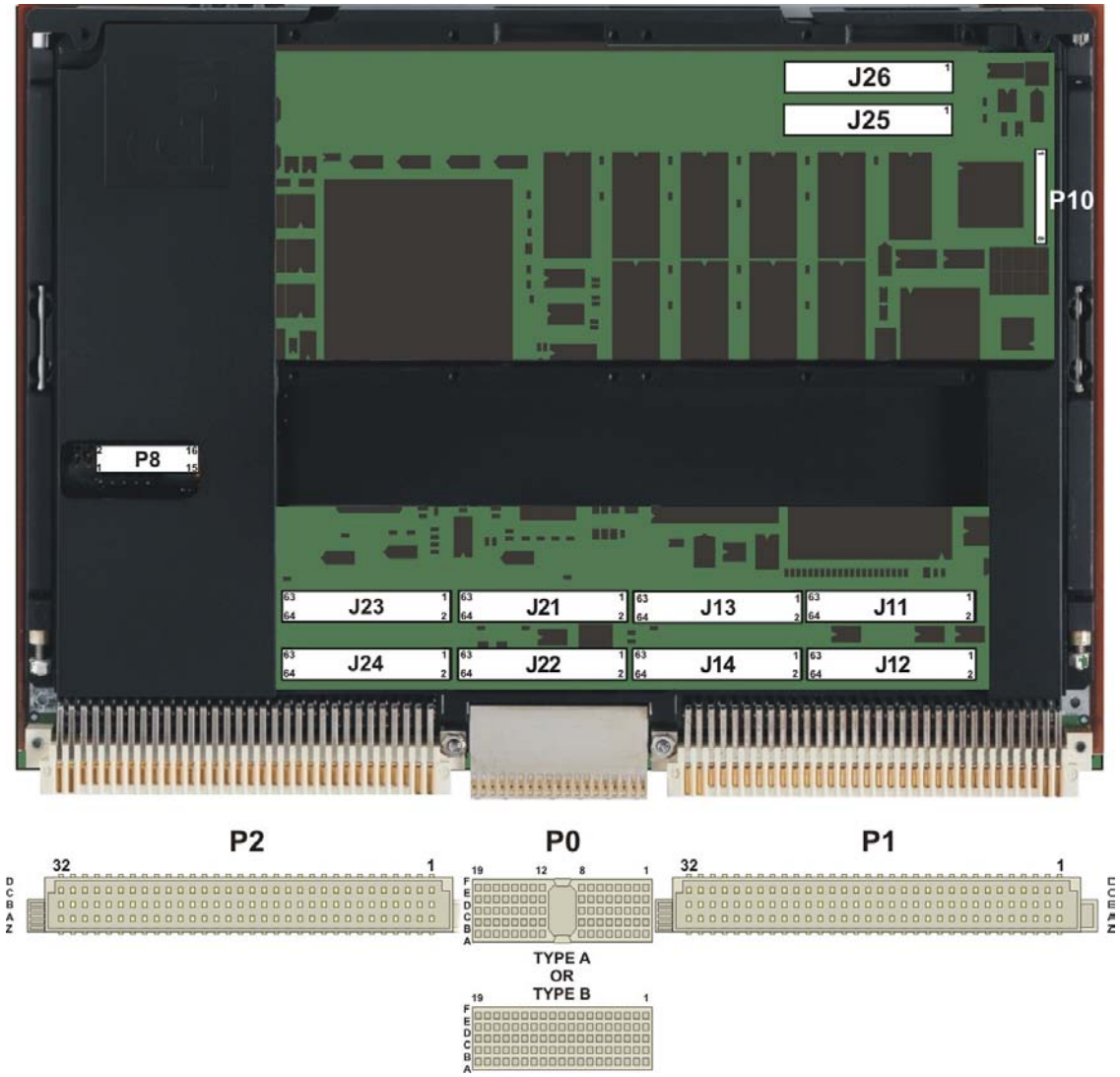
Chapter 5 - Connectors

This chapter gives the pinouts and signal descriptions for the connectors on the PPC7A.

The following table shows the function of the connectors on the PPC7A:

Connector	Function
P1	VMEbus
P2	VMEbus
P0	PMC site 1 I/O
J11, J12, J14	PMC (site 1)
J21, J22, J24	PMC (site 2)
J25, J26	I/O expansion
P8	RISCWatch
P10	JTAG (Factory use)

Figure 5-1. Connector Positions



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P1 (VMEbus) Connector Pinout

Pin No.	Row Z	Row A	Row B	Row C	Row D
1	NC	D00	BBSY~	D08	VCC
2	GND	D01	BCLR~	D09	GND
3	NC	D02	ACFAIL~	D10	NC
4	GND	D03	BG0IN~	D11	NC
5	NC	D04	BG0OUT~	D12	NC
6	GND	D05	BG1IN~	D13	NC
7	NC	D06	BG1OUT~	D14	NC
8	GND	D07	BG2IN~	D15	NC
9	NC	GND	BG2OUT~	GND	NC
10	GND	SYSCLK	BG3IN~	SYSFAIL~	GA0~
11	NC	GND	BG3OUT~	BERR~	GA1~
12	GND	DS1~	BR0~	SYSRESET~	NC
13	NC	DS0~	BR1~	LWORD~	GA2~
14	GND	WRITE~	BR2~	AM5	NC
15	NC	GND	BR3~	A23	GA3~
16	GND	DTACK~	AM0	A22	NC
17	NC	GND	AM1	A21	GA4~
18	GND	AS~	AM2	A20	NC
19	NC	GND	AM3	A19	NC
20	GND	IACK~	GND	A18	NC
21	NC	IACKIN~	NC	A17	NC
22	GND	IACKOUT~	NC	A16	NC
23	NC	AM4	GND	A15	NC
24	GND	A07	IRQ7~	A14	NC
25	NC	A06	IRQ6~	A13	NC
26	GND	A05	IRQ5~	A12	NC
27	NC	A04	IRQ4~	A11	NC
28	GND	A03	IRQ3~	A10	NC
29	NC	A02	IRQ2~	A09	NC
30	GND	A01	IRQ1~	A08	NC
31	NC	N12V	VCCSTDBY	P12V	GND
32	GND	VCC	VCC	VCC	VCC

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P2 Connector Standard Pinout

The following P2 pinout is correct if the J24 connector is not fitted.

Pin No.	Row Z	Row A	Row B	Row C	Row D
1	FLASH_WREN~	DB0~ (SCSI)	+5V	RX0+	COM3_TXD_A
2	GND	DB1~ (SCSI)	GND	RX0-	COM3_TXD_B
3	EXT_RESET~	DB2~ (SCSI)	Reserved	TX0+	COM3_RXD_A
4	GND	DB3~ (SCSI)	A24	TX0-	COM3_RXD_B
5	EXT_ABORT~	DB4~ (SCSI)	A25	RX1+	COM3_RTS_A
6	GND	DB5~ (SCSI)	A26	RX1-	COM3_RTS_B
7	N/C	DB6~ (SCSI)	A27	VSYNC	COM3_CTS_A
8	GND	DB7~ (SCSI)	A28	GPIO0	COM3_CTS_B
9	COM4_TXD_A	DBP0~ (SCSI)	A29	GPIO1	COM5_TXD
10	GND	ATN~ (SCSI)	A30	GPIO2	COM5_RTS
11	COM4_TXD_B	BSY~ (SCSI)	A31	GPIO3	COM6_TXD
12	GND	ACK~ (SCSI)	GND	GPIO4	COM6_RTS
13	COM4_RXD_A	RST~ (SCSI)	+5V	GPIO5	COM5_RXD
14	GND	MSG~ (SCSI)	D16	GPIO6	COM5_CTS
15	COM4_RXD_B	SEL~ (SCSI)	D17	GPIO7	COM3_TT_A
16	GND	C/D (SCSI)	D18	GPIO8	COM3_TT_B
17	COM4_CTS_A	REQ~ (SCSI)	D19	GPIO9	COM3_ST_A
18	GND	I/O (SCSI)	D20	GPIO10	COM3_ST_B
19	COM4_CTS_B	TERMPWR (SCSI)	D21	GPIO11	COM3_RT_A
20	GND	USBP0/MOUSE_CLK	D22	GPIO12	COM3_RT_B
21	N/C	USBP0~/MOUSE_DATA	D23	GPIO13	COM4_RTS_A
22	GND	KBD_5V	GND	GPIO14	COM4_RTS_B
23	N/C	USBP1/KBD_CLK	D24	GPIO16	COM6_RXD
24	GND	USBP1~/KBD_DATA	D25	GPIO17	COM6_CTS
25	COM4_ST_A	COM2_TXD	D26	SPEAKER_OUT	N/C
26	GND	COM2_RXD	D27	KEYLOCK_IN	N/C
27	COM4_ST_B	COM2_RTS	D28	COM1_TXD	COM4_TT_A
28	GND	HSYNC	D29	COM1_RXD	COM4_TT_B
29	COM4_RT_A	COM2_CTS	D30	COM1_RTS	N/C
30	GND	RED	D31	COM1_CTS	N/C
31	COM4_RT_B	GREEN	GND	TX1+	GND
32	GND	BLUE	+5V	TX1-	+5V

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P2 Connector Pinout (when J24 is fitted)

The following P2 pinout is correct if the J24 connector is fitted.

Pin No.	Row Z	Row A	Row B	Row C	Row D
1	PMC2_IO_2	DB0~ (SCSI)	+5V	RX0+	PMC2_IO_1
2	GND	DB1~ (SCSI)	GND	RX0-	PMC2_IO_3
3	PMC2_IO_5	DB2~ (SCSI)	Reserved	TX0+	PMC2_IO_4
4	GND	DB3~ (SCSI)	A24	TX0-	PMC2_IO_6
5	PMC2_IO_8	DB4~ (SCSI)	A25	RX1+	PMC2_IO_7
6	GND	DB5~ (SCSI)	A26	RX1-	PMC2_IO_9
7	PMC2_IO_11	DB6~ (SCSI)	A27	VSYNC	PMC2_IO_10
8	GND	DB7~ (SCSI)	A28	GPIO0	PMC2_IO_12
9	PMC2_IO_14	DBP~ (SCSI)	A29	GPIO1	PMC2_IO_13
10	GND	ATN~ (SCSI)	A30	GPIO2	PMC2_IO_15
11	PMC2_IO_17	BSY~ (SCSI)	A31	GPIO3	PMC2_IO_16
12	GND	ACK~ (SCSI)	GND	GPIO4	PMC2_IO_18
13	PMC2_IO_20	RST~ (SCSI)	+5V	GPIO5	PMC2_IO_19
14	GND	MSG~ (SCSI)	D16	GPIO6	PMC2_IO_21
15	PMC2_IO_23	SEL~ (SCSI)	D17	GPIO7	PMC2_IO_22
16	GND	C/D (SCSI)	D18	GPIO8	PMC2_IO_24
17	PMC2_IO_26	REQ~ (SCSI)	D19	GPIO9	PMC2_IO_25
18	GND	I/O (SCSI)	D20	GPIO10	PMC2_IO_27
19	PMC2_IO_29	TERMPWR (SCSI)	D21	GPIO11	PMC2_IO_28
20	GND	USBP0/MOUSE_CLK	D22	GPIO12	PMC2_IO_30
21	PMC2_IO_32	USBP0~/MOUSE_DATA	D23	GPIO13	PMC2_IO_31
22	GND	KBD_5V	GND	GPIO14	PMC2_IO_33
23	PMC2_IO_35	USBP1/KBD_CLK	D24	GPIO16	PMC2_IO_34
24	GND	USBP1~/KBD_DATA	D25	GPIO17	PMC2_IO_36
25	PMC2_IO_38	COM2_TXD	D26	SPEAKER_OUT	PMC2_IO_37
26	GND	COM2_RXD	D27	KEYLOCK_IN	PMC2_IO_39
27	PMC2_IO_41	COM2_RTS	D28	COM1_TXD	PMC2_IO_40
28	GND	HSYNC	D29	COM1_RXD	PMC2_IO_42
29	PMC2_IO_44	COM2_CTS	D30	COM1_RTS	PMC2_IO_43
30	GND	RED	D31	COM1_CTS	PMC2_IO_45
31	PMC2_IO_46	GREEN	GND	TX1+	GND
32	GND	BLUE	+5V	TX1-	+5V

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Alternate P2 Pinout for GPIO Pins

The following pinout table shows alternate P2 Row C pin functions.

Pin No.	GPIO	Floppy	LPT
8	GPIO0	RDATA~	STROBE~
9	GPIO1	WGATE~	LPTD0
10	GPIO2	WDATA~	LPTD1
11	GPIO3	HDSEL~	LPTD2
12	GPIO4	FD_DIR~	LPTD3
13	GPIO5	STEP~	LPTD4
14	GPIO6	DSKCHG~	LPTD5
15	GPIO7	DRV2~	LPTD6
16	GPIO8	DRV1~	LPTD7
17	GPIO9	MOT0~	ACK~
18	GPIO10	MOT1~	BUSY
19	GPIO11	WPROT~	PERROR
20	GPIO12	TRK0~	SELECT
21	GPIO13	INDEX~	AUTOFD~
22	GPIO14	DENSEL	ERR~
23	GPIO16	GPIO16 (ACGAME3)	INIT~
24	GPIO17	GPIO17 (ACGAME4)	SLCTIN~

Notes: **There is no connection to GPIO15 of the south bridge from the P2 connector.**
There are three build options on these pins:

GPIO and Floppy (standard)

LPT (parallel port)

GPIO or Floppy section is via software control of the south bridge.

Build options also exist for selection of USB ports or Mouse and Keyboard. Standard build is for Mouse and keyboard.

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VMEbus Signal Descriptions

The VMEbus signals occupy rows a, b and c of the P1 connector and row b of the P2 connector.

Mnemonic	Signal Description
A01 to A15	Address Bus (bits 1 to 15). Address lines that are used to broadcast a short address
A16 to A23	Address Bus (bits 16 to 23). Address lines that are used with A01 to A15 and LWORD~ to broadcast a standard address
A24 to A31	Address Bus (bits 24 to 31). Address lines that are used with A01 to A23 and LWORD~ to broadcast an extended or 64-bit address
ACFAIL~	AC Failure. This shows that the AC input to the power supply is no longer being provided or that the required AC input voltage levels are not being met
AM0 to AM5	Address Modifier (bits 0 to 5). These are used to broadcast information such as the address size, cycle type, master identification or any combination of these
AS~	Address Strobe. This shows when a valid address has been placed on the address bus
BBSY~	Bus Busy. This is driven low by the requester associated with the current bus master to show that the master is using the bus
BCLR~	Bus Clear. This is generated by an arbiter to show that there is a higher priority request for the bus than the one being processed. This requests the current master to release the bus
BERR~	Bus Error. This is generated by a slave or bus timer to tell the master that the data transfer did not complete
BG0IN~ to BG3IN~	Bus Grant (0 to 3) In. These signals are generated by the arbiter to tell the board receiving it that if it is requesting the bus on that level, then it has been granted use of the bus. Otherwise the board should pass the signal down the daisy chain. The BGxIN~/BGxOUT~ signals form the bus grant daisy chain, i.e. the BGxOUT~ of one board forms the BGxIN~ of the next board in the daisy chain
BG0OUT~ to BG3OUT~	Bus Grant (0 to 3) Out. These signals are generated by requesters to tell the next board in the daisy chain that if it is requesting the bus on that level, then it can use the bus. Otherwise the board should pass the signal down the daisy chain
BR0~ to BR3~	Bus Request (0 to 3). A low level, generated by a requester, on one of these lines, shows that some master needs to use the bus.
D00 to D31	Data Bus. These are used to transfer data between masters and slaves, and status/ID information from interrupters to interrupt handlers
DS0~, DS1~	Data Strobe 0, 1. These are used with LWORD~ and A01 to show how many byte locations are being accessed (1, 2, 3 or 4). Also, during a write cycle, the falling edge of the first data strobe shows that valid data is available on the bus. On a read cycle, the rising edge of the first data strobe shows that data has been accepted from the data bus
DTACK~	Data Transfer Acknowledge. This signal is generated by a slave. The falling edge shows that valid data is available on the data bus during a read cycle, or that data has been accepted from the data bus during a write cycle. The rising edge shows that the slave has released the data bus at the end of a read cycle
GND	The DC voltage reference for the system
IACK~	Interrupt Acknowledge. This is used by the interrupt handler to acknowledge an interrupt request. It is routed to the IACKIN~ pin of slot 1, where it is monitored by the IACK daisy chain driver
IACKIN~	Interrupt Acknowledge In. This tells the board receiving it that that board can respond to the interrupt acknowledge cycle in process or pass it down the daisy chain. IACKIN~/IACKOUT~ form the interrupt acknowledge daisy chain
IACKOUT~	Interrupt Acknowledge Out. This is sent by a board to tell the next board in the daisy chain that it can respond to the interrupt acknowledge cycle in progress
IRQ1~ to IRQ7~	Interrupt Request (1 to 7). These are driven low by interrupters to request an interrupt on the corresponding level
LWORD~	Longword. This is used with DS0~, DS1~ and A01 to select which byte location(s) within the 4-byte group are accessed during the data transfer
Reserved	This signal is reserved for future enhancements of the VME specification
SERA	The serial clock used to synchronise the data transmission on the serial bus
SERB	This is used for serial data transmission
SYSCLK	System Clock. This provides a constant 16 MHz clock signal that is independent of any other bus timing
SYSFAIL~	System Fail. This shows that a failure has occurred in the system. This signal can be generated by any board in the system
SYSRESET~	System Reset. When this is low, it causes the system to be reset

Continued over leaf.

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VMEbus Signal Descriptions Continued

Mnemonic	Signal Description
WRITE~	Write. This is generated by a master to show whether the data transfer cycle is a read or a write
+5VSTDBY	+5 Volts DC Standby. This supplies +5V DC to devices requiring battery back-up
+5V	+5 Volts DC power
+12V	+12 Volts DC power
-12V	-12 Volts DC power
GA0~ to GA4~	Geographic Address. These are used to set the slave VME address of the board. GA0~ to GA3~ may be set to zero by fitting links E4, E8, E10 and E5 respectively. When GA4~ is not connected, a pull-up resistor on the PPC7A pulls the signal high

P2 I/O Signal Descriptions

Mnemonic	Signal Description
DB0~ to DB7~	SCSI bus data
DBP~	SCSI bus data parity
ATN~	SCSI bus Attention
BSY~	SCSI bus Busy
ACK~	SCSI bus Acknowledge
RST~	SCSI bus Reset
MSG~	SCSI bus Message phase
SEL~	SCSI bus Select
C/D	SCSI bus Command/Data phase
REQ~	SCSI bus Request
I/O	SCSI bus I/O phase
TERMPWR	SCSI bus terminator power. Supplies power for external SCSI bus terminators. Rated at 1 Amp†
MOUSE_CLK	Mouse Clock. Clock drive for mouse
MOUSE_DATA	Mouse Data. Mouse data line
KBD_5V	Keyboard 5V. Supplies power for the keyboard and mouse or USB supply when USB is fitted. Rated at 1A†
KBD_CLK	Keyboard Clock. Clock drive for the keyboard
KBD_DATA	Keyboard Data. Keyboard data line
COM1/2/3/4/5/6_TXD	COM1/2/3/4/5/6 Transmit Data
COM1/2/3/4/5/6_RXD	COM1/2/3/4/5/6 Receive Data
COM1/2/3/4/5/6_RTS	COM1/2/3/4/5/6 Request-To-Send
COM1/2/3/4/5/6_CTS	COM1/2/3/4/5/6 Clear-To-Send
COM3/4_TT	COM3/4 Terminal timing
COM3/4_RT	COM3/4 Receive timing
COM3/4_ST	COM3/4 Send timing
KEYLOCK_IN	Keylock input. Used to detect the state of an external keyswitch. May be used to implement system password protection
SPEAKER_OUT	Loudspeaker Output. Outputs Timer2 Audio. May be used to drive 4Ω or 8Ω loudspeaker
NSELECTIN	Parallel port Select In
nINIT	Parallel port INIT
nFAULT	Parallel port FAULT
nAUTOFD	Parallel port AUTOFD
SELECT	Parallel port SELECT
PERROR	Parallel port PERROR

Continued over leaf.

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P2 I/O Signal Descriptions Continued

Mnemonic	Signal Description
BUSY	Parallel port BUSY
nACK	Parallel port ACK
D1 to D8	Parallel port data bits
nSTROBE	Parallel port STROBE
TX0±/TX1±	10/100BaseT transmit data
RX0±/RX±	10/100BaseT receive data
FLASH_WREN~	Global FLASH write enable
EXT_RESET~	External Reset (Hard Reset)
EXT_ABORT~	External Abort (Soft Reset)
USBP0/USBP0~	USB interface Port 0
USBP1/USBP1~	USB interface Port 1
RED, GREEN, BLUE, VSYNC, HSYNC	VGA port
PMC2_IO_1 to PMC2_IO_46	I/O signals from PMC site 2

† **This is a resettable fuse. The fuse rating is the current rating that the fuse can carry. In 20°C still air, the fuse trips at twice the rated current.**

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P0 Connector Pinout

Type B (95-way)

P0 is routed to J14 and partially to J24.

Note: **Due to the large amount of I/O required to be handled by the PPC7A, Type B connectors are preferred to the Type A (80-pin) shown overleaf, and are fitted by default no particular type is specified.**

Pin No.	Row A	Row B	Row C	Row D	Row E	Row F
1	NC	REDLED~	EXTRESET~	TCE7	TCE6	GND
2	FLASH_WREN~	GREENLED~	EXTABORT~	TCT7	TCT6	GND
3	3.3V†	3.3V†	3.3V†	+5V	+5V	GND
4	PMC1_IO_5	PMC1_IO_4	PMC1_IO_3	PMC1_IO_2	PMC1_IO_1	GND
5	PMC1_IO_10	PMC1_IO_9	PMC1_IO_8	PMC1_IO_7	PMC1_IO_6	GND
6	PMC1_IO_15	PMC1_IO_14	PMC1_IO_13	PMC1_IO_12	PMC1_IO_11	GND
7	PMC1_IO_20	PMC1_IO_19	PMC1_IO_18	PMC1_IO_17	PMC1_IO_16	GND
8	PMC1_IO_25	PMC1_IO_24	PMC1_IO_23	PMC1_IO_22	PMC1_IO_21	GND
9	PMC2_IO_50	PMC2_IO_49	PMC2_IO_62	PMC2_IO_56	PMC2_IO_55	GND
10	PMC2_IO_48	PMC2_IO_47	GND	PMC2_IO_64	PMC2_IO_63	GND
11	PMC2_IO_52	PMC2_IO_51	PMC2_IO_61	PMC2_IO_58	PMC2_IO_57	GND
12	PMC1_IO_30	PMC1_IO_29	PMC1_IO_28	PMC1_IO_27	PMC1_IO_26	GND
13	PMC1_IO_35	PMC1_IO_34	PMC1_IO_33	PMC1_IO_32	PMC1_IO_31	GND
14	PMC1_IO_40	PMC1_IO_39	PMC1_IO_38	PMC1_IO_37	PMC1_IO_36	GND
15	PMC1_IO_45	PMC1_IO_44	PMC1_IO_43	PMC1_IO_42	PMC1_IO_41	GND
16	PMC1_IO_50	PMC1_IO_49	PMC1_IO_48	PMC1_IO_47	PMC1_IO_46	GND
17	PMC1_IO_55	PMC1_IO_54	PMC1_IO_53	PMC1_IO_52	PMC1_IO_51	GND
18	PMC1_IO_60	PMC1_IO_59	PMC1_IO_58	PMC1_IO_57	PMC1_IO_56	GND
19	+5V	PMC1_IO_64	PMC1_IO_63	PMC1_IO_62	PMC1_IO_61	GND

† **The 3.3V pins are *not* connected to a 3.3V supply. They are merely bussed together with the 3.3V pins on the VME P1 connector, the external PMC option is fitted then this is routed to the PMC connectors J12/J22, and capacitively decoupled to ground.**

EXTRESET~ generates a Hard Reset and EXTABORT~ generates a Soft Reset. See the Resetting the PPC7A section in Chapter 8 for more details.

Note: **Analogue signals should not be routed through P0.**

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Type A (80-way)

P0 is routed to J14.

Note: **Due to the large amount of I/O required to be handled by the PPC7A, Type B (95-way) connectors are preferred to Type A, and are fitted by default no particular type is specified.**

Pin No.	Row A	Row B	Row C	Row D	Row E	Row F
1	NC	REDLED~	EXTRESET~	TCE7	TCE6	GND
2	FLASH_WREN~	GREENLED~	EXTABORT~	TCT7	TCT6	GND
3	3.3V†	3.3V†	3.3V†	+5V	+5V	GND
4	PMC1_IO_5	PMC1_IO_4	PMC1_IO_3	PMC1_IO_2	PMC1_IO_1	GND
5	PMC1_IO_10	PMC1_IO_9	PMC1_IO_8	PMC1_IO_7	PMC1_IO_6	GND
6	PMC1_IO_15	PMC1_IO_14	PMC1_IO_13	PMC1_IO_12	PMC1_IO_11	GND
7	PMC1_IO_20	PMC1_IO_19	PMC1_IO_18	PMC1_IO_17	PMC1_IO_16	GND
8	PMC1_IO_25	PMC1_IO_24	PMC1_IO_23	PMC1_IO_22	PMC1_IO_21	GND
9	PMC1_IO_30	PMC1_IO_29	PMC1_IO_28	PMC1_IO_27	PMC1_IO_26	GND
10	PMC1_IO_35	PMC1_IO_34	PMC1_IO_33	PMC1_IO_32	PMC1_IO_31	GND
11	PMC1_IO_40	PMC1_IO_39	PMC1_IO_38	PMC1_IO_37	PMC1_IO_36	GND
12	PMC1_IO_45	PMC1_IO_44	PMC1_IO_43	PMC1_IO_42	PMC1_IO_41	GND
13	PMC1_IO_50	PMC1_IO_49	PMC1_IO_48	PMC1_IO_47	PMC1_IO_46	GND
14	PMC1_IO_55	PMC1_IO_54	PMC1_IO_53	PMC1_IO_52	PMC1_IO_51	GND
15	PMC1_IO_60	PMC1_IO_59	PMC1_IO_58	PMC1_IO_57	PMC1_IO_56	GND
16	+5V	PMC1_IO_64	PMC1_IO_63	PMC1_IO_62	PMC1_IO_61	GND

† **The 3.3V pins are *not* connected to a 3.3V supply. They are merely bussed together with the 3.3V pins on the VME P1 connector, the external PMC option is fitted then this is routed to the PMC connectors J12/J22, and capacitively decoupled to ground.**

EXTRESET~ generates a Hard Reset and EXTABORT~ generates a Soft Reset. See the Resetting the PPC7A section in Chapter 8 for more details.

Note: **Analogue signals should not be routed through P0.**

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P0 I/O Signal Descriptions

Mnemonic	Signal Description
REDLED~	Driven identically to the corresponding LED except that this signal has a separate buffer with a 180Ω series resistor
GREENLED~	Driven identically to the corresponding LED except that this signal has a separate buffer with a 180Ω series resistor
FLASH_WP~	FLASH Write Protect signal
EXTRESET~	Generates a Hard Reset. See the Resetting the PPC7A section in Chapter 8 for more details
EXTABORT~	Generates a Soft Reset. See the Resetting the PPC7A section in Chapter 8 for more details
NC	No connection
TCE6 & TCE7	GT-64260 Timer counter enable
TCT6 & TCT7	GT-64260 Timer counter terminal count
3.3V†	These pins are not connected to a 3.3V supply
+5V	+5 Volts DC power
PMC1_IO_1 to PMC2_IO_64	I/O signals from PMC site 1
PMC2_IO_48 to PMC_IO_52, PMC2_IO_55 to PMC_IO_58 and PMC2_IO_61 to PMC_IO_64	I/O signals from PMC site 2. PMC2_IO_48, PMC2_IO_50, PMC_IO_52, PMC2_IO_56, PMC2_IO_58, PMC2_IO_62 and PMC2_IO_64 are not available when a Fibre Channel PMC with rear I/O is fitted
GND	The DC voltage reference for the system

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PMC Connector Pinouts

J11/J21 and J12/J22 give the signals for 32-bit PCI. J13/J23 give the signals for 64-bit PCI and J14/J24 give the user I/O signals.

J11 and J21

Pin No.	Signal	Pin No.	Signal
1	TCK	2	-12V
3	GND	4	INTA~
5	INTB~	6	INTC~
7	BUSMODE1~	8	+5V
9	INTD~	10	NC
11	GND	12	NC
13	CLK	14	GND
15	GND	16	GNTA~
17	REQA~	18	+5V
19	VIO	20	AD31
21	AD28	22	AD27
23	AD25	24	GND
25	GND	26	C/BE3~
27	AD22	28	AD21
29	AD19	30	+5V
31	VIO	32	AD17
33	FRAME~	34	GND
35	GND	36	IRDY~
37	DEVSEL~	38	+5V
39	GND	40	LOCK~
41	NC	42	NC
43	PAR	44	GND
45	VIO	46	AD15
47	AD12	48	AD11
49	AD09	50	+5V
51	GND	52	C/BE0~
53	AD06	54	AD05
55	AD04	56	GND
57	VIO	58	AD03
59	AD02	60	AD01
61	AD00	62	+5V
63	GND	64	REQ64~

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J12 and J22

Pin No.	Signal	Pin No.	Signal
1	+12V	2	TRST~
3	TMS	4	TDO
5	TDI	6	GND
7	GND	8	NC
9	NC	10	NC
11	BUSMODE2~	12	3.3V†
13	RST~	14	BUSMODE3~
15	3.3V†	16	BUSMODE4~
17	NC	18	GND
19	AD30	20	AD29
21	GND	22	AD26
23	AD24	24	3.3V†
25	IDSELA	26	AD23
27	3.3V†	28	AD20
29	AD18	30	GND
31	AD16	32	C/BE2~
33	GND	34	IDSELB
35	TRDY~	36	3.3V†
37	GND	38	STOP~
39	PERR~	40	GND
41	3.3V†	42	SERR~
43	C/BE1~	44	GND
45	AD14	46	AD13
47	M66EN	48	AD10
49	AD08	50	3.3V†
51	AD07	52	REQB~
53	3.3V†	54	GNTB~
55	NC	56	GND
57	NC	58	NC
59	GND	60	NC
61	ACK64~	62	3.3V†
63	GND	64	NC

† **The 3.3V pins are connected to the PPC7A main 3.3V supply.**

⚠ CAUTION

Do not fit a PMC that requires more than 8 watts from the 3.3V supply.

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J13 and J23

Pin No.	Signal	Pin No.	Signal
1	Reserved (PCI)	2	GND
3	GND	4	CBE7~
5	CBE6~	6	CBE5~
7	CBE4~	8	GND
9	V (I/O)	10	PARR64
11	AD63	12	AD62
13	AD61	14	GND
15	GND	16	AD60
17	AD59	18	AD58
19	AD57	20	GND
21	V (I/O)	22	AD56
23	AD55	24	AD54
25	AD53	26	GND
27	GND	28	AD52
29	AD51	30	AD50
31	AD49	32	GND
33	GND	34	AD48
35	AD47	36	AD46
37	AD45	38	GND
39	V (I/0)	40	AD44
41	AD43	42	AD42
43	AD41	44	GND
45	GND	46	AD40
47	AD39	48	AD38
49	AD37	50	GND
51	GND	52	AD36
53	AD35	54	AD34
55	AD33	56	GND
57	V (I/O)	58	AD32
59	Reserved (PCI)	60	Reserved (PMC)
61	Reserved (PCI)	62	GND
63	GND	64	Reserved (PMC)

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PMC Signal Descriptions

Mnemonic	Signal Description
AD0 to AD63	Address/Data bits. Multiplexed address and data bus
C_BE0 to C_BE7	Command/Byte Enables. During the address phase, these signals specify the type of cycle to carry out on the PCI bus. During the data phase the signals are byte enables that specify the active bytes on the bus
FRAME~	FRAME. Driven low by the current master to signal the start and duration of an access
DEVSEL~	Device Select. Driven low by a PCI agent to signal that it has decoded its address as the target of the current access
PAR	Parity. Parity protection bit for AD0 to AD31 and BE0 to BE3
PARR64	Parity. Parity protection bit for AD32 to AD63
IRDY~	Initiator Ready. Driven low by the initiator to signal its ability to complete the current data phase
LOCK~	LOCK. Driven low to indicate an atomic operation that may require multiple transactions to complete
BUSMODE1~	Bus Mode 1. Driven low by a PMC if it supports the current bus mode
BUSMODE2~, BUSMODE3~ and BUSMODE4~	Bus mode. Driven by the host to indicate the bus mode. On the PPC7A this is always PCI. BUSMODE2~ is only connected to a 4.7 kΩ pull-up. BUSMODE3~ and BUSMODE4~ are connected to GND.
RST~	Reset. Driven low to reset the PCI bus
TRDY~	Target Ready. Driven low by the current target to signal its ability to complete the current data phase
PERR~	Parity Error. Driven low by a PCI agent to signal a parity error
SERR~	System Error. Driven low by a PCI agent to signal a system error
STOP~	STOP. Driven low by a PCI target to signal a disconnect or target-abort
INTA~ to INTD~	Interrupt lines. Level-sensitive, active-low interrupt requests
CLK	Clock. All PCI bus signals except RST~ are synchronous to this clock.
REQA/B~	Request. Driven low by a PCI agent to request ownership of the PCI bus
GNTA/B~	Grant. Driven low by the arbiter to grant PCI bus ownership to a PCI agent
IDSELA/B	Initialisation Device Select. Device chip select during configuration cycles
NC	No connection
REQ64~	Request 64 Bit. Driven low by PCI master to request 64 bit transfer
ACK64~	Acknowledge 64 Bit. Driven low by PCI agent in response to REQ64
TCK	Test Clock. Clock for the PMC JTAG
TMS	Test Mode Select. Select Test Mode for PMC JTAG
TRST~	Test Reset. Reset any PMC JTAG devices
TDI	Test Data In. Input data for PMC JTAG chain
TDO	Test Data Out. Data from a PMC JTAG chain

Note: **The PPC7A supports PMC clocking at speeds up to 66 MHz. However, if a PMC is fitted to the PPC7A that does not support the 66 MHz clocking speed, then *both* sites are limited to 33 MHz.**

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J14 PMC I/O

J14 is routed to P0.

Pin No.	Signal	Pin No.	Signal
1	PMC1_IO_1	2	PMC1_IO_2
3	PMC1_IO_3	4	PMC1_IO_4
5	PMC1_IO_5	6	PMC1_IO_6
7	PMC1_IO_7	8	PMC1_IO_8
9	PMC1_IO_9	10	PMC1_IO_10
11	PMC1_IO_11	12	PMC1_IO_12
13	PMC1_IO_13	14	PMC1_IO_14
15	PMC1_IO_15	16	PMC1_IO_16
17	PMC1_IO_17	18	PMC1_IO_18
19	PMC1_IO_19	20	PMC1_IO_20
21	PMC1_IO_21	22	PMC1_IO_22
23	PMC1_IO_23	24	PMC1_IO_24
25	PMC1_IO_25	26	PMC1_IO_26
27	PMC1_IO_27	28	PMC1_IO_28
29	PMC1_IO_29	30	PMC1_IO_30
31	PMC1_IO_31	32	PMC1_IO_32
33	PMC1_IO_33	34	PMC1_IO_34
35	PMC1_IO_35	36	PMC1_IO_36
37	PMC1_IO_37	38	PMC1_IO_38
39	PMC1_IO_39	40	PMC1_IO_40
41	PMC1_IO_41	42	PMC1_IO_42
43	PMC1_IO_43	44	PMC1_IO_44
45	PMC1_IO_45	46	PMC1_IO_46
47	PMC1_IO_47	48	PMC1_IO_48
49	PMC1_IO_49	50	PMC1_IO_50
51	PMC1_IO_51	52	PMC1_IO_52
53	PMC1_IO_53	54	PMC1_IO_54
55	PMC1_IO_55	56	PMC1_IO_56
57	PMC1_IO_57	58	PMC1_IO_58
59	PMC1_IO_59	60	PMC1_IO_60
61	PMC1_IO_61	62	PMC1_IO_62
63	PMC1_IO_63	64	PMC1_IO_64

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J24 PMC I/O and Partial P2 Option

J24 may be partially routed to the P2 connector, depending on the build option. If used, then COM3 and COM4 are no longer routed to P2. P2 now has the connections shown in the following table:

J24 Pin No.	PMC Signal	Connections		J24 Pin No.	PMC Signal	Connections	
		P2	P0			P2	P0
1	PMC2_IO_1	D1		2	PMC2_IO_2	Z1	
3	PMC2_IO_3	D2		4	PMC2_IO_4	D3	
5	PMC2_IO_5	Z3		6	PMC2_IO_6	D4	
7	PMC2_IO_7	D5		8	PMC2_IO_8	Z5	
9	PMC2_IO_9	D6		10	PMC2_IO_10	D7	
11	PMC2_IO_11	Z7		12	PMC2_IO_12	D8	
13	PMC2_IO_13	D9		14	PMC2_IO_14	Z9	
15	PMC2_IO_15	D10		16	PMC2_IO_16	D11	
17	PMC2_IO_17	Z11		18	PMC2_IO_18	D12	
19	PMC2_IO_19	D13		20	PMC2_IO_20	Z13	
21	PMC2_IO_21	D14		22	PMC2_IO_22	D15	
23	PMC2_IO_23	Z15		24	PMC2_IO_24	D16	
25	PMC2_IO_25	D17		26	PMC2_IO_26	Z17	
27	PMC2_IO_27	D18		28	PMC2_IO_28	D19	
29	PMC2_IO_29	Z19		30	PMC2_IO_30	D20	
31	PMC2_IO_31	D21		32	PMC2_IO_32	Z21	
33	PMC2_IO_33	D22		34	PMC2_IO_34	D23	
35	PMC2_IO_35	Z23		36	PMC2_IO_36	D24	
37	PMC2_IO_37	D25		38	PMC2_IO_38	Z25	
39	PMC2_IO_39	D26		40	PMC2_IO_40	D27	
41	PMC2_IO_41	Z27		42	PMC2_IO_42	D28	
43	PMC2_IO_43	D29		44	PMC2_IO_44	Z29	
45	PMC2_IO_45	D30		46	PMC2_IO_46	Z31	
47	PMC2_IO_47		B10	48	PMC2_IO_48		A10
49	PMC2_IO_49		B9	50	PMC2_IO_50		A9
51	PMC2_IO_51		B11	52	PMC2_IO_52		A11
53	PMC2_IO_53			54	PMC2_IO_54		
55	PMC2_IO_55		E9	56	PMC2_IO_56		D9
57	PMC2_IO_57		E11	58	PMC2_IO_58		D11
59	PMC2_IO_59			60	PMC2_IO_60		
61	PMC2_IO_61		C11	62	PMC2_IO_62		C9
63	PMC2_IO_63		E10	64	PMC2_IO_64		D10

Note: **P0 pins A9, A10, A11, C9, D9, D10 and D11 are not available if a Fibre Channel PMC with rear I/O is fitted.**

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P10 PLD Connector Pinout

P10 is the programming JTAG chain this is normally for factory use.

Pin No.	Description
1	VCC
2	PLD_TDO
3	PLD_TDI
4	N/C
5	KEYWAY
6	PLD_TMS
7	GND
8	PLD_TCK

For more information on JTAG, see Chapter 8.

P8 RISCWatch Connector Pinout

P8 is the RISCWatch connector allowing the connection of software debugging tools that use the processor's JTAG port to control the operation of the processor.

Pin No.	Signal	Pin No.	Signal
1	TDO_CPU	2	EMU~/QACK_IN~
3	TDI_CPU	4	TRST~
5	QREQ~	6	+3.3V pull-up
7	TCK	8	NC
9	TMS	10	NC
11	SRESET_CPU~	12	GND
13	HRESET_CPU~	14	NC
15	CHECKSTOP~	16	GND

For more information on JTAG, see Chapter 8.

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P8 Signal Descriptions

Signal	Description
TDO_CPU	Processor JTAG Test Data Out
EMU~	When connected to GND, creates QACK~ to the processor. This connection should be made with an emulator
TDI_CPU	Processor JTAG Test Data In
TRST~	Processor JTAG Test Reset
+3.3V PULL-UP	Power-on status signal to RISCWatch hardware
TCK	Processor JTAG Test Clock
TMS	Processor JTAG Test Mode Select
SRESET_CPU~	Processor Soft Reset
GND	Signal ground
HRESET_CPU~	Processor Hard Reset
CHECKKSTOP~	Processor Checkstop output
GND	Signal ground

For more information on JTAG, see Chapter 8.

EST Emulator Connection

Pin No.	Signal	Description
1	TDO_CPU	Processor JTAG Test Data Out
2	QACK_IN~	Quiescent grant to Processor
3	TDI_CPU	Processor JTAG Test Data In
4	TRST~	Processor JTAG Test Reset
5	QREQ~	Processor Quiescent request
6	+3.3V pull-up	Power-on status signal to EST hardware
7	TCK	Processor JTAG Test Clock
9	TMS	Processor JTAG Test Mode Select
11	SRESET_CPU~	Processor Soft Reset
12	GND	Signal ground
13	HRESET_CPU~	Processor Hard Reset
15	CHECKKSTOP~	Processor Checkstop output
16	GND	Signal ground

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Chapter 6 - Front Panel

This chapter describes the features found on the PPC7A front panel.

Air-cooled Versions

PMC Slots

There are two PMC slots in the front panel. However, if you have not ordered PMCs for the sites then Radstone will fit a blanking plate in the slot(s) for EMC protection.

If you are fitting a non-Radstone PMC, it must comply with the standard for rugged, conduction-cooled PMCs to ensure that it mates correctly with the PPC7A mechanics. This will be the case for Radstone PMCs.

If you are fitting a PMC yourself, before fitting the module, remove the corresponding blanking plate from the desired PMC slot. The PMC's bezel will fill the slot and will usually provide connection to the module. PMCs are delivered with a full kit of parts for mounting them, and the manual for the module normally contains instructions on how to fit the module.

LEDs

Three software programmable LEDs (DS1 to DS3) are mounted on the front panel. DS1 is yellow, DS2 is red and DS3 is green. See the Software Programmable LEDs section in Chapter 9 for more details.

Switches

A momentary action toggle switch is fitted to allow generation of a hard reset or abort. With the board in the orientation as shown in Figure 6-1, moving the switch to the left causes an abort, and moving the switch to the right causes a hard reset.

See Chapter 9 for more details.

Conduction-cooled Versions

PMC Slots

There are two conduction-cooled PMC slots in the front panel, allowing limited access to PCI signals. If you are fitting a non-Radstone PMC, it must comply with the standard for rugged, conduction-cooled PMCs to ensure that it mates correctly with the PPC4 mechanics. This will be the case for Radstone PMCs.

LEDs

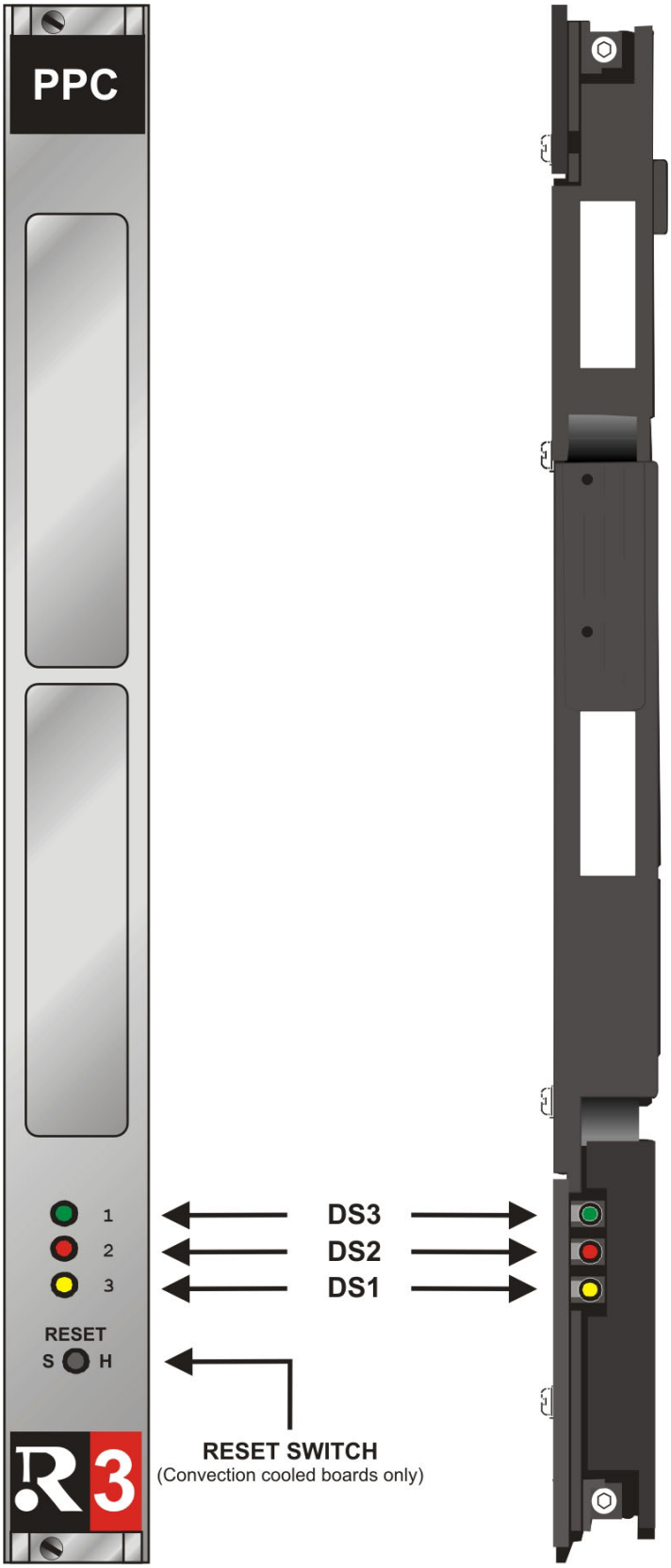
Three software programmable LEDs (DS1 to DS3) are mounted on the front panel. DS1 is yellow, DS2 is red and DS3 is green. See the Software Programmable LEDs section in Chapter 9 for more details.

Switches

There are no switches on the conduction-cooled front panel.

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Figure 6-1. PPC7A Front Panel



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Chapter 7 - Installation and Power-up

This chapter describes the installation of PMC cards on the PPC7A and the installation of the PPC7A board in a system. It then describes power-up of the board.

PMC Installation

Two single width (or one double-width) PMCs may be fitted to the PPC7A, which is keyed to accept only 5V PMCs. See Figure 7-1 for the locations of these PMCs.



Each PMC is supplied with a full kit of parts for mounting it, full fitting instructions and a manual. For Radstone products, the PMC Installation Note, publication number HN4/3-99 contains the fitting instructions. PMCs ordered with a PPC7A can be supplied factory fitted by Radstone, if required.

It may be necessary to install driver software or implement other firmware configuration to achieve full functionality of a PMC (see the specific PMC manual for the exact procedure).

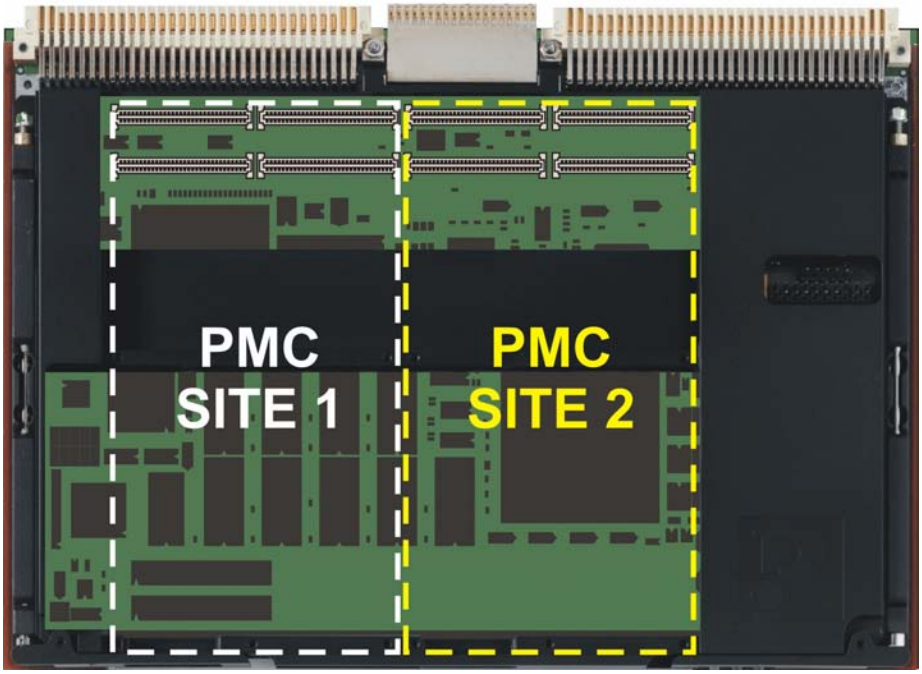
Note: **You are recommended not to route analog signals through P0.**

PMCPCI Expansion Card Installation

The PMCPCI PCI expansion card should only be installed in PMC slot 1, as this routes the full PCI bus through P0. The PMCPCI card occupies half of the slot.

See Appendix A for ordering information.

Figure 7-1. PMC Positions



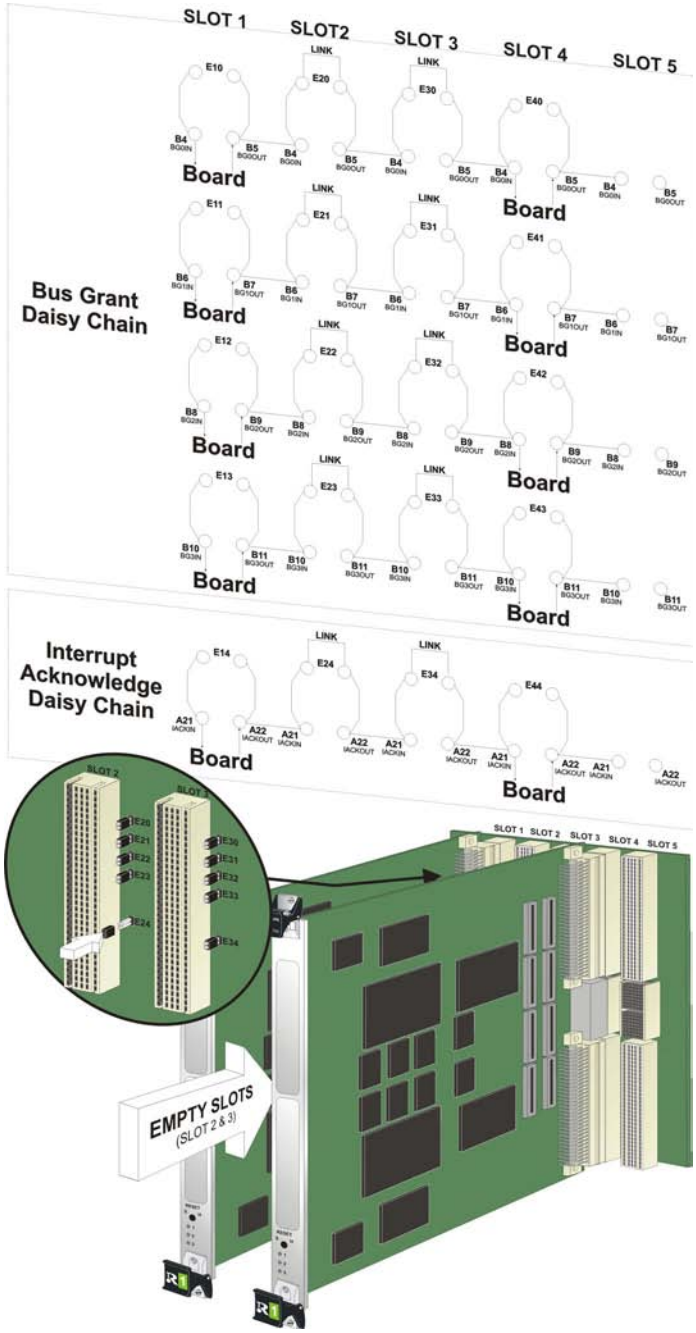
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Board Installation

Radstone enclosures usually have two sets of links in the J1 (VMEbus) half of the backplane. The upper set of four links configures the Bus Grant (BGx) daisy chain. The lower link configures the Interrupt Acknowledge (IACK) daisy chain. When a slot position is not occupied by a board and there are boards further down the daisy chain, connect the appropriate 'In' signal (BGxIN~/IACKIN~) at that slot to the corresponding 'Out' signal (BGxOUT~/IACKOUT~) at the same slot using these links. Some backplanes have daisy chains that automatically link the signals across empty slots (see the manual appropriate to your enclosure for further details)

The following diagram shows the Interrupt Acknowledge and Bus Grant daisy chains on an example 5-slot backplane.

Figure 7-2. Backplane links



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System Configuration Suggestions

Use the PPC7A in a development rack on its own at first, before integrating it into a system with other cards. This enables you to prove operation of the board in isolation before tackling any system configuration issues.

The power supply to the RTC on the PPC7A is fed from the VSTANDBY pin on the VMEbus. VMEbus compliance requires this voltage to be 5V ± 5%.

Link Configuration

You are recommended to use the default link configuration (see Chapter 4) for the first power-up. This will enable you to prove the board's operation before tackling any configuration issues.

Read Chapter 4 - Configuration before altering your PPC7A's user configurable link settings to check that all the settings are correct for your application.

If you are using the SCSI bus, you are recommended to locate the PPC7A at one end and enable the terminator by fitting link E13. If you want to use the PPC7A somewhere other than at the end of the SCSI bus, ensure that E13 is not fitted. Fitting E13 when the PPC7A is not located at the end of a SCSI bus may cause erroneous SCSI operation.

Air-cooled PPC7A

1. Insert the board into the required slot in the rack or enclosure.

Note: **The default link configuration requires the board to be inserted into system slot 1.**

2. Push the board **firmly** home to ensure the connectors mate properly with the backplane.
3. Tighten the captive screws at the top and bottom of the front panel to secure the board in position.

Note: **Pulling on any front panel cable connections could inadvertently disconnect the board if it is not secured.**

4. Ensure that the board receives sufficient air-flow, as detailed in Appendix A.
5. If you need to operate your board on an extender card, fit an additional fan to supply the necessary air-flow.
6. To ensure optimum operation of the board with regard to EMC:
    a. When taking I/O connections from the front panel connectors, or when the board is operating on a VME bus extender card, ensure a connection is made between the front panel and the chassis ground of the system
    b. When taking I/O connections from P2, the Radstone P2 accessory kit (or some equivalent system) can be used. See Appendix A for more details on the P2 accessory kit

Conduction Cooled PPC7A

1. Insert the board into the required slot in the conduction-cooled enclosure.

Note: **The default link configuration requires the board to be inserted into system slot 1.**

2. Push the board firmly home to ensure the connectors mate properly with the backplane.

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3. To ensure a correct mechanical/thermal interface, using a calibrated torque wrench, tighten the screw-driven wedgelocks at the top and bottom of the board to secure it in position. The recommended torque value is 0.6 to 0.8 Nm and the hexagon size is $^{3}/_{32}$".

If you need to operate a conduction-cooled board on an extender card, maintain an airflow of at least 300 feet/minute over it, by the use of a suitable fan.

Before plugging the PPC7A into a development rack, you should first check the rack's backplane configuration links.

Serial Interfaces

The COM1 interfaces are both configured as DTE (9.6 kbaud, 8 bits/character, 1 stop bit, parity disabled)

To interact with the PPC7A's on-board firmware requires a serial terminal or hyperterminal to be attached to the PPC7A. This terminal will use the serial signals on COM1

Cables supplied by Radstone permit direct connection to a terminal without use of a null-modem

Alternatively, a PMC9100/PMC2-9100 graphics PMC and a USB or PS/2 compatible keyboard may be used. If these devices are used, the firmware detects their presence and uses them automatically

Power-up

In preparation for power-up, ensure you have:

- Configured the backplane
- Checked the J1 and J2 connections of the slot

⚠ CAUTION

Only use the PPC7A in backplanes that supply power on both the J1 and J2 connectors.

- Checked the power supply to the board

⚠ WARNING

Do not exceed the maximum rated input voltages or apply reversed bias to the assembly.

If such conditions occur, toxic fumes may be produced due to the destruction of components.

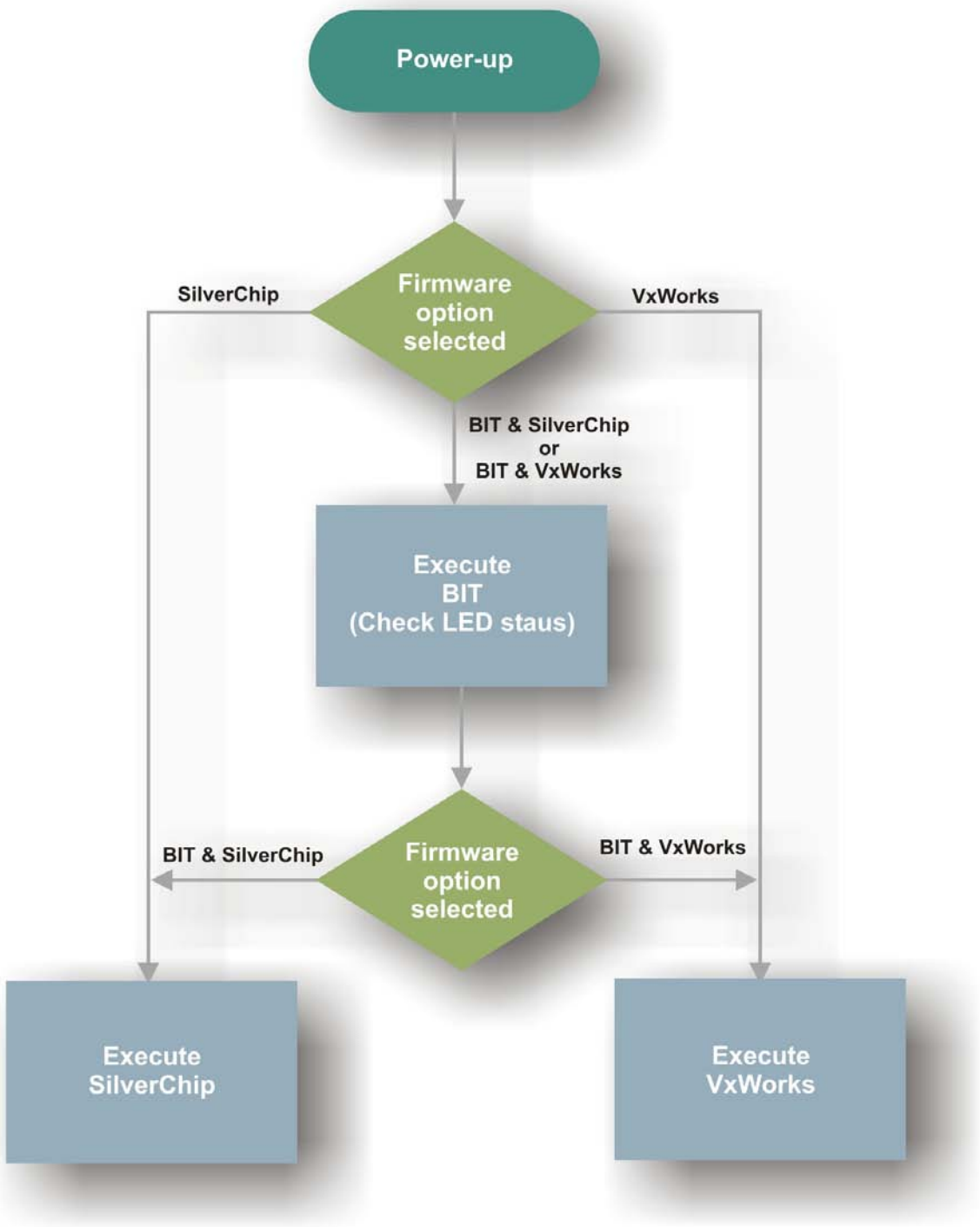
- Followed the system configuration suggestions
- Ensured that the PPC7A is firmly secured in the rack/enclosure

You can now power-up the system.

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Power-up Routine

The power-up routine depends on the firmware options fitted, as shown in the following diagram:



BIT is described in the PPC BIT Release Notes, publication number RT5111.

The Boot firmware is described in the PPC Boot Firmware Manual, publication number RT5078.

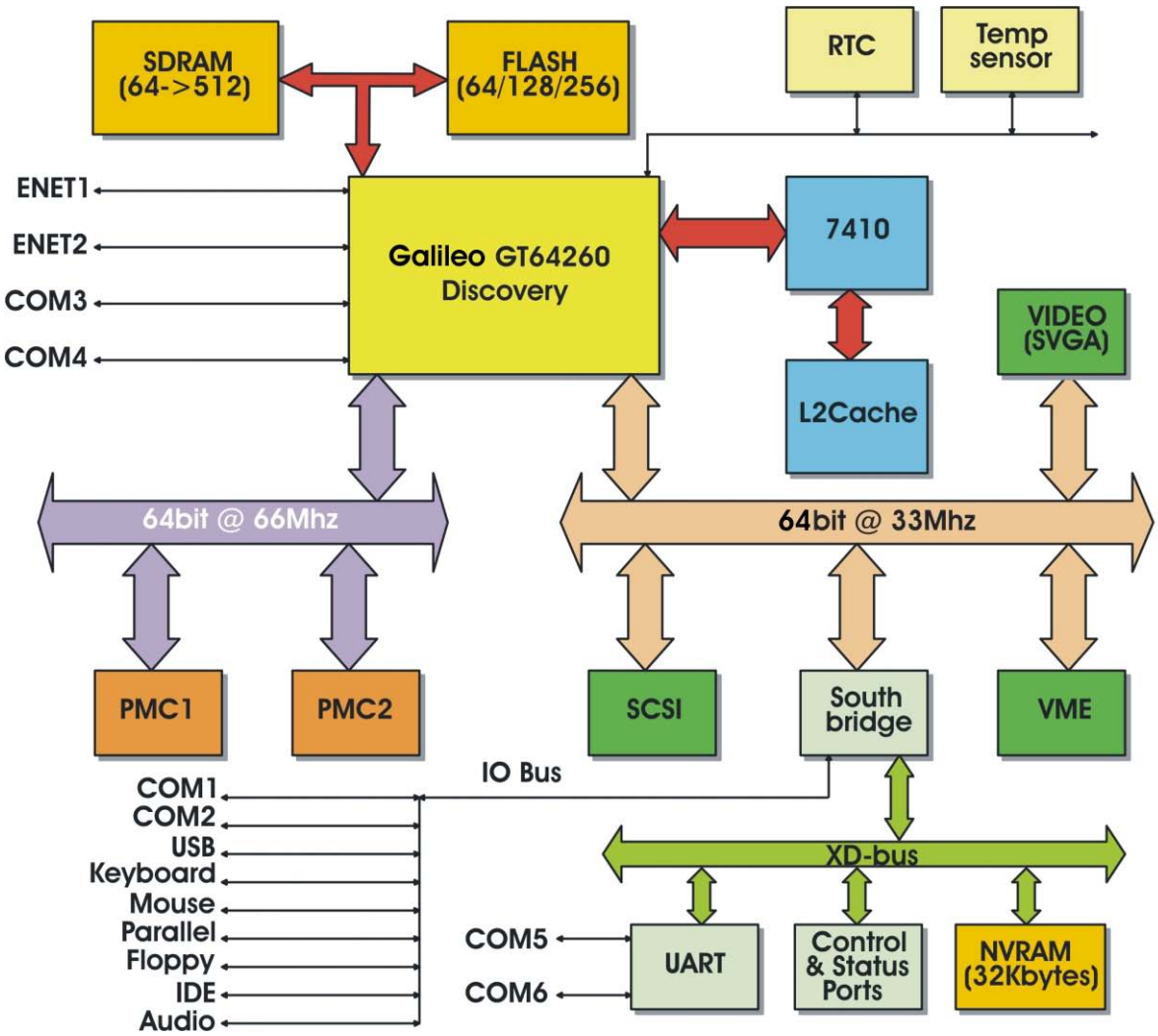
VxWorks is described in the VxWorks BSP for PPCx Release Notes, publication number RT5080.

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Chapter 8 - Functional Description

This chapter gives a detailed description of the PPC7A's functional blocks. For a general description of the board and its features, see Chapter 2.

Figure 8.1 – Block Diagram



Notes:

1. **Due to the increasingly short lifetimes of system components, the I/O devices used on the PPC7A are not guaranteed to remain fixed in the future.**
2. **Hardware should be accessed only through mechanisms provided by the Operating System's "Hardware Independence" mechanism (BSP, HAL, residual data, etc.), and not directly by application software.**
3. **If a standard operating system is not being used, then it is recommended that applications are written in such a way as to minimize direct access to hardware resources, bearing in mind that changes may be necessary to support future iterations of the hardware.**
4. **Radstone supported Operating Systems guarantee compatibility at the application level through the Hardware Independence mechanisms mentioned above.**

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PowerPC Processor

MPC7455

The PPC7A is based around the MPC7455 PowerPC chip. This device contains:

- A 32-bit implementation of the PowerX architecture
- 32 Kbytes, 8-way set associative instruction and data caches
- On chip 256 Kbytes of L2 cache
- A separate 64-bit wide, two-way set associative L3 cache bus

The processor has a 32-bit physical address bus and a 64-bit data bus.

Processor Type	Bus Frequency (MHz)	L3 Frequency (MHz)	Core Frequency (MHz)
MPC7455	100	166 to 266	500 and above

L3 Cache

The L3 cache has the following features:

- Two-way set associative
- 32-byte line size
- 64 bits wide
- Capable of operating in write-through or write-back modes
- Operation at speeds up to 266 MHz through a dedicated L3 cache bus interface
- Can caches memory accesses in the address range 0x0000 0000 to 0x4000 0000 (i.e. SDRAM)
- Entries in write-through mode can be valid or invalid
- Entries in write-back mode can be invalid, valid-unmodified or valid-modified

Having the L3 cache controller inside the MPC7455 allows performance to be further enhanced by parallel compares on L1, L2 and L3 tags, and filtering L3 cache traffic from the system bus. Full coherency on the system bus can be maintained.

L3 cache access times from the processor for a 32-byte burst are:

	200 MHz L3 Interface	Transfer Rate
Burst read hit non-pipelined	3,1,1,1	1066 Mbytes/second
Burst read hit pipelined	1,1,1,1	1600 Mbytes/second

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MPC7410

The PPC7A is based around the MPC7410 PowerPC chip. This device contains

- A 32-bit implementation of the PowerX architecture
- 32 Kbytes, 8-way set associative instruction and data caches
- A separate 64-bit wide, two-way set associative L2 cache bus

The processor has a 32-bit physical address bus and a 64-bit data bus.

Processor Type	Bus Frequency (MHz)	L2 Frequency (MHz)	Core Frequency (MHz)
MPC7410	100	166 to 266	500 and above

L2 Cache

The L2 cache has the following features:

- Two-way set associative
- 32-byte line size
- 64 bits wide
- Capable of operating in write-through or write-back modes
- Operation at speeds up to 266 MHz through a dedicated L2 cache bus interface
- Can caches memory accesses in the address range 0x0000 0000 to 0x4000 0000 (i.e. SDRAM)
- Entries in write-through mode can be valid or invalid
- Entries in write-back mode can be invalid, valid-unmodified or valid-modified

Having the L2 cache controller inside the MPC7410 allows performance to be further enhanced by parallel compares on L1 and L2 tags, and filtering L2 cache traffic from the system bus. Full coherency on the system bus can be maintained.

L2 cache access times from the processor for a 32-byte burst are:

	200 MHZ L3 INTERFACE	TRANSFER RATE
Burst read hit non-pipelined	3,1,1,1	1066 Mbytes/second
Burst read hit pipelined	1,1,1,1	1600 Mbytes/second

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Resetting the PPC7A

There are two types of reset that may be applied to the PPC7A: 'Hard' and 'Soft'.

Hard Reset

This causes the processor to begin executing code from address 0xFFF0 0100 in the System FLASH. By fitting a hardware jumper (E2), the System FLASH addresses may be passed to the VME instead of the FLASH. In this way, the processor can begin executing code from a VME source.

The following table summarizes events that may cause a hard reset:

Source		Action	SYSRESET~ Generation
Hardware Events	Power-on	Hard reset all devices	Yes
	Received SYSRESET~		No
	Watchdog time-out		If System Controller
	Front-panel hard reset		
	P0 (where fitted) hard reset signal (pin C1)		
Software Events	SW_LRST bit	Hard reset excluding VMEbus Interface	No
	VCSR bit		
	SW_SYSRESET bit	Hard reset if System Controller	If System Controller

The SW_LRST, VCSR and SW_SYSRESET bits are located in the Universe II PCI-VME bridge.

The front panel hard reset may be disabled under software control or by fitting hardware jumper E14.

Note: **Integrity of SDRAM data cannot be guaranteed during hard reset, since the memory controller is reset and SDRAM refresh disabled. Similarly, integrity of FLASH or EEPROM data cannot be guaranteed if a hard reset occurs during a FLASH or EEPROM write cycle, respectively.**

See the SDRAM section for SDRAM initialization requirements following a hard reset.

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Soft Reset

This causes the processor to reach a recoverable state and then branch to either 0x0000 0100 or 0xFFF0 0100, depending on the state of the IP bit in the processor's Machine State Register.

The following table summarizes events that may cause a soft reset:

SOURCE	
Hardware Events	Front-panel Soft Reset
	P0 (where fitted) soft reset signal (pin C2)
	P8 (on-board connector) soft reset signal (pin 11)
Software Events	HOT_RESET bit in ISA-bridge

The front panel soft reset switch may be disabled under software control or by fitting hardware jumper E14.

The standard boot firmware does not support the use of soft reset.

VMEbus Remote Reset

Another VME master may reset the PPC7A via the Universe II control registers. This causes a hard reset.

Watchdog Reset

If enabled and triggered (via the Watchdog control register), the watchdog will cause a hard reset unless re-triggered (via the Watchdog Trigger Register) every 1.6 seconds.

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Memory

Controller

The Galileo GT64260 device provides an SDRAM memory controller and a FLASH interface.

Maps

The PPC7A supports programmable memory maps. No memory maps are provided in this manual as no memory locations are fixed in hardware. Please refer to the manuals for the software that is installed on the PPC7A for more information.

SDRAM

The following table shows the options available for SDRAM on-board the PPC7A:

SDRAM SIZE (MBYTES)	BANKS	SDRAM ORGANISATION
64	1	8M x 8
128	2	8M x 8
128	1	16M x 8
256	2	16M x 8
256	1	32M x 8
512	2	32M x 8

The SDRAM is protected by eight ECC bits per 64 data bits. All single bit, double bit and nibble errors can be detected, and single bit errors can be corrected.

Following a hard reset, the Galileo GT64260 PCI Bridge/Memory Controller must be set up for the size and number of banks of SDRAM and the appropriate number of wait states to match the SDRAM speed. This is done by the standard Boot firmware. The size of the SDRAM may be checked by reading the Memory Configuration register (see the Control and Status Registers section).

At least 100µs must have elapsed from the negation of reset before enabling the SDRAM. After being enabled, the SDRAM must not be accessed until at least 8 refreshes have occurred. If ECC is to be enabled, then it is necessary to initialize the SDRAM to set-up valid ECC bits.

SDRAM access times from the processor, for a 32 byte burst are shown in the table:

BUS SPEED	CLOCKS ACCESS	DATA TRANSFER RATE
100 Mhz (no page hit)	16:1:1:1	168 Mbytes/sec
100 Mhz (pipelined)	5:1:1:1	400 Mbytes/sec
100 Mhz (pipelined & page hit)	2:1:1:1	640 Mbytes/sec

SDRAM access times from the PCI, referenced to the 33 MHz PCI clock, for a 32-byte burst with no interference from L1, L2 or L3 caches, are shown in the table:

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	Clock Cycles Initial Access/Subsequent	Equivalent Transfer Rate (Mbytes/Second)
Burst Read	2:1:1:1:1:1:1:1	118Mbytes/sec
Burst Write	2:1:1:1:1:1:1:1	118Mbytes/sec

FLASH

The FLASH array is divided into two sections; one bank is termed the BOOT FLASH and the other is referred to as USER FLASH. Both FLASH sections are configured as 32 wide and the GT64260 bus burst is supported to allow for maximum bus bandwidth.

Boot FLASH

This section is a total of 8 Mbytes in size. The area is broken down into 4 areas, each area being 2 Mbytes in size: Main BOOT, Alternate BOOT, Recovery BOOT and extended BOOT. All areas can be seen (depending on memory map set-up) at anytime but the areas may be swapped around depending on the boot link configuration and/or FLASH control register set-up.

The FLASH has a write capacity of 100,000 cycles per block (128 Kbyte block size) and the software should write to the FLASH as 32-bits.

Notes: **Integrity of FLASH data cannot be guaranteed if a hard reset occurs during a FLASH write cycle.**

Instead of fitting the link E5 (Overall FLASH Write Enable), the signal (FLASH_WREN~) is available on P0 pin A2 (if fitted) or P2 pin Z1 (if J24 option is not fitted). Pulling this signal low is the same as fitting the link.

Main BOOT

This area is used as the main default boot area of the PPC7A. This area would be the area that the user would put his boot firmware. This area is selected for booting by not fitting E7 (BOOT_ALTERNATE) and E8 (BOOT_RECOVERY) links.

To write to this area, Links E5 (Overall FLASH Write Enable) and E9 (System FLASH Write Protected) need to be fitted.

Alternate BOOT

This area would normally contain a backup or alternate boot image. This is useful when developing boot code to be able to switch between two images to check operation. If an alternate boot image is not required, this area can be used to hold User data or for extended boot code. This area is selected for booting from when the link E7 (BOOT_ALTERNATE) is fitted.

To write to this area, Links E5 (Overall FLASH Write Enable) and E9 (System FLASH Write Protected) need to be fitted.

Recovery BOOT

This area contains a boot image that is designed to recover the boot areas when the main and alternate boot areas have been made so that the PPC7A will not boot from them. This area is selected for booting from by fitting the link E8 (BOOT_RECOVERY~).

The recovery image is programmed in the factory. As this area is designed to be able to recover the boot code it has been made so that the user can NOT modify this area. There are no link settings that make this area writeable by the user.

The recovery image only uses 1 Mbyte of the 2 Mbytes of space, the 1 Mbytes of space that is left over is an area of FLASH that is NEVER write protected whatever the write protection links are set to.

Extended BOOT

This area would normally contain data or extended boot code for the boot firmware. If required, a second alternate boot image can be programmed into this area. This boot image is selected by fitting links E7 (BOOT_ALTERNATE) & E8 (BOOT_RECOVERY).

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To write to this area, Links E5 (Overall FLASH Write Enable) and E9 (System FLASH Write Protected) need to be fitted.

User FLASH

This FLASH array is for the user to place application code or data. It is a contiguous array of 56, 120, or 248 Mbytes (depends on FLASH array size).

To write to this area, links E5 (Overall FLASH Write Enable) and E3 (WRITE_ENABLE_USER) need to be fitted.

VME Programming Option

Fitting link E4 (see Chapter 4) allows the PPC7A to have new boot firmware programmed via the VMEbus.

This link is intended for factory use only. Normally, if the Boot firmware gets corrupted the Recovery boot option should be used to restore the Boot firmware.

This link holds the onboard processor in reset. This is required when the onboard FLASH contents are unknown and new boot firmware is required to be loaded into the FLASH from VME.

To load new firmware from VME, the VME master relies on the reset configuration of the Universe. The register set of the Universe appears at address 0x8000 0000 on VME, by default. The VME master will use these registers to set up windows onto the PCI bus from VME.

The GT64260 will have its register set available at address 0x1400 0000. The PowerPC's boot FLASH can be accessed at address 0xFFF0 0000 on PCI. These areas will need mapping onto VME to allow access of the FLASH memory

For correct operation of the FLASH memory, 0xF428 1278 should be written to the GT64260 registers at offset 0x46C. The FLASH memory can now be read or written to. Writes to the FLASH memory should always be done as a 32 bit write.

The boot area that can be accessed at 0xFFF0 0000 will depend on the Boot link settings (E7 & E8). Also, the write protection of the boot areas is also controlled by the link settings (E5 & E9).

Note: The Recovery boot area cannot be written to by configuration of either the Boot links (E7 & E8) or the write protection links (E5 & E9). The Recovery boot area has been designed to only be programmed in the factory.

Once you have programmed the boot section of the FLASH, remove link E4 and carry out a hard reset. Normal booting now occurs from the FLASH and both User and Boot sections are accessible again at their normal addresses.

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JTAG

All of the JTAG chain connections are routed to connector P10 (see Chapter 5 for more details).

There are three chains on the PPC7A. One chain is solely for the purpose of programming the CPLD device, which contains various functions, including the main PPC7A ISAbus registers. This device is programmed via JTAG. The second chain is for the CPU to allow debug tools to be used. The third chain is for all the other JTAG devices on the PPC7A, which can include any PMC JTAG devices.

The JTAG signals from P10 connect into the "CPLD" JTAG signals. They have the following terminations:

TCK ⇒ +3.3V via a 4.7 kΩ pull-up resistor

TMS ⇒ +3.3V via a 4.7 kΩ pull-up resistor

TDI ⇒ +3.3V via a 4.7 kΩ pull-down resistor

The JTAG signals from P8 connect into the "CPU" JTAG signals. They have the following terminations:

TCK ⇒ +3.3V via a 1 kΩ pull-down resistor

TMS ⇒ +3.3V via a 10 kΩ pull-up resistor

TDI ⇒ +3.3V via a 1 kΩ pull-down resistor

TRST~ ⇒ +3.3V via a 1 kΩ pull-up resistor

The JTAG signals from J11 & J12 (PMC site) connect into the "MAIN" JTAG signals on the PPC7A. They have the following terminations:

TCK ⇒ +5V via a 4.7 kΩ pull-up resistor

TMS ⇒ +5V via a 4.7 kΩ pull-up resistor

TDI ⇒ +5V via a 4.7 kΩ pull-up resistor

TRST~ ⇒ +5V via a 1 kΩ pull-up resistor

The chain consists of the following in the order listed:

- PMC Slot 2 - linked out if no PMC is fitted
- Universe II (CA91C042)
- GT64260
- L2 or L3 Cache SRAMs (if JTAG devices are fitted, otherwise linked out)

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JTAG Clock Frequencies

Different parts in the JTAG chain may have different maximum TCK frequencies. The main chain on the PPC7A has the following clock limitations:

Universe II	⇒ 20 MHz
GT64260	⇒ 3 MHz
L2 or L3 cache	⇒ 50 MHz
PowerPC 7410/745x	⇒ 33 MHz

The JTAG clock should not exceed the maximum clock frequency of the slowest element in the JTAG chain. Using the data from the above components, the chain clock frequency should not exceed 10 MHz.

JTAG and PMC

The "MAIN" JTAG chain from J11 & J12 visits the other PMC site. These individually auto-bypass if a PMC is not fitted at the site. To achieve this, the PPC7A has BUSMODE2 to BUSMODE4 wired to 1, 0, 0 respectively. This effectively interrogates the PMC site as to whether it has a PCI compliant card fitted. The response from the PMC is returned on BUSMODE1. If the answer is yes (BUSMODE1 = 0), then the PMC site is included in the JTAG chain. If there is no PMC fitted, then a pull-up resistor on the PPC7A forces BUSMODE1 to 1 and the JTAG is bypassed.



Notes:

1. **The PCI specification (section 2.2.10 on the optional JTAG pins) requires that if a PMC cannot support JTAG, then it must have TDI connected to TDO. This means that the "MAIN" JTAG chain is complete even if there are PMC cards fitted that do *not* support JTAG.**
2. **The PMC sites cannot *source* the JTAG since, being part of a chain, they are expected to *receive* the JTAG signals.**

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PCI Buses

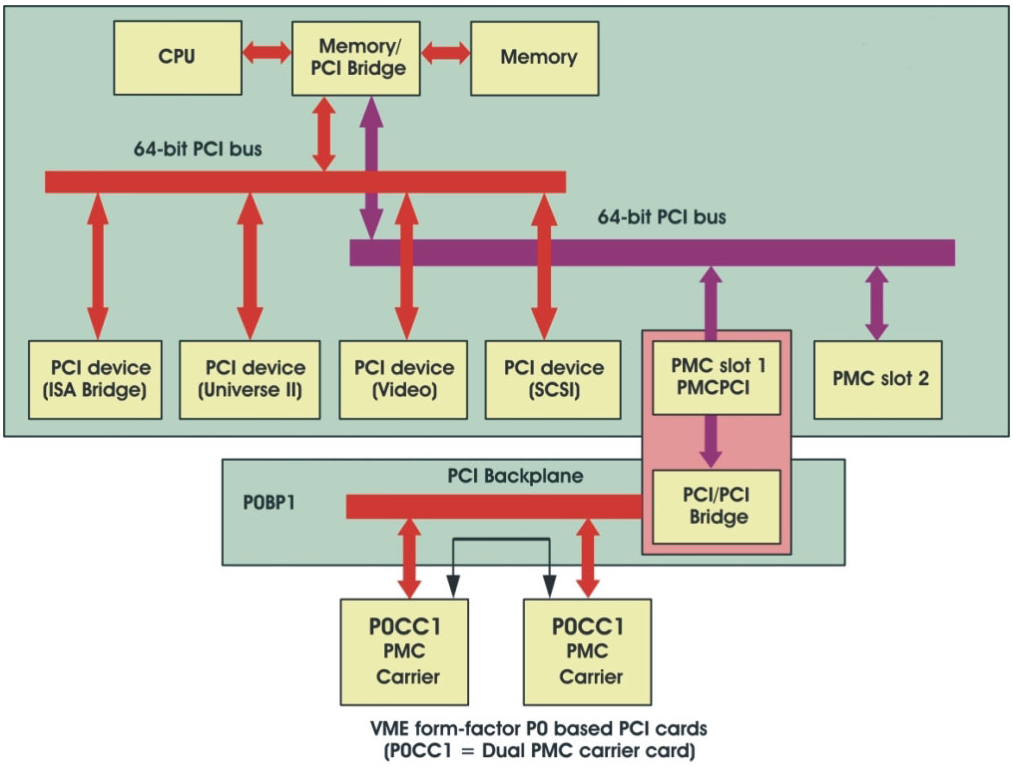
There are two PCI buses on the PPC7A.

PCI0 is connected to all of the on-board PCI devices. This bus is implemented as a 64-bit PCI bus running at 33 MHz (64-bit to Universe device only). This gives a burst rate up to 264 Mbytes/second between PCI agents.

PCI1 is the PCI bus that is routed to the PMC sites, the CPU Host bridge interface. This bus is implemented as a 64-bit PCI bus running at up to 66 MHz. This gives a burst rate up to 528 Mbytes/second between PCI agents.

The PCI bus structure of the PPC7A is shown below:

Figure 8.2 – PCI Bus Diagram



Memory/PCI Bridge

The Memory/PCI Bridge on the PPC7A is provided by a Galileo GT64260 Discovery device:

- This device provides:
- Host Bridge between the processor bus and the two PCI buses
- PCI arbiters
- SDRAM memory controller and FLASH interface (see the Memory section)
- 2 off Ethernet MACs
- 2 off Serial channels (COMs 3 & 4)

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Ethernet Controller

The GT64260 device provides two ethernet MACs. To interface these to the physical interface two National Semiconductor DP83846s are used.

The DMA controllers handle data transfers between CPU memory and on-chip memory with the Ethernet Controller arbitrating between DMA channels to minimise underflow or overflow.

Automatic packet deletion on receive (runt packets or after a collision) and packet re-transmission after a collision on transmission are supported. This minimises bus traffic by removing unnecessary accesses to shared memory. The network addresses (Ethernet number) are factory configured.

Connection to the Ethernet controller is via the P2 connector (see Chapter 5). Eight associated status LEDs (DS16 to DS23) are mounted on the rear of the board near the Ethernet PHY chips (see the Software Programmable LEDs section). The default functions of these LEDs are link, TX activity, RX activity status, and 100BaseT, but they may be overridden by the software.

SCSI Scripts Processor

The NCR53C860 SIOP executes commands, in the form of SCSI scripts. It has a PCI interface and a DMA controller, which are used to access the scripts and data held in system memory. The SIOP can transfer data at 7 Mbytes/second asynchronously and 20 Mbytes/second synchronously or 14 Mbytes/second asynchronously. Connection to the SCSI bus is made through the P2 connector. The pinout is given in Chapter 5.

The PPC7A has an on-board active SCSI terminator, which may be enabled or disabled with a jumper (see the E13 description in Chapter 4). The SCSI specification allows a maximum cable stub length of 10 cm. If the SCSI bus connections are taken directly from the backplane J2 connector, then the PPC7A may be located anywhere on the SCSI bus and the terminator should only be enabled if the PPC7A is at the end of the SCSI bus. Otherwise, the PPC7A must be at the end of the SCSI bus and the terminator must be enabled.

A software programmable SCSI Activity LED (LED DS11) is mounted on the back of the board. See the Software Programmable LEDs section and the SCSI Activity LED Register description for more details.

VGA graphics Processor

The PPC7A uses an Asiliant Technologies 69000 or 69030 PCI to VGA graphics processor device. This is a totally integrated high performance graphics accelerator with integrated 2Mbytes (4Mbytes with the 69030) of fast graphics SDRAM.

The 69000 can provide pixel clock rates at up to 135Mhz (170Mhz with the 69030) and pixel colour depths of up to 24 bit. This gives the maximum resolutions of:

- 1280 x 1024 x 8 @ 75Hz (1280 x 1024 x 24 @ 75 Hz with 69030)
- 1024 x 768 x 16 @ 85Hz (1024 x 768 x 24 @ 85 Hz with 69030)
- 800 x 600 x 24 @ 85Hz

Universe II

This provides the VMEbus Interface. See later.

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South Bridge

An ALI-M1535 provides a bridge from the PCI bus to the ISAbus for connection of native I/O devices. This device also provides the following functions:

Function	Equivalent To Function Of
7 channel DMA between ISAbus and PCI bus	Two 83C37s
Timer block	One 82C54
Interrupt controller	Two 8259s
PCI bus arbiter	-

The south bridge positively decodes some I/O cycles on the PCI bus for internal resources. It subtractively decodes and claims all PCI memory and I/O cycles not claimed by other PCI targets, and forwards them to the ISAbus.

Apart from the south bridge, there are no other ISAbus masters in the PPC7A architecture.

PMC Sites

The PPC7A has two sets of connectors ({J11, J12, J13, J14} and {J21, J22, J23, J24}) that allow standard PMCs to be connected to the PCI bus. The PPC7A can accept either air-cooled or conduction cooled PMCs, as long as adequate cooling is provided. Air-cooled PMCs are defined in the IEEE 1386 Standard. Front panel I/O is fully supported.

The PMC I/O connector are connected to the backplane connectors to allow backplane I/O. J14 (PMC site 1) is connected to P0 and J24 is partially connected to P2.

Fitting a PMCPCI card allows the PCI bus to come out to the backplane via P0 (must be fitted in PMC slot 1).

South Bridge Peripheral Components

The South Bridge, connected to the PCIbus, contains a floppy disk controller, 16-bit digital IO, two serial ports, a parallel port and a keyboard/mouse controller. The IDE interface is not used on the PPC7A.

Floppy Disk Controller

Connection to the FDC is through P2. This interface is only available with the digital IO build option and requires software to direct the FDC to the interface pins. The pinout is given in Chapter 5. The FDC is software compatible with the DP8473, 765A and NS82077.

Serial I/O

The Ultra I/O provides two serial channels (COM1 and COM2) containing FIFOs, software compatible with the INS8250N-B, PC16550A and PC16450. The baud rates are programmable from 50 baud up to 115.2 kbaud, including the MIDI data rate.

Connection to the serial ports is primarily through the P2 connector, although access may be obtained through front panel connectors (depending on options fitted). See Chapter 5 for pinouts.

Parallel I/O

The parallel port includes extended capabilities conforming to IEEE P1284. Connection to the parallel port is through the P2 connector. This interface is only available on the Parallel port build option. The pinout is given in Chapter 5.

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Keyboard and Mouse Controller

A PS/2 compatible Keyboard and Mouse interface with Phoenix BIOS is integrated into the Ultra I/O. Connections to the mouse and keyboard are through the P2 connector. This interface is not available if the USB build option is fitted. See Chapter 5 for pinouts.

VMEbus Interface

The Tundra Semiconductors CA91C142 Universe II PCI to VME bridge provides the VMEbus interface. This complies with the VME64 specification and provides:

- All slot 1 (system controller) functions
- Interrupt control
- A DMA controller
- Interprocessor communications
- Block transfer support

Appendix A details the VMEbus compliance and basic VMEbus performance of the PPC7A.

Note: The Universe II does not self-address.

VMEbus Master Access

Four general-purpose, software-programmable PCI slave images are available for access to the VMEbus.

- All of these can be configured to access VMEbus A32, A24 or A16 address space
- An offset may be applied to translate the local address to a different address on the VMEbus, allowing any local address to access any VMEbus address
- The start and end addresses of the A32, A24 and A16 PCI slave images may be set on any 64 Kbyte boundary in PCI memory or I/O space that is not allocated to other PCI-attached devices or the user FLASH
- One image may be set on 4 Kbyte boundaries to accommodate access to A16 space

One further, special purpose, PCI slave image allows mapping of A16 and A24 space.

- This slave image uses a 64 Mbyte window, aligned to any 64 Mbyte address in PCI memory space
- The window is divided into four 16 Mbyte quadrants
- The top 64 Kbytes of each quadrant maps to A16 space, while the rest of each quadrant maps to A24 space
- The Address Modifiers generated are software configurable for each quadrant

VMEbus master cycles may be coupled or write posted.

- Coupled cycles are retried on the PCI bus until the Universe II has ownership of the VMEbus and are not terminated on the PCI bus until all data has been transferred over the VMEbus
- Posted writes are queued in a FIFO until the VMEbus is available for the data to be transferred

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VMEbus Slave Access

Four general-purpose, software-programmable VMEbus slave images are available.

- All of these may be defined in VMEbus A32, A24 or A16 space
- An offset may be applied to translate the VMEbus address to a different address on the local bus, allowing any VMEbus address to access any on-board address
- The start and end addresses of the A32, A24 and A16 images may be set on any 64 Kbyte boundary

One further, special purpose, VMEbus slave image, the Register Access Slave Image, allows a VMEbus master to access to the Universe II control and staus registers.

VMEbus slave accesses to the PPC7A may be coupled, write posted or pre-fetched block read.

- Coupled slave transfers can only proceed once the slave posted write FIFO is empty
- Slave posted write cycles are queued in a FIFO until the PCI bus is available for the data to be transferred

Indivisible Cycles on VME

The Universe II chip may be programmed to generate RMW cycles on the VMEbus. Data from the read portion is compared with a 32-bit compare value, qualified with a 32-bit mask. If the comparison is true, then those bits enabled by the mask are swapped with a 32-bit swap field.

Alternatively, the Universe chip's VMEbus ownership-bit may be set to cause it to acquire and hold ownership of the VMEbus. This method can be used in combination with VMEbus LOCK cycles to guarantee exclusive access to a VMEbus resource.

The VMEbus slave images may be programmed to generate locked cycles on the PCI bus to handle RMW cycles. The Universe II chip also supports VMEbus lock commands using ADOH cycles.

VMEbus Arbitration

The Universe II chip's VMEbus arbiter supports PRI and RRS arbitration with BCLR~ generation in priority mode. The VMEbus requester may operate in fair or demand mode and may be configured as RWD or ROR.

VMEbus Master Block Transfers

The Universe II chip's DMA controller may be used to transfer data between the PCI bus and the VMEbus. DMA operations on the two buses are decoupled through a bi-directional FIFO. The DMA controller can:

- Transfer multiple blocks of data using entries in a linked-list
- Pack and unpack data to support differing data widths on the PCI bus and the VMEbus
- Generate an interrupt on completion or on encountering an error condition

VMEbus Slave Block Transfers

The VMEbus slave interface can respond to D32:BLT and D64:MBLT. For VMEbus slave block transfers, the Universe II chip may be programmed to pre-fetch read data, which is queued in a FIFO.

Mailboxes

The Universe II contains four 32-bit mailboxes that can generate interrupts on the PCI bus or on the VMEbus when written to. Each mailbox has separate status, enable and interrupt mapping bits.

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Semaphore Register

The Universe II provides a 32-bit register containing four semaphores, one in each byte.

- Each of the four semaphores is a 7-bit data field plus a 1-bit lock field
- Ownership of the semaphore is obtained by writing a unique value to the 7-bit field while setting the lock bit
- The write is only accepted if the lock bit is not already set
- Ownership can be confirmed by reading back the value in the 7-bit field after the write, and comparing it with the unique value written

The semaphores provide a locking mechanism that can be used to guarantee exclusivity of access to system resources shared between:

- Multiple processes
- Processes and bus masters (PCI or VME)
- Bus masters (PCI or VME)

VMEbus Location Monitor

The Universe II contains a VMEbus location monitor for interrupts and message passing.

VMEbus Interrupts

If programmed to do so, the Universe II responds to a VMEbus interrupt with a VMEbus interrupt acknowledge cycle. The Universe captures the status/ID and then raises an interrupt on the PCI bus. No further VMEbus interrupts are handled on that level until the processor reads the status/ID and re-arms the interrupt handler.

The Universe II can be programmed to generate any level of VMEbus interrupt. It can raise an interrupt on the PCI bus when the VMEbus interrupt has been acknowledged.

Seven software interrupts in the Universe II allow an interrupt to be generated on any of the seven VMEbus IRQs.

VME Bus Errors

Assertion of BERR~ during a coupled VMEbus master cycle causes a target-abort (bus error) on the PCI bus. A PCI bus target-abort during a coupled VMEbus slave cycle causes BERR~ on the VMEbus. See the Machine Check Exception section for further details of target abort.

A bus error during posted write transfers raises an interrupt (if enabled) to the processor. Several options are available, including stopping the operation and purging the offending transaction.

A bus error during a DMA operation raises an interrupt and stops the DMA operation on the bus where the error was detected.

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VMEbus Retries

The Universe II chip, as a PCI target, retries the PCI master under the following conditions:

- The PCI initiator requests a coupled cycle to the VMEbus whilst the Universe II is not VMEbus master
- The PCI initiator requests a coupled cycle to the VMEbus whilst the posted write FIFO still contains data
- The PCI initiator requests a posted write cycle when the posted write FIFO can accept no more entries

The PPC7A does not support the VMEbus RETRY~ signal.

VMEbus Reset Options

Several Universe II chip operating features are set at power-up or reset by surface mount jumpers. See the VMEbus Interface Configuration section in Chapter 4 for the default options.

Watchdog Timers

The PPC7A contains a Maxim 706 microprocessor supervisory circuit with a watchdog timer. Once enabled, this timer must be re-triggered every 1.6 seconds or a hard reset results. The trigger control registers is 0x82C and is enabled via Control register 0x828.



Note: Once this bit is enabled as an output, software needs to write to the trigger register to keep the board from resetting. Disabling this pin once it has been enabled does not disable the Watchdog.

The GT64260 also contains a watchdog timer. This timer has a programmable timeout interval. The watchdog output pin needs to be enabled in the GT64260 as MPP bit 9 before the watchdog can reset the PPC7A.

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Software Programmable LEDs

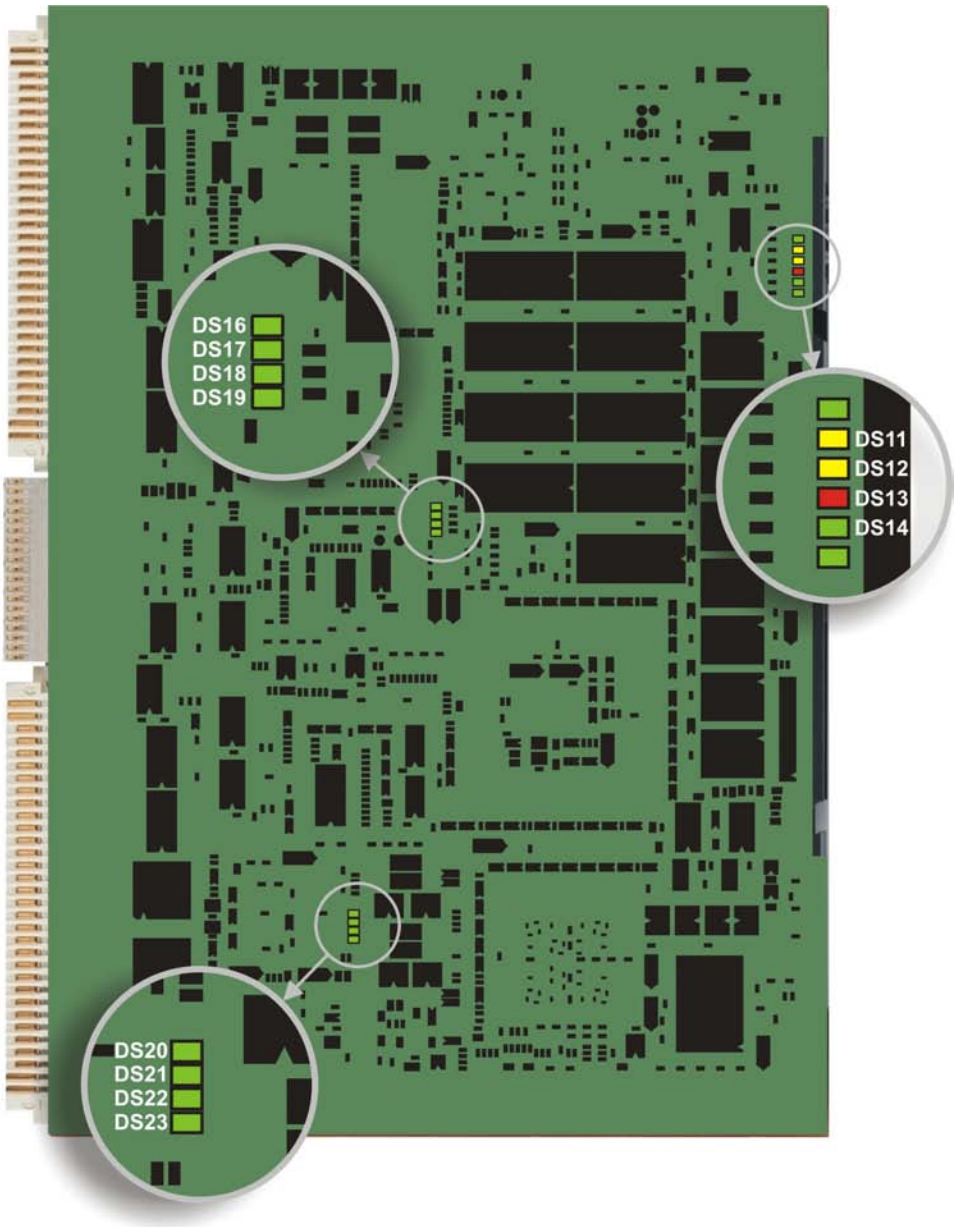
The PPC7A has the following software programmable LEDs:

Control register 0x820 provides four signals, which are connected to four of the LEDs. There is a separate control bit for each LED. Three are visible in the front panel (DS1/2/3) and also on the back of the board as DS12/13/14, together with DS11.

The other 8 LEDs are all surface mounted on the back of the PCB.

DS16, DS17, DS18, and DS19 are Ethernet status LEDs for channel 1, and DS20, DS21, DS22, and DS23 are for channel 2. The default functions of these LEDs are link, TX activity, RX activity status, and 100BaseT respectively, but these may be overridden by the software.

Figure 8.3 – Position of LEDs (Back of the Board)



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Control and Status Registers

ISA I/O Port (Hex)	Description	Row A
0000 to 000F	South Bridge DMA 1 Control	
0020 and 0021	South Bridge Interrupt 1 Control	
0040 to 0043	South Bridge Counter Control	
0060	Keyboard	
0061	South Bridge NMI Status and Control	
0064	Keyboard	
0071 and 0072	RTC	R/W
0078 to 007B	South Bridge BIOS Timer	
0080 to 0090	South Bridge DMA Pages	
00A0 and 00A1	South Bridge Interrupt 2 Control	
00C0 to 00DE	South Bridge DMA 2 Control	
02E8 to 02EF	COM6	R/W
02F8 to 02FF	South Bridge COM2	R/W
03E8 to 03EF	COM5	R/W
03F8 to 03FF	South Bridge COM1	R/W
040A	South Bridge DMA Scatter/Gather	RO
040B	DMA 1 Extended Mode	WO
0410 to 043F	South Bridge DMA Scatter/Gather	
0481 to 048B	South Bridge DMA High Pages	
04D0 and 04D1	South Bridge Edge/Level Control	
04D6	DMA 2 Extended Mode	WO
0804	Memory Configuration	RO
0806	Memory Configuration Extend	RO
0808	SCSI Activity LED	R/W
080C	Equipment Present 1	RO
080E	Equipment Present 2	RO
0810	Equipment Present 3	RO
0818	Key Lock	RO
0820	LEDS	R/W
0824	COMs	R/W
0826	RTS	R/W
0828	Reset	R/W
082C	Watchdog Trig	R/W
0854	Board Revision	RO
0858	Extended ID	RO
0864	ID Link	RO
0866	Motherboard Type	RO
0868	FLASH Write control	RO
086E	FLASH Control	R/W

Where: R/W = Read/Write RO = Read Only WO = Write Only

The control and status registers exist on the PPC7A for controlling or reading the status of the hardware. The addresses are as seen by the processor.

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Certain registers are described in detail in the following pages. The others are registers in the ISA Bridge or other major devices, which are described in the detail in the appropriate device data sheet (which will also give the appropriate 'Type' column entry).

In the following register descriptions, the bit significance is shown in big-endian mode (i.e. from the viewpoint of the PowerPC 750 programmer).

Memory Configuration Register (Port 0x0804)

This register provides information on the SDRAM fitted.

MSB = D0, LSB = D7

D0: Memory type

1 = SDRAM

D1: NVRAM type

0 = FRAM

1 = NVSRAM

D2 to D4: Reserved always read as '1'

D5: Reserved always read as '0'

D6: SDRAM Bank 1 Fitted

0 = Fitted
1 = Not fitted

D7: SDRAM Bank 0 Fitted, always read as '0'

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Memory Configuration Extend Register (Port 0x0806)

This register provides size information for the SDRAM and FLASH memory banks.

MSB = D0, LSB = D7

D0 and D1: SDRAM Bank size

0 = 64 Mbytes
1 = 128 Mbytes
2 = 256 Mbytes
3 = Reserved

D2 to D4: Reserved

D5 to D7: FLASH banks and size configuration

D5	D6	D7	Device Size	No. Of Banks	Mbytes
0	0	0	256 M bit	1	128
0	0	1	128 M bit	1	64
0	1	0	Reserved	1	Reserved
0	1	1	64 M bit	1	32
1	0	0	256 M bit	2	256
1	0	1	128 M bit	2	128
1	1	0	Reserved	2	Reserved
1	1	1	64 M bit	2	64

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SCSI Activity LED Register (Port 0x0808)

This register allows control of the SCSI activity LED.

MSB = D0, LSB = D7

D0 to D6: Reserved.

D7: SCSI activity LED

0 = LED off
1 = LED on

Equipment Present Register 1 (Port 0x080C)

This register provides information on hardware options and the state of the SCSI Terminator power fuse.

MSB = D0, LSB = D7

D0: Hardware ID0 (see the Motherboard Type Register for details)

D1: SCSI_FUSE_GOOD

0 = SCSI fuse bad
1 = SCSI fuse good

Note: This is a re-settable fuse that re-engages when the overcurrent condition is removed.

D2: PRSNT1_2~

0 = Slot 2 PMC present
1 = Slot 2 empty

D3: PRSNT1_1~

0 = Slot 1 PMC present
1 = Slot 1 empty

D4: PCI1 bus speed

0 = 33 Mhz
1 = 66 Mhz

D5 and D6: Cache Size

D5 (SIZE1)	D6 (SIZE0)	SIZE (MBYTES)
0	0	4
0	1	1
1	0	2
1	1	None

D7: Reserved, always reads '0'

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Equipment Present Register 2 (Port 0x080E)

This register provides information on hardware options fitted to the PPC7A.

MSB = D0, LSB = D7

D0: Universe II Fitted

0 = Not fitted
1 = Fitted

D1: Reserved, always reads '0'

D2: COMs 3 to 6 Fitted

0 = Not fitted
1 = Fitted

D3: USB Fitted

0 = Not fitted
1 = Fitted

D4: LPT Fitted

0 = Not fitted
1 = Fitted

D5 and D6: Cache Speed

D5	D6	SPEED (MHZ)
0	0	Reserved
0	1	Reserved
1	0	200
1	1	166

D7: Cache Type

1 = Double data rate
0 = Standard data rate

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Equipment Present Register 3 (Port 0x0810)

This register provides information on hardware options fitted to the PPC7A.

MSB = D0, LSB = D7

D0 to D3: Reserved. Always reads '0'

D4: PMC IO voltage

0 = 5 Volt
1 = 3.3 Volt

D5: 3.3Volt PMC power

0 = Powered by onboard power supply
1 = Power from taken from 3.3V pins on VME connectors

D6 and D7: SCSI clock speed

D6	D7	SPEED (MHZ)
0	0	Reserved
0	1	40
1	0	80
1	1	Reserved

Key Lock Register (Port 0x0818)

This register provides information on the state of the keylock signal. See the Keylock section for more details.

MSB = D0, LSB = D7

D0 to D6: Reserved

D7: Keylock

0 = Keylock signal low
1 = Keylock signal high

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LED Register (Port 0x0820)

This register provides control for the 4 user LEDs fitted to the PPC7A.

MSB = D0, LSB = D7

D0: SCSI_TERM_REQ

0 = SCSI terminator not required (SCSI link not fitted)
1 = SCSI terminator required (SCSI link fitted)

D1: SCSI_TERM_EN

0 = Disable SCSI terminator
1 = Enable SCSI terminator

D2 and D3: Selects the NVRAM page (each page is 8Kbytes)

D4: DS11, yellow

0 = LED off, OFFLINE~ High
1 = LED on, OFFLINE~ Low

D5: DS13 and DS1, Yellow

0 = LED on, SYSFAIL~ Low
1 = LED off, SYSFAIL~ High

D6: DS12 and DS2, Red and S+YSFAIL~ (P0 B1) signal

0 = LED off
1 = LED on

D7: DS14 and DS3, Green and SYSFAIL~ (P0 B2) signal

0 = LED off
1 = LED on

See the Software Programmable LEDs section and Chapter 6 for the location of these LEDs.

Note: **DS12 and DS2 are on by default after power-up.**
The on-board SCSI terminator can be enabled by the SCSI link (E13), or by setting SCSI_TERM_EN to 1.

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COMs Register (Port 0x0824)

This register provides control for COMs 3 & 4, for the Clocks and interface configuration.

MSB = D0, LSB = D7

D0: COM3_CLK_EN, this bit enables the TSCLK3 signal out on to COM3_TT (transmit clock)

0 = Disabled
1 = Enabled

D1: TSCLK3_EN, when enabled COM3_RT (receive transmit clock) is linked to TSCLK3 is

0 = Disabled
1 = Enabled

D2: COM3_RS232, selects which interface is used for COM3

0 = RS232
1 = RS422

D3: COM3_TX_EN, when enabled allows all of the COM3 interface buffers.

0 = Disabled
1 = Enabled

D4: COM4_CLK_EN, this bit enables the TSCLK4 signal out on to COM4_TT (transmit clock)

0 = Disabled
1 = Enabled

D5: TSCLK4_EN, when enabled COM4_RT (receive transmit clock) is linked to TSCLK4 is

0 = Disabled
1 = Enabled

D6: COM4_RS232, selects which interface is used for COM4

0 = RS232
1 = RS422

D7: COM4_TX_EN, when enabled allows all of the COM4 interface buffers.

0 = Disabled
1 = Enabled

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RTS Register (Port 0x0826)

This register provides options for when the COMs channel data transmitters are enabled. This selection logic only works in RS422 interface mode.

MSB = D0, LSB = D7

D0 & D1: Reserved always reads '0'

D2 and D3: COM3 transmitter function select

D3	D2	Transmit Function Selected
0	0	Not enabled
0	1	Enabled
1	0	Enabled by RTS3
1	1	Enabled by RTS3 & stretched

D4 & D5: Reserved always reads '0'

D6 and D7: COM4 transmitter function select

D7	D6	Transmit Function Selected
0	0	Not enabled
0	1	Enabled
1	0	Enabled by RTS4
1	1	Enabled by RTS4 & stretched

Watchdog Register (Port 0x0828)

This register controls the watchdog resets features of the PPC7A.

MSB = D0, LSB = D7

D0: Last reset was a watchdog

0 = Normal reset
1 = Last board reset was caused by a watchdog timeout

D1: Enable NMI from GT-64260

0 = Disabled
1 = NMI can be generated from GT-64260 CPUINT output pin

D2 to D5: Reserved – Reads '0'

D6: Watchdog enable

0 = Trig output disabled
1 = Trig output enabled

Once the trig output is enabled the Watchdog trig register (0x082C) needs to be accessed every 1.5 seconds, or a hard reset of the entire PPC7A occurs.

D7: RESET_SW_EN (output)

0 = Disable the front panel reset switch logic.
1 = Enable the front panel reset switch logic.

Note: This bit has no effect if the switch logic is not present or if link E14 is fitted.

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Watchdog Trig (Port 0x082C)

This is a dummy register that is written to trigger the watchdog.

MSB = D0, LSB = D7

D0 to D7: Don't care for writes, undefined for reads

Note: Data written is not used and Reads don't trigger the watchdog.

Board Revision Register (Port 0x0854)

This register provides information on the build state of the PPC7A.

MSB = D0, LSB = D7

D0 to D2: Number revision of hardware build state

1 = Revision 1
2 = Revision 2
3 = Revision 3
All other values are Reserved.

D3 to D7: Letter revision of hardware build state

0x0 = Revision A
0x1 = Revision B
...
0x18 = Revision Y
0x19 = Revision YA
...
0x1F = Revision YG

Extended ID Register (Port 0x0858)

This register provides Board hardware type.

MSB = D0, LSB = D7

D0 to D7: Board ID register

0x0E = PPC7A - 7410/755
0x0F = PPC7A – 745x
0x10 = PPC7FW (MPC7410 with Firewire)

All other patterns mean the board is not a PPC7A

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ID Link Register (Port 0x0864)

This register allows you to read the Board ID links (E4, E5, E8 and E10) or the VME Geographical address pins.

MSB = D0, LSB = D7

D0: Reserved

D1: Reserved

D2: Reserved

D3: GA4 (VME64 Geographical Address bit 4)

D4: E5/GA3

0 = Link fitted
1 = Link not fitted

D5: E10/GA2

0 = Link fitted
1 = Link not fitted

D6: E8/GA1

0 = Link fitted
1 = Link not fitted

D7: E4/GA0

0 = Link fitted
1 = Link not fitted

Note: **Bits D4, D5, D6 and D7 are also connected to the VME64 Geographical Address bits GA3, GA2, GA1 and GA0 respectively. Do not fit the links if you wish to read the status of the Geographical Address bits, as the links connect these bits to 0 Volts.**

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Motherboard Type Register (Port 0x0866)

This register provides information on the type of motherboard and SDRAM ECC operation. The bits used in this register are compatible with the other members of the current Radstone PPC product range.

MSB = D0, LSB = D7

D0: HW_ECC ENABLE

0 = Non-ECC
1 = ECC enabled

D1: PLL2 (see table below)

D2: ECC_TYPE

0 = Reserved
1 = ECC

D3: ECC

0 = ECC not fitted
1 = ECC fitted

D4: PLL1 (see table below)

D5: PLL0 (see table below)

PLL2	PLL1	PLL0	BUS SPEED (MHZ)
1	1	1	Reserved
1	1	0	Reserved
1	0	1	Reserved
1	0	0	133
0	1	1	Reserved
0	1	0	100
0	0	1	66
0	0	0	Reserved

D6 and D7: Hardware ID2 and ID1 respectively. Used with Hardware ID0 (bit 0 of Equipment Present Register 1) to define the hardware type as follows:

ID2 TO ID0	HARDWARE TYPE
111	PPC1/PPC3
110	PPC2
101	PPC1A
100	PPC2A
011	PPC4
010	PPC4A
000	Use Extended ID

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FLASH Write Protection (Port 0x0868)

This register provides information on the FLASH write protection.

MSB = D0, LSB = D7

D0: FLASH write enable link

0 = link not fitted
1 = link fitted

D1: Status of the P2 or P0 FLASH_WREN~ signal

0 = Signal not active (Pin high)
1 = Signal active (Pin low)

D2: FLASH BOOT write enable link

0 = link not fitted
1 = link fitted

D3: FLASH USER write enable link

0 = link not fitted
1 = link fitted

D4: Always reads '0'

D5: Writes to FLASH recovery section

0 = Disabled
1 = Enabled

D6: Writes to FLASH BOOT section

0 = Disabled
1 = Enabled

D7: Writes to FLASH USER section

0 = Disabled
1 = Enabled

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FLASH Control Register (Port 0x086E)

This register provides status and control signals for the Boot sections of the FLASH devices.

When the PPC7A is reset, this register is reset to reflect the status of the BOOT links (E8, E4 & E7), after boot software can then override these link settings by writing to bits D5 & D7 in this register.

Status signals BOOT_ALTERNATE, BOOT_FROM_VME & BOOT_RECOVERY show the real link settings. Signals SELECT_ALTERNATE & SELECT_RECOVERY show what image is really selected.

MSB = D0, LSB = D7

D0: NVRAM Write Protect

0 = NVRAM is write protected
1 = Writes to NVRAM are enabled

D1: BOOT_ALTERNATE (reflects the status of user link E8). This bit is read-only.

0 = Link not fitted
1 = Link fitted

D2: VME_BOOT_MODE (reflects the status of user link E4). This bit is read-only.

0 = Link not fitted
1 = Link fitted

D3: BOOT_RECOVERY (reflects the status of user link E7). This bit is read-only.

0 = Link not fitted
1 = Link fitted

D4: Reserved reads '0'

D5: SELECT_ALTERNATE

D6: FLASH_CONTROL_WRITTEN

0 = Register not written
1 = Register written

D7: SELECT_RECOVERY

SELECT_ALTERNATE	SELECT_RECOVERY	AREA SELECTED
0	0	Main
0	1	Recovery
1	0	Alternate
1	1	Extended

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Control and Status Registers on CS0

These registers are accessed via the GT64260 CS0 address window (see GT64260 for more information for setting up this address window).

CS0 I/O Port (Hex)	Description	Type
0000	Board ID	RO
0002	Last Reset source	RO
0003	Reset register	R/W
0004 to 0007	Board ID string	RO

Where: R/W = Read/Write RO = Read Only

Board ID (Port 0x0)

This register provides Board hardware type.

MSB = D0, LSB = D7

D0 to D7: Board ID register

0x0E = PPC7A - 7410/755
0x0F = PPC7A – 745x
0x10 = PPC7FW (MPC7410 with Firewire)

All others patterns mean the board is not a PPC7A

Last Reset Source (Port 0x2)

This register provides information about what caused the last reset.

MSB = D0, LSB = D7

D0 to D2: Reserved

D3: GT64260 watchdog timed out

0 = Did not cause the last reset
1 = Caused the last reset

D4: MAX706 Watchdog Timed out

0 = Did not cause the last reset
1 = Caused the last reset

D5: Reset switch

0 = Did not cause the last reset
1 = Caused the last reset

D6: Universe

0 = Did not cause the last reset
1 = Caused the last reset

D7: RiscWatch connector reset driven

0 = Did not cause the last reset
1 = Caused the last reset

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Reset Register (Port 0x3)

This register provides a 4bit register that is not cleared or changed on any reset apart from a power up when it is cleared to '0'.

MSB = D0, LSB = D7

D0 to D3: Reserved Reads '0'

D4 to D7: 4 bit register

Board ID String (Port 0x4 to 0x7)

This register provides a board ID string, which shows 'PPC7A' when read as a 32 bit value.

Port 0x4

MSB = D0, LSB = D7

D0 to D7: Reads 0x50 ('P')

Port 0x5

MSB = D0, LSB = D7

D0 to D7: Reads 0x50 ('P')

Port 0x6

MSB = D0, LSB = D7

D0 to D7: Reads 0x43 ('C')

Port 0x7

MSB = D0, LSB = D7

D0 to D7: Reads 0x37 ('7')

Status Registers on CS1

These registers are accessed via the GT64260 CS1 address window (see GT64260 for more information for setting up this address window).

CS0 I/O Port (Hex)	Description	Type
0000 to 0003	Checker board 1	RO
0004 to 0007	Checker board 2	RO

Where: RO = Read Only

Checker Board 1 (Port 0x0 to 0x3)

This register provides a checker board value of 0x5555 5555 when read as a 32 bit value.

Checker Board 2 (Port 0x4 to 0x7)

This register provides a checker board value of 0xAAAA AAAA when read as a 32 bit value.

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Interrupts and Error Reporting

The following table shows the various external interrupt sources to the processor and their relative priorities. It also shows whether the previous state of the processor is recoverable.

PRIORITY	INTERRUPT	CAUSE	RECOVERABILITY
0	System Reset	Power on, Hard reset	Non-recoverable
1	Machine Check	Address or Data Parity error, Machine Check Input (MCP~), Non-maskable Interrupt (NMI~)	Non-recoverable in most cases
2	System Reset	Soft reset	Recoverable unless Machine Check occurs
3	System Management Interrupt	SMI~ input	Recoverable unless Machine Check or System Reset occurs
4	External Interrupt	INT~ input	Recoverable unless Machine Check or System Reset occurs

System Resets

See the Resetting the PPC7A section at the start of this chapter.

Machine Check Exception

The South Bridge can be configured the signal NMI on certain conditions. The hardware on the PPC7A routes this signal to the CPU as the MCP~ (Machine Check) interrupt.

The South Bridge can drive this signal due to the following conditions:

- PCI bus error
- PCI SERR~ signal driven active

The PCI SERR~ signal can be driven low by other PCI devices to report a error condition.

The processor may be configured to take a machine check exception or enter the checkstop state.

System Management Interrupt (SMI~)

The System Management Interrupt pin of the CPU is connected to the GT64260. This allows the GT64260 to interrupt the processor for events such as an SDRAM parity error.

To allow the GT64260 to provide a SMI~ interrupt to the CPU the output pin MPP[8] needs to be set to Int[0]* (see GT64260 register MPP Control1 - offset - 0xF004). The events that can cause this interrupt to be driven is by register CPU Int[0]* (0xE60).

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External Interrupt (INT~)

The processor external interrupt pin (INT~) is asserted for a pending interrupt from the interrupt controller in the South Bridge.

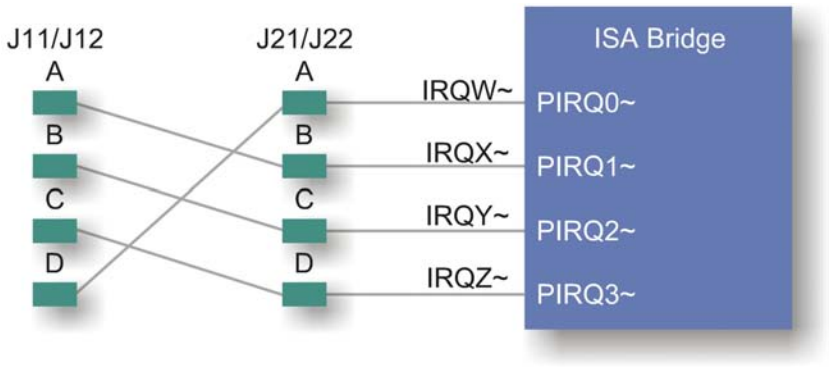
Interrupt priorities and modes are assigned as the firmware running on the PPC7A.

PCI Interrupts

There are 4 interrupt lines for the PMC expansion slots on the motherboard and the PMC carrier. These are connected to the PIRQ~ inputs of the interrupt controller. The PIRQ~ inputs may be routed to any IRQ that is set to level sensitive mode.

The interrupt routing follows the recommendations in the PCI specification and the PCI system design guide with a “rotation” between each slot.

The interrupt lines for the two on-board PMC slots are routed as shown below:



Two single function PMCs (which always use INTA~) are able to use unique IRQs with appropriate programming of the interrupt controller.

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PCI Configuration

The boot process must configure the base address and space type (memory or I/O) of all the PCI attached peripherals. The memory requirements of each PCI device are given in the appropriate device descriptions in this chapter.

Each PCI device also has several registers located in PCI configuration space, which is accessed by the processor through the GT64260 PCI bridge and memory controller using the CONFIG_ADDR and CONFIG_DATA registers. A full description of PCI configuration can be found in the GT64260 specifications.

The device number mapping for the PCI bus 0 attached to the GT64260 is as follows:

Device No.	Function
0 to 15	Not implemented
16	53C860 SCSI controller
17	Not implemented
18	South bridge
19	Not implemented
20	Universe II VME controller
21	Graphics
22 to 30	Not implemented

The device number mapping for the PCI bus is as follows:

Device Number	Function
0 TO 22	Not implemented
23	PMC2
24	PMC1
25 TO 30	Not implemented

Keylock

The keylock input signal allows the software to interrogate an external keyswitch. For example, the boot firmware could request a password if the keyswitch is in the locked position and a password is set up in the NVRAM.

The keylock signal defaults to high if no external connection is made.

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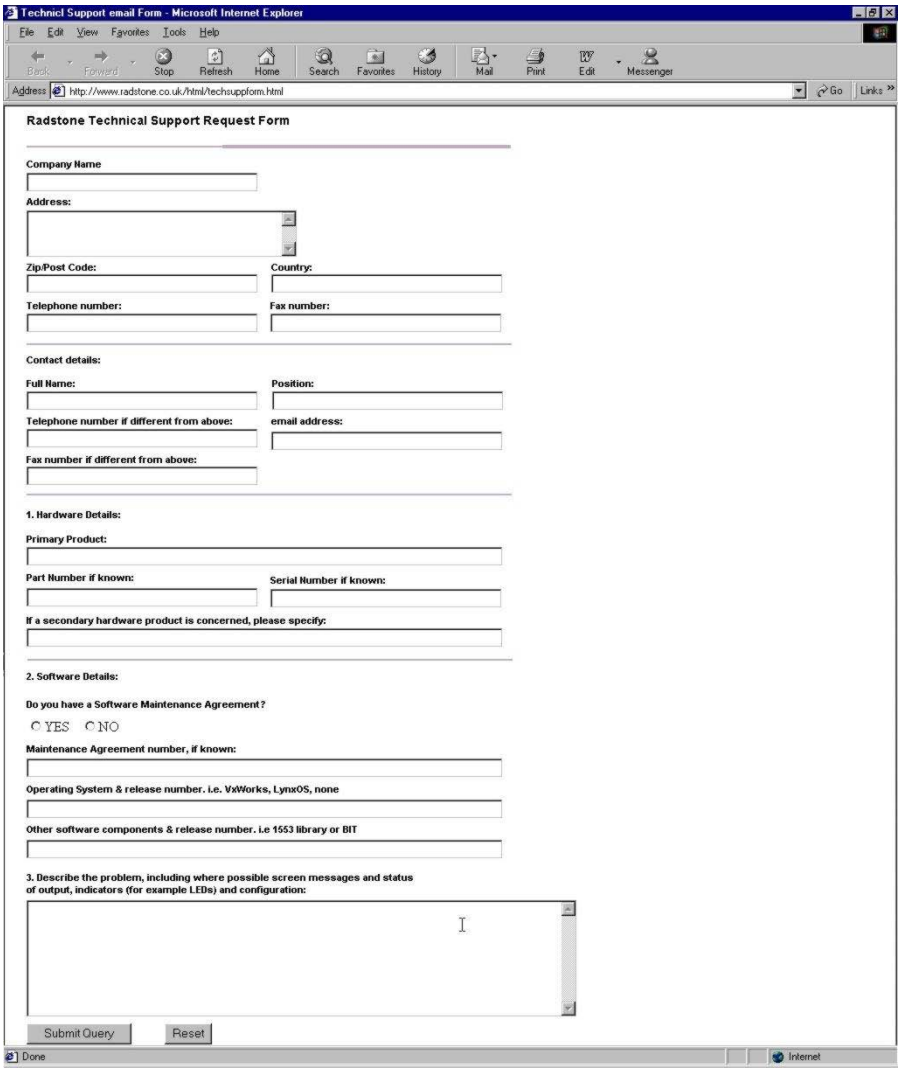
Chapter 9 - Technical Assistance

Radstone Contact Information

In the unlikely event that you experience problems with your PPC7A, for assistance please contact Radstone's Technical Help Line on:

+44 1327 359804 outside the UK
01327 359804 in the UK

Alternatively, you may also register support requests using the Technical Support Request Form available through the Radstone web site at http://www.radstone.co.uk. This form looks like:



Your query will be logged on Radstone's Technical Support database and allocated a unique Call Reference Number (CRN) for use in future correspondence.

If you telephone for technical support, please be prepared to provide the above details.

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Troubleshooting

If you are experiencing a problem with your PPC7A, there follow some general suggestions of actions you may take, which may resolve the problem without the need to contact Radstone's technical support.

- Ensure that the board is firmly seated and secured in the rack and that all male/female connectors mate together correctly
- Check the links on the board and the system backplane
- If you are unsure of which link configuration to use, try the default configuration (see Chapter 4) initially
- Check that the VME rack has terminators, if these are not built in (the manual for your rack should tell you whether the terminators are built in)
- Using a digital volt meter, check that the power supply is within VME limits on +5V, +12V and -12V

⚠ WARNING

Power supply problems should only be dealt with by qualified personnel.

- Check that there is only one board configured as system controller in a system and that this is in slot 1 of the rack
- Check that there are no vacant slots in the rack without jumpers (or that an automatic daisy chaining backplane is being used)
- Prove the PPC7A's operation in isolation before adding it into a multi-board system
- If you are using the SCSI bus, then check that the cable stub length is less than 10 cm. You are also recommended to locate the PPC7A at one end and enable the bus terminator by fitting link E13. If you want to use the PPC7A somewhere other than at the end of the SCSI bus, ensure that E13 is not fitted. **Fitting E13 when the PPC7A is not located at the end of a SCSI bus may cause erroneous SCSI operation.**
- If you have made your own cable for connection between P7 or P2 and a terminal/hyperterminal, check that the pinout is correct
- Check that the terminal is set up for DTE (9.6 kbaud, 8 bits/character, 1 stop bit, parity disabled)
- Ensure that air-cooled PPC7As receive sufficient air-flow. If you need to operate your PPC7A on an extender card, this requires an additional fan to supply the necessary air flow
- Ensure that conduction cooled PPC7As are fully installed in the conduction cooled box and that the wedgelocks are correctly tightened. If, for any reason, you need to operate a conduction cooled PPC7A on an extender card, you must maintain an airflow of at least 300 feet/minute over it
- If you are having problems programming the FLASH, then check that the appropriate write enable link, E3 or E9, is fitted, and that the backplane signal, FLASH_WP~ (P0 pin A2) is connected to GND or E5 is fitted. See the FLASH section in Chapter 8 and the E3, E5 and E9 descriptions in Chapter 4 for more details

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Appendix A - Specifications

This appendix provides the detailed technical specification for the PPC7. It covers the following items:

- VMEbus compliance
- Local resources
- EMC regulatory compliance and safety
- Power requirements
- Reliability/Mean Time Between Failures
- Environmental specifications for both build levels
- General dimensions
- Weight
- Ordering Information and options in:
    - Board
    - Firmware
    - Operating Systems
    - PMCs
    - P2 I/O Modules

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VMEbus Compliance

The PPC7A conforms to the ANSI/VITA 1-1994 standard for VME64.

Master:	A16, A24 and A32 ADO, ADOH A16:LCK, A24:LCK, A32:LCK D08(EO), D08(EO):RMW, D08(EO):BLT D16, D16:RMW, D16:BLT D32, D32:RMW, D32:BLT, D32:UAT D64:MBLT
Slave:	A16, A24 and A32 ADO, ADOH A16:LCK, A24:LCK, A32:LCK D08(EO), D08(EO):RMW, D08(EO):BLT D16, D16:RMW, D16:BLT D32, D32:RMW, D32:BLT, D32:UAT D64:MBLT
Interrupt Handler:	D08(O), IH(1-7)
Interrupter:	I(1-7)
VMEbus Arbiter:	SGL, RRS, PRI, BCLR~ generation
VMEbus Requester:	ROR, RWD Early BBSY~ release Bus capture and hold
Bus Time-out Module:	16, 32, 64, 128, 256, 512, 1024 µS, disabled
Other Slot 1 Functions:	Slot 1 detector, IACK~ daisy chain driver, SYSCLK driver
Auto Slot ID:	VME64 specified and SCV64 compatible modes or geographical addressing via 5-row P1 connector

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Local Resources

Processor	PowerPC 745x at 500 MHz or above.
SDRAM	64 to 512 Mbytes with ECC.
L2 or L3 Cache	1 to 4 Mbyte on private cache bus.
Graphics	Totally integrated 2D graphics processor with 2Mbytes of graphics SRAM on chip. With 69000: Pixel clocks up to 135Mhz, up to 24 bit colour depths per pixel. 1280 x 1024 x 8 @ 75Hz 1024 x 768 x 16 @ 85 Hz 800 x 600 x 24 @ 85 Hz With 69000: Pixel clocks up to 170Mhz, up to 24 bit colour depths per pixel. 1280 x 1024 x 24 @ 80Hz 1024 x 768 x 24 @ 85 Hz 800 x 600 x 24 @ 85 Hz
FLASH	Up to 256 Mbytes, with 8 Mbytes reserved for Boot FLASH banks
RTC	I²C RTC backed up by connection to VMEbus 5VSTDBY pin.
NVRAM	32 Kbytes.
PCI	64-bit @ 66 MHz.
SCSI	8 bit fast Ultra-SCSI via the P2 connector.
Ethernet	2 off, Ethernet 10/100BaseT via the P2 connector.
PMC Slots	Air-cooled: Two 5V, 32-bit IEEE P1386.1 compliant slots with front panel and P0 I/O, and restricted P2 I/O.
Serial I/O	Six serial I/O channels via the P2 connector. Two channels are equipped with clocks for synchronised operation with interfaces that allow for RS422 or RS232.
Keyboard and Mouse	PS/2 compatible Keyboard and Mouse interface via the P2 connector.
Parallel I/O	Centronics style port via the P2 connector.
Floppy Disk Interface	MFM 1.44/2.88 Mbyte via P2 connector.
Counter/Timers	Eight 32-bit timers with a resolution of one bus clock (100 Mhz).
Reset/Abort switch	Front panel mounted
Operating Systems	LynxOS VxWorks/Tornado INTEGRITY
PCI Expansion	PCI through P0 via PMCPCI card.

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I/O Modules	P2 (3U mounting)	SCSI, Six serial, Parallel, floppy Mouse and keyboard, Ethernet: 10/100BaseT
	Miscellaneous	P2 transition module (including 50-way SCSI header)

EMC Regulatory Compliance and Safety

Air-cooled versions of PPC7A are designed for use in systems meeting VDE class B, EN and FCC regulations for EMC emissions and susceptibility.

All PCBs are manufactured by UL approved manufacturers and have a flammability rating of 94V-0.

Power Requirements

Supply Voltage	PPC7A-7410 128 Mbyte SDRAM	PPC7A-7410 256 Mbyte SDRAM
+5V +5 %, -2.5 %	3.5A	3.5A

These figures are based on a 500 MHz MPC7410 running at 500 MHz with a 100 MHz processor bus. The card was running a comprehensive memory test and gave measured values for +5V supply current of 3500 mA for the 128 Mbyte SDRAM version and 3500 mA for the 256 Mbyte SDRAM version.

Note: **When using PMCs, ensure that they do not cause the specified maximum supply current to be exceeded, especially from the +5V supply. The VME specification allows a maximum of 7.5 Amps to be drawn from the +5V supply in a single slot over the PPC7A's specified operating temperature range. It may not be possible to support all combinations of SDRAM and PMCs within this limit.**

The PPC7A uses the undefined pins (rows a, c, d and z) of the VMEbus P2 connector for I/O and power/ground connections. 3.3V is connected to both of the PMC sites.

⚠ WARNING

Do not exceed the maximum rated input voltages or apply reversed bias to the assembly.

If such conditions occur, toxic fumes may be produced due to the destruction of components.

⚠ CAUTION

Only use the PPC7A in backplanes that supply power on both the J1 and J2 connectors.

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Reliability (MTBF)

The following table shows the calculated MTBFs for the PPC7A-1BA-10:

Environment	Fail Rate (Failures Per Million Hours)	MTBF (Hours)
Ground benign 30°c	6.298724	158,762
Ground fixed 40°c	14.72659	67,904
Ground mobile 45°c	26.94278	37,116
Naval sheltered 40°c	23.7376	42,127
Naval unsheltered 45°c	38.72897	25,820
Airborne inhabited cargo 55°c	31.34095	31,907
Airborne inhabited fighter 55°c	41.45621	24,122
Airborne uninhabited cargo 70°c	52.65228	18,993
Airborne uninhabited fighter 70°c	79.78461	12,534
Airborne rotary wing 55°c	56.9936	17,546
Space flight 30°c	5.5010268	181,784
Missile flight 45°c	32.6502	30,628
Missile launch 55°c	78.40276	12,755

These failure rates are based only on the components and connectors fitted to the board at delivery and take no account of user fitted PMCs.

The failure rates used in this calculation are based on MIL-HDBK-217F Notice 1 (parts count method) with commercial or non-military quality level. Where a component did not comply with the MIL-HDBK, the closest equivalent, compliant component was used.

Environmental Specifications

Build Style	Operating Temp (°C)	Storage Temp (°C)	Vibration	Shock	Humidity	Comments
Standard (level 1)	0 to +55 with airflow of 300 feet/minute	-50 to +100	0.002g^2/Hz from 10 to 2000 Hz random, and 2g sinusoidal from 5 to 500 Hz	20g peak sawtooth, 11ms duration	Up to 95% RH	Commercial grade cooled by forced air, for use in benign environments and software development applications.
Extended temp (level 2)	-20 to +65 with airflow of 300 feet/minute	-50 to +100	0.002g^2/Hz from 10 to 2000 Hz random, and 2g sinusoidal from 5 to 500 Hz	20g peak sawtooth, 11ms duration	Up to 95% RH with varying temperature. 10 cycles, 240 hours	As Standard but conformally coated and temperature characterised.

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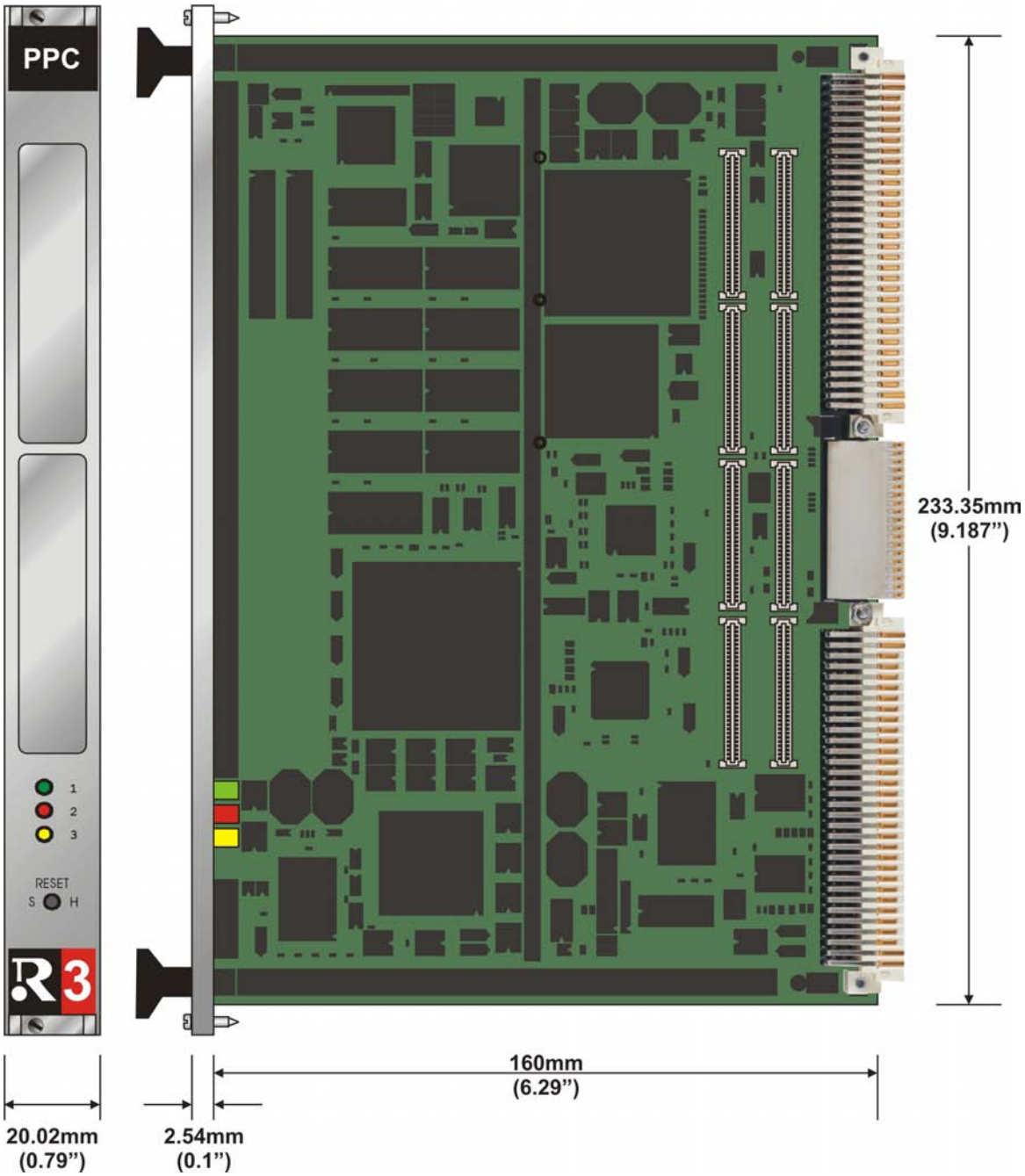
Mechanical Construction

Weight

The approximate weight of the PPC7A is 680g.

Dimensions

The PPC7A is constructed on a multi-layer double Eurocard and conforms to the dimensions specified in the ANSI/VITA 1-1994 specification. The dimensions shown below are in millimetres, with inches (in parentheses) for general guidance only.



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Ordering Information

PPC7A - XXXX - X X X X X X X

SOFTWARE
1 = SilverChip
2 = BIT/SilverChip
3 = VxWorks
4 = BIT/VxWorks

P0 CONNECTOR OPTIONS
O = No P0
A = TYPE A
B = TYPE B

COMMS OPTIONS/P2 PMC I/O
1 = 2 x 10/100BaseT Ethernet, P2 PMC I/O
A = Reserved
B = 2 x 10/100BaseT Ethernet & COM 3/4/5/6

FLASH / USB / GPIO

0 = 64MB, USB, GPIO	1 = 64MB, Keyboard, Mouse, GPIO
2 = 64MB, USB, Parallel	3 = 64MB, Keyboard, Mouse, Parallel
4 = 128MB, USB, GPIO	5 = 128MB, Keyboard, Mouse, GPIO
6 = 128MB, USB, Parallel	7 = 128MB, Keyboard, Mouse, Parallel
8 = 256MB, USB, GPIO	9 = 256MB, Keyboard, Mouse, GPIO
A = 256MB, USB, Parallel	B = 256MB, Keyboard, Mouse, Parallel

MEMORY
0 = Reserved
1 = 128MB
2 & 3 = Reserved
4 = 256MB
5 = 512MB

PROCESSOR

0 to 4 = Reserved	5 = 755 @ 400MHz
6 to 9 = Reserved	A & B = Reserved
C = 7410 @ 500MHz	

LEVEL
1, 2, 3, 4, 5

PROCESSOR
7410

Notes: **P0 options are available on all build levels.**

Due to the large amount of I/O required to be handled by the PPC7A, Type B (95-way) connectors are preferred to Type A (80-pin), and are fitted by default no particular type is specified.

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PMCs

A range of PMCs are available from Radstone and third parties.

PMCs available from Radstone, in various build standards including Radstone's state-of-the-art rugged conduction-cooled PMCs, include:

NAME	TYPE	BUILD LEVELS	DESCRIPTION
PMCPCI	PCI expansion	1 to 5	Brings The PCI Bus Out Of The P0 Connector Allowing The PPC7A To Be Connected To P0 PCI Style Carrier Cards, The Vantegra Range Of SHARC DSP Products And Other Radstone P0 PCI Based Products
PMC2-9100	Graphics	1 to 4	4 Mbytes VRAM. Front panel or rear I/O and analog or digital video output options
PMC1553	MIL-STD-1553B interface	1 to 5	Front panel or rear I/O, single or dual channel, and RT-only or RT/BC/MT options
PMX1553	MIL-STD-1553B and serial interfaces	Level 4 preferred	Single MIL-STD-1553B channel and 4 channels of serial I/O. RT-only or RT/BC/MT and RS232/RS422 options
PMCEXT	Ethernet interface	1 and 2 only	100BaseTX Fast Ethernet interface
PMCATMF	ATM interface	1 to 4	155 Mbps ATM adapter for OC-3 fiber networks
PMCF1	FLASH memory	1 to 5	High capacity FLASH. 32, 64, 96 or 128 Mbytes options
PMCF2	Compact FLASH	1 to 5	Solid state hard disk using 40 Mbyte Compact FLASH Card
PMCFA1	Fibrechannel interface	1 to 5	1 Gbit/second full duplex Fibrechannel adapter
PMCGA1	Graphics	1 to 5	High performance PCI graphics accelerator
PMCGA2	Graphics	1 to 5	High performance PCI graphics accelerator

These products are supported by data sheets and manuals giving more information, and more details on the options. For more detail on any of these or forthcoming products, or for copies of the literature, please contact Radstone directly or your nearest Sales Office.

Note: **Level 1 PMCs (from Radstone and third parties) can be used on both build levels (1 and 2) of the PPC7A, even if the PMC does not meet the extended temperature and environmental requirements of level 2.**

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Operating Systems

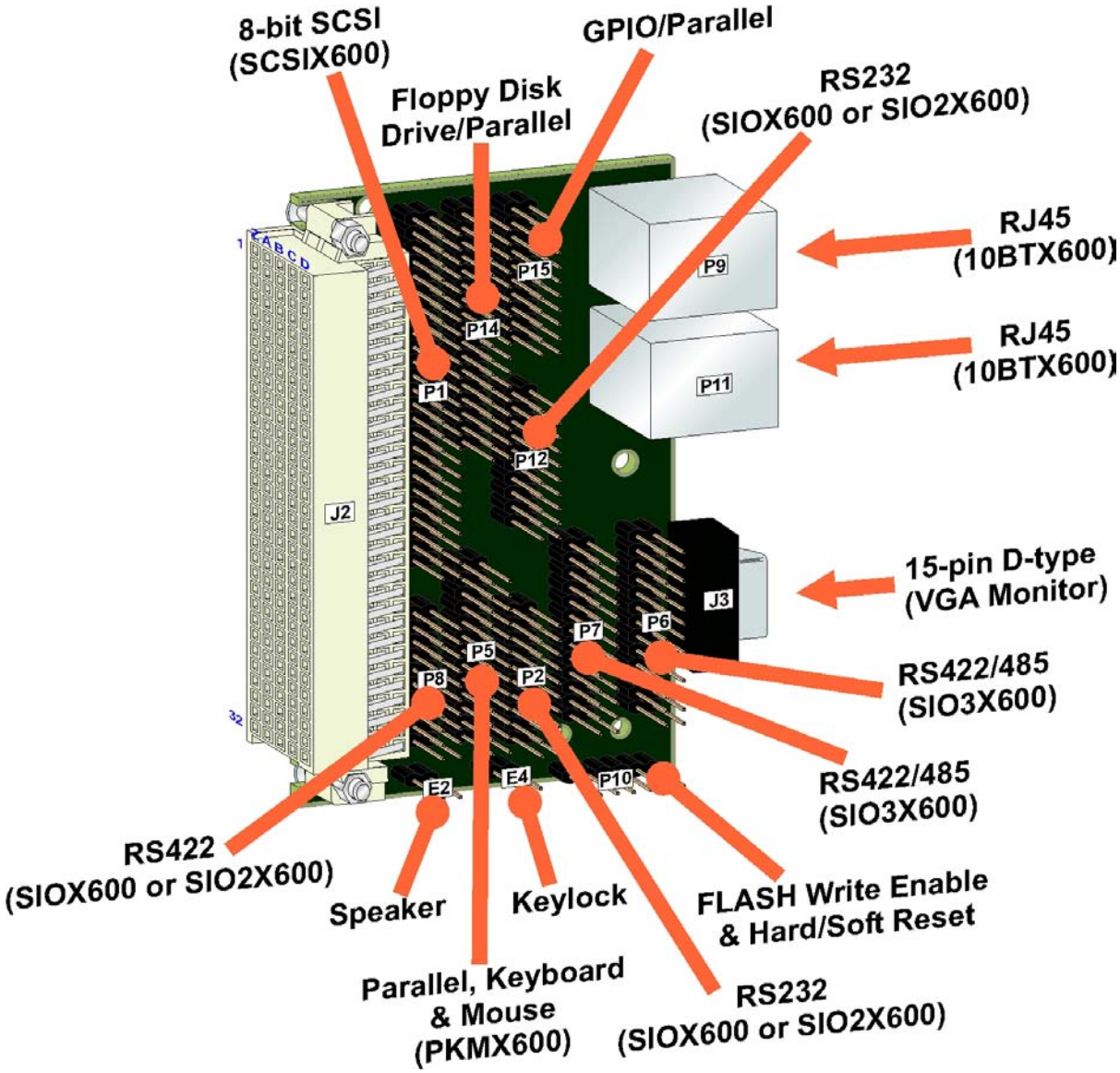
Availability includes:

- LynxOS
- VxWorks/Tornado
- INTEGRITY

Please contact Radstone for more details.

P2 I/O Module

The Backplane Transition Module for the PPC7A is the P25X606, illustrated below. Compatible Rear I/O modules are shown in parenthesise.

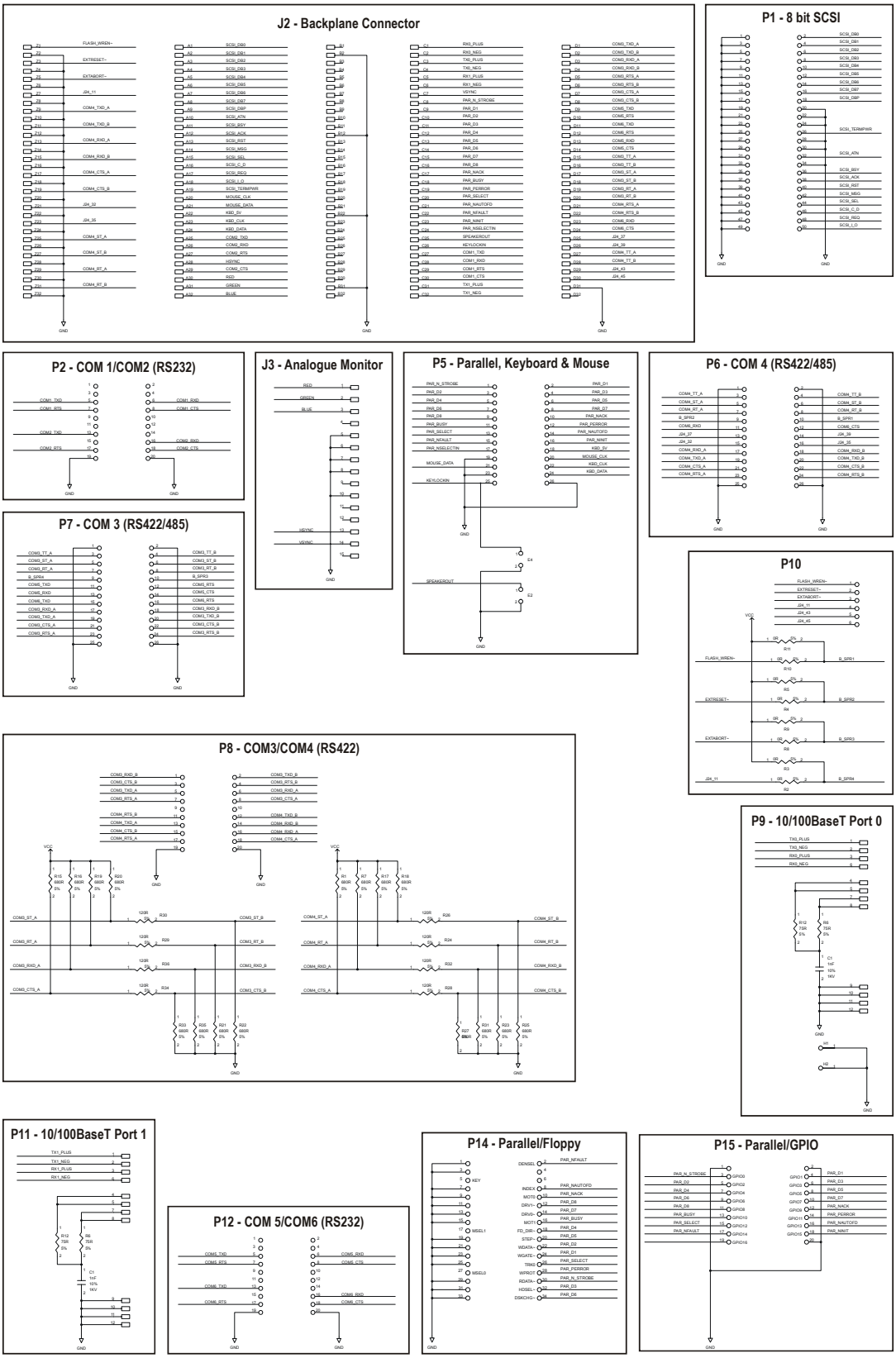


For installation instructions, refer to the I/O Module Installation Guide, Publication Number RT5154. Pin assignments and ordering information are given overleaf.

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Pin Assignments

For P25X606 pin assignments, refer to the schematic diagram below.



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Ordering Information

P25X606 - X X X X X

Additional Signals
0 = Spares unconnected
1 = Spares connected to P2
2 = Spares connected to VCC

COM 3/COM4 RS422 Termination
0 = No termination
1 = COM3 terminated, COM4 not terminated
2 = COM3 not terminated, COM4 terminated
3 = COM3 terminated, COM4 terminated

Ethernet Options
1 = 1 x Ethernet
2 = 2 x Ethernet

Video/Comms Options
1 = Video, COM 1,2,5 RS232, COM3 RS232/422, No COM6
2 = No Video, COM 1,2,5,6 RS232, COM 3,4 RS232/422

Build Level
1 = Level 1
2 = Levels 2,3,4,5

Note: **Where second Ethernet and Video connectors are not fitted, a QXP2IO may be connected. For details of this and other compatible I/O modules, refer to the I/O Module Installation Guide, Publication Number RT5154.**

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Glossary

Notes:

1. **The VMEbus signals are explained in chapter 5.**
2. **See the general Radstone Glossary, Publication Number RT5116.**

BCS

Background Condition Screening.

CR/CSR

Configuration ROM/Control and Status Register.

LRU

Line Replaceable Unit.

PPC7A

Radstone's PowerPC-based processor card. The PPC7A is based on the PowerPC 745x/7410 processor with integral L3/L2 cache controller and uses SDRAM.

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Index

A

Antistatic Precautions 3-1
Applications 1-1

B

BCS 2-8
BIT 2-8
Board ID 3-1
  Register 8-29
Boot Firmware 2-8
Build Styles 2-9

C

Cautions 1-5
Chassis Ground 7-3
CHRP 2-3
Configuration
  Link
    Default 3-2
    E1 4-5
    E17 4-4
    E2 4-3
    E3 4-2
    E4, E5, E8, E10 4-5
Connectors 5-1
  J11/J21 ..... 5-12, 5-16
  J13/J23 5-14
  J14 5-16
  J24 5-17
  Locations 5-1
  P0 ..... 5-9, 5-10
  P2 ..... 5-3, 5-4, 5-17
  P8 5-18
  Signal Descriptions
    P0 5-11

D

daisy chain 7-2
Dimensions A-6
Documentation Audience 1-2
Documentation Scope 1-2
Documentation Structure 1-3

E

ECC 8-6, 8-30
EMC 7-3
  Regulatory Compliance A-4
Environment A-5
EST Emulator Connection 5-19
Ethernet
  Controller 8-12

F

Floppy Disk
  Controller 8-13
Front Panel 6-1
Functional Overview 2-3

H

Heatsink 1-5

I

I/O Capabilities 2-7
I/O Modules A-9
Inspection 3-2
Installation
  Board 7-2, 7-4
  PMCPCI 7-1
Interrupts 8-35
  External 8-36
  Handling A-2
  Interrupter A-2
  PCI 8-36
  SMI 8-35
  VMEbus 8-16
Introduction 1-1
ISA Bus 2-7
  Bridge 8-13

J

JTAG 8-9
  Clock Frequencies 8-10
  PMC 8-10

K

Keyboard/Mouse
  Controller 8-14
Keylock 8-24, 8-37

L

LEDs 5-11, 8-18
  Rear Ethernet 8-12
  SCSI Activity 8-22

M

Machine Check
  Exception 8-35
Mailboxes 8-15
Memory 2-6
  Cache 2-6, 8-2, 8-3

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Controller 8-6
FLASH 8-7
Maps 8-6
SDRAM 8-6
MTBF A-5

O

Operating Systems 2-8
Ordering Information A-7

P

Parallel I/O 8-13
PCI 2-5, 8-11
Bridge/Memory Controller 2-5
PMC
Signal Descriptions 5-15
Site 8-13
Types A-8
Power
Up 7-4
PowerPC Processor 2-4, 8-2
PRePP 2-3

R

Registers 8-33, 8-34
Equipment Present 8-24, 8-25, 8-26, 8-27
Memory Configuration 8-20
Related Documents 1-7
Resets 8-4
Hard 8-4
Remote 8-5
Soft 8-5
Watchdog 8-5
Revision State 8-28

S

Safety A-4
Notices 1-4
SCSI
Processor 8-12
Terminator 8-12, 8-22, 9-2
Semaphores 8-16
Serial I/O 8-13
Software Support 2-8
System Controller 8-14

T

Technical Help 9-1
Telephone Number 9-1

U

Universe II Chip 8-14

V

VMEbus 7-2
Arbitration 8-15
Booting 8-8
Bus Errors 8-16
Compliance A-2
Indivisible Cycles 8-15
Interface 2-7
Location Monitor 8-16
Master Access 8-14
Master BLT 8-15
Requester 8-15
Retries 8-17
Slave Access 8-15
Slave BLT 8-15
Write Posting 8-14

W

Warnings 1-4
Watchdog 8-17
Weight A-6
World Wide Web Sites 1-8

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