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Find the *Abaco Systems / Radstone PPC4-750-1000B* at our website: ***Click HERE***

PowerPC™
755/7410
Single Board Computer
PPC4A

PowerXtreme
POWER PC PROCESSOR

High Performance, High Memory Bandwidth SBC



- **PowerPC 755/7410 AltiVec to 500 MHz & beyond**
- **PReP Architecture**
- **5 Air & Conduction-Cooled Ruggedization Levels**
- Standard Features
  - 1 Megabyte (MB) L2 Cache with private L2 Bus (2 MB for 7410)
  - 64 MB 64 bit wide FLASH
  - Up to 512 MB SDRAM on-board, with ECC
  - 512 Kilobytes (KB) User E²PROM
  - 10/100 BASE-T or 10 BASE-5 Ethernet
  - Ultra SCSI
  - Mouse/Keyboard/Floppy/Parallel/4 x Serial Ports
  - 5 row VME64 & Type A or B P0 Connectors
  - 2 PMC Expansion Slots
  - PMC Carrier Cards with up to 9 PMCs
- **Radstone BIT & SilverChip Firmware**
- **BSPs & ESPs for VxWorks/Tornado, LynxOS, RTEMS**
- **SW Maintenance Support**
- **HW & SW Configuration Management**

Product Overview

The PPC4A COTS 6U VME64 Single Board Computers (SBCs) offer the very latest, high performance, PowerPC processors combined with the same rich feature set of the PowerPC Reference Platform (PReP) architecture Radstone introduced in 1995. PPC4A supports SDRAM on a fast 100 MHz memory bus, for maximum performance.

Five Ruggedization Levels in both Air and Conduction-cooled form factors, make PPC4A the clear choice for Systems Integrators and Defense OEMs serving the market for leading edge Naval, Land Based and Airborne embedded computing platforms.

PowerPC 7410 processors clocked at 500 MHz and higher, and PowerPC 755 processors clocked at 400 MHz or higher, are available to satisfy the most demanding performance requirements while maintaining form, fit and function compatibility with previous generations of Radstone PowerPC SBCs.

Radstone protects your investment in application software by maintaining a standard functional envelope with a clear performance upgrade path enabling technology insertion and maximum hardware and software component re-use across multiple applications and programs.

Software support includes Radstone Built-In-Test (BIT) and SilverChip firmware as well as Board Support Packages (BSPs) and Enhanced Support Packages (ESPs) for VxWorks/Tornado from WindRiver Systems and LynxOS from LynuxWorks. In addition, third-party OS support is available for BlueCat Linux (also from LynuxWorks) and for RTEMS from OAR Corp.

PPC4A is backed by Radstone's 40+ years of experience supplying rugged electronic systems and long term program management to the world's industrial and defense marketplace.

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Features	Benefits
PowerPC 755/7410 AltiVec	The latest in processing power maintaining backward compatibility with current systems
1 MB backside Level 2 Cache (2 MB for 7410)	Exploits the full performance potential of the 755/7410 PowerPC CPU
SDRAM support	High performance with ECC checking on 100 MHz memory bus
PReP based architecture	Support for the latest COTS Software and third-party development environments
Single Slot 6U VME form factor	Reduced system cost and slot occupation
5 Ruggedization Level Options	Maximum component hardware and software re-use across multiple environmental ranges
2 PMC expansion slots	System expansion using IEEE P1386.1 standard single or double width PCI Mezzanine Cards (PMCs)
PMC Carrier Cards	Future proofs your system design by enabling PCI Sub-System expansion to add new, low cost interface capability as required
Radstone Software Support	COTS BIT, SilverChip firmware, BSPs and ESPs for VxWorks & LynxOS
Radstone SW Maintenance	Automatic SW revision updates and technical support
Radstone Configuration Management	Unique part number requiring customer notification authorisation for changes in product revision status

Processor

PPC4A supports the PowerPC755 and 7410 microprocessors with backside Level 2 Cache bus clocked at up to 133 MHz. The standard PReP architecture provides a stable platform facilitating development of high performance solutions today, while anticipating introduction of the very latest technology as soon as it enters production. (Table 1)

Memory

PPC4A supports 128, 256 or 512 Megabytes (MB) of SDRAM on-board. (Table 2)

The CPU to memory interface is supported by the MPC107 bridge from Freescale Semiconductor. This device implements a 64 bit data bus to SDRAM with ECC clocked at up to 100 MHz. Exact CPU core frequency will vary depending on this bus frequency. The MPC107 also supports 64 MB of 64 bit wide FLASH which is paged, with linear addressing (read and write).

The MPC107 also bridges the CPU to the internal 32 bit, 33 MHz PCI bus providing the main interface to both on-board and PCI sub-system resources.

PCI Sub-System

In addition to the two on-board slots supporting air or Conduction-cooled PMCs, PPC4A offers expansion with a family of standard PMC Carrier Cards. (Table 3)

The PCI sub-system can support from 2 to 9 PMCs within a standard VME chassis (see P0CC1 datasheet for more detail). The P0CC1 6U PMC Carrier is a single slot replacement unit supporting two single or one double width PMC which can be linked to the PPC4A host via the P0/J0 interface on each card. (Figure 2)

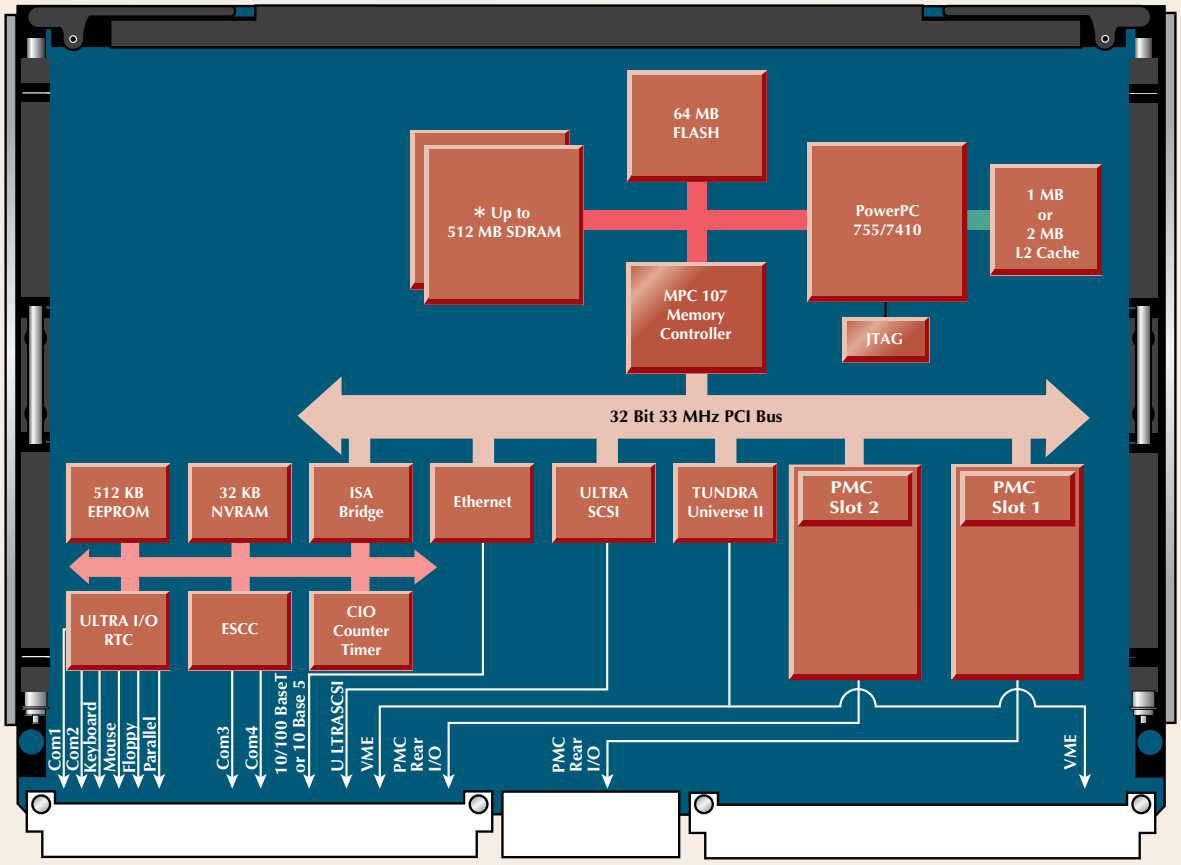
Radstone PMCs for Graphics, Fiber Channel, MIL-1553, Serial, FLASH Memory and Fast Ethernet are available in various ruggedization standards.

Table 1: CPU Selection

CPU	Frequency	SPECint95 *	SPECfp95 *	CPU Typical (Watts) Consumption *	Power SBC Typical Power (Watts) Consumption †
755	400	18.1	12.3	4.5	19
7410 AltiVec	500	22.8	17.0	6.0	20

* Estimates of CPU performance & dissipation provided by Freescale Semiconductor. These figures are presented as a guide to illustrate relative CPU performance only. Radstone SBC performance may vary from these figures.
† Actual power consumption may vary depending on the application and resource usage of the configured system.

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**128 MB SDRAM fitted as standard. 256 MB or 512 MB can be fitted as a build option.*

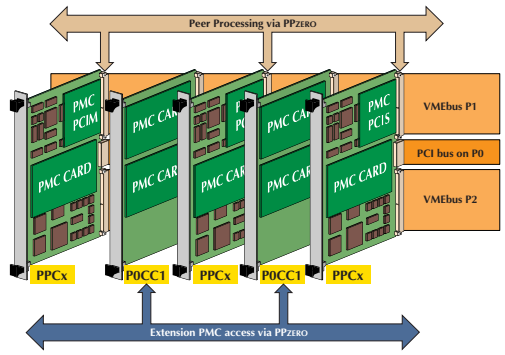
Figure 1: 4A Functional Block Diagram

Table 2: PPC4A Memory

SDRAM	128, 256 or 512 MB on-board	
FLASH E^2PROM	64 MB, 64 bits wide paged with linear addressing (read & write)	Standard surface mount device (not socketed)
Level 2 Cache	1 MB (2 MB for 7410)	Private backside L2 Cache bus at up to 200 MHz
Non-volatile RAM	32 KB Ferroelectric Nonvolatile Ram	
User E^2PROM	512 KB Standard on the internal ISA bus	

Table 3: PMC Expansion on PPC4A

Assemblies	PMC Slots	VME Slots
PPC4A	2	1
PPC4A/PMCPCI/P0CC1	3 to 9	2 to 5



PPzero

- Provides high bandwidth access to peer main processor cards across PCI
- Genuine multi-processing, peers each see the other's main memory
- Standard O/S backplane driver models supported for VxWorks and LynxOS
- Also provides access for up to nine standard PMC cards within five VME slots
- Easy expansion at low incremental cost

Figure 2: PCI Subsystem Expansion

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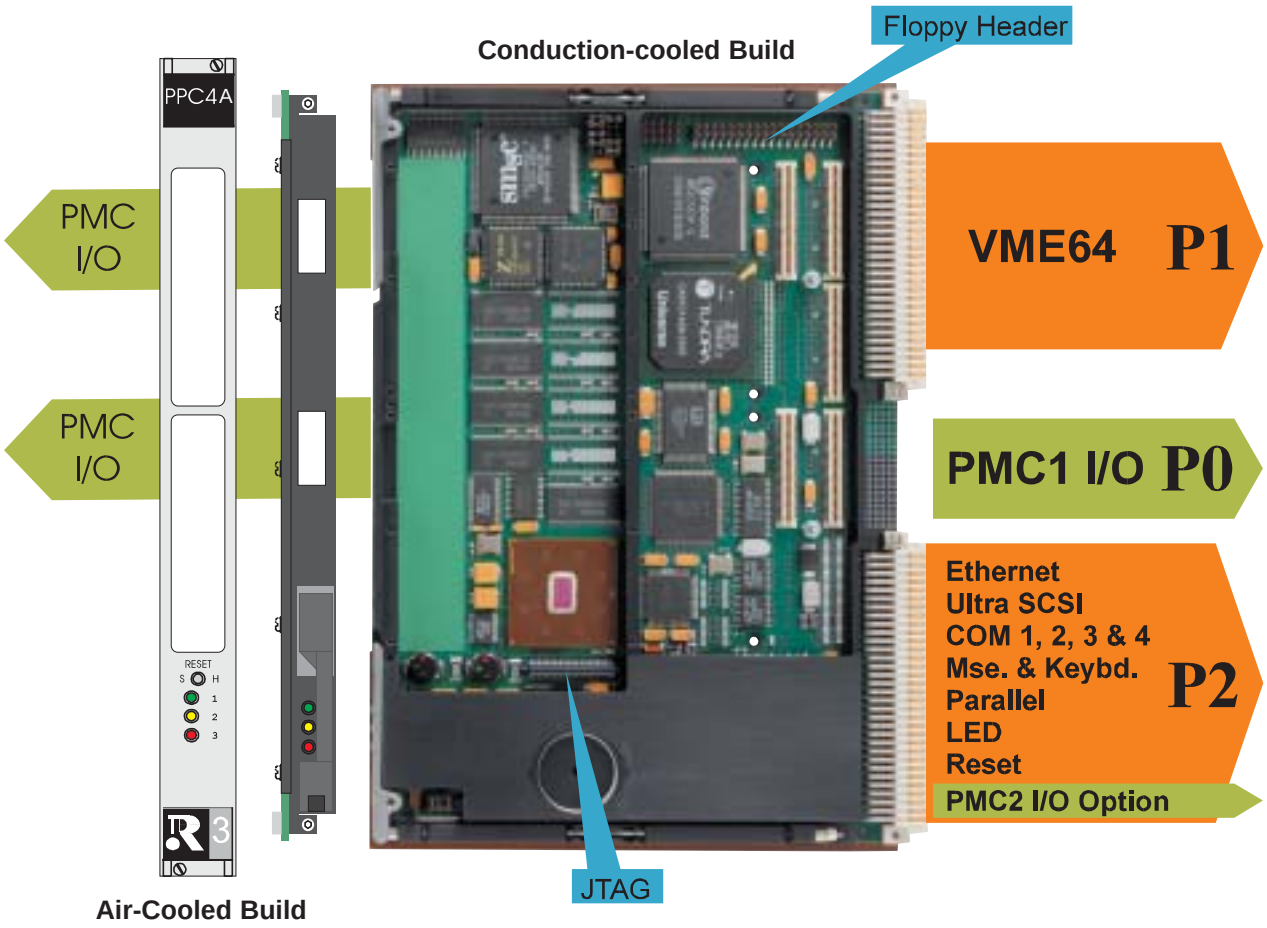


Figure 3: PPC4A I/O Diagram

Input/Output

PPC4A is designed to provide high-density rear I/O for systems requiring sealed box operation and simple card replacement routines for field maintenance. Front panel I/O is limited to the two on-board PMC slots. (Figure 3)

In order to maximise I/O density, PPC4A uses 5 row VME64 P1 and P2 connectors as well as a standard P0 connector for rear access to on-board PMC Slot1. PMC Slot2 may be configured to offer I/O on rows Z & D of the P2 connector. When this build option is specified, the COM 3 & 4 serial ports are no longer supported.

Type A 80 way P0 connectors with guide pin and keying or type B 95 way P0 connectors may be fitted for rear I/O. The required ruggedization option must be specified for all air and Conduction-cooled ruggedization levels when placing your order. Please note that Type A and Type B connectors will not mate interchangeably with system backplanes fitted with the opposite type.

5 Ruggedization Levels

PPC4A is available in Radstone's five ruggedization levels. (Table 4) Air-Cooled variants are designed to be used in standard industrial VME chassis. Conduction-cooled builds are for use in Radstone or third-party ATR style enclosures. In addition to these COTS configurations, PPC4A may be supplied to meet the mechanical and thermal requirements of specific platforms with the addition of mission specific, to-type mechanics.

Radstone uses advanced thermal and mechanical design in the printed circuit board, metal work and assembly process in order to build in the required levels of ruggedness. Ruggedization level 2 and higher circuit card assemblies include Conformal Coating as standard.

PPC4A is a direct successor to PPC2A which has been successfully tested to shock and vibration levels far in excess of Radstone's COTS level 4 and 5 ruggedization standards in order to meet the requirements of specific defense programs. These tests included 400g shock pulses and wing mounted Fast Jet Pod vibration environments with rugged PMCs fitted.

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Table 4: PPC4A Ruggedization Levels

Ruggedization Level	1	2	3	4	5
Cooling Method	Convection			Conduction	
Conformal Coat	Optional	Standard	Standard	Standard	
Low Pressure Operational	15,000ft	15,000ft	15,000ft	70,000ft	
Low Pressure Storage	50,000ft	50,000ft	50,000ft	70,000ft	
Rapid Decompression	N/A	N/A	0-50,000ft	0-70,000ft	
High Temp Operational	55°C @ 300ft/min	65°C @ 300ft/min	75°C @ 600ft/min	75°C At card edge	85°C
Low Temp Operational	0°C	-20°C	-40°C	-40°C	
High Temp Storage	85°C	85°C	100°C	100°C	
Low Temp Storage	-50°C	-50°C	-50°C	-50°C	
Temperature Shock	10°C/min over Ts	10°C/min over Ts	10°C/min over Ts	10°C/min over Ts	
Humidity	95% non-condensing	95% 10cycles 240hrs	95% 10cycles 240hrs	95% 10cycles 240hrs	
Salt Fog	N/A	N/A	5% Salt 48Hrs	5% Salt 48Hrs	
Acceleration	N/A	N/A	13.5g	13.5g	
Vibration Sine	10-500Hz 2g	10-500Hz 2g	5-2000Hz 5g	5-2000Hz 5g	
Vibration Random	$0.002g^2$/Hz from 10-2000Hz	$0.002g^2$/Hz from 10-2000Hz	$0.04g^2$/Hz with a flat response to 1000Hz. 6dB/Oct roll-off from 1000-2000Hz	$0.1g^2$/Hz with a flat response to 1000Hz. 6dB/Oct roll-off from 1000-2000Hz	
Shock	20g Peak Sawtooth 11mSec Duration	20g Peak Sawtooth 11mSec Duration	20g Peak Sawtooth 11mSec Duration Bench Handling	40g Peak Sawtooth 11mSec Duration Bench Handling	

Software Support

Radstone's software strategy for PowerPC is designed to allow fully integrated system level solutions to be realized easily and with confidence.

The Company's 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 the COTS Operating Systems.

The result is standard software support across the widest selection of PowerPC SBCs available in either industrial, or extended temperature, ruggedization levels.

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

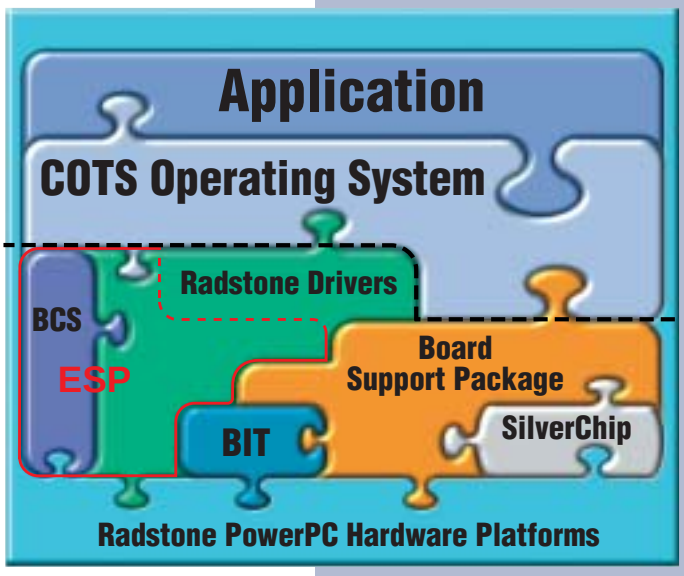


Figure 4: Layered Software Support Model

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COTS Software Products for PPC SBCs

The following software products are available for the entire PPCx family, including PPC4A, providing a common look, feel and interface for technology inserts:

Built-In-Test for PowerPC

PPC BIT probes from the lowest on-card hardware up to Line Replaceable Unit (LRU) level within a system, ensuring the highest degree of confidence in system integrity. BIT includes comprehensive configuration facilities, allowing automatic power-up tests to be defined, for the desired mix of system functionality and options. Further tests can be invoked interactively, also giving BIT a valuable role as a field service tool. Both Object and Source code products are available. For more details please ask for the "BIT for the Radstone PowerPC family" data sheet.

SilverChip Firmware

RADSTONE SILVERCHIP

Developed as an integral part of COTS product strategy, SilverChip firmware provides a foundation layer to interface between the raw PowerPC board hardware, with it's highly programmable device set-ups and flexibility, and the supported Operating Systems (O/S's) which require a straight-forward booting and device interface model. (Figure 4)

SilverChip 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 plus other valuable features for system integrators.

Memory or other speed and feature enhancements are seamlessly absorbed by SilverChip giving the same look and feel to the O/S and the user application as the Radstone PowerPC hardware advances (PPC1, PPC1A, PPC2, PPC2A, PPC4, etc.). Where particular O/S's define the use of alternate boot methods (e.g. VxWorks bootroms) SilverChip technology is absorbed into such boot methodology. Please ask for the "Radstone SilverChip" data sheet for more details.

Board Support Packages

In-house porting expertise for PPCx boards is focused on key Operating Systems, including VxWorks/Tornado from WindRiver Systems and LynxOS from LynuxWorks. Other O/S ports, drivers for third-party hardware, and layered products, including RTEMS from OAR are provided through strategic partnerships with dedicated third-party vendors, who are able to offer high quality products and services complementary to the Radstone range. State-of-the-art development environments and debug tools, available with the above software products, are thus leveraged for use on Radstone's high performance hardware architecture.

VxWorks Tornado™

WindRiver SYSTEMS

TORNADO

VxWorks/Tornado Distributed Real-Time Operating System

- Fully integrated Workstation or PC Development Environment
- High performance, deterministic, highly scaleable run-time system
- ATM, Ethernet and backplane networking
- Comprehensive debug/analysis tools

Tornado represents the latest generation of development and execution environments for embedded and real–time applications. The Tornado suite, which includes the VxWorks operating system, brings a superior development and deployment platform to the embedded developer, based on solid core technology yet adding an evolutionary development interface.

Radstone Board Support Packages (BSPs) that enable VxWorks operation on the PPC4A have been passed using the WindRiver validation suite for the greatest confidence and ease of use. In addition, many of Radstone's I/O and graphics products are also supported by VxWorks libraries and drivers. Please see the "Radstone/VxWorks" data sheet for more details.

LYNUXWORKS

LynxOS FROM LYNUXWORKS

LynxOS Real-Time Operating System

- Conforms to POSIX standards
- Self-hosted, SunOS, or BlueCat Linux development environments
- Designed for hard real-time
- Full MMU support

LynxOS is a UNIX-compatible, POSIX-compliant, multi-process, and multi-threaded operating system designed for complex real-time applications that require fast, deterministic response. The LynxOS kernel was specifically designed for hard real-time applications. Since its first release in 1988, LynxOS has been fully pre-emptible, re-entrant, and compact. The powerful PosixWorks environment complementing LynxOS provides high specification development tools including source debug, real-time analysis, code control, and other rich features. Support is available for Radstone's leading edge family of COTS PowerPC platforms spanning a wide environmental range with drivers/libraries for various compatible I/O products. Please see the "Radstone/LynxOS"data sheet for more details.
The BlueCat Linux is an open-source, for development and

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deployment of embedded products, certified for quality and reliability. The LynuxWorks suite is developed and manufactured using LynuxWorks' ISO 9001 quality processes. Through LynuxWorks, BlueCat applications can be integrated with LynxOS applications to provide a choice of real-time performance and reliability matching the schedule, market and features for embedded development.

RTEMS™

Free Operating System-RTEMS

Developed by OAR Corp., Huntsville, AL for the US Army Missile Command, RTEMS provides all the power and flexibility of real-time executives available on the commercial market today, but without the cost of source code and royalties. RTEMS is freely available from the Internet with no royalties attached. RTEMS is a high performance, object-oriented, multiprocessing executive that forms the cornerstone of re-usable software solutions for today's embedded systems development.

Layered Software Products

Background Condition Screening (BCS)

Available initially under VxWorks, BCS supplements the high test coverage obtained at initialisation by BIT (see above) with further health screening that is able to co-exist with a standard COTS Operating System. Whilst the intensity and coverage of a true traditional BIT style test makes it destructive to O/S's, the configurable BCS package allows functions such as periodic checksumming, 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.

ADA™

Several ADA vendors now offer comprehensive environments layered over standard O/S's such as VxWorks/Tornado and LynxOS. These environments run on any Radstone SBC for which the O/S is supported, without any alteration to the board's regular Board Support Package for the O/S.

Licensing, Maintenance and Support

Radstone supplies the BSPs and drivers necessary to support our hardware for the selected Operating Systems noted above, under license RT5088. Embedded firmwares such as BIT and SilverChip are supplied under license RT5087. Standard Maintenance Contracts are also available for these modules under our Agreement RT5090. Please contact your local sales channel for details.

PPC4A Hardware Technical Summary

Feature	Component	Comments
Processor	755	400 MHz
	7410	500 MHz
Memory Controller & PCI Bridge	MPC107	64 bit Memory bus clocked at up to 100 MHz with 32 bit 33 MHz PCI bus support. Supports ECC parity on SDRAM
SDRAM		128, 256 or 512 MB single VME slot
FLASH ROM	EEPROM	64 MB surface mounted, 64 bit wide with SW & HW write enable/disable
Non Volatile RAM	Ramtron FM 1808	32 KB FRAM
Level 2 Cache	SRAM	1 MB on 755 backside L2 bus. 2 MB for 7410
User E2PROM	ATMEL 28C00	512 KB of non-volatile storage for user data
Ethernet	DEC 21143	10/100 BASE-T or 10 BASE-5 (10 BASE-2 with 3U transceiver module)
Ultra SCSI	Symbios 53C860	8 bit 20 MB/s synchronous
ISA Bridge	Winbond 83C553	7 Channel DMA, Timer & Interrupt Controller
Watch Dog Timer	Maxim 706	1.6 second interval
Parallel Port	SMC FDC37C93X Ultra I/O	IEEE P1284 compatible
Keyboard & Mouse		PS/2 compatible with Phoenix BIOS
Floppy Disk Controller		Available via on-board header
COM 1 & 2 (RS232)		INS8250N-B, PC16550A & PC16450 compatible
Real Time Clock		T.O.D/Calendar, configurable 16 or 32 bit timers. Backed up by VME 5VSTDBY
Timer Counters	Zilog 85C36 CIO	3 independent 16 bit timers with 333ns resolution. 2 of them may be linked to form a 32 bit counter/timer
COM 3 & 4	Zilog Z85230 ESCC	RS422/485 is standard RS232 is available as a build option
VME64 to PCI Bridge	Tundra UNIVERSE II	64 bit VME, 32 bit 33 MHz PCI bus interface, Integral FIFOs, Programmable DMA controller, 70 MBytes/s burst data transfer
VME Compliance:	Master/Slave	A16, A24, 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, D64: MBLT, D32:UAT
	Interrupt Handler	D08(O), IH(1-7), I(1-7)
	Interrupter	SGL, RRS, PRI, BCLR* generation
	VMEBus Arbiter	ROR, RWD, early BSY* release, Bus capture & hold
	VMEBus Requester	IACK* daisy chain driver, SYSCLK driver
	Auto Slot ID	Slot 1 detector and Auto ID
Power Requirements	+5V (+5%, -2.5%), ±12V for PMC feed, +12V for Ethernet feed only on P2	
Weight	Approximately 580 grams	

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PPC4A Standard Ordering Information

Sales Code	400 MHz PowerPC 755 – 128 MB of SDRAM
PPC4A-755-1510Bxy	400 MHz PowerPC 755 6U VME SBC, level 1, 128 MB SDRAM, 1 MB L2 cache, 64 MB FLASH, 512 KB EEPROM, RTC, 10/100 BASE-T, Ultra SCSI, Mouse & keyboard I/F, Floppy, Parallel, 2 x RS232 & 2 x RS422 ports, 2 PMC slots, 5 Row P1 P2 (no P0 fitted)
PPC4A-755-2510Bxy	Air-cooled level 2 as above with conformal coating
PPC4A-755-3510Bxy	Air-cooled level 3 as above with conformal coating
PPC4A-755-4510Bxy	Conduction-cooled level 4 as above
PPC4A-755-5510Bxy	Conduction-cooled level 5 as above
	500 MHz PowerPC7410 – 128 MB of SDRAM
PPC4A-7410-1C10Bxy	500 MHz PowerPC 7410 6U VME SBC, level 1, 128 MB of SDRAM, 2 MB L2 cache, 64 MB FLASH, 512 KB EEPROM, RTC, 10/100 BASE-T, Ultra SCSI, Mouse & keyboard I/F, Floppy, Parallel, 2 x RS232 & 2 x RS422 ports, 2 PMC slots, 5 Row P1 P2 (no P0 fitted)
PPC4A-7410-2C10Bxy	Air-cooled level 2 as above with conformal coating
PPC4A-7410-3C10Bxy	Air-cooled level 3 as above with conformal coating
PPC4A-7410-4C10Bxy	Conduction-cooled level 4 as above
PPC4A-7410-5C10Bxy	Conduction-cooled level 5 as above

x =P0 option, y = software option

NOTE: The standard ordering information (above) defines the standard build variant. Consult your local Radstone sales office for availability of further build options.

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Printed in UK Publication RT209-3 5K07/2003

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