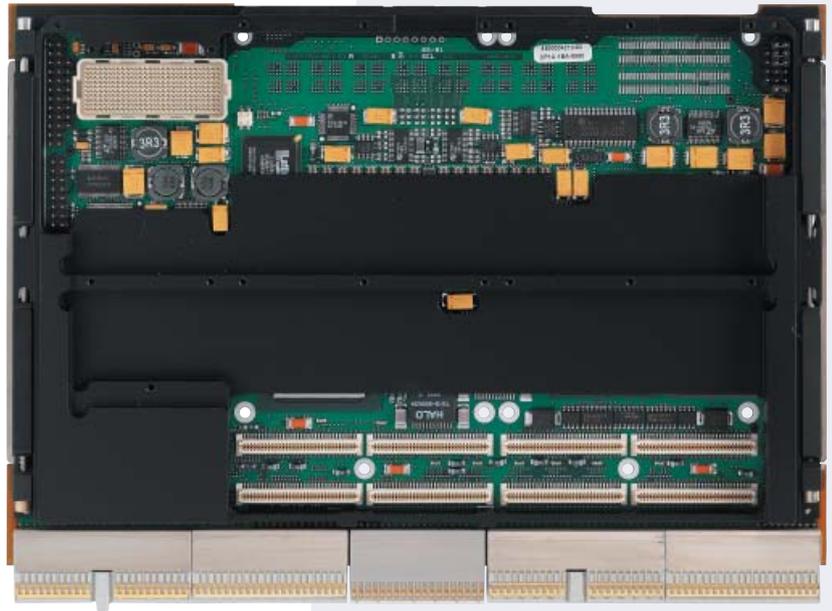


CP1A



6U CompactPCI PowerPC Processor

- High performance 6U CompactPCI processor
- Fully rugged – air/conduction-cooled
- Extensive Radstone software support
- Key features
 - PowerPC 7448
 - Discovery 3 Integrated System Controller
 - DDR SDRAM on 133 MHz memory bus
 - 2 x Gigabit Ethernet ports (PICMG 2.16 compliant)
 - 6 x serial ports
 - 5 x USB2.0 ports
 - 2 x PMC sites
 - AFIX daughter cards



The CP1A 6U CompactPCI single board computer (SBC) is the founder member of Radstone's brand new PowerPact6 family, building on the success of Radstone's established PowerPact3 family of 3U CompactPCI products.

The CP1A is based on the proven designs of Radstone's latest VME SBCs but takes full advantage of the enhanced features of CompactPCI, such as support for hot swap and much higher I/O pin count. An extensive range of I/O coupled with two PMC sites and Radstone's new AFIX (Additional Flexible Interface Xtension) pluggable module make the CP1A the most versatile single slot solution currently in the defense and aerospace market space.

The latest PowerPC 7448 processor and latest Discovery 3 Integrated System Controller, combined with Radstone's industry-leading software support and experience in designing and manufacturing rugged electronics for over four decades, give the CP1A the edge in embedded computing performance.



Features

Processor	PowerPC 7448 at 1.4 GHz	The 7448 is the latest processor in the G4+ family from Freescale, offering a combination of high frequency, efficient power consumption and 1 MByte of on-chip L2 cache. SBC typical power consumption when fitted with 7448 and 512 MBytes SDRAM = 25W
System Controller	Marvell 'Discovery III'	The Marvell Discovery III Integrated System Controller (ISC) combines a high bandwidth memory controller, two PCI-X interfaces and a range of communications peripherals, all on a single chip
Main Memory	512 MBytes DDR SDRAM with ECC	The CPU is interfaced to the main memory via a 64-bit data bus running at 133 MHz. 512 MBytes DDR SDRAM (with ECC supported) is fitted as standard
Flash Memory	256 MBytes Flash	The CPU is interfaced to the Flash memory via a 32-bit data bus running at 133 MHz. 256 MBytes are fitted as standard, 16 MBytes allocated to Boot Flash. Within the Boot Flash is the BANC (Boot Area Non-Corruptible) area which has factory write access only. This contains a firmware monitor that can still re-boot the board should all other loaded programs be corrupted
Non-volatile RAM	32 KBytes autostore NVRAM	NVRAM combines the advantages of SRAM (fast read and write) and EPROM (non-volatility) providing non-volatile storage for data which must not be lost when power is removed. Includes powerdown autostore capability
Real-Time Clock	1 sec. resolution	The RTC provides TOD/calendar with 1 sec. resolution. 5V standby must be connected to maintain data during power down (also features alarm interrupts)
Ethernet Interfaces	10/100/1000 BaseT. Two ports	Two Gigabit Ethernet channels are provided from the Discovery III to J3 (PICMG 2.16 pinout compliant)
Serial Ports	COM 1,2	RS232, provided from the integrated Southbridge to J4. Also available from front panel micro-D connector (build levels 1-3 only)
	COM 3,4	Async/sync capable, provided from the Discovery III ISC to J4. Both channels are software selectable to be RS232/22 or 485
	COM 5,6	RS232/RS422 (software selectable) provided from a UART to J4
Keyboard and Mouse	PS/2 compatible	Available from J4
USB 1,2,3,4,5	USB 2.0 compatible	Two ports available from J5, two ports from 15-way micro-D connector (build levels 1-3 only) and one port from dedicated USB connector on front panel (build level 1 only)
Discrete Digital I/O	Up to 33 bits of TTL compatible discrete digital I/O.	16 bits available from PCI bridge to J4/J5 and 17 bits available to J4 (Eight bits capable of generating an interrupt)
Parallel Port	IEEE P1284 compatible	The seventeen bits of Discrete Digital I/O from the SouthBridge may be re-configured via software to be a parallel port (to J4)
Timers	4 x 32-bit timer / counters	Four 32-bit wide timer/counters configurable as either a timer or counter, provided from the Discovery III ISC
Watchdog Timer	Two available	Programmable Watchdog in the Discovery ISC and a discrete fixed interval Watchdog timer (1.6 sec. time-out period)
DMA Engines	Six available	Six DMA controllers are available in the Discovery ISC for efficiently moving large blocks of data
CompactPCI	PCI 6254 Bridge	33/66 MHz 32/64-bit CompactPCI interface is provided from the PCI to PCI bridge. Hot swap is supported (PICMG 2.1)
Two PMC sites	Full 64 pin rear I/O per site	Two PMC sites are supported (one PCI-X capable up to 133 MHz) on separate buses ensuring no loss of performance if running a state of the art and legacy PMC
AFIX site Additional Flexible Interface Xtension	Daughter card offering a range of standard interfaces or the possibility of customer-specific functionality at a fraction of the cost of a whole board redesign	
	AFIX1553	Dual channel dual redundant MIL-STD-1553 interfaces based on DDC MicroAce
	AFIXSG	Integrated Silicon Motion SM722 graphics accelerator with 8 MBytes on-chip memory, plus 8- or 16-bit Ultra SCSI
JTAG Interface	Via backplane	For PLD programming etc.
	On-card connector	For processor background debug
Software	Full Radstone software support	Radstone's Deployed Test strategy is fully implemented with a combination of BIT (comprehensive power-up built-in test firmware) and BCS (Background Condition Screening) for non-destructive, continuous online testing. Also included in Radstone's COTS software support are BSPs (Board Support Packages) and ESPs (Enhanced Support Packages) for Wind River's VxWorks, and LynuxWorks' LynxOS. Linux support is provided by an open source package which can be downloaded from the Radstone web site.

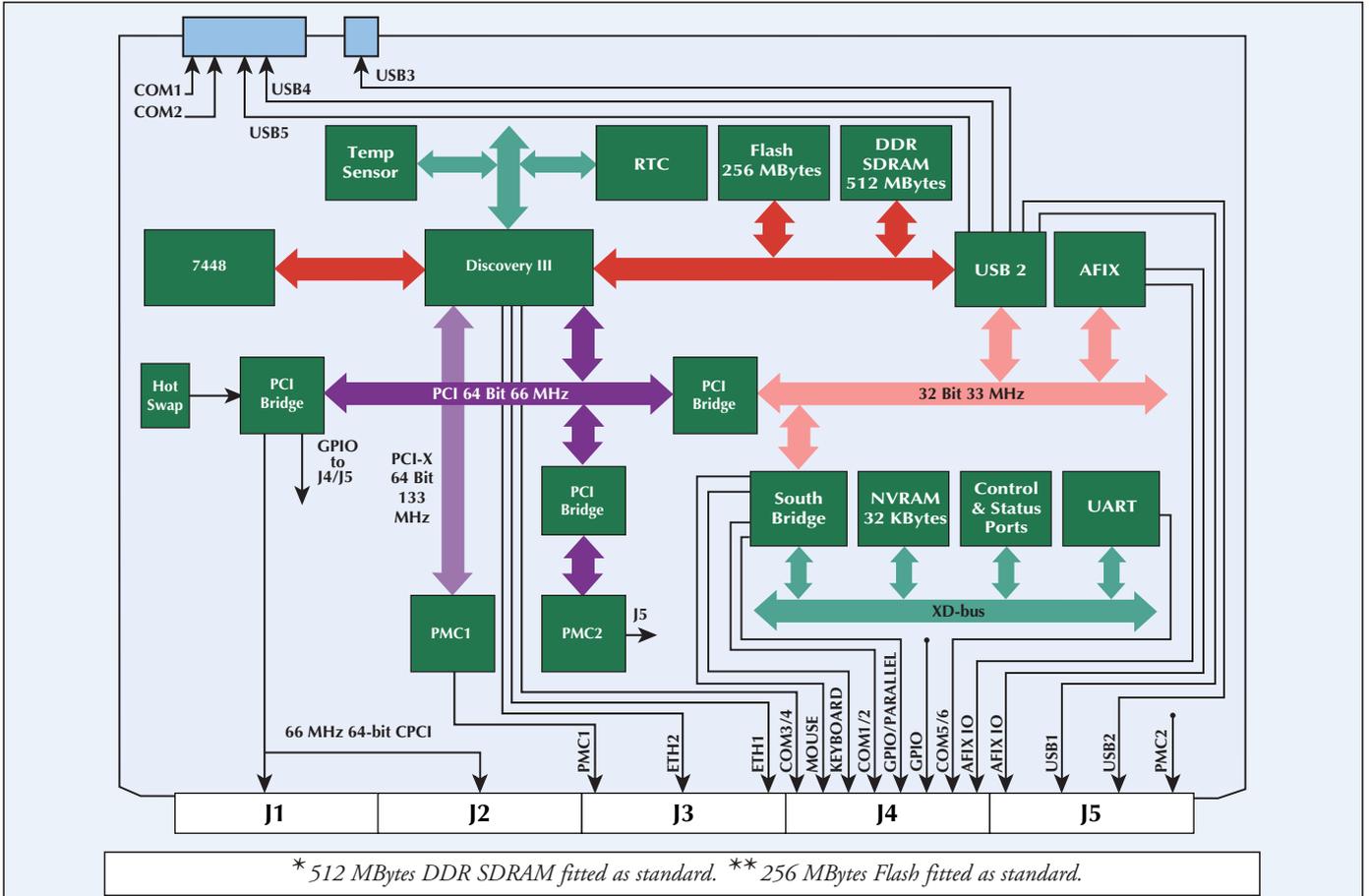


Figure 1: CP1A Functional Block Diagram

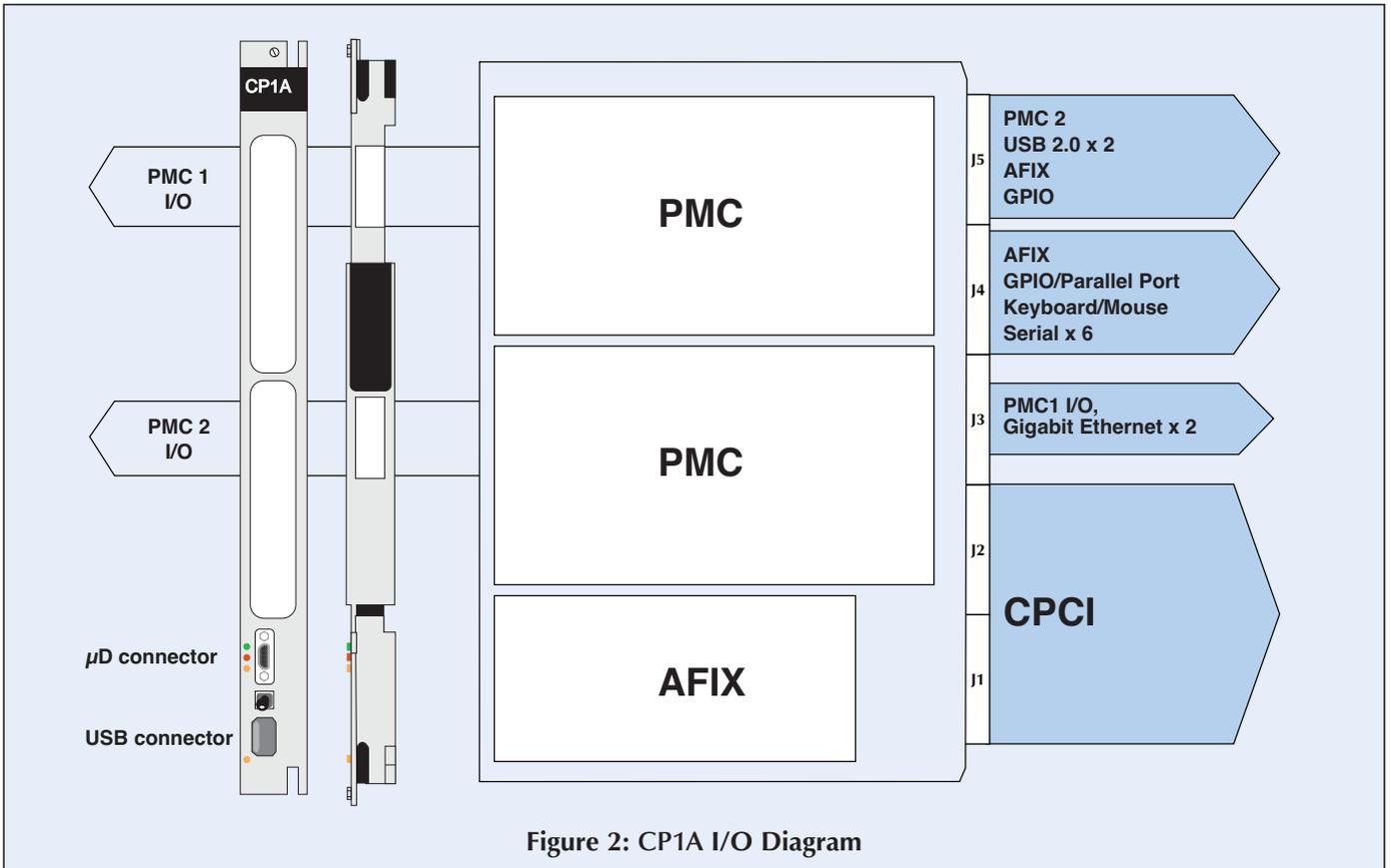


Figure 2: CP1A I/O Diagram

Additional Flexible Interface Xtension (AFIX) Card

For enhanced I/O flexibility the CP1A supports Radstone's new 'plug-on' module which adds rear I/O functionality. The Additional Flexible Interface Xtension (AFIX) card is a factory fitted option, providing fully rugged flexibility to the CP1A's already extensive I/O feature set.

Standard I/O Feature Set (without AFIX)

- 2 x 10 / 100 / 1000 Base-T Ethernet ports
- Keyboard and Mouse
- 5 x USB 2.0 ports
- 17 bits General Purpose I/O from SouthBridge (Eight bits capable of generating an interrupt). Can be software configured as a parallel port
- 16 bits General Purpose I/O from PCI bridge
- Parallel port
- 6 x serial ports

Feature set with AFIX1553

In addition to the above standard feature set, the AFIX1553 provides dual channel, dual redundant MIL-STD-1553B interfaces onto P2.

- 2 x DDC PCI MicroACE
- Each channel offers independently selectable BC, RT, MT modes

- 64 K words of RAM (with parity) per channel
- transformer-coupled / direct-coupled

Feature set with AFIX SG

In addition to the standard feature set, the AFIX SG offers a combination of SCSI and Graphics capabilities.

- 8-bit Ultra SCSI (20 Mbps) or 16-bit Ultra SCSI (40 Mbps)
- RGB Analog Graphics (Silicon Motion SM722 Graphics Accelerator, with integral 8 MBytes memory. Resolutions up to 1280 x1024)

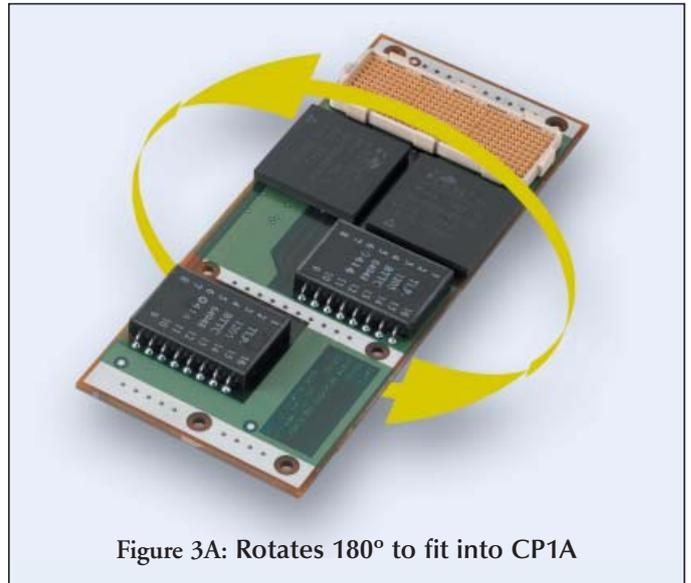


Figure 3A: Rotates 180° to fit into CP1A

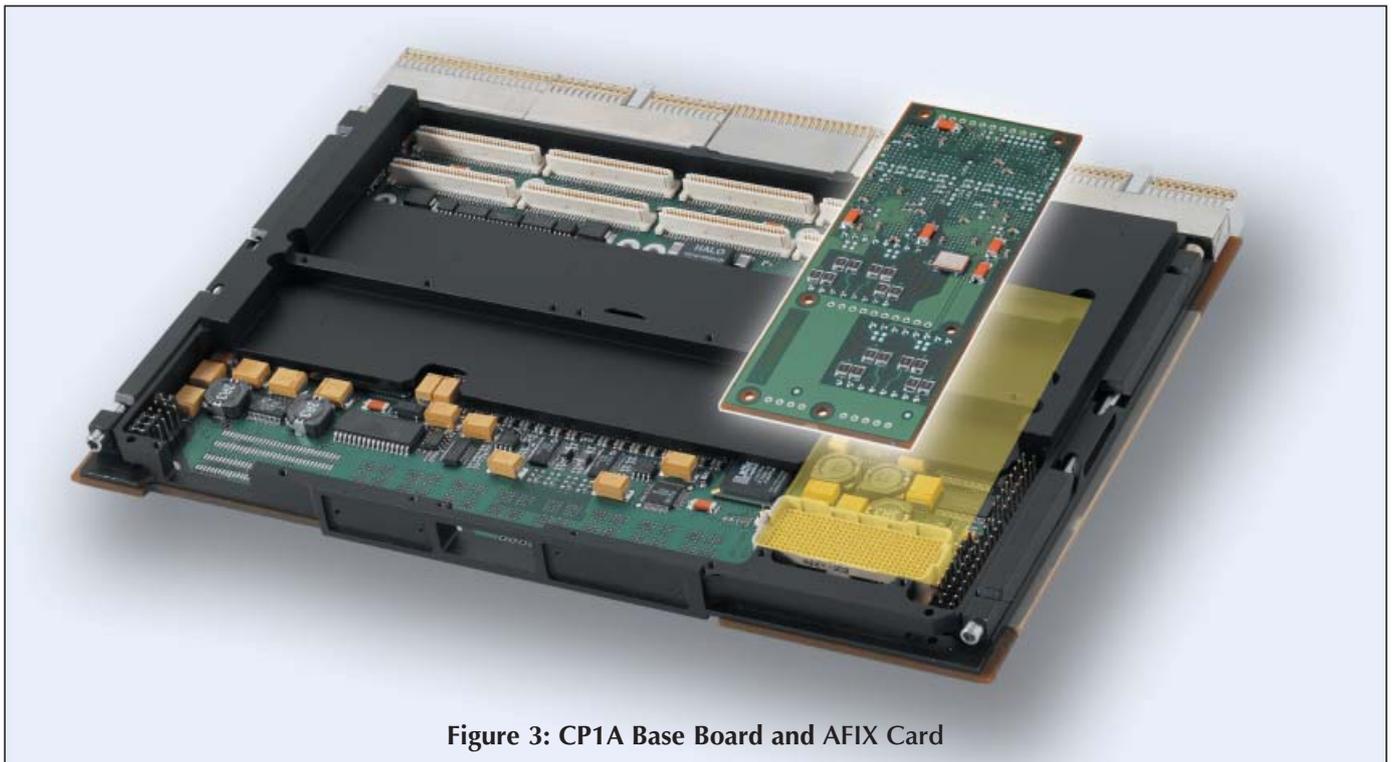


Figure 3: CP1A Base Board and AFIX Card

Ruggedization Levels

CP1A is available in Radstone's five ruggedization levels for use in both convection- and conduction-cooled environments. See Radstone's Ruggedization data sheet (RT184) for further details.

Ruggedization Levels	1	2	3	4	5
Cooling Method	Convection			Conduction	
Conformal Coat	Optional	Standard	Standard	Standard	
High Temp Operational	55°C @ 300ft/min	65°C @ 300ft/min	75°C @ 300ft/min	75°C	85°C
				At card edge	
Low Temp Operational	0°C	-20°C	-40°C	-40°C	

Table 3: Radstone's Ruggedization Levels

Impedance Controlled Tracking From PMC Sites

The CP1A provides impedance controlled tracking from its PMC sites to its J3 and J5 IO connectors, to ensure signal integrity when used with high speed signals.

Each PMC site provides the following tracking

3x150 | Pairs for analog graphics
 10x100 | Triples for digital graphics (4 for DVI, 6 for LVDS)
 6x100 | Pairs for Gigabit Ethernet and Fibre Channel

Operating System Support

Linux, together with a number of proprietary real-time operating systems, will be supported on the CP1A. Deployed Test software and VxWorks 6 support will be available with initial hardware units, followed by support for Linux and the other proprietary operating systems.

WIND RIVER

VxWorks: With a focus on performance, scalability, and footprint, VxWorks enables device software to run faster, better, and more reliably.

Deployed in over 30 million devices, VxWorks 5.x forms the foundation for Wind River platforms, which also include the Tornado Integrated Development Environment (IDE).

The next generation product from Wind River, VxWorks 6 with the Workbench IDE, adds powerful new features with a focus on open standards, performance, reliability and interoperability. These include MMU-based memory protection and enhanced error management.

Board Support Packages containing Wind River defined support, and Enhanced Support Packages providing extra Radstone defined support, are both available direct from Radstone.



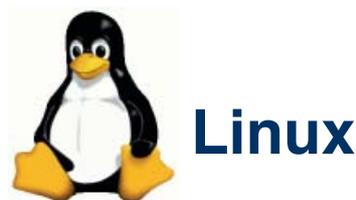
INTEGRITY: This maximum reliability real-time operating system is royalty-free. The INTEGRITY RTOS uses hardware memory protection to isolate and protect itself, and user tasks, from incorrect operation caused by accidental errors or malicious tampering.

Support for Radstone boards, including the PPC1A/2A/4/4A/4B/6/7A/8A/7D and CP1A, is available direct from our technology partner, Green Hills Software Inc.



LynxOS: This fully deterministic real-time Unix offers complete memory management support, including protected address-spaces for tasks. With comprehensive POSIX API conformance 1003.1, .1b & .1c, LynxOS also exhibits true linear scalability, and a Linux application binary interface (ABI) personality. Linux binaries run unchanged on LynxOS v4.0.

Board Support Packages containing LynuxWorks defined support, and Enhanced Support Packages providing extra Radstone defined support, are both available direct from Radstone.



Linux has, in recent years, formed an increasingly attractive alternative to proprietary operating system for

underpinning applications on embedded systems. A range of Linux distributions, targeted at cut-down embedded operation up to large-scale server operation, has increased choice still further, with free and 'added-value commercial' distributions sharing the market and catering for different program needs.

An Open Source package for the PowerPact6 CP1A, released under the terms of the General Public License (GPL) and supporting the Linux 2.6.x kernel, can be downloaded from the Radstone website. Radstone intends to provide confidence of operation with a number of free and commercial distributions, including Yellow Dog, Fedora Core (PowerPC version) and BlueCat from LynxWorks.

Deployed Test Software

CP1A features the most effective Deployed Test strategy in the industry, highly adapted to the characteristics of modern COTS silicon and COTS operating systems. This strategy is implemented through our built-in test (BIT) and Background Condition Screening (BCS) components.

To facilitate smooth technology insertion, the object code modules for BIT and BCS run on all variants of the PowerX board family produced since the family's inception in 1995.

Built-in Test (BIT)

BIT provides an initialization test for all onboard functional areas of the CP1A. Highest possible coverage, 95%, is achieved by the use of intrusive testing, with BIT assuming exclusive use of device resources. BIT executes before any COTS operating system, and passes control to the

operating system upon completion. Testing in conjunction with a COTS operating system is accomplished by BCS (see below).

BIT is a highly configurable component, with options for individual tests and sub-tests. System-wide coverage to Radstone PMCs or other Radstone VME boards is supported. Custom tests for bespoke equipment can readily be added.

Test results are stored in Flash for later analysis by the application, in addition to visual indication. Radstone BIT features 'Fast Start', whereby if BIT detects a state change of a particular backplane pin, it skips all tests. The backplane pin is usually connected to an electromechanical 'brown-out' detector.

For more information on our coverage methodology and proofs for PowerX boards, please request our brochure 'BIT Coverage – a Straightforward Guide'.

Background Condition Screening (BCS)

See BCS features overleaf

BCS provides continuous, online health monitoring. It runs as a task thread, featuring non-intrusive tests that are specifically designed to be co-operative with the normal functioning of the COTS operating system that is running the application. In addition to having minimal impact on system latency, this method avoids a difficulty that arises when 'calling back' into a traditional, stand-alone test firmware, written in ignorance of the operating system and probably assuming exclusive use of board resources. Such firmwares may not guarantee the restoration of the entire and complex machine state as the operating system left it. BCS works chiefly through operating system mechanisms and does not compromise the machine state imposed by the operating system.

Radstone's BCS for VxWorks is downloadable or can be linked to the VxWorks operating system executable image. It can be launched from the VxWorks shell or from an application. Configuration can be static, via the Tornado Project Tool, or dynamic, via an interactive menu.

Configurable parameters include the BCS task priority, plus various test options and other characteristics. An error log is stored in Flash, in addition to visual indication of a detected failure. An application interface is provided for immediate invocation of individual tests in addition to the default running of tests in background mode.

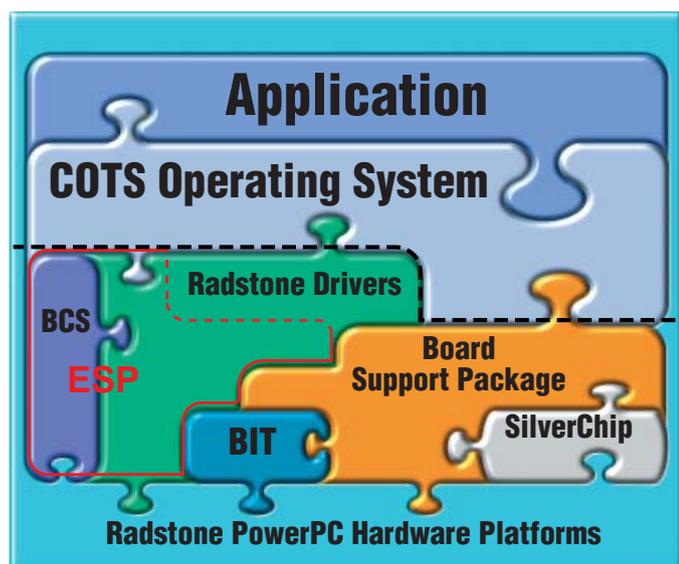


Figure 4: Software Support Model

Background Condition Screening (BCS) Continued...

- Logs and scrubs single bit errors
- Comprehensive main memory test
- System and user background Flash checksumming
- NVRAM checksum
- PCIbus error condition monitoring
- Preset PCI configuration verification
- Temperature monitoring (board and CPU)
- Temperature throttling
- Network connectivity
- SCSI connectivity
- Bus memory probing
- Real-time clock test
- Global hardware register verification
- Tests of 8250-compatible COM port devices
- Altivec and FPU tests
- Custom tests can be integrated

Standard Ordering Information

Sales Code	Description
CP1A-1100Xx	1.4GHz PowerPC 6U CompactPCI SBC, Level 1; 512MB DDRSDRAM, 256MB Flash, 2 x 10/100/1000 BaseT Ethernet Ports (PICMG 2.16 compliant), 2 x RS232 ports, 4 x RS232/422/485 ports, 5 x USB 2.0 ports, Mouse and Keyboard, 33 bits GPIO, 2 x PMC slots.
CP1A-2100Xx	Air cooled level 2 as above with conformal coating
CP1A-3100Xx	Air cooled level 3 as above with conformal coating
CP1A-4100Xx	Conduction cooled level 4 as above
CP1A-5100Xx	Conduction cooled level 5 as above

X=software option

x = AFIX option (0= No AFIX, 1= AFIX1553 single channel, 2= AFIX1553 dual channel, 3= AFIXSG)

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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