

PowerPC™

8240/8245

Single Board Computer

EP1A

Now with
8245 @ 350MHz

 **EmPower™**
POWER PC PROCESSOR

Cost Conscious, Communications Orientated SBC



- PowerPC MPC 8240 or 8245 to 350 MHz
- 5 Ruggedization Levels, Air and Conduction-Cooled
- 64 Megabytes (MB) SDRAM with EDC
- 2 PMC slots
- Optional 4 Synchronous Serial Channels
- Optional MIL-STD-1553 Interface
- 10/100 BASE-T Ethernet
- CompactFlash Site
- Radstone BIT & Boot Firmware
- BSPs & ESPs for VxWorks/Tornado, LynxOS
- Software Maintenance Available
- Hardware and on-board Firmware Configuration Management Available

Product Overview

EP1A is part of the EmPower family of cost-conscious, communications orientated boards from Radstone Technology. These boards are all PowerPC based, and benefit from a hardware and software investment in the PowerPC processor family made by Radstone since 1994. The family share many features with the highly popular and leading edge PowerX main processor Single Board Computers.

EP1A (Embedded PowerPC) is a COTS 6U VME64 board offering cost-effective processing based on the highly integrated MPC8240 or MPC8245, plus four optional sync/async serial lines and an optional MIL-STD-1553 interface for embedded communications and/or control applications. A CompactFlash site is provided making the board suitable for remote applications where mission data is required to be inserted/removed in the field.

Our COTS software support options include Radstone BIT and Boot Firmware, plus BSP's and ESP's (with BCS on-line health monitor) for VxWorks / Tornado from WindRiver Systems and LynxOS from LinuxWorks. X.25 / LAPB and HDLC protocol support are also available.

Applications: EP1A is ideally suited to medium level processor performance applications which:

- are cost sensitive
- require multiple sync/async serial operation and/or 1553
- are power consumption sensitive
- require low parts count for high MTBF's
- require removable (screw retained) mass storage on-board

EP1A is available in 5 ruggedization levels to satisfy the needs of the industrial and defence communities. Radstone has more than 35 years of experience in supplying 'best in field' ruggedized electronic equipment to these markets worldwide.



RADSTONE
TECHNOLOGY

Why settle for less

| Features | Benefits |
|---|---|
| MPC8240 | Low power, low cost, high performance PowerPC603e RISC CPU and system interfaces all in one device as main system resource (SPECint95 = 4.96 est, SPECfp95 = 4.16 est.) |
| MPC8245 | Enhanced low power, low cost, high performance PowerPC603e RISC CPU and system interfaces all in one device as main system resource (SPECint95 = 8.5 est, SPECfp95 = 7.0 est.) |
| 64 MB SDRAM with optional EDC | Lots of high bandwidth main memory for memory intensive applications |
| 64 MB 64 bit wide FLASH | Plenty of fast FLASH memory for execution of application code |
| Optional MIL-STD-1553B interface | Reduced system cost for systems that need 1 dual redundant channel, no PMC required |
| Optional 4 Serial Ports (In addition to 2 "console" ports) | Inter-system and/or legacy equipment connectivity, async or sync with protocol support (software selectable as RS232, 422, 485) |
| CompactFlash socket | Removable on-board solid state disk option for storing application code or mission data (up to 192 MB, currently available from third party suppliers) |
| Single Slot 6U VME form factor | Reduced system cost and slot count |
| 5 Ruggedization Level Options | Maximum component re-use across multiple platforms |
| 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, Boot Firmware, BSPs and ESPs (with BCS) for VxWorks & LynxOS, plus X.25, LAPB, and HDLC support |
| Radstone SW Maintenance | Automatic SW revision updates and technical support is available |
| Radstone Configuration Management | Unique part number service requiring customer authorisation for changes in product revision status is available |

Central Processing Unit

EP1A features the MPC8240/8245, boasting a PowerPC 603e core clocked at up to 350 MHz with on-chip support for main memory, PCI and I2C bus interfaces. These devices are part of Motorola Semiconductor's growing family of integrated embedded controllers that offer a low power compact RISC CPU solution, along with long term product support.

Memory

System memory on EP1A consists of one 64 Megabytes (MB) bank of SDRAM with optional Error Detection and Correction (EDC). In addition 56 MB of 64 bit wide User FLASH is provided, enabling fast execution of application code. A further 8 MB of System FLASH is used to store BIT (optional) and boot

firmware. EP1A provides System/User FLASH write enable/disable via on-board links or via the system backplane.

A CompactFlash module can be fitted to the on-board plug-in site to give up to 192 MB of field removable storage. On all builds the module is mechanically secured to the circuit card assembly.

Table 1: Memory Summary

| | EP1A -8245 Memory |
|-------------------------|---------------------------------------|
| SDRAM with optional EDC | 64 MB on-board |
| FLASH | 1 MB System, 63 MB User, 64 bits wide |
| Non-volatile RAM | 56 Bytes SRAM and 256 Kbit EEPROM |

Table 2: CPU Characteristics

| CPU | Frequency | SPECint95 * | SPECfp95 * | CPU Typical Power (Watts) Consumption * | SBC Typical Power (Watts) Consumption † |
|---------------------|-----------|-------------|------------|---|---|
| MPC8240 (603e core) | 200 | 4.96 est. | 4.16 est. | 3.0 | 10 |
| MPC8245 (603e core) | 350 | 8.5 est. | 8.0 est. | TBA | TBA |

* Estimates of CPU performance & dissipation provided by Motorola 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.

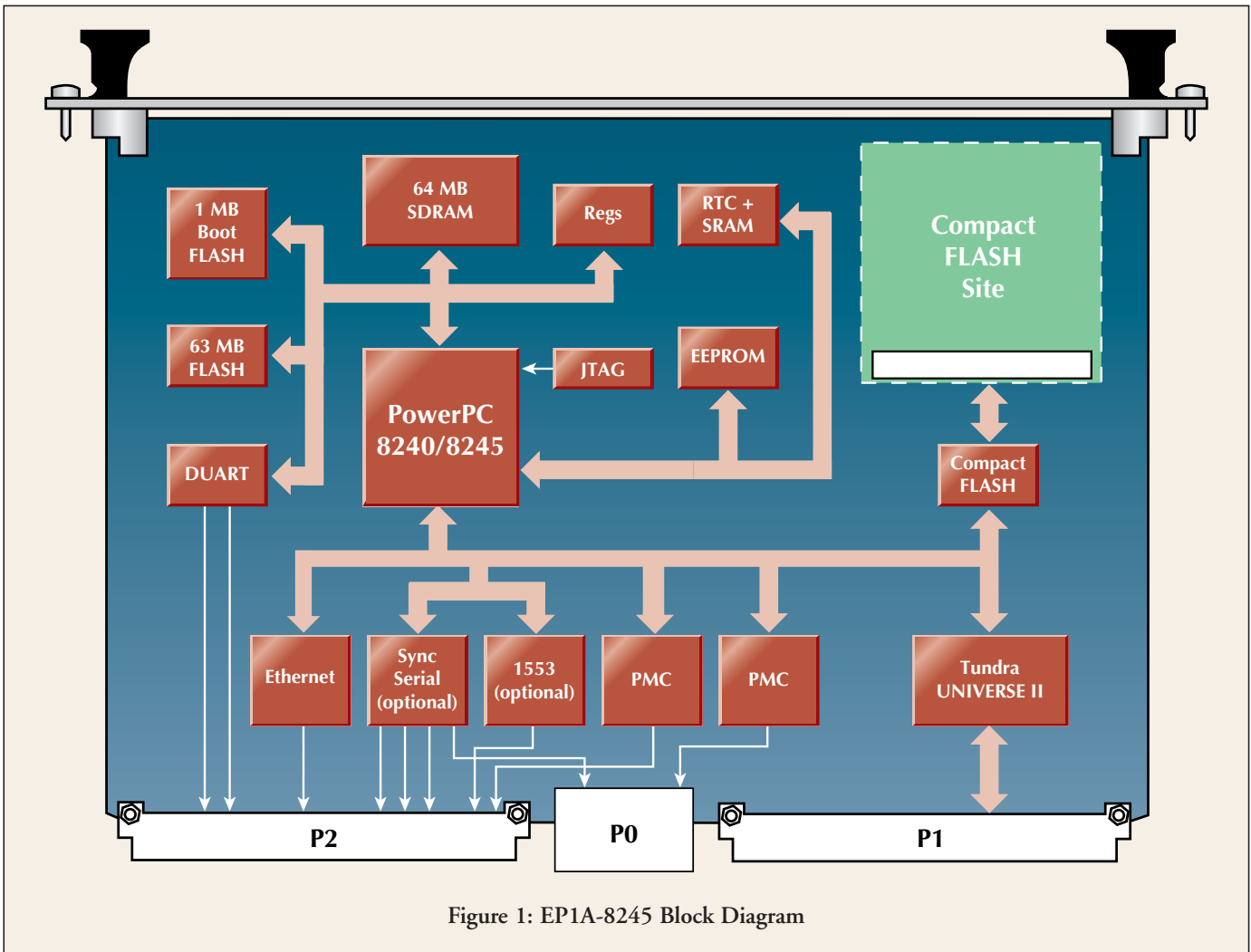


Figure 1: EP1A-8245 Block Diagram

PCI Sub-System

In addition to the two on-board slots supporting air or conduction-cooled PMCs, EP1A offers expansion of slots via a family of standard PMC Carrier Cards. The PCI sub-system can support from 2 to 9 PMCs within a standard VME chassis (see P0CC1 data sheet for more detail). P0CC1 6U PMC Carrier is a single slot replacement unit supporting two single width or one double width PMCs which can be linked to EP1A host via the P0/J0 interface on each card.

Full PCI to VME bridge capability is provided by the Tundra Universe II chip. Radstone PMCs for Graphics, Asynch Serial, ATM, FLASH Memory, Fast Ethernet, Fibre Channel and MIL-STD-1553 are available in various ruggedization levels. Two further Radstone PMC's are particularly suited to extending the role of EP1A as a communications node. The first is the EPMCQ2, another EmPower card featuring a PowerQUICC sub-system offering four serial channels with identical protocol support to EP1A (see opposite). The second is PMCQ1 which offers the same communication features as the optional sections on EP1A itself - four serial channels and a single MIL-STD-1553 interface.

Table 3: EmPower Family Communications Summary

| | Options | Comments |
|--------|-----------------------|---|
| EP1A | 4 sync/async channels | Software selectable, RS422, RS485 or RS232 4 Mbaud maximum |
| | MIL-STD-1553 | Single channel, dual redundant |
| PMCQ1 | 4 sync/async channels | Software selectable, RS422, RS485 or RS232 4 Mbaud maximum |
| | MIL-STD-1553 | Single channel, dual redundant |
| EPMCQ2 | 4 sync/async channels | Software selectable, RS422, RS485 or RS232 10 Mbaud maximum |
| | Ethernet | Single channel 10/100 BASE-T |

5 Ruggedization Levels

EP1A is available in Radstone's 5 environmental ruggedization levels. 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, EP1A 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.

Table 4: For Full Ruggedization Level Details Refer to Radstone Product Summary

| | | | |
|---|-------------------|---------------|--|
| 1 | Air-Cooled | 0 to +55 °C | standard commercial |
| 2 | Air-Cooled | -20 to +65 °C | conformally coated |
| 3 | Air-Cooled | -40 to +75 °C | rugged, coated |
| 4 | Conduction Cooled | -40 to +75 °C | coated, mechanically compliant to IEEE 1101.2-1992 |
| 5 | Conduction Cooled | -40 to +85 °C | as above |

COTS Software Support for EP1A

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

All the software products on this page are available for the both the PPCx family and EmPower base boards including EP1A, thus providing a common look, feel, and interface for technology inserts.

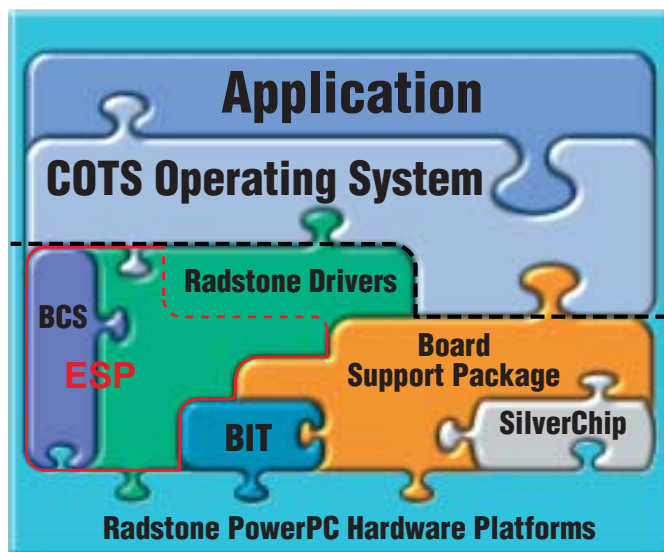


Figure 2: Layered Software Support Model

Built In Test

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 Initialisation 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 Radstone BIT datasheet.

Background Condition Screening (BCS)

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.

Operating System Support

In-house porting expertise for PowerPC based boards is focused on key Operating Systems, including VxWorks/Tornado from Wind River Systems and LynxOS from LynuxWorks. Other O/S 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. State of the art development environments and debug tools available with the above software products are thus leveraged for use on Radstone's performance and flexible hardware architectures.

Please contact Radstone for availability of O/S's additional to the standard VxWorks and LynxOS offerings.

BSPs and ESPs

Board Support Packages (BSPs) provide 'vanilla standard' support for the above Operating Systems as defined by the O/S vendors. Radstone also provide Enhanced Support Packages (ESPs), for comprehensive hardware support additional to that defined by the O/S 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 in 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 (see opposite) is also part of the ESP.

Serial Protocol Model

Standard Communication Protocol Modules (CPMs) are available for EP1A in the form of a Trillium modular X.25 stack, offering straightforward configuration for adaptation to different application situations. Trillium Digital Systems Inc. is a leading provider of communications software solutions.

The CPMs sit above the COTS Operating System (VxWorks or LynxOS) that is running on the MPC8240/8245, taking their system services from this. Not all modules need be present on the stack. For instance only the lower two modules would be required for LAPB and low level HDLC operation. Connections to X.25, LAPB, or low level HDLC may be formed simultaneously for mixed line type operation.

Data transfer between the Serial Chip and main memory is accomplished via DMA over the PCIbus for optimum rates and minimum impact on processor bandwidth.

The CPM modules are identical to those used to support EPMCQ2 and PMCQ1, which may be plugged into the PMC sites of EP1A for up to 4 further sync/asynch serial lines per PMC site. CPM modules running the EPMCQ2 lines may be executed on EPMCQ2 itself (it features its own PowerPC core), or on the host processor.

Licensing, Maintenance and Support

Radstone supplies BSPs/ESPs and drivers for the supported Operating Systems as noted above under license RT5088. Embedded firmwares such as BIT and Boot Firmware are supplied under license RT5087. Standard Maintenance Contracts are also available for these products under our Agreement RT5090. Please contact your local sales channel for details.

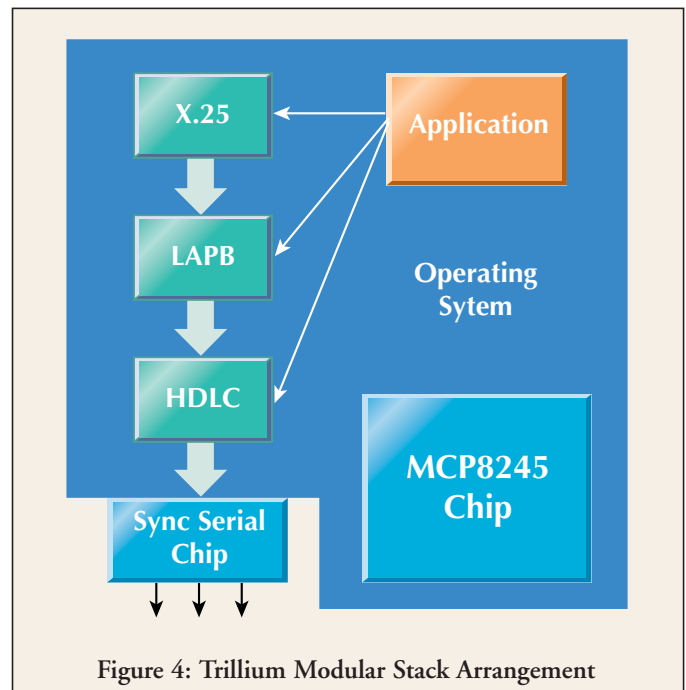


Figure 4: Trillium Modular Stack Arrangement

I/O Access

EP1A 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 and also a Reset / Abort switch on the air-cooled builds of the board (see alternate front panels in Fig 3). EP1A uses 5 row VME64 P1 and P2 connectors as well as an optional P0 connector (type A or B can be specified but only Type B allows full support of COM 5 and 6) for rear access to the on-board PMC Slot1. PMC Slot2 is available via rows D&Z of the P2 connector.

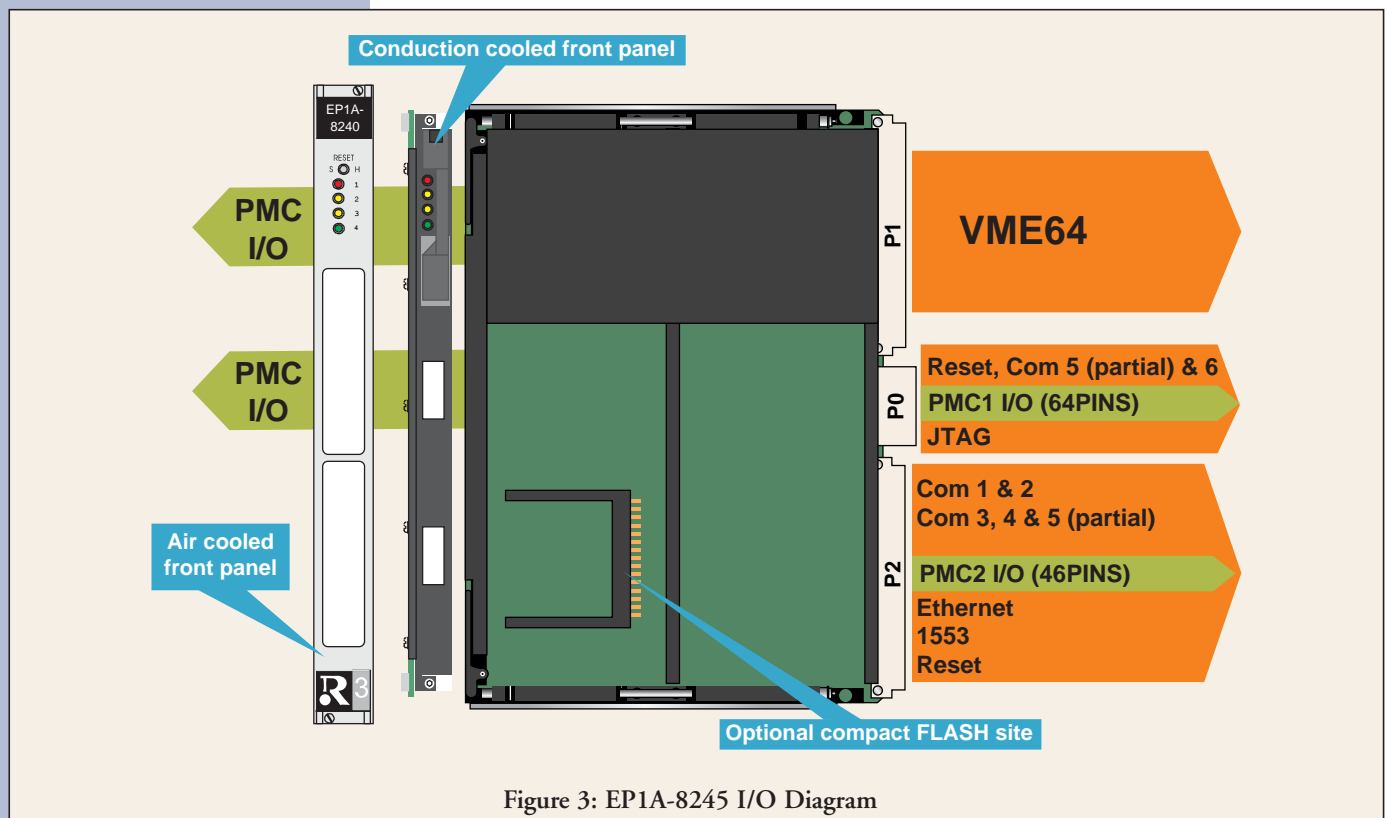


Figure 3: EP1A-8245 I/O Diagram

| | |
|--------------------|---|
| Sales Code | 200 MHz PowerPC 8240 – 64 MB of SDRAM |
| EP1A-8240-1000Bxyz | 200MHz PowerPC 8240 6U VME SBC, level 1; 64MB SDRAM, 64MB Flash, 1MB Boot Flash, RTC, 10/100Base-T, 2 x RS232 ports, 2 PMC slots, 5 Row P1 & P2, (no P0). Boot Firmware onboard |
| EP1A-8240-2000Bxyz | Air-Cooled Level 2 as above with conformal coating |
| EP1A-8240-3000Bxyz | Air-Cooled Level 3 as above with conformal coating |
| EP1A-8240-4000Bxyz | Conduction-Cooled Level 4 as above |
| EP1A-8240-5000Bxyz | Conduction-Cooled Level 5 as above |
| | 350 MHz PowerPC 8245 – 64 MB of SDRAM |
| EP1A-8240-1500Bxyz | 350 MHz PowerPC 8245 6U VME SBC, level 1; 64 MB SDRAM, 64 MB FLASH, 1 MB Boot FLASH, RTC, 10/100 BASE-T, 2 x RS232 ports, 2 PMC slots, 5 Row P1 & P2, (no P0). Boot Firmware on-board |
| EP1A-8240-2500Bxyz | Air-Cooled Level 2 as above with conformal coating |
| EP1A-8240-3500Bxyz | Air-Cooled Level 3 as above with conformal coating |
| EP1A-8240-4500Bxyz | Conduction-Cooled Level 4 as above |
| EP1A-8240-5500Bxyz | Conduction-Cooled Level 5 as above |

x = P0, y = Software option, z = CompactFlash

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

UK

Radstone Technology
Water Lane
Towcester
Northants NN12 6JN

Telephone: +44 (0) 1327 359444
Facsimile: +44 (0) 1327 359662
E-mail: sales@radstone.co.uk
Videoconferencing: +44 (0) 1327 359495
(by arrangement)

USA

Radstone Technology Corporation
50 Tice Boulevard
Woodcliff Lake, NJ 07677-7645

Telephone: +1 (800) 368-2738
Facsimile: +1 (201) 391-2899
E-mail: sales@radstone.com

Eastern Region: +1 (201) 391-2700
North Central Region: +1 (978) 399-0195
Central Region: +1 (480) 964 5407
Western Region: +1 (909) 974-1141

CANADA

Interactive Circuits and Systems Ltd
5430 Canotek Road
Ottawa, Ontario
K1J 9G2

Telephone: +1 (613) 749-9241
Facsimile: +1 (613) 749-9461
Toll Free: (US Only) 800 267-9794
E-mail: info@ics-ltd.com

Helpdesk: +44 (0) 1327 359804
E-mail: support@radstone.co.uk

| | EP1A Board Options |
|--------------------|---|
| EP1A-xxxx-xxx1xxxx | As above with the addition of 4 highspeed Synchronous/Asynchronous serial channels fitted |
| EP1A-xxxx-xx1xxxxx | As above with 1553 fitted |
| EP1A-xxxx-xx11xxxx | As above with 1553 plus 4 highspeed Synchronous/Asynchronous serial channels fitted |

| Empower I/O Kit | I/O kit to support the Empower range of boards. Comprises of the following components |
|-----------------|---|
| EMPOWERIOKIT | P25X601-S: P2 Transition Module with 5 Row VME connector. Provides headers for Ethernet (10/100 BASE-T – RJ45), 1553 Interface, Comms 1,2,3,4 & 5 channels. For use with EP1A |
| | SIO2X600-S: 3U Serial I/O Panel with 2 x 25 Way D type connectors and 0.5m internal ribbon cable. For use on COM 1 & 2 ports |
| | SIO3X600-S: 4 x 3U Serial I/O Panel with 1 x 25 Way type connector and 0.5m internal ribbon cable. For use on COM 3, 4, 5 & 6. : |
| | 10BTX600-S: 3U 10/100 BASE-T Panel with two 1m internal cables. Cables for RJ45 to RJ45 and D type to RJ45 are included. |
| | P0Q110-S: PMCQ1 P0 Paddle Card. Provides headers for Comms 1,2,3,4,5 & 6 and 1553 |



RADSTONE
TECHNOLOGY

Meet us on the Web at www.radstone.com

RADSTONE and the Radstone symbol are registered trademarks of Radstone Technology PLC. All other trademarks are the property of their respective owners.

© Radstone Technology PLC 2004

Printed in UK Publication RT267-2 5K01/2004
This publication is issued to provide outline information only which (unless agreed by the company in writing) may not be used, applied or reproduced for any purpose or form part of any order or contract or be regarded as a representation relating to products or services concerned. The company reserve the right to alter without notice the specification, design, price or conditions of supply of any product or service.

