PPC8A

3rd Generation PowerXpress SBC

PowerXpress™
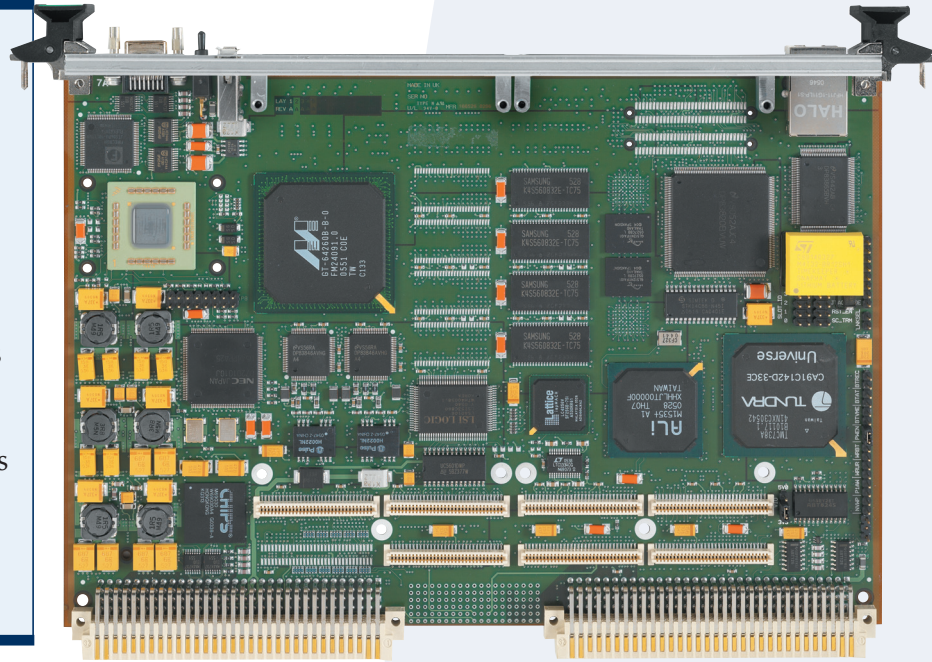POWER PC PROCESSOR

- Latest PowerPC Processors
- High performance Architecture
- Wide range of IO features
- Uniquely designed for Sheltered Defense applications
- Key Features
  - PowerPC 7447 to 1.2 GHz
  - 64 bit 66 MHz PCI to both PMC sites
  - 6 x Serial Ports
  - 2 x 10/100 BASE-T Ethernet ports
  - 1 x 10/100/1000 BASE-T Ethernet ports
  - SVGA Graphics
  - 4 x USB Ports

PPC8A is the latest technology insert step on the PowerXpress roadmap. Technology Insertion underpins Radstone's product strategy, allowing enhanced performance and functionality from successive boards in each product family, yet all delivered with the same hardware and software interface definitions. For example, the PPC8A's pin-out is fully compatible with that of its PowerXpress predecessors (the PPC6 and PPC1A). And the same Board Support Package (BSP) and Deployed Test Software, runs on all 3 boards. This unique commitment to compatibility makes Radstone the supplier of choice to system integrators in defense markets worldwide.

Cost-effective PowerXpress boards target 'sheltered' applications, where expensive 'full ruggedization' is not required (e.g. Naval, Ground Mobile).

Mission-critical services deliver far beyond the PPC8A itself, and include long-term support, configuration control and obsolescence management.

Enhanced features, built above proven core technology, offer the widest design options to new programs and to existing PowerXpress users needing a seamless upgrade. The latest G4+ PowerPC silicon, extra serial ports, Gigabit Ethernet, USB and graphics, are all additional to the PPC6 profile.

RADSTONE
DIGITAL PROCESSING

Features

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Processor	PowerPC 7447 at up to 1.2 GHz compatible with future Freescale offerings	The 7447 is Freescale's latest processor in its G4+ family, offering a combination of high frequency, efficient power consumption and 512 KB of on-chip L2 Cache (SPECInt95 = 43.79 @ 1 GHz, SPECfp95 = 31.61 @1 GHz) SBC Typical Power Consumption when fitted with 7447 and 256 MB SDRAM = 20W
System Controller	Marvell 'Discovery'	The Marvell Discovery Integrated System Controller (ISC) combines a high bandwidth memory controller, two PCI interfaces and a range of communications peripherals, all on a single chip
L2 Cache	512 KB	On-chip L2 cache running at core frequency
Main Memory	256 MB to 1 GB SDRAM with ECC	The CPU is interfaced to the main memory via a 64 bit data bus running at 100 MHz . Up to 1GB SDRAM with ECC supported, 256 MB being fitted as standard
FLASH Memory	64 MB to 128 MB FLASH	The CPU is interfaced to the FLASH memory via a 32 bit data bus running at 100 MHz . 64 MB are fitted as standard, 16 MB of which are allocated to Boot FLASH. Within the Boot FLASH is the BANC area (Boot Area, Non-Corruptible) which has factory write access only. This contains a firmware monitor that can re-boot the board, should all other loaded programs be corrupted
Non-volatile RAM	32kB 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 Power down Autostore capability
Real-Time Clock	1 sec. resolution	The RTC provides TOD/ calendar with 1 sec resolution. Uses top mounted lithium battery
Ethernet Interfaces	2 ports of 10/100 BASE-T	Two Ethernet Channels are provided from the Discovery ISC and are available through the P2 connector (Ethernet 1and 2)
	Gigabit Ethernet	A single channel of 10/100/1000 BASE-T is available on a dedicated front I/O RJ45 socket (Ethernet 3)
Serial ports	COM 1,2	RS232, provided from the integrated Southbridge. Routed as both Front and Rear I/O
	COM 3,4	Async / Sync capable, provided from the Discovery ISC. Both channels are software selectable to be RS232 / 422 or 485
	COM 5,6	Provided from a 16550 compatible DUART. Both channels are software selectable to be RS232 / 422 or 485
Keyboard and Mouse	PS/2 compatible	Available as a build option instead of USB 1.1
USB 1,2	USB 1.1 compatible	Available as a build option instead of Keyboard and Mouse
USB 3,4	USB 2.0 compatible	PCI based USB 2.0 device, one channel routed to dedicated front I/O Type A USB socket, 2nd channel routed to P0
Floppy disk controller		Software compatible with DP8473, 765A and NS82077 (option instead of parallel port)
SCSI	8 bit	Ultra SCSI 40 MB /sec. Routed to P2
Discrete Digital I/O	16 bits	Up to 16 bits of TTL compatible Discrete Digital I/O capable of generating an interrupt. Build option instead of parallel port
Parallel port	IEEE P1284 compatible	Provided from Southbridge. Build option instead of Discrete Digital I/O
Timers	8 x 32 bit timer / counters	Eight 32 bit wide timer/counters configurable as either a timer or counter, provided from the Discovery ISC
Watchdog Timer	2 off	The Watchdog timer has a fixed 1.6 second time-out period provided by CPU supervisor. A second programmable WTD is available in the Discovery ISC
DMA engines	8 available	8 DMA controllers are available in the Discovery ISC for efficiently moving large blocks of data
VME	Tundra Universe II	VME64 Master/Slave with SYSCON capability
Video	Standard SVGA output	Integrated Video accelerator with on-chip memory. 69030 (with 4 MB integrated SDRAM) fitted as an optional feature
JTAG Interface	On-card connector	A JTAG header is accessible for both factory test and software de-bug purposes. Access to JTAG via P1 Row Z. On-card header for CPU emulator access
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 on-line testing). Also included in Radstone's COTS software support are BSPs (Board support Packages) and ESPs (Enhanced Support Packages) for WindRiver's VxWorks, and planned support for LynuxWorks' LynxOS and Green Hills INTEGRITY. (BCS is delivered as part of the ESP)
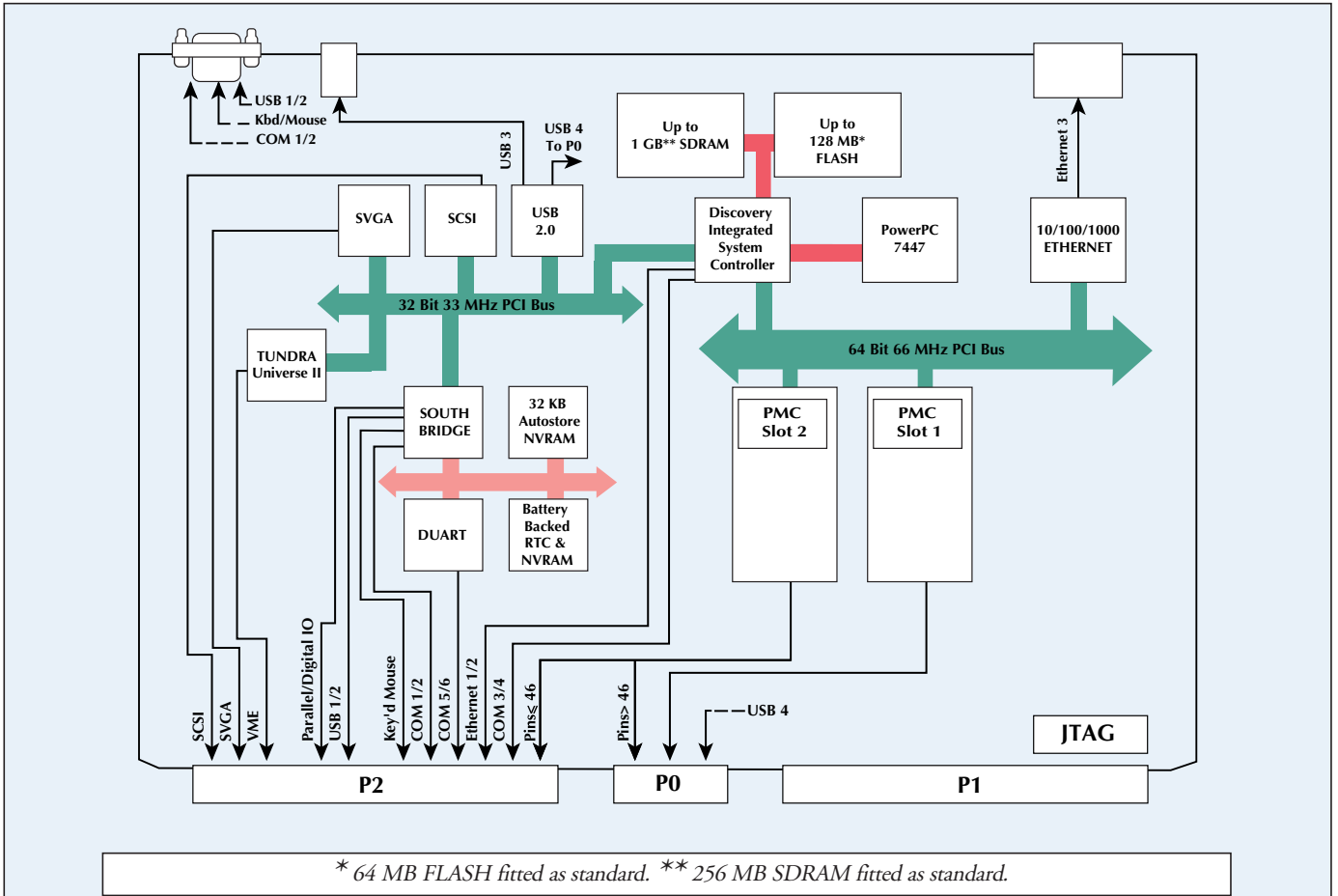
Figure 1: PPC8A Functional Block Diagram

* *64 MB FLASH fitted as standard.* ** *256 MB SDRAM fitted as standard.*
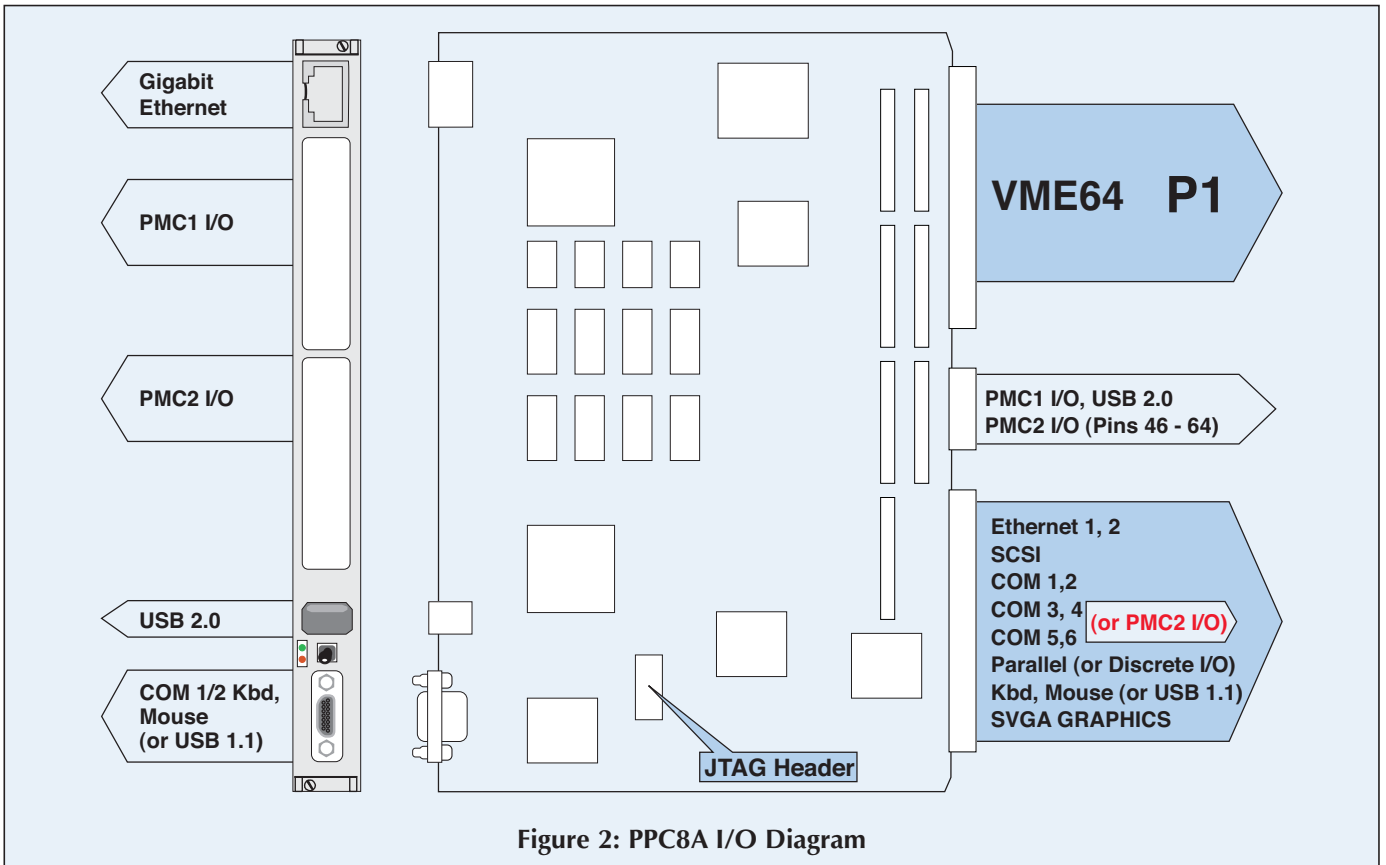
Figure 2: PPC8A I/O Diagram

Summary of Primary and Secondary IO Options

Primary IO options are selected by the 5th digit (X) in the order code ie PPC8A-xxxxXxx

IO Options	P2 PMCRear I/O	Com 3/4/5/6	Graphics
1	✔	-	✔
2	✔	-	-
B	-	✔	✔
C	-	✔	-
Table1: Primary IO Functions			

Secondary IO options are selected by the 4th digit (X) in the order code ie PPC8A-xxxXxx

IO Options	USB	GPIO	Key'd Mouse	Parallel
0	✔	✔	-	-
1	-	✔	✔	-
2	✔	-	-	✔
3	-	-	✔	✔
Table2: Secondary IO Functions				

Ruggedization Levels

The PPC8A is available in Radstone's Ruggedization Levels 1 and 2 for use in convection-cooled environments. See Radstone's Ruggedization data Sheet for further details

Ruggedization Levels	1	2
Cooling Method	Convection	
Conformal Coat	Optional	Standard
High Temp Operational	55ºC @ 300ft/min	65ºC @ 300ft/min
Low Temp Operational	0ºC	-20ºC
Storage Temp	-50 to +100ºC	
Vibration	0.002g2/Hz from 10 to 2000Hz random and 2g sinusoidal from 5 to 500Hz	
Shock	20g peak sawtooth, 11mS duration	
Humidity	Up to 95% RH with varying temperature, 10 cycles, 240 hours	
Table 3: Radstone's Ruggedization Levels		

Impedance Controlled Tracking From PMC Sites

The PPC8A provides impedance controlled tracking from its PMC sites to its P2 and P0 IO connectors, to ensure signal integrity when used with high speed signals.

PMC Site 2 Tracking

3x150Ω Pairs to P2 for Analog graphics
10x100Ω Triples to P2 for Digital graphics (4 for DVI, 6 for LVDS)
6x100Ω Pairs to P0 for Gigabit Ethernet and Fiber Channel

PMC Site 1 Tracking

3x150Ω Pairs to P0 for Analog graphics
10x100Ω Triples to P0 for Digital graphics (4 for DVI, 6 for LVDS)

Operating System Support

A number of of mission critical, real-time operating systems are supported on the PPC8A:-

WIND RIVER

VxWorks; a highly scaleable and deterministic run-time system. Distributed backplane and networking support. Large base of third-party support. The PowerX BSP & ESP from Radstone both run PPC1A/2A/4/4A/4B/6/7A/8A from one object code.

VxWorks, the run-time component of the Tornado II embedded development platform, is the most widely adopted real-time operating system (RTOS) in the embedded industry. Tornado II also includes a comprehensive suite of core and optional cross-development tools and utilities, and a full range of communications options for the target connection to the host.

LYNUXWORKS™

LynxOS; hard real-time Unix with full memory management support. Conforms to full POSIX standards. Features Linux binary compatibility at 4.0. The PowerX BSP & ESP from Radstone both run PPC1A/2A/4/4A/4B/6/7A/8A from one object code.

Summary: hard real-time determinism; complete MMU based protected address spaces for tasks; Linux application binary interface (ABI) personality; Linux binaries run unchanged on LynxOS v4.0; Comprehensive POSIX API conformance 1003.1, .1b & .1c; LynxOS 4.0 also exhibits true linear scalability.

INTEGRITY

INTEGRITY; maximum reliability, royalty-free real-time operating system. Support for Radstone boards including the PPC1A/2A/4/4A/4B/6/7A/8A is available direct from our technology partner, Green Hills Software Inc.

The royalty free INTEGRITY RTOS uses hardware memory protection to isolate and protect itself, and user tasks, from incorrect operation caused by accidental errors or malicious tampering.

Deployed Test Software

PPC8A features the most effective deployed test strategy in the industry, highly adapted to the characteristics of modern COTS silicon and COTS operating systems (O/Ss). 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 PowerX board family members of any age and variant produced since the family's inception in 1995.

Built-In-Test (BIT)

BIT provides an initialization test for all on-board functional areas of PPC8A. 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 O/S, and passes control to the O/S upon completion. Testing in conjunction with a COTS O/S 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 handled. 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 electro-mechanical 'brown-out' detector.

Coverage methodolgy and proofs for PowerX boards are available. Please request our brochure "BIT coverage – a straightforward guide".

Background Condition Screening (BCS)

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 O/S that is running the application. In addition to providing 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 O/S and probably assuming exclusive use of board resources. Such firmwares may not gaurantee the restoration of the entire and complex machine state as the O/S left it. BCS works chiefly through O/S mechanisms and doesn't compromise the machine state imposed by the O/S.

Radstone's BCS for VxWorks is downloadable or can be linked to the VxWorks O/S 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 thread priority to run BCS at, 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.

- Logs and scrubs single bit errors
- Comprehensive main memory test. By dedicating small segments per bank for exclusive BCS usage, and in conjunction with ECC circuitry, all failure modes throughout all the memory can be detected without destructive action outside of the BCS segments.
- 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
	1GHz PowerPC 7447 – 256 MB of SDRAM
PPC8A-1E41CBx	1 GHz PowerPC 7447, 6U VME SBC, Level 1; 256 MB SDRAM, 64 MB FLASH, RTC, 1 x 10/100/1000 BASE-T , 2 x 10/100 BASE-T, Ultra SCSI, 2 x USB 1.1 , 2 x USB 2.0, 2 x RS232 & 4 x RS232 / 422 / 485 ports, Keyboard, mouse, 16 bits GPIO, 2 PMC slots, 5Row P1 & P2, 95 way P0, No Graphics
PPC8A-2E41CBx	Air-cooled level 2 as above with conformal coating
	1GHz PowerPC 7447 – 256 MB of SDRAM
PPC8A-1E45BBX	1 GHz PowerPC 7447, 6U VME SBC, Level 1; 256 MB SDRAM, 128 MB FLASH, RTC, 1 x 10/100/1000 BASE-T , 2 x 10/100 BASE-T, Ultra SCSI, 2 x USB 1.1 , 2 x USB 2.0, 2 x RS232 & 4 x RS232 / 422 / 485 ports, Keyboard, mouse, 16 bits GPIO, 2 PMC slots, 5Row P1 & P2, 95 way P0, Graphics
PPC8A-2E45BBX	Air-cooled level 2 as above with conformal coating

X = software option. Note: The standard ordering information (above) defines the standard build variant. Consult factory for availability of further build options.

PPC8A Accessories

Sales Code	Description
XPRESSIOKIT2	PPC8A I/O kit comprises of the following components
	P25X606-11200 P2 Transition Module- Provides connections for 2 x 10 / 100 BASE- T Ethernet, ULTRA SCSI, COM 1,2,3,4,5 & 6 Serial, Parallel, Mouse & Keyboard ports, GPIO, Video and USB 1.1
	SIOX600-S 3U Serial I/O Panel- Provides 2 x 9 Way D type connectors and 0.5m internal ribbon cable. For use on COM 1 to 6 ports when RS232 is specified. Requires 3 to access all ports, 2 supplied.
	SIO2X600-S 3U Serial I/O Panel- Provides 2 x 25 Way D type connectors and 0.5m internal ribbon cable. For use on COM 1 to 6 ports when RS232 is specified. Requires 3 to access all ports, 1 supplied.
	SIO3X600-S 3U Serial I/O Panel- Provides 1 x 25 Way D type connectors and 0.5m internal ribbon cable. Complies with RS530 pin out and signal set. May be used with COM3 & 4 ports when RS422 is specified. Requires 2 to access both ports, 2 supplied
	PMKX600-S 3U Panel for Parallel, Mouse & Keyboard- Provides a 25 Way D type parallel connector and two PS/2 connectors with 0.5m internal ribbon cable
	SCSIX600-S 3U Honda SCSI Panel- Provides Honda connector and 0.5m internal ribbon cable
	10BTX600-S 3U 10/100 BASE-T Panel- Provides RJ45 plug to RJ45 socket on a 3U mounting plate with 1 metre cable. Requires 2 for both Ethernet ports, 2 supplied
	USBX606-11 3U Panel for 4 USB ports- Provides 4 standard USB sockets on a 3U mounting plate (0.5m cable)
	PPC6MSC1-D151 Cable- Mouse & Keyboard COM 1 cable 15 way Micro D type to PS/2, 1m long
	C-CBL000050-001- Cable for USB
	C-CBL000051-001- Cable for 10/100/1000 Ethernet

RADSTONE
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USA
Telephone: +1 (800) 368-2738
E-mail: sales@radstone.com

EUROPE
Telephone: +44 (0) 1327 359444
E-mail: sales@radstone.co.uk

ASIA
Telephone: +61 (0)7 5538 4442
E-mail: salesasia@radstone.com

Visit www.radstone.com for a full list of regional offices and contact details