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Product Brief

# IPM Sentry™ ShMM-500R and Shelf Manager

## Shelf Management Mezzanine: Shelf Manager Core for AdvancedTCA®

### "The Quickest Path to Compliant & Interoperable Shelf Management Controllers"

The IPM Sentry ShMM-500R, and the IPM Sentry Shelf Manager that comes pre-loaded on it, are part of a series of Pigeon Point Systems (PPS) IPM Sentry off-the-shelf management components.

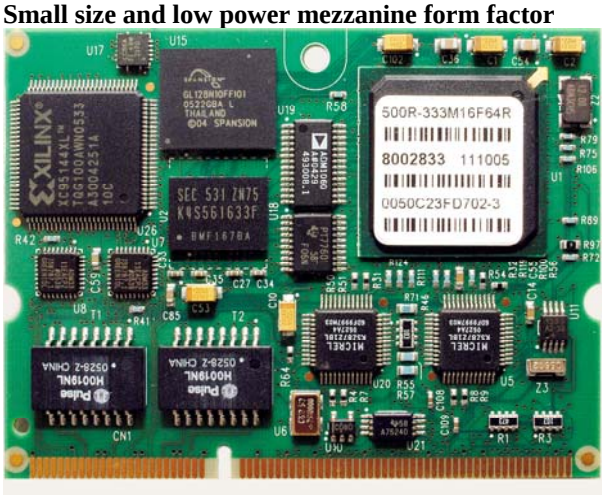
This member of the series provides the core of an AdvancedTCA Shelf Manager. The ShMM-500R mezzanine complies with the 67.60mm x 50.80mm SO-DIMM form factor. It is installed in the SO-DIMM socket of a ShMM carrier board to produce a complete Shelf Manager. The carrier board can be customized to the form factor and feature requirements of the shelf products it supports.

The ShMM-500R can be used in existing carriers designed for the first generation IPM Sentry ShMM-300.

For shelf developers, the ShMM-500R is available in an IPM Sentry Shelf Management Starter Kit (which is detailed in a separate product brief). The kit includes:

- Schematics for a ShMM carrier board, ready for adaptation to the needs of your shelf.
- Bench top hardware, including a Shelf Manager and IPM Controller, allowing your ramp up on AdvancedTCA management to start immediately.
- One-stop support for hardware, firmware and software used in developing and delivering your IPM Sentry ShMM-500R based AdvancedTCA Shelf Manager.

**Small size and low power mezzanine form factor**



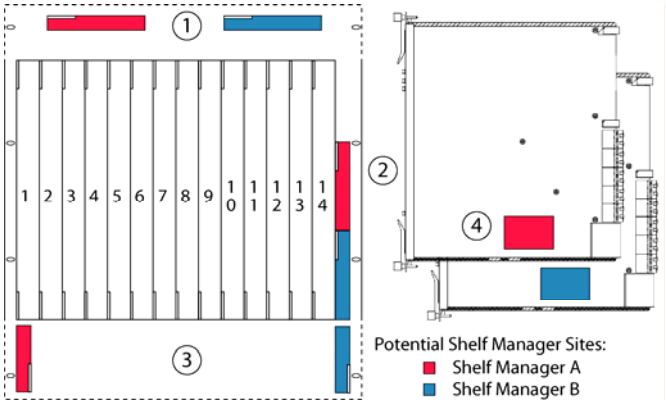

Despite its small size, with high integration the RoHS-compliant ShMM-500R includes a capable compute core, while still remaining low power:

- 333 MHz MIPS processor: the AMD Au1550-333
- Hardware security engine that can accelerate selected VPN protocols and cryptographic algorithms
- 64 or 128 MB of SDRAM
- 16 or 64 MB of Flash for program, data storage (key partitions have two copies to support reliable upgrade)
- Maximum power: less than 5W at 3.3V.

**Outstanding placement flexibility**

This combination of small mezzanine form factor and low power allows a broad range of mechanical options for dual ShMM-500R carriers. Here are some alternatives for a 19-inch shelf with a 14-slot subrack (as shown in the figure below):

1. Horizontal in upper or lower air plenum
2. Vertical next to an 8U slot (but a tight squeeze in 19"!)
3. Vertical in upper or lower air plenum
4. Integrated with 8U ATCA boards (likely hub boards)




**Specification-compliant and interoperability-tested**

When integrated with a suitable carrier, the ShMM-500R complies with PICMG 3.0 R2.0 (including ECN-3.0-2.0-001 for ShMC cross-connects) and IPMI v1.5, document revision 1.1, plus relevant errata. It has been thoroughly tested with other independently implemented management components at PICMG AdvancedTCA Interoperability Workshops.

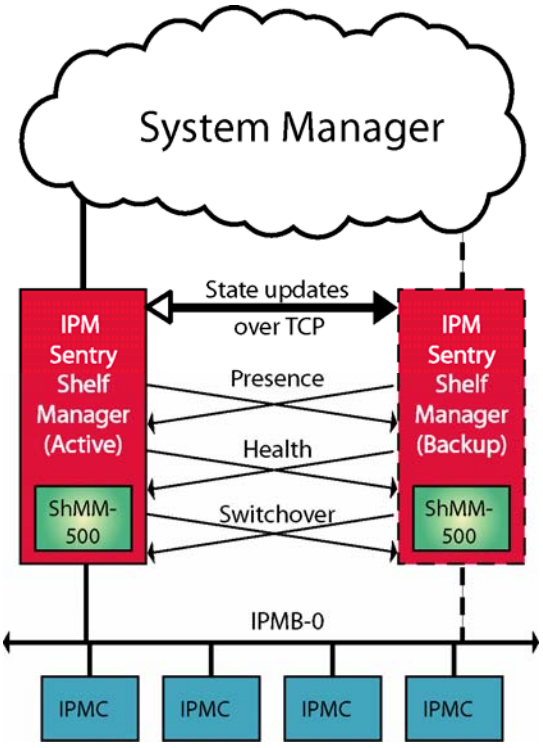


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**Handles overall tracking/management of shelf**
The first major responsibility of the IPM Sentry Shelf Manager is to manage and track the FRU population and common infrastructure of a shelf, especially the power, cooling and interconnect resources and their usage. Within the shelf, this management/tracking primarily occurs through interactions between the Shelf Manager and the IPM Controllers over IPMB-0.

This mission includes negotiating assignments for power and interconnect resources when a shelf is powered up or down or when a FRU arrives or departs. This mission also includes taking action when exceptions are raised in the shelf. For instance, in response to temperature exceptions the Shelf Manager can raise the fan levels or, if that step is not sufficient, even start powering down FRUs to reduce the heat load in the shelf.

**Support for redundant Shelf Managers**
The IPM Sentry Shelf Manager can be configured with active/backup instances to maximize availability. The following diagram shows how both instances are accessible to the System Manager, with only the active instance interacting at any given time. Similarly, only the active instance communicates over IPMB-0 with the IPM Controller population in the shelf. The two instances communicate over TCP/IP, with the active instance posting incremental state updates to the backup. As a result, the backup can quickly step into the active role if necessary.

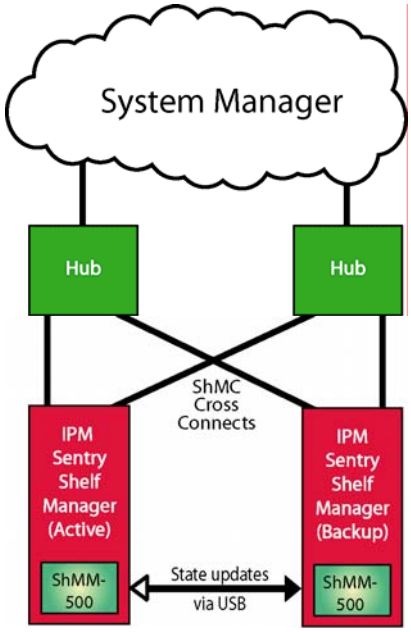



Three cross-connected signals between the two Shelf Manager instances enhance their coordination:

- Presence: each Shelf Manager instance knows whether the other instance is present in the shelf.
- Health: each instance knows whether the other instance considers itself "healthy."
- Switchover: the backup instance can force a switchover if necessary.

**ShMC cross-connect support further improves availability**
In suitably configured shelves, the IPM Sentry Shelf Manager running on the ShMM-500R supports ShMC cross-connects so that each dedicated[1] Shelf Manager can communicate with *both* the Base Interface Ethernet hubs in the shelf, using the two 10/100 Mbit Ethernet links built into the ShMM-500R. As a result, either a hub board or a shelf manager can switch over to its redundant peer, independently. Before ShMC cross-connects were defined in an Engineering Change Notice (ECN) to PICMG 3.0 R2.0, each hub provided a connection to only one dedicated Shelf Manager, which meant that a switchover of *either* of those functions required a coordinated (much more difficult) switchover of *both* the Shelf Manager and hub functions.

Consistent with the requirements of the ECN, the ShMC cross-connect support is fully backward compatible with shelves containing backplanes or hub boards that do not implement ShMC cross-connects.



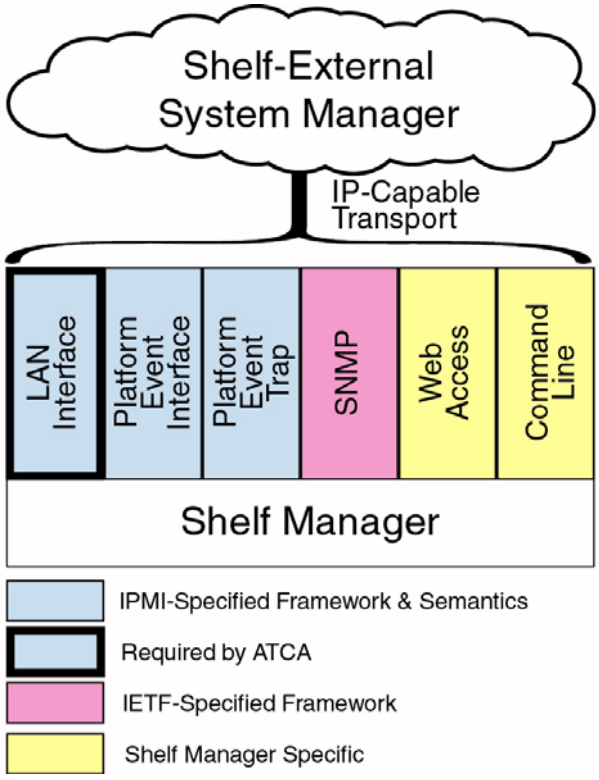

[1] *Dedicated* Shelf Managers are implemented in specific positions in the shelf designed for that particular purpose, versus *integrated* with boards in full size AdvancedTCA slots, such as the hub boards implementing a dual star Ethernet or other fabric.



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**Rich System Manager interface**
The second major responsibility of the IPM Sentry Shelf Manager is to enable the overall System Manager to join in the Shelf Manager's management and tracking activities through the System Manager Interface, which is typically implemented over Ethernet.

This interface supports the second Shelf Manager mission mentioned above. "System Manager" is a logical concept that may include software as well as human operators in the "swivel chairs" of an operations center. As shown in the diagram below, the IPM Sentry Shelf Manager provides a rich set of System Manager interface options, which provide different mechanisms of access to similar kinds of information and control regarding a shelf. Some of the interface options are specification-governed, while others are specific to the IPM Sentry Shelf Manager.




One such mechanism is the IPMI LAN Interface. To maximize interoperability among independently implemented shelf products, this interface is required by the AdvancedTCA specification and supports IPMI messaging with the Shelf Manager via the Remote Management Control Protocol (RMCP). A System Manager that uses RMCP to communicate with shelves should be able to interact with any ATCA-compliant Shelf Manager. This relatively low level interface provides essentially complete access to the IPMI aspects of a shelf, including the ability for the System Manager to issue IPMI commands to IPM Controllers in the shelf, using the Shelf Manager as a proxy.

In addition, the IPM Sentry Shelf Manager provides two interfaces oriented towards human users rather than programmatic ones:

- Command Line Interface (CLI): This interface provides a comprehensive set of textual commands that can be issued to the Shelf Manager via either a physical serial connection or Telnet.
- Web-based Interface: This interface enables essentially the same functionality as the CLI, with access to the Shelf Manager via a web browser.

Using either of these mechanisms, the System Manager can access information about the current state of the shelf, including current FRU population, sensor values, threshold settings, recent events and overall shelf health.

Finally, the IPM Sentry Shelf Manager supports Simple Network Management Protocol (SNMP) access to the shelf. This popular management protocol is supported with a custom Management Information Base (MIB) providing Get and Set access to a wide range of information and controls regarding the shelf.

The remainder of this product brief provides a summary of key features of the ShMM-500R hardware and software. The focus is on features that have software support.

*Note: Features that are marked with the "§" symbol are dependent on suitable support in the ShMM-500R carrier.*

**RoHS Compliant**

- Complies with the Restriction of Hazardous Substances (RoHS) Directive, which becomes effective July 1, 2006
- Works in carriers designed for non-RoHS ShMM-500

**JEDEC-specified SO-DIMM mezzanine format**

- JEDEC 144-pin SO-DIMM, SGRAM variation "HB"
- Choice of SGRAM high profile or very high profile SO-DIMM socket (allows/disallows parts under SO-DIMM)
- Example socket: AMP 390110-1
- PPS-defined mounting hole on free edge of SO-DIMM enables supplementary mechanical support for NEBS vibration and earthquake requirements



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**Compatible with ShMM-300 Sockets**

- ShMM-500R works in existing ShMM-300 carriers, allowing a dramatic performance boost for existing products
- ShMM-500R-specific carriers can take advantage of additional ShMM-500R functionality

**Robust ShMM-500R peripheral complement**

- Dual redundant & buffered IPMB
- Shelf Manager redundancy and hot swap interfaces with on-board CPLD assist
- Two 10/100 Mbit Ethernet controllers with LED indicator controls
- Two serial interfaces; both CMOS & RS-232 levels available
- Master-only $I^2C$ bus for access to on-carrier devices, such as hardware monitors
- Real-time clock to time-stamp System Event Log entries, backed by on-carrier battery
- Watchdog timer external to Au1550 automatically disconnects from IPMB-0 and reboots if software hangs
- USB 1.1 host and device ports
- General Purpose IO signals
- JTAG interface for programming Flash

**Hardware-support for reliable firmware upgrade**

- Included in all standard ShMM-500R configurations; leverages two distinct regions in Flash
- Each region includes a separate copy of U-Boot, Linux kernel and Flash-based Linux root file system
- Firmware in *persistent* region used during normal operation
- During reliable upgrade, new firmware is loaded in *provisional* region
- If provisional region firmware does not start and validate successfully, hardware automatically reboots with persistent region firmware

**Shelf Manager redundancy interfaces§**

- Software redundancy interface (typically routed on the backplane between shelf manager instances) supports state updates from active to backup Shelf Manager, so that backup can take over quickly
- Software redundancy interface can be implemented via one of the ShMM-500R 10/100 Mbit Ethernet links
- Optionally with a ShMM-500R-specific carrier, dual USB links are used for software redundancy interface, freeing both Ethernet links for System Manager communication
- Hardware redundancy interface provides healthy, presence and switchover signals, cross-connected between Shelf Managers
- CPLD assisted management of hardware redundancy interface ensures that only one Shelf Manager is active

**System Manager interface implemented over 10/100 Mbit Ethernet link(s)§**

- Optionally with ShMM-500R-specific carrier, includes both Ethernets and supports ShMC cross-connects
- Activity and status LEDs
- Supports IPMI LAN, SNMP, and web interfaces via ATCA-defined Shelf Manager IP Address, which automatically fails over between active and backup Shelf Managers on switchovers
- Also supports command line interface over telnet

**IPMI LAN interface**

- Complies with IPMI v1.5, document revision 1.1 and relevant subsequent errata
- Includes required support for Remote Management Control Protocol (RMCP)
- Privilege levels: user, administrator, operator
- Authentication types: none, MD5, straight password/key

**Simple Network Management Protocol interface**

- Complies with IETF-defined SNMP v2c and v3 protocols
- Supports several groups of SNMP variables for configuration and control, including: IPM controllers, FRU information devices, sensors, boards, shelf/shelves, System Event Log, LAN configuration parameters, PEF configuration parameters

**Command Line interface (CLI)**

- Accessible via Telnet or ShMM-500R serial console
- Comprehensive status and control access to:
  - Shelf Manager state and parameters
  - Boards and other specialized FRUs, such as fans
  - Management controllers on any intelligent FRUs
  - Sensors
  - System Event Log
  - FRU inventory information, including shelf and board data

**Web interface**

- Accessible via any web browser at the URL: http://<Shelf-Manager-IP -Address>
- Implements simple front end to the command line interface; supports most CLI commands

**Centralized fan management support§**

- Optionally makes the active Shelf Manager directly responsible for fan speed control and measurement
- Typically implemented via Analog Devices ADM1026 controller on carrier with PWM output and up to 16 tachometer inputs
- Provision for carrier-specific parameterization



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**Distributed fan management support§**

- Optionally defers to intelligent (IPM Controller equipped) fan trays to handle local fan speed control and measurement
- AdvancedTCA-defined fan tray support allows interoperability and automatic discovery
- Provision for carrier-specific parameterization

**Flexible temperature monitoring§**

- On-carrier digital or analog temperature monitors
- Off-carrier digital temperature monitors ($I^2C$-accessed), possibly placed at key monitor points in shelf, for instance to measure air ingress and/or egress temperatures
- Provision for carrier-specific parameterization

**Telco alarms§**

- DB15-compatible connector interface with major and minor alarm reset, plus relay connections for critical, major, minor and power alarms
- LEDs for critical, major and minor alarms indicate: no alarm (off), alarm triggered (on) or alarm cut-off activated (blinking)
- Alarm cutoff push button

**ShMM-managed Shelf FRU Information support§**

- Provision for dual redundant SEEPROM storage of shelf description data structures, accessed via $I^2C$ from active Shelf Manager
- Shelf FRU Info SEEPROMs typically attached to backplane
- Supports Atmel AT24C16 and compatible SEEPROM devices

**IPM Controller-managed Shelf FRU Information support§**

- Optionally accesses Shelf FRU Information via IPM Controllers in the shelf
- Configurable to use specific pre-defined IPM Controller addresses or dynamic search for Shelf FRU Information sources

**Miscellaneous features§**

- Carrier slot hardware address detection
- Auto-detection of carrier configuration information
- Up to 3 bi-color LEDs, supported with ATCA-defined LED discovery and control facilities
- Lithium battery backup on carrier for real time clock on ShMM-500R

**Comprehensive firmware and operating system layer**

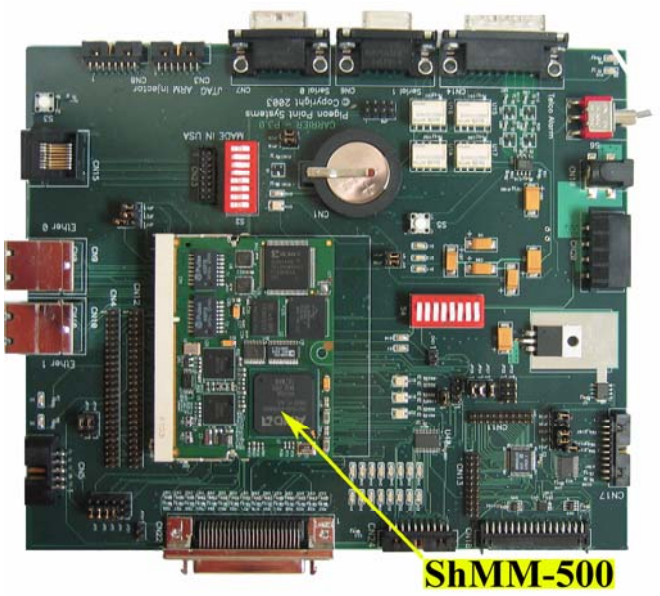
- ShMM-500R operating system is Au1550 Edition of Monterey Linux; key features for Shelf Manager application include:
  - Based on Linux 2.4.x kernel port
  - Special support for the AMD Au1550 processor and peripherals
- All standard configurations include support for reliable remote firmware upgrade for U-Boot, Linux kernel and Linux root file system:
  - Reliable upgrade utility handles upgrade steps, can be invoked locally at ShMM-500R console or remotely via telnet, rsh or ssh
  - New firmware images acquired via highly configurable invocations of reliable upgrade utility
  - Configuration options include multiple protocol choices (e.g., FTP, scp), arbitrary scripts for image validation and upgrade finalization
  - Persistent status file records progress of upgrade steps
- Includes support for several security-related protocols, including the following[2]:
  - IPsec (security-conscious version of IP—Internet Protocol)
  - Remote Authentication Dial-In User Service (RADIUS)
  - Secure Sockets Layer (SSL)
  - Secure Shell (SSH)
- Boot monitor based on U-Boot; key features include:
  - Serial console command-driven user interface
  - Network download via BOOTP or TFTP
  - Extensive support for Flash memory
  - Powerful environment variable facility
  - Autoboot mode
- Kernel debugging supported via KGDB and second ShMM-500R serial port
- See www.montereylinux.com for details on Au1550 Edition of Monterey Linux, including full User Guide

[2] The current release of the Au1550 Edition does not use the Au1550 hardware security engine in connection with these features.



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**Bench top carrier reference implementation**
(shown with compatible non-RoHS ShMM-500)




**Ordering Information**

| | |
|---|---|
| ShMM-500-333M16F64R[3] | 333MHz, 16MB Flash (dual regions), 64MB RAM; not RoHS compliant |
| ShMM-500R-333M16F64R | 333MHz, 16MB Flash (dual regions), 64MB RAM; RoHS compliant |
| ShMM-500-333M64F128R[3] | 333MHz, 64MB Flash (dual regions), 128MB RAM; not RoHS compliant |
| ShMM-500R-333M64F128R | 333MHz, 64MB Flash (dual regions), 128MB RAM; RoHS compliant |

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[3] The non-RoHS-compliant ShMM-500 variants are not recommended for new orders; contact Pigeon Point Systems for availability.



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