

PRODUCT BRIEF

Pigeon Point ChMM-700R and Chassis Manager

Chassis Management Mezzanine & Chassis Manager Core

For VPX and ANSI/VITA 46.11-2022

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The Pigeon Point ChMM-700R, and the Pigeon Point ANSI/VITA 46.11-2022 Tier-2 Chassis Manager that comes pre-loaded on it, are part of a series of Pigeon Point management solutions.

This member of the series provides the core of a Tier-2 Chassis Manager for VITA 46.11-based VPX systems. The ChMM-700R mezzanine complies with the 67.60mm x 41.75mm DDR3 204-pin SO-DIMM form factor. It is installed in the SO-DIMM socket of a ChMM carrier board to produce a complete Chassis Manager. The carrier board can be customized to the form factor and feature requirements of the chassis products it supports.

For chassis developers, the ChMM-700R is available in a Pigeon Point Chassis Management Starter Kit (which is detailed in a separate product brief). The kit includes:

- Schematics for a ChMM carrier board, ready for adaptation to the needs of your chassis
- Bench top hardware, including a Chassis Manager and IPMC, allowing your ramp up on VITA 46.11 management to start immediately
- One-stop support for hardware, firmware and software used in developing and delivering your Pigeon Point ChMM-700R based Tier-2 Chassis Manager

Small size and low power mezzanine form factor



Despite its small size, with high integration, the RoHS-compliant ChMM-700R includes a capable compute core, while still remaining low power:

- 297 MHz ARM processor: the Freescale i.MX287
- Microsemi SmartFusion FPGA
- 128 MB of SDRAM
- 64 MB of Flash for program, data storage (two copies to support reliable upgrades)
- Maximum power: 3.0W at 3.3V/5.0V.

Outstanding placement flexibility

This combination of small mezzanine form factor and low power allows a broad range of mechanical options for single or dual ChMM-700R carriers.

ANSI/VITA 46.11-2022 Tier-2 Chassis Manager

When integrated with a suitable carrier, the ChMM-700R complies with ANSI/VITA 46.11-2022, for Tier-2 Chassis Managers, and IPMI v2.0, document revision 1.0 (as well as the IPv6 aspects of document revision 1.1), plus relevant errata.

- Implements a VITA 46.11 Tier-2 Chassis Manager
- Supports both Tier-1 and Tier-2 IPMCs for VPX modules and other intelligent FRUs in a chassis (including a mixture of Tier-1 and Tier-2 IPMCs)

ANSI/VITA 46.11-2022 Tier-3 Chassis Manager

With the purchase of the Pigeon Point Chassis Management Starter Kit Add-on (detailed in a separate product brief) the ChMM-700R, when integrated with a suitable carrier, complies with ANSI/VITA 46.11-2022 for Tier-3 Chassis Managers.

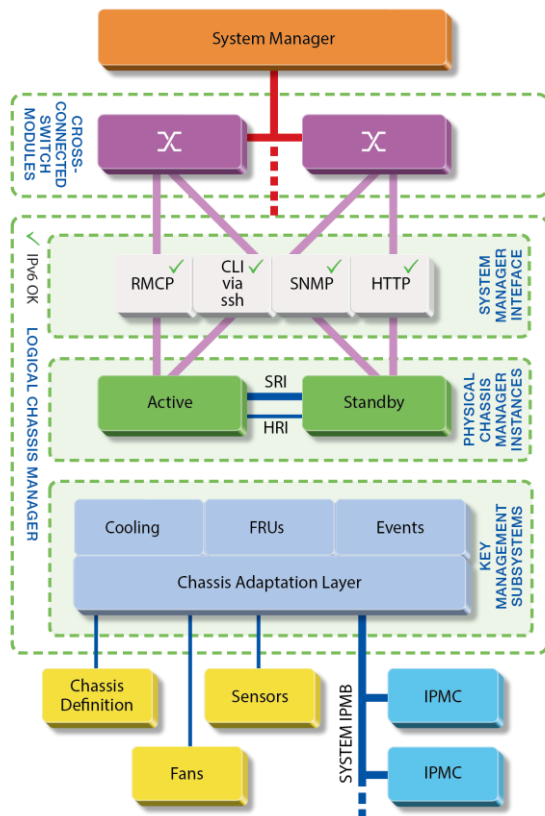
- Implements a VITA 46.11 Tier-3 Chassis Manager
- Supports Tier-1, Tier-2 and Tier-3 IPMCs for VPX modules and other intelligent FRUs in a chassis (including a mixture of Tier-1, Tier-2 and Tier-3 IPMCs)

Overall tracking/management of chassis

One overall responsibility of the Pigeon Point Chassis Manager is to manage and monitor the overall operation of a chassis, including the FRU population and the cooling thereof, as well as events that may be generated by exception conditions in the chassis. Within the chassis, this management/tracking primarily occurs through interactions between the Chassis Manager and the IPMC on each of the VPX modules or other management-equipped FRUs, all via the System IPMB. The figure below shows these key management subsystems and the System IPMB connection with the IPMCs in the chassis.

This mission includes graceful activation and deactivation of FRUs when a chassis is powered up or down. This mission also includes taking action when exceptions are raised in the chassis. For

instance, in response to temperature exceptions the Chassis Manager can raise the fan levels or, if that step is not sufficient, even start deactivating FRUs to reduce the heat load in the chassis.



Support for redundant Chassis Managers

The Pigeon Point Chassis Manager is usually configured with active/backup instances to maximize availability. The above 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 System IPMB with the IPMC population in the chassis. The two instances communicate over the TCP/IP based Software Redundancy Interface (SRI) which is implemented via a pair of USB links between the ChMM-700Rs. The active instance of the Chassis Manager posts incremental state updates to the backup via this interface. As a result, the backup can quickly step into the active role if necessary.

The Hardware Redundancy Interface between the two Chassis Manager instances enables the exchange of hardware level ChMM-700R state information, including the following:

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

ChMC cross-communication links further improve availability

In typical chassis that support Chassis Manager redundancy, the Pigeon Point Chassis Manager running on the ChMM-700R supports ChMC cross-communication links so that each dedicated¹ Chassis Manager can communicate with both of the Ethernet switch modules in the chassis, using the two 10/100 Mbit Ethernet links built into the ChMM-700R.

As a result, either a switch module or a Chassis Manager can switch over to its redundant peer, independently. The figure on this page shows these cross-connects.

Flexible Chassis Adaptation Layer supports wide range of chassis variants

The key technology in this layer is the Pigeon Point Hardware Platform Description Language (HPDL). HPDL enables a textual definition of management aspects of the ChMM carrier board architecture and chassis architecture, including the System IPMB topology, the access methods and implementations of auxiliary FRUs such as fan trays and power entry modules, plus information on chassis level IPMI sensors and IPMI sensors on the ChMM carrier board.

Textual HPDL descriptions are easy for chassis developers to maintain, including for numerous chassis architecture variants. HPDL text is compiled to a binary format and interpreted during chassis operation.

Chassis adaptations via HPDL can be done by chassis development engineers without any programming skills.

¹ *Dedicated* Chassis Managers are implemented in specific positions in the chassis designed for that particular purpose, versus *integrated* with VPX modules in front loading module slots, such as the switch modules implementing a dual star Ethernet or other fabric.

Rich System Manager Interface

Another overall responsibility of the Pigeon Point Chassis Manager is to enable an overall System Manager to join in the Chassis Manager's management and tracking activities through the System Manager Interface, which is implemented over Ethernet on the Pigeon Point ChMM.

"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 figure, the Pigeon Point Chassis Manager provides a rich set of built-in System Manager Interface options, which provide different mechanisms of access to similar kinds of information and control regarding a chassis. Some of the interface options are specification-governed, while others are specific to the Pigeon Point Chassis Manager.

One such mechanism is the Remote Management Control Protocol (RMCP) interface. To maximize interoperability among independently implemented chassis products, this interface is required by the VITA 46.11 specification and supports IPMI messaging with the Chassis Manager. RMCP+, the advanced variant of RMCP specified in IPMI v2.0, is supported as well, though not mandated by VITA 46.11. A System Manager that uses RMCP to communicate with chassis should be able to interact with any VITA 46.11-compliant Chassis Manager. This relatively low level interface provides essentially complete access to the IPMI aspects of a chassis, including the ability for the System Manager to issue IPMI commands to IPMCs in the chassis, using the Chassis Manager as a proxy.

The Pigeon Point Chassis Manager supports several configuration options when both of the ChMM-700R Ethernet ports on each of a redundant pair of ChMMs are connected to the System Manager. Those configurations support one, two or all four Ethernet ports being actively used or monitored at any given time.

In addition, the Pigeon Point Chassis 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 Chassis

Manager via either a physical serial connection or via a remote shell interface, such as ssh.

- **Web-based Interface (implemented via HTTP):** This interface enables a subset of the CLI functionality, with access to the Chassis Manager via a web browser.

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

The Pigeon Point Chassis Manager also supports Simple Network Management Protocol (SNMP) access to the chassis. 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 chassis.

Fan geography support enables fine granularity cooling management

Consistent with VITA 46.11, the Chassis Manager supports chassis that self-describe their *fan geography* – the mapping between the FRUs in the chassis (such as the boards) and the fan devices that cool them. This mapping allows the Chassis Manager to adjust fan speeds for just the fans that cool a particular FRU that is raising a temperature exception. Since increased fan speeds translate to increased acoustic noise, this type of focused response to a temperature exception can be very important for some customers.

Since the fan geography description is included in the Chassis FRU Information, the Pigeon Point Chassis Manager can automatically adjust its management to fit the cooling zones actually implemented in any given chassis.

The remainder of this product brief provides a summary of key features of the ChMM-700R hardware and software. The focus is on features that have software support and the initial feature descriptions elaborate on the System Manager Interface options.

IPMI LAN interface

- Complies with IPMI v2.0, document revision 1.0 (as well as the IPv6-related aspects of document revision 1.1), and relevant subsequent errata
- Includes required support for Remote Management Control Protocol (RMCP), as well as RMCP+, as specified by IPMI v2.0
- Privilege levels: user, administrator, operator
- Authentication types: none, MD5, straight password/key

Support for IPv6

- Supports RMCP sessions with a System Manager over IPv6 protocol
- Supports IPMI-defined IPv6 LAN Configuration Parameters, including get and set operations from CLI
- Allows each network interface to have both IPv4 and IPv6 enabled, or just one of the two

ANSI/VITA 46.11-2022 compliant extensions in System Manager interface

- Get Chassis Manager IP Addresses command allows System Manager to monitor all IP addresses offered by a Chassis Manager, with automatic follow-up if any of the addresses stop responding
- Get/Set Fan Policy commands make it easy for System Manager to retrieve fan geography; additionally, System Manager can temporarily disable Chassis Manager autonomous control of particular fan devices, perhaps for diagnostic operations
- FRU Inventory Device Lock Control/Write commands ensure that concurrent attempts to change chassis configuration information do not cause corruption of that data.
- Support for generic Chassis FRU Information (visible as FRU ID 253) and application-specific view of the Chassis FRU Information (visible as FRU ID 254).
- Bridged Firewall commands (Tier-3 only) allow the System Manager to configure bridging between different IPMI channels (IPMB, LAN/RMCP) on the Chassis Manager.

- Get FRU Hash command (Tier-3 only) allows the System Manager to determine whether Chassis and Chassis Manager FRU information has been updated since the last time this command was issued.

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: IPMCs, FRU information devices, sensors, boards, chassis, System Event Log, LAN configuration parameters, PEF configuration parameters

Command Line Interface (CLI)

- Accessible via Telnet or ChMM-700R serial console
- Comprehensive status and control access to:
 - Chassis Manager state and parameters
 - Boards and other specialized FRUs, such as fans
 - Management controllers on intelligent FRUs
 - Sensors
 - System Event Log
 - FRU inventory information, including chassis and board data

Web interface

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

Based on PPMM-700R hardware platform

- Pigeon Point Management Mezzanine (PPMM-700R) physical module delivered as ChMM-700R for the VITA 46.11 Chassis Manager application
- Delivered and sold separately as a ShMM-700R Shelf Manager module for AdvancedTCA shelves (not further addressed in this product brief)

JEDEC-specified SO-DIMM mezzanine format

- JEDEC 204-pin DDR3 SO-DIMM
- Example socket: TE Connectivity 2013289-1
- Mounting hole on free edge of SO-DIMM enables supplementary mechanical support for vibration and earthquake requirements

Robust ChMM-700R peripheral complement

- Dual redundant System IPMB
- System IPMB supports Fast-Mode (i.e. 400 kHz) operation
- Chassis Manager redundancy support with assistance from on-board SmartFusion FPGA
- Two 10/100 Mbit Ethernet controllers with LED indicator controls
- The ChMM carrier reference design optionally supports a GbE Switch (Micrel KSZ9563R) which allows the carrier board Ethernet interface(s) to be connected to an external GbE device (e.g. a switch)
- Two serial interfaces to the i.MX287 and one serial interface to the SmartFusion FPGA
- Two external master-only I²C ports, two fully compliant I²C ports, and one local master-only I²C bus for carrier devices
- Real-time clock to time-stamp System Event Log entries, backed by on-carrier battery or supercap
- Watchdog timer external to i.MX287 that automatically disconnects from System IPMB and reboots i.MX287 if software hangs
- USB 2.0 host and device ports
- General Purpose IO signals

Hardware support for reliable firmware upgrade

- Leverages redundant firmware instances in Flash
- Each instance includes a separate copy of U-Boot, FPGA image, Linux kernel and Flash-based Linux root file system
- Confirmed firmware executes during normal operation
- During reliable upgrade, new firmware is loaded as the candidate image
- If the candidate firmware does not start and validate successfully, hardware automatically reboots back to the confirmed firmware

Chassis Manager redundancy interfaces[§]

- Software redundancy interface (typically routed on the backplane between Chassis Manager instances) supports state updates from active to backup Chassis Manager, so that backup can take over quickly
- Software redundancy interface is implemented with dual USB links
- Hardware redundancy interface is implemented on a two-wire serial interface between Chassis Managers
- FPGA-assisted management of hardware redundancy interface ensures that only one Chassis Manager is active

System Manager Interface implemented over 10/100 Mbit Ethernet link(s)[§]

- Usually implemented to include both Ethernets
- Activity and status LEDs
- Supports IPMI LAN, SNMP, and web interfaces via VITA 46.11-defined Chassis Manager IP Address (an IPv4 address), which automatically fails over between active and backup Chassis Managers on switchovers
 - Corresponding support for IPMI LAN and web interfaces over IPv6
 - Customers needing IPv6 access to SNMP can request configuration assistance from nVent
- Also supports command line interface over telnet and secure shell (ssh)
- Optionally, uses external DHCP server to acquire Internet Protocol addresses for use on System Manager Ethernet interfaces

Centralized fan management support[§]

- Optionally makes the active Chassis Manager directly responsible for fan speed control and measurement
- Implemented on the ChMM carrier reference design via On Semiconductor ADT7490 controller with up to 3 PWM outputs and up to 4 tachometer inputs
- Provision for carrier-specific parameterization

[§] Features that are marked with the “§” symbol are dependent on suitable support in the ChMM-700R carrier.

Distributed fan management support§

- Optionally defers to intelligent (IPMC-equipped) fan trays to handle local fan speed control and measurement
- VITA 46.11-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 (I²C-accessed), possibly placed at key monitor points in chassis, 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

Remote time management

- Configurable so that Chassis Manager time is set from network-accessed time servers
- Supports operation without battery backup of the ChMM-700R's real-time clock; two protocol options:
 - RFC 868 as implemented in Linux rdate command
 - Network Time Protocol as implemented in Linux ntpdate command

ChMM-managed Chassis FRU Information support§

- Provision for dual redundant EEPROM storage of chassis description data structures, accessed via I²C from active Chassis Manager
- Chassis FRU Info EEPROMs typically attached to backplane
- Supports Atmel AT24C128 and compatible EEPROM devices

IPMC-managed Chassis FRU Information support§

- Optionally accesses Chassis FRU Information via IPMCs in the chassis
- Configurable to use specific pre-defined IPMC addresses or dynamic search for Chassis FRU Information sources

Miscellaneous features§

- Carrier slot hardware address detection
- Auto-detection of carrier configuration information
- Up to 3 bi-color LEDs, supported with VITA 46.11-defined LED discovery and control facilities
- Optional lithium battery or supercap backup on carrier for ChMM-700R real time clock

Comprehensive Chassis Manager foundation layer

- ChMM-700R operating system is based on the Linux 2.6.34 kernel, supporting the Freescale i.MX287
- Support for reliable remote firmware upgrade for U-Boot, FPGA, Linux kernel and Linux root file system:
 - Reliable upgrade utility handles upgrade steps, can be invoked locally at ChMM-700R 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
 - Support for upgrade images in PICMG HPM.1 format
- 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

Comprehensive user documentation

The *Pigeon Point Chassis Manager User Guide* covers installation, upgrading and overall use of the Pigeon Point Chassis Manager. The *Pigeon Point Chassis Manager External Interface Reference* covers the details of the main external interfaces, including the command line, web access, SNMP and RMCP interfaces. The current version of each document is available on the library page of the Pigeon Point website at <http://www.pigeonpoint.com/library.html>

Ordering Information:

ChMM-700R-CC Part #: 21990-603	297MHz, 64MB Flash (dual regions), 128MB RAM; RoHS compliant; rated for commercial temperatures
ChMM-700RI-CC Part #: 21990-602	297MHz, 64MB Flash (dual regions), 128MB RAM; RoHS compliant; rated for industrial temperatures

The following is a high level block diagram of the PPMM-700R module which is the hardware platform for the ChMM-700R:

