AXP1406 System Release 3.1

Installation and Use

6806800B31F

October 2008

Trademarks

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Abbreviations

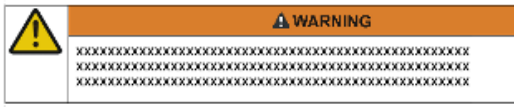
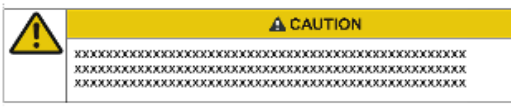
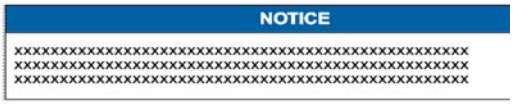
This document uses the following abbreviations:

Acronym	Description
AHA	Advanced High Availability
BBS	Basic Blade Services
BER	Bit Error Rate
BMC	Board Management Controller
BSP	Board Support Package, (Linux Support package)
CFM	Cubic Feet per Minute
DHCP	Dynamic Host Configuration Protocol
DSP	Digital Signal Processing
ESD	Electrostatic Discharge
ETSI	European Telecommunication Standards Institute
FC	Fibre Channel
FRU	Field Replaceable Unit (PEM, FTM, SAM, filters, blades, RTMs)

Acronym	Description
FTM	Fan Tray Module
HSC	Hot Swap Controller.
I2C	Inter-Integrated Circuit bus
ICMB	Interchassis Management Bus
IP	Internet Protocol
IPMB	Intelligent Platform Management Bus
IPMC	Intelligent Platform Management Controller
LED	Light Emitting Diode
LFM	Linear Feet per Minute
LP	Link port (PICMG 2.16)
NCS	NetPlane Core Services
NEBS	Network Equipment Building System.
NSP	Nonsystem processor
PC	Payload Card
PCI	Peripheral Connect Interface
PEM	Power Entry Module
PLD	Programmable Logic Device
PM	Peripheral Manager
PMC	Peripheral Management Controller
PPRB	Packet Processor Resource Boards
QoS	Quality of Service
RTM	Rear Transition Module
SAM	Shelf Management Alarm Module
SELV	Safety Extra Low Voltage
ShMC	Shelf Management Controller (SAM)
ShMM	Shelf Management Mezzanine
SSM	Standby Shelf Manager
TNV	Telephone Network Voltage
VDC	Volts Direct Current
VAC	Volts Alternating Current
VoIP	Voice over IP

Conventions

The following table describes the conventions used throughout this manual.

Notation	Description
0x00000000	Typical notation for hexadecimal numbers (digits are 0 through F), for example used for addresses and offsets
0b0000	Same for binary numbers (digits are 0 and 1)
bold	Used to emphasize a word
`Screen`	Used for on-screen output and code related elements or commands in body text
`Courier + Bold`	Used to characterize user input and to separate it from system output
Reference	Used for references and for table and figure descriptions
File > Exit	Notation for selecting a submenu
<text>	Notation for variables and keys
[text]	Notation for software buttons to click on the screen and parameter description
...	Repeated item for example node 1, node 2, ..., node 12
. . .	Omission of information from example/command that is not necessary at the time being
..	Ranges, for example: 0..4 means one of the integers 0,1,2,3, and 4 (used in registers)
|	Logical OR
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury
	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury
	Indicates a property damage message
	No danger encountered. Pay attention to important information

Summary of Changes

The following changes have been made to this edition. This edition replaces all previous releases.

Date	Description of Change	Replaces
October 2007	Updated Table 3-2 on page 63. Added operation requirement for ambient temperatures, on page 63.	6806800B31B
February 2008	Corrected *Remote Management and Maintenance* on page 37 to removed a reference to the FTMs because the FTMs do not have IPMI firmware. Updated *Preparing the Site for Installation* on page 60 to include Network Telecommunication Facilities and locations where the National Electrical Code (NEC) applies as suitable for installation. Added this statement: The AXP1406 shelf is suitable for installation as part of the Common Bonding Network (CBN) or an Isolated Bonding Network (IBN) or both to *Grounding Options* on page 61. Add the section *Battery* on page 62.	6806800B31C
April 2008	Updated to Emerson style.	6806800B31D
October 2008	Updated the Out of Service and Failure LED in Table 2-9 on page 50 to remove the amber diode option for the fan trays; only red is supported.	6806800B31E

Comments and Suggestions

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In “Area of Interest” select “Technical Documentation”. Be sure to include the title, part number, and revision of the manual and tell us how you used it.

Safety Notes

This section provides warnings that precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed during all phases of operation, service, and repair of this equipment. You should also employ all other safety precautions necessary for the operation of the equipment in your operating environment. Failure to comply with these precautions or with specific warnings elsewhere in this manual could result in personal injury or damage to the equipment.

Emerson intends to provide all necessary information to install and handle the product in this manual. Because of the complexity of this product and its various uses, we do not guarantee that the given information is complete. If you need additional information, ask your Emerson representative.

The product has been designed to meet the standard industrial safety requirements. It must only be used in its specific area of office telecommunication industry, industrial control, and development. It must not be used in safety critical components, life supporting devices or on aircraft.

Only personnel trained by Emerson or persons qualified in electronics or electrical engineering are authorized to install, remove or maintain the product.

The information given in this manual is meant to complete the knowledge of a specialist and must not be used as replacement for qualified personnel.

Keep away from live circuits inside the equipment. Operating personnel must not remove equipment covers. Only factory authorized service personnel or other qualified service personnel may remove equipment covers for internal subassembly or component replacement or any internal adjustment.

Do not install substitute parts or perform any unauthorized modification of the equipment or the warranty may be voided. Contact your local Emerson representative for service and repair to make sure that all safety features are maintained.

System Installation

System Damage
To avoid system damage verify that the system environment meets the environmental and power requirements given in this manual before installing the system.
Before you begin to set up and cable your new system, consider these guidelines:

- **Restricted access area: Install the system only in a restricted access area.**
- **Installation codes: This unit must be installed in accordance with the National Electrical Code, Articles 11016, 11017, and 11018 and the Canadian Electrical Code, Section 12.a**

- **Overcurrent protection: A readily accessible listed branch circuit overcurrent protective device must be incorporated into the building wiring. For appropriate AWG rating of the overcurrent protection device see NEC Table 31016 and other national regulations.**
- **The protective bonding conductor depends on your power distribution topology. Make sure that you use an appropriate protective bonding conductor regarding the rating of the branch circuit protection.**
- **Install the system safely. Make sure that cables and cords are out of the way.**
- **Make sure that the set-up is comfortable for users.**

System Damage
Environmental contamination can impair system operation. Locate the system in a stable area free of excess movement and jarring and free of dust, smoke, and electrostatic discharge (ESD).
Make sure that the temperature does not exceed the operating temperature given in the environmental requirements in this manual and allow room for proper air flow for cooling.

System Damage
The DC power inputs must only be attached to approved Telephone Network Voltage (TNV) or Safety Extra Low Voltage (SELV) branch circuits.
Attaching inputs to non-TNV/SELV approved power sources will cause the system to fail compliance with safety regulations.

Personal Injury or System Damage
The system is supplied by a TNV2 voltage. This voltage is considered hazardous.
Make sure that the external power supply meets the relevant safety standards.

Personal Injury or System Damage
A top-heavy rack can tip, causing damage to equipment and injury to personnel.
If your system is the only one in the rack, make sure to mount the system in the lowest part of the rack. If several systems are installed in one rack, start with the heaviest component at the bottom.
If the rack is equipped with stabilizing devices, make sure that they are installed and extended so that the rack is secure. Then proceed to mount or service the system.

Personal Injury or System Damage
Avoid personal injury or system damage by preventing accidental dropping of the equipment.
Use the appropriate equipment to safely lift and mount the system.

Personal Injury
The system is heavy.
To avoid muscle strain or back injury use lifting aids and proper lifting techniques when removing or replacing the system.

Operation

System Overheating
Cooling Vents
Improper cooling can lead to blade and system damage and may void the Manufacturer's Warranty.
To ensure proper cooling and undisturbed airflow through the system always operate the system in a horizontal position. Do not obstruct the ventilation openings at the top, sides and back of the system. Keep the fresh air intake at the bottom-front side of the chassis completely clear. Make sure that the fresh air supply is not mixed with hot exhaust from other devices.
To ensure proper air flow within the system make sure that all slots are populated with either blades, approved filler panels, or dummy blades.

System Overheating
If you reduce the fan speed the system temperature will rise.Constantly control the system temperature once you have reduced the fan speed. While operating the system make sure the environmental and power requirements are met.

Personal Injury or System Damage
Covers and Panels
Failure to operate the shelf without covering vacant slots will void the manufacturer's warranty.
Do not operate the system with open module slots. For optimal cooling of the system and associated payload and to prevent electrical shock, cover all open module slots and put all panels in place before turning on power. Approved filler panels must remain in place during system operation.

Product Damage
Bent pins or loose components can cause damage to the blade, the backplane or other system components.
Carefully inspect your blade and the backplane for both pin and component integrity before installation.

System Damage
Air Filter
Air contamination can pollute the air filter and obstruct the air intake of the system which may cause system overheating and blade or system component damage.
Air filters should be cleaned at least every 90 days or sooner, depending on the conditions of the central office environment. Because central offices vary in physical location and cleanliness, check your air filters every week after you first install your system. In a dusty environment, a filter may need cleaning more often than a filter in a cleaner environment. Check the filters frequently until you have a good idea of how often it needs cleaning. Based on your findings, establish a regular cleaning schedule and keep a log to record the date of each filter cleaning or replacement.

Product Damage
High humidity and condensation on blade surfaces causes short circuits.
Do not operate the system outside the specified environmental limits. Make sure the system is completely dry and there is no moisture on any surface before applying power.
Do not start the system below -5°C.

Personal Injury
High leakage current can be hazardous and cause injury.
Locate the caution label near the grounding studs (may vary from system to system) and make an earth ground connection before connecting the PEM.

System Malfunction
Prior to the PEM exchange the operating voltage conditions of the system should be made optimal.
To ensure uninterrupted service during PEM exchange, the input voltage should be kept at nominal -48V to -60VDC.

Perosnal Injury or Product Damage
In case the ORing diodes of the blade fail, the blade may trigger a short circuit between input line A and input line B so that line A remains powered even if it is disconnected from the power supply circuit (and vice versa).
To avoid damage or injury, always check that there is no more voltage on the line that has been disconnected before continuing your work.

Personal Injury
At the system's rear there are sharp pins which can cause injury.
Please be careful when handling the system.

Grounding

Personal Injury or Product Damage
To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground.
Failure to observe proper grounding practices may cause a variety of noise, electrostatic discharge, and radio frequency interference problems.

Damage to Circuits
Static discharge can damage circuits.
Avoid touching areas of integrated circuitry or take antistatic precautions (ESD wrist strap or shoes).

Serious Injury or Death
This product operates with dangerous voltages that can cause injury or death.To prevent serious injury or death from dangerous voltages use extreme caution when handling, testing, and adjusting this equipment and its components.

Connectors and Cabling

System Damage
RJ-45 connectors on AMC modules are either twisted-pair Ethernet (TPE) or E1/T1/J1 network interfaces. Connecting an E1/T1/J1 line to an Ethernet connector may damage your system.

- **Make sure that TPE connectors near your working area are clearly marked as network connectors.**
- **Verify that the length of an electric cable connected to a TPE bushing does not exceed 100 m.**
- **Make sure the TPE bushing of the system is connected only to safety extra low voltage circuits (SELV circuits).**

If in doubt, ask your system administrator.

Personal Injury
Cables that are not installed securely can cause injuries due to entanglement or tripping. To avoid injury make sure cables are securely installed. Never change the system's cabling as delivered by Emerson. The cabling should follow existing cable paths using existing or similar cable fastenings.
Check proper function of the system after cabling extensions.

System Malfunction or Damage
Accidental removal of the power cable while the system is operating might impact system operation or cause damage.
To avoid an accidental removal of the power cable during system operation make sure that the power cable is properly fixed to the chassis or the rack.

Personal Injury
To avoid electric shock make sure that contacts and cables of the system cannot be touched while the system is operating.
If in doubt concerning cabling, ask your local Emerson representative.

Expansion and FRU Exchange

System Overload
To avoid system overload check the total power consumption of all components installed.
Make sure that any individual output current of any component stays within its acceptable limits. See the technical specification of the respective component.

Loss of Safety and EMC Compliance
By using additional plug-in blades it may be possible that the system is no longer compliant to safety and EMC regulations.
The system integrator must make sure that the compliancy is guaranteed.

Data Loss
Powering down or removing a board before the operating system or other software running on the board has been properly shut down may cause corruption of data or file systems.
Make sure all software is completely shut down before removing power from the blade or removing the board from the chassis.

System Damage
To avoid system damage the fan replacement must be done within the 1-minute recommended service interval.
Make sure the replacement FTM is available and ready to install.

System Damage
A torn filter is ineffective in trapping particulates and will interrupt air flow distribution. Before returning a filter to service, visually inspect it for tears or rips that may have occurred during cleaning.
Do not reinstall a torn filter. You may order replacement fan filters (part number RAF-1600/6E) by contacting your Emerson sales representative.

Personal Injury or System Damage
Fans may continue to rotate after power is removed. When exchanging a fan, rotating blades in the fan may be exposed.
To prevent injury keep fingers and tools away from rotating blades in the fan.

System Alarm
Bouncing the FTM during insertion may cause an alarm condition in the system.
Insert the FTM with a single, steady motion and do not force the module into the slot.

Pin Damage
Forcing the FTM into the system may damage connector pins.
To avoid crushing or bending the connector pins, back the module out and insert it again if it hangs during insertion.

System Damage
Replacement of a PEM must be executed according to the recommended service interval of 3 minutes and be performed by a skilled service technician.

Personal Injury
To avoid electric shock verify that the system is powered off and that all power sources are disconnected before servicing any components internal to the system.
Couper l'alimentation avant l'entretien et le depannage.
For important grounding information for a DC power source, read the instructions in ***Grounding the Shelf* on page 80****.**

Personal Injury
Hot PEMs may cause injury. Allow the PEM to cool before servicing.

Personal Injury
Removing power from the PEMs cannot be accomplished by pulling the PEM's circuit breakers to the OFF position. The PEMs remain powered until the -48VDC power to each PEM is completely removed.
Make sure you disconnect the power at the external source and allow the capacitors in the power supply to discharge (1 minute) before removing the PEM from the chassis.

Personal Injury
Hazardous energy levels may be present inside the enclosure.
To prevent serious injury or death from dangerous voltages, do not touch any of the exposed leads or terminals inside the enclosure. Only properly trained service personnel should remove or install power supplies.

System Alarm
Bouncing the PEM during insertion may cause an alarm condition in the system. Insert the PEM with a single, steady motion and do not force the module into the slot.

Pin Damage
Forcing the PEM into the system may damage connector pins.
To avoid crushing or bending the connector pins, back the module out and insert it again if it hangs during insertion.

Environment

Environmental
Always dispose of used blades, system components and RTMs according to your country's legislation and manufacturer's instructions.

EMC

FCC Class A
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules, EN55022. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
To ensure EMC protection use only shielded cables when connecting peripherals to assure that appropriate radio frequency emissions compliance is maintained. Installed blades must have the face plates installed and all vacant slots in the shelf must be covered.
Changes or modifications not expressly approved by Emerson Embedded Computing could void the user's authority to operate the equipment.

Sicherheitshinweise

Dieses Kapitel enthält Hinweise, die potentiell gefährlichen Prozeduren innerhalb dieses Handbuchs vorrangestellt sind. Beachten Sie unbedingt in allen Phasen des Betriebs, der Wartung und der Reparatur des Systems die Anweisungen, die diesen Hinweisen enthalten sind. Sie sollten außerdem alle anderen Vorsichtsmaßnahmen treffen, die für den Betrieb des Systems innerhalb Ihrer Betriebsumgebung notwendig sind. Wenn Sie diese Vorsichtsmaßnahmen oder Sicherheitshinweise, die an anderer Stelle diese Handbuchs enthalten sind, nicht beachten, kann das Verletzungen oder Schäden am System zur Folge haben.

Emerson ist darauf bedacht, alle notwendigen Informationen zum Einbau und zum Umgang mit dem System in diesem Handbuch bereit zu stellen. Da es sich jedoch bei dem System um ein komplexes Produkt mit vielfältigen Einsatzmöglichkeiten handelt, können wir die Vollständigkeit der im Handbuch enthaltenen Informationen nicht garantieren. Falls Sie weitere Informationen benötigen sollten, wenden Sie sich bitte an die für Sie zuständige Geschäftsstelle von Emerson.

Das System erfüllt die für die Industrie geforderten Sicherheitsvorschriften und darf ausschließlich für Anwendungen in der Telekommunikationsindustrie, im Zusammenhang mit Industriesteuerungen und in der Entwicklung verwendet werden. Es darf nicht in sicherheitskritischen Anwendungen, lebenserhaltenden Geräten oder in Flugzeugen verwendet werden.

Einbau, Wartung und Betrieb dürfen nur von durch Emerson ausgebildetem oder im Bereich Elektronik oder Elektrotechnik qualifiziertem Personal durchgeführt werden. Die in diesem Handbuch enthaltenen Informationen dienen ausschließlich dazu, das Wissen von Fachpersonal zu ergänzen, können dieses jedoch nicht ersetzen.

Halten Sie sich von stromführenden Leitungen innerhalb des Systems fern. Entfernen Sie auf keinen Fall die Systemabdeckung. Nur werksseitig zugelassenes Wartungspersonal oder anderweitig qualifiziertes Wartungspersonal darf die Systemabdeckung entfernen, um Systemkomponenten zu ersetzen oder andere Anpassungen vorzunehmen.

Installieren Sie keine Ersatzteile oder führen Sie keine unerlaubten Veränderungen am System durch, sonst verfällt die Garantie. Wenden Sie sich für Wartung oder Reparatur bitte an die für Sie zuständige Geschäftsstelle von Emerson. So stellen Sie sicher, dass alle sicherheitsrelevanten Aspekte beachtet werden.

System Installation

Beschädigung des Systems
Bitte beachten Sie, dass die im Handbuch angegebenen Voraussetzungen erfüllt sein müssen, bevor Sie das System installieren.
Beachten Sie folgende allgemeinen Sicherheitshinweise bei der Installation des Systems:

- **Bereich mit eingeschränktem Zugang - Installieren Sie das System nur in Bereichen mit eingeschränktem Zugang.**
- **Installationsrichtlinien: Dieses System muss gemäß folgender Richtlinien installiert werden: National Electrical Code, Artikel 11016, 11017 und 11018 und Canadian Electrical Code, Abschnitt 12.a**
- **Überstrom Schutzeinrichtung - Eine leicht zugängliche Trennvorrichtung muss in der Gebäudeverkabelung eingebaut sein. Einen angemessenen AWG (American Wire Gauge - amerikanische Norm für Drahtquerschnitte) Wert der Überstrom Schutzeinrichtung können Sie der NEC (National Electrical Code) Tabelle 31016 oder anderen nationalen Regelwerken entnehmen.**
- **Der Erdungsleiter ist abhängig von der Spannungsverteilungstopologie innerhalb Ihrer Anlage. Stellen Sie sicher, dass Sie einen angemessenen Erdungsleiter gemäß der Auslegung des Zugangsleitungsschutzes verwenden.**
- **Bauen Sie das System sicher ein. Stellen Sie sicher, dass Kabel und Leitungen nicht im Weg sind.**

Stellen Sie sicher, dass der Systemaufbau anwenderfreundlich ist.

Beschädigung des Systems
Verschmutzungen der Systemumgebung können den reibungslosen Systembetrieb beeinträchtigen.
Betreiben Sie das System an einem erschütterungsfreien Ort, an dem weder Staub, Rauch noch elektrostatische Entladungen auftreten. Stellen Sie außerdem sicher, dass die klimatischen Bedingungen, die in diesem Handbuch spezifiziert sind, eingehalten werden und ausreichend Platz für eine angemessene Kühlung vorhanden ist.

Beschädigung des Systems
Die Gleichspannungseingänge des Systems dürfen ausschließlich an zugelassene Telekommunikationsnetzspannungen (TNV) oder Sicherheits-Kleinspannungs-Stromkreise (SELV) angeschlossen werden. Wenn Sie das System an andere Stromkreise als TNV/SELV Stromkreise anschließen, verfällt die Sicherheitszulassung.

Verletzungsgefahr und Beschädigung des Systems
Das System ist an eine TNV-2 Spannungsquelle angeschlossen. Diese Spannung kann gefährlich sein. Stellen Sie deshalb sicher, dass die externe Spannungsversorgung den entsprechenden Sicherheitsstandards entspricht.

Verletzungsgefahr und Beschädigung des Systems
Wenn die Gewichte im Schaltschrank ungleich verteilt sind, kann der Schaltschrank umkippen und Schäden am System oder Verletzungen verursachen.Bauen Sie das System deshalb ganz unten im Schrank ein, wenn es das einzige System im Schrank ist. Wenn mehrere Systeme in einen Schrank eingebaut werden sollen, platzieren Sie das schwerste System ganz unten und die leichteren weiter oben. Falls der Schaltschrank mit Kippsicherungen ausgestattet ist, stellen Sie sicher, dass diese auch installiert und ausgefahren sind, um einen sicheren Stand des Schranks zu gewährleisten. Beginnen Sie erst danach mit dem Einbau oder der Wartung des Systems.

Verletzungsgefahr und Beschädigung des Systems
Verhindern Sie ein unbeabsichtigtes Herunterfallen des Systems, das Verletzungen oder Beschädigungen am System zur Folge haben kann. Benutzen Sie zum Heben und Einbauen des Systems geeignete Hilfsmittel.

Verletzungsgefahr
Das System ist schwer.Benutzen Sie deshalb zum Ausbau oder Ersetzen des Systems geeignete Hebevorrichtungen. So vermeiden Sie Muskelzerrungen oder Rückenschäden.

Betrieb

Überhitzung des Systems
Lüftungsöffnungen
Unzureichende Lüftung kann Schäden an Blades und am System verursachen und die Herstellergarantie ungültig werden lassen.
Um eine ausreichende Lüftung zu gewährleisten, stellen Sie sicher, dass das System während des Betriebs waagerecht steht. Halten Sie die Lüftungsschlitze an der Oberseite, der Rückseite und den Seiten des Systems frei. Halten Sie die Frischluftzufuhröffnung an der unteren Vorderseite des Systems völlig frei und stellen Sie sicher, dass sich die Frischluft nicht mit der Abluft von anderen Systemen mischt. Um eine ungestörte Luftzirkulation zu gewährleisten, stellen Sie sicher dasss alle Slots mit Blades oder Platzhalter Blades belegt sind.

Überhitzung des Systems
Wenn Sie die Geschwindigkeit der Lüfter reduzieren, steigt die Systemtemperatur an. In diesem Fall müssen Sie die Systemtemperatur über die Sensoren der Lüftermodule regeln. Stellen Sie während des Betriebs sicher, dass die Bedingungen, die im Handbuch beschrieben sind, eingehalten werden.Beschädigung des Systems oder Verletzungsgefahr.

Abdeckungen
Falls Sie das System betreiben, ohne die freien Steckplätze abzudecken, verfällt die Herstellergarantie.
Nehmen Sie das System nur in Betrieb, wenn alle Steckplätze abgedeckt sind. Damit gewährleisten Sie eine optimale Kühlung für das System und vermeiden die Gefahr von Stromschlägen. Alle Abdeckungen müssen während des Systembetriebs an Ort und Stelle bleiben.

Beschädigung des Produktes, der Backplane oder von System Komponenten
Verbogene Pins oder lose Komponenten können zu einer Beschädigung des Produktes, der Backplane oder von Systemkomponenten führen.
Überprüfen Sie daher das Produkt sowie die Backplane vor der Installation sorgältig und stellen Sie sicher, dass sich beide in einwandfreien Zustand befinden und keine Pins verbogen sind.

Beschädigung des Systems
Luftfilter
Verunreinigungen in der Luft können den Luftfilter verschmutzen und so die Luftzufuhr des Systems beeinträchtigen. Das kann zur Überhitzung des Systems und zu Schäden an Systemteilen führen.
Luftfilter sollten mindestens alle 90 Tage ausgewechselt werden. Je nach Umgebungsbedingen kann dies auch früher nötig sein. Da die Verhältnisse in Vermittlungsstellen sehr unterschiedlich sein können, sollten Sie die Luftfilter nach der Erstinstallation des Systems jede Woche kontrollieren. In einer staubigen Umgebung muss ein Filter gegebenenfalls öfter gereinigt werden als in einer sauberen Umgebung. Prüfen Sie den Filter regelmäßig bis Sie eine Vorstellung davon haben, wie oft der Filter gereinigt werden muss. Erstellen Sie aufgrund Ihrer Beobachtungen einen Reinigungsplan und protokollieren Sie jede Reinigung oder jeden Austausch des Filters.

Beschädigung des Systems
Hohe Luftfeuchtigkeit und Kondensat auf den Oberflächen der Blades kann zu Kurzschlüssen führen.
Betreiben Sie das System nur innerhalb der angegebenen Grenzwerte für die relative Luftfeuchtigkeit und Temperatur und stellen Sie vor dem Einschalten des Stroms sicher, dass sich auf dem System und auf den Blades kein Kondensat befindet. Starten Sie das System nicht unter -5°C.

Verletzungsgefahr
Hoher Ableitstrom ist gefährlich und kann Verletzungen verursachen. Suchen Sie das Warnschild in der Nähe der Erdungsbolzen (kann von System zu System unterschiedlich sein) und stellen Sie eine Erdungsverbindung her, bevor Sie die PEMs anschließen.

Störung des Systembetriebs
Bevor Sie die PEMs austauschen, sollten Sie die Betriebsspannung des Systems optimieren.Stellen Sie Eingansspannung auf einen Nennwert von -48V bis -60VDC ein, um einen uneingeschränkten Systembetrieb während des PEM Austauschs zu gewährleisten.

Verletzungen oder Kurzschlüsse
Blade oder Stromversorgung
Falls die ORing Dioden des Blades durchbrennen, kann das Blade einen Kurzschluss zwischen den Eingangsleitungen A und B verursachen. In diesem Fall ist Leitung A immer noch unter Spannung, auch wenn sie vom Versorgungskreislauf getrennt ist (und umgekehrt).
Prüfen Sie deshalb immer, ob die Leitung spannungsfrei ist, bevor Sie Ihre Arbeit fortsetzen, um Schäden oder Verletzungen zu vermeiden.

Verletzungsgefahr
An der Rückseite des Systems befinden sich spitze Stifte, an denen Sie sich verletzen können.Seien Sie vorsichtig beim Umgang mit dem System.

Erdung

Stromschlaggefahr
Stromkabel
Erden Sie das Systemchassis, um das Risiko eines Stromschlags so gering wie möglich zu halten. Falls Sie das System nicht ordungsgemäß erden, kann dies außerdem zu vielfältigen Störgeräuschen, eletrostatischen Entladungen und Interferenzen im Hochfrequenzbereich führen.

Schäden an elektrischen Schaltungen
Statische Entladungen können elektrische Schaltungen zerstören.Berühren Sie keine integrierten Schaltkreise oder treffen Sie Vorsichtsmaßnahmen (ESD Armband oder Schuhe).

Schwere Verletzungen oder Tod
Dieses System wird mit gefährlichen Spannungen betrieben, die schwere Verletzungen oder Tod verursachen können.Gehen Sie deshalb extrem vorsichtig vor, wenn Sie mit dem System oder seinen Komponenten umgehen, es testen oder anpassen.

Stecker und Verkabelung

Beschädigung des Systems
Bei den RJ-45 Steckern, die sich auf den Boards befinden, handelt es sich entweder um Twisted-Pair-Ethernet (TPE) oder um E1/T1/J1-Stecker. Beachten Sie, dass ein versehentliches Anschließen einer E1/T1/J1 Leitung an einen TPE-Stecker Ihr System zerstören kann.

- **Kennzeichnen Sie deshalb TPE-Anschlüsse in der Nähe Ihres Arbeitsplatzes deutlich als Netzwerkanschlüsse.**
- **Stellen Sie sicher, dass die Länge eines mit Ihrem Systems verbundenen TPE-Kabels 100 m nicht überschreitet.**
- **Das System darf über die TPE Stecker nur mit einem Sicherheits-Kleinspannungs-Stromkreis (SELV) verbunden werden.**

Bei Fragen wenden Sie sich an Ihren Systemverwalter.

Verletzungsgefahr
Kabel, die nicht sicher angebracht sind, können zu Stolperfallen werden und Verletzungen verursachen.Stellen Sie sicher, dass die Kabel sicher installiert sind, um Verletzungen zu vermeiden. Verändern Sie nie die von Emerson ausgelieferte Verkabelung des Systems. Stellen Sie sicher, dass die Verkabelung schon existierenden Kabelführungen folgt und bestehende oder ähnliche Befestigungen verwendet. Überprüfen Sie nach der Erweiterung der Verkabelung, ob das System ordnungsgemäß arbeitet.

Beschädigung des Systems
Ein versehentliches Entfernen des Netzkabels während des Betriebs kann den Systembetrieb beeinträchtigen oder Schäden am System verursachen.Schließen Sie ein versehentliches Entfernen des Netzkabels während des Betriebs aus, indem Sie es am Chassis oder am Rack befestigen.

Verletzungsgefahr
Schließen Sie in jedem Fall aus, dass Personen durch einen elektrischen Schlag verletzt werden können, indem Sie sicherstellen, dass Kontakte und Kabel des Systems während des Betriebs nicht berührt werden können.
Falls Sie Fragen bezüglich der Verkabelung haben, wenden Sie sich an die für Sie zuständige Geschäftsstelle von Emerson.

Erweiterungen und FRU Austausch

Systemüberlastung
Verhindern Sie eine Systemüberlastung, indem Sie die gesamte aufgenomme Leistung aller eingebauten Komponenten, also z.B. der installierten Blades und Laufwerke (siehe die technischen Daten der entsprechenden Komponente) überprüfen. Stellen Sie sicher, dass der Ausgangsstrom jedes Verbrauchers innerhalb der zulässigen Grenzwerte liegt.

Verlust der Sicherheits- und EMV-Zulassung
Wenn Sie zusätzliche Blades installieren, können Sicherheits- und EMV-Richtlinien verletzt werden. Der Systemintegrator ist für die Einhaltung dieser Richtlinien verantwortlich.

Datenverlust
Das Herunterfahren oder die Deinstallation eines Boards bevor das Betriebssystem oder andere auf dem Board laufende Software ordnungsmemäss beendet wurde, kann zu partiellem Datenverlust sowie zu Schäden am Filesystem führen.
Stellen Sie sicher, dass sämtliche Software auf dem Board ordnungsgemäss beendet wurde, bevor Sie das Board herunterfahren oder das Board aus dem Chassis entfernen.

Beschädigung des Systems
Tauschen Sie den Lüfter innerhalb des vorgeschiebenen Wartungszeitraums von 1 Minute aus. So vermeiden Sie Beschädigung des Systems. Stellen Sie sicher, dass der Ersatzlüfter für den Austausch bereit ist.

Beschädigung des Systems
Ein beschädigter Filter kann Schwebstoffe nur ungenügend ausfiltern und den Luftstrom beeinträchtigen. Prüfen Sie einen gereinigten Filter auf Risse bevor Sie ihn wieder in Betrieb nehmen. Bauen Sie keine beschädigten Filter in das System ein. Sie können Ersatzfilter (Teilenummer RAF-1600/6E) bei der für Sie zuständige Geschäftsstelle von Emerson bestellen.

Beschädigung des Systems und Verletzungsgefahr
Lüfterschaufeln können sich noch bewegen, nachdem der Strom abgestellt ist. Wenn Sie die Lüfterschublade aus dem Chassis ziehen, werden die Lüfterschaufeln freigelegt. Sie können verletzt werden, wenn Sie Werkzeuge oder Finger in rotierende Lüfter einführen. Achten Sie deshalb beim Austausch der Lüfterschublade auf die rotierenden Lüfterschaufeln. Berühren Sie die Lüfterschaufeln erst, wenn diese still stehen.

Systemalarm
Falls Sie die Lüfterschublade während des Einbaus verkanten, kann dies einen Systemalarm auslösen. Installieren Sie die Lüfterschublade mit einer fließenden Bewegung und wenden Sie dabei keine Gewalt an.

Schäden an Steckern
Wenn Sie die Lüfterschublade mit Gewalt installieren, können die Anschlussstifte in den Steckern beschädigt werden. Falls sich die Lüfterschublade während der Installation verkantet, ziehen Sie die Lüfterschublade wieder heraus und führen Sie sie erneut ein. So vermeiden Sie Schäden an den Anschlussstiften in den Steckern.

Beschädigung des Systems
Tauschen Sie die PEMs innerhalb des vorgegebenen Wartungszeitraums von 3 Minuten aus. Der Austausch muss von erfahrenem Wartungspersonal durchgeführt werden.

Verletzungsgefahr
Stellen Sie sicher, dass das System abgeschaltet und von allen Stromversorungen getrennt ist, bevor Sie Systemkomponenten warten. So vermeiden Sie die Gefahr von Stromschlägen. Lesen Sie den Abschnitt *Grounding the Shelf* on page 80 für weitere wichtige Informationen bezüglich Erdung von Gleichstromsystemem.

Verletzungsgefahr
Sie können sich an heissen PEMs verletzen.Lassen Sie die PEMs abkühlen, bevor Sie mit bloßen Händen herausziehen.

Verletzungsgefahr
Sie können die PEMs nicht allein dadurch spannungsfrei schalten, dass Sie den Trennungsschalter an den PEMs in die OFF Stellung stellen. Die PEMs bleiben unter Spannung, bis die -48V Spannung von jedem PEM vollständig entfernt ist.Stellen Sie deshalb sicher, dass Sie die Spannung an der externen Spannungsversorgung ausschalten. Warten Sie außerdem eine Minute, bis die Kondensatoren im PEMs entladen sind, bevor Sie die PEMs aus dem Chassis entfernen.

Verletzungsgefahr
Innerhalb des Gehäuses gibt es gefährliche Spannungen. Berühren Sie keine Anschlüsse innerhalb des Gehäuses, um ernsthafte Verletzungen oder Tod durch Stromschlag zu vermeiden. PEMs dürfen nur von ausgebildetem Wartungspersonal ein- oder ausgebaut werden.

Systemalarm
Falls Sie ein PEM während des Einbaus verkanten, kann dies einen Systemalarm auslösen.Installieren Sie ein PEM mit einer fließenden Bewegung und wenden Sie dabei keine Gewalt an.

Schäden an Steckern
Wenn Sie ein PEM mit Gewalt installieren, können die Anschlussstifte in den Steckern beschädigt werden.Falls sich ein PEM während der Installation verkantet, ziehen Sie das PEM wieder heraus und führen Sie sie erneut ein. So vermeiden Sie Schäden an den Anschlussstiften in den Steckern.

Umweltschutz

Umweltschutz
Entsorgen Sie alte Blades, RTMs und Systeme gemäß der in Ihrem Land gültigenGesetzgebung und den Empfehlungen des Herstellers.

EMV

FCC Class A
Das Produkt wurde getestet und erfüllt die für digitale Geräte der Klasse A gültigen Grenzwerte gemäß den FCC-Richtlinien Abschnitt 15 bzw. EN 55022 Klasse A. Diese Grenzwerte sollen einen angemessenen Schutz vor Störstrahlung beim Betrieb des Produkts in Geschäfts-, Gewerbe- sowie Industriebereichen gewährleisten. Das Produkt arbeitet im Hochfrequenzbereich und erzeugt Störstrahlung. Bei unsachgemäßem Einbau und anderem als in diesem Handbuch beschriebenen Betrieb können Störungen im Hochfrequenzbereich auftreten.
Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.
Benutzen Sie zum Anschließen von Peripheriegeräten ausschließlich abgeschirmte Kabel. So stellen Sie sicher, dass ausreichend Schutz vor Störstrahlung vorhanden ist.
Die Blades müssen mit der Frontblende installiert und alle freien Steckplätze müssen mit Blindblenden abgedeckt sein.
Änderungen, die nicht ausdrücklich von Emerson erlaubt sind, können Ihr Recht das System zu betreiben zunichte machen.

Platform Architecture

1

1.1 Shelf Overview

The versatile, highly available AXP1406 is designed as an open standard platform on which to run applications in the Telecom Central Office environments. The AXP1406 combines existing PICMG standards featuring high speed serial data fabrics. These standards serve to streamline the architecture by eliminating the overhead of bridging, increasing payload, and eliminating the need for system and nonsystem slot blades. This is accomplished by using the Intelligent Platform Management Interface (IPMI) and dual Ethernet star network which allows for communication between all node blades using Ethernet.

The AXP1406 is a high-availability platform with special locations for Shelf Management Alarm Modules (SAMs), fourteen 8U x 280mm slots, fourteen 8U x 70 mm rear transition modules, Fan Tray Modules, (FTMs), and Power Entry Modules (PEMs).

1.2 PICMG Compliance

The AXP1406 is designed to be compliant with PCI Industrial Computers Manufacturer's Group (PICMG) specifications 3.0 and 3.1, and also provides support for PICMG 1.5.1 IPMI bus for system management.

1.3 Shelf Topology

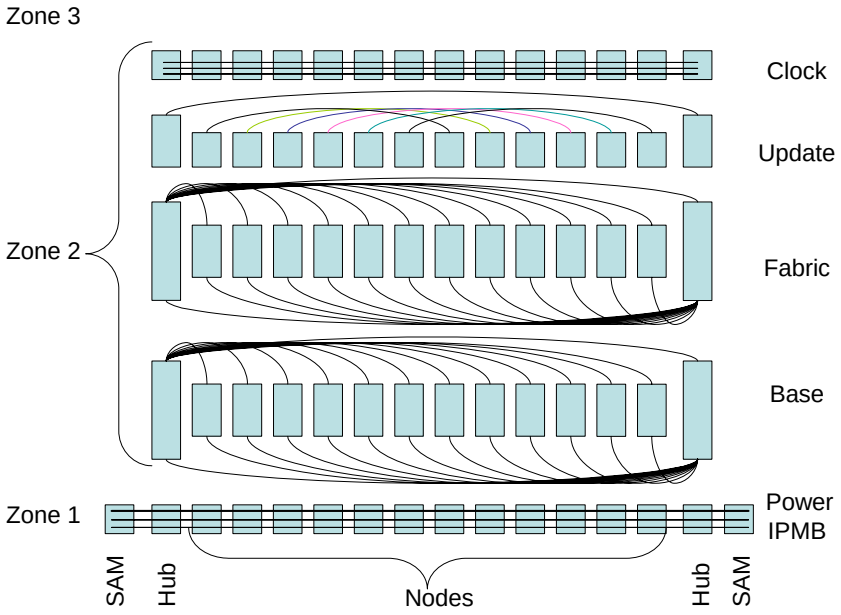
Topology refers to the shape of a network, or the network's physical layout. The way that different nodes in a network are connected to each other and how they communicate are determined by the network's topology.

The backplane of the AXP1406 uses a dual star topology that supports two independent networks. The dual star uses a point-to-point configuration with redundancy added for reliability. All devices on a star network are connected to a central connection point (hub). Nodes communicate across the network by passing data through the hub slot, which on the AXP1406 contains a switching function that forwards packets to the appropriate port based on the packet's address. Switching hubs support traditional Ethernet (10 Mbps), Fast Ethernet (100 Mbps), and Gigabit Ethernet (1000 Mbps) ports.

1.4 Shelf Interfaces

This section describes the operational aspects of each of the shelf's network designs, based on the Base and Fabric interfaces.

Figure 1-1 AdvancedTCA Shelf Interfaces



1.4.1 Base Interface

The blade slots are numbered physically from 01 to 14 going left to right along the front of the shelf. Each slot also has a "logical" slot number that defines it for backplane connectivity; logical slot numbers are not shown on the shelf. Please note that the slots are referred to by their physical slot location.

The base hub slots (physical slots 1 and 14) have four pairs of 1000Base-T signals to node slots which form the dual star topology fabric. Each of the node slots support two base channel interface signals that connect to each hub slot. In turn, the channel 1 base interface of each hub slot is connected to the SAM. Each of the hub slots support a total of 14 base channels.

The hub slots require connectors P23 and P24. The base node slots require only connector P23.

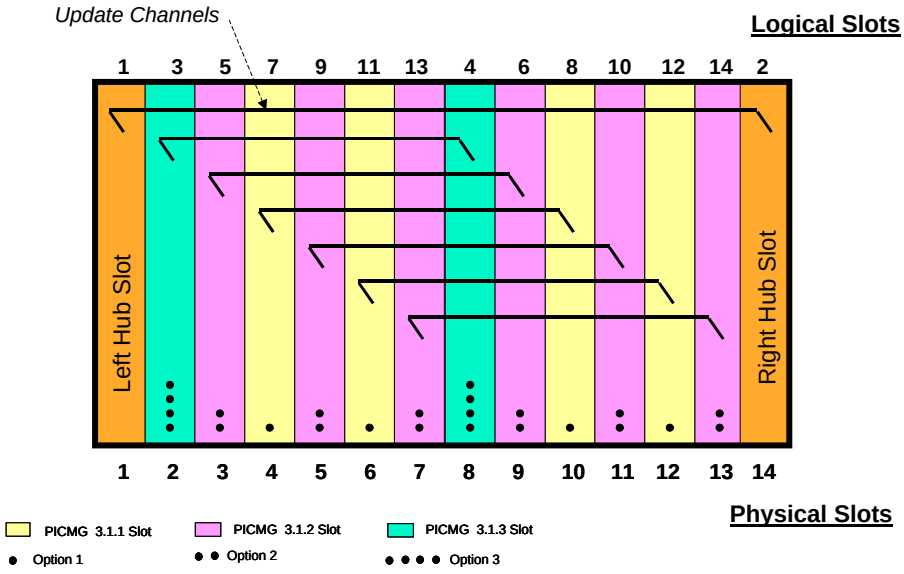
1.4.2 Fabric Interface

The fabric interface supports point-to-point connections between AdvancedTCA blades. In the AXP1406, these fabric connections are configured in a dual star topology that runs back to the hub slots. The AXP1406 system has one, two, or four channel slots. These channels are aggregated at the hub slots into the dual-star topology. In this configuration all node slots support one fabric channel to each of the two hub slots.The fabric channels are located on connector P20 of the node slots, and connectors P20, P21, P22, and P23 of the hub slots.

The implementation of the interface is indicated by the level of PICMG compliance a blade or hub is designed to. For example, on the AXP1406, the fabric interface provides to each fabric slot in an AdvancedTCA shelf. The PICMG 3.1 fabric interface switch supports PICMG 3.1 Option 1 Gigabit Ethernet links to all slots and PICMG 3.1 Option 2 and 3 links to selected slots, providing a bandwidth of up to 4Gbps to support high bandwidth and/or latency sensitive traffic.

A PICMG 3.1 compliant hub provides 1000BASE-BX to the fabric interface of a PICMG 3.1 compliant blade.

Figure 1-2 Fabric Option 1, 2, and 3



The fabric interface switch is also extended outside the AXP1406 shelf via eight external connectors on the RTM.

1.5 IPMI Network

The Intelligent Platform Management Interface (IPMI) is based on a redundant radial topology. Redundant IPMI networks are supported by the Shelf Management Alarm Module (SAM) to manage the shelf resources.

The SAM is the center of the IPMI network; hubs are the center of the Base Interface network. The SAM connects to all slots in the shelf and monitors and reports on the content of the AXP1406. The SAM collects environmental data from sensors within the shelf and can assist high availability software to determine when a failover is necessary due to hardware removal or environmental changes, such as an over-temp condition.

The SAMs contain the Shelf Management Controller (ShMC) which polls all devices resident to the shelf and collects the FRU data records for all the components. The SAM also manages non-IPMI devices for the shelf and performs environmental monitoring of the temperature and voltage. Using the PICMG 3.0 standard, the SAM is able to power off and reset slots for hot swap capability.

1.6 Update Channel Interface

The update channel interface consists of 10 differential pairs on the P20 connector. The physical layer and protocol used on this interface is application specific.

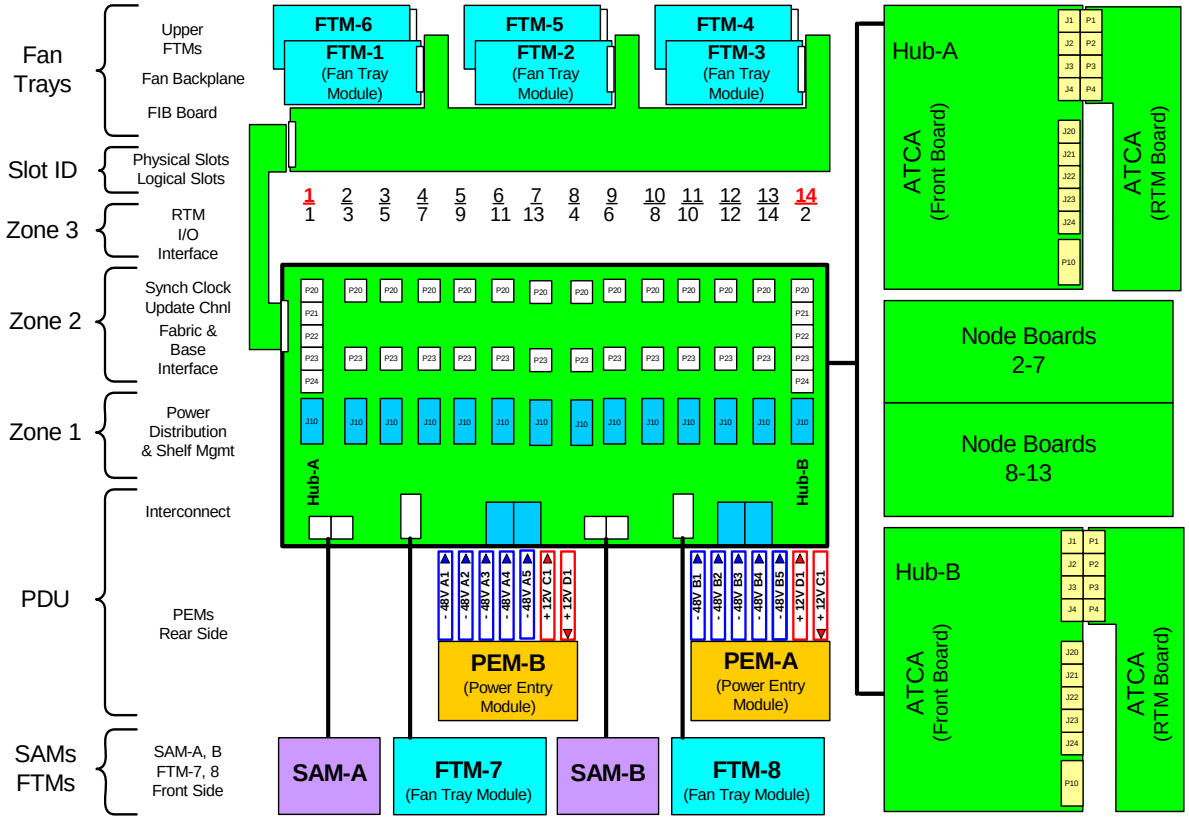
1.7 Backplane and Component Connectivity

The blade connectivity on the AXP1406 backplane is divided among three zones, each with the following characteristics:

- Zone 1 provides redundant, radial IPMI to all blade slots and redundant -48 VDC to all blade slots
- Zone 2, the data transport interface, provides the dual star configuration for the base interface, dual star configuration for the fabric interface, update channel routing for all blade slots, and three redundant, bussed telecom clock signals to all blade slots
- Zone 3 provides the PICMG 3.0 defined open area that is application specific

  Rear Transition Modules connect directly with the connectors on the front-side blade and do not make the connection via the backplane.

Figure 1-3 Location of Zones 1, 2, and 3



1.8 Operating Systems

The AXP1406 comes installed with the following software:

- MontaVista CGE 4.0
- Enhanced Basic Blade Services (BBS)

For more information, contact your Emerson sales representative for other software products for your configuration.

1.9 Remote Management and Maintenance

The AXP1406 supports remote critical management and maintenance procedures. This eliminates the need for on-site maintenance personnel to handle routine maintenance tasks. A standard Telnet connection for remote access to networked functionality provides the ability to:

- Upgrade IPMI firmware flashed on the SAMs, PEMs, node and hub blades
- Upgrade BIOS

- Access in-service application software upgrades
- Access IPMI event logs for performance monitoring
- Access custom designed-in functionality or event logs

Shelf Description

2

2.1 Overview

The AXP1406 shelf supports 14 AdvancedTCA blade slots, of which 12 are I/O node slots that can be populated with task CPU processor blades, network processor blades, or any other blade designed for a specific application, and two slots for the system controller and switching blades. There are slot locations below the AdvancedTCA slots in the front of the shelf for the two SAMs (shelf management alarm modules). All slots comply with PICMG 3.0 for power distribution and form factor and use the PICMG 3.1 for Ethernet and Dual Star interface. The shelf's other components include two Power Entry Modules (PEMs), six upper Fan Tray Modules (FTMs), two lower FTMs, Logo Cover Plate, and a Cable Management tray.

As of the printing date of this manual, the information in this manual applies to only the shelf and backplane, power entry modules (PEMs), fan tray modules (FTMs), and Shelf Management Alarm Modules (SAMs) as identified in the following table. When ordering spare parts, use the order numbers given below. Consult your local sales representative for ordering information on spare parts not listed.

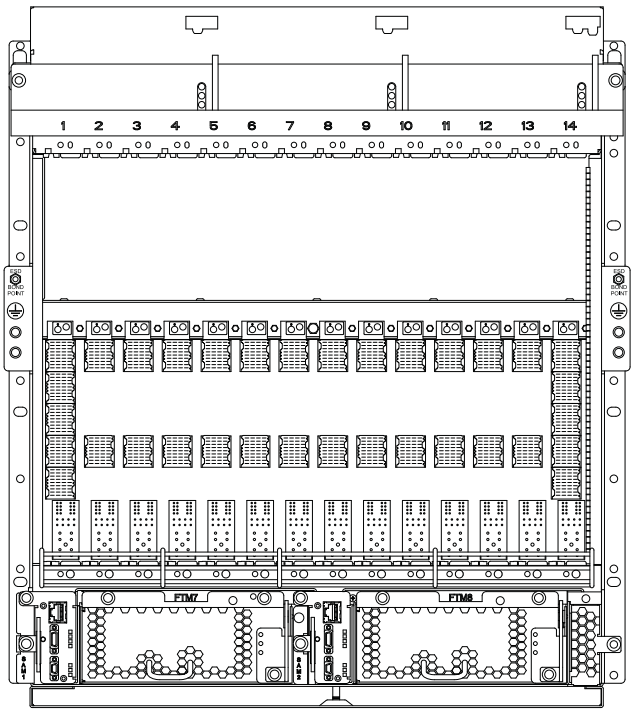
Marketing Model Number	Description
CENT-3406-R3.1-01	Centellis 3406, R3.1 platform core AXP1406 14-slot chassis, one ATCA-F102, and SA-BBS-MV-F102-R3.1 software package
CENT-3406-R3.1-02	Centellis 3406, R3.1 platform core AXP1406 14-slot chassis, two ATCA-F102s, and two SA-BBS-MV-F102-R3.1 software packages
The following part numbers can be ordered only as spare FRUs for existing customers.	
AXP1406-C3R3.1	ATCA 14-slot shelf, spare only
ATCA-F102	ATCA-F102 System Controller and Switching Blade w/1.0 GB Memory
TFT-F-1406/6E	Top Front Fan Tray
TFT-R-1406/6E	Top Rear Fan Tray
BFT-F-1406/6E	Bottom Front Fan Tray
RAF-1406/6E	Replaceable Air Filters
PEM1000-C3R3.1	Power Entry Module
SAM1000-C3R3.1	Shelf Manager and Alarm Module
AXP-F-PANEL	AXP1406 Shelf blank panel, front
AXP-R-PANEL	AXP1406 Shelf blank panel, rear
6706808A01	Right Angle Cable Lug Kit
6706808A02	AdvancedTCA PEM Service Kit

2.2 Platform Features

The AXP1406 includes the following features:

- 14-slot card cage with 14 rear transition module (RTM) slots
- Two Shelf Management Alarm Modules
- Up to two PICMG 3.0 compliant System Controller and Switching blades
- Two DC hot-swappable, N+1 redundant Power Entry Modules
- Fan Trays Modules, six upper and two lower
- Front access service and installation of blades, FTMs and SAMs
- Rear access service and installation of transition modules, FTMs and PEMs
- Air intake plenum at bottom of shelf for additional cooling capacity
- Cable management tray
- Logo Cover Plate
- Filler panels for front and rear slots

Figure 2-1 Front Shelf View



The following figure shows the location of each of the components in the AXP1406.

Figure 2-2 ISO View, AXP1406 Shelf

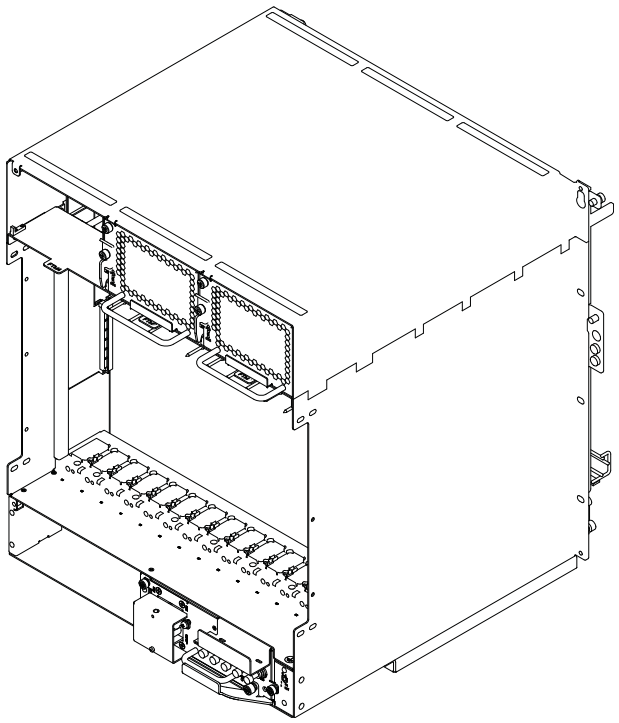


Figure 2-3 Rear Shelf View

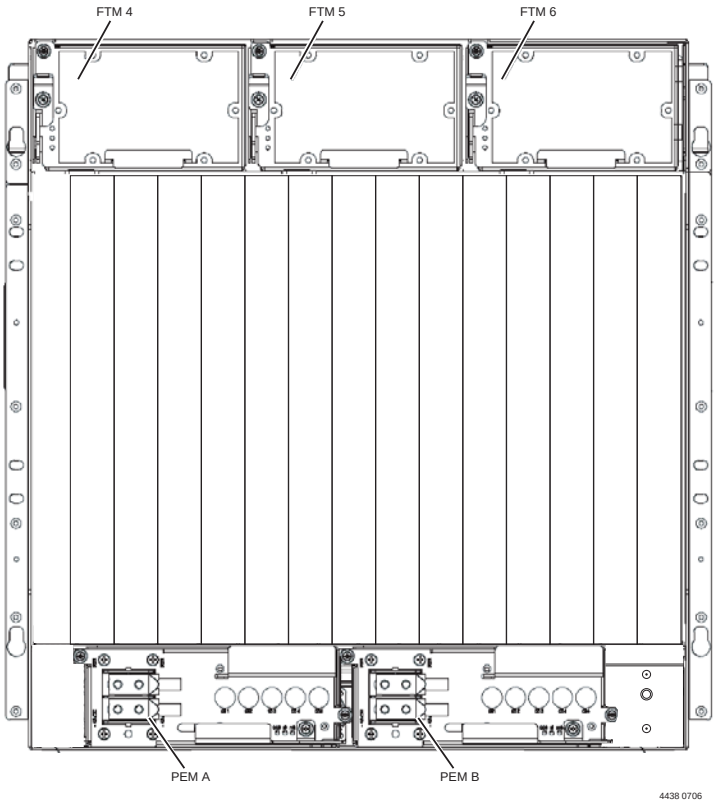


Figure 2-4 Logo Cover Plate

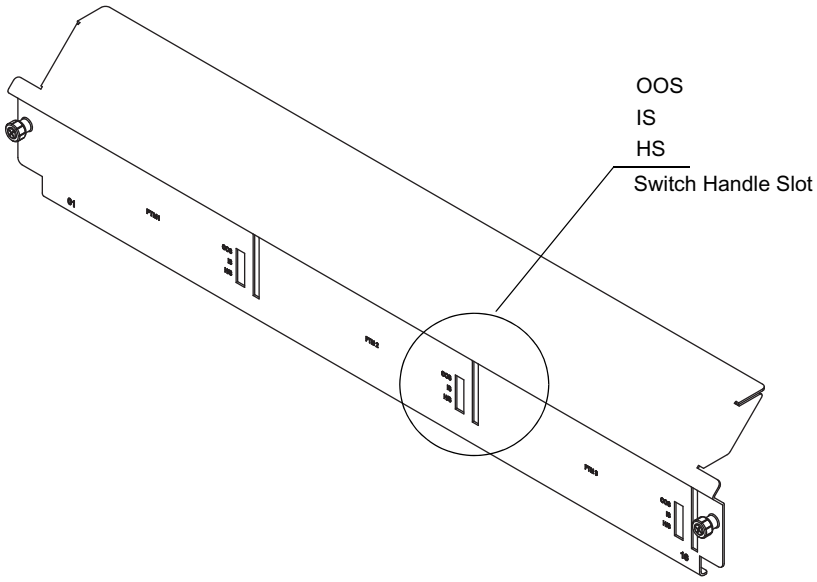


Figure 2-5 Logo Cover Plate

2.3 Enclosure

The AXP1406 shelf consists of a formed 12-1/2U sheet metal card cage with structure and support for the backplane, PEMs, FTMs, SAMs, and 14 card slots. Figure 2-1 on page 40 provides a front view of the shelf. On the front bottom of the shelf is an air intake plenum, which is designed in for additional air intake capacity. The AXP1406 shelf also has a logo cover plate that covers the three, upper front FTMs and allows for LED observation.

The enclosure mounts in a 19" EIA or 600mm ETSI frame using front mounting brackets. Mounting holes for bezel brackets are provided, which allows the use of power supply or card cage (customer designed) bezels. See Appendix A, *Specifications* for details on the physical characteristics of the enclosure.

2.4 Power Consumption

The following table shows the total power requirements for the shelf.

Table 2-1 AXP1406 Shelf Power Requirements

Amps per Fan	Maximum Total Watts
AXP1406 Shelf without AdvancedTCA Blades	400 watts
Assumes the shelf is configured with 2 SAMs, 2 PEMs, and all FTMs running at full speed.	

2.5 Shelf Ground Configuration

The AXP1406 shelf was tested in the default configuration of logic ground and shelf ground and does not connect -48VDC Return with Shelf Ground. The Centellis 3406 platform has been tested in the default configuration and complies with safety and regulatory standards.

As a compliant AdvancedTCA shelf, the AXP1406 allows system integrators, at their own discretion, to remove the mechanism which connects Logic Ground to Shelf Ground and install the mechanism that connects -48VDC Return to Shelf Ground. If the system integrator exercises the option of removing the connections from Logic Ground to Shelf Ground and or adds the connection between -48VDC Return and Shelf Ground, the responsibility for maintaining compliance to CSA (C/US)/VDE safety requirements and EMI/RFI emission limits rests entirely with the system integrator and installer.

2.6 Backplane

The shelf backplane supports 2 hub slots, 12 node slots, and two SAMs. This AdvancedTCA backplane provides the IPMB and I^2C bus interface signals from the shelf manager to all AdvancedTCA blades and the other FRUs. The backplane provides signal routing for fail-over signals between active SAM and standby SAM. The power connectors for the power entry modules are located on the backplane. The backplane is not a Field Replaceable Unit (FRU).

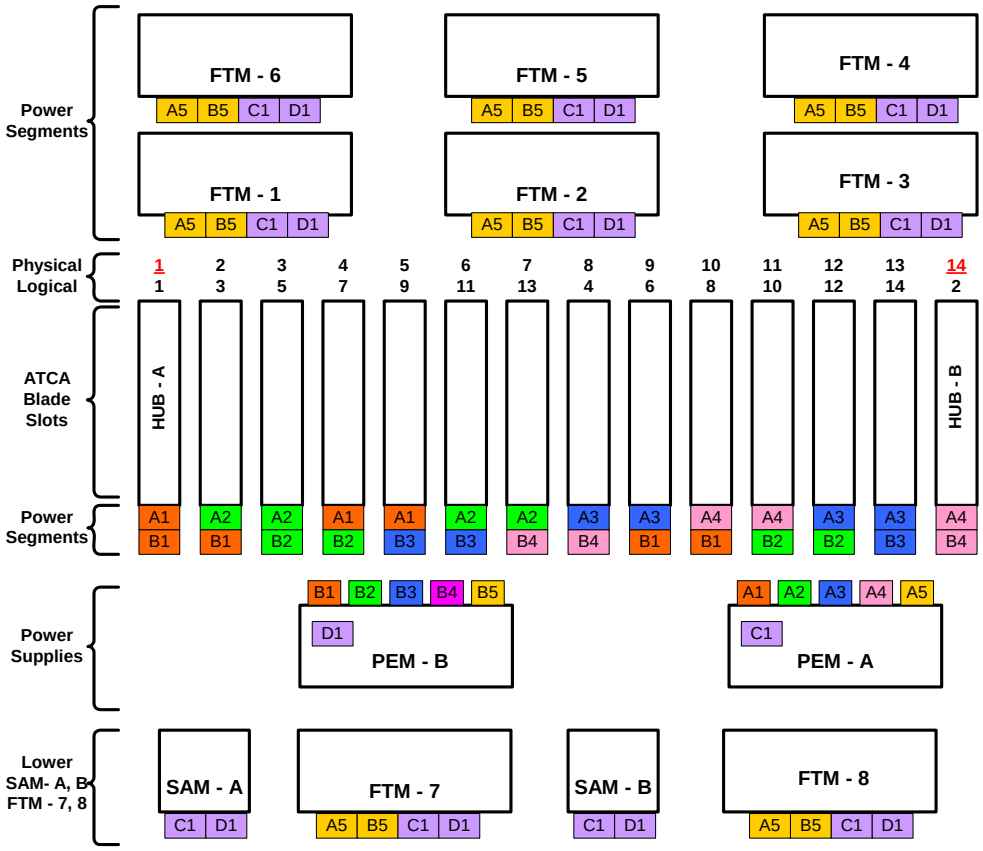
2.6.1 Functional Layout

The backplane provides dual star base interface and dual star fabric interface connections at each slot with segmented power (five power segments) provided by the dual Power Entry Modules (PEMs).

The blade slots are numbered physically from 01 to 14 going left to right along the front of the shelf. Each slot also has a “logical” slot number that defines it for backplane connectivity; logical slot numbers are not shown on the shelf. The backplane functional layout is shown in the following figure.

Please note that the slots will be referred to logically, not by their physical slot location.

Figure 2-6 Backplane Power Segments



2.6.2 Shelf Card Rail Guide

The following table describes the card rail guide for slots 1 through 14 of the backplane. The slot locations are identified by labels in front of the card rail guide that show the physical slot location of the AdvancedTCA blade slots,

Table 2-2 Card Rail Guide

SAM A and SAM B	Controller/Switching Blades	Node Blades
Slot #SAM A and Slot #SAM B	Slots #1 and #14	Slots #2 through #13

2.6.3 E-Keying

The AXP1406 supports the shelf management infrastructure with a process called E-Keying. E-Keying replaces the mechanical connector keying method used in earlier backplane designs. E-Keying prevents damage to blades, prevents misoperation, and verifies fabric compatibility.

E-Keying entries are present as FRU information in the shelf FRU and all blades present in the shelf. The E-Keying entries describe the Base Interface, Fabric Interface, Update Channel Interface as implemented by the shelf and blades. E-keying allows blades that support different PICMG 3 standards to be used in the same shelf.

More detailed information, such as connectivity and requirements for E-Keying can be found in PICMG 3.0 R1.0 AdvancedTCA Specification and in the *AXP1406/AXP1600 Shelf Subsystem IPMI Programmer's Reference*.

2.6.4 Shelf FRU Information

The SEEPROM is located on the PEM's circuit board; the FRU information for the PEM is contained in FRU 0. The PEM IPMC firmware exposes an additional FRU (FRU 1) in which the shelf FRU information is stored. This information is accessed by using the standard IPMI FRU commands over the IPMC. Refer to the *AXP1406/AXP1600 Shelf Subsystem IPMI Programmer's Reference* listed in Appendix B, *Related Documentation*.

The SAM queries all IPMCs during system startup to determine whether they are a source of shelf FRU information and then uses that information to complete initialization. The information is cached as FRU 254 on the active ShMC (0x20). The information in the SEEPROM is only needed when the SAMs are first inserted or when the shelf is powered on for the first time. The redundancy feature provides the shelf-specific information should one SEEPROM be nonfunctional.

2.6.5 Backplane Slot Connectors

The following table provides a summary of what resides on each of the slot connectors.

Table 2-3 Slot Connector Description

Connector	Slots 1 and 14 (Physical) Switches	Slots 2-13 (Physical) Node
J10	Power, IPMB, Hardware Address	Power, IPMB, Hardware Address
P24	Base	N/A
P23	Fabric and Base	Base
P22	Fabric	N/A
P21	Fabric	N/A
P20	Clocks, Update, Fabric	Clocks, Update, Fabric

The following table provides connector-specific information for the backplane slots.

Table 2-4 Backplane Connectors

Zone	Connector	Where Used	Quantity
3			
2	P20	Slots 1 thru 14	14
	P21	Slots 1 & 14	2
	P22	Slots 1 & 14	2
	P23	Slots 1 thru 14	14
	P24	Slots 1 & 14	2
1	J10	Slots 1 thru 14	14
N/A	SAM1_J1 & SAM2_J1	SAM A & B	2
	SAM1_J2 & SAM2_J2	SAM A & B	2
	PEM1_J1 & PEM2_J1	PEM A & B	2
	PEM1_J2 & PEM2_J2	PEM A & B	2
	FTM7_J1, FTM8_J1	Lower Fan 7 & 8	5
	FIB_J1	FTM Interconnect	1

Table 2-5 Other Backplane Connectors

Connector #	Where Used	Quantity
J1	SAM A & B	2
J2	SAM A & B	2
J1	PEM A & B	2
J2	PEM A & B	2
J1,J2, J3, J4, and J5	FTM Backplane	5

Table 2-5 Other Backplane Connectors (continued)

Connector #	Where Used	Quantity
J7	FTM Backplane	1
J1	Fan Tray	8
J1, J2	FTM Interconnect	2

Please note that the slots in the next table are referred to their logical and physical slot location.

Table 2-6 Slot Hardware Addressing for J10

Logical Slot	Physical Slot	HW Address	HA7	HA6	HA5	HA4	HA3	HA2	HA1	HA0
1	1	41h	Gnd	Open	Gnd	Gnd	Gnd	Gnd	Gnd	Open
2	16	42h	Gnd	Open	Gnd	Gnd	Gnd	Gnd	Open	Gnd
3	2	43h	Open	Open	Gnd	Gnd	Gnd	Gnd	Open	Open
4	9	44h	Gnd	Open	Gnd	Gnd	Gnd	Open	Gnd	Gnd
5	3	45h	Open	Open	Gnd	Gnd	Gnd	Open	Gnd	Open
6	10	46h	Open	Open	Gnd	Gnd	Gnd	Open	Open	Gnd
7	4	47h	Gnd	Open	Gnd	Gnd	Gnd	Open	Open	Open
8	11	48h	Gnd	Open	Gnd	Gnd	Open	Gnd	Gnd	Gnd
9	5	49h	Open	Open	Gnd	Gnd	Open	Gnd	Gnd	Open
10	12	4Ah	Open	Open	Gnd	Gnd	Open	Gnd	Open	Gnd
11	6	4Bh	Gnd	Open	Gnd	Gnd	Open	Gnd	Open	Open
12	13	4Ch	Open	Open	Gnd	Gnd	Open	Open	Gnd	Gnd
13	7	4Dh	Gnd	Open	Gnd	Gnd	Open	Open	Gnd	Open
14	14	4Eh	Gnd	Open	Gnd	Gnd	Open	Open	Open	Gnd

Table 2-7 Fan Hardware Addressing

Physical Slot	HW Address	Site Type	HA7	HA6	HA5	HA4	HA3	HA2	HA1	HA0
Fan 1	1	04h					Gnd	Gnd	Gnd	Open
Fan 2	2	04h					Gnd	Gnd	Open	Gnd
Fan 3	3	04h					Gnd	Gnd	Open	Open
Fan 4	4	04h					Gnd	Open	Gnd	Gnd
Fan 5	5	04h					Gnd	Open	Gnd	Open
Fan 6	6	04h					Gnd	Open	Open	Gnd
Fan 7	7	04h					Gnd	Open	Open	Open
Fan 8	8	04h					Open	Gnd	Gnd	Gnd

Table 2-8 SAM and PEM Hardware Addressing

Logical Slot	Physical Slot	HW Address	Site Type	HA7	HA6	HA5	HA4	HA3	HA2	HA1	HA0
	PEM A	1	01h							Gnd	Open
	PEM B	2	01h							Open	Gnd
	SAM A	1	03h							Gnd	Open
	SAM B	2	03h							Open	Gnd

2.6.6 Zone Locations on a Blade

The backplane provides dual star Base Interface and dual star Fabric Interface connections at each slot with segmented power (four power segments) provided by the dual Power Entry Modules (PEMs).

- Zone 1 provides the system management and power interfaces, such as redundant -48VDC power and IPMB
- Zone 2, the data transport interface, provides the Base and Fabric interfaces, Update Channels, and clock synchronization via the ZD connectors per front-side blade
- Zone 3 provides the direct interconnect for user designated I/O
  Rear Transition Modules connect directly with the connectors on the front-side blade and do not make the connection via the backplane.

Figure 2-7 Blade Slot Connectivity

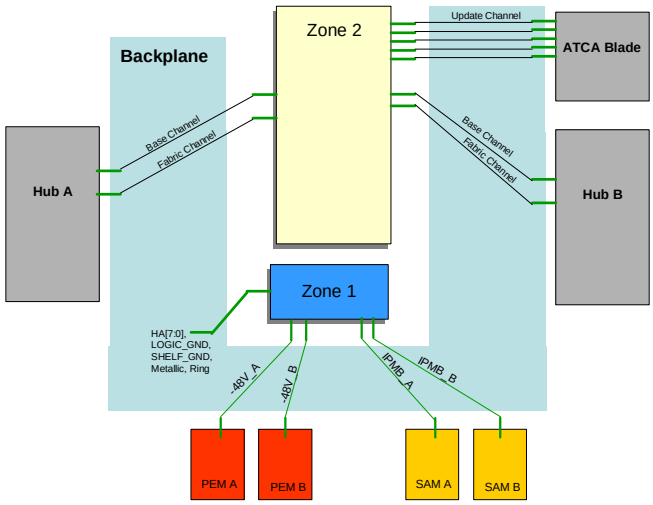
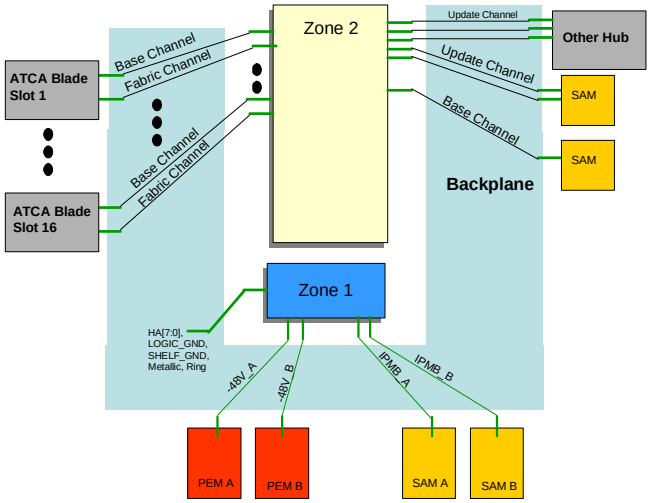


Figure 2-8 Hub Slot Connectivity



2.7 Fan Tray Modules (FTM)

The AXP1406 supports six upper and two lower hot swappable FTMs. Each upper FTM houses two fans each (for a total of 12 fans) and are arranged front and rear for maximum volume airflow, even distribution, and fault resilience (N+1 at the fan level).The two lower FTMs are front accessible modules, each with two fans, that provide a total of four fans for cooling of the rear transition modules and PEMs in the shelf. The upper FTMs connect to the Fan Interconnect board for signal and power; and the lower FTMs draw their power directly from the backplane.

NOTICE

System Damage
For optimal cooling of the AXP1406 shelf and associated payload, all vacant slots in the front and rear of the shelf are required to have approved filler panels or filler modules installed.
Operating the shelf without covering vacant slots will void the manufacturer's warranty.

A front plate covers the upper front FTMs and must be replaced after removing an upper front FTM for service. Replacement for an FTM can take place in under 3 minutes by a trained service person.

The FTM has an ejector handle which signals the IPM Sentry software for hot swap. The face plate of the upper and lower FTMs has the following indicators:

Table 2-9 LED Descriptions

FTM LED	LED Color	State/Condition
[1]In-Service (IS)	Green	Off: no service Blink: FTM activating Glow Steady: service available
[1]Out-of-Service (OOS) and Failure	Red	Off: service available Blink: Deactivation requested Glow Steady: no service
Hot Swap (HS)	Blue	Off: FTM is not ready to be removed Blink: Deactivation requested Glow Steady: FTM is ready to remove
[1]If your system is not running high-availability software, behavior of the LED may be indeterminate.		

The following diagram provides a conceptual view of the connections between the FTMs, backplane, PEMs, and SAM blades.

Figure 2-9 Fan Tray Module Connectivity

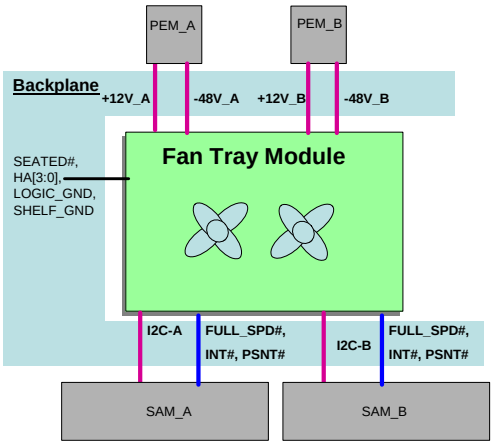


Figure 2-10 Lower Fan Tray Module, Front View

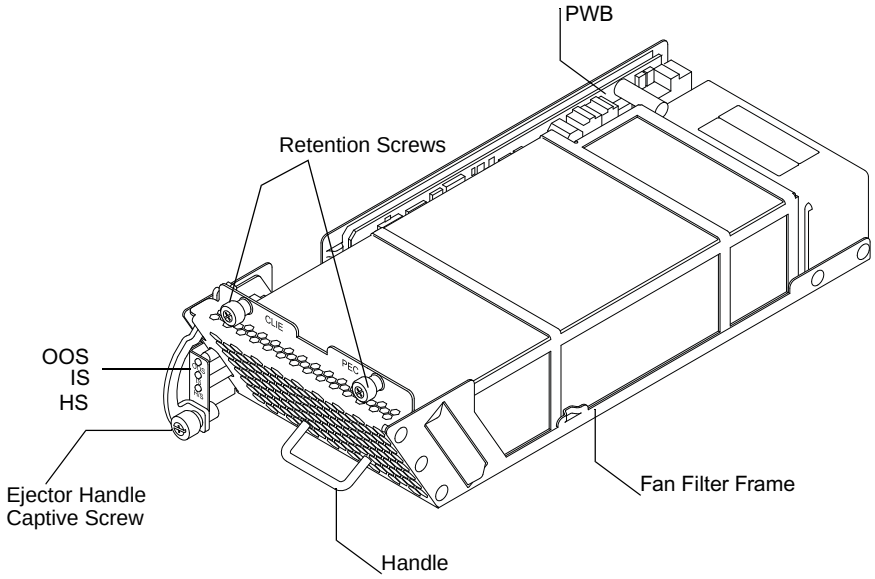


Figure 2-11 Upper Front Fan Tray Module, Front View

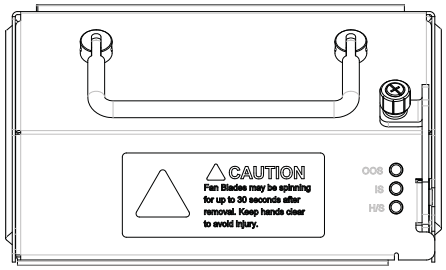


Figure 2-12 Upper Front Fan Tray Module, ISO View

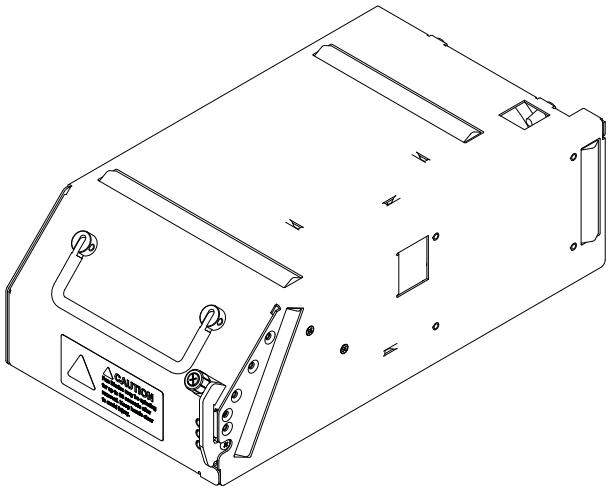


Figure 2-13 Upper Front Fan Tray Module LED and Switch Detail

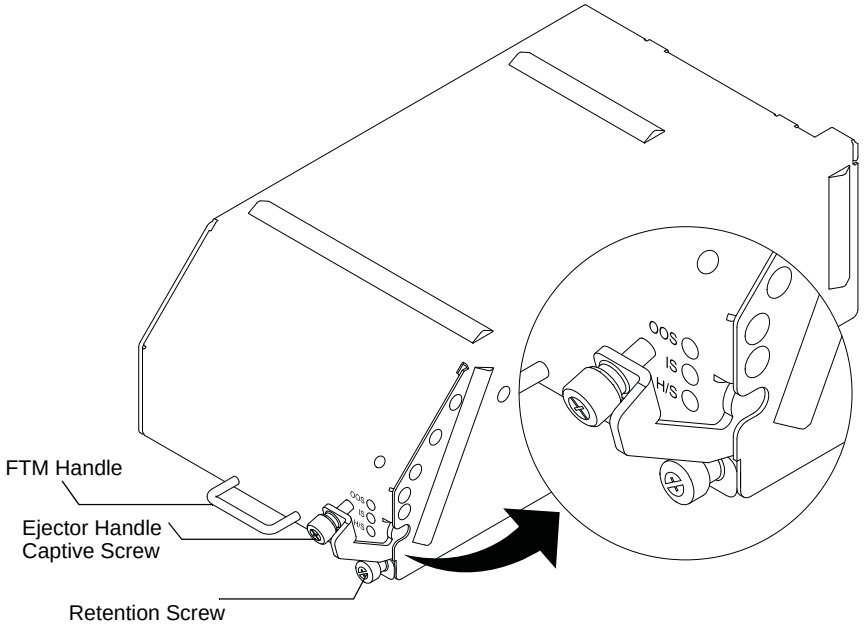
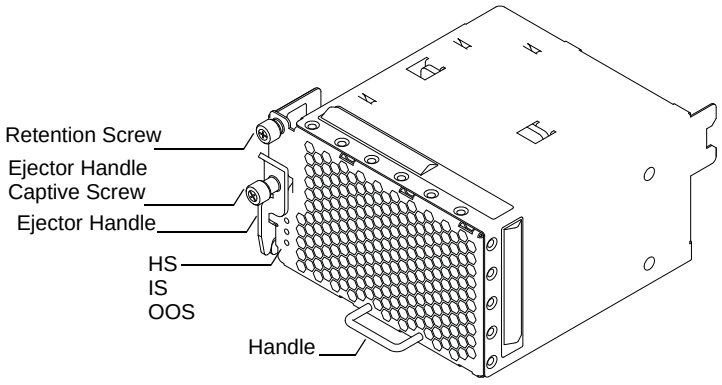


Figure 2-14 Upper Rear Fan Tray Module, Front View



2.8 Power Entry Module (PEM)

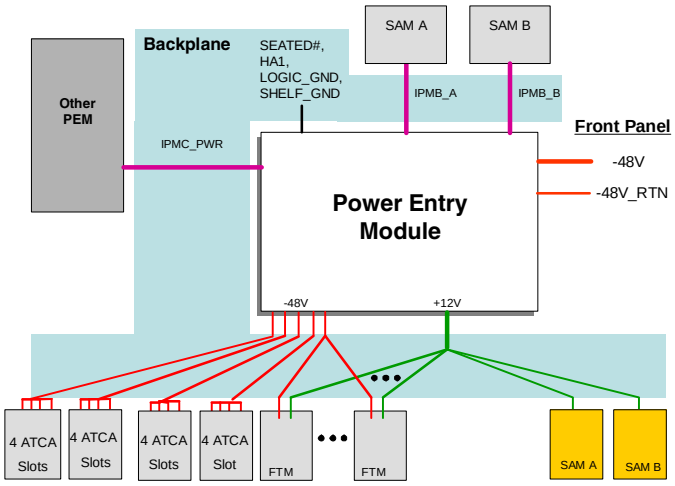
The PEM is a Field Replaceable Unit (FRU) and can be replaced while the system is on, but the power for the PEM being replaced (PEM A or PEM B) must be shut down at the external source. Ensure that the circuit breakers are in the off position and the cables are removed from the PEM before making the replacement. Replacement can take place in under 30 minutes by a trained service person.

For important information on removing power before replacing a PEM, refer to *Recommended Power-Off Procedures* on page 66 and *Power Entry Module* on page 66.

The PEMs are accessible from the back side of the shelf and connect to the power entry module connectors on the backplane. A removable plastic housing covers the power feeds and returns to prevent accidental shorting. The PEM also features an injector/ejector handle that provides the hot swap mechanism for signalling the state of the PEM prior to removal.

The PEMs are hot-swappable and will not cause a fault when one is removed for replacement. Two PEMs are required to support N+1 redundancy. If your system is configured for redundant operation using two power feeds, they operate in load sharing where the total load is equal to or less than what one power feed can provide.

Figure 2-15 PEM Connectivity



Each of the PEMS are equipped with five push/pull (plunger-type) circuit breakers, three status LEDs, hot swap ejector handle, and a plastic cover that protects the dual stud terminal block. The rear of the PEM has two output connectors that mate with the backplane.

Figure 2-16 Power Entry Module, Front View

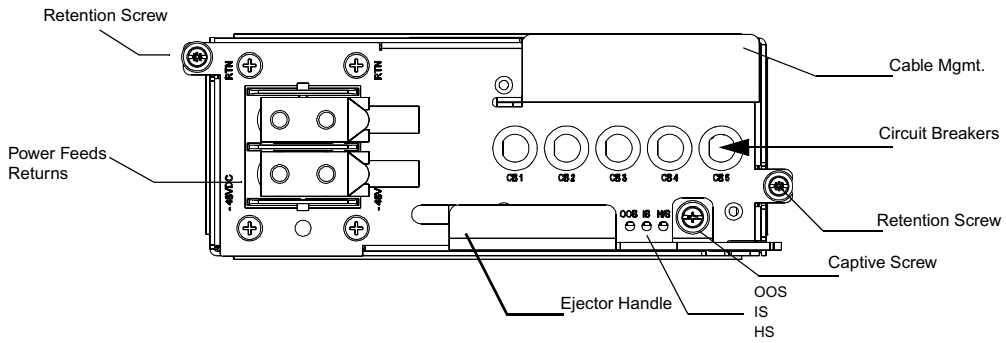


Figure 2-17 Power Entry Module, Connector, ISO View

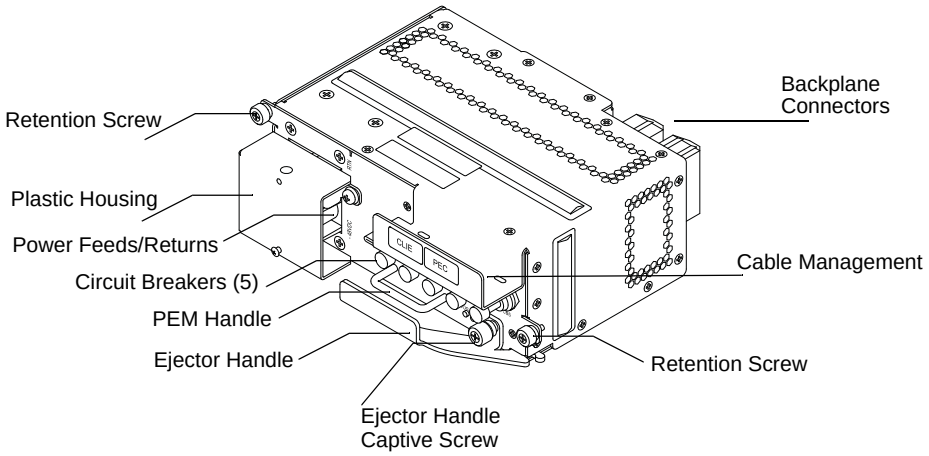


Table 2-10 PEM Status Indicators

Power LED	Color	State/Condition
[1]In Service (IS)	Green	Off: no service Blink: PEM activating Glow Steady: service available
[1]Out of Service (OOS)	Red	Off: service available Blink: Deactivation requested Glow Steady: no service
Hot Swap (HS)	Blue	Off: PEM is not ready to be removed Blink: Deactivation requested Glow Steady: PEM is ready to remove
[1]If your system is not running high-availability software, behavior of the LED may be indeterminate.		

2.9 Stationary Boards

There are three stationary boards in the shelf which are completely passive and are not field replaceable:

- Backplane
- Upper fan interconnect board, provides power and signaling from the backplane to the FTM distribution board
- FTM distribution board, provides the signal and power connections to the upper fan tray modules from the backplane

Site Preparation

3

3.1 Overview

This chapter discusses safety, regulatory and standard compliance, proper placement, environmental conditions, and installation options for the AXP1406.

The major topics covered are:

- *Safety and Regulatory Compliance*
- *Standard Compliances*
- *WEEE Compliance*
- *Receiving and Unpacking the System*
- *Preparing the Site for Installation*
- *Mounting Options*
- *Power Requirements*
- *Environmental Considerations*

3.2 Safety and Regulatory Compliance

The base shelf complies with the safety and regulatory standards applicable to component-level equipment. It is possible to use this product with other components that produce a system not in compliance with system guidelines. Since Emerson cannot anticipate what equipment may be used with this enclosure or how it may be used, the responsibility for designing a system that conforms overall to CSA (C/US)/VDE safety requirements and EMI/RFI emission limits rests entirely with the system integrator and installer.

3.3 Standard Compliances

The base system chassis complies with the safety and regulatory standards applicable to component-level equipment. It is possible to use this product with other components that produce a system not in compliance with system guidelines. Since Emerson cannot anticipate what equipment may be used with this enclosure or how it may be used, the responsibility for designing a system that conforms overall to CSA (C/US)/VDE safety requirements and EMI/RFI emission limits rests entirely with the system integrator and installer.

Table 3-1 Standard Compliances

Standard	Description
PICMG3.0 R1.0 PICMG 1.5.1	Defines mechanics, board dimensions, power distribution, power and data connectors, and system management.

Table 3-1 Standard Compliances (continued)

Standard	Description
UL 60950-1 EN 60950-1 IEC 60950-1 CAN/CSA C22.2 No 60950-1	Safety Legal Requirements
CISPR 22 CISPR 24 EN 55022 EN 55024 EN 300386 FCC Part 15	EMC requirements on system level (predefined Emerson system)
NEBS Standard GR-63-CORE NEBS Standard GR-1089-CORE ETSI EN 300 019 series ETSI ETS 300 753 ETSI EN 300 019 series	Environmental Requirements The product is designed to support NEBS level three. The compliance tests must be done with the customer system configuration.
Directive 2002/95/EC	The product has been designed to meet the directive on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS)

In accordance with European Community directives, a “Declaration of Conformity” has been made and is on file within the European Union. The “Declaration of Conformity” is available on request. Please contact your sales representative.

3.4 WEEE Compliance

To satisfy the requirements for marking electrical and electronic equipment in accordance with article 11 (2) of Directive 2002/96/EC, Waste from Electrical and Electronic Equipment (WEEE), Emerson includes a crossed-out bin symbol on all standard and noncustom chassis product. This marking fulfills the requirement set out by WEEE that a producer of an electrical or electronic appliance that bears their trade name and is put on the European Union market after 13 August 2005, places a clearly identifiable mark on the equipment and that this mark signifies that equipment is to be reprocessed or recycled using authorized recyclers and processes. This minimizes the disposal of unsorted municipal waste, achieves a high level of separate collection of WEEE, and ensures the environmentally sound disposal of electrical and electronic equipment placed on the market after 13 August 2005.

To dispose of equipment marked with the WEEE symbol, Emerson has contracted with certified companies that can reprocess this equipment per European Union requirements. Please visit the Emerson web site or contact your Emerson representative to find out who to contact and how to dispose of the equipment.

To satisfy the requirements for marking electrical and electronic equipment in accordance with article 11 (2) of Directive 2002/96/EC, Waste from Electrical and Electronic Equipment (WEEE), Emerson includes a crossed-out bin symbol on all standard and noncustom chassis product. This marking fulfills the requirement set out by WEEE that a producer of an electrical or electronic appliance that bears their trade name and is put on the European Union market after 13 August 2005, places a clearly identifiable mark on the equipment and that this mark signifies that equipment is to be reprocessed or recycled using authorized recyclers and processes. This minimizes the disposal of unsorted municipal waste, achieves a high level of separate collection of WEEE, and ensures the environmentally sound disposal of electrical and electronic equipment placed on the market after 13 August 2005. To dispose of equipment marked with the WEEE symbol, Emerson has contracted with certified companies that can reprocess this equipment per European Union requirements. Please visit the Emerson web site or contact your Emerson representative to find out who to contact and how to dispose of the equipment.

3.5 Receiving and Unpacking the System

This section provides information about receiving and unpacking the AXP1406.

3.5.1 Receiving the Product

You should receive a packing list, listing all the parts shipped with your system. Upon receiving the system:

- Compare the packing list with the items you received
- If the items on the packing list do not match the items received, immediately notify your carrier agent and Emerson
- Save the shipping cartons for reuse

3.5.2 Unpacking the Equipment

Procedure

Follow these steps when unpacking your equipment.

1. Make sure the packing carton is upright.
2. Carefully cut the sealing tape with a box cutter and open the box.
3. Remove the cardboard packing, any foam packing material, and protective plastic.
4. Lift the shelf carefully out of the carton and move it to the location designated for the installation.

3.6 Preparing the Site for Installation

This section provides the necessary instructions and information to prepare the site and shelf for installation.

Before you begin to set up and cable your new shelf, consider these guidelines.

- Locate the shelf in a stable area, free of excess movement and jarring
- Install the shelf safely and ensure that cables and cords are out of the way
- Ensure that the set-up is comfortable for users
- Allow room for proper airflow for cooling
- Locate the shelf where it can be easily serviced (front and rear)
- Provide an area free of excess heat, dust, smoke, and electrostatic discharge (ESD)

The AXP1406 is suitable for installation in one or more of the following:

- Network Telecommunication Facilities
- Locations where the National Electrical Code (NEC) applies

3.7 Mounting Options

The AXP1406 is designed to be mounted in an equipment rack while maintaining conformance to the NEBS 19" deep lineup and the ETSI 600mm x 600mm lineup standards for telecommunication equipment. For increased stability, we recommend using the front and rear mounting positions.

For mounting instructions in either rack type, refer to Chapter 7, *AXP1406 Shelf Installation*.

3.8 Power Requirements

Power for the rack system should come from a totally dedicated DC power source. Do not plug any other electrical device into an outlet connected to the circuit breaker serving the rack equipment.

Data loss can occur if the circuit is overloaded and the circuit breaker trips.

3.8.1 Guidelines for Branch Circuits

Do not overload branch circuits. Check the manual and/or rating plate of all devices and verify that the sum of the ampere ratings do not exceed two-thirds of the branch rating.

Laser printers and some other devices cause periodic short-duration, heavy loads that do not appear in their ampere ratings. Connect these devices on a separate branch circuit from the shelf.

NOTICE

System Damage
Most surge/transient suppressors can cause system damage from transients if used in the typical manner.
Do not use surge/transient suppressors without careful and expert power system analysis.

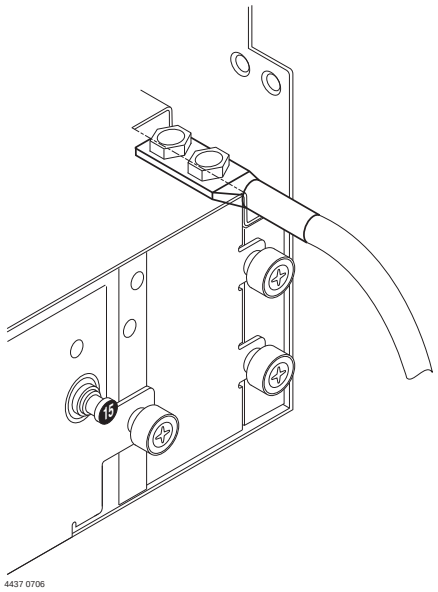
3.8.2 Grounding Options

There are two ways to ground the AXP1406 shelf. Use either of these grounding methods:

- Use a 2 AWG wire with a 2-hole copper lug and connect directly to the earth ground point located on the right side of the back of the shelf
- Screw the mounting brackets to a grounded metal frame

The AXP1406 shelf is suitable for installation as part of the Common Bonding Network (CBN) or an Isolated Bonding Network (IBN) or both.

Figure 3-1 Earth Ground Location, Rear Shelf



3.8.3 Power Circuit Protection

Protect the power circuit with an electrical line filter that prevents voltage spikes from reaching the system.

3.8.4 Circuit Breakers and Power Feeds

Make sure the circuit breakers furnishing power are the correct size to protect the shelf. The shelf may require up to 100 Amps DC. The required cable size for 100 Amps is 2 AWG wire.

3.8.5 Battery

For the AXP1406, the Battery Return (BR) input terminals must be treated as an Isolated DC (DC-I) return.

3.9 Cable Planning

The AXP1406, consoles, and some other peripherals use shielded cables. You can successfully use shielded cables for communication over extended distances. Reliable communication over cables longer than 50 feet, however, depends on the absence of electrical noise, correct ground potentials at termination points, and other variables.

When planning the installation of cables:

- Do not run signal cables parallel to power cables if they are within four inches of each other
- Do not install signal cables close to electric motors, power line regulators, relays, or power supplies
- Avoid laying signal cables close to air conditioners, copy machines, water coolers, and other similar equipment that generates power line “noise”
- Do not run signal cables near equipment that generates radio frequency interference (for example, radio transmitters)
- Do not expose cables to moisture or heat. If you install signal cables outdoors, use a conduit or raceway to protect them from lightning and weather
- Use shielded cable to ensure radio frequency compatibility
- Use the shortest possible cable between the shelf and peripherals
- To ensure maximum protection for equipment and operators, check the protective grounds at each power outlet to make sure they are adequate

- Protect external interconnecting cables from physical damage without endangering users. Install the cables under a raised floor, if possible. Avoid tight pulls against sharp corners.
- The Shelf Management Alarm Module (SAM1000) and the ATCA-7221 blade and RTM require the use of shielded cables.

NOTICE

System Damage
The intrabuilding port(s) of the equipment or subassembly is suitable for connection to intrabuilding wiring or cabling only. The intrabuilding port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP (OutSide Plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling.
The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

3.10 Environmental Considerations

When installing the shelf in a particular environment, keep the environmental specifications of the shelf components in mind. For maximum reliability the system should be operated at a long-term ambient room temperature of 25º C (77º F). Limits for operational conditions are noted in appropriate NEBS documentation (Telcordia GR-63-CORE).

The shelf enclosure is designed for service actions, such as replacement of modules, up to an ambient temperature of 40º C. Do not remove modules if the ambient room temperature is above this limit or the equipment may be damaged due to the disrupted airflow in this environment.

Table 3-2 Environmental Considerations

Feature	Operating	Non-Operating (packed state)
Temperature	-5°C (23°F) to + 55°C (131°F) (exceptional operation) according to NEBS Standard GR-63-CORE +5°C (41°F) to +40°C (104°F) (normal operation) according to NEBS Standard GR-63-CORE	-40°C (-40°F) to +70°C (158°F)
Temperature Change	+/- 0.25°C (32.5°F) (/min 1) according to NEBS Standard GR-63-CORE	+/- 0.25°C (32.5°F) /min1)
Relative humidity	5% to 90% noncondensing according to Emerson-internal environmental requirements	5% to 95% noncondensing according to Emerson-internal environmental requirements

Table 3-2 Environmental Considerations (continued)

Feature	Operating	Non-Operating (packed state)
Vibration (tested in target platform)	0.1 g from 5 Hz to 100 Hz and back to 5 Hz at a rate of 0.1 octave/minute.	5-20 Hz @ 0.01 g2/Hz 20-200 Hz @ -3.0 dB/octave Random 5-20 Hz @ 1 m2/Sec3 Random 20-200 Hz @ -3 dB/oct
Shock	Half-sine, 11 mSec, 30 m/Sec2	
Free Fall		300mm (11.8 in.) packaged 25mm (1 in.) unpackaged per GR-62-CORE Fully populated system
Noise	ETSI ETS 300 753 (Oct-1997) - Telecommunication equipment rooms (attended): 7.2 bel -Measurement of “declared A-weight sound power level” -All values are applicable to normal operating conditions (~23°C/-9.4°F). NEBS GR-63-CORE, Issue 3 - Telecommunication equipment rooms (attended): 78 dB -Measurement of “declared A-weight sound power level” -All values are applicable to normal operating conditions (~27°C/-16.6°F).	

3.11 Enclosure Cooling Considerations

It is essential to properly cool all of the equipment used in a rack mounted configuration. The components of the shelf require an input air temperature nominally below 55ºC (131ºF). Up to 18 internal DC-powered fans cool the shelf’s drives, blades and transition modules (includes both upper FTMs and lower FTM fans). The shelf features an air inlet plenum (under the shelf) to provide additional cooling space when more than one AXP1406 is installed in an enclosure. To ensure adequate cooling, make sure there is ample space at the front and back of the shelf. Refer to *Rack/Cabinet Cooling Guidelines* on page 74.

Operations

4

4.1 Overview

This chapter provides the basic operating procedures for the AXP1406. For software-specific information or information regarding the operation of third-party or add-on components, please refer to the software or hardware product's vendor documentation. You can refer to Appendix B, *Related Documentation*, for a collection of supporting manuals.

This chapter covers the following topics:

- *Recommended Power-On Procedures*
- *Recommended Power-Off Procedures*
- *Emergency Power-Off Procedure*
- *Emergency Power-Off Procedure*
- *Power Entry Module*
- *Fan Tray Modules*
- *Air Filter Maintenance*

4.2 Recommended Power-On Procedures

Power-On Procedure

To power-on your AXP1406, follow these steps.

1. Verify that all shelf modules and associated data and control cables are properly configured and installed. Make sure that all empty or unused slots contain a filler panel.
2. Enable DC power at each external source (branch circuit or power distribution unit).
3. Verify that the shelf configuration's current loads do not exceed 200 W per slot for front-side blades, 25 W per slot for RTMs, across the operating range of the equipment.
4. Push the circuit breakers **inward** to the ON position. They are located on the front of each PEM.
   Each PEM can supply a total of 100 A.

4.3 Recommended Power-Off Procedures

Power-Off Procedure

Follow these steps to shutdown your AXP1406:

The input voltage rating of the AXP1406 is nominal –48VDC to –60VDC.

1. Shutdown all software operations and the operating system. For shelves with independently running segments, each segment must be shut down.
2. Pull each circuit breaker on the front of PEM A and PEM B **outward** to the OFF position.
   This step removes the input power from the slots in the AXP1406 shelf only. It does not remove power to the PEMs, FTMs, or the SAMs. To remove power to these components, refer to the next step.
3. Disable the DC power at each of the external sources (branch circuit or power distribution unit) for both PEM A and PEM B.
   This completely removes power from the shelf and its subassemblies.

4.4 Emergency Power-Off Procedure

Emergency Procedure

Read this notice and follow the next steps if it is necessary to remove power during an emergency situation.

NOTICE

Data Loss
Following this procedure will result in a loss of data and may cause damage to chassis components in a running platform.
Use this method only when normal shutdown procedures cannot be followed.

1. Pull each circuit breaker on the front of PEM A and PEM B **outward** to the OFF position.
2. Disable the DC power at the external sources (branch circuit or power distribution unit) for both PEM A and PEM B.

4.5 Power Entry Module

This section discusses the operations of the Power Entry Module for the AXP1406 configurations.

4.5.1 Description

The AXP1406 has PICMG 3.0 compliant, dual PEMs and is rated for –48VDC to –60VDC. The PEMs plug directly into the midplane and deliver power to the backplane. Each input is rated for 100 amps which is then segmented down to five individual circuits: four 25 A circuit breakers and one 15 A circuit breaker, or five internal feeds with voltage and circuit breaker monitoring per PEM. Each of the four 25 A feeds power four AdvancedTCA slots; the 15 A feed powers the upper and lower FTMs. Each PEM also generates a separate +12 V for redundant powering of the FTMs and SAMs. This voltage is distributed to each of these modules across the backplane.

Power conversion for the SAMs, FTMs, and PEMs consists of two 150 W, +48VDC to +12VDC converters which distribute dual power busses of +12VDC to separate parts of the system. The +12VDC outputs are provided on the backplane connector to the rest of the shelf. Power is redundant via the secondary PEM.

⚠ CAUTION

Personal Injury
Removing power to these subassemblies cannot be accomplished by pulling the PEM's circuit breakers to the OFF position. The PEMs remain powered until the –48VDC power to each PEM is removed.
Make sure you disconnect the power at the external source before removing the PEM from the chassis.

Power is introduced to the PEM using a DC power cable attached to the terminal block on the front of the module (power input cable and return cable). The terminal block consists of a dual stud connection which prevents the power cables from rotating and provides secure contacts for the cable lug. There is a plastic cover that protects the cable connections.

The DC power inputs must only be attached to approved Telephone Network Voltage (TNV) or Safety Extra Low Voltage (SELV) branch circuits. Branch circuits must comply with all requirements called for in these safety standards: IEC 60950, EN 60950, CAN/CSA-C22.2 No. 60950. Attaching inputs to non-TNV/SELV approved power sources will cause the system to fail compliance with safety regulations.

4.5.2 IPMC Circuitry

Each PEM is capable of monitoring voltage and circuit breaker status. The PEMs are loaded with the AdvancedTCA IPMC firmware. Preprogrammed FRU and Sensor Data Record (SDR) information reside on the PEM and is accessible from the SAM via the IPMB ports of the PEM. In addition, the IPMC monitoring functions include circuit breakers to detect breaker trips,

voltage sensors to detect backplane voltages, current sensors to detect current to the backplane, and on-board circuitry to detect failures on the PEM. The PEMs are managed by the Sentry Shelf Management software. Refer to the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference* listed in Appendix B, *Related Documentation*, for more information.

Table 4-1 PEM IPMB Addresses

Description	IPMB Address
PEM A	0x66
PEM B	0x68

Figure 2-6 on page 44 provides a conceptual view of the connections between the PEMs, backplane, FTMs, and SAMs.

4.6 Fan Tray Modules

This section discusses the operations of the Fan Tray Modules (FTMs) for the AXP1406 configurations.

4.6.1 Description

The FTMs are loaded with AdvancedTCA IPMC firmware. The fans are controlled as a group via the IPMI-based interfaces (IPMB) to the SAM. The IPMI interface is used for reporting faults, events, and status.The shelf manager software performs management of the FTM via the IPMB bus.The IPMC circuit provides a temperature sensor for monitoring the temperatures of the FTM board components and for monitoring the inlet and outlet air temperature of the shelf. For further information, refer to the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference* listed in Appendix B, *Related Documentation*.

The six upper FTMs receive their signal and power connections from the backplane via a FTM distribution board. A fan interconnect board connects the backplane to the FTM distribution board. The FTMs are powered from -48VDC from the backplane through the 15 A feed. The two lower FTMS receive their signal and power connections from the AdvancedTCA backplane. Only the lower FTMs have an air filter frame and filter in the module.

The AXP1406 provides 491.7 CFM of airflow with all fans running at high speed and provides 471 CFM of airflow with one fan (worst case) failed and the other fans running at high speed. The shelf provides 358.5 CFM of airflow with all fans running at low speed. The FTMs have variable speed fan control, which is dependent on the temperature readings in the shelf. Airflow rates can vary depending on the fan speed and payload. Fan speed levels are controlled from the SAM via the IPM shelf management software. The fan speed levels change automatically based on temperature sensors. For more information on airflow and cooling, refer to *Fan Speed and Control* on page 102.

The FTM has an ejector handle that interfaces with a mechanical switch to signal the software for hot swap. The handle locks the FTM securely into the shelf. Each FTM is equipped with three status LEDs on the face plate. For removal and installation procedures for the FTMs, refer to Chapter 10, *AXP1406 FRU Replacement Procedures*.

In the event of a Fan/Filter Out-of-Service alarm, first check the fan filters (only on the lower FTMs) to make sure the airflow is not obstructed. For information on the maintenance of air filters, see *Air Filter Maintenance* on page 69.

4.6.2 Cooling Budget

The shelf cooling allows cards with these dissipations to operate with commercial grade components, 70°C/158° F ambient temperature typical.

Table 4-2 Cooling Budget

Ambient Temperature	Condition	Temperature Rise
25° C/77° F	All fans operating at slow speed	Max T - 45° C113° F
45° C/113° F	N-1 fans operating full speed (1 failed fan)	Max T - 25° C/77° F
55° C/131° F	All fans operating at full speed	Max T - 15° C/59° F

The following guidelines can assist in determining the cause of the cooling failure. Also refer to *Environmental Considerations* on page 63 for important information regarding ambient temperature requirements during servicing.

- If the cooling failure is reported by a single FTM only, the failure may be caused by a failed fan or possibly a clogged filter. Check the filter first before replacing the FTM (see *Air Filter Maintenance* on page 69).
- If the cooling failure is reported by more than one FTM, the failure may be caused by a rise in the ambient air temperature or an airflow blockage. Increasing the fan speed or correcting the airflow blockage should correct the situation.

For further information of nonrecoverable temperature events, refer to the FRU information chapter in the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference*.

4.6.3 IPMC Circuitry

Preprogrammed FRU and SDR information reside on the FTMs and is accessible from the SAM via the I^2C bus. FRU information can be found in the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference*, listed in Appendix B, *Related Documentation*.

4.7 Air Filter Maintenance

Air filters should be cleaned every 90 days or sooner, depending on the conditions of the Central Office Environment. Because Central Offices vary in physical location and cleanliness, check your air filters every week after you first install your system. In a dusty environment, a filter may need cleaning more often than a filter in a cleaner environment. Check the filters frequently until you have a good idea of how often it needs cleaning. Based on your findings, establish a regular cleaning schedule and keep a log to record the date of each filter cleaning or replacement.

Air filters should also be checked occasionally to make sure they are not obstructed or damaged. Visually inspect filters for tears or rips. Do not reinstall a torn filter as it will be ineffective in trapping particulates and will interrupt air flow distribution. To maintain safety certification, use only Emerson approved fan filters. You can order replacement fan filters by contacting your Emerson sales representative.

For replacement procedures, refer to *Replacing the Fan Filter* on page 109.

4.8 Cleaning the Air Filter

To ensure the AXP1406 shelf operates properly, routine filter maintenance is required as discussed in *Air Filter Maintenance*. Maintenance includes cleaning, replacing, and properly storing the air filters.

Filter cleaning frequency depends on the environment the system is subjected to. The shelf filter requires routine cleaning to ensure effective filtration and airflow. To prevent air contamination from polluting the air filter and possibly obstructing the air intake of the system, the air filter should be replaced according to the schedule you have established based on your Central Office Environment as discussed in *Air Filter Maintenance*.

Remove and inspect the filter for tears or damage before cleaning it. If the filter is torn or damaged, discard the filter and replace it with a new one. Refer to *Replacing the Fan Filter* on page 109 if you need help.

Cleaning Procedure

If the filter is undamaged, proceed to clean it. There are several methods for cleaning the air filter.

1. Vacuum clean. A few passes of a vacuum cleaner can remove accumulated dust and
   dirt.
2. Oil-free compressor air. Point the compressed air nozzle in the opposite direction of the filter's operating airflow (blow from the filter's exhaust side toward the intake side).
3. Cold water rinse. Collected dirt is washed away using a standard hose nozzle with plain water. Ensure the filter is completely dry before returning to service.
4. Immersion in warm soapy water. Dip the filter in a solution of warm water and mild detergent. Then rinse the filter in clear water and let stand until completely dry before
   returning to service.
   Before returning a filter to service, visually inspect it for tears or rips that may have occurred during cleaning. Do not reinstall a torn filter as it will be ineffective in trapping particulates and will interrupt air flow distribution. You may order replacement fan filters by contacting your Emerson sales representative.

4.9 Storing the Filter

The ideal storage condition for the air filter is a cool, dry, dark environment. High temperature, humidity, and ultraviolet light adversely affect the filter media (foam). Foam also degrades when exposed to solvents and sulfates, such as engine exhaust.

Controlling relative humidity between 40%-80% and temperature between 4.4°C - 32.2°C/40°F - 90°F) yields an acceptable environment. Covering the filters with dark plastic keeps the foam dry and protects it from ultraviolet light. Purchase enough to keep adequate inventory for no more than a few months, filters could degrade under long term storage conditions.

Shelf Installation

5

5.1 Overview

This chapter discusses mounting and installation options for the AXP1406 shelf.

The topics covered are:

- *Installation Prerequisites*
- *Installing the Shelf*
- *DC Power Cable*
- *Connecting the Cables*
- *Grounding the Shelf*
- *Shelf Ground Configuration*
- *Powering Up the System*
- *Accessing the System*

5.2 Physical Characteristics

The following table provides the dimensions and weight of an equipped and unequipped shelf and rack mounting requirements. For exact dimensions refer to Figure 5-3 on page 78 and Figure 5-4 on page 78.

Table 5-1 Physical Characteristics

Characteristics	Specifications
Size:	21 inches (53.3 cm) high, 12-1/2U 17.67 inches (44.9 cm) wide 19.02 inches (48.3 cm) with mounting flanges 21.34 inches (54.2 cm) deep
Weight:	Approximate lbs. (75 lbs./34 kg) base integrated platform Approximate lbs. (81.1 lbs./36.8 kg) fully equipped Base platform: shelf, backplane, 8 FTMs, 2 PEMs, 2 shelf managers Equipped (fully): 2 shelf managers, 2 PEMs, 6 upper FTMs, 2 lower FTM (no payload blades)

Table 5-1 Physical Characteristics (continued)

Characteristics	Specifications
Rack Mounting:	Per ETSI 600 mm x 600 mm ETSI frame on integrated front frame mounting ears using front mounting brackets. Frame mounting brackets are required for a 19" EIA frame. Rear mounting brackets are recommended in both instances for Central Office Environment. Each shelf requires 12.5U of space and effectively takes up 13U when mounted in a rack. Three shelves can fit in a 40U telecom rack, which leaves 1U remaining. Air intake plenum at bottom front of shelf. Cable management trays are in the front only.

5.3 Installation Prerequisites

You will need the following to install the AXP1406 14-slot shelf into an approved EIA 19" or 600 mm x 600 mm ETSI frame:

- Torque wrench
- Nut driver with 7/16 mm socket
- Multimeter
- Phillips head screwdriver, #1
- AdvancedTCA PEM Service Kit, PN 6706808A01 (shipped with your AXP1406)
- Right-angle Cable Lug Kit, PN 6706808A01 (shipped with your AXP1406)

5.3.1 Rack/Cabinet Cooling Guidelines

It is important to have sufficient open space at the front and rear of the shelf when installed in a rack or cabinet. Depending on whether the enclosure has solid or vented doors will determine the recommended open space required. Follow these guidelines for positioning the shelf to allow for the optimal open space for the shelf air inlet and shelf air exhaust.

Do not obstruct the ventilation openings at the top, sides and back of the shelf. Keep the fresh air intake by the air intake plenum completely clear.

Do not use the air intake plenum for storing notebooks, papers, pencils, or other office tools.

Figure 5-1 Diagram for Estimated Open Air Space in an Enclosure

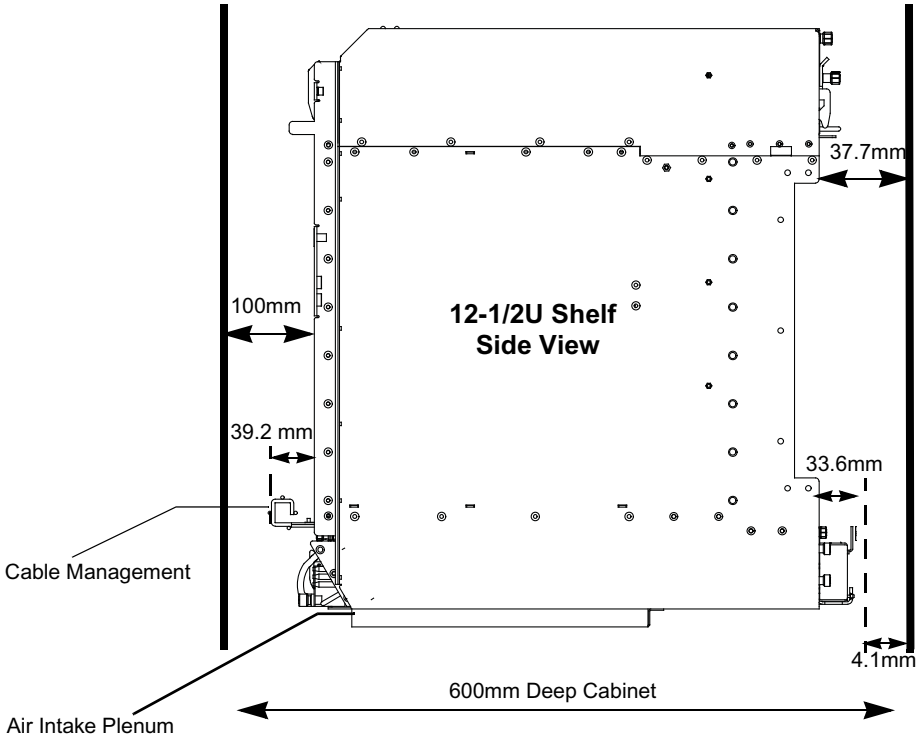
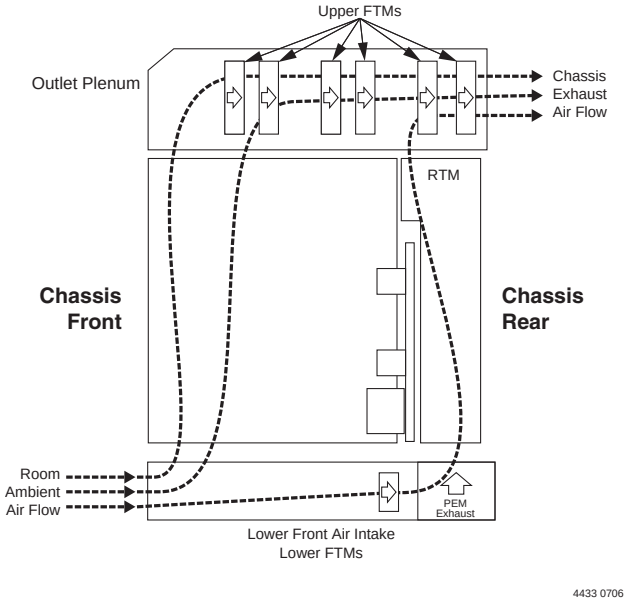


Figure 5-2 Airflow Diagram



5.3.2 Mounting Options and Stabilization

The AXP1406 is designed to be mounted in an equipment rack while maintaining conformance to the NEBS 24" deep lineup and the ETSI 600mm deep lineup standards for telecommunication equipment. For increased stability, we recommend that the rack is securely mounted to the floor, or if using stabilizing devices make sure they are installed and extended.

5.3.3 Weight Distribution Within a Rack

⚠ CAUTION

Personal Injury or Product Damage
Uneven mechanical loading of the rack may cause toppling.
To avoid personal injury or damage to the equipment, plan your installation so that (within the limitations of equipment and cabling):
The weight of the equipment is evenly distributed in the rack.
The heaviest units are mounted nearer the bottom of the rack.

5.3.4 Electrostatic Discharge (ESD) and Safety Procedures

Use ESD protection

Emerson strongly recommends that you use an antistatic wrist strap and a conductive foam pad when installing or upgrading a shelf. Electronic components, such as disk drives, computer boards, and memory modules, can be extremely sensitive to electrostatic discharge (ESD). After removing the component from its protective wrapper or from the shelf, place the component flat on a grounded, static-free surface (and, in the case of a blade, component side up). Do not slide the component over any surface.

If an ESD station is not available, you can avoid damage resulting from ESD by wearing an antistatic wrist strap (available at electronics stores) that is attached to an active electrical ground. Note that a shelf may not be grounded if it is unplugged.

There is one earth ground located at the back of the shelf. There are two ESD bonding points, one on the front and one on the back of the shelf.

5.4 Installing the Shelf

The AXP1406 can be mounted in a 19" EIA or 600 mm ETSI frame using front mounting brackets. Using rear mounting brackets is recommended for all frame types when installed in a Central Office Environment. Front or rear mounting brackets are not shipped with this product. For assistance with the acquisition or design of mounting brackets for your particular application, please contact your Emerson representative.

⚠ CAUTION

Personal Injury or Product Damage
Do not mount a single shelf at the top of the rack. A top-heavy rack can tip, causing damage to equipment and injury to personnel.
Do not use the FTM handles or PEM handles for lifting the shelf.
Make sure you have the appropriate equipment to safely lift and mount the shelf securely.
To avoid personal injury or damage to the equipment, use two persons for the installation procedure.

The following sections provide illustrations that show typical mounting hole locations on the rear and sides of the shelf enclosure.

5.5 19" EIA Rack/Cabinet

Front mounting brackets are required to attach the shelf to an EIA 19" frame.

Refer to these illustrations to locate the standard mounting hole and slot locations on the front mounting flanges on the AXP1406 shelf.

Refer to the next illustration for the location of the mounting holes on the front chassis flanges.

Figure 5-3 Dimensions and Hole Locations for 19"EIA Rack/Cabinet

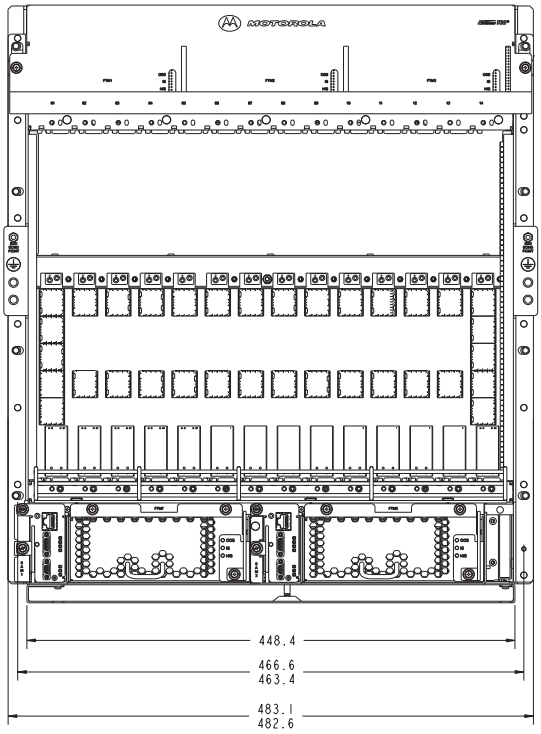
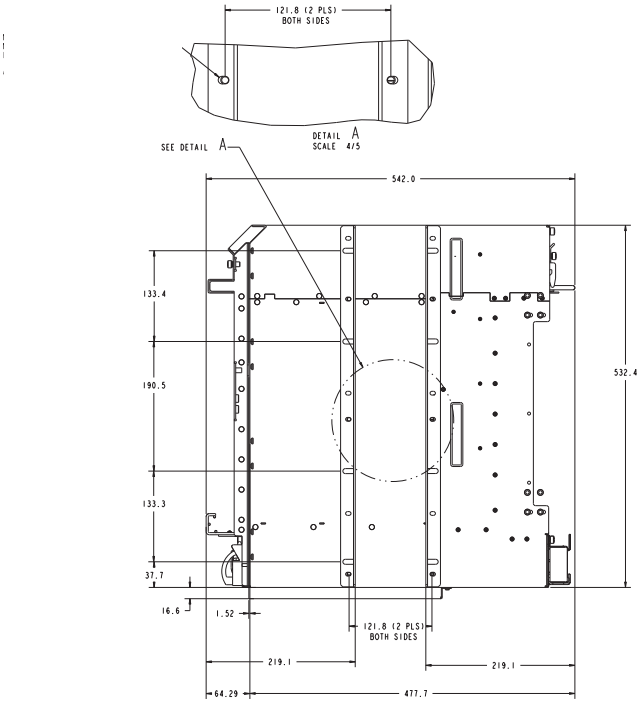


Figure 5-4 Side Dimensions and Hole Locations for 19" EIA Rack/Cabinet



Be sure to mount the shelf with metal screws or bolts that give a good electrical connection between the screws or bolts and the mounting surface.

Tighten all screws using a torque setting of 35.5 to 38.5 inch-pounds

Failure to observe proper grounding practices may cause a variety of noise, electrostatic discharge, and RFI (Radio Frequency Interference) problems.

5.6 600 mm ETSI Rack/Cabinet

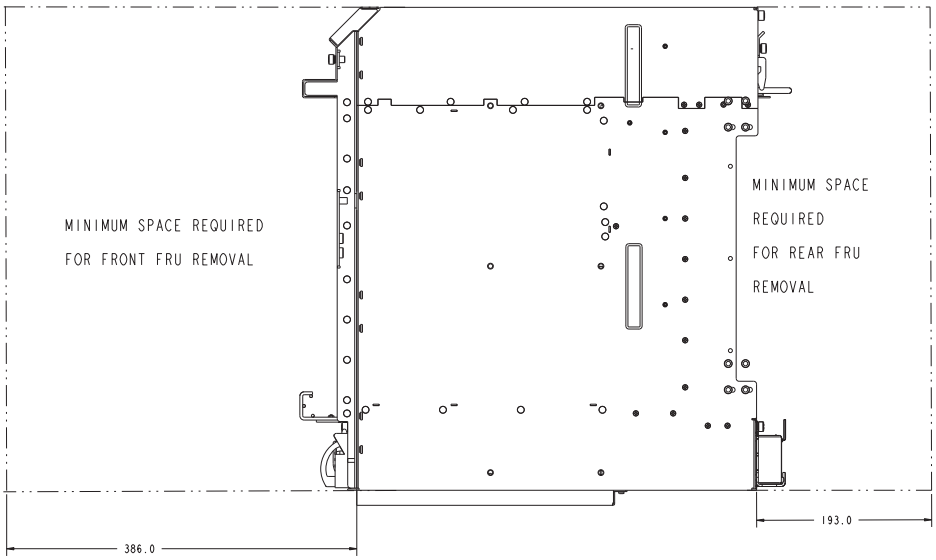
The shelf mounts directly from the integrated flange on the front of the shelf using front mounting brackets.

Refer to Figure 5-3 on page 78 to locate the standard mounting hole and slot locations on the front integrated mounting flanges on the AXP1406 shelf.

5.7 Space Requirements

To ensure there is enough room for front and rear FRU replacement, please use the following dimensions as a guideline for your installation.

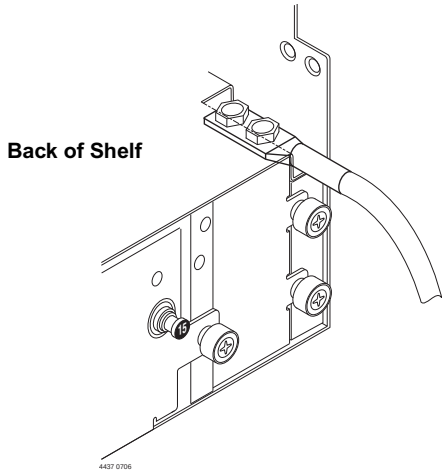
Figure 5-5 FRU Replacement - Space Requirements



5.8 Grounding the Shelf

Use a 2 AWG/6.544 mm wire with a 2-hole copper lug and connect directly to the earth ground point located on the right side of the back of the shelf; connect the other end of the wire to a reliable earth ground. Use the torque setting required by the connector supplier. The 2-hole lug prevents rotation of the lug and ensures a permanent bonding of ground to the shelf.

Figure 5-6 Placement of Grounding Lug



5.9 Shelf Ground Configuration

The AXP1406 shelf was tested in the default configuration of logic ground and shelf ground connected and does not connect -48VDC Return with Shelf Ground. The Centellis 3406 system has been tested in the default configuration and complies with safety and regulatory standards. As a compliant AdvancedTCA shelf, the AXP1406 allows system integrator at their own discretion to remove the mechanism which connects Logic Ground to Shelf Ground and install the mechanism that connects -48VDC Return to Shelf Ground. If the system integrator exercises the option of removing the connections from Logic Ground to Shelf Ground and or adds the connection between -48VDC Return and Shelf Ground, the responsibility for maintaining compliance to CSA (C/US)/VDE safety requirements and EMI/RFI emission limits rests entirely with the system integrator and installer.

5.10 DC Power Cable

Power is introduced to the shelf via redundant DC PEMs. The recommended power cable is an 2 AWG/6.544 mm gauge that meets the specifications for this shelf. The cable has a custom dual-hole lug angled at 30° which attaches to the terminal lugs. The end that connects to the external DC power source should be equipped with an 8 mm terminal.

Please make note of the following installation guidelines:

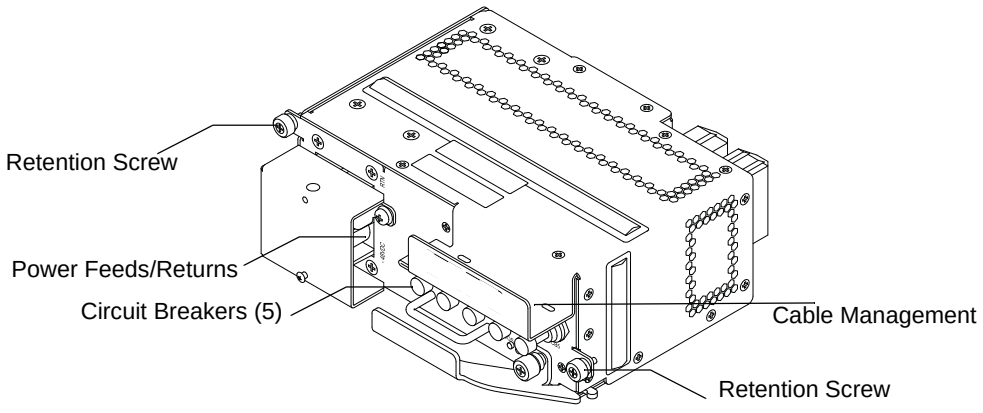
- Always check with your local building authorities for wire sizing requirements for your environment.
- The installation must comply with the 1993 National Electric Code (NEC) and other applicable codes.
- The DC power inputs must only be attached to approved Telephone Network Voltage (TNV) or SELV (Safety Extra Low Voltage) branch circuits. Branch circuits must comply with all requirements called for in these safety standards: IEC 60950, EN 60950, CAN/CSA-C22.2 No. 60950. Attaching inputs to non-TNV/SELV approved power sources will cause the system to fail compliance with safety regulations.
- The ground wire must be connected to a reliable earth ground connection to comply with Class 1 Equipment requirements.

⚠ WARNING

Personal Injury or Death
Multiple power sources are present.
Service only by qualified service personnel.
Mehrfache Energiequellen.
Handhabung nur durch geschultes Personal.
Des sources multiples de pouvoir sont présentes.
L'entretien de cet équipement doit être effectué par du personnel de service qualifié.

Wire	Signal
Earth Ground	PE GND (Primary Earth Ground)
Input power	-48VDC nominal to -60VDC
Return	-48VDC RETURN

Figure 5-7 DC Power Connection

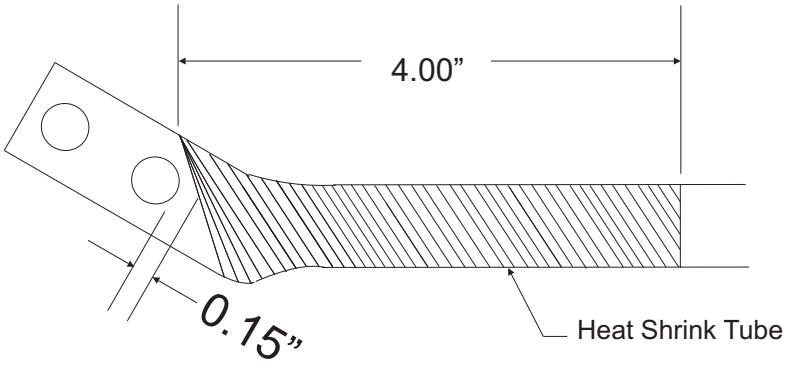


5.11 Power Cable Termination

Custom lugs with a 30 degree bend are used with large gauge wires for up to 100 AMPs DC (2 AWG/6.544 mm) when connecting to the PEM. These are shipped with the product.The lugs are angled to allow the cables to be dressed along the cable management tray, thus protecting the circuit breakers from accidental tripping.

Terminating this lug is identical to terminating standard lugs. To minimize shorting of the terminals, the lugs must be insulated according to the following illustration.

Figure 5-8 Custom Lug with 30° Bend



Heat shrink should be placed as close to the hole as possible (0.15") apart as shown in Figure 5-8. The heat shrink tube should be cut approximately at a 30° angle.

5.12 Connecting the Cables

In a redundant configuration, each terminal block must be connected to a separate DC power source. Power is introduced to each PEM’s terminal block on the front of the module (power input cable and return cable). The lugs provide secure contact for the cable and prevent the power cables from rotating. A plastic housing covers the power feeds and returns and is attached with one screw.

Cabling Procedure

To cable a dual breaker DC system, read all cautions and warnings, properly ground the equipment by following the procedure in *Grounding the Shelf* on page 80, and follow these steps. This procedure assumes that the PEMs are preinstalled in the shelf.

Have the following tools on hand before you begin these steps: standard Phillips screwdriver, nut driver, torque wrench, multimeter, and lug kit.

⚠ CAUTION

Personal Injury or Product Damage
Cables may or may not be preinstalled at the branch circuit or power distribution unit. If the DC power cables are not connected to the branch circuit or power distribution unit, connect the power cables to the PEMs before connecting the DC power cables to the external power source.
If the DC power cables are connected to the branch circuit or power distribution unit, a qualified service person must confirm that the power to the cables is terminated (off) before continuing the steps to attach the cables to the PEMs.
In either case, use a multimeter to check the PEM end of the terminals to confirm there is no power present.

1. Locate the target power input cable's terminals at the branch circuit or power distribution unit.
2. Open the external circuit breakers that provide DC feed power to the PEM.
3. Lock and tag out the circuit breakers on the branch circuit or power distribution unit.
4. Using the appropriate tool, carefully remove the plastic covering over the terminal block.
5. Confirm that there is no power to the PEM lug bolts by using a multimeter. Measure between the two lugs and then measure between the chassis ground and each lug. If the DC potential is 3.0VDC or less, then power is not present.
6. Attach the DC power cables (input and return) to the dual lug bolts on each PEM.
7. Using a torque wrench, tighten the nuts with a recommended torque setting of 35.5 to 38.5 inch-pounds. Make sure all DC leads are fastened securely.
8. Replace the plastic cover over the terminal blocks.
9. Verify that the circuit breakers are pushed **inward** to the ON position.
10. Break the tag out or lockout seals on the branch circuit or power distribution unit.
11. Apply power by closing the branch circuit or power distribution unit.
    The OOS indicator LED will glow solid red and the other LEDs will go dark. The OOS will not go dark and the IS indicator LED will not illuminate until the external power circuit breakers are closed.
12. Verify that all FRU LEDs illuminate and the PEM's IS LED is green, and the OOS LED is dark.

5.13 Powering Up the System

With the installation cabled up, you are ready to apply power to the system.

Power-Up Procedure

Cover all open module slots and put all approved filler panels in place before turning on power. This is necessary to properly cool the chassis and to avoid electrical shock and other possible hazards. Slot covers and panels must remain in place during system operation.

1. Push the PEM circuit breakers **inward** to the ON position.
2. Verify that all FRU LEDs illuminate and the PEM's In Service LED is green.

The system executes its normal start-up routine and is then ready to use.

5.14 Accessing the System

You can access your system using the SAM shelf manager via the RJ-11 connector on the face plate. This connector is configured as DTE. Configure your console or terminal emulation software using the parameters: Baud rate 115200, Data bits 8, Parity None, Stop bits 1, Flow control None.

A custom cable is required for this connector, refer to *RS-232 Serial Interface* on page 99 for pin assignments. Connect the keyboard and mouse cables into their ports on the appropriate card installed in the system if required and start a terminal program to monitor the system output.

For information on accessing the system via the hub or node blades, refer to *Connecting to a Console or Laptop* on page 94.

Installing Blades

6

6.1 Before You Install or Remove a Blade

Blades may be damaged if improperly installed or handled. Replacement procedures should be performed only by qualified service person. Please read and follow the guidelines in this section to protect your equipment.

6.1.1 Observe ESD Precautions

Use ESD protection

Emerson strongly recommends that you use an antistatic wrist strap and a conductive foam pad when installing or upgrading a system. Electronic components, such as disk drives, computer boards, and memory modules, can be extremely sensitive to electrostatic discharge (ESD). After removing the component from its protective wrapper or from the system, place the component flat on a grounded, static-free surface (and, in the case of a blade, component side up). Do not slide the component over any surface.

If an ESD station is not available, you can avoid damage resulting from ESD by wearing an antistatic wrist strap (available at electronics stores) that is attached to an active electrical ground. Note that a system chassis may not be grounded if it is unplugged.

6.1.2 Watch for Bent Pins or Other Damage

NOTICE

Product Damage
If a system contains one or more crushed pins, power off the system and contact your local sales representative to schedule delivery of a replacement shelf assembly. Bent pins or loose components can cause damage to the blade, the backplane, or other system components.
Carefully inspect your blade and the backplane for both pin and component integrity before installation.

Emerson and our suppliers take significant steps to ensure there are no bent pins on the backplane or connector damage to the blades prior to leaving our factory. Bent pins caused by improper installation or by blades with damaged connectors could void the warranty for the backplane or blades.

6.1.3 Use Caution When Installing or Removing Blades

When first installing blades in an empty shelf, we recommend that you start at the left of the card cage and work to the right when blades are vertically aligned.

When inserting or removing a blade in a slot adjacent to other blades, use extra caution to avoid damage to the pins and components located on the primary or secondary sides of the blades.

6.1.4 Preserve EMI Compliance

To preserve compliance with applicable standards and regulations for electromagnetic interference (EMI), during operation all front and rear openings on the shelf or blade faceplates must be filled with an appropriate blade or covered with an approved filler panel. If the EMI barrier is open, devices may cause or be susceptible to excessive interference.

6.1.5 Understand Hot Swap

NOTICE

Product Damage
Inserting or removing non-hot swap blades or transition modules with power applied may result in damage to blade components.
Make sure that your blade manufacturer identifies yours as hot swap ready.

Data Loss
Powering down or removing a board before the operating system or other software running on the board has been properly shut down may cause corruption of data or file systems.
Make sure all software is completely shut down before removing power from the blade or removing the board from the chassis.

To facilitate hot swap, PICMG 2.1 specifies a blue LED on the faceplate, but does not define the LED functionality. In most cases, the LED is under software control.

If your system is using high-availability software that provides full hot swap capabilities, the software will illuminate the blue hot swap LED on the faceplate when software has stopped and it is safe to remove the blade.

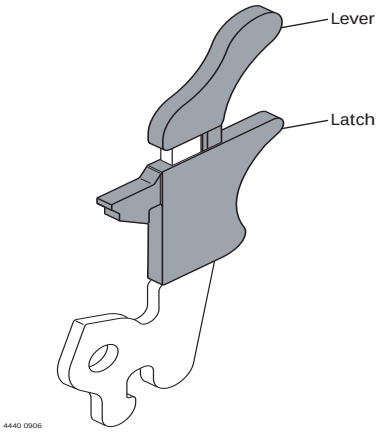
If your system is not running high-availability software, behavior of the blue LED may be indeterminate. In this case, you may need to manually shut down applications or operating systems running on the blade prior to blade removal, even if the blue LED is lit.

Refer to the documents listed in Appendix B, *Related Documentation* for more information about hot swap and the PCI Industrial Computer Manufacturers Group (PICMG) Hot Swap Specification.

6.1.6 Recognize Different Injector/Ejector Lever Types

The blades you install may have different ejector handles and latching mechanisms. The following illustration shows the typical blade ejector handle used with Emerson's AdvancedTCA payload blades. All handles are compliant with the AdvancedTCA specification and are designed to meet the IEEE1101.10 standards.

Figure 6-1 Injector/Ejector Lever Type



Each lever type has a latching mechanism to prevent the lever from being opened accidentally. You must press the lever release before you can open the lever. **Never force the lever.** If the lever does not open easily, you may not have pressed firmly enough on the release. If the lever does not close easily, the blade may not be properly seated in the slot.

To open a lever, press the release and move the lever outward away from the faceplate.

To close a lever, move the lever inward toward the faceplate until the latch engages.

6.1.7 Verify Slot Usage

Prevent possible damage to blades by verifying the proper slot usage for your configuration.

In most cases, connector keying will prevent insertion of a blade into an incompatible slot. However, as an extra precaution, you should be familiar with the symbols (if present on your chassis) and colored blade slot numbers used to indicate slot purpose.The following table lists the slot indicators located on the enclosure.

Table 6-1 Slot Usage

Physical Slot Number	Blade Usage
Slot SAM A and SAM B	SAM A and SAM B
Slots 1 and 14	Hub slots (switches)
Slots 2 through 13	Node slots

6.2 Installing a Blade

This section describes a recommended procedure for installing a blade or RTM in an AXP1406 shelf slot.

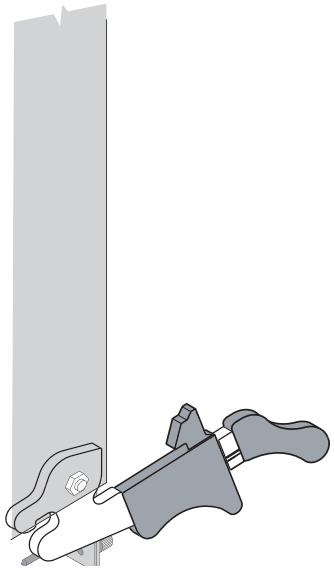
Procedure

Before you install, please read all cautions, notices, and instructions presented in this section and the guidelines explained in *Before You Install or Remove a Blade* on page 85.

Handling blades and peripherals can result in static damage. Use a grounded wrist strap, static-dissipating work surface, and antistatic containers when handling and storing components.

Refer to the illustrations in this procedure and perform these steps when installing blades. Note that this illustration is for general reference only and may not accurately depict the connectors and handles on the blade you are installing. Hot swap compliant blades may be installed while the system is powered on.

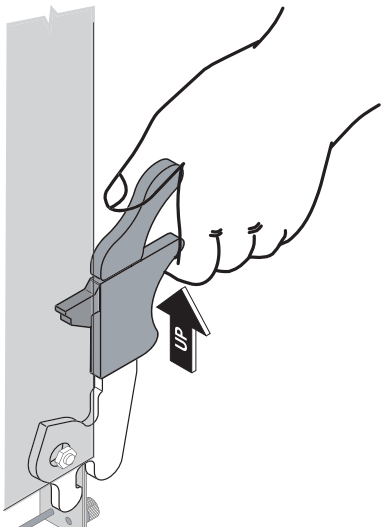
1. Make sure you are working in an ESD-safe environment.
2. Ensure that the top and bottom ejector handles are in the outward position by squeezing the lever and latch together. Open to the outward position.



3. Insert blade into the shelf by placing the top and bottom edges of the blade in the card guides of the shelf. Align the edges of the blade with the card cage rail guides in the appropriate slot.

4. Apply equal and steady pressure to the blade to carefully slide it into the card cage rail guides until resistance is felt. Continue to gently push until the blade connectors engage with the backplane connector. Do not force the blade into the backplane slot.

5. Squeeze the latch and lever mechanisms together and hook the ejector handle into the front edge of the shelf.



6. Fully insert the blade and lock it to the shelf by squeezing the latch and levers of the lower and upper handles together and turning the handles fully towards the faceplate until the latch engages with the faceplate.

7. Wait until the blue LED is switched OFF.
   The switched off blue LED indicates that the blade's payload has been powered up and that the blade is active.
   If your shelf is powered on, the blinking blue LED indicates that the blade is announcing its presence to the shelf management controller.

8. Tighten the retention screws which secure the blade to the shelf.

9. Cable the blade to the intended configuration.

6.3 Removing a Blade

This section describes a recommended procedure for removing a blade from a shelf.

Procedure

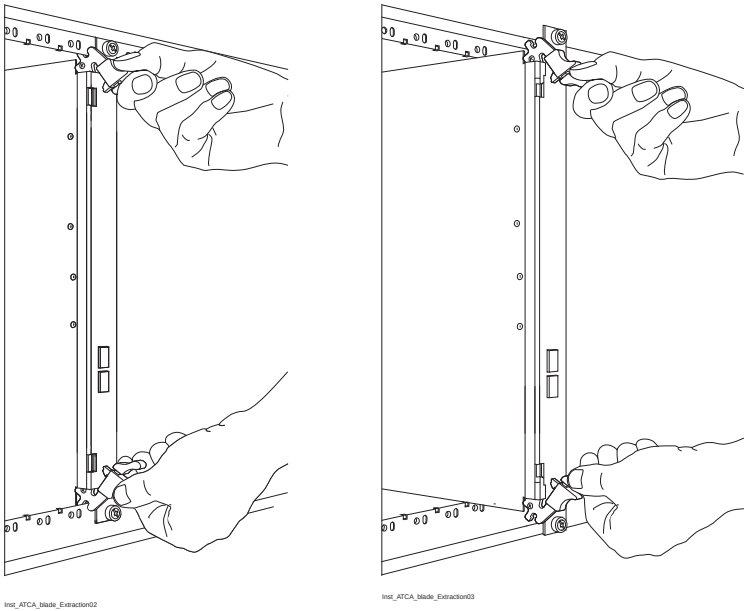
Before you remove your module, please read all cautions, notices, and instructions presented in this section and the guidelines explained in *Before You Install or Remove a Blade* on page 85.

Hot swap compliant blades may be removed while the system is powered on. If a blade is not hot swap compliant, you should remove power to the slot or system before removing the blade. See *Understand Hot Swap* on page 86 for more information.

To remove a blade, follow these steps:

1. Make sure you are working in an ESD-safe environment.
2. Remove any cables connected to the faceplate.
3. Loosen the retention screws at both ends of the blade faceplate.
4. Begin to remove your blade by compressing the ejector levers to deactivate the switch. Refer to the illustration below. Do not remove the blade immediately. Wait for the blue LED to illuminate, see the Notice below.

Figure 6-2 Compressing Ejector Levers and Removing the Blade



NOTICE

Data Loss
Powering down or removing a board before the operating system or other software running on the board has been properly shut down may cause corruption of data or file systems.
Make sure all software is completely shut down before removing power from the blade or removing the board from the chassis.

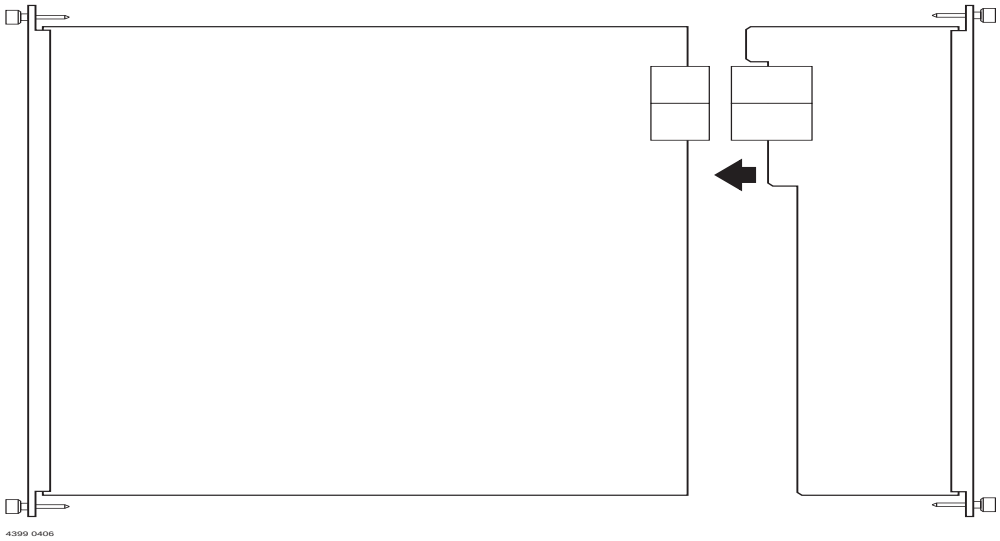
If your blade is hot swap compliant and you are running fully functional hot swap-aware software, unlatching this ejector lever will start the shutdown process on the blade. Software will illuminate the blue hot swap LED on the faceplate when it is safe to remove the blade.
If your blade or system is not running hot swap-aware software, the blue LED may illuminate without regard to software processes still running on the blade. Be sure to manually shut down applications or operating systems running on the blade prior to blade removal. See *Understand Hot Swap* on page 86 for more information.

5. Once the applications and operating system running on the blade have stopped it is safe to remove the blade.
6. Carefully pull the handles to extract the blade from the shelf.
7. Install an approved filler panel if a replacement blade is not being installed.

6.4 Installing an RTM

Rear Transition Modules (RTMs) provide easy access to I/O signal of the base blade through the Zone 3 connector defined by AdvancedTCA specifications. Not all AdvancedTCA blades support RTMs, but for blades that support RTMs there is one specifically designed RTM. It can be installed into a powered or nonpowered system and must be installed into an AdvancedTCA shelf without a Zone 3 midplane.

Procedure



Handling blades and peripherals can result in static damage. Use a grounded wrist strap, static-dissipating work surface, and antistatic containers when handling and storing components.

For blades that do not have hot swappable RTMs, you must either turn off the slot power from the front blade and wait until the blue LED turns off, or remove the front blade from the slot before installing your RTM.

NOTICE

Data Loss
Powering down or removing a board before the operating system or other software running on the board has been properly shut down may cause corruption of data or file systems.
Make sure all software is completely shut down before removing power from the blade or removing the board from the chassis.

1. Make sure you are working in an ESD-safe environment.
2. If necessary, remove the filler panel from the slot you will be installing the RTM into. Keep the filler panel for future use.
3. Compress the handle and apply pressure to the handle to insert the RTM.

4. Verify the proper slot for the RTM you are inserting and align the edges of the RTM with the card cage rail guides in the appropriate slot.
5. Carefully slide the RTM into the card cage rail guides using your thumbs. Apply equal and steady pressure as necessary.
6. If the blade in the front slot is installed, continue to gently push until the Zone 3 connector of the RTM engages with the Zone 3 connector of the front blade and the injector levers make contact with the shelf rails. DO NOT FORCE THE RTM INTO THE BACKPLANE SLOT.
   If the front blade is not present, with the RTM in its rear slot, install the front blade using the steps described in *Installing a Blade* on page 88.
7. Once the RTM is securely seated, release the handle to activate the switch.
8. Wait for the blue LED to switch off, this indicates the RTM is active. Secure it by tightening the retention screws at both ends of the faceplate.

6.5 Removing an RTM

This section describes a recommended procedure for removing an RTM from a shelf.

Procedure

To remove an RTM, refer to the illustrations in the section, *Installing a Blade* and follow these steps:

NOTICE

Data Loss
Powering down or removing a board before the operating system or other software running on the board has been properly shut down may cause corruption of data or file systems.
Make sure all software is completely shut down before removing power from the blade or removing the board from the chassis.

Before you remove your RTM, please read all cautions, notices, and instructions presented in this section and the guidelines explained in *Before You Install or Remove a Blade* on page 85.

1. Make sure you are working in an ESD-safe environment.
2. Switch off the front blade's power and wait until the blue LED is on.
3. Remove any cables connected to the faceplate of the RTM.
4. Loosen the RTM's retention screws at both ends of the faceplate.

5. Begin to remove your RTM by compressing the ejector lever to deactivate the switch. Refer to the illustration *Installing a Blade*. Do not remove the module immediately. Wait for the blue LED to illuminate.
6. Carefully pull the handle to extract the RTM from the shelf.
7. Install an approved filler panel in the slot if another RTM is not being installed.
8. Switch on the power to the front blade.

6.6 Connecting to a Console or Laptop

To connect to a serial console or laptop, check the information that applies to your configuration by referring to the user documentation that came with your blade. A micro-DB9-to-DB9 serial port dongle is provided with the blade (Part Number: SERIAL-MINI-D).

You can monitor local conditions through the blades's serial port connector on the face plate.

Procedure

Follow these steps to connect to a console.

1. Connect to the micro DB-9 connector on your system controller or node blade, the connector is configured as DTE.
2. Configure your console or terminal emulation software using the parameters: Baud rate 9600, Data bits 8, Parity None, Stop bits 1, Flow control None.
3. Start a terminal program to monitor the output.

Shelf Management Alarm Module

7

7.1 Overview

This chapter describes the AdvancedTCA Shelf Management Alarm Module, hereafter known as the SAM, which consists of the Shelf Manager Carrier (ShMC) and the Shelf Management Mezzanine Module (ShMM) which installs on the carrier blade. Two SAMs are installed into two dedicated shelf manager slots located at the bottom-front of the AXP 14-Slot Shelf. The SAM is hot swappable and the connectors are accessible through the face plate.

You will find the following information in this chapter:

- *Features*
- *Block Diagram and Face Plate Layout*
- *Functional Description*
- *Hardware Monitoring and Control*
- *Face Plate LEDs*
- *SAM Software*

The SAM supports redundant operation by automatic switchover between two SAMs. When two SAMs are present in a shelf, one acts as the Active SAM (SAM-A) and the other acts as a Standby SAM (SAM-B). They share signals across the AdvancedTCA backplane that allow them to coordinate their redundant operations. The SAM provides access to the IPMCs for the Power Entry Module (PEM) via the IPMB. The FTMs do not have independent IPMCs, but are represented by the active SAM as an additional FRU which is accessible via the ShMM. The SAMs use IPM Sentry Shelf Manager software for system management. Refer to *SAM Software* on page 107 for further information.

The SAM also provides these operations for the AXP1406 shelf:

- Control for the activation/deactivation of AdvancedTCA blades
- Handles E-Keying
- Control of Power Management
- Monitoring of overall system and blade level health
- Logging for critical system events
- Support for the Command Line Interface (CLI) to access shelf information for:
  - Shelf blade population
  - List of sensors and sensor values
  - Sensor threshold settings

  - System events
  - Shelf health
- Control of chassis cooling management (fan levels)

For additional information on the above operations and the Command Line Interface, refer to the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference* and the *Pigeon Point Shelf Manager External Interface Reference, Release 2.3*, respectively.

7.2 Features

The SAM is based on the AMD Alchemy Au1550, which is a versatile low power, high performance, and high integration network SOC (System on a Chip). Shelf management software executes on the MIPS processor core. The integrated controllers of the Au1550 implement the IPMB, dual Ethernet, dual RS232, and other peripheral interfaces.

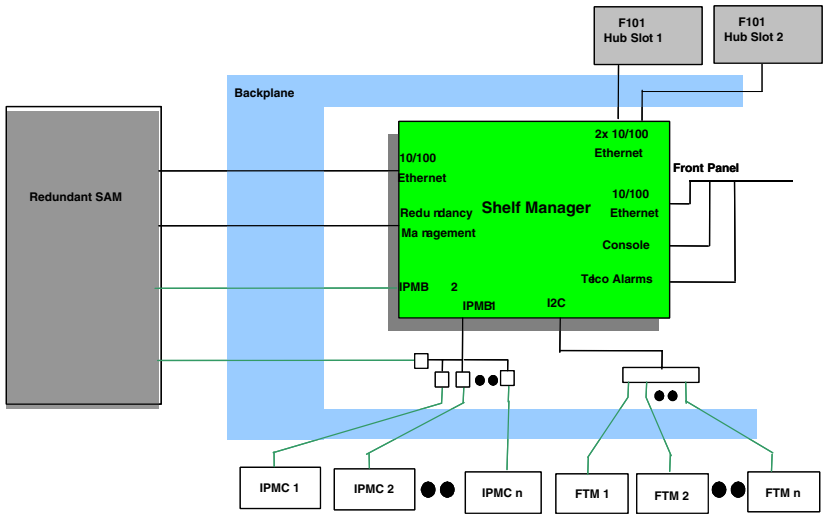
The following lists the features of the SAM.

- 4U x 280mm x2HP form factor
- 333 MHz MIPS RISC core with MMU and caches
- 128MB of SDRAM
- 64MB of flash
- SODIMM socket for the shelf manager mezzanine
- Dual serial interface at RS232 or CMOS levels, EIA/TIA-561 compliant
- Face plate and backplane Ethernet
- IPMB-A/B interfaces with bussed interface
- Management and monitoring for PEMs and FTMs
- Master-only I^2C bus for access to on-carrier devices
- On-board temperature monitoring
- Telco alarm DB-15 interface, LEDs
- Hot swap ejector handle and switch and LED
- Status LEDs
- User SEEPROM
- Battery-backed RTC
- External AdvancedTCA Watchdog Timer
- CLPD devices on system bus for SAM redundancy and hot swap interfaces

7.3 Block Diagram and Face Plate Layout

Figure 7-1 shows a block diagram of the overall SAM architecture and Figure 7-2 on page 98 shows the face plate layout.

Figure 7-1 Block Diagram of SAM

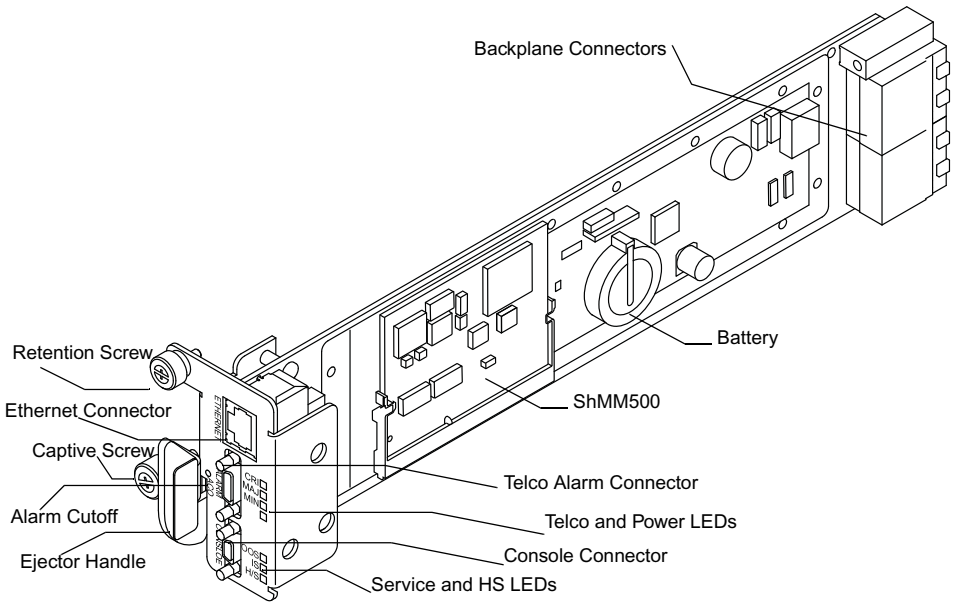


The SAM has these interfaces:

- Four 10/100Base-T Ethernet links
  - One link to each system controller and switching blade (2)
  - One link to the redundant SAM
  - One link to the face plate
- I^2C interfaces for to up to nine FTMs
- One Ethernet link, failover management status signals, and one IPMB branch or segment to the other SAM
- Radial IPMB links for up to 20 modules (16 blades and 2 PEMs)
- Face plate interfaces that include 10/100Base-T Ethernet, RS232 serial console, and Telco alarm interface with connector, indicators, and alarm cutoff push button

The SAM provides the face plate LEDs listed in the following table. More detail on the LEDs is provided in the following sections.

Figure 7-2 Face Plate and Components Layout



7.4 Functional Description

The SAM has a SODIMM socket for the shelf management mezzanine (ShMM) device and front-panel connectors for the serial console, Ethernet, and Telco alarm signals of the mezzanine. The dual-IPMB interface from the mezzanine is connected to the dual IPMBs in the backplane.

The SAM includes several on-board devices that enable different aspects of shelf management based on the shelf management mezzanine. These facilities include I^2C-based hardware monitoring/control and GPIO expander devices.

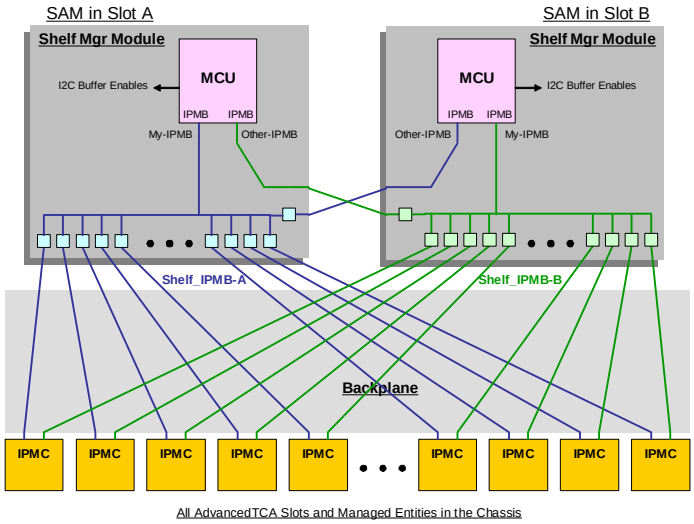
7.4.1 SODIMM Socket

The SAM provides a small outline, dual inline memory module (SODIMM) socket for the ShMM. The socket is a 144-pin, high-profile SDRAM SODIMM connector, providing a 3.7 mm connector height. There are no components on the shelf manager carrier blade underneath the mezzanine device.

7.4.2 IPMB Connectivity

The AXP1406 shelf implements an IPMB topology and each SAM provides for dual IPMBs at the backplane P1 connector. The IPMB signals are buffered on the SAM using the LTC4300A-1 device that implements bidirectional buffering for the IPMB signals. IPMB-A and IPMB-B are then routed to the backplane connector for connection to the other SAM, PEMs, and the 16 AdvancedTCA slots.

Figure 7-3 Slots and Managed Entities in the Shelf



7.4.3 RS-232 Serial Interface

The SAM provides an RS-232 interface on the face plate connector using a MicroDB-9 connector. The connector is routed to the serial port of the shelf manager mezzanine.The default baud rate is 115200, 8, N, 1. Pin assignments for this connector are:

Table 7-1 MicroDB-9 Serial Port Connector Pin Assignments

Pin	Signal	Pin	Signal
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	GND		

7.4.4 Master-Only I²C Bus

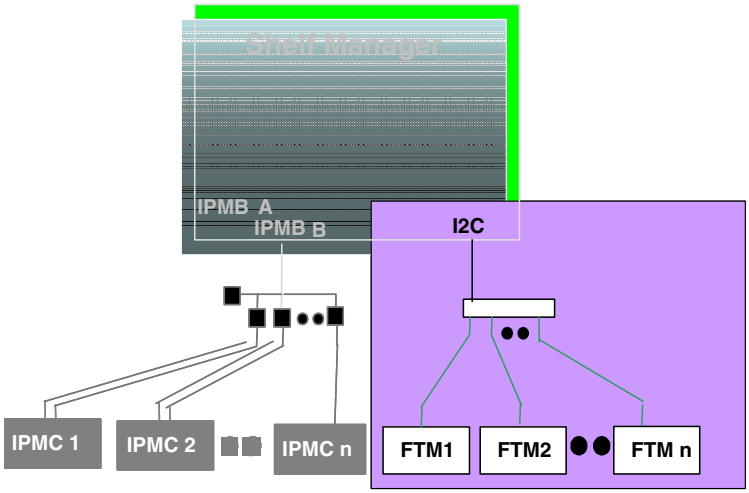
The SAM provides a number of I²C devices using the master-only I²C bus of the shelf manager mezzanine. The master-only I²C bus is used internally on the mezzanine for the real-time clock and EEPROM devices. Additional I²C devices connected to the bus on the SAM are used for the following functions:

- System hardware monitoring and control
- GPIO extension, for various purposes
- Implementation of the off-board I²C busses for the FTMs

7.4.5 I²C Management for FTMs

The fan tray modules are not on the IPMB so they don't have IPMB addresses. Instead, the FTMs utilize a separate radial I²C system. The shelf manager can use this to adjust the fan speed and a fail-safe mechanism ensures that all the fans run at full speed in the event of a SAM failure. The fans appears as FRUs 3 through 11 on the active shelf manager.

Figure 7-4 I2C Bus and FTM Connectivity



For more detail on the FTM's speed and control, refer to *Fan Speed and Control* on page 102.

7.4.6 Shelf FRU SEEPROM

The SAM provides access to the SEEPROMS on both PEM A and PEM B via the master-only I²C. Information stored on the PEMs is separate from the PEM firmware and contains OEM records that enable the SAM to self-configure for either the AXP1600 or AXP1406 shelf.

7.4.7 Face Plate LEDs

The SAM provides the face plate LEDs listed in the following table. More detail on the LEDs is provided in the following sections. Also refer to Figure 7-2 on page 98 for LED locations.

Table 7-2 Face Plate LEDs

SAM LEDs	Type
Telco	Critical alarm (CRIT) Major alarm (MAJ) Minor alarm (MIN)
Power	Power Indicator
In Service	In Service (IS)
Out of Service	Out of Service (OOS)
Hot Swap	Hot swap ready (HS)

7.4.7.1 Hot Swap LED

The SAM provides a blue hot swap LED. This LED indicates when it is safe to remove the SAM from a live shelf.

Table 7-3 Hot Swap LED States

State	Condition
Off	The SAM is not ready to be removed/disconnected from the shelf
Blue	The SAM is ready to be removed/disconnected from the shelf
Long-blink	The SAM is activating itself
Short-blink	Deactivation has been requested

The software running on the shelf manager mezzanine is responsible for turning the LED on/off using the GPIOs on the ShMC.

7.4.7.2 SAM Status LED

Status is shown using a LED on the front alarm panel. The illumination state of the LED is normally controlled by the GPIO on the SAM. The following table describes the LED states.

Table 7-4 SAM Status Indicators

Faceplate Indicator	Color	State	Condition
Critical	Red	On	Active
Major	Red	On	Active
Minor	Red	On	Active
IS (In Service)	Green	On	Active, power good
LED color (red or yellow) is selectable via software.			

Table 7-4 SAM Status Indicators (continued)

Faceplate Indicator	Color	State	Condition
OOS (Out of Service)	Red	On	Failed
Power	Green	On	Power present
HS (Hot Swap)	Blue	On	Remove OK
LED color (red or yellow) is selectable via software.			

7.5 Management and Control

This section gives a general description of the role of the on-board I^2C devices and how management, control, and redundancy is handled by the SAM. Detailed information on sensors can be found in the *AXP1406/AXP1600 Subsystem IPMI Programmer's Reference*.

7.5.1 Hardware Monitoring and Control

The hardware monitoring and control functions implemented by the AXP1406 are provided by the on-board I^2C-based devices.

7.5.2 Voltage Sensors

On-board sensors provide the following power supply voltages. All voltage sensors are implemented using the ADM1026 device on the master-only I^2C bus. System management software running on the SAM is responsible for reacting to an event when an interrupt is triggered by the ADM1026 device.

7.5.3 Temperature Monitoring

An on-board temperature sensor is available on the SAM. This sensor is implemented via the Maxim 6656, which supports on-chip temperature sensor that reads the local temperature and a remote sensor used for airflow sensing.

7.5.4 Fan Speed and Control

All fan speed and fan voltage sensors are exposed on the active SAM.

The FTMs have 10 fan speed settings. The SAM automatically adjusts the fan speed to cool the blade content based on sensor thresholds from the blades. The minimum fan speed is set to 3. There is a dynamic minimum setting that will adjust to the minimum required fan level for a given blade content. The dynamic minimum level adjusts to a point where all thermal sensors are just below their upper noncritical threshold. The dynamic minimum will try to reduce the fan level every 8 hours and then readjust if sensors report over their upper noncritical threshold.

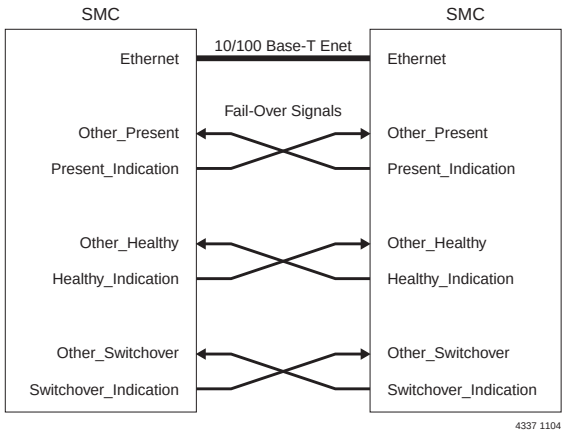
Fan speeds for all level settings are summarized in the next table.

Fan Speed Setting	Average(1) Speed in RPMs
Speed 1	Not recommended
Speed 2	Not recommended
Speed 3	Average speed 2236 +/-10%
Speed 4	Average speed 2916 +/-10%
Speed 5	Average speed 3597 +/-10%
Speed 6	Average speed 4277 +/-10%
Speed 7	Average speed 4958 +/-10%
Speed 8	Average speed 5638 +/-10%
Speed 9	Average speed 6319 +/-10%
Speed 10	Average speed 7200 +/-10%
[1] **Average speeds measured over a large sample size**	

7.5.5 Redundancy Control (Failover Management)

The shelf management mezzanine modules support redundancy between two SAMs. Signals are passed by either an Ethernet link that directly connects the two SAMs via dedicated backplane wiring or several intrashelf management signals which also use dedicated backplane wiring. The Ethernet link is used to transfer redundancy state information between the Active and Standby SAMs and is also used to detect failure of the Active SAM.

Figure 7-5 Failover Management Diagram



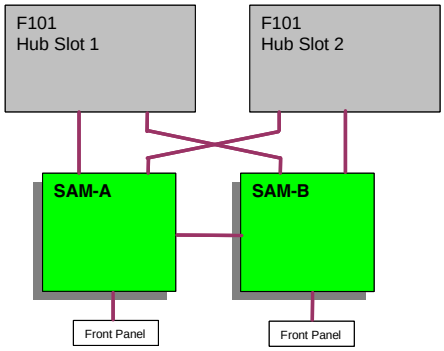
7.5.6 Ethernet Signals

The SAMs implement a four-port 10/100Base-T Ethernet switch. The SAM's 10/100Base-T links to each of the system controller/switching blades in logical hub slots 1 and 2.The backplane has a cross-connect between each hub slot and the other SAM, as shown in the following figure. The shelf manager's carrier card has the following:

- Port to Shmm500R
- Port to BC1 (F101)
- Port to UC1 (F101)
- Port to Other Sam

The shelf manager mezzanine has a port to the face plate (eth0) and a port to the SAM (eth1). The backplane has cross-connects between each hub slot and other SAM.

Figure 7-6 Interhub Slot and Shelf Manager Connectivity



7.5.7 Switchover Scenarios

A switchover takes place when the Standby SAM determines that the Active SAM is no longer operational. The signs of this are:

- The REMOTE_HEALTHY or REMOTE_PRESENT signals change to FALSE. This indicates that the peer SAM is no longer healthy or present
- The TCP connection between the Active and the Standby SAMS closes. The keep alive time-out parameter for this connection is set to 1 second to recognize a malfunction of the Active SAM as quickly as possible. In this case the Standby SAM waits for 3 seconds and then checks the state of the REMOTE_HEALTHY line to make sure the connection is broken due to a failure of the Active SAM and not due to a communication failure.
  If the Standby SAM detects that the Active SAM is still healthy it doesn't perform the switchover but instead reboots itself. After the reboot it makes a second attempt to initialize as a backup and will continue until either it succeeds in establishing the connection with the Active SAM or it detects that the Active SAM is no longer healthy. If it detects that it isn't healthy it will initialize as the Active SAM.

- When the Active SAM receives a switchover command from the Standby SAM and agrees to switchover, it closes the TCP connection, clears the LOCAL_HEALTHY bit and exits the program which indicates the switchover to the Standby SAM.
  If the Standby SAM decides that a switchover should take place it closes the TCP connection and exits this function. Activate callbacks are called for all facilities and the SAM starts to work in active mode, with no backup. At this moment the SAM sets the LOCAL_SWITCHOVER bit, requesting the hardware to recognize it as the Active SAM. In response, the hardware must set the ACTIVE bit. When the formerly active SAM restarts it successfully establishes the connection with the current SAM and starts to operate in the backup mode.

7.6 Telco Alarm Functionality

The SAM provides Telco alarms on the face plate with the following components:

- Telco alarm cutoff push button
- DB15 Telco alarm contacts
- Telco alarm LEDs

7.6.1 Telco Alarm Cutoff Push Button

The SAM provides a Telco alarm cutoff function with the front-panel push button switch. This push button activates the alarm cutoff (ACO) state. When ACO is activated, the active alarm LED blinks and all of the alarm relays are deactivated. This button does not clear alarms. Refer to Figure 7-2 on page 98 for the location of the alarm cutoff push button switch.

7.6.2 Telco Alarm LEDs

These LEDs are used to indicate the presence of the critical, major, and minor alarms. When a LED is lit, the respective alarm is active. A blinking LED signals an alarm cut-off state which is initiated by pressing the alarm cut-off button when an alarm is active.

7.6.3 Telco Alarm Interface

The SAM provides a front-panel alarm connector, which is a standard DB-15 connector with the following pin assignments:

Table 7-5 Telco Alarm Connector Pin Assignments

Pin	Name	Description	Pin	Name	Description
1	AMIR+	MinorReset+	9	AMINC	MinorAlarm – NC
2	AMIR-	MinorReset-	10	AMINCOM	MinorAlarm – COM
3	AMAR+	MajorReset+	11	AMANO	MajorAlarm – NO
4	AMAR-	MajorReset-	12	AMANC	MajorAlarm – NC
5	ACNO	CriticalAlarm - NO	13	AMACOM	MajorAlarm – COM

Table 7-5 Telco Alarm Connector Pin Assignments (continued)

Pin	Name	Description	Pin	Name	Description
6	ACNC	CriticalAlarm - NC	14	APRCO	PwrAlarm – NO
7	ACCOM	CriticalAlarm - COM	15	APRCOM	PwrAlarm – COM
8	AMINO	MinorAlarm – NO	–	Gnd	Not utilized

7.7 Hot Swap Interface

The SAM provides a hot swap interface allowing the SAM to be replaced without powering down the shelf. The hot swap interface is implemented using the shelf manager mezzanine CPLD device. The interface is composed of three components:

- Injector/Ejector handle switch
- Presence signal indicating that the SAM is fully seated in its backplane connector
- HS LED to indicate safe to remove state

7.8 Hardware Address Settings

The SAM implements a selectable hardware address of the backplane connector. The settings are determined from the shelf management software by two GPIO pins on the shelf manager mezzanine.

The following tables show the hardware address pin connections.

Table 7-6 Hardware Address Pin Connections

Hardware Address Pin	GPIO
HA0	E4
HA1	E5

Table 7-7 Hardware Address Pin Descriptions

HA1	HA0	Description
0	0	Error
1	0	First SAM
0	1	Second SAM
1	1	Not seated

7.9 Lithium Battery

The SAM provides a lithium coin cell backup battery installed in a 20 mm holder on the Shelf Manager Carrier. The recommended battery type is 2032. The battery voltage is supplied to the ADM1024 IC and to the shelf manager mezzanine connector.

⚠ CAUTION

Personal Injury or Product Damage
Danger of explosion if battery is replaced incorrectly.
Replace battery only with the same or equivalent type recommended by the equipment manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du même type ou d'un type équivalent recommandé par le constructeur. Mettre au rebut les batteries usagées conformément aux instructions du fabricant.

Explosionsgefahr bei unsachgemäßem Austausch der Batterie. Ersatz nur durch denselben oder einen vom Hersteller empfohlenen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.

7.10 Power

The SAM uses dual +12 V power feeds, one from each PEM. Hot swap circuitry ensures correct operation when a SAM is inserted into or removed from a live system.

Removing power by turning off the circuit breakers on the PEMs does not remove power to the SAMs. The circuit breakers remove power to the blade slots only and do not remove power to the DC-DC power converters in the PEMS, which is how power is supplied to the SAMs.

7.11 SAM Software

The software that runs on the shelf manager is described in detail in the *Pigeon Point Systems IPM Sentry Shelf Manager User Guide*, which provides an introduction to shelf management, the shelf manager, and the shelf management mezzanine. Also available is the *Pigeon Point Systems IPM Sentry Shelf-External Interface Reference* which describes the command line, web, SNMP (Simple Network Management Protocol), and RMCP (Remote Management Control Protocol) interfaces. Refer to Appendix B, *Related Documentation* for more information on these publications.

7.12 imls Utility

A utility called imls is available on the SAM. It can be used to list all firmware images present in flash. Note that the Shelf Manager flash is divided into two banks. Each bank contains a set of three separate firmware images:

- U-Boot
- RFS
- Kernel images

When the rupgrade_tool utility is used to perform a reliable firmware upgrade operation on the Shelf Manager, the flash bank that is currently not active is programmed with the new images, the processor is reset, and the newly programmed flash bank will be selected.

If the new firmware fails to load or execute properly, the Shelf Manager will automatically reset and revert to the previous flash bank. Selection of the bank to be used for booting is not a configurable option at run-time.

The following text shows sample output obtained by running imls at the Shelf Manager Linux prompt. Note that the first three images listed reflect the currently active flash bank contents, and the next set of three images is contained within the other flash bank.

```
# imls
/dev/mtdblock3:
Image Name:   U-Boot 1.1.4 for shmm500 board
Created:      Fri Nov  3 14:31:34 2006
Image Type:   MIPS Linux Firmware (uncompressed)

Data Size:    190148 Bytes = 185.69 kB = 0.18 MB
Load Address: 0x9FC00000
Entry Point:  0x00000000


/dev/mtdblock2:
Image Name:   MIPS Linux-2.4.26
Created:      Fri Nov  3 14:35:06 2006
Image Type:   MIPS Linux Kernel Image (gzip compressed)
Data Size:    861087 Bytes = 840.91 kB = 0.82 MB
Load Address: 0x80100000
Entry Point:  0x802C2040


/dev/mtdblock4:
Image Name:   sentry.shmm500 RFS Ramdisk Image
Created:      Fri Nov  3 14:37:04 2006
Image Type:   MIPS Linux RAMDisk Image (gzip compressed)
Data Size:    3662958 Bytes = 3577.11 kB = 3.49 MB
Load Address: 0x00000000
Entry Point:  0x00000000
```

```
/dev/mtdblock8:
Image Name:   U-Boot 1.1.4 for shmm500 board
Created:      Thu Nov  2 16:13:37 2006
Image Type:   MIPS Linux Firmware (uncompressed)
Data Size:    190180 Bytes = 185.72 kB = 0.18 MB
Load Address: 0x9FC00000
Entry Point:  0x00000000


/dev/mtdblock7:
Image Name:   MIPS Linux-2.4.26
Created:      Thu Nov  2 16:17:49 2006
Image Type:   MIPS Linux Kernel Image (gzip compressed)
Data Size:    861093 Bytes = 840.91 kB = 0.82 MB
Load Address: 0x80100000
Entry Point:  0x802C2040


/dev/mtdblock9:
Image Name:   sentry.shmm500 RFS Ramdisk Image
Created:      Thu Nov  2 16:19:46 2006
Image Type:   MIPS Linux RAMDisk Image (gzip compressed)
Data Size:    3660606 Bytes = 3574.81 kB = 3.49 MB
Load Address: 0x00000000
Entry Point:  0x00000000
```

From the sample output, it is possible to see the compilation dates of the U-Boot, RFS, and Kernel images for both the active and nonactive firmware banks. Compilation times will never be identical for all three images, but should be relatively close to each other.

FRU Replacement Procedures

8

8.1 Overview

This chapter provides the removal and installation procedures for these field-replaceable components in a AXP1406 shelf.

- *Power Entry Modules*
- *Removing the PEM*
- *Installing the Replacement PEM*
- *Removing an Upper Front FTM*
- *Installing the Upper Front FTM*
- *Removing an Upper Rear FTM*
- *Installing the Upper Rear FTM*
- *Removing the Lower Fan Tray Module*
- *Installing the Lower FTM*
- *Replacing the Fan Filter*

The AXP1406 backplane is not a field-replaceable unit.

8.2 Read These Warnings Before Proceeding

⚠ WARNING

Personal Injury or Death
Dangerous voltages, capable of causing death, may be present in this equipment.
Use extreme caution when handling, testing, and adjusting.

⚠ CAUTION

Personal Injury
Multiple power sources are present.
Service only by qualified service person.
Mehrfache Energiequellen.
Handhabung nur durch geschultes Personal.
Des sources multiples de pouvoir sont présentes
L'entretien de cet équipement doit être effectué par du personnel de service qualifié

The DC power inputs must only be attached to approved Telephone Network Voltage (TNV) or SELV (Safety Extra Low Voltage) branch circuits. Branch circuits must comply with all requirements called for in these safety standards: IEC 60950, EN 60950, CAN/CSA-C22.2 No. 60950. Attaching inputs to non-TNV/SELV approved power sources will cause the system to fail compliance with safety regulations.

8.3 Power Entry Modules

The AXP1406 shelf supports two Power Entry Modules (PEMs). Since the shelf is equipped with a redundant power distribution system, the removal of a single PEM does not interrupt system operation. PEMs are accessible from the rear of the shelf. Each PEM has EMI gaskets on all sides of the module that provide EMI shielding.

The following instructions describe how to replace a power entry module. For further information on power entry modules, refer to *Power Entry Module* on page 66.

Tools You Will Need

- Multimeter
- Standard Phillips-head screwdriver
- Torque wrench
- Nut driver
- AdvancedTCA PEM Service Kit, PN 6706808A01 (shipped with AXP1406)

8.3.1 Removing the PEM

When replacing a PEM, make sure you have a replacement PEM available. Replacement can take place in under 30 minutes by a qualified service person. PEMs are accessible from the rear of the shelf.

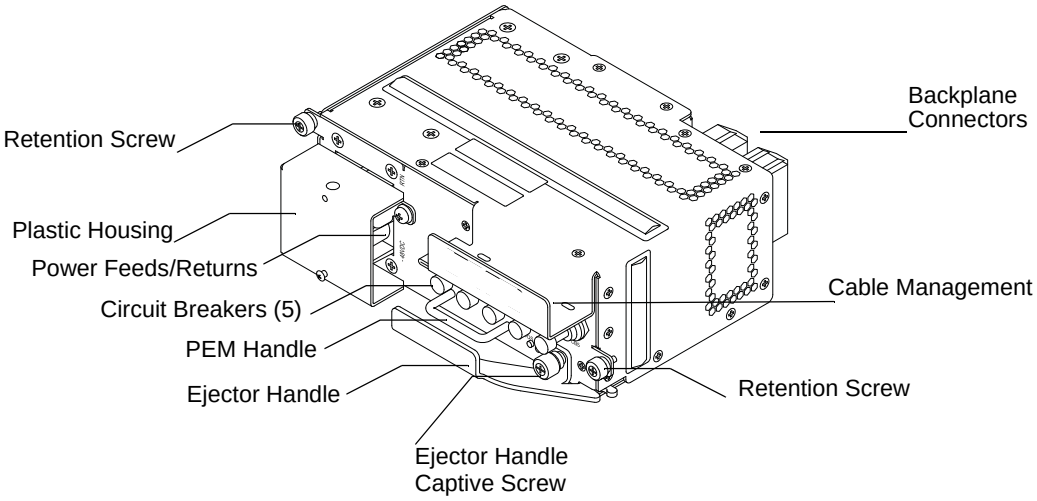
Replacing one PEM is done while the other PEM is in operation. Having the PEM located in the shelf is critical to maintaining proper airflow and cooling of the shelf. Steps in which a PEM is removed from a slot and reinserted should be completed within 3 minutes to maintain the shelf within safe operating temperatures.

Procedure

Read all cautions and warnings, and ensure the equipment is properly grounded by reviewing the procedure in *Grounding the Shelf* on page 80, and follow these steps. The PEM has multiple power sources. This procedure should be followed precisely to ensure the PEM is isolated from all power sources before removing the PEM from the shelf, or removing the plastic terminal block lug cover.

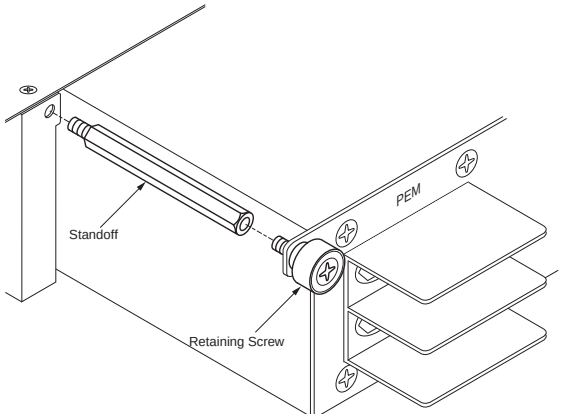
This procedure assumes that the redundant PEMs are powered on in the shelf.

To remove a PEM, refer to the next figure and follow these steps.

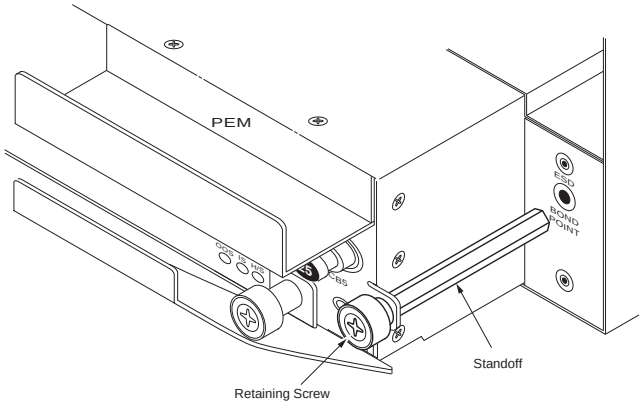


1. Locate the target power input cable's terminals at the branch circuit or power distribution unit.
2. Open the external circuit breakers that provide DC feed power to the PEM you are replacing.
3. Lock and tag out the circuit breakers on the branch circuit or power distribution unit.
4. Using the appropriate tool, loosen the chassis retention screws on each side of the PEM.
5. Loosen the captive screw located on the ejector handle. This will signal the switch to deactivate the hot swap signal. Watch for the Blue LED to go solid and steady, signalling that it is ready to remove.
6. Pull the handle to the full open position. You will feel the PEM disconnect from the backplane.
7. Using the handle on the front of the PEM, or the tabs at each side of the PEM, pull the module straight out from the rail guides, about 3 inches.

8. With the PEM in place and before removing the terminal block lug cover, screw a standoff/lockout screw extension onto the retaining screws located on each side of the PEM.



9. Align the threaded end of the standoff/lockout screw extension with the screw holes on each side of the shelf and securely tighten to lock the PEM approximately 2 inches out of the shelf.



10. Using the appropriate tool, carefully remove the plastic covering over the terminal block.

If the multimeter indicates there is still power present and power cannot be removed from the terminals, the entire shelf must be powered down to perform the PEM replacement.

11. Confirm that there is no power to the PEM lug bolts. Using a multimeter, measure between the two lugs and then measure between the chassis ground and each lug. If the DC potential is 3.0VDC or less, then power is not present.

12. Remove the DC power cable from the dual lug bolts on the PEM you are replacing, being careful to place the two cables so they cannot short to each other or to other conductors.

13. Loosen the standoff/lockout screw extensions and remove the PEM from the slot by pulling straight out of the rail guides.

14. Remove the standoff/lockout screw extensions and put them aside to use when installing the new PEM.

8.3.2 Installing the Replacement PEM

Procedure

Have the correct replacement PEM available and follow these steps to install the replacement PEM.

1. Screw a standoff/lockout screw extension onto the retaining screws located on each side of the replacement PEM.
2. Align the back end of the replacement PEM with the rail guides in the empty PEM slot and slide the PEM into the slot.

The PEM should be inserted with a single, steady motion. Bouncing the PEM during insertion may cause an alarm condition in the system. Also, the PEM should not be forced into the slot. To avoid crushing or bending the connector pins, back the PEM out and insert it again if it hangs during insertion.

3. Align the threaded end of the standoff/lockout screw extension with the screw holes on each side of the shelf and securely tighten to lock the PEM approximately 2 inches out of the shelf. Refer to the figure on page 114.
   The replacement PEM should be locked into the slot within 3 minutes to maintain the proper cooling properties of the shelf.

4. Loosen the PEM ejector handle captive screw and pull the PEM ejector handle to the full open position.

If the DC power cables are connected to the branch circuit or power distribution unit, a qualified service person must confirm that the power to the cables is terminated (off) before continuing the steps to attach the cables to the PEMs.

5. Remove the plastic covering over the terminal block.
6. Verify that the lock and tag out on the branch circuit or power distribution unit is still intact to ensure the system is in a safe state.
7. Attach the DC power cable to the dual lug bolts on the PEM (power -48VDC input and Return) and tighten the nuts with a recommended torque setting of 35.5 to 38.5 inch-pounds. Make sure all DC leads are fastened securely.
8. Replace the plastic cover over the terminal blocks.
9. Remove the standoff/lockout screw extensions.
10. Gently press the PEM into the slot until the ejector handle engages and then press the ejector handle to the closed position to seat the PEM into the backplane. The OOS indicator LED will glow solid red and the other LEDs will go dark. The OOS will not go dark and the IS indicator LED will not illuminate until the external circuit breakers are closed.
11. Tighten the two retention screws located at each side of the PEM using the appropriate tool. Begin with the left-side fastener to prevent the PEM from shifting and causing possible cross-threading of the fastener. The recommended torque setting is 5 inch-pounds.
12. Tighten the ejector handle captive screw to 3 inch-pounds and observe the HS LED begin to blink and then turn off.

⚠ CAUTION

System Damage or Injury
Failure to operate the shelf without covering vacant slots will void the manufacturer's warranty.
Do not operate the system with open module slots. For optimal cooling of the system and associated payload and to prevent electrical shock, cover all open module slots and put all panels in place before turning on power.
Slot covers and panels must remain in place during system operation.

13. Break the tag out or lock out seals on the branch circuit or power distribution unit.

14. Apply power by closing the branch circuit or power distribution circuit breaker to the shelf.

15. Verify that all FRU LEDs illuminate and the PEM's IS LED is green and the OOS LED is dark.

8.4 Upper and Lower Fan Tray Modules

To prevent system damage, the operator must replace the fans within the recommended service interval shown in the following table to prevent a decline in shelf operability. Make sure the replacement FTM is available for exchange and ready to install. If the exchange of an upper FTM will exceed the recommended service interval, the display panel must be reinstalled and remain in place until the replacement FTM in ready for installation.

Service Interval for 1 FTM	Temperature Range
1 minute	55× C
3 minutes	45× C
5 minutes	35× C

8.4.1 Removing an Upper Front FTM

Follow these steps and refer to the figures to remove an FTM from the shelf.

Procedure

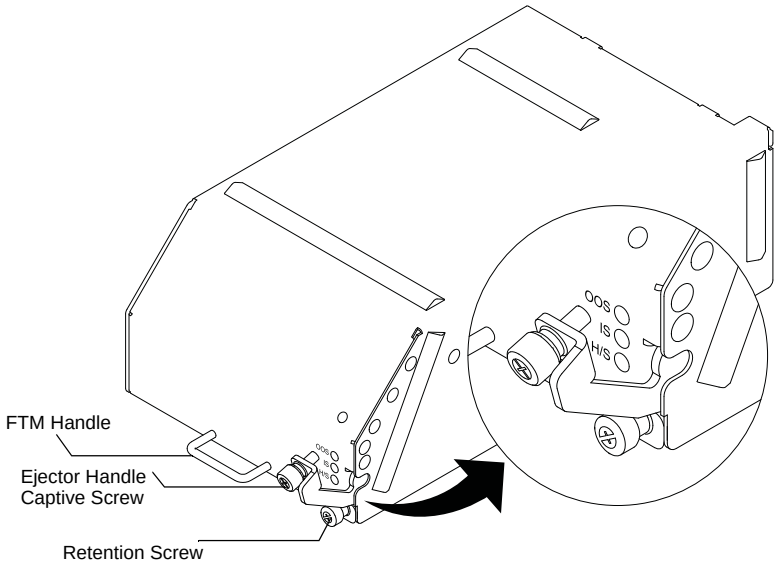
Please read the following cautions before replacing any of the FTMs.

⚠ CAUTION

Personal Injury
Fans may continue to rotate after power is removed.
Keep fingers away from the bottom of the FTM enclosure.

1. Loosen the retention screw to the chassis before loosening the ejector handle screw.

Figure 8-1 Upper Front FTM Ejector Handle and LEDs



2. Locate the captive screw on the ejector handle and loosen it. Pull the ejector handle outward to a slightly open position to disengage the FTM from the connectors. Watch for the blue LED to blink. When the blinking stops and the LED remains a solid blue, the FTM is ready to be removed.
3. Open the ejector handle to a full open position.
4. Using the handle on the front of the FTM, slowly pull the FTM out of the shelf, while supporting the bottom of the module with the palm of your hand.

8.4.2 Installing the Upper Front FTM

Procedure

Have the correct replacement FTM available and follow these steps to install an upper front FTM.

1. While supporting the FTM with the palm of one hand, align the FTM carefully into the appropriate fan slot in the shelf and slowly slide the FTM until connection with the backplane connector is made.
   The FTM is connected when the assembly is firmly seated in the upper backplane connector and the hot swap handle moves to the closed position.

2. Tighten the captive screw located on FTM ejector handle. The recommended torque setting is 3 inch-pounds.
3. Tighten the chassis retention screw to secure the FTM. The recommended torque setting is 5 inch-pounds.

When the Blue LED turns off, the fan is operating.

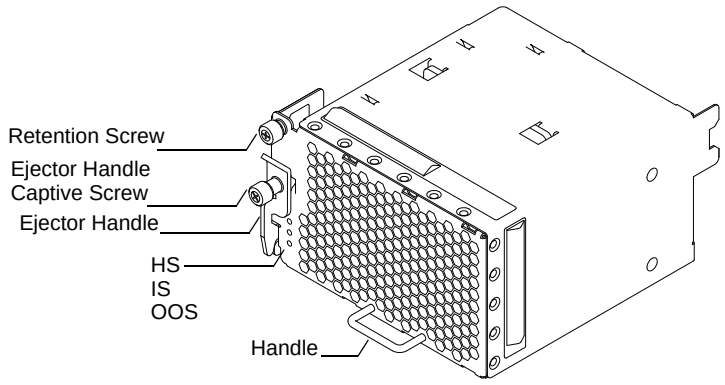
8.4.3 Removing an Upper Rear FTM

Procedure

Follow these steps and refer to the figure to remove a FTM from the top rear side of the shelf.

1. Loosen the chassis retention screw in the upper left corner of the FTM before loosening the ejector handle screw.

Figure 8-2 Upper Rear FTM Ejector Handle and LEDs



2. Locate the captive screw on the ejector handle and loosen it. Pull the ejector handle outward to a slightly open position to disengage the FTM from the connectors. Watch for the blue LED to go solid. When the LED remains a solid blue, the FTM is ready to be removed.
3. Open the ejector handle to a full open position.
4. Using the handle on the front of the FTM, slowly pull the FTM out of the shelf, while supporting the bottom of the module with the palm of your hand. Be careful to not place fingers near the fans.

8.4.4 Installing the Upper Rear FTM

Procedure

Have the correct replacement FTM available and follow these steps to install the upper rear FTM.

1. While supporting the FTM with the palm of one hand, align the FTM carefully into the appropriate fan slot in the shelf. A guide on the left FTM slot will assist in aligning the FTM.
2. Slowly slide the FTM into the slot until connection with the backplane connector is made.
   The FTM is connected when the hot swap handle is in the closed position and the assembly is firmly seated in the upper backplane connector.
3. Tighten the captive screw located on FTM ejector handle. The recommended torque setting is 3 inch-pounds.
4. Tighten the chassis retention screw to secure the FTM. The recommended torque setting is 5 inch-pounds.

When the Blue LED turns off, the fan is operating

8.4.5 Removing the Lower Fan Tray Module

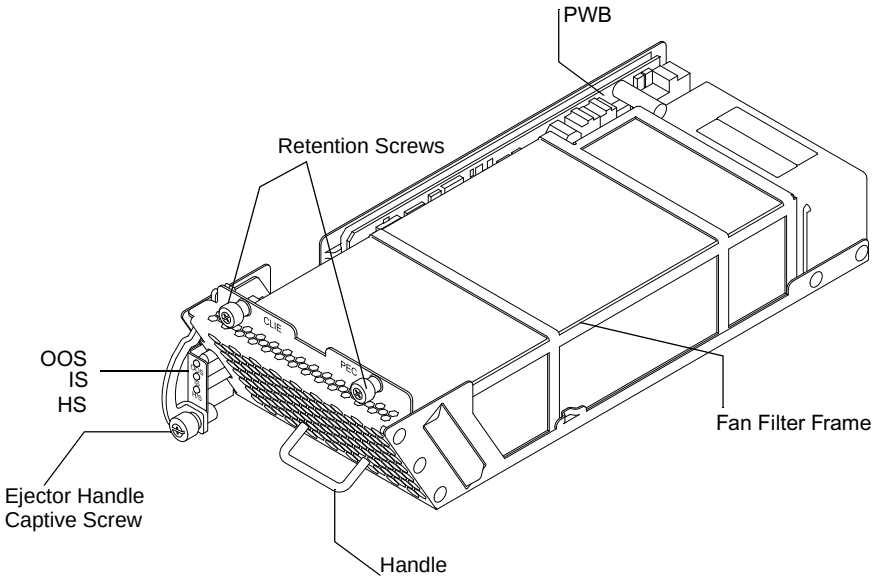
Procedure

Follow these steps and refer to the figure to remove a rear access FTM.

1. Lift the cable management rail that is located just above the lower FTMs. Loosen the two captive screws located at the sides of the cover and remove it to expose the FTM.
2. Using a Phillips screwdriver, loosen the two chassis retention screws.
3. Loosen the captive screw on the ejector handle and wait for the blue LED to glow solid, this indicates the FTM is ready to be removed.

4. Using the U-shaped handle, slide the FTM completely from the shelf.

Figure 8-3 Lower FTM Ejector Handle and LEDs



8.4.6 Installing the Lower FTM

Procedure

Have the correct FTM available and follow these steps to install the lower FTM module.

1. Carefully align the FTM to the appropriate FTM slot and slide the FTM into the chassis using the U-shaped handle.
2. Gently push the FTM until it is securely seated with the backplane connector and the ejector handle is in a closed position.
3. Tighten the captive screw on the insertion handle. The recommended torque setting is 3 inch-pounds.
4. Tighten the two chassis retention screws. The recommended torque setting is 5 inch-pounds.

When the Blue LED turns off, the fan is operating.

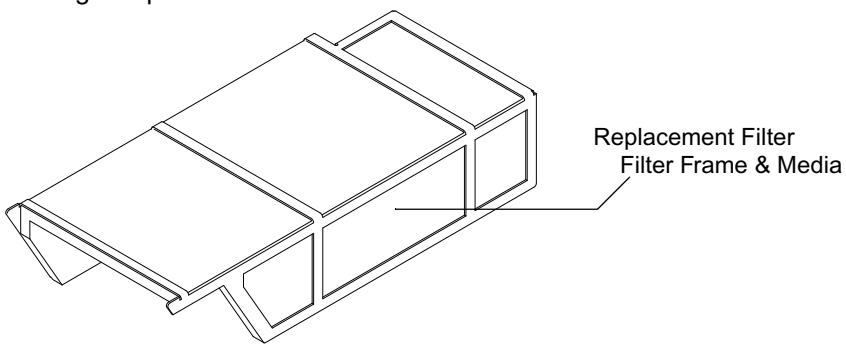
8.5 Replacing the Fan Filter

Your replacement fan filter consists of a metal frame and filter media for a lower Fan Tray Module. The fan filter is kept in place by two tabs located on the inner left-side in front of the stationary circuit board and one tab slot on the inner right-side of the FTM.

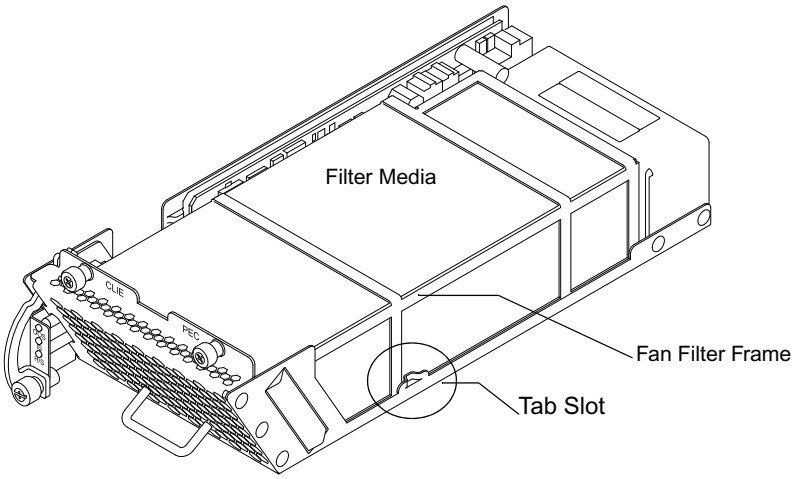
Air filters should be checked occasionally to make sure they are not obstructed or damaged. Visually inspect filters for tears or rips. Do not reinstall a torn filter as it will be ineffective in trapping particulates and will interrupt air flow distribution. To maintain safety certification, use only Emerson approved fan filters. You can order replacement fan filters (part number RAF-1406/6E) by contacting your Emerson sales representative. For detailed information on filter maintenance and cleaning, see *Air Filter Maintenance* on page 69.

Procedure

To replace the fan filter for a lower FTM, refer to *Removing the Lower Fan Tray Module* and follow these steps to replace a fan filter. Please have your replacement fan filter available before starting this procedure.

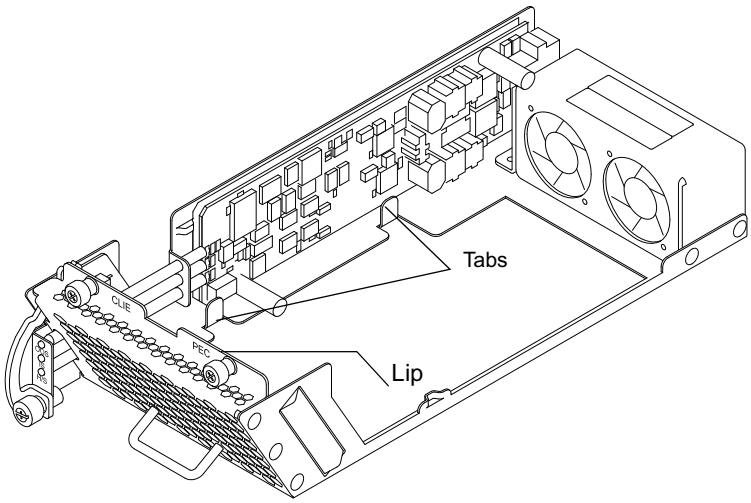


1. With the FTM removed and placed on a solid surface, position the FTM with the right side facing you.
2. Using a screwdriver or similar tool, assist the lower frame past the tab slot while holding the back end of the FTM with your right hand.



3. Gently lift the rear of the fan filter upward and outward from the FTM.

4. Insert the replacement fan filter by positioning the front of the fan filter under the lip at the front of the FTM.



5. Align the fan filter so that it will clear the two tabs located in front of the stationary board and any wires inside the FTM.
6. Carefully lower the fan filter into position, making sure to clear the two tabs on the inside left and the tab slot on the right side of the FTM. You may apply light pressure on the sides of the lower frame during insertion to help position the fan filter properly so that the tab is secured in the slot on the right hand side.
7. Release the fan filter and make sure the fan filter is in position and secure.
8. Reinstall the lower FTM using the procedure described in *Installing the Lower FTM*.

Specifications

A

A.1 Mechanical Characteristics

Table A-1 Physical Characteristics

Characteristics	Specifications
Size:	21 inches (53.3 cm) high, 12-1/2U 17.67 inches (44.9 cm) wide 19.02 inches (48.3 cm) with mounting flanges 21.34 inches (54.2 cm) deep
Weight:	Approximately lbs (75 lbs./34 kg) base integrated platform Approximately lbs. (81.1 lbs./36.8 kg) fully equipped Base platform: shelf, backplane, 8 FTMs, 2 PEMs, 2 shelf managers Equipped (fully): 2 shelf managers, 2 PEMs, 6 upper FTMs, 2 lower FTM (no payload blades)
Rack Mounting:	Per ETSI 600mm x 600mm ETSI frame on integrated front frame mounting ears using front mounting brackets. Frame mounting brackets are required for a 19" EIA frame. Rear mounting brackets are recommended in both instances for Central Office Environment. Each shelf requires 12.5U of space and effectively takes up 13U when mounted in a rack. Three shelves can fit in a 40U telecom rack, which leaves 1U remaining. Air intake plenum at bottom front of shelf. Cable management trays are in the front only.
Slots:	Hot swap capable slots, including: 14 8Ux6HP280mm slots 14 8Ux6HPx70mm RTMs
Power Entry Modules (2):	Power Entry Modules, 3”H X 7.5”W X 8.0”D (7.63cm H X 19.05cm W X 20.32cm D) 5 lbs./2.7 kg ea.
Switches:	Four 25 AMP/One 15 AMP DC circuit breakers per PEM
Fans (6 upper) (3 lower):	Six upper Fan Tray Modules in N+1 redundant configuration (three front accessible, three rear accessible). Two lower Fan Tray Modules, front accessible. All FTMs have LED indicators and speed control circuit. The lower FTMs have a filter option.
Top Front Cover Panel	Front panel for placement in front of upper FTMs
Air Flow:	Bottom front inlet, top rear exhaust
ESD Grounding	One ESD ground point
Earth Ground	One earth ground point

A.2 Environmental Characteristics

The AXP1406 shelf was designed to comply with NEBS and ETSI environmental specifications as listed in the following table. This system has not been tested to NEBS or ETSI specifications as of this release.

Table A-2 Environmental Characteristics

Item	Description
Designed to comply with ETSI	ETSI Storage: EN 300 019-2-1, Class 1.2 equipment (not temperature controlled storage locations). ETSI Transportation: EN 300 019-2-2, Class 2.3 equipment (public transportation). ETSI Stationary Use: EN 300 019-2-3, Class 3.1 equipment (partly temperature controlled locations). ETSI Environmental EN 300-132-2 Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc). ETSI acoustic noise requirements per ETS-300-753, Equipment Engineering (EE); Acoustic noise emitted by telecommunications equipment.
Designed to comply with NEBS	GR-63-CORE NEBS Physical Protection, Level 3 Criteria. Telcordia GR-1089-CORE, Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Type 2 Equipment. Level 3 Criteria. Telcordia GR-3028-CORE, “Thermal Management In Telecommunications Central Office”, Preferred EC-Class Cooling Method.

Related Documentation

B

B.1 Emerson Network Power - Embedded Computing Documents

The Emerson Network Power - Embedded Computing publications listed below are referenced in this manual. You can obtain electronic copies of Emerson Network Power - Embedded Computing publications by contacting your local Emerson sales office. For documentation of final released (GA) products, you can also visit the following website: http://www.emersonnetworkpowerembeddedcomputing.com > Solution Services> Technical Documentation Search. This site provides the most up-to-date copies of Emerson Network Power - Embedded Computing product documentation.

Table B-1 Emerson Network Power Publications

Document Title	Publication Number
AXP1406/AXP1600 Subsystem IPMI Programmer's Reference	6806800B66
ATCA-F102-5E System Controller and Switching Blade Installation and Use	6806800C59
ATCA-7221 Reference Guide	6806800A50
ATCA-7107 Reference Guide	6806800A48
ATCA-C110/1G AMC Carrier Blade Installation and Use	6806800A83
PrAMC-7201 Processor AMC Module Installation and Use	6806800A92
ATCA-S100 Reference Guide	6806800A36
ATCA-F102 Basic Blade Service Software Release 3.1	6806800D08
ATCA-7221 Basic Blade Service Software Release 3.1	6806800D10
ATCA-7107 Basic Blade Service Software Release 3.1	6806800D09
ATCA-C110 Basic Blade Service Software Release 3.1	6806800C39
PrAMC-7201 Basic Blade Service Software Release 3.1	6806800C40
Centellis 3406/3600 Release 3.1 Document Collection	6806800D05

B.2 Manufacturers' Documents

For additional information, refer to the following table for manufacturers' data sheets or user's manuals. As an additional help, a source for the listed document is provided. Please note that, while these sources have been verified, the information is subject to change without notice.

Table B-2 Manufacturer's Documents

Document Title and Part Number	Web Site Source
IPM Sentry Shelf Manager User Guide, Release 2.1.1	DOCSHMUG
IPM Sentry Shelf - External Interface Reference, Release 2.3	20060728

B.3 Related Specifications

For additional information, refer to the following table for related specifications. As an additional help, a source for the listed document is provided. Please note that, while these sources have been verified, the information is subject to change without notice.

Table B-3 Related Specifications

Document Title and Source	Publication Number
IEEE http://standards.ieee.org/catalog/	
IEEE Standard for Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Institute of Electrical and Electronics Engineers, Inc.	IEEE 802.3 March 2002
IEEE Amendment 1: Media Access Control parameters, Physical Layers, and Management Parameters for 10Gb/s Operation	IEEE 802.3ae August 2002
PCI Industrial Manufacturers Group (PICMG) http://www.picmg.com/	
PICMG 3.0 AdvancedTCA Base Specification, Revision 1.0	PICMG 3.0 R 1.0 December 30, 2002
PICMG 3.0 AdvancedTCA Serial Interconnect Specification R2.0	PICMG 3.0, R2.0
PICMG 3.1 AdvancedTCA Ethernet/Fibre Channel, Revision 1.0	PICMG 3.1 R1.0 January 22, 2003
PICMG 3.0 ECN 3.0-1.0-001	ECN 3.0, 1.0-001 January 21, 2004

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