AdvancedTCA Shelf, 16-slot User's Manual

Product Number:

11592-500
11592-501
11592-502
11592-503

Rev.	Date updated	Change
D1.0	January 10, 2006	Draft Release
R1.0	Mai 30, 2006	Initial Release
R1.1	June 12, 2006	Minor layout improvements
R1.2	August 10, 2007	Layout improvements, some chapters revised

Table of Contents

1 Safety

The intended audience of this User's Manual is system integrators and hardware/software engineers.

1.1 Safety Symbols used in this document

	Hazardous voltage!
	This is the electrical hazard symbol. It indicates that there are dangerous voltages inside the Shelf.

	Caution!
	This is the user caution symbol. It indicates a condition where damage of the equipment or injury of the service personnel could occur. To reduce the risk of damage or injury, follow all steps or procedures as instructed.

	Danger of electrostatic discharge!
	The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.

1.2 General Safety Precautions

	Warning!
	Voltages over 60 VDC can be present in this equipment. As defined in the PICMG 3.0 Specification, this equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.

- Service personnel must know the necessary electrical safety, wiring and connection practices for installing this equipment in a telecommunication environment.
- Install this equipment only in compliance with local and national electrical codes.
- For additional information about this equipment, see the PICMG 3.0 Specification (*www.picmg.com*).

1.3 References and Architecture Specifications

- Pigeon Point Systems IPM Sentry Shelf-External Interface Reference (*www.pigeonpoint.com*)

- PICMG® 3.0 Revision 2.0AdvancedTCA® Base Specification ECN 002 (*www.picmg.com*)

- PICMG® Engineering Change Notice ECN 3.0-2.0-00

1.4 Product Definition

The Schroff 11592-50x is a 13U / 16 Slot AdvancedTCA Shelf.

- Product Number 11592-500: Dual Star Backplane, bused IPMB
- Product Number 11592-501: Dual Star Backplane, radial IPMB
- Product Number 11592-502: Full Mesh Backplane, bused IPMB
- Product Number 11592-503: Full Mesh Backplane, radial IPMB

The Schroff 11592-50x is designed to work with two redundant Schroff ShMM-ACB-IV Shelf Managers, at least one Shelf Manager is needed for a working System.

- Product Number 21593-375: Shelf Manager with bused IPMB

Product Number 21593-376: Shelf Manager with radial IPMB.

The Shelf Managers are not included with the Shelf.

1.5 Terms and Acronyms

Table 1: Terms and Acronyms

Term	Definition
ATCA	Advanced Telecom Computing Architecture
Backplane	Passive circuit board providing the connectors for the front boards. Power distribution, management and auxiliary signal connections are supported
CDM	Chassis Data Module
Chassis	Enclosure containing subrack, Backplane, boards, cooling devices, PEMs, same as Shelf
CMM	Chassis Management Module, same as Shelf Manager
ECN	Engineering Change Notice
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
FRU	Field Replaceable Unit
IPMB	Intelligent Platform Management Bus
IPMC	Intelligent Platform Management Controller
IPMI	Intelligent Platform Management Interface
PCB	Printed Circuit Board
PEM	Power Entry Module
RTC	Real Time Clock
RTM	Rear Transition Module

2　Hardware Platform

The Schroff 13 U / 16 Slot AdvancedTCA Shelf implements the following features:

- Compliant to PICMG 3.0 Revision 2.0

- 16 slot ATCA Backplane with Full Mesh or Dual Star Fabric Interface, Dual Star Base Interface and bused or radial IPMB interface, supporting fourteen 8U node board slots and two 8U hub slots

- Removable mounting brackets for ETSI cabinets

- Additional fixing points at the rear side of the Shelf

- ESD Wrist Strap Terminals at the front and the rear

- 2 Dedicated Shelf Manager slots accepting Schroff ShMM-ACB-IV Shelf Managers

- Cooling for 200 W per Front Board and 25 W per Rear Transition Module

- 3 Hot Swap Fan Trays, rear pluggable

- Air inlet filter including air filter presence sensor

- Rear pluggable Shelf Alarm Panel (SAP): Provides Telco Alarm interface

- Front pluggable Shelf Alarm Display (SAD): Provides Alarm Status LEDs, Fan Tray Alarm LEDs and Serial Interfaces for the Shelf Managers

- Dual redundant Power Entry Modules (PEM). Each PEM providing connection of 4 power feeds

2.1 Shelf Front and Rear View
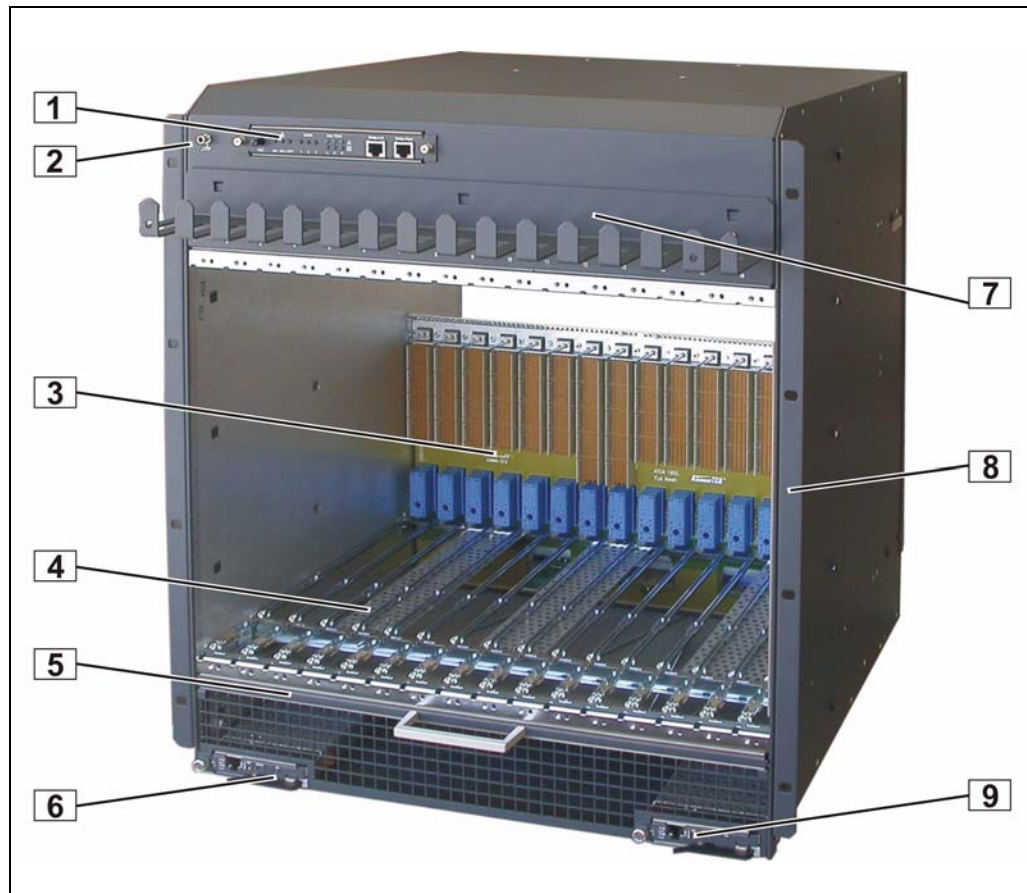
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1	Shelf Alarm Display (SAD)	6	Primary Shelf Manger (left)
2	ESD Wrist Strap Terminal	7	Front Cable Tray
3	ATCA 16-Slot Backplane	8	Removable Mounting Bracket
4	Front Card Cage	9	Secondary Shelf Manager (right)
5	Air Filter		

Figure 1: Shelf Rear View
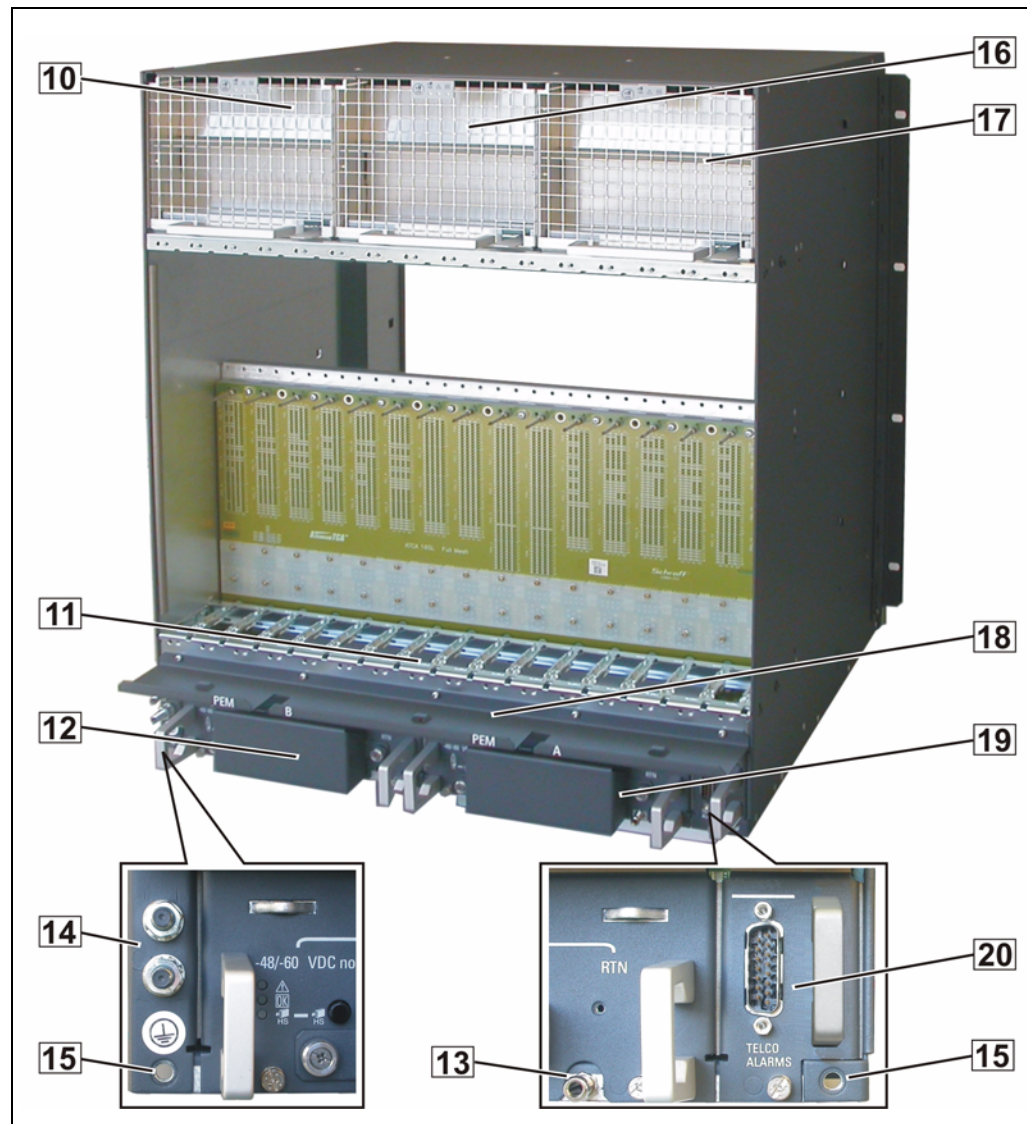
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10	Fan Tray #2	16	Fan Tray #1
11	Rear Card Cage	17	Fan Tray #0
12	Power Entry Module B (PEM B)	18	Rear Cable Tray
13	ESD Wrist Strap Terminal	19	Power Entry Module A (PEM A)
14	Shelf Ground Terminal (M6 studs)	20	Shelf Alarm Panel (SAP)
15	Additional Fixing Point		

2.2 ESD Wrist Strap Terminals

⚠	**Danger of electrostatic discharge!** *Static electricity can harm delicate components inside the Shelf. You must wear an ESD wrist strap before exchanging any part or electric component!*

Two ESD Wrist Strap Terminals are located at the front and rear side of the Shelf

2.3 Shelf Electrical Components Overview

Figure 2: Shelf Electrical Components Overview
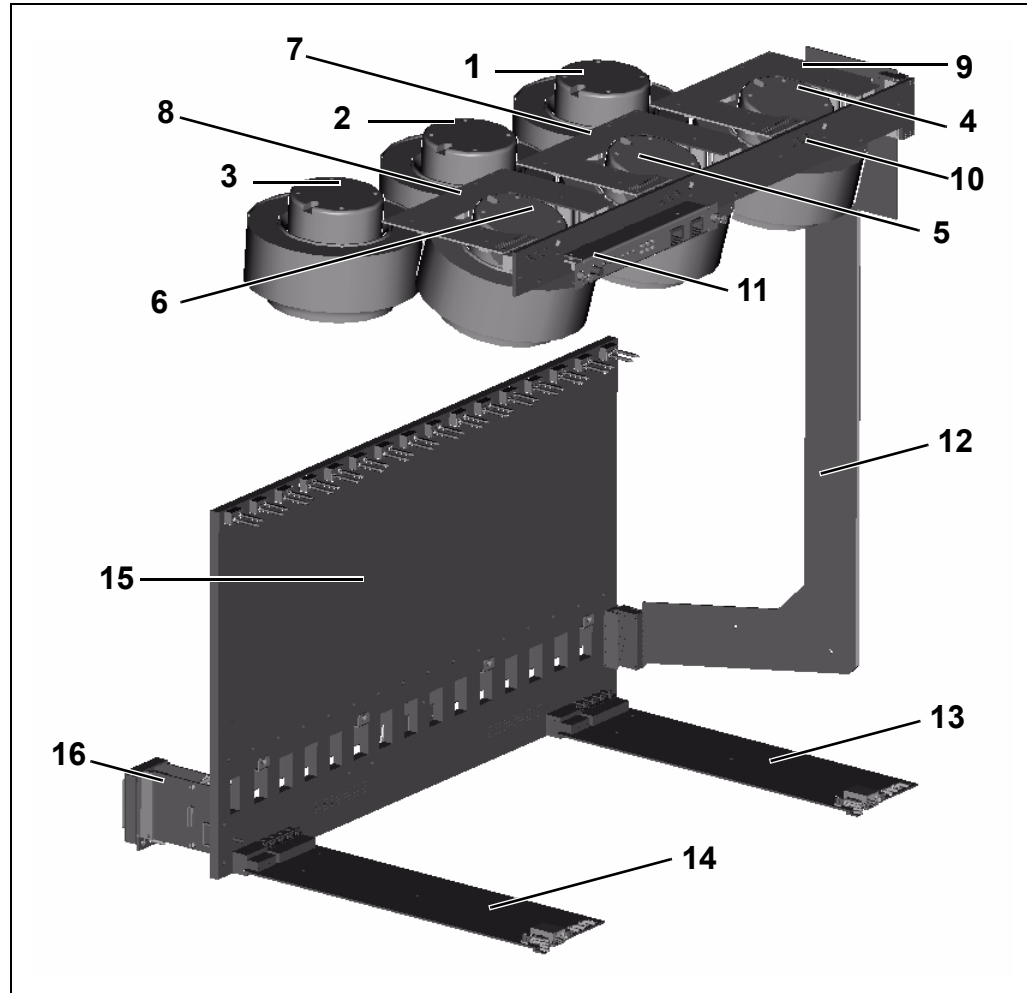
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1	Fan #5	9	Control Board Fan Tray #2 (right)
2	Fan #3	10	Horizontal Board
3	Fan #1	11	Shelf Alarm Display
4	Fan #4	12	Riser Board
5	Fan #2	13	Shelf Manager 2
6	Fan #0	14	Shelf Manager 1
7	Control Board Fan Tray #1 (center)	15	ATCA Backplane
8	Control Board Fan Tray #0 (left)	16	Shelf Alarm Panel (SAP)

3 ATCA Backplane

The 16-slot ATCA monolithic Backplane provides:

- 14 ATCA Node slots
- Two ATCA Hub slots
- Two Dedicated Shelf Manager slots
- Two Power Entry Module (PEM) slots
- Two slots for the Shelf FRU Data Modules (CDM)

3.1 Logical to Physical Slot Mapping

The physical slots are sequentially numbered from left to right. The logical slots are mapped to the physical slots according to Table 2.

Table 2: 16-Slot ATCA Full Mesh Backplane physical to logical slot mapping

	Node	Node	Node	Node	Node	Node	Hub Slot	Hub Slot	Node	Node	Node	Node	Node	Node	Node	Node
Physical slot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Logical slot	15	13	11	9	7	5	1	2	3	4	6	8	10	12	14	16
HW-Address (Hex)	4F	4D	4B	49	47	45	41	42	43	44	46	48	4A	4C	4E	50
IPMB-Address (Hex)	9E	9A	96	92	8E	8A	82	84	86	88	8C	90	94	98	9C	A0
Update Channel	●—●		●—●		●—●		●—●		●—●		●—●		●—●		●—●	
Power Segment	1	2	1	2	1	2	1	2	3	4	3	4	3	4	3	4

Table 3: 16-Slot ATCA Dual Star Backplane physical to logical slot mapping

	Node	Node	Node	Node	Node	Node	Node	Hub Slot	Hub Slot	Node	Node	Node	Node	Node	Node	Node
Physical slot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Logical slot	15	13	11	9	7	5	3	1	2	4	6	8	10	12	14	16
HW-Address (Hex)	4F	4D	4B	49	47	45	43	41	42	44	46	48	4A	4C	4E	50
IPMB-Address (Hex)	9E	9A	96	92	8E	8A	86	82	84	88	8C	90	94	98	9C	A0
Update Channel	●—●		●—●		●—●			●—●			●—●		●—●		●—●	
Power Domain	1	2	1	2	1	2	1	2	3	4	3	4	3	4	3	4

3.2 Interfaces

3.2.1 Base Interface

Logical slots 1 and 2 are the hub slots for the Dual Star Base Interface. Base Interface Channel 1 (ShMC) of logical slot 1 and 2 is cross connected to both Dedicated Shelf Manager slots on the ATCA Backplane.

3.2.2 Fabric Interface

The Fabric Interface in the ATCA Backplane is wired as:

- Full Mesh with a Full Channel, interconnecting each ATCA slot
  (Product Number: 11592-502/503)

- Dual Star, supporting four ports per channel
  (Product Number: 11592-500/501)

See PICMG® 3.0 AdvancedTCA® Base Specification for details.

Single Star, Dual Star, and Dual-Dual Star configurations are a subset of a Full Mesh configuration. A Shelf with a Full Mesh Backplane can be used as a Single Star or a Dual Star system by installing combination Fabric and Base Interface Hub boards in logical slots 1 and/or 2.

For a Dual-Dual Star configuration, logical slots 3 and 4 are used as additional Fabric and Base Interface hub slots.

3.2.3 Synchronization Clock Interface

6 differential pairs of synchronization clocks are bused between all 16 ATCA slots and terminated at both ends with 80.5 Ohms between each differential pair.

3.2.4 Update Channel Interface

The Update Channels are wired between two redundant ATCA Backplane slots as 10 differential pairs with 100 Ohms impedance. (See Table 3 in this Chapter)

The Update Channel is intended to pass information between two redundant ATCA Boards.

The Update Channel assignment is printed on the front side of the Shelf.

3.2.5 Power Interface

Power distribution within the ATCA Backplane is divided into four Power Domains. This topology is used for safety reasons to keep the max. current per fuse less the 30 A. Slots connected by update ports, are on separate power domains as well as both hub slots, the Shelf Manager slots and the Fan Trays.

3.2.6 Intelligent Platform Management Interface

The IPMB_A and IPMB_B are routed to the ATCA slots in:

- a bused configuration
  (Product Number: 11592-500/502)

- a radial configuration
  (Product Number: 11592-501/503)

The IPMBs at each slot are wired redundantly. Every ATCA board is connected to an IPMB-A and IPMB-B and routed to both Dedicated Shelf Manager slots on the ATCA Backplane.

Figure 3: Bused IPMB
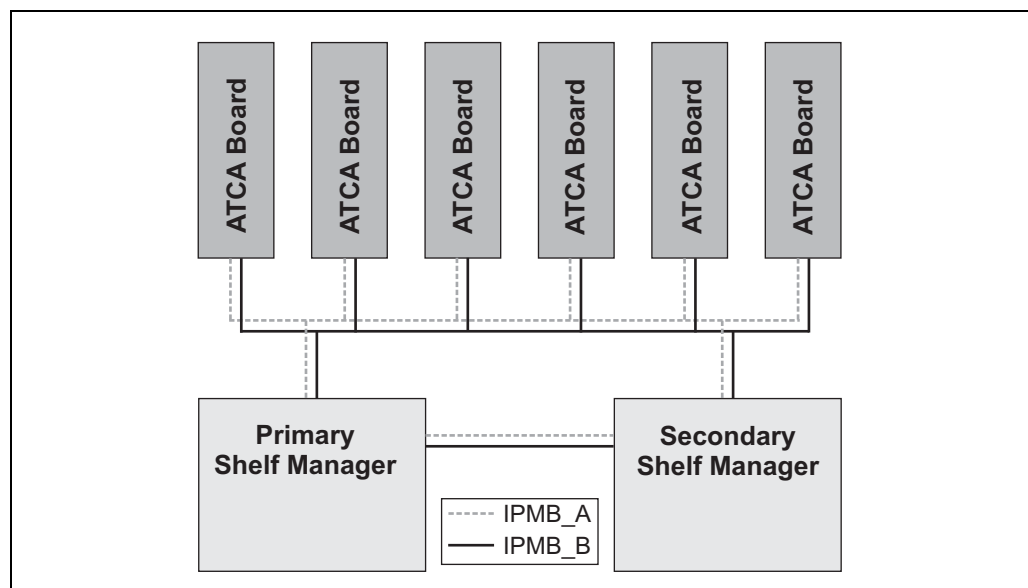
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Figure 4: Radial IPMB
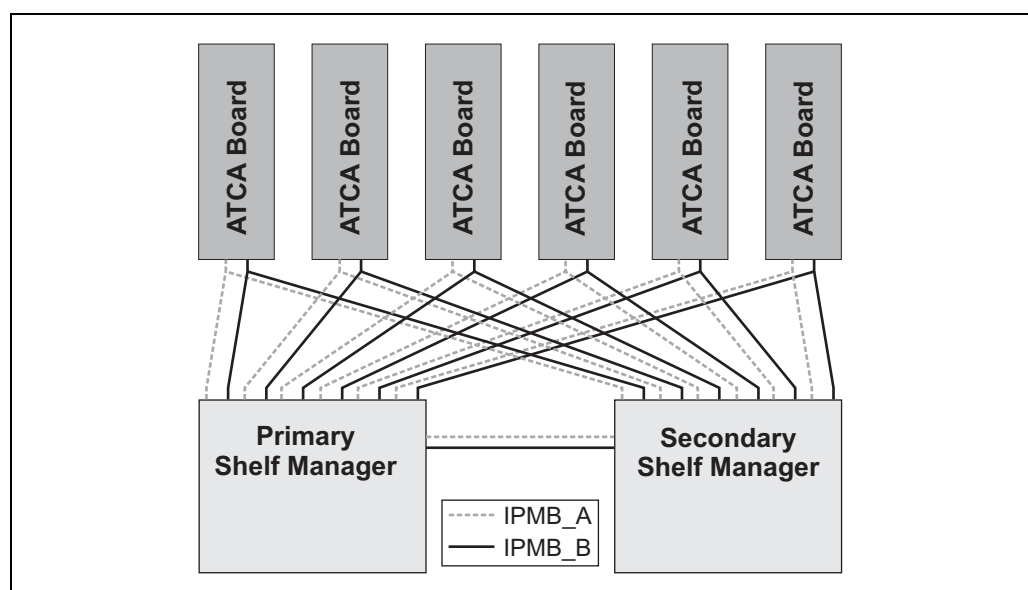
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3.3 Non-ATCA Connectors on the ATCA Backplane

Figure 5: ATCA Backplane front connectors
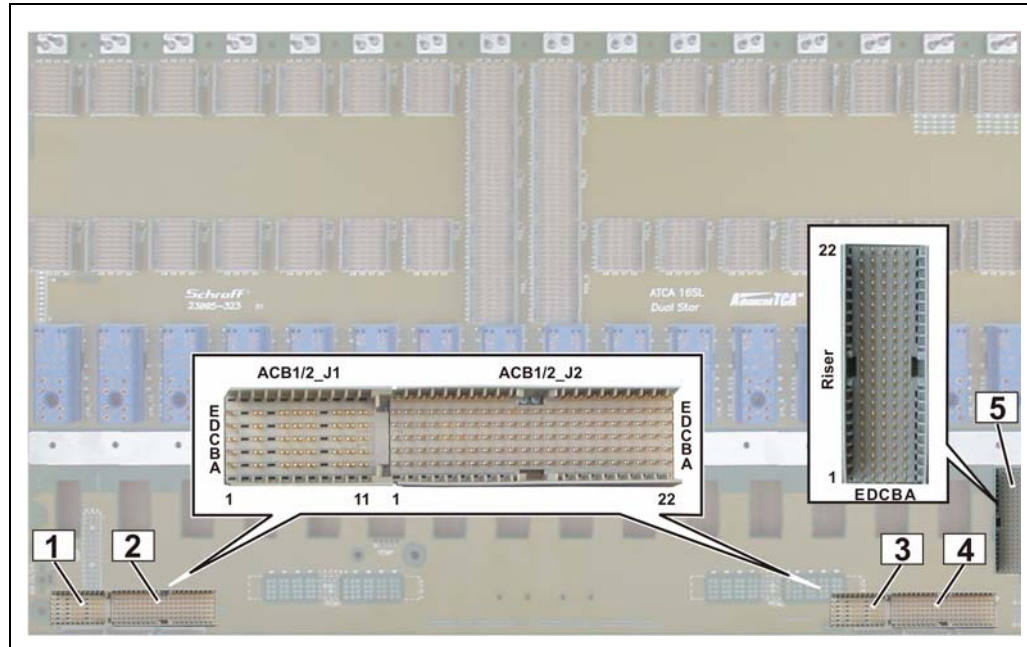
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Table 4: ATCA Backplane front connectors

#	Name	Type	Designation
1	ACB1_J1	HardMetric C11	Backplane Connector (J1) Shelf Manager 1
2	ACB1_J2	HardMetric AB22	Backplane Connector (J2) Shelf Manager 1
3	ACB2_J1	HardMetric C11	Backplane Connector (J1) Shelf Manager 2
4	ACB2_J2	HardMetric AB22	Backplane Connector (J2) Shelf Manager 2
5	Riser	HardMetric AB22	Backplane Connector Riser Board to Horizontal Board

3.3.1 Shelf Manager Backplane Connectors

For pin assignment see *Chapter 11.15, "Shelf Manager Front Panel and Backplane connectors"*.

Figure 6: ATCA Backplane rear connectors
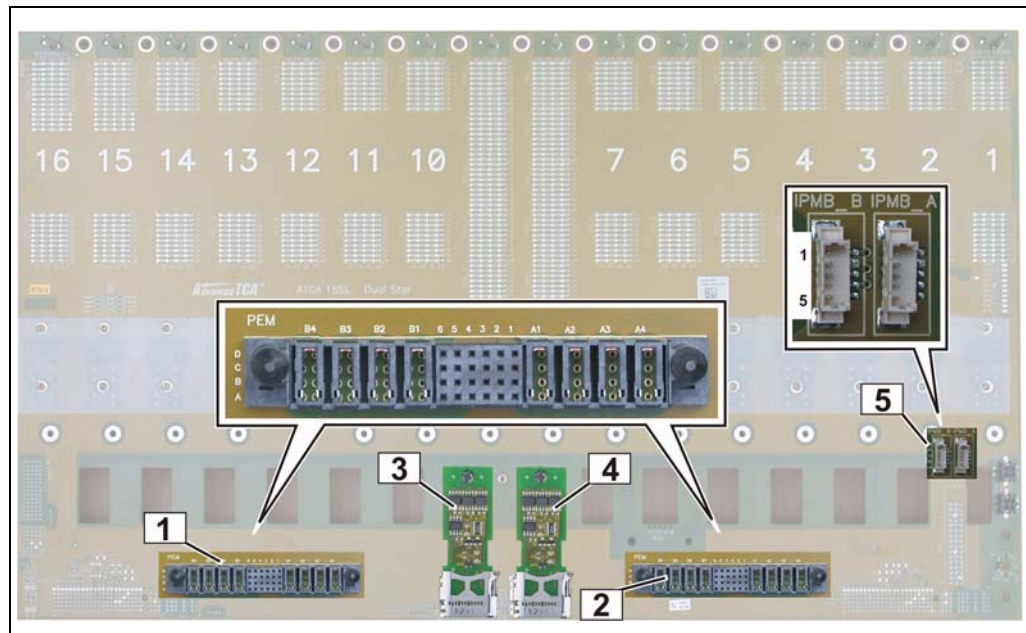
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1	PEM B Backplane Connector	4	Shelf FRU Data Module 1
2	PEM A Backplane Connector	5	IPMB-A and IPMB-B Connectors
3	Shelf FRU Data Module 2		

3.3.2 PEM Backplane Connectors

For pin assignment see *Chapter 9.7, "PEM Connectors"*.

3.4 Shelf FRU Data Modules (CDMs)

The Shelf FRU Data Module (CDM) is a carrier board for:

• The FRU SEEPROM (24LC256)

• 3 temperature sensors (LM75)

• A Hall Effect sensor (Air filter presence)

Figure 7: Shelf FRU Data Modules (CDMs)
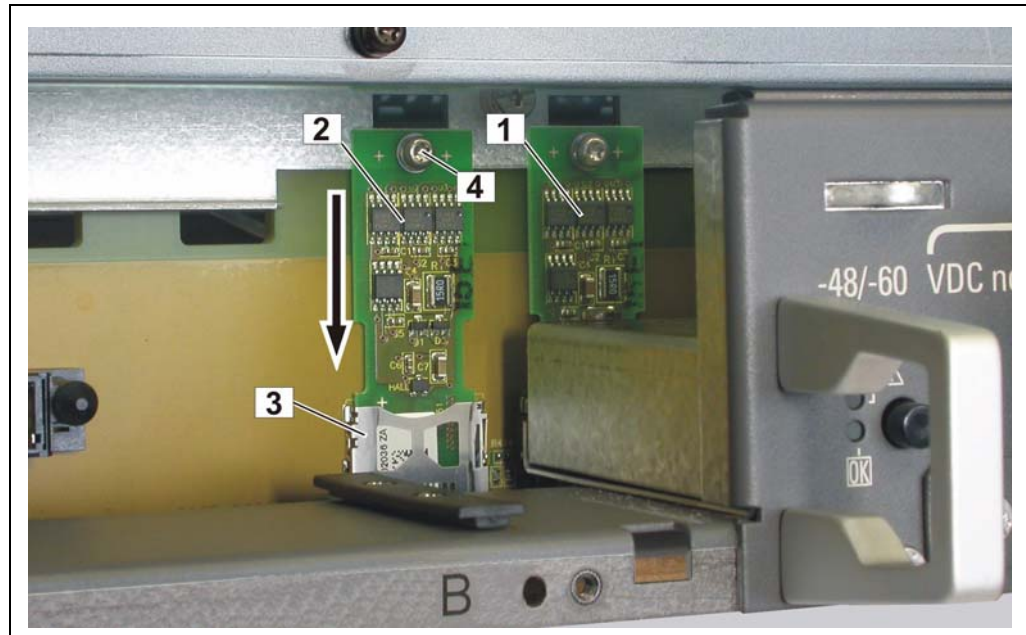
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| 1 | Shelf FRU Data Module 1 | 3 | Slot |
| 2 | Shelf FRU Data Module 2 | 4 | Fixing Screw |

Both Shelf FRU Data Modules are pluggable modules and located on the rear side of the ATCA Backplane. The modules can be accessed after removing the respective Power Entry Module (PEM).

| ⚠ | **Warning!**
Before removing a PEM, make sure that the Power Domains of the other PEM are fully functional. |

Remove a Shelf FRU Data Module:

After removing the fixing screw, push the Shelf FRU Data Module in direction of the arrow to release the locking mechanism in the Shelf FRU Data Module slot.

Table 5: Shelf FRU Data Module I²C addresses

CDM	I²C-Channel	I²C-bus address
CDM 1, SEEPROM	Channel 1	0xa4 / 52
CDM 2, SEEPROM	Channel 2	0xa4 / 52
CDM 1, LM75 (left)	Channel 3	0x98 / 4c
CDM 1, LM75 (center)	Channel 3	0x9a / 4d
CDM 1, LM75 (right)	Channel 3	0x9c / 4e

3.4.1 IPMB_A Connector (Assembly Option)

Connector IPMB_A is wired to the IPMB-A bus and is not assembled by default.

Table 6: IPMB_A Connector

Pin#	Description
1	IPMB-A, Serial clock
2	Logic Ground
3	IPMB-A, Serial Data
4	3,3 VDC power supply for Shelf I²C-bus devices
5	-

3.4.2 IPMB_B Connector (Assembly Option)

Connector IPMB_B is wired to the IPMB-B bus and is not assembled by default.

Table 7: IPMB_B Connector

Pin#	Description
1	IPMB-B, Serial clock
2	Logic Ground
3	IPMB-B, Serial Data
4	3,3 VDC power supply for Shelf I²C-bus devices
5	-

3.5 Shelf Manager Cross Connect

The ATCA Backplane provides cross connect traces between the Base Hubs and the Shelf Managers according to PICMG Engineering Change Notice ECN 3.0-2.0-001. This ECN adds an option for dual 10/100 Base-T links from each Base Hub to both Dedicated Shelf Manager slots.

Figure 8: Shelf Manager Cross Connect
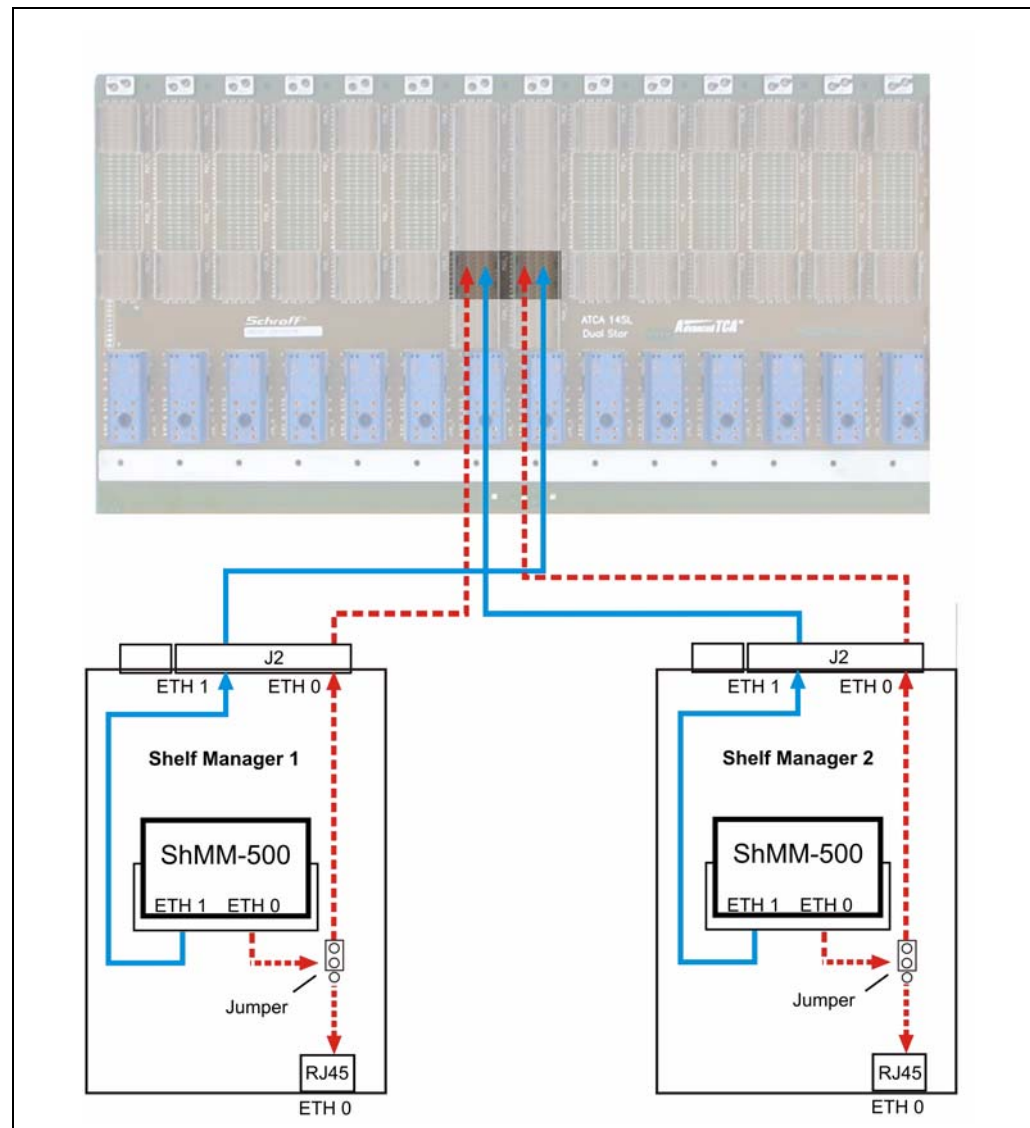
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Table 8: Connector (P23) pin assignments for Shelf Manager Cross Connect

Row	Designation	ab		cd		ef		gh	
5	Shelf Manager Port with Shelf Manager Cross Connects	Tx1+	Tx1-	Rx1+	Rx1-	Tx2+	Tx2-	Rx2+	Rx2-
		Shelf Manager Cross Connect 1				Shelf Manager Cross Connect 2			

3.6 Logic Ground

Figure 9: Logic Ground
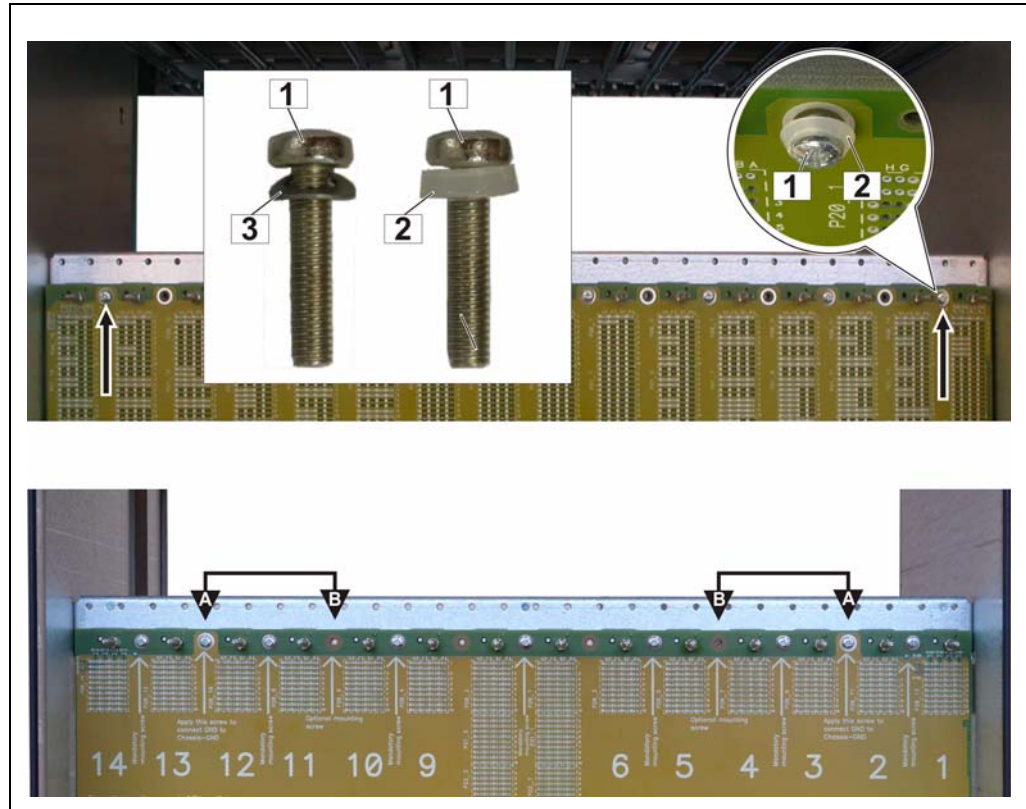
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The ATCA backplane provides a mechanism to connect Logic Ground and Shelf Ground. Depending on the revision status of the Backplane, the upper row of the backplane mounting screws (1) have a metallic (3) or plastic (2) washers. In case of plastic washers Shelf Ground and Logic Ground is isolated. To connect Logic Ground and Shelf Ground remove the both outer mounting screws (arrows in the upper picture) and exchange the plastic washer with a metallic washer.

Metallic washer Specifications:

DIN EN ISO 7098 for screw M3

Max. Diameter: 7 mm

Torque for the mounting screws: 0.7 Nm +10%

The later Backplanes have metallic washers by default (lower picture). You can connect/isolate Logic Ground by swapping the mounting screws from position (A) to position (B).

- Mounting screws at position (A): Logic Ground and Shelf Ground connected.
- Mounting screws at position (B): Logic Ground and Shelf Ground isolated.

Torque for fixing screw: 0.7 Nm +/-10%

4 Air Filter

Figure 10: Air Filter
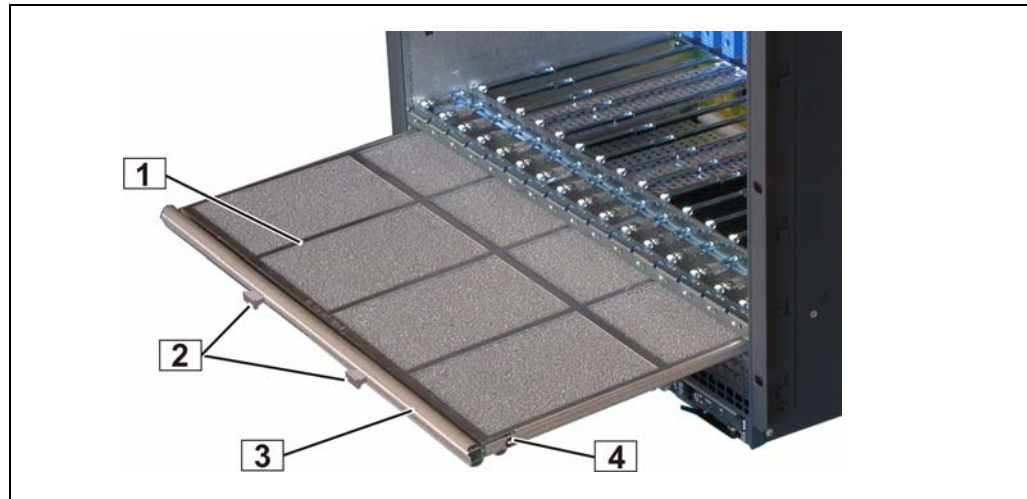
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1	Filter Element	3	Filter Tray
2	Handles	4	Spring mounted ball lock

4.1 Introduction

The ATCA Shelf provides a front replaceable air filter.

The filter meets the requirements of the Telcordia Technologies Generic Requirements GR-78-CORE specification.

4.2 Air Filter Replacement

The air filter tray can be removed by pulling the air filter's handles. To re-install, push the air filter tray into the guide rails at each side of the shelf until the spring mounted ball lock engage.

When installing the air filter, the filter element must be in top position

4.3 Air Filter Presence Sensor

The air filter presence is detected by a Hall effect sensor located on the Shelf FRU Data Module. The Hall effect sensor is activated by a magnet at the rear side of the air filter metal frame.

5 Shelf Ground Connection

⚡	**Hazardous voltage!**
	Before powering-up the Shelf, make sure that the Shelf Ground terminals are connected to Protective Earth (PE) of the building.

The ATCA Shelf provides a Shelf ground terminal at the left rear bottom side. The Shelf ground terminal provides two M6 studs to connect a double-lug Shelf ground terminal cable.

Figure 11: Shelf Ground Terminal
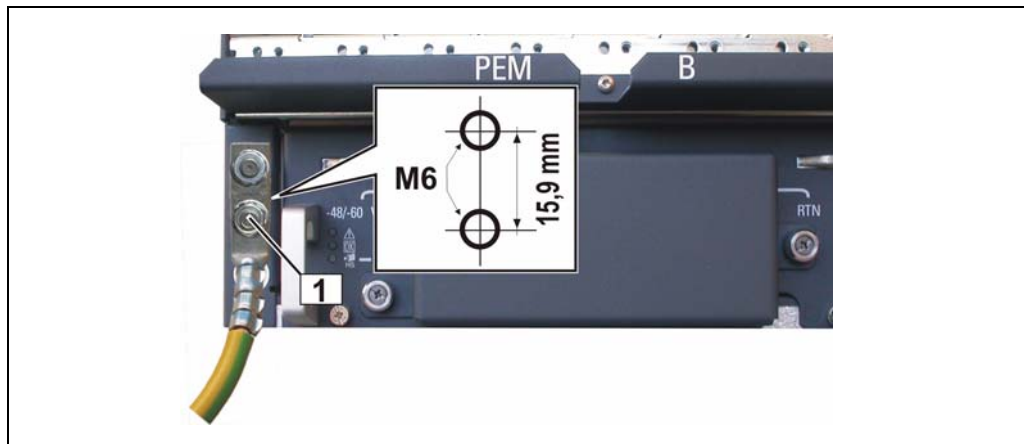
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1   Shelf Ground Terminal

ℹ	*Please note, that in a typical telecom environment, the VRTN path of the -48 V supply is grounded to Protective Earth (PE) of the building.*

5.1 Specification for the Shelf Ground connection cable

Required wire size: AWG6

Required terminals: Use only double lug terminals with 45° angle tongue.

Example for terminal:

PANDUIT part no. **LCD6-14AH-L**, or **Thomas&Betts** part no. **54205UF**

See catalogs at www.panduit.com and www.tnb.com.

6 Shelf Alarm Panel and Shelf Alarm Display

6.1 Introduction

Some Shelf Manager I/O functionalities have been moved to separate boards called Shelf Alarm Panel (SAP) and Shelf Alarm Display (SAD).

Figure 12: Connection between Shelf Manager and SAP
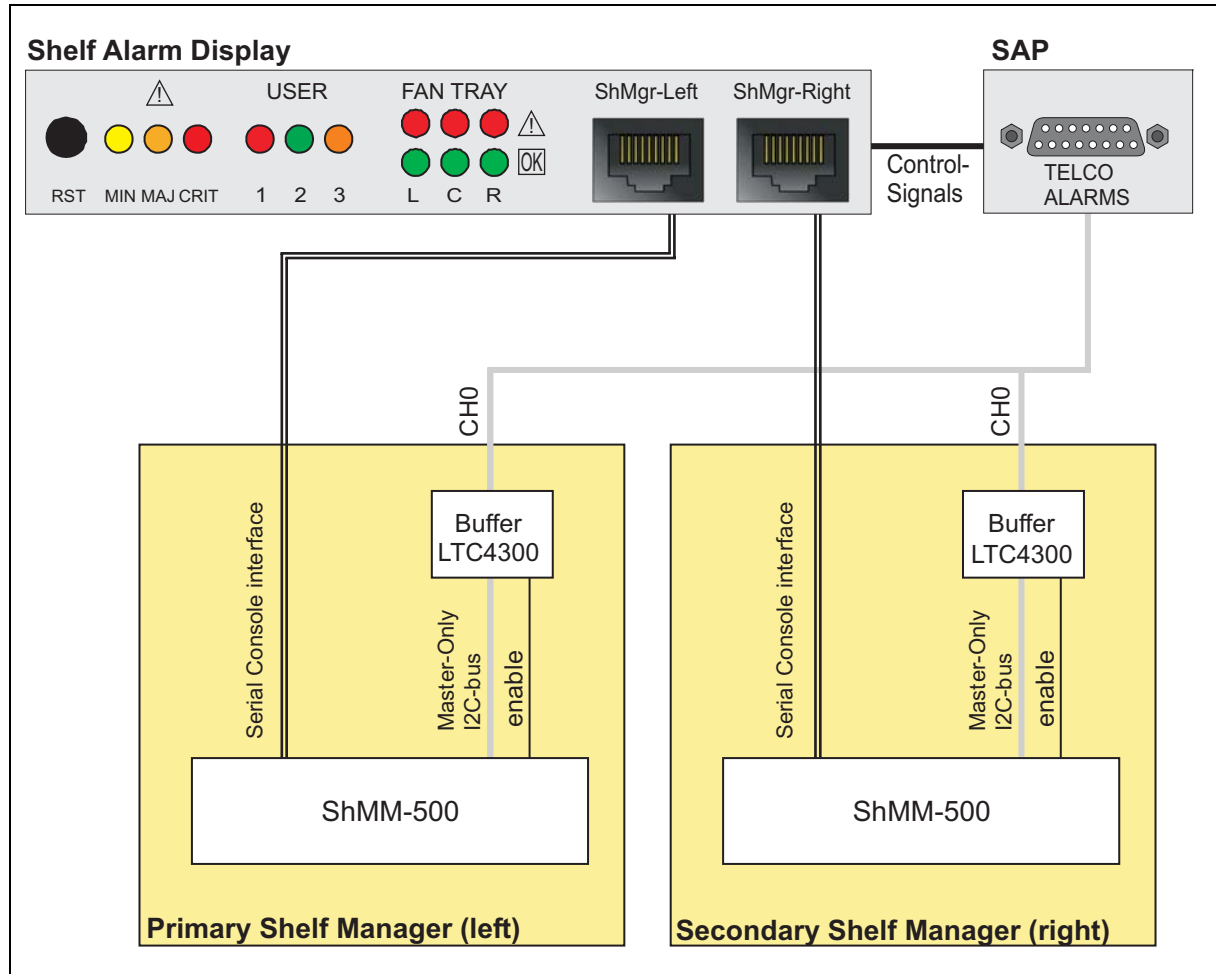
6.2 Shelf Alarm Panel (SAP)

The Shelf Alarm Panel (SAP) is located at the right rear bottom side of the Shelf. It provides the Telco Alarm connector (DB15-male). The I²C-bus devices on the SAP are connected to the Master-Only I²C-bus of both Shelf Managers. Only the active Shelf Manager has access to the SAP.

Figure 13: Shelf Alarm Panel (SAP)
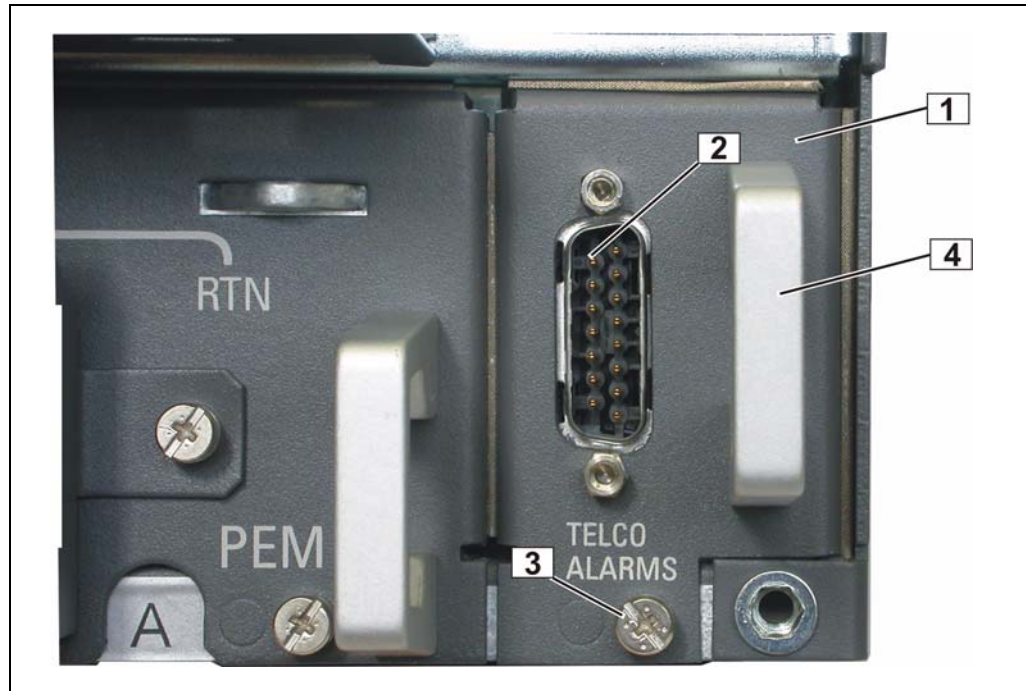
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1	Shelf Alarm Panel (SAP)	3	Fixing Screw
2	Telco Alarm Connector (DB15-male)	4	Extraction Handle

6.3 Shelf Alarm Display

The Shelf Alarm Display is a user interface and located at the left front top of the Shelf. It provides:

- 3 Shelf Alarm LEDs (MINOR, MAJOR, CRITICAL)
- 3 User-definable LEDs (USER1, USER2, USER3)
- 3 Fan Tray Alarm LEDs (Left, Center, Right)
- 3 Fan Tray OK LEDs (Left, Center, Right)
- The Alarm Silence push button
- 2 serial console interfaces for both Shelf Managers (RJ45 connectors)

Figure 14: Shelf Alarm Display
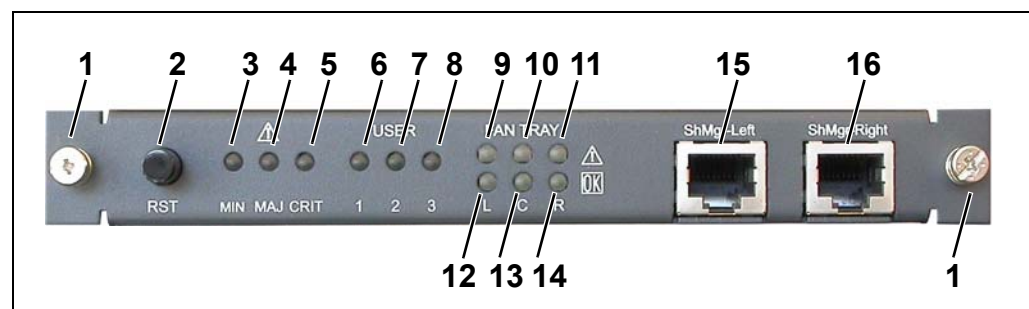
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1	Fixing screw	9	LED Fan Tray Left Alarm (red)
2	Alarm Silence push button	10	LED Fan Tray Center Alarm (red)
3	LED Min. Alarm (yellow)	11	LED Fan Tray Right Alarm (red)
4	LED Maj. Alarm (amber)	12	LED Fan Tray Left OK (green)
5	LED Crit. Alarm (red)	13	LED Fan Tray Center OK (green)
6	User definable LED 1 (red)	14	LED Fan Tray Right OK (green)
7	User definable LED 2 (green)	15	Serial Console Interface Shelf Manager 1 (Left)
8	User definable LED 3 (amber)	16	Serial Console Interface Shelf Manager 2 (Right)

6.3.1 User definable LEDs

The LEDs USER (1, 2, 3) are user definable and connected to the I²C-bus I/O port of the PCA 9555 on the SAP.

6.4 SAP Block Diagram

Figure 15: SAP Block Diagram
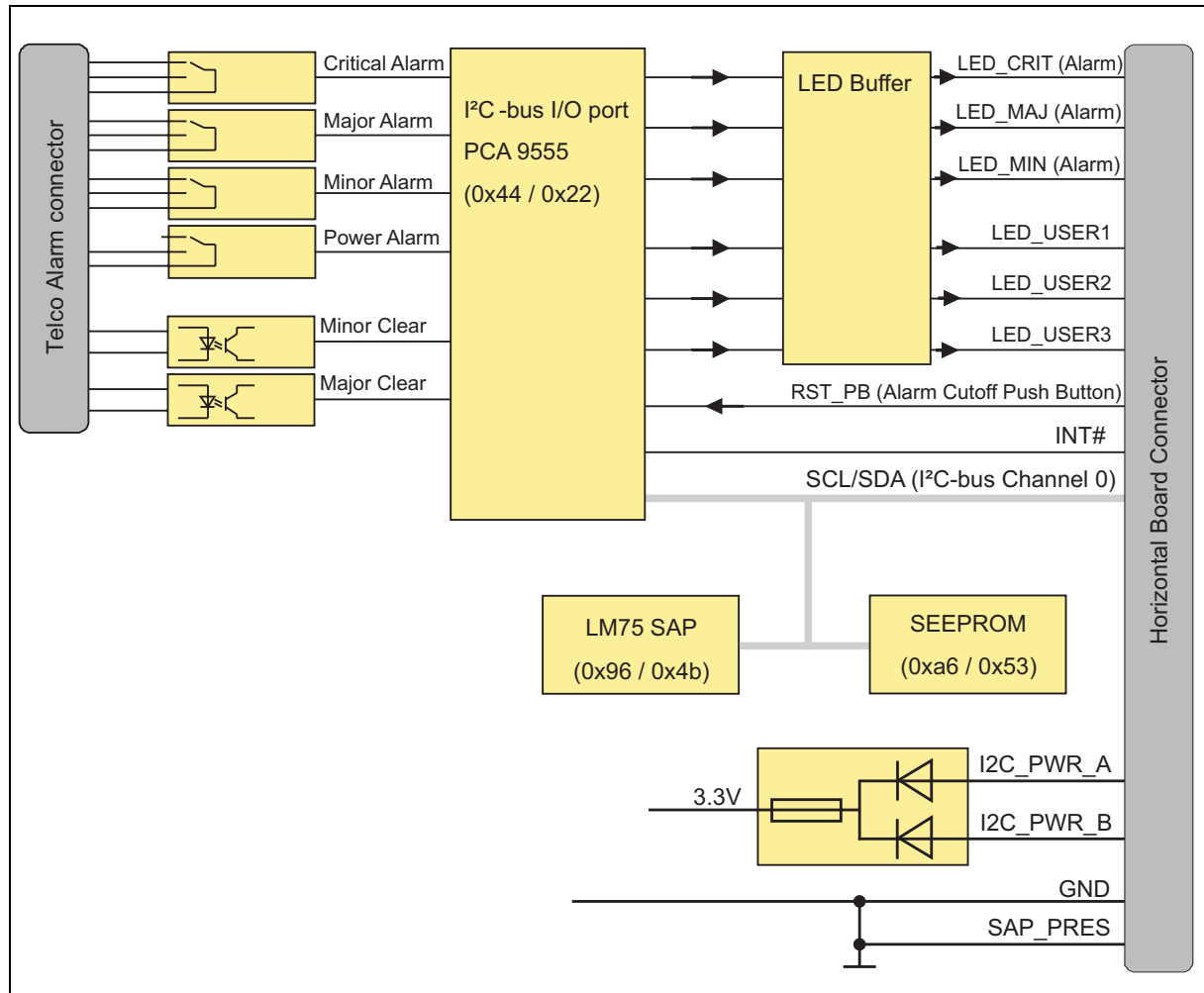
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6.5 Shelf Alarm Display Block Diagram

Figure 16: Shelf Alarm Display Block Diagram
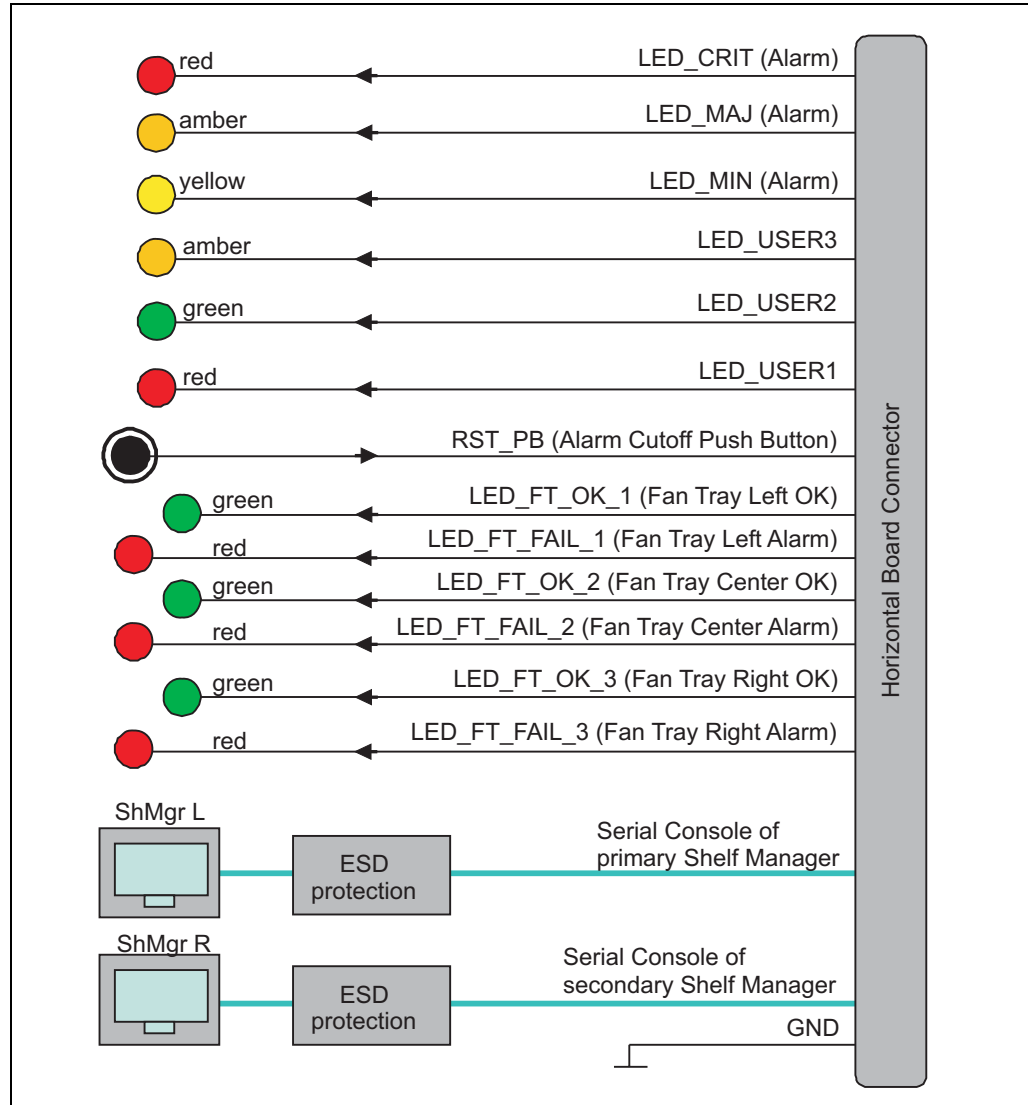
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6.6 RS-232 Serial Console Interfaces on Shelf Alarm Display

Figure 17: RS-232 Serial Console Interfaces on Shelf Alarm Display
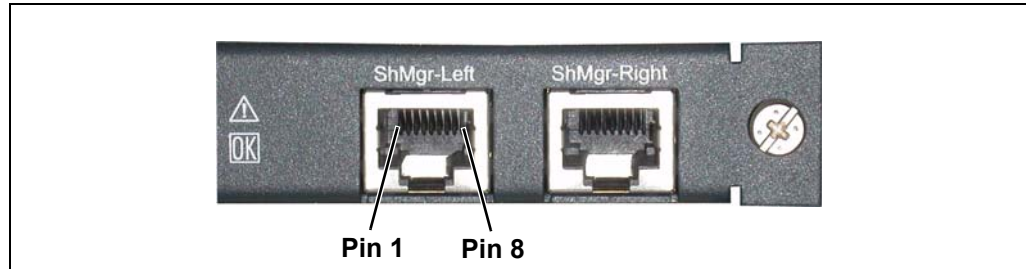
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The Shelf Alarm Display provides two RS-232 serial console connectors for the primary (Left) and the secondary (Right) Shelf Manager. The connectors are 8-pin RJ45 modular receptacles.

A full set of RS-232 signals, including modem control is provided. The serial interface is implemented on the ShMM-500.

The serial console default configuration is:
- *115200 baud*
- *no parity*
- *8 data bits*
- *1 stop bit*

Table 9: RS-232 Serial Console Interface Pin assignment

RJ45 Pin	RS-232 Signal	Type	Description
1	RTS	Out	Request To Send
2	DTR	Out	Data Terminal Ready
3	TxD	Out	Transmit Data
4	GND	---	Logic Ground
5	GND	---	Logic Ground
6	RxD	In	Receive Data
7	DSR	In	Data Set Ready
8	CTS	In	Clear To Send

6.7　SAP Telco Alarms

6.7.1　Telco Alarm Interface

The SAP provides a Telco Alarm interface on the DB15-male connector. Three relay outputs are used for remote alarm distribution, reflecting the state of the three Alarm LEDs. The relays are capable of carrying 72 VDC or 1 A with a max. rating of 30 VA.

6.7.2　Telco Alarm LEDs

The Shelf Alarm Panel provides the Telco Alarm LEDs. These LEDs indicate presence of Critical, Major and Minor alarms as follows:

Table 10:　Telco Alarm LEDs

State	Description
Off	No alarm active
On	Alarm active
Flashing	Alarm active, but silenced

6.7.3　Alarm Silence Push Button

The Alarm Silence push button on the Shelf Alarm Panel faceplate deactivates the alarm relays. During the time Alarm Silence is activated, the Alarm LEDs flash. By pressing the Alarm Silence push button a second time, the alarm relays are reactivated and the Alarm LEDs are solid.

*The **Alarm Silence** push button only activates the Alarm Silence state, but does not reset the alarms. If the silence interval (default 600 s) is exceeded without resolving the alarms, the alarms will be re-initiated.*

6.7.4　Alarm Reset

Hardware Reset:

Two relay inputs at the DB15 connector are used to reset the Minor and Major alarm state.

The reset inputs accept timed pulse inputs for clearing Minor and Major alarm states. Reset is accomplished by asserting a voltage differential from 3.3 VDC to 72 VDC for between 200 ms and 300 ms. The acceptance voltage range is from 0 to 48 VDC continuous (handles up to 60 VDC at a 50% duty cycle). The current drawn by a reset input does not exceed 12 mA.

There is no hardware reset (reset input) for the Critical Alarm state.

Software Reset:

The RMCP and CLI functions can be used to set and reset the Telco Alarms (incl. Critical Alarm). See the Pigeon Point Shelf Manager External Interface Reference for more information.

6.8 SAP and SAD Connectors

6.8.1 Telco Alarm Connector (DB15-male)

Figure 18: Telco Alarm Connector (DB15-male)
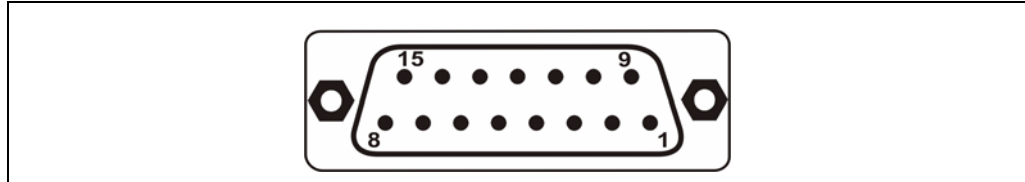
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Table 11: Telco Alarm Connector Pin Assignment

Pin	Name	Description
1	AMIR+	Minor Reset+
2	AMIR-	Minor Reset-
3	AMAR+	Major Reset+
4	AMAR-	Major Reset-
5	ACNO	Critical Alarm - NO
6	ACNC	Critical Alarm - NC
7	ACCOM	Critical Alarm - COM
8	AMINO	Minor Alarm – NO
9	AMINC	Minor Alarm – NC
10	AMINCOM	Minor Alarm – COM
11	AMANO	Major Alarm – NO
12	AMANC	Major Alarm – NC
13	AMACOM	Major Alarm – COM
14	APRCO	Pwr Alarm – NO
15	APRCOM	Pwr Alarm - COM
Shield	Shelf-GND	Shelf Ground

6.8.2 Shelf Alarm Display Horizontal Board Connector

Figure 19: Shelf Alarm Display Horizontal Board Connector
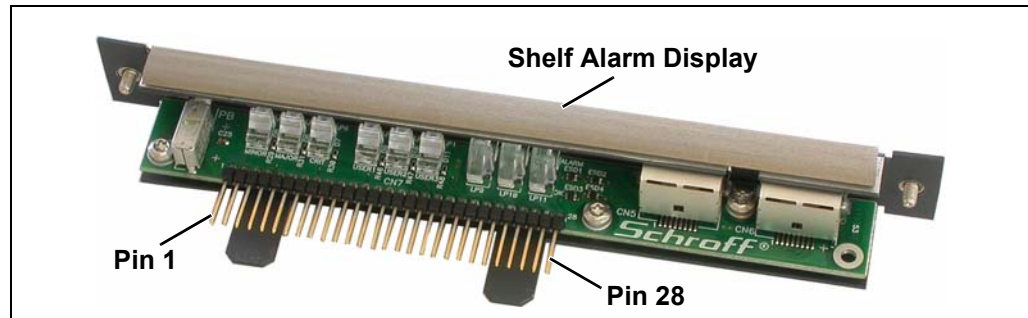
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Table 12: Shelf Alarm Display Horizontal Board Connector Pin Assignment

Pin	Signal Name	Description
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	RXD0_ACB1	Receive Data to Shelf Manager 1
5	RXD0_ACB2	Receive Data to Shelf Manager 2
6	TXD0_ACB1	Transmit Data from Shelf Manager 1
7	TXD0_ACB2	Transmit Data from Shelf Manager 2
8	DSR_ACB1	Data Set Ready to Shelf Manager 1
9	DSR_ACB2	Data Set Ready to Shelf Manager 2
10	DTR_ACB1	Data Terminal Ready from Shelf Manager 1
11	DTR_ACB2	Data Terminal Ready from Shelf Manager 2
12	CTS_ACB1	Clear To Send from Shelf Manager 1
13	CTS_ACB2	Clear To Send from Shelf Manager 2
14	RTS_ACB1	Request To Send to Shelf Manager 1
15	RTS_ACB2	Request To Send to Shelf Manager 2
16	LED_MIN	Signal to Minor Alarm LED
17	LED_MAJ	Signal to Major Alarm LED
18	LED_CRIT	Signal to Critical Alarm LED
19	LED_USER1	Signal to User Definable LED1
20	LED_USER2	Signal to User Definable LED2
21	LED_USER3	Signal to User Definable LED2
22	RST_PB	Signal from Alarm Silence Push Button
23	LED_FT_FAIL_1	Signal to Fan Tray Left Alarm LED
24	LED_FT_FAIL_2	Signal to Fan Tray Center Alarm LED
25	LED_FT_FAIL_3	Signal to Fan Tray Right Alarm LED
26	LED_FT_OK_1	Signal to Fan Tray Left OK LED
27	LED_FT_OK_2	Signal to Fan Tray Center OK LED
28	LED_FT_OK_3	Signal to Fan Tray Left OK LED

6.8.3 Shelf Alarm Panel Backplane Connector

Figure 20: Shelf Alarm Panel Backplane Connector
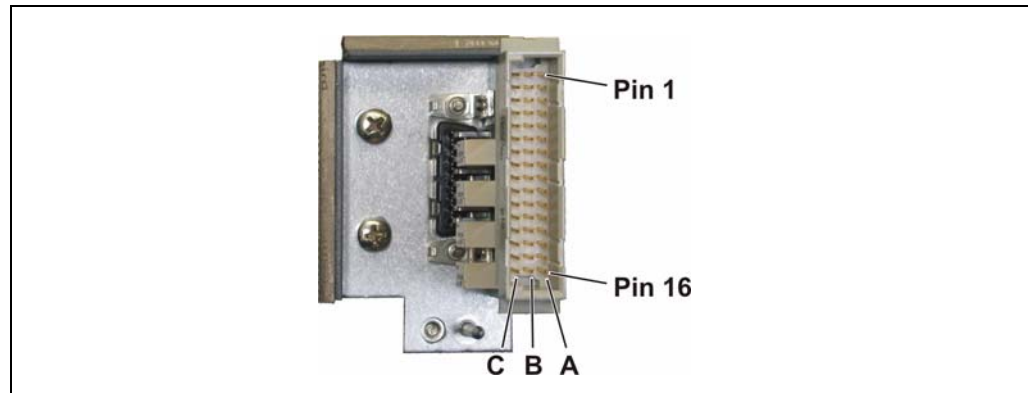
12705924

Table 13: Shelf Alarm Panel Backplane Connector Pin Assignment

	SAP ATCA Backplane Connector					
Pin	**A**	**Description**	**B**	**Description**	**C**	**Description**
1	LED_USER3	Signal to User Defin-able LED1	LED_USER 2	Signal to User Defin-able LED2	LED_USER 1	Signal to User Definable LED3
2	LED_CRIT	Signal to Critical Alarm LED on Shelf Alarm Display	LED_MAJ	Signal to Major Alarm LED on Shelf Alarm Display	LED_MIN	Signal to Minor Alarm LED on Shelf Alarm Dis-play
3	reserved		GND		RST_PB	Signal from Alarm Silence Push Button on Shelf Alarm Display
4	reserved		reserved		reserved	
5	reserved		reserved		reserved	
6	reserved		reserved		reserved	
7	reserved		reserved		reserved	
8	reserved		reserved		reserved	
9	reserved		reserved		reserved	
10	reserved		GND		reserved	
11	SCL_CH0	Serial Clock Master-Only I²C-Bus Channel 0	SAP_PRES	SAP Presence signal (Grounded on SAP)	INT#	External Interrupt Request (Master-Only I²C-Bus)
12	SDA_CH0	Serial Data Master-Only I²C-Bus Channel 0	reserved		reserved	
13	reserved		reserved		reserved	
14	reserved		reserved		I2C_PWR_ A	3,3 VDC power supply for Shelf I²C-bus devices
15	reserved		reserved		GND	
16	reserved		reserved		I2C_PWR_ B	3,3 VDC power supply for Shelf I²C-bus devices

6.9 SAP SEEPROM

The SAP SEEPROM is connected to the Master-Only I²C-bus and is a Microchip 24LC256 device.

6.10 SAP Temperature Sensor

The LM75 temperature sensor measuring the board temperature is located on the SAP PCB. The temperature sensor is connected to the Master-Only I²C-bus.

6.11 SAP I²C Addresses

Table 14: SAP I²C Addresses

LM75	SEEPROM	PCA9555
0x96/0x4b	0xa6/0x53	0x44/0x22

6.12 SAP PCA9555

The PCA9555 device:
* controls the status of the LEDs at the Shelf Alarm Display
* reads the status of the Telco Alarm Cutoff push button (RST)
* controls the Telco Alarm relays

Table 15: SAP PCA9555 Device Function

PCA9555 I/O pins	Function	State
0.0	Power Alarm to telco relays output	1 = relays powered
0.1	Minor Alarm to telco relays output	1 = relays powered
0.2	Major Alarm to telco relays output	1 = relays powered
0.3	Critical Alarm to telco relays output	1 = relays powered
0.4	N/C	Pulled High
0.5	LED_MIN (Minor alarm LED) output	1 = On
0.6	LED_MAJ (Major alarm LED) output	1 = On
0.7	LED_CRIT (Critical alarm LED) output	1 = On
1.0	Alarm cutoff push button input	0 = push button pushed
1.1	Minor Clear input	0 = voltage applied to input pins
1.2	Major Clear input	0 = voltage applied to input pins
1.3	N/C	Pulled High
1.4	N/C	Pulled High
1.5	LED_USER3 output	1 = On
1.6	LED_USER2 output	1 = On
1.7	LED_USER1 output	1 = On

6.13 SAD Console Cable for the Shelf Manger Serial Interface

Figure 21: RJ45 to DB9 Serial Console Cable
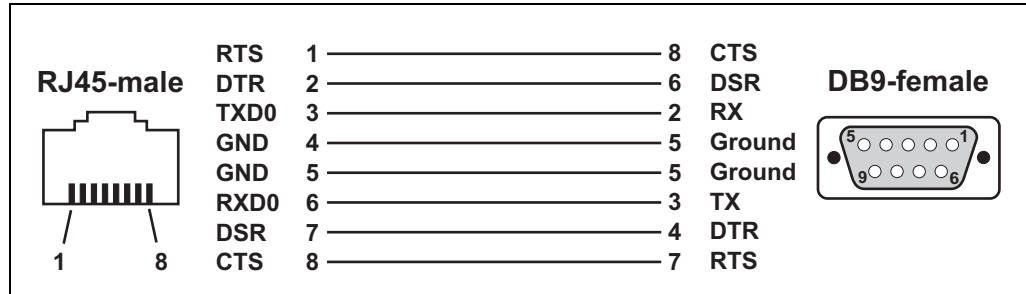
The connectors are shown with the cables pointing away.

The serial console default configuration is:
- *115200 baud*
- *no parity*
- *8 data bits*
- *1 stop bit*

The serial console cable is not included with the Shelf.

7 Fan Trays

7.1 Introduction

The 16 Slot ATCA Shelf contains three interchangeable Fan Trays. The Fan Trays are plugged-in at the rear top of the Shelf and can be removed by lifting the retention lever.

Each Fan Tray contains two radial fans for cooling the front boards and the RTM section of the Shelf. The cooling of the RTM section is provided by guiding air through cutouts in the ATCA Backplane.

The fan speeds are monitored by a tachometer signal sent from the Fan Trays to the Shelf Manager. The Shelf Manager regulates the fan speed with a PWM signal.

The display module at the Fan Tray provides:
*   A blue Hot Swap LED
*   A red Fan Tray Alarm LED
*   A green Fan Tray OK LED
*   A Hot Swap push button

Figure 22: Fan Tray, Front and Rear View
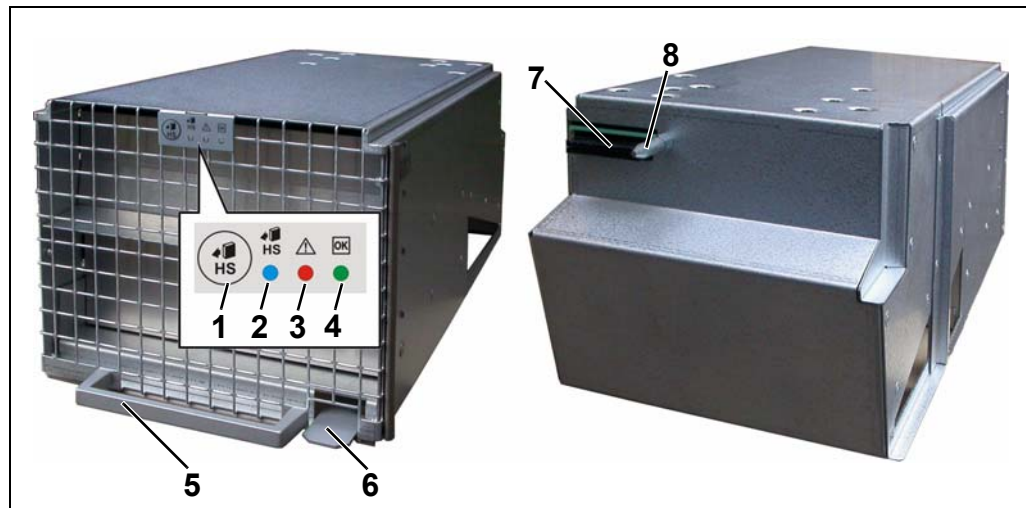
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1	Hot Swap push button	5	Extraction handle
2	Hot Swap LED (blue)	6	Retention lever
3	Fan Tray Alarm LED (red)	7	Horizontal Board connector
4	Fan Tray OK LED (green)	8	Guiding Pin

Figure 23: Fan Tray Numbering

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0	Fan #0	5	Fan #5
1	Fan #1	10	Fan Tray #0 (left)
2	Fan #2	11	Fan Tray #1 (center)
3	Fan #3	12	Fan Tray #2 (right)
4	Fan #4		

7.2 Fan Tray Block Diagram

Figure 24: Fan Tray Block Diagram
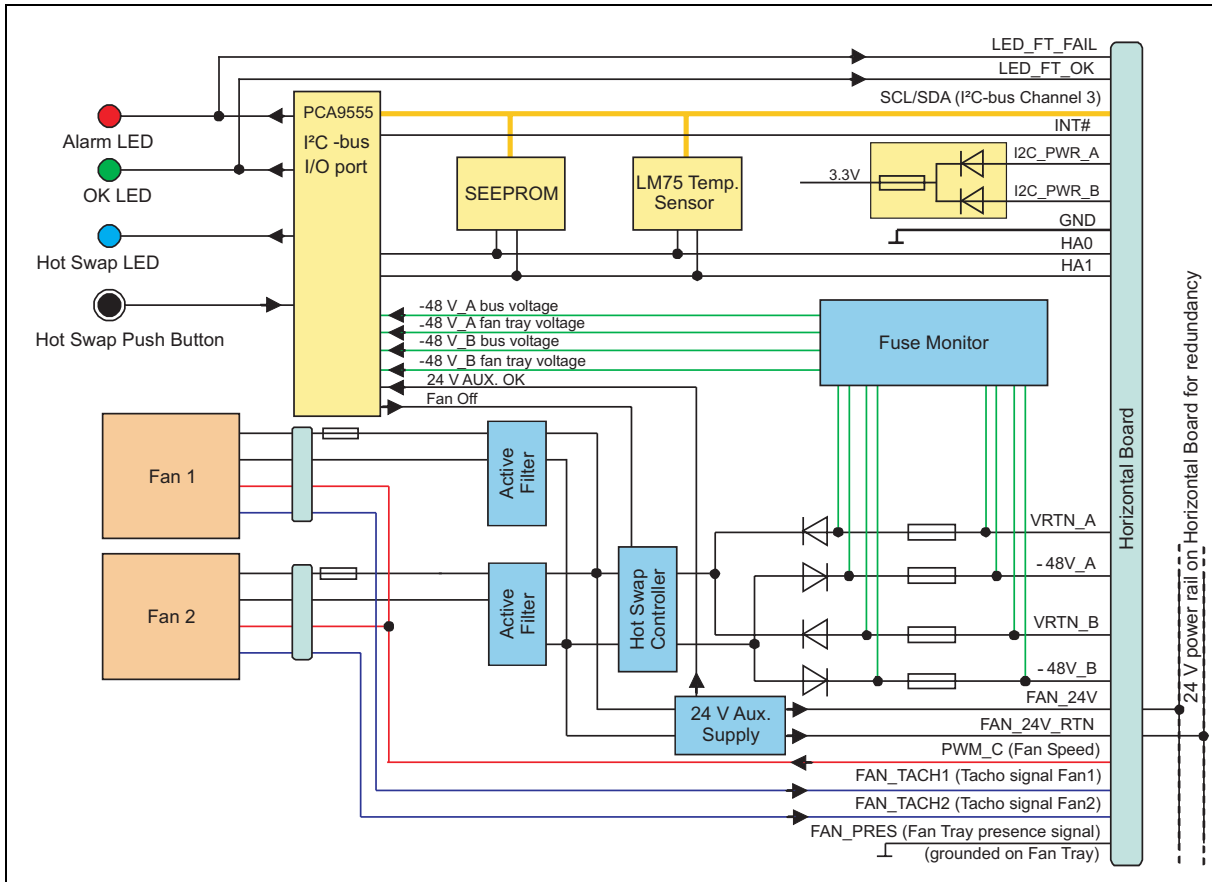
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7.3 Fan Tray Signals

The Fan Tray provides signals for:

- Voltage monitoring
- Switching off the fans
- Status of the 24 V DC/DC converter

These signals are controlled by the PCA9555 I²C device on the Fan Tray PCB. The Shelf Manager has access to these signals via Channel 3 of the Master-Only I²C-bus.

Table 16: Fan Tray Signals

Signal	description
-48 V_A bus voltage	Indicates the presence of the –48 V_A / VRTN_A at the Horizontal Board Connector
-48 V_A fan tray voltage	Indicates the presence of the –48 V_A / VRTN_A after the fan tray's mains fuse
-48 V_B bus voltage	Indicates the presence of the –48 V_B / VRTN_B at the Horizontal Board Connector
-48 V_B fan tray voltage	Indicates the presence of the –48 V_B / VRTN_B after the fan tray's mains fuse
24 V Aux OK	Indicates the proper functioning of the 24 V DC/DC converter which generates the 24 V auxiliary voltage supply
Fan Off	Turns off the fans

7.4 Fan Tray Temperature Sensor

The temperature sensors (LM75) in the Fan Trays measure the exhaust temperatures of the Shelf. The temperature sensors are connected to Channel 3 of the Master-Only I²C-bus.

I²C-bus addresses see *Table 19*.

7.5 Fan Tray control board SEEPROM

The SEEPROM (Microchip 24LC256) on the Fan Tray control board stores the FRU data and is connected to Channel 3 of the Master-Only I²C-bus.

I²C-bus addresses see *Table 19*.

7.6 Fan Tray Connectors and Indicators

Table 17: LEDs on Fan Tray control panel

Color	Description
blue	Hot Swap LED
red	Alarm LED
green	Fan Tray OK LED

Figure 25: Fan Tray Horizontal Board connector
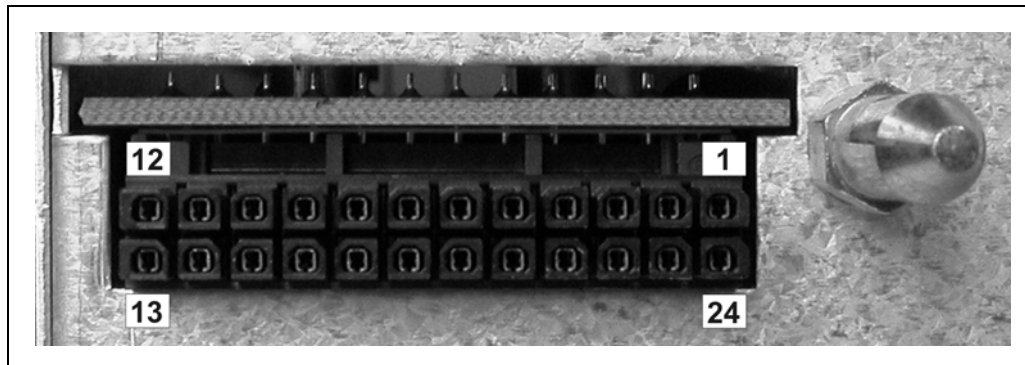
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Table 18: Fan Tray Horizontal Board connector pin assignment

Pin #	Signal	Pin #	Signal
1	FAN_24V_RTN	13	FAN_24V
2	FAN_TK1	14	VRTN_B
3	FAN_TK2	15	VRTN_A
4	PWM_C	16	-48V_B
5	N.C.	17	-48V_A
6	N.C.	18	N.C.
7	LED_FT_FAIL	19	N.C.
8	LED_FT_OK	20	INT#
9	SDA_CH3	21	SCL_CH3
10	HA1	22	I2C_PWR_B
11	HA0	23	I2C_PWR_A
12	GND	24	FAN_PRES

7.7 Fan Tray I²C Addresses

Geographic address pins (HA0, HA1) at the Fan Tray Horizontal board connector determine the I²C addresses of the devices.

Table 19: Fan Tray I²C addresses

Fan Tray Location (front view)	SEEPROM	LM75	PCA9555
#0 (Left)	0xa8/0x54	0x90/0x48	0x48/0x24
#1 (Center)	0xaa/0x55	0x92/0x49	0x4a/0x25
#2 (Right)	0xac/0x56	0x94/0x4a	0x4c/0x26

The addresses are shown in 8 bit/7 bit format.

7.8 Fan Tray I/O Device

The Fan Tray I/O device (PCA9555):
• controls the status of the LEDs
• reads the status of the Hot Swap push button
• reads the status of the DC/DC converter for the 24 VDC aux. power supply
• can enable the Hot Swap controller to switch off the fans

Table 20: Fan Tray PCA9555 pin assignment

PCA9555 I/O pins	Function	State
0.0	-48V_A bus voltage	0 = Voltage OK
0.1	-48V_A fan tray voltage	0 = Voltage OK
0.2	-48V_B bus voltage	0 = Voltage OK
0.3	-48V_B fan tray voltage	0 = Voltage OK
0.4	24 VDC AUX OK	0 = Voltage OK
0.5	FAN OFF	0 = Fans switched off
0.6	N/C	Pulled high
0.7	N/C	Pulled high
1.0	N/C	Pulled high
1.1	N/C	Pulled high
1.2	N/C	Pulled high
1.3	Green LED (OK)	1 = On
1.4	Hot swap push button switch	1 = not pushed, 0 = pushed
1.5	Red LED (Alarm)	1 = On
1.6	N/C	Pulled high
1.7	Blue LED (Hot swap)	1 = On

Configuration registers 6 and 7 in the PCA9555 control the direction of the I/O pins. Normally a 0xdf is written to register 6 and a 0x17 is written to register 7. This will make all pins to inputs except for 0.5, 1.7, 1.6, 1.5 and 1.3.

Configuration registers 4 and 5 in the PCA9555 control the inversion of the I/O pins. Normally a 0x00 is written to register 4 and 5. This will make the polarity of all of the pins the same as the bits in the registers.

8 Horizontal Board

Figure 26: Horizontal Board
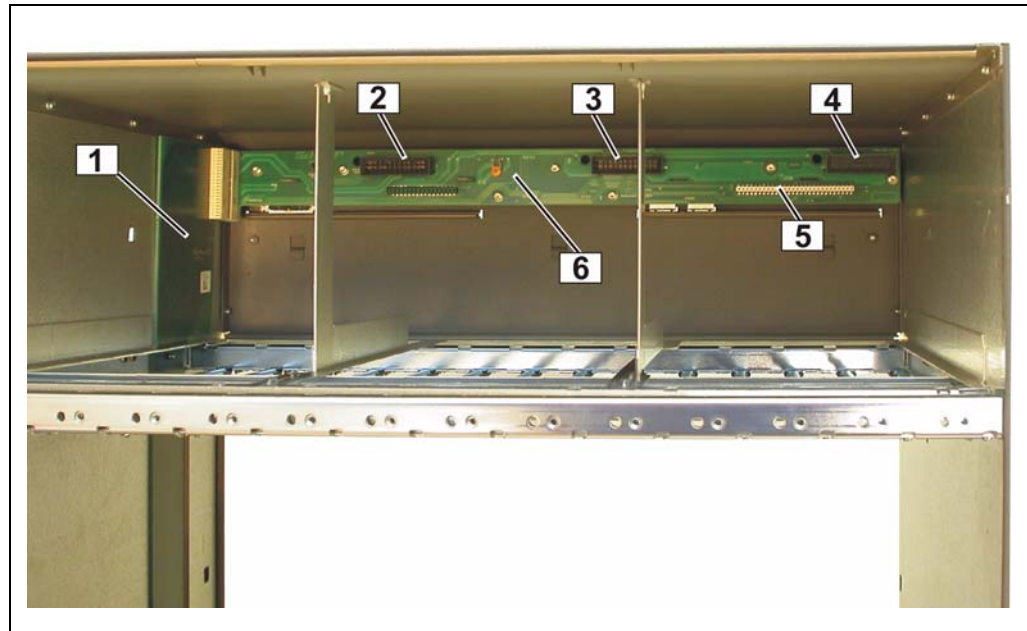
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1	Riser Board	4	Connector Fan Tray #0
2	Connector Fan Tray #2	5	Connector Shelf Alarm Display
3	Connector Fan Tray #1	6	Horizontal Board

The Horizontal Board (6) is located behind the Fan Trays at the top of the Shelf. The Horizontal Board provides the connectors for the Fan Trays (2, 3, 4) and the Shelf Alarm Display (5).

The signals from the Fan Trays and the Shelf Alarm Display are routed through the Riser Board (1) to the ATCA Backplane.

9 Power Entry Module (PEM)

	Hazardous voltage!
⚡	*Before working ensure that the power is removed from the power connection cables. When the system is powered on, do NOT touch the power terminals.*

	Warning!
⚠	*Although there are fuses in the power entry circuit of the PEM, the power lines must be protected on rack level with 30 A breakers or 30 A fuses.*

ℹ	*The Shelf can be powered using a regular telecommunication power supply of -48/-60 VDC with a VDC return. The specified voltage range is from -36 VDC to -72 VDC.The Shelf supports redundant power supplies but the two supplies should be independently powered.*

9.1 Introduction

Two pluggable redundant Power Entry Modules (PEMs) are located at the rear bottom side of the Shelf. Each PEM provides power terminals for four 30 A power feeds. Each power feed to the PEM consists of a –48 VDC cable and its corresponding return cable.
Overcurrent protection is provided by 30 A fuses in the -48 VDC input lines and the corresponding return lines.

The power filtering consists of filtered power terminals and discrete line-filter for each power feed.

The PEM provides:
- A PCA9555 I/O device for voltage monitoring and Hot Swap functionality
- A LM75 temperature sensor
- A 24LC256 FRU SEEPROM

These devices are connected to the I²C-bus via a LTC4300 I²C buffer.

To detect a missing or low supply voltage as well as a blown fuse, the input voltages at the power terminals and after the fuses are monitored by the PCA9555 chip.

To indicate to the Shelf Manager the presence of the PEM, a presence signal is grounded by the PEM.

A Hot Swap Push Button and a Blue Hot Swap LED provide Hot Swap functionality.
A red (power failure) and a green (OK) LED provide status indication.

Each of the four redundant power feeds supplies power to a separate part of the ATCA Backplane.

9.2 PEM Components

Figure 27: PEM components
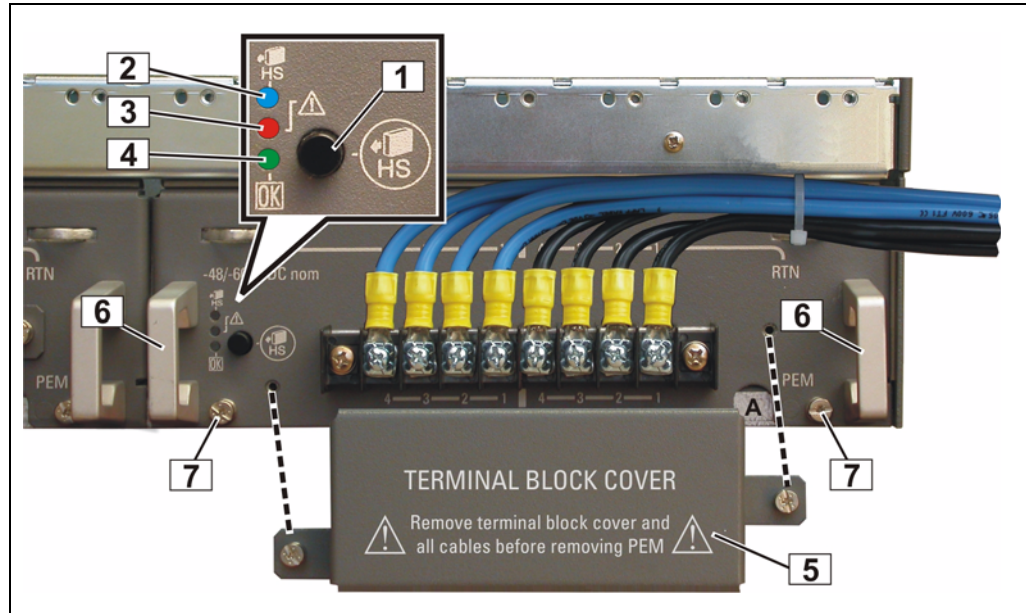
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1	Hot Swap push button	5	Power Terminal cover
2	Hot Swap LED (blue)	6	Handles
3	PEM Alarm LED (red)	7	PEM fixing screws
4	PEM OK LED (green)	8	Ground Terminal

Table 21: PEM Input Power Terminal

Terminal -48/-60 VDC#	Designation	Terminal RTN#	Designation
1	Power Input Feed 1	1	Return Voltage Feed 1
2	Power Input Feed 2	2	Return Voltage Feed 2
3	Power Input Feed 3	3	Return Voltage Feed 3
4	Power Input Feed 4	4	Return Voltage Feed 4

9.3 PEM Power Feeds

The ATCA Backplane is divided into four Power domains. Each of the four redundant power feeds supplies power to a separate part of the ATCA Backplane.

Figure 28: Power distribution of the four Power Feeds within the Shelf
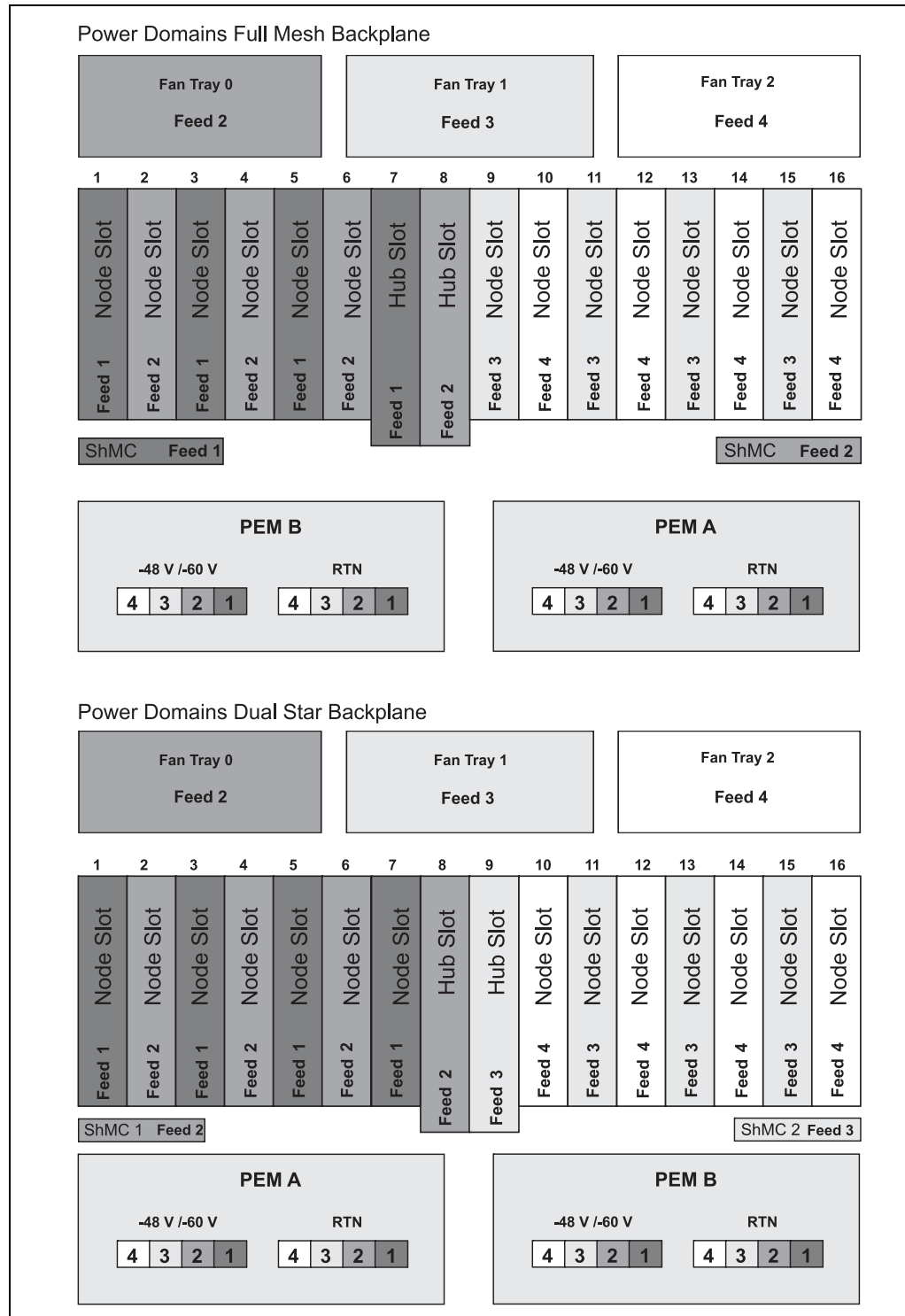
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9.4 PEM Block Diagram

Figure 29: PEM Block Diagram
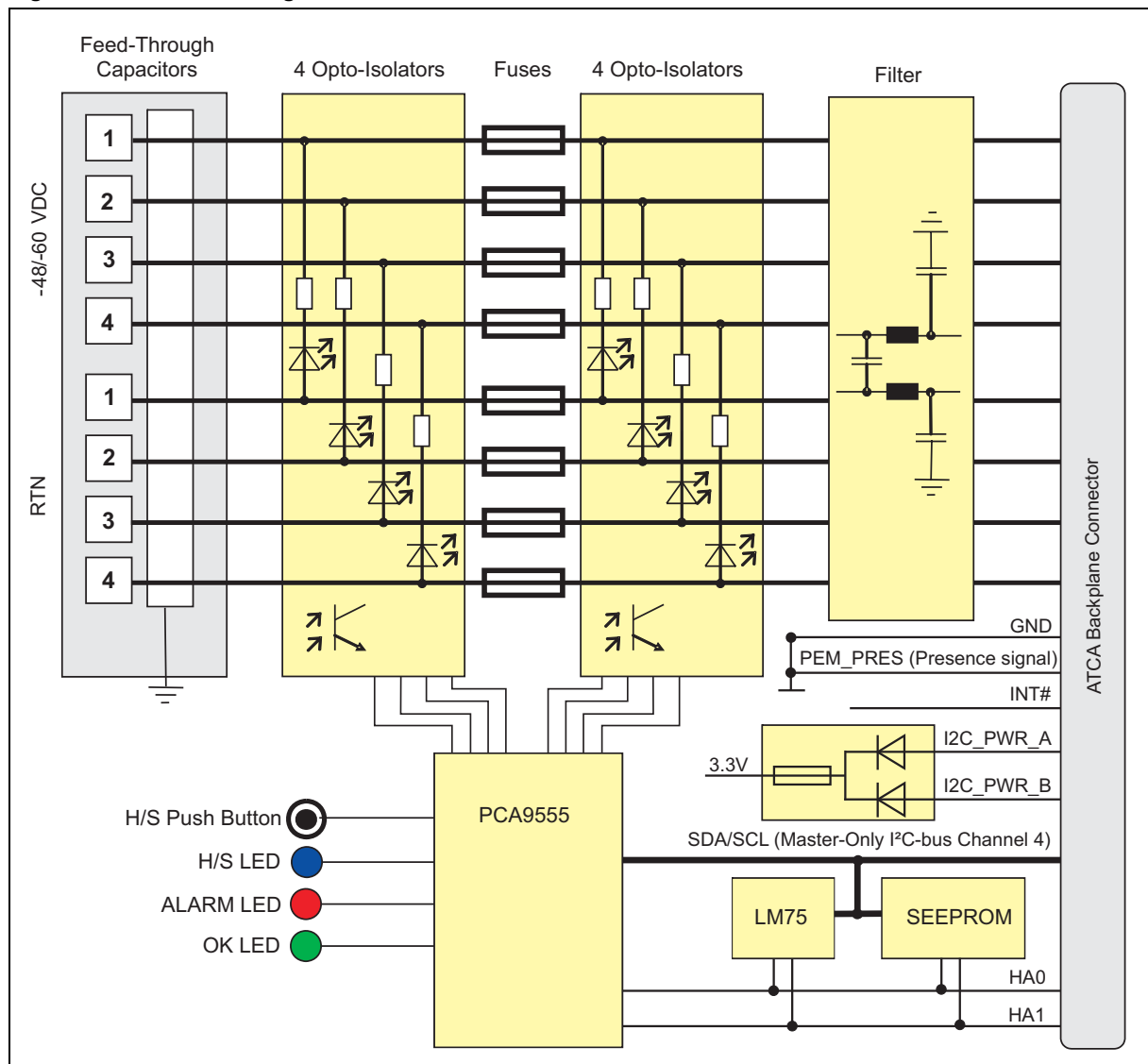
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9.5 PEM I²C-bus addresses

Geographic address pins (HA0, HA1) on the PEM determine the I²C addresses of the devices. The I²C devices on the PEMs are connected to Channel 4 of the Master-Only I²C-bus of the Shelf Managers.

Table 22: PEM I²C-bus addresses

PEM Location	SEEPROM	LM75	PCA9555
PEM A (Right, view from rear)	0xa8/54	0x98/4c	0x48/24
PEM B (Left, view from rear)	0xaa/55	0x9a/4d	0x4a/25

9.6 PEM I/O Device

The PEM I/O device (PCA9555):

• controls the status of the LEDs

• reads the status of the Hot Swap push button

• reads the status of the -48 VDC inputs

Table 23: PEM PCA 9555 pin assignment

PCA9555 I/O pin	Function	State
0.0	Power Input 2 present	-48 V present = 0 -48 V absent = 1 (3.3V)
0.1	Power Input 2 after the fuse present	-48 V present = 0 -48 V absent = 1 (3.3V)
0.2	Power Input 1 present	-48 V present = 0 -48 V absent = 1 (3.3V)
0.3	Power Input 1 after the fuse present	-48 V present = 0 -48 V absent = 1 (3.3V)
0.4	N/C	Pulled High
0.5	N/C	Pulled High
0.6	Power Input 4 present	-48 V present = 0 -48 V absent = 1 (3.3V)
0.7	Power Input 4 after the fuse present	-48 V present = 0 -48 V absent = 1 (3.3V)
1.0	Power Input 3 present	-48 V present = 0 -48 V absent = 1 (3.3V)
1.1	Power Input 3 after the fuse present	-48 V present = 0 -48 V absent = 1 (3.3V)
1.2	N/C	Pulled High
1.3	Green LED	1=on
1.4	Push-button switch	1 = out, 0 = pushed
1.5	Red LED	1=on
1.6	N/C	Pulled High
1.7	Blue LED	1=on

9.7 PEM Connectors

Figure 30: PEM Backplane Connector
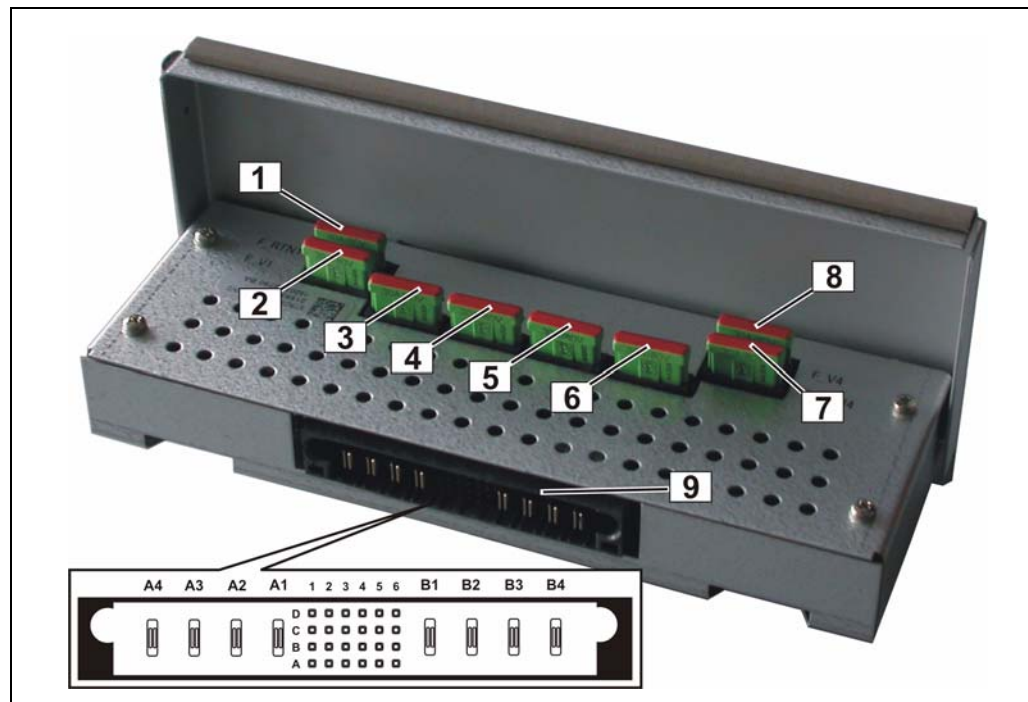
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1	30 A Fuse VRTN_1 (F101)	6	30 A Fuse -48V_3 (F302)
2	30 A Fuse -48V_1 (F102)	7	30 A Fuse VRTN_4 (F401)
3	30 A Fuse VRTN_2 (F201)	8	30 A Fuse -48V_4 (F402)
4	30 A Fuse VRTN_3 (F301)	9	PEM Backplane Connector
5	30 A Fuse -48V_2 (F202)		

Table 24: PEM Backplane connector power contacts

A4	A3	A2	A1	B1	B2	B3	B4
-48 V_1	VRTN_1	-48 V_2	VRTN_2	-48 V_3	VRTN_3	-48 V_4	VRTN_4

Table 25: PEM Backplane connector signal contacts

Pin #	1	2	3	4	5	6
D		INT#	PEM_PRES			
C		HA0	HA1			
B		SCL_CH4	GND			
A		SDA_CH4	I2C_PWR_A	I2C_PWR_B		

9.8 Specification for the power connection cables

Required wire size:

Diameter 6 mm² rest. AWG10

max. length 2.5 to 3.0 m

suitable for 30 A at 65° C ambient temperature.

Required terminals:

Use ring terminals for screw M4 or UNC 8-32.

Max. outside diameter is 9.3 mm.

10 Distribution of the Master-Only I²C Bus

The master-only I²C bus is used internally on the ShMM-500 for the RTC and SEEPROM devices. The ShMM-ACB-IV also has a number of onboard I²C devices connected to the master-only I²C bus. These devices read the slot's hardware address, communicate with the System Management controllers ADM1024/1026 and monitor the presence signals from the PEMs and Fan Trays.

The master-only I²C bus is fed to a 4-channel switch (PCA9545) and then routed through the ATCA Backplane connector (J2) to:

• the Shelf FRU SEEPROMs on the CDMs (Channel 1 and 2)

• the exhaust temperature sensors on the Fan Trays (Channel 3)

• the intake temperature sensors on the CDMs (Channel 3)

• the PEMs (Channel 4)

The master only I²C-bus is also buffered by an LTC4300 device and then routed to the SAP (Channel 0). The 'Active' signal of the ShMM-500 is used to enable the I²C switch and the LTC4300 buffer, so that only the active Shelf Manager has access to the Shelf I²C-bus devices.

Figure 31: Distribution of the Master-Only I²C-bus
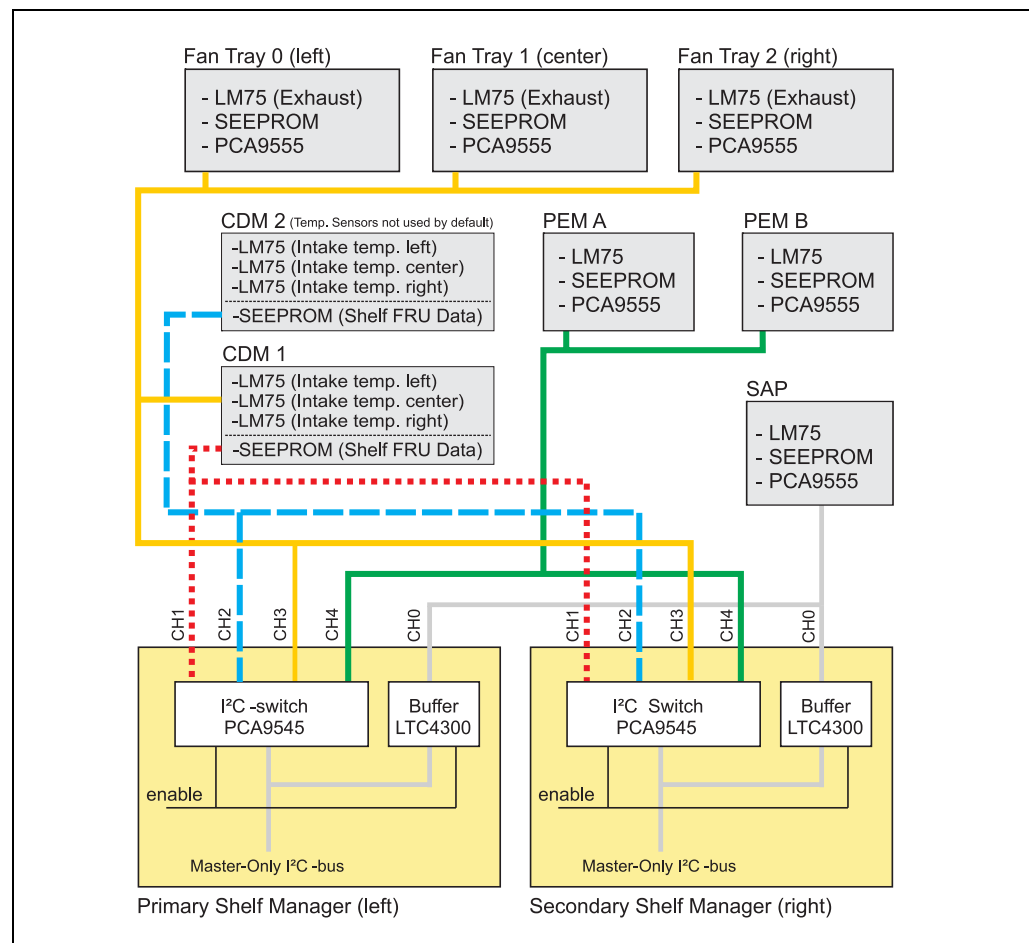
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Table 26: I²C-bus addresses of the Shelf

I²C addr.	Shelf Manager		FRU				
	ShMM-500	ACB-IV	CH 0 (SAP)	CH 1	CH 2	CH 3 (FT/ Tmp)	CH 4 (PEM)
0x44 / 22			PCA9555 Telco Alarms				
0x46 / 23		PCA9554 HW-Addr					
0x48 / 24						PCA9555 Fan Tray 0 (left)	PCA9555 PEM A
0x4a / 25						PCA9555 Fan Tray 1 (center)	PCA9555 PEM B
0x4c / 26						PCA9555 Fan Tray 2 (right)	
0x58 / 2C		ADM1024					
0x5c / 2E		ADM1026					
0x90 / 48						LM75 exhaust temp. left	
0x92 / 49						LM75 exhaust temp. center	
0x94 / 4a						LM75 exhaust temp. right	
0x96 / 4b			LM75 SAP temperature				
0x98 / 4c						LM75 intake temp. (left)	LM75 PEM A
0x9a / 4d						LM75 intake temp. (center)	LM75 PEM B
0x9c / 4e						LM75 intake temp. (right)	
0xa0 / 50	SEEPROM						
0xa4 / 52				SEEPROM SHCDM-A 1	SEEPROM SHCDM-A 1		
0xa6 / 53			SEEPROM SAP				
0xa8 / 54						SEEPROM Fan Tray 0 (left)	SEEPROM PEM A
0xaa / 55						SEEPROM Fan Tray 1 (center)	SEEPROM PEM B
0xac / 56						SEEPROM Fan Tray 2 (right)	
0xe0 / 70		PCA9545 I²C-bus switch					
0xe8 / 74		PCA9539 radial IPMB enable					
0xea / 75		PCA9539 radial IPMB enable					
0xee / 77		PCA9539 radial IPMB enable + GPIO					
0xd0 / 68	RTC DS1337						

11 Shelf Managers

This Chapter describes the Shelf Manager hardware. For explicit software documentation see:

• Pigeon Point Shelf Manager User Guide

• Pigeon Point Shelf Manager External Interface Reference

The documentation is available for registered users at www.schroff.biz

• Product Number 21593-375: Shelf Manager with bused IPMB

• Product Number 21593-376: Shelf Manager with radial IPMB

The Shelf Managers are not included with the Shelf.

11.1 Introduction

The Schroff Shelf Manager is a 78 mm x 280 mm form factor board that fits into a dedicated Shelf Manager slot in a Schroff ATCA Shelf.

The Shelf management based on the Pigeon Point Shelf management solution for AdvancedTCA products.
The Shelf management executes on the **Shelf Management Mezzanine 500** (**ShMM-500**), a compact SO-DIMM form-factor module, installed on a carrier board called **ATCA Carrier Board version IV** (**ACB-IV**).
The **ShMM-500** and the **ACB-IV** together build the **ShMM-ACB-IV,** the Shelf Manager for the Schroff ATCA Shelves.
The ACB-IV carrier board includes several on-board devices that enable different aspects of Shelf management based on the ShMM-500. These facilities include I²C-based hardware monitoring/control and GPIO expander devices.

The Shelf Manager has two main responsibilities:

1 Manage/track the FRU population and common infrastructure of a Shelf, especially the power, cooling and interconnect resources and their usage. Within the Shelf, this management/tracking primarily occurs through interactions between the Shelf Manager and the IPM Controllers over IPMB-0.

2 Enable the overall System Manager to join in that management/tracking through the System Manager Interface, which is typically implemented over Ethernet.

To maximize availability, the Schroff ATCA Shelves are designed to work with two redundant Schroff ShMM-ACB-IV Shelf Managers.

The ShMM-ACB-IV also provides individual Ethernet connections to both Base Hubs (ShMC cross connect), according to PICMG Engineering Change Notice ECN 3.0-2.0-001

Figure 32: Schroff Shelf Manager
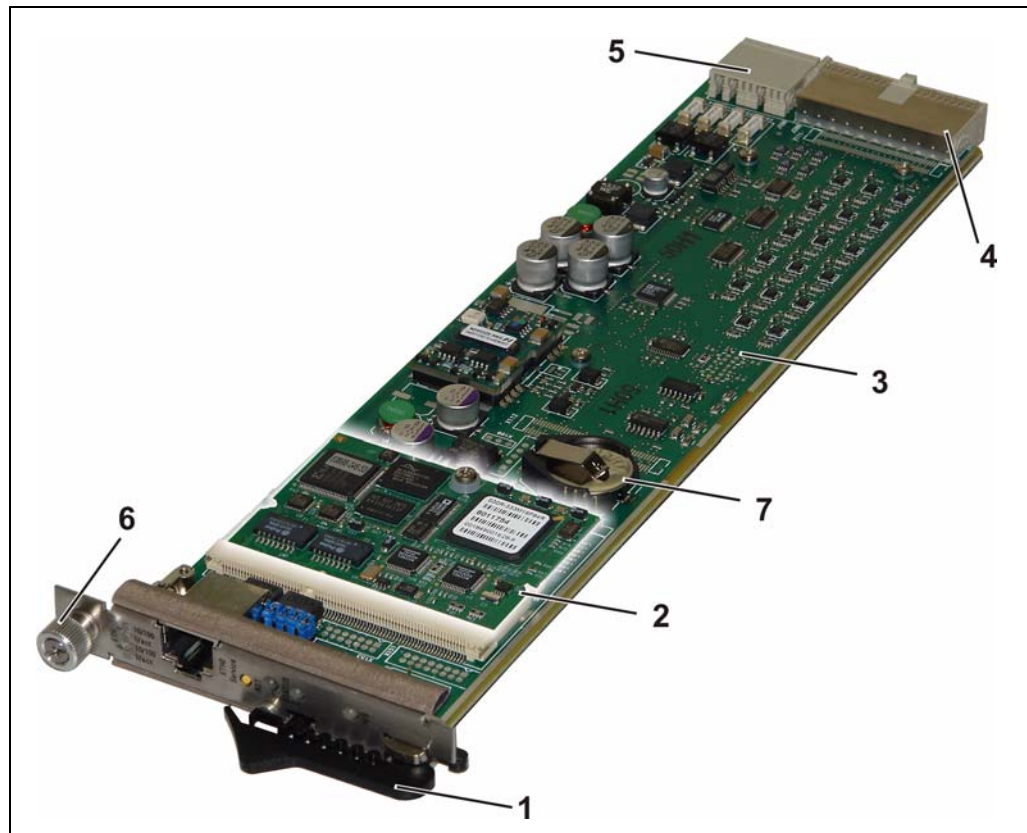
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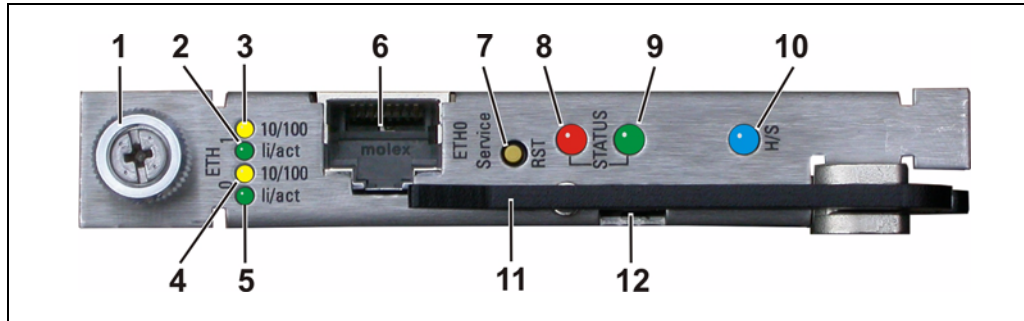|			
1	*Extraction handle*	5	*Backplane Connector (J1)*
2	*ShMM-500*	6	*Fixing screw*
3	*ACB-IV Carrier Board*	7	*RTC Backup Battery*
4	*Backplane Connector (J2)*		

11.2 Front Panel Components

Figure 33: Shelf Manager Front Panel Components

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1	Fixing screw	7	RESET push button
2	ETH 1 Link/Activity LED (green) - On = Link - Off = No Link - Blinking = Activity	8	Shelf Manager Status LED (red) - Red = Out of Service
3	ETH 1 Speed LED (yellow) - Off = 10 Mb - On = 100 Mb	9	Shelf Manager Status LED (green) - Solid Green = in Service, active Shelf Manager - Blinking = in Service, Backup Shelf Manager
4	ETH 0 Speed LED (yellow) - Off = 10 Mb - On = 100 Mb	10	Hot Swap LED (blue) - Solid Blue = ready to remove - Blinking = Hot Swap is requested - Off = No Hot Swap possible
5	ETH 0 Link/Activity LED (green) - On = Link - Off = No Link - Blinking = Activity	11	Extraction handle
6	ETH 0 Ethernet Service Connector (RJ45)	12	Hot Swap switch - Hot Swap is activated by lifting the extraction handle.

11.3 Bused IPMB Interface

**Only Shelf Managers with Product Number: 21593-375
for Shelves 11592-400/402**

The ShMM-500 provides two IPMBs. The IPMB_A and IPMB_B from the ShMM-500 are routed directly through the Shmm-ACB-IV PCB to the Backplane connector (J2). The ATCA Backplane buses the two IPMBs to the ATCA boards.

The Active# signal of the ShMM-500 is used to switch on/off the pull-up resistors of the IPMBs.

Figure 34: Block diagram bused IPMB
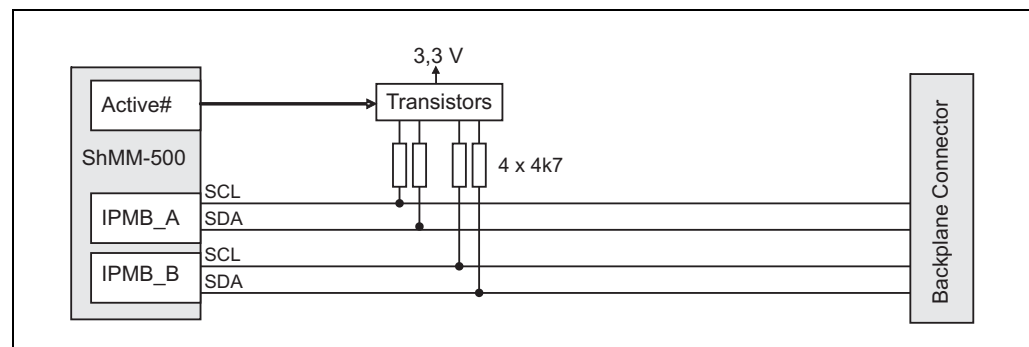
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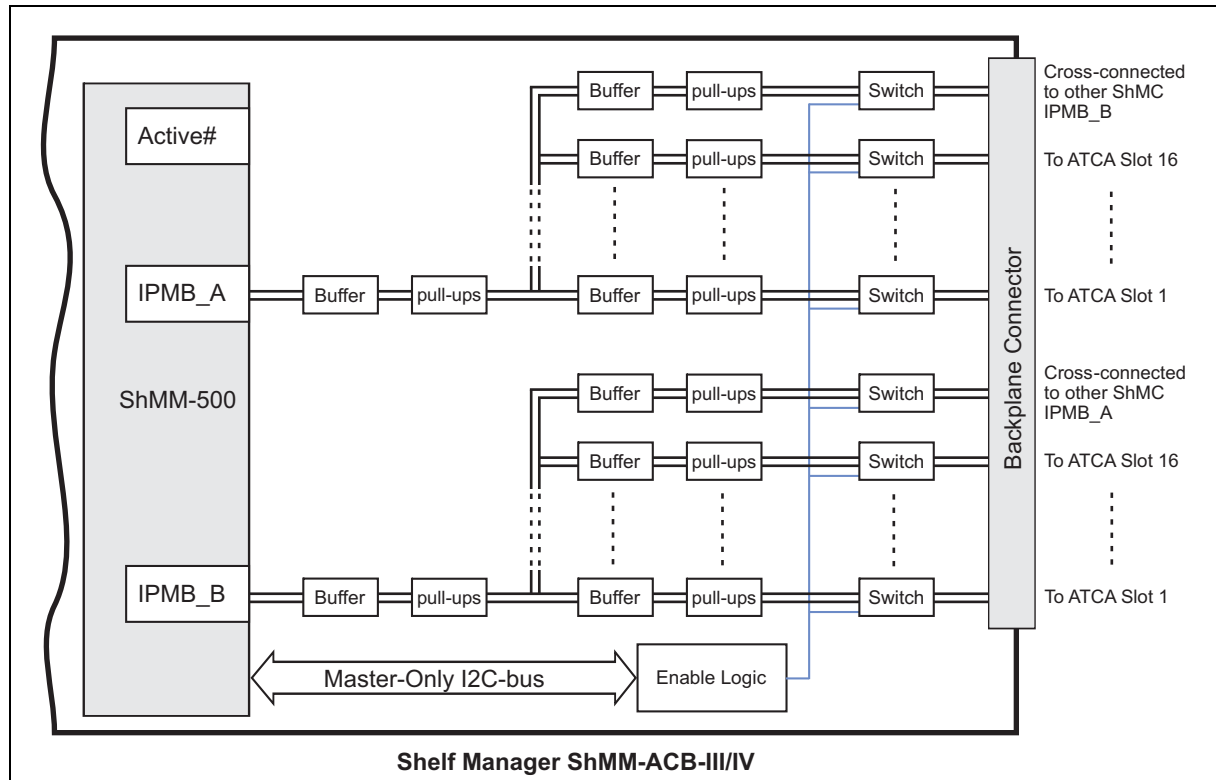
11.4 Radial IPMB Interface

**Only Shelf Managers with Product Number: 21593-376
for Shelves 11592-401/403**

The IPMB-A and IPMB-B buses from the ShMM-500 are routed through IPMB
hubs and FETs to the Backplane connector J2. The ATCA Backplane connects
the individual IPMBs from the IPMB hub to the ATCA boards

Figure 35: Shelf Manager with radial IPMB

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11.4.1 Radial IPMB Enables

If installed, the ShMM-ACB-IV implements the FET enables for the radial IPMB with three Philips PCA9555 16-bit GPIO port devices. See the table below for the enable bit to IPMB channel mapping.

Table 27: Radial IPMB enable-bit to IPMB-channel mapping

To Backplane Logical slot	IPMB-Channel	Enable Signal	I2C I/O Port on PCA9555	IPMB Port	J2 Pin
	CROSS A	EN10	U11 0x42 I/O 0.2	CROSS_SCL-SDA_A	C20-D20
	CROSS B	EN25	U07 0x40 I/O 1.4	CROSS_SCL-SDA_B	A18-A17
Slot 1	Channel A	EN33	U13 0x4e I/O 1.0	SCL-SDA_A01_R	C13-A13
Slot 2	Channel A	EN04	U07 0x40 I/O 0.0	SCL-SDA_A02_R	E22-D22
Slot 3	Channel A	EN13	U11 0x42 I/O 0.1	SCL-SDA_A03_R	A12-A11
Slot 4	Channel A	EN12	U11 0x42 I/O 0.4	SCL-SDA_A04_R	C16-B16
Slot 5	Channel A	EN14	U11 0x42 I/O 0.0	SCL-SDA_A05_R	C12-B12
Slot 6	Channel A	EN08	U07 0x40 I/O 1.3	SCL-SDA_A06_R	E14-D14
Slot 7	Channel A	EN07	U07 0x40 I/O 1.2	SCL-SDA_A07_R	C14-B14
Slot 8	Channel A	EN05	U07 0x40 I/O 1.0	SCL-SDA_A08_R	E12-D12
Slot 9	Channel A	EN11	U11 0x42 I/O 0.5	SCL-SDA_A09_R	A16-A15
Slot 10	Channel A	EN06	U07 0x40 I/O 1.1	SCL-SDA_A10_R	E13-D13
Slot 11	Channel A	EN02	U07 0x40 I/O 1.7	SCL-SDA_A11_R	C18-B18
Slot 12	Channel A	EN03	U07 0x40 I/O 0.1	SCL-SDA_A12_R	C22-B22
Slot 13	Channel A	EN09	U11 0x42 I/O 0.3	SCL-SDA_A13_R	B19-A19
Slot 14	Channel A	EN01	U07 0x40 I/O 1.6	SCL-SDA_A14_R	E18-D18
Slot 15	Channel A	EN15	U11 0x42 I/O 1.6	SCL-SDA_A15_R	C9-D9
Slot 16	Channel A	EN16	U11 0x42 I/O 1.7	SCL-SDA_A16_R	D10-C10
Slot 1	Channel B	EN29	U07 0x40 I/O 0.5	SCL-SDA_B01_R	B20-A20
Slot 2	Channel B	EN30	U07 0x40 I/O 0.4	SCL-SDA_B02_R	E21-D21
Slot 3	Channel B	EN21	U11 0x42 I/O 1.3	SCL-SDA_B03_R	C11-B11
Slot 4	Channel B	EN28	U07 0x40 I/O 0.6	SCL-SDA_B04_R	E17-D17
Slot 5	Channel B	EN31	U07 0x40 I/O 0.3	SCL-SDA_B05_R	C21-B21
Slot 6	Channel B	EN27	U07 0x40 I/O 0.7	SCL-SDA_B06_R	E16-D16
Slot 7	Channel B	EN34	U13 0x4e I/O 1.1	SCL-SDA_B07_R	A14-B13
Slot 8	Channel B	EN22	U11 0x42 I/O 1.2	SCL-SDA_B08_R	E11-D11
Slot 9	Channel B	EN24	U11 0x42 I/O 0.6	SCL-SDA_B09_R	E20-E19
Slot 10	Channel B	EN18	U11 0x42 I/O 1.1	SCL-SDA_B10_R	E15-D15
Slot 11	Channel B	EN26	U07 0x40 I/O 1.5	SCL-SDA_B11_R	C17-B17
Slot 12	Channel B	EN23	U11 0x42 I/O 0.7	SCL-SDA_B12_R	C19-D19
Slot 13	Channel B	EN32	U07 0x40 I/O 0.2	SCL-SDA_B13_R	A22-A21
Slot 14	Channel B	EN17	U11 0x42 I/O 1.0	SCL-SDA_B14_R	C15-B15
Slot 15	Channel B	EN19	U11 0x42 I/O 1.4	SCL-SDA_B15_R	A9-B9
Slot 16	Channel B	EN20	U11 0x42 I/O 1.5	SCL-SDA_B16_R	B10-A10

11.5 Ethernet Channels

The Shelf Manager provides two 10/100 Ethernet interfaces. The first Ethernet channel (ETH0) is routed either to the RJ45 connector on the front panel or to the ATCA Backplane connector J2 (default setting). The routing depends on the position of the jumpers B141-B143. The ATCA Backplane routes ETH0 from the connector J2 to the ShMC port on the corresponding Base Interface Hub board. The second Ethernet channel (ETH1) is routed to the other Base Interface Hub board (ShMC Cross Connect). Both Ethernet ports support 10 Mb (10BASE-T) and 100 Mb (100BASE-TX) connections.

The Shelf Manager provides two status LEDs for each Ethernet channel (ETH0 and ETH1). The LEDs are:

• Yellow: indicates 100 Mb speed when lit

• Green: indicates link when lit and activity when blinking

Table 28: Jumpers B141 - B144

Jumper	Name	Settings	Description
B141	TX0P	1-2	Connect TX0P signal from the ShMM-500 to the RJ45 Ethernet connector on the front panel
		2-3 (default)	Connect TX0P signal from the ShMM-500 to the Backplane signal connector (J2)
B142	TX0N	1-2	Connect TX0N signal from the ShMM-500 to the RJ45 Ethernet connector on the front panel
		2-3 (default)	Connect TX0N signal from the ShMM-500 to the Backplane signal connector (J2)
B143	RX0P	1-2	Connect RX0P signal from the ShMM-500 to the RJ45 Ethernet connector on the front panel
		2-3 (default)	Connect RX0P signal from the ShMM-500 to the Backplane signal connector (J2)
B144	RX0N	1-2	Connect RX0N signal from the ShMM-500 to the RJ45 Ethernet connector on the front panel
		2-3 (default)	Connect RX0N signal from the ShMM-500 to the Backplane signal connector (J2)

Figure 36: Jumpers B141-144 shown in default position 2-3

ShMM-ACB-IV
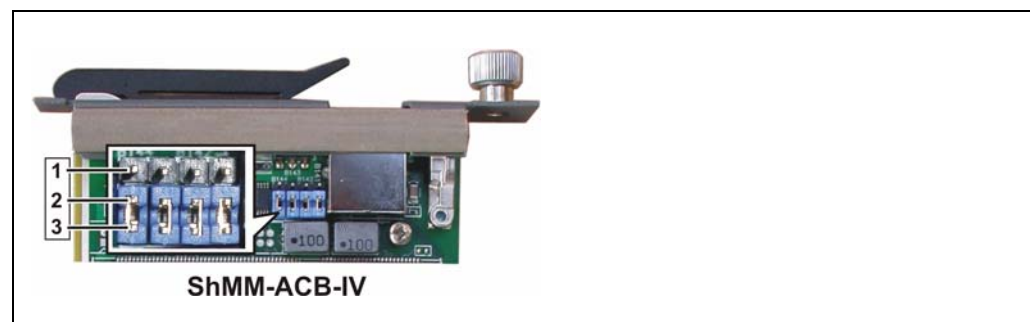
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Figure 37: Shelf Manager Cross Connect
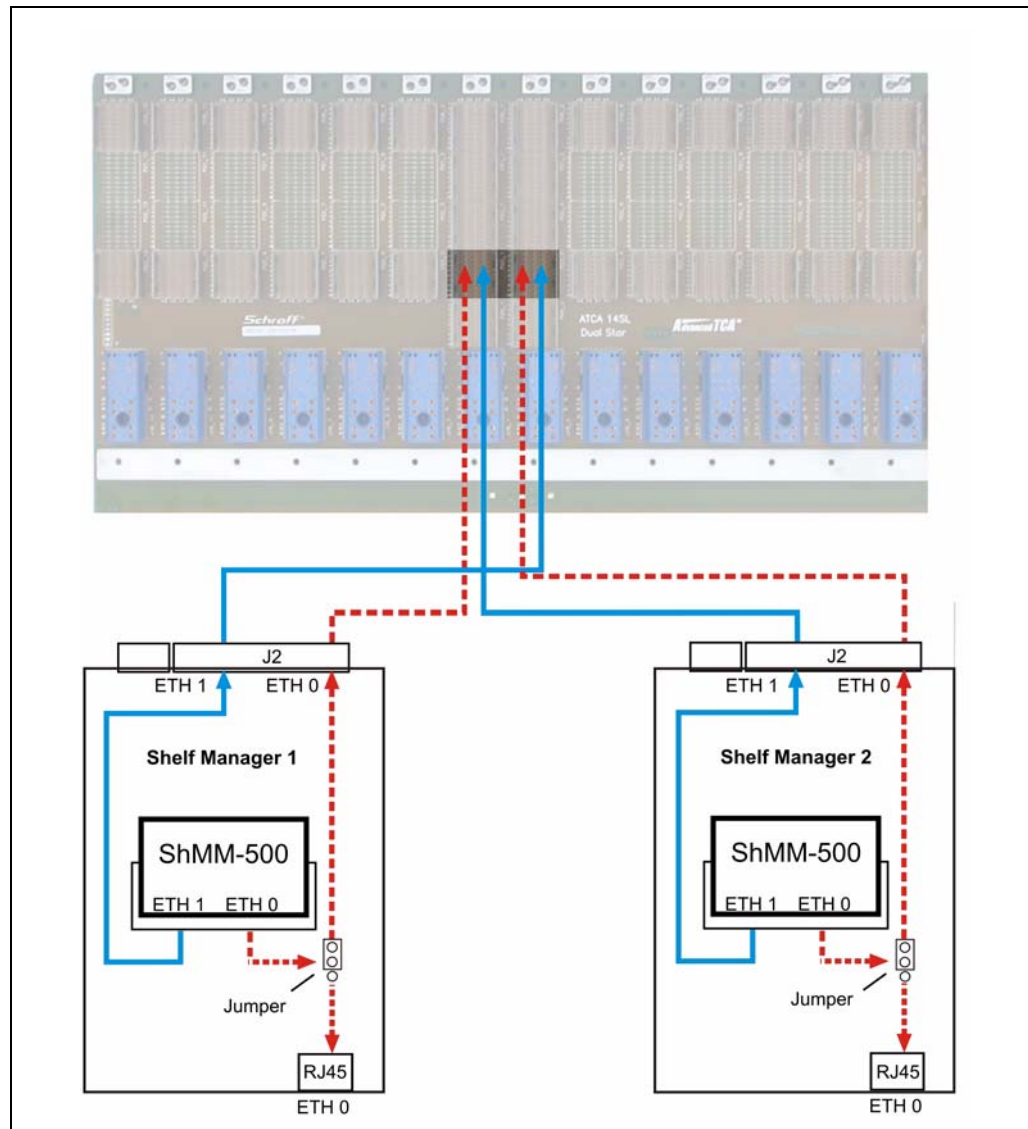
12707814

Table 29: Connector (P23) pin assignment for Shelf Manager Cross Connect

Row	Designation	ab		cd		ef		gh	
5	Shelf Manager Port with Shelf Manager Cross Connects	Tx1+	Tx1-	Rx1+	Rx1-	Tx2+	Tx2-	Rx2+	Rx2-
		Shelf Manager Cross Connect 1				Shelf Manager Cross Connect 2			

11.6 Shelf Manager RS-232 Console Serial Interface

A serial interface is implemented on the ShMM-500.The Shelf Manager provides an RS-232 console interface that provides a full set of RS-232 signals, including modem control. These signals are routed through the ShMM-ACB-IV backplane connector to a RJ45 connector on the front panel of the Shelf Alarm Display.

The serial console default configuration is:
- *115200 baud*
- *no parity*
- *8 data bits*
- *1 stop bit*

11.7 Front Panel RESET push button

The ShMM-ACB-IV provides a RESET push button on the front panel. It is connected to the ShMM-500's /MR signal.

Pushing the RESET button will reset the Shelf Manager

11.8 Hot Swap Interface

The ShMM-ACB-IV provides a Hot Swap interface allowing the ShMM-ACB-IV to be replaced without powering down the Shelf. The Hot Swap interface is implemented using the on-ShMM-500 CPLD device. The interface is composed of three components:

• Hot Swap switch at injector/ejector handle
• Presence signal indicating that the ShMM-ACB-IV is fully seated in its backplane connector
• Hot Swap LED

11.8.1 Hot Swap Switch

The injector/ejector micro-switch provides an input (HS_LATCH) to the ShMM-500 CPLD, which is responsible for taking appropriate hardware actions as well as signaling the condition to the software.

Micro-Switch	HS_LATCH Signal	HSL Bit in the CPLD	Condition
Open	High	0	Handle opened
Closed	Low	1	Handle closed

11.8.2 Board Presence

Each Shelf Manager grounds the PRES_1# input signal of the other Shelf Manager when installed into the ATCA Backplane. This signal is responsible for taking appropriate hardware action as well as signaling the condition to the software.

11.8.3 Hot Swap LED

The Shelf Manager provides a a blue Hot Swap LED. The LED indicates when it is safe to "remove" the Shelf Manager from a powered Shelf.

Table 30: Hot Swap LED

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

11.9 Input Voltage and Fuse Monitoring

To detect a missing supply voltage as well as a blown fuse the ShMM-ACB-IV provides voltage monitoring and control functions. The -48 VDC input voltage before and behind the fuses are connected to the ADM1026 chip through optical-isolation devices.

Figure 38: Input Voltage and Fuse Monitoring
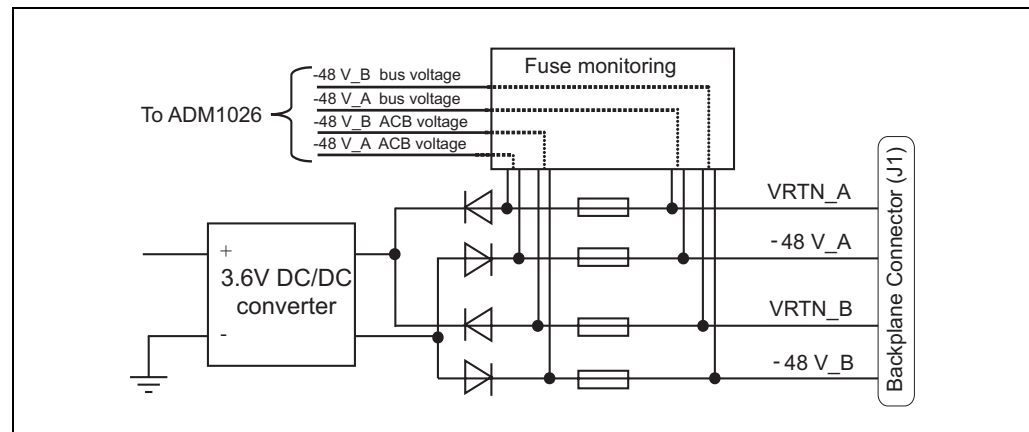
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Signal	description
-48 V_A bus voltage	Indicates the presence of the –48 V_A / VRTN_A at the backplane con-nector (J1). This signal is connected to pin 46 of the ADM1026
-48 V_A ACB voltage	Indicates the presence of the –48 V_A / VRTN_A behind the ACB-IV's mains fuse. This signal is connected to pin 44 of the ADM1026
-48 V_B bus voltage	Indicates the presence of the –48 V_B / VRTN_B at the backplane con-nector (J1). This signal is connected to pin 45 of the ADM1026
-48 V_B ACB voltage	Indicates the presence of the –48 V_B / VRTN_B behind the ACB-IV's mains fuse. This signal is connected to pin 43 of the ADM1026

11.10 Hardware Address

The ShMM-ACB-IV reads the hardware address and parity bit from the backplane connector of the Dedicated Shelf Manager slot. Geographic address pins (HA[0], HA7) at the Backplane connector determine bit 0 and bit 7, bit 1...6 are hardware-coded on the Shelf Manager PCB.

	HW-Addr.	IPMB-Addr.
Primary Shelf Manager	0x08	0x10
Secondary Shelf Manager	0x09	0x12

11.11 Redundancy Control

The Shelf Manager supports redundant operation with automatic switchover using redundant Shelf Managers. In a configuration where two Shelf Manager are present, one acts as the active Shelf Manager and the other as a standby. The Shelf Managers monitor each other and either can trigger a switchover if necessary.

11.11.1 Hardware Redundancy Interface

The hardware redundancy interfaces of the Shelf Managers are as follows:

- Cross connected Shelf Manager present input (PRES_1#) and output (PRES_GND#)
- Cross connected Shelf Manager health input (HLY_Input#) and output (HLY_Output#)
- Cross connected negotiation input (SWR_Input#) and output (SWR_Output#)
- Active output from the ShMM-500 (ACTIVE#) that is used by the ShMM-ACB-IV to enable interfaces that must be exclusively driven by the active Shelf Manager, specifically PWM and fan tachometer buffers
- Two status LEDs using the SWS_LED_G# (Green) and SWS_LED_R# (Red) signals
- The PRES_1# signal is grounded on the redundant Shelf Manager. This indicates both Shelf Managers the presence of the other.

The figure below shows the hardware redundancy interface of the ShMM-ACB-IV.

Figure 39: Shelf Manager redundancy control
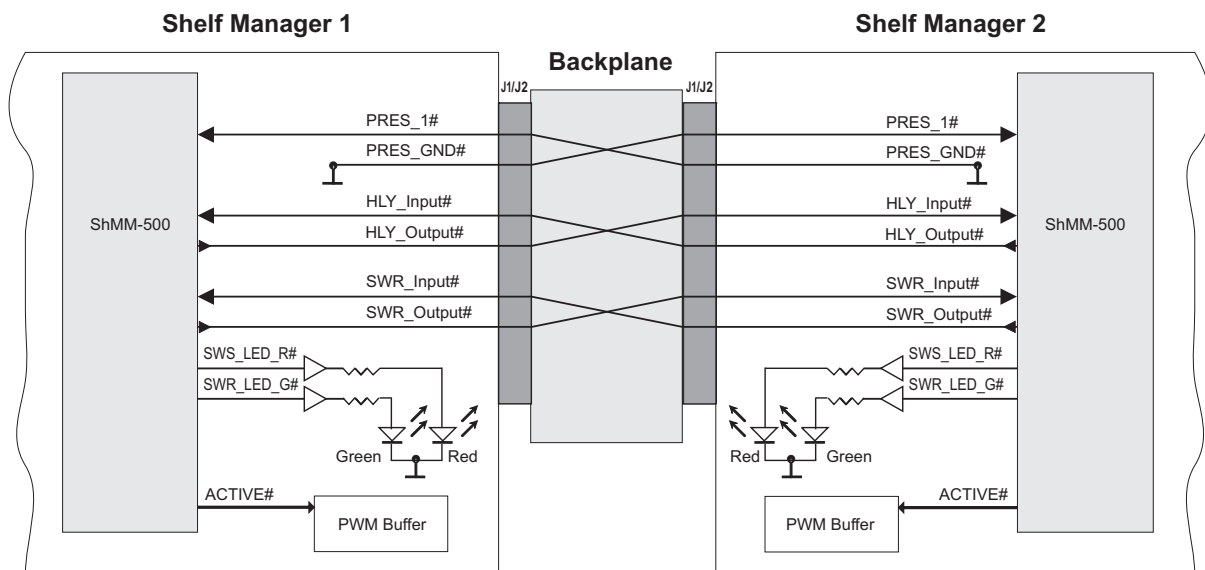
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11.12 RTC Backup Battery

⚠	**Caution!**
	There is a danger of explosion if the battery is incorrectly replaced or handled. When the battery is replaced, the same type or an equivalent type recommended by the manufacturer must be used. Used batteries must be disposed of according to the manufacturer's instructions.

The ShMM-ACB-IV board provides a Lithium "Coin Cell" backup battery installed in a 20 mm holder. The recommended battery type is CR2016. The battery voltage is supplied to the ADM1026 system monitor and to the ShMM-500 connector. Each of these connections is routed through two 1K Ohm resistors for UL compliance.

When the battery is installed and the main power is turned off, the RTC chip on the ShMM-500 gets its power from the backup battery. If the ShMM-500 is removed from the socket, the RTC is powered from the on-board Tantalum capacitor. The capacitor is capable of keeping the RTC running for 30 seconds. This feature allows replacing ShMM-500s without loss of the time/date or other information stored in the RTC NVRAM.

The Vbat nominal voltage is 3 V. Vmin is 2 V, and Vmax is 3.7 V.

The lifetime of the battery is aprox. 3 years.

Specification for the Backup Battery

Duracell	DL2016
Varta	CR2016
Maxell	CR2016

11.13 Command Line Interface (CLI)

The Command Line Interface (CLI) connects to and communicates with the IPM-devices of the Shelf, the boards, and the Shelf Manager.
The CLI is an IPMI-based library of commands, service personnel or system administrators can access the CLI through Telnet, SSH, or the Shelf Managers serial port on the SAP.
With the CLI, users can access information about the current system status including sensor values, threshold settings etc.
Users can also access and modify Shelf- and Shelf Manager configurations, perform actions on a FRU a.e. set fan speeds etc.

The default user account is "root" and there is no password.
The default IP address of the primary Shelf Manager is 192.168.0.2

To access all sensor datas you have to connect to the active Shelf Manager!

11.13.1 Basic CLI Commands

Service personnel can read system information, FRU information and sensor datas with the following basic commands. For a full list of all CLI commands refer to the Pigeon Point Shelf Manager External Interface Reference Manual.

- **Change IP address of the primary Shelf Manager:**

      clia setlanconfig *channel* ip *value*

Value represents the IP address in dotted decimal notation.

      clia setlanconfig 1 ip 192.168.0.2

- **Display the Shelf Managers firmware version:**

      clia version

Info: To get a complete list of all information just type in "version".

- **List all IPM Controllers in a Shelf:**

      clia ipmc

- **List all boards in the Shelf:**

      clia board

- **List all sensors on a board:**

      clia sensor *IPMI-address*

- **List only sensors which are outside of established thresholds:**

      clia sensor -t

- **Get data (value) from a sensor on a board:**

      clia sensordata *IPMI-address sensor-number*

- **Display the FRU information in a board:**

      ```
      clia fruinfo IPMI-address FRU-id
      ```

- **Change the speed for a Fan Tray:**

      ```
      clia setfanlevel IPMI-address Fru-id speed
      ```

Info: The value for the speed is from 0 to 4.

- **Display the contents of the System Event Log (SEL):**

      ```
      clia sel
      ```

- **Clear the System Event Log (SEL):**

      ```
      clia sel clear
      ```

11.14 Firmware Update

The Shelf Management software is stored in the FLASH memory on the ShMM-500. The software is:

U-boot
sentry.kernel
sentry.rfs

The U-boot program is usually permanent and allows the user to configure the software and network environment of the ShMM-500 and install new software from a network server. Sentry.kernel is the ShMM-500's Linux kernel and sentry.rfs is the ShMM-500's root file system.

11.14.1 Reprogramming the Shelf Manager from a TFTP server

- Download the sentry.kernel and sentry.rfs images and place them in the /tftpboot directory of your network reachable TFTP server. (A TFTP server is included with most UNIX and Linux systems)

- Connect the first Ethernet port (ETH0) of the Shelf Manager to the TFTP server. There are two ways to do this task:
  (a) Set the jumpers B141-B143 in position 1-2 and connect an Ethernet cable
       between the Ethernet connector at the Shelf Manager's front panel and the TFTP server, or
  (b) Set the jumpers B141-B143 in position 2-3 and connect the TFTP server to the ATCA Base Interface Hub.

- Connect a serial terminal or emulator to the console port on the front of the Shelf Alarm Panel (SAP).

- Set the terminal to 115000, N, 8, 1.

- Power on your Shelf Manager and interrupt the boot-up process.
  (When the Shelf Manager is first powered up a message is displayed on the console that says: "Hit any key to stop autoboot:".)

- The Shelf Manager will now allow you to interact with the U-boot program.

- Configure the network settings where the Shelf Manager expects to find the TFTP server.
  ```
  serverip=192.168.0.7
  ipaddr=192.168.0.2
  netmask=255.255.0.0
  gateway=192.168.0.1
  ```

- Start the upgrade process by typing in: „run net"

- After successful upgrade reboot the Shelf Manager and log-in as „root".

- Enter the command „clia version" and verify the firmware version.

A detailed instruction on how to reprogram the Shelf Manager is distributed with each new Firmware release.

11.15 Shelf Manager Front Panel and Backplane connectors

Table 31: Front Panel 10/100 Ethernet Service Connector

Pin #	Ethernet Signal	ShMM-500 Signal
1	TX+	TX+
2	TX-	TX-
3	RX+	RX+
4, 5	Unused pair; terminated on **ShMM-ACB-IV**	
6	RX-	RX-
7, 8	Unused pair, terminated on **ShMM-ACB-IV**	

Table 32: Backplane Signal Connector (J1) pin assignment

	a	b	c	d	e
1	-48 V_A	VRTN_A	NC	-48 V_B	VRTN_B
2					
3	SHELF_GND	SHELF_GND	SHELF_GND	SHELF_GND	SHELF_GND
4					
5	FAN_TACH0	FAN_TACH1	FAN_TACH2	FAN_TACH3	FAN_TACH4
6	FAN_TACH5	FAN_TACH6	FAN_TACH7	FAN_TACH8	PWM_C
7	FAN_SPEED	NC	FAN_24V	FAN_24V_RTN	PWM_E
8					
9	PEM_PRES_A	SAP_PRES	SWR_Input#	HLY_Input#	SWR_Output#
10	TX+	TX-	HS_EN	HLY_Output#	HA7
11	AIR_FILT_PR	PEM_PRES_B	RX+	RX-	PRES_1#

Table 33: Backplane Signal Connector (J2) pin assignment

	a	b	c	d	e	f
1	FAN_PRES0	TXD0	TXD1	FAN_PRES2	INT#	GND
2	FAN_PRES1	DTR	Pres_GND	CI	DSR	
3	CD	RTS	RXD1	HA[0]	CTS	GND
4	RXD0	SDA_CH1	INV_ACTIVE	SDA_CH0	GND	
5	SCL_CH1	SCL_CH0	RI	GND	SDA_CH3	GND
6	S1_TX+	S1_TX-	GND	S2_TX+	S2_TX-	
7	S1_RX+	S1_RX-	GND	S2_RX+	S2_RX-	GND
8	SDA_CH4	SCL_CH4	SCL_CH3	SCL_CH2	I2C_PWR_B	
9	SCL_B15_R	SDA_B15_R	SCL_A15_R	SDA_A15_R	SDA_CH2	GND
10	SDA_B16_R	SCL_B16_R	SDA_A16_R	SCL_A16_R	I2C_PWR_A	
11	SDA_A3_R	SDA_B3_R	SCL_B3_R	SDA_B8_R	SCL_B8_R	GND
12	SCL_A3_R	SDA_A5_R	SCL_A5_R	SDA_A8_R	SCL_A8_R	
13	SDA_A1_R	SDA_B7_R	SCL_A1_R	SDA_A10_R	SCL_A10_R	GND
14	SCL_B7_R	SDA_A7_R	SCL_A7_R	SDA_A6_R	SCL_A6_R	
15	SDA_A9_R	SDA_B14_R	SCL_B14_R	SDA_B10_R	SCL_B10_R	GND
16	SCL_A9_R	SDA_A4_R	SCL_A4_R	SDA_B6_R	SCL_B6_R	
17	CROSS_SDA_B	SDA_B11_R	SCL_B11_R	SDA_B4_R	SCL_B4_R	GND
18	CROSS_SCL_B	SDA_A11_R	SCL_A11_R	SDA_A14_R	SCL_A14_R	
19	SDA_A13_R	SCL_A13_R	SCL_B12_R	SDA_B12_R	SDA_B9_R	GND
20	SDA_B1_R	SCL_B1_R	CROSS_SCL_A	CROSS_SDA_A	SCL_B9_R	
21	SDA_B13_R	SDA_B5_R	SCL_B5_R	SDA_B2_R	SCL_B2_R	GND
22	SCL_B13_R	SDA_A12_R	SCL_A12_R	SDA_A2_R	SCL_A2_R	

Table 34: Backplane connector (J1) and (J2) pin description

-48V_A	-48 VDC supply A
-48V_B	-48 VDC supply B
AIR_FILT_PR	Air filter presence (connected to switch to detect a missing air filter)
CD	Carrier Detect
CI	Shelf Intrusion signal
CROSS_SCL_A	Serial Clock of IPMB_A, cross-connected to serial clock of IPMB_B of other Shelf Manager
CROSS_SCL_B	Serial Clock of IPMB_B, cross-connected to serial clock of IPMB_A of other Shelf Manager
CROSS_SDA_A	Serial Data of IPMB_A, cross-connected to serial clock of IPMB_B of other Shelf Manager
CROSS_SDA_B	Serial Data of IPMB_B, cross-connected to serial clock of IPMB_A of other Shelf Manager
CTS	Clear To Send
DSR	Data Set Ready
DTR	Data Terminal Ready
FAN_24V	Auxiliary 24 VDC supply, generated on Fan Trays
FAN_24V_RTN	Auxiliary 24 VDC, generated on Fan Trays, return path
FAN_PRES[0...2]	Fan Tray present (grounded when present)
FAN_SPEED	DC for Fan Speed Control (1.5V = min. speed, 10V = max speed)
FAN_TACH[1...9]	Tachometer signals from Fan Trays
GND	logic ground
HA[0]	Hardware address of Shelf Manager, bit 0
HA7	Hardware address of Shelf Manager, bit 7
HLY_Input#	Health of the other Shelf Manager
HLY_Output#	Health of this Shelf Manager
HS_EN	Tells the Shelf Manager that it is plugged in
I2C_PWR_A	3.3V power redundant path A for Shelf I^2C-devices
I2C_PWR_B	3.3V power redundant path B for Shelf I^2C-devices
INT#	External Interrupt request (Master Only I^2C-bus)
INV_ACTIVE	This ShMM is in active mode (inverted signal of ShMM)
NC	not connected
PEM_PRES_[A, B]	PEM [A, B] presence (grounded when present)
PRES_1#	Board presence signal of the other Shelf Manager
PWM_C	Opto isolated PWM signal for fan speed control, collector
PWM_E	Opto isolated PWM signal for fan speed control, emitter
RI	Ring Indication
RTS	Request To Send
RX(+-)	Ethernet interface (ETH1) to Hub-Slot (ShMC cross connect)

-48V_A	-48 VDC supply A
RXD[0...1]	Serial interface receive data
S1_RX(+-)	Ethernet interface (ETH0) to either front panel or hub-slot base interface (jumper configurable)
S1_TX(+-)	Ethernet interface (ETH0) to either front panel or hub-slot base interface (jumper configurable)
S2_RX(+-)	USB interface to other Shelf Manager
S2_TX(+-)	USB interface to other Shelf Manager
SAP_PRES	Presence signal of SAP (Grounded when present)
SCL_A_[1...13, 15...16]	Serial Clock, radial IPMB_A
SCL_A_14	Serial Clock, IPMB_A Channel 14 (for bused IPMB, or radial IPMB to logical slot (14)
SCL_B_[1...13, 15...16]	Serial Clock, radial IPMB_B
SCL_B_14	Serial Clock, IPMB_B channel 14 (for bused IPMB, or radial IPMB to logical slot (14)
SCL_CH0	Master Only-I^2C-bus to SAP
SCL_CH1	Master-Only I^2C-bus Channel 1 (to CDM1 FRU SEEPROM)
SCL_CH2	Master-Only I^2C-bus Channel 2 (to CDM2 FRU SEEPROM)
SCL_CH3	Master-Only I^2C-bus Channel 3 (to Fan Trays)
SCL_CH4	Master-Only I^2C-bus Channel 4 (to PEMs)
SDA_A_[1...13, 15...16]	Serial Data, radial IPMB_A
SDA_A_14	Serial Data, IPMB_A Channel 14 (for bused IPMB, or radial IPMB to logical slot (14)
SDA_B_[1...13, 15...16]	Serial Data, radial IPMB_B
SDA_B_14	Serial Data, IPMB B channel 14 (for bused IPMB, or radial IPMB to logical slot (14)
SDA_CH0	Master Only-I^2C-bus to SAP
SDA_CH1	Master-Only I^2C-bus Channel 1 (to Backplane FRU SEEPROM1)
SDA_CH2	Master-Only I^2C-bus Channel 2 (to Backplane FRU SEEPROM2)
SDA_CH3	Master-Only I^2C-bus Channel 3 (to Fan Trays)
SDA_CH4	Master-Only I^2C-bus Channel 4 (to PEMs)
SHELF_GND	Shelf Ground
SWR_Input#	Switchover signal from the other Shelf Manager
SWR_Output#	Switchover signal to the other Shelf Manager
TX(+-)	Ethernet interface (ETH1) to Hub-Slot (ShMC cross connect)
TXD[0...1]	Serial interface transmit data
VRTN_A	Voltage return supply A
VRTN_B	Voltage return supply B

12 Technical Data

Table 35: Technical Data

Physical Dimensions	
Height	571.6 mm
Width	533 mm
Depth	506.54 mm (with cable trays)
Weight	
Shipping weight completely assembled with packaging	47 Kg
Shelf weight (w/o fan tray and w/o PEMs)	22.3 Kg
Shelf weight completely assembled	35.7 Kg
Power	
Input voltage	-40.5 VDC …. -72 VDC
Input Power	30 A per power feed (total 4 + 4 power feeds)
Overcurrent Protection	30 A Fuses on PEM
Cooling Capacity	
Front Boards	200 W / Board
RTM	15 W / Board
Environmental	
Ambient temperature	+5°C…+45°C
Humidity	+5%...+85%, no condensation
EMI	
Conducted Emissions	EN 55022 Class B
Radiated Emissions	EN 55022 Class B
Safety	
File E229721	UL 60950-1
CB Test Certificate	IEC 60950-1
Protected Earth Test	EN60950-1, test current 25 A, resistance <100mOhm
Hipot Test	EN60950-1, 1000V

12.1 Part Numbers

Table 36: Part Numbers

Number	Part
11592-500	16-Slot ATCA Shelf, Dual Star Backplane, bused IPMB
11592-501	16-Slot ATCA Shelf, Dual Star Backplane, radial IPMB
11592-502	16-Slot ATCA Shelf, Full Mesh Backplane, bused IPMB
11592-503	16-Slot ATCA Shelf, Full Mesh Backplane, radial IPMB
21593-375	Shelf Manager ShMM-ACB-IV with bused IPMB
21593-376	Shelf Manager ShMM-ACB-IV with radial IPMB
21594-143	Fan Tray
21596-020	PEM
21596-025	Shelf Alarm Panel (SAP)
21596-026	Shelf Alarm Display (SAD)
21594-144	Air Filter Element
21596-012	Filler Panel for Shelf Manager slot
21591-079	Filler Panel with airflow baffle for front boards
21591-099	Filler Panel with airflow baffle for RTM boards
21596-023	Chassis Data Module (CDM)
21191-207	Fuse 30 A/80 V (10 pcs for PEM)

12.2 Shelf Mechanical Dimensions

Figure 40: Shelf Mechanical Dimensions
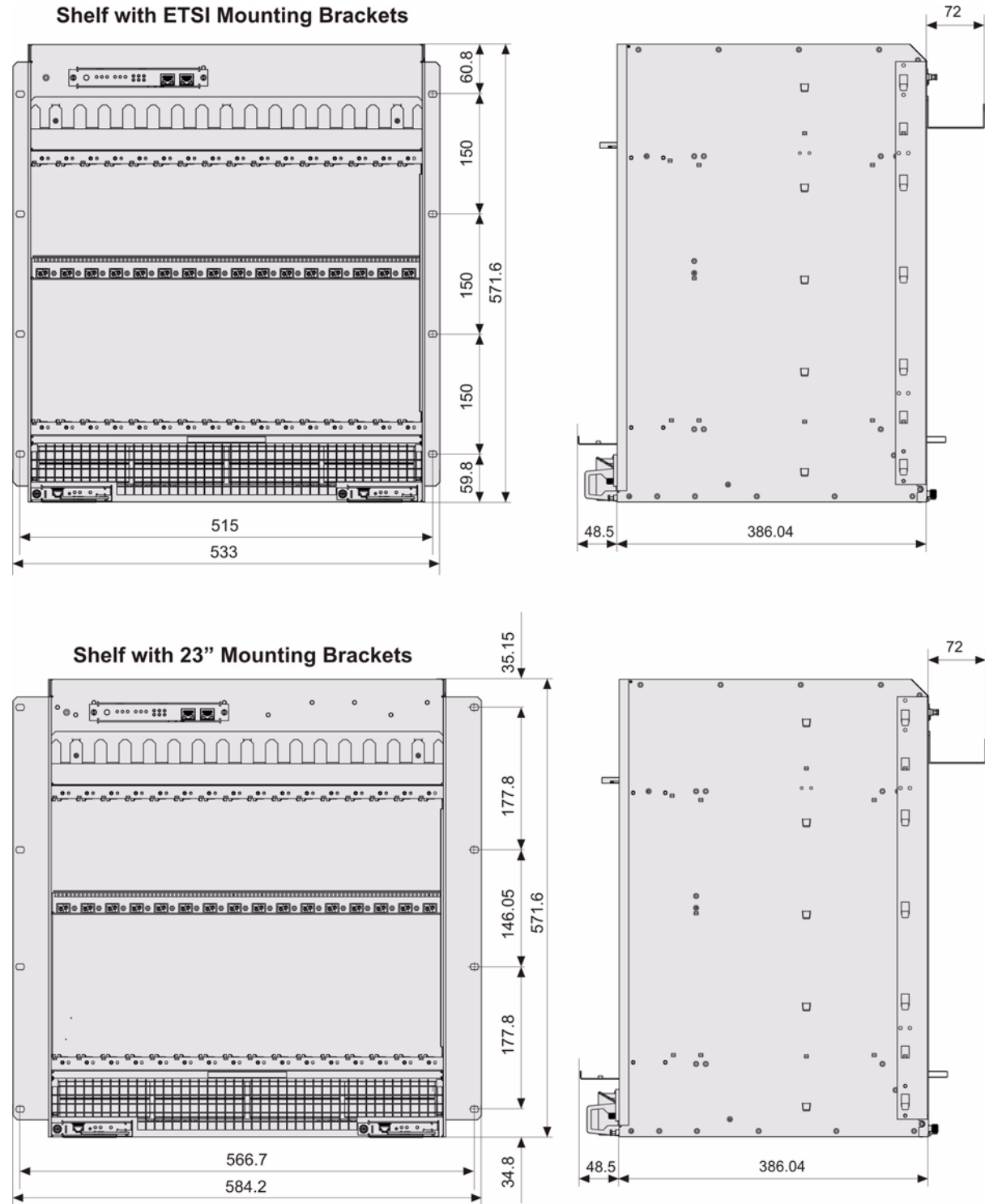
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All dimensions are in millimeters (mm).

Tables

Figures