PATTON Electronics Co.

Model 6476
ForeFront FullPipe Chassis Assembly

User Guide

Sales Office: **+1 (301) 975-1000**
Technical Support: **+1 (301) 975-1007**
E-mail: **support@patton.com**
URL: **www.patton.com**

Document Number: **120021U Rev. 7**
Part Number: **07M6476**

Patton Electronics Company, Inc.
7622 Rickenbacker Drive
Gaithersburg, MD 20879 USA
tel: +1 (301) 975-1000
fax: +1 (301) 869-9293
support: +1 (301) 975-1007
url: www.patton.com
e-mail: support@patton.com

Trademark Statement

The terms *ForeFront* and *FullPipe* are trademarks of Patton Electronics Company. *CompactPCI* and *PICMG* are registered trademarks of the PCI Industrial Computer Manufacturers Group. All other trademarks presented in this document are the property of their respective owners.

Notices

The information contained in this document is not designed or intended for use as critical components in human life-support systems, equipment used in hazardous environments, or nuclear control systems. Patton Electronics Company disclaims any express or implied warranty of fitness for such uses.

The information in this document is subject to change without notice. Patton Electronics assumes no liability for errors that may appear in this document.

Any software described in this document is furnished under license and may be used or copied only in accordance with the terms of such license.

Contents

Contents **3**
Compliance Information **7**
Radio and TV Interference 7
Industry Canada Notice 7
FCC Part 68 Compliance Statement 7
CE Notice 8
About this guide 9
Audience 9
Structure 9
Precautions 10
Style conventions used in this document 10
Typographical conventions used in this document 11
General conventions 11
Mouse conventions 12
Bibliography 12
1 Introduction **13**
Product features and benefits 14
What is CompactPCI? 14
About Patton Electronics Company 15
2 Chassis specifications **17**
4U CPCI subrack 18
Description of Chassis Front Side 19
Description of Chassis Rear Side 20
Electromagnetic compatibility (EMC) 21
Electrostatic discharge (ESD) protection 22
Fan Tray Assembly 24
Chassis System Specifications 25
Power Considerations 25
3 System Architecture **27**
CompactPCI form factor 28
Board front panels 29
Transition Boards 29
Pin and socket connectors 31
J1/P1 & J2/P2 connectors 33
J3/P3 through J5/P5 connector 33
Reserved Pins 33
Power Pins 33
Backplane Architecture 33
Signaling Environment 35

Backplane power distribution 35
External power connections 35
AC Interface 36
Backplane Power Lugs and Connectors 36
In-rack power connections 37
Front panel keying for power supplies 39
Power decoupling 39
Hot-Swap Capability 39
Keying of CPCI backplanes and boards 40
Backplane connector keys 40
Front panel and cardguide keys 41

4 Installation checklist 43
4U quick set-up checklist 44
Power cable installation 45
Installing the power cables—AC unit 45
Installing the power cables—DC unit 45
Grounding the Model 6476—AC and DC units 46
Changing the VI/O configuration jumper 47
Slot Designation 47
Optional Frame Ground/Signal Ground Connect 48

5 Maintenance 49
Preventive Maintenance 50
Cleaning the fan filter 50
Troubleshooting 50
System won't power up 50
Hot-swap of power supply fails 50
No-load condition generates a false alarm 50

6 Contacting Patton for assistance 51
Introduction 52
Contact information 52
Service 52
Warranty Service and Returned Merchandise Authorizations (RMAs) 52
Warranty coverage 53
Out-of-warranty service 53
Returns for credit 53
Return for credit policy 53
RMA numbers 53
Shipping instructions 53

A Glossary of Terms 55
C 56
CFM 56
CSA 56

CT 56
D 56
Dual Redundant 56
E 56
ECTF 56
EIA 56
EMC 56
EMI 56
EN 56
Enumeration 56
ESD 56
Eurocard 56
H 56
Hot-Swap 56
HP 56
I 57
IDE 57
IEC 57
IEEE 57
IN/C 57
ISA 57
K 57
Keying 57
N 57
N+1 Redundant 57
NEBS 57
NP 57
P 57
PCI 57
PCI SIG 57
PICMG 57
Platform 57
S 57
SELV 57
S-HAZ 57
Shroud 58
T 58
TDM 58
TNV 58
U 58
U 58
W 58
Warm-Swap 58

Compliance Information

Radio and TV Interference

The Model 6476 ForeFront™ FullPipe™ Chassis generates and uses radio frequency energy, and if not installed and used properly—that is, in strict accordance with the manufacturer's instructions—may cause interference to radio and television reception. The Model 6476 ForeFront FullPipe has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the Model 6476 ForeFront FullPipe Chassis causes interference to radio or television reception, which can be determined by disconnecting the cables, try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna, and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

In order to comply with UL60950 leakage current requirements, it is recommended that the AC inputs be supplied from separate and isolated sources.

Industry Canada Notice

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction. Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above condition may not prevent degradation of service in some situations. Repairs to some certified equipment should be made by an authorized maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. Users should ensure for their own protection that the ground connections of the power utility, telephone lines and internal metallic water pipe system, are connected together. This protection may be particularly important in rural areas.

Users should not attempt to establish or modify ground connections themselves, instead they should contact the appropriate electric inspection authority or electrician.

FCC Part 68 Compliance Statement

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. Refer to the plug-in cards' user guide for details.

CE Notice

The CE symbol on your Patton Electronics equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the European Union (EU). A Certificate of Compliance is available by contacting Technical Support.

About this guide

This manual is a comprehensive hardware reference tool for the Patton Electronics 4U CPCI Redundant Backplane/Midplane and Chassis line of products.

Audience

This guide is intended for the following users:

- System developers installing and integrating the products into their systems
- Operators
- Installers
- Maintenance technicians

Structure

This guide contains the following chapters and appendices:

- Chapter 1, "Introduction"—provides an overview of the product, about Patton Electronics, warranty, and service information.
- Chapter 2, "Chassis specifications"—provides an overview of the chassis features.
- Chapter 3, "System Architecture"—provides an overview of CompactPCI specifications, as well as a more in-depth description of the product's features.
- Chapter 4, "Installation checklist"—provides a quick set-up checklist for installing the Model 600.
- Chapter 5, "Maintenance"—provides a quick set-up checklist, tips for troubleshooting, warranty information, and where to get help.
- Appendix A, "Glossary of Terms"—defines terms and acronyms used in this document.

For best results, read the contents of this guide *before* you install the enclosure.

Precautions

Notes and cautions, which have the following meanings, are used throughout this guide to help you become aware of potential problems. *Warnings* relate to personal injury issues, and *Cautions* refer to potential property damage.

Note Calls attention to additional or noteworthy information or tips.

The shock hazard symbol and WARNING heading indicate a potential electric shock hazard. Strictly follow the warning instructions to avoid injury caused by electric shock.

The alert symbol and WARNING heading indicate a potential safety hazard. Strictly follow the warning instructions to avoid personal injury.

The shock hazard symbol and CAUTION heading indicate a potential electric shock hazard. Strictly follow the instructions to avoid property damage caused by electric shock.

The alert symbol and CAUTION heading indicate a potential hazard. Strictly follow the instructions to avoid property damage.

This symbol and the CAUTION heading indicates a situation where damage to equipment can be caused by electrostatic discharge.

This symbol and the IMPORTANT heading provides information which should be followed for best results when installing, configuring, or operating the Patton product.

Style conventions used in this document

Tables contain information of a descriptive nature. For example, pin assignments or signal description.

Cross-references, figure titles, and table titles are hyperlinked. This means that if you have the on-line version of this document, you can click on the cross-reference and it will "jump" you to that reference within the document. This feature only works with references to sections/tables/figures within this document. References to other documents (for example, *PICMG 2.5 R1.0 CompactPCI Computer Telephony Specification*) are not hyperlinked.

The symbols "/" and "#" indicate signals that are active low.

Specific safety-related terms, traceable to certain safety regulatory agency requirements (i.e., IEC950 and harmonized derivative specifications) are used within this manual. Refer to the referenced document for a definition of these terms.

Typographical conventions used in this document

This section describes the typographical conventions and terms used in this guide.

General conventions

The procedures described in this manual use the following text conventions:

Table 1. General conventions

Convention	Meaning
Garamond blue type	Indicates a cross-reference hyperlink that points to a figure, graphic, table, or section heading. Clicking on the hyperlink jumps you to the reference. When you have finished reviewing the reference, click on the **Go to Previous View** button in the Adobe® Acrobat® Reader toolbar to return to your starting point.
Futura bold type	Indicates the names of menu bar options.
Italicized Futura type	Indicates the names of options on pull-down menus.
Futura type	Indicates the names of fields or windows.
Garamond bold type	Indicates the names of command buttons that execute an action.
< >	Angle brackets indicate function and keyboard keys, such as <SHIFT>, <CTRL>, <C>, and so on.
`Are you ready?`	All system messages and prompts appear in the `Courier` font as the system would display them.
`% dir *.*`	Bold Courier font indicates where the operator must type a response or command

Mouse conventions

The following conventions are used when describing mouse actions:

Table 2. Mouse conventions

Convention	Meaning
Left mouse button	This button refers to the primary or leftmost mouse button (unless you have changed the default configuration).
Right mouse button	This button refers the secondary or rightmost mouse button (unless you have changed the default configuration).
Point	This word means to move the mouse in such a way that the tip of the pointing arrow on the screen ends up resting at the desired location.
Click	Means to quickly press and release the left or right mouse button (as instructed in the procedure). Make sure you do not move the mouse pointer while clicking a mouse button.
Double-click	Means to press and release the same mouse button two times quickly
Drag	This word means to point the arrow and then hold down the left or right mouse button (as instructed in the procedure) as you move the mouse to a new location. When you have moved the mouse pointer to the desired location, you can release the mouse button.

Bibliography

The following publications are used in conjunction with this manual.

- ECTF H.110 (CT Bus) Specification (Revision 1.0)
- CompactPCI Hot Swap Specification—PICMG 2.12 (Revision 1.0)
- CompactPCI Specification—PICMG 2.0 (Revision 3.0)
- Keying of CompactPCI Boards and Backplanes Specification—PICMG 2.10 (Revision 1.0)
- UL60950, Safety of Information Technology Equipment, including Electrical Business Equipment
- IEC 61076-4-101 (1995-05), Specification for 2mm Connector System
- IEEE 1101.10, IEEE Standard for Additional Mechanical Specifications for Microcomputers using IEEE 1101.1 Equipment Practice

Chapter 1 Introduction

Chapter contents

Product features and benefits 14
What is CompactPCI? 14
About Patton Electronics Company 15

Product features and benefits

Thank you for purchasing Patton Electronics Co. Model 6476 ForeFront FullPipe Chassis with CPCI 4U backplane/midplane. The Model 6476 FireFront FullPipe Chassis is a modular 4U x 19 inch rackmount sub-rack-type packaging system suitable for open bus architectures such as CPCI, or custom bus applications. The base unit is adaptable to a wide array of product configurations.

The product offers a low cost, turnkey solution for customers desiring eight 4U x 160mm slots (a full CPCI bus segment) in the least possible vertical rack space. The superior design also provides eight 3U x 160mm slots to mount up to four Power Supply Modules configured for external DC or AC power input. Additional 3U slots can be used for a variety of disk drive configurations.

The rear of the chassis provides eight 4U x 80mm slots for CPCI transition modules. Cooling is provided by the specially designed model 6410 plug-in fan tray module.

The Model 6476 ForeFront FullPipe Chassis complies with the *PICMG 2.0 R3.0 CompactPCI Specification*, and *PICMG 2.5, ECTF H.110 (CT Bus) Specification* (Rev. 1.0), making it an excellent choice for redundant, fault tolerant applications

What is CompactPCI?

CompactPCI (Compact Peripheral Component Interconnect) is a high-performance industrial computer platform based on the standard PCI electrical specification in rugged 3U or 4U Eurocard-style packaging, with a high-quality 2mm metric pin and socket connector.

CompactPCI is an open specification supported by the PICMG (PCI Industrial Computer Manufacturers Group), which is a consortium of companies involved in utilizing PCI for embedded applications.

Distinct advantages of CompactPCI (“CPCI”) include:

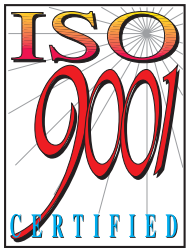
- Cost/time savings—Because it is electrically compatible with PCI, CPCI allows designers to tap into the wealth of available hardware and software. CPCI provides a substantial reduction in engineering and manufacturing costs because off-the-shelf items can be shipped to meet your configuration needs and delivery schedules.
- Rugged and reliable—The Eurocard-style packaging—which includes two-piece shielded connectors for better reliability and vertical card orientation for better cooling—provides a robust system based on a sub-rack backplane architecture.
- Flexibility—CPCI allows either 32- or 64-bit PCI, plus offers an open architecture. Additional connectors are defined for adding standard or proprietary buses or other needs. Hybrid CPCI systems allow bridging to other buses or custom applications.
- Hot-swap capability—Boards can be hot-swapped without disrupting operation, a critical feature in real-time and high-availability applications.

CompactPCI is rapidly becoming the backbone of today’s high-performance, embedded systems. It is ideally suited for telecommunications, computer telephony, real-time machine control, industrial automation, real-time data acquisition, instrumentation, military systems and other applications requiring high speed computing and modular, robust packaging design.

About Patton Electronics Company

Patton Electronics excels in the design, development and production of Embedded Data Communications and Telecommunications Platforms based on open system bus architecture standards (for example, CPCI and VME). These platforms form a significant part of the infrastructure for today's information technology revolution—including the emergence of new packet-based (IP) global communication networks.

Datacom/Telecom platforms require robust and reliable packaging solutions that address key technology issues, such as line density, thermal management, power distribution, scalability, and regulatory compliance. With an increasing number of applications demanding downtime measured in minutes rather than hours, special consideration has to be given to enclosure system functionality. Patton Electronics' full line of enclosure solutions are designed specifically to meet industry's stringent high availability requirements where redundant operation, quick accessibility and high reliability are essential. Patton has a broad engineering background in the development of these technologies for advanced circuit and packet-switched telecommunications systems running voice, data and video applications for commercial and government customers.



Patton offers a wide range of platforms consisting of standard rack/chassis, high speed backplane, power, thermal management, single board computer (SBC) and alarm/network interface products for commercial, voice/data communications, and government/military system applications. Patton Electronics is ISO-9001 certified.

Chapter 2 Chassis specifications

Chapter contents

4U CPCI subrack 18
Description of Chassis Front Side 19
Description of Chassis Rear Side 20
Electromagnetic compatibility (EMC) 21
Electrostatic discharge (ESD) protection 22
Fan Tray Assembly 24
Chassis System Specifications 25
Power Considerations 25

4U CPCI subrack

The Model 6476 ForeFront FullPipe is a modular 4U x 19 inch rackmount subrack-type packaging system designed for the ForeFront CompactPCI open bus architecture. The rugged, rack-mounted chassis system is ideal for carrier-class, defense, industrial, enterprise, and commercial environments. The 6476 excels in its ease of access, superior cooling, and power distribution. The base unit is adaptable to a wide array of product configurations.

Product features include:

- ✔ Available in AC, DC, and mixed AC + DC power supply configurations
- ✔ Fully compatible with all Patton ForeFront modules
- ✔ EMI shielding on entire assembly, with continuous chassis ground
- ✔ Lightweight and durable aluminum construction, suitable for rugged environments
- ✔ Only 11.70 in. (29.80 cm) deep
- ✔ Standard powder coating finish
- ✔ Front mounting flanges for 19 in. rack mount environments

Figure 1. Model 6476

Description of Chassis Front Side

There are eight 6U x 160mm slots (a full CPCI bus segment) at the front of the chassis (see figure 2). Front-entry ForeFront modules, in accordance with PICMG 2.0 R2.1 CompactPCI specifications, are plugged into these slots.

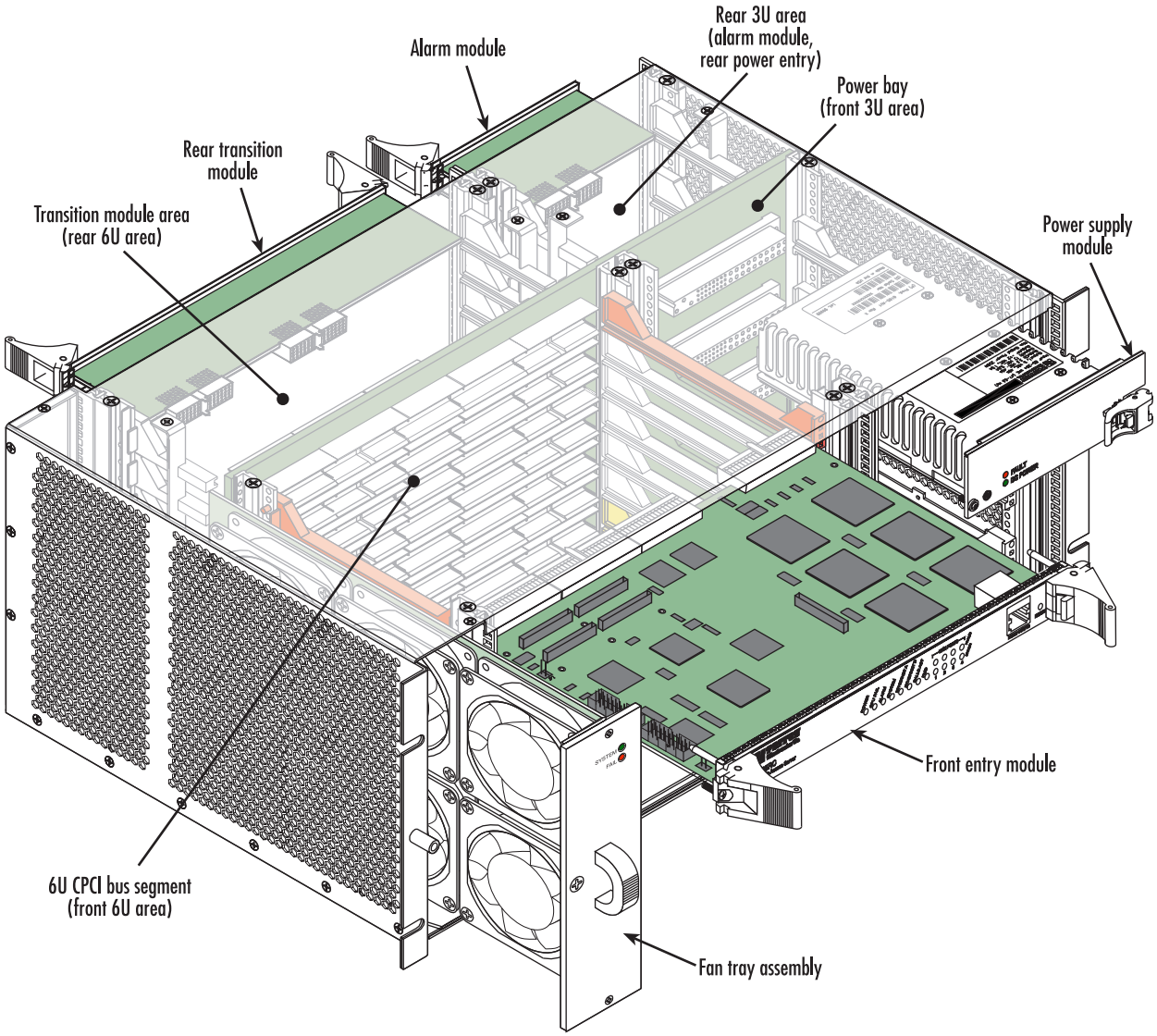


Figure 2. Model 6476 ForeFront FullPipe Chassis

The front of the chassis also provides four slots suitable for 3Ux8HP ForeFront power supplies, model 6160 (DC) or 6165 (AC). These devices are described more completely in the 6160/6165 Users Manual.

All slots provide 4HP module spacing and are on 0.80 in. centers (except for the power supply slots, which are offset 0.1" as per PICMG 2.11 standard). Card guides are molded plastic with metallic ESD contacts (see "Electrostatic discharge (ESD) protection" on page 22) per CompactPCI PICMG 2.0 R3.0 & IEEE 1101.10.

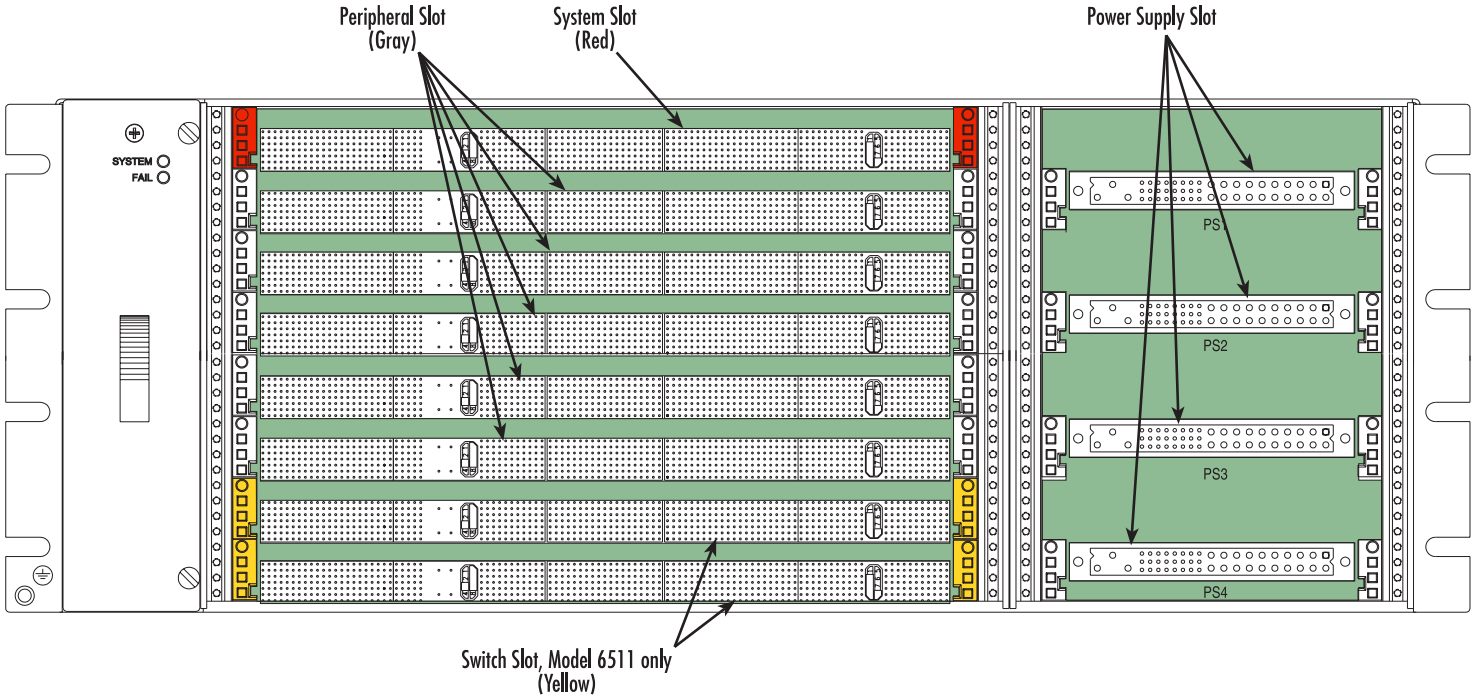


Figure 3. Front view of chassis

Description of Chassis Rear Side

The rear of the chassis is divided into two areas:

- A set of eight 6U slots for ForeFront transition modules (see figure 2 on page 19). These modules typically contain cable connections for I/O interfaces such as T1/E1 trunks, optical fiber trunks, DSL lines, Ethernet, etc.
- A set of 3U slots allocated for the following uses (see figure 4 on page 21):
  - Power input modules—either Patton Model 6112 (DC) or Patton Model 6117 (AC) (see figure 5 on page 21). These modules provide power input to the power supplies in the front of the chassis (see figure 2 on page 19). Each input module provides input for two power supplies. The following configurations are possible:
    - Two DC input modules (supports up to 4 DC supplies)
    - Two AC input modules (supports up to 4 AC supplies)
    - One AC, one DC input module (supports up to 2 DC and up to 2 AC supplies)
  - Telephony Battery Input Module (optional)—Patton Model 6129. Provides input of telephony trunk voltages required for some analog telephony interface applications.

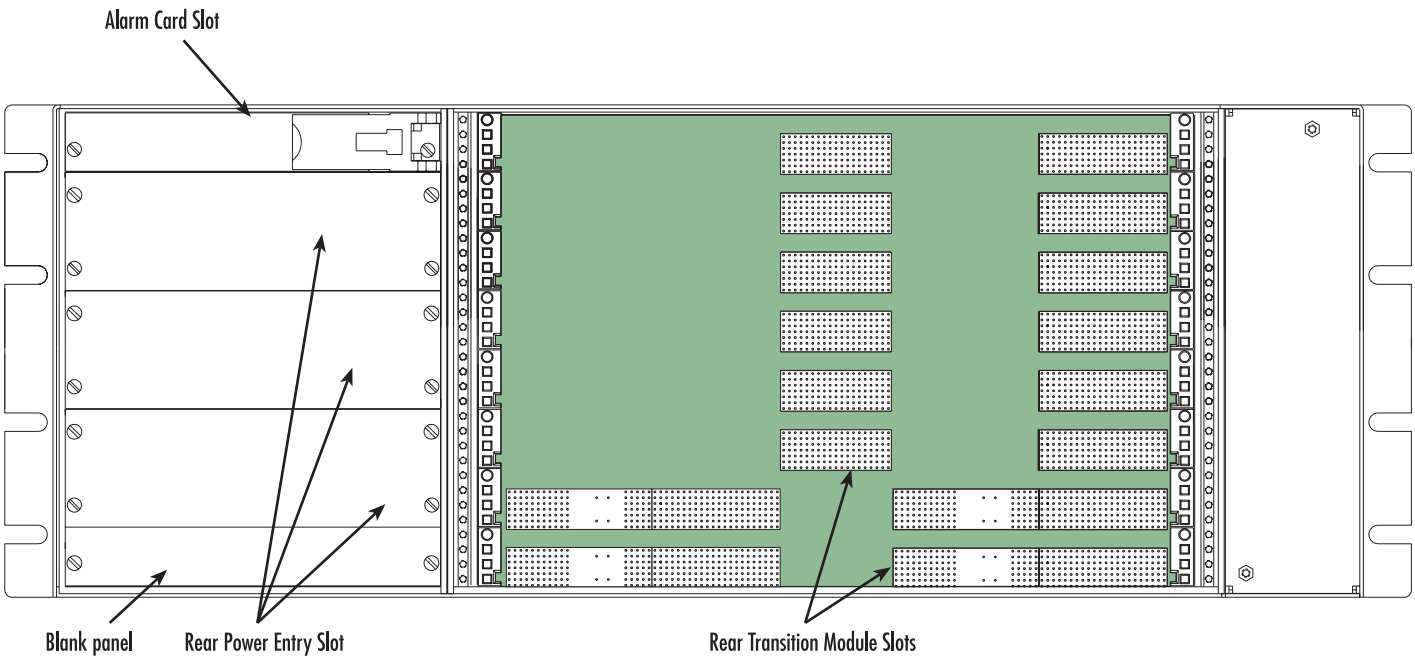


Figure 4. Rear view of chassis

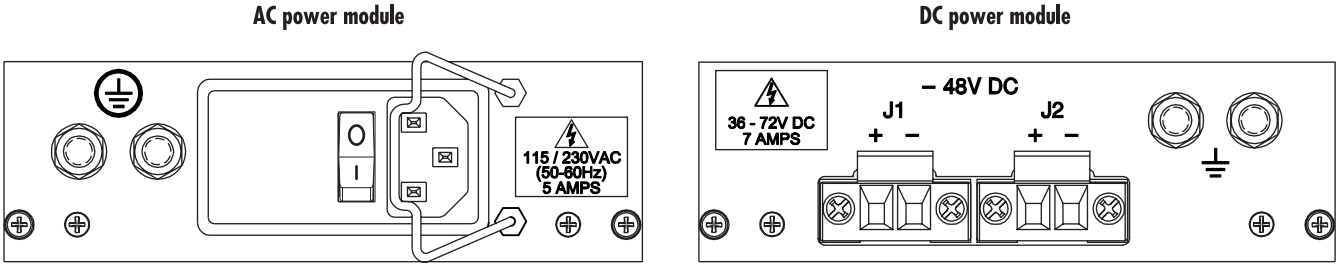


Figure 5. AC and DC rear power entry modules

Electromagnetic compatibility (EMC)

The Model 6476 ForeFront FullPipe is designed to provide the highest level of EMC performance—in terms of both interference and susceptibility. The chassis has the following design features to mitigate the effects of electromagnetic interference (EMI):

- All gaskets, contacts, and contact surfaces are electrically conductive.
- The mating surfaces of the EMC chassis and the EMC plug-in unit front panels and/or optional EMC filler panels are also conductive by use of gaskets/strips.
- All chassis and plug-in contact surfaces are connected to a common chassis ground.

Mating EMC gaskets and strips are used on the chassis, front panels of boards, and optional filler panels. An EMC gasket is attached to the bottom of the chassis (front view), and an EMC strip is attached to the top. Plug-in boards have the corresponding mates on the opposite side (see figure 6).

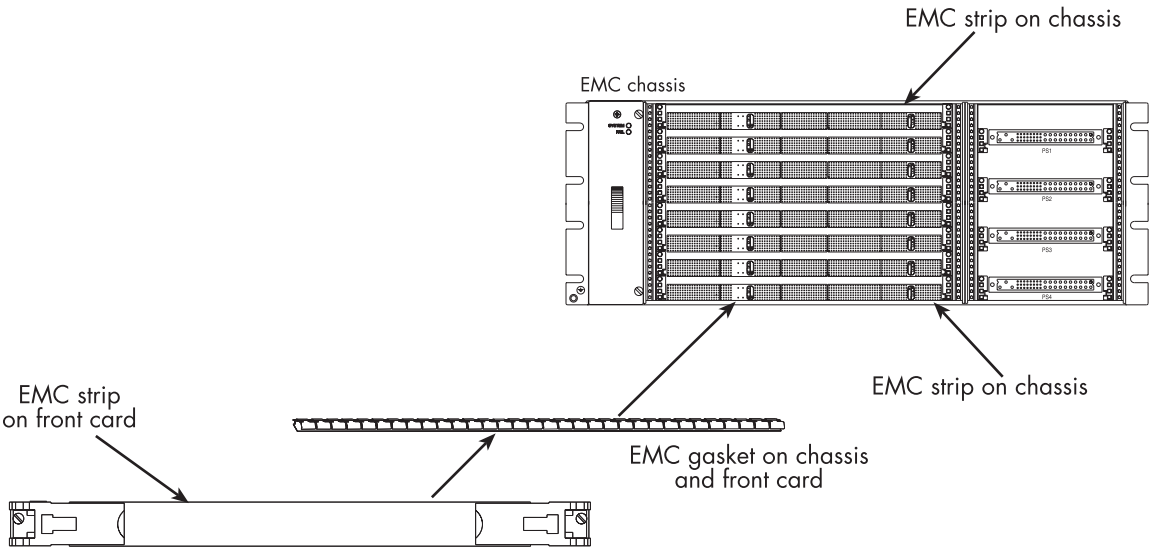


Figure 6. EMC strip and gasket on chassis and cards

The EMC strip on the left side of the board mates with the EMC gasket attached to the chassis when it is plugged into the first slot. Each board mates together with corresponding gaskets/strips.

In addition, all aluminum components of the subrack are surface treated and conductive. Top, bottom, sides and rear EMC covers provide mechanical protection and EMC shielding on the subrack. Retaining clips ensure conductive connection.

The chassis contains an optional frame ground to signal ground jumper. By default, in all ForeFront FullPipe products, this jumper is not installed. This means that frame ground (the electrical potential of the chassis shell itself and all panels, screws, etc. that are connected to it) is electrically isolated from the signal ground (the electrical potential corresponding to “0 volts” with respect to the power supplies and cards in the chassis). Patton Electronics recommends that this isolation be maintained, in order to improve the EMC characteristics of the system and the integrity of the two distinct grounds.

See the chapter on installation and maintenance for further information on the jumper settings.

Electrostatic discharge (ESD) protection

The 6476 ForeFront FullPipe chassis provides ESD protection in compliance with IEEE 1101.10.

ESD contacts are embedded inside and in the front section of card guides for making early as possible contact with a discharge strip on one or both, the upper and/or lower edge of the plug-in board/module. Only the card guides located at the bottom rail of the chassis (right vertical rail for the 4U chassis), both front and rear (when there is a transition module present in the chassis), contain the ESD clips. The ESD clip in the card guide is connected to the Chassis GND (ground).

There is an alignment/ESD pin on the injector/ejector handle of boards (see figure 7).

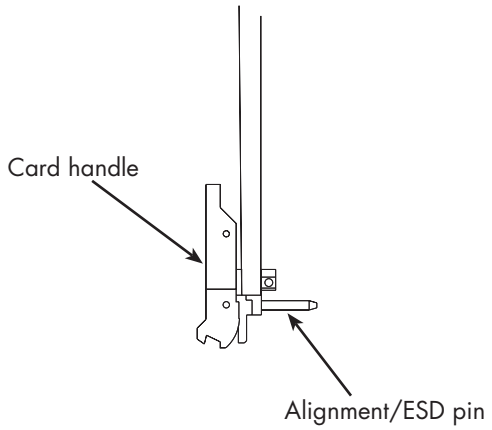


Figure 7. Alignment/ESD pin on card handle

The alignment pin does the following:

- Ensures that the connectors are correctly aligned before they engage
- Provides solid/protected keying
- Provides board ESD contact
- Ensures that the EMC gasket is properly aligned (see "Electromagnetic compatibility (EMC)" on page 21)
- Ensures that when the board is inserted in the card guide, an integrated ESD clip discharges ESD from the board to the right vertical rail chassis ground.

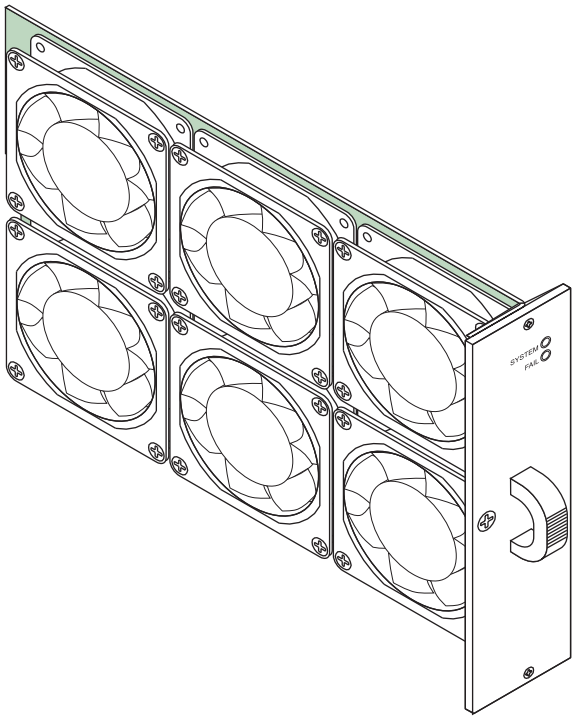


Figure 8. Model 6470-series fan tray assembly

Fan Tray Assembly

Cooling is provided by the specially-designed, Patton Electronics Company, 6410 Plug-In Fan Tray Module (see figure 8). The unit utilizes six 12 VDC axial cooling fans which are positioned for optimum side-to-side air flow through the subrack.

The fan tray is hot-swappable for air filter replacement.

Table 3. Fan tray specifications

Item	Description
Physical	Height: 6.875 in. (17.463 cm) Width: 1.70 in. (4.32 cm) Depth: 10.875 in. (27.623 cm)
Power requirements	1.3 A at 12 VDC
Performance	42.5 CFM per fan (quantity: 3 fans)
Reliability	15,000 hours at 122°F (50°C)
Operating environment	32–122°F (0–50°C), 5–95% relative humidity, non-condensing
Fan tray model no.	51-00182 SA
Replacement air filter part no.	Bellcore 05-00083-01

Chassis System Specifications

A list of the 4U model 6476 chassis materials specifications is provided in table 4.

Table 4. 4U chassis materials specifications

Item	Description
Physical	• Height—4U (5.25 in.) • Width—19 in. (standard EIA rack mount) • Depth—11.70 in. (29.70 cm)
DC interface	Rear DC interface panel includes dual ground lugs, -48V DC power interface for *N+N* redundant power operation.
AC interface	Rear AC interface panel includes: two IEC 320 AC inlet connectors, equipped with cord retaining clips for 1+1 redundant power, ground lug, power fuses.
Optional Telephony Battery Input Module	Connectors for VRG, VRGRTN, -SEL VBAT and SEL VBATRTN.
Slot configuration	• Front—6U x 160 mm slots, Qty: 8 and 3U x 160 mm slots, Qty 8 • Rear—6U X 80 mm slots, Qty: 8 Slots are on 0.80 in. (2.0 cm) centers, except power slots are 1.6 in. (4.1 cm) center
Module keying and alignment	4HP module spacing, cardguide provides for keying and alignment pin in accordance with IEEE 1101.10, section 6
Card guides	Molded plastic with snap-in ESD contacts for plug-in module and injector/ejector handle alignment pin
Plug-in unit injector/ejector handles	Subrack dimensional format accepts modules with injector/ejector handles as specified in IEEE 1101.10, section 8
Operating environment	32–122°F (0–50°C), 5–95% relative humidity, non-condensing

Table 5. Power input and power supplies

Item	Description
Power input	DC: -48 VDC nominal (-36 to -75V) AC: 115/230 VAC, 50–60 HZ
Maximum current	DC: 7.0 A per power input AC: 5.0 A per power supply
Power supply fusing	DC: 250 V, 12.5 A, Slow blow (one fuse per PSU) AC: 250 V, 5 A, Slow blow (one fuse per PSU)

Power Considerations

For DC systems:

- An approved external source must be rated a maximum of 75 VDC, 7.0 A and provide over current protection upstream of the equipment.
- An approved disconnect device with a minimum 3.0 mm contact separation must be provided upstream of the device and rated at least 75 VDC, 7.0 A and be located so it is accessible to the operator.
- This equipment shall be connected directly to the DC supply system bonding jumper from an earthing terminal bar or bus to which the DC supply system earthing electrode is connected.

- This equipment shall be located in the same immediate area as any other equipment that has a connection between the earthed conductor of the same DC supply circuit and the earthing conductor, and also the point of earthing of the DC system. The DC system shall not be earthed elsewhere.
- There shall be no switching or disconnecting devices in the earthed circuit conductor between the DC source and the point of connection of the earthing electrode conductor.

For AC systems: When used with AC supplies, the device must be connected to an earthed mains socket outlet.

Chapter 3 System Architecture

Chapter contents

CompactPCI form factor 28
Board front panels 29
Transition Boards 29
Pin and socket connectors 31
J1/P1 & J2/P2 connectors 33
J3/P3 through J5/P5 connector 33
Reserved Pins 33
Power Pins 33
Backplane Architecture 33
Signaling Environment 35
Backplane power distribution 35
External power connections 35
AC Interface 36
Backplane Power Lugs and Connectors 36
In-rack power connections 37
Front panel keying for power supplies 39
Power decoupling 39
Hot-Swap Capability 39
Keying of CPCI backplanes and boards 40
Backplane connector keys 40
Front panel and cardguide keys 41

CompactPCI form factor

CompactPCI is flexible in the mechanical and connector area, using a passive backplane and plug-in daughter-boards. The architecture is based on the IEC 1101.10 and 1101.11 Eurocard standard for the fixed 160mm depth (for front boards), but allows for two board heights:

- 3U—100 mm high
- 4U—233.35 mm high

This variety enables a wider variety of applications and industries. 3U, which is the minimum for CompactPCI as it accommodates the full 64-bit CompactPCI bus, is popular for embedded industrial automation applications, while 4U provides additional board real estate for more complex applications. 4U also provides more connectors for rear-panel I/O often needed in telecom products.

Eurocard boards offer a long list of advantages:

✔ Extensive board keying capabilities so that boards can only be plugged into appropriate slots

✔ Card guides for solid rear backplane connectors alignment

✔ Injector/ejector handles

✔ EMC compliance that minimizes electromagnetic interference

CompactPCI boards are inserted at the front of the chassis—which provides maximum configuration flexibility—with options for I/O connections to either the front and/or rear of the card. The cards are firmly held in position by their connector, card guides on both sides, and a face plate which solidly screws into the card cage.

Board front panels

CompactPCI boards provide a front panel interface that is consistent with Eurocard packaging and compliant with IEEE 1101.10 (EMC panels). Ejector/injector handles are used on the boards. 3U boards only use one handle, while the 6U board uses two (see figure 9). Filler panels do not require handles.

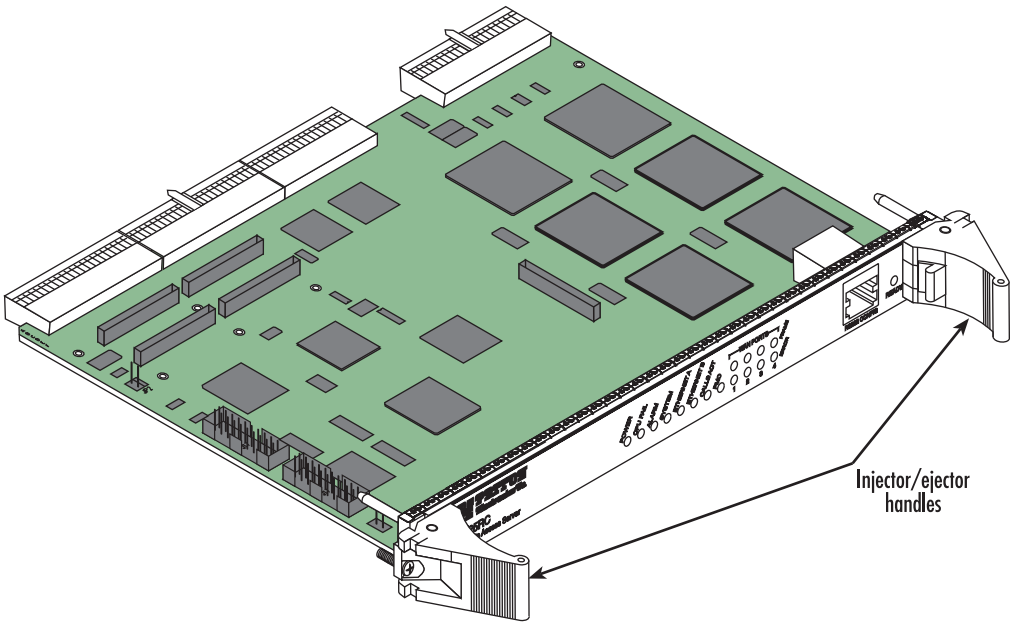


Figure 9. Front panel—6U front-entry card

Transition Boards

There are two types of boards:

- Front-entry boards (described in section “Board front panels”)
- Rear-entry boards for rear-panel I/O

The front-entry boards may route I/O through the backplane. Backplanes that enable rear I/O are called often midplanes because the legs of the backplane connector’s pins stick through the board to become pins for rear-

panel interconnections. An illustration of the front-entry board and rear-panel I/O board interface with the backplane/midplane is shown in figure 10.

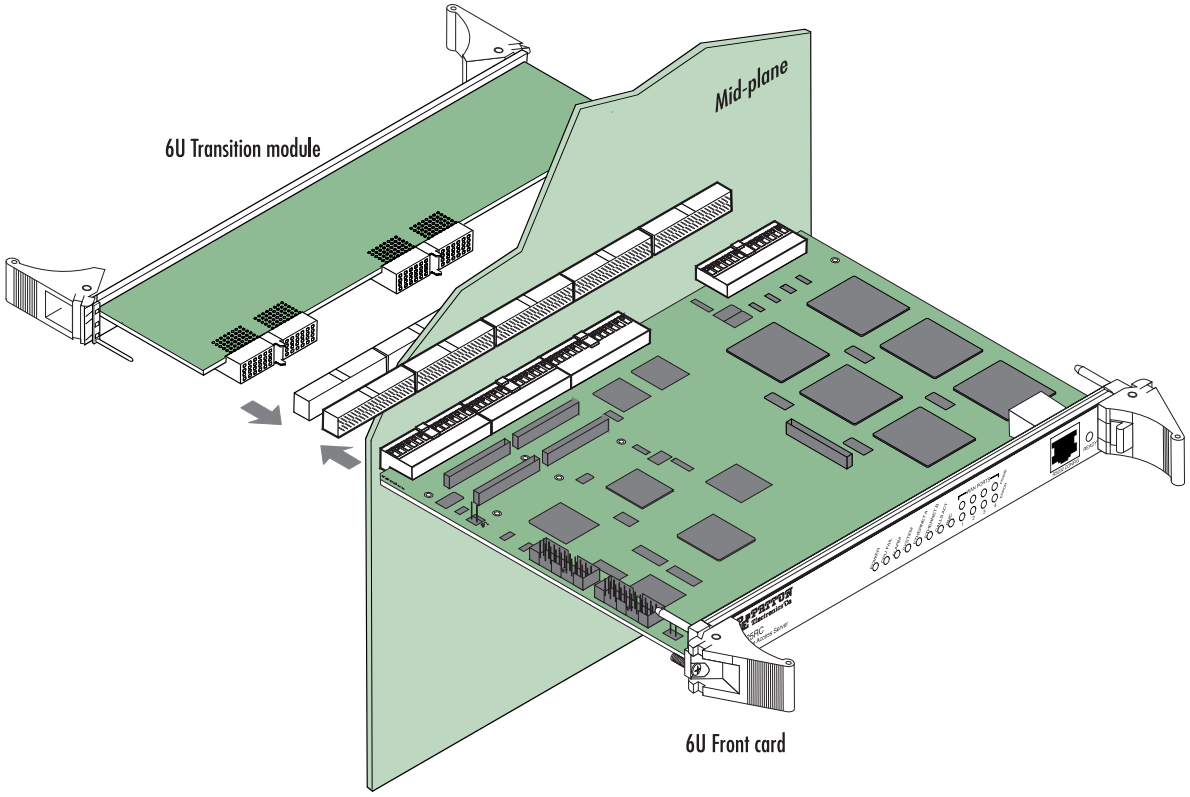


Figure 10. Front/rear boards and backplane interface

Rear-panel I/O boards are either 3U or 6U in width and are typically 80mm in depth. Other depths are allowed depending on the application requirements. The 4U chassis provides an 80mm transition module section. This section provides eight 6U x 80mm slots for cPCI transition modules.

All front-entry board features (handles, keying, alignment pin, EMC, etc.) are also utilized on the rear-entry boards. The rear-panel I/O transition boards are “in-line” with the front-entry boards. This means that the front panels of rear-panel I/O transition boards are reversed (mirrored) from the front boards. The top handles are on the bottom and vice versa. The slot keying holes and hole labels in both the card guides and front panels are upside down compared to the front boards and card guides (see section “Keying of CPCI backplanes and boards” on page 40 for more information on keying).

The same connector pin labeling sequence is used on the rear I/O transition boards as on the front boards, with the position numbers going from bottom to top. This is a mirror image of the front board’s layout orientation. Using the same 1-for-1 pin mapping sequence eliminates confusion and I/O signal pin mapping problems. For example, pin A3 is the same on the front boards, on the rear I/O transition board, and on the backplane.

Rear-panel I/O transition boards may have active components in some applications. Power can be applied either through the I/O pins from the front board, or from the normal power and ground pins defined as part of the J1/P1 and J2/P2 connector pin assignments.

Rear I/O transition boards that only populate Rear J5 (RJ5) for the purpose of telephony I/O, shall utilize a Type AB connector body on RJ5. This type of connector provides an integral alignment feature to avoid damage to the backplane pins during mating. Patton Electronics Company, 4U Model 6476 Backplane/Midplane is compliant with this requirement and provides a Type AB connector shroud on RP3, RP4, and RP5.

Pin and socket connectors

The connection between boards and backplane is through a two-piece, 2 mm connector. Backplanes use male (pin) connectors and plug-in boards use female (socket) connectors. This pin and socket connector offers greater reliability, particularly when subject to shock, vibration, or temperature variations.

These pin and socket connectors provide:

- Faster propagation times
- Reduced reflection at the bus/connector interface
- Lower noise
- Better impedance matching
- Higher mechanical stability

The connector is a 235-pin device, arranged in 47 rows of 5 pins, with a total of 220 pins (15 pins are lost to the keying area). The connector is shielded and devotes a large number of pins to ground. This reduces reflections, increases EMI immunity in noisy environments, and reduces ground bounce.

The fixed or male connector on the backplane is numbered P1-P5, starting at the bottom. The corresponding female connectors are also numbered from the bottom up as follows:

- 3U cards—J1-J2 (see figure 11 on page 32)
- 6U cards—J1-J5 (see figure 12 on page 32)

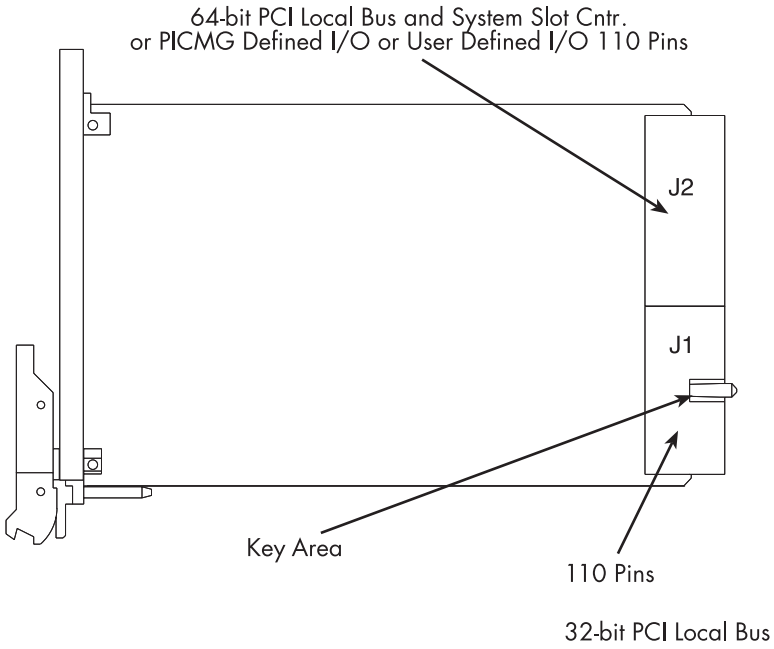


Figure 11. J1 and J2 connectors on the 3U card

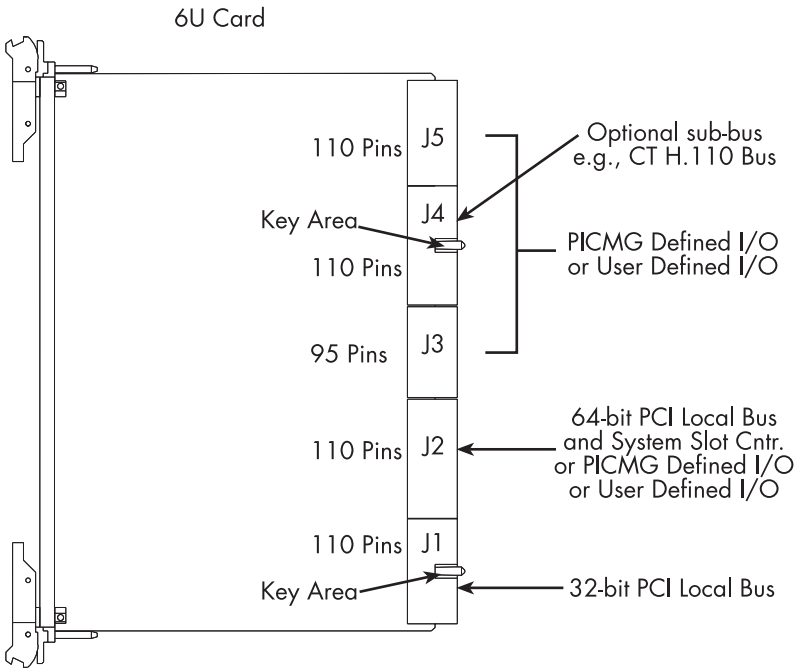


Figure 12. J1 through J5 connectors on the 6U card

3U and 6U cards use a single 220 pin connector for all power, ground, and all 32- and 64-bit PCI signals. This connector consists of two halves—the lower half (110 pins) is called J1/P1 and the upper half (also 110 pins) is called J2/P2. Twenty pins are reserved for future use. The connector is divided in J1/P1, a 25-row connector that includes voltage keying, and J2/P2, a 22-row connector without keying. The 4U card can have up to four additional connectors with a total of 315 pins, which can be used for a variety of purposes.

A system CPU uses J1 and J2, but 32-bit peripherals cards only need to use J1 for full CompactPCI functionality. J3 through J5 on 4U cards can be user-defined I/O. Optional buses, such as the CT H.110 bus, use the J4 position.

J1/P1 & J2/P2 connectors

The CompactPCI bus spans the J1/P1 & J2/P2 connectors, with 32-bit PCI implemented on J1/P1 and full 64-bit PCI implemented on J2/P2 on the Model 6476 Midplane. J1/P1 is always devoted to 32-bit PCI in CompactPCI systems, however, use of J2/P2 for 64-bit PCI can be optional. For instance, in a 3U system, J2/P2 may be defined for user I/O, or sub-buses like the CT H.110 bus. J2 is always used on system slot boards to provide arbitration and clock signals for peripheral boards.

J3/P3 through J5/P5 connector

J3/P3 through J5/P5 connectors, available only in 4U systems, are generally defined for user I/O. However, sub-bus interconnects (for example, CT H.110 bus) can be configured on the J4/P4 connector.

Reserved Pins

There are bused and non-bused reserved pins as noted below:

- The BRSVPxxx signals SHALL be bused between connectors and are reserved for future CompactPCI definition.
- The RSV signals are non-bused signals that SHALL be reserved for future CompactPCI definition.

Power Pins

The 4U Model 6476 Backplane/Midplane has a customer-selectable signaling environment. All connectors on the 4U Model 6476 Backplane/Midplane provide pins for +5V, +3.3V, +12V and -12V operating power (see section "Signaling Environment" on page 35). In addition, there are power pins labeled +V(I/O). The V(I/O) power pins on the connector are used to power the buffers on the peripheral boards, allowing a card to be designed to work in either interface.

CompactPCI supports this dual-interface scheme by utilizing backplane connector keying (see section "Keying of CPCI backplanes and boards" on page 40 for more information).

Backplane Architecture

Patton Electronics Company, 4U Model 6476 Backplane/Midplane provides eight 6U board locations with 20.32 mm (0.8 inch) board center-to-center spacing. The 6U cards are stacked horizontally in the 4U model, however, the special design provides vertical convection cooling with the installed plug-in fan tray module.

There are also eight 3U x 160mm slots on the front right side, called the "Power Bay", to mount Patton Power Supply Modules configured for external DC or AC power input, or other cPCI compatible power modules.

A rear view of the 4U Model 6476 is shown in figure 13.

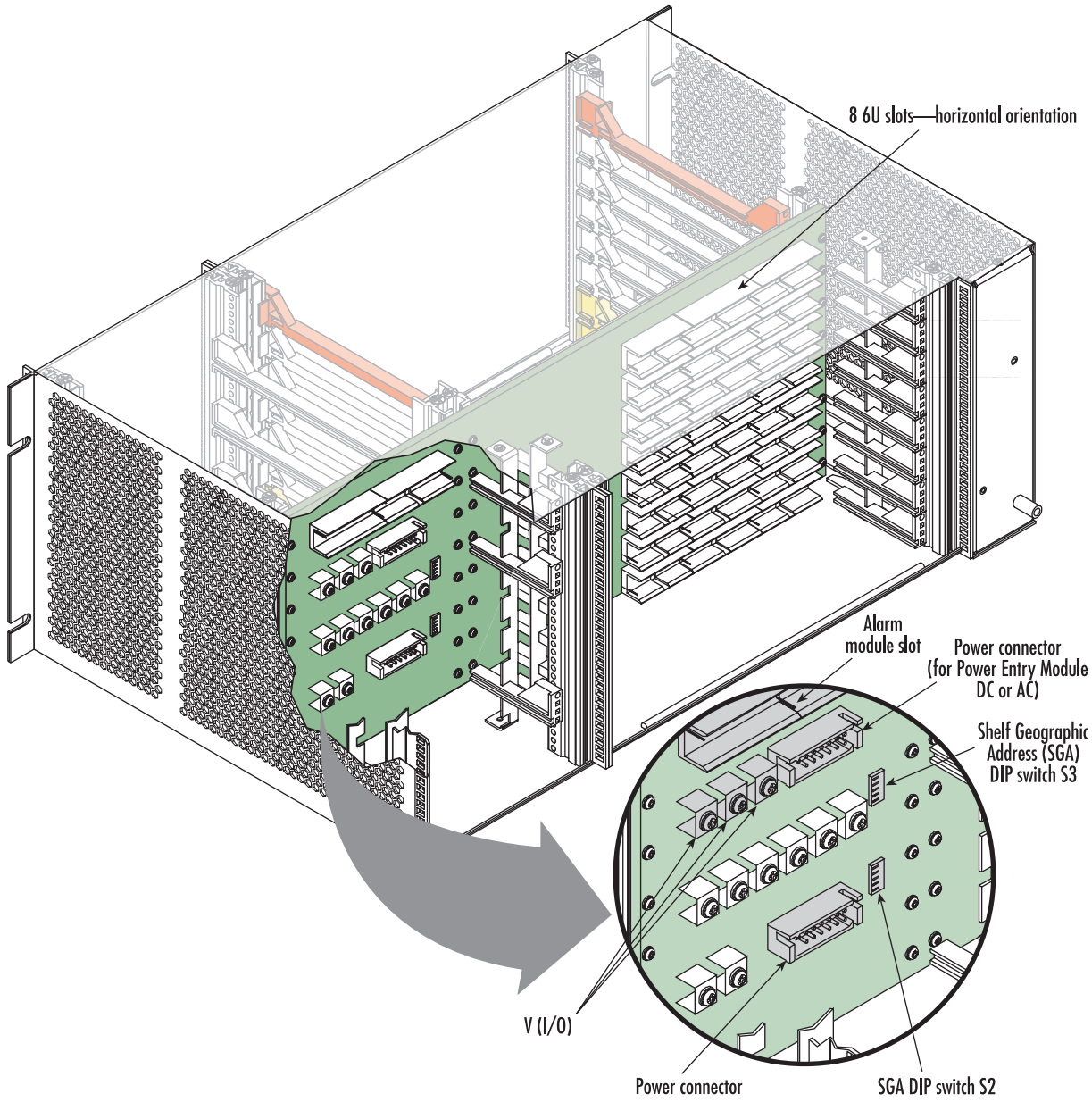


Figure 13. Rear view of chassis showing the midplane/backplane

Two user-configurable headers, “JP1” and “S1”, are located in the power bay area, as well.

JP1 is a two-pin header, utilizing a jumper for a connect/no-connect selection feature. JP1 enables you to configure the backplane V(I/O) signaling level (See Signaling Environment on page 35), and also provides the option to connect the Frame Ground (FG)/Signal Ground (SG).

S1 has a DIP switch that enables you to configure the shelf enumeration feature, used for multi-shelf CompactPCI systems.

Signaling Environment

The 4U Model 6476 Backplane/Midplane provides for either a 5V or 3.3V signaling environment.

PCI allows for two types of buffer interfaces for interboard connection. The V(I/O) power pins on the connector are used to power the buffers on the peripheral boards, allowing a card to be designed to work in either interface. These are called universal boards. It should be noted, that backplanes are *never* universal. The V(I/O) level distributed on the backplane is either 5.0V or 3.3V. It is only possible that boards can be tolerant of either voltage levels, and considered universal.

The factory default setting for the 4U Model 6476 Backplane/Midplane is for the 5V signaling environment (denoted by the brilliant blue connector key). The signaling environment, called the Voltage Input/Output (V(I/O)), can be configured for 3.3V signaling via a header labelled JP1, located at the front, left side of the backplane, within the Power/Drive Bay area (See figure 13 on page 34).

JP1 is a two-pin header, utilizing a jumper for a connect/no-connect selection feature. This jumper also enables you to configure the Frame Ground/Signal Ground connect feature.

Backplane power distribution

Power is distributed in a CompactPCI system via the backplane. The backplane provides standard direct current (DC) supply voltages as specified in table 6 below

Table 6. Power specifications

Mnemonic	Description	Nominal Value	Tolerance
5 V	+5 VDC	5.0 V	±5%
3.3 V	+3.3 VDC	3.3 V	±5%
+12 V	+12 VDC	12.0 V	±5%
-12 V	-12 VDC	-12.0 V	±5%
GND	Ground		

External power connections

The chassis provides a rear DC interface panel with -48V DC power interfaces for *N+N* power operation and dual ground lugs, as shown in figure 5 on page 21. The connectors are described in table 7.

Table 7. Description of rear interface panel connectors

Item	Description
-48 VDC power terminal	DC rear-entry module accepts 36–75 VDC at 7.0 A max input via Phoenix connector. Polarity should be applied as marked (negative—top position, positive—bottom position). Each connector is independent and designed to power one 3U power suppply module. There are three connectors provided for *N+N* power operation.
AC power interface	The AC power interface accepts 115/230 VAC (50–60 Hz), 5 amp maximum.
Ground lugs	The dual frame ground lugs must be used to connect the chassis to earth ground on DC interfaces. Failure to do this will cause excessive RF emissions and could possibly create a safety hazard. The double ground lug meets NEBS and will accept Amp part # 606209-1. NEBS requires a double lug on DC chassis to ensure that the ground connection will not rotate and become loose.

WARNING

The dual frame ground lugs on DC interfaces must be used to connect the chassis to earth ground. Failure to do this will cause excessive RF emissions and could possibly create a safety hazard.

AC Interface

An AC interface with AC/DC converter is available (figure 5 on page 21). Two IEC320 receptacles provide a wide range AC voltage (115/230 VAC, 50–60 Hz) to the AC/DC converter. Refer to table 7 on page 35 for descriptions of the *VRG/VRGRTN*, *-SEL VBAT/SEL VBATRTN*, and ground lugs.

Backplane Power Lugs and Connectors

The 4U transition module provides Phoenix connectors for the -48 VDC power interfaces, discussed in the previous section. Refer to table 8 on page 37 for a description of the internal backplane connectors shown in figure 14.

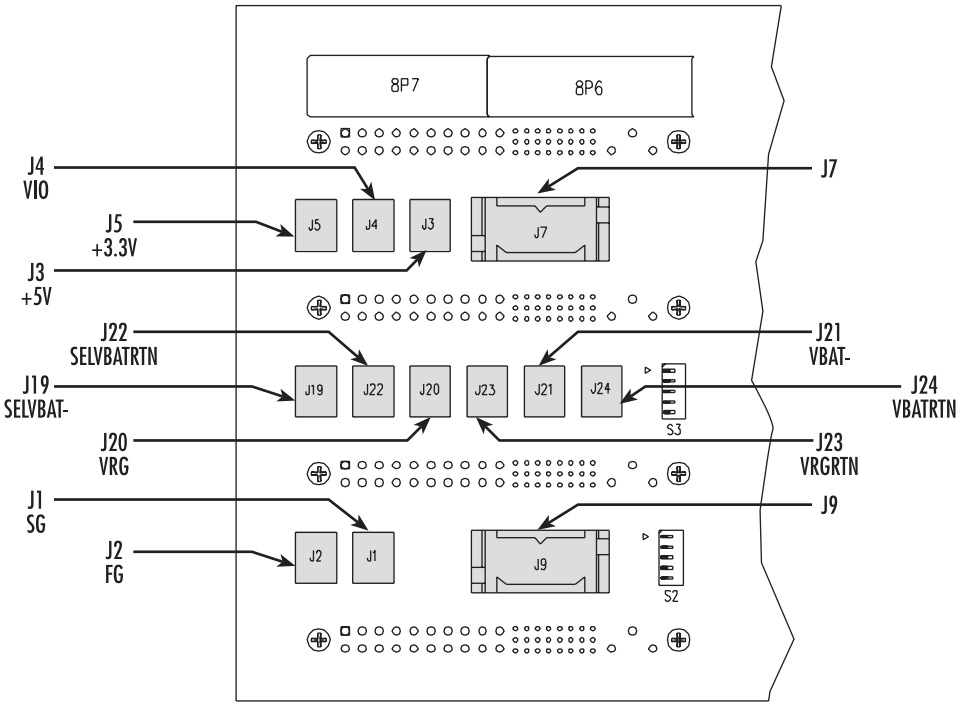


Figure 14. Backplane power lugs

Table 8. Description of internal backplane connectors

Item	Description
J7, J9	DC rear-entry module accepts 36–75 VDC at 7.0 A max input via Molex 8-pin connectors. Polarity should be applied as marked (negative—right position, positive—left position). The male (pin) connector is on the backplane, and the mate is the female (socket) connector. Each connector is independent and designed to power two 3U power suppply modules. There are two connectors provided for *N* + *N* power operation.
J19—J24	No. 6 X 3/8 in. screw-ring terminal power lugs that you hard-wire. ± Hv (high voltage) requires 14 GA wire. Refer to table 7 on page 35 for descriptions of VRG (J20), VRGRTN (J23), -SEL VBAT(J19) and SEL VBATRTN (J22). -VBAT (J21)—telecom power source VBATRTN (J24)—telecom power source return
J1, J2	No. 6 X 3/8 in. Screw-ring terminal power lugs that you hard-wire. Depending on the environment, J1—signal ground (SG) and J2—frame ground (FG) can be wired together for EMC considerations and noise reduction. (See also "Electromagnetic compatibility (EMC)" on page 21)

WARNING

The –Vbat and VbatRtn telecom power supply buses are qualified to source Unearthed SECONDARY HAZARDOUS voltages as defined by IEC950 and harmonized derivative specifications. The -SELVbat and SELVbatRtn buses are not qualified for SECONDARY HAZARDOUS voltage distribution. Voltage sourced on the –SELVbat bus is within SELV limits.

In-rack power connections

Three Positronics 47-pin/socket connectors are provided for in-rack modular power supplies on the Model 6476 Midplane for *N* + *N* power operation (See figure 13 on page 34). The female connector is located on the backplane and the male connector is located on the power supply module.

The power connectors mate with Patton Electronics Company, 3U Power Supply Module. In the 4U chassis, there is room for four power supply modules, 3U high x 160mm deep x 8HP wide.

Note The chassis guide rails are 1/2HP offset for plug-able power supplies. That is to say, the card guide's slot and injector/ejector PCB mounting surface are shifted 0.1 inch to the right of the card, or up in reference to the chassis.

In addition, there is a 40-pin IDE signal connector for a hard drive or 3.5 floppy drive. The connector provides power ("P4"), and front to rear pass-thru connections suitable for IDE cabling ("J303").

The backplane power connector pin assignments are provided in table 9 on page 38.

Note Some functions are not currently available on the Model 6476 Midplane. The excluded functions are footnoted with an *a*.

Table 9. Backplane power connector pin assignments

Pin no.	Staging	Signal Name	Description
1-4	M	V1	+5 VOLT OUT
5-12	M	RTN	SIGNAL GROUND
13-18	M	V2	+3.3 VOLT OUT
19	M	RTN	SIGNAL GROUND
20	M	V3	+12 VOLT OUT
21	S	V4	-12 VOLT OUT
22	M	RTN	SIGNAL GROUND
23	M	RES	RESERVED
24	S	RTN	SIGNAL GROUND
25	M	ADD1	ADDRESS BIT 1[a]
26	M	RES	RESERVED
27	S	EN#	ENABLE SIGNAL—0 will enable the supply
28	M	ADD2	ADDRESS BIT 2[a]
29	M	V1 ADJ	V1 ADJUST[a]
30	M	V1 SENSE	+5 VOLT SENSE
31	M	ADD3	ADDRESS BIT 3[a]
32	M	V2 ADJ	V2 ADJUST[a]
33	M	V2 SENSE	+3.3 VOLT SENSE
34	M	S RTN	SIGNAL GROUND
35	M	V1 SHARE	+5 VOLT CURRENT SHARE—connect between modules
36	M	V3 SENSE	+12 VOLT SENSE[a]
37	M	TX	SERIAL COMM, TRANSMIT[a]
38	M	DEG#	DEGRADE SIGNAL—0 indicates imminent failure
39	M	INH#	INHIBIT SIGNAL[a]
40	M	RX	SERIAL COMM, RECEIVE[a]
41	M	V2 SHARE	+3.3 VOLT SHARE—connect between modules
42	M	FAL#	FAIL SIGNAL—0 indicates module has failed
43	M	INT	SERIAL COMM, INTERRUPT[a]
44	M	V3 SHARE	V3 SHARE[a]
45	L	CGND	CHASSIS GROUND
46	S	ACN/+DC IN	POSITIVE DC VOLTAGE INPUT
47	S	ACL/-DC IN	NEGATIVE DC VOLTAGE INPUT

a. This function is not provided on the 4U Model 5406 Backplane/Midplane. It is listed in the table as an optional CompactPCI specification. In other words, Patton can customize the backplane connectors to make the function available at that pin location, if so required.

Front panel keying for power supplies

Power supply keying options have been registered with PICMG. Since power supplies use a different type of connector than other CompactPCI slots, there is no possibility of mating problems with 2mm connectors. The power supply key options are independent of the 2mm application card keys, and may duplicate key codes that are used for different purposes elsewhere in the system (see section "Keying of CPCI backplanes and boards" on page 40 for more information on front panel keying).

Specific front panel keying is defined to prevent damaging an AC power supply inserted into a backplane wired for DC and vice versa.

Power decoupling

CompactPCI boards can use any of the voltages in table 6 on page 35. Adequate power decoupling is required on the backplane for 5V and 3.3V power to ensure power operation will not be intermittent. Power voltages on the backplane are decoupled to ground so as to provide for reasonable management of switching currents (*di/dt*). Low-impedance power planes and connections to low equivalent series resistance (ESR) capacitors are used. The bypass guidelines that are used for each connector are provided in table 10.

Table 10. Backplane decoupling specifications

Mnemonic	Description	Decoupling Capacitance	Voltage[a]
5V	+5 VDC	44 mF ±20%[b]	15 V MIN.
3.3V	+3.3 VDC	44 mF ±20%[b]	10 V MIN.
V(I/O)	+5/3.3 VDC	44 mF ±20%[b]	15 V MIN.
+12V	+12 VDC	15 mF ±20%	35 V MIN.
-12V	-12 VDC	15 mF ±20%	35 V MIN.

a. Voltage values are three times the decoupled voltage value to avoid stressing a tantalum capacitor due to very fast power supply turn-on times.
b. Recommended decoupling capacitance per connector best distributed across the length of each connector.

Hot-Swap Capability

Hot-swapping is the capability of removing and replacing components without turning off the system. Hot-swap capability is becoming increasingly important in systems requiring continuous operation at some level. Because boot times of many popular operating systems are long, the hot-swap capability is crucial for high-end PC servers, and even more so for telecommunication systems, such as base stations, where board-level exchanges must be made without any downtime. CompactPCI supports dynamic configuration to allow hot removal/insertion of boards without interrupting backplane transactions or disturbing DC voltages in the power system.

The hot-swap feature is implemented on the CPCI boards, not on the backplane. The backplane remains passive. Therefore, CompactPCI boards either are or are not hot-swappable.

Signal lines must be precharged to 1V before being plugged into the backplane to maintain ongoing bus transactions. Also, power must be ramped up or down in a controlled manner to allow the power supply to adjust to

the change in load. The power supply, ground and signal pins on the connectors are staged to allow sequencing, so as to not disturb the operation of the surrounding boards in the bus. The three levels of sequencing are:

- Short pins for BD_SEL#
- Medium pins for signals
- Long pins for power/ground

The system uses two levels of sequencing so that power/ground is made first/broken last. The short pin (BD_SEL#) connection is made only when the board is firmly seated, which signals the control circuitry to power up any high-current devices. Conversely, BD_SEL# breaks first to provide early warning to the control circuitry.

Keying of CPCI backplanes and boards

To safely support overlapping uses of CompactPCI user-definable pins, keying mechanisms are required. The two types of keying mechanisms are:

- Backplane connector keys—defined in IEC 61076-4-101
- Front panel and cardguide keys—defined in IEEE 1101.10

Assignment and registry of these keys is centrally administered by the *PICMG Technical/Executive Committee*.

Backplane connector keys

Backplane connector keys prevent inadvertent installation of boards designed for one particular purpose into backplane slots defined for another.

The Type A connectors used in the J1/P1 and J4/P4 locations allow installation of a keying block having eight coding positions. Within the keying block, four coding positions are filled with blocking pins and four are left open to receive pins from the mating keying block. There are 70 mutually exclusive mating pairs.

There are currently ten defined backplane connector keys, four of which (brilliant blue, cadmium yellow, nut brown and strawberry red) are discussed below.

The Model 6476 Midplane is available in either conventional 5.0V logic or 3.3V (See "Signaling Environment" on page 35). To prevent damage to the system resulting from incorrect insertion of cards with differing logic, coding keys are snapped into the male (backplane) and female (card) connectors. Positions 12–14 of the J1/P1 connector are used for the voltage keying mechanism. The unique, bright color of the coding pairs allows for quick and easy visual identification and differentiation. The mechanical design ensures electrical contact will not take place in the event the wrong board is inserted into a coded slot.

A brilliant blue connector key (RAL #5007) is used to denote 5.0V logic, and cadmium yellow (RAL #1021) for the 3.3V logic. Universal boards may operate in either 5.0V or 3.3V systems. Typically, universal boards are

shipped with a 5 volt key installed, and a spare 3.3 volt key, with a recommendation to the user to install the key which matches the system. In some cases, universal boards may not have any keying.

The V(I/O) level distributed on the backplane can be either 3.3V (cadmium yellow key) or 5.0V (brilliant blue key). Backplanes are never universal. It is only possible that boards can be tolerant of either voltage levels, and considered "universal".

The J4/P4 backplane connector key, when populated, will have a key signifying which bused interconnect is in use, or if the connector is allocated for user I/O, indicated by the nut brown key. A strawberry red coding key, RAL #3018, is used exclusively for the CT H.110 bus interconnect on J4/P4. Telephony cards would use the corresponding strawberry red coding key. This prevents the use of non-telephony boards with alternate J4 definitions from being used in the backplane. However, other boards not using the J4 connector may still be used.

If you have purchased Patton's Model 6476 Midplane with the H.110 bus configured on P4, you ***must*** use a processor that is H.110 compliant, or remove the J4 connector from the processor card. Failure to do so will result in damage to the processor card and the backplane.

Front panel and cardguide keys

Keying to functionally identify connectors J2, J3, and J5 is located at the board front panel-to-card guide interface. They are called Front Panel Keys, pursuant to IEEE 1101.10.

The card guides, located on the chassis, and the card's handles have three rectangular cavities (along with an alignment pin on the card, and alignment pin chamber on the card guide. (See also "Electrostatic discharge (ESD) protection" on page 22). Three keying pegs can be inserted, which fill half of the cavity in any of four possible orientations. The mating key block on the card handle is fitted with keying pegs in complimentary orientation to the card guide keys.

The three top cavities (4U cards only) are labeled A, B, C, and the three bottom cavities are D, E, and F. The cavities are hierarchically arranged, with cavity D on the lower keying block being the major functional designator. Cavity E provides additional functional detail, and cavity F provides slot specific I/O differentiation. The keying cavities in the lower key block differentiate the utilization of J2 for 3U boards, and may also be used with upper key blocks of 4U boards to differentiate uses of J3 and J5.

3U cards use just the lower keying block (cavities D, E and F), since there is only one handle. This results in 64 keying possibilities for the 3U form factor. A 6U card has two handles, so it uses both the top and bottom keying blocks (A-F), resulting in 4096 keying possibilities.

Keying pegs come in two colors: red and grey. The red keying pegs are always used for controller system cards/slots, and the grey pegs are used for peripheral cards/slots.

The majority of the 4096 available keying combinations are primarily used for differentiation of slot specific, user-defined I/O functions. Only those keying combinations needed to protect bused interconnects on J2/P2,

J3/P3, and/or J5/P5 will be reserved. The PICMG registry, now under development, will enable companies to identify their keying scheme and prevent other companies from using the same scheme.

Due to dangerous Telephone Network Voltages (TNV), four, unique front panel keys used exclusively for the CT H.110 Bus are required.

If your 4U model has the CT H.110 bus interconnect on the J4/P4 pins (identified with the strawberry red connector key), there are four reserved front panel keys, reserved for exclusive use due to dangerous telephone network voltages (TNV).

To prevent damaging an AC power supply inserted into a backplane wired for DC, and to avoid damaging a DC power supply inserted into a backplane wired for AC, specific front panel keying for plug-in power supplies is defined. See "Front panel keying for power supplies" on page 39.

Chapter 4 Installation checklist

Chapter contents

4U quick set-up checklist....44
Power cable installation....45
Installing the power cables—AC unit....45
Installing the power cables—DC unit....45
Grounding the Model 6476—AC and DC units....46
Changing the VI/O configuration jumper....47
Slot Designation....47
Optional Frame Ground/Signal Ground Connect....48

4U quick set-up checklist

The Model 6476 Mid-plane & Chassis can be easily configured according to your system requirements. Due to the broad application possibilities, the following checklist is provided as a quick set-up guideline.

1. **Select signaling environment**—The signaling environment, called the Voltage Input/Output (V(I/O)), can be configured for 3.3V (factory default) or 5V signaling via power lugs, located at the rear, left-side of the backplane (see section "Changing the VI/O configuration jumper").
2. **Connect frame ground/signal ground (FG/SG)**—You may opt to connect the FG/SG for EMC considerations and noise reduction, via power lugs, located at the rear, right-side of the backplane. The factory default is "no connect".
3. **Assign shelf address**—For multi-shelf systems, each sub-rack bus segment can be assigned a shelf address via the S1 header, located at the rear, left-side of the backplane.
4. **Install 4U chassis on rack**—the chassis front mounting flanges should be securely fastened to the rack with screws.
5. **Install power supply modules**—For *N*+1 power operation, install up to four Patton power supply modules configured for external DC at the front of the chassis.
6. **Install cards**—Plug the system administration card(s) in the system slot(s) at the front of the 4U chassis, and up to 14 peripheral cards can be plugged into remaining slots. Plug alarm card in the left-hand slot at the back of the chassis, and plug transition cards in remaining slots, if needed.
7. **Wire rear panel for optional VRG/VBAT.**
8. **Wire rear panel for power.**

WARNING

Due to possible injuries to people and severe damage to objects caused by electric shock, always wire for power as the last step.

Power cable installation

This section describes installing the power and ground cables.

Installing the power cables—AC unit

This section describes installing the power cables into the IEC-320 connectors on the Model 6476 power supply. ***Do not connect the remaining end of the power cables to the power outlet at this time***. Do the following:

1. Install a power cable into an IEC-320 connector (see figure 15). The AC main socket outlet shall be within 3 meters of the equipment and shall be easily accessible.

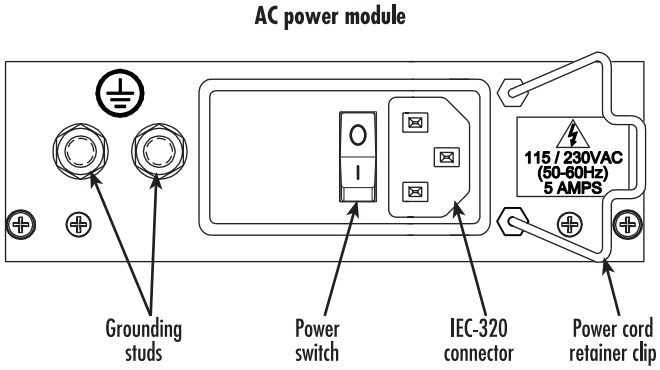


Figure 15. IEC-320 connector and grounding stud locations

WARNING

To avoid the risk of injury from electric shock, the power cords connected to the IEC-320 connectors must be grounded power cords.

2. Rotate the power cable retainer clip (see figure 15) so it secures the power cable plug in the IEC-320 connector.

Installing the power cables—DC unit

This section describes installing the power cables into the DC power input module. **Do not connect the remaining end of the power cables to the DC power source at this time.** The Model 6476 DC power supply module comes with two power input terminal blocks (J1 and J2). The Model 6476 can draw power from sources connected to either of these terminal blocks (inputs are *diode-ORed* and combined to provide for redundant power input). Although the power supply module is designed to operate normally with one power

source, users may want to connect two independent power sources, one to each terminal block, to provide uninterrupted operation in the event of one source failure.

CAUTION

Use AWG 18 copper conductors for the DC supply.

1. Connect the earth ground of the DC source to the grounding stud on the Model 6476 chassis as described in section "Grounding the Model 6476—AC and DC units".
2. Strip back the insulation on each of the supply wires approximately 1/4 inch.
3. Insert the stripped end of the positive lead into the "+DC input" of the terminal block. Tighten the screw until the power lead is firmly fastened. Repeat the procedure for the negative lead, using the "-DC input" of the terminal block. Make sure that there is no exposed wire.

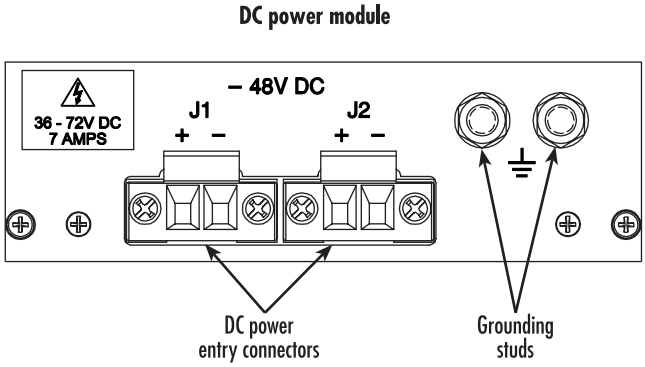


Figure 16. DC connector, -DC and +DC input view

4. Repeat steps 1 through 3 to install the remaining DC power connection.

Grounding the Model 6476—AC and DC units

Do the following:

1. Assemble a ground wire using #10 AWG wire with green-colored insulation and two ring terminals. Make the wire long enough to reach one of the following ground sources:
   - The building ground rod (generally located at the site's main service entrance)
   - A sprinkler system pipe
   - A cold-water pipe
   - Building structural steel

WARNING

To avoid the risk of personal injury, the distance between ground and the equipment rack must not exceed the distance specified in either local electrical codes or the National Electrical Code.

2. Install the ground wire between the grounding studs (see figure 15 on page 45 for AC power entry, or figure 16 on page 46 for DC power entry) and the grounding source.

Changing the VI/O configuration jumper

The Model 6476 VI/O is factory configured for 3.3V. To change the default setting from 3.3V to 5V do the following:

1. Locate lugs J3, J4, and J5 on the backplane (see figure 14 on page 36). Using a Philips screwdriver, remove the jumper from the "3.3V"—"VIO" position (headers J5—J4). See figure 17.

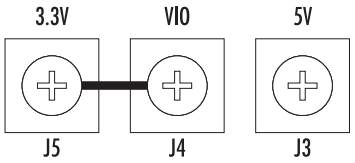


Figure 17. VI/O in the 3.3V position (factory default)

2. Connect the jumper between J4 and J3 (see figure 18), then secure it with the Phillips head screws.

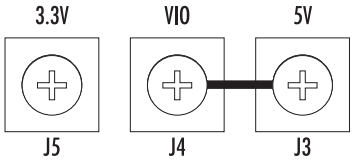


Figure 18. VI/O in the 5V position

IMPORTANT

If you change the V(I/O) to 5V, the cadmium yellow connector key should be preplaced with the blue connector key. should be replaced with the cadmium yellow connector key. See section "Keying of CPCI backplanes and boards" on page 40 for more information on keying.

Slot Designation

Consistent with CompactPCI specifications, the cPCI bus segment consists of one system slot, and seven peripheral slots. The system slot is located in the first slot, or bottom slot in the 4U model.

The system slot provides arbitration, clock distribution, and reset functions for all boards on the segment. The system slot performs system initalization by managing each local board's IDSEL signal. The peripheral slots may contain simple boards, intelligent slaves, or PCI bus masters.

CompactPCI defines slot numbering based on the concept of physical and logical slots. Physical backplane slots are designated 1, 2, 3, through N, where N is the number of slots. Physical slot numbering starts at the bottom slot on the 4U Model 6476 Backplane/Midplane.

Logical slot numbers are defined by the IDSEL signal and associated address used to select the slot. Logical numbers are used in the nomenclature to define the physical outline of a connector on a bus segment. Logical and physical slot numbers may not always coincide.

Each slot may be implemented with 1 to 5 connectors numbered P1-P5, starting from the bottom of the board.

Optional Frame Ground/Signal Ground Connect

There are two headers, J1 and J2, located in the power bay area (see figure 14 on page 36). J1 corresponds to signal ground (SG) and J2 corresponds to frame ground (FG). These two headers provide an option to connect FG and SG. The factory default is for FG and SG to not be connected. Depending on the environment, you can opt to connect the FG/SG for EMC considerations and noise reduction.

To connect FG to SG, do the following:

1. Locate J1 and J2 at the bottom of the power bay area (see figure 14 on page 36).
2. Use a Phillips screwdriver to loosen the screws on both headers.
3. Connect a jumper between J1 and J2 (see figure 19), then secure it with the Phillips head screws.

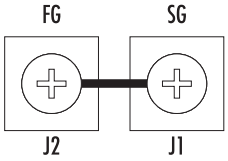


Figure 19. Frame ground connected to signal ground

Chapter 5 Maintenance

Chapter contents

Preventive Maintenance....50
Cleaning the fan filter....50
Troubleshooting....50
System won't power up....50
Hot-swap of power supply fails....50
No-load condition generates a false alarm....50

Preventive Maintenance

Cleaning the fan filter

Periodically clean the filter on the Fan Tray Assembly. The frequency of cleaning depends on the environmental conditions of where your equipment is located. Clean filter with a mild detergent and water, then air-dry, or you can use compressed air. It should be completely dry before reuse.

Spare filters (part no. 05-00083-01) are available from Patton Electronics Company.

Troubleshooting

System won't power up

If the green LED on the power supply module does not light up, you should: turn off the power supply module's front panel switch, and remove it from the chassis (warm-swap). Then plug it back in, making sure it is seated properly. Flip the switch to "on". If green LED still does not light up, check to make sure the polarity is wired correctly at the back of the chassis.

If the green LED lights up on the power supply module, but the system still isn't powering-up, then the module may be faulty and should be returned to the manufacturer.

Hot-swap of power supply fails

The power supply module is designed for a warm-swap, and should not be hot-swapped. To warm-swap the power supply module, simply turn the power switch to "off" on the front panel prior to removal/insertion. If it has been hot-swapped and is not working, turn the switch "off" and remove it from the chassis. Allow a minute or two for the module to cool down, then plug it back in with the switch "off". Once it is seated, turn switch on.

No-load condition generates a false alarm

The power supply module may generate a false alarm under a no-load condition (no cards installed). A minimum of 1/2 amp (system admin card would suffice) needs to be plugged into the sub-rack to prevent this false alarm.

Chapter 6 Contacting Patton for assistance

Chapter contents

Introduction 52
Contact information 52
Service 52
Warranty Service and Returned Merchandise Authorizations (RMAs) 52
Warranty coverage 53
Out-of-warranty service 53
Returns for credit 53
Return for credit policy 53
RMA numbers 53
Shipping instructions 53

Introduction

This chapter contains the following information:

- "Contact information"—describes how to contact Patton technical support for assistance.
- "Warranty Service and Returned Merchandise Authorizations (RMAs)"—contains information about the RAS warranty and obtaining a return merchandise authorization (RMA).

Contact information

Patton Electronics offers a wide array of free technical services. If you have questions about any of our other products we recommend you begin your search for answers by using our technical knowledge base. Here, we have gathered together many of the more commonly asked questions and compiled them into a searchable database to help you quickly solve your problems.

- Online support—available at **www.patton.com**.
- E-mail support—e-mail sent to **support@patton.com** will be answered within 1 business day
- Telephone support—standard telephone support is available from **8AM** to **5PM EST** (**8:00 to 17:00 UTC-5**), **Monday** through **Friday**, by calling **+1 (301) 975-1007**

Service

Patton Electronics' technical staff is also available to answer any questions that might arise concerning the installation or use of your Model 6476. Technical Service hours: **8AM** to **5PM EST** (**8:00 to 17:00 UTC-5**), **Monday** through **Friday**.

All warranty and non-warranty repairs must be returned freight prepaid and insured to Patton Electronics (for more information about warranty and non-warranty repairs, see section "Warranty Service and Returned Merchandise Authorizations (RMAs)"). All returns must have a Return Materials Authorization number on the outside of the shipping container. This number may be obtained from Patton Electronics Technical Service at:

- Tel: **(301) 975-1007**
- E-mail: **support@patton.com**
- URL: **www.patton.com**

Note Packages received without an RMA number will not be accepted.

Warranty Service and Returned Merchandise Authorizations (RMAs)

Patton Electronics is an ISO-9001 certified manufacturer and our products are carefully tested before shipment. All of our products are backed by a comprehensive warranty program.

Note If you purchased your equipment from a Patton Electronics reseller, ask your reseller how you should proceed with warranty service. It is often more convenient for you to work with your local reseller to obtain a replacement. Patton services our products no matter how you acquired them.

Warranty coverage

Our products are under warranty to be free from defects, and we will, at our option, repair or replace the product should it fail within one year from the first date of shipment. Our warranty is limited to defects in workmanship or materials, and does not cover customer damage, lightning or power surge damage, abuse, or unauthorized modification.

Out-of-warranty service

Patton services what we sell, no matter how you acquired it, including malfunctioning products that are no longer under warranty. Our products have a flat fee for repairs. Units damaged by lightning or other catastrophes may require replacement.

Returns for credit

Customer satisfaction is important to us, therefore any product may be returned with authorization within 30 days from the shipment date for a full credit of the purchase price. If you have ordered the wrong equipment or you are dissatisfied in any way, please contact us to request an RMA number to accept your return. Patton is not responsible for equipment returned without a Return Authorization.

Return for credit policy

- Less than 30 days: No Charge. Your credit will be issued upon receipt and inspection of the equipment.
- 30 to 60 days: We will add a 20% restocking charge (crediting your account with 80% of the purchase price).
- Over 60 days: Products will be accepted for repairs only.

RMA numbers

RMA numbers are required for all product returns. You can obtain an RMA by doing one of the following:

- Completing a request on the RMA Request page in the *Support* section at **www.patton.com**
- By calling **+1 (301) 975-1000** and speaking to a Technical Support Engineer
- By sending an e-mail to **returns@patton.com**

All returned units must have the RMA number clearly visible on the outside of the shipping container. Please use the original packing material that the device came in or pack the unit securely to avoid damage during shipping.

Shipping instructions

The RMA number should be clearly visible on the address label. Our shipping address is as follows:

Patton Electronics Company
RMA#: xxxx
7622 Rickenbacker Dr.
Gaithersburg, MD 20879-4773 USA

Patton will ship the equipment back to you in the same manner you ship it to us. Patton will pay the return shipping costs.

Appendix A **Glossary of Terms**

Chapter contents

C 56
CFM 56
CSA 56
CT 56
D 56
Dual Redundant 56
E 56
ECTF 56
EIA 56
EMC 56
EMI 56
EN 56
Enumeration 56
ESD 56
Eurocard 56
H 56
Hot-Swap 56
HP 56
I 57
IDE 57
IEC 57
IEEE 57
IN/C 57
ISA 57
K 57
Keying 57
N 57
N+1 Redundant 57
NEBS 57
NP 57
P 57
PCI 57
PCI SIG 57
PICMG 57
Platform 57
S 57
SELV 57
S-HAZ 57
Shroud 58
T 58
TDM 58
TNV 58
U 58
U 58
W 58
Warm-Swap 58

C

CFM
Cubic feet per minute—A measurement of how much air is moved through a fan.

CSA
Canadian Standards Association—Organization which operates a listing service for electrical and electronic materials and equipment. It is the body that establishes telephone equipment (and other) standards for use in Canada.

CT
Computer Telephony—is the adding of computer intelligence to the making, receiving, and managing of telephone calls.

D

Dual Redundant
An environment containing two power supplies, with fault tolerance such that one power supply may fail and the system will continue to operate.

E

ECTF
Enterprise Computer Telephony Forum—A non-profit corporation formed to focus on the technical challenges of interoperability among Computer Telephony Integration (CTI) products.

EIA
Electronics Industry Association—Trade organization of manufacturers which sets standards for use of its member companies.

EMC
Electromagnetic Compatibility—Is the ability of equipment or systems to be used in their intended environment within designed efficiency levels without causing or receiving degradation due to unintentional EMI.

EMI
Electromagnetic Interference—any electromagnetic interference, periodic or random, narrow or broadband, which may have a disturbing influence on devices exposed to it.

EN
European Norms—Prefix assigned to documents adopted by the CE designating required standards (for example, EN 60950 is the safety specification (equivalent to UL 1950)).

Enumeration
The action taken by the Host to poll the configuration spaces of the PCI devices and allocate (deallocate) the necessary resources (memory and/or I/O address space, interrupts, software drivers).

ESD
Electrostatic Discharge—Discharge of a static charge on a surface or body through a conductive path to ground. Can be damaging to integrated circuits.

Eurocard
A series of mechanical board form factor sizes for rack-based systems.

H

Hot-Swap
The capability of removing and replacing components without turning off the system. Hot-swap capability is increasingly important in systems used for applications such as telecommunications, which require that the system be operational at some level continuously.

HP
Horizontal Positioning—A unit of measurement used for the width of CPCI cards/modules. 1 HP = 0.2” wide

I

IDE
Integrated Drive Electronics—a hard disk drive standard interface for PCs.

IEC
International Electrotechnical Committee

IEEE
Institute of Electrical and Electronics Engineers

IN/C
Insulation No Connect—required for safety agency insulation requirements.

ISA
Industry Standard Architecture—A specification by which Personal Computers (PCs) add boards.

K

Keying
A mechanical means of polarizing connectors in order to prevent similar connectors from being mated. This is necessary when 2 or more similar connectors must be connected to a backplane which requires that the board being connected is unique for a particular slot.

N

N+1 Redundant
An environment containing more than two power supplies, where the power supplies typically current share, with fault tolerance such that one power supply may fail and the system will continue to operate.

NEBS
Network Equipment Building Standards—Defines a rigid and extensive set of performance, quality, environmental and safety requirements developed by Bellcore, the R&D and standards organization owned by the seven regional Bell operating companies (RBOC's).

NP
Not Populated—pins within connector that must not be populated due to safety requirements.

P

PCI
Peripheral Component Interconnect. A specification for defining between logic components. Typically used for interconnecting high-speed, PC-compatible chipset components. The PCI specification is issued through the PCI Special Interest Group (PCI SIG).

PCI SIG
Peripheral Component Interconnect Special Interest Group

PICMG
PCI Industrial Computers Manufacturers Group—a consortium of industrial computer product vendors who develop specifications for PCI-based systems and boards for use in industrial computing applications.

Platform
Describes the system environment, including the backplane and related enclosure.

S

SELV
Safety Extra Low Voltage—a term generally defined by the regulatory agencies as the highest voltage that can be contacted by a person and not cause injury. It is often specifically defined as 30 VAC or 42.4 VDC.

S-HAZ
Secondary Hazardous—any voltage within a system that is greater than 60VDC (42.4VAC-peak), NOT meeting the requirements for a LIMITED CURRENT CIRCUIT, or for a TNV CIRCUIT. Typical ringing voltage is considered SECONDARY HAZARDOUS unless it is current limited. Raw ringing is considered SECONDARY HAZARDOUS. (Refer to IEC950 or PICMG 2.5 R1.0 CompactPCI, Computer Telephony Specification for information.)

Shroud
A male connector body designed to fit over the extended tails of a long tail connector which allows a female connector to be mated from the rear side for midplane or rear I/O applications.

T

TDM
Time Division Multiplex—A technique for transmitting a number of separate data, voice and/or video signals simultaneously over one communications medium by quickly interleaving a piece of each signal one after another.

TNV
Telephone Network Voltages—any voltage present on the telephone network side of the isolation device on any device (for example, board) that connects to the telephone network.

U

U
An EIA unit of measurement equal to 1.75 in. (4.45 cm) for equipment racks.

W

Warm-Swap
An environment supporting removal and insertion of power supplies while under power, wherein the power supply is disabled during insertion and removal, avoiding the need for the connectors to make and break high current connections while under load.