



# CPCI Backplane Manual

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The products described in this manual are in compliance with all applied CE standards.



## Revision History

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## Imprint

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This manual was realized by: **TPD/Engineering, PEP Modular Computers GmbH.**



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These products have been manufactured to satisfy environmental protection requirements where possible. Many of the components used (structural parts, printed circuit boards, connectors, batteries, etc.) are capable of being recycled.

Final disposition of these products after their service life must be accomplished in accordance with applicable country, state, or local laws or regulations.



## Explanation of Symbols



### ***CE Conformity***

This symbol indicates that the products described in this manual are in compliance with all applied CE standards. Please refer also to the section “Applied Standards” in this manual.



### ***Caution, Electric Shock!***

This symbol and title warn of hazards due to electrical shocks (> 60V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

Please refer also to the section “High Voltage Safety Instructions” on the following page.



### ***Warning, ESD Sensitive Device!***

This symbol and title inform that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Please read also the section “Special Handling and Unpacking Instructions” on the following page.



### ***Warning!***

This symbol and title emphasize points which, if not fully understood and taken into consideration by the reader, may endanger your health and/or result in damage to your material.



### ***Note...***

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.



## For Your Safety

Your new *PEP* products have been developed and tested carefully to provide all features necessary to ensure their compliance with electrical safety requirements. They were also designed for a long fault-free life. However, the life expectancy of your products can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new *PEP* products, you are requested to conform with the following guidelines.

### High Voltage Safety Instructions



#### **Warning!**

All operations on these products must be carried out by sufficiently skilled personnel only.



#### **Caution, Electric Shock!**

Before installing your new *PEP* products into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks.

Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.

### Special Handling and Unpacking Instructions



#### **ESD Sensitive Device!**

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle these products out of their protective enclosures while they are not used for operational purposes unless they are otherwise protected.

Whenever possible, unpack or pack these products only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the products with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the products contain batteries for RTC or memory back-up, ensure that they are not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits.



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## General Instructions on Usage

In order to maintain PEP's product warranty, these products must not be altered or modified in any way. Changes or modifications to these products which are not explicitly approved by *PEP Modular Computers* and described in this manual or received from PEP Technical Support as a special handling instruction will void your warranty.

These products should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific product version which must not be exceeded. If batteries are present their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board please re-pack it as nearly as possible in the manner in which it was delivered.

Special care is necessary when handling or unpacking the product. Please, consult the special handling and unpacking instruction on the previous page of this manual.



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*PEP Modular Computers* grants the original purchaser of PEP products a **TWO YEAR LIMITED HARDWARE WARRANTY** as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of PEP are valid unless the consumer has the express written consent of *PEP Modular Computers*.

*PEP Modular Computers* warrants their own products, excluding software, to be free from manufacturing and material defects for a period of 24 consecutive months from the date of purchase. This warranty is not transferable nor extendible to cover any other users or long-term storage of the product. It does not cover products which have been modified, altered or repaired by any other party than *PEP Modular Computers* or their authorized agents. Furthermore, any product which has been, or is suspected of being damaged as a result of negligence, improper use, incorrect handling, servicing or maintenance, or which has been damaged as a result of excessive current/voltage or temperature, or which has had its serial number(s), any other markings or parts thereof altered, defaced or removed will also be excluded from this warranty.

If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation (see our safety instructions).

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# General

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## 1. Overview

The *PEP Modular Computers'* backplane family includes 4, 6 and 8-slot boards both in 3U and 6U format. They can be provided with either a standard DIN M-series, a Faston plug/M4 screw or an ATX power supply connector. Backplanes are available as 32-bit or 64-bit implementations.

### 1.1 Slot Assignment

A CompactPCI system board (backplane) is composed of up to eight CompactPCI board locations (slots) with 20.32 mm center-to-center spacing. A CompactPCI backplane consists of one system slot and up to seven peripheral slots. The system slot provides arbitration, clock distribution and reset functions for all boards connected to the bus. The system slot is responsible for performing system initialization by managing each local board's IDSEL signal.

The system slot is always marked by a triangle on the front side of the board containing the physical slot number. The following symbols provide visual indication of backplane connector and adapter board capability:

 System slot — slot 1;  Peripheral slot — slots 2 ... *n*.



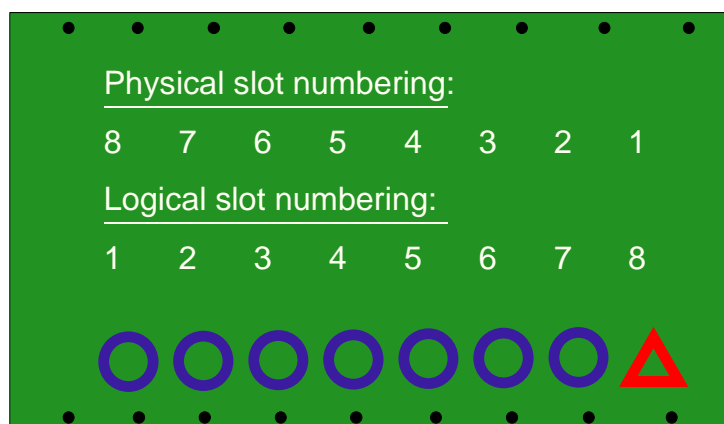
**Warning!**

A system master CPU should be inserted into the system slot only. The peripheral slots may contain simple adapters, intelligent slaves, PCI bus masters or peripheral master CPU's.

Physically, the system slot may be located at the left or right end of the backplane. For simplicity and system expandability (heat-sink, cooling fan etc.), all *PEP Modular Computers* CompactPCI backplanes have their system slots at the right end when viewing the backplane from the front side.

The logical slot numbering may differ from the physical numbering on the backplanes. The relation between the two numbering systems are shown in the figure below.

**Figure 1: PEP Modular Computers Slot Numbering (both 3U and 6U boards)**





## 1.2 PCB Form Factor

The size of *PEP Modular Computers* backplanes is based upon the Eurocard industry standard and depends on their height format (3U/6U), their number of slots and power supply unit.

**Table 1: PCB Form Factor [mm]**

Slot Number/ PSU	3U			6U		
	Faston/M4	DIN M-Series	ATX	Faston/M4	DIN M-Series	ATX
4-Slot	80.28*128.7	100.7*128.7	—	—	—	—
6-Slot	—	120.7*128.7	131.5*128.7	—	—	—
8-Slot	—	197.12*128.7	—	—	222.52*262.05	—
11-Slot	—	283.0*128.7	—	—	—	—

## 1.3 PCI Bus Extension

The PICMG 2.0 CompactPCI Specification restricts the length of a bus segment of a given CompactPCI backplane to 8 slots or less. This restriction has been determined by extensive simulation and characterization and guarantees an optimum operation of PCI-compliant integrated circuits. Since the inception of PCI, design engineers have extended this eight-slot restriction by using PCI-to-PCI bridge components. Thanks to the use of such bridge components, which are put into effect on a special bridge module, the implementation of CompactPCI backplanes providing more than 8 slots is possible.

## 1.4 Distinctive Features

The *PEP Modular Computers* CompactPCI backplanes can be distinguished according to the following distinctive features:

- Form factor (height)
- Dimensions
- Number of slots
- Bus resolution
- Bus frequency
- Rear I/O connectivity
- Hot-swap capability
- Power Supply Connector
- Redundant power supply
- Flexible grounding option
- Fan connector
- Drive connector
- Power LED Connector
- PS-ON Connector
- Reset function connector



## 2. Clocks

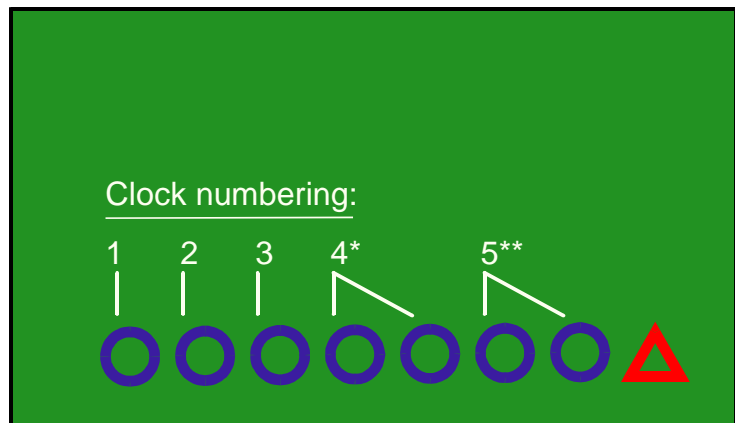
The CompactPCI system slot drives five buffered clocks, while every adapter slot receives its specific clock.

The 6-slot and 8-slot versions are provided with individual clock timings for the three slots on the opposite end of the backplane. The remaining slots are assigned one clock for each two slots.

**Figure 2: Backplane Clock Assignment (3U backplanes)**

The system slot provides clock signals for all the PCI peripherals in the system, including devices on the system slot board. Peripheral boards are provided with clock signals via the CompactPCI backplane.

The 8-slot backplanes are provided with a diode termination according to the CompactPCI Specification.

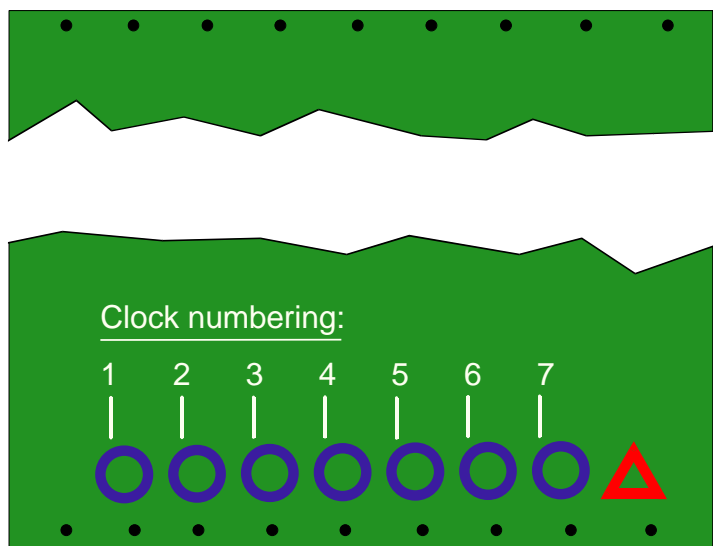


- \* 6-slot/8-slot backplanes only
- \*\* 8-slot backplanes only

**Figure 3: Backplane Clock Assignment (6U backplanes)**

Clock skew is the difference between the maximum and minimum propagation delay of any PCI clock signal. There are two different types of clock skew: backplane and system slot board clock skew.

The two concepts of backplane and system slot board clock skew are explained in the following.



### 2.1 Backplane Clock Skew

A CompactPCI backplane provides the distribution of clock signals for all of the board slots in the system. The differences in the trace routing and net topologies contribute to skew and also define the longest clock delay. Particular attention is paid by the PEP Modular Computers system design to meet overall system clock skew requirements namely through simulation, testing, and qualification.



## 2.2 System Slot Board Clock Skew

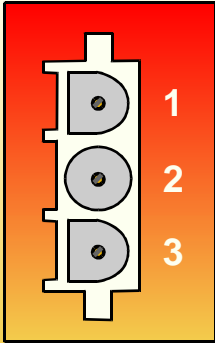
This is the clock skew that may be attributed to the onboard routing differences (if any) of all of the PCI clocks as well as the skew specification for the type of integrated circuit driver used for clock distribution. The onboard clock routing is designed to complement the propagation delays of distributing the clock to a backplane and still meet overall system skew requirements.

## 3. Backplane Interfaces

### 3.1 Line Connection

Both AC and DC power supply to most backplanes are connected by means of 3-pole Mate-N-Lok connectors marked "LINE1" and, on some 6U backplanes, "LINE2" on the backplane reverse side.

Figure 4: Orientation and Pinouts of AC/DC Line Connectors



**Table 2: Pinouts of AC/DC Line Connector**

Pin	AC	DC
1	N	- DC supply
2	L	+ DC supply
3	PE	PE



**Attention!**

AC/DC power supply units must be installed only with backplanes/systems connected to an AC power line and DC/DC power supply units with backplanes/systems connected only to a DC power line.

Failure to comply with this warning will result in damage to your equipment.

### 3.2 Power Supply Connectors

The AC or DC input voltages to the power supply unit and the Vo1...Vo4 output voltages from the power supply unit to the backplane are connected via a power supply connector complying with one of the below described specifications.



**Note...**

The term "power supply connector" is used both for the connectors receiving the backplanes' power supply and the mating output connectors of the power supply units.



Table 3: Power Supply Connectors

Connector Type	Description
DIN M-Series	3 or 4-pole DIN M-series female power supply connectors for power throughput to the power supply unit and a 30- (32-) pole DIN M24/8 female power supply connector for power reception from the power supply unit (DIN 41612)
Faston/M4	M4 screw connection combined with 6.3mm*0.8mm strip connectors.
ATX	Male 20-pole ATX connector for power supply from the reverse side of the backplane; the ATX PSUs available on the market are provided with a matching connector.

The pinouts of the DIN M24/8 and of the ATX power supply connectors are illustrated below.



**Note...**

As the overall pinout of the DIN M24/8 connector installed on a 3U backplane is identical to that of both DIN M24/8 connectors installed on a 6U backplane taken together, on a 6U backplane some functions are connected on the upper or on the lower connector only and, therefore, are not connected on the other connector (see tables below).

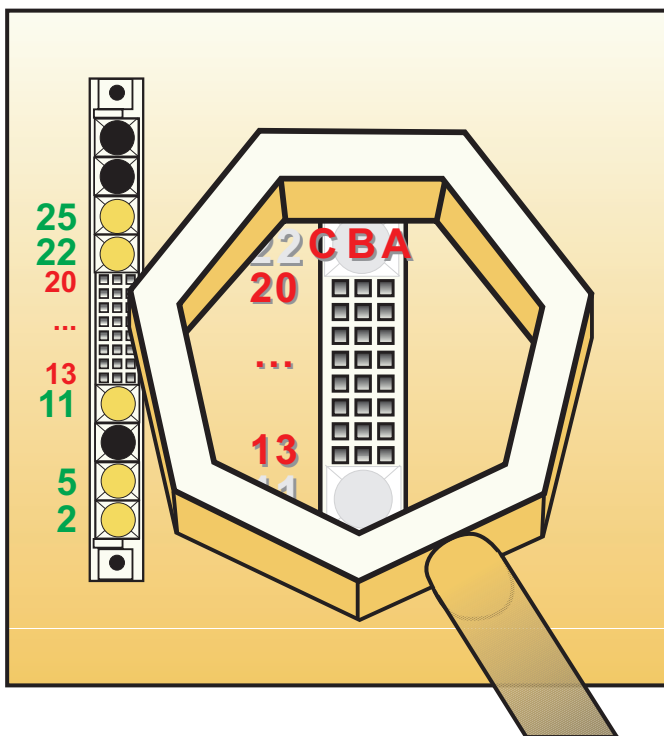


Figure 5: DIN M24/8 Power Supply Connector



**Warning!**

Please note that the pinouts of the DIN M24/8 power supply connectors of various power supply units differ. Therefore, please refer also to the pinout tables of the single power supply units for any possible differences to the pinouts supplied in the tables below.



Table 4: DIN M24/8 Connector Pinouts (3U Backplanes)

Pin	Function	Pin	Function
2	L1	B.16	+3.3VL
5	N	B.17	+3.3VL
8	N/C	B.18	+3.3VL
11	PE	B.19	+12VL
A.13	INT	B.20	-12VL
A.14	INH	C.13	EN
A.15	INT	C.14	DEG
A.16	OVF	C.15	INT
A.17	+5VF	C.16	+3.3VL
A.18	+3.3VL	C.17	+3.3VL
A.19	+12VL	C.18	+3.3VL
A.20	-12VL	C.19	+12VL
B.13	+3.3VL	C.20	-12VL
B.14	+3.3VL	22	+5VL
B.15	+3.3VL	25	OVL

L1 = live connection, N = neutral, PE = earth protection; INT = internally connected; N/C = not connected.



**Warning!**

To ensure correct 5V operation of your equipment it is necessary to connect 5VL to 5VF and 0VL to 0VF.

The maximum voltage compensation is 0.25V per line.



Table 5: DIN M24/8 Connector Pinouts (6U Backplanes)

Pin	Function		Pin	Function	
	Lower Connector	Upper Connector		Lower Connector	Upper Connector
2	L1	N/C	B.16	+3.3VL	+3.3VL
5	N	N/C	B.17	+3.3VL	+3.3VL
8	N/C	N/C	B.18	+3.3VL	+3.3VL
11	PE	N/C	B.19	N/C	+12VL
A.13	N/C	N/C	B.20	N/C	-12VL
A.14	INH	N/C	C.13	EN	N/C
A.15	N/C	N/C	C.14	DEG	N/C
A.16	N/C	N/C	C.15	INT	N/C
A.17	N/C	N/C	C.16	+3.3VL	+3.3VL
A.18	+3.3VL	+3.3VL	C.17	+3.3VL	+3.3VL
A.19	N/C	+12VL	C.18	+3.3VL	+3.3VL
A.20	N/C	-12VL	C.19	N/C	+12VL
B.13	+3.3VL	+3.3VL	C.20	N/C	-12VL
B.14	+3.3VL	+3.3VL	22	N/C	+5VL
B.15	+3.3VL	+3.3VF	25	OVL	OVL

L1 = live connection, N = neutral, PE = earth protection; INT = internally connected; N/C = not connected.



**Warning!**

To ensure correct 5V operation of your equipment it is necessary to connect 5VL to 5VF and 0VL to 0VF.

The maximum voltage compensation is 0.25V per line.



Figure 6: ATX Power Supply Connector on 3U Backplane (left) and 6U Backplanes (optional, right)

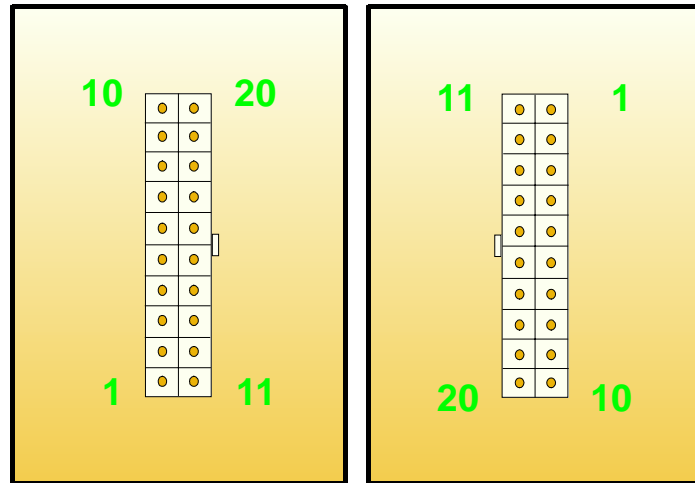


Table 6: ATX Connector Pinouts

Pin	Function	Pin	Function
1	+3.3V	11	+3.3V
2	+3.3V	12	-12V
3	GND	13	GND
4	+5V	14	PS-ON
5	GND	15	GND
6	+5V	16	GND
7	GND	17	GND
8	PW-OK	18	-5V
9	+5V SB	19	+5V
10	+12V	20	+5V





### 3.3 Signalling Environment

Each CompactPCI backplane supports a 5V or a 3.3V signaling environment (VIO), and PCI allows for two types of buffer interfaces for interboard connection. However, a gradual shift to 3.3V is occurring as the semiconductor industry shifts to the lower power interface for speed and power dissipation reasons. For this reason, the *PEP Modular Computers* system backplanes are also designed for 3.3V usage.



#### **Warning!**

Using both 3.3V and 5V boards within the same system may result in damage to your equipment. Please note that the presence of only one 5V board determines a 5V signalling environment. The default setting is 5V.

When changing the signalling environment from 5V to 3.3V or vice-versa, please make sure that coding keys of the appropriate color are used (see Coding Keys section of this chapter).

### 3.4 Rear I/O Connectivity

According to PICMC CompactPCI Specification, V. 2.0, R. 3.0, standard rear I/O connectivity is provided on the P3 backplane connector. The standard rear I/O pinouts of the P3 connector are shown in the Overview chapter of this manual.

In addition, board-specific rear I/O connectivity can be provided on one or more of the backplane connectors P2, P4, P5. For the pinouts of any board-specific rear I/O connectors please refer to the User's Manual of the relating board.



### 3.5 Coding Keys

**Figure 7: Board/Rack Coding Keys**

*PEP Modular Computers* Compact-PCI systems present an advantage in the form of a special combination of coding keys. They ensure proper mating of boards and backplanes in terms of voltage and function. For this purpose, two different kinds of coding keys have been devised, which are described in the following.

#### Main Board Keying

Proper board installation is ensured by the use of colored coding keys for 3.3V (yellow) or 5V (blue) operation, thus preventing incorrect installation of adapter boards. This facility also prevents confusion when hot-swapping boards.

#### Additional Board Keying

The function of the additional board coding key depends on the backplane. Backplanes equipped with an H110 telephony connector are marked with a red H110 key. Dual-PCI backplanes use coding keys for 3.3V (yellow) or 5V (blue) operation of the upper PCI bus.

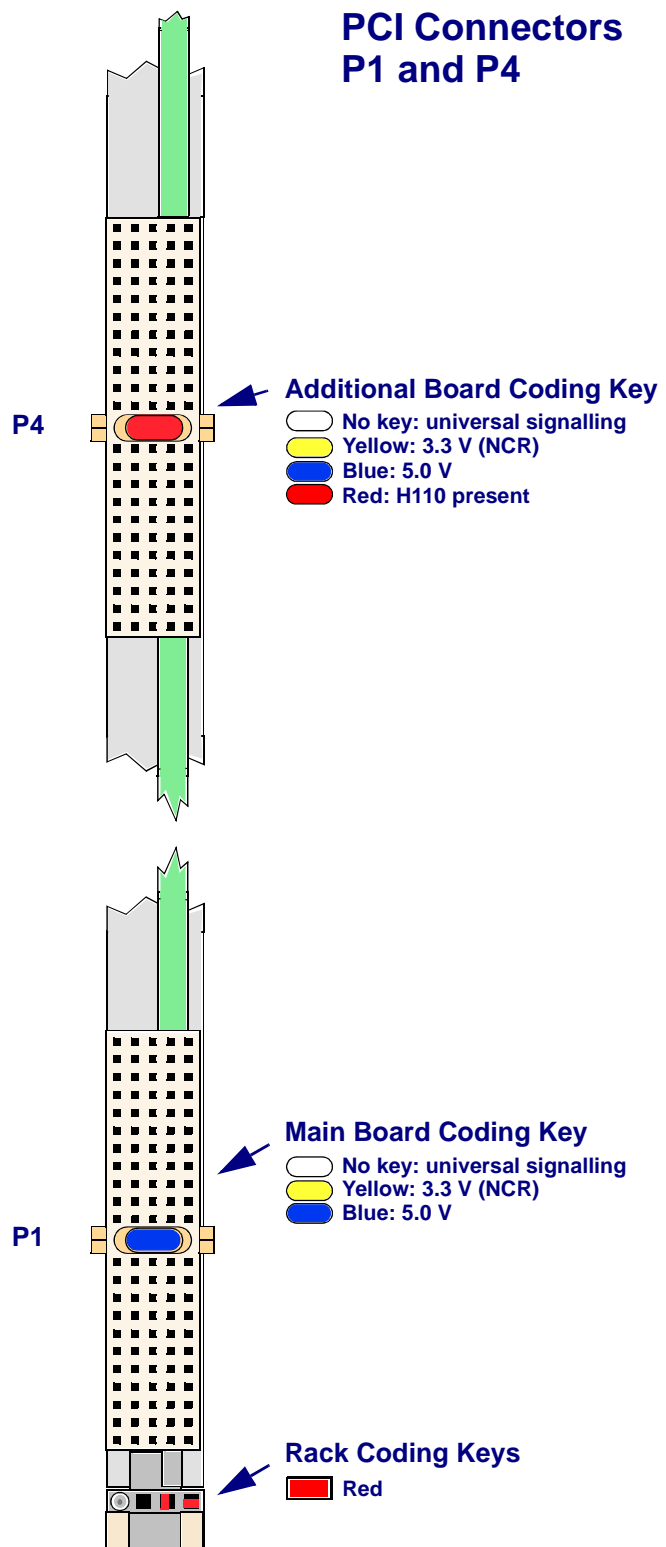
#### AC/DC Keying

To ensure proper connection in terms of AC/DC power, all *PEP Modular Computers* power supply units are provided with special AC/DC coding keys.

The coding standard is not fully defined at the moment of writing. It will be implemented as soon as available.

#### Rack Keying

Boards must be fitted into a Compact-PCI backplane in a certain order, depending on whether they are bus master boards or I/O boards. To this end, special asymmetrically shaped coding keys can be used by the customer to ensure that the boards are inserted properly.





## 3.6 Flexible Grounding Option

With certain backplane types it is possible to select electrical isolation or connection between the bus GND and the backpanel support PE (rack), thanks to the fact that every second fastening hole of backplanes is non-conducting. If only these fastening holes are used, there is no electrical connection between GND and PE on the system bus. If additional holes are used, a multi-point connection is created such as may be required for EMI protection purposes.

## 3.7 Rack Dividers

3U boards may be used in a 6U rack. If one or two 3U backplanes are used, a middle bar is used to hold the 3U boards in place. If the 3U boards are installed on a 6U backplane, a split kit must be used in place of the backplane's P3 connector(s). For further details on split kit and middle bar separation, please refer to the Racks chapter of this manual.



## 4. PEP CompactPCI Standard Backplanes

Table 7: PEP CompactPCI Standard Backplane Family

Form Factor	Slots*	Power Supply Connector	Backplane
3U	4	Faston plugs/M4 Screw-Type	CP3-BP4
		DIN M-Series	CP3-BP4-M
	6	ATX	CP3-BP6-ATX
	8	DIN M-Series	CP3-BP8-M
		DIN M-Series	CP3-BP8-RIO
11	DIN M-Series	CP3-BP11-M	
6U	8	DIN M-Series	CP6-BP8-STD
	8/15**	DIN M-Series	CP6-BP8-DUALPCI
	8	DIN M-Series	CP6-BP8-H110

\* System slot on all backplanes on the right.

\*\* 8 6U slots or down to 1 6U slot in combination with up to 14 3U slots.

Table 8: PEP CompactPCI Standard Backplanes – Mechanical Characteristics

Backplane	Special Features	Size	Weight
<b>CP3-BP4</b>	—	80.3*128.7 mm	170g
<b>CP3-BP4-M</b>	—	100.7*128.7 mm	165g
<b>CP3-BP6-ATX</b>	Rear I/O connectivity	120.7*128.7 mm	270g
<b>CP3-BP8-M</b>	Rear I/O connectivity	197.1*128.7 mm	400g
<b>CP3-BP8-RIO</b>	Rear I/O connectivity	197.1*128.7 mm	440g
<b>CP3-BP11-M</b>	Rear I/O connectivity	283.0*128.7 mm	700g
<b>CP6-BP8-STD</b>	Rear I/O connectivity, hot-swap capability	222.5*262.0 mm	1,000g
<b>CP6-BP8-DUALPCI</b>	Dual PCI, hot-swap capability	222.5*262.0 mm	960g
<b>CP6-BP8-H110</b>	H.110	222.5*262.0 mm	980g

\* System slot on all backplanes on the right.

\*\* 8 6U slots or down to 1 6U slot in combination with up to 14 3U slots.



## 5. Product Documentation Organization

The product documentation organization for *PEP's* CPCI Power Supplies is as follows:

1. CPCI Backplane Manual (ID: 24229)
2. CPCI Backplane Product Documentation Guide (ID: 24229, Sub-ID: PDG)
3. Specific *PEP* CPCI Backplane Product Documentation (ID: 24229, Sub-ID: PDnn)

Item 1 above is represented by this manual which provides generic information about *PEP's* CPCI backplanes. Item 2 is enclosed with this manual for referencing to applicable CPCI Backplane Product Documentation. Item 3 represents the individual product documentation for specific backplanes. For each backplane addressed in item 2 there is a separate document available.

Each of the above items are maintained independently of one another, whereby item 2 always reflects the current status of available product documentation.

## 6. Applied Standards

The *PEP Modular Computers' CompactPCI* backplanes comply where applicable with the requirements of the following standards.

### 6.1 CE Compliance

- Emission EN50081-1, EN 55011/EN 55022
- Immission EN50082-2, EN 61000-4
- Electrical Safety EN60950, VDE 0100, VDE 0805

### 6.2 Other Safety Standards

- UL, CSA, DVE, NEMKO

### 6.3 Mechanical Compliance

- Mechanical Dimensions IEEE 1101.10

### 6.4 Environmental Tests

- Vibration/Broad-Band IEC68-2-6
- Random Vibration IEC68-2-64 (3U boards)
- Permanent Shock IEC68-2-29
- Single Shock IEC68-2-27

## 7. Related Publications

### 7.1 CompactPCI Systems/Boards

- CompactPCI Specification, V. 2.0, Rev. 2.1
- DIN 41612
- ATX Specification
- CompactPCI Power Interface Specification, 2.11 R1.0