CPCI
Backplane
Manual

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Explanation of Symbols

CE Conformity

This symbol indicates that the product described in this manual is in compliance with CE standards.

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.

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For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product 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 Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

Warning!

All operations on this device must be carried out by sufficiently skilled personnel only.

Caution, Electric Shock!

Before installing your new Kontron product 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 this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product 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 product 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 product contains batteries for RTC or memory backup, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the board.

General Instructions on Usage

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

This device 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 board 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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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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Chapter **1**

General

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1. Overview

The *Kontron Modular Computers'* backplane family includes both 3U and 6U form factor backplanes. 3U form factor backplanes are available with 2, 4, 5, 6, 8, and 11 slots. The 6U form factor backplanes are available with 4 and 8 slots.

Depending on system requirements, the backplanes can be provided with a wide variety of power supply connections: bolt type terminal lugs, screw lugs, Faston plug/M4 screw terminals, ATX power supply connector, DIN type M pluggable power connectors, and Positronic type 47 position pluggable connectors.

In addition, backplanes are available: as 32-bit or 64-bit implementations; with either 33 or 66 MHz PCI clock; with rear IO configurations, telephony configurations; with system management bus (IPMB); with support for power supply redundancy and load sharing; and with support for various monitor and control devices.

1.1 Slot Assignment

A CompactPCI system board (backplane) is composed of up to eight CompactPC slots per backplane segment with 20.32 mm center-to-center spacing. A CompactPCI backplane segment consists of one system slot and up to seven peripheral slots.

The functionality of the system master controller in the system slot is to provide bus arbitration, clock distribution, and reset functions for all boards connected to the bus. In addition, it is responsible for performing system initialization and configuration.

The location of the system slot is always identified by a triangle below the corresponding P1 connector on the front side of the backplane. Peripheral slots are indicated by a circle.

Warning!

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

Physically, the system slot may be located at any position of the backplane. However, for simplicity and system expandability (heat-sink, cooling fan etc.), most *Kontron Modular Computers'* CompactPCI backplanes have their system slots on the right of the bus segment when viewing the backplane from the front side.

The physical slot numbering of a backplane always begins at the upper left corner of the backplane and is always indicated on the board with appropriate markings.

The logical slot numbering which is a function of the IDSEL signal and the associated address used to select the slot may differ from the physical numbering on the backplanes. When the system slot is on the left of the backplane segment the logical slot numbering is from left to right starting with one. When the system slot is on the right of the backplane segment the logical slot numbering is from right to left beginning with one on the right. The relation between the two numbering systems are shown in Figure 1. All *Kontron Modular Computers'* backplanes follow this scheme.

Note …

The actual on board markings of backplane Pn connectors do not necessarily represent the logical number of the slot.

Figure 1:   **Kontron Modular Computers Slot Numbering (both 3U and 6U boards)**
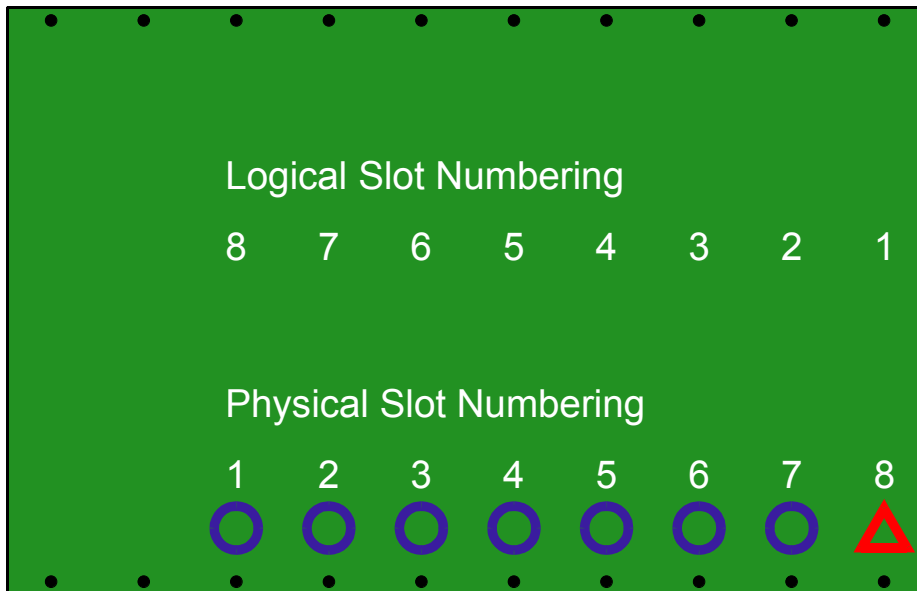
1.2   PCI Bus Extension

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 optmimum 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 using a special bridge module, the implementation of CompactPCI backplanes providing more than 8 slots is possible.

1.3   Distinctive Features

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

- Form factor (height and width)
- Number of slots
- Position of the system slot (primarily to the right)
- Bus resolution
- Bus frequency
- Rear I/O connectivity
- Telephony connectivity
- Hot-swap capability
- Power Supply Connector
- Redundant power supply

- IPMI/IPMB functionality
- Flexible grounding option
- Fan connector
- Drive connector
- Power LED Connector
- PS-ON Connector
- Reset function connector

2.   Clocks

2.1   Clock Assignment

The system slot provides clock signals for all the PCI peripherals in the system including devices on the system slot board. Each peripheral slot is provided with only one clock signal. Clock numbering assignment begins with the slot adjacent to the system slot and is numbered starting from 0.

Figure 2:   Backplane Clock Assignment
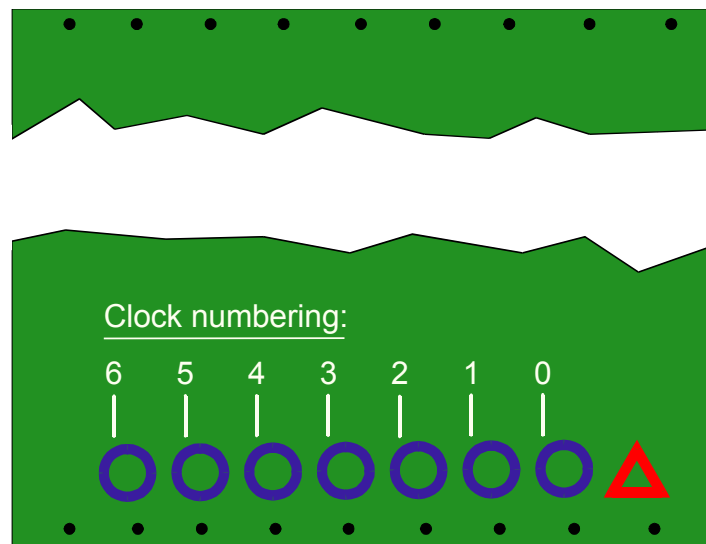
> *Note ...*
>
> The CompactPCI Specification, 2.0, R2.1 requires only five discrete PCI clocks to be available. Backplanes and system controller boards which support R2.1 but not R3.0 do not necessarily support seven PCI clocks. For this reason, it is necessary to refer to the documentation provided with such backplanes or system slot boards to determine the actual clock output and numbering for the system.

2.1.1   Clock Skew

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 as follows.

2.1.2   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 *Kontron Modular Computers'* system design to meet overall system clock skew requirements namely through simulation, testing, and qualification.

2.1.3   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   Power Supply Line Input Connections

Distribution of power supply main input power is a function of the individual backplane. Some backplanes do not have any main input power distribution capability at all whereas others have several possibilities.

Where a given backplane has distribution capability, main input power is either connected directly to the backplane power supply connector or, if available, to a separate LINE IN connector. In both cases, AC as well as DC main input power may be connected depending on the type of power supply to be used.

Refer to the individual backplane documentation for specific information concerning the connection possibilities.

Warning!

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

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

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Warning!

All Kontron Modular Computers' backplanes and power supplies which use the DIN type M power connector use contacts B2 and B5 for AC and DC power supply input power. This differs from the CompactPCI Power Interface Specification which calls for DC power supplies to use contacts B28 and B31 for input power.

This implementation simplifies backplane and power supply design making it possible for a given backplane to use either an AC or a DC power supply.

System integrators, however, must ensure that DC power supplies which comply 100% with the CompactPCI Power Interface Specification for connector pinout are not used with Kontron backplanes which use the DIN type M connector.

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

3.2   Backplane Input Power Distribution

DC input voltage distribution to backplanes is a function of the individual backplane. Input voltage connection capabilities range from single, bolt type, terminal lugs for individual voltage connections to the 47-contact Positronic type PCIH47 connector. The following table summarizes the various types of connectors used. For specific information regarding pinouts of backplane connectors refer to the appropriate product documentation for the backplane in question.

Table 1: Backplane Input Power Connections

CONNECTOR TYPE	DESCRIPTION
Bolt Terminals	Special press-through threaded M3 bolt terminal
Faston/M4	M4 screw connection with and without 6.3mm*0.8mm strip male Faston connectors. Single Faston spade type connectors
ATX	20-contact, male, ATX connector for backplane input power supply on the reverse side of the backplane; the ATX PSUs available on the market are provided with a matching connector.
DIN Type M	32 position, 29-contact, female DIN type M power supply connector for power supply input power and backplane input power
Positronic 47-Contact	47-contact, female, Positronic PCIH47 power supply connector for power supply input power and backplane input power
Power Bar	Copper strapping bar (2.5 mm x 8.1 mm x nn, where nn is function of width and number of backplanes installed in system) This type of power connection is designed for backplanes which have no other type of power connector

The following figures illustrate the various types of connectors used with *Kontron Modular Computers'* backplanes.

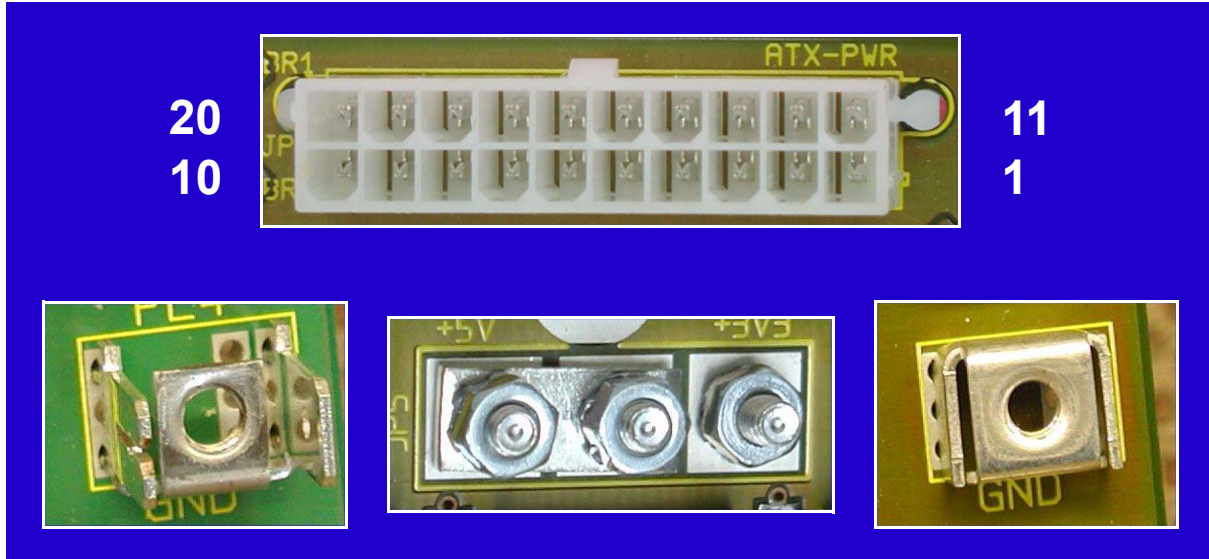**Figure 3:   Bolt Terminal, M4 Screw, Faston/M4, and ATX Connectors**

Figure 4:   Power Bar Connection
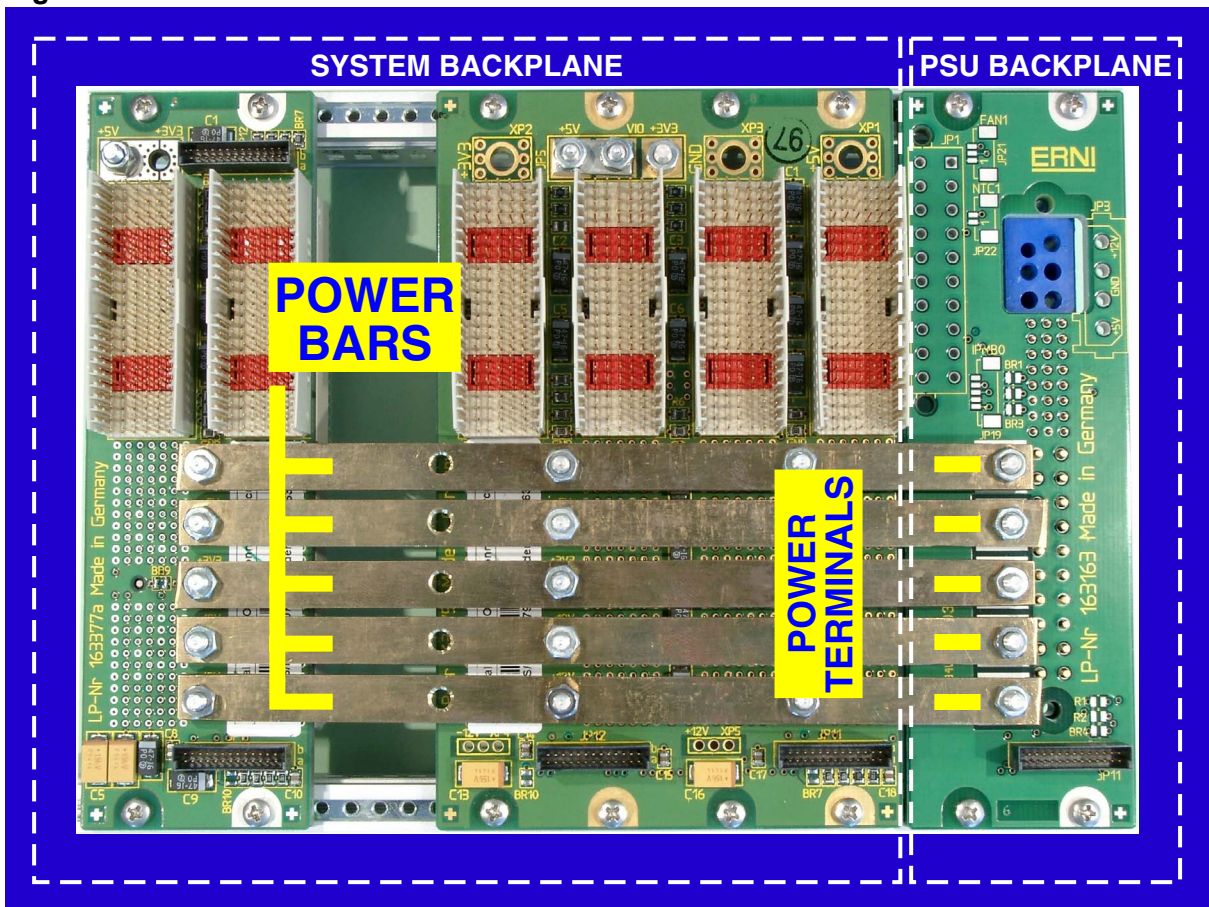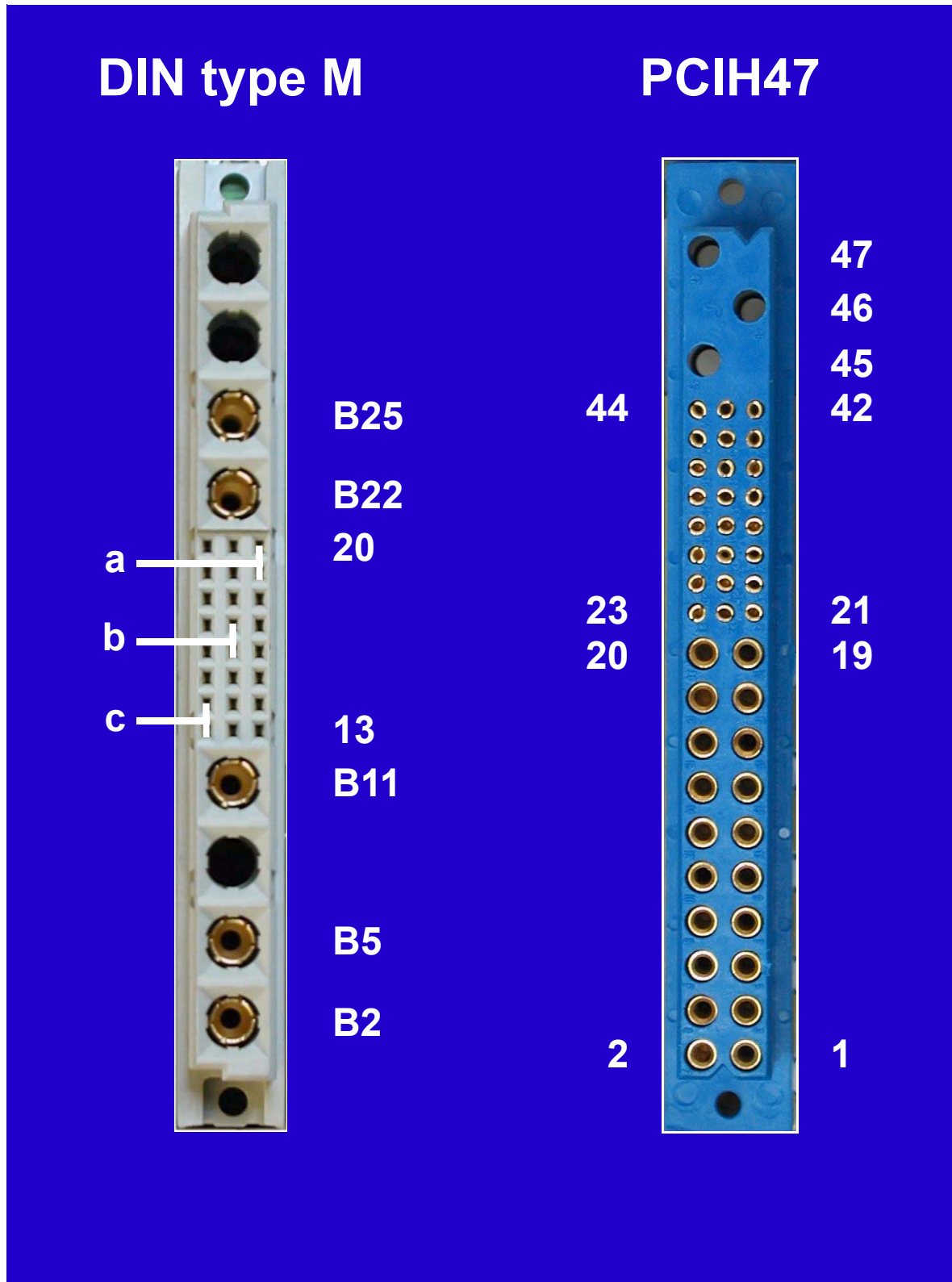
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Figure 5: DIN Type M and Positronic PCIH47 Female Connectors

3.3   Signalling Environment

Each CompactPCI backplane supports a 5V or a 3.3V signaling environment – V(I/O), 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 *Kontron 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 signaling environment. The default setting is 5V.
>
> When changing the signaling environment from 5V to 3.3V or viceversa, 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

Rear I/O capability is a function of the individual backplane. *Kontron Modular Computers* provides both 3U and 6U backplanes with rear I/O functionality. Refer to Table 3 for information regarding the rear I/O capability of Kontron's backplanes. For the exact configuration (slots, connectors, and pinouts) of rear I/O backplanes refer to the appropriate backplane product documentation.

3.5   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.

3.6   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 information concerning split kits and middle bar separation refer to the appropriate product documentation.

3.7 Connector Coding Keys

Figure 6: Backplane/Rack Coding Keys

Kontron 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.
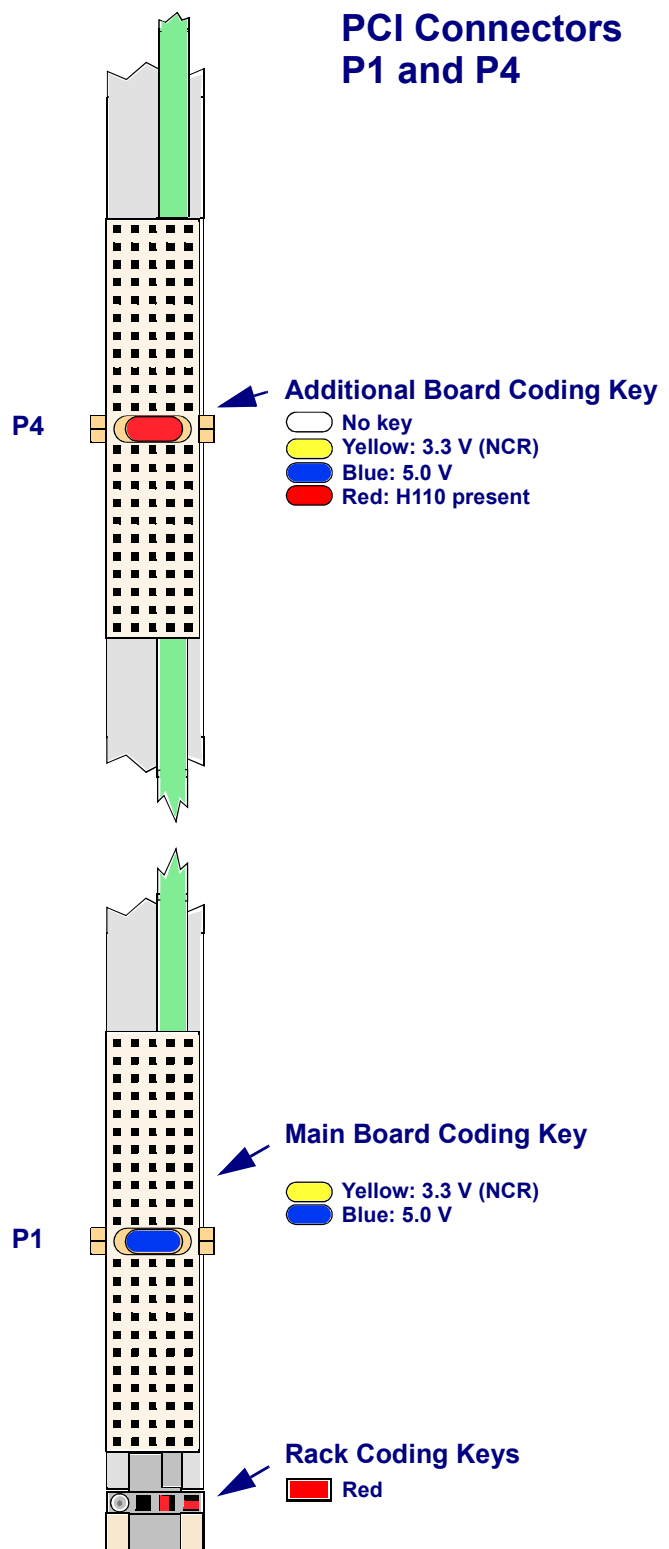
Backplane Keying

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 Backplane 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.

Rack Keying

Boards must be fitted into a CompactPCI 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.

PCI Connectors P1 and P4

P4

Additional Board Coding Key

No key
Yellow: 3.3 V (NCR)
Blue: 5.0 V
Red: H110 present

P1

Main Board Coding Key

Yellow: 3.3 V (NCR)
Blue: 5.0 V

Rack Coding Keys

Red

4. Kontron CompactPCI Standard Backplanes

Table 2: Kontron CompactPCI Standard Backplane Family

Form Factor	Slots*	Power Supply Connector	Backplane
3U	–	Positronic PCIH47 (input) Power Bar (output)	CP-ADAP-P47-PB (3U) (power distribution adapter)
	2	Power Bar	CP3-BP2-PB-RIO
	4	Power Bar	CP3-BP4-PB-RIO
		Faston/M4 Screw	CP3-BP4
		DIN type M	CP3-BP4-M
	5	Power Bar	CP3-BP5M-PB-RIO
		DIN type M	CP3-BP5M-PB-RIO
	6	ATX and Faston/M24 Screw	CP3-BP6-ATX
	8	DIN type M and Faston/M24 Screw	CP3-BP8-M
		DIN type M and Faston/M24 Screw	CP3-BP8-M-RIO
		Positronic PCIH47, Faston/M24 Screw, and Terminal Lugs	CP3-BP8-P47-RIO
	11 (7 and 4)***	DIN type M and ATX	CP3-BP11-M
		Positronic PCIH47 and ATX	CP3-BP11-P47
6U	–	Positronic PCIH47 (input) Power Bar (output)	CP-ADAP-P47-PB (6U) (power distribution adapter)
	4	Power Bar	CP6-BP4-PB-RIO
	8/15**	DIN type M, ATX, and Faston/M24 Screw	CP6-BP8-DUALPCI
	8	DIN type M, ATX, and Faston/M24 Screw	CP6-BP8-H110
		Positronic PCIH47, Faston/M24 Screw, and Terminal Lugs	CP6-BP8-P47-STD
		Positronic PCIH47, Faston/M24 Screw, and Terminal Lugs	CP6-BP8-P47-STD-SL*
		DIN type M, ATX, and Faston/M24 Screw	CP6-BP8-STD

* System slot on all backplanes on the right except for CP6-BP8-P47-STD-SL.
** 8 6U slots or down to 1 6U slot in combination with up to 14 3U slots
*** Dual segment backplane, 7 slots left and 4 slots right.

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Table 3: Kontron CompactPCI Standard Backplanes - Mechanical Characteristics

Backplane	Special Features	Size	Weight
CP-ADAP-P47-PB (3U)	Power distribution adapter	39.64*128.7 mm	77g
CP3-BP2-PB-RIO	Rear I/O connectivity	39.64*128.7 mm	100g
CP3-BP4	—	80.3*128.7 mm	170g
CP3-BP4-M	—	100.7*128.7 mm	165g
CP3-BP4-PB-RIO	Rear I/O connectivity	80.3*128.7 mm	196g
CP3-BP5M-PB-RIO	Rear I/O connectivity	121*128.7 mm	260g
CP3-BP6-ATX	Rear I/O connectivity	120.7*128.7 mm	270g
CP3-BP8-M	Rear I/O connectivity	197.1*128.7 mm	400g
CP3-BP8-M-RIO	Rear I/O connectivity	197.1*128.7 mm	440g
CP3-BP8-P47-RIO	Rear I/O connectivity	202.1*128.7 mm	450g
CP3-BP11-M	Dual Segment: 7/4 slot Rear I/O connectivity	283.0*128.7 mm	700g
CP3-BP11-P47	Dual Segment: 7/4 slot Rear I/O connectivity	283.0*128.7 mm	700g
CP-ADAP-P47-PB (6U)	Power distribution adapter		167g
CP6-BP4-PB-RIO	Rear I/O connectivity		463g
CP6-BP8-DUALPCI	Dual PCI, rear I/O connectivity, hot-swap capability	222.5*262.0 mm	960g
CP6-BP8-H110	H.110, rear I/O connectivity	222.5*262.0 mm	980g
CP6-BP8-P47-STD	Rear I/O connectivity, hot-swap capability	202.2*262.0 mm	986g
CP6-BP8-P47-STD-SL	Rear I/O connectivity, hot-swap capability	202.2*262.0 mm	986g
CP6-BP8-STD	Rear I/O connectivity, hot-swap capability	222.5*262.0 mm	1,000g

5. Product Documentation Organization

The product documentation organization for *Kontron's* CPCI Backplanes is as follows:

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

Item 1 above is represented by this manual which provides generic information about Kontron'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 *Kontron 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. 3.0
- CompactPCI Computer Telephony Specification, V. 2.5, Rev. 1.0
- CompactPCI Power Interface Specification, 2.11 R1.0
- DIN 41612
- ATX Specification

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