

# Scalable without loss of slot Modular CompactPCI Backplanes

By Bernd Eifer and Manfred Schock

*In addition to a comprehensive product range at system level, the success of a modern bus system such as CompactPCI, relies on flexible backplanes and housing systems for plug-in cards and relevant connecting components which can be economically applied. Featuring modular design, CompactPCI backplanes now offer a flexible platform for optional system expansion without the loss of a slot. They utilize a redundant power supply.*

A wide range of standard backplanes for the CompactPCI bus are already available for tele- and data-communication applications, as well as industrial control and automation applications. Comprising backplanes in 3U and 6U sizes with four, six, or even eight slots, the ERNI product range uses a PCI-to-PCI-bridge module. This now makes it possible to use backplanes for applications requiring more than the maximum eight slots of the CompactPCI bus or segment.

In conjunction with a new modular CompactPCI backplane series, the introduction of an eight-slot backplane (6U) puts the emphasis on flexible system expansion without the loss of any slots. The 6U CompactPCI backplane with eight slots and the 6U power backplane of the new, modular CompactPCI backplane series are shown in Figure 1. Enabling the implementation of versions from four to 16 slots in 3U or 6U formats (4, 6, 8, 4+6, 6+6, 6+8, 8+8 slots), the new backplanes are available with either a left-hand or right-hand system slot. This means the backplanes can be cascaded mechanically and electrically without the loss of slots or space. In combination with the power backplanes also available, the new modular backplane series, along with the power supply, can be configured individually for the relevant application.

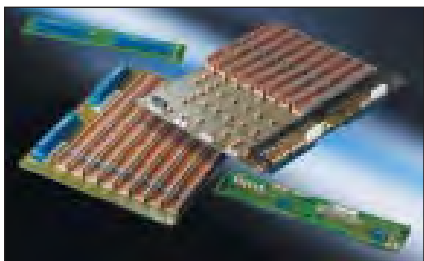


Figure 1

Designed in accordance to the CompactPCI specification PIGMG 2.0 Rev. 3.0, the new backplane represents a complete 64-bit implementation. On the 10-layer backplane, a dedicated clock signal is provided for each peripheral slot. The backplane is fully shielded, with no signals routed along the surface of the printed circuit board (stripline technology). No pallet bridge is required on the backplane, as the PCI resources are optimally used by CPUs with two PCI connections. The principle of the CPU with double CompactPCI interface and two system buses is shown in Figure 2. The drive control signals for the left-hand CompactPCI segment come from the CPU card itself. The second CompactPCI segment is driven from a mezzanine level, offset by one slot to the right. The auxiliary signals (IPMB0, IPMB1, DEG#, FAL#) between the backplanes can be cascaded, as required, by means of a universal ribbon cable. The interconnection from backplane to backplane and backplane to power backplane is made by means of a power bridge, screwed on with nuts and bolts, providing for potential equalization and a power balance between the power supply units.

Moreover, the system provides for hot swap support for plug-in type cards, which implement basic or full hot swap in accordance to the "Hardware Connection

Control" of PICMG 2.1 R 2.0 (Section 4.1.6). In addition, the system management specification, according to PICMG 2.9 R 1.0 (IPMB0 and IPMB1) is fully supported. The backplane is built to fit into DIN 41494 or IEC297-3 and IEEE 1101 racks; the P3, P4, and P5 connectors do not have any electrical connection with the backplane and can therefore be used for rear I/O applications.

Further features of the new modular backplane family are:

- V(I/O) freely selectable: 5V or 3.3V
- Two connectors for fans
- Two connectors for fan control (NTC resistance)
- Two power connectors for disk drive units
- N+1-redundant power supply option
- High signal integrity of the power supplies
- Electrical safety according to EN60950 or IEC950
- Optional stiffening elements for vibration and shock protection

A flexible grounding option, via the mounting holes of the backplane, makes it possible to separate the bus GND and PE of the assembly carrier or to make a connection between them. With half the mounting holes designed as non-conductive holes, there is no electrical connection between GND and housing or PE when only these bolts are used. However, by using the other mounting bolts, a full surface connection is set up as might be required for EMC.

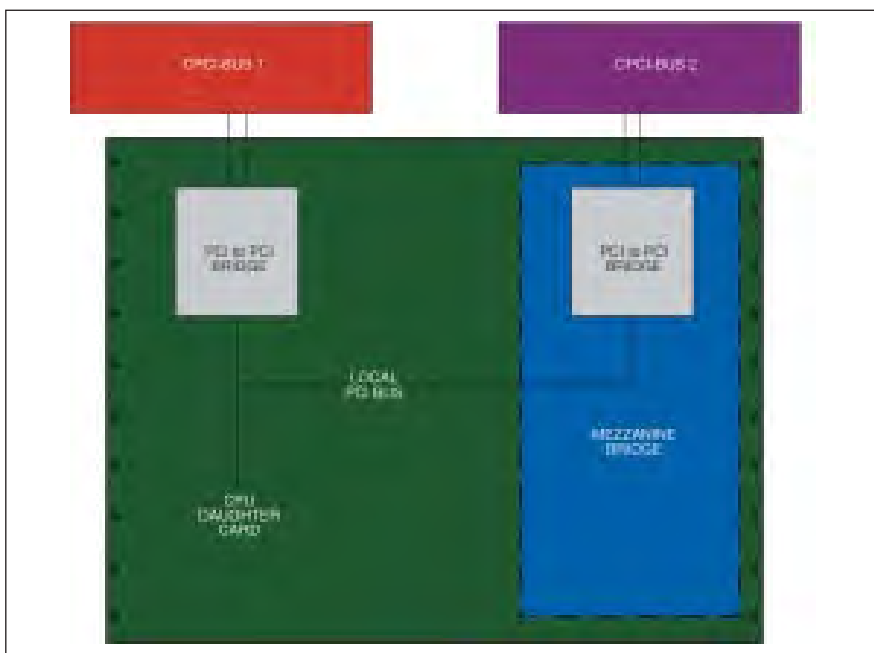


Figure 2

Power backplanes can also be connected to the new CompactPCI backplane with connection being made via a power bridge module to achieve high signal integrity in the power supply. Using 3U power supply units, it is possible to build a redundant power supply system on the 6U bus; with full expansion, using 3U power supply units, an eight-fold power supply redundancy is possible. The power backplane is provided with an additional connector for the system management bus with definable geographic addresses. If, for instance, only a 6U power backplane is used, then this can be populated with either a 6U power supply unit (available up to approximately 350 watts) or with two 3U power supply units (up to 250 watts with redundancy and up to 450 watts without redundancy) one on top of the other. If two eight-slot CompactPCI backplanes, interconnected by a power bridge, are combined with two power backplanes, the following configurations can be achieved: 10 (6+4), 12 (6+6), 14 (6+8), and 16 (8+8) slots, four 6U power supply units (4x 350 watts) or eight 3U power supply units (1400 watts with redundancy or 1200 watts without redundancy). If even higher demands are made on the power supply, then additional power backplanes can be attached. The cascading principle and the configuration possibilities, including the power backplanes are shown in Figure 3.

### Safe transfer

Based on system or space considerations, it is frequently necessary to pass signals across the rear side of the plug-in card or backplane. When replacing modules, this eliminates the need to changeover the front-end cable connections, thus reducing downtime (MTTR). For these mid-plane or rear I/O technologies, a special transfer system has been developed in accordance to IEEE 1101.11. Comprising male connectors with long terminal pins and shield contact rows (16mm in length throughout), the transfer system also incorporates a shroud system for various printed circuit board thickness' and different module types.

The ERmet transfer system is characterized by the special design of relevant shrouds. On one hand they allow long axial guidance of the long terminal pins, so that inclined positions are excluded. On the other hand, they provide secure fixing of the shroud to the rear of the backplane as the locking elements are pre-latched in the shroud and can be engaged into their final position with an audible click, using a simple assembly tool.

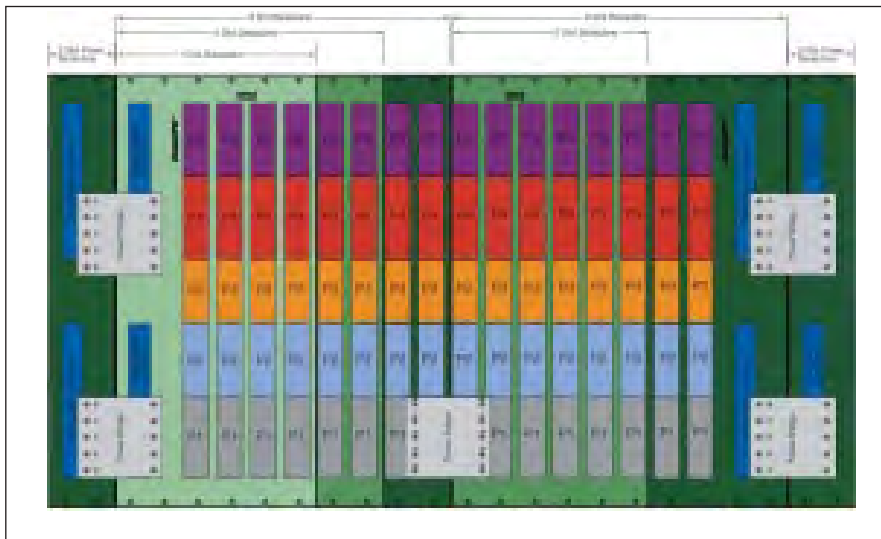


Figure 3

For a secure and guided plug-in on the rear side of the backplane, the use of AB shrouds and AB female connectors on P3 and P5 are recommended. These integrate, in a single connector, all the B-module contacts and A-module guide elements.

### Complete systems

In addition to backplane design, assembly and testing, ERNI also supplies complete systems in profile and sheet bending technology according to customer requirements.

The fan and power supply unit integration includes final test of the complete system and is a component part of ERNI's system solutions. Custom designs can include an economic ventilator slide-in unit solution. In this way, the customer obtains a modular, expandable system where additional ventilation elements can simply be retrofitted or replaced as required. A complete 4HE CompactPCI system, including the CompactPCI backplane with horizontal slots for the plug-in cards designed by ERNI, is shown in Figure 4.



Figure 4

### Expansion

For CompactPCI system expansion beyond the standard eight slots, or for signal transfer via the backplane (rear I/O),

appropriate board-to-board connectors are required. As the PICMG 2.0 CompactPCI specification limits CompactPCI systems to eight slots for one bus segment, two or even more PCI bus segments must be bridged for larger CompactPCI systems (as described in the PCI-to-PCI-Bridge Architecture Specification 1.1). For this bridging, the ERmet female connectors are used in a 2.0 mm pattern straight design. Using a CompactPCI bridge module, a 3U backplane with 11 slots has also been implemented. Here, the four slots of the first segment operate at 66 MHz with full 64-bit implementation, while the remaining seven slots are designed for 33 MHz (32-bit). Six of the slots feature rear I/O functionality.

### Summary

Modular and scalable backplanes, together with corresponding connector solutions, provide economical and rational rack system configurations for CompactPCI or other industrial bus systems, which are customized for their respective tasks. However, in many cases, customers demand more than just individual component supply, and there is a clear customer trend towards pre-configured sub systems or even complete customer-specific solutions. Appropriate system know-how is therefore increasingly being demanded from component manufacturers.



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## Backplanes

Company/Model	Web site/Product	Hot Swap	H.110	Switched Fabric	Slots	3.3 Volt	5 Volt	Rear I/O	Ruggedized	Serial Mesh	PICMG 2.16 Ethernet	Operating Temp. (°C)	Form Factor	NEBS compliant	Alarm Module	Custom Design	
<b>Aberdeen</b>		<a href="http://www.aberdeeninc.com">www.aberdeeninc.com</a>															
NuPRO HPCI-19S18 PCI/PC	Full-size backplane	x	x	x													
<b>Advantech Network Computing</b>		<a href="http://www.advantech.com">www.advantech.com</a>															
N/A	Backplane integrated into enclosures	x	x		2-14	x		x	x		x	0 to 50	6U	x	x	x	
<b>APW Electronic Solutions</b>		<a href="http://www.apw.com">www.apw.com</a>															
441-651114	3U/6U cPCI backplanes	x			4/6/8	x	x	x				-20 to 85	3U/6U			x	
441-662324	6U cPCI telephony backplanes	x	x		4/6/8	x	x	x				-20 to 85	6U			x	
445-684116	3U/6U cPCI backplanes				4/6/8	x	x	x				-20 to 85	3U/6U			x	
CPSB21R0	2.16 EtherPlane backplane	x	x	x	15/21	x	x	x			x	-20 to 85	6U			x	
Horizon HZNC4D64T2430ASR	3U/6U Horizon backplanes				4/6/8	x	x	x				-20 to 85	3U/6U			x	
Titan TTNC82R64D302ASR	3U/6U Titan backplanes				4/6/8	x	x	x				-20 to 85	3U/6U			x	
Vanguard VAN9U82002ASR	3U/6U Vanguard backplanes				4/6/8	x	x	x				-20 to 85	3U/6U			x	
<b>Bustronic</b>		<a href="http://www.bustronic.com">www.bustronic.com</a>															
106GIGAXXX	GigaBridge HA backplane	x	x	x	12	x	x	x					6U			x	
106STARXXX	PICMG 2.16 backplanes	x	x	x	17	x	x	x			x		6U			x	
105CPSXXX	PICMG 2.16 backplanes			x	Various	x	x	x			x		6U			x	
102CPCI608	6U backplane	x											6U				
104CTEL608	H.110 backplanes	x	x		2-8												
102CPCI608	6U backplanes	x			2-21								6U				
105CPCI702	7U backplanes	x			2/4								7U				
105CTEL702	7U H.110 backplanes	x	x		2/4								7U				
106STAR621	StarFabric prototype backplanes			x	21												
106CPSB616	cPSB backplanes			x	Various												
102CPXI608	6U cPCI w/PXI backplanes	x			8								6U				
102CPCI308	3U backplanes	x			4/6/8								3U				
105CPCI616	6U, 16-slot backplane	x											6U				
105CTEL616	6U, 16-slot H.110 backplane	x	x										6U				
<b>CG Mupac</b>		<a href="http://www.gavazzi-mupac.com">www.gavazzi-mupac.com</a>															
Fabricpac 6851	Fabricpac	x	x					x			x						x
P Series	cPCI backplanes - left justified	x	x														
R Series	cPCI backplanes - right justified	x	x														
<b>Dage Group</b>		<a href="http://www.dage-group.com">www.dage-group.com</a>															
N/A	Custom design	x	x	x													
<b>Dawn VME Products</b>		<a href="http://www.dawnvme.com">www.dawnvme.com</a>															
06-101108X	6U cPCI backplane	x			2-8	x	x					-65 to 105	6U			x	
06-101109X	3U cPCI backplane	x			2-8	x	x					-65 to 105	6U			x	
06-101129X-Y	6U cPCI telephony backplane	x	x		2-8	x	x					-65 to 105	6U			x	
06-10118X	3U cPCI backplane	x			2-8	x	x					-65 to 105	3U			x	
06-10119X-Y	6U cPCI backplane	x			2-8	x	x					-65 to 105	6U			x	
<b>ELMA Electronic</b>		<a href="http://www.elma.com">www.elma.com</a>															
69-CE	6U cPCI backplane	x											6U				
69CH	6U computer telephony backplane		x										6U				
69-CPS216	cPSB			x													
<b>Ganymed Computer</b>		<a href="http://www.ganymed.com">www.ganymed.com</a>															
11078	8-slot backplane	x	x		8	x	x	x	x			5 to 40	6U		x	x	
11079	16-slot backplane	x	x		16	x	x	x	x			5 to 40	6U		x	x	

continued on next page

Company/Model	Web site/Product	Hot Swap	H.110	Switched Fabric	Slots	3.3 Volt	5 Volt	Rear I/O	Ruggedized	Serial Mesh	PICMG 2.16 Ethernet	Operating Temp. (°C)	Form Factor	NEBS compliant	Alarm Module	Custom Design	
<b>Hartmann Elektronik</b>	<b>www.hartmann-elektronik.de</b>																
33RA083314	3HE, 8-slot backplane	x			8								3U				x
33RAXX3314	3U, 2-21-slot backplane	x			2-21								3U				
36RA088514	6U, 8-slot telephony backplane	x	x		8								6U				
36RAXX3314	6U, 2-8-slot backplane	x			2-8								6U				
<b>Hybricon</b>	<b>www.hybricon.com</b>																
B024	2.16 packet switching backplane	x	x	x													
B024-6314	14-slot hot swap/H.110 backplane	x	x		14												
B024-63x	Hot swap/H.110 backplane	x	x														
<b>I-Bus/Phoenix</b>	<b>www.ibus.com</b>																
OSS-BP-6U-14-H110-P47	14-slot H.110 backplane	x	x		14	x	x	x	x			-20 to 85	6U		x	x	
OSS-BP-6U-14-H110-P47	16-slot H.110 backplane	x	x		16	x	x	x	x			-20 to 85	6U	x	x	x	
<b>Inova Computers</b>	<b>www.inova-computers.com</b>																
ICP-BPL-1M30	1-slot, 3.3V backplane w/rear I/O	x			1	x		x									
ICP-BPL-2M30	2-slot, 3.3V backplane w/rear I/O	x			2	x		x									
ICP-BPL-3M30	3-slot, 3.3V backplane w/rear I/O	x			3	x		x									
ICP-BPL-4M30	4-slot, 3.3V backplane w/rear I/O	x			4	x		x									
ICP-BPL-5M30	5-slot, 3.3V backplane w/rear I/O	x			5	x		x									
ICP-BPL-6M30	6-slot, 3.3V backplane w/rear I/O	x			6	x		x									
ICP-BPL-7M30	7-slot, 3.3V backplane w/rear I/O	x			7	x		x									
ICP-BPL-8M30	8-slot, 3.3V backplane w/rear I/O	x			8	x		x									
ICP-BPL-1M50	1-slot, 5V backplane w/rear I/O	x			1		x	x									
ICP-BPL-2M50	2-slot, 5V backplane w/rear I/O	x			2		x	x									
ICP-BPL-3M50	3-slot, 5V backplane w/rear I/O	x			3		x	x									
ICP-BPL-4M50	4-slot, 5V backplane w/rear I/O	x			4		x	x									
ICP-BPL-5M50	5-slot, 5V backplane w/rear I/O	x			5		x	x									
ICP-BPL-6M50	6-slot, 5V backplane w/rear I/O	x			6		x	x									
ICP-BPL-7M50	7-slot, 5V backplane w/rear I/O	x			7		x	x									
ICP-BPL-8M50	8-slot, 5V backplane w/rear I/O	x			8		x	x									
ICP-BPL-AM30	8+2-slot, 3.3V backplane	x			8+2	x		x									
ICP-BPL-AM31	8+2-slot, 3.3V backplane	x			8+2	x		x									
ICP-BPL-7M31	3.3V backplane w/rear I/O	x			7	x		x									
ICP-BPL-8M31	3.3V backplane w/rear I/O	x			8	x		x									
ICP-BPL-7M51	5V backplane w/rear I/O	x			7		x	x									
ICP-BPL-BM30	4-slot, 3.3V backplane	x			4	x											
ICP-BPL-BM50	4-slot, 5V backplane	x			4		x										
ICP-BPL-0M00	PSU M-connector, ATX, power rail	x			0												
<b>Kaparel</b>	<b>www.kaparel.com</b>																
PS1220 Series	3U power supply backplanes	x											3U				
PS1240 Series	6U x 16HP power supply backplanes	x											6U				
PS1250 Series	6U x 8HP power supply backplanes	x	x										6U				
PS1260 Series	6U x 24HP power supply backplanes	x											6U				
PS1300 Series	3U modular backplanes	x			2-8								3U				
PS1400 Series	6U modular backplanes	x			2-8								6U				
PS1400B Series	6U modular backplanes	x											6U				
PS4400 Series	6U modular cPCI/H.110 backplanes	x	x										6U				
PS4400B Series	6U cPCI/H.110 modular backplanes	x	x										6U				
PS4700 Series	Horizontal chassis backplanes	x	x	x	2-8	x		x			x		1U-4U			x	

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# Backplanes

Company/Model	Web site/Product	Hot Swap	H.110	Switched Fabric	Slots	3.3 Volt	5 Volt	Rear I/O	Ruggedized	Serial Mesh	PICMG 2.16 Ethernet	Operating Temp. (°C)	Form Factor	NEBS compliant	Alarm Module	Custom Design
<b>Kaparel cont.</b>	<a href="http://www.kaparel.com">www.kaparel.com</a>															
PS4800 Series	StarFabric backplanes			x												
PS4900 Series	2.16 backplanes	x	x													
<b>Knurr USA</b>	<a href="http://www.knurr.com">www.knurr.com</a>															
CPCI 3U Series	3U backplane	x			4-8	x	x	x	x			-20 to 85	3U			x
CPCI 6U Series	6U backplane	x	x	x	4-8	x	x	x	x		x	-20 to 85	6U	x	x	x
<b>Kontron</b>	<a href="http://www.kontron.com">www.kontron.com</a>															
CP3-BP11	3U, 11-slot backplane	x			11	x	x	x	x			-40 to 85	3U			
CP3-BP4	3U, 4-slot backplane				4	x	x		x			-40 to 85	3U			
CP3-BP8-M	3U, 8-slot backplane w/M-connector	x			8	x	x	x	x			-40 to 85	3U			
CP3-BP8-M-RIO	3U backplane w/P2 rear I/O	x			8	x	x	x	x			-40 to 85	3U			
CP6-BP8-H110	6U backplane w/telephony bus	x	x		8	x	x	x	x			-40 to 85	6U			
CP6-BP8-P47-STD	Backplane w/rear I/O support	x			8	x	x	x	x			-40 to 85	6U			
CP6-BP8-STD	Backplane w/rear I/O support	x			8	x	x	x	x			-40 to 85	6U			
<b>Miltron/Mektron Systems</b>	<a href="http://www.mektron.co.uk">www.mektron.co.uk</a>															
N/A	Backplanes	x	x						x							
<b>One Stop Systems</b>	<a href="http://www.onestopsystems.com">www.onestopsystems.com</a>															
OSS-BP-3U-01-P47	1-slot backplane w/P47 connectors	x			1	x	x					-20 to 85	3U			x
OSS-BP-3U-04-ATX	Backplane w/P47 connectors, ATX	x			4	x	x	x				-20 to 85	3U			x
OSS-BP-3U-04-P47	4-slot backplane w/P47 connectors	x			4	x	x					-20 to 85	3U			x
OSS-BP-3U-06	6-slot backplane (RH)	x			6	x	x					-20 to 85	3U			x
OSS-BP-3U-07-M	7-slot backplane w/M connector (RH)	x			7	x	x					-20 to 85	3U			x
OSS-BP-3U-08	8-slot backplane (RH)	x			8	x	x					-20 to 85	3U			x
OSS-BP-3U-08-L	8-slot backplane (LH)	x			8	x	x					-20 to 85	3U			x
OSS-BP-3U-20-BI	20-slot burn-in backplane	x			20	x	x					-20 to 85	3U			x
OSS-BP-6U-02-L	2-slot backplane w/rear I/O	x			2	x	x	x				-20 to 85	6U		x	
OSS-BP-6U-03-L	3-slot backplane w/rear I/O	x			3	x	x	x				-20 to 85	6U			x
OSS-BP-6U-04	4-slot backplane w/rear I/O (RH)	x			4	x	x	x				-20 to 85	6U			x
OSS-BP-6U-04-L	4-slot backplane w/rear I/O (RH)	x			4	x	x	x				-20 to 85	6U			x
OSS-BP-6U-05	5-slot backplane w/rear I/O (RH)	x			5	x	x	x				-20 to 85				x
OSS-PSBP-3U-P47-1	20-slot burn-in backplane	x			20	x	x					-20 to 85	3U			x
OSS-PSBP-3U-P47-2	PS backplane w/2 P47 connectors	x			2	x	x					-20 to 85	3U			x
OSS-PSBP-6U-P47-2	PS backplane w/2 P47 connectors	x			2	x	x					-20 to 85	6U			x
<b>Pentair Electronic Packaging</b>	<a href="http://www.pentair-ep.com">www.pentair-ep.com</a>															
23006-548 to 678	8-slot backplanes	x			8								3U/6U			
23006-custom	H.110, Switched Fabric, user I/O	x	x	x												
<b>Polyrack</b>	<a href="http://www.polyrack.com">www.polyrack.com</a>															
64230003	3U backplane	x											3U			
64230023	6U backplane	x											6U			
<b>Twin Industries</b>	<a href="http://www.twinhunter.com">www.twinhunter.com</a>															
2000-6U-BPNL	6U backplane												6U			
2000-BPNL-8	3U backplane												3U			
<b>Vector Electronics</b>	<a href="http://www.vectorelect.com">www.vectorelect.com</a>															
CPCIBP8-6	8-slot, 6U backplane	x			8	x	x	x				-20 to 70	6U			x
<b>VMIC</b>	<a href="http://www.vmic.com">www.vmic.com</a>															
VMICPCI-P301	6U backplane w/ATX power connector	x											6U			
VMICPCI-P302	Backplane w/screw terminal connector	x				x	x									
VMICPCI-P303	Telephony H.110 backplane w/ATX	x	x													