MECHANICAL CONSIDERATIONS
FOR COMPACTPCI AND H.110 COMPUTER TELEPHONY APPLICATIONS
REVISED 16 APRIL 1999

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ABSTRACT

The CompactPCI bus architecture lends itself to computer telephony applications. The 6U-160 Eurocard subrack dimensions integrate well into 19" and 23" Bellcore Network Equipment Building Specification (NEBS) equipment racks. The Euro-card subrack also provides a defined structure to allow a 6U-160 mm subrack to be divided, allowing a CompactPCI system to control a larger Enterprise Computer Telephony Forum (ECTF) H.110 TDM bus. A combination of 3U-160mm and 6U-160mm cards may make up the complete system. The IEC 61076-4-101 2mm H.M. connector system is particularly compatible with such systems and provides increased density and electrical performance over the established DIN 41612 family of 2.54 mm connectors that were originally designed as part of the Euro-card subrack system. Finally, the PCI Industrial Computer Manufacturer's Group (PICMG) telecom subcommittee has defined special versions of the 2mm connector to meet IEC 950 safety considerations, future hot swap requirements and other needs of the public telephone network. These special connector features include, split shields, depopulated pin fields, rear I/O versions and a combination of early mate and late mate pins for sequential mating.

BACKGROUND

One of the most dramatic and thrilling aspects of the CompactPCI bus architecture has been the enthusiastic response of the telecommunication industry. This bus was originally conceived by its inventors as an upgrade path for the STD bus architecture. The STD bus was an older Intel based bus that was used primarily for instrumentation and control applications. However, since the late seventies when the STD bus was developed, much faster versions of the Intel microprocessor have come to dominate the office environment. Intel X86 based systems continue to offer an attractive price / performance combination. In addition, Windows9X and WindowsNT are well established as the operating system of choice for client and server applications within today's office environment. Desktop PCI is now a part of every Intel based desktop PC. This makes the PCI bus a relevant platform for computer telephony applications which can merge various telecom applications such as voice mail, fax on demand, interactive call response, and wireless paging at the office desktop.

Two trade associations jointly developed bus architecture standards to support computer telephony applications on CompactPCI. The PICMG, which is the standards developing body for CompactPCI, has a completed a Telephony Specification for CompactPCI. In addition, the ECTF has developed the H.100 bus which combines the SCSA architecture with the MVIP architecture. The implementation of H.100 on CompactPCI is known as H.110. This standard was defined by a group of telecom and computer telephony providers many of whom are also members of the PICMG as well as the ECTF.

The desktop PCI architecture, as implemented within an Intel PC motherboard, had a number of limitations such as serviceability, cooling and limited slot count. For these reasons, CompactPCI was developed by the PICMG. This new mechanical packaging scheme and higher performance backplane solved these problems while still using the electrical and logical architecture of the popular PCI bus. The principal features of this new architecture were: the use of existing PCI silicon, the Euro-card subrack (IEC 297.3 / IEEE 1101.10), IEC 61076-4-101 connectors, an advanced backplane design with 20.32 (0.8") spacing, 8 slots and provisions for extensive rear panel I/O. The original desktop PCI card is shown in figure 6 and can be compared with the 6U Euro-card shown in figure 5. The size of a 3U Euro-card is shown as a subset of the 6U drawing.

SUBRACK DESIGN AND NEBS

Mean time between failure" (MBTF) and serviceability are two of the most important design considerations for the telecommunications industry. The Euro-card subrack (IEEE 1101) provides for the precise alignment of daughter cards, an efficient cooling path, a well supported backplane and a front removable daughter card arrangement. Recently the IEEE 1101.10 specification was developed as an extension to the existing IEEE 1101 specification. This new improvement to the Euro-card subrack system offers improved front panel EMI/RFI shielding, heavy duty card injector/extractors, front panel keying, and a front panel ground path for static dissipation. The new injectors/ejectors were needed to handle the insertion and withdrawal forces of higher density connectors. The features of the new IEEE 1101.10 front panel are shown in figure 4.

The Bellcore NEBS document (formerly TR-NWT-000063) defines equipment racks and mounting requirements consistent with the IEEE 1101.10 standard in a narrow 12.5" deep subrack. The 3U-160 mm and 6U-160 mm card sizes (100 mm x 160 mm and 233.34 mm x 160 mm respectively), specified by CompactPCI, fit easily into this shallow subrack depth. A typical divided Euro-card subrack is shown in figure 1. A typical EIA 310D rack mounted enclosure incorporating a Euro-card subrack is shown in figure 2.

A CompactPCI card can be either 3U or 6U. As mentioned previously, one of the design accomplishments of CompactPCI was to extend the PCI bus to eight slots from the original maximum of four slots. There is no such limitation on the number of slots permitted in a H.110 application. In fact, it is likely that when a CompactPCI system supports a set of H.110 cards, a variety of card size combinations and arrangements will be possible. Figure 3 depicts such a possible arrangement. The configuration shown, is not an actual system but shows how a six slot CompactPCI card set might support up to 20 H.110 3U cards including one 6U H.110 bridge card. The flexible, Euro-card subrack system allows an almost endless number of practical combinations.

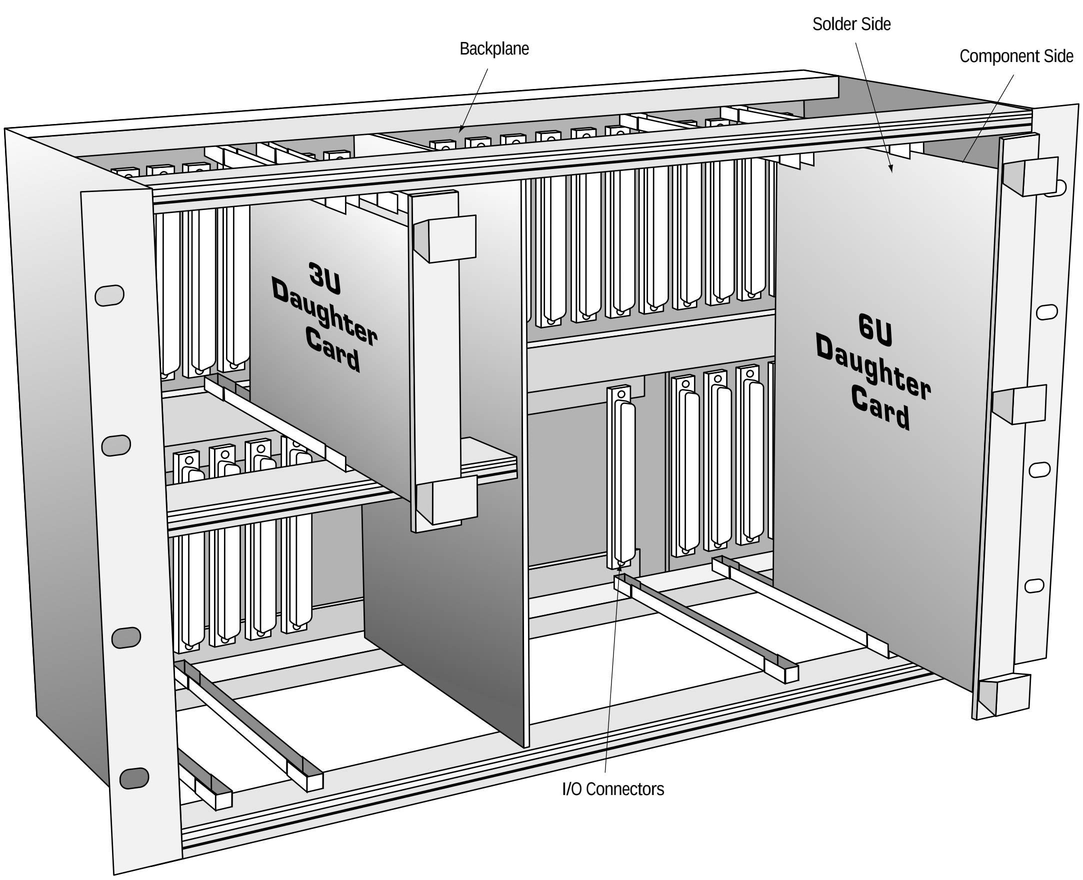


Figure 1: Euro-card Subrack For 19” Rack Mounting

Figure 2: Typical Telecom Enclosure

Figure 3: Possible Combination Of CompactPCI and H.110 In A 6U Subrack

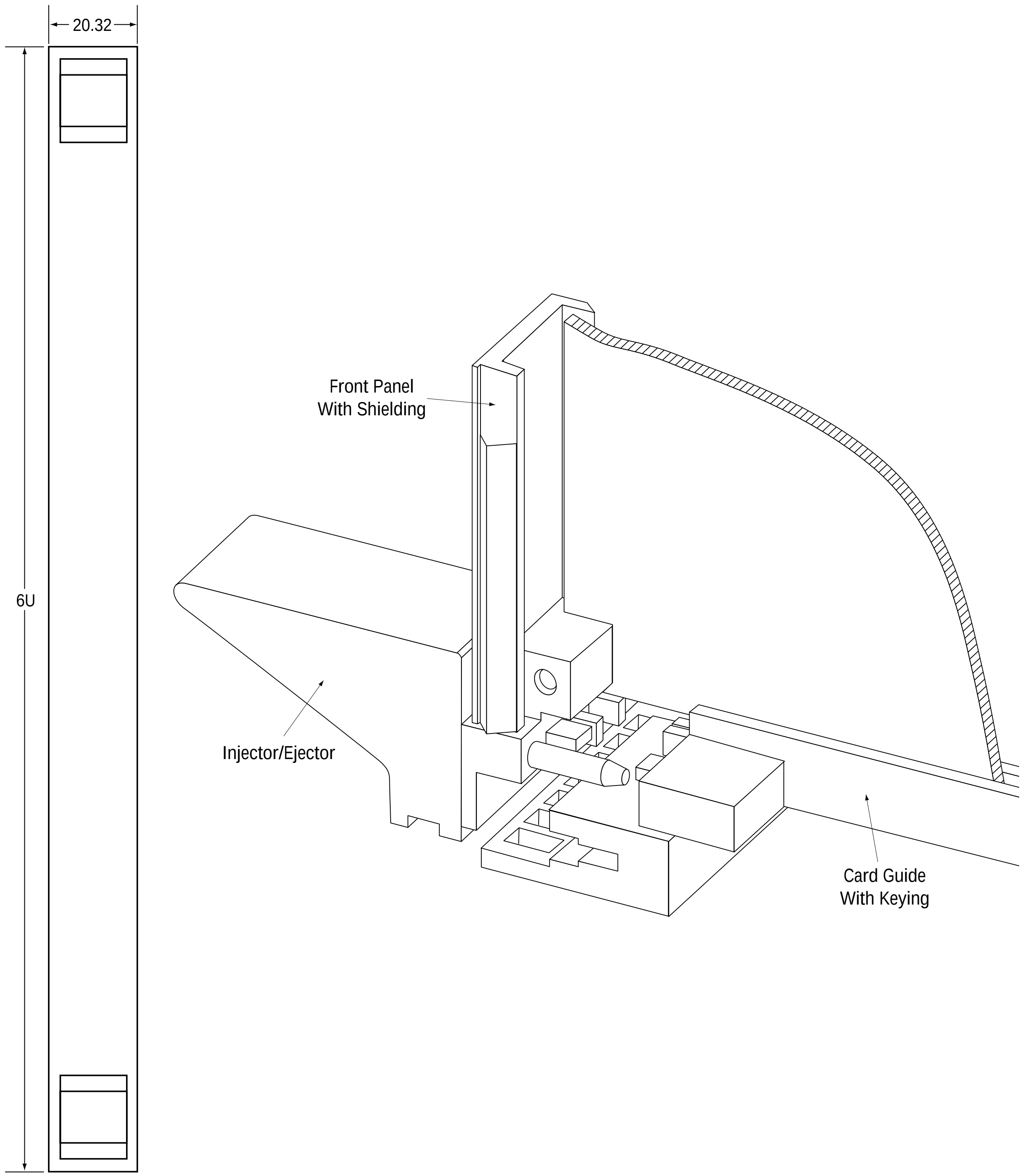


Figure 4: Front Panel And Card Guide In Accordance With IEEE 1101.10

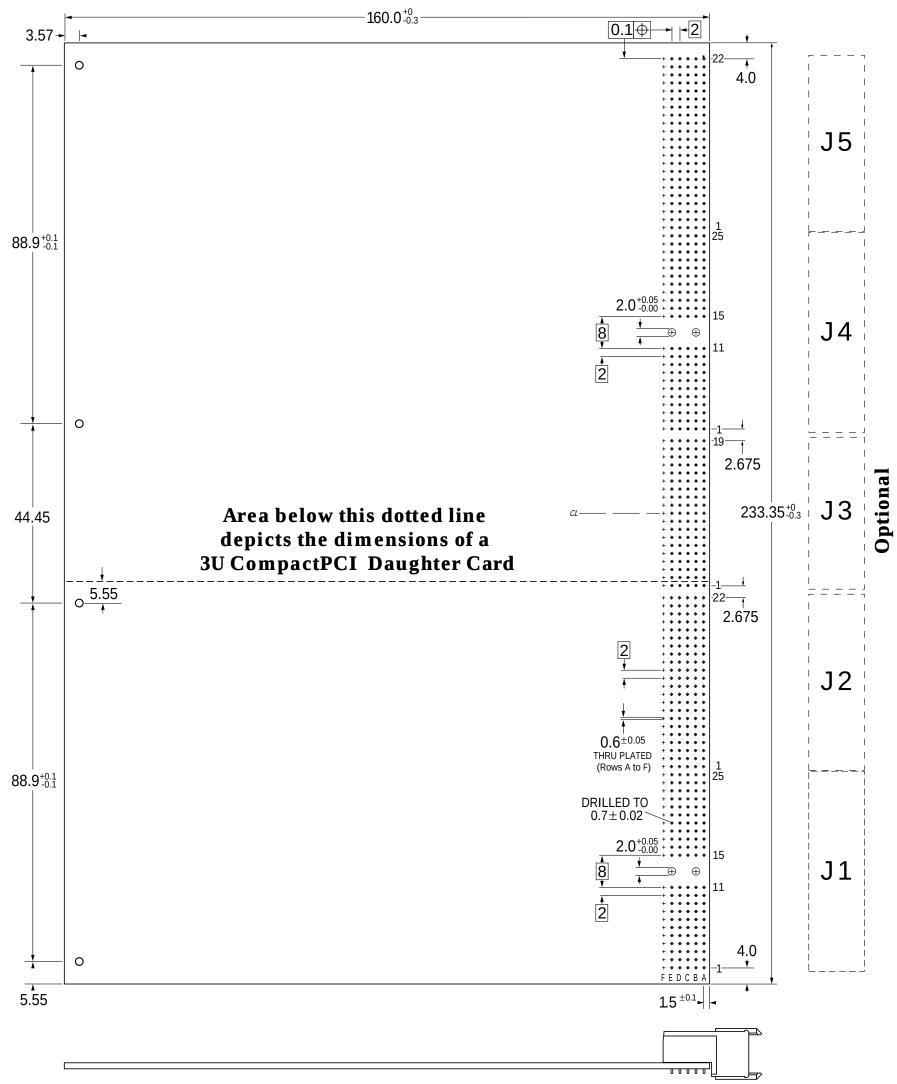


Figure 5: 6U CompactPCI Daughter Card (Euro-card Style)

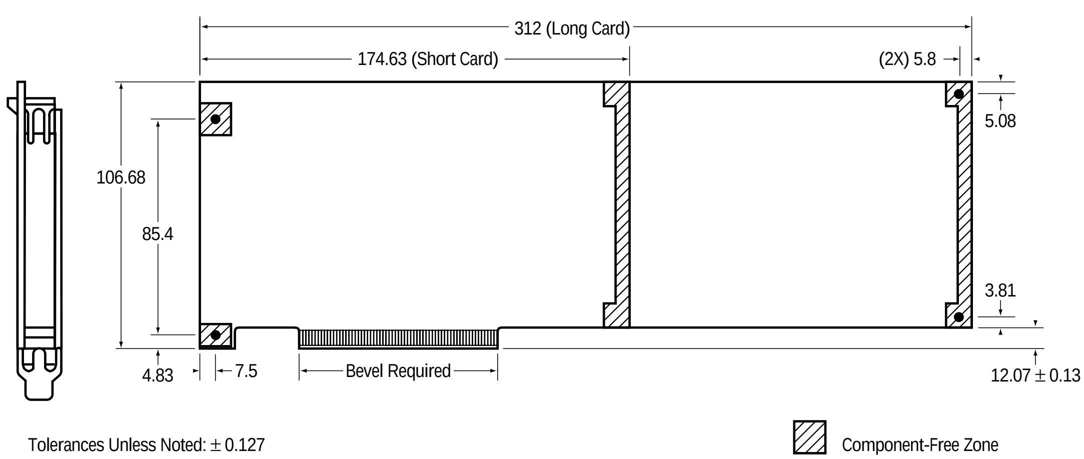


Figure 6: Desktop PCI Daughter Card (PC-AT Style)

CONNECTOR

The IEC 61076-4-101 2mm H.M. connector was chosen for the CompactPCI specification due to its pin density, electrical performance, shielding features, coding and compatibility with the 12.5 mm mating condition of the Eurocard subrack. In a typical 6U high (10.5" rack height, 233.34 mm card height) CompactPCI Telecom card definition there are 5 possible rear mounted connectors. On the daughter card they are numbered from the bottom up as J1, J2, J3, J4 and J5. Figure 5 shows the layout of a typical 6U CompactPCI daughter card. The J1, J2, and J3 connectors are defined by PICMG 2.0 R2.1 CompactPCI Core specification. The J4 and J5 have special features defined by the PICMG 2.5 R1.0 Computer Telephony specification. These features were necessary to accommodate special safety requirements defined within IEC 950 and other special requirements of the H.110 bus. Such features as 48VDC system voltage (Telephone Network Voltages TNV) for such functions as tip and ring routing, and Safety Extra Low Voltages (SELV) for other logic functions. Pin lengths for sequential mating for future live insertion requirements are also provided. A split shield on the J4 connector was necessary to maintain the proper isolation between low voltage logic (typically 5.0 VDC) and the public network tip and ring voltages (48 VDC). This connector is shown in figure 7. Some contacts within the J4 connector have been removed to maintain the required isolation In addition, additional isolation between the shield of the J4 and J5 connector is also assured by trimming the top of the J4 shield by .5 mm.

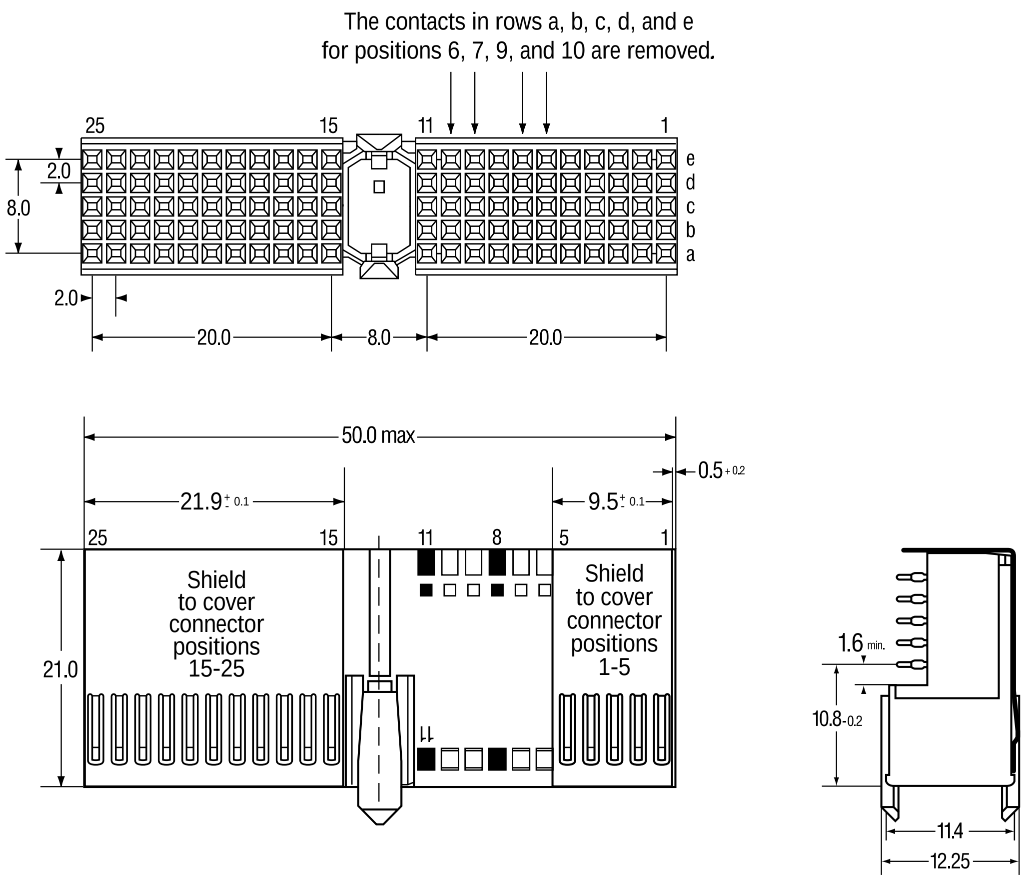


Figure 7: J4 CompactPCI Telecom Connector with split shield (ERNI P/N 104512)
(numbering in accordance with the PICMG CompactPCI specification)

On the backplane the connectors are similarly numbered from the bottom up as P1, P2, P3, P4 and P5. As above, the connectors P1, P2 and P3 are defined within PICMG 2.0 R2.1 CompactPCI Core specification. The P4 and P5 connectors are specifically defined within the PICMG 2.5 R1.0 Computer Telephony specification and depicted below (see figures 8 and 9). Note that C pins mate 1.5 mm before B pins and A pins are the shortest and mate 1.5 after the B pins. Also note that specific pins have been omitted in the J4 connector in the areas where corresponding wafers have been omitted within the J4 female daughter card connector.

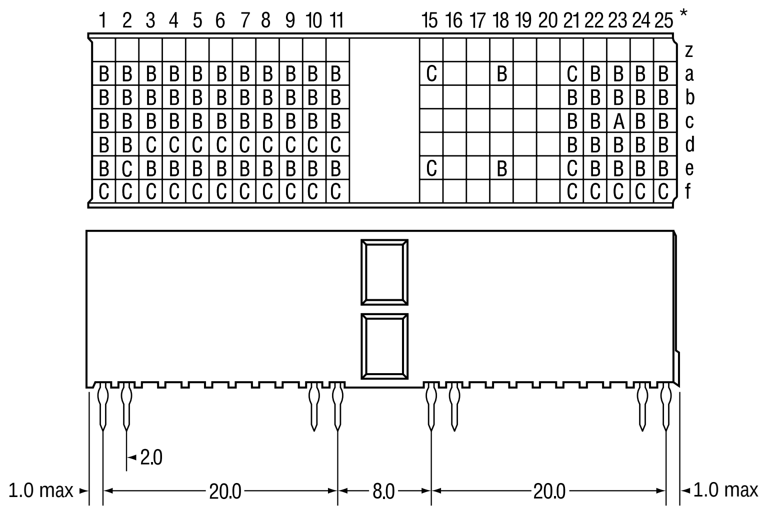
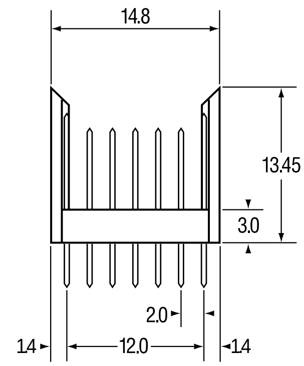


Figure 8: P4 CompactPCI Telecom Connector
(ERNI P/N 923160)



End of CompactPCI P4/P5
Telecom Connector

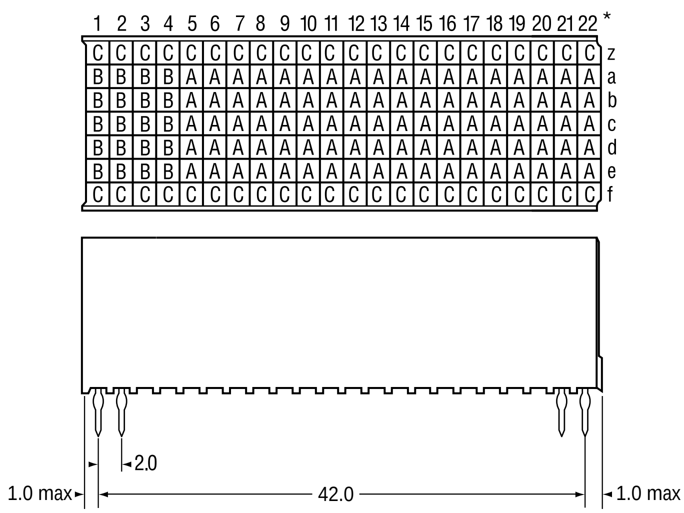


Figure 9: P5 CompactPCI Telecom Connector
(ERNI P/N 923162)

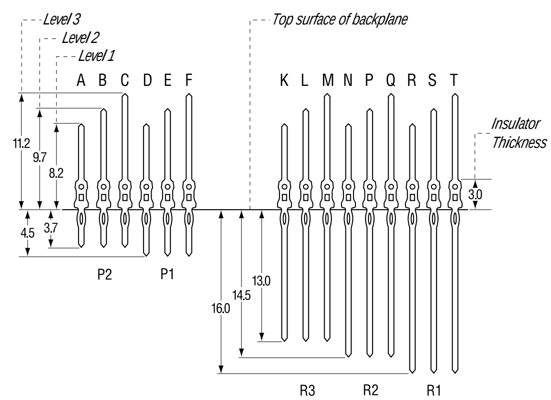


Figure 10: Pin Dimensions for P1/P4/P5
Backplane Connectors Shown Here

REAR I/O PROBLEM - THE AB SOLUTION

After the release of the PICMG 2.0 R2.1 CompactPCI Core Specification and during the development of the PICMG 2.5 R1.0 Computer Telephony (CT) Specification, an issue arose with regards to rear I/O boards to be used with telephony backplanes.

The PICMG CT specification provided that the P3 and P5 connectors are to be used for I/O and that the P4 connector is used for the systems bus. Furthermore, the simulation stipulated that the P4 connector not support rear plug in cards due to a limit on stub capacitance and inductance. The rP3 and rP5 (rear shrouds in the P3 and P5 positions) were Type B connectors with no central service module for pre-alignment. Therefore, during mating, rear CT cards would often stub during insertion due to misalignment.

The solution that the subcommittee arrived at was to develop a new connector type known as the Type AB. This connector was created by adding the pre-alignment pins of a type A to the outside of the envelope of a type B connector. ERNI was the first connector company to complete the tooling for this new connector and shroud. This Type AB connector will fit existing rear CT transition card positions rJ3 and rJ5. New Type AB

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* The numbering in figures 8, 9 and 11 conform to the CompactPCI specification, not the IEC-1076-4-101 standard.

shrouds are now required for the rP3 and rP5 CT backplane positions. These parts are required and described in the PICMG 2.5 R1.0 CT Specification and are intended to become required in revision 3.0 of the PICMG Core specification which is now being proposed. This means that long terminal (feed-thru) backplane connectors installed in CT backplane positions P3 and P5 must be “AB Compatible.” Due to the design of the AB shrouds, some long terminals in the area of the prealignment pins must be short to accept the AB shrouds without interference. Existing long pins can be clipped in these specific locations and new backplanes should call out the correct part numbers for the new AB Compatible male connectors in positions P3 and P5. This is a wise precaution for all 6U CompactPCI backplanes not just CT style backplanes. If the P2 is a long terminal connector, it would be wise to utilize AB Compatible male connectors and shrouds in that position as well.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
																			z
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	a
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	b
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	c
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	d
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	e
T	T	T	T	T	T	T	T	C	C	C	T	T	T	T	T	T	T	T	f

Figure 11: B19 male - AB compatible for Telecom P3
(ERNI P/N 923346)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
T	T	T	T	T	T	T	T	C	C	C	T	T	T	T	T	T	T	T	z
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	a
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	b
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	c
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	d
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	e
T	T	T	T	T	T	T	T	C	C	C	T	T	T	T	T	T	T	T	f

Figure 11a: B19 male - AB compatible with z row pins
(ERNI P/N 923341)

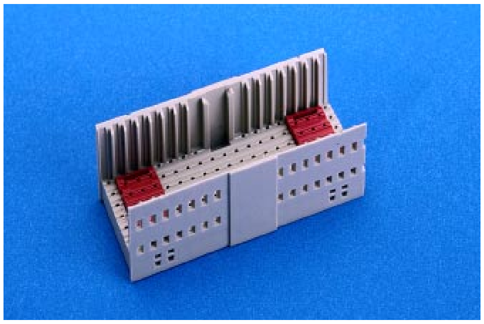


Figure 12: AB19 shroud for rP3
(ERNI P/N 114486)

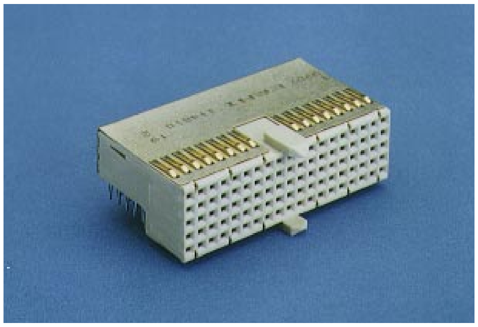


Figure 13: AB 19 female for rJ3 transition cards
(ERNI P/N 114810)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
																						z
S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	a
S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	b
S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	c
S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	d
S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	e
T	T	T	T	T	T	T	T	T	T	C	C	T	T	T	T	T	T	T	T	T	T	f

Figure 14: B22 male - AB compatible for Telecom P5
(ERNI P/N 923339)

* The numbering in figures 11, 11a and 14 conform to the CompactPCI specification, not the IEC-1076-4-101 standard.

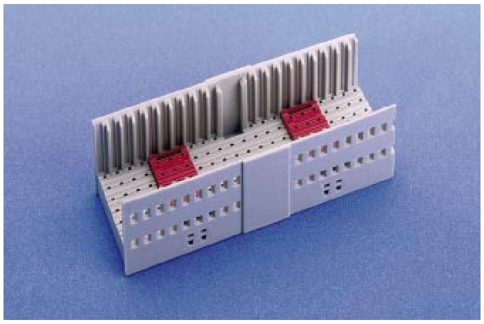


Figure 15: AB22 shroud for rP5
(ERNI P/N 114428)

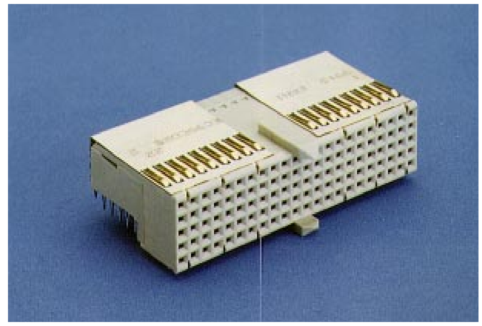


Figure 16: AB22 female for rJ5 transition cards.
(ERNI P/N 114809)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
z																						
a	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
b	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
c	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
d	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
e	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
f	T	T	T	T	T	T	T	T	T	T	C	C	T	T	T	T	T	T	T	T	T	T

Figure 17: B22 male - AB compatible for General Purpose P5
(ERNI P/N 923345)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
z	T	T	T	T	T	T	T	T	T	T	C	C	T	T	T	T	T	T	T	T	T	T
a	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
b	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
c	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
d	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
e	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
f	T	T	T	T	T	T	T	T	T	T	C	C	T	T	T	T	T	T	T	T	T	T

Figure 17a: B22 male - AB compatible with z row pins
(ERNI P/N 923340)

	1	2	3	4	5	6	7	8	9	10	11	15	16	17	18	19	20	21	22	23	24	25 *
z	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
a	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
b	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	B	B	B	B	B	B	B
c	B	B	B	C	B	C	B	B	B	B	B	B	B	B	B	B	B	B	C	B	C	B
d	B	B	C	B	C	B	C	B	C	B	C	A	B	C	B	C	B	B	B	C	B	B
e	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
f	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

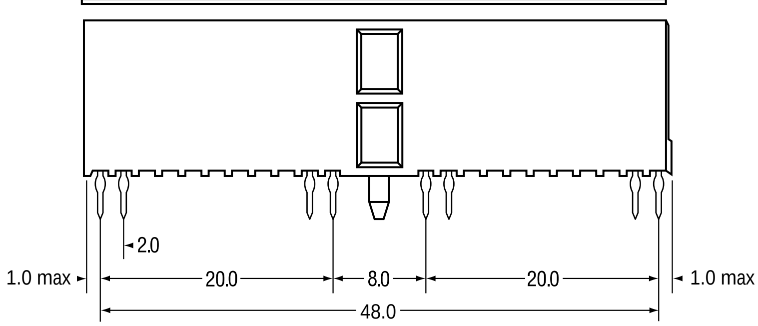
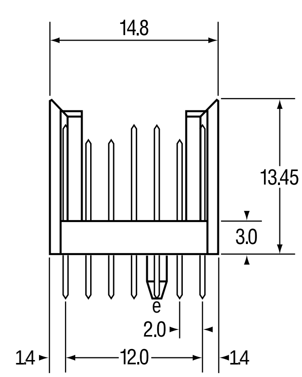


Figure 18: CompactPCI P1 Connector (Hot Swap Compatible)
(ERNI P/N 923190)



End View of
Proposed New CompactPCI
P1 Connector

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* The numbering in figures 17, 17a and 18 conform to the CompactPCI specification, not the IEC-1076-4-101 standard.

The keying system utilized for CompactPCI is shown in Figure 12. These color coded plastic keys are available in over 70 different colors and mating configurations. Two have been identified to discriminate between 5.0 and 3.3 volt CompactPCI cards. Integrators may define additional colors for other unique cards which need to be excluded from general CompactPCI slots. These coding pieces are available from several suppliers and are completely interchangeable. The colors are standardized by the European agency: RAL-Farbkartenvertrieb.

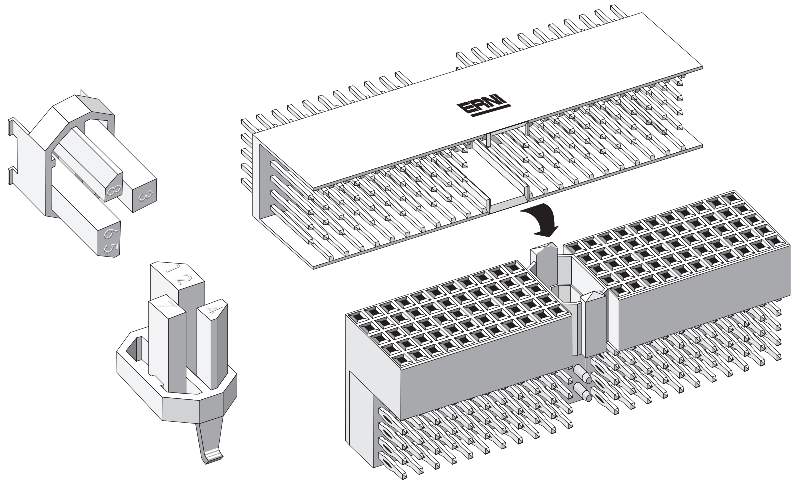

Figure 19: IEC 1076-4-101 Coding System Utilized For CompactPCI P1/J1 And P4/J4 Connectors

CONCLUSION

In conclusion, the Computer Telephony Specification has defined specific hardware requirements beyond the requirements of the CompactPCI core specification. The connector requirements for P4/J4 support the H.110 Computer Telephony bus as defined by the ECTF. This P4/J4 connector combination supports both isolated voltages as well as early-mate and late-mate pins. The P5 connector provides a combination of early-mate and late-mate pin lengths to support system I/O and future live insertion requirements. In addition, Type AB shrouds and connectors are required for rear transition cards in the rP3/rJ3 and rP5/rJ5 positions. Although CompactPCI defines a bus architecture limited to 8 slots, it will likely be combined with the H.110 Computer Telephony bus in a great variety of card sizes and subrack configurations. The domination of Windows95 and WindowsNT in the office network makes a Computer Telephony bus based on the PCI architecture a logical partner for CompactPCI.

Michael Munroe is the Product Manager at ERNI for the ERmet 2mm H.M. connector family. With 12 years of experience in the packaging and interconnect industry, Mr. Munroe has contributed many industry articles published in such magazines as *I&CS*, *VITA Journal*, *OEM Magazine*, *Futurebus+ Design*, *Connector Specifier*, *Electronic Products* and *Electronic Design*.

Mr. Munroe is a former vice-chair of the VITA Standards Organization. He continues to play an active role in the PICMG, VITA, and VME64 Extension committees and is a professional member of the IEEE.

Mr. Munroe lives in Chesterfield, Virginia with his wife Julie and their three sons.
