

# **Parsytec CC Series**

**(Hardware-Documentation)**

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## 1. Overview

The Parsytec CC System architecture is based on the integration of fully functional, individual, PC or PowerPC compatible processor nodes into a parallel computer system. Every node may have its own disc as well as other standard IO units. Each node contains a high-speed communications interface to accommodate the creation of networks. The network can be created as an ATM LAN with direct connections or over a network router connections that has a link speed of up to 1 GBit/s.

Parsytec CC Systems have two types of nodes. P-nodes are optimized for processing whereas IO-nodes are optimized for adaptation to a variety of input-output options. The network-router is a physically independent unit. It can handle up to 8 links and can be cascaded within the network.

All modules: P, IO, R, and NT (power supply) are fully encapsulated 6U modules of individual widths which plug into a standard 19" card rack.

The modular system concept offers the flexibility to select and configure exactly those modules needed for a particular application.

Examples of different CC architecture models:

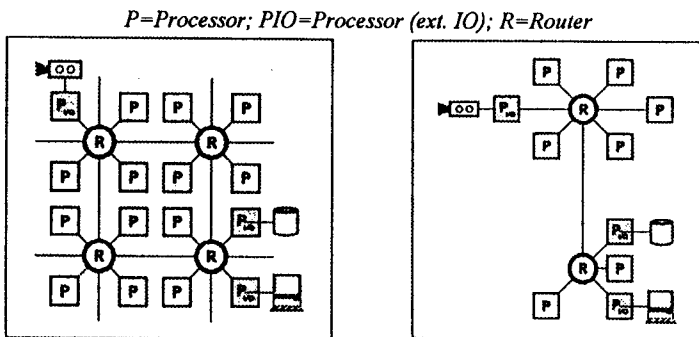


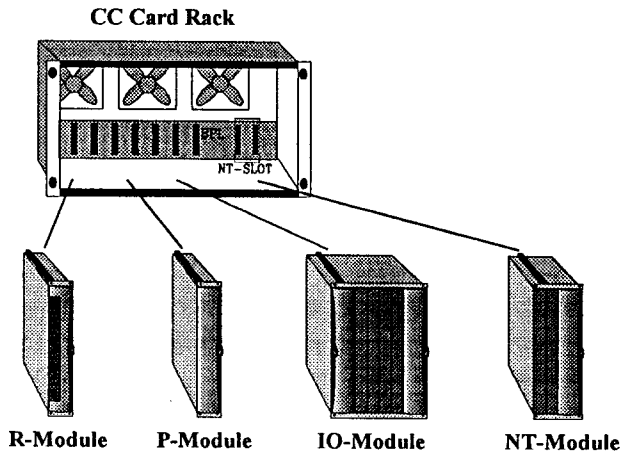
Fig.1

Fig.2

Parsytec CC systems hardware is realized in a modular "building block" fashion that includes the enclosures employed. This insures a maximum of system adaptability to application specific requirements. Systems are configured with the following components:

- case and module organization
- control structure
- processor boards
- communications interfaces
- optional products for the PCI bus

Modules are constructed as 6U cassettes which plug into a 6U card rack to form a system. The card rack conforms to standard 19" rack mount dimensions. A fixed backplane in the rear of the card rack electrically integrates the modules. The backplane provides the power and control net connections to each CC System card slot.

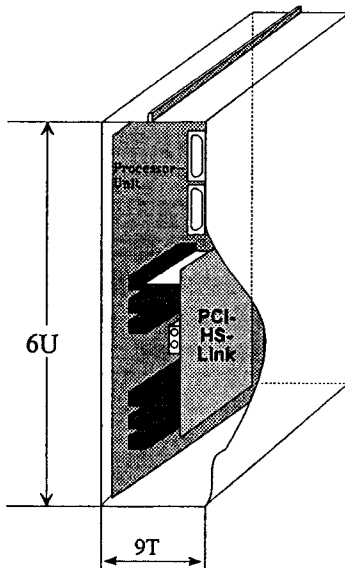


*Fig. 3: Modular construction of a Parsytec CC system*

When configuring a custom CC System the modules may be arranged in any order. Variation is only limited by the fixed position reserved for the NT-module (power supply) and the total of 7 available slots in the card rack.

The HS-link (HS=high speed) is the primary means of communications between CC modules. Highly flexible, thin coaxial cables routed along the card rack front side provide for the HS-link

interconnections. The Parsytec HS/PCI interface and the HS-link hardware router are the major components of this communication technique. The HS/PCI interface is a PCI plug-in card that is connected to a P- or IO- module's processor by inserting it into a standard PCI card slot (see Fig. 4).



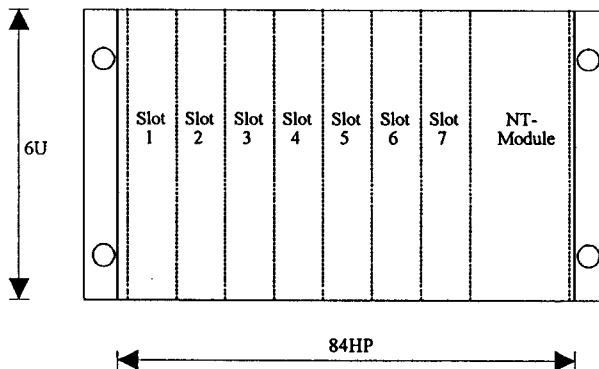
*Fig. 4: Integrating the HS/PCI interface into a P-module*

The HS/PCI plug-in card and the HS-link hardware router are the inter-module communication components of a Parsytec CC System. The router is a physically separate system unit that is integrated as the R-module.

## 2. CC System Components

### 2.1 The CC Card Rack

The Parsytec CC System is an autonomous unit at the card rack level. The CC card rack subsystem provides the system with its infrastructure which includes power supply and cooling as well as protection from spurious EMI via its physical shell. The system is configured as a standard 19" rack mountable unit which accepts the various 6U plug-in modules. This modularity allows a flexible configuration of seven, physically identical, 9HP wide slots (1HP  $\approx$  5.08 mm). Each slot has its own connector which is integrated into a backplane within the card rack. The flexibility of this design ensures that the CC system can be configured accurately to the demands of the application.



*Fig. 5: Front view of the CC card rack*

The power supply unit (NT module) has a width of 18HP, as shown in Fig. 5, and must be plugged into its specific location in the card rack. The router module is plugged into slot 1 in

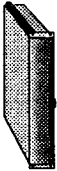
standard configurations. This selection is not mandatory but rather has simply proved to be the optimal position in installed systems. The card rack's depth is 430mm.

## 2.2 CC Computer Modules

A Parsytec CC system consists of a variable number of individual computer modules that are selected on the basis of application requirements. Each module is self-contained in an encapsulating metal housing. This design provides EMI protection, a maximum of flexibility for the system integrator, ease of handling, and simple maintenance. CC modules are assembled without screws. Mechanical stability and internal module framework are achieved through the use of special polypropylin inlays. Air channels in the inlays are central to the innovative cooling design. These air channels are fabricated in such a manner as to guarantee optimal cooling of individual components and thereby avoid "hot spots".

Customer specific CC systems are assembled from combinations of the following four module types:

### I. P-Module



Module	Function	Features	Interfaces	Dimensions	Power Requirem.
P-module	processing node	1x PReP (PowerPC 604) 1x HS/PCI-Card	1 x HS/PCI-Interface 1x Ethernet( <i>on board</i> ) 1x RS-232 ( <i>on board</i> ) 1x control net	6 U / 9 HP (233 x 45 x 355) mm	max. 50 W

*Front side connections::*

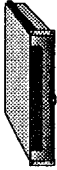
- HS-Link-In: SMB coaxial connector, marked black
- HS-Link-Out: SMB coaxial connector, marked red
- Ethernet: Twisted pair connector (*10Base-T*)

*Rear connector:*

- backplane connector for power, control net, RS232



## II. R-Module



Module	Function	Features	Interfaces	Dimensions	Power Requirem.
Router-Module	active routing cross-bar switch	8 way router	8x HS-Link 1x control net	6 U / 9 HP (233 x 45 x 355) mm	max. 40 W

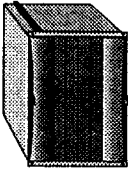
*Front side connections:*

- 8 HS-Link-In: SMB coaxial connectors, marked black
- 8 HS-Link-Out: SMB coaxial connectors, marked red
- arranged and numbered (1...8) as 8 In/Out pairs

*Rear connector:*

- backplane connector for power and control net

### III. IO-Module



Module	Function	Features	Interfaces	Dimensions	Power Requirem.
IO-Module	processing node with expanded IO-capabilities (e.g. Entry-Node)	2x PReP (PowerPC 604) 2x HS/PCI-Card optional: 2x 2,5"- or 2x 3,5"-harddisc	2x HS/PCI-Interface 2x Ethernet ( <i>on board</i> ) 2x RS-232 ( <i>on board</i> ) 2x SCSI-2 ( <i>on board</i> ) 2x 2 PCI-Slots 2x control net	6 U / 36 HP (233 x 180 x 355) mm	max. 120 W

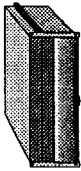
*Front side connections:*

- 2 HS-Link In: SMB coaxial connectors, marked black
- 2 HS-Link Out: SMB coaxial connectors, marked red
- 2 Ethernet: Twisted pair connectors (*10Base-T*)
- 4 PCI slots for optional customer specific or standard PCI expansion cards

*Rear connector:*

- backplane connector for power, control net, RS232

#### IV. NT-Module



Module	Function	Features	Interfaces	Dimensions	Power output
NT-module	power supply	supplies up to 7 modules	control net	6 U / 18 HP (233 x90 x 355) mm	600 W

- Front side connections:*
- standby power switch
  - power on switch
  - 2 TMC fuses (A & B)  
(Fuse A, Fuse B)

- LED indicators:*
- AC Good A, AC Good B  
DC Good A, DC Good B
  - reset switch

- Rear connector:*
- backplane connector for power and control net

P- and IO- modules are always coupled by way of an R-module. Communication devices, customer unique interfaces and standard PCI interfaces are attached to given processor nodes by inserting an appropriate interface card into the selected module. A P-module accepts only its own HS/PCI interface card whereas an IO-module contains two free PCI slots per node (see Fig. 6). Any expansion card that conforms to the Standard-PCI specification may be integrated in these free slots.

If PCI-Short-Form cards are used there is enough space for either 2.5" or 3.5" hard disk mass storage units for each of the two IO-module nodes. PCI cards that exceed the short-form format allow only the use of 2.5" hard disks.

Expansion units of the following types are foreseeable:

- Ethernet/PCI interface with 10BaseT/BNC/AUI connectors as add-on (in addition to the 10BaseT connection mounted on board of every processor node)
- SCSI-2 bus as standard DSUB connector (optional Fast or Fast Wide SCSI) that can be integrated with in a CC IO-module PCI slot
- any customer specified PCI plug-in card on any free PCI slot of an IO module
- Parsytec HS-link/PCI interface as high speed communication unit
- OS-link/PCI interface for attachment to transputer networks (T4/T8)
- Framegrabber/PCI interfaces for connecting various standard cameras (S/W, grey-scale, colour, digital)

Optionally a control net, proprietary to CC systems, is available for system monitoring, control and diagnostic purposes. This control net can be plugged onto the backplane of the CC when needed. The RS232 interfaces (1 per backplane slot) as well as all related connections of the control net are accessible from the rear wall of the CC card rack (see Fig. 7a).

### 3. Creating a CC System

#### 3.1 CC System Configuration

Parsytec CC parallel computer systems are based on a MIMD architecture with local memory. The processing node communication channels of a system with N processors are interconnected with active routing elements (8 way routing). Parsytec CC systems may be as small as a single card rack or as a cascaded system of a multiple of such card racks to form an individually tailored parallel computer system. The size and structure of individual systems is dependent upon the required computer performance and application architecture. Fig. 6 shows a typical Parsytec CC system hardware configuration. It consists of an Ethernet hub, an R-module (optional), 2-3 P-modules, an IO module and an NT-module which supplies power for the entire CC card rack.

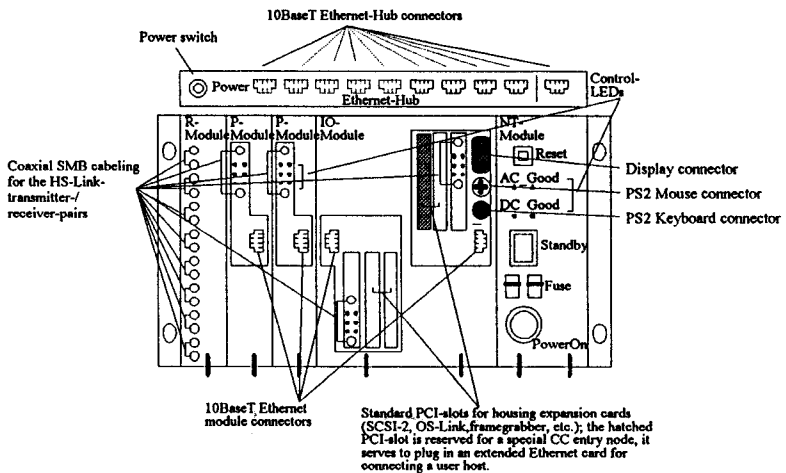
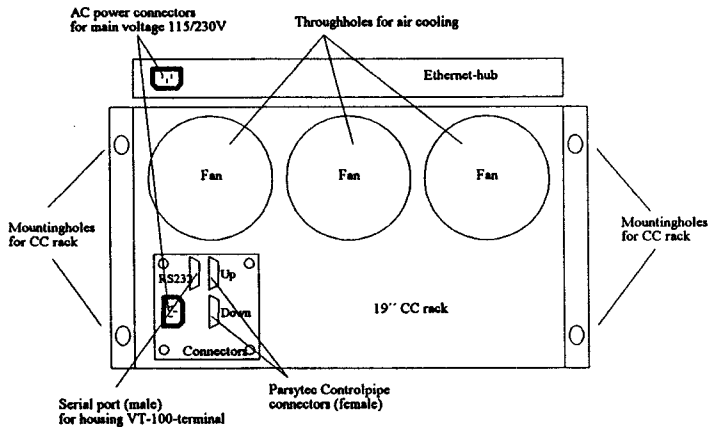


Fig. 6: Integrating a specific architecture model into a 19" CC rack (front view)

The Ethernet hub is used to connect, via twisted pair Ethernet cable (10BaseT), all of the existing computer nodes within the parallel computer system and, when applicable, also an additional system host.

The HS-Link based network router, integrated into the R-module, can be connected to every participant in the HS-link network. It also offers the possibility of cascading multiple individual CC card racks or, indeed, even large independent CC systems (see Fig. 9).

Parsytec CC systems are cooled with ambient air moved horizontally, from front to rear, by fans mounted in the rear wall of the card rack. Air enters through the hole pattern in the module front bezels and exits through the three fan apertures at the rear of the card rack (see Fig. 7a and 7b). The CC system can be configured with or without a parallel Parsytec controlstructure. Fig. 7a shows the rear of a card rack with a controlstructure integrated, fig. 7b is delivered without controlstructure. Please check your CC system order to determine, whether a controlstructure is used or not.



*Fig. 7a: Rear view of a 19" CC card rack with controlstructure*

In addition to the vent holes for CC rack cooling, the card rack's rear chassis wall contains a connector field. This field contains connectors for the proprietary control net (if installed), a serial interface and an RFI protected, ground isolated, power inlet.

Via the serial interface the system operator has access to the Entry-nodes of the CC system for configuration and installation purposes. Connecting a VT100-terminal to the CC gives direct access to the serial port of the installed Entry-node in the I/O-module (see chapter 3.4). By programming the controlboard, the system operator has access to all processing nodes in the corresponding rack. Please refer to the documentation "Controlstructure of the CC" for further information.

The power supply has a wide-range primary input. Input power can be selected (115V or 230V, AC), without any system modification, allowing the power supply to be used with all common source voltages compliant to general power requirements. A single CC card rack, of a multi-rack system, can also be powered on or off, during on-going operation of the system. This feature significantly eases maintenance and service operations.

The function of the control net is to provide information about the condition of the entire CC system infrastructure, e.g. power supplies and processing nodes. These control net functions are executed without involving any processing node resources. Beyond these pure monitoring functions, it is also possible (from an independent control processor, the C-node) to initiate other special actions.

Mechanisms implemented within the scope of the control net are as follows:

- shut-down of an individual power supply
- diagnose of the system and its modules
- reset of individual components
- initialization and supervision of communications systems

The control net gains access to all modules of a CC card rack via its connections in the backplane of the card rack. This applies to processor modules as well as router and power supply modules. The special logic that permits the processing modules to initiate contact with the control net and also allows the control net to monitor temperature, execute a reset and monitor the HS/PCI interface is located on the HS/PCI interface card. The router module has the same functionality. The power supply module contains a power off mechanisms, which can be activated from the controlnode on dangerous conditions.

If no parallel Parsytec controlstructure is integrated, the rear connectorfield of the CC racks has two serial connectors and a power plug (see fig. 7b.).

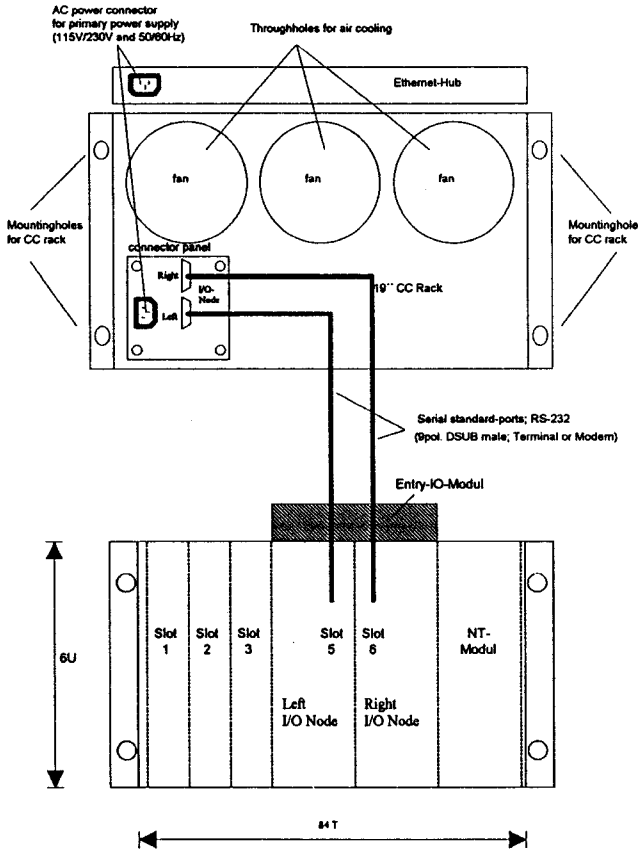


Fig. 7b: Rear view of a 19" CC card rack without controlstructure

The upper serial 9-pin RS232 connector is directly connected to the serial port of the right I/O CC node of the I/O-Module located in the CC rack (Slot 6). The lower serial 9-pin RS232 connector is directly connected to the serial port of the left I/O CC node of the I/O-Module located in the CC rack (Slot 5). For configuration purposes only a VT100-terminal with a terminal emulation program has to be connected to the serial port of the Entry-node (see chapter 3.4 for terminal installation and configuration).



### 3.2 Coupling the CC System to Ethernet

Host access to a CC system is decoupled from the CC systems own Ethernet by an additional Ethernet/PCI card which must be inserted into a pre-defined slot of the IO-module. Connection between host and, such a configured, entry node may be made with BNC, AUI or 10BaseT type cable connections as desired. Local (sub-net) Ethernet connections are made by connecting a, system independent, Ethernet hub with each of the CC processing nodes via 10BaseT connections (see Fig. 8).

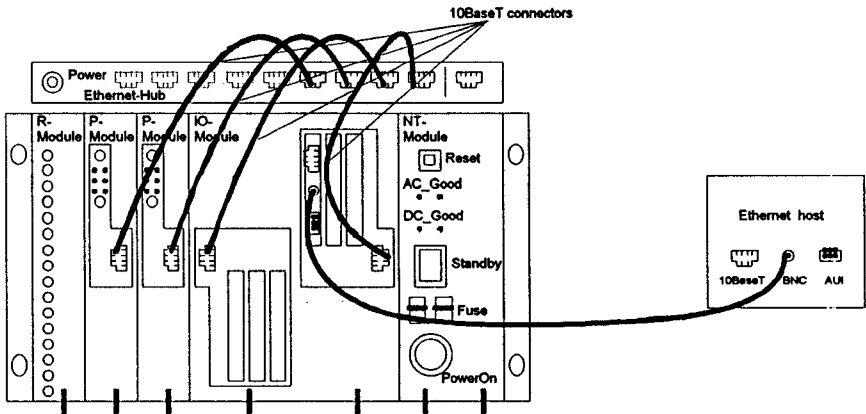


Fig. 8: Ethernet Cabling of a CC Entry IO-Module

### 3.3 Establishing the CC HS-Link Network

The cabling of the HS-Link network (HS=High Speed) is dependent upon the specific routing topology of the CC system. HS-link connections are made with SMB type coaxial connectors that are arranged as send/receive pairs for each HS-link within the CC system. When cabling a new network or modifying an existing network one should be careful only to connect the red marked plugs into the corresponding red marked jacks and, accordingly, the black plugs into the black jacks.

Fig. 9 shows a physical sample of a HS-link topology. The external HS-links (shown as ended at the left of the R-module) could be used to cascade more independent CC systems.

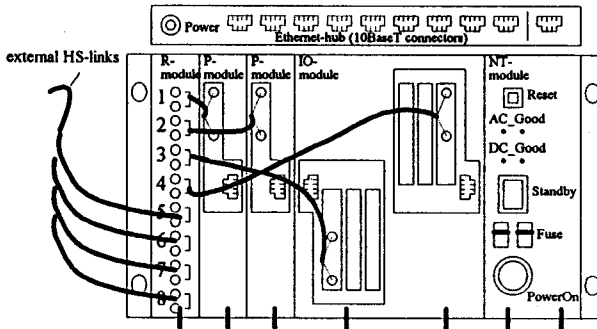


Fig. 9: Sample CC HS-Link Topology

### 3.4 Connecting a VT100-Terminal to a CC Rack

The connector field on the rear wall of every CC card rack contains at least one serial interface for connection of a VT100 terminal. The required serial cable connections, depicted in Fig. 10a and 10b, are to be made with a 9 pole DSUB connector. Before connecting the VT100-terminal to CC rear connectorfield, please determine whether a controlstructure is integrated or not. A CC system with controlstructure has to be connected to the left male 9-pin DSUB connector as pictured in fig. 10a. A CC system without a controlstructure has to be connected to the upper male 9-pin DSUB connector as pictured in fig. 10b. Please check your CC order.

**Note:** The terminal used must be configured for software handshake or the handshake signals shorted on the terminal end. The serial port does not support any hardware handshake as only send, receive, and GND lines are used.

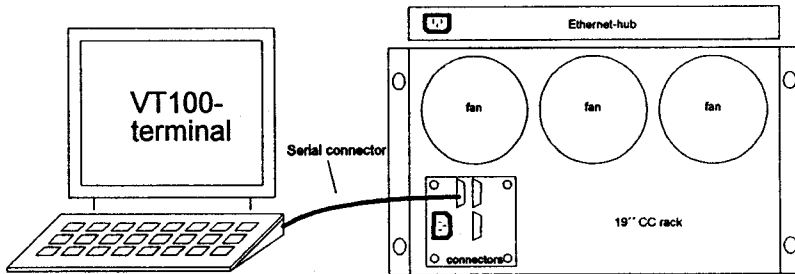
A null-modem can be used, either with DSUB9/DSUB9 connectors or with DSUB25/DSUB9 connectors. The pin layout for these two variations are as follows:

	<i>DSUB9/DSUB9 Connections</i>		<i>DSUB25/DSUB9 Connections</i>	
Signal	DSUB9	DSUB9	DSUB25	DSUB9
read	2	3	2	2
send	3	2	3	3
gnd	5	5	7	5
rts/cts	7-8		4-5	
dcd/dtr	1-4-6		6-8-20	
rts/cts		7-8		7-8
dcd/dtr		1-4-6		1-4-6

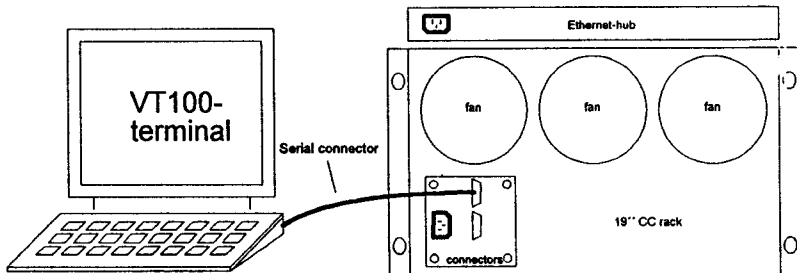
The terminal program must be capable of emulating a VT100 standard terminal. The serial port on all Entry-nodes has the following characteristics:

Baud rate	9.600
Parity	none
Bits per character	8
number of stop bits	1
flow control	xon

Connecting a VT100 terminal to the CC system via the serial port of the Entry-nodes, is displayed in fig. 10a and 10b, depend on a installed controlstructure.



*Fig. 10a: Connecting a VT100 Terminal via the Serial Port (with a controlstructure)*



*Fig. 10b: Connecting a VT100 Terminal via the Serial Port (without a controlstructure)*

## 4. CC System Startup and Shutdown

### 4.1 CC System Startup

Once installed and configured in accordance with the preceding sections, a single CC card rack system can be started as follows:

- switch on the Ethernet hub and the VT100-terminal if existing
- press the Standby switch of all CC NT-modules. The red indicator in the switch should illuminate.
- press the PowerOn switch of all CC NT-modules, until the control LEDs of all processing modules in the CC rack, illuminate; now you can leave the PowerOn switch and the EPX operating system will boot automatically.

**Note:** In some system configurations the control LEDs are illuminated after pressing the Standby switch. The startup procedure is not influenced by that, only the PowerOn switch has no function in that configuration and can be skipped.

After a successful booting of the CC system, a login prompt appears on the monitor of the VT100-terminal:

*AIX Version 4*

*(C) Copyrights by IBM and by others 1982, 1994*

*Console login: \_*

For software configurations and installations, please refer to "CC Software and Hardware installation".

## 4.2 CC System Shutdown

To execute an orderly shutdown of the system carefully follow the instructions below:

- issue the command `ccsh halt_bg` (halt to all CC processor nodes!) to initiate a software shutdown of the CC card rack to be shut down.
- approx. 30s after initiating the software shutdown the NT-module can be turned off with the Standby switch.

### Caution:

The operating system used by CC systems implements a UNIX-like file system, such that, the start-up and shut-down processes described in this section must be followed exactly to ensure system integrity.

### 4.3 Control structure

The control net of CC systems with more than one CC card rack can be cabled in a pipelined manner, i.e. from one card rack to the next as depicted in Fig. 11. The control net is based on OS-link technology with infinite expansion capability and employs differential transmission techniques. To perform diagnostic testing for example, it can be connected to a system independent OS-link host.

The CC control net is automatically booted and configured by the CC operating system (EPX) after power-on (see section 4.1). Subsequently, the implemented monitoring, switching, and control functions, as described in section 3.1, are active. The control net is implemented with autonomous, card rack specific, control processors that can function completely autonomous and independent of any external control units. As mentioned before, the control structure is an optional feature of a CC system. All control functions are only active, if such a control structure is integrated. Please check your CC order regarding this.

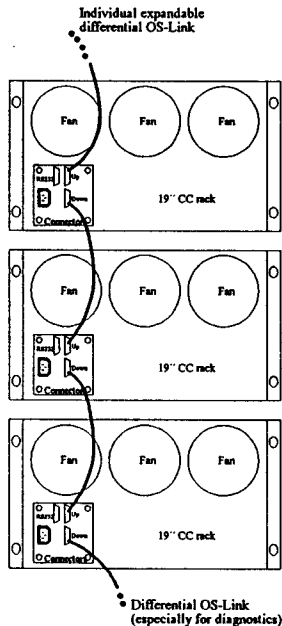
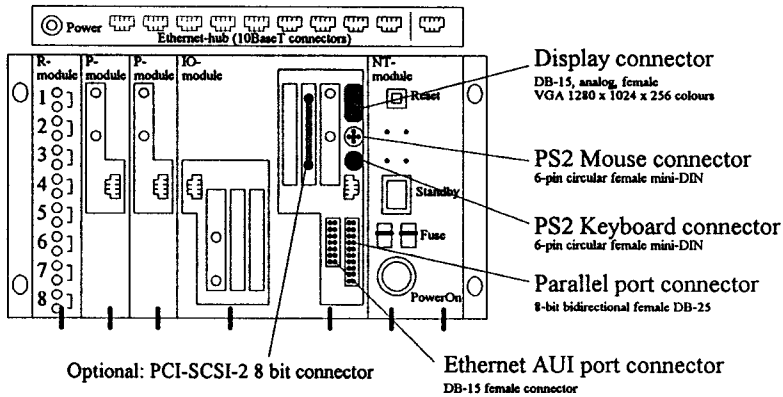


Fig. 11: Topology of a CC Control Net

## 4.4 Optional Interfaces

External IO-capabilities can be added by using up to 4 configurable PCI-slots of a CC IO-module and the direct I/O-connectors on the I/O-panels of the CC system. Here are some standard interfaces which are used in the Parsytec CC system (see fig. 12):



*fig. 12: CC I/O-Interfacing*

### PCI I/O-Interfaces:

- Ethernet/PCI-interface with BNC/AUI sockets as add\_on to the 10BaseT socket of each computer node
- SCSI-2-bus as standard DSUB connector (fast wide SCSI) mounted on a PCI-Slot of a CC IO-module
- additional customer specific IO interfaces on each free PCI-slot



**Standard I/O-Interfaces:**

- **Monitor:** Super VGA Graphics Port with 1MB or 2 MB Videomemory for resolutions:

I.: 800 x 600 x 16M colours, non-interlaced, 60 Hz vertical

II.: 1024 x 768 x 64K colours, non-interlaced, 75 Hz vertical

III.: 1280 x 1024 x 256 colours, non-interlaced, 60 Hz vertical

The video chip supports local bus DMA and is compatible with 8514/A, VGA, EGA, HGC and MDA.

A standard monitor cable is used to connect the monitor to the female analog output DB-15 connector.

- **Keyboard interface:** For keyboard connections to the CC system a standard PS2 keyboard interface is integrated. A 6-pin circular female mini DIN connector is directly located under the SVGA Display connector.
- **Mouse interface:** A standard 6-pin circular female mini DIN connector is used for interfacing the CC system with a PS2 mouse.
- **Parallel interface:** A standard Centronics compatible 8-bit bidirectional parallel port is implemented. The interface is IEEE1284 compatible and accessible via a DB-25 pin female connector.
- **Ethernet interface:** Two Ethernet interface connectors, a RJ-45 for 10Base-T and a DB-15 connector for AUI, are implemented on the I/O-node I/O-panel. For parallel CC systems the onboard ethernet interface is reserved for the internal CC ethernet network (RJ-45), so that the AUI connector not usable for the customer.

Before you turn on the CC system, please install all additional I/O-environments to the CC and connect all needed cables to the system.

## 5. CC System Operating Conditions

The following section sets forth the necessary pre-requisites for the proper installation and disturbance-free operation of a Parsytec CC Series System.

### Mechanical

The Parsytec CC system is a modular parallel computer. Valid dimensions and weight for a given configuration is dependent upon the number and types of nodes. CC card racks are, in themselves, independent system units. The weight of a card rack, including all necessary CC modules, is approximately 35kg.

Exact Parsytec CC system dimensions and infrastructure details can be found in section 2.

### Power Source

The power source must be in accordance with local regulations. A separation of neutral and ground conductors is strongly recommended.

### Power Source Tolerances

The primary side of the power supply integrated into every CC card rack has a wide-range input with isolated ground. Every CC card rack may be powered with either 115V or 230V (see section 3.1). Input power frequency may vary between 50 and 60 Hz. Tolerance from the selected (115 or 230) input voltage may not vary more than 10%. Frequency tolerance is; long term 10%, short term 20%.

Harmonic distortions for the 2nd to 5th upper harmonics may not exceed 10% of the total effective voltage between voltage carrying conductors. An additional 2% of total effective voltage is the maximum tolerance for the sum of the 6th to 30th upper harmonics.

Asymmetric loading may not affect voltage or neutral supply lines in excess of 2%.

Voltage surges with rising or trailing edges between 500ns and 500micro sec. may not exceed 1.5ms nor a peak value of more that 200% of RMS voltage.

Voltage breaks in any phase of a single cycle may not exceed 3ms. Neutral line voltages may not exceed 3ms. A period of at least 1s must separate two consecutive breaks. Voltage may not drop below 20% of peak voltage for longer than one cycle. A period of at least 1s must separate consecutive drops.

### **Power Rating and AC Connection**

The power rating of the machine, as well as the type and number of necessary outlet connections, are dependent upon the size of the machine. A Parsytec CC card rack has a power rating of 0.85kVA maximum at 110/115V 16A or 220/230V 8A. It may be coupled to a standard, ground isolated outlet (see section 3.1).

### **Power Dissipation**

Power dissipation may be as high as 90% of rated power. Allowing for a 10% margin of safety and consideration for other devices that may be installed in the same space, provision must be made to evacuate the dissipated heat emitted by the Parsytec CC system.

### **Cooling**

An un-hindered flow of cooling air as well as sufficient evacuation of exhausted warm air is necessary to guarantee adequate cooling of the Parsytec CC system. The air volume required, per card rack, is  $54 \cdot 10^{-3}$  m<sup>3</sup>/s or 195m/h. A free space of at least 100mm in front and rear of the CC card rack is necessary to meet these requirements.

### **Air Purity**

Ambient air must be free of aggressive chemicals, dust and suspended particles. Air filters placed in the air path at the front of the CC card rack are recommended for operating environments that are not dust free. Such air filters must meet the following specifications:

- space between filter and CC card rack front surface:  $\geq 100$ mm
- filter size:  $\geq 450 \times 250$  mm<sup>2</sup>
- open filter surface space:  $\geq 63\%$
- terminal pressure:  $\geq 200$ Pa

Air filters should be regularly cleaned or replaced (optimally prior to reaching terminal pressure) since a badly soiled filter tends to block airflow which will ultimately lead to excessive temperatures of electrical components within the system. Operating with filters over terminal pressures (heavily soiled) and ambient air temperatures at maximum allowable may lead to system drop-outs.

### **Humidity**

20% to 80%, non-condensing

### **Operating temperature**

Room temperature must be maintained constant with a minimum of 10 °C, nominal 20 °C, maximum 35 °C.

### **Storage temperature**

Storage temperature should not exceed a minimum of -25 °C or a maximum of 60 °C.