

# **MultiCluster-3**

## **MultiCluster-3 DE**

### **Technical Documentation**

August 1992

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# 1. General Information

## 1.1 Features of the MC-3 system family

The Parsytec MC-3 system family offers exceptionally high performance in automation and image processing: modular components for I/O, data acquisition and image processing can easily be configured to create tailored solutions to any problem.

Apart from the standard T805, the Parsytec MC-3 system family is able to incorporate the new generation of transputer, and thus provide a maximum performance of 25 MFLOPS and 200 MIPS per processor. Thanks to the inclusion of the T9000, the investment in the Parsytec MC-3 system family ensures a state-of-the-art system for years to come.

- high performance in automation
- high performance in image processing
- scalable performance over several orders of magnitude
- integration of all UniLink modules
- integration of T9000 based modules
- built-in redundancy and automatic error recognition

## 1.2 Performance Data

The range of MC-3 system family hardware sets new standards in performance, expandability, reliability and communications capability. It allows a well defined and almost unlimited increase in performance through the addition of processor modules.

With up to 48 processors it can deliver a performance of up to 1200 MFLOPS, double precision, peak performance.

## 1.3 Various Applications

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The Parsytec MC-3 product line offers three different systems according to various applications:

- **Parsytec MC-3** is designed primarily for applications involving process monitoring and control, pattern recognition, quality assurance and data acquisition under real time constraints. It makes the entire range of UniLink modules available for automation and data acquisition. Boards exist for A/D and D/A conversion, digital I/O, high resolution graphics, signal analysis, etc.
- **Parsytec MC-3 DE** serves as a local development station for super massively parallel algorithms. So it allows applications to be developed, tested and optimized before being loaded onto a "production" machine. The Parsytec MC-3 DE also acts as a standalone system for computationally intensive applications and becomes a workstation accelerator for special applications: as solid state wind channel, as workstation for drug design or as platform for real time animation.
- **Parsytec MC-3 M** serves as a mobil station. It is a system that can be used as well in laboratories as in vehicles. Therefore the backplane provides connectors for 220 V (AC) and for 12/24 V (DC). For system monitoring the Parsytec MC-3 M has a sophisticated error supervision. This two stage error supervision gives an optic and audible alarm first and then switches the machine off before any serious damage takes place.

## 1.4 Available Hardware

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Parsytec provides several modules for different applications:

- for automation:  
TPM-ADC, TPM-DAC, TPM-DIO, DBI-1 to DBI-5
- for pattern recognition:  
TIP-MFG, TIP-VPU, TIP-CGD



## 1.5 Available Software

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The Parsytec MC-3 system family can be supplied complete with system software:

RTSM - the Real Time System Manager - supports the user in the development and execution of real time applications. Firmware allows access to all boards via standardized protocols: it synchronizes and controls communication. A communication core allows fast and automatic routing, precedence ratings during communication setup and error tolerance. The latter includes recognition of failed links and even automatic bridging, if the topology allows it. The components defined by RTSM respond to Toolset or Helios Interfaces. Application software and libraries will also be made available on the Parsytec MC-3 system family.

The versions of the software environment PARIX run on purely T8 based systems. On delivery of the next chip generation, PARIX will be provided in a T9 based 100% compatible version. You can benefit immediately from the performance leap to the processor.

For the MC-3 DE, the same tools are available as have been developed for Parsytec GC: user interfaces such as X, debugging tools, performance monitors, graphics libraries continue to be developed and where possible, conform to existing and emerging industry standards.

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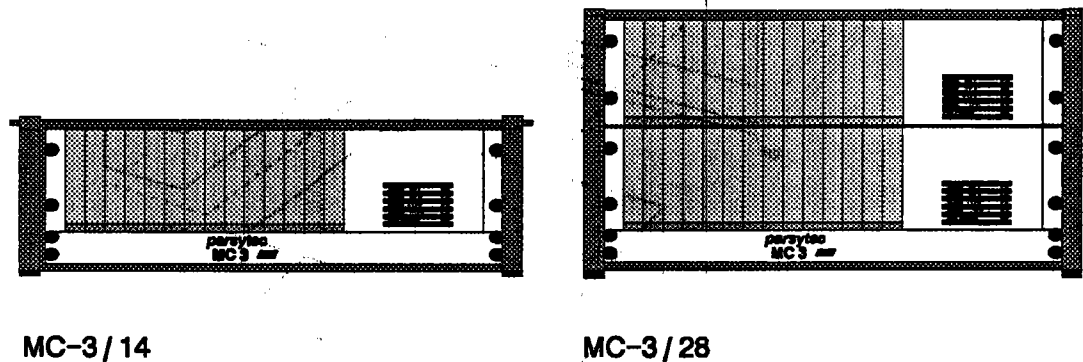
## 2. Hardware Description

For the **FIRST** installation of the Parsytec MC-3 system please refer to Appendix A where you find a detailed description of unpacking, a checklist indicating delivered items and important notes for the placing.

### 2.1. General Overview: the MC-3 and the MC-3 DE

- MC-3/14 is a MC-3 cabinet with one rack for up to 14 transputer modules.
- MC-3/28 is designed with two racks to integrate up to 28 T8 or T9 based processor modules.

Figure 2 - 1: MC-3

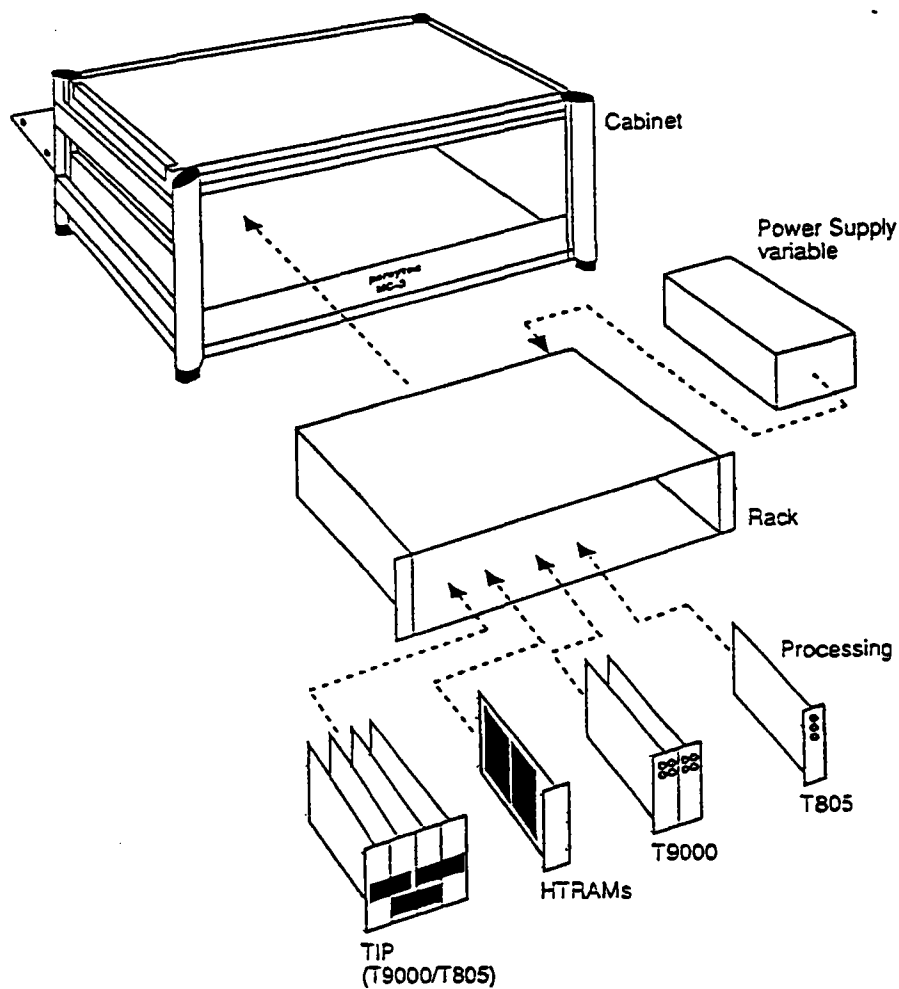


- MC-3/14 DE stands for local development environment. The processors form a matrix and can be connected with other Parsytec modules for I/O, mass storage and networking.
- MC-3/28 DE is a double MC-3/14 DE system for up to 28 processor modules.

Figure 2 - 2 shows the construction of the Parsytec MC-3 system family.

The systems are housed in stackable 19" cabinets which can hold 14 or 28 boards. The heart of each system is the rack, which contains the power supply and up to 14 boards. The universal backplane system allows a wide range of connection structures and the integration of boards with different depth. The Parsytec MC-3 system family can be connected to workstations via S-Bus or VME-Bus, whilst the difficulties of harsh industrial conditions are overcome by using fibre optic cables. The modular design of Parsytec hardware components and strict adherence to industrial standards allows Parsytec systems to be integrated in complex and heterogeneous environments.

Figure 2 - 2: Construction of a MC-3



On the right hand side, the front panel of the Parsytec MC-3 system shows four green LEDs for 5 and 12 Volt power supply, and one red LED which indicates a malfunction. It lights up only in the case of a fan failure.

The left hand side is reserved for 14 slots for transputer modules. These slots are numbered from right to left (slot #00 to slot #13).

• **NOTE**

**The eight screws near the sides are holding the rack and the fans and should not be opened.**

Figure 2 - 3: Front view of the MC -3/14

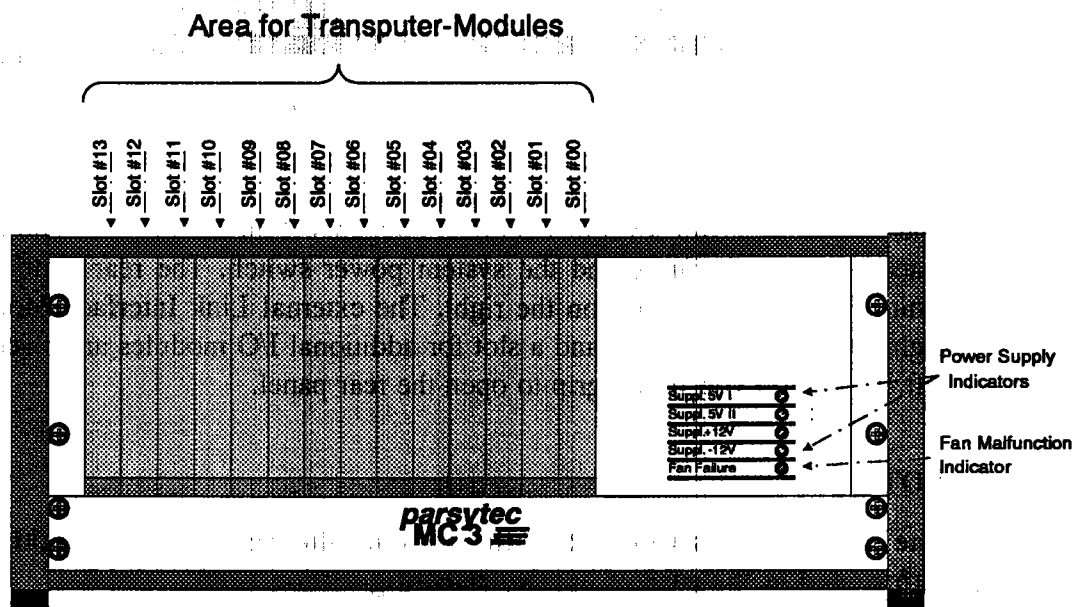
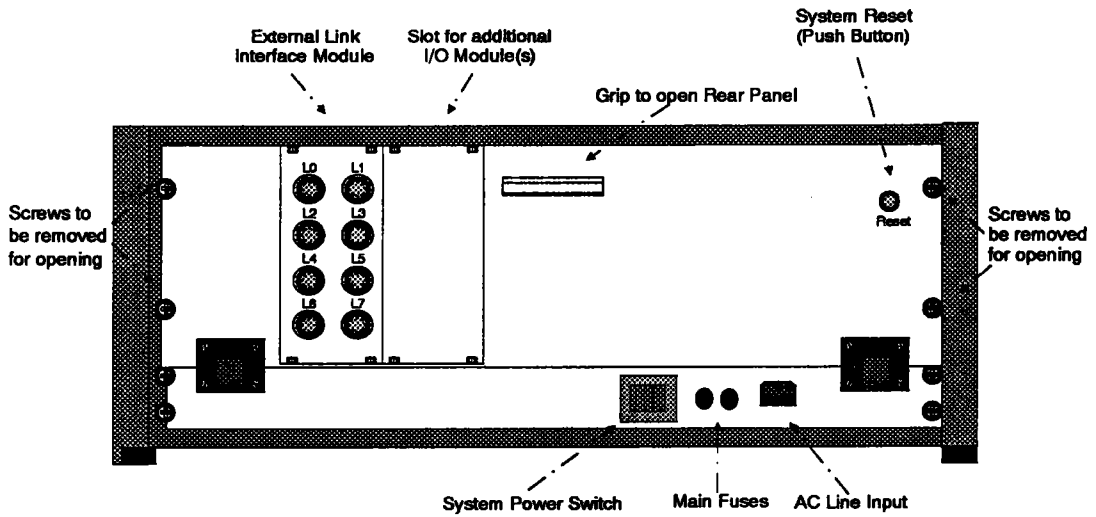


Figure 2 - 4: Rear view of the MC-3/14



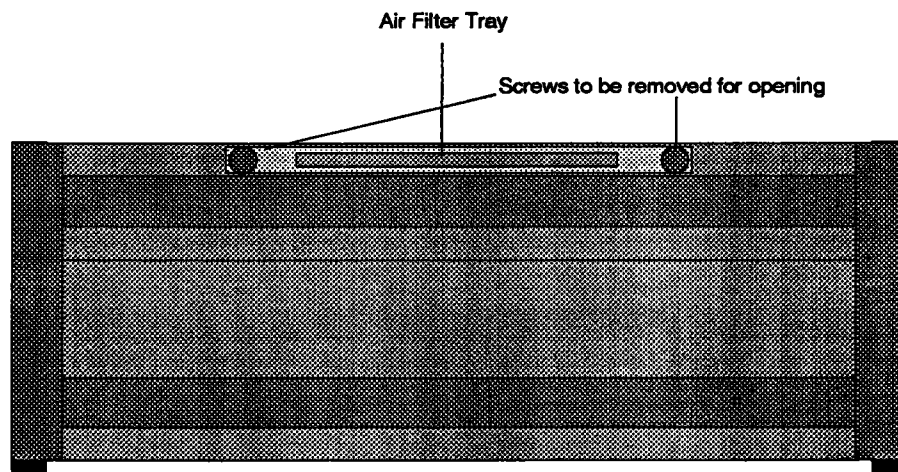
The rear view shows several functional elements. You see the AC Line Input, the place of the main fuses and the system power switch. The rear panel carries a white system reset button on the right. The external Link Interface Module with eight I/O links (L0 to L7) and a slot for additional I/O modules are placed on the left. At the top you find a grip to open the rear panel.

• **NOTE**

The four outer screws at both sides of the rear panel should only be unfastened in the case of hardware configuration work.

At the right hand side of the MC-3 cabinet you find the Air Filter Tray which you need in case of maintenance work. For detailed description refer to Appendix B.

Figure 2 - 5: Right side of the MC-3/14



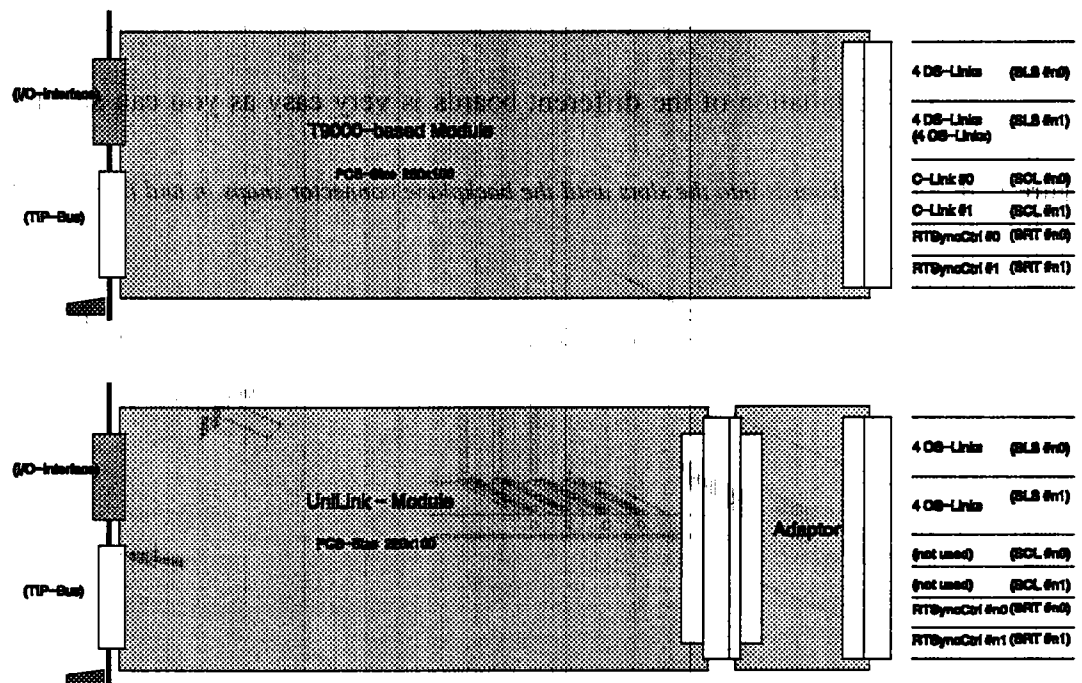
## 2.2 Installation of Transputer Modules

The Parsytec MC-3 system family can accommodate various processor boards even in mixed configurations up to 28 processors in a rack. Supported processors include T225, T805 and T9000 with memory sizes from 64 KB SRAM to 8 MB DRAM.

The range of hardware allows a well defined and almost unlimited increase in performance through the addition of processor modules. Thus a sufficiently rapid reaction to external events is ensured and fast task-switching is performed. The system can be tailored to precise performance demands via simple scalable expansion path.

The MC-3 system family is designed for T9000 modules (PCB-size 280 mm x 100 mm). To enlarge the shorter UniLink modules (PCB-size 220 mm x 100 mm) use the adaptors MC-3 AD1 to reach the backplane connectors. In this case the SCL slots are not used. For the MC-3 AD1 refer also to chapter 3.3.3.

Figure 2 - 6: Different size of Transputer Modules

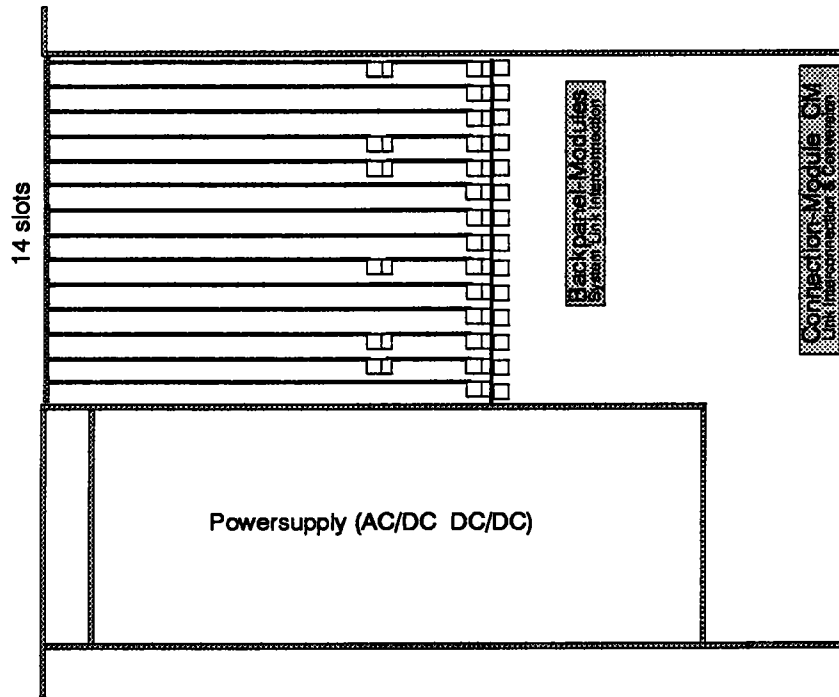


To install transputer modules remove the according number of shields which cover the 14 slots at the front panel of the MC-3 cabinet. Each shield is fixed with two screws (see figures 2 - 2, 2 - 8 and 2 - 9).

• **NOTE**

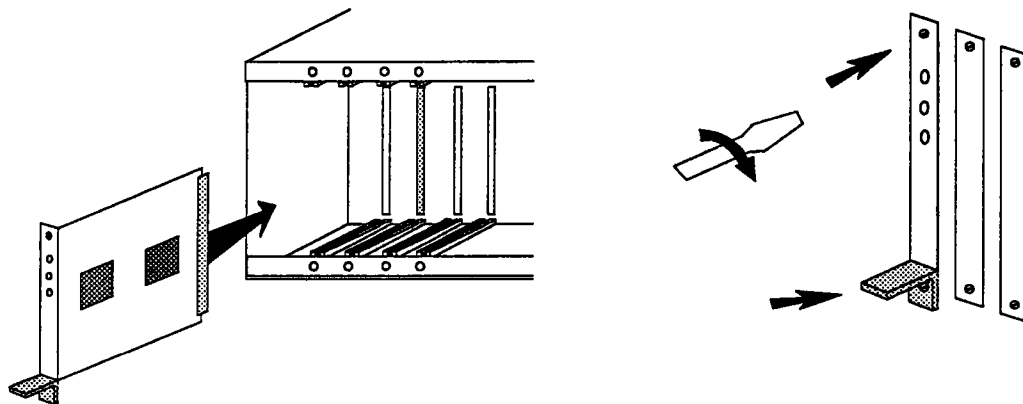
If the boards installed in the slots #0 to #9 are all equipped with two processors, the processors installed in the slots #10 to #13 can not be configured via the Connection Module (see figure 3 - 4). In this case the upgraded system is recommended to solve this problem.

**Figure 2 - 7:** MC-3 rack with 14 UniLink and T9000 boards, top view

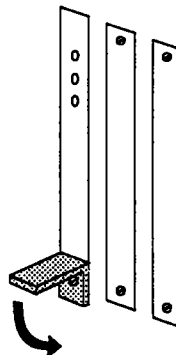


The installation of the different boards is very easy as you can see in the figures below.

**Figure 2 - 8:** Push the boards into the slots until the backplane connector snaps in and fix it with the screws.



**Figure 2 - 9:** To eject a board push the ejector at the bottom down.





## 2.3 Connectors

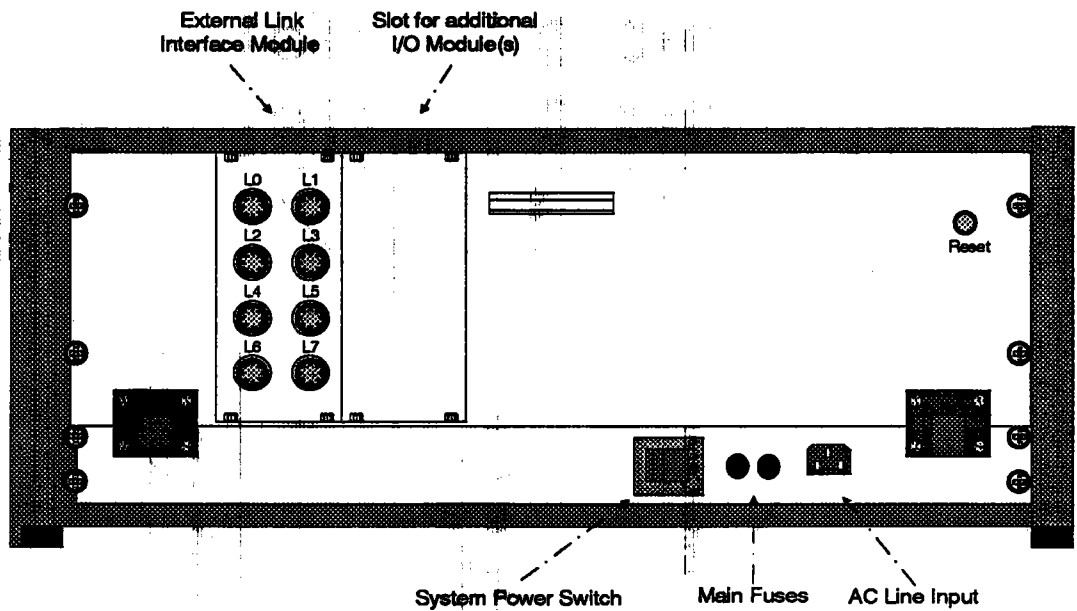
### 2.3.1 AC Power Connection

Please compare voltage and frequency of the Parsytec MC-3 system and your local power supply. A MC-3 and a MC-3 DE can be run on 187-264V AC, 47-63 Hz.

Then push the power cable into the AC Line Input slot.

The power consumption of a MC-3 system depends on the number and types of computation and peripheral modules inserted.

Figure 2 - 10: Connectors on the rear panel of the MC-3

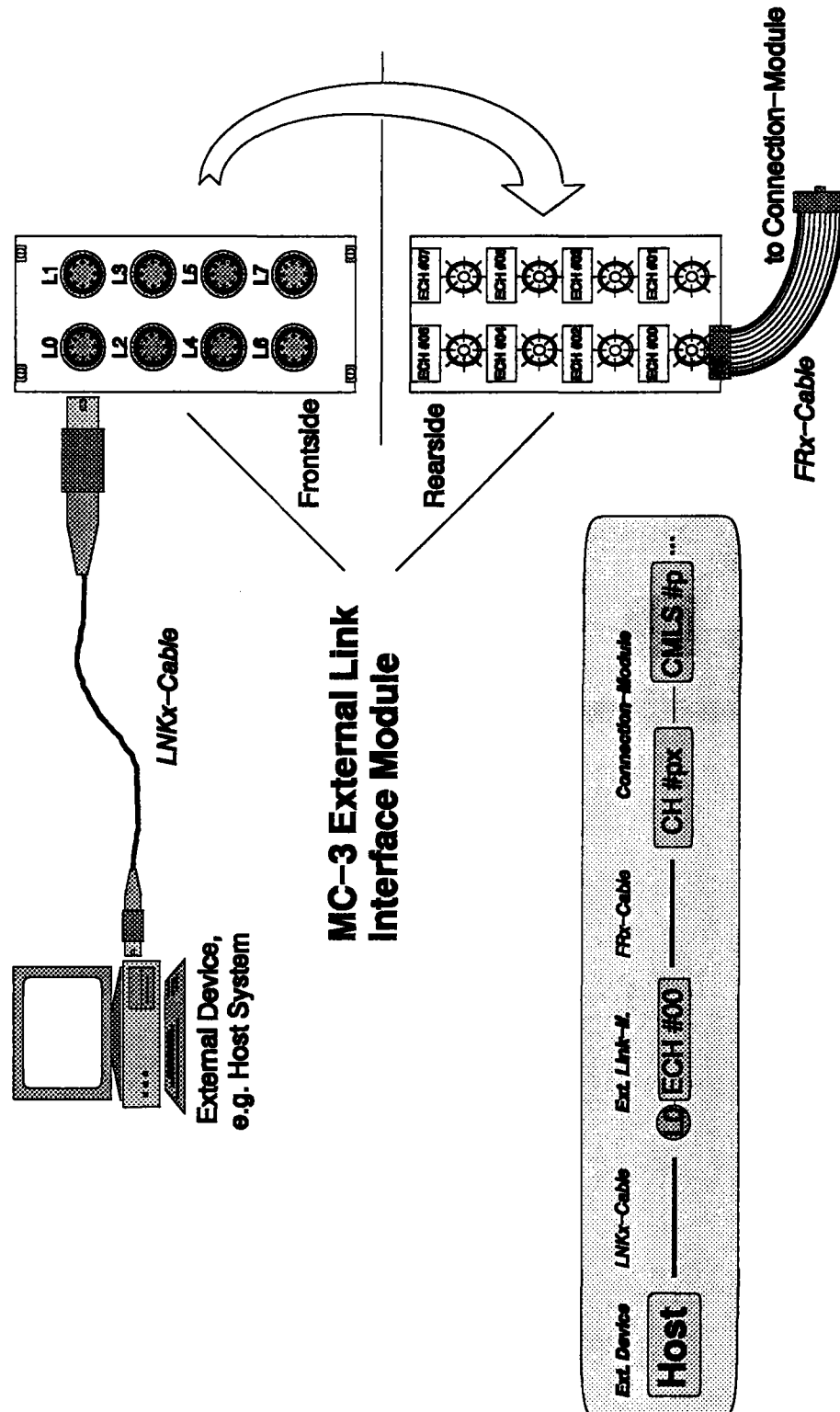


## 2.3.2 External Linkage

The MC-3 system family provides one external Link Interface Module with eight Lemosa female plugs, numbered L0 to L7. There is also a slot for additional I/O modules.

Figure 2 - 11 shows the front- and rearside of the external Link Interface Module and the further routing to the Connection Module. The illustration of the rearside of the I/O module is vertically mirrored.

Figure 2 - 11: Device Routing



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## 3. Hardware Configuration

### 3.1 Opening the Rear Panel

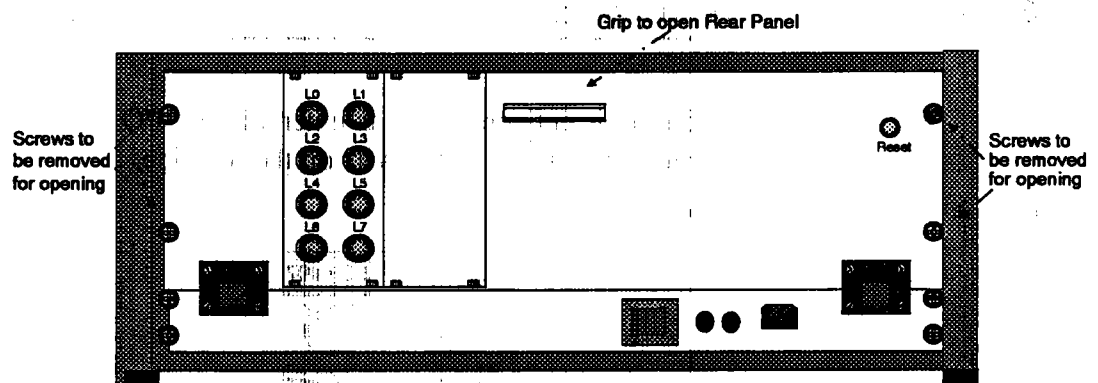
The MC-3 cabinet should only be opened for the installation of new processor-, peripheral-boards or for routine maintenance (see chapter 2.2, Appendix B).

• **NOTE**

**For the protection of both, the user and the MC-3 system, always switch it off and disconnect it from the line before opening the cabinet. Metallic parts dropped into a running MC-3 system may cause serious damage.**

- Remove the four screws from the rear panel, two on each side, as shown in figure 3 - 1. Remember to keep all screws and small parts in a safe place.
- Draw the grip carefully to open the rear panel.
- When closing the rear panel take care that no cables are stuck and fix the screws again.

Figure 3 - 1: Placement of the screws holding the rear panel



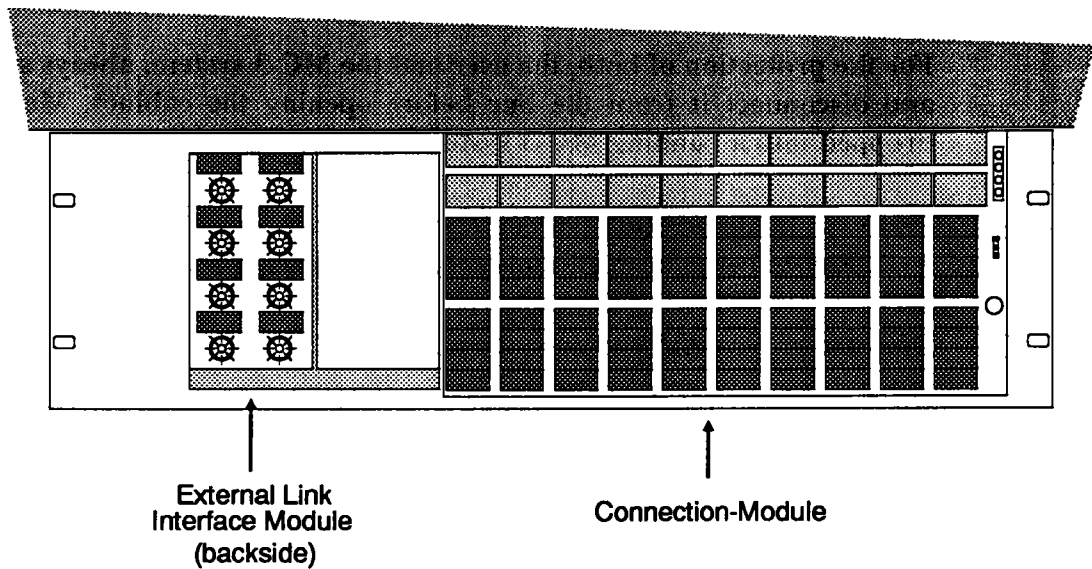
## 3.2 The Rear Panel

Figure 3 - 2 shows the scheme of the interior rear panel side of a MC-3 system. On the left you see the rear side of the external Link I/O Module.

The main part of the rear panel is used by the Connection Module for connecting up to ten boards entered in slot #04 to #13.

The system link speed jumper is far on the right (refer to chapter 3.2.4).

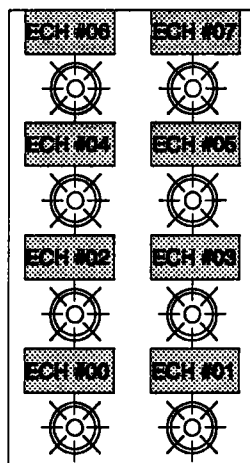
Figure 3 - 2: Interior View of the rear panel



### 3.2.1 External Link I/O Module

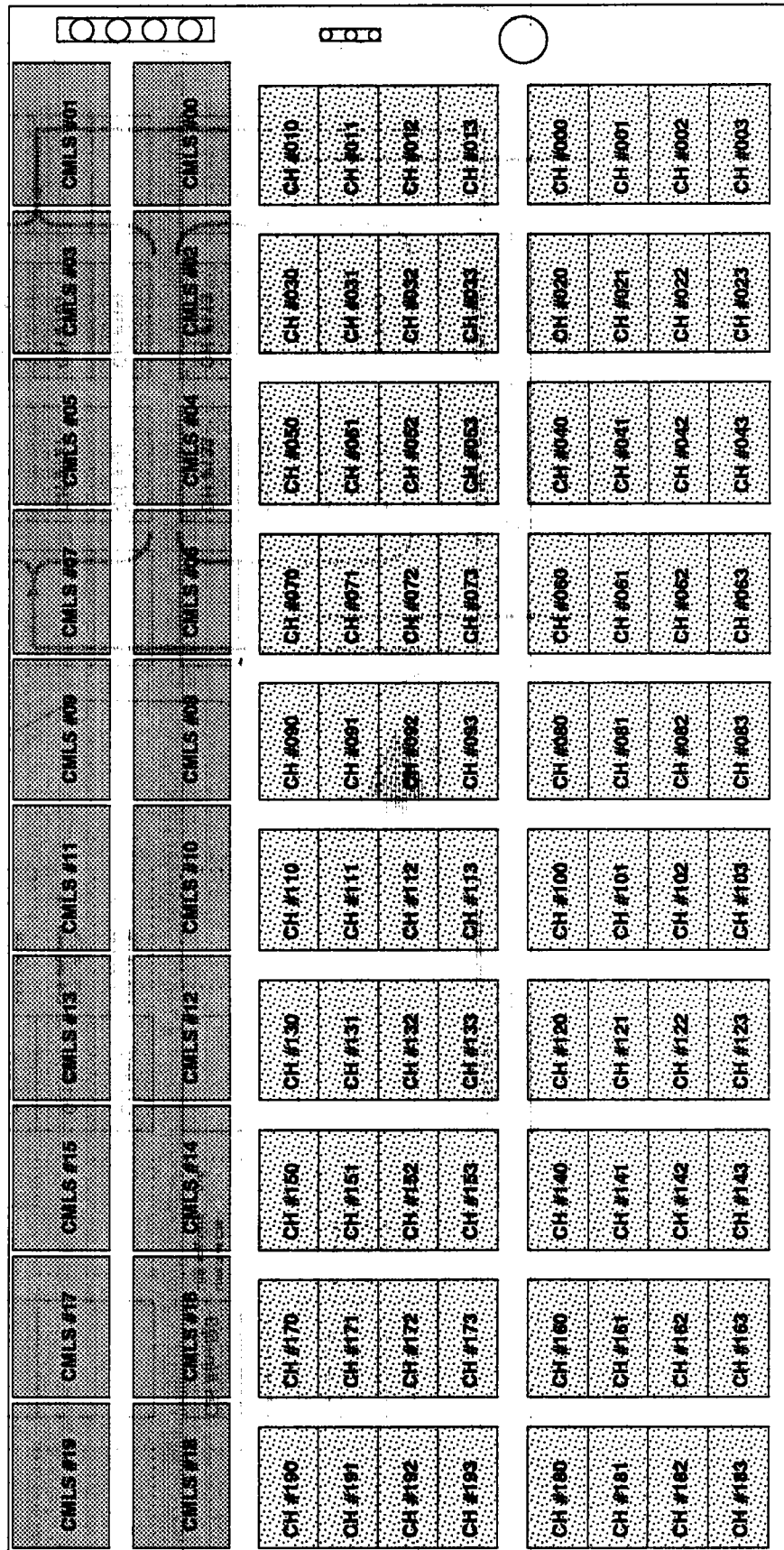
The MC-3 system family is delivered with an external Link I/O Module with eight plugs L0 to L7, named ECH #00 to ECH #07 on the rearside.

Figure 3 - 3: Rearside of the I/O Module



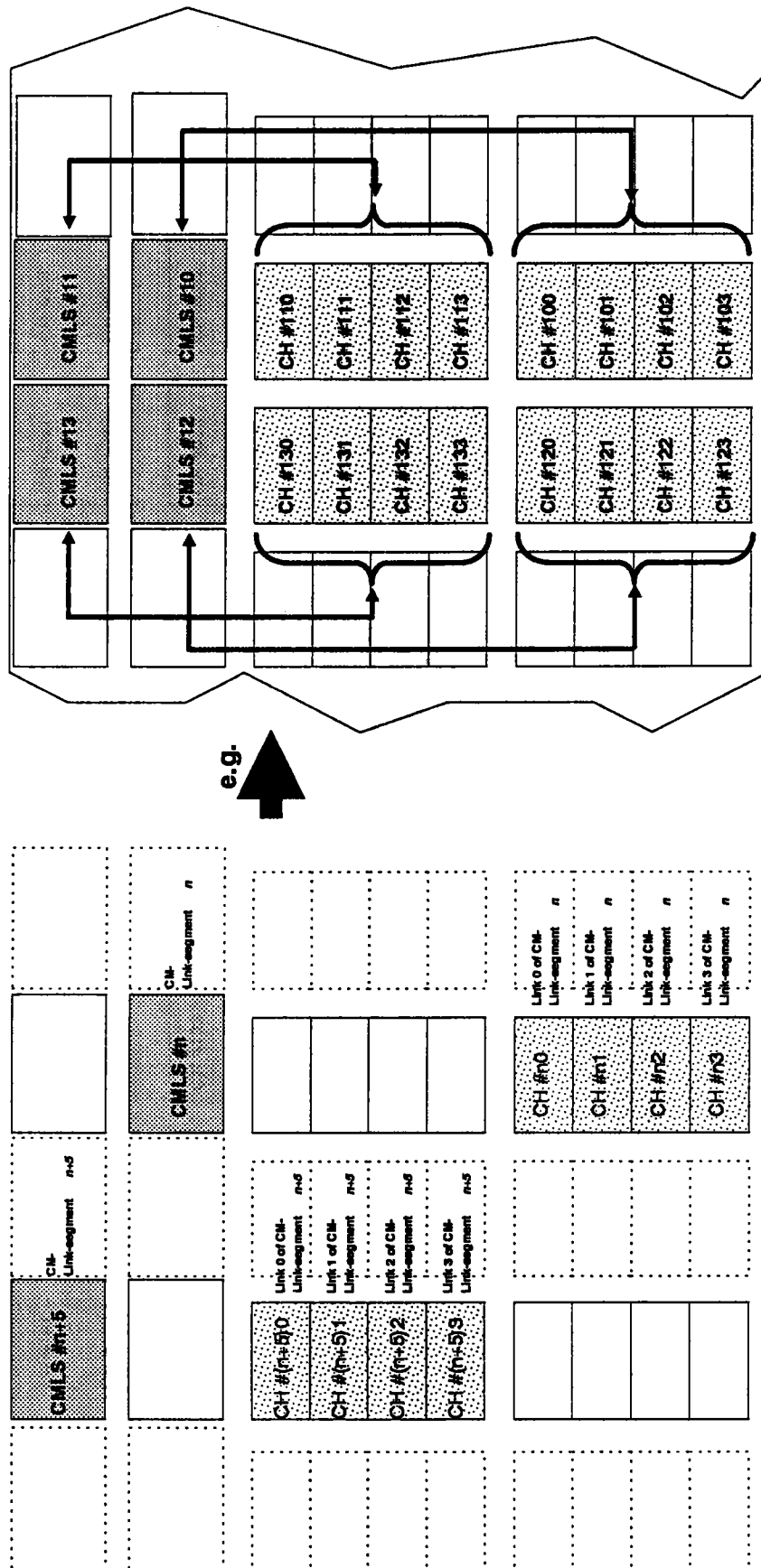
### 3.2.2 Connection-Module

Figure 3 - 4: Assignment of the Connection Module



### 3.2.3 Linkage Example

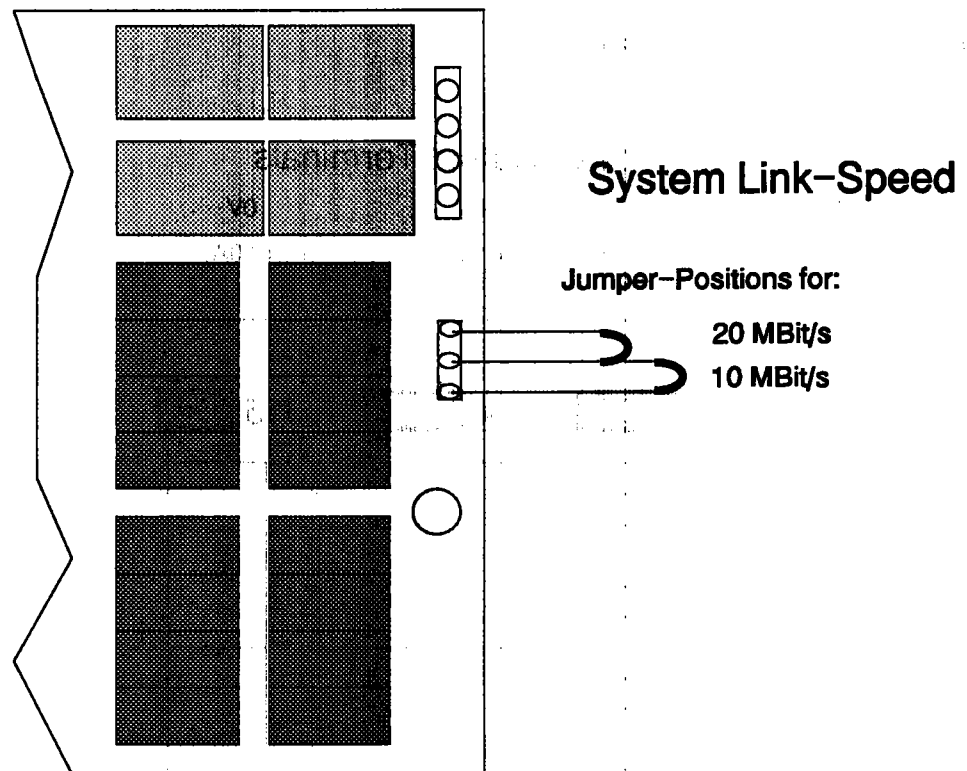
Figure 3 - 5: Linkage on the Connection Module



### 3.2.4 System Linkspeed

At the right side of the rear panel of a MC-3 cabinet you find the jumper for the system link speed. The link speed of the whole system can be set to 10 or 20 MBit/s, independent of the jumper settings on a single board.

Figure 3 - 6: *Link Speed setting*





### 3.3 The Backplane

Opening the rear panel and looking through it into the cabinet you see the backplane. It is divided into two segments, each of them for seven slots. At the top are auxiliary power output terminals for 12 and 5 V. Power input terminals for 12 and 5 V are at the bottom as well as a control terminal for link speed and master reset.

Figure 3 - 7: One half of the Backplane

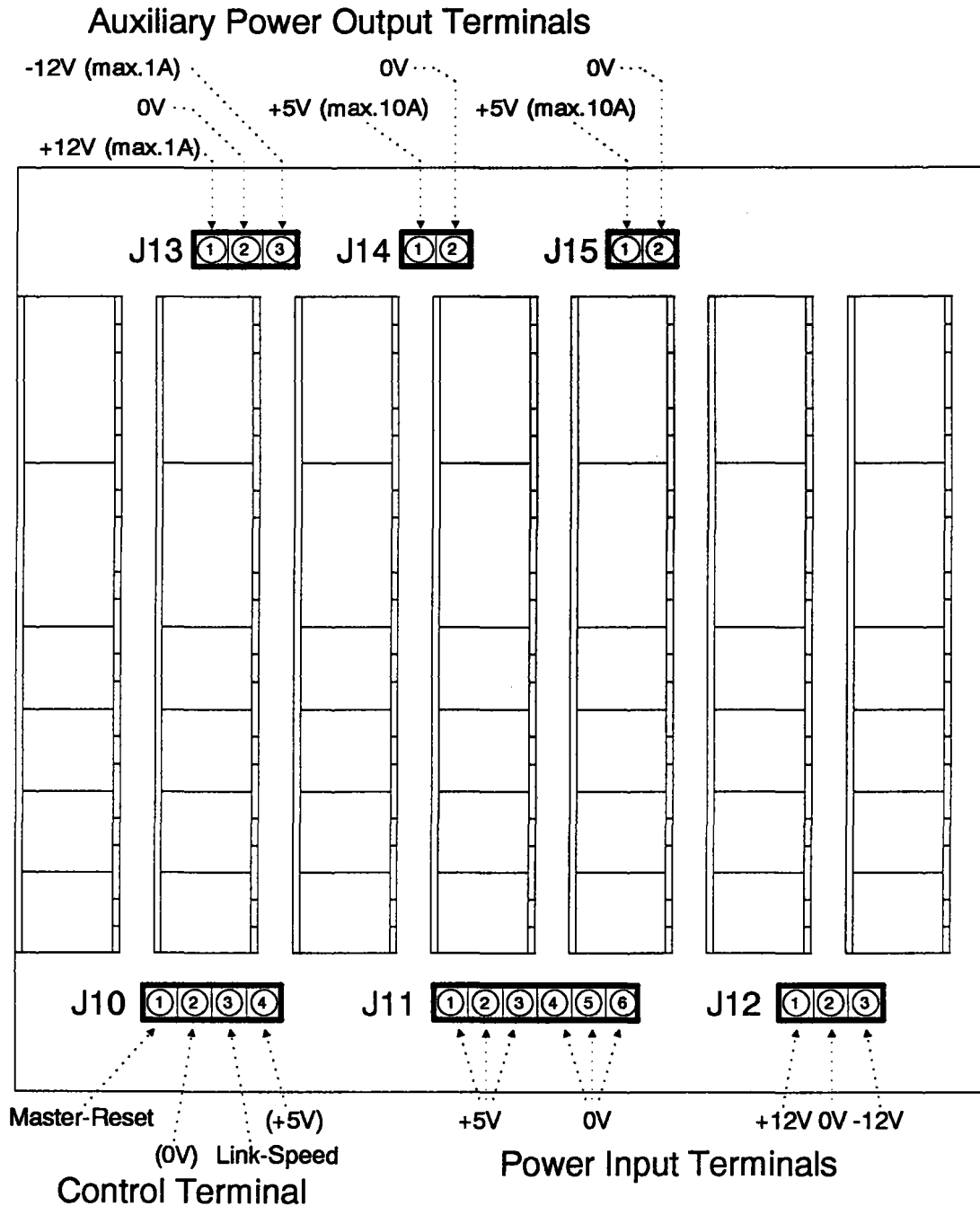
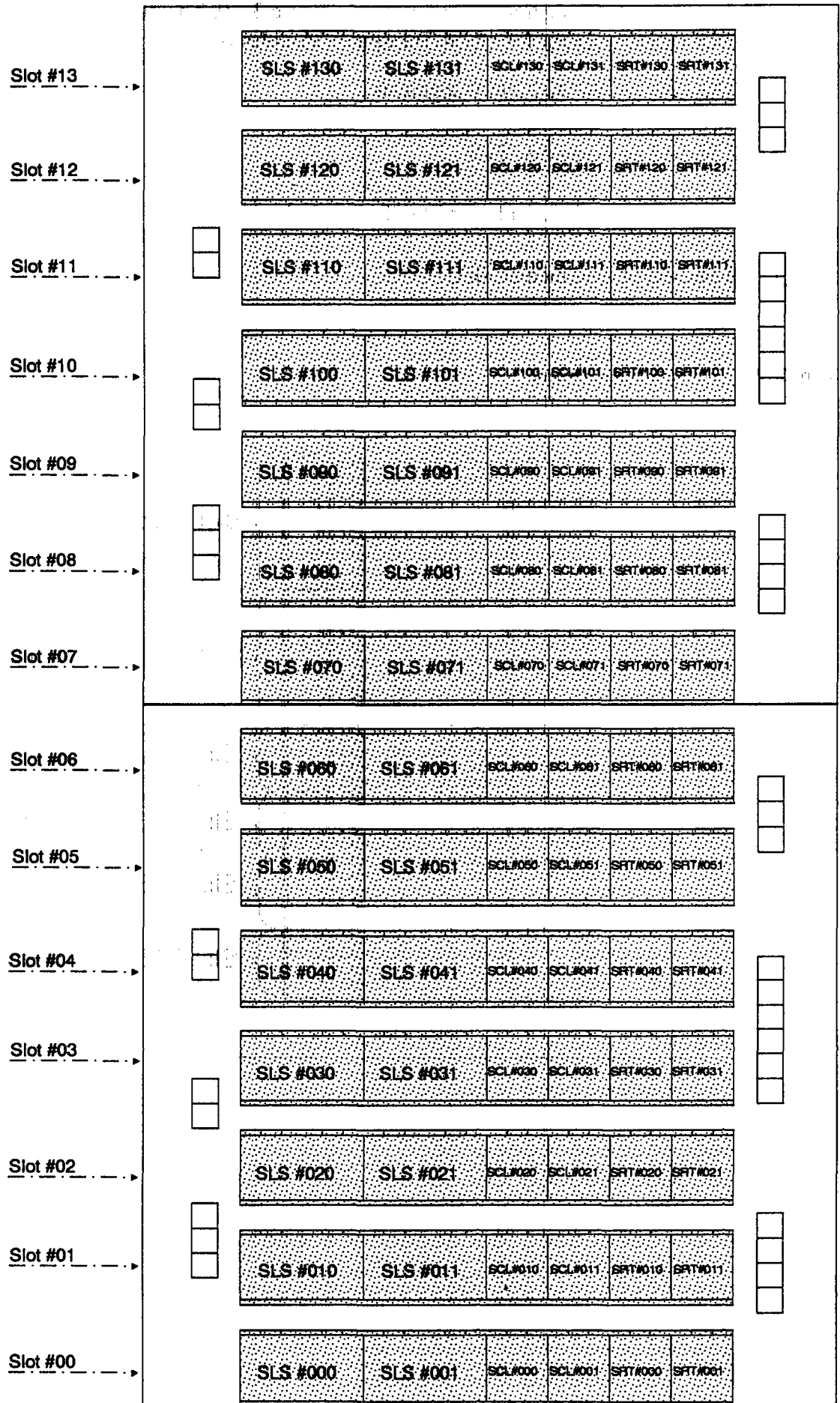


Figure 3 - 8: Assignment of the slot segments



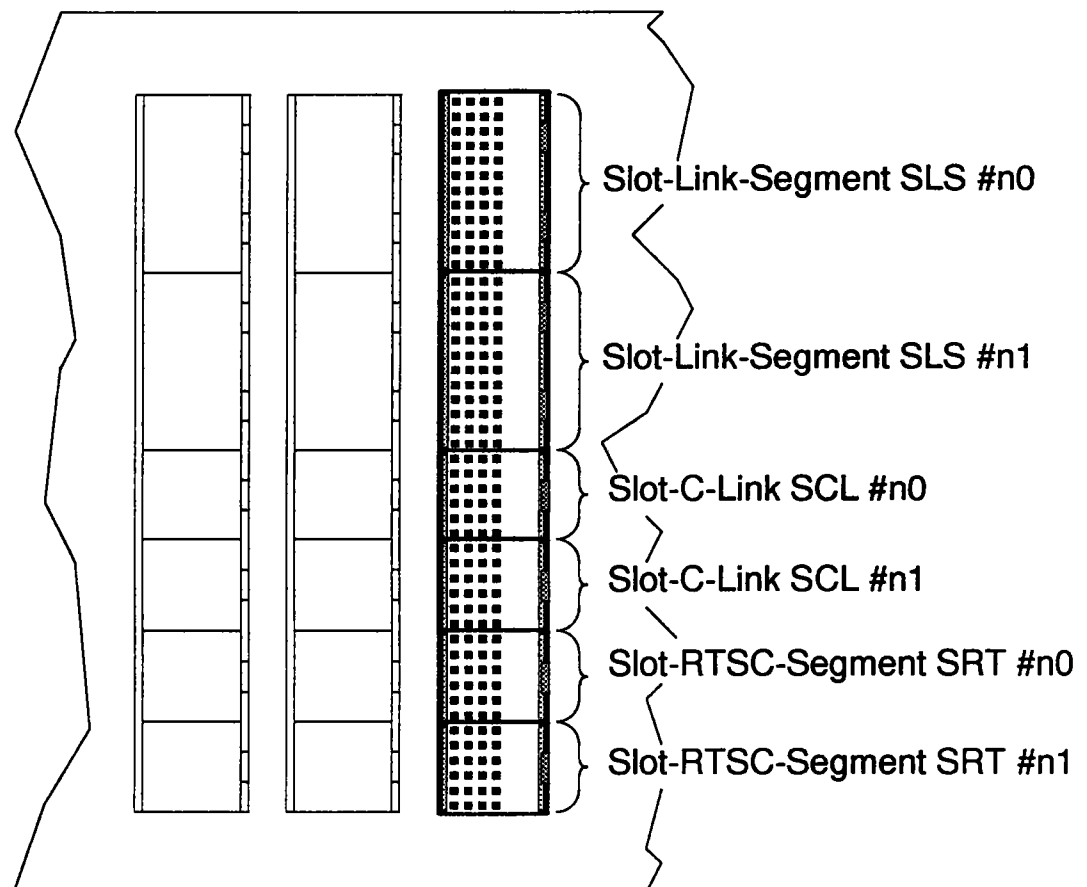
### 3.3.1 Slot-Segments of the MC-3

A general slot assignment can be seen in figure 3 - 9. The detailed assignment of each single segment for all 14 Transputer Modules is shown in figure 3 - 8.

The slots are divided into 6 segments:

- 2 Slot-Link-Segments: SLS
- 2 Slot-C-Link: SCL (only for T9000 modules)
- 2 Slot-RTSC-Segments: SRT

Figure 3 - 9: *General Slot Assignment*

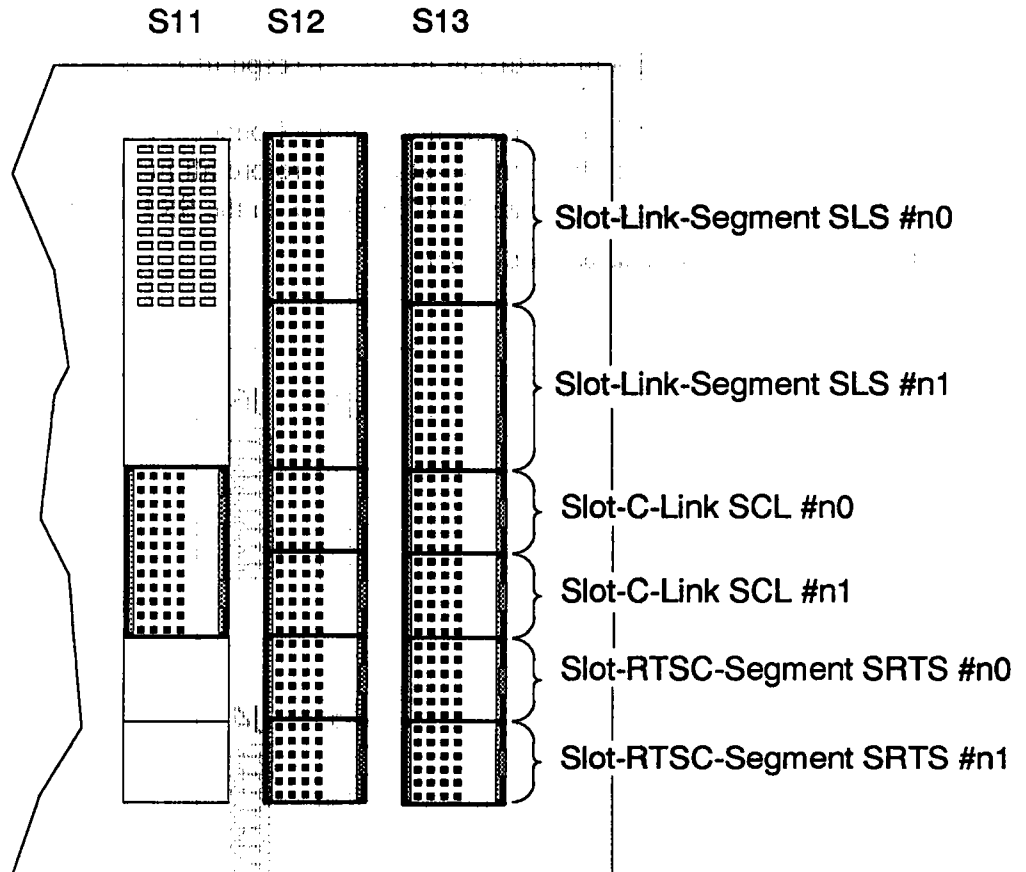


### 3.3.2 Slot-Segments of the MC-3 DE

The Backplane of the MC-3 DE is presetted by the Matrix Module fixed to the slots #0 to #11 (see also figure 3 - 10).

Slot #12 and #13 can be used as shown for the MC-3.

Figure 3 - 10: Matrix Module in a MC-3 DE



### 3.3.3 Configuration of the RTSC Channels

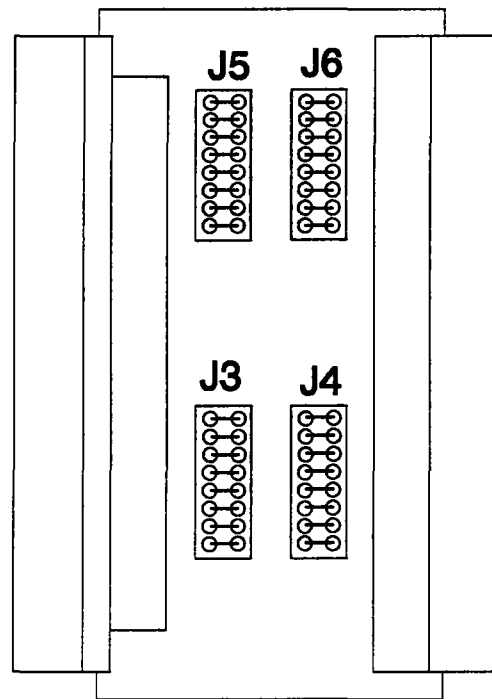
The series of Parsytec's industrial modules (e.g. TPM-ADC, TPM-DAC, TPM-DIO, TPM-MEM, TPM-UCS) are equipped with the RTSC (Real Time Synchronisation Control) - channels, in order to provide a global synchronization of the modules. The configuration of these channels can be done in the conventional way via the Connection Module.

- **NOTE**

**Refer also to the documentation of the corresponding board.**

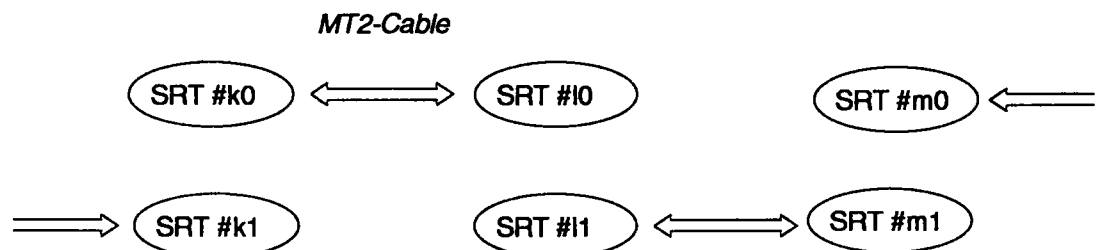
In order to save configuration resources of the Connection Module, there is a more convenient way to do this configuration. Therefore all jumpers of the MC-3-AD1 adaptor have to be set, to route the RTSC-lines to the SRT-fields of the backplane.

Figure 3 - 11: Jumpers of the board adaptor MC-3-AD1



If this is done, the configuration can be done directly on the backplane by the use of MT2-cables.

Figure 3 - 12: Routing by MT2-cables



### 3.4 General Configuration

Figure 3 - 13: The way from the Transputer Links to the MC-3 I/O Module, using MT4-cables

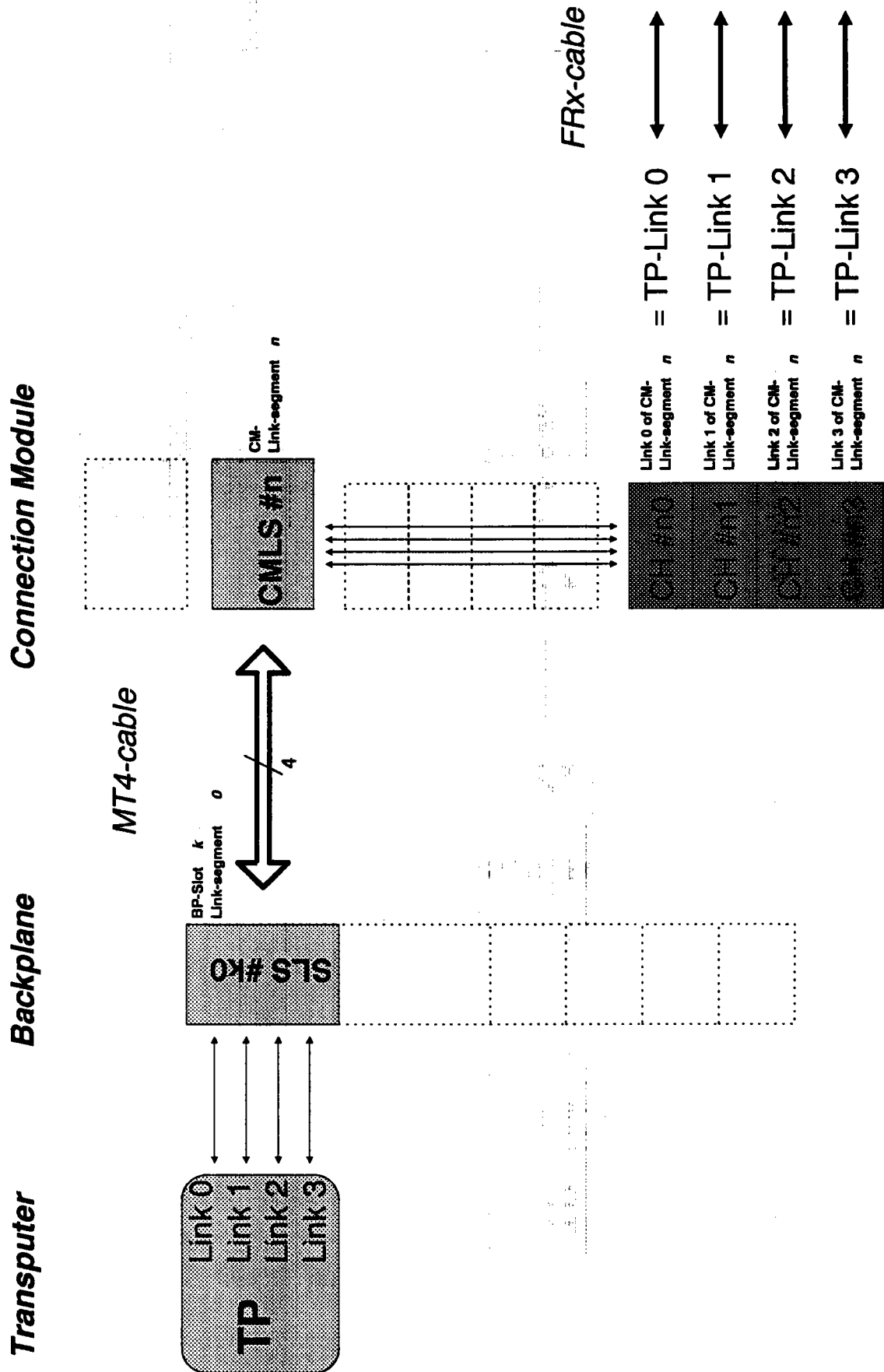


Figure 3 - 14: The way from the Transputer Links 0 and 1 to the MC-3 I/O Module, using the MT2-cables

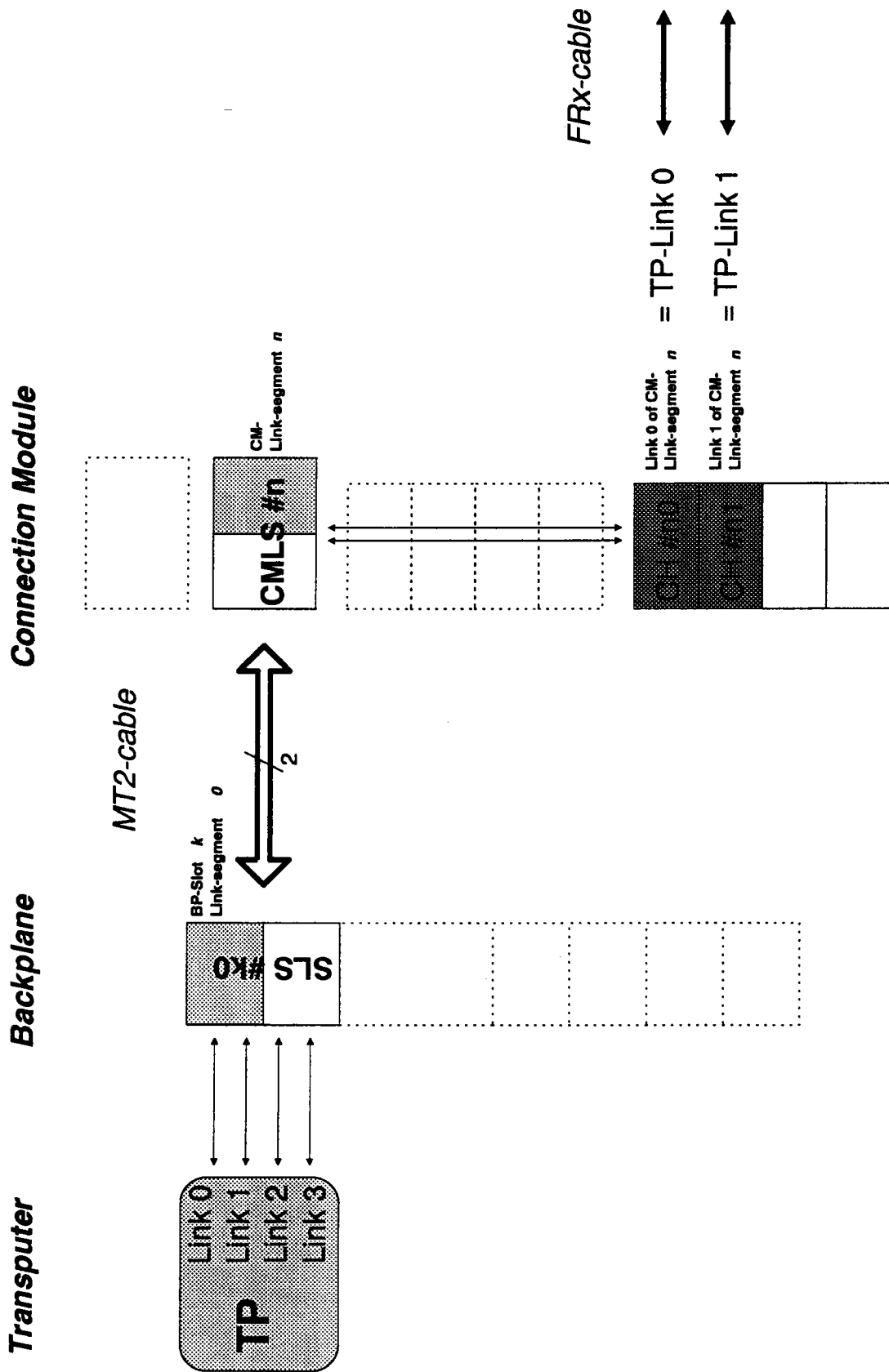
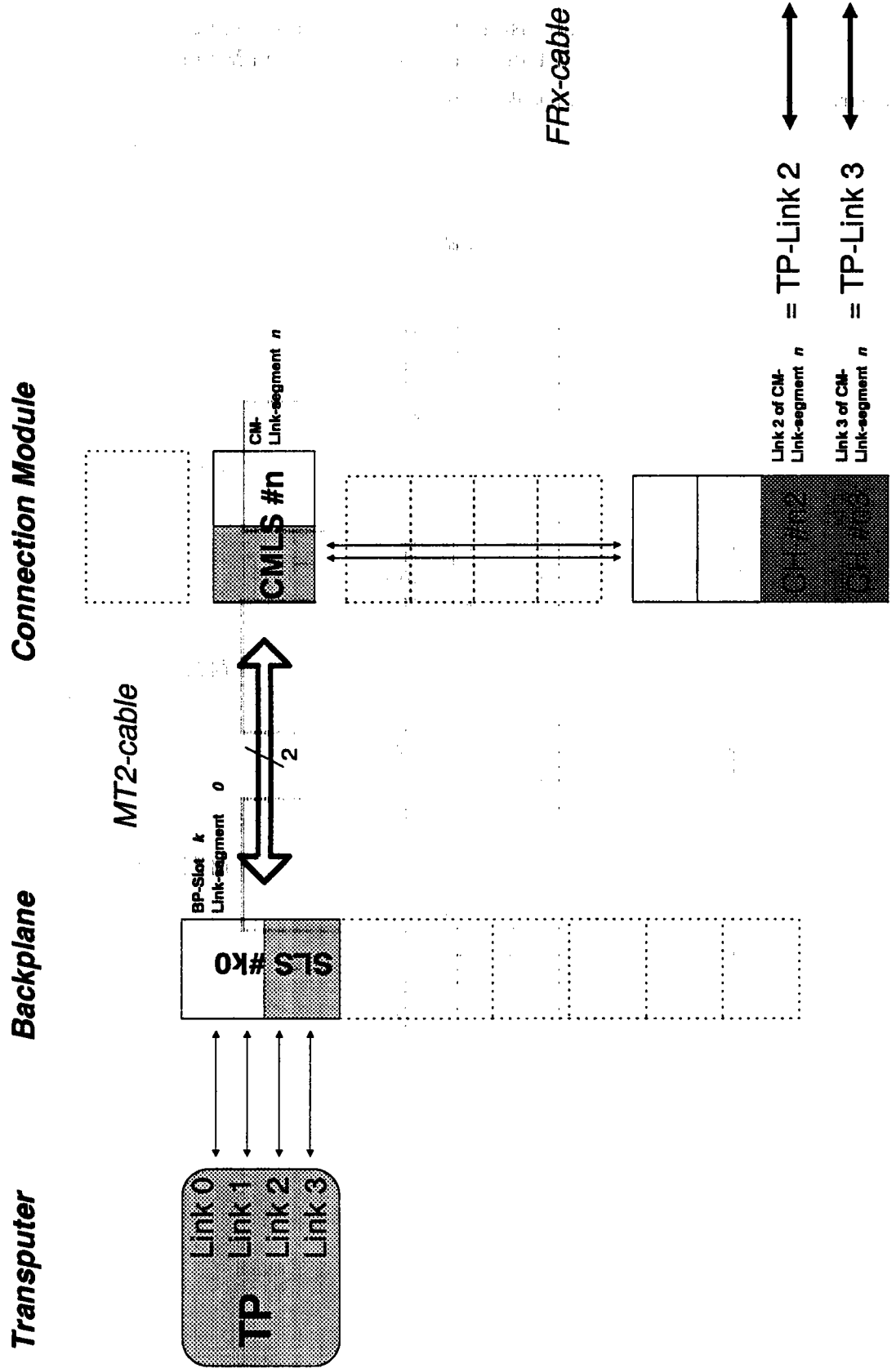


Figure 3 - 15: The way from the Transputer Links 2 and 3 to the MC3-I/O Module, using MT2-cables

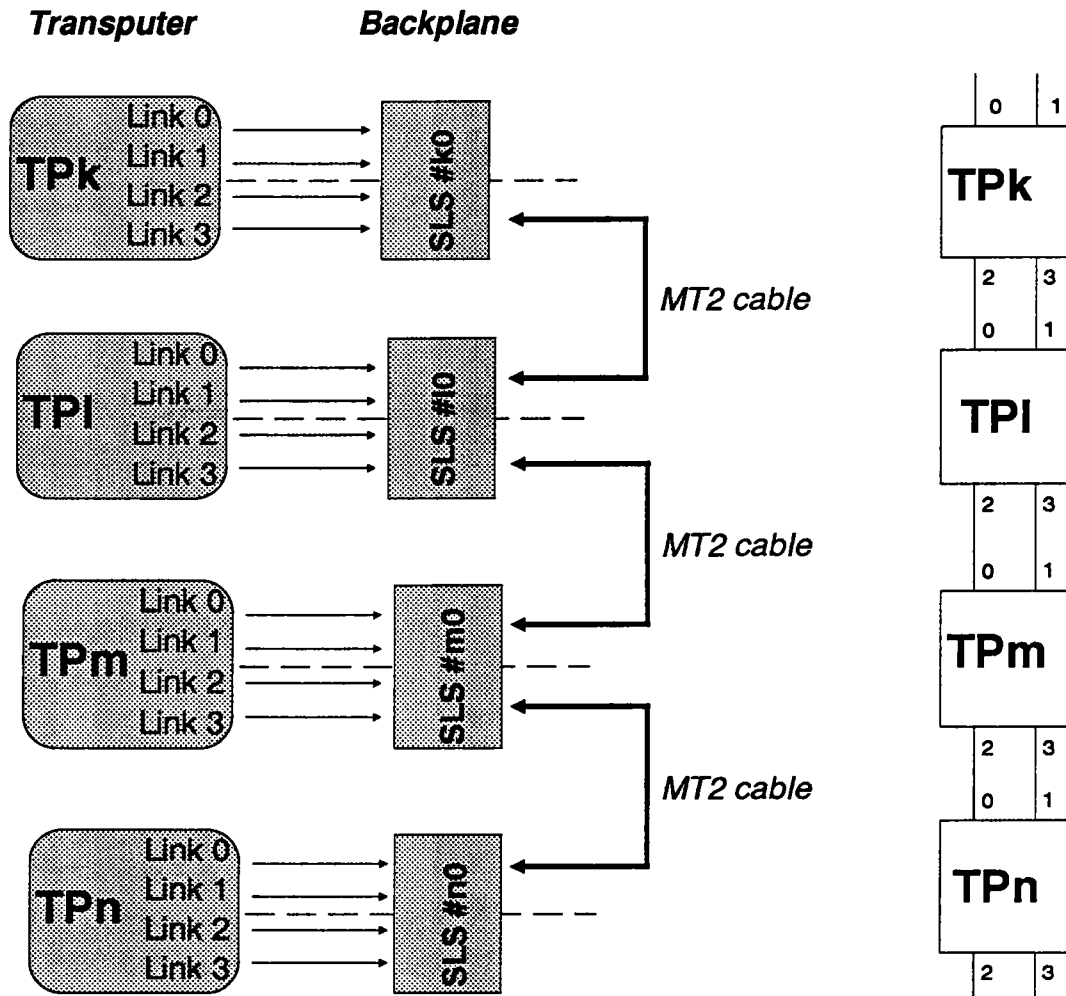




### 3.5 Configuration without Connection Module

MT2-cables are very useful to configure simple structures like pipelines directly on the backplane, without use of the Connection Module.

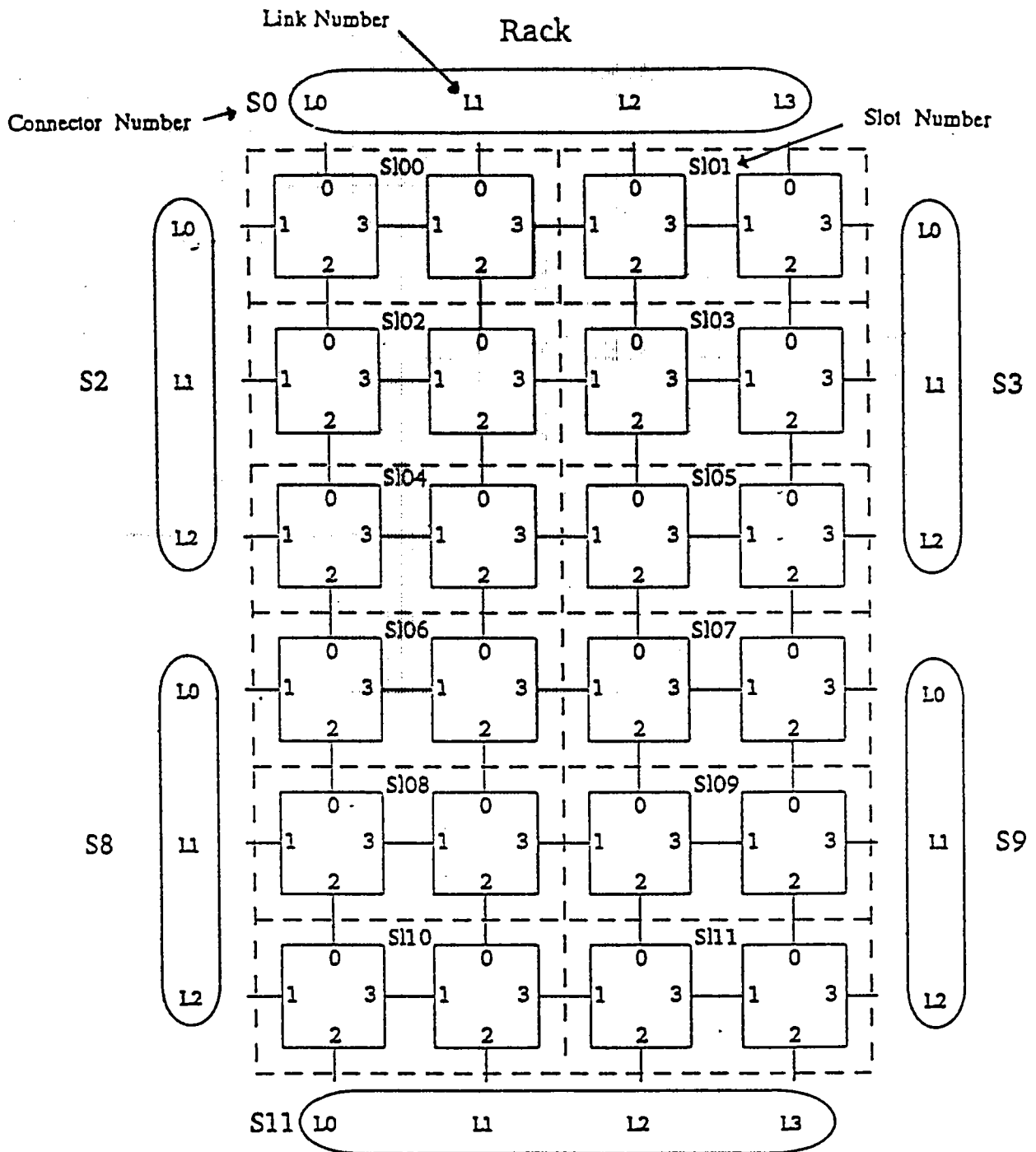
Figure 3 - 16: Direct connection for simple structures



### 3.6 MC-3 DE Matrix Module

For PARIX the transputers in the MC-3 DE system are linked by the Matrix Module:

Figure 3 - 17: Matrix Module of the MC - 3 DE



### 3.7 Configuration Example for MC-3 system family

To get more familiar with the configuration technique of the MC-3 product line, here is an example for a simple transputer configuration:

Figure 3 - 18: A Three Processor Ring

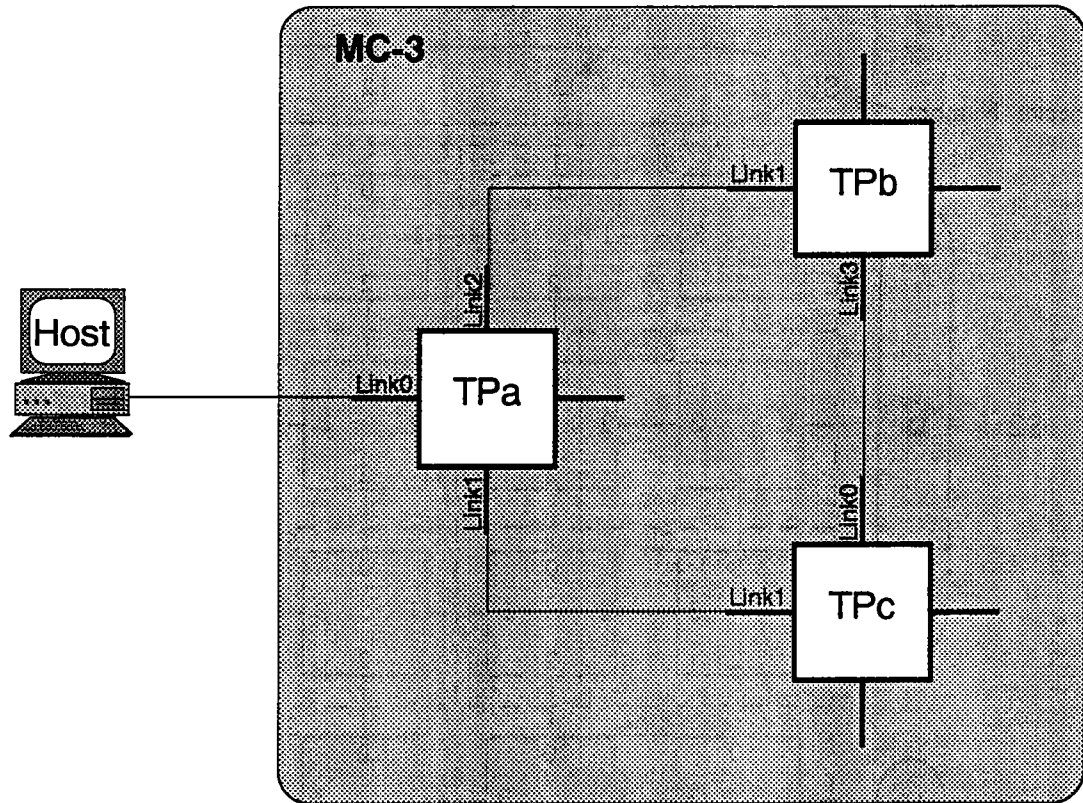
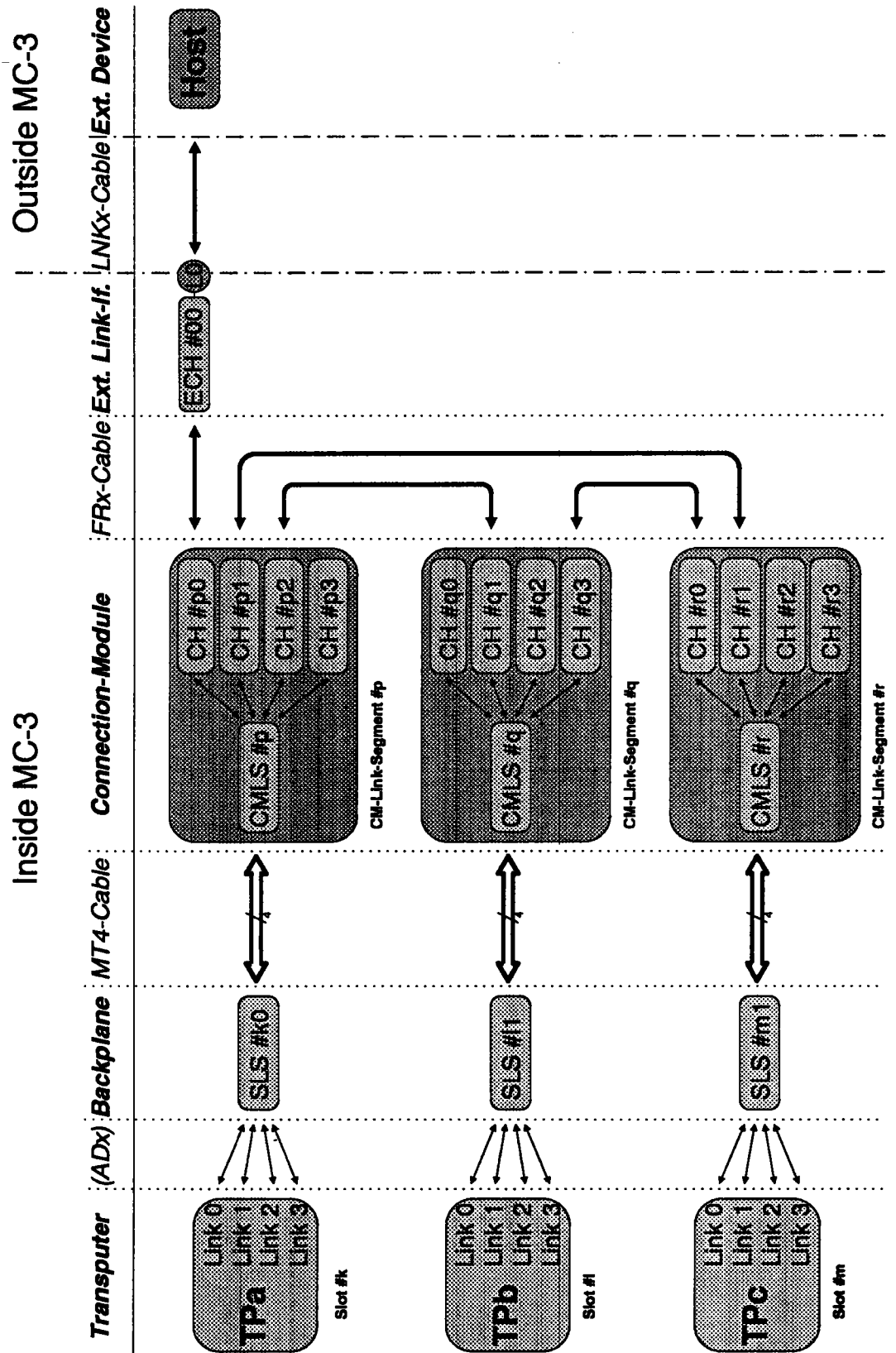


Figure 3 - 19: Connections for the Ring Example



<b>Appendix A: System Installation .....</b>	<b>A - 1</b>
A.1 Delivery Items .....	A - 1
A.2 Unpacking .....	A - 1
A.3 Placing .....	A - 2
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# Appendix A: System Installation

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This Appendix describes the unpacking and the first installation of a MC-3 system. You can also find power, environmental and physical requirements.

## A.1 Delivery Items

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Please check if every indicated item is in the container.

- MC-3 cabinet
- Power cable
- cables
- Manual(s)
- additional Transputer Modules

## A.2 Unpacking

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- Open the outer transport container by carefully cutting the tape.
- Open the lids of the both outer and inner transport container.
- Carefully lift the computer out of the container.

- **NOTE**

**Because a MC-3/14 cabinet weights 30 kg (MC-3/28 - 50 kg), this job is easier be done if somebody else helps holding the box.**

## **A.3 Placing**

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The MC-3 system is designed to operate under standard office conditions: 20°C to 35°C, 30% to 80% RH.

The minimum space necessary to set up the MC-3 cabinet is described detailed in Appendix A.6.

- **NOTE**

**Make sure that the external airflow to and from the internal cooling system is never blocked! A MC-3 must never be moved while in operation!**

## **A.4 Power Requirements**

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The MC-3 system needs a clean and stable computer AC line.

A MC-3 and a MC-3 DE run on 187-264 V AC, 47-63 Hz.

Before connecting the MC-3 system to a power outlet, compare the default voltage setting at the rear of the cabinet.

- **NOTE**

**And do not forget that electric devices should not come in contact with water.**

The power consumption of a MC-3 system depends on the number and types of computation and peripheral modules inserted.

The value listed on the cabinet's rear panel represents the maximal power consumption:

— for the MC-3/14, MC-3/14 DE: **650 W**

— for the MC-3/28, MC-3/28 DE: **1300 W**

## **A.5 Environmental Requirements**

The specific operation and storage requirements depend on the environmental conditions your MC-3 system will encounter.

The tables below show the requirements of temperature and humidity and of vibration and shock.

	Operation	Transport and Storage
Temperature:	-20 to +60 °C	-20 to +60 °C
Gradient:	20°C per hour	20°C per hour
Humidity:	20% to 80% RH (non condensing at 35%)	95% RH
Gradient:	30% per hour	30% per hour

	Operation	Transport and Storage
Vibration	0.2 G, range to 300 Hz magnitude 0.5 p-p	0.5 G, range to 300 Hz
Shock	2 G, 10 ms maximum	15 G, 10 ms maximum



## A.6 Further Physical Parameters

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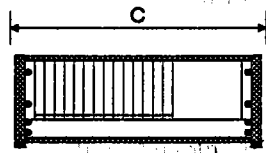
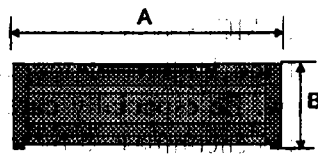
An empty MC-3/14 cabinet weights approximately 30 kg (MC-3/28 about 50 kg). The final weight depends on the number and type of processor and expansion modules inserted into the cabinet.

When installing a MC-3 system, please remember that in addition to the dimensions of the cabinet enough room must be left around to guarantee adequate ventilation! The space requirements listed below represent the absolute minimum necessary in order to protect the system from overheating. We advise leaving more space, as this not only to widen the safety margin, but also to make installing and wiring a lot more comfortable.

	Dimensions		Required Space	
	MC-3 / 14	MC-3 / 28	MC-3 / 14	MC-3 / 28
Height:	285 mm	375 mm	335 mm	425 mm
Width:	585 mm	585 mm	605 mm	605 mm
Depth:	600 mm	600 mm	900 mm	900 mm

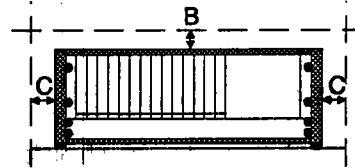
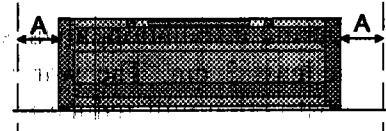
When installing the MC-3 system in a closed shelf, i.e. when only the front panel is exposed, leave at least 15 cm to all sides of the MC-3 system. The MC-3 system's ground clearance has to be 3 cm at least. Make sure the flow of cool air is never blocked, otherwise the system may overheat.

**Figure A - 1: Dimensions and required space**



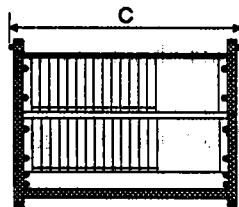
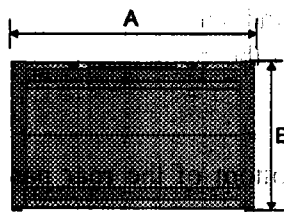
System's Outline  
Dimensions :

	mm	Inch
A	600	23.6
B	285	11.2
C	585	23.0



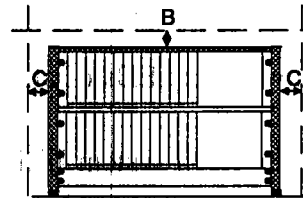
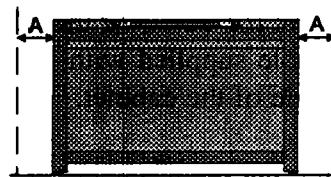
Required free space  
for proper cooling :

	cm	Inch
A	15	6
B	5	2
C	10	4



System's Outline  
Dimensions :

	mm	Inch
A	600	23.6
B	375	14.8
C	585	23.0



Required free space  
for proper cooling :

	cm	Inch
A	15	6
B	5	2
C	10	4

## A.7 Installation

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During installation, always be certain that the MC-3 system's ground clearance is at least 3 cm. The warm air is blown out the bottom of the cabinet and any obstruction will reduce the necessary air flow. Be especially careful not to place the system on any surface smaller than the area encompassed by the cabinet's four feet, as this would block off the lower ventilation grid entirely and cause damage to your system and the modules contained therein.

- **WARNING**

**MC-3 systems should never be used in closed cabinets, as adequate ventilation cannot be guaranteed under those circumstances.**

### A.7.1 Starting a MC-3 system

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If all the requirements listed above have been met, you can start your MC-3 system:

- Connect the MC-3 or the MC-3 DE to a clean and stable 220 V AC line. Use the AC cable supplied with the system. Plug it into the built-in AC-connector at the rear side of the cabinet.
- Switch the main power switch located at the bottom of the rear panel to the ON position.
- The power-on LEDs of all installed transputer modules should be on now.
- The four green system LEDs for + 5 V and +/- 12 V should be lightened.
- The red LED for Fan Failure should be off.

## **A.7.2 Connecting to a Bootstation**

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The bootstation downloads the link configuration software via the configuration link input to the network configuration units of a MC-3 system. The process executing the boot phase requires a default wiring between bootstation and the MC-3 system.

- **NOTE**

**It is not possible to connect more than one MC-3 system or one unit consisting several MC-3 system devices to one bootstation.**

Connect Link 3 of the integrated transputer module via the Backplane and the rear panel to the external I/O module on the rear side of the MC-3 cabinet. Normally you should use L0. Now connect your bootstation to the L0 plug.

- **NOTE**

**Please refer to the documentation of the transputer module used in your workstation where its Link 3 plug is located.**

## **A.7.3 Booting the MC-3 system**

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Booting can be performed in two ways. One method is to boot with the MultiTool programming environment installed in the bootstation. The other approach is to boot from the operating system level of the bootstation. Booting a MC-3 system means sending the configuration software to the network configuration units.

- **NOTE**

**Please refer to the appropriate sections of your system software installation manual.**

# Appendix B: General Maintenance

In order to guarantee steady and sufficient cooling, the MC-3 system's built-in ventilation unit requires periodic inspections. These include regular checks of the system's function and its filter, the time intervals between checks are depending on the dust level of the surrounding area. Excessive dust deposits will block the air flow necessary for cooling.

## **B.1 Checking the Fans**

---

The MC-3 system's ventilation unit is located at the bottom of the cabinet.

Each of the 6 fans is constantly monitored, and a red LED at the front panel will signal any malfunction.

If the red LED lights up, the system has to be shut down as soon as possible, regardless of the consequences (the software can be saved first). If one of the fans has failed completely, this leads to an insufficient air flow.

In case of trouble the ventilation unit switches off automatically. After the system is switched off, the fans continue running until a certain minimum temperature is reached. Defective fans have to be replaced before restarting the system.

- **NOTE**

**Defective ventilation units may be replaced by Parsytec technicians only.**

## B.2 Replacing the Air Filter

The air filter should be examined periodically to avoid excessive dust deposits. The intervals between inspections depend on the dust level of the surrounding area because excessive dust deposits will block the air flow necessary for cooling. The air filter is located at the top of the MC-3 system, immediately below the cooling grid.

In order to replace the air filter, first remove the two screws at the right side of the system. This unlocks the air filter tray, and you can pull it out. When this has been done, remove the filter. After a clean filter has been put in, insert the Air Filter Tray and push it back. Now fix the two screws again.

Figure B - 1: Right side of the MC-3

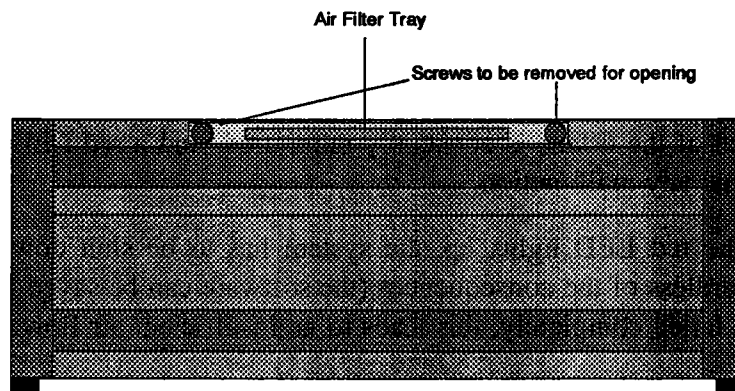
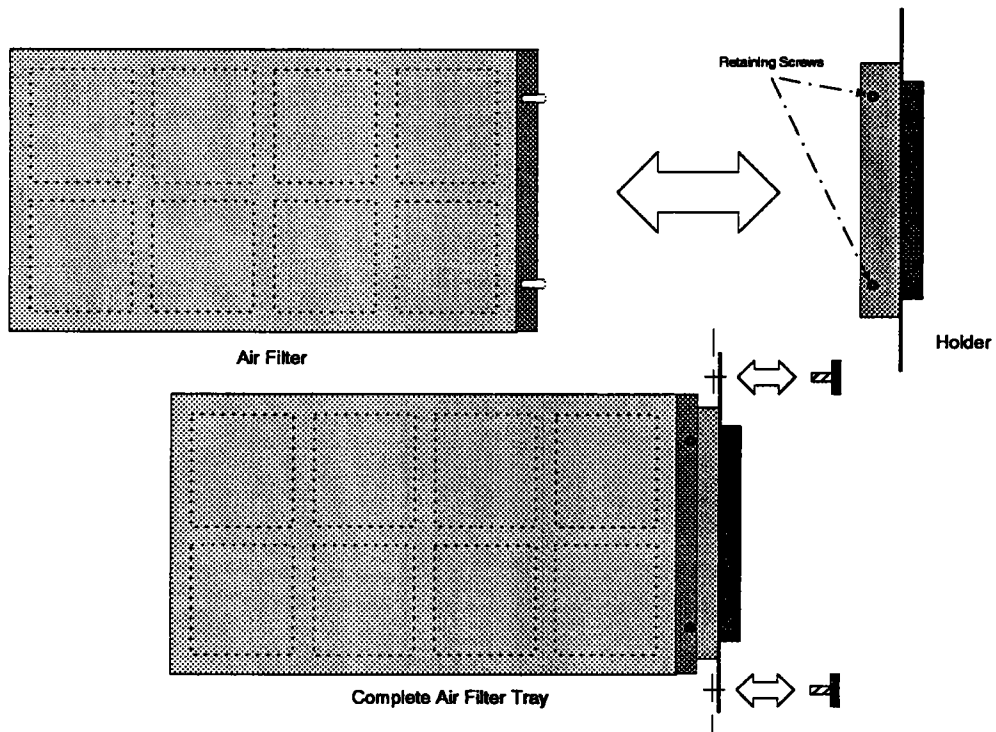


Figure B - 2: Air Filter Tray



## **B.3 Replacing Fuses**

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Although it is unlikely, the MC-3 system's main fuses may burn out and have to be replaced. If the fuses burn out frequently you should try to discover the reason for these failures before reconnecting the MC-3 system's power supply. High voltage peaks are the most frequent cause.

The main fuses of the MC-3 system are located in the rear panel, just between the main power switch and the power socket.

- **NOTE**

**As a safety precaution always remember to disconnect the unit from the line before replacing the fuses.**

## **Cabinet**

The system is housed in a 19" cabinet which can hold 14 or 28 boards.

## **CMLS**

Connection Module Link Segment

## **Connection module**

It connects up to ten boards entered in slot #04 to #13.

## **ECH**

External Channel

## **Matrix module**

The backplane of the MC-3 DE is presetted by the Matrix module fixed to the slots #0 to #11 for using the PARIX software environment.

## **MC-3-AD1**

It is an adaptor for the shorter Uni-Link-modules (PCB-size 220 mm X 100 mm) to reach the backplane connectors. All jumpers of the MC-3-AD1 adaptor have to be set, to route the RTSC-lines to the SRT-fields of the backplane.

## **PARIX**

PARIX is a software environment. There are ACE EXPERT Compilers for C and FORTRAN to run under PARIX.

## **Rack**

The rack contains the power supply and up to 14 or 28 boards.

## **RTSC**

Real Time Synchronization Control. The RTSC provides a global synchronization of Parsytec's industrial modules (e. g. TPM-ADC, TPM-DAC, TPM-DIO, TPM-MEM, TPM-UCS).

## **RTSM**

Real Time System Manager. The RTSM supports the user in the development and execution of realtime application.



**SCL**

Slot-C-Link. It is only for T9000 modules.

**SLS**

Slot-Line-Segment

**system**

The cabinet, the rack, the ventilation unit, the connection modules and the transputer modules form a MC-3 system.

<b>A</b>		<b>S</b>	
AC Connector	2-7	SCL	3-9
air filter	2-4, B-2	shock	A-3
applications	1-2	slot-segment	3-9
<b>B</b>		SLS	3-9
Backplane	3-6	software	1-3
board installation	2-5	space required	A-4
booting	A-7	SRT	3-9
bootstation	A-7	start	A-6
<b>C</b>		system installation	A-6
configuration	3-11, 3-12, 3-14, 3-15	system link speed	3-5
connection module	3-2	system reset button	2-4
consumption	A-2	<b>T</b>	
<b>D</b>		temperature	A-3
dimensions	A-4	<b>V</b>	
<b>F</b>		vibration	A-3
fans	B-1	<b>W</b>	
fuses	2-4, B-3	Weight	A-4
<b>H</b>			
hardware	1-2		
humidity	A-3		
<b>L</b>			
LED	2-3, B-1		
Linkage	2-8, 3-4		
<b>M</b>			
matrix module	3-15		
MC-3-AD1	2-5, 3-10		
<b>P</b>			
PARIX	1-3		
performance	1-1		
placing	A-2		
<b>R</b>			
Rear Panel	3-1		
RTSC	3-10		
RTSM	1-3		