



# **INSTALLATION GUIDE**

## **AML/E**

**AUTOMATED**

**MIXED-MEDIA**

**LIBRARY**

**/ENTRY**





## **Table of Contents**

---

### **1 Data of Your AML/E-System**

---

1.1	Project Data .....	1 - 1
1.2	Components .....	1 - 1
1.3	Emissions .....	1 - 1

### **2 Before You Begin Working with AML/E**

---

2.1	Explanation of Symbols and Notes .....	2 - 1
2.2	About This Manual .....	2 - 3
2.3	Copyright .....	2 - 4
2.4	Product Observation .....	2 - 5

### **3 For Your Safety**

---

3.1	Intended Use .....	3 - 1
3.2	Hazard Alert Messages .....	3 - 2
3.3	Further Symbols .....	3 - 3
3.4	Area of Application .....	3 - 5
3.5	Intended Audience/Authorized Persons .....	3 - 5
3.6	Guards .....	3 - 7
3.7	Before You Switch On the System .....	3 - 13
3.8	Work on Live Parts .....	3 - 14
3.9	Mechanic Work .....	3 - 15
3.10	Safety Check .....	3 - 16
3.11	High Leakage Current .....	3 - 16
3.12	Place of Power Connector .....	3 - 16

## Table of Contents

---

### 4 Transport

---

4.1	Packing .....	4 - 2
4.2	Transport to the Installation Site .....	4 - 12
4.3	Transport at the Installation Site .....	4 - 14
4.4	Storage Conditions .....	4 - 16
4.5	Unpacking .....	4 - 17
4.6	Disposing of Packing Materials .....	4 - 18

### 5 Assembly

---

5.1	Preparation .....	5 - 1
5.2	Mechanic Components .....	5 - 2
5.3	Cabling .....	5 - 18
5.4	Assembly Check .....	5 - 20

## **Table of Contents**

---

### **6 First Operation**

---

6.1 Documenting First Operation .....	6 - 1
6.2 Installing and configuring AMU .....	6 - 2
6.3 Installing Robot & Tower software .....	6 - 2
6.4 Transferring the Files for rho and the Drive Amplifiers .....	6 - 3
6.5 Checking the Hardware .....	6 - 7
6.6 Parameterizing rho .....	6 - 14
6.7 Parameterizing the Drive Amplifiers .....	6 - 18
6.8 Parameterizing rho .....	6 - 20
6.9 Testing the Axes .....	6 - 22
6.10 Teaching .....	6 - 24
6.11 Checking the Handling Unit .....	6 - 25
6.12 Inserting Media .....	6 - 32
6.13 Software Backup .....	6 - 33
6.14 Software Tools .....	6 - 36

### **7 Dismantling**

---

7.1 Preparation .....	7 - 1
7.2 Mechanic Components .....	7 - 4
7.3 Cabling .....	7 - 12

### **8 Appendix**

---

8.1 Tools Required .....	8 - 1
8.2 Small Parts for Installation .....	8 - 1

### **9 Index**

---

---

## **Table of Contents**

# **1 Data of Your AML/E-System**

---

## **1.1 Project Data**

---

### **1.1.1 Electrical Data**

---

Power AMU	230 V $\pm 10\%$ 1, N, PE
Power entire system	230 V $\pm 10\%$ 1, N, PE
Fusing (customer's site installation)	16 A wire fuses medium slow blow
Voltage, power section	400 V
Frequency	50 Hz/60 Hz
Control voltage	=24 V
Enclosure type	IP 50

## **1.2 Components**

---

The main components are:

- AML management unit (AMU) and operating panel
- handling unit
- archive
- input/output area (I/O unit)

## **1.3 Emissions**

---

- heat max. 0.9 kW
- noise 65 dB(A)









## **2.3 Copyright**

---

This document is copyrighted and may not, without written permission from ADIC/GRAU Storage Systems, be copied either in whole or in part, duplicated, translated or held on any electronic medium or in machine readable form.

The AML/E system (mechanics, hard- and software) described in this document is supplied on the basis of a general licence agreement or single license (entailing the commitment not to pass it on to third parties). The software may only be used and copied as authorized by the agreement. The same applies without restriction to the entire documentation of the AML/E system. Who copies the software (AMU, handling unit) without authority onto cassettes, disks or any other storage medium is liable to prosecution.

ADIC/GRAU Storage Systems reserves the right to change or adapt the functions described in this manual without stating reasons.

AML/E registered trade mark of ADIC/GRAU Storage Systems - Germany

BOSCH registered trade mark of Robert Bosch GmbH

CM/2 registered trade mark of IBM

DB 2/2 registered trade mark of IBM

IBM registered trade mark of IBM

OS/2 registered trade mark of IBM

PS/2 registered trade mark of IBM



## **Product Observation**

---











### 3.5.2 Authorized Persons

Only **trained** specialists (installation training) must install the AML/E system. The names of trained specialists are entered in the system logbook.

We therefore assume this personnel has the necessary knowledge of the safety regulations for work on electrotechnical systems.

The system logbook can be found in a compartment on the inside of the control cabinet door.



#### System Logbook

Order-No.:			
Customer:			
Address:			
Contact Person: Tel.: Fax:			
Trained staff of customer (VBG 4 / VDE 0105 / VDI 2853) :			
Name: <hr/> <hr/> <hr/> <hr/>	Signature: <hr/> <hr/> <hr/> <hr/>	Name: <hr/> <hr/> <hr/> <hr/>	Signature: <hr/> <hr/> <hr/> <hr/>
Service-Partner: Tel.: Fax:			
Trained specialists of the service partner (VBG 4 / VDE 0105 / VDI 2853):			
Name: <hr/> <hr/>	Signature: <hr/> <hr/>	Name: <hr/> <hr/>	Signature: <hr/> <hr/>

Fig. 3-1: System Logbook









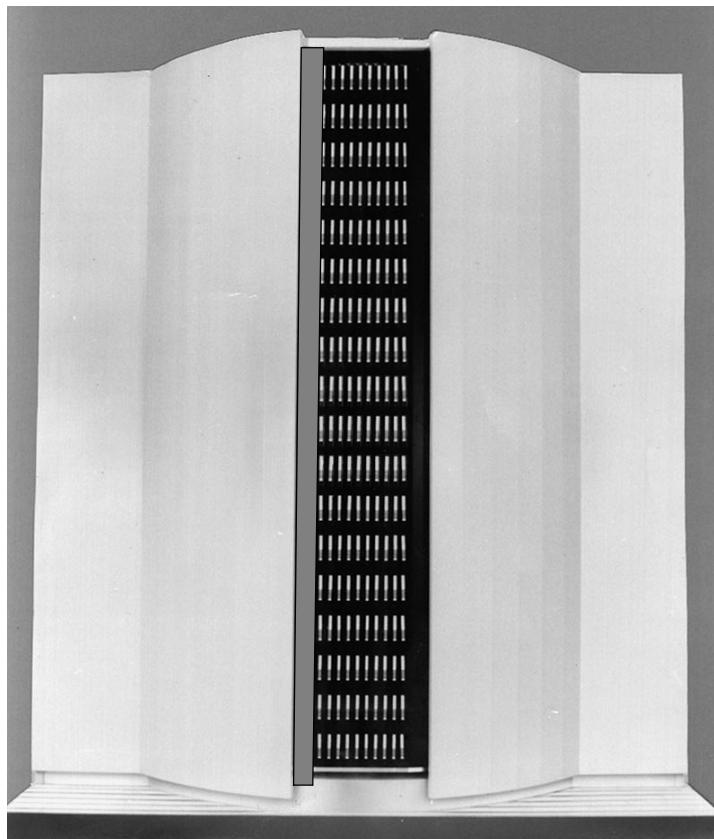


### **3.6.4 Guard Door of Quadro Tower**

In the “AUTO” operating mode the guard door of the Quadro tower must be closed.

The guard door is locked when the Quadro tower moves.

In the AML/E system it can be opened only in “EMERGENCY” operating mode.



*Fig. 3-2: Quadro Tower Guard Door*











## 4.1 **Packing**

### 4.1.1 **Packing Materials**

Use the following packing materials:

Wood	<ul style="list-style-type: none"><li>• Euro pallets</li><li>• Transport crates</li></ul>
Metal	<ul style="list-style-type: none"><li>• Steel tapes</li><li>• Stillages</li></ul>
Paper and cardboard	<ul style="list-style-type: none"><li>• Corrugated cardboard</li><li>• Boxes</li><li>• Cartons</li></ul>
Plastics	<ul style="list-style-type: none"><li>• Bags</li><li>• Foils</li><li>• Air-cushion foil</li><li>• Foamed foil</li><li>• Foam</li><li>• Plastic tape</li><li>• Cut-to-size high-resistance foam</li><li>• Shaped high-resistance foam for Hexa tower</li></ul>
Reused packing material of sub-suppliers	<ul style="list-style-type: none"><li>• Paper and cardboard</li><li>• Plastics</li></ul>
Auxiliary materials	<ul style="list-style-type: none"><li>• Desiccant clay in paper bags (desiccant according to DIN 55 473 execution A): Bentonit</li><li>• Corrosion protection oil: Heinol E-Takt</li></ul>

### 4.1.2 Preparation

---

#### **Indispensible**

- at least two people
- the partlist of the AML/E system to be packed
- packing materials
- stacker
- industrial scales

#### **Advantageous**

- foil sealing device
- fork lift
- crane

#### **Prepare crates**

- a) calculate gross space required by the components
- b) use suitable crates
- c) number the crates
- d) clad the inside of the crates with foil

### Arrange stillages



*Fig. 4-1: Stillage*

- a) Clad the metal posts of the stillage with foam.
- b) Pack into stillages:
  - the cover plates
  - the door of the AML/E system



### I/O unit

- I/O unit
  - handling boxes (inserted in I/O unit)
- a) Clad the I/O unit with foam or foamed foil.

### Hexa tower

- mineral cast iron with round table and drive
  - tower plate
  - segments
  - tower rim
- a) Clad the parts individually with foamed foil or air-cushion foil.
- b) Put the tower plate(s) onto a Euro pallet.
  - Put pieces of high-resistance foam between the tower plates.
  - Secure the finnished pallets with steel tapes.
- c) Proceed the same way with
  - the tower rims
  - the segments

### Quadro tower

- support structure
  - lubrication
  - gearing
  - frame structure
- a) Clad the parts individually with foamed foil or air-cushion foil.
- b) Put pieces of high-resistance foam between the gearing parts.
- c) Put the components of the gearing onto Euro pallets.
  - Put pieces of high-resistance foam between them.
  - Fasten everything with steel tapes.

### Plates

- covers
- covers with windows
- support parts for covers
- corner pillars
- footboards
- door

- a) Clad the individual plates with foamed foil or air-cushion foil.
- b) Put the stillages into the crates.
- c) Put the covers and the door into the stillages.
  - Put pieces of high-resistance foam between them.
  - Fasten everything with plastic tapes.

### Support structure

- drive adjusting feet
- handling unit frame
  - frame profiles
  - frame brackets

### Cables

- a) Gather up all cables loosely without bending them.

### Air hoses

- a) Gather up all air hoses loosely without bending them.





## **ADIC/GRAU manuals, diskettes and other accessories**

German and/or English version of manuals:

- For AML/E:
  - Installation Guide (the present manual)
  - Operator Guide
  - Maintenance Guide
- For HACC/MVS:
  - System Reference Guide
  - Operator Guide
  - Installation & Customization
  - General Information Guide
  - Messages & Codes
  - ISPF User Guide
  - Release Guide
  - Quick Reference
  - Installation & Customization Reference (from HACC/MVS 3.0)
  - Command Reference (from HACC/MVS 3.0)
  - Conversion Notebook (from HACC/MVS 3.0)
- For other HOST software:
  - HACC/DAS manuals
  - HACC/OS400: RTHS-AS 400 Operator Guide (English only)
  - HACC/VM

ADIC/GRAU software diskettes

- Configuration Files (CFG-Files)
- AMU software
- Robot & Tower software

Accessories:

- system logbook
- file “Software Backup”
- electrical diagrams
- sign “Maintenance Work”

### 4.1.4 Close and Label Crates

---

- a) Put bags with desiccant into each crate.
- b) Fold the foil.
- c) Seal the foil.
- d) Close the crates.
- e) Label the crates with information such as
  - “Open on this side”
  - “Can be unscrewed”
  - “Top”
- f) Label the crates with symbols such as the following



Protect from MOISTURE!



CAUTION GLASS!

- g) Weigh the crates.
- h) Write the weight of the crate
  - onto each crate
  - onto the packing list

## **4.2 Transport to the Installation Site**

---

You may transport the packed AML/E system by

- freight carrier
- air freight
- sea freight

### **4.2.1 Loading onto a Truck**

---

To load a truck you need:

- stacker
- fork lift (optional)
- crane (optional)

Employ qualified personnel for loading:

- fork lift driver
- crane driver
- AML/E installation staff

a) Load the crates.

b) Secure them from slipping:

e. g. nail strips between the crates onto the floor of the truck.



## **4.3 Transport at the Installation Site**

---

### **4.3.1 Preparation**

---

To unload you need:

- load lift
- fork lift
- stacker
- crane

Employ qualified personnel for unloading:

- fork lift driver
- crane driver
- AML/E installation staff

Provide a suitable storage area (☞ page 4 - 16)

- at the installation site
- in the direct vicinity of the installation site





### **4.5 Unpacking**

---

Provide the required auxiliary equipment:

- stacker
- fork lift

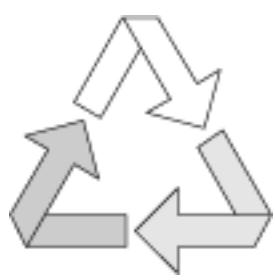
Employ only qualified personnel for unpacking:

- AML/E installation personnel
- fork lift driver

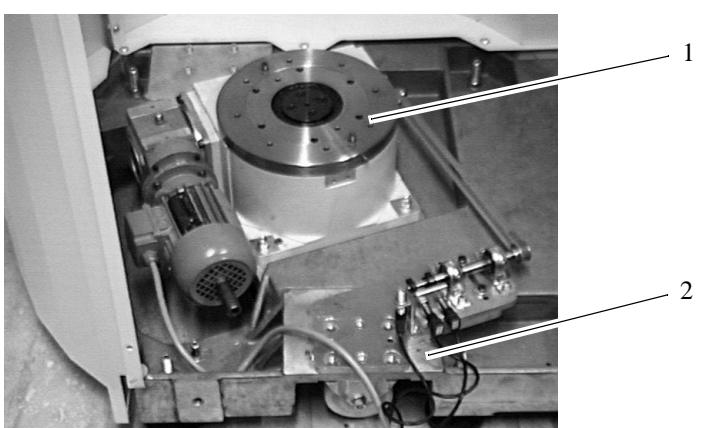
a) Provide sufficient space for unpacking.

b) Have all crates unpacked.

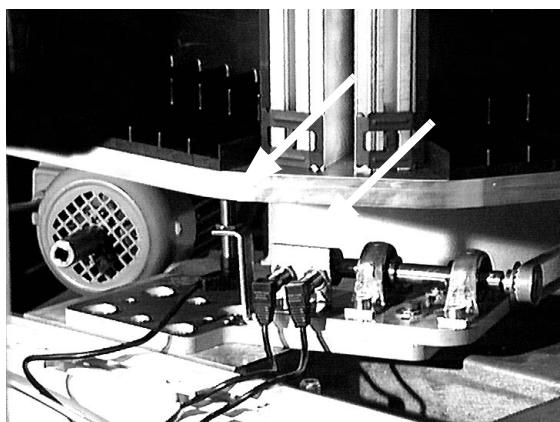
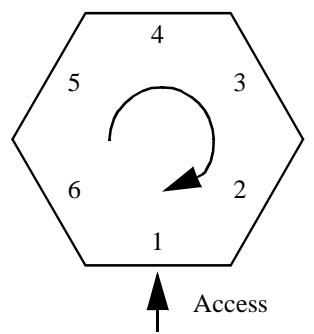
Check for completeness by comparing with the packing list.











### 5.2.3 Hexa Tower 3 and 4

---

- a) Position the base plate according to the system layout (☞ page 5 - 2).
- b) Assemble the handling unit (☞ page 5 - 6).
- c) Attach the Hexa tower to the handling unit.
- d) Adjust the Hexa tower to the height of the handling unit.
- e) Level the Hexa tower.
- f) Mount the tower plate.
- g) Mount the segments.
- h) Finally check
  - the switching distance of the three reference switches: setpoint 1-2 mm
  - the segment identification (numbering)

### 5.2.4 Handling Unit (Part 1)

#### Base plate with robot

- a) Position the base plate according to the system layout: in the reference position (=condition upon shipment) the gripper points toward the I/O unit or the archive access.

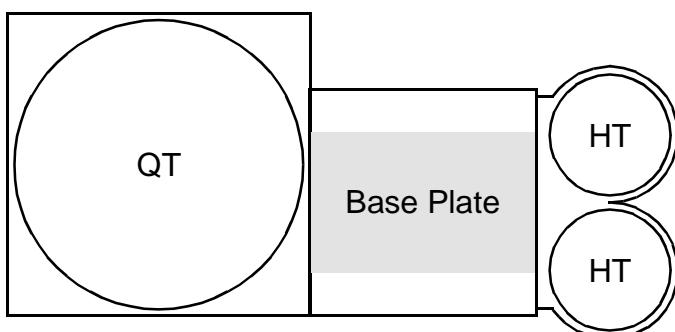
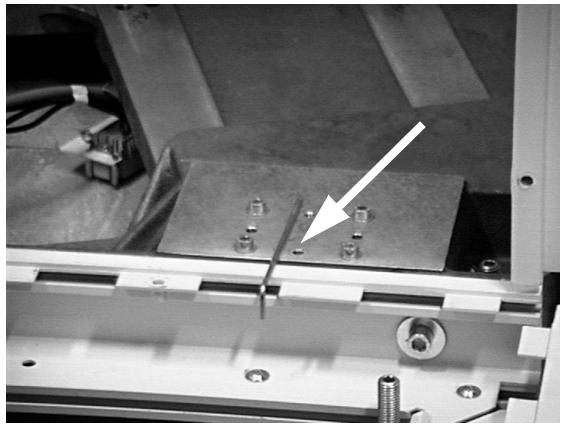


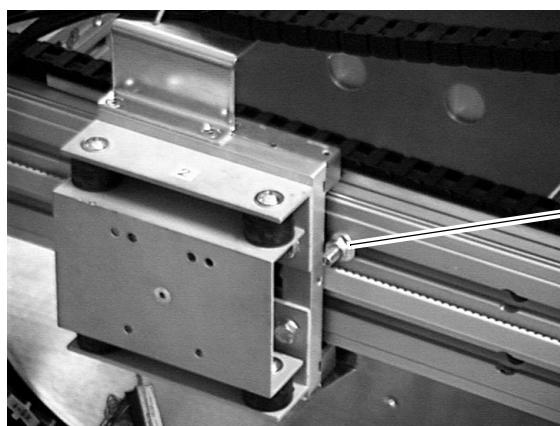
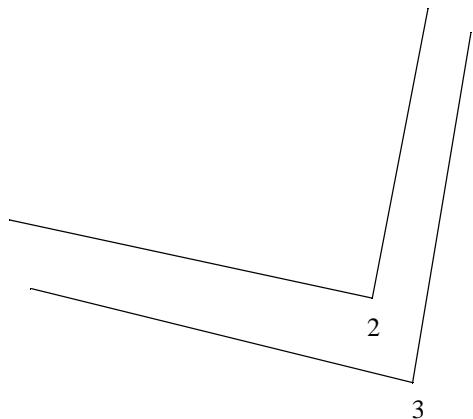
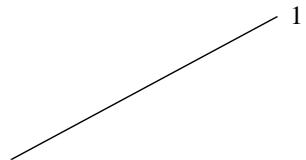
Fig. 5-4: Example for the Position of the Handling Unit Base Plate in the AML/E System

#### Mount the frame

The frame consists of four profiles and four brackets.

- a) Mount two profiles onto the base plate.
  - Attach the profiles to the two vertical surfaces.
  - Align the profiles: loosely handtighten the screws and push the opposite profile in the same direction until stop.
  - Tighten the screws.
- b) Mount the four brackets to the profile - do not yet mount the feet.
- c) Close the frame with the two remaining profiles.
- d) Mount the small retaining plates for the covers.
- e) Attach the handling unit to the Hexa tower 1/Quadro tower 1





## Mechanic Components

---

- c) Level the handling unit (tolerance  $\pm 0.1$  mm/m)
  - axis 1
  - axis 2



*Fig. 5-8: Levelling Axis 1 with a Spirit Level*



*Fig. 5-9: Levelling Axis 2 with a Spirit Level*

- d) Adjust the centre feet: keep an eye on the outside feet as you do this; they must not come off the floor! (all feet must firmly rest on the ground)
- e) Tighten the six lock nuts of the feet.
- f) Install the feet of the frame and tighten the lock nuts.
- g) Check whether all feet firmly rest on the ground.

2



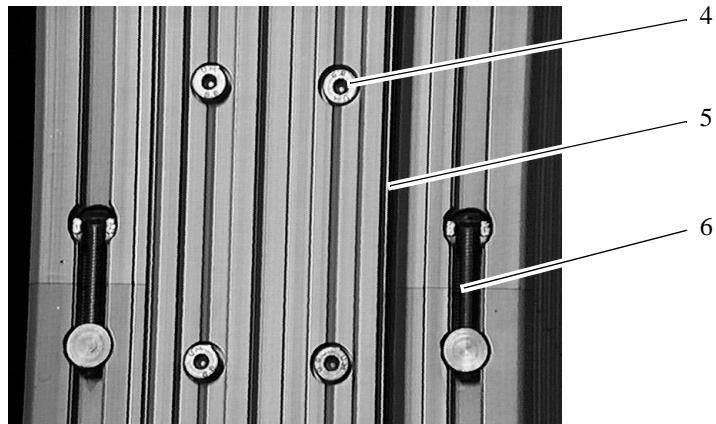
3



## Mechanic Components

---

- e) Dismount the carrying frame.



*Fig. 5-12: Connecting Column Sections*

- f) The guide rods (5) must be attached to the groove and must not have seams. To check gently rub with your finger along the “edge”.
- g) Loosely handtighten the screws (4) of the guide profiles.
- h) Insert the four bolt connectors (6) and loosely handtighten the screws.
- i) Align the column elements.  
To check gently rub with your finger along the “edge”  
- on the sides of the column  
- on the guide rods inside the guide profiles
- j) Tighten the screws (4) of the guide profiles (torque = 20 Nm)
- k) Tighten the four bolt connectors.
- l) Retighten the screws of the guide profiles (torque = 20 Nm)
- m) Axially secure the guide rods: loosely handtighten the pressure bolts at the upper column section and lock them.



## Mechanic Components

---

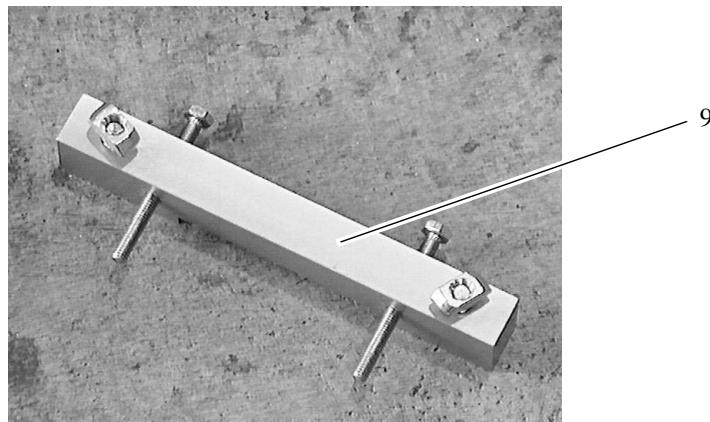


Fig. 5-14: Mounting Rail with Adjusting Screws

- d) Mount the mounting rail (9) to the column below the flange plate.
- e) Position the drive head with the adjusting screws on the mounting rail:  
adjust the flange plate flush with the upper column end.  
To check gently rub along the “edge” with your fingers.
- f) Tighten the screws of the flange plate (torque = 25 Nm)
- g) Remove the mounting rail.
- h) Push the stoppers to the flange plate and tighten the screws (torque = 20 Nm)
- i) Remove the belt mark.
- j) Mount the cable gutter.
  - Untie the upper cable gutter and unfold it upward.
  - Mount the cable gutter to the drive head.
  - Screw the upper and the bottom cable gutters.
- k) Insert the motor plug.
- l) Check the drive belt tension and readjust it if necessary.  
(☞ MG 6.4 “Mechanic Maintenance”)
- m) Finally check whether the reference marks of the axes 1 through 4 are present and okay.

### 5.2.5 Control Unit

---

- a) Position the control unit according to the system layout.

### 5.2.6 AMU Processor

---

Position the AMU processor according to the system layout.

Connect the cables:

- power cable
  - AMU
  - monitor
  - printer (optional)
  - modem (optional)
- monitor
- keyboard
- mouse
- control unit interface
- modem interface ( below)
- backup AMU interface (optional)
- printer interface (optional)

### 5.2.7 Modem for telediagnostic service (optional)

---

Position the modem next to the AMU processor.

Connect the cables:

- power cable
- telephone connection
- AMU interface



### Mount the I/O unit

- a) Adjust the height to the holes for the covers.
- b) On each side mount six screws.
- c) Provide the compressed air supply and connect it .
  - the air hose (feed it below the handling unit and do not pinch it!)
  - the failure monitoring (24 V; motor, line) ( page 7 - 5)
  - the grounding cable from the control unit
  - the grounding cable to the handling unit
  - the compressor plug
- d) Insert the handling boxes.
- e) Remove the transport protection of the shutter

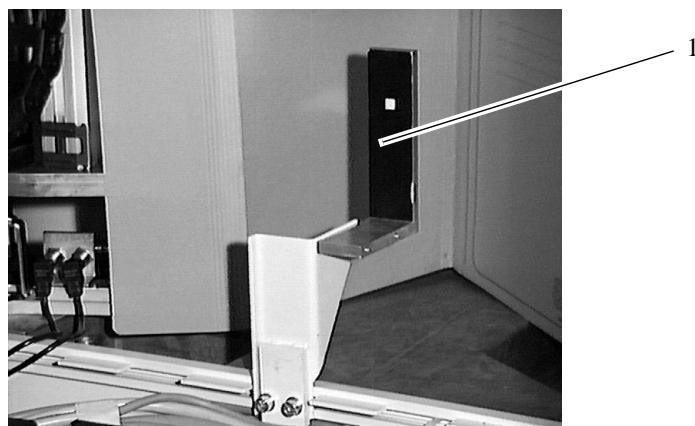
### Mount the covers

Observe the sequence!

- drive side
- if available closed side
- access to the archive (last)
  - Mount the door lock.
  - Adjust the mating piece of the door lock.

### Mounting further elements

- a) Connect the cables
  - the grounding (normally prepared in duplicate)
  - the Hexa tower plug  
(one plug for two Hexa towers, two plugs for four Hexa towers)
  - the two handling unit plugs
- b) Mount the alignment station (1)  
(not in the moving area of the handling unit)
  - between the Hexa towers (☞ see figure below)
  - on systems without Hexa towers in one corner of the Quadro tower



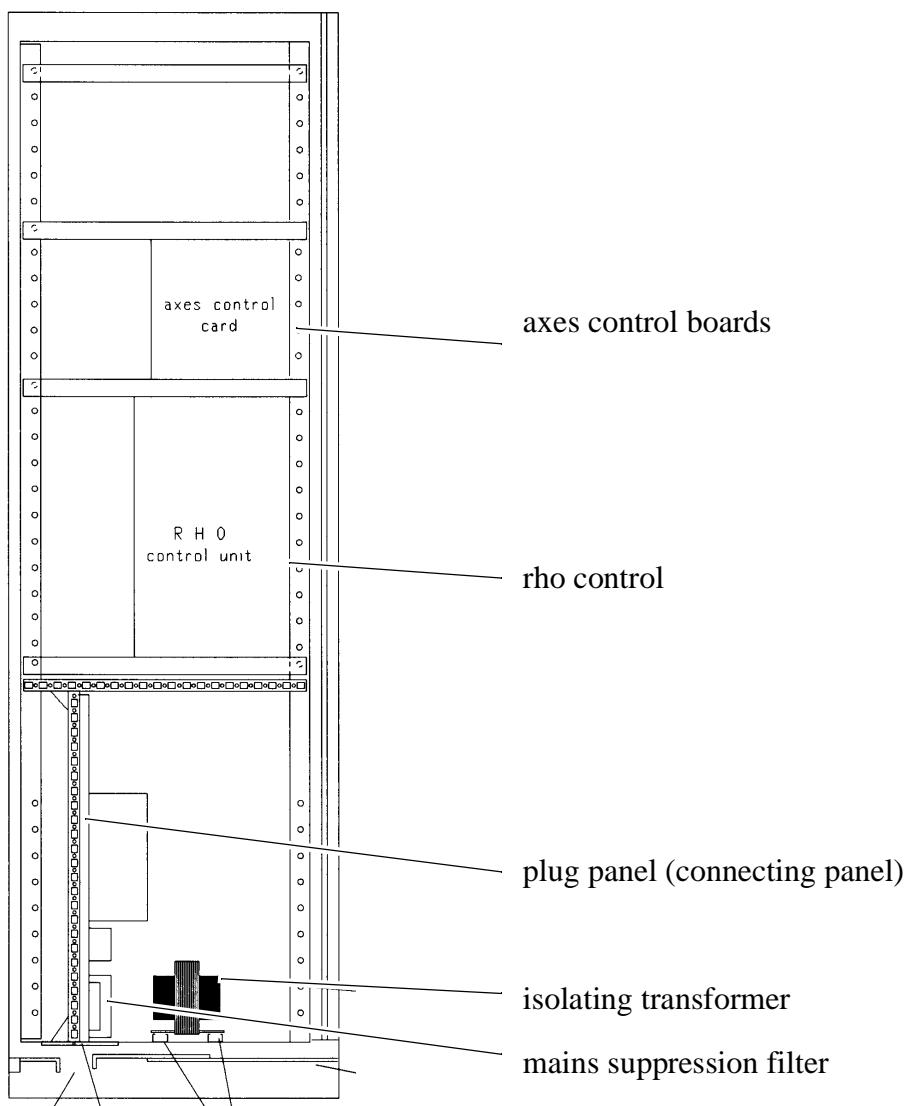
*Fig. 5-15: Alignment Station between the Hexa Towers*

- c) Mount the footboards.
- d) Mount the gripper (☞ Maintenance Guide).
- e) Check the gripper connections.
  - Are the gripper cable and the air hose secured?
  - Are the arrangement of the gripper cable and the strain relief of the gripper cable okay? (correct if necessary)

### 5.2.10 Drives

---

- a) Mount the stopper for the drive to the frame.
- b) Position the drives according to the system layout.
- c) Push the drive against the stopper.



## **Cabling**

---

- a) Arrange cables in loops behind clamps.
- b) It must be possible to pull the 19“ rack forward.
- c) Check the shielding of the scanner cables at the interface modem.
- d) Finally check all connections.  
Have you mounted all strain reliefs?

---

## 5.4 Assembly Check

---

### 5.4.1 Check Safety

---

Check all guards:

- the <EMERGENCY STOP> buttons
  - at the I/O unit
  - at the PHG
- two safety switches each
  - at the archive access
  - inside the archive
  - at the Quadro tower guard door
  - at the I/O door
- the door locks (readjust if necessary)
  - of the archive access
  - of the Quadro tower guard door
  - of the I/O door

### 5.4.2 Check Grounding and Strain Reliefs

---

Check whether all connections are present and connected.

- Are all strain reliefs mounted?
- Are all components grounded?
  - the handling unit
  - the Hexa towers
  - the I/O unit
  - the Quadro tower (main tower drive motor/auxiliary tower drive motor)

## **6      First Operation**

---

### **6.1     Documenting First Operation**

---

Document the first operation. Complete the documents supplied parallel to the first operation:

- parameter lists in the file “Software Backup”
- sheet with “Plant Data”

## 6.2      **Installing and configuring AMU**

---

### 6.2.1    **Installation**

---

(☞ AMU Installation Guide)

### 6.2.2    **Konfiguration**

---

(☞ AMU Reference Guide)

## 6.3      **Installing Robot & Tower software**

---

You receive the software on diskette as self-extracting file (EXE-file):  
e.g. „AEV230x.EXE“

- a) Copy the EXE-file on drive C:
- b) Unzip the file AEV230x on drive C:. Observe the notes on your screen
- After the software has been installed on your PC, create on drive C: the following directories
  - MOOG
  - ROBOT
- c) Copy all files from directory C:\PRS in directory C:\MOOG (copy \*.\*)
- Copy all files (+ below: on demand) from directory C:\PIC to directory C:\ROBOT:
  - „MAX2KIN.RHO“ from 0 to 1 tower
  - „MAX3KIN.RHO“ from 2 to 3 towers

### **6.4 Transferring the Files for rho and the Drive Amplifiers**

---

#### **6.4.1 Preparation**

---

- a) Switch the main switch on.
- b) Change to an OS/2 input window.
- c) Insert the diskette “Robot & Tower Software” in drive A:

#### **6.4.2 Copy the Files**

---

- a) Enter the following commands in the OS/2 input window:

```
[C:\]md robot  
[C:\]cd robot  
[C:\ROBOT]a:  
[A:\]cd bas  
[A:\BAS]copy *.dat c:\robot  
[A:\BAS]cd..  
[A:\]cd pic  
[A:\PIC]copy *.p2x c:\robot  
[A:\PIC]cd..  
[A:]cd bin  
[A:\BIN]copy *.bin c:\robot  
[A:\BIN]cd..  
[A:\]cd sourcen  
[A:\SOURCEN]copy *.ird c:\robot  
[A:\SOURCEN]copy *.dat c:\robot  
[A:\SOURCEN]copy *.c11 c:\robot\*.dat  
[A:\SOURCEN]c:
```



## **Transferring the Files for rho and the Drive Amplifiers**

---

### **Edit drive types**

<b>Pos.</b>	<b>Line</b>	<b>Entry</b>
78-84	170-176	all used drive types

### **Edit software limits**

<b>Pos.</b>	<b>Line</b>	<b>Entry</b>
141	257	maximum value of the Z-coordinate: • 143 500 (12R, Grundeinstellung) • 181 900 (15R) • 218 900 (18R)

### **Edit diagnosis**

<b>Pos.</b>	<b>Line</b>	<b>Entry</b>
144	266	1

### **Edit gripper OFFSET**

<b>Pos.</b>	<b>Line</b>	<b>Entry</b>
148	276	type of gripper (0=small, 1=large)
152-158	284-292	values of the gripper data sheet [1/100 mm]

### **Save “KONFIG.DAT”**

- a) Save the entries and quit the EPM editor by pressing <F4>.







## Checking the Hardware

### 6.5.2 Power Supply 160

(☞ MG “Power Supply 160”)

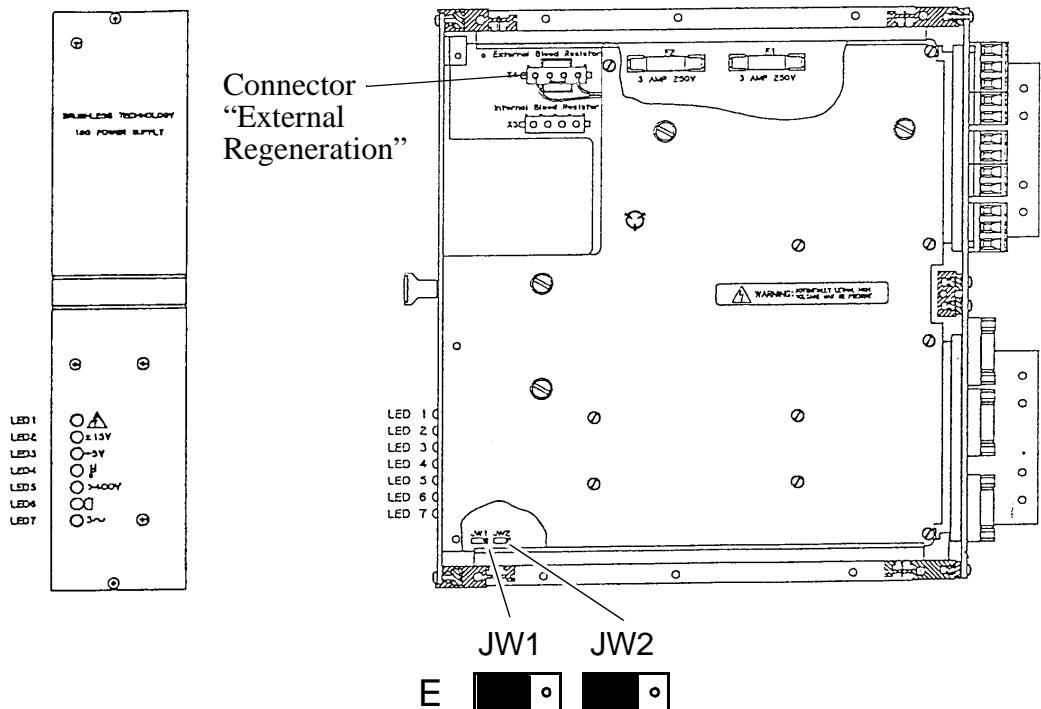


Fig. 6-1: Power Supply 160

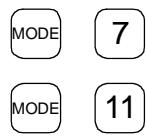
- When checking the power supply 160 look for the following
  - latest version (160 B and 204 A)
  - the plug “Internal/External Regeneration”.  
This plug must be plugged onto “External Regeneration”.













EEPROM wird  
programmiert



1

## 6.6.2 Tranferring Files to rho

- Start the **Rho File Manager**.
- In the **Connection** menu select the command **Send to Rho**.  
The **Send File AMU --> Control** window appears:

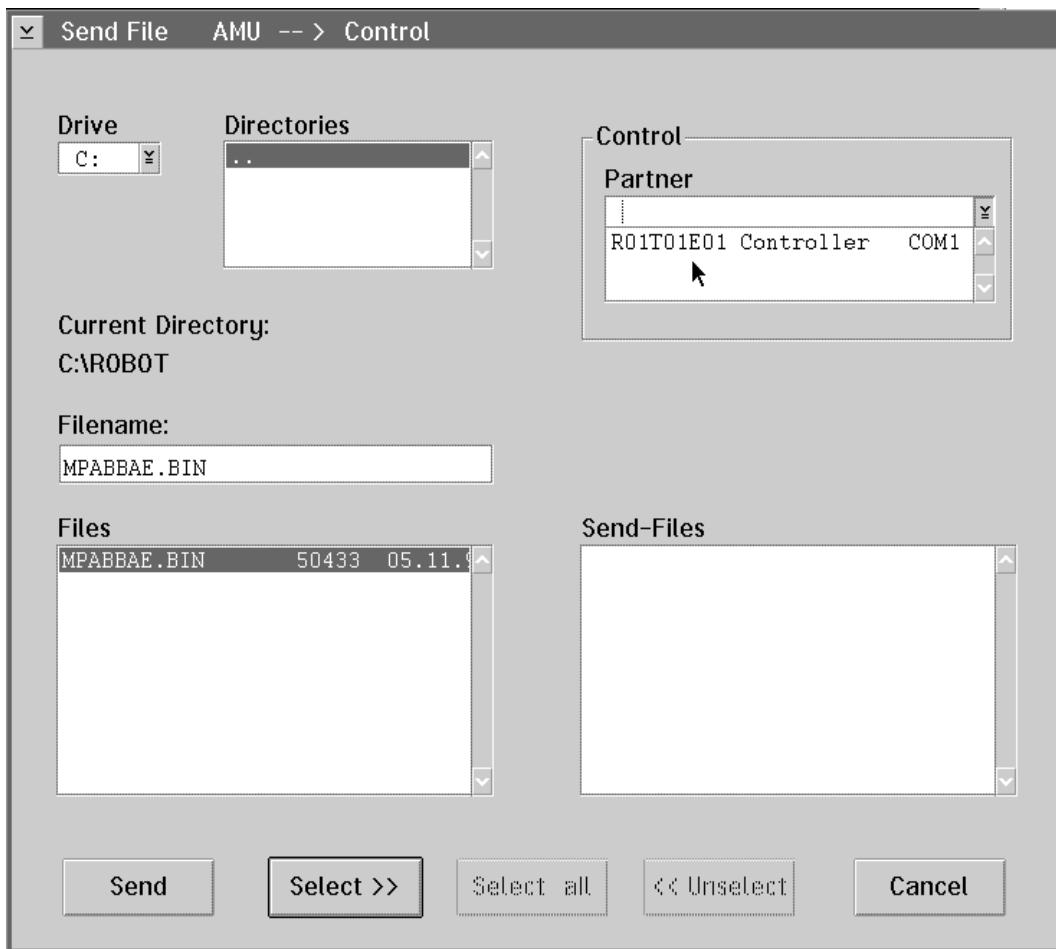


Fig. 6-3: Window "Send File AMU --> Control"

- Adjustments in the **Send File AMU --> Control** window:
  - **Control Partner**: click on the only choice.
  - **Drive**: C
  - **Directories**: ROBOT
  - **Files**: MPAMLE.BIN
- Select **Select**.
- Transfer the files by selecting **Send**.  
During the transfer the **Send File AMU --> Control** window appears.



### 6.7 Parameterizing the Drive Amplifiers

---

#### 6.7.1 Connecting the Drive Amplifiers to AMU

---

(☞ MG “Connect AMU to the board”)

- a) Plug the installation cable
  - at the AMU interface COM1 or COM2  
(if necessary disconnect another cable)
  - at the drive amplifier socket X6
- b) Open an OS/2 input window.
- c) Insert the diskette “Robot & Tower Software” in drive A:
- d) Enter following commands:
  - [C:\AMU]a:
  - [A:\]cd moog
  - [A:\MOOG]boschtrm
- e) To configure enter <C>.
- f) Set the configuration:
  - Communication Mode                    RS 232        <1>
  - Communication Port                    COM1            <1>
  - COM2            <2>
  - Controller Type                        T 161 Series    <2>

#### 6.7.2 Parameterizing the Drive Amplifiers for the Axes 1-4 (Handling Unit)

---

(☞ MG “Parameterizing the drive amplifiers for axes 1-4 (handling unit”))

#### 6.7.3 Parameterizing the Drive Amplifiers for the Axes 5+6 (Quadro Tower)

---

(☞ MG “Parameterize the drive amplifiers of axis 5+6 (Quadro tower”))

### 6.7.4 Adjusting the Resolver Zero-Point (HPO) to the Measured Value

---

At Offset enter the values recorded on the datasheet (Bosch commissioning robot).

(☞ MG 7.4.16 h) “Adjust the resolver zero-point (HPO) to the measured value”)

### 6.7.5 Disconnecting the Connection to the Drive Amplifier

---

- a) Unplug the installation cable from the (if you had unplugged another cable replug it):
  - AMU interface
  - drive amplifier socket X6
- b) Remove the diskette “Robot & Tower Software” from drive A:
- c) Exit the OS/2 input window.
- d) Reset the control system by pressing the reset button on the power supply PS75.





<input type="radio"/> 1+	<input type="radio"/> 1-
<input type="radio"/> 2+	<input type="radio"/> 2-
<input type="radio"/> 3+	<input type="radio"/> 3-
<input type="radio"/> 4+	<input type="radio"/> 4-

## **Testing the Axes**

---

### **6.9.3 Quadro Tower**

---

a) Move the axes of the Quadro tower:

- Press **5+** +<dead man> or **5-** +<dead man>
- Press **6+** +<dead man> or **6-** +<dead man>

### **6.9.4 Completing the Axes Test**

---

- a) Shut off the AML/E system.
- b) Reset the rho control unit:  
remove the 24 V from input 0.0.
- c) Switch the main switch on.
- d) Let the rho control unit boot.
- e) Press <CONTROL ON>.
- f) The AML/E system carries out reference movements.

### **6.9.5 Message in the LOG**

---

a) Open the **LOG Control Center - Online** window.

When the configuration of the handling unit has been completed successfully  
the following message appears  
“The configured robot(s) 1 ready for AMU”

---

## **6.10    Teaching**

(☞ MG “Teaching”)

There are two possibilities for teaching the AML/E system.

---

### **6.10.1   Single Command**

(☞ MG “Single command“)

This is the more complicated version. It will require too much time if employed for initial teaching of the entire system. Use teaching with single commands only to teach individual components.

---

### **6.10.2   Graphical Teaching**

(☞ MG “Graphical teaching”)







- “KONFIG.DAT” (line 63-98):  
enter the correction values found.
  - Press **[MODE]**, then **[SHIFT] + [E]** (Terminate and Save)
  - Activate the value by pressing **[ALT] + [SHIFT] +<dead man>**
  - Select **[2]** (Read)
  - Select **[0]** (Exit)
- f) Restart **Get...** and check the process.  
Only when the medium is handled with precision you may start the next step.





1

2

1

1



### **6.13 Software Backup**

---

(☞ MG “Software Backup of the AML/E System”,  
☞ MG “Backup”)

#### **6.13.1 Preparation**

---

- a) Insert the correct diskette in drive A: (☞ page 6 - 34).

#### **6.13.2 Selection in the Rho File Manager**

---

(☞ MG 5.4 “Rho File Manager”)

- a) Select the following in the **Connection** menu under command **Backup**:
  - **Partner**
  - **Directories**: correct directory
  - **Drive**: A
  - **Backup**

### **6.13.3 Directory of the Backup Files**

---

#### **Diskette 1**

- SOURCEN\  
- AMULESE.IRD  
- AMUSCHR.IRD  
- EXPROG.DAT  
- FBARCODE.IRD  
- FLW3490.IRD  
- FLW34907.DAT  
- FLW34909.DAT  
- \*.DTA  
- FLWMULTI.IRD  
- FNEWGRIP.IRD  
- FRACK.IRD  
- FTEACH.IRD  
- FTEST.DAT  
- FTEST.GER  
- FTEST.IRD  
- HOMEPOS.DAT  
- HTURM.IRD  
- INIT.IRD  
- KONFIG.DAT  
- KOPPLUNG.DAT  
- PERMAN.IRD  
- QTURM1.IRD  
- QTURM2.IRD  
- TKONFIG8.DAT  
- VERSION.DAT  
- IQ\_AMLE.P2X  
- MPRHO3.BIN





### **6.14.4 “JUSTUTIL.EXE”**

---

(☞ AMU Reference Guide)

### **6.14.5 “KRNPSET.CMD”**

---

Command file supplied with the AMU Installation Program.  
It is executed during the initial installation of AMU.

### **6.14.6 “SETUPAMU.CMD”**

---

Command file supplied with the AMU Installation Program.  
It is executed during a supplementary installation of the AMU, that is, when a database is present.

### **6.14.7 “BOSCHTRM.EXE”**

---

Communication program for communication between PC (AMU computer) and the drive amplifiers.

(☞ Documentation for AML/E components: 9. Moog amplifier (RMC))

### **6.14.8 Rho File Manager**

---

(☞ MG “Rho File Manager”)

### 6.14.9 "EPM.EXE"

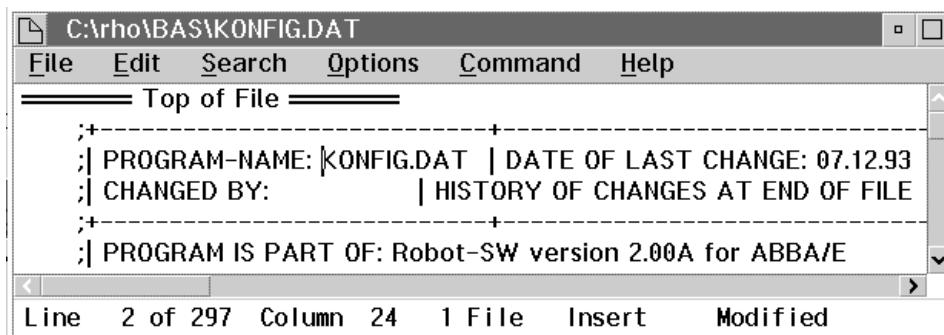


Fig. 6-5: OS/2 Standard-Editor EPM

Standard Editor of the operating system OS/2 (☞ Documentation of OS/2).

- a) Start editor by entering:

[C:\]epm FILENAME







## 7.2 Mechanic Components

---

### 7.2.1 Handling Unit

---

- a) Dismantle the drives and drive controllers.
- b) Dismantle the gripper.  
(☞ MG 7.4.15 “Gripper”, ☞ MG 7.4.15 b) “Dismounting”)
- c) Dismantle the door lock of the archive access.
- d) Dismantle the cover plates all around.  
Begin on the side of the drives. Further sequence:
  - storage towers
  - I/O unit
  - archive access
- e) Dismantle the footboards.
- f) Dismantle the roof lamp:
  - Remove the fluorescent lamp.
  - Open the cable duct and remove the cable.
  - Dismantle the cable duct if necessary.

### 7.2.2 Dismantling the I/O Unit

---

- a) Remove all handling boxes.
- b) Dismantle the compressor.



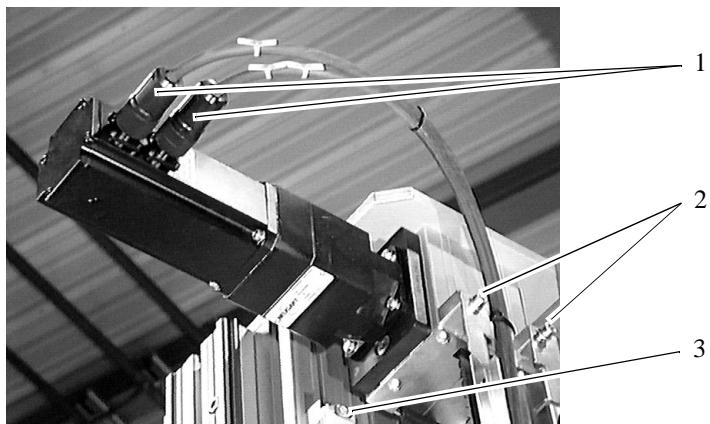
Fig. 7-3: Compressor of I/O Unit

- Remove the cover plates.
- Pull the compressor forward.
- Disconnect the plug X1E.



### 7.2.3 Separating the Column Sections (only on 15 or 18 row units)

#### Remove the cable gutter



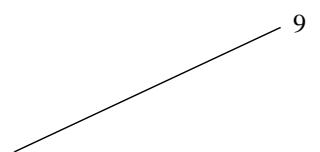
*Fig. 7-5: Cable Gutter on the Handling Unit*

- a) Unplug the motor plug (1).
- b) Remove the connecting screws of the cable gutter (4).
- c) Remove the screws (2) on the drive head.
- d) Fold the cable gutter down. Do not bend the cable as you do this.
- e) Screw the cable gutter.

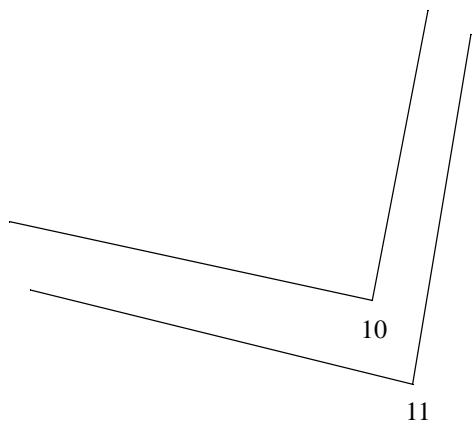








9



10

11





### 7.3.1 Control Unit

---

Loosen the cable clamps (strain reliefs) and unplug the cables:

- PHG
- the connections of the handling unit and the storage towers:  
19" rack on the rear of the control unit

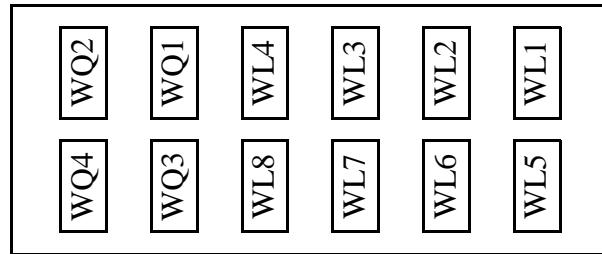


Fig. 7-13: Plug Panel on the 19" Rack

- 4x HE motor (W1-W4)
- 4x HE resolver (W5-W8)
- 2x QT motor (WQ1-WQ2)
- 2x QT resolver (WQ3-WQ4)

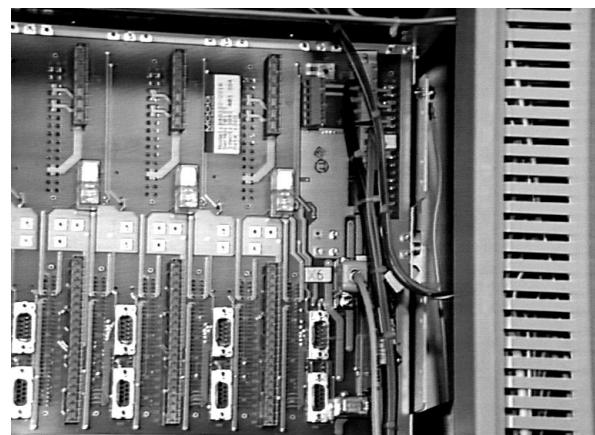


Fig. 7-14: Rear View of 19" Rack in the Control Unit

- Connecting panel

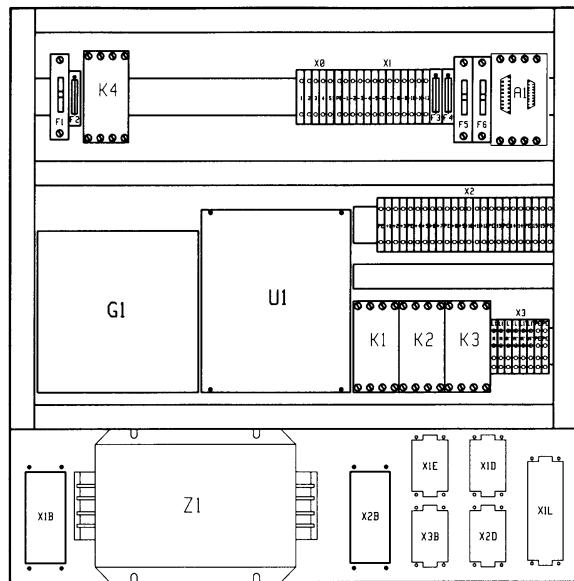
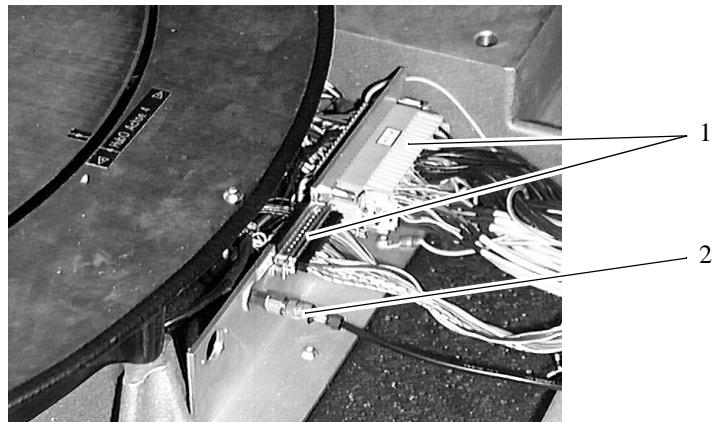


Fig. 7-15: Control Unit Connecting Panel

- X1B: power supply
- X2B: connection to door - remains plugged
- X1L: W1, WG1
- X1E: WEA1, WEA2
- X3B: WS8, MG1
- X1D: WH1, WH2, W2 (double if system has four Hexa towers)
- X22: only with two towers (QT, 4 HT)
- WA1: interface modem + ground (shield)
- the grounding wire from the rear grounding rail

### Handling Unit

Loosen the cable clamps (strain reliefs)..

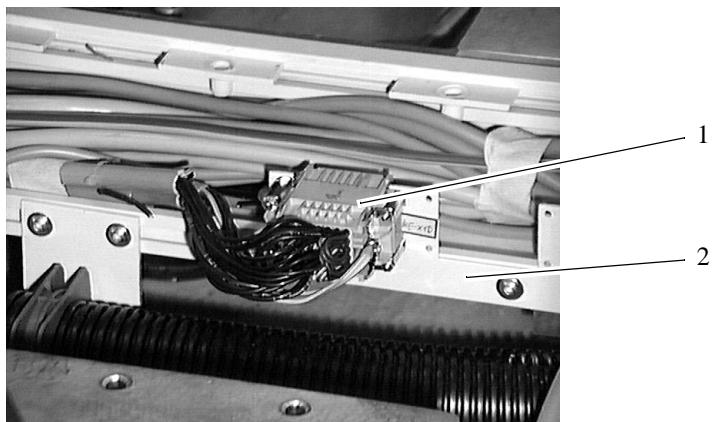


*Fig. 7-16: Handling Unit Connecting Panel*

- compressed air (2)
- 2 plugs (1)
- ground connections
  - to control unit
  - to I/O unit
  - to the storage towers (Hexa tower, Quadro tower)
- Archive access: remove the door lock and disconnect it at the end of the cable (not at the door lock).

## Storage towers

Hexa towers



*Fig. 7-17: Storage Towers Connecting Plug*

- a) Disconnect the grounding wire from the base plate.
- b) Unplug one plug (1) for two Hexa towers.
- c) Remove the plate with the socket(s) (2).

Quadro tower

- a) Disconnect the grounding wire.
- b) Unplug one plug (1) of each Quadro tower.
- c) Remove the plate with the socket(s) (2).
- d) Unplug the motor plugs (four plugs):
  - main tower drive
  - auxiliary tower drive
- e) Unplug the reference switch.

### AMU computer

Disconnect the cables:

- power
  - AMU
  - monitor
  - printer, if provided
  - modem, if provided
- monitor
- keyboard
- mouse
- control unit interface
- modem interface, if provided
- Dual-AMU interface, if provided
- printer interface, if provided



# **8      Appendix**

---

## **8.1     Tools Required**

---

(☞ List of tools)

## **8.2     Small Parts for Installation**

---

(☞ List of small parts)

### **8.2.1    AML/2 Literature**

---

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Operator Guide AML/2	German	DOC B00 000
	English	DOC B00 001
Maintenance Guide 2.3 AML/2	German	DOC B00 018
	English	DOC B00 019

### **8.2.2    AML/E Literature**

---

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Operator-Guide AML/E	German	DOC C00 002
	English	DOC C00 003
Maintenance Guide 2.3 AML/E	German	DOC C00 021
	English	DOC C00 022

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Installation Guide 2.3 AML/E	German	DOC 000 018
	English	DOC C00 019

### **8.2.3 AML/J Literature**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Operator-Guide AML/J	German	DOC D00 002
	English	DOC D00 003
	French	DOC D00 008
Maintenance Guide 2.4 AML/J	German	DOC D00 009
	English	DOC D00 010
Installation Guide AML/J	German	DOC D00 006
	English	DOC D00 007

### **AMU Literature**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
AMU Installation Guide	English	DOC E00 003
AMU Reference Guide	German	DOC E00 004
	English	DOC E00 005
AMU Problem Determination Guide	German	DOC E00 006
	English	DOC E00 007
AML Controller User Guide	English	DOC E00 014

### **8.2.4      HOST Software Literature**

---

#### **HACC/MVS**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
General Information Manual	German	DOC H00 019
	English	DOC H00 007
Installation and Customization	German	DOC H00 017
	English	DOC H00 005
System Reference Guide	German	DOC H00 016
	English	DOC H00 001
Operator Guide	German	DOC H00 018
	English	DOC H00 003
Messages and Codes	German	DOC H00 020
	English	DOC H00 009
Operator Quick Reference	German	DOC H00 026
	English	DOC H00 015
ISPF User Guide	German	DOC H00 021
	English	DOC H00 011
Conversion Notebooke	German	DOC H00 024
	English	DOC H00 025
Installation and Customization Reference	German	DOC H00 023
Command Reference	German	DOC H00 022

**HACC/VM**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
System Reference Guide	German	DOC V00 009
	English	DOC V00 001
Installation and Customization	German	DOC V00 008
	English	DOC V00 005
Operator Guide	German	DOC V00 006
	English	DOC V00 007

**HACC/OS 400**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
User Guide	English	DOC O00 001
Backup/Restore User Guide	English	DOC O00 001

**HACC/DAS**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Administration Guide	English	DOC F00 010
Interfacing Guide	English	DOC F00 011
Interfacing Guide Win-NT/95	English	DOC F00 015
Message Filter Installation Guide	English	DOC F00 012
VirOp for IMS User Guide	English	DOC F00 013

**VolServ**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
VolServ 2.3 Documentation		

## **Small Parts for Installation**

---

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
Set for SGI	English	600308-01
Set for Solaris	English	600308-02
Set for Sun	English	600308-03
VolServ 2.2 Documentation		
Set for Convex	English	600254-01

## **AMASS**

<b>Manual</b>	<b>Language</b>	<b>Order No.</b>
AMASS 4.5 Documentation		
Set	English	600307
AMASS 4.7 Documentation		
Set	English	600614

## **Small Parts for Installation**

---

# 9 Index

---

## A

---

- Access to the Archive ..... 3 - 8
- Address ..... 4 - 9, 4 - 18
- Adjustments ..... 6 - 11
  - input boards ..... 6 - 11
- Adjustments/connections
  - compressed air supply ..... 6 - 13
  - Hexa tower ..... 6 - 12
  - I/O unit ..... 6 - 12
  - output board ..... 6 - 12
  - Quadro tower ..... 6 - 12
- Adresses ..... 6 - 4
- Alignment station
  - assembly ..... 5 - 17
  - find coordinates ..... 6 - 31
- AML ..... 8 - 2
- AML/E
  - project data ..... 1 - 1
  - trade mark ..... 2 - 4
- AMU
  - position in the system ..... 1 - 1
- AMU processor
  - assembly ..... 5 - 14
  - dismantling ..... 7 - 17
- AMUINST.EXE ..... 6 - 36
- Anschrift GRAU Storage Systems 2 - 2, 2 - 5
- Appendix ..... 8 - 1
  - installation ..... 8 - 1
  - tools required ..... 8 - 1
- Archive (position in the system) . 1 - 1

- Archive access ..... 5 - 16
- Assembly ..... 5 - 1
  - alignment station ..... 5 - 17
  - AMU processor ..... 5 - 14
  - base plate (HT) ..... 5 - 2
  - base plate (HU) ..... 5 - 6
  - cabling ..... 5 - 18
  - check ..... 5 - 20
  - compressed air supply ..... 5 - 16
  - control unit ..... 5 - 13
  - drives ..... 5 - 17
  - gripper ..... 5 - 17
  - handling unit ..... 5 - 6, 5 - 15
  - Hexa tower ..... 5 - 2
  - inserting cables ..... 5 - 15
  - modem ..... 5 - 14
  - of mechanic components ..... 5 - 2
  - preparation ..... 5 - 1
  - push drive head ..... 5 - 12
  - Quadro tower ..... 5 - 2
  - roof lamp ..... 5 - 15
- Authorized persons 2 - 3, 3 - 5, 3 - 6
- AUTO (operating mode) ..... 3 - 11

## B

---

- Backup files ..... 6 - 34
- Base plate
  - handling unit ..... 5 - 6
  - Hexa tower ..... 5 - 2
- Board CP/MEM 4 ..... 6 - 14
- BOSCH (trade mark) ..... 2 - 4

## Index

---

BOSCHTRM.EXE ..... 6 - 37

## C

---

### Cables

  inserting ..... 5 - 15  
  packing ..... 4 - 7

### Cabling

  assembly ..... 5 - 18  
  control unit ..... 5 - 18  
  dismantling ..... 7 - 12

Cartridge types ..... 6 - 4

Check the handling ..... 6 - 25  
  Get... ..... 6 - 27  
  Look... ..... 6 - 29  
  Put... ..... 6 - 29  
  sequence ..... 6 - 26

### Check...

  assembly ..... 5 - 20  
  grounding ..... 5 - 20  
  hardware ..... 6 - 7  
  safety ..... 5 - 20  
  strain relief ..... 5 - 20

CM/2 (trade mark) ..... 2 - 4

### Column

  assembly ..... 5 - 10  
  dismantling ..... 7 - 6

### Components

  AMU processor ..... 5 - 14  
  cables ..... 5 - 15  
  control unit ..... 5 - 13  
  dismantling ..... 7 - 4  
  drives ..... 5 - 17  
  handling unit ..... 5 - 6, 5 - 15  
  Hexa tower ..... 5 - 2  
  mechanic ..... 5 - 2  
  modem ..... 5 - 14  
  Quadro tower ..... 5 - 2

Components of the AML/E system 1 - 1

### Compressed air supply

  adjust pressure ..... 6 - 13  
  adjustments/connections ..... 6 - 13

  dismantling ..... 7 - 4  
  mounting ..... 5 - 16

Connection, electrical ..... 1 - 1

### Control unit

  assembly ..... 5 - 13  
  dismantling ..... 7 - 13

Copyright ..... 2 - 4

Corrosion protection oil ... 4 - 2, 4 - 5

## D

---

DB 2/2 (trade mark) ..... 2 - 4

Desiccant ..... 4 - 2

Diagnosis ..... 6 - 5

Dismantling ..... 7 - 1

  AMU processor ..... 7 - 17  
  backup of files ..... 7 - 3  
  cabling ..... 7 - 12  
  column ..... 7 - 6  
  compressed air supply ..... 7 - 4  
  control unit ..... 7 - 13  
  drives ..... 7 - 4  
  gripper ..... 7 - 4  
  handling unit ..... 7 - 4, 7 - 15  
  Hexa tower ..... 7 - 11  
  I/O unit ..... 7 - 4  
  mechanic components ..... 7 - 4  
  modem ..... 7 - 14  
  move drive head ..... 7 - 7  
  preparation ..... 7 - 1  
  Quadro tower ..... 7 - 11  
  roof lamp ..... 7 - 4  
  shutting down the system ..... 7 - 3  
  storage towers ..... 7 - 16

Documentation ..... 6 - 1, 6 - 35

  AML/2 ..... 8 - 1

  AML/E ..... 8 - 1

  AML/J ..... 8 - 2

  AMU-Software ..... 8 - 2

## **Index**

---

HOST-Software .....	8 - 3
Drive amplifiers .....	6 - 10
KONFIG.DAT editing .....	6 - 4
parameterizing .....	6 - 18
TKONFIG8.DAT editing ...	6 - 6
transferring files .....	6 - 3
Drive head	
assembly .....	5 - 12
belt .....	5 - 12
dismantling .....	7 - 7
Drive types .....	6 - 5
Drives	
dismantling .....	7 - 4
first operation .....	6 - 26
mounting .....	5 - 17

## **E**

---

Electrical connection .....	1 - 1
Electrical fusing .....	1 - 1
Electrics (safety) .....	3 - 14
EMERGENCY (operating mode)	3 - 11
EMERGENCY STOP	
buttons .....	3 - 9, 3 - 10
function .....	3 - 9
Emissions	
heat .....	1 - 1
noise .....	1 - 1
Enclosure type .....	1 - 1
explanation of pictorials .....	3 - 3

## **F**

---

Fire extinguishing equipment ....	5 - 1
First operation .....	6 - 1
checking the hardware .....	6 - 7
compressed air supply .....	6 - 13
documenting .....	6 - 1, 6 - 35
drives .....	6 - 26
Foil sealing device .....	4 - 5
Fusing, electrical .....	1 - 1

## **G**

---

Gripper	
air pressure .....	6 - 13
dismantling .....	7 - 4
mounting .....	5 - 17
OFFSET .....	6 - 5
Grounding (check) .....	5 - 20
Guards .....	3 - 7
access to the archive .....	3 - 8
hazards .....	3 - 7
Quadro tower guard door ...	3 - 12

## **H**

---

Handling boxes .....	5 - 16
Handling unit	
assemble column .....	5 - 10
assembling corner columns .	5 - 15
assembly .....	5 - 6, 5 - 15
base plate with robot .....	5 - 6
dismantling .....	7 - 4, 7 - 15
drive belt in drive head .....	5 - 12
frame .....	5 - 6
levelling .....	5 - 7
mounting the covers .....	5 - 16
mounting the roof .....	5 - 15
mounting the roof lamp ....	5 - 15
mouting the I/O unit .....	5 - 16
move drive head .....	7 - 7
position in the system .....	1 - 1
push drive head .....	5 - 12
removing the roof lamp ....	7 - 4
hazard alert messages .....	3 - 2
Heat .....	1 - 1

## **Index**

---

### **H**

---

Hexa tower  
  adjustments/connections . . . . . 6 - 12  
  assembly . . . . . 5 - 2  
  base plate . . . . . 5 - 2  
  covers . . . . . 5 - 3  
  dismantling . . . . . 7 - 11  
  rotary indexing table . . . . . 5 - 2  
  segments . . . . . 5 - 4  
  tower plate . . . . . 5 - 3

### **I**

---

### **I/O unit**

  adjustments/connections . . . . . 6 - 12  
  compressed air supply 5 - 16, 7 - 4  
  dismantling . . . . . 7 - 4  
  handling boxes . . . . . 5 - 16  
  position in the system . . . . . 1 - 1  
IBM (trade mark) . . . . . 2 - 4  
INIPAT.EXE . . . . . 6 - 36  
INISHOW.EXE . . . . . 6 - 36  
Insert media . . . . . 6 - 32  
Installation  
  small items . . . . . 8 - 1  
  tools . . . . . 8 - 1  
Intended audience . . . . . 3 - 5  
Intended use  
  button . . . . . 3 - 10  
  AML/E system . . . . . 3 - 1

### **J**

---

JUSTUTIL.EXE . . . . . 6 - 37

### **K**

---

#### **KONFIG.DAT**

  addresses . . . . . 6 - 4  
  cartridge types . . . . . 6 - 4  
  diagnosis . . . . . 6 - 5  
  drive types . . . . . 6 - 5  
  editing . . . . . 6 - 4  
  OFFSET gripper . . . . . 6 - 5  
  software limits . . . . . 6 - 5  
KRNTPSET.CMD . . . . . 6 - 37

### **L**

---

Lamp (roof lamp) . . . . . 5 - 15, 7 - 4  
Live parts . . . . . 3 - 14  
Loading . . . . . 4 - 12  
Logbook . . . . . 3 - 6

### **M**

---

Mechanics (instructions) . . . . . 3 - 15  
Modem  
  assembly . . . . . 5 - 14  
  dismantling . . . . . 7 - 14  
MPRHO3.BIN . . . . . 6 - 20

### **N**

---

Noise . . . . . 1 - 1  
notes . . . . . 3 - 3

### O

---

- OFFSET gripper ..... 6 - 5
- Oil (corrosion protection) . 4 - 2, 4 - 5
- Operating modes
  - AUTO ..... 3 - 11
  - EMERGENCY ..... 3 - 11
- Operator Guide ..... 2 - 3
- OS/2
  - trade mark ..... 2 - 4

### P

---

- Packing ..... 4 - 2
  - accessories ..... 4 - 10
  - cables ..... 4 - 7
  - diskettes ..... 4 - 10
  - gripper ..... 4 - 9
  - Hexa tower ..... 4 - 6
  - I/O-unit ..... 4 - 6
  - in crates ..... 4 - 3, 4 - 11
  - manuals ..... 4 - 10
  - packing list ..... 4 - 5
  - packing materials ..... 4 - 2
  - plates ..... 4 - 7
  - pneumatic hoses ..... 4 - 7
  - preparation ..... 4 - 3
  - Quadro tower ..... 4 - 6
  - sealing foils ..... 4 - 5
  - small items ..... 4 - 8
  - small parts ..... 8 - 1
  - stillage ..... 4 - 4
  - supplier's articles ..... 4 - 8
  - support structure ..... 4 - 7
  - tools ..... 4 - 9, 8 - 1
- Packing list ..... 4 - 5
- Packing materials
  - disposal ..... 4 - 18
- Pneumatic hoses
  - packing ..... 4 - 7

- Power supply 160 ..... 6 - 9
- product observation ..... 2 - 5
- Project data ..... 1 - 1
- PS/2 (trade mark) ..... 2 - 4

### Q

---

- Quadro tower
  - adjustments/connections ..... 6 - 12
  - assembly ..... 5 - 2
  - dismantling ..... 7 - 11
  - first operation ..... 6 - 12

### R

---

- rho ..... 6 - 10
  - edit KONFIG.DAT ..... 6 - 4
  - parameterizing ..... 6 - 14, 6 - 20
  - TKONFIG8.DAT editing ..... 6 - 6
  - transferring files ..... 6 - 3
- Rho File Manager ..... 6 - 37
- Roof lamp ..... 5 - 3
  - mounting ..... 5 - 15
  - removing ..... 7 - 4

### S

---

Safety check .....	3 - 16, 5 - 20
Sea freight .....	4 - 13
SETUPAMU.CMD .....	6 - 37
Small items .....	8 - 1
Software Backup .....	6 - 33, 6 - 34
Software limits .....	6 - 5
Software tools .....	6 - 36
AMUINST.EXE .....	6 - 36
BOSCHTRM.EXE .....	6 - 37
INIPAT.EXE .....	6 - 36
INISHOW.EXE .....	6 - 36
JUSTUTIL.EXE .....	6 - 37
KRPNSET.CMD .....	6 - 37
Rho File Manager .....	6 - 37
SETUPAMU.CMD .....	6 - 37
Stillage .....	4 - 4
Storage conditions .....	4 - 16
air .....	4 - 16
electromagnetic fields .....	4 - 16
floor .....	4 - 16
location .....	4 - 16
temperature .....	4 - 16
Storage towers	
dismantling .....	7 - 16
Strain relief (check) .....	5 - 20
Symbols	
formatting .....	2 - 1
information/note .....	2 - 1
symbols	
explanation .....	3 - 3
hazard alert messages .....	3 - 2
System logbook .....	3 - 6
System shut-down .....	7 - 3

### T

---

Teaching .....	6 - 24
Technical data	
electronics .....	1 - 1
Test axes .....	6 - 22
TKONFIG8.DAT .....	6 - 6
Tools .....	8 - 1
Trade marks	
BOSCH .....	2 - 4
CM/2 .....	2 - 4
DB 2/2 .....	2 - 4
IBM .....	2 - 4
OS/2 .....	2 - 4
PS/2 .....	2 - 4
Transport .....	4 - 1
at the installation site .....	4 - 14
hazards .....	4 - 1
sea freight .....	4 - 13
to installation site .....	4 - 12
transport routes .....	4 - 15
truck .....	4 - 12

### U

---

Unloading .....	4 - 15
Unpacking .....	4 - 17

### W

---

Working on the equipment	
installation .....	3 - 13
live parts .....	3 - 14
mechanics .....	3 - 15