AML/J Version 4.00

Maintenance Guide

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1 Introduction

1.1 Contents

The Guide contains all information and instructions which you require for maintaining the AML/J system.

1.2 Target group

The Guide is intended for trained service personnel who repair and install the AML/J system.

1.3 Structure of the Guide

The Guide is structured in the following chapters:

Chapter 1	*Introduction* - Notes on using the Guide
Chapter 2	*Overview* - Description of the functions of the "AML/J"
Chapter 3	*Safety* - Information on the safe handling of the AML/J
Chapter 4	*PMMaint* - Description of the installation and diagnostic program for AML/J
Chapter 5	*Start* - Notes on the procedure in a service call
Chapter 6	*Error messages* - List of all error messages and the associated necessary activities
Chapter 7	*Position of the components* - Help on locating the position of components in the system
Chapter 8	*Adjustment and replacement procedures* - Instructions on the necessary adjustment, repair and maintenance work
Chapter 9	*Power supply* - Explanations of the power supply in the AML/J
Chapter 10	*Cables* - Overview of the installed cables in the AML/J
Chapter 11	*Installation* - Procedures for extending the AML/J system
Appendix C	*Index* - Reference list to information in the Guide

1.4 Further documentation

DOC E00 003	AMU Installation Guide
DOC E00 007	AMU Problem Determination Guide
DOC E00 014	AML Controller User Guide
DOC E00 005	AMU Reference Guide
DOC D00 007	AML / J Installation Guide
DOC D00 014	AML / J Software Backup
DOC D00 025	AML / J Operator Guide

1.5 Explanation of the symbols and notes

The following symbols and notes draw your attention to important information.

For detailed explanation of the symbols see *Warning indications* auf Seite 3-3.

<1>+<2>	Press keys simultaneously
italics	Heading, e.g. Chapter 3, *Safety* File name, e.g. *dasdata.ini* Variable, e.g. *client_name*
Chicago	Term appearing on the workspace of the AMU
bold	Special term, e.g. **Scratch-Pool**
`courier`	Lines or terms in an input window - Program message - Command - Parameter or file
`[courier]`	Optional parameters
`Param1 | Param2`	Alternative parameters
☞	Reference

1.6 Technical support

Warning

The use of the AML/J by untrained personnel can lead to dangerous situations. The consequence can be severe to lethal injuries due to moving or current-conducting parts. For this reason an introductory course at ADIC/GRAU is recommended for all persons who handle the AML/J.

The operator is responsible that the following functions are performed on the system only by qualified personnel:

- Preparation for operation
- Setting up
- Starting the system
- Application
- Shutting the system down
- Maintenance
- Restart

Warning

You may perform certain work and adaptations yourself only if you are qualified for this by corresponding education and training.

It is extremely important that the user is familiar with all safety rules before working with the system and follows them.

If you cannot solve a problem with the aid of this document or if you are interested in a recommendation regarding training, please contact your contract partner or the ADIC/GRAU Technical Assistance Center (ATAC).

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1.7 Product observation

We are legally obliged to observe our products even **after** delivery. Therefore please notify us about everything which is of interest to us:

- Changed setting data
- Experience with the product
- Repetitive faults
- Difficulties with this Guide

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2 Description of the AML/J system

2.1 Names and abbreviations

Different names are used in Europe and North America for some components.

Table 2-1: Abbreviations

Abbreviation in Europe	Abbreviation in North America	Explanation
AML/J		**A**utomated **M**ixed-Media **L**ibrary **/J**unior
AMU		AML Management Unit
AMS		AML Management Software
DAS		Distributed AML Server
HACC	HCC	Host AML Communication Control
I/E/F		Unit for Insert, Eject, Foreign Media
PMAC		Programmable Multi Axis Controller

2.2 Overview of the system components

Storage media such as magnetic tape cartridges, optical disks and CD-ROMs are brought automatically into the associated drives and fetched from there again with the AML/J. The storage media are brought to the drives with the aid of software in the host and in the AML/J control unit and discharged from these drives again.

The AML/J is a modular system and consists of

- a basic module
  - Handling unit
  - Storage racks
  - Control cabinet
  - I/O unit (E/I/F)
- up to 9 extension modules (optional)
  - Storage racks
  - I/O unit (E/I/F)

Figure 2-1: AML/J basic module

2.3 Host connection

AML/J is connected through the AMU (AML Management Unit) to one or several hosts. The possibilities of the connection are described in the AMU Reference Guide.

2.4 Description of function

The AML/J system can be installed on the unfinished floor or on a false floor.

The handling unit moves the cartridges between the storage cells, drives and the I/O unit. The handling unit has a gripper. A barcode scanner on the gripper identifies the cartridges at the compartments in the archive. Further details are described under *Handling unit* on page 2-7. The cartridges can be brought into the AML/J system or moved out from the system with the aid of the I/O unit without interrupting the work. Additional details are described under *I/O unit* on page 2-8.

Manual access to the compartments in the archive, the handling unit and the drives is through an access door after switching off the power supply.

The cartridges in the AML/J are moved by host requests. Primary requests are for mounting and discharging cartridges in the drives and for inserting/ejecting cartridges into/out from the AML/J.

Each cartridge can have an external machine and user readable label to identify the cartridge in the AML/J at stocktaking and when adding a cartridge to the AML/J. The AMU stores the physical storage location of the cartridge in a database which is based on the **Volser** (Volume Serial Number).

Apart from the commands for moving the tape cartridges, the host can also request status, configuration and cartridge storage information from the AML/J control unit.

2.5 Functional units

The AML/J system consists of the following functional units:

- Drives
- Control cabinet with:
- AML/J control unit
- AMU (AML Management Unit)
- Storage cells (linear racks)
- Handling unit
- I/O units

2.5.1 Drives

The AML/J system supports a large number of drives for different storage media. You will find a list of the supported drives in the Chapter *Drives* on page 12-10.

2.5.2 Control cabinet

The control unit of the system is housed in a control cabinet. This control cabinet contains:

- AMU PC
- Control unit
  - Power supply
  - Motor control
  - Interface converter
  - Safety system
- Drive(s) (extra equipment)

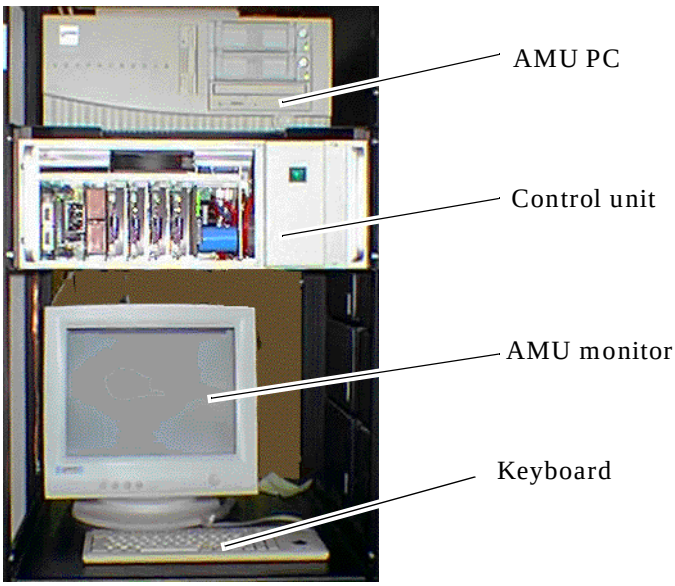


Figure 2-2: Control cabinet

2.5.3 AML Management Unit (AMU)

The AMU is the control processor for the AML system. In the normal mode the host computer sends the commands to the AMU for controlling the system. The AMU is located next to further power supply components in the control cabinet Figure 2-2: on page 2-4.

It is possible to connect a second AMU PC in parallel to back up against failures due to failures of the PC hardware. This redundant version is called **Dual-AMU**, and a few cables have to be reconnected for the change.

Hardware components

The AMU hardware consists of:

- A computer (AML controller) with screen, keyboard and trackball or mouse
- Programmable Multi-Axis Controller (PMAC board)
- Network board (Token Ring, Ethernet or FDDI)

Software components

The AMU software components are:

- Operating system OS/2
- TCP/IP
- Communication Manager/2 (optional)
- Database Manager/2
- AML Management Software (AMS)

Tasks of the AMU:

- Host communication
  - interprets the commands coming from the host computer
  - checks these commands for executability
- Archive catalogue administration
  - stores the logical coordinates of the compartments
  - assigns the cartridges to the compartments
  - knows the status of compartments and drives
  - stores information on scratchpool administration
- Conversion of the logical coordinates into physical coordinates
- Communication with the control unit
- User interface
  - for start-up
  - for service
  - for the operator
- Configuration (describes the individual structure of the archive)

Information

The AMU does not register the data contents of the cartridges.

2.5.4 Storage cells

The AML/J system contains compartments (storage cells) in linear racks (stationary storage segments (☞ Figure 2-3:). Table 2-2: Coordinates of the storage cells on page 2-6 contains the coordinates of the storage cells.

Figure 2-3: Example of storage cells

Table 2-2: Coordinates of the storage cells

L3 - LD	01 - 99	01	01 - 99	01 - 99
Type (☞ page 12-10)	Module	Segment	Row	Compart-ment

The module number corresponds to the number of the segment whereby the assignment of the module numbers to the segment can be determined by the user at start-up and the segment is always 01. The rows are counted from below to above and the compartments from the left to the right. In the case of optical disks two compartment coordinates are used per disk, one each for the A and the B side.

2.5.5 Handling unit

The handling unit identifies and moves cartridges between the storage cells, drives and the I/O unit.

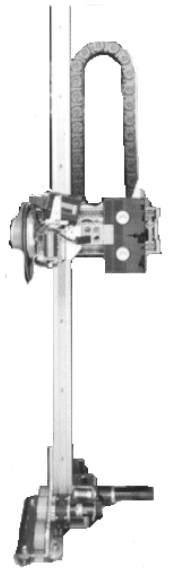


Figure 2-4: AML/J handling unit

Access to the archive compartments and the drives is facilitated with the handling unit. The handling unit executes the commands of the AML Management Software (AMS) and returns status messages as response.

The handling unit is equipped with a (laser) barcode scanner. Typical tasks of the handling unit are inserting and ejecting cartridges, placing and gripping cartridges in the archive, mounting the connected drives with the cartridges and reading a barcode label attached to the cartridges.

Technical data of the handling unit

- Cartesian robot with 4 axes:
  - 3 linear axes
  - 1 rotary axis
- Drive with direct current servomotors
- Position measuring system (optical digital encoder) and home position sensors
- Transmission of the torques with toothed drive belts
- Driving axis guided
  - with rollers on 2 guide rods below
  - by one guide rod with loose bearing (play compensation) above

2.5.6 I/O unit

The I/O unit facilitates inserting and ejecting cartridges without interrupting normal processing (☞ Figure 2-5:).

One or several compartments are integrated in the I/O unit for holding cartridges in the case of faults (problem box).

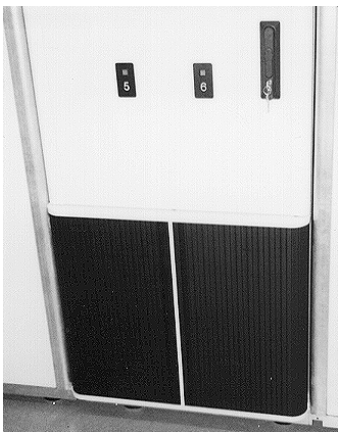


Figure 2-5: I/O unit/E

2.6 Cartridges

Each cartridge in the AML/J system can have an external user and machine readable label for identifying the Volsers (Volume Serial Number). The external label contains between one and 16 characters for the Volser. The Volser is composed of the uppercase letters A-Z and the numbers 0-9. The AML/J system supports different types of label (e.g. “Code 39” and “STK”).

2.7 Functional diagram

The most important electrical elements of the AML / J are described in the following section:

Table 2-3: AML / J most important electrical components

Designation	Explanation
PM	"Programmable Multi Axis Controller" (PMAC), ISA board in the AMU processor for controlling the AML / J. The board is connected through the plug board with the controllers for the servomotors, the 2-axis controller, the decoders and the servomotors and to further sensors and magnetic switches.
SP	Plug board, connection and distribution board of the control unit, connected with the bus board
BK	Bus board, PC board for holding the plug-in boards in the control unit, connected with the plug board
AC	2-axis controller, controlling the stepping motors in the gripper. Connection through bus board to the stepping motor board and the PMAC board.
SM / TP	Stepping motor board and test points Power unit for energizing the stepping motors in the gripper and measuring points for setting the controllers for the servomotors
DP	Choke board, connected through the bus board with the controllers and the servomotors
NT	Power supply unit board, rectifier and fuse for the power supply for the controllers in the control unit.
SM1	Controller for the feed axis (X axis)
SM2	Controller for the driving axis (Y axis)
SM3	Controller for the lifting axis (Z axis)
SM4	Controller for the swivelling axis (A axis)

Table 2-3: AML/J most important electrical components

Designation	Explanation
G	Gripper board, connections for gripper motors, sensors and barcode scanner, DC/DC converter for scanner power supply
M0 - M9	Module distributor board, connection for I/O unit/C and D, home sensor of the Y axis in the basic module and the door switch

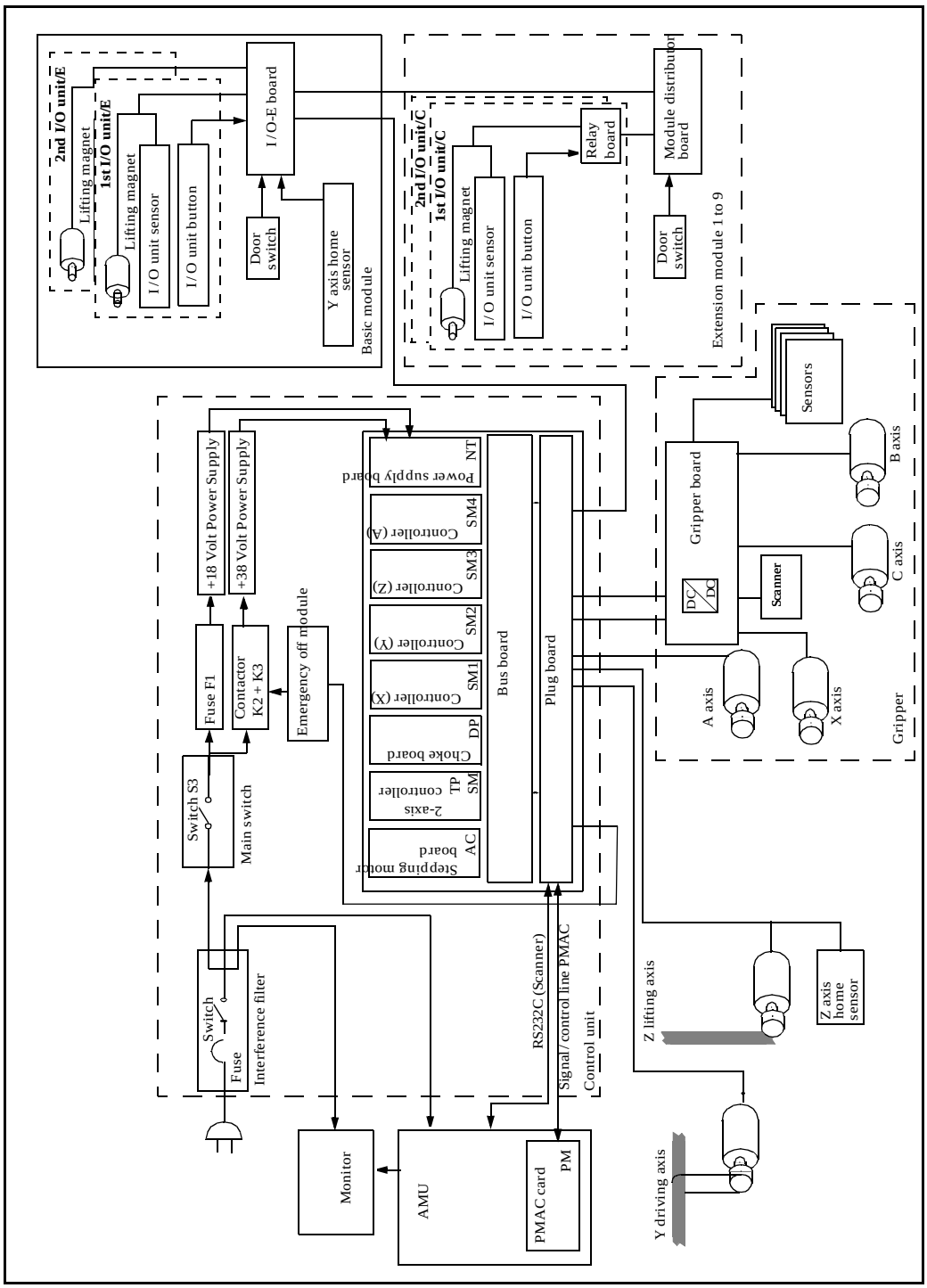


Figure 2-6: The most important electrical AML/J components

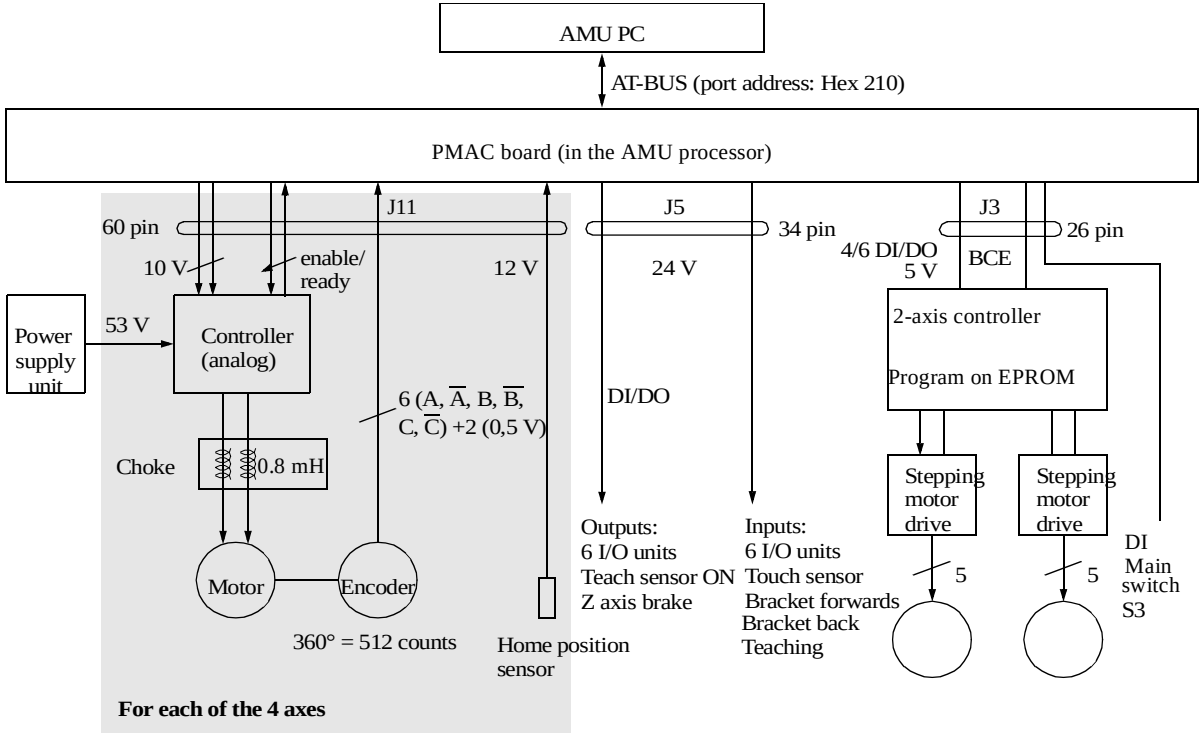


Figure 2-7: Connections to the PMAC board

Figure 2-7: shows the connections to the PMAC board in the AML/J.

3 Safety

Information

Apart from the safety provisions in this chapter, the local and specific technical safety regulations apply.

Avoid hazards during maintenance and in operation of the system by

- safety-conscious behaviour
- careful actions

CAUTION!

Knowledge of and observance of these instructions are indispensable for the safe handling of the ADIC/GRAU Storage Systems AML/J systems.

3.1 Use as intended

The quotation and the order confirmation as well as the scope defined in this document are part of the AML/J documentation. Any use other than that specified in this is considered to be not as intended.

This system is intended for processing:

- Magnetic tape cartridges
- Optical disks
- CD-ROMs in the CADDY housing

Any use extending beyond this is not as intended.

ADIC/GRAU Storage Systems is not liable for damages which arise because of use not agreed with it - the user bears the risk alone.

The following are also included in use as intended

- Compliance with the instructions in the instructions delivered with the system (this Guide, Operator and AMU Guides)
- Compliance with the inspection and maintenance regulations

3.2 Warning indications

ADIC/GRAU classifies hazards into different categories. Table 3-1: shows the relation between symbols, signal words, actual hazards and possible consequences.

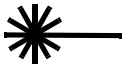
Table 3-1: Warning indications

Symbol	Damage to...	Signal word	Definition	Consequences
	Persons	**DANGER!**	Directly threatening danger	Death or very severe injuries (maiming)
		WARNING!	Possibly dangerous situation	Possibly death or very severe injuries
		CAUTION!	Less dangerous situation	Possibly light or slight injuries
		WARNING! Dangerous voltage!	Directly approaching electrical danger situation	Death or severe injury
		CAUTION!	Less dangerous situation	Possibly light or medium injury
	Material	**ATTEN-TION!**	Situation possibly causing damage	Possibly damage of the product and its environment
		Electro-statically sensitive	Potential risk of damage to the electronics	Possibly damage to the product
		Information	Application tips and other important/useful information and hints	No dangerous or damaging consequences for persons or things

Especially emphasized paragraphs in this Guide warn against a hazard or draw your attention to important information.
These include the following paragraphs and symbols:

In connection with the signal words of 'Danger' or 'Warning', this symbol warns against a dangerous situation in which personal death or severe injuries are threatening.
In connection with the signal word of 'Caution', the symbol warns against a dangerous situation in which light injuries can be the consequence.

There is risk of a lethal electric shock. Electrical current is possibly present at places identified with this symbol. Before all work always ensure that no electrical connections are under voltage.



Caution!

This symbol is a laser warning.
Use only the described procedures for adjusting and setting up the laser. Injuries can be caused by laser light if other procedures are used.

This symbol refers to specific regulations, rules, instructions and working procedures which must be observed. Nonobservation of this symbol can result in equipment damage or destruction or other material damage.

This symbol refers to the risk of equipment damage because of electrostatic discharges.

This symbol indicates a hint or important information for the user. No risks of personal or material damage are connected with this symbol.

3.3 Scope

These instructions apply for the ADIC / GRAU Storage Systems AML / J systems.

Further safety regulations for the components used in the system are not put out of force by these instructions.

Information

The documentation of the external manufacturers are integral part of the AML/J documentation.

3.4 Protective devices

The AML / J system is equipped with the following protective devices:

- Monitored access to the system
- Mechanical interlock
- Main switch

3.4.1 System access

The AML / J system is surrounded completely by panelling. Access to the system is possible only through a monitored door (or doors).

The panelling of the AML / J system separates the danger area from the normal working area. The danger area of the system is the area in which there is a risk of injury due to a movement of the components.

WARNING!

Movements of the mechanical components in the AML/J system can cause severe injuries. The access to the system may be opened only by authorized personnel.

3.4.2 Mechanical lock

The access door(s) to the system can be opened from the outside only with a key. Authorized personnel are responsible for the safety of the key.

3.4.3 Main switch

If you switch off the main switch, you stop the movement electronics and separate the system from the power supply. All movements of the robot are stopped immediately. Switch the main switch off immediately in the case of risk of injury or possible material damage.

ATTENTION!

Apart from emergency situations, the AML/J system is firstly always stopped with the normal shutdown routine before the main switch is switched off. ADIC/GRAU Storage Systems is not liable for damages because of actuation of the main switch in a manner not intended. The user bears responsibility solely for this.

WARNING!

Movements of the mechanical components in the AML/J system can cause severe injuries. Before switching on the main switch and restarting the AML/J system convince yourself that no risks for persons and material are caused by this.

3.5 Before working on the system

DANGER!

Before starting work check the position

- **of the main switch S3**
- **of the power switch S1**
- **of the power supply plug**

Never put the safety devices out of operation other than prescribed.

Information

Bridging over such devices is forbidden and can have criminal legal consequences!

- Switch the AML/J system off before starting maintenance and repair work.
- Attach a sign with the following wording:

WARTUNGSARBEITEN
Anlage nicht einschalten!

MAINTENANCE WORK IN PROGRESS
Do not switch on the system!

TRAVAUX D'ENTRETIENT EN COURS
Ne pas mettre l'installation en marche!

Figure 3-1: Warning sign

Proceed extremely carefully if because of the required work on the system you

- switch off only using the main switch S3
- do not switch off at all (e.g. functional check).

3.5.1 Operating modes of the AML/J system

Normal mode

In the normal mode the host controls the AML/J system.

WARNING!

Movements of the handling unit in the archive can cause very severe injuries.

Persons are forbidden to stay in the archive during normal operation.

Make sure before starting the AML/J system that no one is in the archive.

Emergency operation

Emergency operation is provided for

- manual insertion and ejection of media
- manual operation of the drives

WARNING!

If you open the protective door(s) of the AML/J system, then operation of the system is interrupted.

If persons are in the archive, do not close the protective doors.

The system continues to work as soon as all doors close.

- **Close the door locks with the door open**
- **Keep the key in a safe place or always have it with you**

3.6 Before switching the system on

WARNING!

Movements of the handling unit in the archive can cause very severe injuries.

Make sure before starting the AML/J system that

- **no one is staying in the archive any longer**
- **no dangers can arise**

3.7 Work on live parts

DANGER!
Dangerous voltage!

Contact with live parts can result in very severe to lethal burns and internal injuries due to electric shock.

In the case of contact, the person affected can frequently no longer free himself from the electric circuit on his own.
A second person must be able to interrupt the power supply immediately in the case of a hazard.

Components on which work is done may stand under voltage only if expressly specified.

The main switch S3 is also under voltage in its switched off position.

Switch off the power supply at the power switch S1 or pull out the mains plug before working on the other electrical components.

Secure the system against being switched back on.

Work on live parts of the system must be approved by your superior.

Observe without fail when performing the work

- the accident prevention regulations (e.g. VBG 4)
- the VDE 0105
- the following points:
  - Use only suitable and intact tools and measuring instruments
  - Check the measuring instruments for correct setting of the measuring ranges
  - Work only with one hand. This can prevent internal organs being affected in the case of an electric shock since a closed electric circuit (through both arms and the body) cannot be built up
  - Avoid contact with conductive floor coverings (especially those made of metal) or system parts - line the working area with suitable rubber protective mats if appropriate

WARNING!
Dangerous voltage!

Never assume that a circuit is de-energized - always check it for safety's sake!

3.8 Mechanical maintenance work

Observe the following points:

- Where are the escape routes and emergency exits - keep these absolutely free of any objects
- Place dismantled machine and other parts aside safely and not accessible to unauthorized persons while working
- Keep the system clean during the work and clear up conscientiously afterwards.

Remove or install before or after your work all safety precautions attached for the maintenance work such as:

- Covers
- Safety instructions
- Warning signs
- Ground cables

Your clothes must comply with the safety regulations.

- They may not have any metal closures
- They should fit so closely that they cannot be caught on running machine parts
- Button the sleeves or fold them up.
- Push the ends of a scarf or shawl into your clothing.
- Use protection completely covering your hair in the case of long hair.
- Remove your watch, rings, jewellery etc.

Wear protective goggles when:

- using a hammer
- using an electric drill
- working with springs, snap rings etc.
- soldering, cable work
- cleaning work with chemical agents
- all work in which the eyes are at risk

Wear safety boots when working on heavy components.

ATTENTION!

Desist from everything which could endanger other persons or damage equipment and devices.

3.9 Check the safety system

Check all safety devices after working on the system:

- Protective door(s) (= access to the archive)
- Main switch S3

4 PMMaint

Installation and diagnostic program for AML/J.

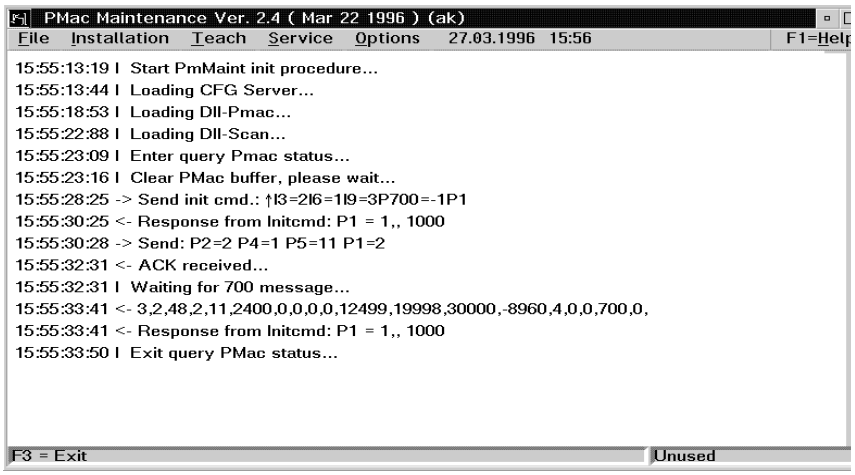


Figure 4-1: "PMac Maintenance" window

4.1 Starting PMMaint

Information

Firstly end all AMU processes before you start PMMaint.

Starting from the OS/2 workspace

Step 1 Double-click on the "PMMaint" symbol.
The "PMac Maintenance" window opens

Starting by OS/2 command line

Figure 4-2: "PMMaint startup switches" in the "F1=Help" menu

Step 1 Open an OS/2 window and change into the AMU folder.

```
C:> cd AMU
```

Step 2 Enter

```
C:\AMU> pmmaint [/q] [/n] [/l] [/p:x]
```

Option	Explanation
/q	Suppresses all acoustic messages
/n	Starts the PMMaint without ADIC/GRAU logo
/l	Writing a log file (file name e. g. DEZ08_95.LOG)
/p:x	Selection of the COM port for the scanner (x = selected COM port) possible values: 1- 9

4.2 Menu file

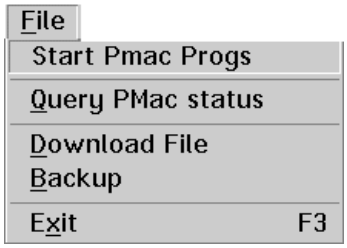


Figure 4-3: "File" menu

4.2.1 Start/Stop Pmac Progs

Command	Field	Explanation
Start Pmac Progs		The PLC program 0 (GLOBAL.PMC) on the PMAC board is started (i5=1). It starts all further processes on the PMAC board. On positive response of the initialization (message 700) all menu items are allowed.
Stop Pmac Progs		The active programs on the PMAC board are stopped (i5=0). The **Teach** and **Initial Teach** menu item under **Installation** menu item are disabled in the operator interface. The following are now possible • the data transmission to the PMAC board (with **Download File**) • **Backup** (parameter backup of the PMAC board)

4.2.2 Query PMac status ...

Command	Field	Explanation
Query PMac status...		Status query to the PMAC board whether the robot is ready (`waiting for 700 message`). With positive response of the initialization (message 700) all menu items (apart from **Download**/**Backup**) can be activated.

Information

Click on Query PMac status if the robot has finished homing, but the menu items in the program are still grayed out.

4.2.3 Download File

Command	Field	Explanation
Download File		Transmission of the PMC files from the AMU to the PMAC board.

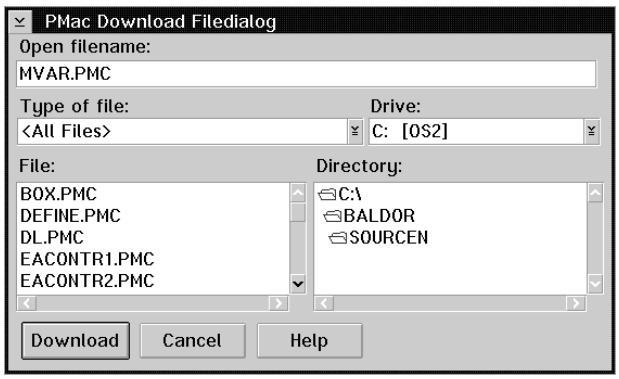


Figure 4-4: "PMac Download Filedialog" window

Open filename:	Name of the file to be transferred, can be selected by reference to **Drive**, **Directory** and **File**
Type of file:	Type of the file to be transferred (select only *.PMC files for a transfer)
Drive:	Selection of the drive
File:	List of all files in the corresponding folder
Directory:	Selection of the folder `C:\AMU` (default for BACKUP.PMC file) or `C:\BALDOR\SOURCES` (for all other *.PMC files)
Download	Starts the download

4.2.4 Backup

Command	Field	Explanation
Backup		Backing up all system-specific data (determined by the file PMVAR.BAK) of the PMAC board in the BACKUP.PMC file in the C:\AMU folder: • Drive data • Adjustment point data • Motor limits **Information** **Always reset the PMAC program to active (I5=1) with Start Pmac Progs in the File menu before you exit the PMMaint program. Otherwise the system can no longer be started.**

4.2.5 Exit

Command	Field	Explanation
Exit		The PMMaint program is ended. The status of the programs on the PMAC board is not changed.

4.3 Installation menu

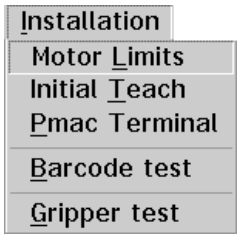


Figure 4-5: "Installation" menu

4.3.1 Motor Limits

Command	Field	Explanation
Motor Limits		Current values are loaded from the PMAC board. The bright fields can be edited (you can enter values there).

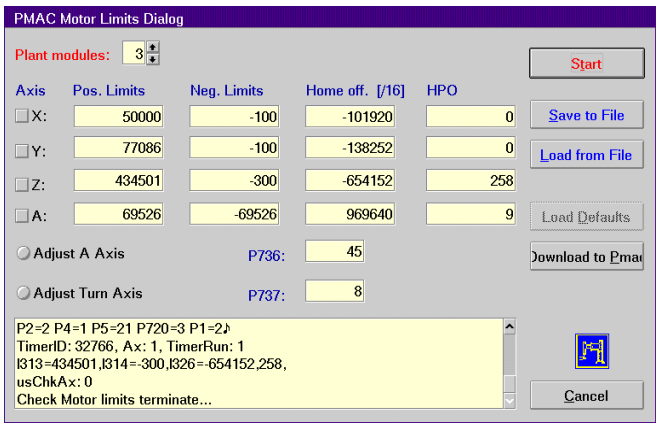
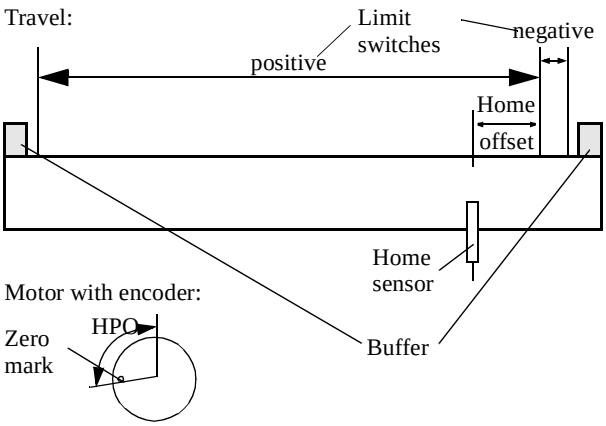


Figure 4-6: "PMAC Motor Limits Dialog" window

Plant modules: Number of the modules (basic module + all extension modules).
For faster determination of the positive software limit switch for Y axis.

Axis Select the axes to which you have changed something (motor replacement, belt replacement etc.) and want to determine the parameters.

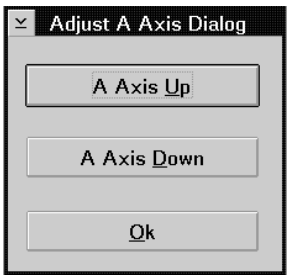
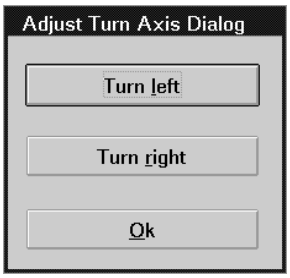
Command	Field	Explanation
Motor Limits (continued)	**Pos. Limits**	Maximum positive travel of the robot in this axis (variable ix13) [in 1/16 counts]
	Neg. Limits	Maximum negative travel of the robot in this axis (variable ix14) [in 1/16 counts]
	Home off. [/16]	Distance between home position (home position sensor + zero pulse of the encoder) and the coordinate zero point [in 1/16 counts]
	HPO	Distance between home position sensor and zero pulse of the encoder. If the value is < 45° or > 315°, then a warning is displayed • Shift the position of the home position sensor. • Repeat the procedure *Determine "Motor Home Position"* **on page 8-10**



Home Position Offset (HPO)

Command	Field	Explanation
Motor Limits (continued)	**Start**	Robot starts parameter determination for the selected axes **Information** **Replace the motor if** • **the message appears "Please check Encoder for ... Motor HPO Message occur** • **or the HPO value remains unchanged at 359° or 1°.**
	Save File	Storage of the determined parameters on the PMAC board **Information** **The values are stored additionally in the file C:\AMU\PmAxConf.DAT.** (Do not forget to back up the changed parameters in the BACKUP.PMC file.)
	Load File	The parameters are loaded from the PmAxConf.DAT file into the window display. **ATTENTION!** **The values do not necessarily agree with the values on the PMAC board.**

Command	Field	Explanation
Motor Limits (continued)	**Load Defaults**	**ATTENTION!** **Loading the basic settings destroys the existing values of all 5 axes!** **Better in the case of necessary measurement of an axis:** • **Click on only this one axis at Axis** • **Click on Start** Only with stationary system (robot not ready): Loading the basic settings in the window display. The AML/J system always homes with these basic settings.
	Save to Pmac	Downloading and backing up the values from the window display on the PMAC board. (Do not forget to back up the changed parameters in the BACKUP.PMC file.)

Command	Field	Explanation
Motor Limits (continued)	**Adjust A Axis**	Accurate measurement of the A axis (swivelling axis) with a small spirit level, e. g. after gripper replacement or crash.  Figure 4-7: "Adjust A Axis Dialog" For procedure refer to *Replace gripper* on page 8-37.
	Adjust Turn Axis	Accurate measurement of the C axis (turn axis) with a small spirit level, e. g. after gripper replacement or crash.  Figure 4-8: "Adjust Turn Axis Dialog" For procedure see *Replace gripper* on page 8-37.
	P736:	A axis handling offset (+90 °) [in 1/100 °]
	P737:	C axis home offset

Information

The determined values must be saved in the PMAC board with "Save to PMAC" or "Save File". Use also the Backup function of the File menu to back up the parameters on hard disk in the BACKUP.PMC file.

4.3.2 Initial Teach

Command	Field	Explanation
Initial Teach		Determines the coordinates for one teach point each per component (in the AMU: **Graphical Configuration**).

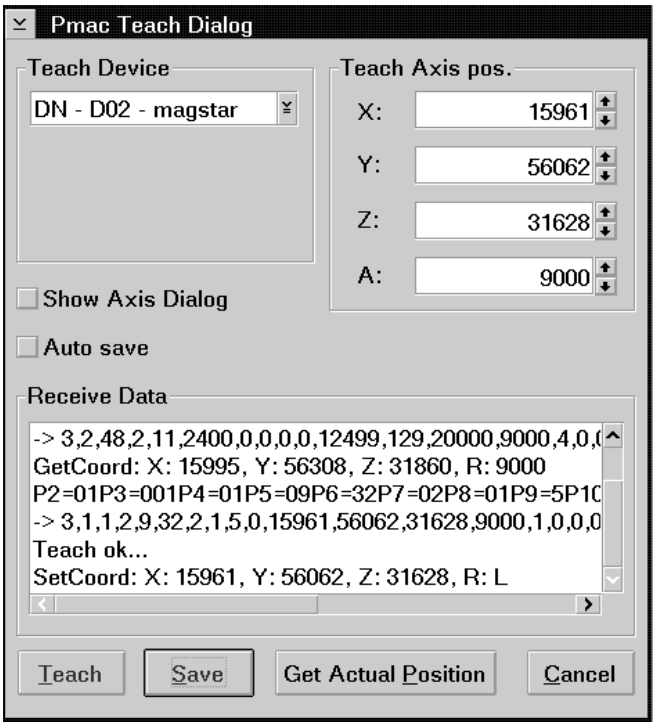


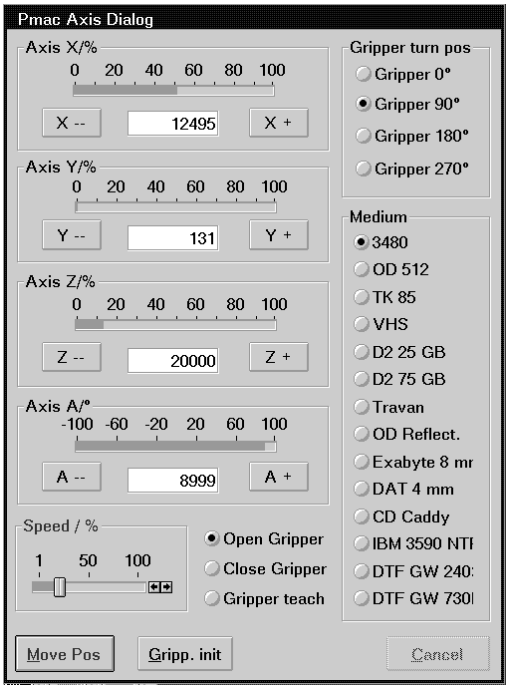
Figure 4-9: "Pmac Teach Dialog" window

Teach Device

Component the teach point of which should be determined.
You can select all components defined in **Graphical Configuration** (AMUCONF.INI) and the regrip station when using the I/O unit/E
Example: Display E5 - E01 - E/I/F 1:

- Component type: e. g. E5 (I/O unit/C)
- Component address: e. g. E01 (first I/O unit)
- Description: e. g. E/I/F 1

Command	Field	Explanation
Initial Teach (continued)	**Teach Axis pos.**	Coordinates of the teach point. Values are changed on: • Selection of a **Teach Device** • **Get Actual Position** • Changing over with the mouse pointer from **Pmac Axis Dialog** (Figure 4-10: on page 4-14) to **Pmac Teach Dialog** • Robot has determined teach coordinates The values [in 1/100 mm or 1/100 °] can also be changed manually.
	Show Axis Dialog	The **Pmac Axis Dialog** window appears in addition on clicking (Figure 4-8: on page 4-11) **Information** **For switching over from the Initial Teach to Move Axis and back you must previously click on the background area of the new window (gray area) to activate the new window. The activated header is not sufficient.**
	Auto save	On positive acknowledgement of **Teach**, the values are taken over automatically in the AMUCONF.INI.
	Receive Data	Log of the commands in the **Initial Teach**
	Teach	The robot starts its teach label search at the coordinates stated in **Teach Axis**
	Save	Saving the coordinates from **Teach Axis** in the AMUCONF.INI file (**Graphical Configuration**)
	Get Actual Position	Entering the coordinates of the actual robot position in **Teach Axis**

Command	Field	Explanation
Initial Teach (continued)	**Show Axis Dialog**	Move axes.  Figure 4-10: "Pmac Axis Dialog"
	Speed / % **1..100**	Selection of the speed in percent. **Information** **Speed values apply here only in the Pmac Axis Dialog.**
	Axis **X% 0..100** **Y% 0..100** **Z% 0..100** **A° -100..100**	Actual position of the robot: • in percent of the total length of - X axis - Y axis - Z axis • in degrees (0 ° = gripper upwards) - for axis A

Command	Field	Explanation
Initial Teach (continued)	X--/X+ Y--/Y+ Z--/Z+ A--/A+	**Information** **Firstly reduce the value at Speed for small movements.** Move the X, Y, Z or A axis by clicking on the relevant field. The robot moves only as long as you keep the mouse button pressed. **Information** **In the case of the Y, Z or A axis the speed is increased automatically if you select the corresponding field with the mouse button longer than 3 seconds.**
	Move Pos	**WARNING!** **Crushing of limbs** **Damage to the system!** **Use this command only to move the coordinates that you know.** The robot moves to the position of the coordinates displayed [in 1/100 mm or in 1/100 °].
	Open Gripper	Opening the gripper.
	Close Gripper	Closing the gripper.
	Gripper teach	Teach the gripper. Close the gripper jaws so that the light beam of the teach sensor strikes the teach marks
	Gripper turn pos	Gripper 0°/90°/180°/270° Turning the gripper (axis C) to the corresponding number of degrees

Command	Field	Explanation
Initial Teach (continued)	**Medium**	Adjusting the gripper to a certain medium. The selection of the medium corresponds to the width of the gripper opening/closing.
	Gripp. init	New homing run of the stepping motors (A and C axis).

Command	Field	Explanation
	Initial Teach procedure	
	Step 1	Click on **Show Axis Dialog**
	Step 2	Click on the gray background in the Pmac Axis Dialog window
	Step 3	To position the swivelling axis (A axis) enter 9000 or -9000 in the coordinate field and click on **Move Pos**
	Step 4	Move the other axes by clicking on the + and - fields until you have positioned the gripper with the pin in the center on the lower left teach label in each case.
	Step 5	Go back into the **Pmac Teach Dialog** window and click on the gray background
	Step 6	Select in the **Teach device** the components for teaching (all components from the graphic configuration and the adjustment point for the I/O unit/E are displayed)
	Step 7	Click on the **Get actual Position** field
	Step 8	Click on **Teach** and wait until the process is concluded.
	Step 9	Click on **Save**
	Step 10	End the Initial Teach Dialog by clicking on **Cancel**

4.3.3 Pmac Terminal

Command	Field	Explanation
Pmac Terminal	Sending PMAC online commands.	

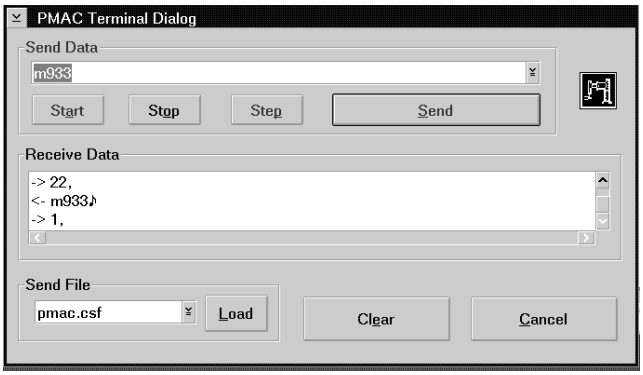


Figure 4-11: "PMAC Terminal Dialog" window

Send Data	Entry field for online commands. You can enter the commands or select them from the file under **Send File** (*PMAC online commands* on page 12-8)
Start	Starting commands from the file in the **Send File** field
Stop	Ending the endless loop
Step	Executing a command from the file in the **Send File** field and switching over to the next command
Send	Sending the contents of the **Send Data** field. The result stands in the **Receive Data** field
Receive Data	Log of the executed commands, the answers come from the PMAC board. Communication with the PMAC board: <- to the PMAC -> from the PMAC

Command	Field	Explanation
Pmac Terminal (continued)	**Send File**	Selection of a file from a list of all *.CSF files in the C:\AMU folder. The commands of the selected file appear in the **Send Data** field
	Load	The file selected under **Send File** is loaded into the program
	Clear	Delete the contents of the **Receive Data** window

4.3.4 Barcode test

Command	Field	Explanation
Barcode test		Testing the scanner function. Configuration of the barcode types to be read

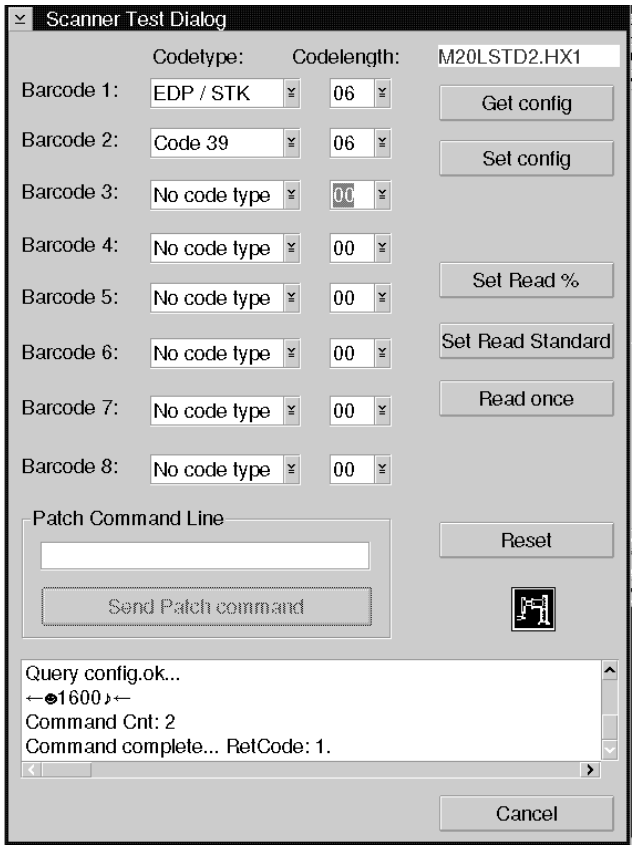


Figure 4-12: "Scanner Test Dialog" window

Barcode 1..8: Register for the configured barcode types. According to scanner software, you can configure max. 4 or max. 8 different barcode settings.

Command	Field	Explanation
	Codetype:	Barcode type. Select the types present in the system: • Straight 2 of 5 • Interleaf 2 of 5 • EDP/STK (Code 39 modified) • Code 39 • Code 128 • No code type (register not configured)

Command	Field	Explanation
Barcode test (continued)	**Code-length:**	Number of characters in your Volsers: **Information** **Prefer fixed code lengths. The error source "Wrong barcode" is thus strongly reduced.** • 00 = arbitrary number of characters • 01..16 = according to Volser length
	Get config	Loading the scanner configuration in the **Scanner Test Dialog** window
	Set config	Sending the parameters set in the **Scanner Test Dialog** window (and additional other standard parameters) to the scanner. Storing the parameters in the scanner EEPROM
	Set Read %	Switching on the quality diagnosis for barcode reading. At each subsequent **Read** the scanner returns the Volsers and the reading quality in % (☞ Log window). **Information** **Select this command only for optimizing Read.**
	Set Read Standard	Switching off the quality diagnosis immediately after the **Read** optimization (= standard in production)
	Read once	**Read** at current robot position. Results display (☞ Log window)
	Reset	Preparation of the operator interface of the window for new command. Resetting the scanner communication
	Patch Command Line	Command line for entering CRT commands (☞ Scanner documentation)
	Send Patch command	Sending the commands entered in **Patch Command Line** to the scanner

4.3.5 Gripper test

Command	Field	Explanation
Gripper test		Test of the sensors and motors on the gripper.

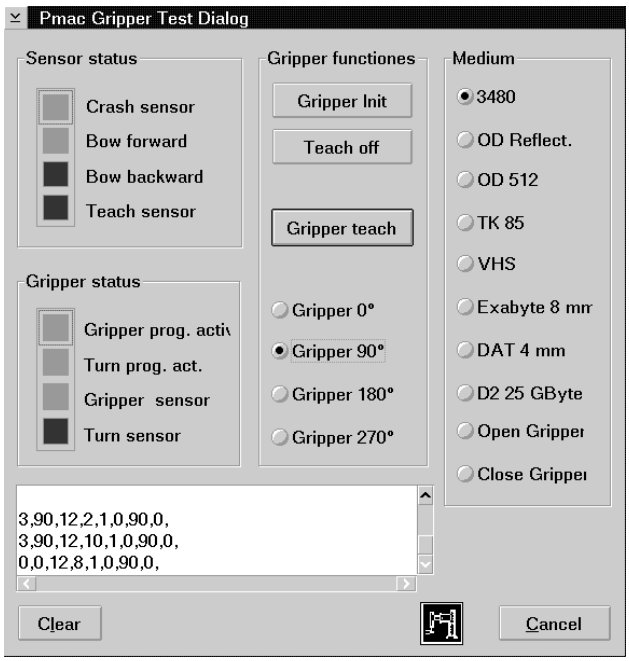


Fig. 4-13: "Pmac Gripper Test Dialog" window

Sensor status

Possible status of the gripper sensors:
- red = sensor active
- green = sensor inactive
- yellow = no information

Displayed gripper sensors:
- **Crash sensor**
- **Bow forward** (query pin)
- **Bow backward** (query pin)
- **Teach sensor**

Gripper status

Display of the signals for the gripper motors (B and C axis stepping motors)
- **Gripper prog. active**
- **Turn prog. act.**
- **Gripper sensor**
- **Turn sensor**

Command	Field	Explanation
Gripper test (continued)	**Gripper functions**	**Gripper Init** New homing of the gripper motors **Teach on/off** Switching the reflected light sensor on/off (= teach sensor) **Gripper teach** Closing the gripper jaws so that the light beam of the teach sensor strikes the teach marks **Gripper 0°/90°/180°/270°** Turning the gripper (axis C) to the corresponding number of degrees
	Medium	The selection of the medium corresponds to the width of the gripper opening/closing. **Open Gripper** Open gripper **Close Gripper** Close gripper
	Clear	Delete contents of the log window

4.4 Teach menu

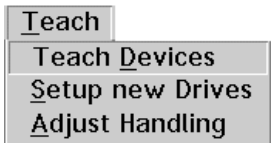


Figure 4-14: "Teach" menu

4.4.1 Teach Devices

Teach command with the same functions as teaching from the AMU operator interface:
PMMaint program

- Starts the KRN / P from the AMU
- Sends commands to the KRN / P

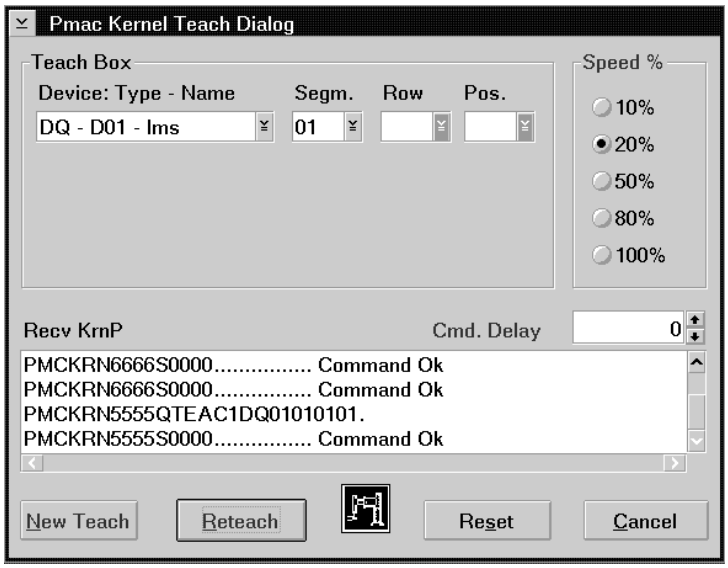


Figure 4-15: "Pmac Kernel Teach Dialog" window

Command	Field	Explanation
Teach Box	**Device: Type - Name**	Selection of the component to be taught (from all components defined in the **Graphical Configuration** - "AMU-CONF.INI" file). Display DQ - D01 - lms • Component type: e. g. DQ (Philips LMS drive) • Component address: e. g. D01 (first drive) • Description: e. g. lms
	Segm.	Selection of a segment for storage towers (remains always 1 for AML/J, exception I/O unit/D (HICAP): 1 or 2)
	Row	not used
	Pos.	not used
Speed %	Speed for **Teach**. **Information** **Reduce the speed if your are not sure that the basic teach coordinate is correct.**	
Cmd. Delay	Waiting time between clicking on the **Execute** field and execution of the command by the robot. **Information** **Delaying command execution is useful in larger system.**	
Recv KrnP	Log window for displaying the data exchange with the KRN/P of the AMU	

Command	Field	Explanation
	New Teach	New teaching of a component (AMU option **1N**). **ATTENTION!** **New teaching of only segment 1 of the I/O unit/D (HICAP) with New Teach.** • Possibly existing values in the KrnRefPt.R00 file for this component are deleted • The robot determines from the basic teach coordinates from (AMU-CONF.INI) the coordinates of all necessary teach points of the component • Teach points are stored automatically in the KrnRefPt.R00 file
	Reteach	Reteaching of a component (AMU option 1). **ATTENTION!** **Always reteach segment 2 of the I/O unit/D (HICAP) with reteach.** • The robot determines on the basis of the teach point file KrnRefPt.R00 the coordinates of all necessary teach points • Changed values are automatically stored again in the KrnRefPt.R00 file
	Reset	• Delete contents of the log window • Preparation of the operator interface for starting a new command **Information** **The command processing is not reset in the PMAC board with Reset.**

4.4.2 Setup new Drives

Command	Field	Explanation
Setup new Drives		Set up handling of the drives.

Figure 4-16: "PMAC Setup new Drives Dialog"

Drive Selection of a drive defined in the **Graphical Configuration**.

Trace Clicking on opens the communication window **PMAC Trace Dialog**:

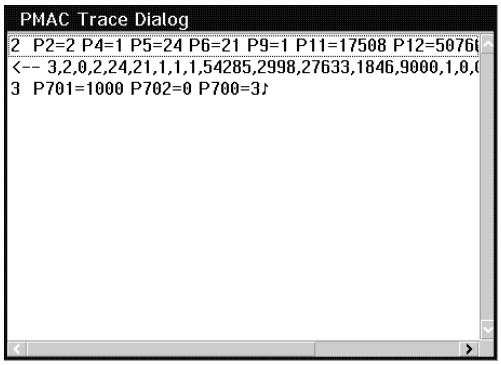


Figure 4-17: "PMAC Trace Dialog"

Command	Field	Explanation
Setup new Drives (continued)	PVar	Clicking on opens a display of the PVAR values:

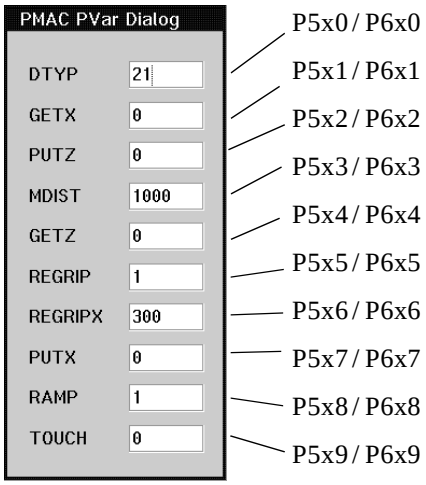


Figure 4-18: "PMAC PVAR Dialog"

(Table 4-1: P variables for drive configuration on page 4-32)
Changes via **Pmac Terminal**
(*Pmac Terminal* on page 4-18)

	Offset	Clicking on opens a display of the offset values in AMUCONF.INI or AMUCONST.INI:

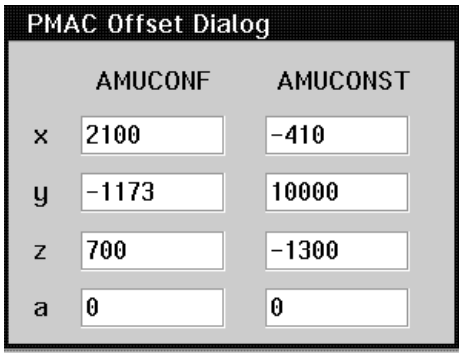
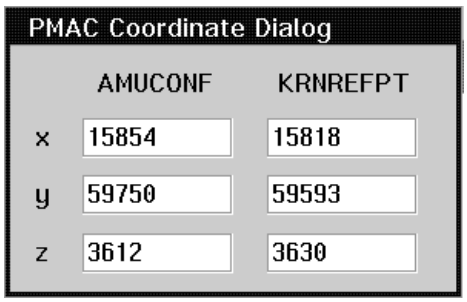


Figure 4-19: "PMAC Offset Dialog"

Changes of all offsets in the **AMUCONF** also with *Adjust Handling* **on page 4-33**

Command	Field	Explanation
Setup new Drives (continued)	**Coor.**	Clicking on opens a display of the X, Y, and Z coordinates in AMUCONF.INI or KRNREFPT.R00:  Figure 4-20: "PMAC Coordinate Dialog" Changes of the teach coordinates in the **AMUCONF** with *Initial Teach* **on page 4-12** Changes of the teach coordinates in the **KRNREFPT** with *Teach Devices* **on page 4-25**
	axis	Selection of the axis to be moved.
	mm/step	Selection of the stepping width (in mm/step).
	action	Selection of the command: • **Get**: Place medium in drive • **Put**: Take medium out from drive • **Disc**: Pressing the discharge button
	Join Off-set	Clicking on sets the offsets of **Get** and **Put** equal.
	New Drive	Basic setting. Slows down the speed on setting up new drives. The robot moves to a safe starting position in front of the drive. Move the robot with the aid of the mouse gradually into the destination position.

Command	Field	Explanation
Setup new Drives (continued)	**GO!/CLOSE** **GO!/OPEN**	**GO!** Starting the movement for **Get/Put/Disc** **CLOSE** Gripper closes for **Get** **OPEN** Gripper opens for **Put**
	move +/-	Direction of the movement in space coordinates. Only active if manual axis movements are possible.
	regrip?/ push tape? y/n	Questions for drive handling. **REGRIP** *PMAC PVAR Dialog* on page 4-32 **MDIST** *PMAC PVAR Dialog* on page 4-32
	save	Saving the determined parameters in the • PMAC board (P500..P699) • AMUCONF.INI (offsets)

PMAC PVAR Dialog

- You can define a maximum of 20 different drives (x = 0 .. 9):

Table 4-1: P variables for drive configuration

Parame-ter	PVAR	Explanation
5x0 6x0	DTYP	Drive type: PMAC value (defined in AMU-CONST.INI) QVW
5x1 6x1	GETX	Distance in forwards movement after a medium was recognized in **Keep** X offset [in 1/100 mm]
5x2 6x2	PUTZ	**Put** Z offset [in 1/100 mm]
5x3 6x3	MDIST	How far the gripper pushes the medium into the drive: -3500 no pushing 0 forwards pushing by 3500 [in 1/100 mm]
5x4 6x4	GETZ	**Get** Z offset [in 1/100 mm]
5x5 6x5	REGRIP	Regripping during **Keep** (0 = No, 1 = Yes)
5x6 6x6	REGRIPX	Distance in regripping during **Keep** 0 1300 [in 1/100 mm] other values 1300 [in 1/100 mm] + value
5x7 6x7	PUTX	X offset for following **Put** (after **Get** on drive) Use this parameter if it is not necessary to grip the medium completely. (Completely means here "No distance from the medium to the 2 gripper pins)
5x8 6x8	RAMP	Factor for ramp acceleration while pushing for **Put** (higher values correspond to lower acceleration)
5x9 6x9	TOUCH	Two bytes hexadecimally coded (however display decimal) for the waiting time after the Put process and the media recognition in Keep 1st byte: Value * 0.1 ms (waiting time after pushing on) 2nd byte: Media recognition for the drive 349 type 0 touch 1 no touch

4.4.3 Adjust Handling

Dialog for checking and adjusting the handling

- With the functions **Put**, **Get**, **Look**, **Unload Unit** and **Discharge** from the AMU operator interface (☞ AMU Reference Guide)
- Connected with the editing function of the AMUCONF.INI for the handling offset values (OSET)

PMMaint program

- Starts the KRN / P of the AMU
- Sends commands to the KRN / P

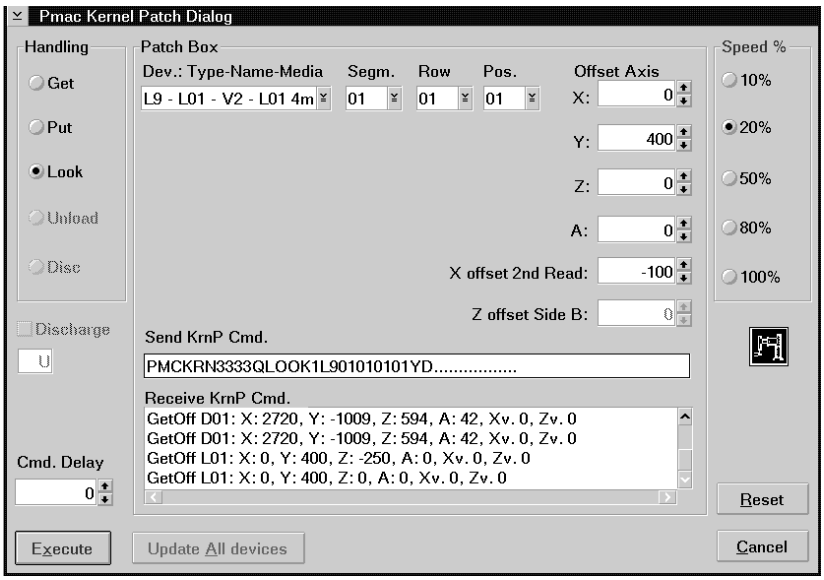


Figure 4-21: "Pmac Kernel Patch Dialog" window

Command	Field	Explanation
Pmac Kernel Patch Dialog	**Patch Box Device: Type - Name**	Selection of the component to be patched (from all components defined in **Graphical Configuration** AMUCONF.INI). Display L9 - L01 - 4mm • Component type: e. g. L9 (linear rack over 3 of 6 modules) • Component address: e. g. L01 (first linear rack) • Description: e. g. 4mm

Command	Field	Explanation
Pmac Kernel Patch Dialog (continued)	**Segm.**	Selection of a segment for storage towers (remains always 1 for AML/J, exception I/O unit/D (HICAP): 2 segments)
	Row	Selection of the linear rack row. Always 1 for drive and problem box. **Information** **Check especially the handling of extreme positions (top and bottom row).**
	Pos.	Selection of the compartment **Information** **Each optical disk occupies two compartments.**
	Offset Axis	Correction values in gripper coordinates [in 1/100 mm or 1/100 °] for the selected handling command. The values are stored after clicking on the **Execute** field (in AMUCONF.INI file). **X offset 2nd Read** X offset for **Look** (2nd Read) **Z offset Side B** Z offset for **Look** on a linear rack for optical disks on the label of the B side
	Get	Gripping the medium. The command can be executed only if no medium is in the gripper. After positive acknowledgement, the program switches automatically over to **Put**

Command	Field	Explanation
Pmac Kernel Patch Dialog (continued)	**Put**	Placing the medium. The command can be executed only if a medium is in the gripper. After positive acknowledgement, the program switches automatically over to **Get**
	Look	Reading the barcode. The command can be executed only if no medium is in the gripper and the handling is configured for **Get**. After positive acknowledgement, the Volser is displayed in the **Recv KrnP - Command** field
	Unload	Only for 3490 drives. Corresponds to a **Keep** after **Disc.** (Gripping an unloaded medium from the drive)
	Disc.	Actuating the discharge button on the drive
	Discharge	Reserved for future use
	Speed %	Speed for **Patch**. **Information** **Reduce the speed to be able to observe the handling accurately.**
	Receive KrnP Cmd.	Log window for display of the data exchange with the KRN/P of the AMU
	Cmd Delay	Waiting between clicking on the **Execute** field and execution of the command by the robot. **Information** **Delaying the command execution is useful in larger systems.**

Command	Field	Explanation
Pmac Kernel Patch Dialog (continued)	**Execute**	Click on **Execute** to start the previously selected command
	Update All devices	**ATTENTION!** **Destruction of all handling settings!** **By clicking on this button you immediately update the settings of** • **all linear racks** • **all drives of the same type** • **all I/O units/C** **to the values in the active window.** Only active if the handling has been selected.
	Reset	• Delete contents of the log window • Preparation of the operator interface for starting a new command **Information** **Command processing is not reset in the PMAC board with Reset.**

4.5 Service menu

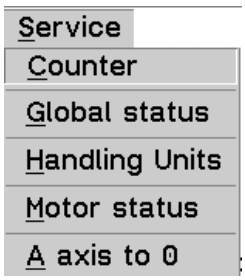


Figure 4-22: "Service" menu

4.5.1 Counter

Command	Field	Explanation
Counter	Counter for the running performance of the system (maintenance intervals).	

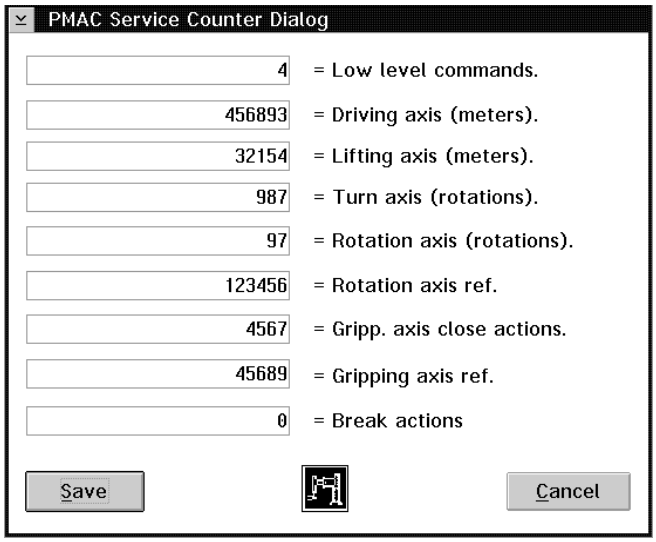


Figure 4-23: "PMAC Service Counter Dialog"

Low level commands	Number of all individual commands (each AMU command is composed of several individual commands)
Driving axis (meters).	Distance covered of the Y axis [in m]

Command	Field	Explanation
Counter (continued)	**Lifting axis (meters)**	Distance covered by the Z axis [in m]
	Turn axis (rota-tions).	Number of rotations of the A axis
	Rotation axis (rota-tions).	Number of rotations of the C axis
	Rotation axis ref.	Number of homing runs of the C axis
	Gripp. axis close act.	Number of the gripping actions
	Gripping axis ref.	Number of the homing runs of the B axis
	Break actions	Number of the changes of the brake con-dition of the Z axis
	Save	Saving the counter values in a file in the C:\AMU folder (e. g. FEB27_96.CNT)

4.5.2 Global status

Command	Field	Explanation
Global status		Display of global status bits. For diagnosis of errors.

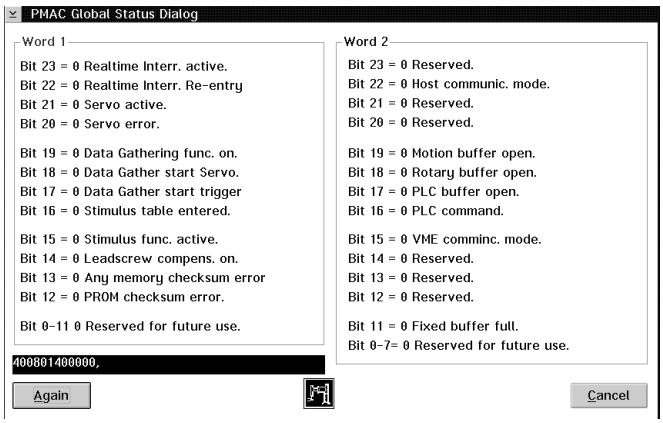


Figure 4-24: "PMAC Global Status Dialog" window

Realtime Interr. active	For internal use (in the PMAC board), this bit is 0 for communication. PMAC executes a program in the realtime interruption level (PLC 0 or moving planning)
Realtime Interr. Re-entry	Program of the realtime interruption level has taken more time (I8+1 servo cycles). The following realtime interrupt has already been triggered
Servo active.	For internal use (in the PMAC board), this bit is 0 for communication. PMAC executes a program with servo updating
Servo error.	PMAC could not execute the servo routines completely
Data Gathering func. on.	"Data Gathering" function in PMAC is active

Command	Field	Explanation
Global status (continued)	**Data Gather start servo**	"Data Gathering" function is activated with the next servo cycle
	Data Gather start trigger	"Data Gathering" function is activated with the start of the machine input 2
	Stimulus table entered.	"Stimulus table" was loaded in the PMAC board
	Stimulus func. active.	"Stimulus table" is active in the PMAC board
	Lead-screw compens. on.	"Leadscrew Compensation" is active on the PMAC board
	Any memory check-sum error	Checksum error has occurred in the memory of the PMAC firmware or in the user program memory
	PROM check-sum error.	Checksum error has occurred in the PROM memory of the PMAC firmware
	Host communic. mode.	Alphanumeric character was received through the "Host port". Thus the card is prepared for "Host communication" (PC bus or STD bus). The bit is set to 0 through the serial interface with <CTRL> <Z> (AML/J uses only PC bus)
	Motion buffer open.	Motion program buffer is opened (PROG or ROT) for entries
	Rotary buffer open.	Rotary movement program buffer is opened (ROT) for entries
	PLC buffer open	PLC program buffer is opened for entries
	PLC command.	PLC command is currently performed. (Bit for internal use)

Command	Field	Explanation
Global status (continued)	**VME comminc. mode.**	Alphanumeric character was received through the "Mailbox port". Thus the board is prepared for "VME Bus Communication". The bit is set to 0 through the serial interface with <CTRL> <Z> (AML/J uses only PC bus)
	Fixed buffer full.	• Either no fixed motion program opened • or PLC buffer opened • or with opened buffer less memory than agreed in variable I18 available
	Again	Updating the screen display

4.5.3 Handling units

Command	Field	Explanation
Handling units		Display of the status bits for the handling unit.

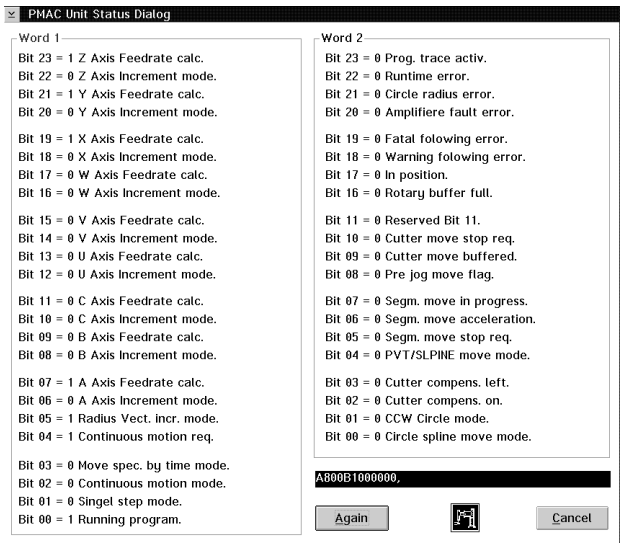


Figure 4-25: "PMAC Unit Status Dialog" window

Z-Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
Z Axis Increment mode	Axis performs a shift movement from the last programmed point (command INC)
Y Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
Y Axis Increment mode	Axis performs a shift movement from the last programmed point (command INC)
X Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates

Command	Field	Explanation
Handling units (continued)	**X Axis Increment mode**	Axis performs a shift movement from the last programmed point (commando INC)
	W Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
	W Axis Increment mode	Axis performs a shift movement from the last programmed point (commando INC)
	V Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
	V Axis Increment mode	Axis performs a shift movement from the last programmed point (commando INC)
	C Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
	C Axis Increment mode	Axis performs a shift movement from the last programmed point (commando INC)
	B Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
	B Axis Increment mode	Axis performs a shift movement from the last programmed point (commando INC)
	A Axis Feedrate calc.	Axis performs "Vector based feedrate" for "F-based" motion in the system of coordinates
	A Axis Increment mode	Axis performs a shift movement from the last programmed point (command INC)
	Radius Vect. incr. mode.	System of coordinates performs a shift motion for a circular motion
	Continuous motion req.	A command with several movements is started for the system of coordinates (e. g. R command)

Command	Field	Explanation
Handling units (continued)	**Move spec. by time mode.**	The current motion is based on a time value (TM or TA)
	Continu-ous motion mode.	System of coordinates performs a sequence of motions without intermediate stop
	Single step mode.	• Motion programs performs single steps (single motions or blocks of motions) • or a Q command (Quit) was sent
	Running program.	System of coordinates performs motion program
	Prog. trace activ.	Motion program trace is active (TRACE command). Stopping with ENDTRACE
	Runtime error.	System of coordinates has stopped the motion program because of an error (e.g. jump to nonexistent mark in the program or wrong computing time)
	Circle radius error.	Command for circular motion with more than twice the distance as the radius of the circle
	Amplifier fault error.	A motor in the system of coordinates has received an amplifier error
	Fatal following error.	A motor in the system of coordinates can no longer follow the motion specifications (Ix11)
	Warning following error.	A motor in the system of coordinates has an increased difference between actual position and setpoint (Ix12)
	In posi-tion.	All axes in the system of coordinates have the setpoint position • Setpoint speed is 0 • No motion command with time (DWELL) active • Axes inside the following error limits (Ix28)
	Rotary buffer full.	"Rotary buffer" is activated for the system of coordinates, but more than the com-mand lines defined in the variable I16 are in the memory

Command	Field	Explanation
Handling units (continued)	**Cutter move stop req.**	A movement with "Cutter Compensation" is stopped
	Cutter move buffered.	During a movement with "Cutter Compensation" a new movement is calculated and buffered
	Pre jog mode flag.	An axis in the system of coordinates performs a jog movement (J command)
	Segm. move in progress.	Bit for internal use. System of coordinates performs movement in "Segmentation mode" (I13 > 0)
	Segm. move acceleration.	Bit for internal use. System of coordinates performs movement in "Segmentation mode" (I13 > 0) and accelerates from standstill
	Segm. move stop req.	Bit for internal use. System of coordinates performs movement in "Segmentation mode" (I13 > 0) and decelerates down to standstill
	PVT/ SLPINE move mode.	System of coordinates performs movement in "PVT/SPLINE mode"
	Cutter compens. left.	"Cutter Compensation" is active. The compensation is on the left side in the direction of the movement
	Cutter compens. on.	"Cutter Compensation" is active in the system of coordinates
	CCW Circle mode.	The system of coordinates is in the "CIRCLE2 move mode" (counterclockwise arc command)
	Circle spline move mode.	The system of coordinates is in the CIRCLE/SLINE move mode (bit 4 decides whether SPLINE or CIRCLE mode)
	Again	Updating the screen display

4.5.4 Motor status

Command	Field	Explanation
Motor status		Display of the status bits of the direct current motors.

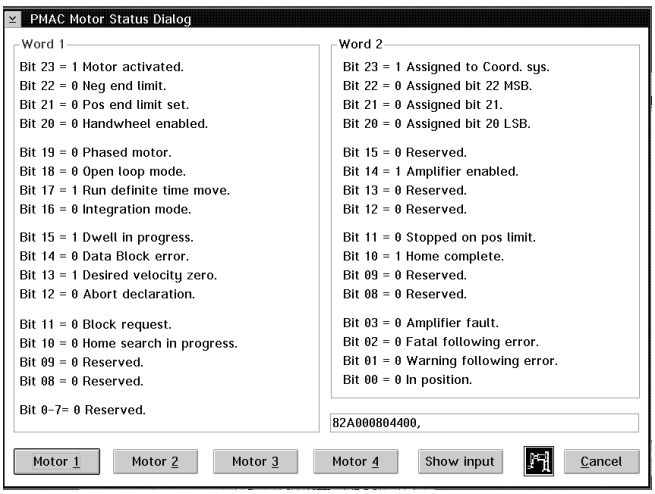


Figure 4-26: "PMAC Motor Status Dialog" window

Motor activated.

Motor activated (variable Ix00)

- Servo calculations every 30 µsec/cycle
- No unconditional motor enable

Neg. end limit.

Current position value is less than the value of the negative software limit switch (Ix14)

- Motor movements and motion programs are aborted
- Motors are braked corresponding to Ix15

Pos. end limit set.

Current position value is larger than the value of the positive software limit switch (Ix13)

- Motor movements and motion programs are aborted
- Motors are braked corresponding to Ix15

Handwheel enabled.

Following mode is activated (Ix06)

Command	Field	Explanation
Motor status (continued)	**Phased motor.**	Motor actuation (commutation) is performed by PMAC board (Ix01) • Phase calculation every 3 µsec / cycle • Two analog outputs for the motor
	Open loop mode.	Position control loop is opened (bit for the amplifier enable)
	Run definite time move.	Motor performs a movement with predefined end point and predefined end time.
	Integration mode.	"Servo Loop Integrator" is active only if the setpoint speed is 0 and Ix34 is 1
	Dwell in progress.	Motor system of coordinates performs the DWELL command (dwell between two movements)
	Data Block error.	Movement was interrupted since the values for the next movement cycle were not available on time
	Desired velocity zero.	Motor control loop is closed and the desired velocity is 0 (current position is held)
	Abort declaration.	Motor is braked • because of an abort command • or because of reaching the software limit switches
	Block request.	Motor has reached new movement section (for internal use)
	Home search in progress.	Motor searches the home position signal (signal is reset as soon as the trigger signal is there)
	Assigned to Coord. sys.	Motor is assigned to an axis in the system of coordinates
	Assigned bit 22 MSB **Assigned bit 21** **Assigned bit 20 LSB**	Binary coded value for motor address (number in the system of coordinates - 1)

Command	Field	Explanation
Motor status (continued)	**Amplifier enabled**	Outputs for drive amplifier are enabled: • either in "Open-loop" mode • or in "Closed-loop" loop
	Stopped on pos limit.	Motor was stopped at the software limit switch. The bit also remains set if the condition for the stop is no longer present
	Home complete	Home position run is successfully ended (axis has regular system of coordinates)
	Amplifier fault	Amplifier has switched off because of a fault (amplifier fault signal)
	Fatal following error.	Motor has switched off because of exceeding the "Fatal Following Error Limits" (Ix11)
	Warning following error.	Motor has exceeded the "Warning Following Error" value
	In position	• "desired velocity bit" = 1 (no motion command active and position control loop closed) • All program timers are switched off (DWELL and DELAY commands) • Value of the position deviation is less than variable Ix28
	Motor 1	Screen display of the X motor status. Select this field with problems with the X axis
	Motor 2	Screen display of the Y motor status. Select this field with problems with the Y axis
	Motor 3	Screen display of the Z motor status. Select this field with problems with the Z axis
	Motor 4	Screen display of the A motor status. Select this field with problems with the A axis

Command	Field	Explanation
Motor status (continued)	Show Input	**Information** **Enter a 12-digit Hex number and a comma in the input field.** Converts the statement in the input field to the individual bits of word 1 and word 2.

4.5.5 A Axis to Service Position

The gripper is turned into the service position with this command. You can dismantle the gripper best of all in this position and pack it in the gripper case.

5 Start

You will find general information on the procedure in a service call at AML/J systems in this section.

5.1 Activities in the service situation

In a service call work systematically through the stated points. Try to localize the cause of error as accurately as possible before you make changes to the setting or replace individual parts.

Step 1 Use Table 5-2: on page 5-4 to find out the necessary service activities. Prepare the system for the service call (☞ "Preparation of the service call" on page 5- 2.).
An attempt is made in the tables to order the activities and causes of error according to their priority.

Step 2 Follow the service procedures until you have found one or several possible replaceable components which cause the problem.

Step 3 Check before a replacement that the fault on the component was not caused by a loose cable, plug or another optically detectable cause which you can perhaps correct on the system. Obtain the corresponding spare parts only if you can detect no such problems.

Step 4 Replace the parts individually one after the other. If a part does not correct the error, replace it by the original part again before you replace the next possible part.

Step 5 After each service call on the system please check the function of the entire system and not only the faulty function.

Step 6 Back up the changed parameters on floppy disk.

Step 7 Return the system to the customer for production.

Step 8 Log your activities in the system logbook.

5.2 Preparation of the service call

Before you start with your work on the system, you should make preparations for an as speedy and smooth process as possible.

Table 5-1: Preparation of the service call

Task	Preparation of the task
Service is not possible during production	
• **Problem with the control system (electrical boards must be replaced)** • **General maintenance** • **Drive problem in a single drive or drive with front maintenance**	1. Ask the user to end or break off the current actions. 2. Ask the user of the application to unload all cassettes from the drives and bring them into the home position and then to set the drives offline 3. Back up the counter readings and the current parameters 4. Switch the system off. 5. In the case of drive problems please use the associated drive documentation
Problem on the robot and its components.	1. Ask the user to end or break off the current actions. 2. Ask the user of the application to unload all cassettes from the drives and bring them into the home position and then to set the drives offline 3. Back up the counter readings and the current parameters 4. Move the robot into the service position 5. Switch the system off.

Table 5-1: Preparation of the service call

Task	Preparation of the task
Service is possible during production	
Drive problem, further drives are available and drive type is installed in an ADIC/GRAU drive cabinet or allows maintenance from the back.	1. Ask the user to take the defective drive out from production (set offline). In the case of twin drives or several drives on a module, all drives of this unit must be taken out from production. 2. Set the drive in the service position 3. Please use the associated drive documentation to eliminate the drive problem

5.3 Service start

Select from the following table which section of this Guide is now relevant in your situation.

Table 5-2: Actions in the service situation

Situation	Actions
A LED on the power supply board is off. The LEDs are on the front of the power supply board on the control unit.	Check the power cabling in the system
Power supply problem in the AML/J	
AML/J does not react to commands	Start the AML/J system anew. Check the AMU log for possible error messages.
AML/J does not perform the initialization or not completely	Start the AML/J system anew. Check the AMU log for possible error messages. Use PMMaint for a diagnosis of individual components (gripper, scanner ..)
Command to the AML/J system was acknowledged with an error message	1. Prepare the system for service. 2. Perform the procedures which are listed in the Chapter *Error messages* on page 6-1.
Repeated warnings in the AMU log of the AML/J system	1. Prepare the system for service. 2. Perform the procedures which are listed under the same message number as errors in the Chapter *Error messages* on page 6-1.
Other error situations on the AML/J (e.g. noises or visible problems)	Perform the procedure *Other AML/J problems* on page 5-6.
Drive problem	Use the documentation for the drives to correct the problem.
Installation of components	Perform the procedure *Installation* on page 11-1.
Microcode update required	Perform the procedure *PMAC microcode update* on page 8-85.

Table 5-2: Actions in the service situation

Situation	Actions
Creation and backup of a trace file for error diagnosis	Perform the procedure *Creating a trace file* on page 8-92.
Maintenance of the AML/J system is due (preventive maintenance is necessary annually)	Perform the procedure *Preventive maintenance* on page 8-93.

5.4 Other AML/J problems

Some other possible problems in the AML/J system which are not displayed by error messages are listed below:

Table 5-3: Error analysis with no error message

Symptom	Possible cause	Action or spare part	Spare part	Further Info. on page
Noise of the Y axis	Rollers or deflection pulley defective or too much bearing play	Adjust toothed drive belt tension		8-13
		Replace lubricating felt	3B	8-97
		Adjust play of the roller		8-54
		Replace lower roller	*35*	8-52
		Replace upper roller	*36*	8-54
		Replace deflection pulley	*37*	
Noise of the lifting axis	Lifting carriage bearing defective or loose	Replace handling unit	*34*	8-57

6 Error messages

If an error is detected by the AML/J control system (PMAC board in the AMU PC), the system attempts to correct this itself. In this case a warning appears in the AMU log. If the system is not able to correct the error, an error message is entered in the AMU log.

The following table lists all error messages caused by the AML/J control system.

Reference is made to spare parts in the list if the error could be due to a hardware defect. Further you find the reference to the installation of the spare part.

However, please note that every error can have different (partially also complex) causes. You will find further background information on the AMU error messages in the AMU Problem Determination Guide. The relevant meaning of the variables %1, %2 .. in the message text is also explained in this Guide.

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0098	**Controller %1 measuring system error (controller has been switched off).**		
		Switch the main switch on	Operator Guide
	1E	Replace the main switch (rocker switch in the installation frame)	8-81

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0102	**Controller %1 %2 measuring system error (emergency stop [0528]).**		
		Check the EMERGENCY OFF circuit (safety switches in the access doors)	
	22	Replace the safety switches	8-82
	21	Replace the module distributor board or the I/O-E board.	8-61 / 8-62
	23	Replace the ribbon cable module - control unit connection	
	24	Replace the ribbon cable module connection	
	1C	Replace the EMERGENCY OFF module	
	1D	Replace the auxiliary contactor	
	62	Replace the 26-core shielded ribbon cable	
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0301	**Syntax error %1 in command string from AMU.**		
		Check that the version of the microcode in the PMAC board is compatible with the installed AMU version.	
		Create an AMU trace with the trace ID "KRN9"	8-92
		Perform a system shutdown and restart the AML/J. If the error continues to occur, please contact the Technical Support of ADIC/GRAU.	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0303	**Timeout error %1. Tower- or E/I/F access is denied.**		
		Check that the I/O unit is closed.	
		Check the input signals of the I/O unit.	
	21	Replace the module distributor board or the I/O-E board.	8-61 /8-62
	23	Replace the ribbon cable module - control unit connection	
	24	Replace the ribbon cable module connection	
	52/54	Replace the microswitch in the I/O unit	
	59/5A	Replace the relay board	8-64
	61	Replace the PMAC board	8-69
		During start-up: Check that the correct software modules have been loaded.	8-85
0304	**Coordinate sent by AMU is out of range %1**		
		Check the "Motor Limits".	8-10
		Teach the system	8-31
		Check the parameters for the gear factors	
		Perform a system shutdown and restart the AML/J. If the error continues to occur, please contact the Technical Support of ADIC/GRAU.	Operator Guide

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0401	**Touch sensor %1. Unexpected collision.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Configure the adjustment point	8-23
	33	Replace the gripper	8-37
0402	**Cartridge not in gripper %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Configure the adjustment point	8-23
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0403	**Cartridge control activated, please check the gripper handling for %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Teach the system	8-31
		Adjust the handling	8-15
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
0404	**Handling not configured. %1.**		
		Configure the drive	
		Create an AMU trace with the trace ID "KRN9"	8-92
		Perform a system shutdown and restart the AML/J. If the error continues to occur, please contact the Technical Support of ADIC/GRAU.	Operator Guide
0407	**Cartridge in gripper %1. %6**		
		Look whether there is really a cartridge in the gripper: If there is a cartridge in the gripper: • Save the AMU log. • Start the system anew. *At the first command the robot brings the cartridge into the problem box.* No cartridge is in the gripper. • Perform the actions of the error code 403.	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0412	**Gripper not open %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0413	**Gripper not closed %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
0416	**Bow not in back position %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0417	**Bow not in forward position %1.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
0418	**Cartridge lost. %6**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0420	**Cartridge not ejected from drive for %1. %6**		
		Check where the cartridge is in the system: • No cartridge in the drive Check the command and the database • Cartridge in the drive in the GET position. Perform the actions of error code 403. • Cartridge in the drive but not discharged	
		Check the KEEP delay time: • For AMU 2.4.0: AMUCONST.INI and PMAC variable P345 • For AMU 3.00: "Drive Configuration" in "Graphical Configuration"	AMU Reference Guide
		Check the unload (discharge) function (host command to drive or command to robot for operating unloading button)	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0422	**Touch sensor %1 during GET from drive. %6**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0423	**Touch sensor %1 during PUT to drive. %6**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
		Check the drive	
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67
0440	**Rack position empty for %1.**		
		Check that really no cartridge is in the compartment: If the compartment is empty: • Check the database of the AMU If the compartment is occupied: • Perform the actions of error code 0417.	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0442	**Touch sensor %1 during GET from rack.**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
		Check the "Motor Home Position"	8-10
		Teach the system	8-31
		Adjust the handling	8-15
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
0443	**Touch sensor %1 during PUT to rack.**		
		Check whether a cartridge is already in the compartment: If the compartment is occupied: • Check the database (possibly inventory) If the compartment is free: • Perform the actions of error code 0442.	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0501	**Teach label not recognized %1.**		
		Teach another component to test the teach sensor	8-31
		Check the teach label (possibly clean or repaint)	
		Teach the component anew	8-31
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
0502	**Barcode not recognized %1.**		
		Check that • the cartridge is correctly in its compartment • the barcode is not damaged or soiled • the barcode corresponds to the specification	
		Check the barcode scanner configuration with "PMMaint Barcode test"	4-20
		Check the barcode reading with "PMMaint Adjust Handling"	4-33
		Replace the barcode scanner	8-35

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0506	**Illegal range %1 during teaching.**		
		Teach the component anew	8-31
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
0522	**Turn axis not ready**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67
	62	Replace the 26-core shielded ribbon cable	

Table 6-1: Error messages

Error code	Spare part ID	Recommended service action	Further information on page
0524	**Grip axis not ready**		
		Check the gripper sensors with "PMMaint Gripper test"	4-23
	33	Replace the gripper	8-37
	25	Replace the power supply	8-56
	61	Replace the PMAC board	8-69
	12	Replace the bus board + plug board	8-65
	14	Replace the 2-axis controller	8-66
	16	Replace the stepping motor board B + C axis	8-67
	62	Replace the 26-core shielded ribbon cable	
0799	**%1 is being initialized**		
		Wait for the robot ready status message <0700>.	Operator Guide
0804	**Illegal command %1.**		
		Check that the version of the microcode in the PMAC board is compatible with the installed AMU version.	
		Create an AMU trace with the trace ID "KRN9"	8-92
		Perform a system shutdown and restart the AML/J. If the error continues to occur, please contact the Technical Support of ADIC/GRAU.	Operator Guide

6.1 PMAC memory log

The PMAC program writes on switching off the control voltage a block in the AMU log with which possible errors can be localized.

Table 6-2: PMAC memory log

Message in the AMU log	Explanation
Handlingsunit first statusword = 0.	First hexadecimal coded status word of the handling unit (*Handling units* on page 4-42)
Handlingsunit second statusword = aaaab0.	Second hexadecimal coded status word of the handling unit (*Handling units* on page 4-42)
not used = 0.	Reserved for later use
not used = a80020.	Reserved for later use
first Globalstatusword = 400801.	First hexadecimal coded general status word (independent of the handling unit kinematics) (*Global status* on page 4-39)
second Globalstatusword = 400000.	Second hexadecimal coded general status word (independent of the handling unit kinematics) (*Global status* on page 4-39)
Following error Motor 1 =0.	Difference between the desired position (command) and the measured value of the encoder for the X axis in encoder counts (following error) (If the value exceeds 2000 counts the PMAC board switches the power off)
Following error Motor 2 =-2006.	Difference between the desired position (command) and the measured value of the encoder for the Y axis in encoder counts (following error) (If the value exceeds 2000 counts the PMAC board switches the power off)

Table 6-2: PMAC memory log

Message in the AMU log	Explanation
Following error Motor 3 = -1.	Difference between the desired position (command) and the measured value of the encoder for the Z axis in encoder counts (following error) (If the value exceeds 2000 counts the PMAC board switches the power off)
Following error Motor 4 = 2.	Difference between the desired position (command) and the measured value of the encoder for the A axis in encoder counts (following error) (If the value exceeds 2000 counts the PMAC board switches the power off)
over current warning = 0.	Binary coded warning for over-current: 1=X axis, 2=Y axis, 4=Z axis, 8=A axis
over current error = 0.	Binary coded warning for over-current: 1=X axis, 2=Y axis, 4=Z axis, 8=A axis
actuall X-axisposition = 12499.	Measured value of the encoder, converted into 1/100 mm for X axis
actuall Y-axisposition = 176607.	Measured value of the encoder, converted into 1/100 mm for Y axis
actuall Z-axisposition = 817.	Measured value of the encoder, converted into 1/100 mm for Z axis
actuall A-axisposition = 9052.	Measured value of the encoder, converted into 1/100 degrees for A axis
first Motorstatusword Motor 1 =840000.	Hexadecimal coded 24-bit first motor status word for the X axis (*Motor status* on page 4-46)

Table 6-2: PMAC memory log

Message in the AMU log	Explanation
second Motorstatusword Motor 1 = 800400	Hexadecimal coded 24-bit second motor status word for the X axis (*Motor status* on page 4-46)
first Motorstatusword Motor 2 = 850000.	Hexadecimal coded 24-bit first motor status word for the Y axis (*Motor status* on page 4-46)
second Motorstatusword Motor 2 = 800406	Hexadecimal coded 24-bit second motor status word for the Y axis (*Motor status* on page 4-46)
first Motorstatusword Motor 3 = 840000	Hexadecimal coded 24-bit first motor status word for the Z axis (*Motor status* on page 4-46)
second Motorstatusword Motor 3 = 800400	Hexadecimal coded 24-bit second motor status word for the Z axis (*Motor status* on page 4-46)
first Motorstatusword Motor 4 = 850000	Hexadecimal coded 24-bit first motor status word for the A axis (*Motor status* on page 4-46)
second Motorstatusword Motor 4 = 800400	Hexadecimal coded 24-bit second motor status word for the A axis (*Motor status* on page 4-46)
X-axis startposition = 12499	Position (in 1/100mm] of the X axis at which the last command was acknowledged positively
Y-axis startposition = 176596	Position (in 1/100mm] of the Y axis at which the last command was acknowledged positively
Z-axis startposition = 816	Position (in 1/100mm] of the Z axis at which the last command was acknowledged positively
A-axis startposition = 8999 .	Position (in 1/100 degrees] of the A axis at which the last command was acknowledged positively
turn-axis startposition = 0	Position (in 1/100 degrees] of the C axis at which the last command was acknowledged positively

Table 6-2: PMAC memory log

Message in the AMU log	Explanation
low level commandcounter = 666.	Number of the "Low Level" commands which the ABBA / J has performed since the last reset of the counter
counter for Y-axis = 659 .	Total distance in meters which were travelled by the Y axis since the last reset of the counter
counter for Z-axis = 85 .	Total distance in meters which were travelled by the Z axis since the last reset of the counter
counter for A-axis = 11 .	Total number of revolutions which the motor of the A axis has made since the last reset of the counter
counter for turn-axis = 65 .	Total number of revolutions which the motor of the C axis has made since the last reset of the counter
turn-axis reference counter = 10 .	Number of homing runs of the C axis
counter for Grip-axis = 249 .	Number of the actions with open and close gripper
grip-axis reference counter = 10 .	Number of homing runs of the B axis
counter for Z-axis break = 215 .	Number of the actuations of the brake in the Z axis

The second motor status word is important for a simple analysis. It is binary coded in the last digit whether the motor has caused the fault with following or drive amplifier error:

Table 6-3: Last digit of the motor status word

Bit	Error	Value
3	Drive amplifier error	8
2	Too high following error	4
1	Warning because of following error	2

Table 6-3: Last digit of the motor status word

Bit	Error	Value
0	No error (axis in position)	1

7 Position of the components

7.1 Basic module

Figure 7-1: AML/J basic module

7.2 Overview of the system components

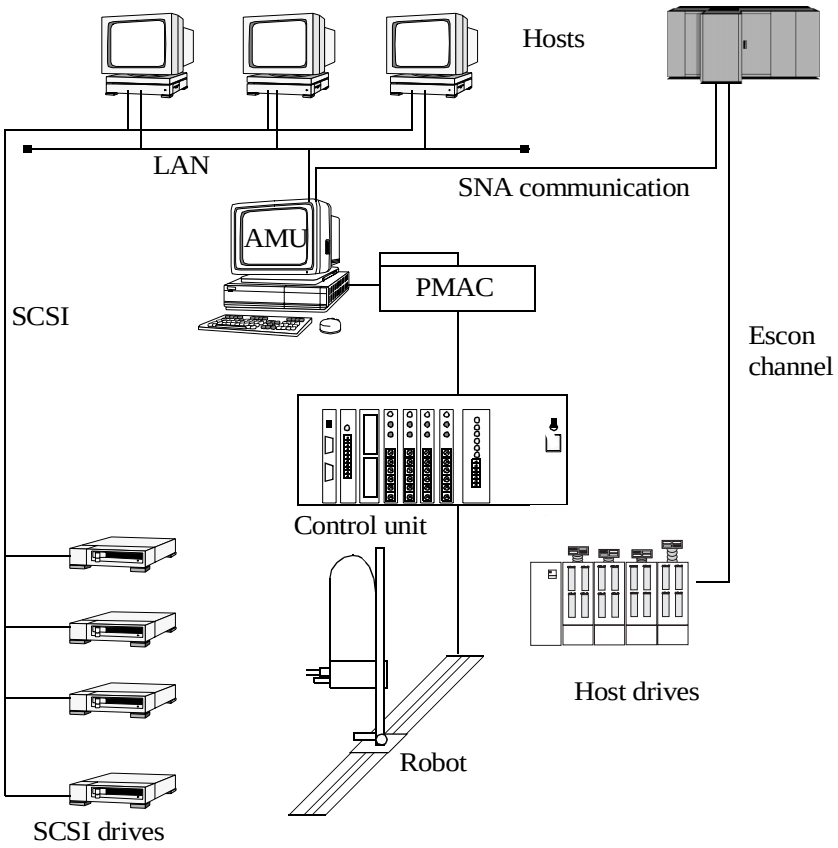


Figure 7-2: Overview of the system components

7.3 Control cabinet

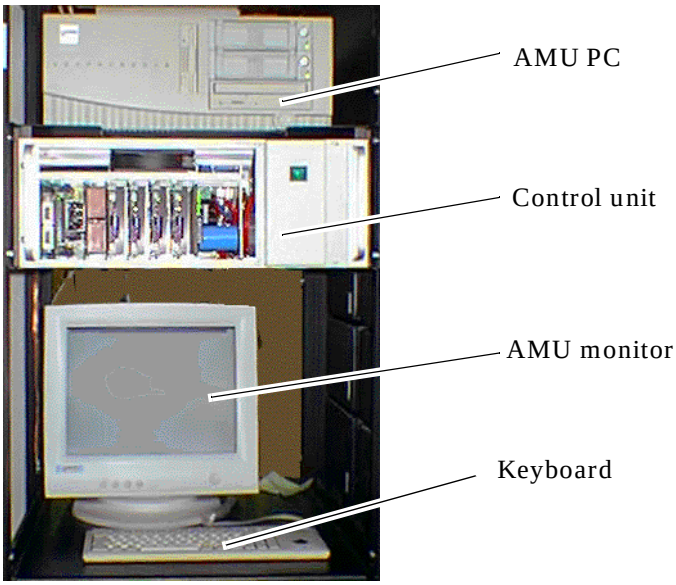


Figure 7-3: Internal view of the control cabinet

7.4 PMAC board

The PMAC board is installed in the AMU computer

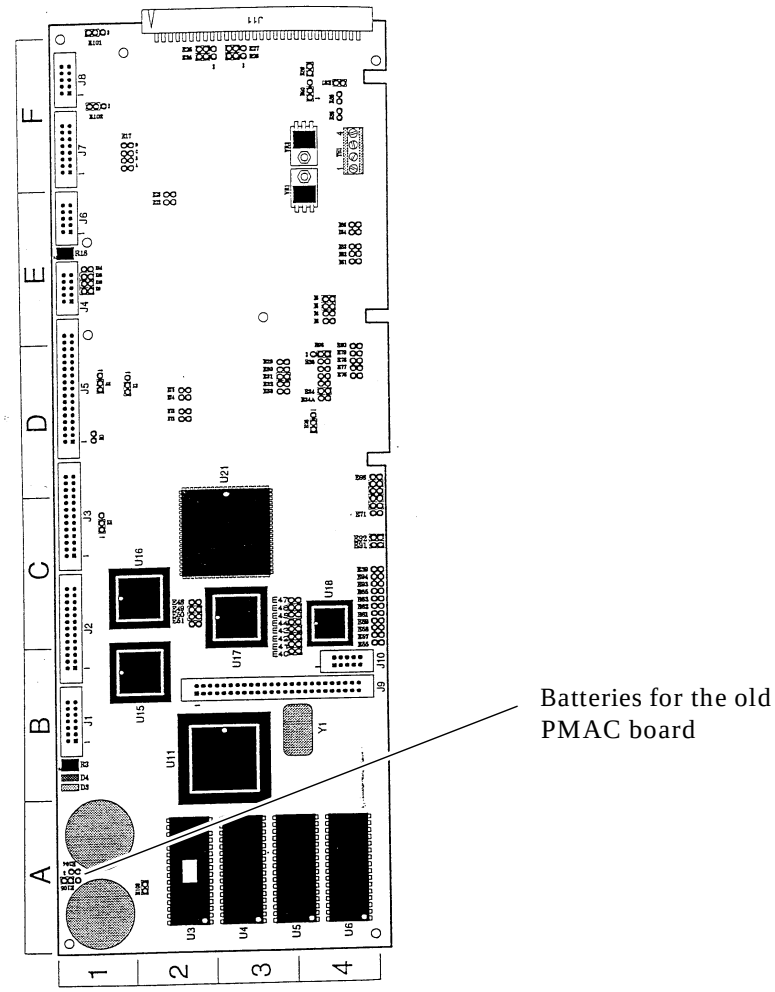


Figure 7-4: PMAC board

7.5 Control unit

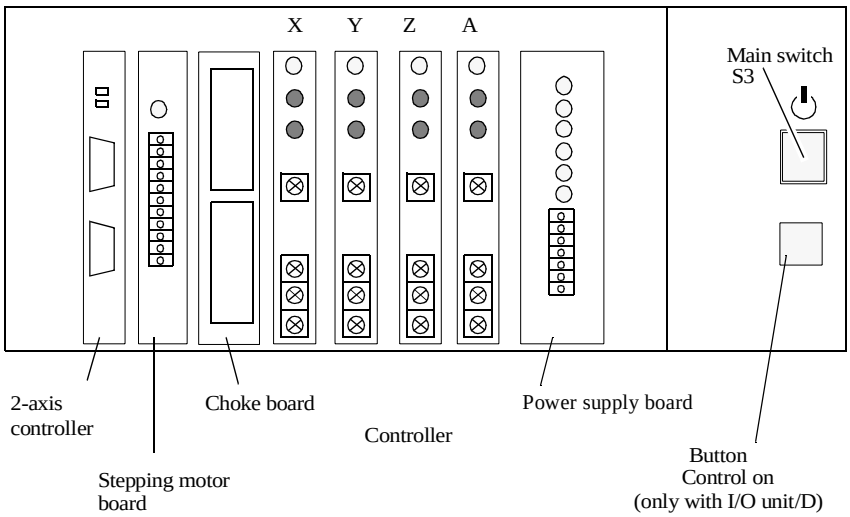


Figure 7-5: Control unit from the front with left front panel opened

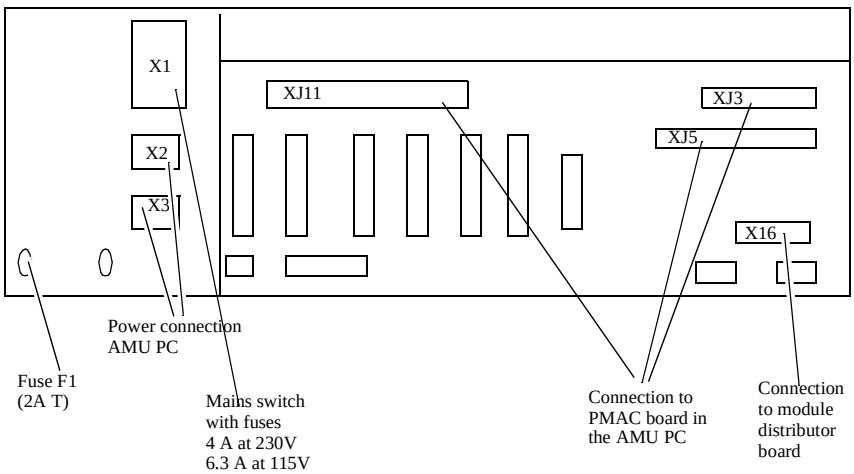


Figure 7-6: Control unit from the back

7.5.1 2-axis controller

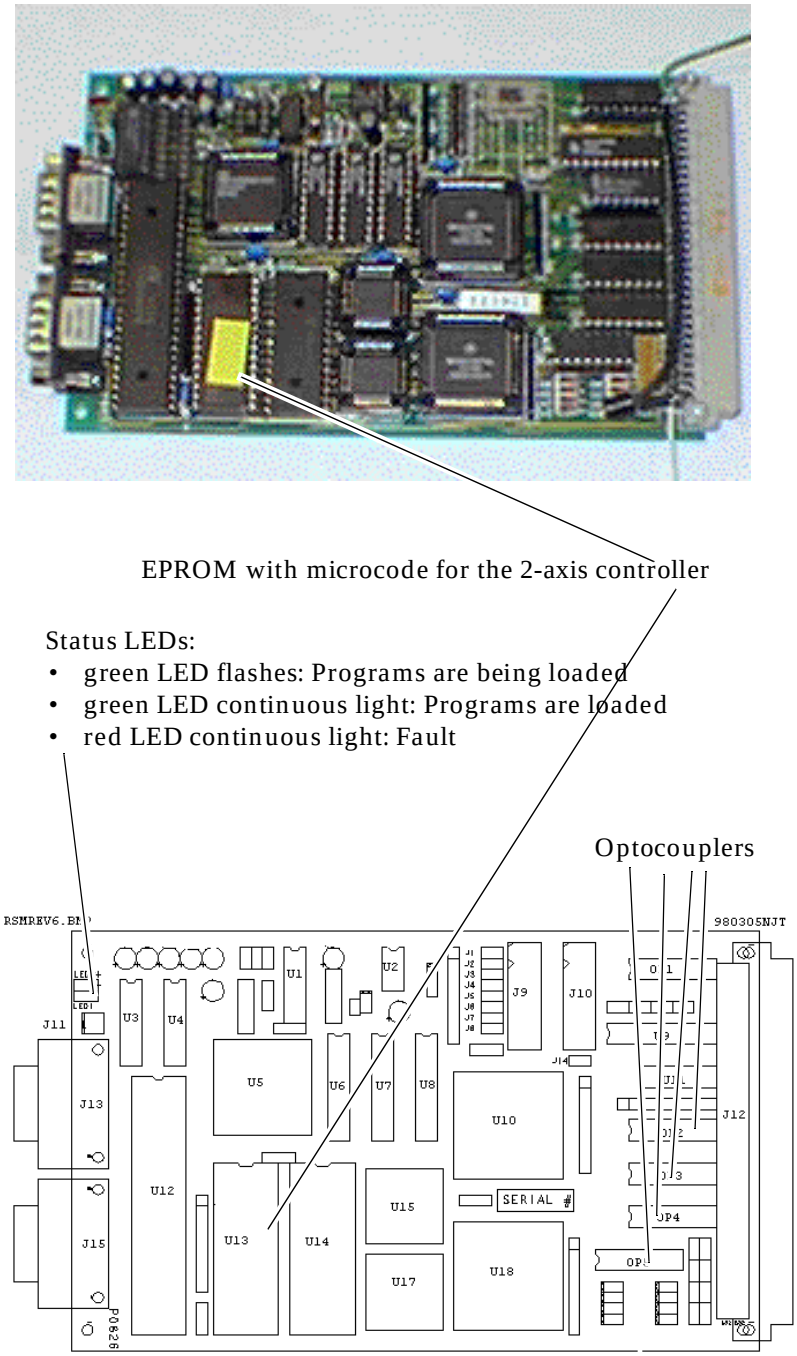


Figure 7-7: 2-axis controller

7.5.2 Stepping motor board

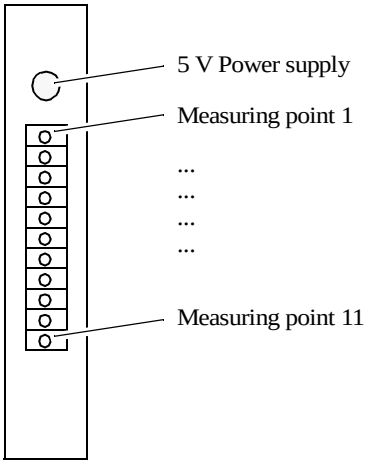


Figure 7-8: Stepping motor board

- Power unit for driving the stepping motors of the
  - Gripper axis B
  - Turn axis C
- Indicator for operating voltage 5 V (stepping motors) of the PMAC board

Measuring points

Table 7-1: Measuring points

Measuring point	Meaning
1	12 V+ DC
2	GND
3	12 V- DC
4	Current desired value motor 1
5	Current actual value motor 1
6	Current desired value motor 2
7	Current actual value motor 2
8	Current desired value motor 3
9	Current actual value motor 3
10	Current desired value motor 4
11	Current actual value motor 4

7.5.3 Controller

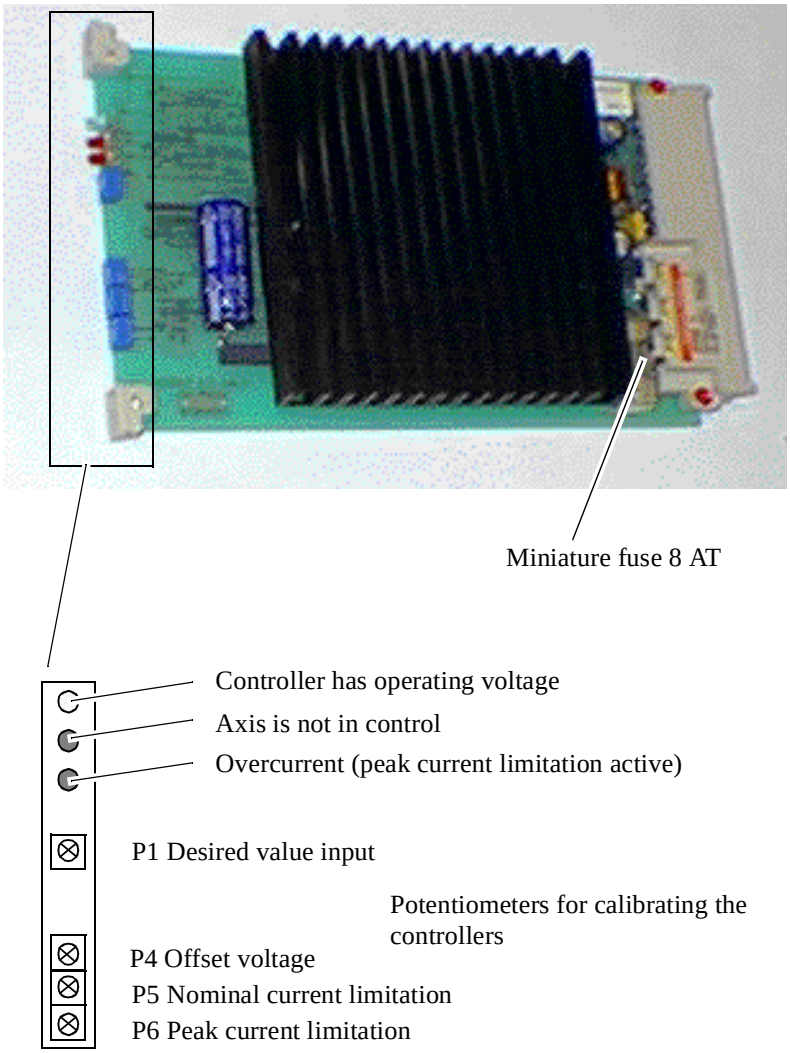


Figure 7-9: Controller

7.5.4 Power supply board

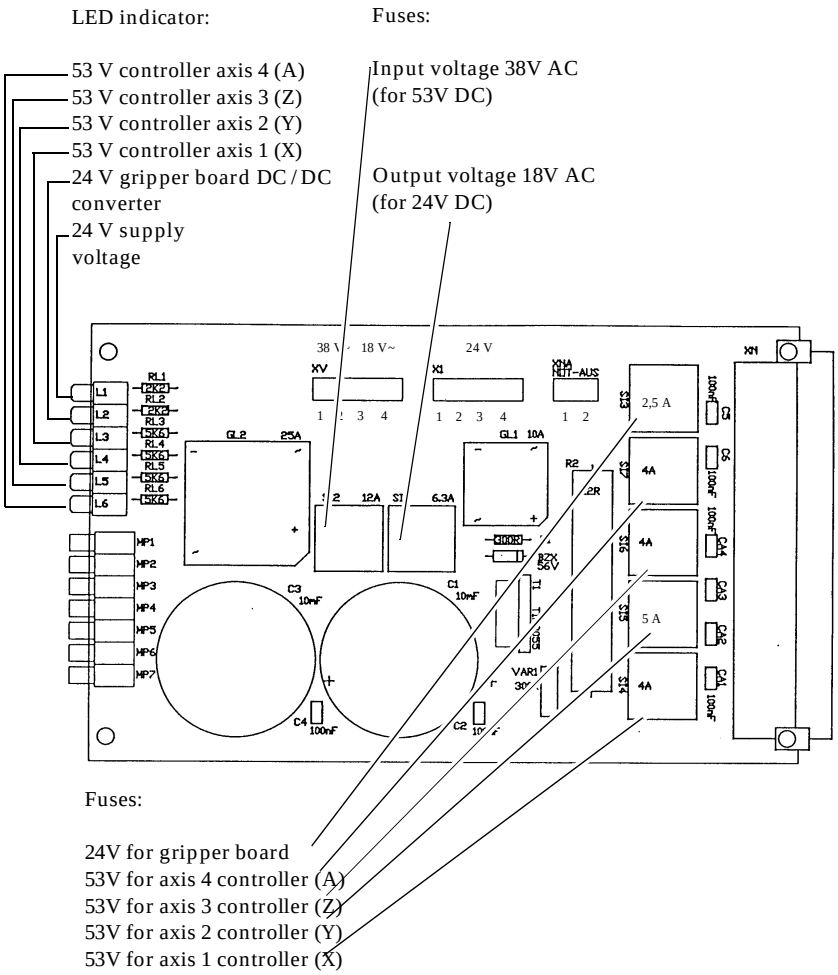


Figure 7-10: Power supply board

- Supply of the drive amplifiers with stable direct voltage
  - Auxiliary voltage 24 V DC
  - Power 53 V DC
- Measuring points and indicator for the supply voltage
- Fuses

Measuring points

Table 7-2: Measuring points

Measuring points	Meaning
MP1	18 V ~ (AC)
MP2	
MP3	38 V ~ (AC)
MP4	
MP5	24 V + (DC)
MP6	53 V + (DC)
MP7	0 V (GND)

Fuses

Table 7-3: Fuses

Fuse	Value	Meaning
SI1	6.3 A	18 V AC supply before SI3; indication by L1, L2
SI2	12 A	38 V AC supply and before SI4 to SI7
SI3	2.5 A slow	24 V gripper board with DC / DC converter (indication L2)
SI4	4 A slow	53 V controller axis 1 (X), indication L3
SI5	5 A slow	53 V controller axis 2 (Y), indication L4
SI6	4 A slow	53 V controller axis 3 (Z), indication L5
SI7	4 A slow	53 V controller axis 4 (A), indication L6

7.6 Handling unit

7.6.1 Coordinate world

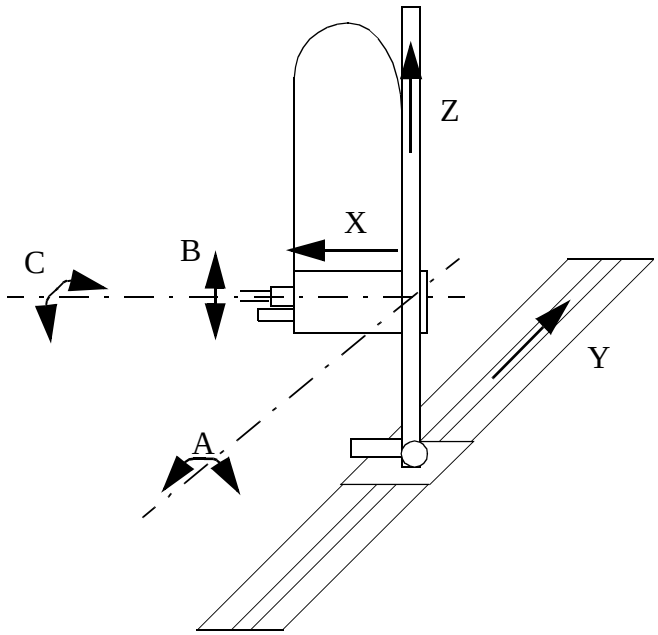


Figure 7-11: AML/J spatial system of coordinates

The AML/J system moves in two coordinate worlds:

- Spatial system of coordinates (cylindrical coordinates)
- Gripper system of coordinates (Cartesian coordinates):
  - Use of the Cartesian system of coordinates from the viewpoint of the gripper
  - The sign of the Y axis changes according to the position of the swivelling axis of the gripper

Robot axes and motors

Table 7-4: Cartesian AML/J coordinates

Axis	Coordinate	Name of the axis	Motor type
1	X	Feed axis	Direct current servomotor
2	Y	Driving axis	
3	Z	Lifting axis	Direct current servomotor **with brake**
4	A	swivelling axis	Direct current servomotor
5	B	Gripper axis (open/close)	Stepping motor
6	C	Turn axis	

7.7 Gripper

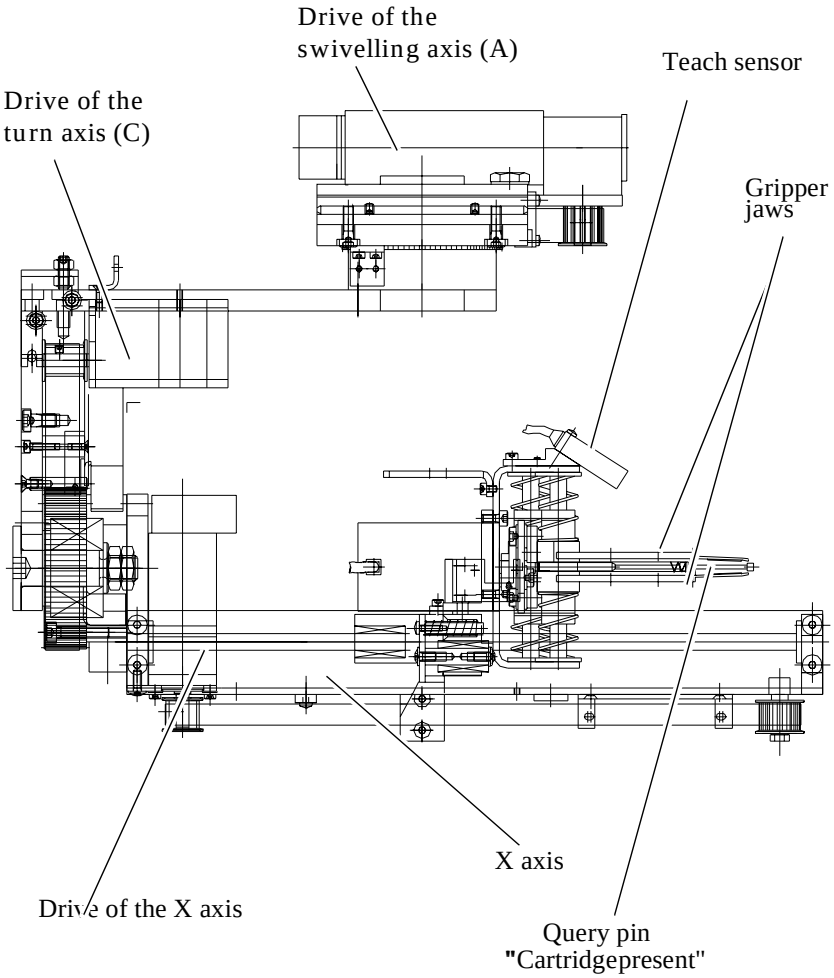


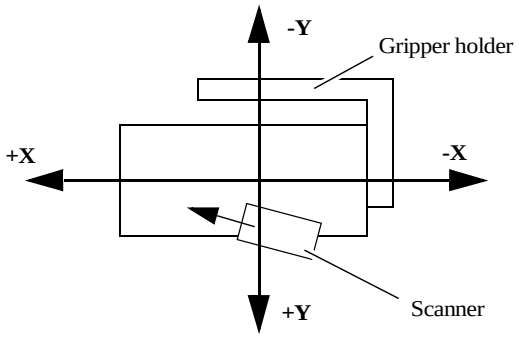
Figure 7-12: AML/J gripper

- Mechanical system with
  - 2 stepping motors (B and C axes)
  - 2 direct current servomotors (X and A axes)
- Holding all media with parallel jaws
  (holding closed with spring force)
- Guiding the feed axis (X axis)
  with bearings on 2 guide rods

- Gripper sensors:
  - Crash sensor:
    mechanical resistance in direction of feed axis is reported
  - "Bow forward" sensor (query pin):
    no medium in the gripper or positioned for teaching
  - "Bow backward" sensor (query pin):
    medium in the gripper
  - X axis home sensor:
    calibrate X axis
  - A axis home sensor:
    calibrate A axis
  - C axis home sensor:
    calibrate C axis
  - B axis home sensor:
    calibrate B axis or the gripper is open
  - Teach sensor:
    reflected light sensor for adjusting the system components

Coordinate word of the gripper

FROM ABOVE:



FROM THE SIDE:

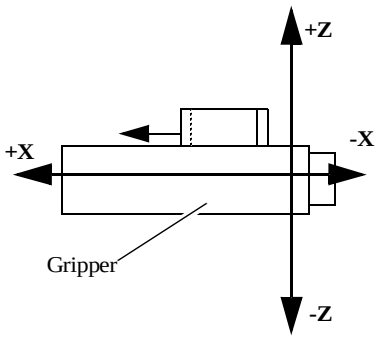


Figure 7-13: AML/J gripper coordinates

Gripper system of coordinates:

- Use of the Cartesian system of coordinates from the viewpoint of the gripper
- The sign of the Y axis changes according to the position of the swivelling axis of the gripper

7.7.1 Scanner

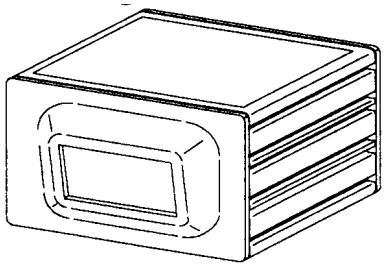


Figure 7-14: AML/J scanner

Electronic laser scanner for determining the Volsers
(= Volume Serial Number, stands on the barcode of the media).

- Power supply: 5 V
  (plug board on the gripper with DC/DC converter)
- Communication: RS 422
- Internal evaluation logic for bright/dark sequence of the barcodes in ASCII
- Storage of the parameters on the EEPROM in the scanner.
  Configuration programs (change parameters and store them in the EEPROM):

- A LED is provided on the scanner for scanner diagnosis:

Table 7-5: Scanner diagnosis LED

LED	Description
yellow flashing	Power supply ok but no trigger signal (rest conditions)
yellow continuous light	Scanner has trigger signal
green for one second	Scanner has read barcode
red for 0.5 seconds	Scanner could not read barcode

7.8 I/O units

7.8.1 I/O unit/C (European version)

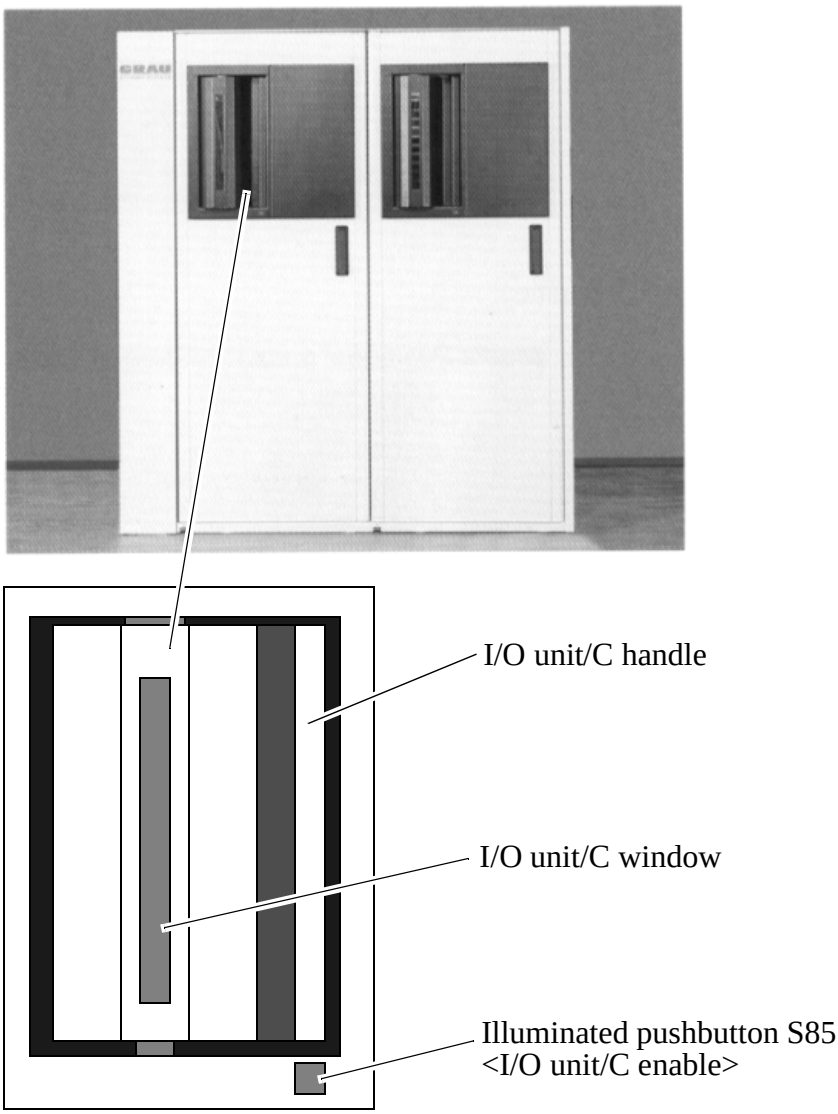


Figure 7-15: Closed I/O unit/C

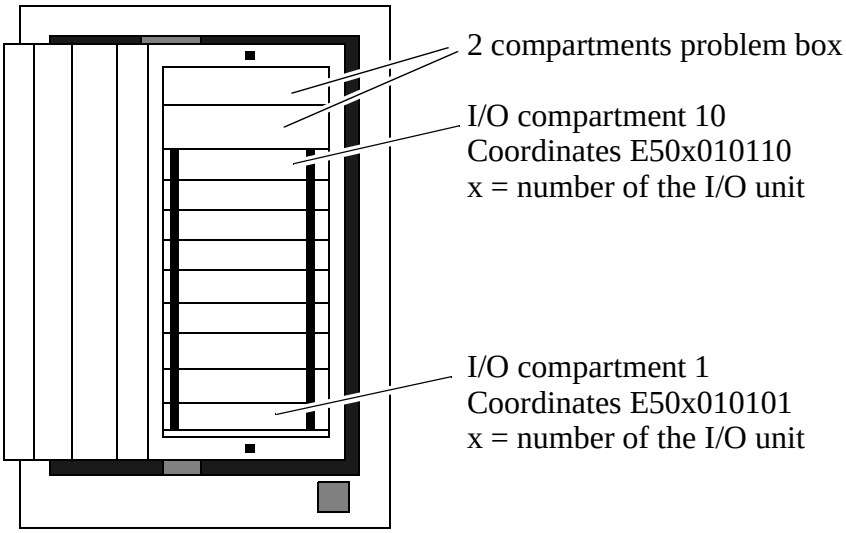


Figure 7-16: Example: Open I/O unit/C for 3490 cartridges

7.8.2 I/O unit/D (HICAP)

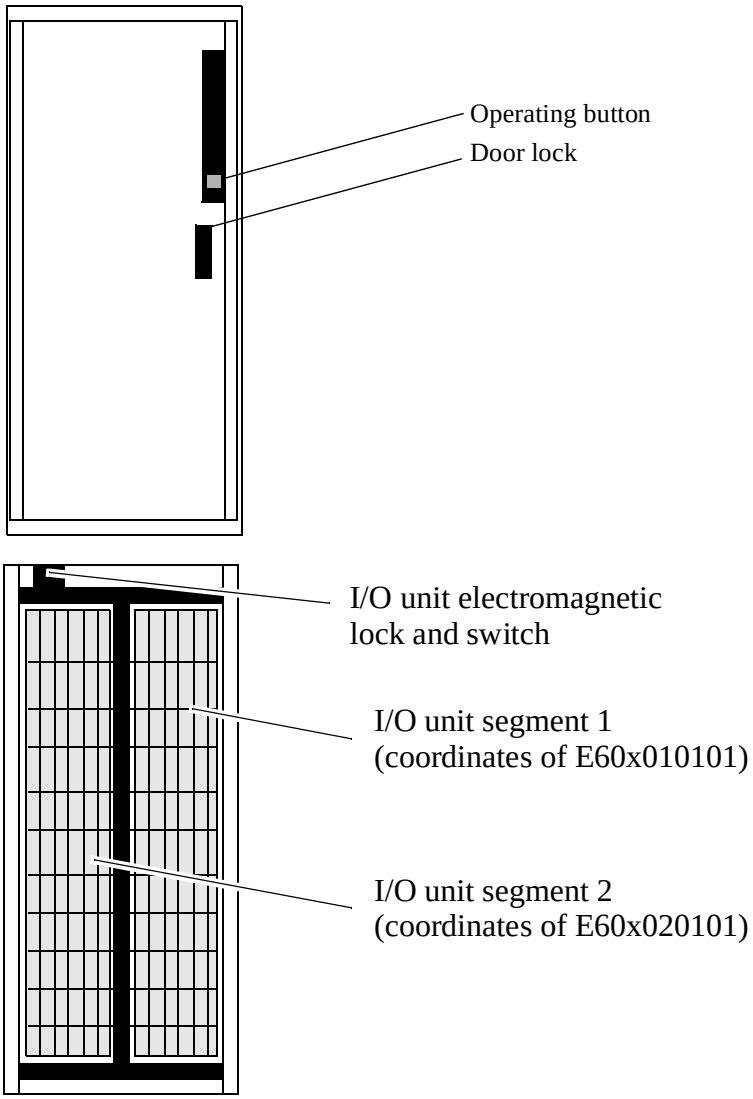


Figure 7-17: I/O unit/D (HICAP)

7.8.3 I/O unit/E

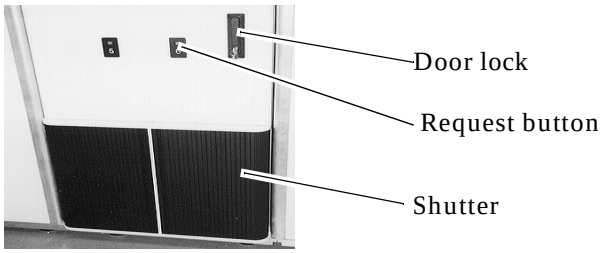


Figure 7-18: Two I/O units/E

I/O-E board

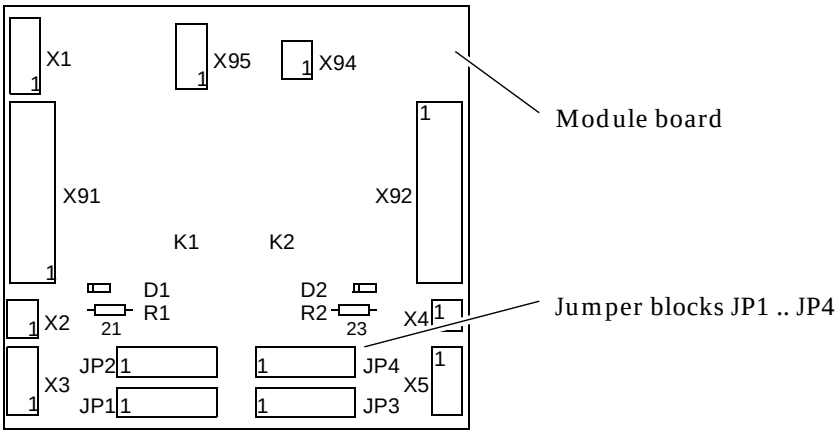
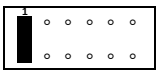
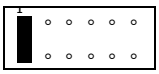
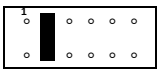
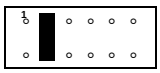
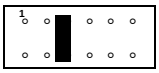
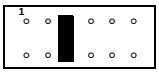
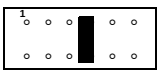
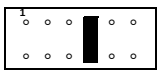
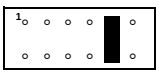
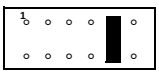
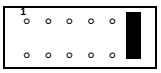
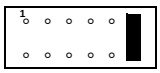


Figure 7-19: Layout of the I/O-E board:

Connections:

- X1: To the request button (S81 / S82)
- X2: Magazine 1 sensor (S86) (left)
- X3: Shutter sensor (S85) and magnetic switch (Y82) (left)
- X4: Magazine 2 sensor (S88) (right)
- X5: Shutter sensor (S87) and magnetic switch (Y83) (right)
- X91: To the next I / O-E or module distributor board or terminating plug
- X92: To the plug board
- X94: Home sensor (B10) of the driving axis (only on the basic module)
- X95: Door safety switch (S91)

Table 7-6: Jumpers on the I / O-E board

I/O unit	JP 1	JP 2	JP 3	JP 4
1				
2				
3				
4				
5				
6				

8 Adjustment and replacement procedures

All procedures for adjustment as well as for replacement of spare parts are described in this section.

Before you start replacing components, you should observe the following points:

- Diagnosis of the error as far as allowed within the service time and the conditions on site to localize the cause of error.
  (*Start* on page 5-1)
- Backing up system parameters before these parameters are no longer accessible by adjustment or dismantling.
  (*Back up system parameters* on page 8-84)
- Compliance with the safety instructions for working with electrical machines. (*Safety* on page 3-1)

8.1 List of the spare parts

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name		Order number	Spare part ID	Reference to page
Control unit	AML/J Mixed-Media control unit		207003202	11	8-83
	Bus board + plug board		15A120019	12	8-65
	Power supply board		15A120020	13	8-78
	2-axis controller		207001336	14	8-66
	EPROM for 2-axis controller	1-3	207001337	15	8-91
		3-4	207001333		
		4-4	207001338		
	Stepping motor board B + C axis		207001313	16	8-67
	4-fold choke board		15A120032	17	
	X axis controller		15A960003	18	8-68
	Y axis controller			19	8-68
	Z axis controller			1A	8-68
	A axis controller			1B	8-68
	Emergency off module BD 5987.02-001 DC 24V		15K970003	1C	
	Auxiliary contactor DIL ER-31-GI 48683		15K770001	1D	
	Rocker switch in the installation frame		20F002820	1E	8-81
	Extension cable type KV, 88F353		15W110024	1F	
	Plug with filter CEE22 238-895		15X810003	1G	8-79
	Axial fan 90B1476		15M110001	1H	

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name	Order number	Spare part ID	Reference to page
Electrical components in the basic and extension module	Module distributor board	15A120023	21	8-61
	I/O-E board	15A027001		8-62
	Safety switch AZ 16-02	15S410006	22	8-82
	Module-control unit connection ribbon cable	207001314	23	
	Module connection ribbon cable	207001315	24	
	Power supply M1	207001306	25	8-56
	Power supply M2 - M3	207001307		
	Power supply M3 - M5	207001308		
	Power supply M5 - M9	207001309		
	Power supply - M10	207001320		
	Barcode reading system AML/J scanner	15A109001	26	8-35
	Y axis home sensor	15B330009	27	8-42
	Z axis home sensor		28	8-48
	Illuminated pushbutton green complete	207001699	29	

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name		Order number	Spare part ID	Reference to page
Mechanical components	Driving axis (Y) motor		207000311	31	8-43
	Lifting axis (Z) drive with coupling and coupling housing		20F002818	32	8-49
	Gripper V4		201002869	33	8-37
	Handling unit		202002214	34	8-57
	Lower roller		120000106	35	8-52
	Upper roller (loose bearing)		205000310	36	8-54
	Toothed drive belt deflecting pulley for driving axis		20F002819	37	
	Synchronizing pulley		203000123	38	
	Eccentric (door stopper)		203000123	39	
	Toothed drive belt	Length M1: 1.25m M2: 2.00m M3: 2.75m M4: 3.50m M5: 4.25m M6: 5.00m M7: 5.75m M8: 6.50m M9: 7.25m M10: 8.00m	118000052	3A	8-46
	Lubricating felt (soaked with Structovis EHD)		202002189	3B	8-97
	Felt wiper (under linear guide)		173000015	3C	8-95

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name		Order number	Spare part ID	Reference to page
Fuses	12.5A fuse	for power supply board	15F110024	41	7-9
	10 A fuse	for control unit 110V	15F110008	42	7-5
	8 A fuse	for controller	15F110026	43	7-8
	6.3 A fuse	for control unit 230V	15F110002	44	7-5
	5 A fuse	for power supply board	15F110006	45	7-9
	4 A fuse	for power supply board	15F110022	46	7-9
	2,5A fuse	for power supply board	15F110016	47	7-9
	2A fuse	for control unit	15F110003	48	7-5

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name	Order number	Spare part ID	Reference to page
I/O unit	I/O unit/C lifting magnet	119000500	51	
	I/O unit/C microswitch	143000010	52	
	I/O unit/C pneumatic spring	205000804	53	8-60
	I/O unit/E microswitch	15S410011	54	
	I/O unit/E lifting magnet	15S014001	55	
	I/O unit/E pneumatic spring	205001627	56	
	Momentary contact element	15S240012	57	
	LED green	15V240001	58	
	I/O unit/C relay board	15A120028	59	
	I/O unit/D relay board	15A120029	5A	
	I/O unit/E magazine installation kit	202001440	5B	

Table 8-1: AML/J spare parts with order numbers

Type	Spare part name	Order number	Spare part ID	Reference to page
AMU PC	PMAC Lite 4-Opt. 4A-700: ID No. 27085A conf.	207001331	61	8-69
	Ribbon cable, shielded 26core	207001705	62	
	Ribbon cable, shielded 34core	207001706	63	
	Ribbon cable, shielded 64core	207001707	64	
	Interface cable COM2	207001708	65	
	AML controller	407000764	66	
	Keyboard with trackball (German)	15A025001	67	
	Keyboard with trackball (US)	15A025002	68	
	Keyboard with trackball (GB)	15A025003	69	
	Keyboard with trackball (F)	15A025004	6A	
	15” monitor type: Novia 110-220V	15A102003	6B	
	Etherlink III board 3C509TP 762-0015	15A105004	6C	
	Etherlink XL Combo PCI	15A105008	6D	
	Token-Ring 16/4 II ISA adapter	15A230122	6E	
	3278-79 adapter F-C 0252 39F9228	15A230122	6F	
	PMAC battery (only for old PMAC board 23073B)	15G990001	6G	
	Battery CR2032 for AMU	15G360001	6H	

8.2 Procedures

8.2.1 Bring robot into service position

Step 1 Ensure that the applications which use the robot system are not endangered by shutting down and the service call (☞ Documentation of the host software).

Step 2 Perform a **Shutdown** of the AMS.

The AMS is ended. The robot moves into the home position (provided the robot no longer works because of a fault)

or

Step 1 Start **PMMaint** (symbol on the workspace of the AMU)

Step 2 Perform the function **A axis to Service Position** in the **Service** menu

The gripper is turned into the service position. The control of the axes is switched off.

Step 3 Now back up the current settings before you replace components or change values
(*Back up system parameters* on page 8-84)

Step 4 Switch the system off

- Switch main switch S3 off
- AMU shutdown of the OS/2 operating system
- Switch off the AMU computer

Step 5 Now open the system corresponding to the necessary work

- Access doors
- Front cover (as from version 3.0 this cover can be simply unhinged after loosening a locking screw.)

8.2.2 Bring drive into service position

Step 1 Agree with all users which drive is currently no longer available. Use the corresponding commands of the host software to set the drive offline.

Step 2 Loosen the lock of the drive rack

Step 3 Pull the drive rack carefully to the back

ATTENTION!

The working area of the robot is opened by the pulled out drive. Take care that no one grasps in this area.

Step 4 Please use the documentation of the drive manufacturer for the further steps in drive servicing.

8.2.3 Determine "Motor Home Position"

•

Step 1 End the AMS

Step 2 Double-click on the "PMMaint" icon.

The **Pmac Maintenance** *window appears*

Step 3 Wait for the message **Exit query PMAC status ...**

Information

If the homing run aborts with error, you must change the home offsets (PMMaint program in the Installation Motor Limits menu):

- **Enter in the case of problems with the Y axis the value -100 000 for the Y axis in the Home Offset field**
- **Enter in the case of problems with the Z axis the value -400 000 for the Z axis in the Home Offset field**
- **and click on Download to PMAC**

Step 4 Switch the mains switch S3 on.
Wait for the homing run

Step 5 If the **Motor Limits** command is not active in the **Installation** menu (lettering gray), then click on the **Query Pmac Status** command in the **File** menu.

The handling unit homes and
the **Motor Limits** *command is activated (lettering black)*

Step 6 Click on **Motor Limits** in the **Installation** menu.

The **PMAC Motor Limits Dialog** *window appears:*

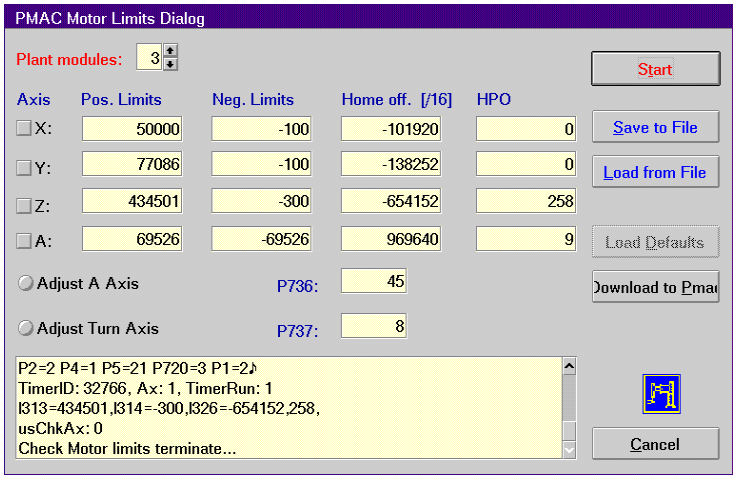


Figure 8-1: "PMAC Motor Limits Dialog" window

Step 7 Select only the axis which you want to check or adjust. (✔)

Step 8 Select in the **Plant modules** field the number of the stored modules (e.g. M3 with a basic module and 2 extension modules: 3). This selection is only necessary fort the "Motor Limits" of the Y axis.

Step 9 Click on **Start**

Information

The acceptable values for HPO are between 45 ° .. 315 °. Message "Check motor limits terminate...".

With other values the error message "Sensor .. Axis should be moved" appears. Then shift the home sensor.
If the value is within the limits continue the procedure with Step 10.

Tool for shifting the home sensor

- 2 17 mm wrenches

Information

Shift only if the error message "Sensor Y Axis should be moved" has appeared on adjusting the Motor Limits.

- Make sure that the mains switch S3 is switched off

Information

Y axis

- **The carriage is up against the buffer on the front. Check that as much as possible of the sensor area stands above the carriage.**
- **Shift the home sensor of the Y axis from one stopper to the other**

Z axis

- **If the lifting carriage lies quite below on the stopper, the home sensor must always still be active.**
- **Shift the home sensor of the Z axis by up to 3 mm with the default direction downwards.**

- Switch the mains switch S3 on.

  The handling unit homes.

- Repeat the adjustment for the motor limits
  for the axis the home sensor of which was shifted.

Step 10 Save the settings with **Save File**.

The messages „`Sent PMAC command „save““` and „`Check motor limits terminate...`“ appear

Step 11 Exit the **PMAC Motor Limits Dialog** window with **Cancel**

Step 12 Exit the "PMMaint" program

8.2.4 Adjust the toothed drive belt tension

If you have a frequency meter, you can as an alternative also adjust the toothed drive belt tension with it (*Measure toothed drive belt tension with frequency meter* on page 8-14)

Information

There are two marks on the toothed drive belt the spacing of which (= pretension) depends upon the size of the system. As required you can renew the marks according to the following table.

Table 8-2: Length changes for the toothed drive belt tension

Module	1	2	3	4	5	6	7	8	9	10
Preten-sion [mm]	1.5	2.5	3.5	5.0	6.0	7.0	8.0	9.0	10.5	11.5

Prerequisites for successful tensioning are

- **loosened lock nuts on the tensioner,**
- **loosened adjusting screws (toothed drive belt lies completely relaxed in the linear guide) and**
- **switched off main switch S3.**

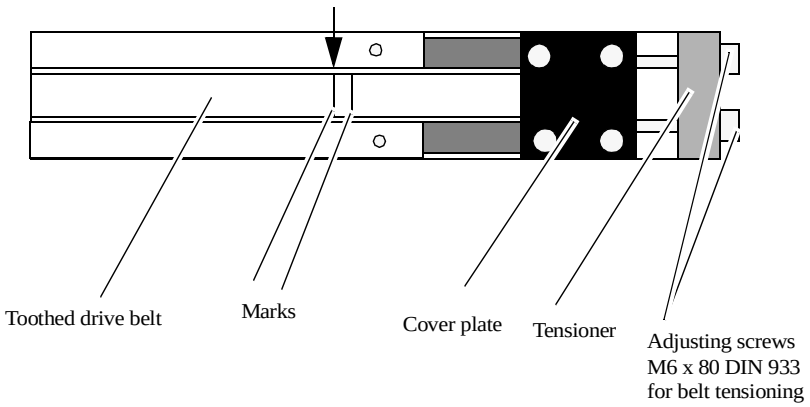


Figure 8-2: Marks for the toothed drive belt tension

Step 1 Mark the position of the right mark on the linear guide

Step 2 Uniformly turn the two adjusting screws for belt tensioning until the left mark agrees with the marked lines on the linear guide

ATTENTION

An incorrectly adjusted toothed drive belt leads to premature belt wear.

Step 3 Align the toothed drive belt with the adjusting screws parallel to the linear guide.

Step 4 Tighten the 2 lock nuts on the tensioner.

Measure toothed drive belt tension with frequency meter

Equipment required:

- CLAVIS belt tension meter
- Flat material 25mm x 15mm x 60mm

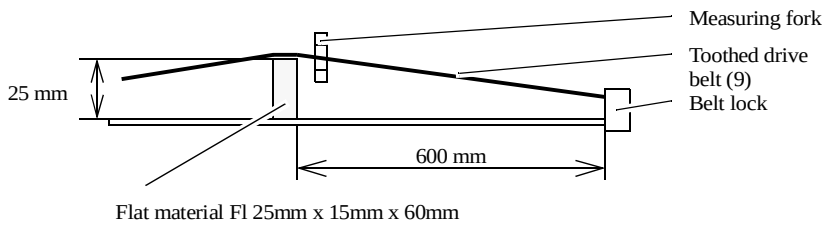


Figure 8-3: Measuring setup for driving axis Y belt tension

Step 1 Switch the AML/J system off.

Step 2 Push the handling unit up to the front stopper.

Step 3 Place the flat material corresponding to Figure 8-3: under the toothed drive belt.

Step 4 Lift the measuring fork of the switched-on meter above the toothed drive belt according to Figure 8-3:

Step 5 Make the toothed drive belt oscillate by striking it.

The meter indicates the oscillating frequency.

Information

The frequency must be between 60 and 75 Hz.

8.2.5 Adjust handling of the system

Determining the offset values for the correct handling of the cartridges (*Adjust Handling* **on page 4-33**).

Step 1 End the AMS

Step 2 Start "PMMaint" by double-clicking the icon on the OS/2 workspace.

The **Pmac Maintenance** *window appears.*

Step 3 Select the **Adjust Handling** command under the **Teach** menu.

The **Pmac Kernel Patch Dialog** *window appears.*

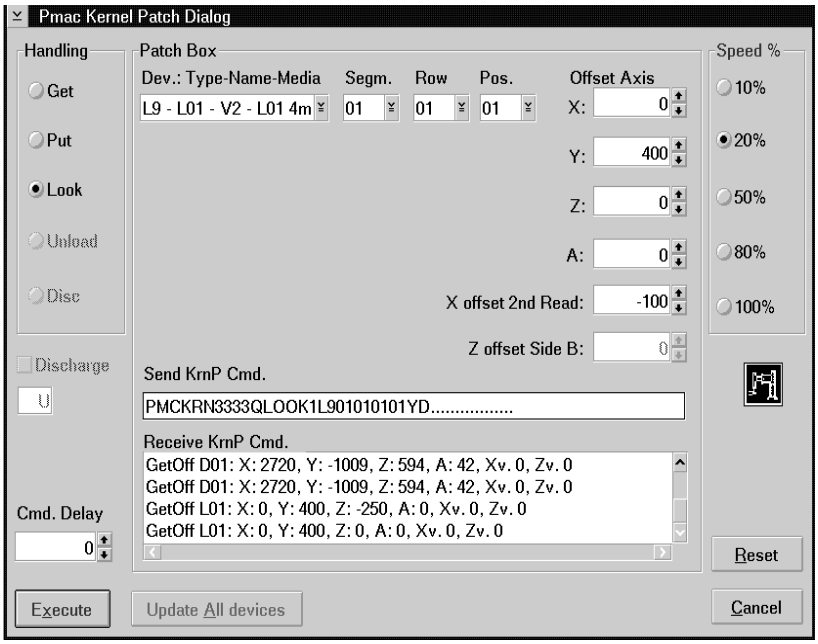


Figure 8-4: "Pmac Kernel Patch Dialog" window

Information

Start the adjust handling process with a speed of 10 %.

Perform the following steps with each cartridge frequently enough until the handling works perfectly and smoothly.

Increase the Speed gradually up to 100 % only if the handling is in order.

Step 4 Select at **Dev.: Type-Name-Media** firstly the component to be set up.

Step 5 Then select the exact position of the cartridge:

- **Segm.** (segment 1 or 2 for HICAP)
- **Row** (row in the linear rack or magazine)
- **Pos.** (compartment within the row)

Step 6 Select the suitable speed under **Speed**

- 1st test 10%
- Final test 100%

Step 7 Select the delay time under **Cmd. Delay**
(possibility of going up to the handling unit after the command was started)

Step 8 Test the handling: click on the following commands one after the other and in each case confirm with **Execute**

- **Get** (cartridge is gripped)
- **Put** (cartridge is placed down)
- **Look** (barcode of the cartridge is read)

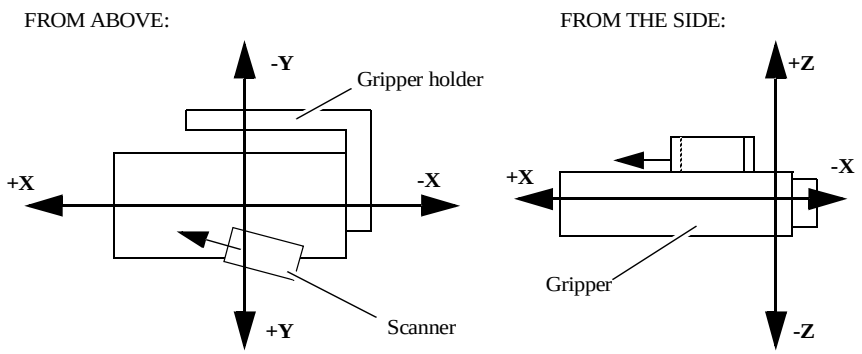


Figure 8-5: AML/J gripper system or coordinates

Step 9 Observe the handling of the cartridge accurately and note

- for each action (**Get**, **Put**, **Look**)
- the associated possible offset values in 1/100 mm:

Table 8-3: Handling offsets for a component

Action	Axis	X	Y	Z	A
Get	**Offset [1/100 mm]**				
Put					
Look					

Step 10 Enter the necessary offset values of the axes under **Offset Axis**

Step 11 Repeat (from observing the handling up to here) all steps until the handling is in order

Step 12 Now increase **Speed**

Step 13 Then make the "Hearing test":
at **Put** the cartridge must not strike against the component

Step 14 Subsequently test the handling of the cartridge in all components defined for it:
e. g. of drive D03 for I/O unit/C E04
for linear rack L01 for linear rack L02

Step 15 After adjusting the correct handling in the entire system, exit the **Pmac Kernel Patch Dialog** window with **Cancel**

Step 16 Exit the **Pmac Maintenance** window with **Exit**

8.2.6 Adjust controllers

Step 1 End the AMS

Step 2 Start "PMMaint":
double-click on the "PMMaint" icon on the OS/2 workspace

Step 3 Switch the main switch S3 on

Step 4 Open the **PMAC Terminal Dialog** under **Pmac Terminal** command in the **Installation** menu

Step 5 If the gripper is in a horizontal position, interrupt the homing run with <STRG> <k>

Step 6 Check the status of the system

- Open the **PMAC Terminal** window and enter
  –`I469`
  –Click on **Send**
  –If `I469=150` restart the robot and repeat the procedure as from Step 4. Otherwise continue with Step 7.

Step 7 Enter `i5=0` in the **PMAC Terminal Dialog** window

Step 8 Switch the main switch S3 off

Step 9 Remove the choke board

Step 10 Enter in the **PMAC Terminal Dialog** window in the **Send Data** field:

- `P308=1` (Z axis brake closed)
- Click on **Send**

Step 11 Switch the main switch S3 on

Step 12 Enter in the **PMAC Terminal Dialog** window in the **Send Data** field:

- `i5=1`
- Click on **Send**

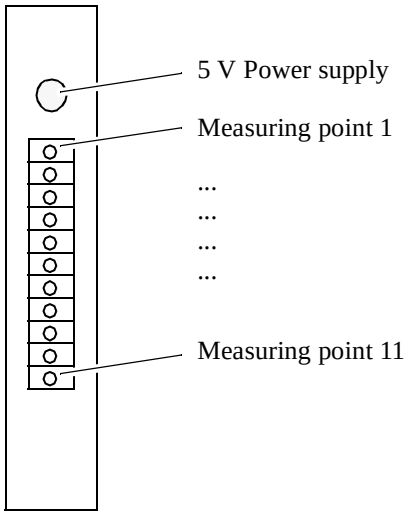


Figure 8-6: Stepping motor board with measuring points for the controllers

Step 13 Connect the voltmeter on the stepping motor board between measuring point 2 for "Ground" and measuring point B (☞ Table 8-4:).
Use the following settings:

- Setting range: < 10V DC (direct current)
- Measuring point 2: GND (0 V)
- Measuring point: Setpoint of the corresponding motor

Table 8-4: Measuring points for controller adjustment on the stepping motor board

Measuring point	Signal
2	"Ground"
4	X axis setpoint #1
6	Y axis setpoint #2
8	Z axis setpoint #3
10	A axis setpoint #4

Information

Enter only the suitable number (☞ Table 8-5:) and take the associated limit values from Table 8-6: on page 8-21:

Table 8-5: Selection numbers for the axes

Axis	Number for the selection
X axis motor	#1
Y axis motor	#2
Z axis motor	#3
A axis motor	#4

Step 14 Enter in the **Send Data** window

- `#1` (here only as example: X axis motor #1 (☞ Table 8-5:))
  Click on **Send**
- `o0`
  Click on **Send**

Axis 1 has operating voltage: green LED on, red LEDs off

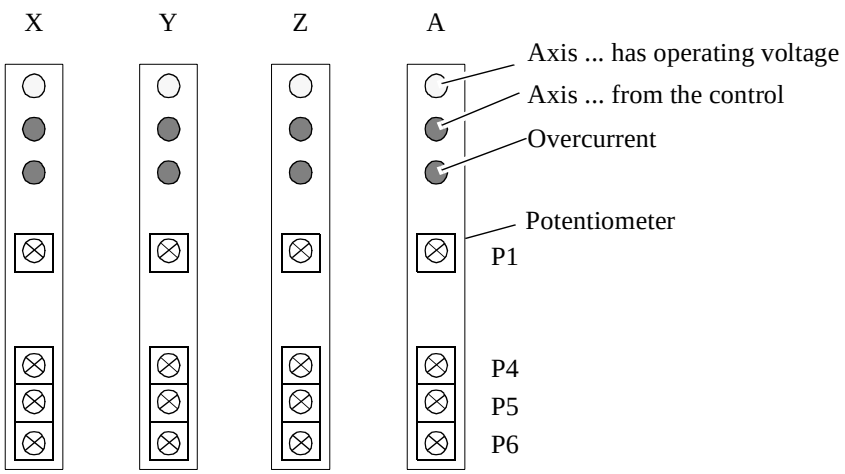


Figure 8-7: Controllers in the control rack: LEDs and potentiometers

Step 15 Turn the potentiometers P5 and P6 clockwise up to the stop

Step 16 Set the zero offset of the controller with potentiometer P4 to 0V

Information

Pay attention especially for axis 1 to the exact value of 0 VDC ± 0.01.

Step 17 Turn the potentiometers P5 and P6 counterclockwise up to the stop

Step 18 Enter in the **Send Data** field

- `o100`
- Click on **Send**

Step 19 Adjust the nominal current corresponding to the values in Table 1 with the aid of the potentiometer P5

Table 8-6: Setting values for the controllers

Measuring point	Signal	Nominal current limitation [V]	Peak current limitation [V]
2	0V GND		
4	X axis setpoint	| 0.2 |	| 0.5 |
6	Y axis setpoint	| 1.7 | or highest possible value	| 7.0 | or highest possible value
8	Z axis setpoint	| 1.7 |	| 7.0 | or highest possible value
10	A axis setpoint	| 0.7 |	| 2.0 |

Information

If values cannot be reached (e.g. 7V for axis 2 and axis 3) then set the highest possible value (potentiometer on stop).

Step 20 Enter in the **Send Data** window

- `o-100`
- Click on **Send**

Step 21 Adjust the peak current with the potentiometers P6 corresponding to Table 8-6: on page 8-21

Step 22 Enter in the **Send Data** window

- <Strg><k>
- Click on **Send**

Information

The axis is taken out from control by entering <k> (green and red LED active).

Step 23 If you still want to adjust other boards, go to Step 12

Step 24 Switch the main switch S3 off

Step 25 Secure the potentiometers with lacquer and label the controllers

Step 26 Fit the choke board

Step 27 Exit

- **Pmac Terminal Dialog** with **Cancel**
- "PMMaint" with **File** menu and **Exit** command

8.2.7 Configure adjustment point

I/O unit/C adjustment point

Step 1 End the AMS

Step 2 Make sure that the PMAC software was loaded with the correct basic parameters on the PMAC board:

- neuinst.pmc (only one I/O unit/C)
- neuinst2.pmc (2 and more I/O units/C)

Step 3 Start "PMMaint" by double-clicking the icon on the OS/2 workspace

Step 4 Open the **Adjust Handling** command in the **Teach** menu. The **Pmac Kernel Patch Dialog** window opens

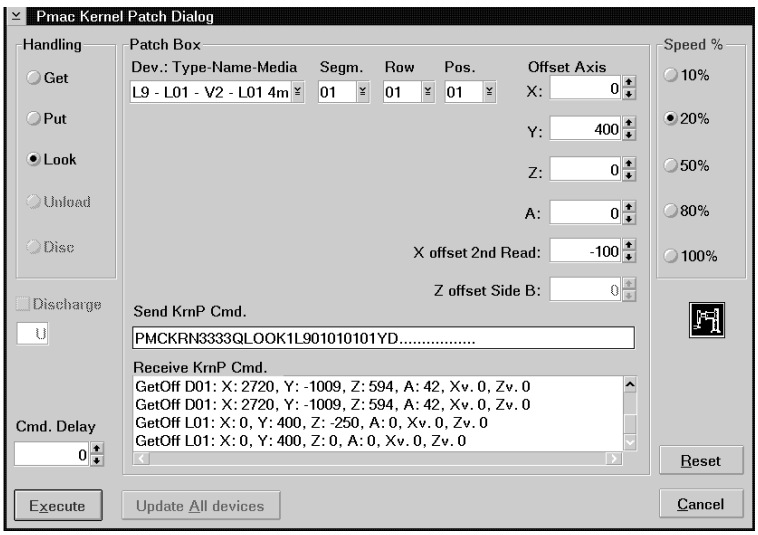


Figure 8-8: "Pmac Kernel Patch Dialog" window

- Grip a medium with the **Get** command
- Exit the window with **Cancel**

Step 5 Open the **Initial Teach** command under the **Installation** menu.

The **Pmac Teach Dialog** *window opens:*

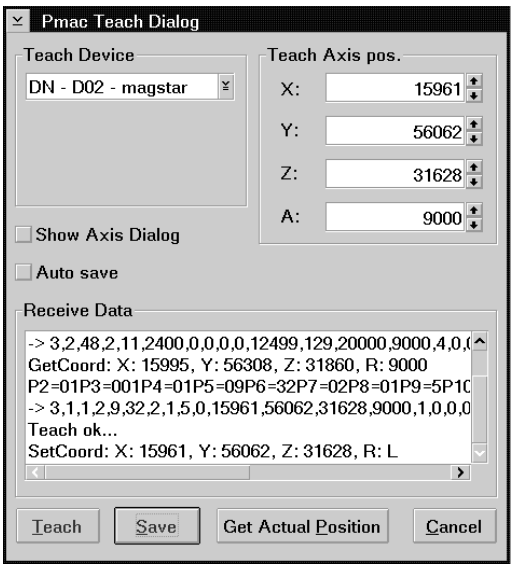


Figure 8-9: "Pmac Teach Dialog" window

Step 6 Select **Show Axis Dialog**, the corresponding **Pmac Axis Dialog** window opens:

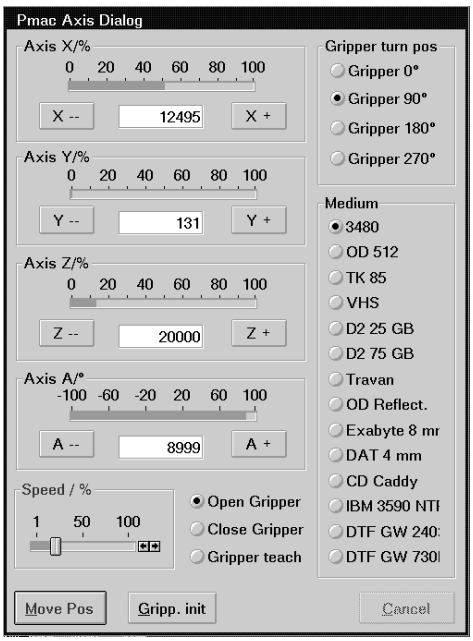


Figure 8-10: "Pmac Axis Dialog" window

Step 7 Move the cartridge exactly to the adjustment point:

- Enter the value `-9000` at **A**
- Enter the values from the table for Z and Y depending upon the medium and number of I/O units
  Enter for X the value from the table reduced by 4000
- Press the **Move Pos** button

Table 8-7: Parameters for the adjustment point

Media type	Axis	Name	P variable	Input for one I/O unit/C]100 mm]	Input for two or more I/O units/C]100 mm]
1 - 3480	X	NEWGRIP_X1	P231	11400	11400
	Y	NEWGRIP_Y1	P232	29000	60500
	Z	NEWGRIP_Z1	P233	120100	120100
2 - OD Reflec-tion	X	NEWGRIP_X2	P234	7800	7800
	Y	NEWGRIP_Y2	P235	29000	29000
	Z	NEWGRIP_Z2	P236	121400	121400
3 - OD 512	X	NEWGRIP_X3	P237	8800	8800
	Y	NEWGRIP_Y3	P238	29000	60500
	Z	NEWGRIP_Z3	P239	121400	121400
4 - TK 85	X	NEWGRIP_X4	P240	12900	12900
	Y	NEWGRIP_Y4	P241	29000	60500
	Z	NEWGRIP_Z4	P242	120100	120100
5 - VHS	X	NEWGRIP_X5	P243	13200	13200
	Y	NEWGRIP_Y5	P244	29000	60500
	Z	NEWGRIP_Z5	P245	124100	124100

Table 8-7: Parameters for the adjustment point

Media type	Axis	Name	P variable	Input for one I/O unit/C]100 mm]	Input for two or more I/O units/C]100 mm]
6 - 8mm	X	NEWGRIP_X6	P246	18000	18000
	Y	NEWGRIP_Y6	P247	29000	60500
	Z	NEWGRIP_Z6	P248	119500	119500
7 - 4mm	X	NEWGRIP_X7	P249	18800	18800
	Y	NEWGRIP_Y7	P250	29000	60500
	Z	NEWGRIP_Z7	P251	118600	118600
8 - D2 small	X	NEWGRIP_X8	P252	12400	12400
	Y	NEWGRIP_Y8	P253	29000	60500
	Z	NEWGRIP_Z8	P254	123400	123400
9 - D2- me- dium	X	NEWGRIP_X9	P255	8300	8300
	Y	NEWGRIP_Y9	P256	29000	60500
	Z	NEWGRIP_Z9	P257	127500	127500
10 - 3590	X	NEWGRIP_X10	P258	11400	11400
	Y	NEWGRIP_Y10	P259	29000	60500
	Z	NEWGRIP_Z10	P260	120100	120100
11 - TRA- VAN	X	NEWGRIP_X11	P261	18000	11400
	Y	NEWGRIP_Y11	P262	29000	60500
	Z	NEWGRIP_Z11	P263	119500	120100
12 - CD- Caddy	X	NEWGRIP_X12	P264	8800	11400
	Y	NEWGRIP_Y12	P265	29000	60500
	Z	NEWGRIP_Z12	P266	121400	120100

Table 8-7: Parameters for the adjustment point

Media type	Axis	Name	P variable	Input for one I/O unit/C]100 mm]	Input for two or more I/O units/C]100 mm]
13 - DTF-Small	X	NEWGRIP_X13	P267	14000	11400
	Y	NEWGRIP_Y13	P268	29000	60500
	Z	NEWGRIP_Z13	P269	122800	120100
14 - DTF-Large	X	NEWGRIP_X14	P270	11400	11400
	Y	NEWGRIP_Y14	P271	29000	60500
	Z	NEWGRIP_Z14	P272	120100	120100
15 - Beta-CAM small	X	NEWGRIP_X15	P273	11400	11400
	Y	NEWGRIP_Y15	P274	29000	60500
	Z	NEWGRIP_Z15	P275	120100	120100
16 - Beta-CAM large	X	NEWGRIP_X16	P276	11400	11400
	Y	NEWGRIP_Y16	P277	29000	60500
	Z	NEWGRIP_Z16	P278	120100	120100
17 - Audio	X	NEWGRIP_X17	P279	11400	11400
	Y	NEWGRIP_Y17	P280	29000	60500
	Z	NEWGRIP_Z17	P281	120100	120100

Step 8 Move all axes until the medium stands in the correct adjustment point (absolutely in the corner of the angle)

Step 9 Note the values in **X**, **Y** and **Z** (axis A is always **-9000**)

Step 10 Exit the **Pmac Axis Dialog** window with **Cancel**

Step 11 Open the **Adjust Handling** menu under **Teach**

Step 12 Bring the medium back to its place with the **Put** command

Step 13 Perform Step 3 to 11 for all media in the system

Step 14 Click on the **Installation** menu in the PMMaint window

Step 15 Open the **Pmac Terminal** menu

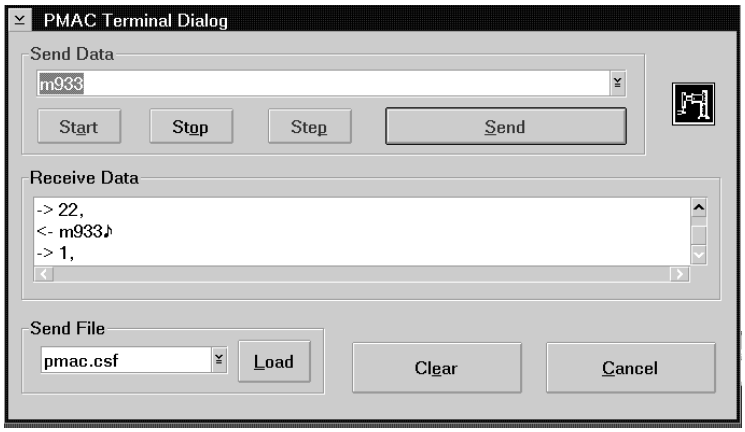


Figure 8-11: "PMAC Terminal Dialog" window

Step 16 Enter the parameters in the **Pmac Terminal Dialog** window under **Send Data**:

- Newgrip for X, Y, Z (☞ Software Backup)
- Send them away consecutively with **Send**
- Check the NEWGRIP_A parameter
  (A axis coordinate: P230=-9000)
- Check the teach point of the adjustment point:
  –P297=0’
  –P298=0
  –P299=0

Step 17 Then close the **PMAC Terminal Dialog** with **Cancel**

Step 18 Test the entered values:
Provoke a crash for each medium in the system
(e.g. by **Put** on occupied compartment)

Step 19 If the adjustment is in order, then close the **PMAC Patch Dialog**

Step 20 Perform the procedure *Back up system parameters* on page 8-84.

I/O unit/E adjustment point

Step 1 End the AMS

Step 2 Make sure that the PMAC software was loaded with the correct basic parameters on the PMAC board:

- neuinst3.pmc(I/O unit/E and adjustment point on the drive rack)

Step 3 Start "PMMaint" by double-clicking the icon on the OS/2 workspace

Step 4 Perform the **Initial Teach** command on the teach label at the I/O unit/E (*Initial Teach* **on page 4-12**)

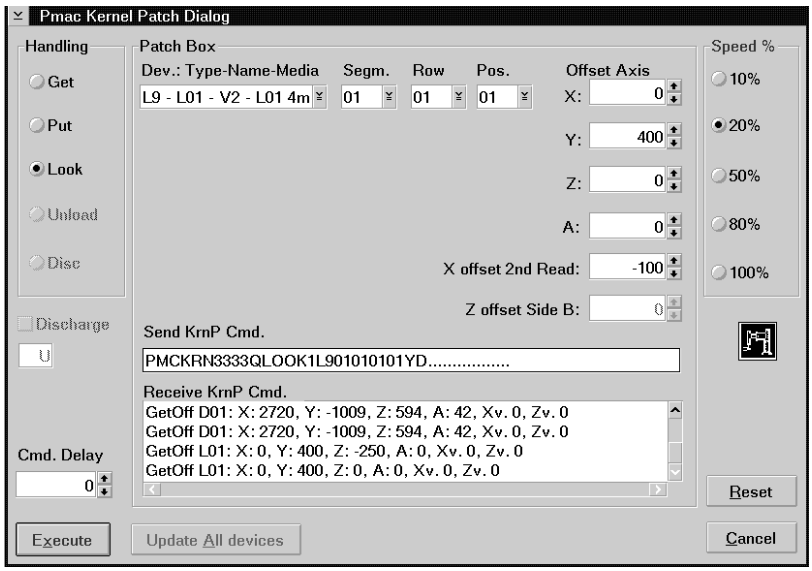


Figure 8-12: "Pmac Kernel Patch Dialog" window

Step 5 Select the **Adjust Handling** command in the **Teach** menu. The **Pmac Kernel Patch Dialog** window opens

- Grip a medium with the **Get** command.
- Test the adjustment point:
  Provoke a crash for each medium in the system
  (e. g. with **Put** on an occupied compartment)

Step 6 Check the regripping process

- Note any necessary correction values for regripping (estimate how many millimetres the medium is away from its optimum position on the adjustment angle)

Step 7 Return the medium to the compartment with **Put**

Step 8 Exit the window with **Cancel**.

Step 9 Open the **Pmac Terminal** window in the installation menu

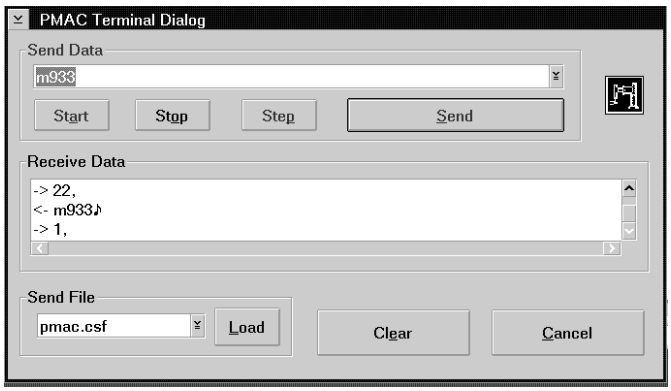


Figure 8-13: "PMAC Terminal Dialog" window

Step 10 Enter the parameters in the **Pmac Terminal Dialog** window in the **Send Data** field:

- Enter the correction values for the handling in X, Y, Z (☞ *Parameters for the adjustment point* on page 8-25)
- Transfer the **Send** parameters consecutively to the PMAC board.
- Check the NEWGRIP_A parameter (A axis coordinate): P230=9000
- Save all changes at the end with the word "save"

Step 11 Close the **PMAC Terminal Dialog** with **Cancel**.

Step 12 Close PMMaint when all setting work is completed.

Step 13 Perform the procedure *Back up system parameters* on page 8-84.

8.2.8 Teach the system

Step 1 Start die AMS

Step 2 Log on in the **Service** menu with **Logon**

Step 3 Open the **Trace** window in the **View** menu

Step 4 Select the **Trace ID** KRN 8 and KRN2 and click on **Online**

Step 5 Select the **MTCGdialog** command under **Teach** in the **Service** menu menu

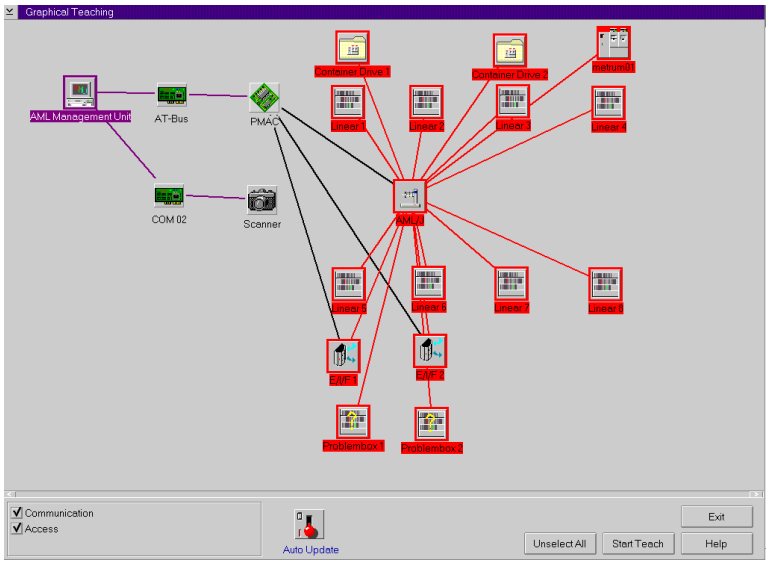


Figure 8-14: AMU window "Graphical Teaching"

Step 6 Click one after the other on

- **Select all**
- **Start Teach**

Step 7 Confirm the drive query with **OK**

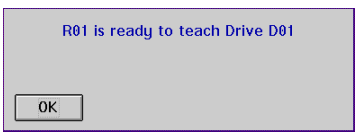


Figure 8-15: AMU window "R01 is ready to teach Drive D01"

Step 8 Check in the Trace window that teaching has produced a change.

```
12:42:35:72 03900 <**** CONKRN0002QTEAC1L511010101.
12:42:35:73 03900 ---->
P2=2P3=8P4=1P5=9P6=102P7=11P8=1P9=1P10=0P11=10621P12=449582P13=8536P14=9000P1=2
 to PMAC
12:42:57:50 03900 <---- 3,2,8,2,9,102,11,1,0,0,10671,449527,8566,8999,1,0,0,0,0,
12:42:57:50 03900 ---->
P2=2P3=9P4=1P5=9P6=102P7=11P8=1P9=1P10=0P11=10671P12=472926P13=8523P14=9000P1=2
 to PMAC
12:43:12:85 03900 <---- 3,2,9,2,9,102,11,1,0,0,10731,472871,8551,8999,1,0,0,0,0,
12:43:12:86 03900 ---->
P2=2P3=10P4=1P5=9P6=102P7=11P8=1P9=1P10=0P11=10621P12=449141P13=145967P14=9000P1=2
 to PMAC
12:43:29:73 03900 <---- 3,2,10,2,9,102,11,1,0,0,10651,449096,145986,9000,1,0,0,0,0,
12:43:29:73 03800 AMU1105: UL diff X =       30, Y =      -45, Z =       19    .
12:43:29:73 03800 AMU1105: DR diff X =       60, Y =      -55, Z =       28    .
12:43:29:73 03800 AMU1105: DL diff X =       50, Y =      -55, Z =       30    .
12:43:29:74 03900 ****> CONKRN0002S0000................
```

Figure 8-16: Trace with teach differences

Step 9 After completion of the teach procedure, exit the **MTCGdialog** dialog with **Exit**

Step 10 Perform the procedure *Back up system parameters* on page 8-84

8.2.9 Brake of the lifting axis (Z)

Release brake

Step 1 End the AMS

Step 2 Switch the main switch S3 off

ATTENTION!

The gripper can be damaged severely by the impact after an unbraked downwards movement. Secure the gripper before opening the brake carefully.

Step 3 Secure the gripper against dropping down (e.g. with a strap)

Step 4 Start "PMMaint" by double-clicking the icon on the OS/2 workspace

Step 5 Select the **Pmac Terminal** command in the **Installation** menu

The "PMAC Terminal Dialog" window opens.

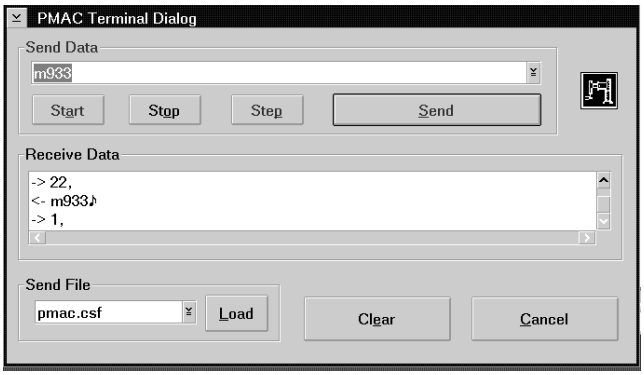


Figure 8-17: PMMaint window: "PMAC Terminal Dialog"

Step 6 Enter in the **PMAC Terminal Dialog** window that appears in the **Send Data** field

- `i5=0` (all programs are stopped)
- Click on **Send**
- `M939=1` (open brake)
- Click on **Send**

Step 7 Switch the mains switch S3 on

Close the brake

Step 1 Switch the mains switch S3 off

Step 2 Enter in the **PMAC Terminal Dialog** window in the **Send Data** field

- `i5=1` ("GLOBAL.PMC" program activated)
- Click on **Send**
- `M939=0` (close brake)
- Click on **Send**

Step 3 Close the **PMAC Terminal Dialog** window with **Cancel**

Step 4 Remove any securing devices in the archive

8.2.10 Replace the barcode scanner

Tools and aids

- 3.32mm Allen key
- 2.5 mm Allen key
- Slotted head screwdriver

Dismantling

Step 1 Determine the set barcode types with the PMMaint program in the **Barcode test** menu.

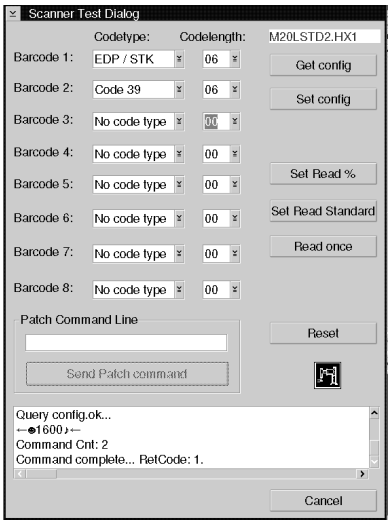


Figure 8-18: PMMaint window "Scanner Test Dialog"

Step 2 Switch the system off

Step 3 Unscrew the scanner plug

Step 4 Unscrew the scanner

Installation

Step 1 Fasten the new scanner

Step 2 Carefully connect the ground cable under the lower fastening screw

Step 3 Fasten the scanner plug

Step 4 Switch the system on

Step 5 Start PMMAINT

Step 6 Select the command **Look** on an occupied compartment in the **Teach Adjust Handling** menu

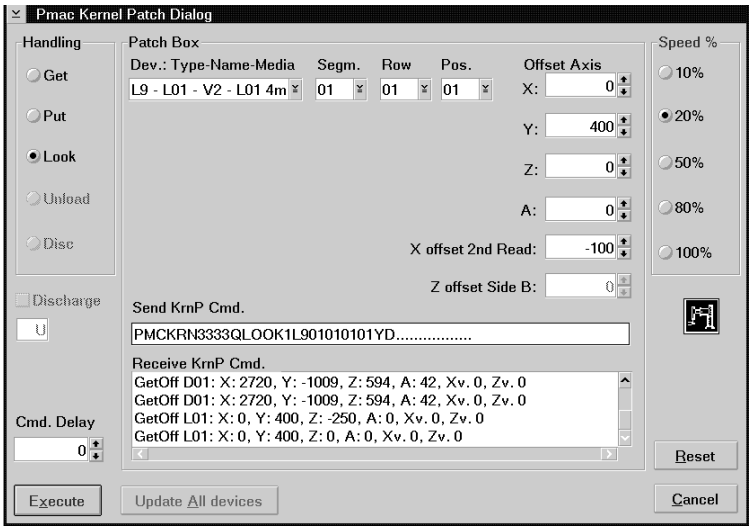


Figure 8-19: PMMaint window "Pmac Kernel Patch Dialog"

Step 7 Select **Installation Barcode Test**

Step 8 Set the barcode types and the associated code length

Step 9 Select **Continuous read** in barcode test

Step 10 Check the scan beam:

- The beam must be parallel to the label and strike the label underneath the pin between the gripper jaws
- Adjust the scanner by shifting after you have loosened the setting screws.

Step 11 Test barcode reading with **Teach Adjust Handling**, pay special attention to the compartments on the outside left

Step 12 Change as required the offset values for the reading position with the aid of the Pmac Kernel Patch Dialog (☞

8.2.11 Replace gripper

Information

The gripper determines the associated microcode for the 2-axis controller. Replace the EPROM on the 2-axis controller if a gripper of an older series was previously installed in your AML/J.

Store the gripper documentation together with the system documentation.

The gripper position is predetermined by

- **two pins in the flange on the handling unit**
- **two holes in the gripper flange**

Tools and aids

- 4 mm, 5 mm Allen key
- Slotted head screwdriver
- Socket wrench 4.5 mm
- 10 mm wrench
- Small spirit level

Dismantling the old gripper

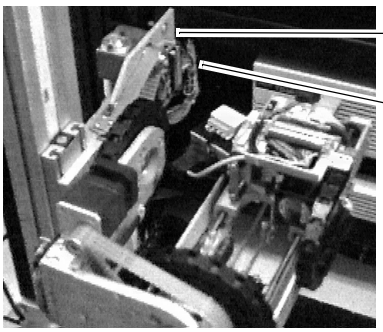


Figure 8-20: Position of the gripper on the flange on the handling unit

Step 1 Perform the procedure *Bring robot into service position* on page 8-8

Step 2 Remove the fastening screws of the Sub-D plug on the gripper

Step 3 Remove the 2 M6 x16 screws of the cable tow

Step 4 Loosen the 4 fastening screws of the gripper so far that the gripper

- can be withdrawn from the two pins
- and can be pulled out upwards

Step 5 Store in the transport crate

- the old gripper
- the associated completed service report

Installation of the new gripper

Step 1 Take the new gripper out from the transport crate

Step 2 Loosen the four fastening screws as far as possible

Step 3 Thread the gripper from above into the flange of the handling unit. The Sub-D socket must be on the same side as the cable tow (towards the control cabinet)

Step 4 Press the gripper firmly on the flange of the handling unit (the holes in the gripper flange must fit on the pins in the flange of the handling unit)

Step 5 Fasten the gripper with the 4 fastening screws

Step 6 Fasten the cable tow to the gripper (2 M6 x 16 screws)

Step 7 Fasten the Sub-D plug on the gripper

Step 8 Check the version of the microcode on the 2-axis controller and if necessary perform the procedure *2-axis controller microcode update* on page 8-91.

Set up the swivelling axis (A axis)

Step 1 End the AMS

Step 2 Switch the main switch S3 on

Step 3 Start "PMMaint" by double-clicking the icon on the OS/2 work-space.

The **Pmac Maintenance** *window appears*

Step 4 Open the **PMAC Motor Limits Dialog** window with the **Motor Limits** command in the **Installation** menu

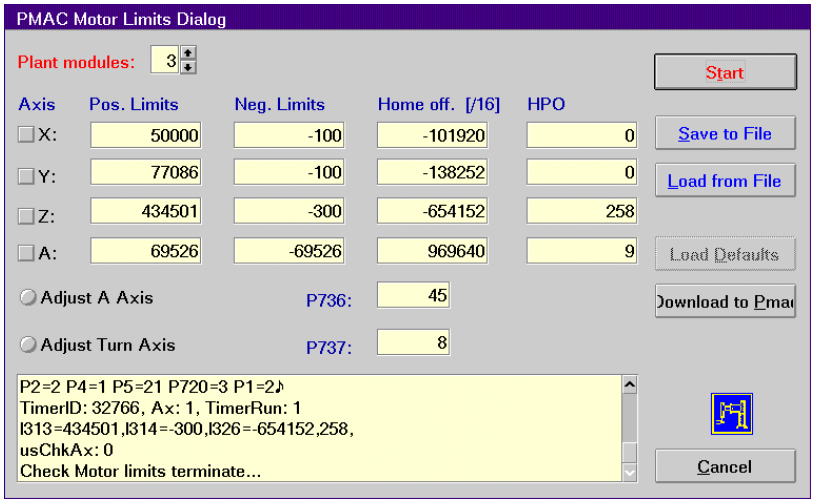


Figure 8-21: "PMAC Motor Limits Dialog" window

Step 5 Select the X and A axes (deselect Y and Z)

Step 6 Start the measurement by clicking on Start

The gripper starts with homing run and measurement.

Step 7 Wait until the procedure is complete.

Step 8 Click on **Save to File**

Step 9 Select **Adjust A Axis** in the **PMAC Motor Limits Dialog** window

The **Adjust A Axis Dialog** *window opens,*
the gripper turns into its starting position

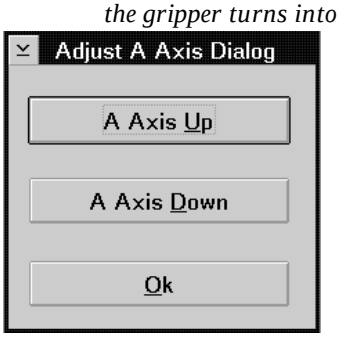


Figure 8-22: "Adjust A Axis Dialog" window

Step 10 Place the small spirit level longitudinally on the gripper

Step 11 To align accurately, then click on

- either **A Axis Up**
- or **A Axis Down**

Step 12 After you have accurately aligned the A axis on this side

- take the spirit level down
- click on **OK**. The gripper turns.

Step 13 Repeat from Step 8) to 10) for the second side

Step 14 Save the settings with **Save to File**

Step 15 Exit the **PMAC Motor Limits Dialog** window with **Cancel**

Step 16 Select **Adjust Turn Axis** in the **PMAC Motor Limits Dialog** window:

The **Adjust Turn Axis Dialog** *window opens,*
the gripper turns into its starting position

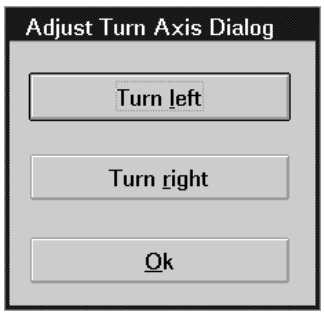


Figure 8-23: "Adjust Turn Axis Dialog" window

Step 17 Place on the spirit level

Step 18 To align accurately then click on

- either **Turn left**
- or **Turn right**

Step 19 After you have accurately aligned the turn axis on this side

- take the spirit level down
- Click on **OK**. The gripper turns.

Step 20 Save the settings with **Save to File**.

Step 21 Exit the **PMAC Motor Limits Dialog** window with **Cancel**

Step 22 Exit the "PMMaint" program

Step 23 Perform the procedure *Teach the system* on page 8-31.

Step 24 Perform the procedure *Adjust handling of the system* on page 8-15.

Step 25 Perform the procedure *Back up system parameters* on page 8-84.

8.2.12 Replace Y axis home sensor

Tools and aids

- 2 17 mm wrenches

Dismantling the old home sensor

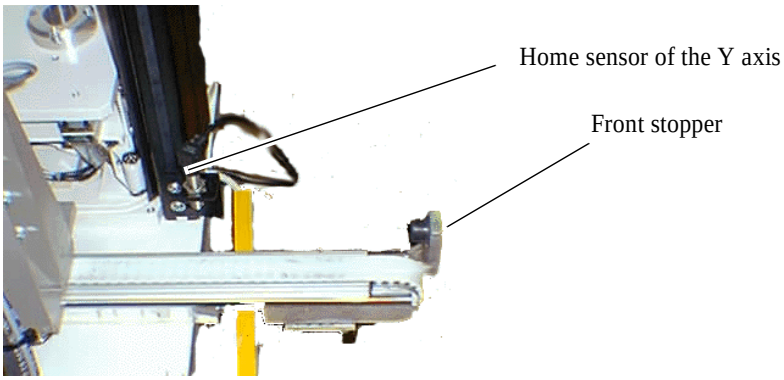


Figure 8-24: Position of the Y axis home sensor

Step 1 Perform the procedure *Bring robot into service position* on page 8-8

Step 2 Unscrew the plug from the Y axis home sensor

Step 3 Unscrew the upper nut from the home sensor

Step 4 Remove the home sensor

Installation of the home sensor

Step 1 Screw a nut on the home sensor

Step 2 Insert the home sensor in the holder

Step 3 Screw the second nut on the home sensor

Step 4 Push the handling unit up to the stopper

Step 5 Adjust the home sensor:

- Distance from the sensor surface to the carriage approx. 0.5 mm
- Horizontal position so that the sensor still stands fully on the carriage

Step 6 Tighten the nut

Step 7 Screw the plug on the home sensor

8.2.13 Replace drive of the Y axis

Tools and aids

- 4 mm Allen key
- Socket wrench with ratchet 10 mm
- 10 mm wrench
- Medium slotted head screwdriver
- Small side cutters
- Cable ties
- Waterproof felt pen

Dismantling the old Y axis motor

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

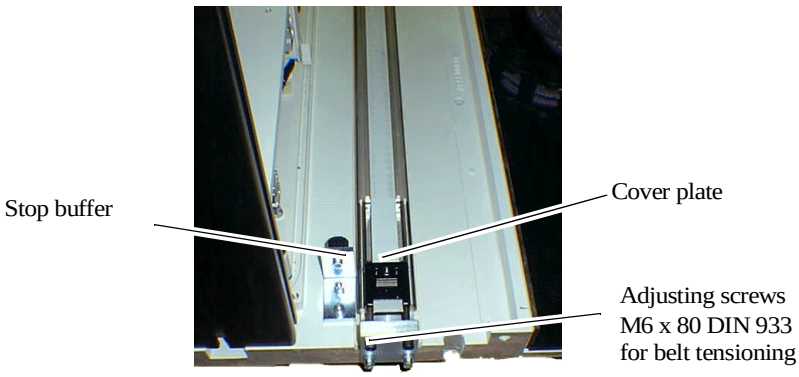


Figure 8-25: Toothed drive belt tension assembly with adjusting screws and stop buffer

Step 2 Loosen the screw on the Ω deflection on the carriage

Step 3 Loosen the tensioned toothed drive belt:

- Loosen the 2 lock nuts on the adjusting screws
- Unscrew the two adjusting screws M6 x 80 DIN 933

Step 4 Remove the synchronizing pulley
Use the extracting device as required
(Order No. 205 002 223)

Step 5 Unplug the cable on the carriage

- Loosen the 2 fastening screws between socket and plug X22
- Cut the cable ties open with the side cutters
- Unplug the plug X22

Step 6 Loosen the fastening of the Y axis motor:
4 M5 Allen screws

Step 7 Remove the motor with cable

Installing the new Y axis motor

Step 1 Fasten the new motor on the carriage with the 4 M5 Allen screws firmly:

- Alignment of the motor: output cable X22 (on the motor) must point in the direction of the socket X22 (on the carriage)
- Screw tight in crosswise sequence: top left - bottom right - bottom left - top right

Step 2 Plug the cable in on the carriage:

- Insert the plug in the socket X 22
- Fasten the plug with the 2 fastening screws to the socket
- Fasten the cable with cable ties to the cable harness

Step 3 Install the synchronizing pulley on the motor shaft

Step 4 Fasten the synchronizing pulley with the screw

Step 5 Push the handling unit fully onto the front buffer

Step 6 Tauten the completely relaxed belt by hand without force

Step 7 Turn the adjusting screws by hand back in the tensioner until the belt lies loosely in the linear guide

Step 8 Perform the procedure *Adjust the toothed drive belt tension* on page 8-13.

Step 9 Perform the procedure *Determine "Motor Home Position"* **on page 8-10**.

Step 10 Perform the procedure *Teach the system* on page 8-31.

Step 11 Perform the procedure *Back up system parameters* on page 8-84.

8.2.14 Replace toothed drive belt of the Y axis

Tools and aids

- 10 mm wrench
- 10 mm ratchet and socket
- 5 mm Allen key

Dismantling the old toothed drive belt

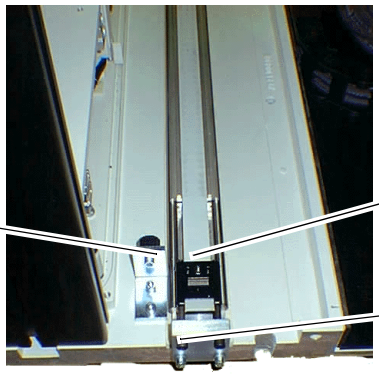


Figure 8-26: Toothed drive belt tension assembly with adjusting screws and stop buffer

Step 1 Loosen the tensioned toothed drive belt at the end of track

- Open the two lock nuts on the adjusting screws
- Unscrew the two adjusting screws M6 x 80 DIN 933

Step 2 Unscrew the 4 M6 Allen screws from the cover plate

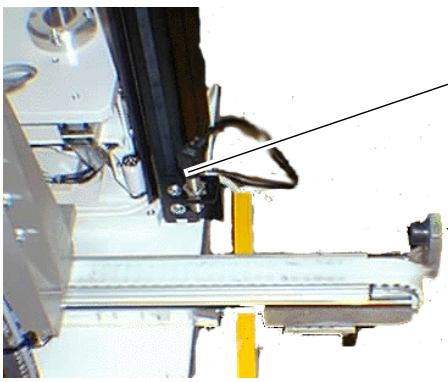


Figure 8-27: Linear guide at the start of track

Step 3 Unscrew three of the four M6 Allen screws at the start of track (under the linear guide)

Step 4 Turn the toothed drive belt holding plate to the side

Step 5 Remove the toothed drive belt

Installing the new toothed drive belt

Step 1 Thread the toothed drive belt in:

- Teeth downwards
- Start at the Ω deflection on the carriage
- Carefully thread in the linear guide
- Pull the toothed drive belt forwards up to the front toothed drive belt holding plate

Step 2 Turn the front toothed drive belt holding plate under the linear guide and insert the toothed drive belt in the front toothed drive belt holding plate

Step 3 Fasten the front toothed drive belt holding plate with the three M6 Allen screws firmly

Step 4 Pull the toothed drive belt tautly to the back up to the holding plate

Step 5 Place the toothed drive belt under the cover plate of the belt tensioner and
firmly fasten the cover plate with the four M6 Allen screws

Step 6 Perform the procedure *Adjust the toothed drive belt tension* on page 8-13.

Step 7 Fasten the terminating panel at the front

Step 8 Close all protective doors

Step 9 Switch the mains switch S3 on

Step 10 Perform the procedure *Determine "Motor Home Position"* **on page 8-10**.

Step 11 Perform the procedure *Teach the system* on page 8-31.

Step 12 Perform the procedure *Back up system parameters* on page 8-84.

8.2.15 Replace home sensor of the Z-axis

Tools and aids

- 2 17 mm wrenches

Dismantling the old home sensor

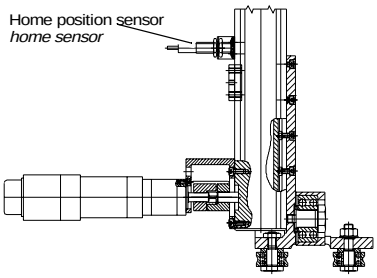


Figure 8-28: Position of the Z axis home sensor

Step 1 Move the lifting axis down to the lower stopper (*Initial Teach* **on page 4-12**).

Step 2 Switch the AML/J system off

Step 3 Unscrew the plug from the Z axis home sensor

Step 4 Unscrew the upper nut from the home sensor

Step 5 Remove the home sensor

Installing the home sensor

Step 1 Screw a nut on the home sensor

Step 2 Insert the home sensor in the holder

Step 3 Screw the second nut on the home sensor

Step 4 Push the handling unit onto the stopper

Step 5 Adjust the home sensor:

- Distance of the sensor surface to the lifting carriage approx. 0.5 mm
- Vertical position so that the sensor still stands fully on the lifting carriage

Step 6 Tighten the nuts

Step 7 Screw the plug on the home sensor

8.2.16 Replace drive of the Z axis

Tools and aids

- 2.5 mm, 3 mm, 4 mm Allen key
- Medium slotted head screwdriver
- Small side cutters
- Cable ties

Dismantling the old motor (Z axis)

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Secure the gripper against dropping down:

- Sling the strap around the gripper and upper linear guide
- Secure the closed strap against loosening

Step 3 Unplug the cable on the carriage

- Loosen the 2 fastening screws between socket and plug X23
- Cut open the cable ties with the side cutters
- Unplug the plug X23
- Unplug the proximity switch of the Z axis (on the lifting axis)

Step 4 Loosen the screw on the coupling (lifting axis side)

Step 5 Remove the coupling housing (with motor and coupling of the Z axis) from the carriage:
Unscrew the 4 M5 Allen screws.

Installation of the new motor (Z axis)

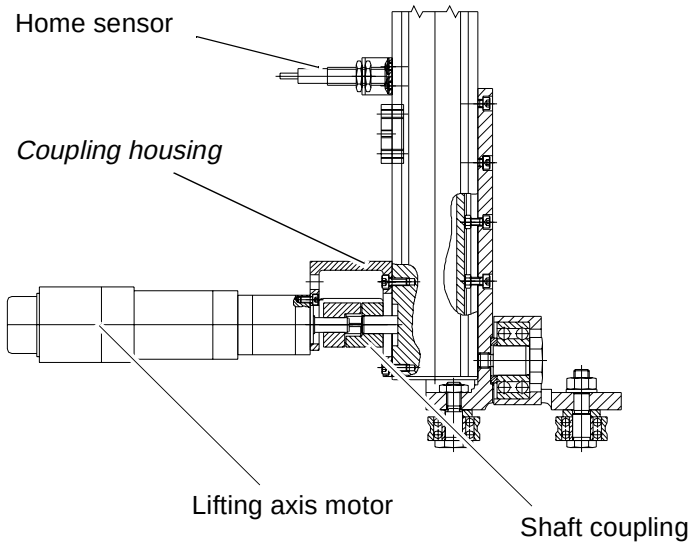


Figure 8-29: Lifting axis motor with shaft coupling and coupling housing

Information

Take care that the bolt-on flange of the flexible coupling is made of aluminium.

Step 1 Fasten the metal bracket to the lifting axis:
Tighten the 4 M5 Allen screws

Step 2 Tighten the screw of the coupling (lifting axis side)

Step 3 Plug in

- X 23 on the cable tow
- the proximity switch of the Z axis (on the lifting column)

Step 4 Fasten the cable of the proximity switch on the cable harness (from cable tow to lifting column)

Step 5 Loosen the locking device of the lifting axis

Step 6 Perform the procedure *Determine "Motor Home Position"* **on page 8-10**.

Step 7 Perform the procedure *Teach the system* on page 8-31.

Step 8 Perform the procedure *Back up system parameters* on page 8-84.

8.2.17 Replace lower rollers

Tools and aids

- 17 mm wrench

Dismantling the old lower rollers

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Draw out the handling unit up to the front stopper

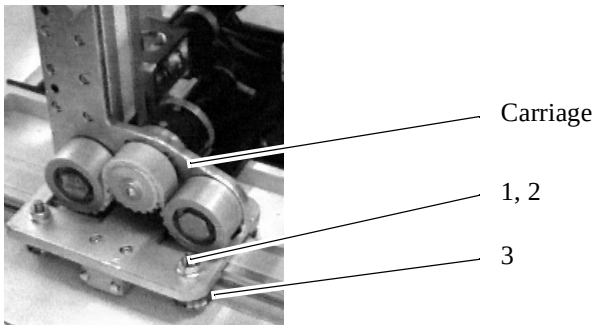


Figure 8-30: Carriage with lower rollers

Step 3 Remove the nut (1)

Step 4 Press the screw (2) out downwards:
the roller (3) also falls out

Step 5 Repeat Steps 3 and 4 for the remaining three rollers

Installation of the new lower rollers

Step 1 Set a roller on the guide rod

Step 2 Insert the screw (2) through the roller (3) and the hole in the carriage

Step 3 Screw the nut (1) on loosely (it may be necessary to hold the screw (2))

Step 4 Repeat Step 1 to 3 for the remaining three rollers

Step 5 Tighten the screws for the rear rollers

Step 6 Now adjust the play of the rollers (3):
Adjust the eccentric (hexagonal head screws on the front two rollers (view through the open protective door of the basic

module)).
The rollers

- must still turn by hand
- may not clatter when pushing the carriage backwards and forwards
- must turn when the carriage moves

Step 7 Now tighten the screws of the front rollers

8.2.18 Replace upper rollers

Tools and aids

- 13 mm wrench
- 19 mm wrench (ground flat)
- 5 mm Allen key

Dismantling the old upper rollers

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Draw the handling unit out up to the front stopper

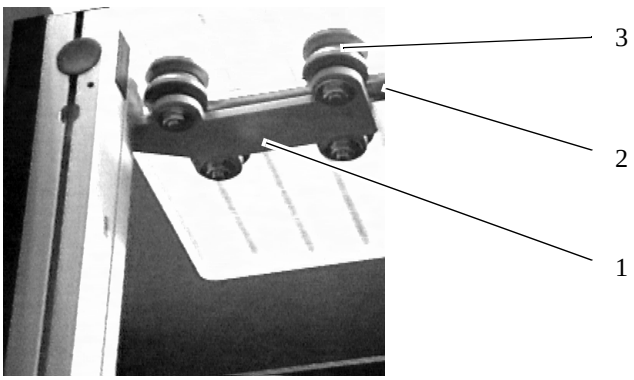


Figure 8-31: Upper rollers

Step 3 Unscrew the 2 M6 Allen screws of the roller holder (1): the roller holder is separated from the lifting column

Step 4 Turn the roller holder (1) to the control cabinet side

Step 5 Draw the roller holder (1) to the front off from the guide rod (2):
you may have to push the lifting column slightly to the right and pull the roller holder (1) past it

Step 6 You can now take the four old rollers (3) down from the roller holder (1)

Installation of the new upper rollers

Step 1 Set the four new rollers (3) on the roller holder (1)

Step 2 Thread the roller holder (1) in the guide rod (2):

- Mounting holes for M6 Allen screws as last
- Roller holder (1) points in the direction of the control cabinet
- Press the roller holder (1) to the back on the guide rod (2): you may have to push the lifting column slightly to the right and pull the roller holder (1) past it

Step 3 Fasten the roller holder (1) again to the lifting column:
Fit the two M6 Allen screws again

Step 4 Now adjust the play of the rollers (3):
Adjust the eccentric (hexagonal head screws on the front two rollers (view through the open protective door of the basic module)).
The rollers

- must still turn by hand
- may not clatter when pushing the carriage forwards and backwards
- must turn when the carriage moves

8.2.19 Replace power supply

Tools and aids

- Slotted head screwdriver
- Allen key
- Wrench
- Cable ties

Dismantling the power supply

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Loosen the plugs of the power supply:

- on the gripper
- on the motor of the Y axis
- on the motor of the Z axis
- on the control unit

Step 3 Loosen the fastenings of the power supply and strain relief

- on the gripper
- on the handling unit
- on the track
- in the control cabinet

Step 4 Remove the power supply

Installation of the power supply

Step 1 Place the power supply in the track

Step 2 Fasten the power supply

- on the track
- on the handling unit
- on the gripper
- in the control cabinet

Step 3 Fasten the plugs of the power supply

- on the gripper
- on the motor of the Y axis
- on the motor of the Z axis
- on the control unit

Step 4 Fasten loose cables with cable ties

8.2.20 Replace handling unit

Crushing feet!

Work only with safety boots.

Information

In the case of defects on

- **Toothed drive belt of the Z axis**
- **Carriage**
- **Lifting column**

replace the complete assembly of lifting column with carriage.

Tools and aids

- 5 mm Allen key
- 10 mm, 17 mm wrench
- 10mm ratchet and socket

Dismantling the old lifting column with carriage

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Dismantle the gripper corresponding to the procedure *Replace gripper* on page 8-37.

Step 3 Remove the toothed drive belt corresponding to the procedure: *Replace toothed drive belt of the Y axis* on page 8-46.

Step 4 Remove the upper rollers corresponding to the procedure: *Replace upper rollers* on page 8-54

Step 5 Remove the lower rollers corresponding to the procedure: *Replace lower rollers* on page 8-52

CAUTION!

Crushing feet by the lifting column dropping on the floor.

Step 6 Draw the old lifting column with carriage assembly out from the upper and lower guide rail

Installation of the new lifting column with carriage

Step 1 Push the new lifting column with carriage assembly on the upper and lower guide rail

Step 2 Install the lower rollers corresponding to the procedure: *Replace lower rollers* on page 8-52

Step 3 Install the upper rollers corresponding to the procedure: *Replace upper rollers* on page 8-54

Step 4 Install the toothed drive belt corresponding to the procedure: *Replace toothed drive belt of the Y axis* on page 8-46

Step 5 Install the gripper corresponding to the procedure: *Replace gripper* on page 8-37

Step 6 Perform the procedure *Determine "Motor Home Position"* **on page 8-10**.

Step 7 Perform the procedure *Teach the system* on page 8-31.

Step 8 Perform the procedure *Back up system parameters* on page 8-84.

8.2.21 Replace storage boxes

Removing the boxes

Step 1 Remove the fastening clamps from the frame profiles

Step 2 Loosen the fastening plates on the door profiles

Step 3 Turn the fastening plates to the side

Step 4 Pull the box out

Installing the boxes

Step 1 Insert the box

Information

When inserting the boxes pay attention to the correct horizontal alignment of the boxes and the position of the teach points.

Step 2 Turn the fastening plates over the box

Step 3 Screw tight the fastening plates at the door profiles

Step 4 Attach the fastening clamps

Step 5 Perform the procedure *Teach the system* on page 8-31.

8.2.22 Replace I/O unit/C pneumatic spring

Information

Replacement of the pneumatic spring after 5 years at the latest.

Tools and aids

- 3 mm Allen key
- Small, medium Philips screwdriver
- Medium slotted head screwdriver
- Blue Loctite (removable screw retention)
- Possibly an assistant who compresses the pneumatic spring on installation

Dismantling the old pneumatic spring

Step 1 Switch the mains switch S3 off

Step 2 Open the protective door in which the I/O unit/C with the pneumatic spring to be replaced is located

Step 3 Remove the box directly under the I/O unit/C (dismantling according to the procedure *Replace storage boxes* on page 8-59)

CAUTION!

Injuries to the face and hands!
The pneumatic spring is under compression.

Step 4 Removal of the pneumatic spring:
Unscrew the two mounting screws

Step 5 Remove the old pneumatic spring

Installing the new pneumatic spring

Step 1 Provide the two mounting screws with blue Loctite

Step 2 Screw the new pneumatic spring tight with the first mounting screw

Step 3 Compress the pneumatic spring and screw in the second mounting screw

Step 4 Attach the box again (installing according to the procedure *Replace storage boxes* on page 8-59)

8.2.23 Replace module distributor board

Tools and aids

- Screwdriver
- Small pliers

Dismantling the module distributor board

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Remove the cover of the module distributor board

Step 3 Mark the cables

Step 4 Loosen the cables from the module distributor board

Step 5 Withdraw the board from the fastening pins.
Press the pins together at the tip.

Installing the module distributor board

Step 1 Fit the module distributor board on the fastening pins

Step 2 Fasten the cables

Step 3 Fit the cover of the module distributor board

8.2.24 Replace I/O-E board

Tools and aids

- Small pliers

Dismantling the I/O-E board

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

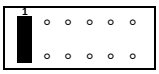
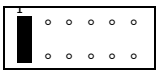
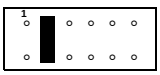
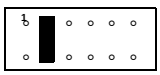
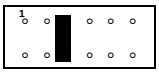
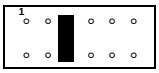
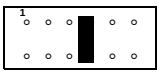
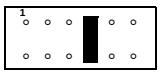
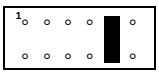
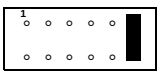
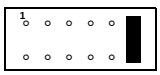
Step 2 Unplug the plugs from the I/O-E board

Step 3 Pull the board out from the fastening pins.
Press the pins together at the tip.

Installing the I/O-E board

Set the jumpers on the I/O-E board

Table 8-8: Jumpers on the I/O-E board

I/O unit	JP 1	JP 2	JP 3	JP 4
1				
2				
3				
4				
5				
6				

Step 4 Fit the I/O-E board on the fastening pins

Step 5 Plug the plugs into the I/O-E board

- X1: To the request button (S81 / S82)
- X2: Magazine 1 sensor (S86) (left)
- X3: Shutter sensor (S85) and magnetic switch (Y82) (left)
- X4: Magazine 2 sensor (S88) (right)
- X5: Shutter sensor (S87) and magnetic switch (Y83) (right)
- X91: To the next I / O-E or module distributor board or terminating plug
- X92: To the plug board
- X94: Home sensor (B10) of the driving axis (only on the basic module)
- X95: Door safety switch (S91)

8.2.25 Replace relay board

Tools and aids

- Screwdriver

Dismantling the relay board

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Remove the storage boxes under the I/O unit/C (*Replace storage boxes* on page 8-59).

Step 3 Label the cables on the relay board

Step 4 Loosen the cables on the relay board

Step 5 Dismantle the relay board

Installing the replay board

Step 1 Install the relay board under the I/O unit/C

Step 2 Fasten the cables on the relay board

Step 3 Install the storage boxes under the I/O unit/C again (*Replace storage boxes* on page 8-59).

8.2.26 Replace bus board and plug board

Tools and aids

- Screwdriver
- Allen key

Dismantling the bus board and plug board

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Perform the dismantling according to the procedure *Replace the control unit* on page 8-83.

Step 3 Remove all plugged-in boards from the control unit

Step 4 Dismantle the upper cover of the control unit

Step 5 Loosen the remaining cables from the plug board

Step 6 Remove the bus board with the plug board from the back

Installing the bus board and plug board

Step 1 Install the plug board and the bus board in the control unit

Step 2 Fit the cables to the plug board

Step 3 Fit the upper cover

Step 4 Plug all boards to be plugged into the control unit

Step 5 Install the control unit
(*Replace the control unit* on page 8-83).

8.2.27 Replace 2-axis controller

Tools and aids

- Small slotted head screwdriver

Dismantling

Step 1 Remove the left front panel from the control unit

Step 2 Withdraw the 2-axis controller from the control unit

Installation

Step 3 Check the new 2-axis controller

- Correct EPROM version (☞ Table 8-9:)
- Built-in optocouplers
  (at position U13, U14, U17 and U20 it is the module PS 2502-4) (☞ Figure 7-7:)

Table 8-9: Compatibility of the grippers to the stepping motor microcode

Gripper version / EPROM version	0	1	3	4
05.10.95	x	x		
V1-2	x	x		
V2-2			x	
V1-3	x	x		
V3-3			x	
V3-4			x	
V4-4				x

X: Permissible gripper - stepping motor microcode combination

Step 4 Insert the new 2-axis controller in the control unit

Step 5 Fasten the left front panel back on the control unit

8.2.28 Replace stepping motor board

Tools and aids

- Small slotted head screwdriver

Dismantling

Step 1 Remove the left front panel from the control unit

Step 2 Withdraw the stepping motor board from the control unit

Installation

Step 3 Insert the new stepping motor board in the control unit

Step 4 Fasten the left front panel back on the control unit

8.2.29 Replace controller

Tools and aids

- Small slotted head screwdriver
- 2 measuring adapters
- Voltmeter

WARNING!
Dangerous voltage!

The voltage of the controller can be up to 54 V.

Information

The procedure is similar for all 4 controllers (☞ Deviations see associated information).

Dismantling the controller

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Remove the left front panel from the control unit

Step 3 Withdraw the controller from the control unit

Installing the controller

Step 1 Insert the new controller in the control unit

Step 2 Perform the procedure *Adjust controllers* on page 8-18.

Step 3 Install the front panel of the control rack

8.2.30 Replace PMAC board

Tools and aids

- Small slotted head screwdriver

Dismantling the old PMAC board

Step 1 Perform the procedure *Back up system parameters* on page 8-84.

Step 2 Switch the system off

Step 3 Pull out the mains plug

Step 4 Make sure that all cables are labelled (at the back of the AMU computer)

Step 5 Remove all cables (back of the AMU computer):

- Loosen the fastening screws of the plugs if necessary
- Pull the plugs off

Step 6 Draw the AMU computer out to the front and set it on a table, for instance

Step 7 Open the AMU computer:

- Loosen the 4 screws on the rear panel (of the AMU computer)
- Lift up the cover

Step 8 Remove the old PMAC board:

- Loosen the fastening screws
- Pull the old PMAC board out

Installing the PMAC board

Step 1 Check the jumper positions of the new PMAC board by reference to

- Table 8-10: on page 8-71 and
- Figure 8-32: on page 8-70

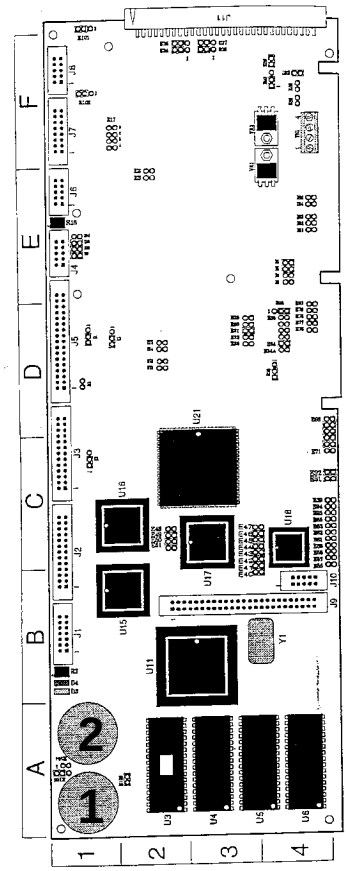


Figure 8-32: Localizing grid on the PMAC board with battery

Information

The lines in Table 8-10: with a gray background are jumper positions which deviate from the Baldor factory setting.

Jumper setting

Table 8-10: Jumper setting on the PMAC board for AML/J

Jumper	Position	Jumper setting	Explanation
E0	D3	No jumper	reserved
E1	D1	1-2	Gnd to Pin 11 of U26
E2		1-2	+V to Pin 10 of U26
E3	E4	No jumper	Servo clock frequencycontrol
E4		No jumper	
E5		Jumper	
E6		Jumper	
E7	C1	1-2	machine input source/sink control
E9	E1	Jumper	serial interface handshake control
E10		Jumper	
E11		Jumper	
E13		Jumper	
E14		Jumper	
E17a	F1	No jumper	Amplifier-enable/Direction polarity control
E17b		No jumper	
E17c		No jumper	
E17d		No jumper	
E22	E2	No jumper	Control panel handwheel enable
E23		No jumper	
E24	F3	2-3	Encoder Differential Control
E25		2-3	
E26		2-3	
E27		2-3	
E28	D4	2-3	Warning following error/ watchdog timer signal control

Table 8-10: Jumper setting on the PMAC board for AML/J

Jumper	Position	Jumper setting	Explanation
E29		No jumper	Phase clock frequency control
E30		No jumper	
E31		Jumper	
E32		No jumper	
E33		No jumper	
E34	C4	Jumper	Encoder sampling clock frequency control
E35		No jumper	
E36		No jumper	
E37		No jumper	
E38		No jumper	
E39	C4	1-2	Reset from bus enable
E40	C3	Jumper	Software adress control
E41		Jumper	
E42		Jumper	
E43		Jumper	
E44	C3	No jumper	Communication control
E45		Jumper	
E46		Jumper	
E47		No jumper	
E48	C2	No jumper	RAM wait state control
E49	C2	Jumper	Serial communication parity control
E50	C2	Jumper	EAROM save enable/disable
E51	C2	No jumper	Re-initializing power up (can be used during installation for general reset)

Table 8-10: Jumper setting on the PMAC board for AML/J

Jumper	Position	Jumper setting	Explanation
E55	B4	No jumper	Host interrupt signal select
E57	C4	No jumper	
E58		No jumper	
E59		No jumper	
E61		No jumper	
E62		No jumper	
E63		No jumper	
E65		No jumper	
E66	C4/D4	No jumper	Bus base hardware address (210 Hex)
E67		Jumper	
E68		Jumper	
E69		Jumper	
E70		Jumper	
E71		No jumper	
E72	D2	No jumper	Panel analog timr base signal enable
E73		No jumper	
E74	D2	No jumper	Clock output control for ext. interpolation
E75		No jumper	
E76	D4	No jumper	Host interrupt signal select (no interrupt)
E77		No jumper	
E78		No jumper	
E79		No jumper	
E80	E4	No jumper	
E81		No jumper	
E82		No jumper	
E83		No jumper	
E84		No jumper	

Table 8-10: Jumper setting on the PMAC board for AML/J

Jumper	Position	Jumper setting	Explanation
E85	F4	No jumper	Host-supplied analog power source enable
E86	E4	No jumper	Host interrupt signal select
E87	F4	No jumper	Host-supplied analog power source enable
E88		No jumper	
E89	F3	Jumper	Amplifier-supplied switch pull enable
E90	C1	1-2	Host-supplied switch pull-up enable
E91	C4	Jumper	Bus base adress select (high bits)
E92		Jumper	
E93	C4	No jumper	Reset from bus by software enable
E94		No jumper	
E98	D4	1-2	DAC/ADC clock frequency control
E101		2-3	Amplifier enable output configure
E102		2-3	
E103	A2	Jumper	Watchdog timer
E104	A1	No jumper	Boot from PROM IC
E105 (only boards with battery)	A1	1-2	Battery on position bat 1
		2-3	Battery on position bat 2

Step 2 Check the installed optocouplers on the board (Table 8-11: on page 8-75)

Table 8-11: Optocouplers on the PMAC board

Chip	Place	Designation	Order No.	Explanation
U26	D1	ULN2803A	-	Machine output
U54	F1	UDN2981A	15U900003	Amplifier output

Step 3 Check the installed resistance arrays on the board (Table 8-12: on page 8-75)

Table 8-12: Resistance arrays on the PMAC board

Chip	Place	Order No.	Type
RP 50	F3	15R00001	L83S121 (4 x 120 Ω 8 Pins)
RP 44	F3	15R00001	L83S121 (4 x 120 Ω 8 Pins)
RP 34	F3	15R00001	L83S121 (4 x 120 Ω 8 Pins)

Step 4 Install the new PMAC board:

- Plug the new PMAC board in its slot
- Tighten the fastening screws

Step 5 Close the AMU computer:

- Push the cover over the computer housing
- Tighten the 4 screws on the rear panel of the AMU computer

Step 6 Place the AMU computer in the top shelf of the control cabinet

Step 7 Cable the AMU computer:

- Plug the plugs in the sockets (observe labelling)
- Tighten the fastening screws of the plugs where necessary

Step 8 Plug in the mains plug

Step 9 Switch only the AMU computer on (not the main switch S3).

Step 10 End the AMS

Step 11 Open the "PMMaint" program by double-clicking the icon on the
OS/2 workspace

Step 12 Select the **Pmac Terminal** command in the **Installation** menu. The **PMAC Terminal Dialog** window opens

Step 13 Enter `$$$***` in the **Send Data** field and click on **Send** (the communication to the PMAC board can be lost in this case)

Step 14 Test the communication to the PMAC board by entering `i5` in the **Send Data** field and click on **Send**:

- `i5=0` in the **Receive Data** field means that the communication is in order
- If the **Receive Data** field remains empty, the communication is not in order.
  Then only restart "PMMaint"

Information

If even after restarting PMMaint and the complete AMU computer several times no communication is possible the PMAC board can possibly still be activated by a hardware reset. Plug the jumper E51 on the board and thus switch the AMU PC on and back off. Before you now start with the download, you must remove the jumper again.

Step 15 Close the **PMAC Terminal Dialog** window with **Cancel**

Step 16 Open the **Download File** command in the **File** menu

The **PMac Download Filedialog** *window appears*

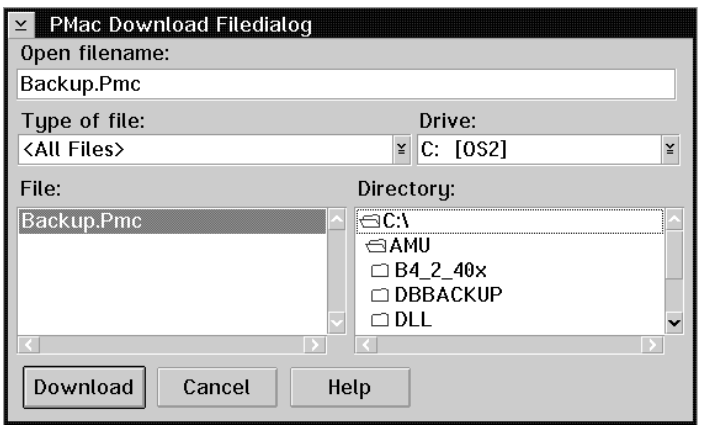


Figure 8-33: "PMac Download Filedialog" window

Step 17 Select the DL.PMC file from the c:\BALDOR\SOURCEN folder and click on **Download**

Step 18 Wait until loading is ended (approx. 16 minutes)

Step 19 Select the BACKUP.PMC file from the c:\AMU folder and click on **Download**

Step 20 Wait until loading is ended

Step 21 Close the **PMac Download Filedialog** window with **Cancel**

Step 22 Select the **Pmac Terminal** command in the **Installation** menu. The **PMAC Terminal Dialog** window opens

Step 23 Enter $$$ in the **Send Data** field and click on **Send**

Step 24 Exit the "PMMaint" program with **Exit** under the **File** menu

8.2.31 Replace power supply board

Tools and aids

- Small slotted head screwdriver

Dismantling

Step 1 Remove the left front panel of the control unit

Step 2 Pull the power supply board a little out from the control unit

Step 3 Unplug the plugs from the power supply board

Installation

Step 4 Insert the plugs in the power supply board. Pay attention to the colour assignment.

Step 5 Insert the new power supply board in the control unit

Step 6 Fasten the left front panel back on the control unit

8.2.32 Replace plug with filter

Tools and aids

- Small slotted head screwdriver
- Small Philips screwdriver
- 4 mm Allen key

Dismantling

Step 1 Switch the system off completely

Step 2 Pull out the mains plug

Step 3 Make sure that all cables are labelled (at the back of the control rack)

Step 4 Remove all cables (back of control rack):

- Loosen the fastening screws of the plugs
- Pull the plugs off

Step 5 Remove the control rack fastening:
4 screws on the front

Step 6 Using the handles draw out the control rack to the front and set it on a table, for instance

Step 7 Open the cover of the control rack:

- Remove all Philips screws on the top of the side panels (of the control rack)
- Lift up the cover
- Remove the disturbing crossbars

Step 8 Remove the old plug with filter:

- Make sure that all cables are correctly labelled
- Pull all cables off from the plug with filter
- Remove the switch fastening from the back of the control rack:
  Unscrew the 2 slotted head screws
- Pull the plug with filter out to the back

Installation

ATTENTION!

The installation position of the plug with filter depends upon the national version.
It must be possible to read off the selected version on the control rack in the built-in condition:

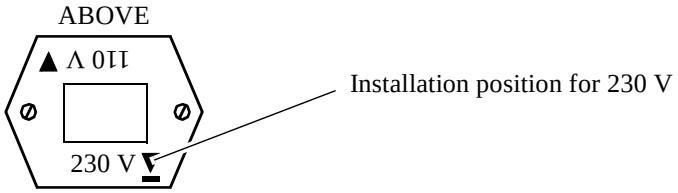


Figure 8-34: Plug with filter - Installation position for 230 V

Step 9 Install the new plug with filter:

- Push the plug with filter from the back into the control rack (Installation position ☞ Figure above)
- Fasten the plug with filter with the 2 slotted head screws
- Cable the plug with filter (observe labelling)

Step 10 Close the control rack:

- Attach all missing crossbars
- Place the cover in position
- Tighten all Philips screws on the top of the side panels (of the control rack)

Step 11 Using the handles push the control rack into the control cabinet

Step 12 Fasten the control rack with 4 screws on the control cabinet front

Step 13 Connect all cables to the back of the control rack:

- Plug the plugs into the suitable sockets (observe labelling)
- Tighten the fastening screws in the plugs

Step 14 Plug in the mains plug

8.2.33 Replace the main switch

Step 1 Switch the main switch S3 off

Step 2 Switch off

- the AMU computer
- the screen

Step 3 Pull out the mains plug

WARNING!

Dangerous voltage! Test that the system is really free of voltage before starting dismantling.

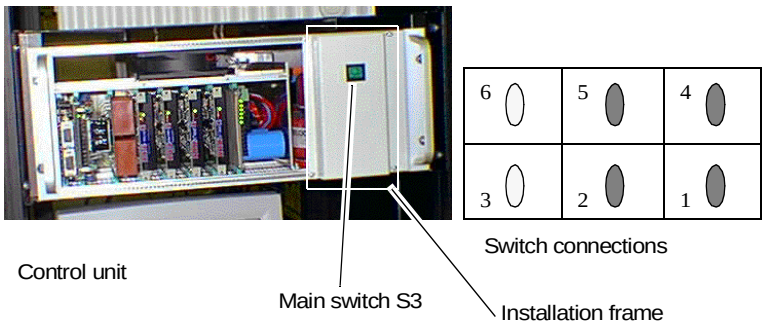


Figure 8-35: Connections of the main switch

Step 4 Unscrew the front panel with main switch S3

Step 5 Hinge the front panel to the front and mark the cables (☞ Figure 8-35:)

Step 6 Pull the individual cables off

Step 7 Plug the cables onto the suitable locations on the new main switch S3

Step 8 Screw the front panel onto the control rack

Step 9 Plug in the mains plug

8.2.34 Replace the safety switch

Tools and aids

- Philips screwdriver
- Wrench

Dismantling the safety switch

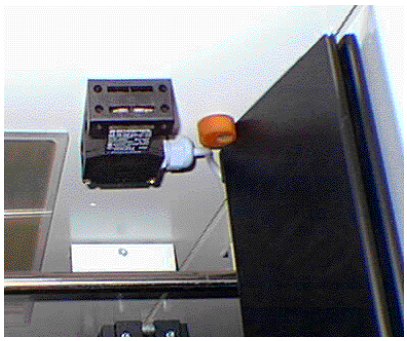


Figure 8-36: Position of the safety switch

Step 1 Perform the procedure *Bring robot into service position* on page 8-8.

Step 2 Open the safety switch

Step 3 Loosen the cables in the safety switch

Step 4 Loosen the screw connection on the safety switch

Step 5 Mark the position of the safety switch

Step 6 Unscrew the safety switch

Installing the safety switch

Step 1 Break out the opening for the cable connection in the safety switch

Step 2 Fasten the safety switch corresponding to the marking

Step 3 Screw the screw connection onto the safety switch

Step 4 Install the cables

Step 5 Tighten the screw connection

Step 6 Close the safety switch

8.2.35 Replace the control unit

Tools and aids

- Small slotted head screwdriver
- 4 mm Allen key

Dismantling

Step 1 Switch the system off

Step 2 Pull out the mains plug

Step 3 Make sure that all cables are labelled
(at the back of the control rack)

Step 4 Remove all cables (back of the control unit):

- Loosen the fastening screws of the plugs
- Pull the plugs off

Step 5 Remove the control unit fastening:
4 screws on the front

Step 6 Using the handles draw the old control unit out to the front

Installation

Step 1 Using the handles push the new control unit into the control cabinet

Step 2 Fasten the control rack with 4 screws to the control cabinet front

Step 3 Connect all cables on the back of the control unit:

- Plug the plugs into the suitable sockets (observe labelling)
- Tighten the fastening screws in the plugs

Step 4 Plug in the mains plug

8.3 Microcode service

8.3.1 Back up system parameters

Step 1 Stop all running applications on the AMU (e. g. host communication, AMU, PMMaint)

Step 2 Switch the control off (main switch S3)

Step 3 Back up the current Backup.PMC file

```
c:> c:\amu\backup.pmc c:\amu\backup.old
```

Step 4 Start PMMaint (click on the PMMaint icon on the workspace)

Step 5 Select Backup from the File menu

Step 6 Wait until the backup is completed

Step 7 Switch the main switch S3 on

Step 8 Select the **Start Pmac Progs** command from the **File** menu

Step 9 End the PMMaint program

Step 10 Start the applications again (AMU, host communication, DAS)

Information

Copy the BACKUP.PMC file on all places from which the system could be started and onto floppy disk:

- **Second hard disk (if installed)**
- **Dual AMU (if installed)**
- **Second hard disk of the Dual AMU (if installed)**

Step 1 Back up the changed files from the AMU folder on floppy disk (☞ Software Backup).

- KrnRefPt.R00
- BACKUP.PMC
- AMUCONF.INI

8.3.2 PMAC microcode update

Prerequisites

- Current stepping motor microcode (EPROM)
  (Table 8-9: on page 8-66)
- AMU software 2.40_ or higher

Procedure

Step 1 Switch the main switch (S3) off

Step 2 Back up the current version of the robot software

```
c:> md c:bador\sourcen\b4_300
c:> move \baldor\sourcen\*.* \baldor\sourcen\b4_300
```

Step 3 Copy all files of the robot software into the `c:\baldor\sourcen` folder

```
c:> copy a:\robot\*.* c:\bador\sourcen
```

Step 4 Start an ASCII editor, e.g. OS/2 Editor EPM with the DL.PMC file:

```
c:> epm c:\baldor\sourcen\dl.pmc
```

Information

Compare the settings in the DL.PMC file in the case of doubt with the previously backed up file.

Step 5 Set semicolons at the start of the lines with the files which should not be transferred to the PMAC board:

- Hardware version which does not correspond with your system:
  #include „version*.pmc“
- Version of the adjustment position (neuinst.pmc, neuinst2.pmc, neuinst3.pmc)
- I/O units which are not installed in your system:

Table 8-13: Parameters in the DL.PMC file

Parameter	Remarks	
File selection for the download. A file is excluded from the download by the semicolon (;) at the start of a line. In the following files you must make the selection for the: • Hardware version which does not correspond to your system: • Version of the adjustment point • I/O units which are not installed in your system		
`version0.pmc`	Adaptation to the hardware of the zero series of AML/J	
`version1.pmc`	Adaptation to the hardware of series 1 to 3 of AML/J	
`NEUINST.PMC`	Initialization of the I and P variables which should not be overwritten in a microcode update. Preallocation of the coordinates and offsets for the adjustment point at an individual I/O unit/C	
`NEUINST2.PMC`	Initialization of the I and P variables which should not be overwritten in a microcode update. Preallocation of the coordinates and offsets for the adjustment point at two I/O units of the type C	
`NEUINST3.PMC`	Initialization of the I and P variables which should not be overwritten in a microcode update. Preallocation of the coordinates and offsets for the adjustment point without I/O unit/C	
`NEUZ_MOT.PMC`	Adaptation of the parameters to the new motor in the lifting axis (Parvex)	

`EACONTR1.PMC`
`EACONTR2.PMC`
`EACONTR3.PMC`
`EACONTR4.PMC`
`EACONTR5.PMC`
`EACONTR6.PMC`
	I/O unit/C	The coordinates for the adjustment point are in the NEUINST2.PMC file for systems with two I/O units/C

`EA-D_3.PMC`
`EA-D_4.PMC`
`EA-D_5.PMC`
`EA-D_6.PMC`
	I/O unit/D (HICAP)	-

Table 8-13: Parameters in the DL.PMC file

Parameter	Remarks	
EA-E_1.PMC EA-E_2.PMC EA-E_3.PMC EA-E_4.PMC EA-E_5.PMC EA-E_6.PMC	I/O unit/E	The correction values for the adjustment point are stored in the NEUINST3.PMC file for systems without I/O unit/C (you must teach the adjustment point)
GRIPPER_VER	4.0	Gripper201002869
	3.0	Gripper 201 001 980
	1.0	Gripper 201 001 140
	0.0	Gripper 201 000 060
ON_SHIP	0 or 1	If the system does not stand horizontal or oscillates (motor of the Y axis is not switched in the current-saving mode (Parameter P385)
Y_SPEED_FACT	General percentage value for reduction of the speed of the Y axis. Reduce the speed in the case of problems with following errors and voltage problems (Parameter P380)	
Z_SPEED_FACT	General percentage value for reduction of the speed of the Z axis. Reduce the speed in the case of problems with following errors and voltage problems (☞ Product Alert 6) (Parameter P381)	

The number in the file name stands for the number of the I/O unit in the system (address in the AMU configuration)

Example file for an update to hardware version 3, and two I/O units/E

```
;*****************************************************************
;*
;* Program name     :             DL.PMC
;* Program type      :             Download file
;* Program number   :
;*
;* Version number   :             3.00
;* Release date :
;* Last change  :             18.02.98
;* Changed by   :
;*
;* Function         : Program for downloading all files
;* Call           :
;*
;*****************************************************************

#include "DEFINE.PMC"
;#include "version0.pmc"  *definitions for Version 0 Hardware
#include "version1.pmc"  ;* definitions for Version 1 Hardware
#include "MVAR.PMC"
;#include "NEUINST.PMC"  ;* Axis parameter only for new installation 1 EAC
;#include "NEUINST2.PMC" ;* Axis parameter only for new installation 2 EAC
;#include "NEUINST3.PMC" ;* Axis parameter only for new installation EAE
#include "NEUZ_MOT.PMC"  ;* Parameter for new Z-axis motor (Parvex)
#include "BOX.PMC"
#include "FAHREBIS.PMC"
#include "GETPOS.PMC"
#include "GLOBAL.PMC"
#include "GRIPPER.PMC"
#include "HOME.PMC"
#include "INSTDRV.PMC"
#include "NEWGRIP.PMC"
#include "OBSERV.PMC"
#include "RACK.PMC"
#include "ROBO.PMC"
#include "SCHREIB.PMC"
#include "TEACH.PMC"
#include "TESTMESS.PMC"
#include "TESTMOVE.PMC"
#include "TESTGRIP.PMC"
#include "TESTAXIS.PMC"
#include "UNIT.PMC"
#include "LAUFWERK.PMC"         ;* Parameter for device handling
;#include "EACONTR1.PMC"        ;* definition for I/O-C 1
;#include "EACONTR2.PMC"        ;* definition for I/O-C 2
;#include "EACONTR3.PMC"        ;* definition for I/O-C 3
;#include "EACONTR4.PMC"        ;* definition for I/O-C 4
;#include "EACONTR5.PMC"        ;* definition for I/O-C 5
;#include "EACONTR6.PMC"        ;* definition for I/O-C 6
;#include "EA-D_3.PMC"          ;* definition for HIGHCAP I/O-D 1
;#include "EA-D_4.PMC"          ;* definition for HIGHCAP I/O-D 2
;#include "EA-D_5.PMC"          ;* definition for HIGHCAP I/O-D 3
;#include "EA-D_6.PMC"          ;* definition for HIGHCAP I/O-D 4
#include "EA-E_1.PMC"           ;* definition for I/O-E 1
#include "EA-E_2.PMC"           ;* definition for I/O-E 2
;#include "EA-E_3.PMC"          ;* definition for I/O-E 3
;#include "EA-E_4.PMC"          ;* definition for I/O-E 4
;#include "EA-E_5.PMC"          ;* definition for I/O-E 5
;#include "EA-E_6.PMC"          ;* definition for I/O-E 6
GRIPPER_VER = 4.0               ;* Gripper version 4.0   PN 201 002 ???
                                ;*              or 3.0   PN 201 001 980
                                ;*              or 1.0   PN 201 001 140
                                ;*              or 0.0   PN 201 000 060
ON_SHIP = 0                     ;* Parameter for installation on boat
Y_SPEED_FACT = 100              ;* Factor for reduction of Y speed
Z_SPEED_FACT = 100              ;* Factor for reduction of X speed
```

Step 6 Save the file

Step 7 Change to the **PMMAINT** program

Step 8 Click on the **Save** field in the **Counter** function in the **Service** menu

Step 9 Click on **Backup** in the **File** menu (all system-specific parameters of the PMAC board are saved in the C:\AMU\BACKUP.PMC file)

Information

Apply Step 10 only for an update of the version 2.30.

Step 10 Edit the BACKUP.PMC file

- Open an OS/2 window
- Enter: `EPM C:\AMU\BACKUP.PMC`
- Delete the lines with P261 to P299
- Save the file
- End the editor

Step 11 Change to the **PMAC Terminal Dialog** window of the "PMMaint" program

Step 12 Enter:

- in the **Send Data** field
  `$$$*** <ENTER>`
- **Send**

Step 13 End the PMAC Terminal Dialog

Step 14 End the PMMaint program

Step 15 Restart the PMMaint program

Step 16 Select the **Download file** command in the **File** menu

Step 17 Select the "DL.PMC" file in the C:\BALDOR\SOURCEN folder and start the transfer with **Download**.

Step 18 Wait until the transfer is completed (around 16 minutes).

Step 19 Select the "BACKUP.PMC" file in the C:\AMU folder and start the transfer with **Download**.

Step 20 Wait until the transfer is ended (around one minute).

Step 21 Enter in the **PMAC Terminal Dialog** window of "PMMaint":

- in the **Send Data** field
  `$$$ <ENTER>` (resetting the PMAC board)
- **Send**

Step 22 Close all windows with **Cancel**

Step 23 Switch the main switch S3 on

8.3.3 2-axis controller microcode update

Information

Observe the compatibility of the microcode to your gripper (☞ Table 8-9:)

Tools and aids

- Small slotted head screwdriver

Procedure

Step 1 Remove the left front panel of the control unit

Step 2 Draw the 2-axis controller out from the control unit

Step 3 Carefully remove with a screwdriver the EPROM from the base U13

Step 4 Plug the new EPROM on the base U13

Step 5 Insert the new 2-axis controller in the control unit

Step 6 Fasten the left front panel back on the control unit

8.3.4 Creating a trace file

Step 1 Open the **Trace** window in the **View** menu

Step 2 Select the suitable **Trace ID** (☞ AMU Reference Guide) and click on **Online**

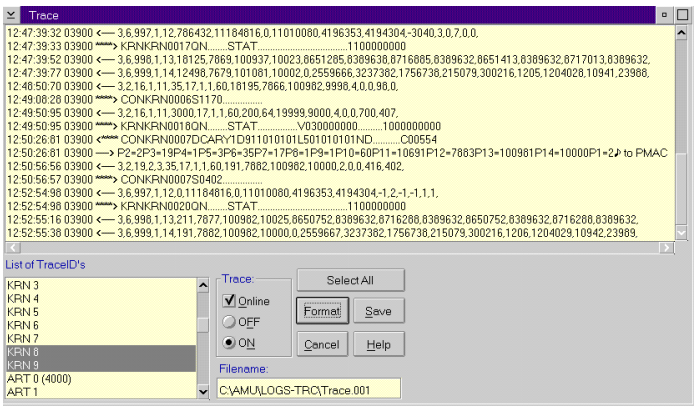


Figure 8-37: "Online-Trace" window

Step 3 Provoke the situation / error for which you want to record a trace

Step 4 Write the path and file name for the binary file of the trace in the **Filename** field:

Step 5 Click on **Save**

Step 6 Click on **Format**

Step 7 Write the path and file name for the ASCII file of the trace in the **Outfile** field:

Step 8 Click on **Start Formatting**

Step 9 Close all windows with **Cancel**

8.4 Preventive maintenance

Perform the procedures of the following section:

- After the end of one year
- On reaching prematurely the maximum motor runtime

8.4.1 Preparation of the maintenance work

WARNING!

All maintenance work - except for function tests - shall be performed in deenergized condition.

Deenergize the system before you start with the maintenance work: Pull out the mains plug.

Attach a warning sign to the system.

Information

Document the maintenance work in the system logbook with

- **Date**
- **Signature and**
- **Next date for maintenance work**

The following parts are required for each maintenance:

Table 8-14: Parts for maintenance

Number	Part designation	Order number	When necessary?
2 per module	Felt wiper	173 000 015	only when contaminated
2	Lubricating felt	202 002 189	after 12 months
1	Lifting axis (Z) drive with coupling and coupling housing	20F 002 818	at the latest after 36 months
1	Driving axis drive	207 000 311	at the latest after 2,000 km
4	Rollers	205 000 310	only when worn
1	Gripper	20F 002 843	after 10,000,000 low level commands or 1,200,000 revolutions of the A axis
	Separating agent ALRO OL 153	178 000 080	for I/O unit/E
1	PMAC battery	15G 990 001	only older PMAC boards
1	PC battery	15G 360 001	only Dell PC

Maintenance work (system switched off)

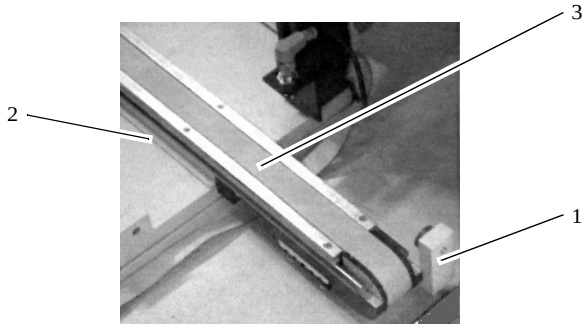


Figure 8-38: Basic module with stopper (1), felt wiper (2) and toothed drive belt (3)

Table 8-15: Maintenance work on the track

Unit (what?)	Place (Where?)	Measure (how?)	Interval [months]	Duration [min]
Stopper (1)	Basic module	Test the fastening	12	5
Felt wiper (2)	under linear guide	Test for contamination (replacement on contamination, Order No. 173 000 015)	12	10
Energy chain	Carriage / module floor	Test • Wear (abrasion, damage) • Fastening	12	10
Toothed drive belt (3)	Driving axis Y	Test • Wear (abrasion, damage, play too large) • Toothed drive belt tension (*Adjust the toothed drive belt tension* on page 8-13)	12	15

Table 8-15: Maintenance work on the track

Lower guide rods (4) and roller bearing (5)	Carriage / linear guide	Test • Joint between the guide rods • Without offset • Without gap (gap size 0 mm). Remedy: grinding with oil stone • Wear (abrasion, damage) • Cleaning off deposits • Fastening	12	10
Ω deflection (6)	Carriage	Test the axial play	12	5

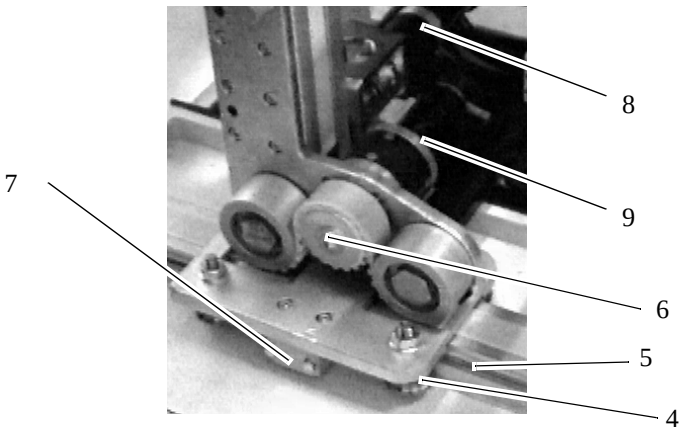


Figure 8-39: Driving axis lubricator

Table 8-16: Maintenance work on the handling unit (1)

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Lubricator (7)	Carriage	Open both lubricators (on the left and right of the carriage) Replace the oil-soaked lubricating felt (Order No. 202 002 189) Close the lubricator with the protective plug (Order No. 119 000 519) In old systems replace the previous metal cover by this plug.	12	20
Drive unit of the lifting axis	Carriage	**WARNING! Danger of crushing hands and feet!** **Secure the gripper before replacing motor:** Replace the drive of the lifting axis Z (8)	after 1,500,000 meters or 3,000,000 low level commands or 50,000 break actions or after 36 months	30
Drive unit of the driving axis	Carriage	Replace the motor and gearbox of driving axis Y (9)	after 2,000,000 meters	20

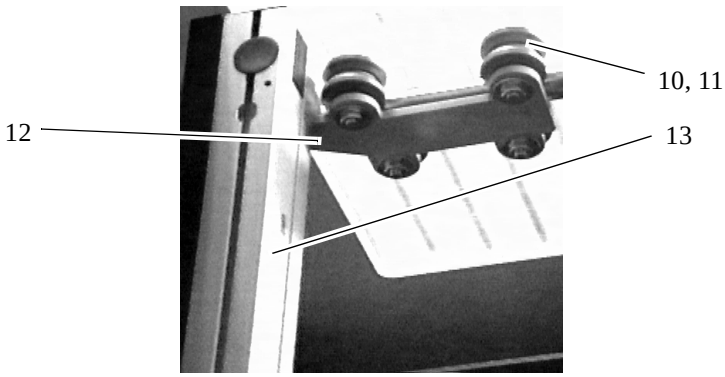


Figure 8-40: Roller guide above

Table 8-17: Maintenance work on the handling unit (2)

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Upper roller guide (10) and loose bearing (11)	Carriage / lifting column	Test the play. The front rollers are adjustable (eccentric). In the case of severe wear of the loose bearing replace the loose bearing rollers (Order No. 205 000 310)	12	10
Guide rod above (12)	Carriage / lifting column	Test the joint between the guide rods without offset without gap (gap size 0 mm). Remedy: grinding with oil stone Wear (abrasion, damage) Fastening	12	10

Table 8-17: Maintenance work on the handling unit (2)

Toothed drive belt (13)	Lifting axis Z	Test the wear (abrasion, damage, play too large) **Information** **Always replace the complete lifting axis Z in the case of a defective toothed drive belt** *Replace handling unit* ***on page 8-57***.	12	5

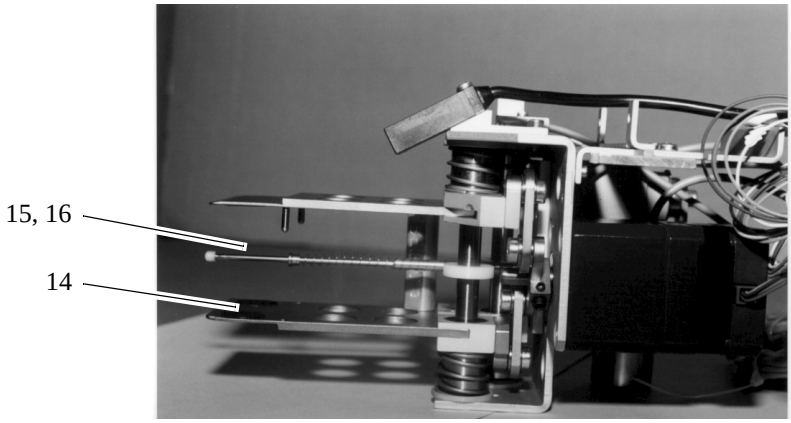


Figure 8-41: Gripper AML/J

Table 8-18: Further maintenance work

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Gripper	Carriage	Replace the gripper	after 10,000,000 low level com-mands or 1,200,000 revolutions (turn axis) (*Counter* on page 4-37)	30

Table 8-18: Further maintenance work

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Jaws	Gripper unit	Test the rubber (14) for abrasion	12	20
Springs (15) of the query pin	Gripper unit	Visual inspection: • not broken • not bent	12	
Query pin (16)	Gripper unit	Test • Easy movement • Straightness • Cleanliness	12	
Feed axis (X axis)	Gripper	Test • Easy movement • Cleanliness of the guide rods	12	
Scan window	Barcode scanner	Test for cleanliness and clean if necessary	12	
Plug con-nections	Gripper	Test for firm seating	12	
Cable	Gripper	Test • Wear (abrasion, damage) • Fastening	12	

Table 8-18: Further maintenance work

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Pneu-matic spring	I/O unit/E	Test • Oil loss (tightness) • Spring force with spring balance (Min. 25N)	12	5
Guide rail		Test • Contamination (clean very contami-nated guide rails) • Easy movement (function test) • Damage (replace the magazine installa-tion kit completely in the case of dam-age Order No. 202 001 440)	12	5
Shutters		Test easy movement (function test open and close) Lubricate the guide groove as required only with separating agent ALRO OL 153 S (Order No. 178 000 080)	12	5
Battery (only PMAC without Flash RAM)	PMAC board in AMU PC	Replace the battery • Open the AMU • Remove the jumper E105 • Insert the new bat-tery next to the old battery • Remove the old bat-tery • Insert the jumper E105 1-2 battery position 1 2-3 battery position 2	12	15

Table 8-18: Further maintenance work

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Battery (only Dell PC)	AMU PC, underneath the hard disk	Replace the battery • Open the AMU • Remove the old battery • Install the new battery • Close the PC	36	10
Plug and terminal connections	AMU PC	Test the fastening	12	5

Functional test (system switched on)

Table 8-19: Maintenance work: Functional test

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Locking unit	I/O/E	Function test	6	20
Fan	Control rack	Test function	12	
Fan	AML controller • CPU • Power supply	Function test	12	
Proximity switch (2) (home sensor Y and Z axes)	Basic module	Test function: Homing run in order?	12	
Door	Basic module, extension module	Test all door switches: • Open: system stops • Pull on closed door: Switch may not trigger a system stop	12	
I/O unit/D	Basic module, extension module	Test function: • System stops after pressing the button and homing command, door unlocks • Door locks immediately after closing	12	

Table 8-19: Maintenance work: Functional test

Unit (what?)	Place (where?)	Measure (how?)	Interval [months]	Duration [min]
Pneu-matic spring	I/O/C bottom	Test function: I/O turn insert must snap in and be locked during operation **Information** **Replacement of the pneumatic spring (Order No. 119 000 501) after 5 years at the latest** **(***Replace I/O unit/C pneu-matic spring* ***on page 8-60***).	12	5

9 Power supply

The AML/J power supply is described in the following section.

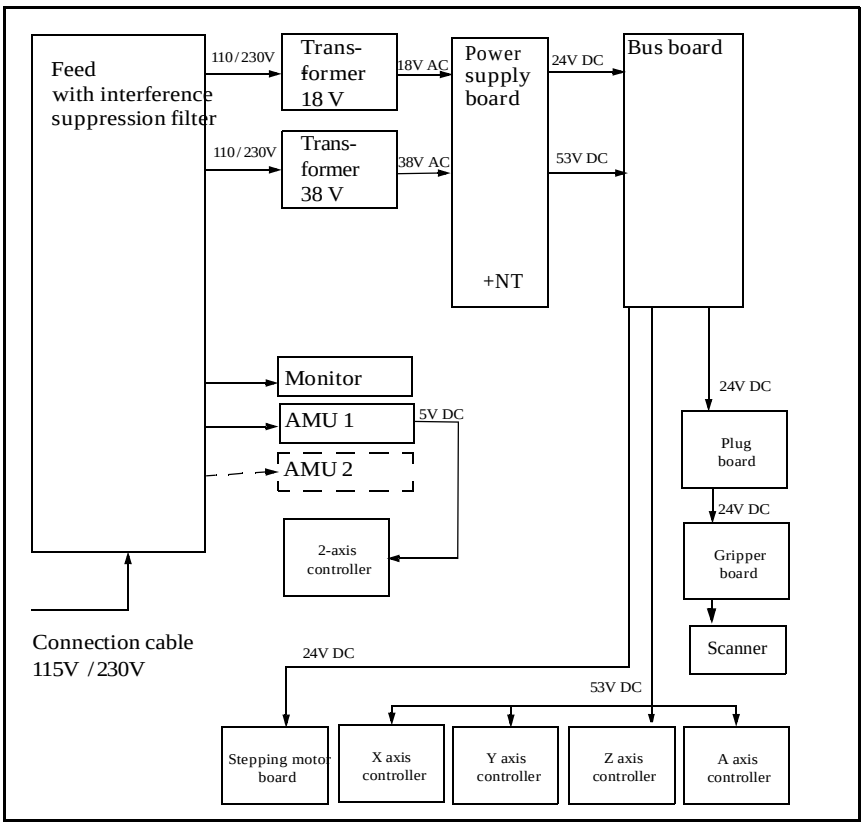
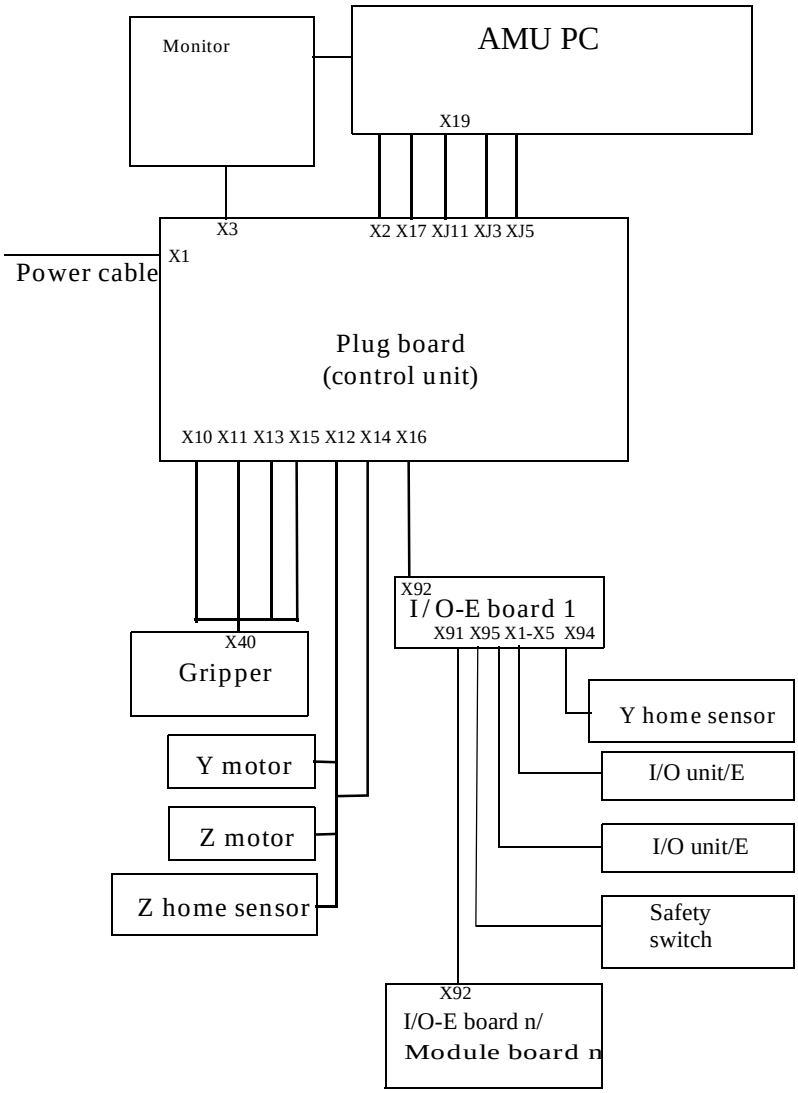


Figure 9-1: General power supply in the AML/J

10 Cables

The installed cables and plug connections are shown in the following diagrams. The following abbreviations are used in the diagrams and the AML/J circuit diagrams:

- **X** : Plug
- XJ: Plug for PMAV connection cable



11 Installation

11.1 Installation of a drive

Tools and aids

- 4mm Allen key
- 5mm Allen key

Procedure for drives in the 19" rack

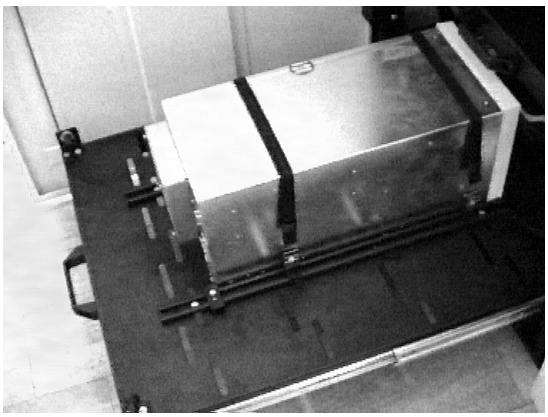


Figure 11-1: Drive rack with drive

ATTENTION!

When installing the drive pay attention to right angled alignment of the drive to the track. Certain drive types (e.g. DLT) can be damaged easily by skew operation.

Step 1 Place the drive on the drive rack

Step 2 Align the drive on the rack:

- front: teach angle stop
- laterally: fixing block on rail

Step 3 Loosen the back stop on the rails

Step 4 Screw the back stop firmly directly behind the drive

Step 5 Screw the second rail on at the other side of the drive

Step 6 Screw the stop firmly on the second rail directly behind the drive

Step 7 Fix the drive with the tightening straps

Step 8 Fasten the loose ends of the tightening straps in a loop

Step 9 Connect the drives
(☞ Documentation of the drive manufacturer)

Step 10 Push in the drive rack (the rack snaps in)

Step 11 Attach the cover to the control cabinet

Information

You require an associated teach label for each new drive in the system. Teach labels are installed as

- **Plate bracket on the 19" rack**
- **Sticker on the drive housing**

ATTENTION!

Configure and teach each drive as independent component even if several drives are in one housing.

11.1.1 Drive configuration in the AMU

Step 1 Select the **Configuration** command from the **Admin** menu

Step 2 Insert a drive in the **Graphical Configuration** window with the right mouse button pressed

Step 3 With the left mouse button pressed, draw connection lines to the

- Robot
- Host (not for DAS/2 1.3 hosts)

Step 4 Open the **Configuration** window by double-clicking on the drive icon and adapt the parameters

- **Type**
- **Description**
- **Unload parameters**
- **Dismount Management**
- **Clean Management**
  (☞ AMU Reference Guide)

Step 5 Repeat Step 2 to Step 4 for several drives

Step 6 Save the configuration with **Save**

Step 7 Open the **AMU Log**

Step 8 Select in the **Admin Update Devices** and wait until the message appears in the **AMU Log**:
„`The database ABBA is now ready for use`“

Step 9 Perform the **Shutdown AMU**

11.1.2 PMMaint drive integration

Step 1 Start the PMMaint program (click on icon on the workspace)

Step 2 Select the **Initial Teach** command from the **Installation** menu (*Initial Teach* **on page 4-12**)

Step 3 Select the **Teach Device** function from the **Teach** menu and start **New Teach** for the inserted drive
(*Teach Devices* **on page 4-25**)

11.1.3 New adress for already available drive types

Step 1 Select the **Adjust Handling** command from the **Teach** menu.

Step 2 Select a exist drive adress of the type.

Step 3 Click on the button **Update all devices**.

Step 4 Continue at step 18 on page 11-9.

11.1.4 Drive configuration for not available drive types

Information

Prerequisites for the drive configuration with Setup new Drives:
The drives to be configured are

- **defined in the Graphical Configuration and**
- **taught with the PMMaint commands Initial Teach and Teach**

11.1.5 Set up drive

Step 1 Make sure that all processes of the AMU have been run down

Step 2 Open "PMMaint" by double-clicking on the icon on the OS/2 workspace

Step 3 When setting up the drive test all commands as described below:

- **Get**
- **Put**
- **Disc** (if the discharge button operation is supported by the system)

Step 4 Place by hand a medium in the drive to be configured (mount)

Step 5 Give the drive an unload command

- either by pushbutton
- or by host command

Step 6 Select the **Setup new Drives** command in the **Teach** menu.
The **PMAC Setup new Drives Dialog** window opens:

Figure 11-2: "Pmac Setup new Drives Dialog" - Starting the movement

Step 7 In the **PMAC Setup new Drives** window click on:

- the required drive in the **Drive** field
- the required **Join Offset** (automatically compensate **Put**/**Get** offsets) or **New Drive** (slows down the speed on setting up new drives and stops at a safe distance in front of the drive) additions
- to start the movement: **GO!**
  The robot moves to a safe starting position for **Get**:

Step 8 The **PMAC Setup new Drives Dialog** window changes (moving with **+-**, gripping with **CLOSE**):

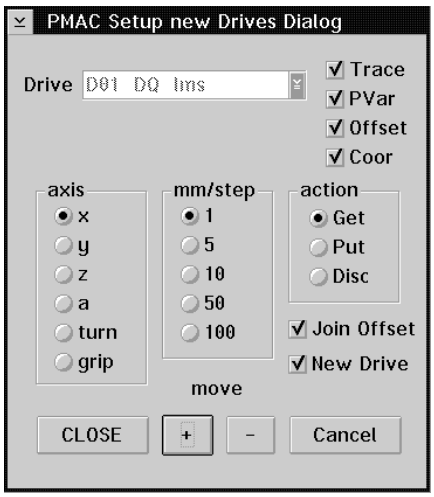


Figure 11-3: "PMAC Setup new Drives Dialog" window - Moving/gripping with Get command

Step 9 In the **PMAC Setup new Drives** window click on:

- the required displays: **Trace**, **PVar**, **Offset**, **Coor**
- the axis to be moved under **axis**
- the step size in **mm/step**

Information

The position of the gripping position also depends upon the mode of working of the drive. In certain types of drive the medium can be brought only a few millimetres between the gripper jaws.

- With **+** you move in positive direction, with **-** in the negative direction until you have the correct gripping position for the corresponding medium (gripper stands centrally in front of the medium):

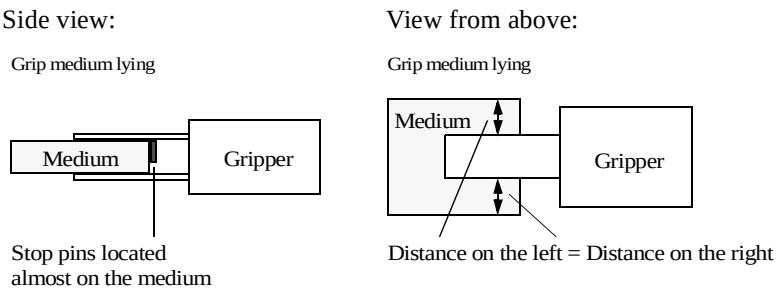


Figure 11-4: Correct and safe gripping of a medium

- You then close the gripper with **CLOSE** to grip the medium

Step 10 The **PMAC Setup new Drives Dialog** window changes (gripping once again with **regrip?** / **y n**):

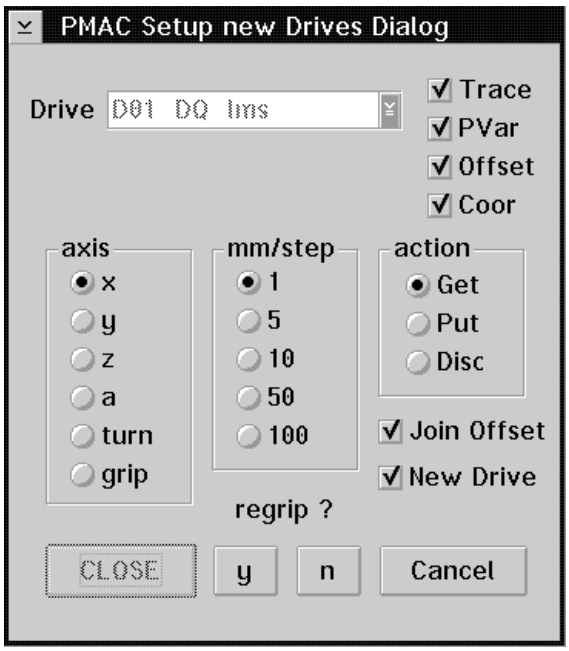


Figure 11-5: "PMAC Setup new Drives Dialog" window - Gripping once again with Get command

- Click **y** if the medium is not yet lying correctly up against the stop pins
- Click **n** if the medium is almost at the stop pins

Step 11 The **PMAC Setup new Drives Dialog** window changes (starting a **Put** command with **GO!**) opens:

Figure 11-6: "Pmac Setup new Drives Dialog" window - Starting a Put command

Step 12 In the **PMAC Setup new Drives** window click on:

- To start the movement: **GO!**

Step 13 The **PMAC Setup new Drives Dialog** window changes (moving / gripping with **Put** command with +-):

Figure 11-7: "PMAC Setup new Drives Dialog" window - Moving / open gripper with Put

Step 14 In the **PMAC Setup new Drives** window click on:

- the required displays: **Trace**, **PVar**, **Offset**, **Coor**
- the axis to be moved under **axis**
- the step size in **mm/step**
- the required **Join Offset** (automatically adjust **Put** / **Get** offsets) or **New Drive** (slows down the speed when setting up new drives) additions

ATTENTION!
Damage of the medium!

With certain drive types the medium must not be inserted to far (check code on the drive, if medium is still held while drawing in).

- With + you move in the positive direction, with - in the negative direction until you have the correct placing position for the corresponding medium in the drive (position for automatic drawing in of the medium by the drive)
- With **OPEN** you then open the gripper to place the medium

Step 15 The **PMAC Setup new Drives Dialog** window changes (pushing with **y n**):

Figure 11-8: "PMAC Setup new Drives Dialog" window - Pushing with Put command

- Query **push tape?**: click on **y** for pushing (medium is otherwise not drawn in) or
  n for handling without pushing (medium is drawn in without pushing)

Step 16 If you have answered the question **push tape** with **y**, you can now determine the distance by clicking on + or - until the medium is drawn in correctly by the drive.

Step 17 In the **PMAC Setup new Drives** window click on:

- to save the values in the AMUCONF.INI file and the changed P variables on the PMAC board: **SAVE!**

Step 18 Test with the **Put** and **Get** all new drives with Adjust Handling - pay attention to changes regarding the archive catalogue. (*Adjust Handling* from page 4-33)

Step 19 Check the handling on the drive (the medium must slide smoothly into the drive without striking the corners or edges).

Step 20 Also test at full speed (100%).

Information

Other values for the time response and for the special drive operation of the A and B side for optical disks must be set with the PMAC Terminal Dialog. (*Drive configuration ("Patch")* **on page 11-11)**

Step 21 Save the changes in the files:

- C:\AMU\AMUCONF.INI
- C:\AMU\KRNREFPT.R00
- C:\AMU\BACKUP.PMC
  (*Back up system parameters* on page 8-84)

11.1.6 Drive configuration ("Patch")

ATTENTION!

Most drives are predefined for the AML/J. Change the values in the system only

- **if the predefined values do not function correctly in your drive**
- **in cooperation with ADIC or ADIC/GRAU Storage Systems.**

Change the parameters with care. Wrong values can destroy the drive.

During installation, the "LAUFWERK.PMC" file is loaded in the PMAC board. This file contains predefined values for most drives (PMAC Parameters P501 - P699)

The parameters in this file are generally valid for all drives of a type.

There is a set of 10 or 20 parameters for each type of drive (OD drives and IBM3490 drive have 20 parameters).

The first parameter of such a set is the index and contains the drive type encoded.
Two numbers per drive type exist for OD drives and IBM3490 drives:

1st number: OD side A or IBM3490 Mount Position and
Keep after emergency discharge

2nd number OD side B or IBM3490 Keep Position

- The following table shows all parameters of a set. The parameters which have a gray background are adapted with the **Setup new drive** function.

Table 11-1: P variables in the LAUFWERK.PMC

Parame-ter	Explanation
Pxx0	Drive type: PMAC value (defined in AMUCONST.INI)
Pxx1	Distance on forwards pushing after a medium was recognized in **Keep** X offset [in 1/100 mm]
Pxx2	Z offset **Put** [in 1/100 mm]
Pxx3	How far the gripper pushes the medium into the drive: -3500 no pushing 0 forwards pushing by 3500 [in 1/100 mm]
Pxx4	Z offset **Get** [in 1/100 mm]
Pxx5	Regripping during **Keep** (0 = never, 1 = as required, 2 = always) (only 0 or 1 can be selected with Setup new Drives)
Pxx6	Distance on regripping during **Keep** 0 1300 [in 1/100 mm] other values 1300 [in 1/100 mm] + value
Pxx7	X offset for following **Put** (after **Get** on drive) Use this parameter if it is not necessary to grip the medium completely. (Completely here means "No distance from medium to the 2 gripper pins)
Pxx8	Factor for ramp acceleration during pushing for **Put** (higher values corresponds to low acceleration)
pxx9	2 bytes in hexadecimal coded form for the waiting time after pushing and contact of the medium (recognizing the medium in Keep): 1st byte: Value * 0.1 ms (waiting time after pushing) 2nd byte: Medium recognition (only IBM 3490) 0 contact 1 no contact Hexadecimal values can be entered with "$" e.g. P529=$71

The Q variables are assigned corresponding to the drive type parameter (Pxx0)

Table 11-2: Q variables in the laufwerk.pmc file

Para-meter	Explanation
Qxx0	Speed factor for the PUT command if the gripper pushes the cartridge into the drive. Value range: 0.2 - 3
Qxx1	Forwards movement in PUT after opening the gripper in 1/100 mm
Qxx2	Backwards movement in 1/100 mm for checking that the cartridge remains in the drive after the mount Use is recommended for optical disks The value 0 switches the function off
Qxx3	Gripper movement in direction of the Y axis in PUT before pushing into the drive in 1/100 mm
Qxx4	Gripper movement in direction of the Z axis in PUT before pushing into the drive in 1/100 mm
Qxx5	Waiting time in the GET command before driving into the drive in ms. Use is recommended for AUDIO drives
Qxx6	Waiting time in the GET command before the gripper is closed in ms

Procedure for adapting the drive operation

Step 1 Backing up the current values (*Back up system parameters* on page 8-84)

- Select the **Start Pmac Progs** function from the **File** menu
- Find the parameter set for your drive:
- Open the file in the EPM editor
  `epm c:\amu\backup.pmc`
- Find the PMAC parameter for your drive in the range P500 - P699

Step 2 Select from the **Installation PMAC Terminal** menu

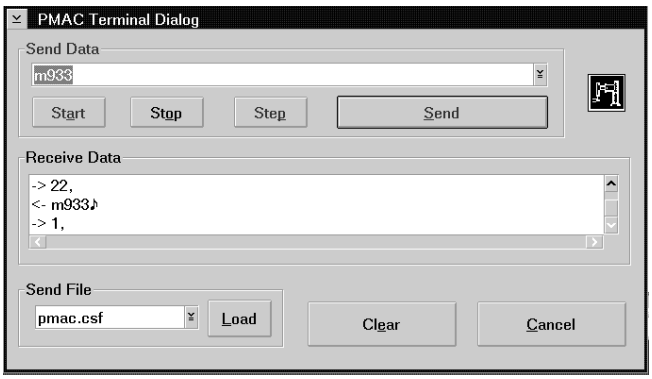


Figure 11-9: "PMAC Terminal Dialog" window

Step 3 Enter the changed value in the **Send Data** field (Table 11-1: on page 11-12)

- e. g. P502=100000 (Z offset Put)
- Click on **Send** after the entry
- End the dialog when you have entered all parameters with **Cancel**

Step 4 Select the **Adjust Handling** function from the **Teach** menu (*Adjust Handling* **on page 4-33**.)

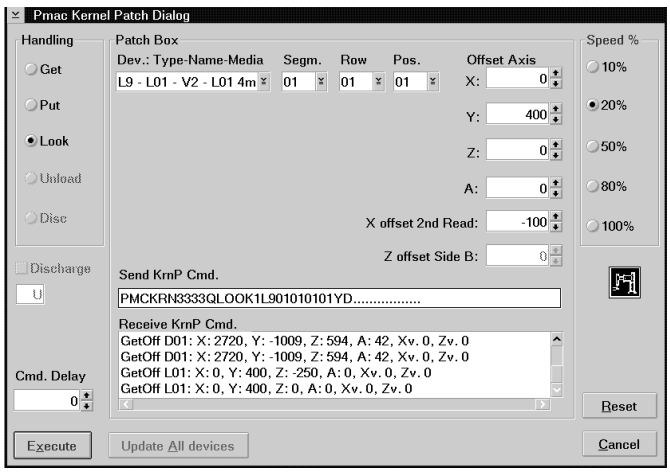


Figure 11-10: "Pmac Patch Dialog" window

Step 5 Select a **Get** for gripping a test medium out from the storage archive

Step 6 Check the drive handling:

- Reduce the speed to **Speed 10 %**
- Insert the medium with **Put** in the drive
- Remove the medium with **Get**

Step 7 If necessary change the base points (X, Y, Z, A):

- Close **Pmac Patch Dialog** with **Cancel**

Step 8 Exit "PMMaint"

11.2 Integration of an Add-On Module

Tools and aids

- hexagon socket screw key size: 5mm
- hexagon socket screw key size: 6mm
- torque wernch
- Retinax EP2 grease
- assembly oil

Procedure

Step 1 Save your current Configuration files

–AMUCONF.INI
–KRNREFPT.R00
–BACKUP.PMC

Step 2 Remove the covering from last module.

Step 3 Looseen the belt in the y-axis and remove the stopper and the tensioner.

Step 4 Remove the terminator in the last module.

Step 5 Remove the 8 screws M6x15 from the clamping profile of the linear guiding in the add-on module.

Step 6 Remove the clamping profile.

Step 7 Remove the two guide rods under the linear guiding.

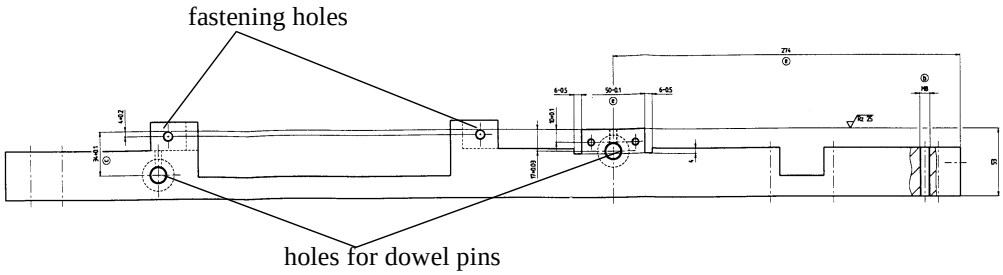


Figure 11-11: Base plate with dowel pins

Step 8 Grease all the guiding pins with Retinax EP 2.

Step 9 Greae the guide in the movable bearings shaft of all the add-on modules with Retinax EP 2.

Step 10 Push the add-on module against the basic module (previous add-on module).

Information

Tip the modules slightly if the pins are not flush with the holes in the basic module.

Step 11 Insert the dowel pins into the holes.

ATTENTION!

When pushing the parts together pay attention to the joining of the movable bearings shaft to avoid the edges of the shaft end being damaged.

Step 12 Push the add-on module right up against the basic module.

Step 13 Lubricate the threads of the tow M8x24 hexagon socket screw keys with oil.

Step 14 Screw the basic module and the add-on module togehter using the two M8x24 hexagon socket screw keys with a washer under each one (torque: 21 Nm).

Step 15 Repeat steps 5 to 14 for each further add-on module.

11.2.1 Aligning the modules

Tools and aids

- 2 machine spirit levels
- hexagon socket screw key size: 8mm
- open-jawed wrench 24mm

Procedure

Step 1 Set the adjustable feet of all the added modules to the floor (4 adjustable feet per module; they must all stand firmly).

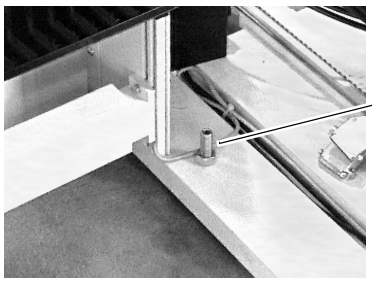


Figure 11-12: Adjustable foot on the basic module

Step 2 Verify that none of the castors are touching the floor.

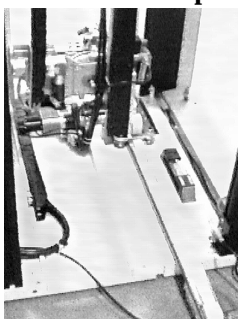


Figure 11-13: Aligning the basic module with a machine spirit level

Step 3 Check the slant of all the modules with a machine spirit level.

Step 4 Find the relatively highest point.

Step 5 Start the alignment with the highest module.

Step 6 Position the two machine spirit levels in the ighest module

- one machine spirit level parallel to the guide rod.
- the other one perpendicular to it.

Step 7 Turn the adjustable feet until the module is standing horizontal (tolerance ± 0,2mm / m).

Step 8 Repeat this alignment for all the modules

Step 9 Verify that all the adjustable feet are standing firmly on the floor.

Step 10 Tighten the locking nuts of all the adjustable feet.

11.2.2 Screwing modules together at the top

Tools and aids

- hexagon socket screw key size: 5mm
- assembly oil

Procedure

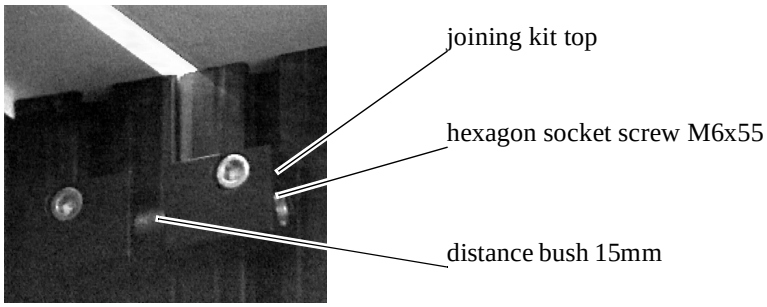


Figure 11-14: Joining kit between basic module and add-on module top

Step 1 Lubricate the threads of the M6x55 and M6x55 hexagon socket screws with oil.

Step 2 Position the distance bush 15mm between the two joining pieces on the control cabinet side.

Step 3 Screw together the foining pieces using the M6x55 hexagon socket screw.

Step 4 Screw together the joining pieces at the door side using the M6x55 hexagon socket screw.

11.2.3 Assembling the linear guiding (bottom)

Tools and aids

- hexagon socket screw key size: 5mm
- torque wrench
- cleansing materials
- soft cloth
- fine oilslip (oil stone)

Procedure

Step 1 Clean the groove and surface for the guide rods and the clamping profile.

Step 2 Clean the guide rods.

ATTENTION!

There must be no large gap, ridge or hard edge at the connecting points of the linear guiding after assembly.

Step 3 Place one guide rod each on the left and right sides into the groove of the linear guide in the add-on module.

Step 4 Push the guide rods right up to the basic module (overlapping approx. 30mm).

Step 5 Place the clamping profile onto the guide rods.

Step 6 Lubricate the threads of the 10 M6x16 hexagon socket screws with oil.

Step 7 Screw down the large clamping profile (592mm) using the 8 M6x16 hexagon socket screws (torque 9 Nm).

Step 8 Screw down the small clamping profile (147mm) using the two M6x16 hexagon socket screws (torque 9 Nm).

Step 9 Use your fingernail to check the seams for ridges and bumps.

Step 10 Smooth down the seams with an oilstone if necessary.

11.2.4 Assembling the movable bearings shaft

Tools and aids

- hexagon socket screw key size: 6mm
- torque wrensch
- fine oilslip (oil stone)
- plastic tip hammer

Procedure

ATTENTION!

There must be no ridge or hard edge at the joining points of the linear guiding after assembly.

Step 1 Check the seams of the movable bearings shaft. If the tolerance is to large:

- loosen the attackment screws of the movable bearings shaft in the add-on modules.
- hit the end of the movable bearings shaft with the plastic tip hammer.
- tighten the attachment screws of the movable bearings shaft (torque 21 Nm).

Step 2 Use your fingernail to check the seams for ridges and bumps.

Step 3 Smooth down the seams with an oilstone if necessary.

11.2.5 Assembling and tensioning the belt

Tools and aids

- hexagon socket screw key size: 5mm
- ratchet wrench 10mm
- open-jawed wrench 10mm

Procedure

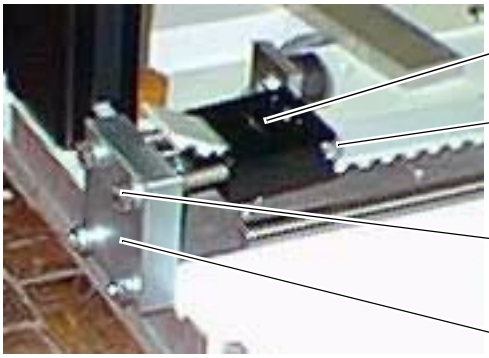


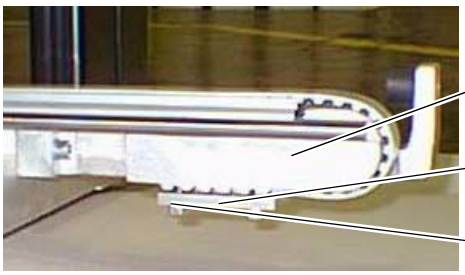
Figure 11-15: Assembly group toothed belt tensioning with positioning screws/arresting buffer

Information

The length of the belt depends on the size of the system.

Step 1 Loosen the two M6x80 hexagon socket screws and the M6 hexagon nuts.

Step 2 Loosen the toothed belt from the deflecting pulley at the start of track by removing the 4 hexagon head screws and the pressure plate.



Step 3 Remove the old toothed belt complete.

Step 4 Mount the new toothed belt with the pressure plate and the 4 hexagon head screws at the deflecting pulley.

Step 5 Move the belt through the Ω-deflection of the carriage.

ATTENTION!

The belt must lie exactly in the middle of the deflecting pulley.

Step 6 Place the belt into the tension block. Screw the tension block with two M6x80 hexagon socket screw and M6 hexagon nuts at the tension jack.

Step 7 Push the complete handling unit at the front stopper.

Step 8 Tighten the completely loosened belt by hand without force.

Infromation

There are two marks on the toothed belt: the distance between these depends on the size of the system. You can alter the marks if necessary using the following table:

Modul	1	2	3	4	5	6	7	8	9	10
Pre-tension [mm]	1,5	2,5	3,5	5,0	6,0	7,0	8,0	9,0	10,5	11,5

Step 9 Place an object with a straight edge against the first mark (e.g. machine spirit level).

Step 10 Turn the two hexagon socket screws equally to tighten the belt until the second mark is in line with the straight edge.

ATTENTION!

An incorrectly set toothed belt can cause premature wear and tear.

Step 11 Align the toothed belt parallel to the linear guiding using the hexagon socket screws.

11.2.6 Electrical Connection

Step 1 Put down the flat cable, beginning at the last add-on module into the previous module.

Step 2 Put the flat cable into the jack X92 at the module circuit board each add-on module.

Step 3 Check the final connector at the last add-on module.

11.2.7 Software Configuration

Step 1 Select the **Configuration** function from the **Service** menu.

Step 2 Pull the symbol of the linear rack (or an other component type which you have added) into the window **Graphical Configuration** with the right mouse button pressed.

Step 3 Connect the symbol with the symbol of the robot with the left mouse button pressed.

Step 4 Open the Configuration window with a double click on the symbol.

Step 5 Update the values off **Description**, **Type**, **Media Type** and **Arrangement**.

Step 6 Edit the **Volser Ranges** (☞ AMU Reference Guide).

Step 7 Close the Configuration window with **OK**.

Step 8 If you integrate several modules repeat the procedure step2 - 7.

Step 9 Save the changed Configuration with **Save**.

Step 10 Close the window **Graphical Configuration**.

Step 11 Open the **LOG Control Center**.

Step 12 Select **Archive...Update Devices** in the **Service** menu and wait for the message `"The database ABBA is now ready for use"` in the **LOG Control Center**.

Step 13 Execute **Shutdown ABBA...**.

11.2.8 Determination Hardware Parameter

Motor limits

Step 1 Make sure that all AMU processes are stopped.

Step 2 Start the PMMaint with a double click of the symbol.

Information

If the reference movement breaks off yo have to change Home Offsets:

- **Enter for the y-axis -100 000 in the field Home Offset**
- **Enter for the z-axis -400 000 in the field Home Offset**

and click Download to PMAC.

Step 3 Switch on the main switch S3 and wait at the end of the reference movement.

Step 4 Wait for the message
`Exit query PMAC status....`

Step 5 If the **Motor Limits** command is not activated (grey), click **Start Pmac Progs** in the **File** menu.

- the handling unit refers
- the **Motor Limits** command is activated (bold)

Step 6 Click **Motor Limits** in the **Installation** menu. The **PMAC Motor Limits Dialog** window appears.

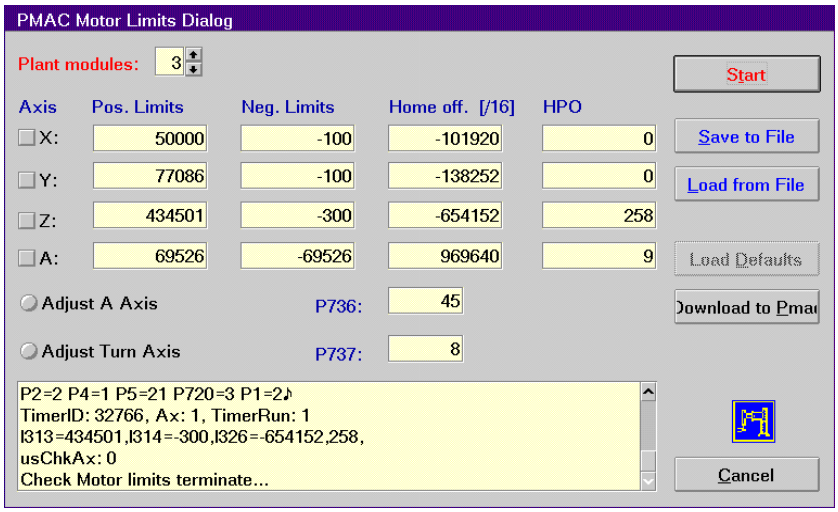


Figure 11-16: "PMAC Motor Limits Dialog" window

Information

Please carry out the following steps in the exact order given! The setting can take up to 5 minutes.

Step 7 Select the y- and the z-axis (✔).

Step 8 Select the total number of modules at **Plant modules** (this means the basic module and the add-on modules).

Step 9 Click **Start**.

Information

The acceptable values for HPO lie between 45° and 315°. Message "Check motor limits terminate...".

If you have other values:

- **either the error message "Sensor Y Axis should be moved" appears. Only the should you push the appertaining reference point switch fo the y-axis. (***Moving the reference point switch* **from page 11-27)**
- **or the error message "Sensor Z Axis should be moved" appears. Only then you should push the appertaining reference point switch of the z-axis. (***Moving the reference point switch* **from page 11-27)**

Step 10 Save the setting with **Save to File**.
The message `"Sent PMAC command "save"` and `"Check motor limits terminate..."` appears.

Information

The values will be saved in

- **the PMAC board as P-variables**

Step 11 Quit the **PMAC Motor Limits Dialog** window via **Cancel**.

11.2.9 Moving the reference point switch

Tools and aids

- 2 open-jawed wrench 17mm

Procedure

Information

Only move it when the error message "Sensor...Axis should be moved" appears whilst setting the motor limits.

Step 1 Switch off the main switch S.

Step 2 Open the guard door.

Information for y-axis

Carriage touches the hardware limit stop in the front (bumper). Check that as much as possible of the sensor surface covers the carriage area.

Information for z-axis

If possible, dont‘t move the reference point switch too far upwards. The z-axis could reach the internal limit stop before arriving at the reference point switch.

Step 3 Move the corresponding reference point switch from one limit stop to the other.

Step 4 Close the guard door.

Step 5 Switch on the main switch S3: the handling unit refers.

Step 6 Repeat the setting for the corresponding axis (axes) (*Motor limits* from page 11-25).

Initial Teach

Initial Teach prepares the values for the **Graphical Configuration**: these values are saved there.

Step 1 Start the PMMaint programm if it is not actived (click the symbol at the workshelf).

Step 2 Select **Initial Teach** command form **Installation** menu. (☞*Initial Teach* from page 4-12)

Teaching the new components

Step 1 Click in the **Pmac Maintenance** window in the **Teach** menu the **Teach Devices** command. The **Pmac Kernel Teach Dialog** window opens:

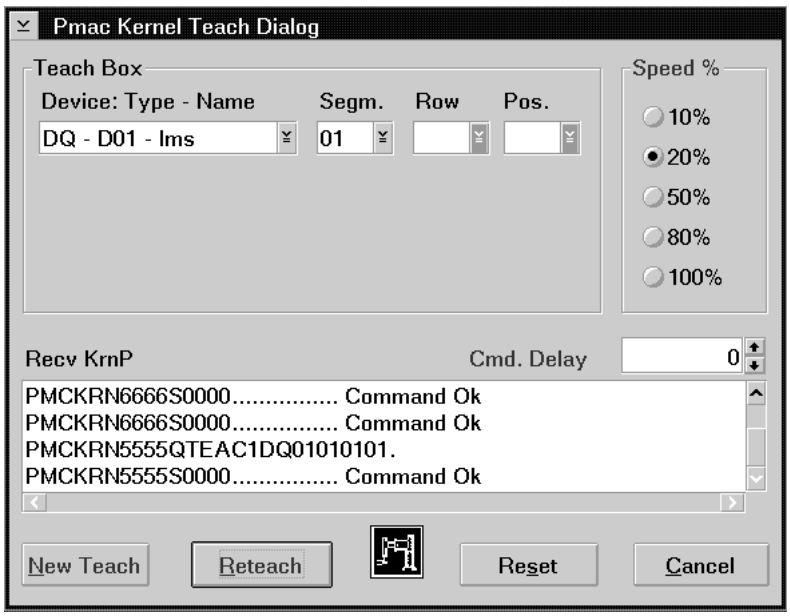


Figure 11-17: "Pmac Kernel Teach Dialog" window

Step 2 Select at **Device** the component to be taught.

Step 3 Click **New Teach**.

Step 4 Teach:

- all the components
- in every module

Step 5 Quit the **Pmac Kernel Teach Dialog** window via **Cancel**.

Step 6 Select from **Teach** menu the function **Adjust Handling** (☞*Adjust Handling* from page 4-33).

11.2.10 Software Backup

Step 1 Save following files at disk and write the changed parameters in the lists of the folder Software Backup (☞*Back up system parameters* on page 8-84).

–BACKUP.PMC
–AMUCONF.INI
–KRNREFPT.R00

12 Appendix

12.1 Terms used

AML/J	**A**utomated **M**ixed-Media **L**ibrary; AML/J software and physical archive. **/J** stands for Junior.
AMU	**A**ML **M**anagement **U**nit Central intelligence of the AML/J system. Consists of hardware and software.
AMU workspace	OS/2 program for operating the DAS system (CON.EXE).
Archive	The archive consists of -physical archive and -logical archive The physical archive consists of storage shelves for keeping the cartridges/optical disks (= media). The logical archive (archive catalogue is the assignment of the Volsers to the compartments in the physical archive.
Archive catalogue	An OS/2 database with the logical archive. Contains the assignment of the Volsers to the compartments in the physical archive as well as further important information about the media and drives.
Archive coordinates	Define the compartment of a medium in the physical archive.
Order, command	Command sent to the AML/J system: -from the host computer -direct entry by the operator through the AMU workspace
Barcode label	Label on the medium. This carries the Volsers of the medium in a form legible for the robot (barcode).
I/O unit	Input/output area. The media are inserted or rejected through the I/O unit.
Handling unit	2-axis robot
Host computer	Mainframe computer. The data of the host computer are stored in the archive of the AML/J system on the media.

Clicking	Short pressing and releasing of the mouse button.
Configuration	Determining the AML/J system. The components and their connections among one another are defined in the configuration. -Host computer -AMU -Linear racks -Handling unit -I/O units -Scanner -Drives
Linear rack	Storage archive (only one storage level)
Medium	Storage medium in the archive, e. g. magnetic tape cartridge or optical disk
Media mounting	Inserting (MOUNT) a medium in a drive is designated as mounting, removing (KEEP) a medium as demounting.
Operator	Instructed user of the AML/J system.
Problem box	Special compartments in the I/O unit: These hold: -not identified media -media in the case of a robot fault
Scratch media	Scratch media are media of the archive released for rewriting. They are used without statement of the Volsers for data output (non-specific media request).
External media	Media which are not designated with a Volser in the archive catalogue. They are processed by the DAS system through the I/O unit.
Teaching	Teaching the robot system.
Teach label	White reference marks. These are acquired spatially (accurately to 1/100 mm). They serve for calculating all points in the system which the robot must move to. The coordinates of all taught points are saved in the KRNREFPT.R0**0** file (**0** stands for the handling unit of the AML/J system).
Volser, VSN	English: **vol**ume **ser**ial number A six-digit (with leading zeroes) alphanumeric character string. It designates one medium in each case (cartridge, optical disk) in the archive. The Volser is applied to the medium as barcode label and can be read by the robot.

12.2 PMAC parameters and commands

12.2.1 Parameters

Parameter types

Table 12-1: PMAC parameter types

Parameter type	Explanation
I variable	Fixed variable for setup and personality of the board (e.g. status query)
M variable	Variable for storage localization (for user) (e. g. system parameter, gear factor, speed)
P variable	Global variable for programming (e. g. drive variable)
Q variable	Local variable (in the system of coordinates) for programming

Information

You obtain the current system status by opening

- **either the "PE.EXE" window**
- **or PMMaint menu Continuous Send and entering**
  `i5 <ENTER>`

I variable

PLC program control parameter i5

PLC program control

All PLC programs enabled by the parameter i5 are started by

- either pressing the reset button on your AMU computer
- or switching off and on the main switch S3 on the control rack

Table 12-2: PLC program control parameters

Parameter value	Meaning
i5=0	No PLC program can be activated (necessary for upload / download of programs)
i5=1	PLC program 0 ("GLOBAL.PMC") can be activated PLC programs 1 - 31 cannot be activated
i5=2	PLC program 0 cannot be activated PLC programs 1 -31 can be activated
i5=3	All PLC programs can be activated

Table 12-3: Further I_Variables

Parameter	Default	Meaning
I126		X axis home offset [16 / counts]
I226		Y axis home offset [16 / counts]
I326		Z axis home offset [16 / counts]
I426		A axis home offset [16 / counts]

M variable

Table 12-4: M variables

Parameter	Default	Meaning
M90		Software switch warning (motor binary coded e. g. motor 4 = 8)
M91		Software switch (motor binary coded e. g. motor 4 = 8)
M100	<300	DAC output (current) motor 1
M200	<2000	DAC output (current) motor 2
M300	<2000	DAC output (current) motor 3
M400	<500	DAC output (current) motor 4
M114		Axis X home
M214		Axis Y home
M314		Axis Z home
M414		Axis A home
M911		Gripper open/close home
M912		Gripper turn axis home
M901		I/O unit 1 input
M902		I/O unit 2 input
M903		I/O unit 3 input
M904		I/O unit 4 input
M905		I/O unit 5 input
M906		I/O unit 6 input
M907		24 V input
M908		Control on
M913		Crash sensor input
M914		Bow front input
M915		Bow back input
M916		Teach sensor
M933		I/O unit 1 output

Table 12-4: M variables

Parameter	Default	Meaning
M934		I/O unit 2 output
M935		I/O unit 3 output
M936		I/O unit 4 output
M937		I/O unit 5 output
M938		I/O unit 6 output
M939		Open brake
M948		Teach sensor output

P variable

P variables can also be checked and changed with the aid of the AMS software:

Step 1 Log on as **Supervisor**

Step 2 Open the "**Command - TEAC**" window via the **Service - teach singlecommand ..** menu

Step 3 Open the trace window via the **View Trace** menu and switch the KRN9-Trace on

Step 4 Enter 1P in the **Option** field in the "**Command - TEAC**" window

Step 5 Enter the required P variable in the **Source** field (e.g. 300=200000)

Table 12-5: P variables

Parameter	Default	Meaning
P230		A axis for teach point of the adjustment point
P231 .. P281		(☞ Software Backup "Newgrip coordinates")
P295		Counter integration motor current (set to 0 in the case of problems)
P297		X axis for teach point of the adjustment point

Table 12-5: P variables

Parameter	Default	Meaning
P298		Y axis for teach point of the adjustment point
P299		Z axis for teach point of the adjustment point
P300	200000	Global speed
P301		Acceleration time TA (rising -> slower)
P302		Acceleration time TS (rising -> slower)
P304	60000	Handling speed
P305		Acceleration time TA (handling)
P306		Time for S curve (handling)
P308		Z axis brake (lifting axis) open = 0, closed = 1
P345	60	Waiting time for Keep [sec.]
P380	100	Speed factor for the Y axis
P381	100	Speed factor for the Z axis
P385	0	ON_SHIP (shutoff option for the Y axis, shutting down and thus unbraked at 0, no shutdown at 1)
P736		A axis handling offset (+90 °) in 1 / 100 °
P737		C axis home offset

12.2.2 PMAC online commands

Information

Press <ENTER> after each of the following commands.

Table 12-6: PMAC commands

Command	Meaning
ver	Display of the PMAC operating system version
<Ctrl>a	Close control loop for all axes (precondition i5=1)
b10r	Selection and start of program 10 (homing all axes)
b104r	Selection and start of program 104 (gripper axis homing e. g. after crash!)
f	Following error of the activated axis
<Ctrl>k	Open control loop for all axes
p	Current position of the activated axis [counts]
#x	Selection of a direct current servomotor (x= motor number)
$$$	Reset
$$$***	**ATTENTION!** **Deletes all programs and parameters on the PMAC board.**

12.2.3 Component types

Storage units

Table 12-7: Types of the storage components

Type	Component	PMAC value
L3	Shelf over one flat drive rack	102
L4	Shelf over two flat drive racks	
L5	Shelf (standard, without drive or I/O unit)	
L6	Shelf over four flat drive racks	
L7	Shelf over five flat drive racks	
L8	Shelf next to the I/O unit/C	
L9	Shelf over three flat drive racks	
LA	Shelf over one high drive rack	
LB	Shelf over two high drive racks	
LC	Shelf over three high drive racks	
LD	Shelf next to the I/O unit/E	
LE	Shelf over the I/O unit/E	

I/O unit

Table 12-8: Types of the I/O units

Type	Component	PMAC value
P5	Problem box over I/O unit/C	124
P7	Problem box over I/O unit/E	126
E5	I/O unit/C	114
E6	I/O unit/D (HighCap)	115
E7	I/O unit/E	116

Drives

Table 12-9: Drive types

Type	Manufac-turer	Medium	AMU type	PMAC type
DLT7100 ER 90	AMPEX	D2-S	DA	30
DST 310	AMPEX	D2-S / D2-M	DA	30
BetaCAM PBC 2800	BETACAM	BetaCAM - Small / Large	D5	39
6380-B, 18 track	COM-PAREX	3480	D2	11
6390-B02, 18 track	COM-PAREX	3480	D3	12
6390-B04, 18 track	COM-PAREX	3480	D3	12
6390-B20, 36 track	COM-PAREX	3490	D3	12
6390-B40, 36 track	COM-PAREX	3490	D3	12
6390-C10, 36 track	COM-PAREX	3490	D2	11
6390-C20, 36 track	COM-PAREX	3490	D2	11
3490-TA91	DIGITAL	3480	D9	35
ER 90-TM	ADIC	D2-S / D2-M	DA	30
8590, 128 track	ADIC / GRAU (OEM)	3590	DN	32
DLT 2000	ADIC / GRAU (OEM)	DLT	DE	17
DLT 4001	ADIC / GRAU (OEM)	DLT	DE	17

Table 12-9: Drive types

Type	Manufac-turer	Medium	AMU type	PMAC type
DLT 4002	ADIC / GRAU (OEM)	DLT	DE	17
DLT 7001	ADIC / GRAU (OEM)	DLT	DE	17
8900T Mammoth	EXABYTE	8MM	DC	15
M2483 (DIANA-2),36 track	FUJITSU	3490	DQ	21
M2485 B / H	FUJITSU	3480	DQ	21
M2488C	FUJITSU	3480	DQ	21
7480-B22, 18 track	HDS	3480	D2	11
7490-B02, 18 track	HDS	3480	D3	12
7490-B04, 18 track	HDS	3480	D3	12
7490-B20, 36 track	HDS	3490	D3	12
7490-B40, 36 track	HDS	3490	D3	12
7490-C10, 36 track	HDS	3490	D3	12
7490-C20, 36 track	HDS	3490	D3	12
7492E, MT530-20W (C22)	HDS	3490	DQ	21
MT550; 5394	HDS	3490	DQ	21
2600fx (C1114G; 2,6GB)	HP	OD-512	DP	25
6400 / 1300S (DDS-1)	HP	4MM	DF	29
6400 / 4000 DC (DDS-2)	HP	4MM	DF	29
OD 1300T (1,3GB)	HP	OD-512	DP	25
OD 6300 650A	HP	OD-512	DP	25
7208-011	IBM	8MM	DC	15
3480-B02, 18 track	IBM	3480	D9	35

Table 12-9: Drive types

Type	Manufac-turer	Medium	AMU type	PMAC type
3480-B04, 18 track	IBM	3480	D9	35
3480-B10, 18 track, no flap	IBM	3480	D9	35
3480-B20, 18 track, no flap	IBM	3480	D9	35
3480-B22, 18 track, no flap	IBM	3480	D9	35
3490-B20, 36 track	IBM	3490	D9	35
3490-B40, 36 track	IBM	3490	D9	35
3490-C10, 36 track	IBM	3490	D9	35
3490-C11, 36 track	IBM	3490	D9	35
3490-C22, 36 track	IBM	3490	D9	35
3490-D31, 18 track	IBM	3480	D9	35
3490-D32, 18 track	IBM	3480	D9	35
3490-D41, 36 track	IBM	3490	D9	35
3490-D42, 36 track	IBM	3490	D9	35
3590 B1A,128 track	IBM	3590	DN	32
DDS 7206 005	IBM	4MM	DF	29
5480-SP2, 18 track	MEMOREX	3480	D9	35
5490-B02, 18 track	MEMOREX	3480	D9	35
5490E	MEMOREX	3480	D9	35
MOUNTAINGATE RSP- 2150	METRUM	VHS	DV	22
T490E-DS-S	OVER-LAND	3480	DU	21
LMS TD3610, 36 track	PHILIPS	3490	DQ	21
NCTP - L - DE W	PHILIPS	NCTP	DQ	21
RF 7010X, MF	PLASMON	OD-R	DO	23
RF 7030e, MF	PLASMON	OD-R	DO	23

Table 12-9: Drive types

Type	Manufac-turer	Medium	AMU type	PMAC type
RF6950e	PLASMON	OD-512	DP	25
PX-12CSe (12X)	PLEXTOR	CD-Caddy	DW	37
3580-B02, 18 track	SNI	3480	D9	35
3580-B04, 18 track	SNI	3480	D9	35
3580-B10, 18 track, no flap	SNI	3480	D9	35
3580-B20, 18 track, no flap	SNI	3480	D9	35
3580-B22, 18 track, no flap	SNI	3480	D9	35
3588-GL -M1 TwinPeak, 36 track	SNI	3490	DS	14
3590-B20, 36 track	SNI	3490	D9	35
3590-B40, 36 track	SNI	3490	D9	35
3590-C10, 36 track	SNI	3490	D9	35
3590-C11, 36 track	SNI	3490	D9	35
3590-C22, 36 track	SNI	3490	D9	35
3590-D31, 18 track	SNI	3480	D9	35
3590-D32, 18 track	SNI	3480	D9	35
3590-D41, 36 track	SNI	3490	D9	35
3590-D42, 36 track	SNI	3490	D9	35
MK13	SNI	8MM	DC	15
OS 13 (1,3GB)	SNI	OD-512	DP	25
OS 25, (HR-650)	SNI	CD-Caddy	DW	37
OS 48 (2,6GB)	SNI	OD-512	DP	25
PXT 0901	SNI	3490	DQ	21
W2001	SNI	CD-Caddy	DW	37
AKEBONO (GY-10D)	SONY	DTF-S/L	DX	38

Table 12-9: Drive types

Type	Manufac-turer	Medium	AMU type	PMAC type
BVW-75P	SONY	BetaCAM - Small/ Large	D5	39
DVW-500P	SONY	Digital Bet-aCAM - Small/ Large	D5	39
DVW-A500P	SONY	Digital Bet-aCAM - Small/ Large	D5	39
NWP - 559	SONY	OD-512	DP	25
SVO-5800P / SVP-5600P	SONY	VHS	DV	22
SVO-9620	SONY	VHS	DV	22
4480-M22, 18 track	STK	3480	DL	19
4480-M24, 18 track	STK	3480	DL	19
4490 Silverton, 36 track	STK	3490	DL	19
4890 TwinPeak, 36 track	STK	3490	DS	14
9490 TimberLine, 36 track	STK	3490	DL	19
SD-3 (Redwood)	STK	SD-3	DL	19
GigaBurst	STORM	OD-512	DP	25
5180, 18 track, no ACL	TANDEM	3480	DT	20
5190, 18 track	TANDEM	3480	DU	21
5194, 36 track	TANDEM	3490	DU	21
5196, 36 track	TANDEM	3490	D9	35

Barcode scanner

Table 12-10: Options of the barcode scanner

Type	Component	PMAC value
S0	Barcode scanner (option abortion of the command after barcode reading error)	
S1	Barcode scanner (option continuation of the command after barcode reading error + positive acknowledgement at the host)	

Media types

Table 12-11: Media types

Type	Description	Manufac-turer	AMS type	PMAC type
3480	1/2" Tape (different length available)	3M	C0	1
3490	1/2" Tape (different length available)	3M	C0	1
3490 E	1/2" Tape	3M	C0	1
3490E D-3	1/2" Tape (STK-Red-wood)	STK	C0	1
3590	1/2" Tape (NTP=>New Tape Product)	3M	C2	10
4MM-60M	Digital Audio Tape (DAT)	Fuji	V2	7
4MM-90M	Digital Audio Tape (DAT)	Fuji	V2	7
4MM-120M	Digital Audio Tape DDS-2 (DAT)	Fuji	V2	7
4MM-125M	Digital Audio Tape DDS-3 (DAT)	Fuji	V2	7
8MM	8 MM tape (different length available)	3M	V1	6
8MM-112M	8mm Tape- 112m	EXABYTE	V1	6
8MM-160M	8mm Tape- 160m	EXABYTE	V1	6
8MM-54M	8mm Tape- 54m	EXABYTE	V1	6
Audio - car-tridge	Standard Audio Car-tridge		VA	17
BetaCAM - Large	Analog Tape Format	SONY	V9	16
BetaCAM - Small	Analog Tape Format	SONY	V8	15
CD-Caddy	CD with enclosure		C6	12
D1-M	D1 medium tape	ADIC	V3	8

Table 12-11: Media types

Type	Description	Manufac-turer	AMS type	PMAC type
D1-S	D1 small tape	ADIC	V4	9
D2-M	D2 medium tape	ADIC	V4	9
D2-S	D2 small tape	ADIC	V3	8
Digital Beta-CAM - Large	Digital Tape Format (like DTF-L)	SONY	V9	16
Digital Beta-CAM - Small	Digital Tape Format (like DTF-S)	SONY	V8	15
DLT Tape III XT	Digital Linear Tape	maxell	C1	4
DLT Com-pacTape-III	Digital Linear Tape	digital	C1	4
DLT Com-pacTape-IV	Digital Linear Tape	Quantum	C1	4
DTF-L	DTF-Large tape, (Dig-ital Tape Format)	SONY	V7	14
DTF-S	DTF-Small tape, (Dig-ital Tape Format)	SONY	V6	13
OD-512	Optical Disk 5 1/4"	3M	O1	3
OD-R	Optical Disk 5 1/4"	Reflection	O0	2
SD-3	1/2" Tape (STK-Red-wood)	STK	C0	1
S-VHS	Super - Video Home Service	SONY	V0	5
TRAVAN TR-1	Streamer Tape	3M	V5	11
TRAVAN TR-2	Streamer Tape	3M	V5	11
TRAVAN TR-3	Streamer Tape	3M	V5	11
TRAVAN TR-4	Streamer Tape	3M	V5	11
VHS	Video Home Service	3M	V0	5

12.3 Lubricants

The following table contains the approved lubricants.

Table 12-12: Lubricants

Nat ure	Type (manufac-turer)	Article No.	Delivery unit (DU)	Use	Waste key
Oil	Structovis EHD Klüber	205 000 270	1 piece	Lubricators for guide rods on the carriage below (2 DU/system)	54113 ☞ 2 below
	Isoflex EHD Klüber		0.5 litres	Guide rods above on the carriage cabinet	54113 ☞ 2 below
	ALRO OL 153 S	178 000 080		I/O unit/E guide groove of the shutter	
Grea se	Retinax EP 2 (Shell)	178 000 001	Cartridge 400 g	Installation grease	54 202 ☞ 1 below

Explanations for the waste key

1. Dispose of after consultation with the communal authorities as hazardous waste (incineration or special refuse tip).
2. After consultation with the communal authorities dispose of as old oil of category I (suitable for recycling).

12.4 Tools and aids

Measuring instruments

Table 12-13: Measuring instruments

Order number	Designation
170000007	Clavis belt tension meter (30..300 Hz) (for measuring belt tension axis 2 (Y))
171000048	Measuring point adapter red for voltmeter
171000049	Measuring point adapter blue for voltmeter
-	Voltmeter
-	Machine spirit level
-	Torque wrench (up to 25 Nm)
-	Small spirit level

Tools

Table 12-14: Tools

Order number	Designation
-	Small Philips screwdriver
-	Medium POZIDRIVE screwdriver (battery screw-driver)
-	Small slotted head screwdriver
-	Medium slotted head screwdriver
-	2.5 mm Allen key
-	3 mm Allen key
-	4 mm Allen key
-	5 mm Allen key
-	6 mm Allen key
-	8 mm Allen key
-	9 mm wrench

Table 12-14: Tools

Order number	Designation
-	10 mm wrench
-	13 mm wrench
-	17 mm wrench
-	19 mm wrench (ground flat)
-	24 mm wrench
-	4.5 mm socket wrench
-	Socket wrench
-	Ratchet with socket 10 mm
-	Pointed pliers
-	Small side cutters
-	Rubber hammer

Aids

Table 12-15: Aids

Order number	Designation
205 002 223	Synchronizing pulley extractor
15S410009	Archive door safety switch bridging over
-	Sharp knife
-	Fine grindstone (oil stone)
-	Cable ties (1 pack)
-	Felt pen (fine, waterproof)
-	Tightening strap
-	Blue Loctite (removable screw retention)
-	Soft cloth or paper

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