MAINTENANCE GUIDE

AML/2

AUTOMATIC

MEDIA-

LIBRARY-

/2

Order No. DOC B00 019-B

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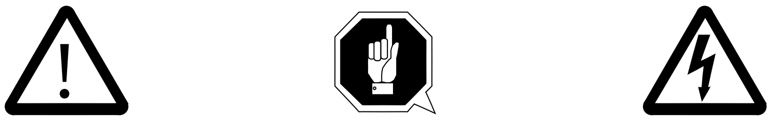
1 Before You Begin Working with AML/2

1.1 Intended Audience

This manual contains all information and instructions you need for maintenance of the AML/2 system.

1.2 Explanation of Symbols and Notes

The following symbols and highlighted passages draw attention to important information.



Explanations of these symbols see chapter „Hazard Alert Messages" (☞ page 3 - 2).

Information

Information important for understanding this introduction.

<KEY>	Key on the keyboard of the AMU processor
↑	Key or key combination on the PHG (robot control hand terminal) e. g. for "Up" you have press together Shift and 3)
<1> + <2>	Press these keys simultaneously
„ABCD"	Headline, e. g. chapter 3 „For Your Safety" Special term, e. g. „Manage Users" Filename, e. g. „AMUINST.EXE"
ABCD	Terms appearing on the AMU operating console
ABCD	Command line appearing in the OS/2 input window,

e. g. `[C:\]cd amu`

☞ Reference to a description
- on another page of this manual
  (☞ page 3 - 1)

1.3 Associatted Documents

DOC B00 001	AML/2 Operator Guide
DOC B00 005	AML/2 System Log Book
DOC D00 017	AML/2 Software Backup
DOC E00 003	AMU Installation Guide
DOC E00 005	AMU Reference Guide
DOC E00 007	AMU Problem Determination Guide
DOC E00 014	AML Controller User Guide

1.4 Assistance

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).

ADIC/GRAU Storage Systems GmbH
Eschenstrasse 3

89558 Boehmenkirch
Germany

ADIC
10949 East Peakview avenue
Englewood, CO 80112
U.S.A.

We would be pleased to help you further.

Telefax:	**+49 (0) 6196-59 08 69**	
Email:	**techsup@adic.com**	
Telephone:	**1 800 827 3822**	**North America**
	+49 6142 992364	**Germany**
	00800 9999 3822	**(the rest of the world)**

1.5 About this Maintenance Guide

This manual contains all information and instructions you will need for safe maintenance of the system.

You have received comprehensive training at ADIC or ADIC/GRAU Storage Systems and can operate and service the AML/2 system without endangering yourself or others.

WARNING!

Operation and maintenance of the AML/2 system by untrained persons can lead to dangerous situations.

The consequence could be severe or fatal injury caused by moving parts or contact with live connections.

Introductory training at ADIC or ADIC/GRAU Storage Systems therefore is an indispensible precondition for all who work with the AML/2 system!

You are servicing the plant and are therefore also repsonsible to ensure only trained personnel authorized by ADIC or ADIC/GRAU Storage Systems carries out the following on the equipment

- prepare for operation
- set-up
- start
- operate
- shut down
- maintain
- restart

Refer to the Operator Guide if there is an operating problem.

If you cannot solve the problem

- consult a trained specialist
- consult the service partner, ADIC or ADIC/GRAU Storage Systems

Please note however:

WARNING!

You may carry out some work and adaptations only if you have the appropriate qualifications and training!

And most importantly:

Be sure to read the chapter “For Your Safety”, before you begin working with the equipment!

1.6 Copyright

1.7 Product Observation

We are obliged by law to monitor our products even **after** delivery to the customer.

Therefore please communicate every point of interest.

- modified set-up data
- experiences with the product
- repetitive faults
- difficulties with this manual

ADIC/GRAU Storage Systems GmbH
Eschenstrasse 3

89558 Boehmenkirch
Germany

ADIC
10949 East Peakview avenue
Englewood, CO 80112
U.S.A.

Telefax:	**+49 (0) 6196-59 08 69**	
Email:	**techsup@adic.com**	
Telephone:	**1 800 827 3822**	**North America**
	+49 6142 992364	**Germany**
	00800 9999 3822	**(the rest of the world)**

2 Description AML/2

2.1 Names and Acronyms

For same components will be used different names in Europe and North America

Acronym Europe	**Acronym North America**	**Description**
AML/2		**A**utomated **M**ixed-Media **L**ibary **/2**
AMU		AML Management Unit (Archive Management Unit)
AMS		AML Management Software (Archive Management Software)
DAS		Distributed AML Server
HACC	HCC	Host AML Communication Control
I/E/F		I/O Unit (Unit for Insert, Eject, Forein Media)
PMAC		Programmable Multi Axis Controller

2.2 Technical Data

2.2.1 Quadro tower, linear rack, robot

Measurements

		12 R	15 R	18 R
	length x depth	**needed height of room**		
Quadro tower	2,24 m x 2,24 m (7,35 ft x 7,35 ft)	2,05 m (6,73 ft)	2,43 m (7,97 ft)	2,80 m (9,19 ft)
linear rack	1,12 m x 0,25 m (3,7 ft x 0,82 ft)			
robot	-			

Weight with/without media (3480/3490)

	12 R		15 R		18 R	
Quadro tower	2540 kg	3500 kg	2600 kg	3800 kg	2660 kg	4100 kg
linear rack	105 kg	135 kg	135 kg	175 kg	165 kg	215 kg
robot	260 kg	-	285 kg	-	310 kg	-

Maximum floor load

	12 R	15 R	18 R
Quadro tower	550 kg/m^2		
linear rack	400 kg/m^2		
robot			

2.2.2 I/O units, control cabinet, AMU

Measurements

Information

The following components have all the same height.

	length x depth	needed height of room
I/O unit/A	0,75 m 0,77 m (2,46 ft x 2,53 ft)	2,05 m (6,73 ft)
I/O unit/B	0,75 m x 0,3 m (2,46 ft x 0,98 ft)	
control cabinet	0,6 m x 0,6 m (1,97 ft x 1,97 ft)	
AMU	0,6 m x 0,6 m (1,97 ft x 1,97 ft)	

Weight with/without media (3480/3490)

	60 positions		120 positions		240 positions	
I/O unit/B	135 kg	152 kg	155 kg	186 kg	-	-
I/O unit/A	-	-	300 kg	331 kg	450 kg	509 kg

control cabinet	250 kg
AMU	250 kg

2.2.3 Electrical Data

Equipment	European Values	North America Values
Power entire system	400 V + 6 %, -10% 1, N, PE	208 V ± 10% 1, N, PE
Fusing (customer´s site installation) system with up to 3 Quadrotower	3 x 16 A MT wire fuse medium-blow	3 x 20 A wire fuse slow blow
system with more then 3 Quadrotower or twin	3 x 25 A MT wire fuse medium-blow	
Voltage, power section	400 V =	
Frequency	50 Hz	60 Hz
Control voltage	24 V =	
Enclosure type	IP 50	

Power drain and heat loss

	power drain	heat loss
single-AML	max. 3 QT: 1,2 kVA	1,1 kW / 4000 kJ/h
	more then 3 QT: 1,6 kVA	1,4 kW / 5000kJ/h
twin-AML	max. 3 QT: 1,7 kVA	1,5 kW / 5500 kJ/h
	more then 3 QT: 2,2 kVA	2,0 kW / 7200 kJ/h

2.2.4 Noise

entire system	65 dB (A)

2.2.5 Climatic conditions

temperature	10 .. 32 °C
humidity	15 .. 80 %

2.3 Layout of Your AML/2 System

2.4 Examples of System Layouts

Symbol explanation:

AMU	AML management unit and operating cabinet
I/O	I/O unit
DC	Drive controller
D	Drive for cassette tapes
OD	Drive for optical disks
QT	Quadro tower
RS	Robot system
CC	control cabinets with control and supply components
MR	Maintenance room

2.4.1 Single-AML

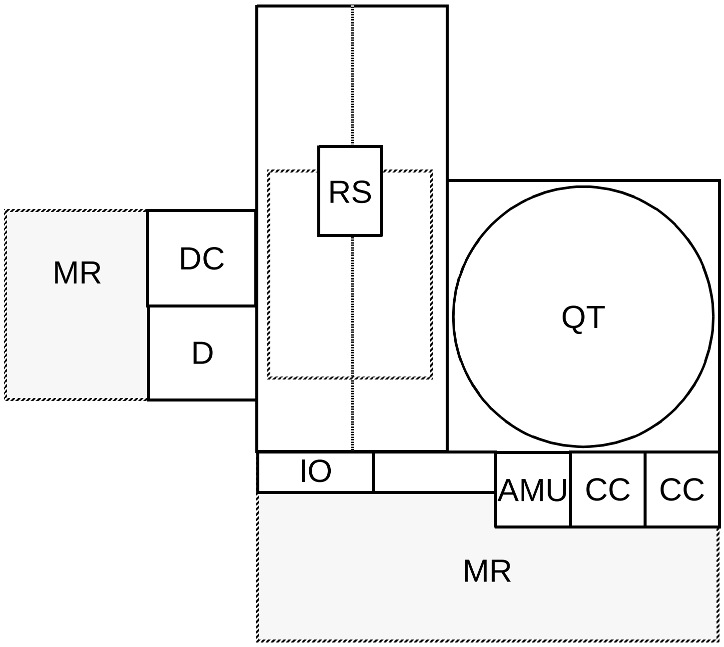


Fig. 2-1: Layout Example Single-AML

2.4.2 Twin-AML

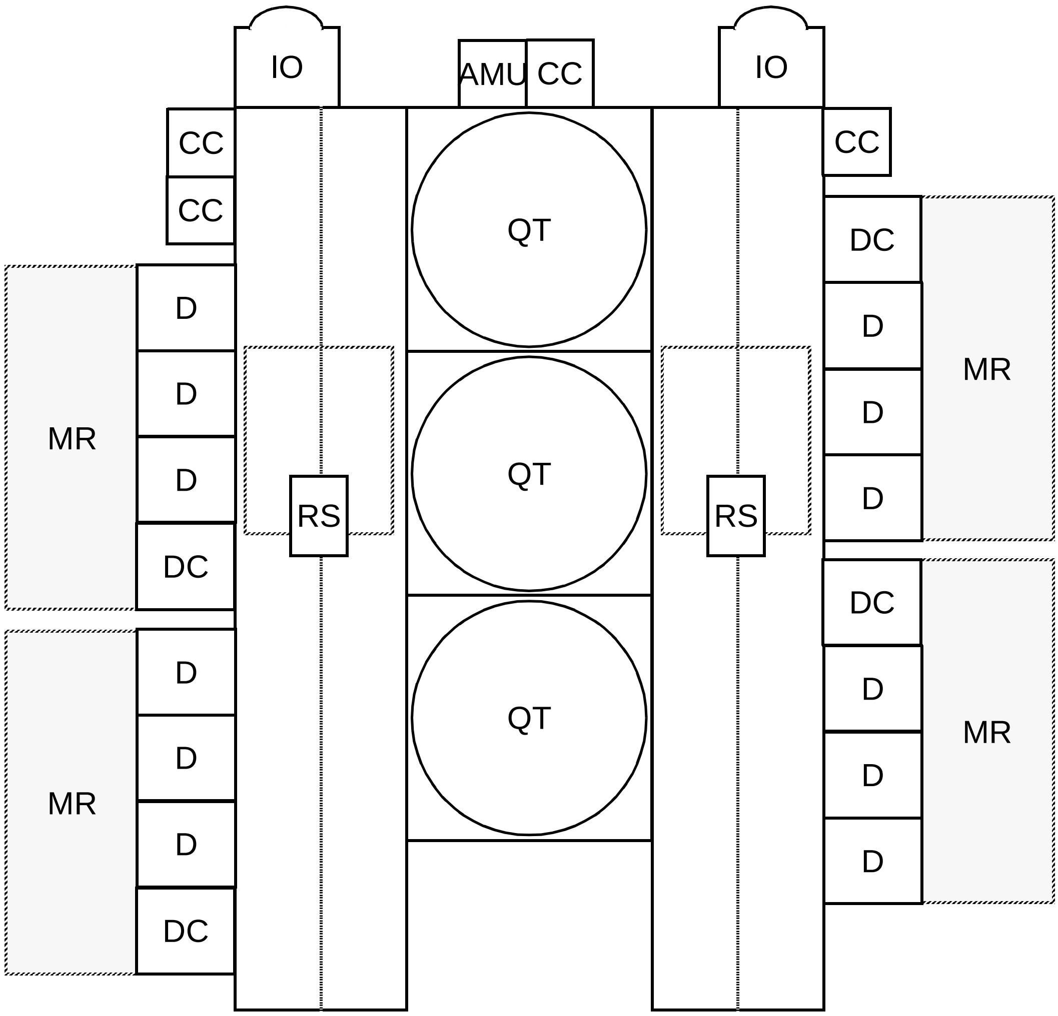


Fig. 2-2: Layout Example Twin-AML

3 For Your Safety

Information

In addition to the safety instructions in this manual, local and professional safety rules apply.

Avoid hazards when operating the equipment

- by safety-conscious behavior
- by careful action

Read and carefully observe the hazard alert information in this manual and in the Operator Guide.

ATTENTION!

Knowing and observing the instruction are indispensible for safe operation of the AML/2 system.

3.1 Intended Use

The offer and the order confirmation as well as the purposes for use defined in these documents are part of the AML/2 documentation. Any use other than the specified, is not considered intended use.

This equipment is designed for processing of

- magnetic tape cartdridges
- optical disks
- VHS-cartdridges

Any other application is not considered intended use.

ADIC/GRAU Storage Systems shall not be held liable for damage arising from unauthorized use of the system. The user assumes all risks in this aspect.

Intended use also includes

- observing the instructions supplied with the equipment (Operator and Maintenance Guides)
- observing inspection and maintenance instructions

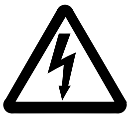
3.2 Hazard Alert Messages

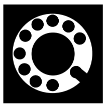
We classify the hazards in several categories. The following table shows the relation of symbols, signal words, the actual hazard, and its (possible) consequences.

Symbol	Damage to...	Signal Word	Definition	Consequences
	People	**DANGER!**	imminently hazardous situation	death or serious injury (maiming)
		WARNING!	potentially hazardous situation	possibly death or serious injury
		CAUTION!	less hazardous situation	possibly minor or moderate injury
	Property	**ATTENTION!**	potentially damaging situation	possibly damaging to: • the product • its environment
		Information	tips for users and other important/useful information and notes	no hazardous or damaging consequences for people or property

3.3 Further Symbols

The table below lists all symbols used in this manual and explains their meaning.

Symbol	Damage to ...	Signal Word	Definition	Consequences
	People	**WARNING! Hazardous Voltage!**	potentially hazardous situation replaces the pictorial  hazard of electric shock	possibly death or serious injury After an EMER-GENCY STOP and also after swit-ching off the main switch, voltage can still be present at the places mar-ked with this sym-bol. Hazard of fatal electric shock.
	Personen	**CAUTION! Laser Light! Do not stare into beam**	less hazardous situation: laser light	possibly minor or moderate injury lase light during opening
	Personen	**CAUTION! Danger Light!**	less hazardous situation: laser light	possibly minor or moderate injury use of controls, adjustments, or performance of procedures other than specified may result in hazar-dous laser light radiation exposure

Symbol	Damage to ...	Signal Word	Definition	Consequences
	**People**	-	less hazardous situation: wear safety glasses	possibly minor or moderate injury
	**People**	-	less hazardous situation: wear safety shoes	possibly minor or moderate injury
		-	identifies the address of your contact person	no hazardous or damaging consequences for people or property

3.4 Area of Application

This information applies to the entire AML/2 system.

Further safety instructions for components used in the equipment are not invalidated by these instructions.

3.5 Intended Audience/Authorized Persons

3.5.1 Intended Audience

This Maintenance Guide is intended for **service- and maintenance work**. Consequently, the hazard alert messages apply only to maintenance of the equipment.

Authorized persons for service and maintenance are the trained specialists of the customer and the maintenance personnel of the service partner.

3.5.2 Authorized Personnel

Only **trained** specialists (maintenance training) are allowed to maintain and repair the AML/2 system. The names of trained specialists are entered into the system logbook.

Knowledge of safety rules for work on electrotechnical systems is therefore expected.

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

adic

System Logbook

Order-No.:
Customer:
Address:
Contact Person: **Tel.:** **Fax:**

Trained staff of customer (VBG 4 / VDE 0105 / VDI 2853) :

Name:	Signature:	Name:	Signature:

Service-Partner: **Tel.:** **Fax:**

Trained specialists of the service partner (VBG 4 / VDE 0105 / VDI 2853):

Name:	Signature:	Name:	Signature:

Fig. 3-1: System Logbook

3.6 Guards

The system is equipped with the following guards:

- monitored access to the archive
- <EMERGENCY STOP>
- monitored guard door on Quadro tower
- operating mode selector switch

3.6.1 Access to the Archive

Inside the archive on new systems an <EMERGENCY STOP> button is located on the inside of the I/O unit.

The archive is completely enclosed in a housing. The only access to it is a monitored guard door. The interlock is active when the main switch has been switched on.

The guard door cannot be opened in operating mode “AUTO”.

The housing around the archive serves as a **separating guard** according to VDI 2853. It separates the danger area of the AML/2 system from the normal working area.

The danger area (archive) of the AML/2 system is the area in which persons could be injured due to hazardous movements of the robot or the storage towers.

Hazardous movements can be:

- expected movements
- unexpected movements

The guard door can be opened from the outside only with a key. The authorized person is responsible for this key.

WARNING!

In the archive, movements of components can cause serious injury.

Access to this area is therefore restricted to authorized persons. Persons who have not been trained in the use of the system may only enter the archive under supervision.

Access to the archive is allowed only

- **during test operation with reduced speed and operation with PHG manual control**
- **in the operating mode “EMERGENCY” after the key has been removed from the operating mode selector switch**
- **after switching off the main switch and**
- **securing it against being switched on again**

Unauthorized persons are especially at risk in the danger area since they

- are not trained in operating the system
- are not aware of the hazards
- cannot correctly appraise the reactions of the system

3.6.2 <EMERGENCY STOP> Buttons

All <EMERGENCY STOP> buttons (operating panel, I/O unit, archive, PHG...) have the same function: EMERGENCY STOP switches off the output electronics. All movements of the robot system and the storage towers stop immediately.

When persons or property are at risk immediately press the nearest <EMER-GENCY STOP> button.

Moving parts stop at once.

WARNING!
Hazardous Voltage!

Pressing an <EMERGENCY STOP> button will not render the entire AML/2 system voltageless. Only the drive amplifiers are switched off.

Emergency stop does not switch off:

- the control units of the robot and the storage towers
- the AMU
- the drives
- the compressed air supply

Shut off the power supply to these components at a suitable point (e. g. connecting plug or switch)!

The following components are no part of the main switch circuit:

- AMU processor
- drives
- compressed air

ATTENTION!

If the <EMERGENCY STOP> buttons are frequently used contrary to their purpose, just to stop the system, this may lead to:

- **increased wear of mechanical parts**
- **damage to electronic and electric components of the AML/2 system**

Do not use the <EMERGENCY STOP> buttons to stop the normal operation of the AML/2 system.

Stop the system only with the appropriate AMU or host computer commands (☞ HACC/ROBAR)!

ADIC/GRAU Storage Systems will not be responsible for damages caused by improper use of the <EMERGENCY STOP> buttons. The risk lies entirely with the user.

WARNING!

Movement of components inside the archive can cause serious injury.

Before releasing the <EMERGENCY STOP> buttons and before starting the AML/2 system, ensure that the start will not endanger persons or property!

3.6.3 Operating Modes of the AML/2 System

Operating mode “AUTO”

In the “AUTO” mode the host computer controls the AML/2 system.

WARNING!

Movements of components in the archive can cause serious injury.

In “AUTO” mode nobody must be inside the archive.

Before starting “AUTO” operation ensure nobody is in the archive.

- Lock the operating mode selector switch in position “AUTO”.
- Carefully guard the key or keep it with you always.

The archive access interlock is active as soon as the main switch has been switched on. All other guards are active as soon as the luminous push-button <CONTROL ON> has been pressed.

Information

This operating mode is the precondition for starting the AML/2 system.

Operating mode “MANUAL”

“MANUAL” operation is intended for

- manual eject of media
- manual operation of drives
- automatic movement of storage towers

ATTENTION!

Manual ejection changes the archive catalog!

In this operating mode personnel listed in the system logbook (trained persons and trained specialists) are allowed to work inside the archive.

WARNING!

The door interlock of the archive access is not active in this operating mode.

- Lock the operating mode selector switch in position “MANUAL”.
- Safely guard the key or keep it with you always.

The robot system is shut down.

The guard doors of the Quadro towers are locked during movements.

Operating mode “EMERGENCY”

The operating mode “EMERGENCY” is intended for

- manual output of media
- manual operation of drives
- In this operating mode, personnel listed in the system logbook (trained persons and trained specialists) are allowed to work inside the archive.

ATTENTION!

Manual ejection changes the archive catalog!

WARNING!

The door interlock of the archive access is not active in this operating mode.

- Lock the main switch in position “OFF”.
- Safely guard the key or keep it with you always.

The robot system is shut down.

The guard doors of the quadro towers are not locked.

3.6.4 Guard Door of Quadro Tower

In the operating mode “AUTO” the guard door of the quadro tower

- must be open (AML/2 system).
- must be closed (AML/E system).

When the Quadro tower moves the guard door is locked.

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

Information for AML/2 twin systems

If both robots are to run in the “AUTO” operating mode, the guard doors must be open on both sides.

If one robot is to run in the “AUTO” operating mode and the other in the “MANUAL” operating mode, the guard doors must be closed on the “manual” side.

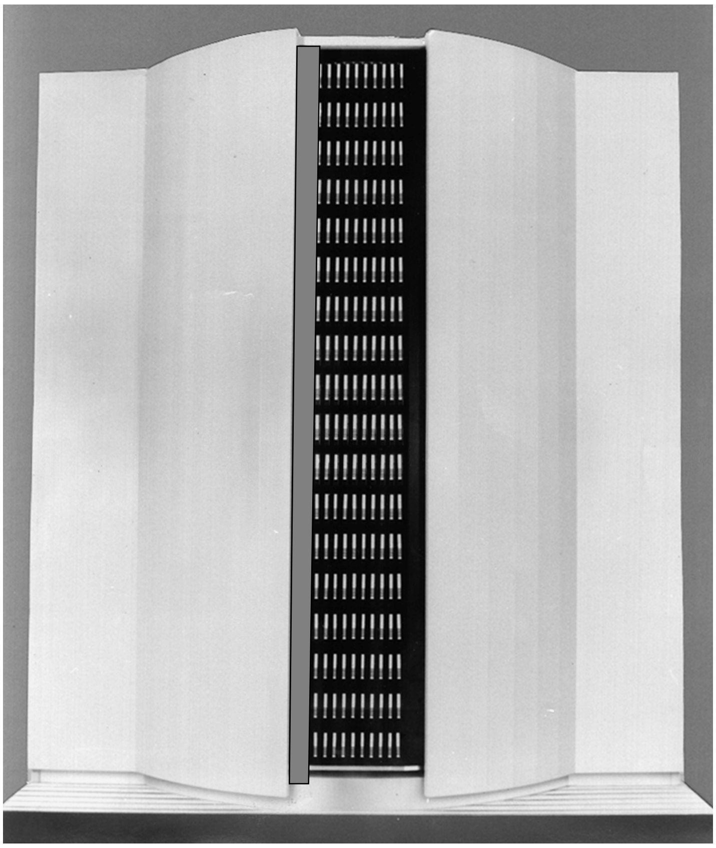


Fig. 3-2: Quadro tower Guard Doors

3.7 Before Working on the Equipment

DANGER!

Before commencing work, familiarize yourself with the location of

- **the <EMERGENCY STOP> buttons**
- **the main switch**

Never put gaurds out of operation other than instructed.

Information

Bridging of such guards is forbidden and lead to legal prosecution!

- Before commencing with maintenance or repair work switch the AML/2 system off with the main switch.
- Secure the main switch with a padlock against switch-on.
- Carefully guard the key or keep it with you always.

All drive units and all hazardous voltages are switched off.

Put the yellow sign with following text onto the system:

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!

Fig. 3-3: Warning Sign

Proceed with utmost care, if you do not switch the system off with the main switch because of required work (e. g. functional checks).
For such work, apply the described operating modes and measures before starting work (☞ beginning of respective chapters).

3.8 Before Restarting the Equipment

WARNING!

Movement of components inside the archive can cause serious injury.

Before starting the AML/2 system, ensure that nobody is inside the archive.

3.9 Working on Live Parts

DANGER!

Contact with live parts can cause severe or fatal burns and internal injury as the consequences of electric shock. After contact with live parts people often cannot by themselves break loose from the part.

A second person must stand near the main switch to be able to switch it off immediately in a hazardous situation.

Components worked on must be live only when this is specifically required.

The main switch and the push-button <SYSTEM LIGHTING> are live even when the main switch is shut off. When working on these parts disconnect the plug X1B on the connecting panel of the operating cabinet (☞ page 10 - 6).

Before working on other electric components switch off power with the main switch and secure the switch with a padlock against power-up.

Carefully guard the key or keep it with you always.

Work on live parts of the equipment must be authorized by your superior.

When carrying out such work, be sure to observe the following

- the accident prevention rules (eg VBG 4)
- the standard VDE 0105
- the following points:

Use only suitable tools and measuring devices in good working condition.

Check the measuring devices for correct adjustment of measuring ranges.

Work with one hand only. This can prevent injury to internal organs in case of electric shock, because the electric circuit will not be closed (through both arms and the body).

Avoid contact with conducting floors (especially of metal) or equipment parts.
If necessary, cover the working area with suitable protective rubber mats.

DANGER!

Never assume a circuit is voltageless - always check it for your safety!

DANGER!

Remove maximum 1 rack from the control cabinet. The cabinet can fall over.

3.10 Mechanic Maintenance Work

Observe the following:

- where are the escape routes and emergency exits - be sure to keep these free of obstacles
- keep dismounted machine components and other parts safely and inaccessible for unauthorized persons
- keep the equipment clean during work, be sure to tidy up carefully afterward

After maintenance be sure to reinstall safety provisions that had been removed for the maintenance job, such as:

- covers
- harzard alert messages
- warning signs
- grounding wires

Your clothing must be in agreement with the safety rules. It must

- not have metal fasteners
- should be so close-fitting that it cannot be caught in moving machine parts

Button up the sleeves or roll them up.

Put the ends of a scarf you wear into the clothing.

For long hair use a protection that fully covers it.

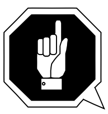
Take off your watch, rings, jewelry etc.

Wear safety glasses when

- using a hammer
- using an electric drill
- working on springs, retaining rings etc.
- soldering, working on cables
- cleaning with chemical agents
- changing oil (hazard of oil splashes)

all work that endangers the eyes

When handling heavy components wear safety shoes.



ATTENTION!

Refrain from any action that could endanger people, or that could damage installations or equipment.

3.11 Safety Check

Check all guards every 6 months:

- <EMERGENCY STOP> button
- door interlocks
  - archive access
  - Quadro tower guard door
- operating mode selector switch

4 About the AML/2 System

4.1 General

The name **AML/2** is an acronym made up of the first letters of

- **A**utomatic
- **M**ixed-Media
- **L**ibrary
- **/2** means version 2 of the system

The host computer is linked to the AML/2 system by the AMU (AML Management Unit).

4.2 How the Components Work Together

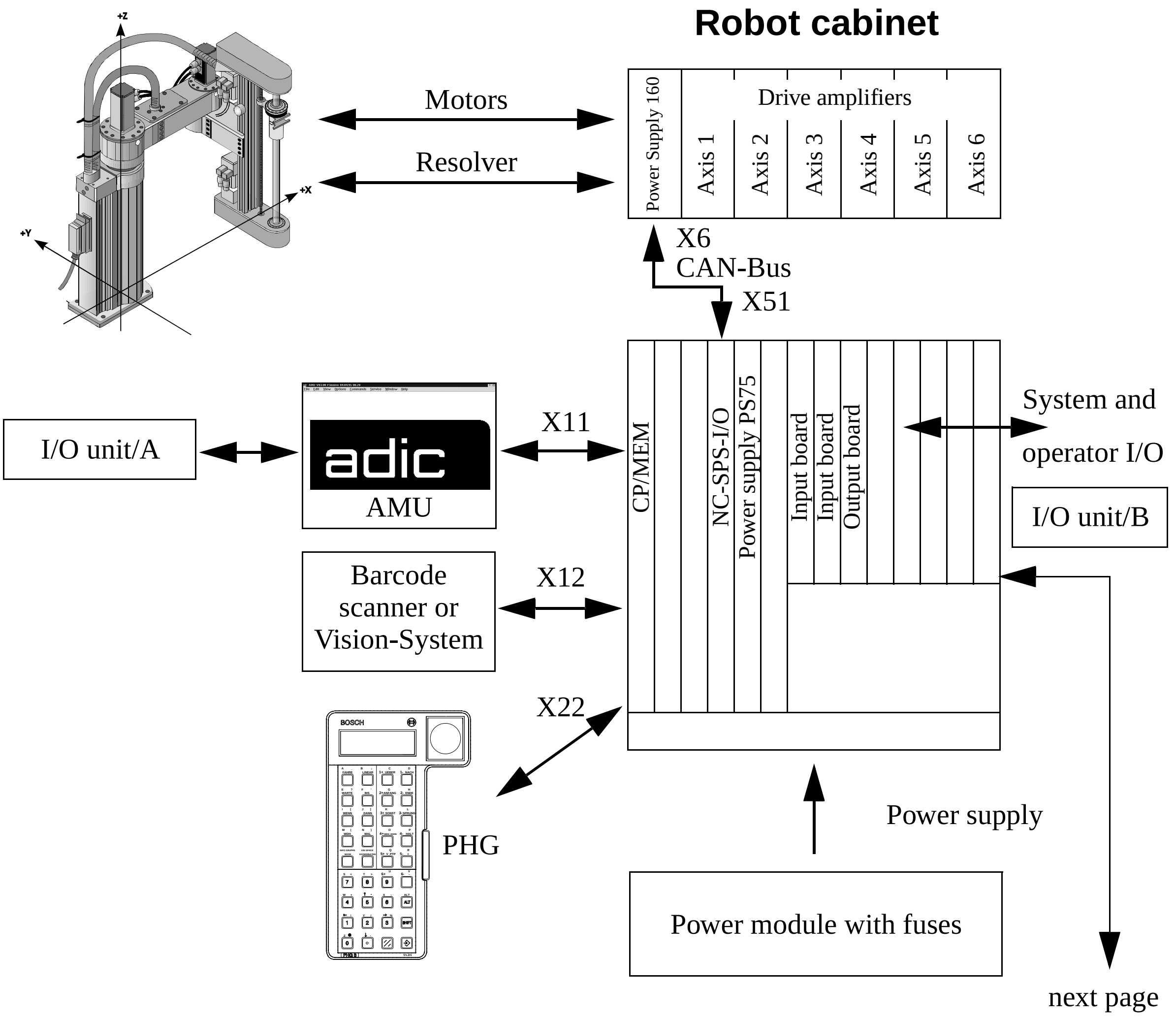


Fig. 4-1: How the components work together inside the Robot Cabinet

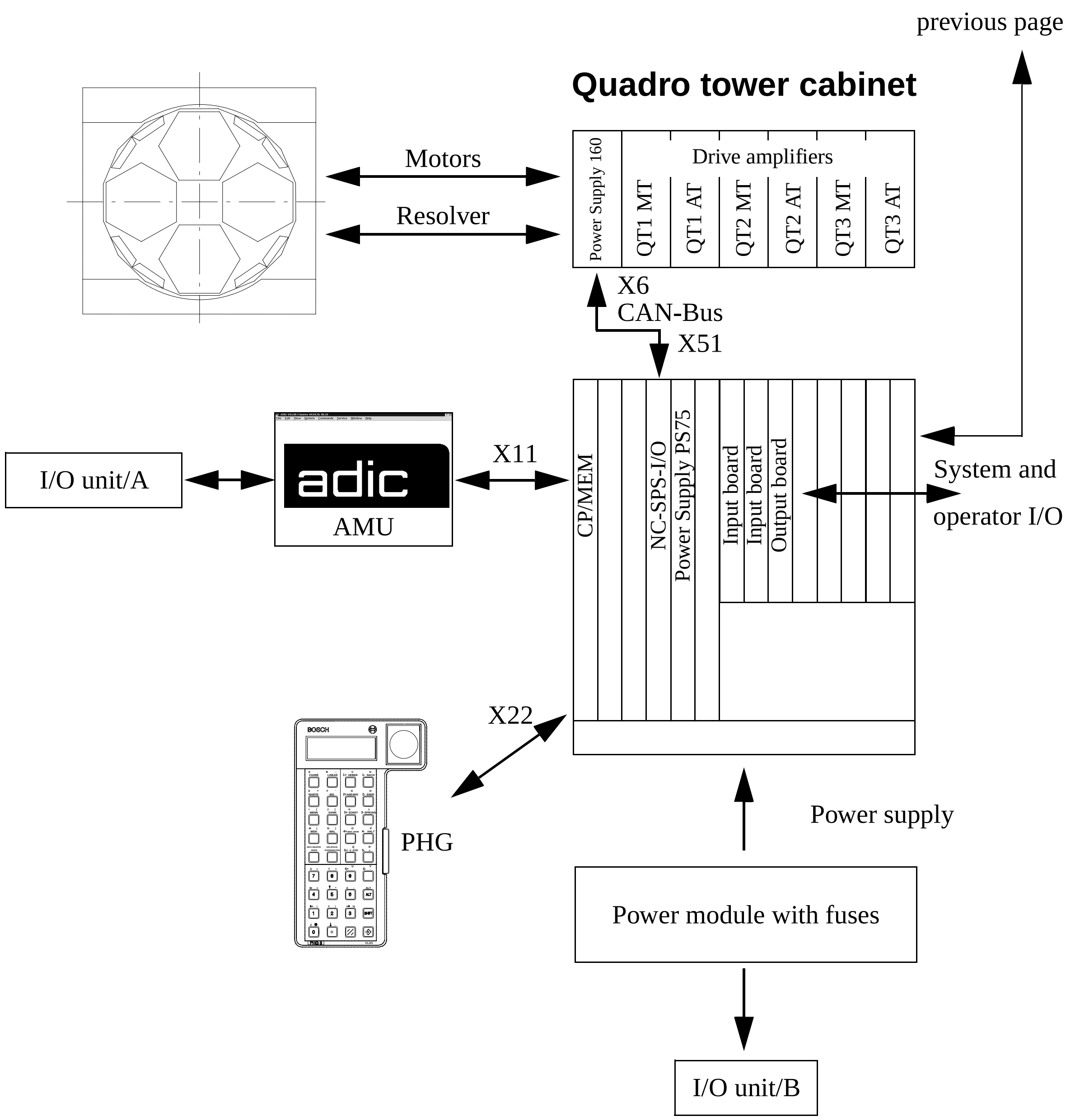


Fig. 4-2: How the Components Work together

Flow of command execution:

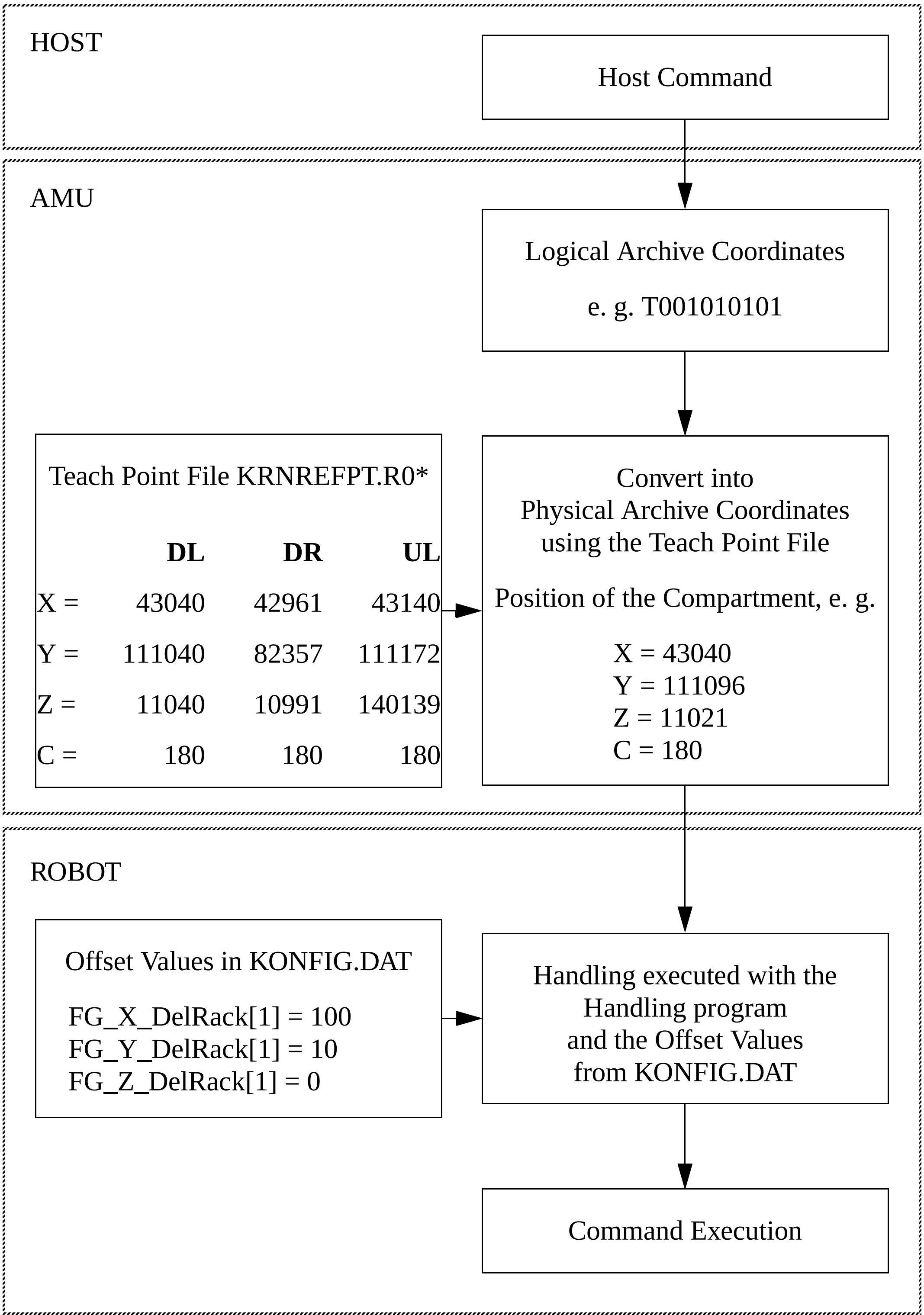


Fig. 4-3: Flow Chart of Host Command Execution

4.3 AML/2 Management Unit (AMU)

The AMU is the central interface of the unmanned AML/2 system. In normal operation (“AUTO”) the host processor controls the system.

AMU consists of hardware and software:

- Hardware: AMU (AML Management Unit) (☞ AMU Guides)
- Software: AMS (AML Management System) (☞ AMU Guides)

4.3.1 Tasks of AMU

- Host communication
  - interprets commands received from the host processor
  - checks these commands for executibility
- Management of archive catalog
  - saves the logical coordinates of the compartments
  - assigns media to compartments
  - tracks down the status of compartments and drives
- Converting logical coordinates into physical coordinates
- Communication with
  - the control unit of the robot
  - the control unit of the storage towers
  - the I/O unit/A
- Operator interface for
  - first operation
  - service
  - the operator
- Communication of errors (LOG and Trace)
- Configuration (describes the individual structure of the archive)

Information

AMU/AMS does not register the data content of media.

4.3.2 AMU/AMS Application

The software consists of five individual programs (processes) running in parallel (Multi-Tasking). Each process accomplishes a specific task.

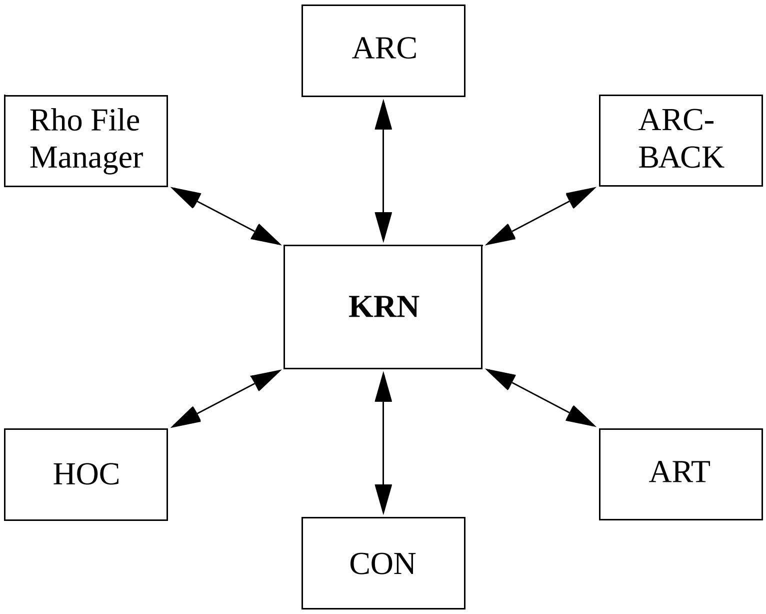


Fig. 4-4: Processes of AMU

- **ARC** (**ARC**hive) management and journaling of the archive catalog; SQL database
- **ARCBACK** (**ARC**hive-**BACK**up) backup and restoration of the archive catalog (database)
- **ART** (**A**le**RT**er) writes logs and traces
- **CON** (AML Operator **CON**sole) operator console
- **HOC** (**Ho**st and **O**ther **C**ommunication)
  Communication with
  - host computers
  - controls of the robot and the storage towers
- **KRN** (**K**e**RN**el) central logic, converts host commands into control commands splitted in:
  - **KRN/L** (**L**ogical) logical control, queing, command control
  - **KRN/P** (**P**hysical) convert commands for the robots and tower control
- **RFM** (**R**ho **F**ile **M**anager) transfers files (control software) between the AMU and the rho control

4.4 Product Description - Mechanic Components

4.4.1 Robot System

Description

The robot system consists of

- BOSCH turboscara SR 80 G with 4 axes (swivelling arm robot)
  - axes 1 and 2 common: X or Y
  - axis 3: additionally vertical to axis 6 (Z)
  - axis 4: rolling axis R
- carriage axis 5 (additional H-axis to axis X)
- lifting column axis 6 (V-axis: Z)
- track for carriage

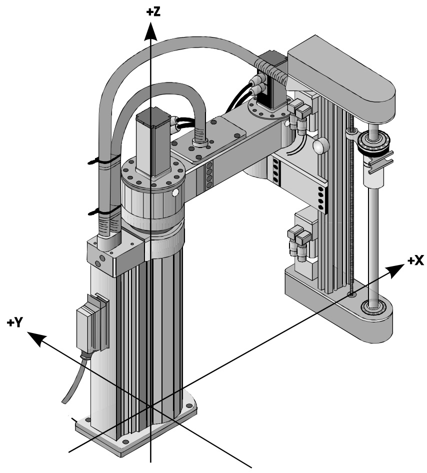


Fig. 4-5: BOSCH Turboscara SR 80 G

Special features

- BOSCH turboscara SR 80 G
  - brushless motors
  - reducing gear “Harmonic Drive” in axes 1 and 2
  - light construction of extruded aluminium profiles
  - proximity limit switches defining the reference point (robot arm extended): center position of axes 1, 2, and 4, top position of axis 3
- axes 5 + 6 (H- and V-axis)
  - compact mechanic construction
  - pinion and rack drive
  - end positions of the axis defined by proximity limit switches for the reference points and with limit switches

Operating range

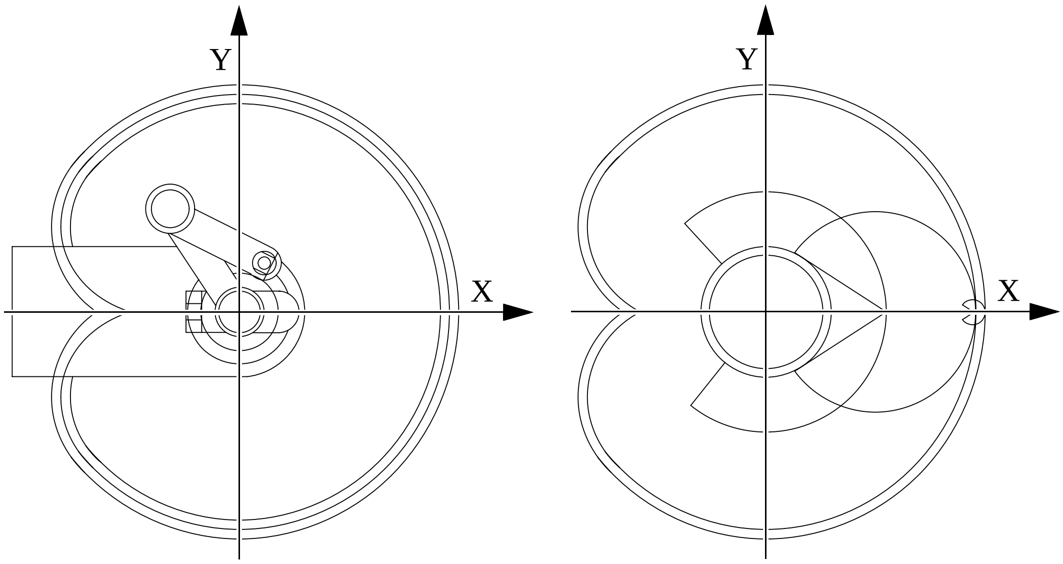


Fig. 4-6: Operating Range of the Robot

Right hand rule

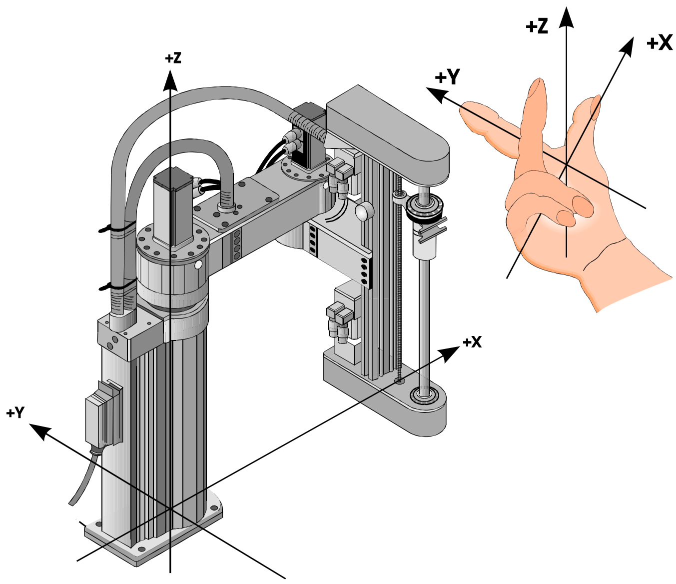


Fig. 4-7: Right Hand Rule

Coordinate system of the robot (physical)

ATTENTION!

All coordinates are indicated with reference to this zero-point!
All indications made in 1/100 mm.

Definition of the zero-point

The robot is in reference position (position after reference movement).

After referencing the robot moves to a right arm position.

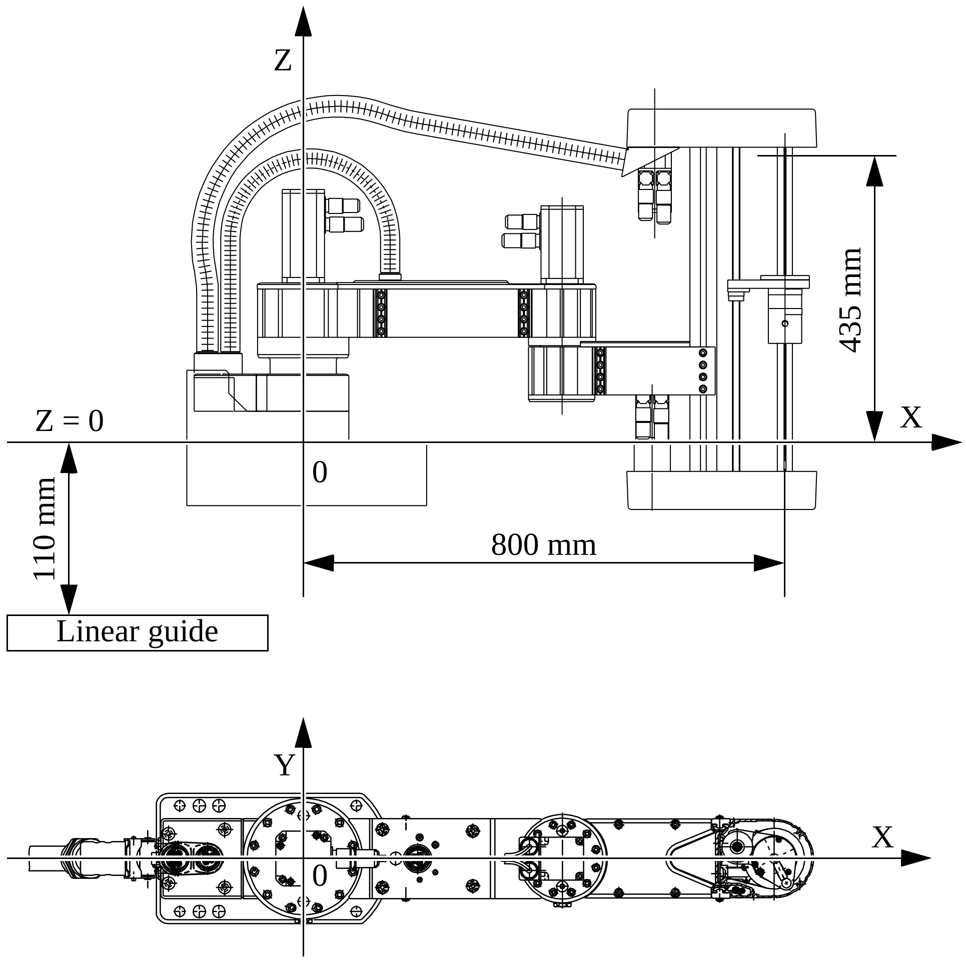


Fig. 4-8: Coordinate System

Gripper

An electromechanical gripper is mounted to the robot for safe handling of various media (magnetic tape cartridges, VHS cartridges and optical discs).

All gripper movements are powered pneumatically by micro valves and cylinders or by springs.

Following gripper movements are possible (all end positions identified by * are monitored by sensors):

- gripper open *
- gripper closed (held closed by springs even when power fails)
- gripper vertical (put down media in the archive)
- gripper horizontal (mount media in drives)
- gripper tilt 7° (operation of special drive types)
- gripper 0° (operation of the archive)
- pusher forward * (reduced pressure or full pressure)
  - push media into the correct position
  - check distance in the teach procedure

Further sensor:

- The CRASH sensor notices mechanic resistance during movements in gripping direction.

A reflex light sensor is mounted to the gripper for teaching. The light spot is reflected by the white teach marks, allowing to determine the size and location of the marks during the gripper movement .

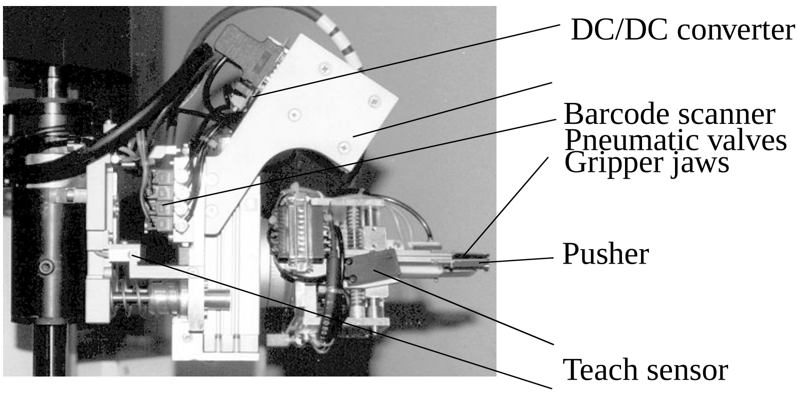


Fig. 4-9: Parallel gripper with Barcode Scanner

Barcode Scanner

A barcode scanner is integrated into the gripper. It checks the media Volsers. Using laser light, a scan line is projected onto the barcode label. The barcode scanner reads the reflection and immediately decodes it. The barcode scanner can read 200 times per second and decodes 200 times per second.

Power is supplied by a DC/DC converter board located on the rear (supply voltages ±12 V, 5 V).

4.4.2 Quadro Tower

This storage tower consists of a main tower with four auxiliary towers.

These are driven by a special gear drive in the base frame. It is powered by two (brushless, electrically commutated) electronic motors with planetary gears. Positioning upon power-up is achieved by two reference point switches (behind the Quadro tower guard-door, next to the auxiliary tower's drive). Segments (shelf units) of various kind and defined overall height (e. g. 15 rows) are mounted onto this drive mechanism.

An auxiliary tower has 6 segments.
The main tower consists of 4 pairs of segments.

To ensure shortest possible access times the tower always rotates into the direction requiring the least amount of movement.

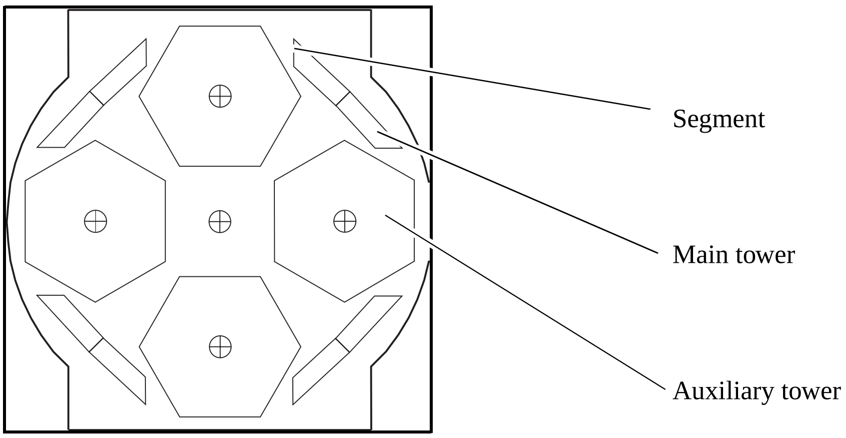


Fig. 4-10: Quadro Tower

4.4.3 I/O Unit/A

Components (☞ Operator Guide)

- compressed air supply
- problem box
- operator panel (BDE)
  - single-chip microcomputer
  - LCD display
  - operating system on EPROM
- turning unit(s) with 4 handling boxes each

This unit is used to put new media into the archive and to eject currrently not used or worn media (e. g. cleaning cartridges).

It is operated with the operator panel on the I/O unit. The doors are opened upon commands from this operator panel.

4.4.4 I/O Unit/B

Components (☞ Operator Guide)

- base frame
- shutters
- I/O door
- problem box
- distributor box
- handling box
- compressor
- operating panel

This unit is used to put new media into the archive and to eject currrently not used or worn media (e. g. cleaning cartridges).

It is operated with the luminous push-button <ON> on the operating panel of the I/O unit.

The I/O door is integrated into the EMERGENCY STOP circuit together with the shutters, that is, if both are open, the system cannot be switched on or an EMERGENCY STOP will be triggered.

ATTENTION

Be sure the I/O door is closed when you switch on the system.

4.5 Product Description - Electric Components

4.5.1 Operating Cabinet

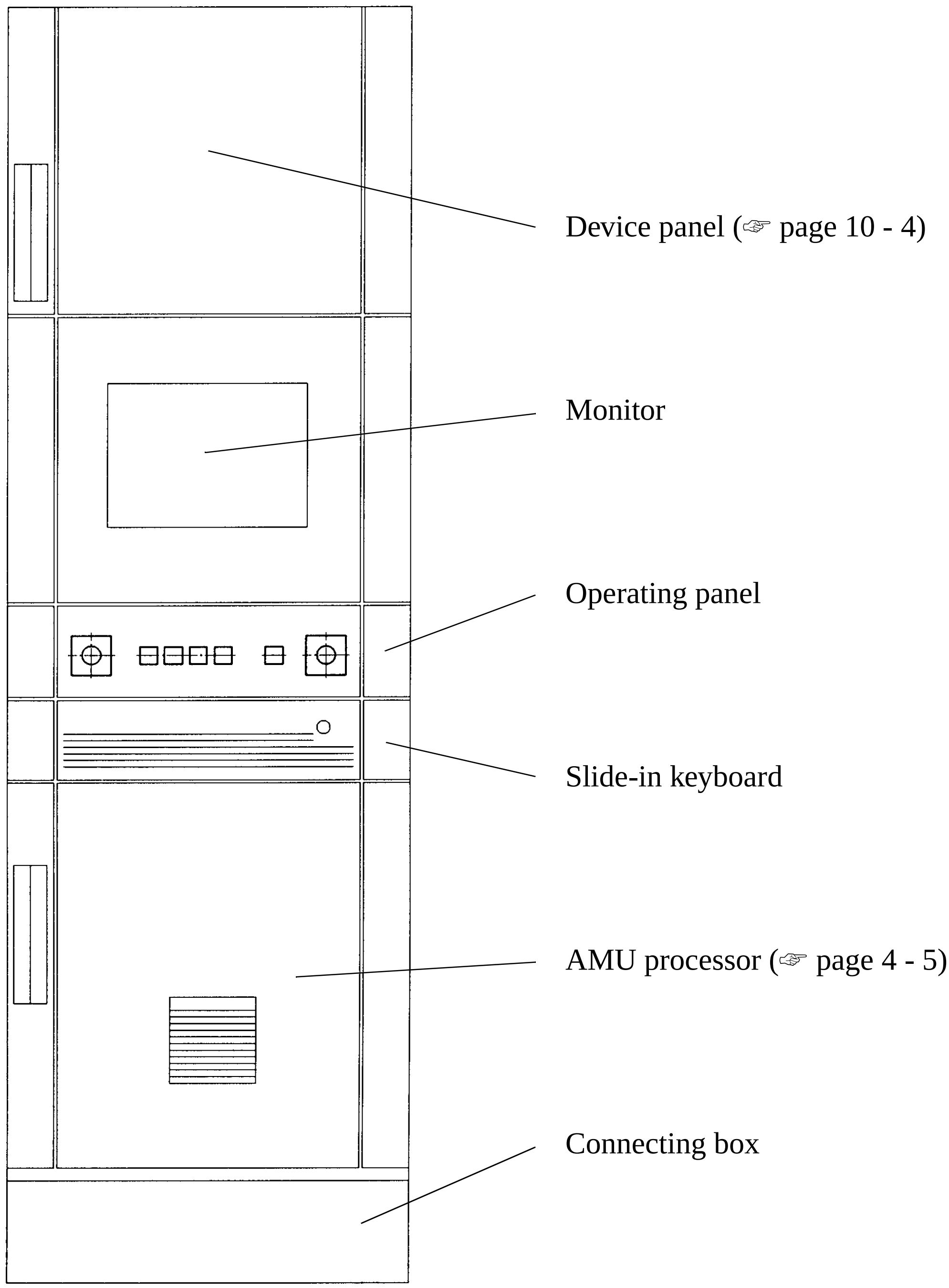


Fig. 4-11: Operating Cabinet - Overview

4.5.2 Robot Cabinet

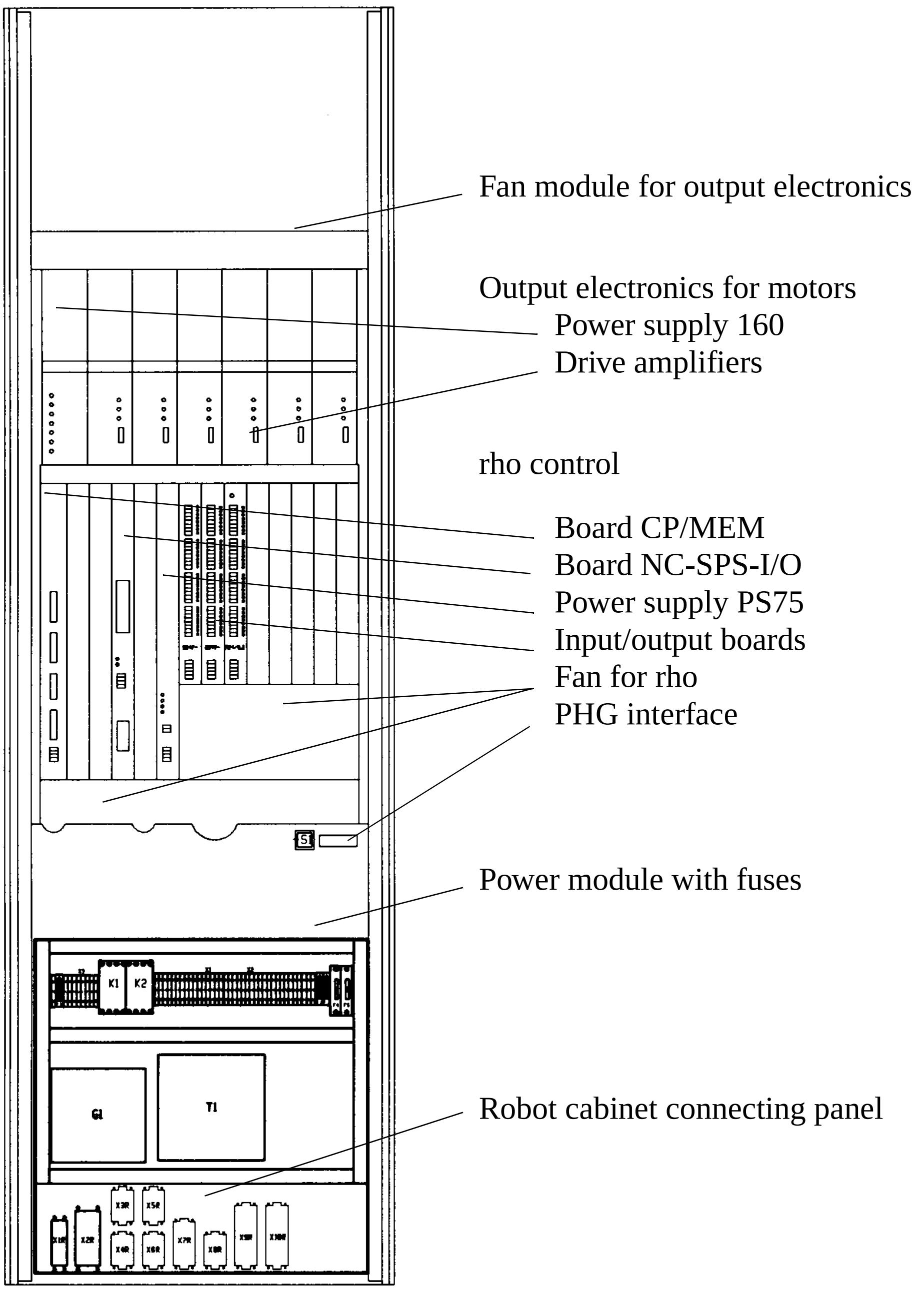


Fig. 4-12: Robot Cabinet - Overview

4.5.3 Quadro Tower Cabinet

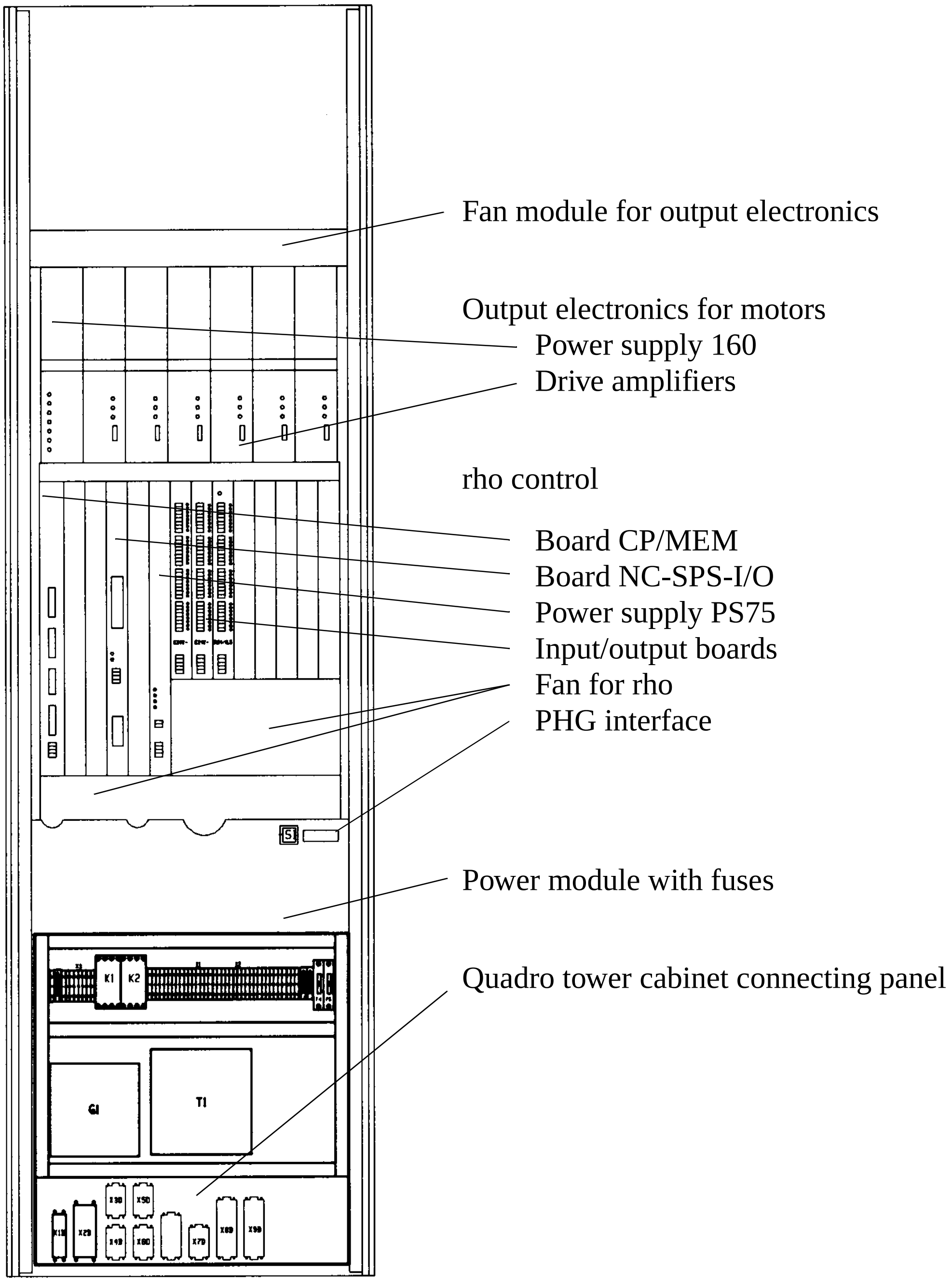


Fig. 4-13: Quadro Tower Cabinet - Overview

4.5.4 Power Supply 160

The power supply generates the intermediate circuit direct current by rectifying and smoothing the input voltage. When the motor brakes rapidly the excessive energy is dissipated through a limiting resistor. The LED status display allows diagnosis when power fails.

The relay “power supply ready” drops out when error LED 4, 5 and 7 are on.

- LED1 (green): intermediate circuit voltage ready
- LED2 (green): ±15 V DC ready (internal logic voltage generated from 24 V)
- LED 3 (green): 5 V DC ready (internal logic voltage generated from 24 V)
- LED 4 (red): excess temperature in power supply
- LED 5 (red): intermediate circuit voltage >400 V DC
- LED 6 (yellow): limiting resistor active
- LED 7 (red): one phase missing (3-phase monitoring)

Reset of error messages:

- switch off the main switch and switch it on after 30 s.

Plug “Internal/External Regeneration”

- the plug must be plugged into “External Regeneration”.

Connector X5 (rear of 19’’rack):

- Pin 1: +24 V brake
- Pin 2: 0 V brake
- Pin 3: +24 V external power supply
- Pin 4: 0 V external power supply
- Pin 5: power supply O.K. relay
- Pin 6: power supply O.K. relay
- Pin 7: PE ground
- Pin 13: system ready (READY signal)
- Pin 14: system ready (READY signal)
- Pin 15: automatic mode for all axes (output 0.7)

Fuses:

- F1: 2,5 A T for limiting resistor
- F2: 10 A T for internal logic voltage

Jumper “JW1”

- activates 3-phase failure monitoring (must be plugged to E)

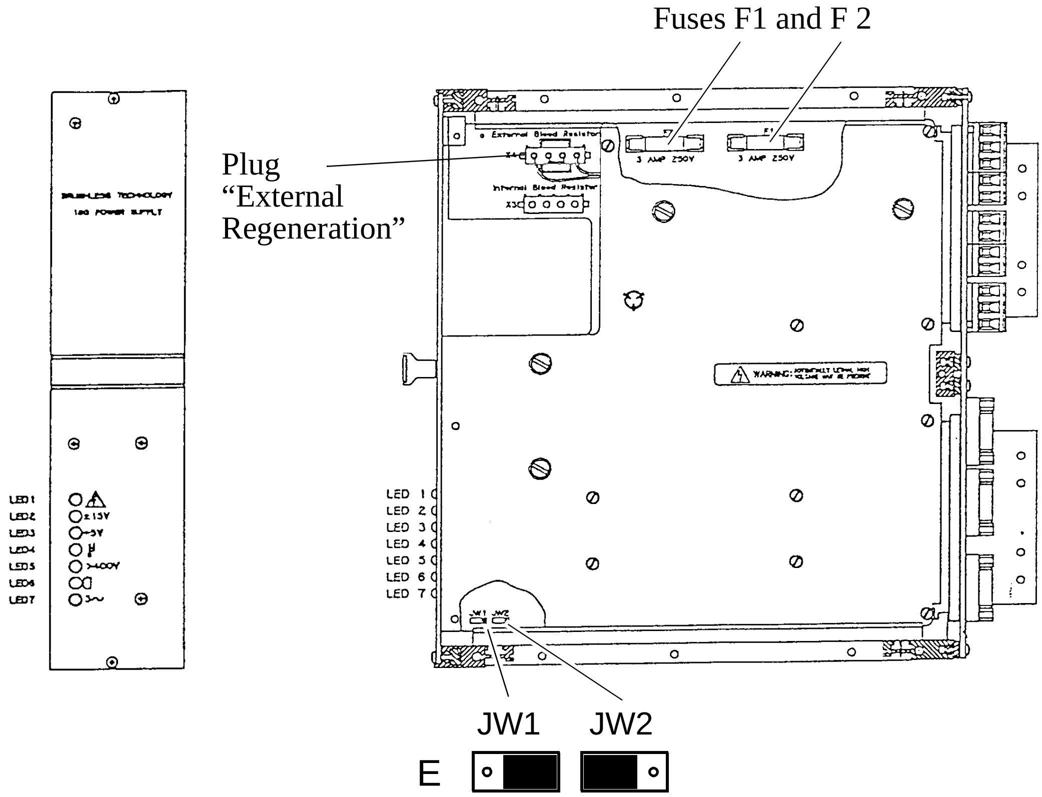


Fig. 4-14: Power Supply 160

4.5.5 Drive Amplifiers (Servo Controller T161)

The servo controller provides the electic commutation of the servo motors. It closes the speed regulating circuit and supplies a 3-phase sine-shaped motor current, which is in turn controlled by current regulators of high bandwidth.

The plug-on module (MCO-module) adapts the motor to the hardware.

The LEDs indicate errors.

- LED 1 (red): failure (look up the errror in window **LOG Control Center**)
- LED 2 (yellow): torque limit active (not in use)
- LED 3 (green): release (normal amplifier operation)

Connector X 6: connection to the PC (transfer of parameters with the program “Terminal”)

Jumper 2, 3 and 5 must be set „ON“ for activate communication on connector X 6

Information

Diagnosis of the drive amplifier is possible via the program “Terminal” or the PHG (Mode 7.2).

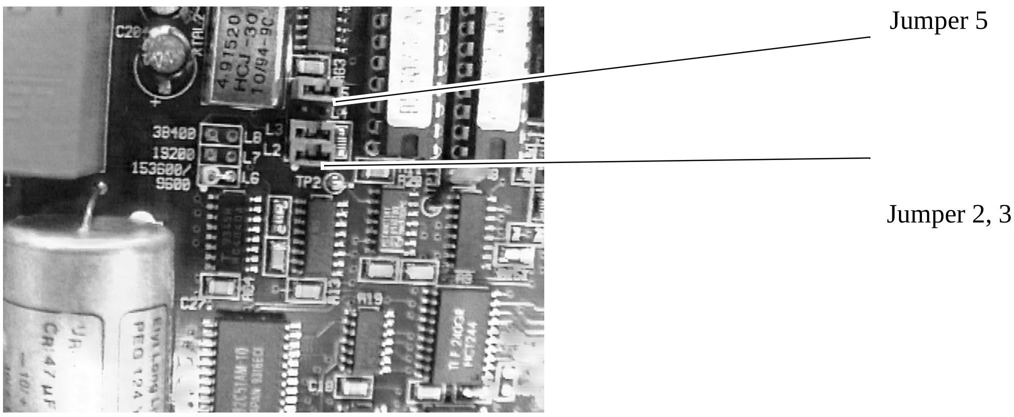


Fig. 4-15: Jumper for communication

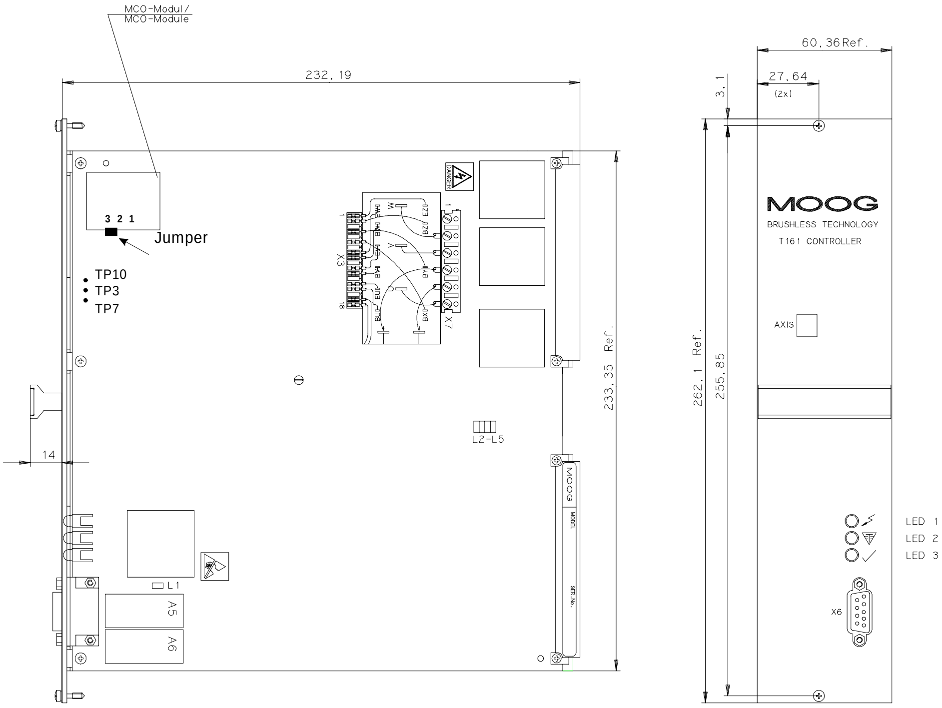


Fig. 4-16: Drive Amplifiers

4.5.6 rho

rho is a modular control system for robots and their peripherals developed by Bosch.

Features

- operating system core EMX (Echtzeit(Realtime)-Multitasking-Executive)
- multitasking capability
- controls several kinematics (independent axis control)

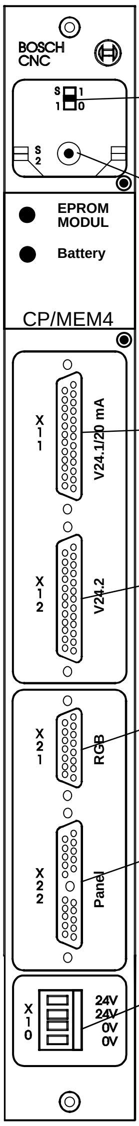
Boards of rho

- board CP/MEM
- board NC-SPS-I/O (PIC board)
- power supply PS75
- input boards
- output board

4.5.7 Board CP/MEM

Description

The processor and memory board has been developed for control of numerically controlled machine tools. It is equipped with the 32 bit processor module 32CG16 and a floating point processor FPU 32381 (15 MHz, optional 30 MHz). The PHG-interface and the two serial interfaces on the connector X11 and X12 are served by the communication processor 8085. 1 MByte of battery buffered CMOS-RAM is available as memory. Additionally a 512 kByte EEPROM memory is provided for storing machine parameters. The operating system is stored on an EPROM board behind a cover.



Switches

S1: write protection for machine parameters (1 = write protected)

S2: always set to “0”

Interfaces

X11: connection to AMU (V24.1)

X12: connectionto barcode scanner /Vision-System (V24.2)

X21: monitor connection, not used (RGB)

X22: connection to PHG without EMERGENCY STOP function (panel)

X10: supply voltage, only terminal “0 V” used for potential equalization

Fig. 4-17: Board CP/MEM 4

Files stored on Board CP/MEM of the the Robot Cabinet

Files stored in the battery buffered RAM (exception: MPRHO3.BIN).

Depending on the configuration only the modules required are stored.

Robot cabinet

File name	Content
AMULESE.IRD	program modul for communication
AMUSCHR.IRD	program modul for communication
PBARCODE.IRD	program module for barcode reading
EXPROG.DAT	file for automatic program start
INIT.IRD	main program
KONFIG.DAT	configuration file for handling unit
KOPPLUNG.DAT	internal file for communication with PC
MPRHO3.BIN	system parameters of the control system (in EEPROM)
PLW3480.IRD	module for control of movements on drive 3480 and compatibles
PLW3490.IRD	module for control of movements on drive 3490
PLWMULTI.IRD	module for control of movements on drives (optional)
PNEWGRIP.IRD	module for control of movements on the alignment spot
PERMAN.IRD	program module for monitoring and error detection, runs even after <CONTROL OFF>
PRACK.IRD	module for control of movements on compartments
PTEACH.IRD	module for control of teaching process
PTEST.DAT	dialog texts for the robot test program (German or English)
PTEST.IRD	robot test program

Files stored on board CP/MEM of the Quadro Tower Cabinet

File name	Content
AMULESE.IRD	program module for communication
AMUSCHR.IRD	program module for communication
EXPROG.DAT	file for automatic program start
INIT.IRD	main program
KONFIG.DAT	configuration file for the Quadro tower
KOPPLUNG.DAT	internal file for communication with PC
MPRHO3.BIN	system parameters of the control unit (in the EEPROM)
PERMAN.IRD	program module for monitoring and error detection, runs even after <CONTROL OFF>
QTURM1.IRD	module for control of Quadro tower 1
QTURM2.IRD	module for control of Quadro tower 2
QTURM3.IRD	module for control of Quadro tower 3
TEST.DAT	dialog texts for the Quadro tower test program (German or English)
TEST.IRD	Quadro tower test program

4.5.8 Board NC-SPS-I/O (PIC Board)

PIC = programmable interface controller with CAN connection

This board facilitates direct coupling to the input and output boards of the combined rack. The board is internally connected to the I/O boards by the backplane.

The PIC file is stored on the board.

- robot cabinet: “IQ_ROBO.P2X”
- Quadro tower cabinet: “IQ_TURM.P2X”

Fuses F1 and F2 on the board: 3,15 A MT

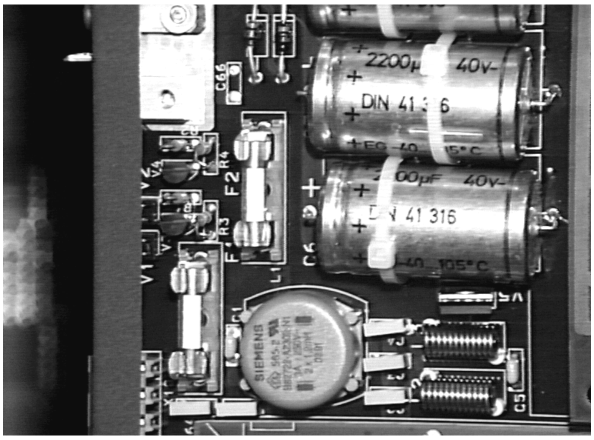
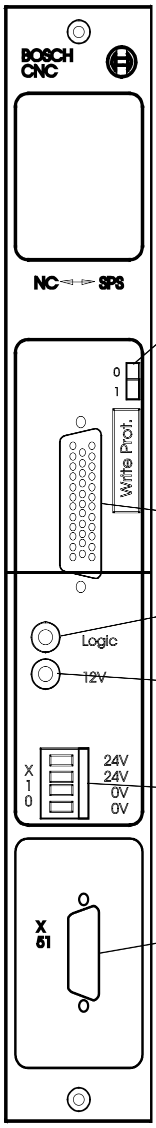


Fig. 4-18: Board NC-SPS-I/O: Fuses



Write protection PIC 250

- position 0: access to PIC program allowed (transfer/write)
- position 1: access disabled

Connector X61: not used

LED logic: internal logic voltage for input and output boards is present

LED 12V: internal 12 V supply is present on the CMOS bus

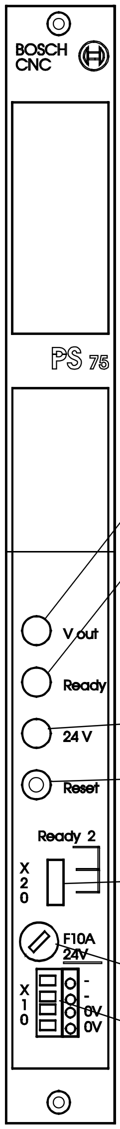
Connector X10: supply voltage (2 x 24 V, 2 x 0 V)

Connector X51: connection to the drive amplifiers (CAN bus = controller area network)

Fig. 4-19: Board NC-SPS-I/O

4.5.9 Power Supply PS75

The power supply generates the internal voltages for rho (logic control circuits of all modules, e. g. CP/MEM board).



LED Vout: output voltage present on backplane

LED ready 2: monitoring of the system

- on when control is ready
- off when there is a
  - voltage error
  - measuring system error
  - servo error
  - watchdog error
  - over temperature of air supply >58° C

LED 24 V: input voltage present on X10

Reset button: resets all error messages and restarts the entire rho control system

X20: relay contact (normally open) of system monitoring (ready 2; cuts out when the control system is not ready) used to control the CONTROL ON circuit.

Fuse for 24 V input (type: F 10 A)

X10: input voltage (2 x 24 V DC +30 %/ -15 % max.)

Fig. 4-20: Power Supply PS75

4.5.10 Input Boards

The input boards are tracing binary signals in the system.

Connection of inputs

The input signals are connected with four 8-fold plug-in terminals each
(e. g. byte 0 ... byte 3)

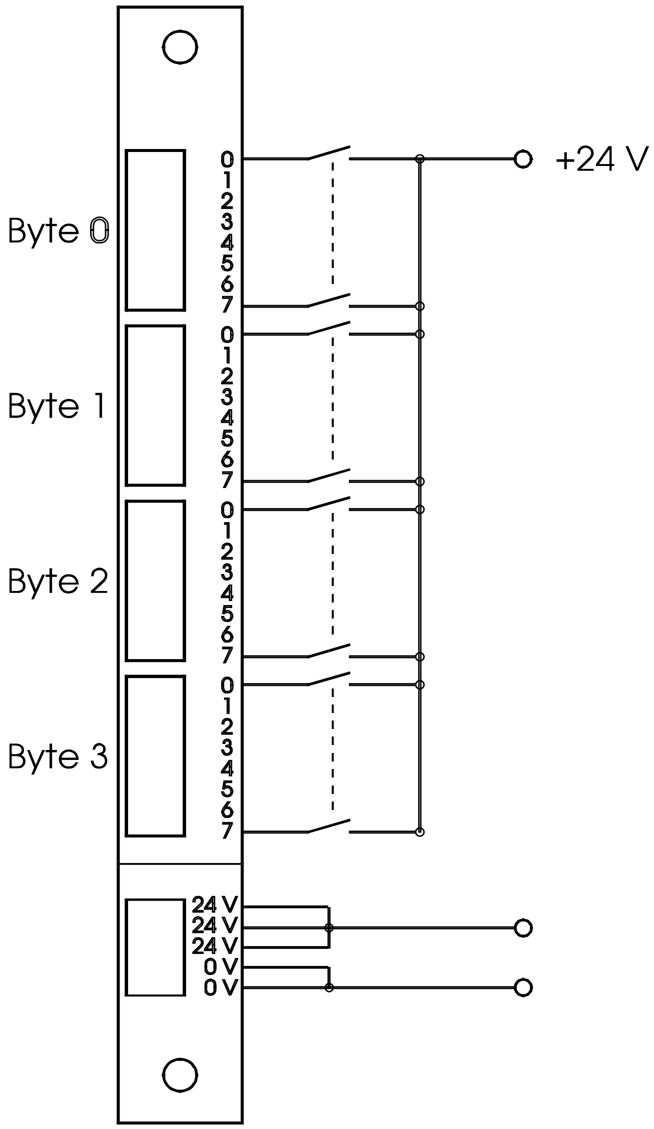


Fig. 4-21: Connection of Inputs

Adressing the board

Each board has four 8-fold plug-in terminals. Each 8-fold plug-in terminal constitutes one input byte for the control system. The DIP switch on the bottom right of the board defines the address of the first byte in binary code, that is, for the top 8-fold plug-in terminal.When several boards are used the address of the first byte must be set to the next vacant address.

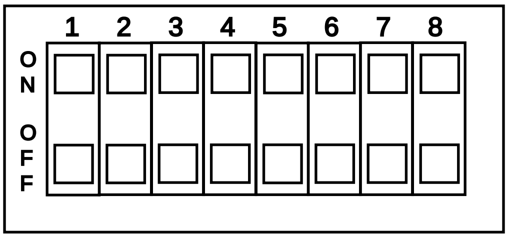


Fig. 4-22: DIP Switch for Board Address Adjustment

Addresses

- board 1: address 0 (all switches “OFF”)
- board 2: address 4 (only switch 3 “ON”, remaining switches “OFF”)

Input configuration

Robot cabinet

Input board 1		Input board 2	
E0.0	set-up operation	E4.0	Release from DI tower 1
E0.1	Reserve	E4.1	Release from DI tower 2
E0.2	Reserve	E4.2	Release from DI tower 3
E0.3	Reserve	E4.3	Release from DII tower 4
E0.4	Reserve	E4.4	Release from DII tower 5
E0.5	EMERGENCY-STOP circuit, not	E4.5	Release from DII tower 6
E0.6	CONTROL ON	E4.6	Release from DIII tower 7
E0.7	Release power supply 160	E4.7	Release from DIII tower 8
E1.0	Ref.Pt. 1st axis	E5.0	Release from DIII tower 9
E1.1	Ref.Pt. 2nd axis	E5.1	Release from DIV tower 10
E1.2	Ref.Pt. 3rd axis	E5.2	Release from DIV tower 11
E1.3	Ref.Pt. 4th axis	E5.3	Release from DIV tower 12
E1.4	Ref.Pt. horizontal axis	E5.4	Box 1 on position I/O unit/B 1
E1.5	Ref.Pt. vertical axis	E5.5	Box 2 on position I/O unit/B 1
E1.6	Reserve	E5.6	Box 3 on position I/O unit/B 1
E1.7	Reserve	E5.7	Box 4 on position I/O unit/B 1
E2.0	Crash	E6.0	Reserve
E2.1	Pusher at the front	E6.1	Ref.Pos. robot (straight arm)
E2.2	Pusher at the back	E6.2	Reserve
E2.3	Reserve	E6.3	Problembox empty I/O unit/B 2
E2.4	Teachsensor	E6.4	Shutter top I/O unit/B 2
E2.5	Reserve	E6.5	Door closed and locked I/O unit/B 2
E2.6	Reserve	E6.6	Shutter down I/O unit/B 2
E2.7	Reserve	E6.7	Reserve
E3.0	Reserve	E7.0	Box 1 on position I/O unit/B 2
E3.1	Reserve	E7.1	Box 2 on position I/O unit/B 2
E3.2	Release I/O unit/A filing / Reserve I/O unit/B	E7.2	Box 3 on position I/O unit/B 2
E3.3	Release I/O unit/A top / I/O unit/B 1 Problembox empty	E7.3	Box 4 on position I/O unit/B 2
E3.4	Release I/O unit/A bottom / I/O unit/B 1 shutter up	E7.4	Lock system access DI
E3.5	Reserve I/O unit/A / I/O unit/B 1 door closed and locked	E7.5	Lock system access DII
E3.6	Reserve I/O unit/A / I/O unit/B 1 shutter down	E7.6	Lock system access DIII
E3.7	Reserve	E7.7	Lock system access DIV

Quadro tower cabinet

Input board 1		Input board 2	
E0.0	set-up operation	E4.0	Release from Rob1 tower 1
E0.1	Reserve	E4.1	Release from Rob1 tower 2
E0.2	Reserve	E4.2	Release from Rob1 tower 3
E0.3	Reserve	E4.3	Release from Rob2 tower 1
E0.4	Reserve	E4.4	Release from Rob2 tower 2
E0.5	EMERGENCY-STOP circuit	E4.5	Release from Rob2 tower 3
E0.6	CONTROL ON	E4.6	Reserve
E0.7	Release power supply 160	E4.7	Reserve
E1.0	Ref.Pt. Main tower 1	E5.0	Reserve
E1.1	Ref.Pt. Auxiliary tower 1	E5.1	Reserve
E1.2	Ref.Pt. Main tower 2	E5.2	Reserve
E1.3	Ref.Pt. Auxiliary tower 2	E5.3	Reserve
E1.4	Ref.Pt. Main tower 3	E5.4	Reserve
E1.5	Ref.Pt. Auxiliary tower 3	E5.5	Reserve
E1.6	Reserve	E5.6	Reserve
E1.7	Reserve	E5.7	Reserve
E2.0	Reserve	E6.0	Reserve
E2.1	Reserve	E6.1	Reserve
E2.2	Reserve	E6.2	Reserve
E2.3	Reserve	E6.3	Reserve
E2.4	Door tower 1 Rob 1 open	E6.4	Reserve
E2.5	Door tower 1 Rob 2 open	E6.5	Reserve
E2.6	Door tower 1 Rob 1 closed	E6.6	Reserve
E2.7	Door tower 1 Rob 2 closed	E6.7	Reserve
E3.0	Door tower 2 Rob 1 open	E7.0	Reserve
E3.1	Door tower 2 Rob 2 open	E7.1	Reserve
E3.2	Door tower 2 Rob 1 closed	E7.2	Reserve
E3.3	Door tower 2 Rob 2 closed	E7.3	Reserve
E3.4	Door tower 3 Rob 1 open	E7.4	Reserve
E3.5	Door tower 3 Rob 2 open	E7.5	Reserve
E3.6	Door tower 3 Rob 1 closed	E7.6	Reserve
E3.7	Door tower 3 Rob 2 closed	E7.7	Reserve

4.5.11 Output Board

The output board outputs binary signals at 24 V, 0.5 A.

LED

Excessive current on one of the output

Connection of outputs

The outputs are connected with four 8-fold plug-in terminals each
(e. g. byte 0 ... byte 3)

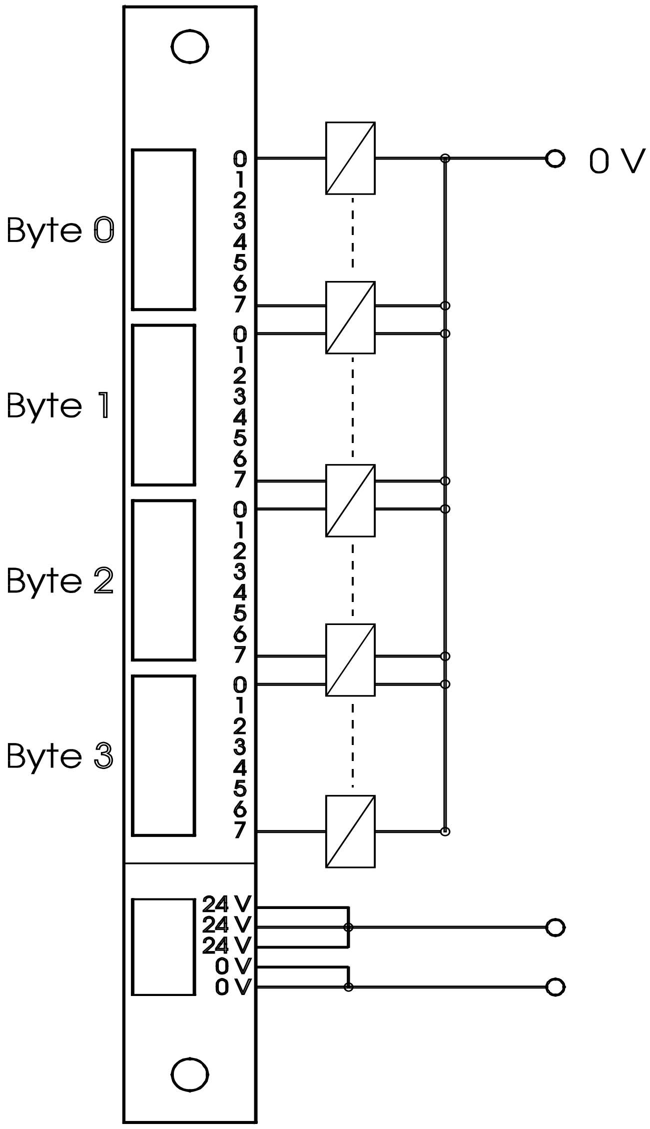


Fig. 4-23: Connection of Outputs

Adressing of the board

The board has four 8-fold plug-in terminals. Each 8-fold plug-in terminal constitutes one output byte for the control system. The DIP switch on the bottom right of the board defines the address of the first byte in binary code, that is, for the top 8-fold plug-in terminal.

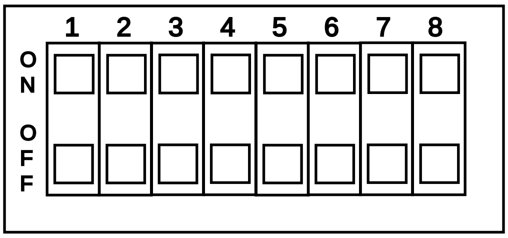


Fig. 4-24: DIP Switches for Board Address Adjustment

The address of the board is 0 (all switches “OFF”).

Output configuration

Robot cabinet

Output board			
A0.0 A0.1 A0.2 A0.3 A0.4 A0.5 A0.6 A0.7	Shutter up I/O unit/B 1 Release I/O unit/B 2 Door locking I/O unit/B 2 Shutter down I/O unit/B 2 Shutter up I/O unit/B 2 Lock system access reserve Lock system access 1 100 % output	A2.0 A2.1 A2.2 A2.3 A2.4 A2.5 A2.6 A2.7	Release to DI tower 1 Release to DI tower 2 Release to DI tower 3 Release to DII tower 4 Release to DII tower 5 Release to DII tower 6 Release to DIII tower 7 Release to DIII tower 8
A1.0 A1.1 A1.2 A1.3 A1.4 A1.5 A1.6 A1.7	Gripper vertical Gripper horizontal Gripper semi-open Gripper open Pusher pressure reduced Pusher full pressure Gripper 0° Teachsensor on	A3.0 A3.1 A3.2 A3.3 A3.4 A3.5 A3.6 A3.7	Release to DIII tower 9 Release to DIV tower 10 Release to DIV tower 11 Release to DIV tower 12 Stop Mixed Media Release I/O unit/A filing / Release I/O unit/B 1 Release I/O unit/A top / Door locking I/O unit/B 1 Release I/O unit/A bottom / Shutter down I/O unit/B 1

Quadro tower cabinet

Output board			
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7	Reserve Reserve Reserve Reserve Reserve Reserve Reserve 100 % output	2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7	Ready to Rob 1 tower 1 Ready to Rob 1 tower 2 Ready to Rob 1 tower 3 Ready to Rob 2 tower 1 Ready to Rob 2 tower 2 Ready to Rob 2 tower 3 Reserve Reserve
1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7	Access Rob 1 shut Access Rob 2 shut Door tower 1 Rob 1 shut Door tower 1 Rob 2 shut Door tower 2 Rob 1 shut Door tower 2 Rob 2 shut Door tower 3 Rob 1 shut Door tower 3 Rob 2 shut	3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7	Reserve Reserve Reserve Reserve Reserve Reserve Reserve Reserve

4.5.12 Handheld Programming Unit (PHG)

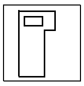
About the PHG

The PHG has an LCD display (4 x 20 characters) and a keypad. Additionally, it is provided with a confirm button (dead man) and an <EMERGENCY STOP> button (☞ “<EMERGENCY STOP> Buttons” from page 3 - 8).

Depending on control by the operating system, a number of system functions can be released with the PHG (☞ menu tree of rho on the following pages).

A number of operating system functions (not automatic programs) can be used only in the operating mode “set-up“ of the rho control (24 V on input board 1 input 0.0 connected).

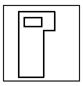
Connecting the PHG

Socket: on the rho control unit next to the button  .

ATTENTION!

Possible interruption of the EMERGENCY STOP circuit.

If the AML/2 system is switched on. Press the button

 **when you insert the plug. This bridges the EMERGENCY STOP circuit.**

Operating the PHG

Most of the keys on PHG have three functions.

Switch-over is made with SHIFT or ALT .

The basic configuration of the keys is different in the various modes.

Operating PHG functions requires some practicing.

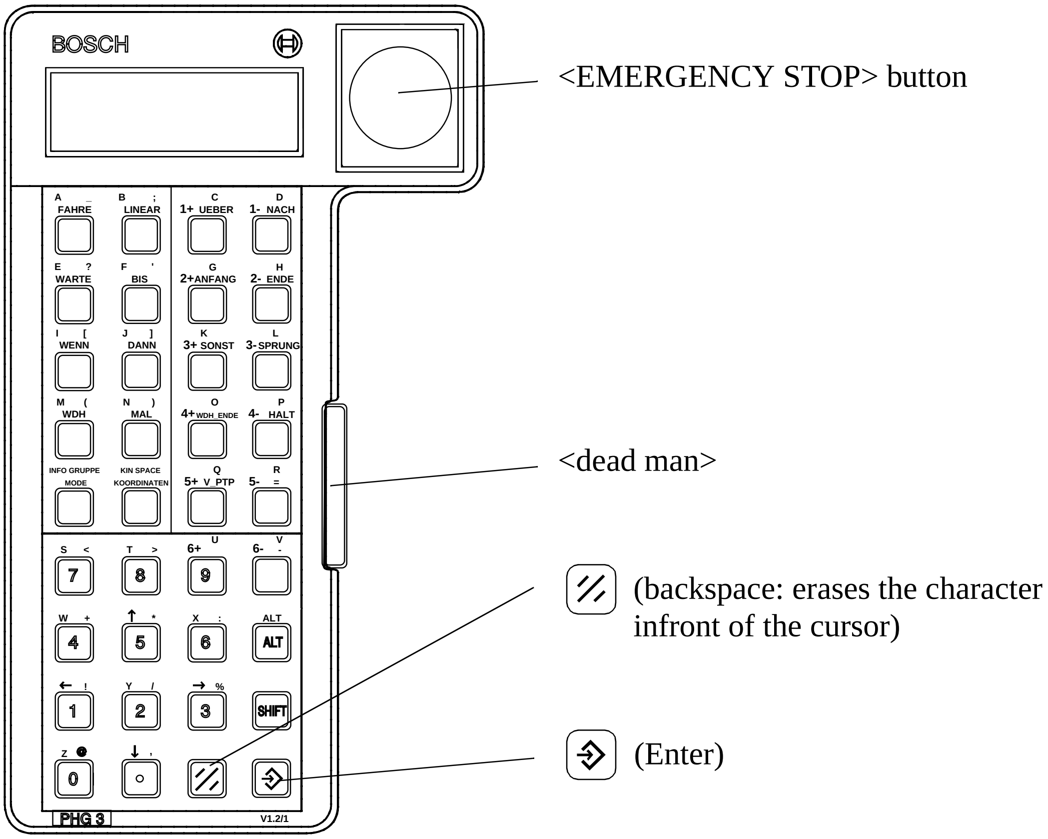


Fig. 4-25: Handheld Programming Unit (PHG)

Menu tree of rho PHG operating system

Prompt display after MODE input: `mode:#`

Select with MODE , No , ⇒ , Cancel with ←

- 1 Reference points
- 2 Manual
  - Position
  - Axis lag
  - Offset
- 3 Progr. BAPS/PIC.
  - 1 Progr. BAPS-Prog.
    - 1 Edit
      - program Select
        Input Prg.-Name

E	Exit (terminate and save)
Q	Quit (terminate without saving)
L	Line (position line)
S	Search (search a string)

- 7 Diagnosis
  - 1 Axis Display
    - Positions
    - Axis Lag
    - Offset
    - Endpoint
  - 2 Errors/Warnings
  - 3 System Conditions
    - 1 Control cond.
    - 2 Process condition
    - 3 Actual Op.-Mode
    - 4 HW-Configuration
  - 4 Digital Inputs
  - 5 Digital Outputs
  - 8 Machine Param.
    - 1 List Mach. Param.
    - 2 Set Mach. Param.
    - 3 Default Settings
  - 9 Test Dig. Outputs
  - 10 Display PHG Keys
  - 11 Versions
- 8 Inactivate PHG
- 9 Device/File I/O
  - 1 Default settings
    - 1 Coupling
    - 3 Read/Write SER_1
    - 4 Read/Write SER_2
  - 2 List Files
  - 3 Delete Files
  - 5 Memory Allocation
- 11 Help Functions
  - 1 Initial Position
  - 2 Show and Set Clock
  - 3 Reset RC
  - 4 Adjust VFAKTOR
  - 5 Adjust AFAKTOR
  - 6 Adjust DFAKTOR
- 12 Information

Protocol	4	8	-
Interface	1	0	0
Baudrate	9600	9600	9600
Stop-Bit number	1.0	1.0	1.0
Parity (0,1,2)	2	2	2
Wordlength	7	8	8
Soft-Hardw.hsk	1	1	1
Timeout read	4000	--	-1
Timeout write	2000	--	5000

5 Operating the AML/2 System

5.1 Overview of AMU Commands

Inputs at the operating console of the AML/2 system (AMU operating console) have the same priority as host commands.

Input at the AMU must be restricted to the following situations:

- when host communication fails (“AUTO”).
- when the the robot fails (manual update of the archive catalog after manual intervention ☞ Operator Guide).

Information

All non-executable commands or options are displayed with a shadow.

5.1.1 Using the Operator Console

Layout and operation conform to SAA standards.

It is controlled by

- the keyboard
- the mouse

Further information is found in the OS/2 manuals.

5.1.2 Starting the Operating Console AMU

Information

Do this only when the operating console AMU is not shown on the monitor or has been quit unintentionally.

a) Press <CTRL> + <ESC> (process list)

b) Check whether AMU and KRN have already been started

If only KRN.EXE has been started:

c) Change to an OS/2 window

d) Change to the AMU directory c:\amu (command `cd \amu`)

e) Enter `con` and confirm the input by pressing <ENTER>

If only AMU has been started:

c) Change to an OS/2 window

d) Change to the AMU directory c:\amu (command `cd \amu`)

e) ENTER `krn` and confirm the input by pressing <ENTER>

f) Press <CTRL> + <ESC> (process list) and change to the AMU process

If none of the two processes has been started:

c) Change to an OS/2 window

d) Enter `startup` and confirm the input by pressing <ENTER>

5.1.3 Window Layout

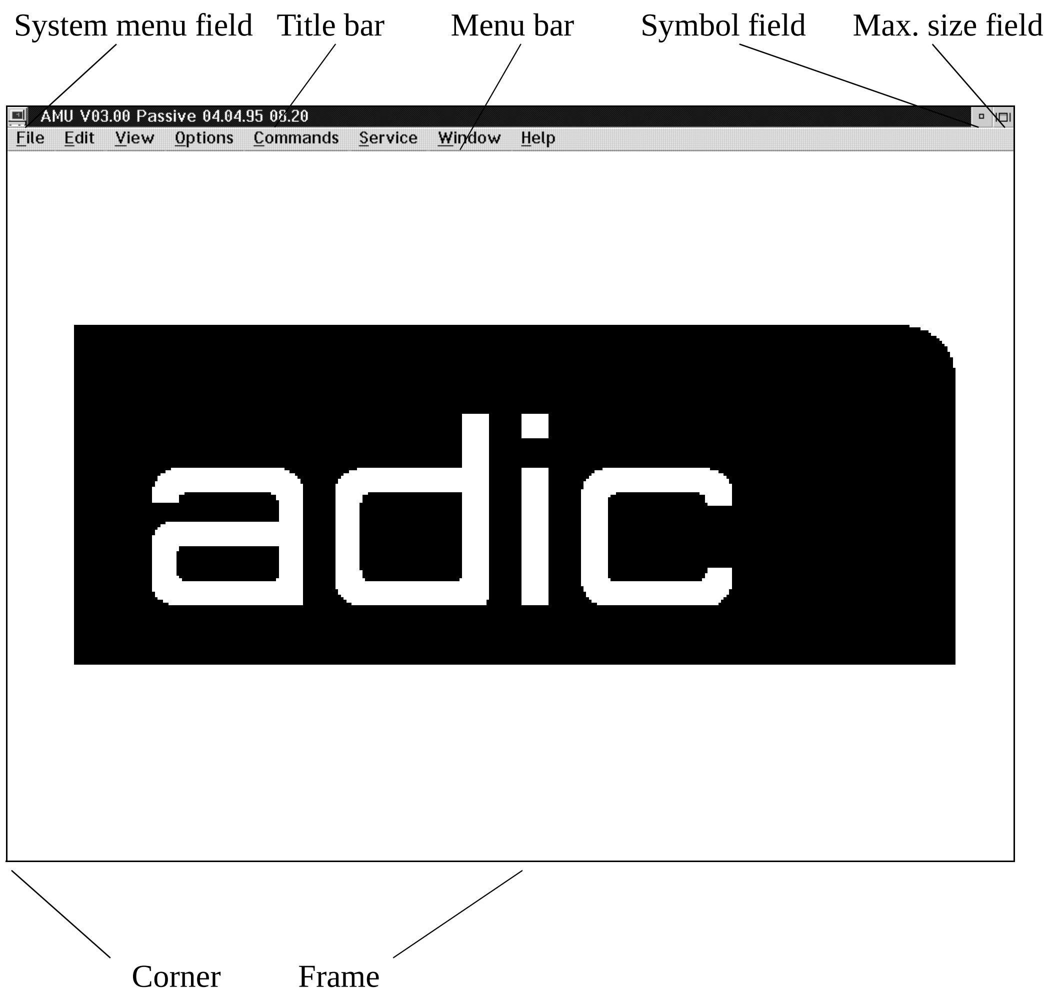


Fig. 5-1: Window Layout of the Operating Console

Information

When the window is active the title bar has a blue background. When the window is inactive the title bar has a grey background.

The following functions are the same in all windows:

Button	Function
Cancel	Cancels the current function and closes the window.
Help	Opens the online help.

5.1.4 Selecting a Command

With the mouse:

a) move the mouse pointer to the desired menu in the menu bar

b) click on the menu; the menu opens

c) click on the command in the menu; the command window opens

With the keyboard:

a) press the <ALT> key and the underlined letter in the menu bar. The menu opens

b) Now press the underlined letter in the menu to select the command

With a command code:

a) If a key or a combination of keys is specified following the command you can directly select the command with it

5.1.5 Altering a Window's Size

Resizable windows have a frame all around (e. g. Trace window).

a) Move the mouse to any corner of the active window.
The mouse pointer changes into a double arrow

b) Press the mouse button and pull the window to the desired size while you keep the mouse button pressed

5.1.6 Moving a Window

a) Move the mouse pointer onto the title bar

b) Move the window while you keep the mouse button pressed

5.1.7 Closing a Window

a) Close the window by a double click on the system menu field

Information

Description of AMU Operating menu (☞ ARG).

5.2 Teaching

Information

- **Teaching means to instruct the robot system as to its functions.**
- **Teach labels are square white marks on defined spots.**

Details about the command handling on the AMU for Teach are located in the AMU Reference Guide (☞ AMU Reference Guide).

5.2.1 When Do I Have to Teach?

Initial teaching

- For first operation of the AML/2 system.
- When the AML/2 system has been extended (e. g. further drives).

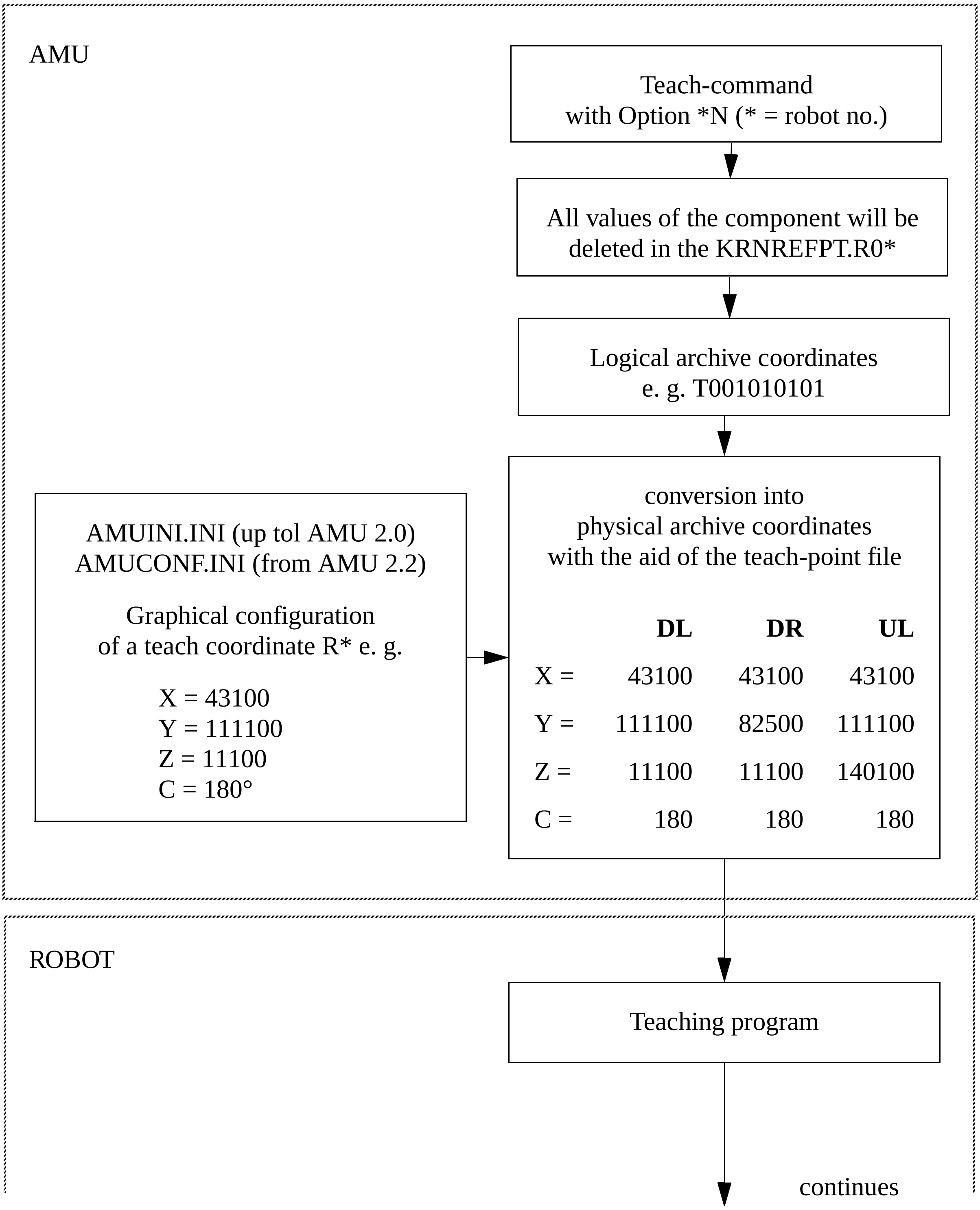
Reteaching

After mechanical changes on the AML/2 system
(e. g. replacement of components).

5.2.2 Procedure for Teaching

Initial teaching (option 1N)

a) Teach first component segment with option 1N, teach the remaining segments with option 1.



ROBOT

continued

Physical archive coordinates

found by the robot, e. g.

	DL	DR	UL
X =	43040	42965	43140
Y =	111040	82347	111172
Z =	11040	10991	140139
C =	180	180	180

AMU

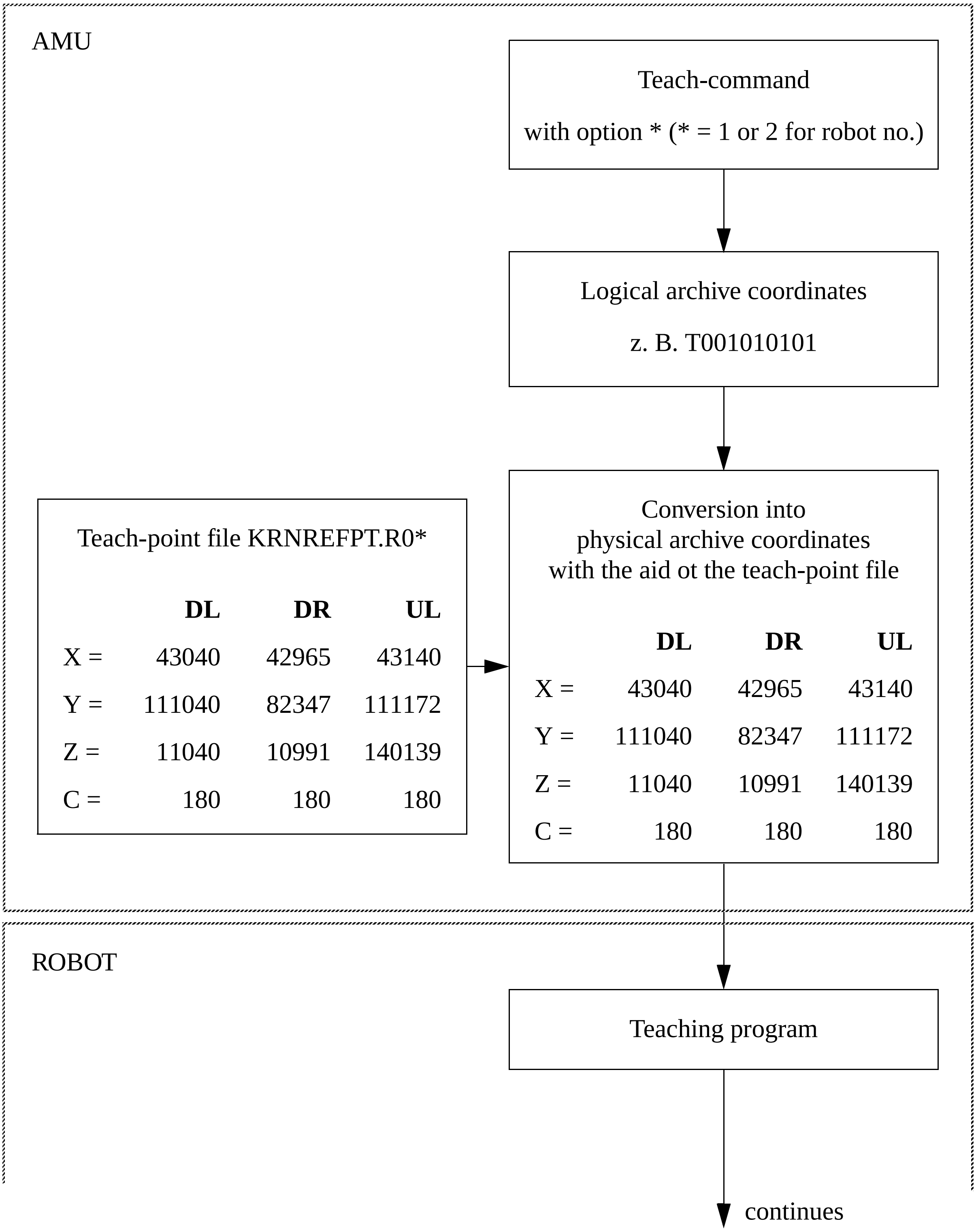
Window Online-Trace KRN 8
displays the differences, e. g.

	DL diff	DR diff	UL diff
X =	-60	-135	40
Y =	-60	-153	72
Z =	-60	-109	39

New input of the component in the
teach-point file
KRNREFPT.R0*

	DL	DR	UL
X =	43040	42965	43140
Y =	111040	82347	111172
Z =	11040	10991	140139
C =	180	180	180

Reteaching of a segment (option 1)



ROBOT

AMU

continued

Physical archive coordinates

found by the robot, e. g.

	DL	**DR**	**UL**
X =	43036	42971	43140
Y =	111040	82357	111172
Z =	11080	10163	140178
C =	180	180	180

Window Online-Trace KRN 8
displays the differences, e. g.

	DL diff	**DR diff**	**UL diff**
X =	-4	6	0
Y =	0	10	3
Z =	40	828	39

Correction of the component segment
in the teach-point file
KRNREFPT.R0*

	DL	**DR**	**UL**
X =	43036	42971	43140
Y =	111040	82357	111175
Z =	11080	10163	140178
C =	180	180	180

5.2.3 Procedure for Initial Teaching

To teach a point the first time or to find the teach values for the configuration proceed as follows.

a) Switch the main switch on

b) Switch the control unit on

c) Wait until the reference movements are completed

d) Call up the robot test program: press ALT + SHIFT + <dead man>

e) Press 1 + <dead man> (TEST)

f) Press 2 + <dead man> (move axis)

g) Press 3 + <dead man> (help functions)

h) Press 1 + <dead man> (teachpoints)

i) Select the direction of the teach label (right elbow = +Y)

j) Position the gripper in front of the the teach label:
- Vision-system: bring the teach label into the camera window
- Barcode scanner: position the light spot on the teach label (max. distance aprox. 3 cm)

k) Measure the teach label: interrupt axis movement by pressing 0

- After measurement the results are displayed by the PHG: `Teacherror!` means that the teach label has not been recognized. Causes are either the incorrect distance between gripper and teach label, or the teach label is not within the search area

l) Read off the coordinates

m) Enter the coordinates into the Graphical configuration of the AMU

n) Save the configuration

o) Close the test program

p) Shutdown AMU

q) Start AMU

r) In the menu **Service** select the command **Teach MTCGdialog**:

s) the window **Graphical Teaching** opens

t) Selecting the component:
- click twice with the left mouse button - the component is shown in blue
- keep <CTRL> pressed, and select robot and green connection, is shown in red

u) Start teaching with **Start Teach** (initial teaching)

v) Wait for positive confirmation (component appears green)

w) Selecting the component:
- click once with the left mouse button - the component is shown in red
- keep <CTRL> pressed, and select robot and green connection, is shown in red

x) Start teaching with **Start Teach** (re-teaching)

y) Wait for positive confirmation (component appears green)

z) Repeat the above steps for all further components

aa) Cancel the window **Graphical Teaching** with **Cancel**

5.2.4 Teach Labels

Teach label data

Size: 8 x 8 mm

Colour: white on black background

The coordinates of the teach label consist of

- the basic value in AMUINI.INI for one label per unit,
- the offset value (Offset) for all teach labels used in the file KRNREFPT.R0* (* = robot number).

Drives

ATTENTION!

Teach each drive slot separately. This is required even when several drives are mounted in the same housing.

a) Switch the drive off.

b) Insert the teach rule into the drive until stop:
   - on 3x80 drives with ACL (Automatic Cartridge Loader): insert the teach rule one position above the draw-in position
   - on 3x80 drives with cover: close the cover

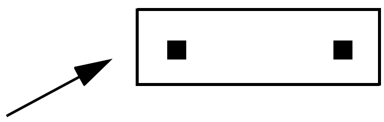


Fig. 5-2: Teach rule with Teach Label

The coordinates refer to the left teach label.

I/O unit/A

Teach each turning unit separately.

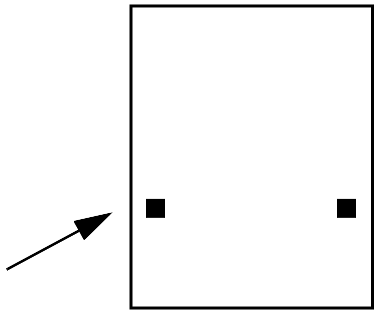


Fig. 5-3: Teach Labels of the Handling Boxes (Side Facing Robot)

The coordinates refer to the teach label indicated.

I/O unit/B

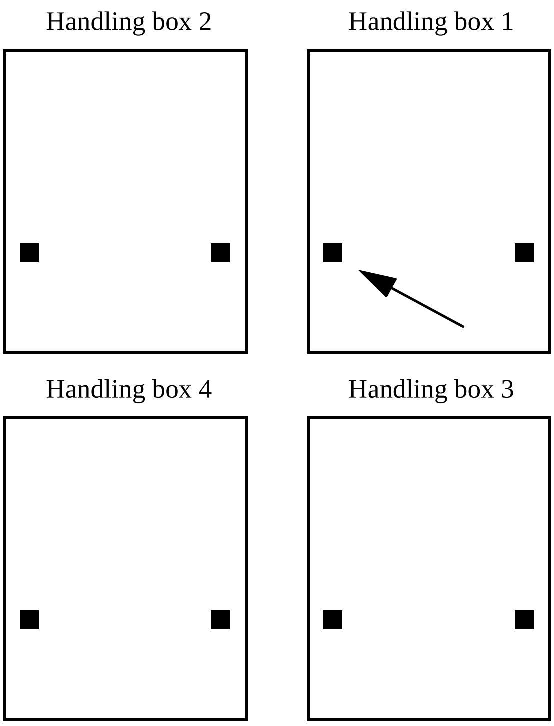


Fig. 5-4: Teach Labels on the Handling Boxes (inside)

The coordinates refer to the teach label indicated.

Problem box

Fig. 5-5: Teach Labels on the Problem Box

The coordinates refer to the left teach label.

Tower segment

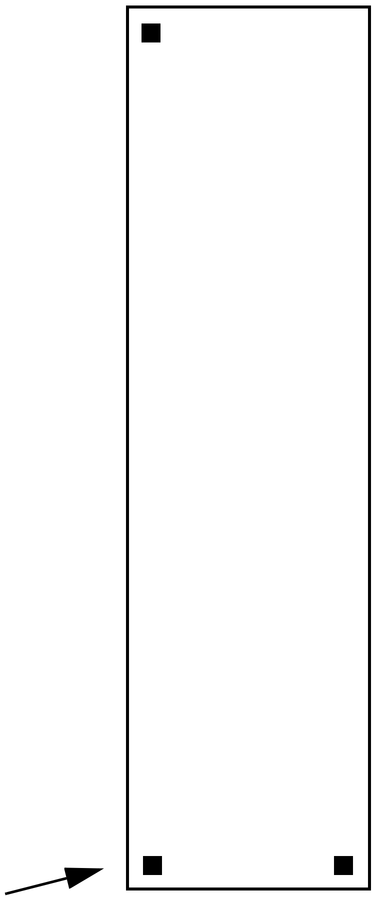


Fig. 5-6: Teach Labels on a Tower Segment

The coordinates refer to the bottom left teach label.

Information

The top right teach label is not used.

5.2.5 AMU-Commands

Single command

To teach a single object, e. g. a tower segment or a drive proceed as follows.

a) Select **Teach single command**

Window	Field	Explanation

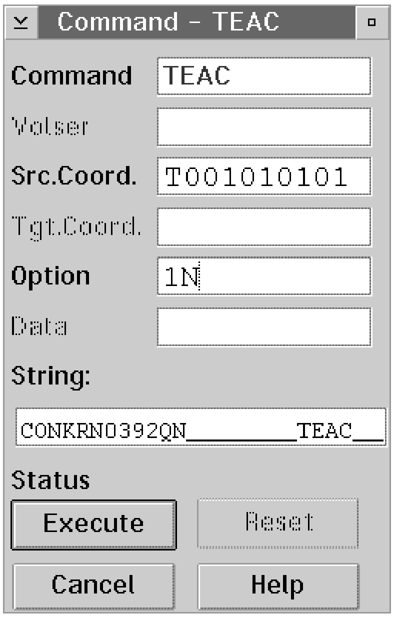


Fig. 5-7: window Command

Command — Displays the selected command, here TEACH.

Src.Coord — 10digit source coordinate (e. g. T001010101).

Option — Parameters specifying the details of the TEACH-command.

- on AML/E only 1, 1N
- on AML/2 1, 1N and on twin systems also 2, 2N

1N or 2N = first teaching

ATTENTION!

All data for the component in KRNREFPT.R01 or KRN-REFPT.R02 will be erased. The target coordinates are deleted from the configuration. The entire component must be taught afresh.

1 or 2 = correction of coordinates (the data in KRNREFPT.R01 or KRNREF-PT.R02 are corrected).

String: — Displays the command string. Composition of the string (☞ ARG)

Status — Displays messages.

Execute — Executes the command.

Reset — Interrupts the command transfer.

Graphical teaching

For graphically supported teaching, of e. g. a Quadro tower, several drives or the complete system.

a) Select **MTCGDialog**

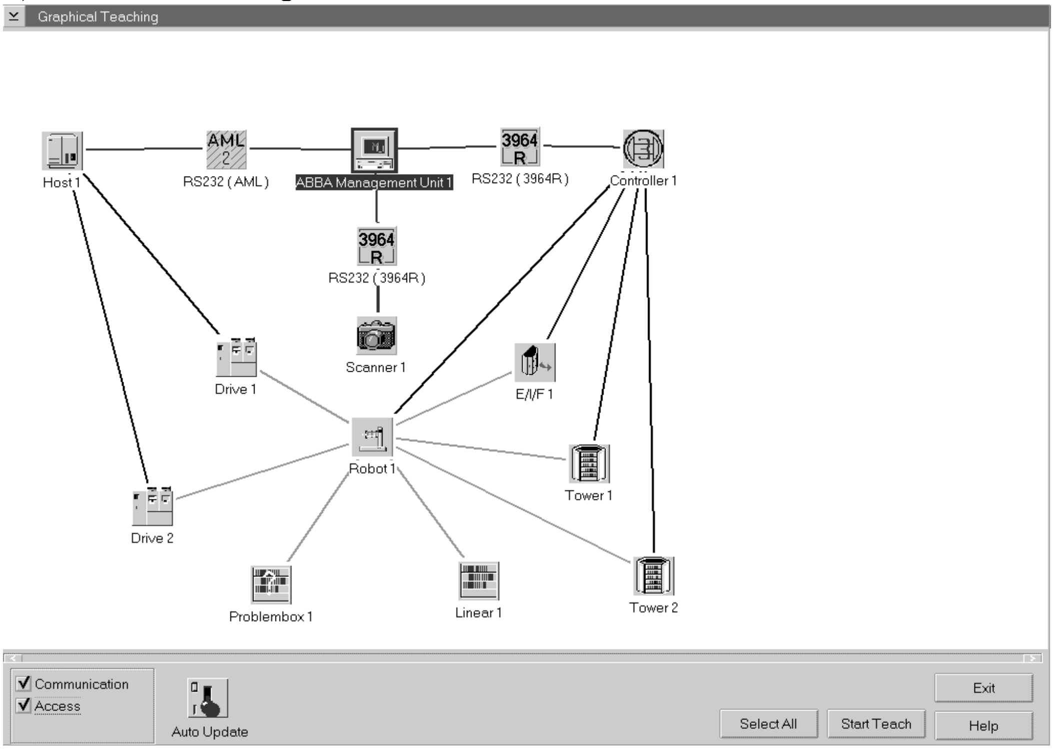


Fig. 5-8: Window Graphical Teaching

Command	Explanation
Connection:	Switch allowing to display or hide the connections (☞ ARG) • **Communication**: data connection • **Access**: mechanic access
Auto Update	Here no function
Select All	Selects all components.
Unselect All	Unselects all selected components.

<table>
<tr><th>Command</th><th>Explanation</th></tr>
<tr><td></td><td>
Selecting a single component:

teach (1): click once with the left mouse button - the component is shown in red
re-teach (1N): click twice with the left mouse button - the component is shown in blue

To select several components keep <CTRL> pressed.

Information

To determine which robot teaches the component you must select the robot, the component and the connection.

When you teach a drive the system prompts you to check if the teach rule has been inserted.

How to proceed with a twin robot:

robot 1 begins with the first tower in ascending order
robot 2 begins with the last tower in descending order

After teaching:

component appears green: no errors
component appears dark brown:
error message and prompt
- Retry: teach once more
- Ignore: ignore error and teach the next component
- Abort: abort the teaching (all components)

</td></tr>
<tr><td>Start Teach</td><td>Start the teach routine for the selected components.</td></tr>
<tr><td>Stop Teach
(during teaching only)</td><td>Stop the teach routine.</td></tr>
</table>

a) Problems during Teaching

Problem	Cause	Solution
Teach label not recognized	teach label dirty	a) Clean the teach label
	too little contrast of teach label and storage box	a) Clean teach label and storage box
	teach label out of search area	a) Shift the teach label by altering the coordinates of the search area b) Select **Configuration...** in the **Service** menu c) Select the component and then **Configure** d) Alter the coordinate(s) e) Restart the teaching
	teach sensor or connection defective	a) Check the connection, if necessary replace the gripper

5.2.6 Integrating a Drive

Information

If you want integrate a new type of drive in the system, you need

- **the teach rule for the drive type**

ATTENTION!

Configurate and teach each drive slot as an individual component. This also applies when several drives are mounted in the same housing.

a) Select **Configuration** in the Service menu

b) Pull one drive into the window **Layout** with the right mouse button pressed

c) Open the **Configuration** window with a double click on the item. Update only the **Description** and the **Type** (☞ ARG)

d) With the left mouse button pressed draw the connections to
   - robot
   - host

e) If you integrate several drives repeat the procedure b) - e)

Information

If no drive is yet available, measure the coordinates with the test program as described at **h).**
If you have a drive taught, do as described at f) .

f) Open the Configuration window of a drive taught and note the coordinates of the reference position.

g) Coordinates of the new drive:
measure the distance from the reference position and recalculate it with 1/100 mm accuracy (observe the right hand rule!). Go on with point i).

h) Robot test program:
   - Switch the main switch on
   - Switch the control unit on
   - Wait until the reference movements are completed
   - Call up the robot test program: press ALT + SHIFT + <dead man>
   - Press 1 + <dead man> (TEST)
   - Press 2 + <dead man> (move axis)

- Press 3 + <dead man> (help functions)

- Press 1 + <dead man> (teachpoints)

  Select the direction of the teach label (right elbow = +Y)
- Position the gripper infront of the the teach label:
  Vision system: bring the teach label into the camera window.
  Barcode scanner: position the light spot on the teach label.
- Measure the teach label: interrupt axis movement by pressing 0 .

  After measurement the results are displayed by the PHG.
  `Teacherror!` means that the teach label has not been recognized.
  Causes are either the incorrect distance between gripper and teach label, or the teach label is not within the search area
- Read off the coordinates
- Enter the coordinates into the Graphical configuration of the AMU
- Repeat the procedure if you integrate several drives
- Save the configuration
- Close the test program

i) Open the **Configuration** window of the new drive.
   - Enter the coordinates measured
   - Select the **Arrangement**

j) Save the configuration: click on **Save** and close the window

k) Open the **LOG Control Center**

l) Select **Archive ... Update Device** in the **Service** menu and wait for the message `The database AML is ready to use“` in the **LOG Control Center**.

m) Execute **Shutdown AML...**

n) Restart the AMU with `startup` at the appearing OS/2 window

o) In the file “KONFIG.DAT” check the drive type(☞ ARG) and change it with the EPM editor if necessary

p) If you have changed the “KONFIG.DAT” transfer it with the **Rho File Manager**

q) Restore the “KONFIG.DAT” to the rho control:

   - Press ALT + SHIFT + <dead man>.

   - Press 2 + <dead man> (Read).

   - Press 0 + <dead man> (Exit).

r) Reduce the processing speed to 10% (PHG Mode 11.4).

- Press MODE (# appears on PHG display)
- Press 1 , 1 (11), press ⇒ (help functions)
- Press MODE (# appears on PHG display)
- Press 4 , press ⇒ (adjust VFACTOR)
- Press 0 , . , 1 (0.1), press ⇒

s) Teach the new drive with the option **1N** or **2N** (**Teach...singlecommand**)
t) Reteach the new drive with the option **1** or **2**
u) Test the AMU commands **Put** and **Get** (or **Mont** and **Keep**) on all new drives - keep track of possible archive changes
v) Check whether the gripper moves into and out of the drive slot smoothly (does not bump into the edges of the slot).
w) Adjust the normal processing speed (100 %).
(if menue VFACTOR already present, do only the last order)

- Press MODE (# appears on PHG display)
- Press 1 , 1 (11), press ⇒ (help functions)
- Press MODE (# appears on PHG display)
- Press 4 , press ⇒ (adjust VFACTOR)
- Press 1 , press ⇒ .

x) Save changed data on diskette 3 “AMU Update“:
- C:\AMU\AMUCONF.INI
- C:\AMU\KRNREFPT.R0x

y) Save “KONFIG.DAT” with the **Rho File Manager**

6 Test Programs

6.1 Robot and Tower Test Programs

The following test programs are available

- robot test program (PHG plugged in at the robot cabinet)
- Quadro tower test program (PHG plugged in at the Quadro tower cabinet)
- I/O unit/A test program (from the control panel of the I/O unit)

Information

When you enter numeric values a meaningless numeric value may be displayed. It is not active anymore, however.

Preconditions for the test program

- Robot or Quadro tower has completed the reference movements.
- Files required in the rho control system:

Filename	Filename for Quadro towers
INIT.IRD	INIT.IRD
KONFIG.DAT	KONFIG.DAT
PTEST.IRD	TEST.IRD
PTEST.DAT	TEST.DAT
PTEACH.IRD	QTURM1.IRD
	QTURM2.IRD
	QTURM3.IRD

a) Parameterize the file “KONFIG.DAT”

6.2 Starting the Program

The start procedure depends on the PHG-Echo.
The individual PHG-Echo modes (0-3) mean the following:

- 0: no PHG display, operation with AMU
- 1: with PHG display, operation with AMU
- 2: with PHG display, stand-alone operation without AMU
- 3: with PHG display, stand-alone operation without AMU and without gripper (robot control only)

Information

You can read back all DAT files with the command “READ”.

When quitting the Quadro tower test program you can change the PHG-Echo**!**

```
Should be set
PHG-Echo to
2 , 1 or 0 ??
2 / 1 / 0
```

When quitting the Robot test program you can change the position from gripper**.**

```
1 base position

ENTER end
```

- input: 1 : gripper in„normal“-position
- input: : reach gripper position after exit test program

ATTENTION!
Collision hazard!

There must be enough space for the robot.

```
ROBOT IS IN
DANGEROUS POSITION,
GET HIM OUT OF THIS
1 = TEST
```

PHG-Echo 0 oder 1

Start the program:

- from the running production program by pressing ALT + SHIFT + <dead man>
- from the main menu by pressing 1 (TEST)

```
TEST  VERSION V0230

3 = INFO    2 = READ
1 = TEST    0 = EXIT
```

```
TEST  VERSION  2.3.0
     T O W E R
3 = INFO    2 = READ
1 = TEST    0 = EXIT
```

When you have started the program the following main menu appears:

```
1 installation
2 move axis
3 continous run
9 END
```

```
1 adjust Offset QT
2 turm Tower manu.
3 Continous run
0 Cancel
```

No further commands of AMU are executed.

PHG-Echo 2 or 3

The program starts automatically, when the robot or Quadro tower has completed its reference movement.

6.3 Robot-Test Program AML/2

Menu Tree Barcode Scanner, Version 2.20

- 1 installation
  - 1 offset robot
    - 1 1st axis
      - 1 w. dial test indic.
      - 2 with gripper
      - 0 cancel
    - 2 roll axis (axis 4)
      - 1 w. dial test indic.
      - 2 with gripper
      - 0 cancel
    - 3 HPO (home position offset)
    - 0 cancel
  - 2 offset tower
  - 3 gripper test
    - 1 gripper test
    - 2 gripper cont. run
    - 3 Barcode reading
      - 1 barcode offset
      - 2 scanner test
        - 1 continous run %
        - 2 continous run (read)
        - 0 cancel
      - 3 set codetype
      - 0 cancel
    - 0 Cancel
  - 0 cancel
- 2 move axis
  - 1 single axis
    - 1 joint coordinates
    - 2 world coordinates
    - 0 cancel
  - 2 defined values
  - 3 help functions
    - 1 teachpoints
      - 1 right hand
      - 2 left hand
      - 3 forward
      - 0 cancel
    - 2 ROBOT straightpos
    - 3 calibration point
      - 1 right elbow
      - 2 left elbow
      - 0 cancel
    - 0 cancel
  - 0 cancel
- 3 continous run
  - 1 HV-axis
  - 2 ROBOT
  - 3 HV-Axis + ROBOT
  - 0 cancel
- 9 END

1 installation

1.1 offset robot

1.1.1 1st axis

1.1.1.1 with dial test indicator

- Adjust the PHG-Echo in the “KONFIG.DAT” to “3”
  (stand-alone operation without AMU and without gripper)
- Read “KONFIG.DAT” back with READ
- Call up the test program by pressing ALT + SHIFT + <dead man>
- press 1 + <dead man> (TEST)
- press 1 + <dead man> (installation)
- press 1 + <dead man> (offset robot)
- press 1 + <dead man> (axis 1)
- press 1 + <dead man> (w. dial test indic.)

```
zero adjustment
ROBOT
enter front X-pos
   with       ENTER
```

input:

```
start pos 200 - 700
```

input: movement (200 - 700 mm)

Information

Adjust a track that is as long as possible. This will ensure a more precise measurement. Shorten the track length only on small systems.

During the measurement the software limit switch of axis 5 must not be tripped.

ATTENTION

The robot will move!

- Move the robot to the start position with

Information

On the opposite sides of the track, two stable contact surfaces (e. g. bracket screwed to it (2) or part of the Quadro tower) for attachment of the dial gauge are required or must be mounted.

- Move the H-axis to a suitable start position
- Stop positioning by pressing 0 .

  The robot moves to the first measuring point
- Mount the assembly plate (3)
- Attach the dial gauge (1) and adjust it to the first measured valun

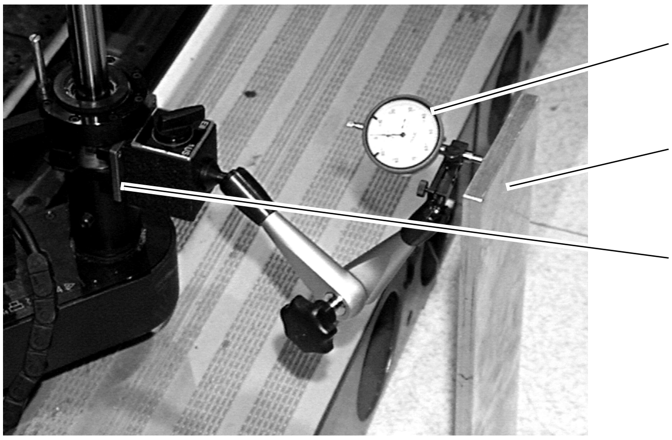


Fig. 6-1: Measuring Procedure Zero-Point of Robot AXIS 1

- Enter the first measured value [mm]
- Move the robot to the second measuring point by pressing

Information

The dial gauge must always be attached to the contact surface.
If the measuring range is not sufficient estimate the second measured value.

- Enter the second measured value

The first angle is output.

- Return the robot to the first measuring point by pressing
- Check the first measured value

Information

If the deviation exceeds 0.02 mm repeat the measurement.

- Remove the dial gauge

ATTENTION

The dial gauge must not be mounted when you position the robot on the other side of the track!

- Position the robot on the opposite side by pressing
- Measure on this side

The second angle is output.

- Press

The change of the angle is output.

- Note the change of the angle
- Remove the dial gauge

Information

You can repeat the entire measurement by pressing SHIFT .

Pressing returns you to the menu item `Offset Robot`**.**

- Press 0 + <dead man> (cancel)
- Press 0 + <dead man> (cancel)
- Press 9 + <dead man> (end)
- Press 0 + <dead man> (exit)

```
ROBOT IS IN
DANGEROUS POSITION,
GET HIM OUT OF THIS
1 = TEST
```

- Press <CONTROL OFF>
- Reset the control unit: press <Reset> on the power supply PS75 in the robot cabinet
- Change the parameters
  - add the change of angle to the parameter 207 A_1

Sample calculation (sample values only):

change of angle: -0.15°
parameter 207 A_1: 1.23° + (-0.15°) = 1.23° - 0.15° = 1.08°

- Check the parallelity of the robot
  - repeat the entire measurement
- If the angle changes by more than 0,02° rechange the parameters also

1.1.1.2 with gripper

- Dismount the foot boards around the reference point
- Mount teach rules on both sides of the intended spots
- Stretch the robot arm
- Press <SYSTEM ON>
- Press <CONTROL ON> and wait until the reference movement is completed

- Call up the test program by pressing ALT + SHIFT + <dead man>
- press 1 + <dead man> (TEST)
- press 1 + <dead man> (installation)
- press 1 + <dead man> (offset robot)
- press 1 + <dead man> (axis 1)
- Press 2 + <dead man> (with grippe)

```
zero adjustment
ROBOT
drive to base pos
with          ENTER
```

input:

```
axis  1 and 4
maybe adjust manual
(remember angle !!)
with ENTER
```

Coarse alignment of axis 1 and 4.

input:

The menu “move axis” appears.

```
1:0.000002:0.00000
3:300.0004:0.00000
5:0.000006:10.0000
0 cancel
```

Note the angle.

Align the axes and subtract the new angles from the old angles.

Note these changes of angles.

Exit the positioning with 0 .

```
machine parameters
change with 3

go on with ENTER
```

Have you aligned the axes?

- Yes: quit the test program with [3]

  and change the machine parameters (add the change of angle to parameter P207 (☞ page 6 - 11))

- No: press [⇒] (more)

```
drive to base
position
with ENTER
0 cancel
```

Move to the start position with [⇒].

The menu “move axis” appears.

The robot move to the base position.

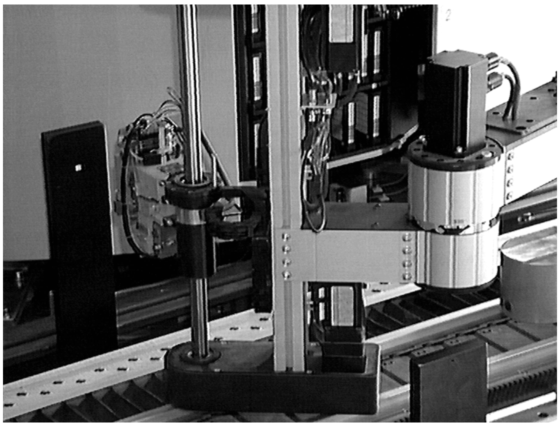


Fig. 6-2: Robot on the teach rule

```
move
H-axis

with ENTER
```

input: [⇒]

The menu “move axis“ appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Move axis 5 in front of the teaching

template with [5+].

Quit the positioning with [0].

```
start measurement

with ENTER
0 cancel
```

Start the measurement with .

```
angle  1: ?.?????
             degrees

go on with ENTER
```

Display of the first change of angle.

input:

```

other side

with ENTER
```

input:

```
angle 2: ?.?????
             degrees

go on with ENTER
```

Display of the second change of angle.

input:

```
change angle
parameter 207 for
           degrees
go on with ENTER
```

Display of the change of angle for parameter 207 A_1. Note this value, if value > 0.00*.

Move the robot to the home position with .

- machine parameter change
  - Value> 0,00*°:press 3 and confirm with
  - Value≤ 0,00*°:press (more) to rolling axis
- press <EMERGENCY STOP>
- one after the other press MODE , 7 , (diagnosis)
- one after the other press MODE , 8 , (machine parameters)
- one after the other press MODE , 2 , (set machine parameters)

- set the parameters: enter number and confirm with 
- P207 A_1: add the noted change of angle to the reference point actual value of axis 1
- complete the input with ←
  - write the input to the EEPROM with ←
- Confirm the safety prompt with 1 (as of operating system TO03).

  An automatic RESET is called.
- Let the control unit run up
- Reset the write protection of the board CP/MEM to “1”
- Stretch the robot manually
- Release <EMERGENCY STOP>
- Press <SYSTEM ON>
- Press <CONTROL ON>.

The robot makes a reference movement

- Check the alignment
  - repeat the measurement
- If the deviation exceeds
  - > 0,0*° change parameter again
  - ≤ 0,00*° goto roll axis

1.1.2 roll axis

1.1.2.1 with dial test indicator

Information

Precondition for the procedure: Robot are in straight position and parallel to the track (Position after reference movement).

- Call up the test program by pressing ALT + SHIFT + <dead man>
- press 1 + <dead man> (TEST)
- press 1 + <dead man> (installation)
- press 1 + <dead man> (offset robot)
- press 2 + <dead man> (roll axis)
- press 1 + <dead man> (with dial test indicator)

```
1 short track
2 long track

0 cancel
```

Select the length of the installation:

- short installation: 1

  (track length of only one Quadro tower)

- large installation: 2

```
zero adjustment
ROBOT R-axis
move manual
        ENTER
```

input:

```
drive ROBOT arm to
straight position
with ENTER
0 cancel
```

input:

The robot arm stretches.

```
move
H-, Y- a.Z-axis
with ENTER
0 cancel
```

input:

The menu “move axis” appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Reduce the speed with

1 + <dead man>.

```
velocity
   type between
0.001 and 0.3
```

input: 0.001; with .

- Mount long mounting plate (1) and bracket (2)

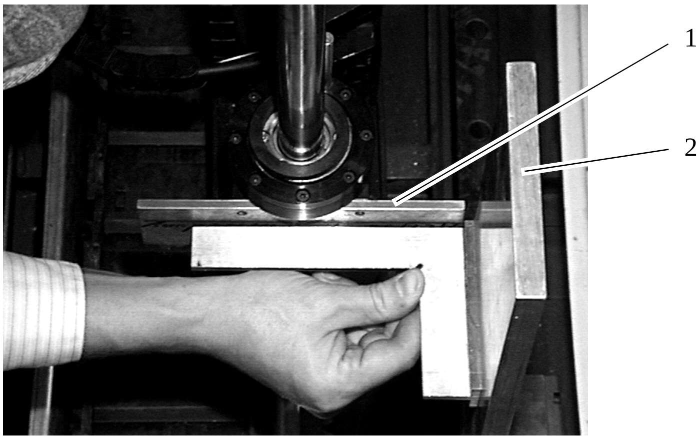


Fig. 6-3: Measurement of the Zero-Point of the Robot Rolling-Axis

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Move the rolling axis manually until the mounting plate is normal to the track.

Read of the angle of the rolling axis and note it.

Quit the positioning with 0 .

```
machine parameters
change with 3

go on with ENTER
```

Have you aligned the axes?

- Yes: quit the test program with 3

  and change the machine parameters (add changes of angle to parameter P207: (☞ page 6 - 11))
- No: press (more)

- Repeat the entire process to check the results

Information

You can repeat the entire measurement by pressing SHIFT .

Pressing returns you to the menu item Offset Robot.

- press 0 + <dead man> (cancel)
- press 0 + <dead man> (cancel)
- press 9 + <dead man> (end)
  - press 0 + <dead man> (exit)

```
ROBOT IS IN
DANGEROUS POSITION,
GET HIM OUT OF THIS
1 = TEST
```

- Press <CONTROL OFF>
- Reset the control: press Reset on the power supply PS75 in the robot cabinet
- Change the parameter
- add the angle from parameter 207 A_4

Sample calculation (sample values only):

angle of rolling axis: R: -0.78°
parameter 207 A_4: 9.01° + (-0.78°) = 9.01° - 0.78 = 8,23°

- Check the alignment
- repeat the measurement
- If the deviation exceeds ≥ 0.02° rechange the parameters
- Press <CONTROL OFF>
- Switch off the main switch
- Mount the gripper
- Switch on the main switch
- Reset the PHG-Echo in the “KONFIG.DAT” to “0”
- Reset the control: press Reset on the power supply PS75 in the robot cabinet

1.1.3. HPO(Homeposition Offset)

This procedure finds the offset between the reference point switch and the zero mark of the motor measuring system after mechanic alterations of the drive system.

- Call up the test program by pressing [ALT] + [SHIFT] + <dead man>
  - press [1] + <dead man> (TEST)
  - press [1] + <dead man> (installation)
  - press [1] + <dead man> (offset robot)
  - press [3] + <dead man> (Homepos. Offset)

```
AML2 TEST V 2.3.0
HOME POSITION OFFSET
 0 cancel
 go on with ENTER
```

input: [⏎]

```
drive ROBOT in
secure area
0 cancel
go on with ENTER
```

ATTENTION

The robot stretches and could collide with the device in front of the track.

Position the robot at sufficient distance.

input: [⏎]

The menu “Move axis” appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Position the robot at sufficient distance to the I/O unit.

Quit the positioning with [0].

`detecting HPO` `?. axis` `0 next axis` `go on with ENTER`	Go to the next axis with 0 Select the axis with .
`gearing faktor` ` 1  131` ` 2  100` `PRESS ENTER`	Press .
`type in the actual` `value P207 of` `           ?.axis`	Enter the current HPO value. (☞ „Software Backup, Parameters of Robot Amplifier“ or boschtrm program)
`type in the actual` `Home Position Offset` `of ? .axis`	input:
`measuring HPO` `?      .axis` `0 cancel` `go on with ENTER`	Display of measured values. Note deviating values. input:
`new values ?. axis` `HPO: ???` `P207: ???` `go on with ENTER`	input:

- Copy changed values:
  - HPO-Offset with program “BOSCHTRM” to amplifier
  - Parameter P207 with PHG to operating system rho control

Save changed file MPRHO3.BIN

1.2 Offset tower

(☞ page 6 - 36)

1.3 gripper test

1.3.1 gripper test

- all gripper functions will testeted seperatly
- Display of sensor signals on PHG

```
1 base position

0 go on
ENTER end
```

- Input: 1 to cancel the gripper test

  with „standard“ gripper position
- Input 0 to start gripper test
- Input ENTER to cancel gripper test with

  actual gripper position

```
gripper open
not reached
go on with ENTER
0 cancel
```

- Example of the display during gripper test
- Press ENTER for toggle to the next gripper function

Which gripper typ installed?

```
mixedmediagripper?
1 yes
2 no
```

- Input 1 for gripper 180° turnable

  (function for Optical Disk

Input 2 for 3480 or D2 gripper

```
1 base position

0 go on
ENTER end
```

- Input: 1 to cancel the gripper test

  with „standard“ gripper position
- Input 0 to start gripper test
- Input ENTER to cancel gripper test with

  actual gripper position

Information

The response from system to PHG commands are here very different . If you pressed the PHG keys to long, you run over same test steps.

1.3.2 gripper cont. run

Continous test for gripper functions

```
mixedmediagripper?
1 yes
2 no
```

Which gripper typ installed?

- Input 1 for gripper 180° turnable

  (function for Optical Disk

Input 2 for 3480 or D2 gripper

```
continous run
gripper

0 cancel
```

- PHG Display for gripper continous run
- Cancel with 0

1.3.3 barcode reading

1.3.3.1 barcode offset

Finds barcode reading parameters automatically.
This may take a relatively long time (approx. 5 min.).

The barcode reading parameters are measured separately for the storage towers (rack) and the I/O unit.

Preconditions:

- values have been entered in the “KONFIG.DAT”: all values from the gripper datasheet
- plant illumination and lighting conditions as in normal operation
- the respective segment must have been taught
  - medium must be inside compartment (I/O unit: handling box 1 or 2, storage tower: row 6 - 12)
  - next compartment right of the medium must be empty

Information

If STK and Code 39 barcodes are used in the system, test the barcode reading with STK labels. These are harder to read and therefore better for optimization of barcode reading.

a) Send a **`Look`** command to a suitable compartment

b) Call up the test program by pressing ALT + SHIFT + <dead man>

- Press 1 + <dead man> (TEST)
- Press 1 + <dead man> (installation)
- Press 3 + <dead man> (gripper test)

  Press 3 + <dead man> (barcode reading)
- Press 1 + <dead man> (barcode offset)

```
detecting
     Offset for
 barcode reading
 go on with ENTER
```

input: ⟨ENTER⟩

The test program now tries to read the barcode.

- If the 1st attempt fails, the error routine starts.
- If the further attempts also fail the test program quits trying. In this case you change the values manually in “KONFIG.DAT”.
- “KONFIG.DAT” is read with READ after each change.

```
BC=??????
??%   1 correction
        0 cancel
 go on with ENTER
```

Displays the barcode and the reading level, prompts you to decide how to continue:

- change gripper position with [1] (menu “Move axis”)
- quit barcode reading with [0]
- optimize barcode reading with ⟨ENTER⟩

```
Mediatype:
1=34x0 2=OD 3=VHS
4=TK85 5=D2(25GB)
6=D2(75GB)
```

Enter numer for media type (basic value for distance scanner - media)

```
detecting
    -Offset for
 barcode reading
 go on with ENTER
```

Start optimizing by pressing ⟨ENTER⟩ .

```
X: ???.???Y: ???.???
Z: ???.???C: ???.???
BC=????????????????
ACT   ??% BEST=??%
```

Display during the optimization:

- current position
- barcode and reading level
- best level

```
following values
have to be added to
KONFIG.DAT values
go on with ENTER
```

Input

```
FG_X_BC_OFF = _
FG_Y_BC_OFF = _

go on with ENTER
```

- Display of optimized values (☞ table)
- Note all values.
- Cancel Display with

name of parameter		Explanation
I/O unit	RACK	
FG_X_BC_EA	FG_X_BC_RACK	gripper offset forward
FG_Y_BC_EA do not use	FG_Y_BC_RACK	gripper offset horizontal

ATTENTION!

Do not use the optimized value for the I/O unit in Y!

Find this value by trial and error: a medium that is placed up side down must not be read.

a) Add the note values to the “KONFIG.DAT”

Information

There are two ways you can edit “KONFIG.DAT” :

- **directly from the PHG in the rho or**
- **with the EPM editor on the AMU processor**

If you edit “KONFIG.DAT” on the AMU processor you must afterwards transfer it to rho using the `Rho File Manager`.

- Read “KONFIG.DAT” back with READ after this first measurement or reset the control unit (press the reset button on power supply PS75)
- Check the values by sending a **`Look`** command for another compartment

1.3.2 scanner test

Preconditions:

- A **`Look`** command was sent to a suitable compartment.

a) Call up the test program by pressing ALT + SHIFT + <dead man>

- Press 1 + <dead man> (TEST)
- Press 1 + <dead man> (installation)
- Press 3 + <dead man> (gripper test)
- Press 3 + <dead man> (barcode reading
- Press 2 + <dead man> (scanner test)

```
  scanner test
BC=
Level   =      %
go on with ENTER
```

- Display of the actual read processes
- Input (display submenu)

1.3.3.2.1 continous run (%)

```
  . run
BC=
Level   =      %
0 cancel
```

- evaluation of 50 scans each
- display of the respective attempt and the reading level (Level)
- when the continuous run is quit the percentage of the reading level is output in relation to the attempts (level sum)

```
  . run
BC =
total level =      %
0 cancel
```

Quit the continuous run with 0 .

1.3.3.2.2 continous run (read)

```
  . run
BC=
Level    =        %
0 cancel
```

- comparison of barcodes read and the first value read, quit upon deviation
- display of the barcode and the attempts

Quit the continuous run with 0 .

1.3.3.3 set code type

```
CODETYPE: Code 39/STK
    Code test?

ENTER=Yes/0=No
```

Select Barcode Type with

The following barcode types can be chosen (more than one possible)

- Code 39 and STK-Code (only in combination)
- Code 128 (COMPAREX)
- SONY 2/5

```
CODETYPE: Code 39/STK
fixed code length ?

ENTER=Yes/0=No
```

Select the number of digitis of the volser:

- Input for volser with a fixed number of digits in the code (the next window ask for the number of digits)
- Input 0 for volser with max. 16 digits

```
CODETYPE: Code 39/STK
media type digit?

ENTER=Yes/0=No
```

Selection of the featue of an VolTag :

- Input 0 (VolTag is not supported by AMU software)

```


Seperator:  #

```

Enter the Separator symbol (symbol in the Volser between native Volser and VolTag) default: “-”and confirm

with

```
Start/Stop Output?


ENTER=Yes/0=No
```

Select the STK Code frame symbol ($) :

- Input for output $” on STK
- Input 0 for no output of “$” (prefered)

```
BC= ???????
      enable

ENTER=Yes/0=No
```

Barcode is read and displayed by PHG.

There after activate the barcode type with (enabled: confirmed by a beep).

2 move axis

2.1 single axis

Information

In the menu “Move axis” you can call the robot arm to swivel over by pressing

SHIFT + 6 + <dead man>.

2.1.1 joint coordinates

Moves axes 1 - 6.

```
1: ???.???2: ???.???
3: ???.???4: ???.???
5: ???.???6: ???.???
0 cancel
```

Display of the axis position after each movement.

Alter the speed of movement with 1 + <dead man>.

- axis 1: 1+ , 1- + <dead man>
- axis 2: 2+ , 2- + <dead man>
- axis 3 (Z): 3+ , 3- + <dead man>
- axis 4 (R): 4+ , 4- + <dead man>
- axis 5 (H): 5+ , 5- + <dead man>
- axis 6 (V): 6+ , 6- + <dead man>

Quit the function by pressing 0 .

2.2 world coordinates

Moves axes 1 - 6.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Display of the axis position after each movement.

Alter the speed of movement within the range between

0,001 and 0,3) with 1 + <dead man>.

Display of machine coordinates with

2 + <dead man>.

- axis 1/2 (X): 1+ , 1- + <dead man>
- axis 1/2 (Y): 2+ , 2- + <dead man>
- axis 3 (Z): 3+ , 3- + <dead man>
- axis 4 (R): 4+ , 4- + <dead man>
- axis 5 (H): 5+ , 5- + <dead man>
- axis 6 (V): 6+ , 6- + <dead man>

Quit the function by pressing 0 .

2.2 defined values

ATTENTION!

Collision hazard!
The positions are not checked!

Information

Pressing or 0 does not change the position.

a) Enter the end positions of the movement in the following sequence:
   - X (axes 1/2/R)
   - Y (axes 1/2/R)
   - Z (axis 3)
   - R (axis 4)
   - H (axis 5)
   - V (axis 6)
- Move to the position with

2.3 help function

2.3.1 teachpoints

Measures the coordinates of a teach label for the AMU configuration. The values measured are entered directly into the configuration (values in 1/100 mm).

```
1 posit.y-direct.l
2 negat.y-direct.r
3 forward
0 cancel
```

Select the direction of the teach label.

```
ENTER    drive to
start position
 0 hold actual
 position
```

input:

The robot moves to the start position and holds the 0-position of the H-axis.

```


go on with ENTER
0 cancel
```

input:

```
move
H-axis , V-axis ,
Y-axis
with ENTER
```

input:

The menu “Move axis” appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Position the gripper in front of the teach label:

- barcode scanner: light spot on the teach label
- adjust the distance between teach label and gripper bracket to approx. 1 cm

Quit the positioning with 0 .

The teach label is measured.

```
teacherror !!!!!
 ???

go on with ENTER
```

`Teacherror!` means that the barcode label has not been recognized.
Causes are either the incorrect distance between gripper and teach label or the teach label is not within the search area.

```
X: ???.??? Y: ???.???
Z: ???.??? R: ???.???

go on with ENTER
```

Output of values in 1/100 mm.
You can enter these values directly into the AMU configuration.

Continue with

```
repeat with ENTER
0 cancel
```

Input: Measure next teach label

Input: 0 Return to menu help function.

2.3.2 straight robot

(in Maschinenkoordinaten).Stretches out the robot arm. Axes 1 through 4 all move to position 0
(in machine coordinates).

ATTENTION!
Collision hazard!

There must be enough space for the robot.

a) Call up the test program by pressing ALT + SHIFT + <dead man>

- Press 1 + <dead man> (TEST)
- Press 2 + <dead man> (move axis)
- Press 3 + <dead man> (help function)
- Press 2 + <dead man> (robot straightpos)

```
drive ROBOT arm to
straight position
with ENTER
0 cancel
```

move robot to straight position with ENTER.

2.3.3 calibration point

Find the grip points with left and right elbow for various media. The values are entered in KONFIG.DAT.

Get medium from the storage tower with **Get**.

a) Call up the test program by pressing ALT + SHIFT + <dead man>

- Press 1 + <dead man> (TEST)
- Press 2 + <dead man> (move axis)
- Press 3 + <dead man> (help function)
- Press 3 + <dead man> (calibration point)

```
calibration point
1 right elbow
2 left elbow
0 cancel
```

Select right elbow with [1] or

the left elbow with [2]

The menu “Move axis” appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Position the medium in the alignment station:

- medium must have contact.
- gripper not in „crash“

Read off values displayed on the PHG and enter them in KONFIG.DAT.

Quit the positioning with [0] .

3 continuous run

The continuous runs test individual axes and the gripper

3.1 HV-axis

The continuoes runs check the (axis 5 + 6).

ATTENTION!

Collision Hazard!
The limits are not checked!

a) Enter the paths
  - track (axis 5)
  - lifting column (axis 6)

b) Enter the speed with [1] (values 0.1 to 1)

c) Quit the function by pressing [0] + <dead man>

3.2 ROBOT (4 gripper)

Information

If there is no gripper, waiting times between the movements will result.

a) Move the carriage to the continuous run position

b) Start the continuous run with

c) Enter the speed with 1 (values 0.1 to 1)

d) Quit the function by pressing 0 + <dead man>

3.3 HV-axis + ROBOT

ATTENTION!

Collision Hazard!
The limits are not checked!
Consider also the forward movement of the robot.

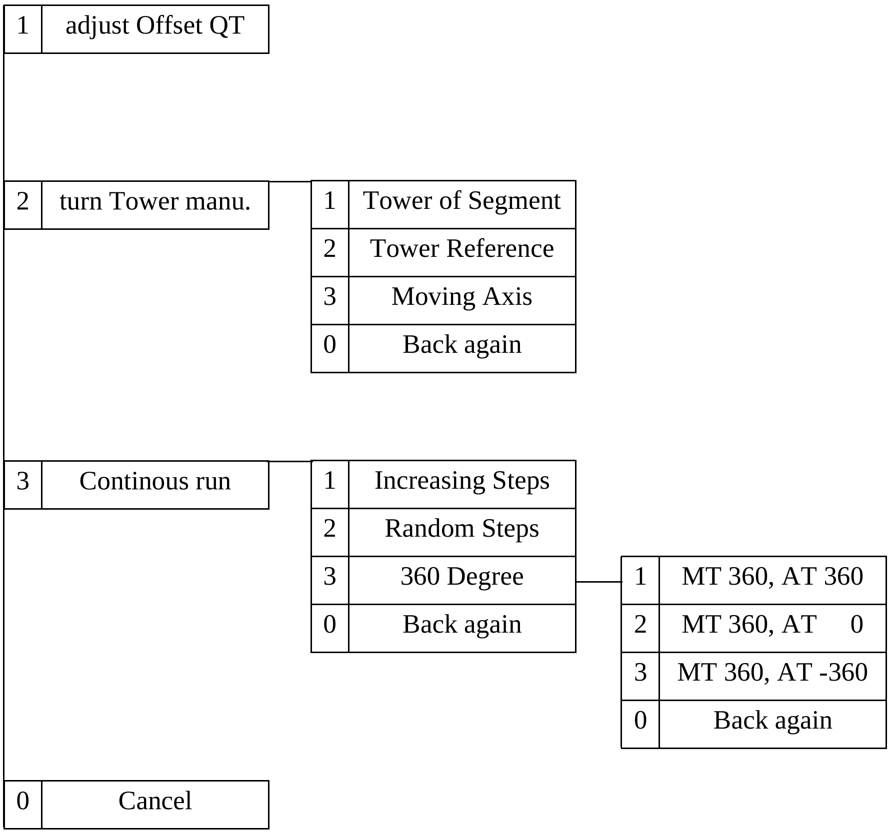
a) Enter the paths
- track (axis 5)
- lifting column (axis 6)

b) Enter the speed with 1 (values 0.1 to 1)

c) Quit the function by pressing 0 + <dead man>

6.3.1 Quadro Tower Test Program

Menu Tree



1 Adjust Offset QT (align Quadro tower to the track)

Application

- for initial installations
- when the support of the reference switch has been readjusted

Preconditions

- no accessories
- zero-point of robot has been adjusted
- gripper functions
- Quadro tower in reference position
- 2 PHGs (robot/Quadro tower) with active test program in main menu

- must be in the test program (ALT + SHIFT + <dead man>

Procedure

Quadro tower PHG:

```
1 adjust Offset QT
2 turn Tower manu.
3 Continous run
0 cancel
```

input: 1 + <dead man>

```
  Home Pos.Adjustment
  of Quadrotower

 More with ENTER
```

input:

```
which Quadrotower
should be adjusted
1, 2 or 3 ?
0 Back again
```

select Quadro tower: ? + <dead man>

```
 Adjustment from
 ?. Quadrotower

 More with ENTER  A
```

input:

The selected Quadro tower turns to segment 7 (main tower). During the turning “A” appears on the PHG display.

```
Distance on Slot 1
Input with ENTER
0 Back again
```

Continue with robot.

Robot PHG:

```
1 installation
2 move axis
3 continous run
9 END
```

input: 1 + <dead man>

```
1 offset robot
2 offset tower
3 cancel
```

input: 2 + <dead man>

```
zero adjustment
TOWER drive to base
position with ENTER
0 cancel
```

input:

During the movement the PHG display is blank.

```
type TOWER pos
against ROBOT sight
1 = right
2 = left
```

choose a side: ? + <dead man>

```
zero adjustment
drive to start pos
with ENTER
0 cancel
```

input: [ENTER]

The menu “move axis” appears.

```
X:          Y:
Z:          R:
H:          V:
0 cancel
```

Position the gripper infront of the bottom left teach label (compartment 1):

- Barcode scanner: position light spot on teach label.
- Vision system: move teach label into the camera window.
- Adjust the distance between teach label and gripper bracket to approx. 1 cm.
- The gripper must be able to reach compartment 10 from this position without moving axis 6 (V-axis).

Quit the positioning by pressing [0].

Compartment 1 is measured.

```
1. V-value: ???.???

go on with ENTER
```

Display of 1st offset value.

Enter this offset value on the Quadro tower PHG.

Quadro tower PHG:

```
Distance on Slot 1
Input with ENTER
0 Back again
        ???.???
```

Enter the distance value measured with robot PHG

and confirm by pressing [ENTER].

```
Distance on Slot10
Input with ENTER
0 Back again
```

Continue with robot PHG.

Robot PHG:

```
1. V-value: ???.???

go on with ENTER
```

input:

Compartment 10 is measured.

```
2. V-value: ???.???

go on with ENTER
```

Display of 2nd offset value.

Enter this offset value on the Quadro tower-PHG.

Quadro tower PHG:

```
Distance on Slot10
Input with ENTER
0 Back again
        ???.???
```

Enter offset value measured with the robot PHG
and confirm by pressing .

```
Home Pos. Adjustmen
of Main-Tower
More with ENTER
```

input:

```
Main-Tower
Adjustment again
necessary
More with ENTER
```

If the correction is not sufficient, measure the offset values once more.

input:

```
Distance on Slot1
Input with ENTER
0 Back again
```

Continue with robot PHG.

Robot PHG:

zero adjustment TOWER repeat with ENTER 0 cancel	Measure offset values once more by pressing ⟐ .
1. V-value: ???.??? go on with ENTER	Display of 1st offset value. Enter this offset value on the Quadro tower PHG.

Quadro tower PHG:

Distance on Slot 1 Input with ENTER 0 Back again ???.???	Enter offset value measured with robot PHG and confirm by pressing ⟐ .
Distance on Slot10 Input with ENTER 0 Back again	Continue with robot PHG.

Robot PHG:

1. V-value: ???.??? go on with ENTER	input: ⟐ Compartment 10 is measured.
2. V-value: ???.??? go on with ENTER	Display of the 2nd offset value. Enter this offset value on the Quadro tower PHG.

Quadro tower PHG:

```
Distance on Slot10
Input with ENTER
0 Back again
        ???.???
```

Enter offset value measured with robot PHG and confirm by pressing [ENTER].

```
Home Pos. Adjustmen
of Main-Tower
More with ENTER
```

input: [ENTER]

```
Adjustment of the
Main-Tower OK
Offset: ??.????
More with ENTER
```

input: [ENTER]

```
Distance on Slot 1
Input with ENTER
0 Back again
```

When the main tower offset has been measured successfully the tower automatically turns to the auxiliary tower segment 1. The same previous procedure for the main tower offset now begins.

```
Adjustment of the
Auxilary-Tower OK
Offset: ??.????
More with ENTER
```

input: [ENTER]

```
Should be saved
the new Values?
Yes=1 / No=0
```

save values: [1]

Press [1] if more then one tower tob be adjust

```
Save all changed
Values in file
KONFIG.DAT
```

The offset values are automatically entered into the KONFIG.DAT.

```
Quadrotower ?
referencing
```

There after the Quadro tower references with the new offset values. This takes a few minutes to reference

d) Save the file “KONFIG.DAT” with the **Rho File Manager** (☞ AMU Reference Guide)

2 Move Axes Manually

Preparation

The test program has been started in the menu `turn Tower manu.`

```
1 Tower of Segment
2 Tower Reference
3 Moving Axis
0 Back again
```

a) Select menu by pressing [?] + <dead man>

2.1 Turn tower to segment

Turns the Quadro tower to a segment between 1 and 32.

```
which Quadrotower
should be turn ?
1, 2 or 3 ?
0 Back again
```

Select Quadro tower: [?] + <dead man>

```
Tower ? Segment ?
Input with Enter
0 Back again
```

Select segment: [?] + <dead man>

```
Quadrotower ?
is turning !!
```

The Quadro tower turns at medium speed.

```
Tower ? Segment ?
Input with Enter
0 Back againg
```

Select a new segment or quit.

2.2 Reference tower

References the Quadro tower.

```
which Quadrotower
should be reference
1, 2 or 3 ?
0 Back again
```

Select Quadro tower: ? + <dead man>

```
Quadrotower ?
referencing
```

The Quadro tower is referencing.

```
which Quadrotower
should be reference
1, 2 or 3 ?
0 Back again
```

Select new Quadro tower or quit.

2.3 Move axis individually

Moves the main or auxiliary towers.

```
 For Axis-Movement
 press only Button
 1+,1-,2+, 2-, et.
0 Back again
```

- main tower 1: 1+ , 1- + <dead man>
- auxiliary tower 1:

  2+ , 2- + <dead man>
- main tower 2: 3+ , 3- + <dead man>
- auxiliary tower 2:

  4+ , 4- + <dead man>
- main tower 3: 5+ , 5- + <dead man>
- auxiliary tower 3:

  6+ , 6- + <dead man>

Quit the function by pressing 0 .

3 Continuous Runs

The continuous runs start only for Quadro towers that have been configured.

```
1 Increasing Steps
2 Random Steps
3 360 Degrees
0 Back again
```

a) Select the menu by pressing ? + <dead man>

3.1 In increasing steps

Moves to all segments in increasing sequence.

```
Segments turned in
Increasing Steps
1,2,3,..
More with Enter
```

input: ⟐

```
Should be turn all
in KONFIG.DAT def.
Quadrotowers ??
Yes=1 / No=0
```

select Quadro towers:

- all with 1 or
- selected towers with 0

```
Speed input with
Enter (in percent)
0 Back again
```

Enter the speed in percent (1 to 100).

```
 *** AUTOMATIC ***
Movement:  ?

(c) 1991 BOSCH
```

The number of movements is protocolled on the PHG display.

```
End Continous Run
End Continous Run
End Continous Run
End Continous Run
```

Quit the function by pressing

0 + <dead man>.

3.2 In random steps

Moves to all segments in random sequence (☞ page 6 - 47).

3.3 360 degree turns

```
360 Degree
Continous run
More with Enter
```

input:

```
Should be turn all
in KONFIG.DAT def.
Quadrotowers ??
Yes=1 / No=0
```

select Quadro towers:

- all with 1 or
- selected towers with 0

```
Speed input with
Enter (in percent)
0 Back again
```

Enter speed in percent (1 to 100).

```
1 MT 360, AT 360
2 MT 360, AT 0
3 MT 360, AT -360
0 Back again
```

Select motors and rotation direction.

- main tower and auxiliary tower in the same direction (1)
- only main tower (2)
- main tower and auxiliary tower not in the same direction (3)

```
 Test with oposite
 Destination turning
 Motors
 0 Cancel
```

Confirmation of the selection (sample display on PHG).

```
 *** AUTOMATIC ***
Movements:  ?

(c) 1991 BOSCH
```

The number of movements is protocolled on the PHG display.

```
End Continous Run
End Continous Run
End Continous Run
End Continous Run
```

Quit the function by pressing

0 + <dead man>.

6.4 I/O Unit/A: BDE Test Program

Precondition

No commands from AMU or host to the I/O unit or the robot.

Procedure

Fig. 6-4: Maintenance Door of I/O Door

a) Open the maintenance door of the I/O unit
b) Press the reset button (arrow) on the rear of the operating panel and select the test menu with F3 during the run-up
c) Select test

- 1 keyboard test
- 5 test of inputs and outputs
- ESC quit test program and return to automatic operation

Keyboard test 1

The configuration of the key just pressed is shown.

a) Press all keys one after the other and check their configuration.
Sequence:
- from top to bottom
- from left to right

Test of inputs and outputs 5

The display shows the status of the inputs and outputs:

- X2/ST7 IN (inputs)
- X2/ST7 OUT (outputs)
- X3/ST8 IN (inputs)
- X3/ST8 OUT (outputs)

You can change the status of the outputs.

The display shows the keyboard configuration on the last three lines.

a) Select pin with ↑ or ↓

b) Toggle Byte (X2/ST7, X3/ST8) with ←, →

c) Set bit or reset bit (only outputs) with

Input configuration

Pin	Configuration of Byte X2/ST7	Pin	Configuration of Byte X3/ST8
1 2	problem box in position problem box in position	1 2	problem box released turning unit 1 released
3 4 5 6 7 8	Seg. 1 2 3 4 5 6 7 8 1 0 1 1 - - - - 0 1 1 1 - - - - 1 1 1 0 - - - - - - - - 1 0 1 1 - - - - 0 1 1 1 - - - - 1 1 1 0	3 4 5 6 7 8	turning unit 2 released type of unit: 120/240 media reserve reserve turning unit 1 row 1 occupied turning unit 1 row 2 occupied
9 10	turning unit 1 turns turning unit 2 turns	9 10	turning unit 1 row 3 occupied turning unit 2 row 1 occupied
11 12	handling box top handling box bottom	11 12	turning unit 2 row 2 occupied turning unit 2 row 3 occupied
13 14	door turning unit 1 CLOSED door turning unit 2 CLOSED	13 14	reserve reserve
15 16	door turning unit 1 OPEN door turning unit 2 OPEN	15 16	problem box occupied reserve

Output configuration

Pin	Configuration of Byte ST7/X2	Pin	Configuration of Byte ST8/X3
20 21	problem box turnable problem box locked	20 21	frequency converter ON frequency converter OFF
22 23	motor turning unit 1 ON motor turning unit 1 OFF		
24 25	motor turning unit 2 ON motor turning unit 2 OFF		
26 27	open door turning unit 1 close door turning unit 1		
28 29	open door turning unit 2 close door turning unit 2		
30 31	release problem box lock problem box		
32 33	release turning unit 1 lock turning unit 1		
34 35	release turning unit 2 lock turning unit 2		

7 Help Procedures

7.1 Rho 3 Operating System

7.1.1 Edit file „KONFIG.DAT“ with PHG

Precondition: PHG in operating system - not in test program

a) One after the other press MODE , 3 , (program BAPS/PIC)

b) One after the other press MODE , 1 , (program BAPS-program)

c) One after the other press MODE , 1 , (edit)

d) Select “KONFIG.DAT” with ↑ or ↓ and confirm by pressing

e) To select the line
- either scroll with the cursor buttons
- or press MODE , press L and enter the line number, press

ATTENTION!

If you keep pressed too long the entire line will be erased!

If that happens quit the file without saving the changes:

press MODE , press Q .

f) Change the parameters (only possible in insert mode):

- Place the cursor on the right of the value to be changed
- Erase the value with
- Enter the new value

g) Save the file: press MODE , press E

h) Update the file “KONFIG.DAT” in the main memory.
Choose one of the following possibilities:
- only in “Auto” operating mode: start the test program and select the command “READ” - then quit the test program
- reset the control: press the reset button on power supply PS75

i) Save “KONFIG.DAT” with the Rho File Manager (☞ AMU Reference Guide).

7.1.2 Edit Machin Parameters „MPRHO3.BIN“ with PHG

Precondition:

- PHG in operating system - not in test program
- Emergency Stop
- Write Protect switch set to „0“

j) One after the other press MODE , 7 , ⮊ (diagnosis)

k) One after the other press MODE , 8 , ⮊ (machine parameters)

l) One after the other press MODE , 2 , ⮊ (set machine parameters)

m) Set the parameters: enter number and confirm with ⮊

n) To select the line
- either scroll with the cursor buttons

o) Complete the input by pressing ←

p) Write the input to the EEPROM by pressing ←

q) Confirm the safety prompt with 1 (as of operating system TO03).

An automatic reset is called
- Let the control unit run up

r) Save “MPRHO3.BIN” with the Rho File Manager (☞ AMU Reference Guide).

7.1.3 Preparation for manual mode

a) Shutdown AMU

b) Set the rho control to set-up:
apply with jumper 24 V to input 0.0

c) Switch the main switch on and let the rho control unit boot

d) Press <PLANT ON>, <CONTROL ON>

e) Wait for display:

```
   ***manual***
TO03G     23.06.1993
no reference points!
(c) 1991 BOSCH
```

7.1.4 Manually Moving the Axes of the Handling Unit

In the PHG operating system:

a) One after the other press MODE , 2 , (Move Axis)

b) Press COOR +<dead man> ((5) in explanation of the display panel) (☞ page 7 - 4)

ATTENTION!

Risk of collisions!

Before moving axis 5 position axes 1 and 2.

Explanation of the Display Panel

Information

You cannot see the display until the coordinate system has been selected.

- `Increment`**: (press jog keys just briefly)**
  minimum traversing unit for jog mode
- `Cont. L.`**: continous slow traversing**
- `Cont. S.`**: continous rapid traversing**

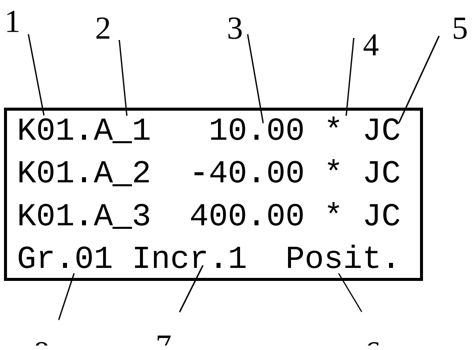


Fig. 7-1: Display panel

Field	Description
1	Kinematic name
2	Axis name (selection with ↓)
3	Value (mm or °) (refers to the fields `2`, `5` and `6`)
4	Status position servo loop • no display: axis position not corrected • `*`: axis is within the defined position range
5	Active coordinate system • `JC`: joint coordinates (machine coordinates) • `WC`: world coordinates (room coordinates) • `GC`: gripper coordinates
6	Signification of the values (refers to field `3`) • `Posit.`: axis position • `Lag.`: difference between actual and target coordinate • `Offset`: not in use
7	Traversing mode (selection with →)
8	Group (always `Gr. 01`)

Axis movement:

- axis 1 : 1+ , 1- +<dead man>
- axis 2 : 2+ , 2- +<dead man>
- axis 3 (Z): 3+ , 3- +<dead man>
- axis 4 (R): 4+ , 4- +<dead man>
- axis 5 (H): 5+ , 5- +<dead man>
- axis 6 (V): 6+ , 6- +<dead man>

Quadro Tower

Move the axes of the Quadro tower:

- main tower 1 : 1+ , 1- +<dead man>
- auxilary tower 1 : 2+ , 2- +<dead man>
- main tower 2: 3+ , 3- +<dead man>
- auxilary tower 2: 4+ , 4- +<dead man>
- main tower 3: 5+ , 5- +<dead man>
- auxilary tower 3: 6+ , 6- +<dead man>

7.1.5 Completing the Axes Test

a) Shutdown AML
b) Remove the jumper 24 V from input 0.0
c) Switch the main switch on
d) Let the rho control unit boot
e) Press <PLANT ON>, <CONTROL ON>
f) The AML/2 system does its reference movements

7.2 Adjustment of AMU interface

The protocol 3964R needs a defined timing of its communication partners.
If the AMU reaction time is too long, the communication AMU - rho will be cut off.
To minimize this problem, you can increase the timeout values with the following procedure.

ATTENTION!
Destruction of robot!

Wrong input of interface parameters can cause total destruction of the robot.
There is no control of data input.
Enter the parameters very carefully.

Information

The interface parameters are not part of the machine parameters.
They are saved on the EEPROM of board CP/MEM.

When do you have to adjust the AMU interface?

- After the installation of a new system
- After an backup of the EEPROM on board CP/MEM
- After the changing of board CP/MEM

How to adjust the AMU interface

a) Stop the robot with the host commands HOLD and ROSO

b) Press the <EMERGENCY STOP> button

c) Determine the version of the operating system. Press step by step
  - `Mode 7 Enter` (Diagnosis)
  - `Mode 11 Enter` (Version)
  - Read the operating system version from the PHG (TO02F TO03G or TO05L)
  - Press `Shift 1` (Cancel version)

d) Choose `Edit Machine Parameters.` Press step by step
  - `Mode 8 Enter` (Machine parameters)
  - `Mode 2 Enter` (Edit machine parameters)
  - `-00000 Enter` (Input password)
  - `Enter` (Accept parameter set name)
  - `Enter`

Procedure for operating system version TO02F

a) Check the address of your specific version (VAA - version specific address). Press step by step
- `=== Enter` (address input) display `address=`
- `005180 Enter` (address) display `address=005180:`
- `NCKD Enter` display `18D04`
- `Enter`

Information

If the initialization flag has value 1, there is no reset of communication parameters during startup.

b) Set the initialization flag. Press step by step
- `=== Enter` (address input) display `address=`
- `018D04 Enter` (address) display `address=018D04:`
- `NCKB Enter` display `0`
- `1 Enter`

c) Set the repeat delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018D06 Enter` (address) display `address=018D06:`
- `NCKD Enter` display `FA0` (old value 4000 ms)
- `001F40 Enter` (new value 8000 ms)

d) Set the acknowledge delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018D0A Enter` (address) display `address=018D0A:`
- `NCKD Enter` display `226` (old value 550 ms)
- `003A98 Enter` (new value 15000 ms)

e) Set the symbol delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018D12 Enter` (address) display `address=018D12:`
- `NCKD Enter` display `DC` (old value 220 ms)
- `003A98 Enter` (new value 15000 ms)

f) Copy the changed values to the EEPROM. Press step by step
- `Shift` and `1`
- `Shift` and `1`

g) Release the <EMERGENCY STOP> button

h) Start the system

Procedure for operating system version TO03G

a) Check the VAA. Press step by step
- `=== Enter` (address input) display `address=`
- `005180 Enter` (address) display `address=005180:`
- `NCKD Enter` display `18DCC`
- `Enter`

Information

If the initialization flag has value 1, there is no reset of communication parameters during startup.

b) Set the initialization flag. Press step by step
- `=== Enter` (address input) display `address=`
- `018DCC Enter` (address) display `address=018DCC:`
- `NCKB Enter` display `0`
- `1 Enter`

c) Set the repeat delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018DCE Enter` (address) display `address=018DCE:`
- `NCKD Enter` display `FA0` (old value 4000 ms)
- `001F40 Enter` (new value 8000 ms)

d) Set the acknowledge delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018DD2 Enter` (address) display `address=018DD2:`
- `NCKD Enter` display `226` (old value 550 ms)
- `003A98 Enter` (new value 15000 ms)

e) Set the symbol delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018DDA Enter` (address) display `address=018DDA:`
- `NCKD Enter` display `DC` (old value 220 ms)
- `003A98 Enter` (new value 15000 ms)

f) Copy the changed values to the EEPROM. Press step by step
- `Shift` and `1`
- `Shift` and `1`

g) Confirm saving with `1`, `ENTER`

h) Release the <EMERGENCY STOP> button

i) Start the system

Procedure for operating system version TO05L

a) Check the VAA. Press step by step
- `=== Enter` (address input) display `address=`
- `005190 Enter` (address) display `address=005190:`
- `NCKD Enter` display `18330`
- `Enter`

Information

If the initialization flag has value 1, there is no reset of communication parameters during startup.

b) Set the initialization flag. Press step by step
- `=== Enter` (address input) display `address=`
- `018330 Enter` (address) display `address=018330:`
- `NCKB Enter` display `0`
- `1 Enter`

c) Set the repeat delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018332 Enter` (address) display `address=018332:`
- `NCKD Enter` display `FA0` (old value 4000 ms)
- `001F40 Enter` (new value 8000 ms)

d) Set the acknowledge delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `018336 Enter` (address) display `address=018336:`
- `NCKD Enter` display `7D0` (old value 2000 ms)
- `003A98 Enter` (new value 15000 ms)

e) Set the symbol delay time. Press step by step
- `=== Enter` (address input) display `address=`
- `01833E Enter` (address) display `address=01833E:`
- `NCKD Enter` display `DC` (old value 220 ms)
- `003A98 Enter` (new value 15000 ms)

f) Copy the changed values to the EEPROM. Press step by step
- `Shift` and `1`
- `Shift` and `1`

g) Confirm saving with `1`, `ENTER`

h) Release the <EMERGENCY STOP> button

i) Start the system

Addresses

Parameters	General address	Address TO02F	Address TO02J	Address TO03F	Address TO03G	Address TO05L
Version specific address	VAA	018D04	018D08	018D98	018DCC	018330
Repeat delay time	VAA + 02 hex	018D06	018D0A	018D9A	018DCE	018332
Acknowledge delay time	VAA + 06 hex	018D0A	018D0E	018D9E	018DD2	018336
Buffer delay time	VAA + 0A hex	018D0E	018D12	018DA2	018DD6	01833A
Symbol delay time	VAA + 0E hex	018D12	018D16	018DA6	018DDA	01833E

Parameters

Parameter	old value (ms)	old value (hex)	new value (ms)	new value (hex)
Repeat delay time	4000	000FA0	8000	001F40
Acknowledge delay time	550	000226	15000	003A98
Buffer delay time	400	000190	400	000190
Symbol delay time	220	0000DC	15000	003A98

7.2.1 Moving Axis 6 (V-Axis) with function generator

Axis 6 must be moved when

- the robot must be replaced, because it cannot be moved anymore
- the motor of axis 6 is to be replaced

Information

In this operating mode (function generator operation) the drive amplifier forces the motor to perform a cyclical movement.
The path, the acceleration and the time of the movement can be adjusted.

WARNING!

The EMERGENCY STOP function is not active!

Shutdown is possible only with the main switch!

a) Apply power to the power supply 160 by manual operation of the contactor K2 (“CONTROL ON”-circuit): apply 24 V on pin 8 (contact 48) of the contactor (the contactor K2 is on the middle level of the device panel)

b) Switch on the main switch

c) Connect the installation cable to the interface connector COM 1 or COM 2 (if necessary disconnect another cable)

d) Connect the installation cable to the drive amplifier plug X6

e) Open the AMU OS/2 window

f) Insert the disk “Robot & Tower Software”

g) Change to drive “A:\” (a:)

h) Change to directory “A:\ROBOT\MOOG” (cd robot\moog)

i) Call up the communication program “boschtrm” (boschtrm)

j) Enter <C> for configurate

k) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Interface type	IQ140/RHO3 CAN	<2>
- Helpfile	IQ 140/RHO	<2>

l) Press <ENTER> until the following message appears:

```
Enter first
letter of a
command or H
for help >
```

input: <SHIFT>+<*>

`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <O>
`Enter second letter >>`	input: <R>
`Sure (Y/N)?`	input: <Y>
`Options:` `1 CAN Reference` `2 Analog Ref` `3 Functions Gen` `? (1/2/3) >>`	input: <3>
`- Traverse` `    1.000 E 1 (revs)` `?`	= 24 cm path from the start position; positive = up input: <1>, <0>
`- Tuning Acc.` 1.000 EZ [rad/s^2] `?`	input: <ENTER>
`- Tuning Max Speed` `? [RPM]`	input: <5>, <0>
`- Tuning Frequenz Hz` `    1.000 E-1` `?`	input: <ENTER>
`Function` `Generator` `Initialisation`	
`Enter first` `letter of a` `command or H` `for help >`	input: first letter and second letter of the command (☞ table)

Command	Input (first /second letter)	Result
Start cyclical movement from the start point	<M>, <I>	The brake is released and the axis moves back and forth.
Stop movement	<M>, <O>	The axis stops in the current position and the brake locks.
Release/lock brake	<M>, <B>	`Brake is On bzw. OFF` `Release Brake` `(Y/N)?` **WARNING!** **When you release the brake the robot slides down!** **Support the robot before releasing the brake.** input: • <Y> releases the brake • <N> locks the brake

m) Unplug the installation cable (replug other cable)
   - AMU interface
   - drive amplifier socket X6

n) Remove the disk “Robot & Tower Software”

o) Switch off the main switch

Information

You can also release the brake, by applying 24 V directly to “Logic” and “brake off”. The 24 V required are available at the power supply 160 when the main switch is on.

7.3 Software-Backup of the AML/2 System

After each alteration of the AML/2 system a software backup is required.

An overview of the backups required is shown on the next page.

Information

Copy the altered files of

- **the AMU with the OS/2 command “copy“**
- **the AMU database with the Database Manager (☞ page 7 - 16)**
- **the CP/MEM board with the Rho File Manager (☞ AMU Reference Guide)**
- **the drive amplifiers with the program “Boschtrm”or „terminal“ (☞ page 10 - 20)**

Alteration	File Altered	Copy File to
Component in the graphical configuration • added • altered	C:\AMU\AMUINI.INI (**Shutdown AML...** required)	A:\ (Disk AMU Update)
	C:\AMU\KRNREFPT.R01	
	Board CP/MEM: KONFIG.DAT	A:\ROBOT1 or A:\ROBOT2 (Disks Robot & Tower Software)
	AMU database	A:\ (Disk Database-Backup)
Reteaching	C:\AMU\KRNREFPT.R01	A:\ (Disk AMU Update)
Gripper replaced	Board CP/MEM: KONFIG.DAT	A:\ROBOT1 or A:\ROBOT2 (Disks Robot & Tower Software)
Storage tower-offset adjusted	Board CP/MEM: KONFIG.DAT	
Motor replaced	board CP/MEM: MPRHO3.BIN	
HPO altered	Drive amplifier: *.PRS (* = name of file)	A:\MOOG (Disks Robot & Tower Software)
Volser ranges altered	C:\AMU\AMUINI.INI	A:\ (Disk AMU Update)
	AMU database	A:\ (Disk Database Backup)
Host computer connection altered	Configuration files of the Communications Manager (☞ page 7 - 16)	A:\ (Disk AMU Update)
Update of robot- and storage tower software	Board CP/MEM: all files (“Backup” command of the Rho File Manager)	A:\ROBOT1 or A:\ROBOT2 (Disks Robot & Tower Software)
AMU-fix	All files of the AMU-fix on the correction disk	A:\UPDATE (Disk 3 AMU Update)

7.3.1 Saving the CM/2 Configuration

Information

Dependent on your communication type you have to save

- **that special configuration file to directory C:\CMLIB**
- **the files „PROTOCOL.INI“, „SETUP.CMD“ and „STARTUP.CMD“ to the directories shown below**

Directory	Filename	Communication Type
C:\CMLIB\	3270.*	EXCP
	LU62S.*	LU 6.2 Single Session
	LU62SC.*	LU 6.2 Single Session with additional Coax
	LU62P.*	LU 6.2 Parallel Session
	LU62PC.*	LU 6.2 Parallel Session with additio-nal Coax
	BOCA.*	only DCAF connection
C:\IBMCOM	PROTOCOL.INI	LAN Adapter and Protocol Support
C:\TCPIP\BIN	SETUP.CMD STARTUP.CMD	TCP/IP

a) Change to the OS/2 desktop

b) Open an OS/2 window

c) Insert disk 3 „AMU Update“

d) Copy the files to disk 3

e) Remove the disk

7.3.2 AMU Archive catalog (Database)

(☞ AMU Reference Guide

8 Maintenance

8.1 For Your Safety

According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 maintenance work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.

WARNING!

During all work observe the safety rules in chapter 3 “For Your Safety” (☞ page 3 - 1).

8.2 Preparing Maintenance Work

WARNING!

All maintenance work, except functional checks (e. g. shutter) must be carried out only when the system is switched off and voltageless.

Shut the AML/2 system down before (☞ Operator Guide) and secure it against switch on.

a) Attach a warning sign to it (☞ page 3 - 14)

Information

Protocol every maintenance job in the system logbook with

- **date and**
- **next due date for this maintenance job**

When replacing lubricating cartridges additionally record

- **the adjusted time of the lubricating cartridge**
- **the next due date for replacement**

When inserting the 400 g-cartridge at the grease gun additionally air the grease gun.

8.3 Putting Back into Service

WARNING!

Before starting the AML/2 system be sure the start will not

- **endanger people,**
- **damage property.**

a) Start the AML/2 system (☞ Operator Guide)

8.4 Mechanic Maintenance

On the following pages the maintenance jobs are listed in tables:

- track (☞ page 8 - 3)
- carriage 1+2 (☞ page 8 - 4)
- lifting column part 1+2 (☞ page 8 - 6)
- robot part 1-3 (☞ page 8 - 8)
- gripper part 1+2 (☞ page 8 - 11)
- I/O units (☞ page 8 - 13)
- Quadro tower 1+2 (☞ page 8 - 16)

The time in the table is calculated for 1 robot with 1 Quadro tower.

Track

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Rack (4)	below the big expansion bellows	clear off coarse contamination and excessive lubricant (around toothing)	8-2	0.5	10
Oil tray	below the big expansion bellows	clear out oil residues with a cloth	8-2	0.5	5
Chain conduit (1)	centre of the track	check chain for damage or wear open chain at intervals of approx. 1 m • remove covers with a screw driver (5) check cables and air hose (3) for • damage • scarfing • parallel positioning (not twisted)	8-1 8-3 8-2	1	15

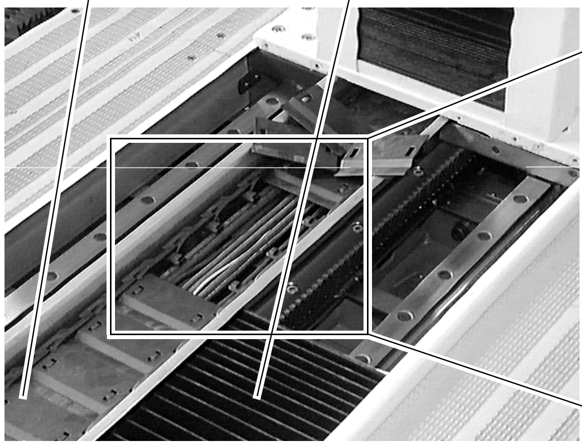


Fig. 8-1: Open Track

Fig. 8-2: Open Chain Conduit

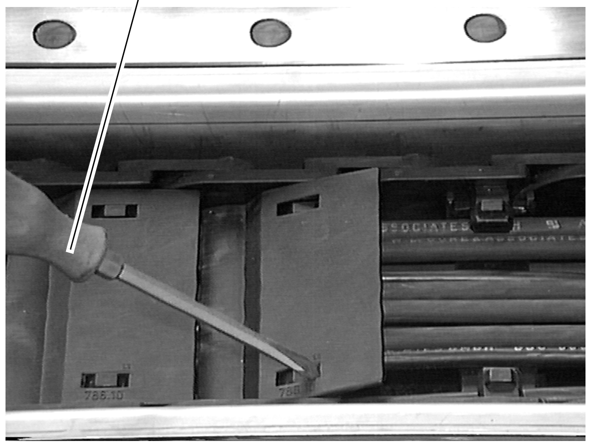
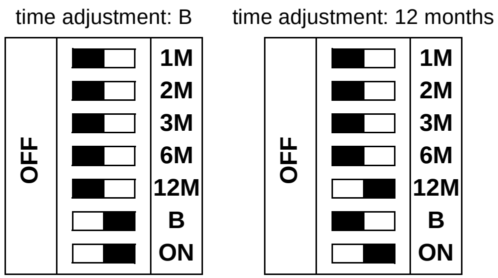


Fig. 8-3: Opening the Chain Conduit

Carriage 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Gear axis 5 (2) (H-axis)	below the cover behind the lifting column	check for tightness	8-5	1	5
		oil change • dismount gearing with motor • open venting screw and drain screw (2), drain oil • screw in the drain screw • fill in oil (approx. 110 ml Klüber Syntheso HT 220) • screw in venting screw • mount gearing with motor • adjust reference point and resolver zero-point (HPO) (☞ page 9 - 10)	8-5	3	40
Lubricating cartridge (6) for circulating elements of the linear guide rails	below the cover behind the lifting column (new systems)	replace (Order-No.: 134 000 005 [125 ml for 1 Q tower] or 134 000 002 [475 ml for 2 to 6 Q towers]) • remove old lubricating cartridge • mount new lubricating cartride - lubricant: Centoplex GLP 500 - time adjustment: ☞see table below	8-4, 8-8	☞ table below	10
Oil tray (4)	behind the cover of the lifting column	clear out coarse contamination and oil residues with a cloth (drive robot in manual mode in top position)	8-6 8-7	0.5	10

Q Towers	Time	Interval
1 - 4	B	12 months
5 - 6	12 months	6 months



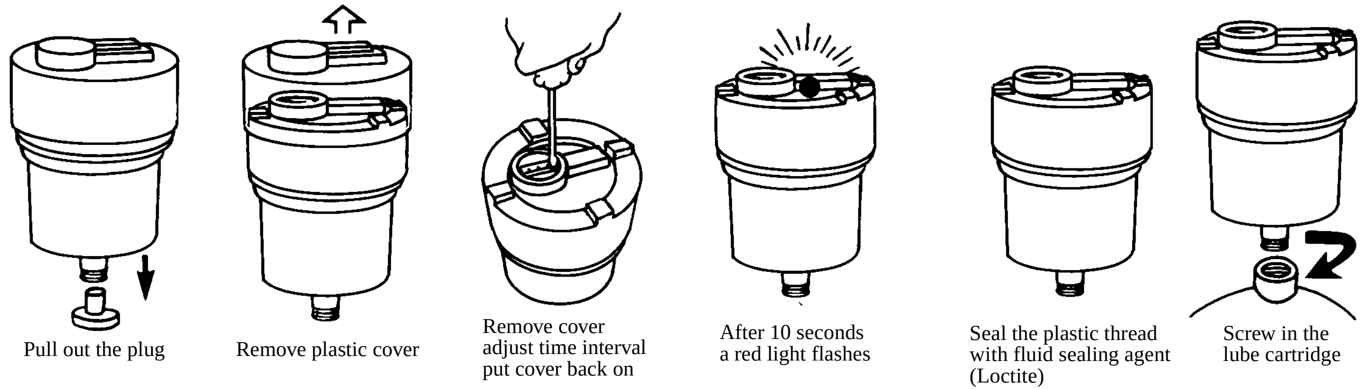
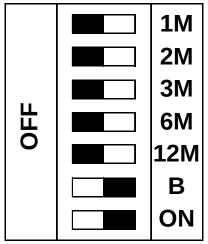


Fig. 8-4: Adjusting the Lube Interval and Mounting the Cartridge

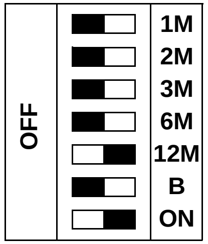
Carriage 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Lubricating cartridge (1) for rack and pinion	below the cover behind the lifting column	replace (Order-No.: 134 000 000) • remove old lubricating cartridge • mount new lubricating cartride - lubricant: Structovis BHD - time adjustment: ☞see table below	8-4, 8-5	☞ table below	10
Maintenance unit (5) with micro filter	below the cover of the lifting column	check pressure adjusted (display 5 ... 5.5 bar) drain condensate (manually)	8-6	0.5	5

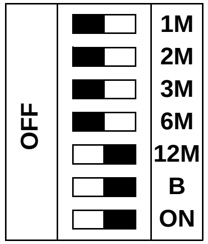
time adjustment: B



time adjustment: 12 months



time adjustment: 12 months + B



Q Towers	Time	Interval
1 - 3	B	12 months
4 - 5	12 months	6 months
6	12 months + B	6 months

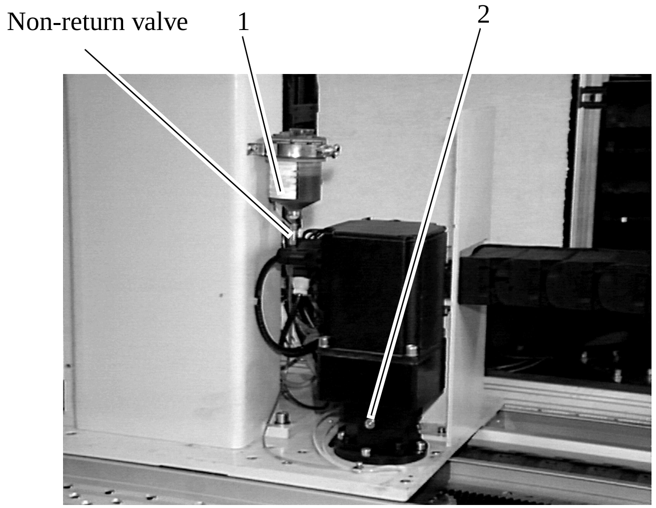


Fig. 8-5: Motor and Gearing of Carriage

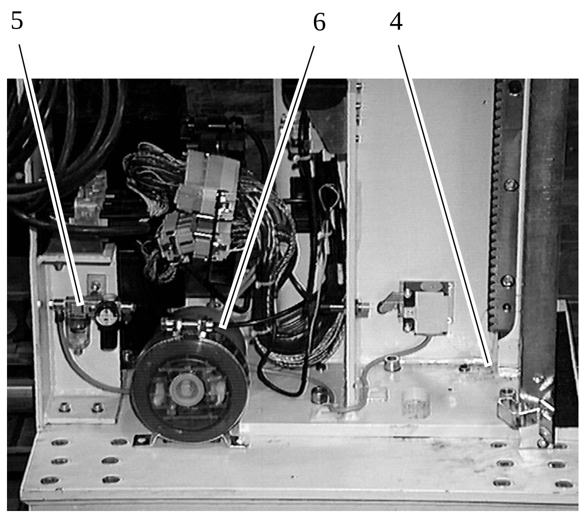


Fig. 8-6: Lube Cartridge on Carriage (new systems)

Lifting Column 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Rack	below the expansion bellows	clear off coarse contamination and excessive lubricant (around toothing)	-	0.5	10
Expansion bellows	2x on the lifting column	check for flexibility, damage and wear	-	0.5	5
Chain conduit (2)	behind the cover of the lifting column	check chain for damage or wear	8-8	1	10
		check cables and air hose (1) for • damage • scarfing • parallel positioning (not twisted)	8-8	1	15
Circulating elements of the linear guides	4 grease nipples (3) on the lifting carriage	grease with 2 g per nipple - lubricant: Retinax EP	8-8	0.5	5
Lubricating cartridge (4) for rack and pinion	behind the cover of the lifting column below the gearing of axis 6	replace (Order-No.: 134 000 000) • remove old lubricating cartridge • mount new lubricating cartridge - lubricant: Structovis BHD - time adjustment: B	8-4, 8-9 8-4	1	15

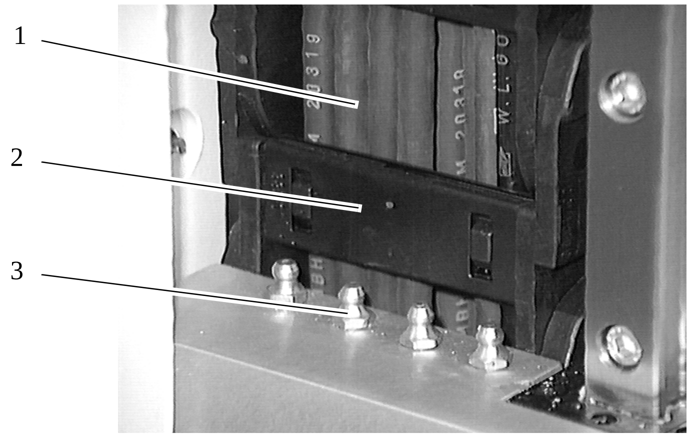


Fig. 8-7: Grease Nipples and Chain Conduit on Lifting Carriage

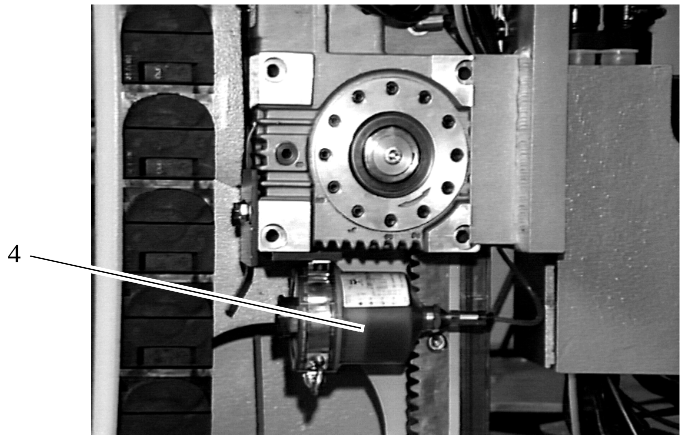


Fig. 8-8: Lube Cartridge for Lifting Carriage

Lifting Column 2

Unit	Location	Job	Fig.	Interval [year]	Time [time]
Gearing axis 6 (6) (V-axis)	behind the cover of the lifting column	Check for tightness (6)	-	1	5
		oil change • open filling screw (7)) • open drain screw (8) and drain oil (Dispose of oil according of disposal instructions!) • screw in the drain screw (8) and tighten it • fill in oil with tube - type: Klüber Syntheso HT 220 (approx. 300 ml) (Order-No.: 178 000 003) - up to bottom edge of venting orifice • screw-in filling screw (7)) and tighten them	8-10	1	20
Rollers of the chain conduits (5)	behind the cover of the lifting column	check for easy movement and scarfing; if they move hard or are worn replace them (roller Order-No.: 323 001 173) - open chain links - remove the retaining ring - replace the roller - mount the retaining ring - close the chain links	8-9	0.5	15

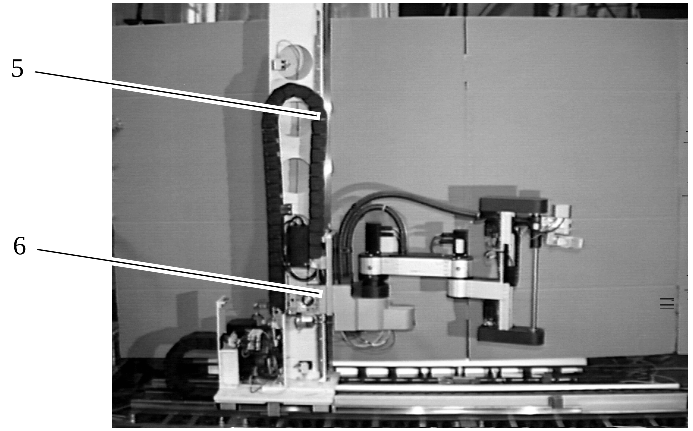


Fig. 8-9: Side View of Lifting Column

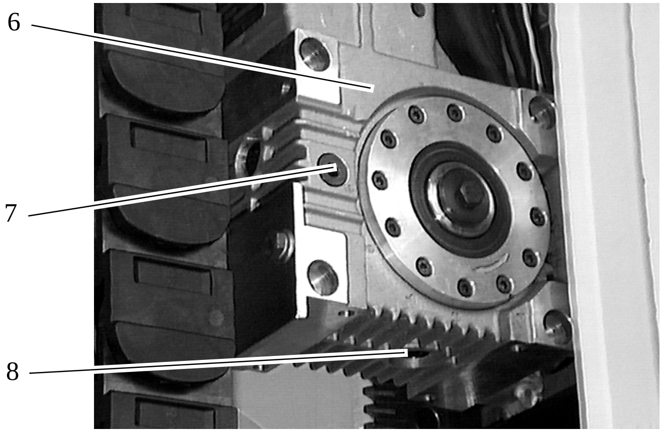


Fig. 8-1:0 Gearing of Axis 6 (V-Axis)

Robot 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Gearing axis 1 (1)	arm 1	check for tightness; if oil leaks out replace the robot	8-12	0.5	5
		oil change • open venting screw and filling screw (5, 6) • open drain screw (3) and drain oil • screw in the drain screw with a new seal (10±3 Nm) • fill oil into the hose with a syringe - type: Aral Gegol BG 46 SAE 90 - to middle of oil window on the gearing of axis 1 (1) • screw in the venting and the filling screws (5, 6) with new seals (10±3 Nm)	8-12 8-11 8-11 8-11 8-12	0.5	15
Gearing axis 2 (2)	arm 2	check for tightness; if oil leaks out replace the robot	8-11	0.5	5
		oil change • open venting screw and filling screw (7, 8) • drain old oil (4) • fill in new oil with a syringe - type: Aral Gegol BG 46 SAE 90 - to middle of oil window on the gearing of axis 2 (2) • screw in the venting and the filling screws (7, 8) with new seals (10±3 Nm)	8-12 8-11 8-12	0.5	15

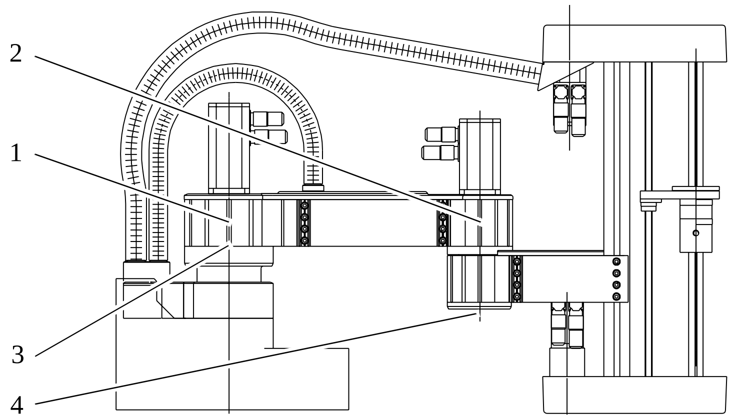


Fig. 8-11: Robot (Side View)

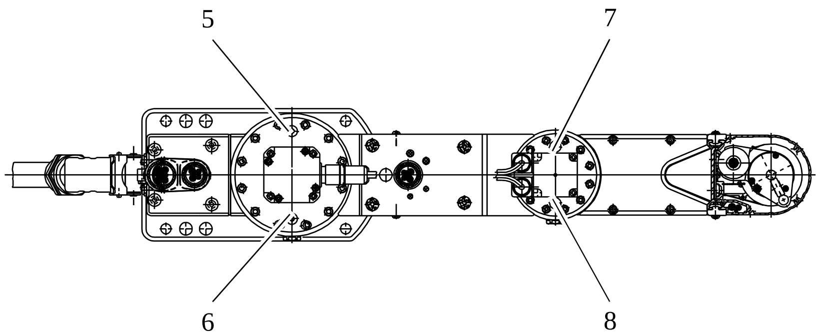


Fig. 8-12: Robot (Top View)

Robot 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Toothed drive belt	axis 3 (Z-axis)	check tensioning and retension if necessary • remove cover (12) • check tightening torque (3 Nm) of the motor fixture (9) • slightly loosen the screws (10) • put a loop or an eye around the motor shaft • apply a spring scale and pull with F = 150 N • tighten screws (10) (tightening torque: 3 Nm) • eventually adjust proximity switch (11) (< 0,5 mm) • remount cover (12)	 8-14 8-13 8-13 8-13 8-13 8-13 8-14	0.5	15
Spindle below the motor axis	axis 3 (Z-axis)	grease with Klüber Isoflex Topas NCA 52 • apply grease to the spindle (13) • move axis in the set-up operating mode • if necessary grease repeatedly	8-14	0.5	5
linear bearing of the axis	axis 3 (Z-axis)	grease with Klüber Isoflex Topas NCA 52 • apply grease to the braring with a brush (17) • move axis in the set-up operating mode • if necessary grease repeatedly	8-14	0.5	5

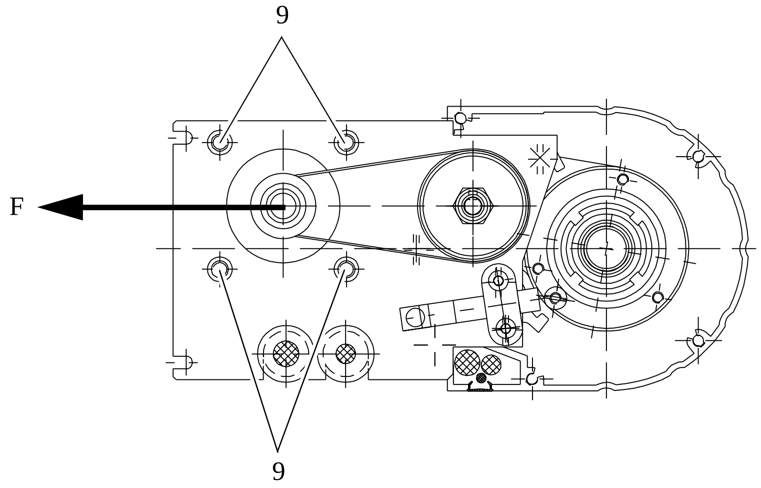


Fig. 8-13: Toothed Drive Belt on Axis 3

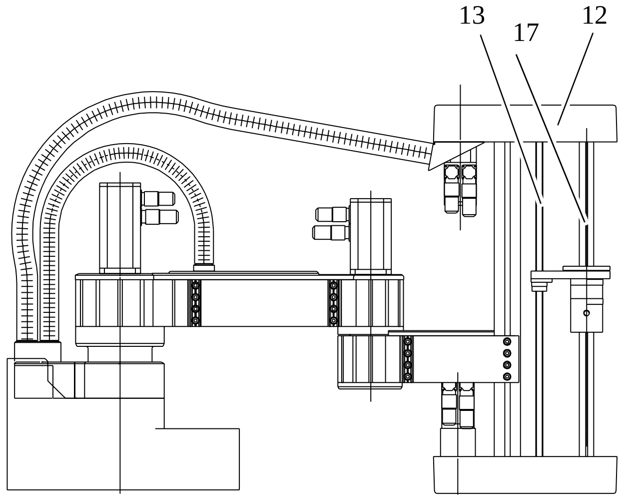


Fig. 8-14: Robot (Side View)

Robot 3

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Toothed drive belt	axis 4 (R-axis)	check tensioning and retension if necessary • if necessary position the robot: move axis 6 (V-axis) to a suitable hight using the test program • remove cover (14) • slightly loosen screws (15) • put a loop or eye around the motor shaft • apply spring scale and pull with F = 300 N (105 Hz Frequency measuring device)(• tighten screws (15) (tightening torque: 10 Nm) • remount cover (14) • check angle of the rolling axis using the test program	 8-15 8-16 8-16 8-15	0.5	15
Cables, air hoses	energy conduit to the gripper (16)	check energy duct for wear, replace if necessary • damage (scarfing, damage) • fastening	8-17	0.5	10
		on systems without track extension • replace energy duct (16) (☞ page 9 - 59) on systems with track extension	8-17	1	

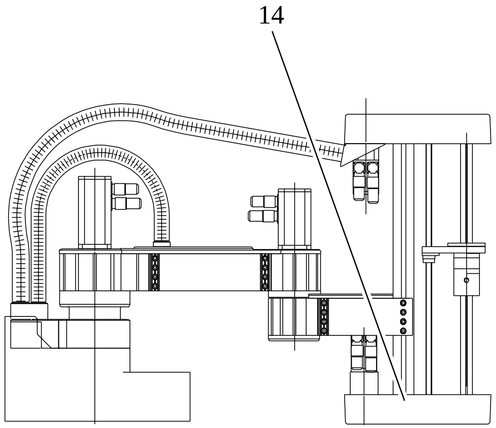


Fig. 8-15: Robot (Side View)

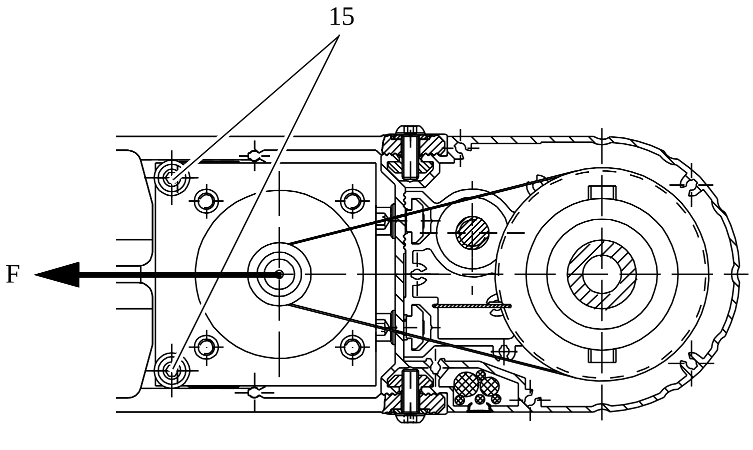


Fig. 8-16: Toothed Drive Belt on Axis 4

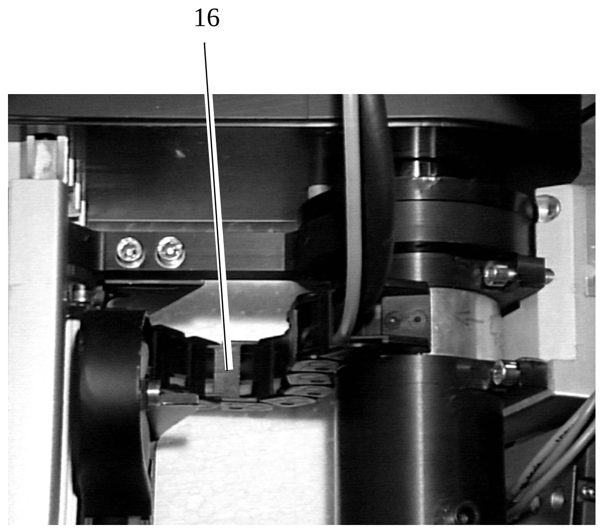


Fig. 8-1:7 Energy Conduit to Gripper

Gripper 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Jaws (1)	gripper mechanics	Check functions: • start robot testprogram • start gripper testprogram (☞ page 6 - 19)	8-18	0.5	10
Pusher (2)	gripper mechanics		8-18	0.5	
Pusher (2)	gripper mechanics		8-18	0.5	10
Turning mechanics (3)	gripper mechanics	check for easy movement • shut off compressed air supply • turn by 90°	8-18	0.5	
Scan window (5)	barcode scanner	clean	8-18	0.5	

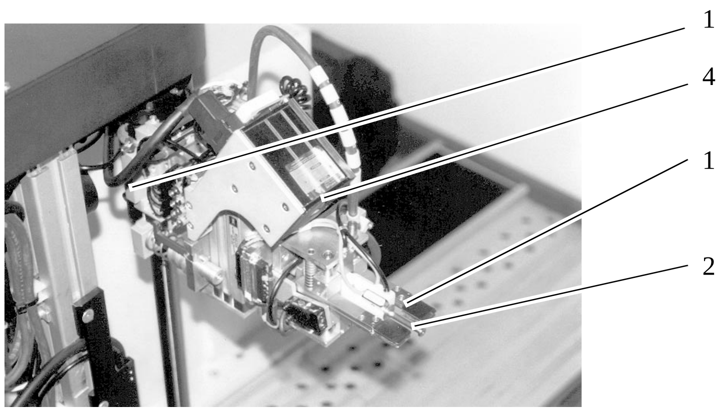


Fig. 8-18: Gripper Mechanics

Gripper 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Cables of sensors	gripper	check • wear (abrasion, damage) • fastening	-	0.5	10
Air hoses	gripper	check • wear (abrasion, damage) • fastening	-	0.5	
Connector (5)	below the cover of the grip-per	check for secure fastening	8-19	0.5	

5

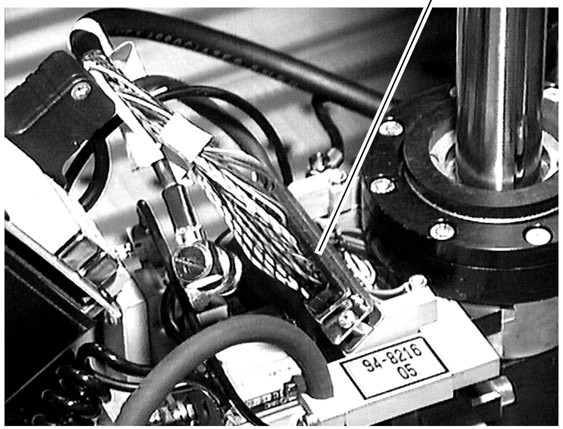


Fig. 8-19: Gripper Connections (Barcode Scanner)

I/O-Unit A

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Cassette slide	telescopic rails • left and right (2) • on the base plate (3)	clean off lubricant and contaminations grease with Klüber Isoflex Topas NCA 52 (as needed)	8-21	1	10
Compressed air supply compressor	top compartment • condensate container (6)	drain • remove the cover of the problem box • remove and empty the container • remount the container • remount the cover of the problem box	8-22	0.5	15
	top compartment • filter (4)	check filter sight glass • green: filter is okay • red: replace filter	8-22	0.5	
	below turning unit 1 • pressure regulating valve (1)	check pressure adjustment and readjust if necessary: 5 bar operating pressure	8-20	0.5	

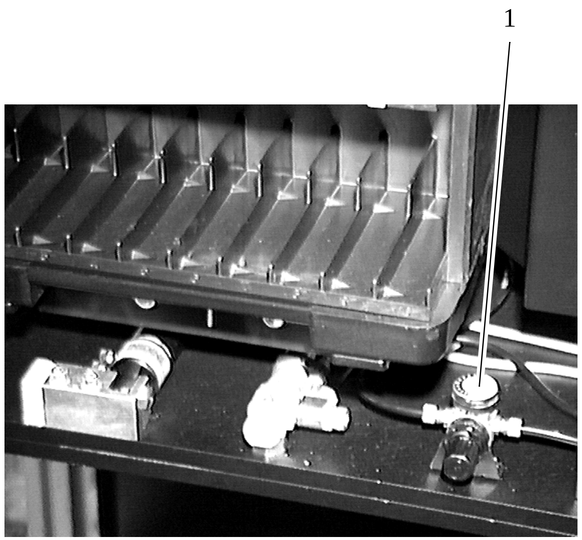


Fig. 8-20: Pressure Regulating Valve

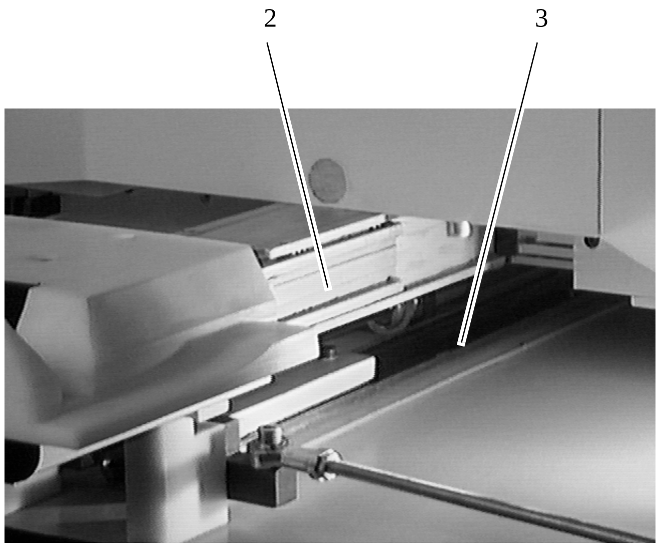


Fig. 8-21: Telescopic Rails of Cassette Slide

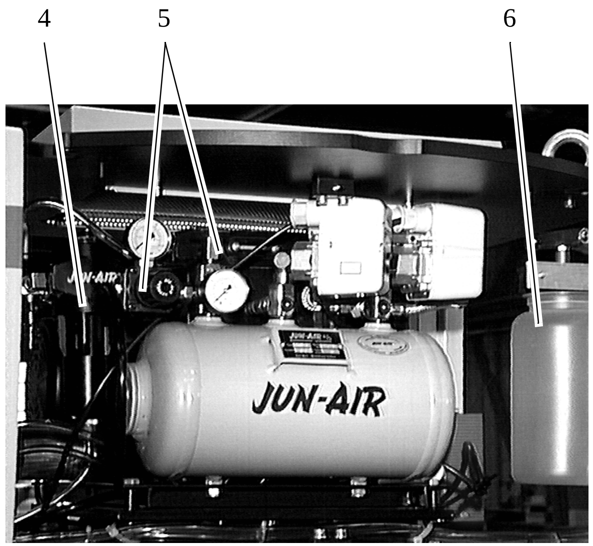


Fig. 8-22: Compressed Air Supply

E/A-Einheit A

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Compressed air supply compressor	top compartment • pressure regulating valves (5)	check pressure adjustment and readjust if necessary • left 5 bar operating pressure • right 6..8 bar accumulator pressure A: area screw- adjustment of the cut-in pressure (turn right both screws = higher shift-point) B: difference screw - adjustment of the cut-off pressure (turn right = bigger difference)	8-22 8-23	0,5	15

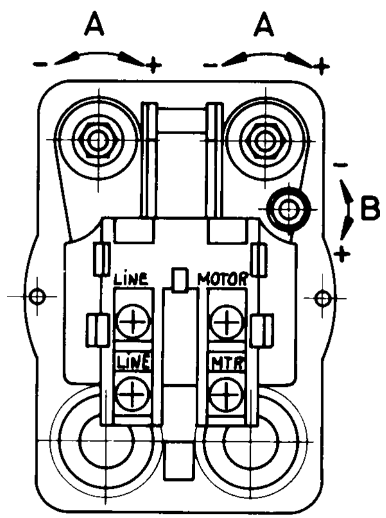


Fig. 8- 23: Compressed air supply

I/O-Unit B

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Shutter		check the function (close and open)	-	0.5	
Lightbarrier (1) Problem box	problem box	check the function, if necessary clean opposite reflector • put a medium into the problem box - first problem box: input 3.3 off - second problem box: input 6.3 off • remove the medium - first problem box: input 3.3 on - second problem box: input 6.3 on	8-24	0.5	5
Compressed air supply Compressor	bottom compartment • condensate container (2)	drain	8-25	0.5	
	bottom compartment • pressure regulating valves (3)	check pressure adjustment and readjust if necessary • left 5 bar operating pressure • right 6..8 bar accumulator pressure	8-25	0.5	10

1

Fig. 8-24: Problem Box seen from Inside

2 3

Fig. 8-25: Compressed Air Supply

Quadro Tower 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Auxiliary tower drive (2, 5)	drive unit behind the right cover	check for tightness; if oil leaks out replace the drive	8-26 8-28	0.5	5
Main tower drive (1)	drive unit behind the left cover	check for tightness; if oil leaks out replace the drive	8-26	0.5	
Cross roller bearing and four-point bearing (3, 4)	grease nipple next to the auxiliary tower drive	grease with 100 g Retinax EP2 (Shell) each (ca. 8 time pres-sed)	8-27	1	10

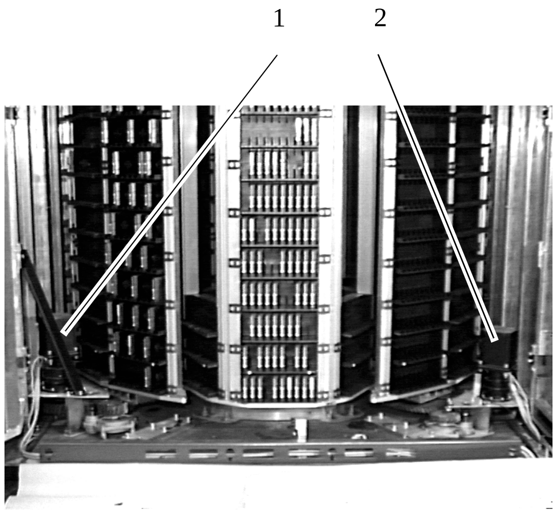


Fig. 8-26: Drive Units of the Quadro Tower

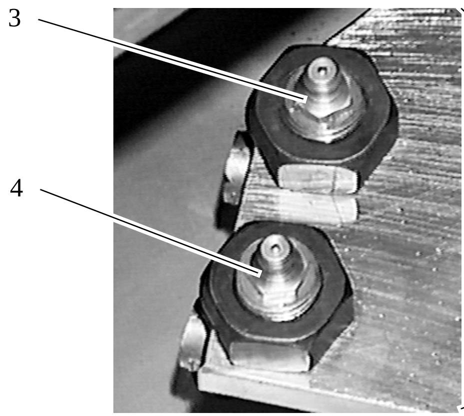


Fig. 8-27: Detail Grease Nipples

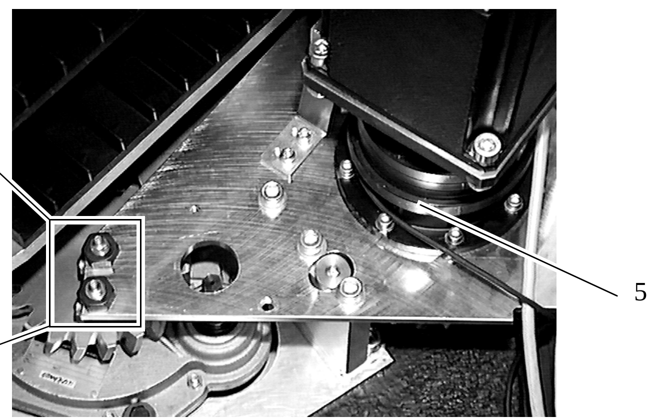


Fig. 8-28: Nipples next to the Auxiliary Tower Drive

Quadro Tower 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Grease nipples for toothed wheel MT - drive (1)	Below Quadro Tower embossed sheets • on the side of the main tower (left-hand side)	• disassemble the embossed sheets • move MT manually with ca.1 turn/sec. • grease nipples by pressing 9 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 18 g grease) • move MT 10 turns (spreading of grease) • repeat greasing • repeat spreading the grease by turning	8-30 8-31	1	
Grease nipples for toothed wheel AT - drive (2)	Below Quadro Tower embossed sheets • on the side of the auxiliary tower (right-hand side)	• move AT manually with ca.1 turn/sec. • grease nipples by pressing 9 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 18 g grease)	8-30	1	45
Turning grease nipples AT - Hexa tower toothed wheels (3)	Left-hand side, below MT segments	• turn MT until you can handle the 1st gresae nipple • move AT manually with ca.1 turn/sec. • grease nipples by pressing 12 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 24 g grease) • do the same at the 2nd grease nipple	8-30 8-29	1	

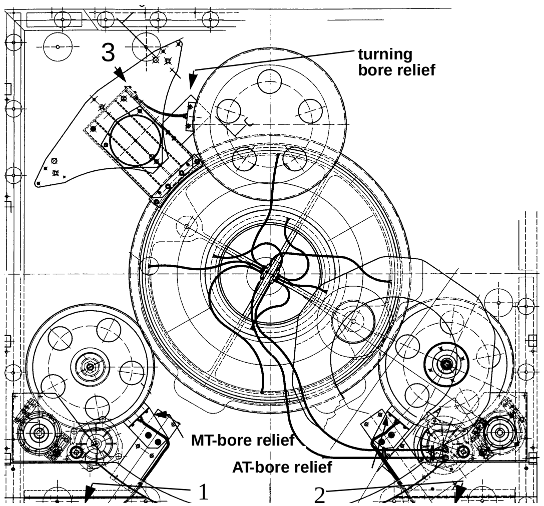


Fig. 8-29:Location of lubrication bore reliefs

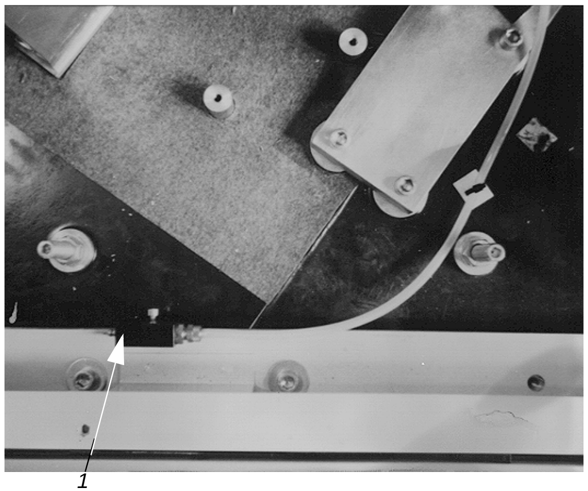


Fig. 8-30:Grease nipple Main Tower drive side (left-hand side)

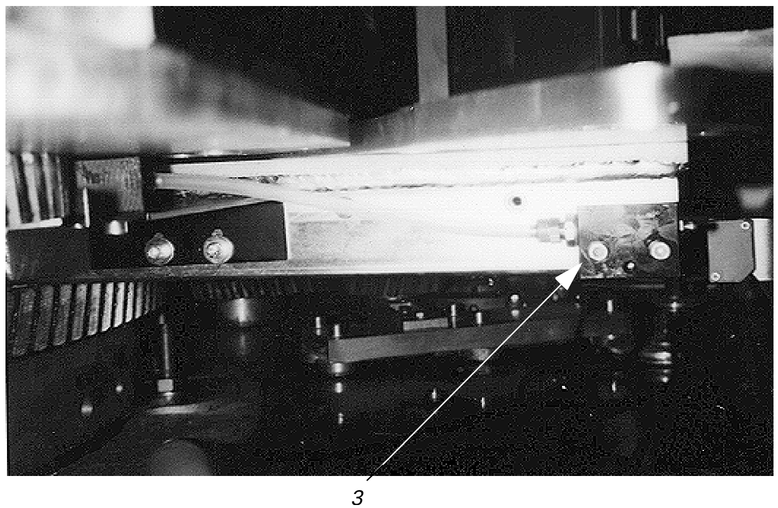


Fig. 8-31:Grease nipple below turning MT segments

8.5 Electric Maintenance (Control Cabinet)

Unit	Location	Job	Fig.	Interval [year]	Time [min]
<EMERGENCY STOP> circuit	<EMERGENCY STOP> button on the I/O unit	check the function	-	0.5	5
Door locks	archive access (door) I/O door	• check the electric function • check the lock mechanism (lock must click into place audibly and must remain locked during operation)	-	0.5	
	Quadro tower guard door	the guard door must be locked in the “MANUAL” operating mode			
Plugged and clamped connections	control cabinets	check	-	0.5	
Filter mats of fans (2)	robot and Quadro tower control cabinets	check degree of contamination • if necessary clean in soap water, **dry**, and reinsert dry • replace them when they are badly contaminated	8-32	1	30
CP/MEM board below the cover (EPROM module, battery)	robot and Quadro tower control cabinets	replace buffer battery (alcalene-manganese battery 4.5 V) • remove cover (1) • remove old battery • short new battery for a short while then insert it; observe proper polarity! • record date of battery replacement on the cover • mount the cover (1)	8-32 8-32	1	
Battery	AMU PC	exchange the battery: • IBM PC Order no. 15A 230 164 • SNI PC Order no. 15G 360 001	-	2	10

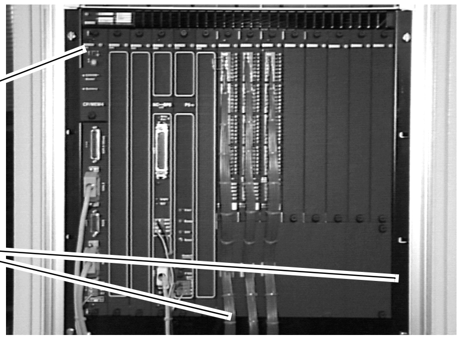


Fig. 8-32: rho Control Unit

9 Repair of Mechanic Components

9.1 For Your Safety

According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 repair work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.

WARNING!

During all work observe the safety rules in chapter 3 “For Your Safety” (☞ page 3 - 1).

9.2 Preparations

WARNING!

All repair work must be carried out only when the system is switched off and voltageless.

Shut the AML/2 system down before (☞ Operator Guide) and secure it against switch on.

Exceptions:

- **functional checks**
- **measurement of parameters**

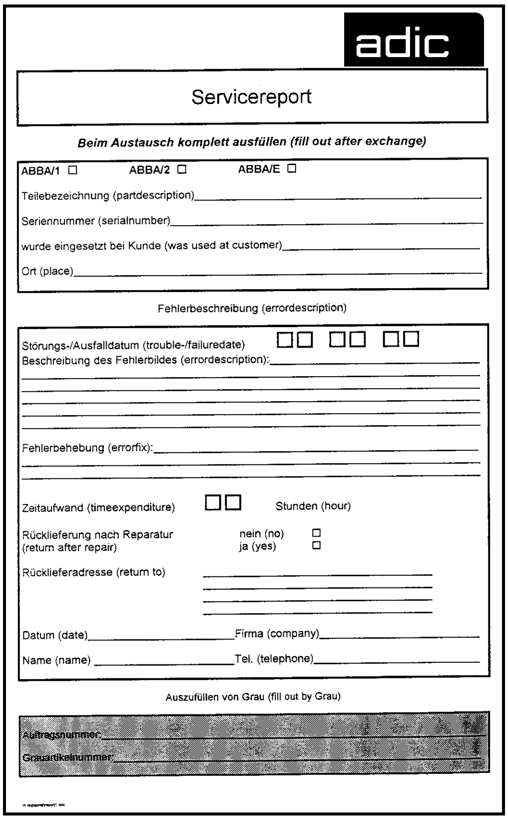
a) Attach a warning sign (☞ page 3 - 14)

9.3 After the Repair Job

Complete the datasheet “ Servicereport”:

a) Enter time required for trouble shooting and replacement

b) If the defective gripper is to be repaired note this under “whereabout faultpart”


adic

Servicereport

Beim Austausch komplett ausfüllen (fill out after exchange)

ABBA/1 ☐ ABBA/2 ☐ ABBA/E ☐

Teilebezeichnung (partdescription)__________

Seriennummer (serialnumber)__________

wurde eingesetzt bei Kunde (was used at customer)__________

Ort (place)__________

Fehlerbeschreibung (errordescription)

Störungs-/Ausfalldatum (trouble-/failuredate) ☐☐ ☐☐ ☐☐

Beschreibung des Fehlerbildes (errordescription):__________

Fehlerbehebung (errorfix):__________

Zeitaufwand (timeexpenditure) ☐☐ Stunden (hour)

Rücklieferung nach Reparatur (return after repair) nein (no) ☐ ja (yes) ☐

Rücklieferadresse (return to)

Datum (date)__________ Firma (company)__________

Name (name) __________ Tel. (telephone)__________

Auszufüllen von Grau (fill out by Grau)

Auftragsnummer:__________

Grauartikelnummer:__________

Fig. 9-1: Datasheet “Servicereport”

9.4 Putting back into Service

WARNING!

Before starting the AML/2 system be sure the start will not

- **endanger people,**
- **damage property.**

a) Start the AML/2 system (☞ Operator Guide)

9.5 Track

9.5.1 Expansion Bellows

Dismounting

a) Loosen the screwed fitting
b) Compress the expansion bellows completely
c) Twist them and remove them

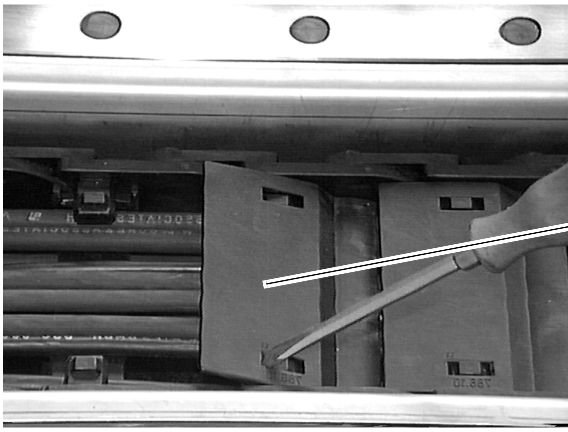
Fig. 9-2: Removing the Expansion Bellows

Mounting

a) Fully compress the expansion bellows
b) Insert and twist them
c) Tighten the screwed fitting

9.5.2 Chainlinks of the Energy Guide

Dismounting



1

Fig. 9-3: Chainlink Cover

2

Fig. 9-4: Webs on the Chainlink

a) Lift off the cover (1) with a screw driver

b) Remove the webs (2)
   - shift the webs parallel to the cables and hoses

c) Remove the chain-link

Mounting

reverse sequence

9.5.3 Reference Switch of Axis 5

below the foot board approx. 0.5 m before the ends of the track

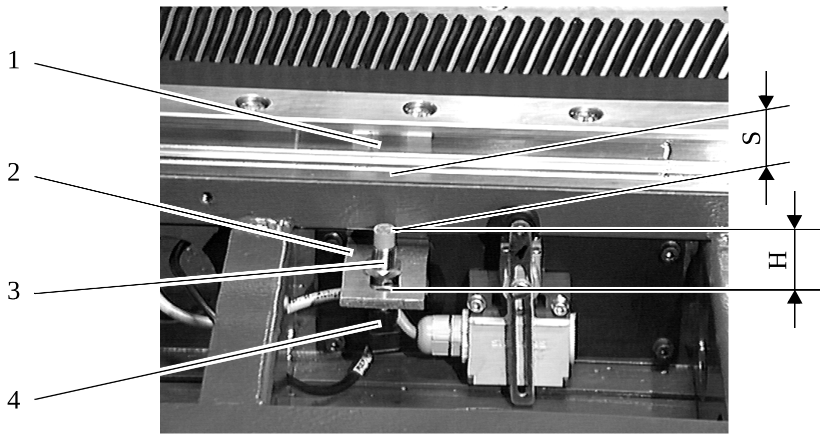


Fig. 9-5: Reference Switch Track (Axis 5)

Dismounting

a) Remove the foot board

b) Measure and note the position of the defective reference switch (3)
  - height (H) above the bracket (2)
  - distance (S) to the linear guide (1)

c) Loosen the upper lock nut

d) Remove the reference switch

e) Disconnect the reference switch from the plug (4)

Mounting

a) Connect the plug (4) to the new reference switch and tighten it

b) Mount the reference switch (3) and handtighten the lock nut

c) Adjust the reference switch
  - height (H) above the bracket (2)
  - distance (S) to the linear guide (1)

ATTENTION!

Do not tighten the lock nut excessively. This may destroy the reference switch.

  - tighten the lock nut

d) Mount the foot board

e) Check the function: does the robot move to the reference position?

9.5.4 Limit Switch of Axis 5

under the foot board approx. 0.5 m before the ends of the track

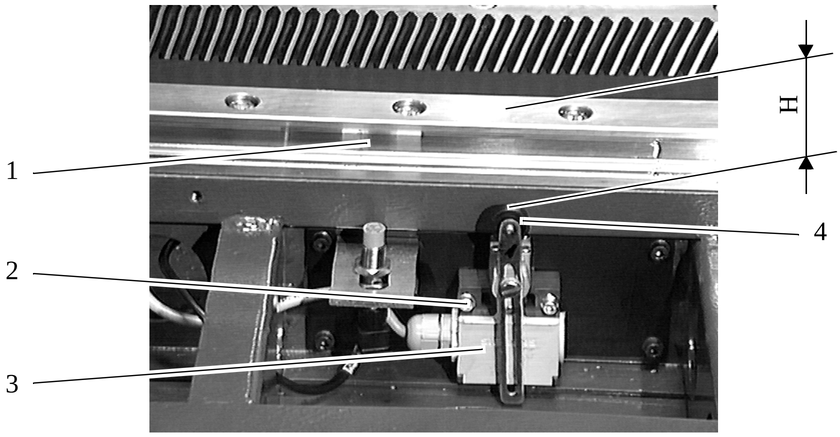


Fig. 9-6: Limit Switch Track (Axis 5)

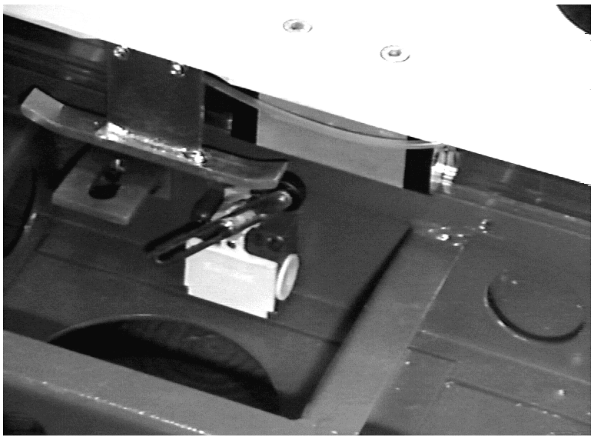


Fig. 9-7: Limit Switch Track with Switch Catch

Dismounting

a) Remove the foot board

b) Measure and note the position of the defective limit switch (3)
   - height (H) of the roller (4) above the linear guide (1)

c) Remove the retaining screws (2)

d) Remove and disconnect the limit switch
   - open the cover of the defective limit switch
   - note the terminal connections
   - disconnect the cable

Mounting

a) Connect the limit switch
   - open the cover of the new limit switch (3)
   - connect the terminals as noted for the defective limit switch
   - close the cover of the limit switch

b) Adjust the roller distance as measured for the defective switch

c) Mount the limit switch (3)

d) Adjust the height (H) of the roller (4) above the linear guide (1)

e) Mount the foot board

f) Check the function

9.6 Carriage

9.6.1 Gearing with Motor 5 (H-Axis)

behind the cover of the lifting column

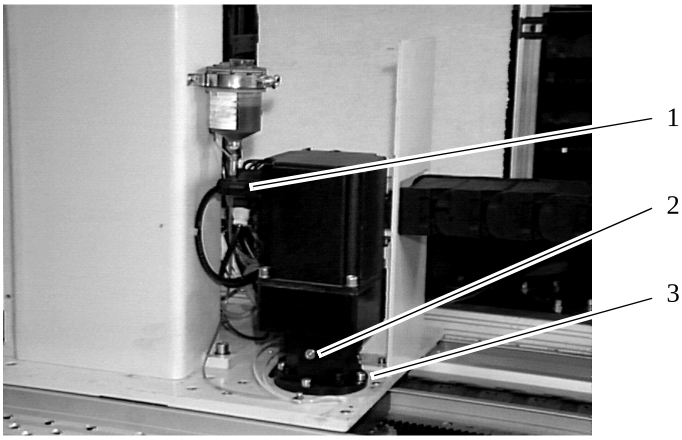


Fig. 9-8: Gearing with Motor 5 (H-Axis)

Information

The gearing is shipped with oil.

Dismounting

a) Pull the motor plug (1)
b) Loosen the retaining screws (3)
c) Remove gearing with motor
d) Remove the pinion

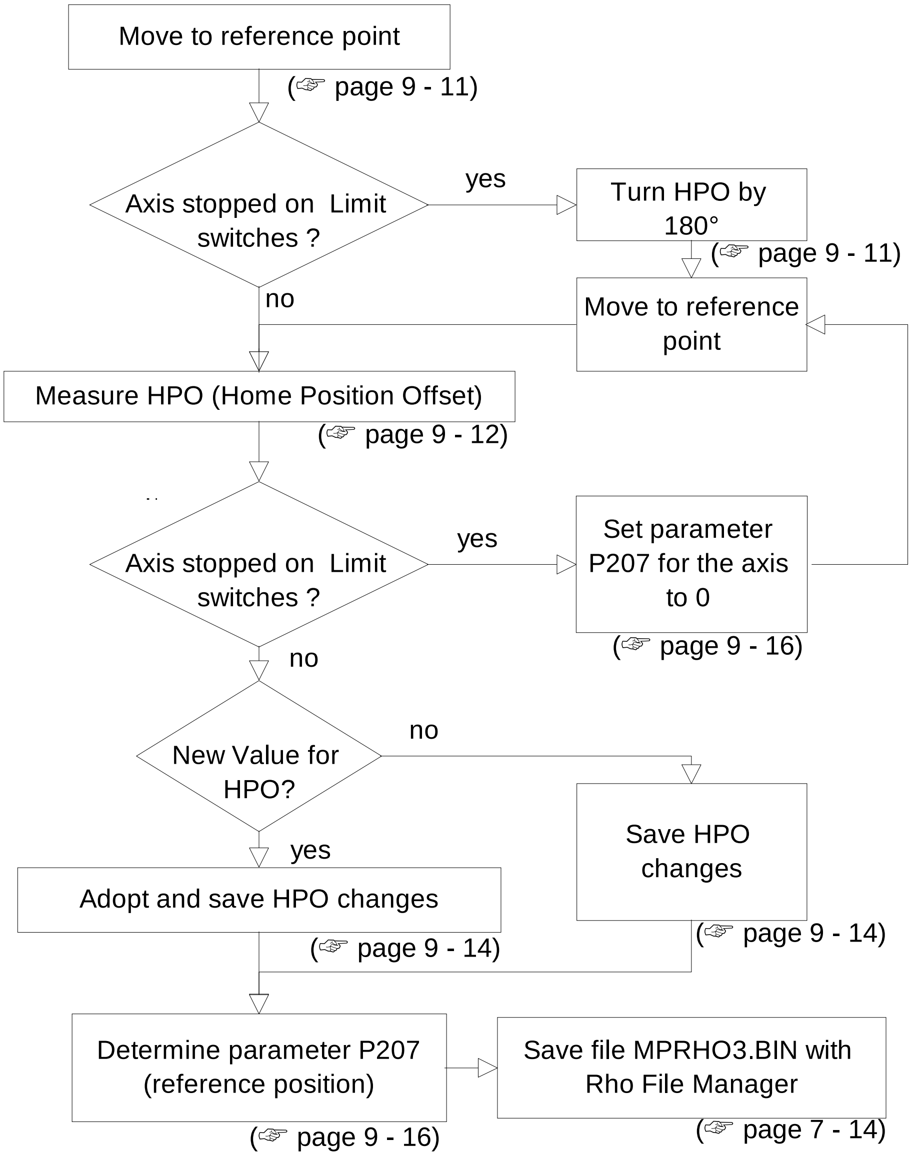
Mounting

Information

Turn the unit slowly until the pinion engages the rack.

a) Carefully insert the gearing with motor
b) Observe the position of the oil filling screw (2)
c) Handtighten the retaining screws and washers
d) Tighten the retaining screws to 10 Nm
e) Connect the motor plug (1)

9.6.2 Adjust the Reference Point



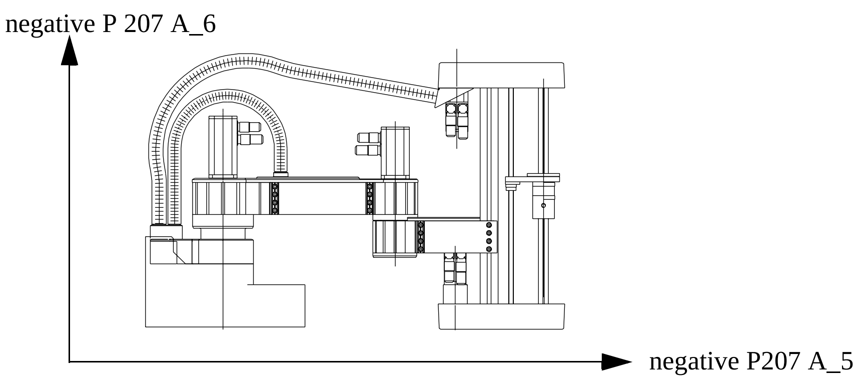


Fig. 9-9: Calculation of reference point parameters

Move to Reference Point

a) Switch on the main switch

b) Let the control system run up

c) Press <SYSTEM ON>

Information

During reference movement the changed axis could stop on the limit switch. Then make a change of the HPO value by 180°.
Otherwise repeat step c).

d) Press <CONTROL ON>. The robot makes a reference movement

Turn HPO by 180°

a) Open the AMU OS/2 window

b) Change to directory “C:\MOOG” (`cd moog`)

c) Call up the communication program “BOSCHTRM” (`boschtrm`)

d) Enter <C> for „Configurate“

e) Adjust the configuration

-	Communication Mode	RS 232	<1>
-	Communication Port	COM1	<1>
		COM2	<2>
-	Interface type	IQ140/RHO3 CAN	<2>
-	Helpfile	IQ 140/RHO	<2>

f) Press <ENTER> and wait until the following message appears:

`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT>+<*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!`	input: <7>, <8>, <2>, <3>

`Enter first letter of a command or H for help >`	input: <o>, <o> (letter)
`Home Position Offset [Deg] 12 -more-`	input: <ENTER>
`Offset [Deg] 0 - 360 ?`	input: old value changed about 180°(+ or -), <ENTER>

g) Reset rho

h) Let the control system run up.
The robot makes a reference movement

Measure HPO (Home Position Offset)

This procedure finds the offset between the reference point switch and the zero mark of the motor measuring system after mechanic alterations of the drive system.

a) Call up the test program by pressing ALT + SHIFT + <dead man>

- press 1 + <dead man> (TEST)
- press 1 + <dead man> (installation)
- press 1 + <dead man> (offset robot)
- press 3 + <dead man> (Homepos. Offset)

```
AML2 TEST V 2.2.0
HOME POSITION OFFSET
 0 cancel
 go on with ENTER
```

input:

```
drive ROBOT in
secure area
0 cancel
go on with ENTER
```

ATTENTION

The robot stretches and could collide with the device in front of the track.

Position the robot at sufficient distance.

input:

The menu “Move axis” appears.

```
X: ???.???Y: ???.???
Z: ???.???R: ???.???
H: ???.???V: ???.???
0 cancel
```

Position the robot at sufficient distance to the I/O unit.

Quit the positioning with 0 .

```
detecting HPO
?. axis
0 next axis
go on with ENTER
```

Go to the next axis with 0

Select the axis with .

```
gearing faktor
 1  131
 2  100
PRESS ENTER
```

Press .

```
type in the actual
value P207 of
           ?.axis
```

Enter the Parameter 207 of the current axis.
(☞ „Software Backup,
Machine Parameters of Robot)

confirm with: .

```
type in the actual
Home Position Offset
of ? .axis
```

Enter the HPO value of the current axis.
(☞ „Software Backup,
Parameters of axis amplifiers)

confirm with:

```
measuring HPO
?     .axis
0 cancel
go on with ENTER
```

Display of measured values.

Note deviating values.

input: ⎆

```
new values ?. axis
HPO: ???
P207: ???
go on with ENTER
```

input: ⎆

If the parameter has not been changed, go to
(☞ “Determine Parameter P207” from page 9 - 16).

Adopt and Save HPO changes

Information

Start terminal program („BOSCHTRM“ or „terminal“) only, if it’s not already running.

a) Open the AMU OS/2 window

b) Change to directory “C:\MOOG” (`cd moog`)

c) Call up the communication program “BOSCHTRM” (`boschtrm`)

d) Enter <C> for „Configurate“

e) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Interface type	IQ140/RHO3 CAN	<2>
- Helpfile	IQ 140/RHO	<2>
-		

f) Press <ENTER> until the following message appears:

```
Enter first
letter of a
command or H
for help >
```

input: <SHIFT>+<*>

Privileged Mode (Y/N) >>	input: <Y>
Password ? OK!	input: <7>, <8>, <2>, <3>
Enter first letter of a command or H for help >	input: <o>, <o> (letter)
Home Position Offset [Deg] 12 -more-	input: <ENTER>
Offset [Deg] 0 - 360 ?	input: noted value, if it deviates, <ENTER>
Enter first letter of a command or H for help >	input: <C>
Sure (Y/N)?	input: <Y>
EEPROM ID ?	input: number of axis, <ENTER>
Wait-	
Saving Defaults Gaints in EEPROM	<ESC> exit

Determine Parameter P207

a) Reset the control unit: press <Reset> on the power supply PS75 in the robot cabinet.
   The robot makes a reference movement

b) Measure and note the reference point offset [mm]

c) Press <CONTROL OFF>

d) One after the other press [MODE] , [7] , [⇨] (diagnosis)

e) One after the other press [MODE] , [8] , [⇨] (machine parameters)

f) One after the other press [MODE] , [2] , [⇨] (set machine parameters)

g) Set parameters: enter the number and confirm with [⇨]

h) Press [⇨] until the axis number is in the display

   - A_5 for motor change axis 5
   - A_6 for motor change axis 6

i) Calculate new parameters
   - see picture „Calculation of reference point parameters“ (☞ page 9 - 10)
   - calculate with the noted offset the new value

j) Complete the input with [←]

k) Write the input to the EEPROM with [←]

l) Confirm the safety prompt with [1] (as of operating system TO03).

   An automatic reset is called

m) Let the control system run up

n) Press <SYSTEM ON>

o) Press <CONTROL ON>. The robot makes a reference movement

Teach with trace "KRN8"

a) Open the **Trace** window in the **View** menu

b) Select **Online**

c) Select **TraceID KRN8**

d) Reteach (☞ page 5 - 6)

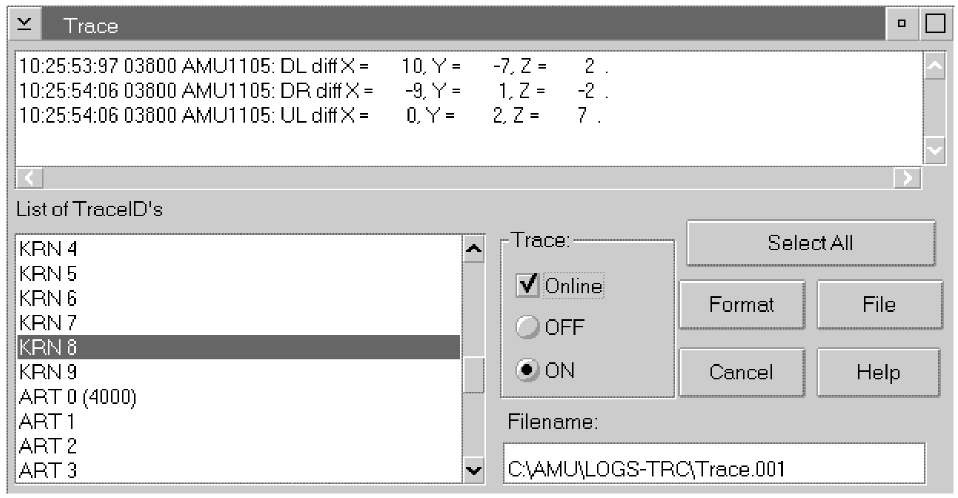


Fig. 9-10: Trace Window with KRN8

e) The **Trace** window displays the differences: if the offset values are > 100, correct the values in Parameter P207 and on the datasheet

f) Check the reference point offset, repeat the procedure if required

g) Save the file "MPRHO3.BIN" with the **Rho File Manager** (☞ AMU Reference Guide)

h) Fill all changed values in the list „Software Backup“
- Home Position Offset
- Reference point

9.7 The Lifting Column

9.7.1 Expansion Bellows

(☞ “Expansion Bellows” from page 9 - 3)

9.7.2 Motor 6 (V-Axis)

behind the cover of the lifting column

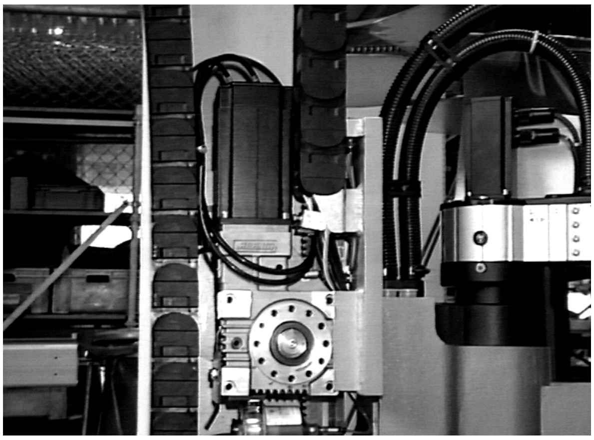


Fig. 9-11: Motor 6 (V-Axis)

WARNING!

Be sure to lock the lifting carriage with the clamping device before dismounting the motor!

The brake on the motor blocks the lifting carriage. When you remove the motor the lifting carriage is freed and slides down!

Hazard of injury!

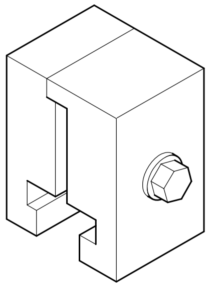


Fig. 9-12: Clamping Device for the Lifting Column

Dismounting

a) Lock the lifting carriage
   - compress the expansion bellows
   - insert the clamping device below the lifting column and tighten it

b) Open the cover

c) Disconnect the motor plug

d) Loosen the retaining screws

e) Remove the motor

f) Dismount the coupling components

Mounting

a) Mount the coupling components

b) Carefully insert the motor

Information

Slowly turn the motor until the spline shaft engages.

c) Insert the retaining screws and washers

d) Tighten the retaining screws crosswise to 20 Nm

e) Connect the motor plug

f) Close the cover

g) Remove the clamping device

Adjust the reference point

(☞ page 9 - 10)

9.7.3 Gearing (Axis 6)

behind the cover of the lifting column

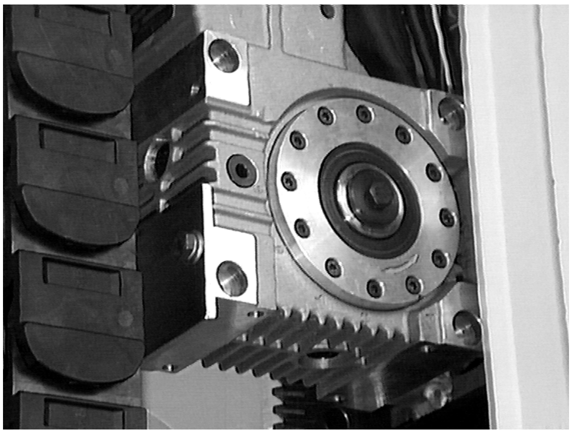


Fig. 9-13: Gearing of the Lifting Column (Axis 6)

WARNING!

Be sure to lock the lifting carriage with the clamping device before dismounting the gearing!

The brake on the motor blocks the lifting carriage. When you remove the motor or the gearing the lifting carriage is freed and slides down!

Hazard of injury!

Dismounting

a) Lock the lifting carriage
   - compress the expansion bellows
   - insert the clamping device below the lifting column and tighten it

b) Dismount the robot (☞ “Robot” from page 9 - 26)

c) Open the cover

d) Remove the motor (☞ “Motor 6 (V-Axis)” from page 9 - 18)

e) Remove the cover plate
   - loosen the nuts (4 pcs) from inside

f) Loosen the retaining screws

g) Remove the gearing

Mounting

a) Insert the gearing
b) Insert the retaining screws and washers
c) Tighten the retaining screws crosswise to 20 Nm
d) Mount the motor (☞ “Motor 6 (V-Axis)” from page 9 - 18)
e) Mount the robot (☞ “Robot” from page 9 - 26)
f) Mount the cover plate
g) Close the cover
h) Remove the clamping unit
i) Mount the expansion bellows

Adjust the reference point and the resolver zero-point (HPO)

(☞ page 9 - 10)

9.7.4 Energy Guide

behind the cover of the lifting column

Dismounting and Mounting

(☞ “Chainlinks of the Energy Guide” from page 9 - 4)

9.7.5 Reference Switch of Axis 6

below the cover of the lifting column

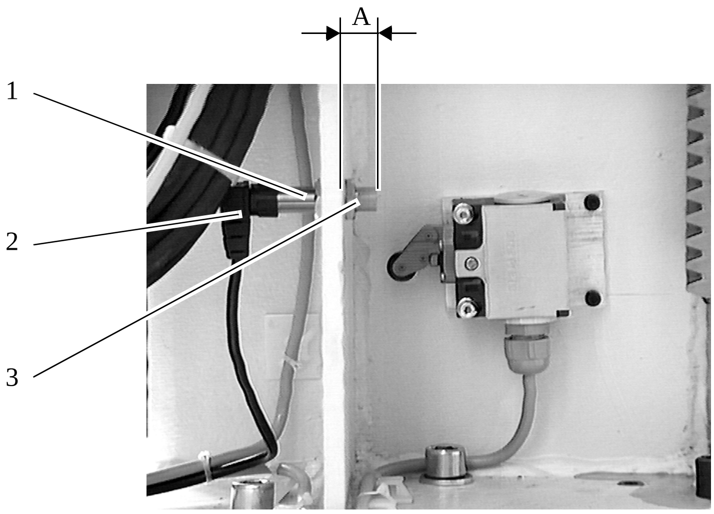


Fig. 9-14: Reference Switch of the Lifting Column (Axis 6)

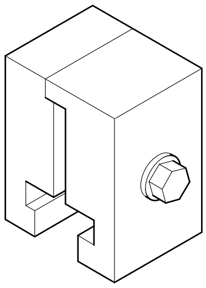


Fig. 9-15: Clamping Unit of the Lifting Column

WARNING!

Be sure to lock the lifting carriage with the clamping device before dismounting the reference switch!

The lifting carriage is freed and slides down!

Dismounting

a) Lock the lifting carriage
   - compress the expansion bellows
   - insert the clamping device below the lifting column and tighten it

b) Compress the expansion bellows

c) Measure and note the distance (A) of the defective reference switch

d) Disconnect the plug (2)

e) Loosen the lock nut (3)

f) Remove the reference switch

Mounting

a) Insert the reference switch

b) Adjust the distance (A)

c) Tighten the lock nut

d) Connect the plug

e) Remove the clamping device

f) Check the function: does the robot move to the reference position?

9.7.6 Limit Switch Axis 6

below the cover of the lifting column

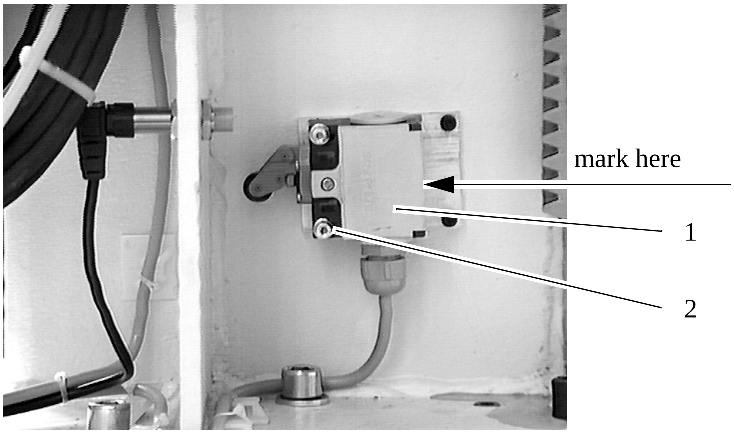


Fig. 9-16: Limit Switch of the Lifting Column (Axis 6)

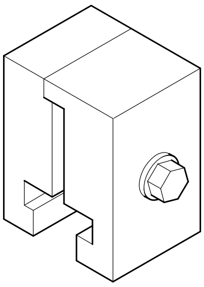


Fig. 9-17: Clamping Device of the Lifting Column

WARNING!

Be sure to lock the lifting carriage with the clamping device before dismounting the limit switch!

The lifting carriage is freed and slides down!

Dismounting

a) Lock the lifting carriage
   - compress the expansion bellows
   - insert the clamping device below the lifting column and tighten it

b) Compress the expansion bellows

c) Mark the position of the defective limit switch (1)

d) Loosen the retaining screws (2)

e) Remove the limit switch

f) Disconnect the limit switch
   - open the cover of the defective limit switch
   - note the terminal connections
   - disconnect the cable

Mounting

a) Connect the limit switch
   - open the cover of the new limit switch
   - connect the terminals as noted on the defective switch
   - close the cover of the switch

b) Mount the limit switch and align it on the mark

c) Tighten the retaining screws

d) Remove the clamping device

e) Check the function

9.8 Robot

The robot is always replaced entirely, exclusively robot installation kit..

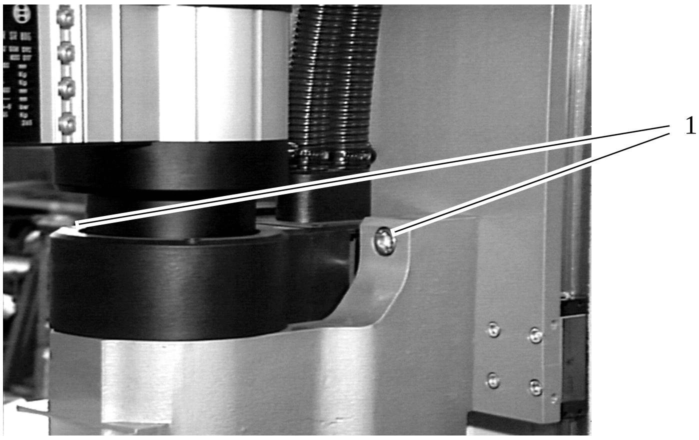


Fig. 9-18: Retaining Screws on Robot Console

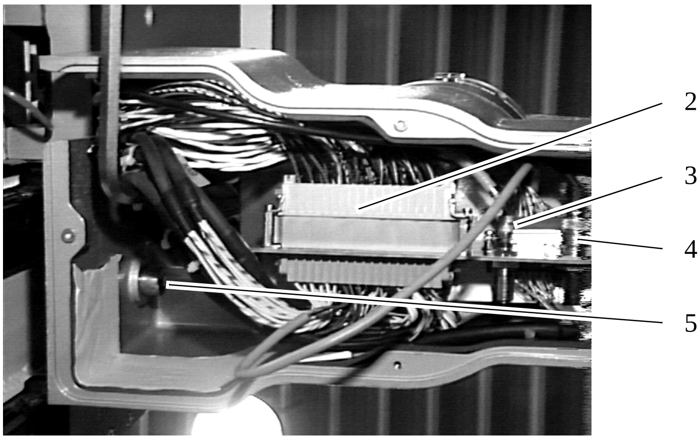


Fig. 9-19: Underside of Robot Console

WARNING!

When you loosen the retaining screws the robot falls off the lifting carriage!

Be sure to secure the robot before dismounting it:

- **suspend the robot from a hoist**
- **safely support the robot with a suitable bracing**

Information

The robot weighs approx. 55 kg.

9.8.1 Dismounting

a) Dismount the gripper (☞ page 9 - 35)

b) Remove the bottom cover plate on the robot console

c) Disconnect the plugs
  - multiple plug (2)
  - air hose (3)
  - coaxial cable (4)

d) Remove the screw (5)

e) Remove the 2 screws (1)

f) Remove the robot

9.8.2 Mounting

a) Position the robot in front of the the lifting column

b) Handtighten the retaining screws

c) Tighten the retaining screws to 80 Nm

d) Connect the plug
  - multiple plug (2)
  - air hose (3)
  - coaxial cable (4)

ATTENTION

Do not bend the air hose!

e) Remove the cover of the lifting platform

9.8.3 Adjusting the Parameters of the Robot Data Sheet

a) Connect the PHG to the robot cabinet

b) Switch on the main switch.
The PHG displays:

```
 *** AUTOMATIC ***


(c) 1991 BOSCH
```

c) One after the other press [MODE] , [7] , [⇨] (diagnosis)

d) One after the other press [MODE] , [8] , [⇨] (machine parameters)

e) One after the other press [MODE] , [2] , [⇨] (set machine parameters)

f) Set the parameters: enter number and confirm with [⇨]

- P207 A_*: reference point actual value of axes 1 - 4
- P307 axis length 1
- P307 axis length 2
- P310 offset of world coordinate system

g) Complete the input by pressing [←]

h) Write the input to the EEPROM by pressing [←]

i) Confirm the safety prompt with [1] (as of operating system TO03).

An automatic reset is called

j) Let the control unit run up

k) Stretch the robot arm manually

9.8.4 Modify the Resolver Zero-Point (HPO)

Use the following procedure for axis 1-4

a) Connect the installation cable to the interface connector COM 1 or COM 2 (if necessary disconnect another cable)

b) Connect the installation cable to the drive amplifier plug X6

c) Open the AMU OS/2 window

d) Change to directory “C:\MOOG” (`cd moog`)

e) Call up the communication program “BOSCHTRM” (`boschtrm`)

f) Enter <C> for „Configurate“

g) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Interface type	IQ140/RHO3 CAN	<2>
- Helpfile	IQ 140/RHO	<2>

h) Press <ENTER> until the following message appears:

`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT>+<*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <o>, <o> (letter)
`Home Position` `Offset [Deg]` `12` `-more-`	input: <ENTER>
`Offset [Deg]` `0 - 360` `?`	Input HPO values from robot data sheet, <ENTER>

`Enter first` `letter of a` `command or H` `for help >`	input: <C> (save)
`Sure (Y/N)?`	input: <Y>
`EEPROM ID ?`	input: number of the axis, <ENTER>
`Wait-`	
`Saving Defaults` `Gaints in EEPROM`	
`Enter first` `letter of a` `command or H` `for help >`	input: <CTRL> + <T>
`File Transfer function.` `'D' to down load from a disk file to the RMC.` `'U' to up-load data from the RMC to a disk file.` `'Q' to return to emulator`	
`Please enter option:`	input: <U>
`Please enter the source filename with` `no extension followed by return.`	
`Source file:`	input: filename <ENTER> filenames: • BA1G100 or BA1G131 • BA2G100 • BA3G60 • BA4G29
`Enter first` `letter of a` `command or H` `for help >`	input: <ESC>

i) Unplug the installation cable (replug other cable)
   - AMU interface
   - drive amplifier socket X6

9.8.5 Aligning Axis 1 (with Dial Gauge)

(☞ page 6 - 5)

9.8.6 Aligning Axis 1 (with Gripper)

(☞ page 6 - 9)

9.8.7 Adjusting Axis 4 (without Gripper)

(☞ page 6 - 13)

9.8.8 Testing the Gripper Functions

(☞ page 6 - 19)

9.9 Robot Installation Kit

The installation kit is always replaced entirely.

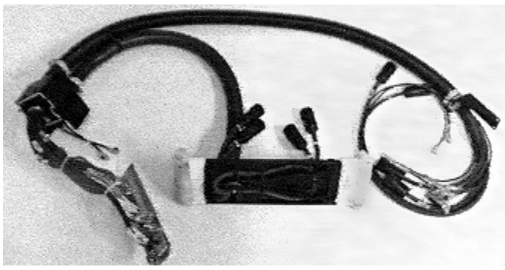


Fig. 9-20: Robot Installation Kit

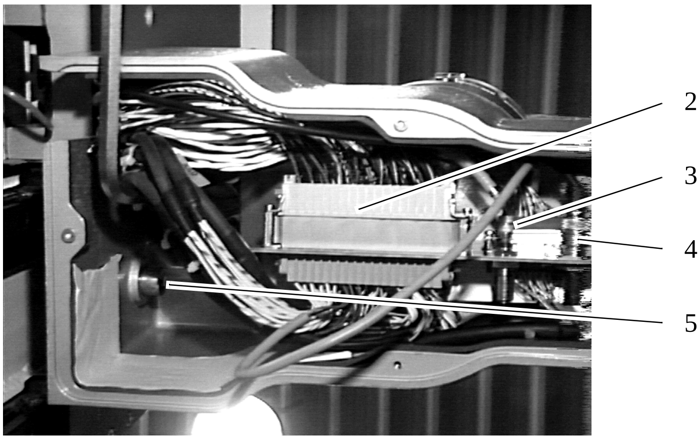


Fig. 9-21: Underside of Robot Console

9.9.1 Dismounting

a) Remove the bottom cover plate on the robot console

b) Disconnect the plugs
   - multiple plug (2)
   - air hose (3)
   - coaxial cable (4)

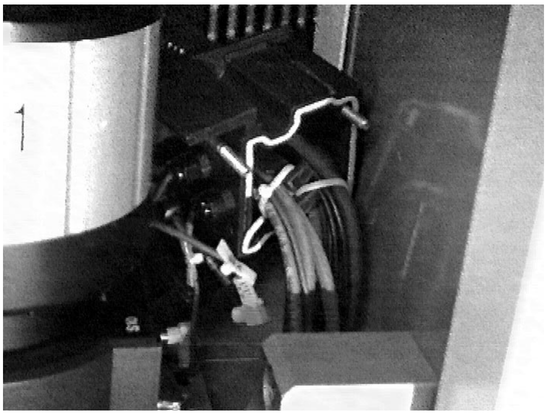


Fig. 9-22: Plastic Cover on Robot Console

c) Remove the plastic cover on robot console

d) Disconnect aproximately switches 1.0 and 1.1

e) Remove cable from the console

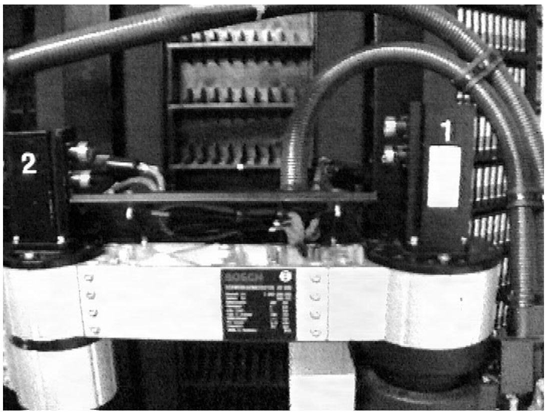


Fig. 9-23: Plastic Cover between axis 1 and 2

f) Disconnect motor and resolver connectors axis 1, 2, 3 and 4

g) Remove plastic cover between axis 1 and 2

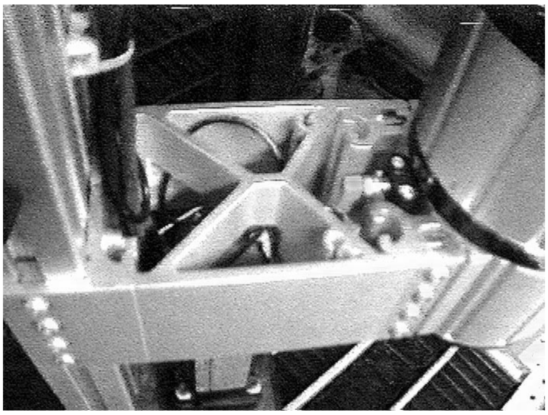


Fig. 9-24: aluminium profile between axis 2 and axis 3

h) Remove the metal cover between axis 2 and axis 3.
i) Disconnect aproximately switch 2.0 and 2.1
j) Cut cable strips along axis 3
k) Remove plastic cover axis 3 top
l) Disconnect aproximately switches 3.0 and 4.0
m) Disconnect connector to cable duct

9.9.2 Mounting

reverse sequence

9.10 Gripper

9.10.1 Parallel gripper

Information

- **Gripper for large media: order no. 401 004 920**
  (gap between jaws > 3 mm)
  for 1/2 Inch cartridges, VHS, TK, DTF-Large, 8mm-cartridges (Exabyte), Travan, D2 Small and D2 Medium

- **Gripper for small media: order no. 401 004 930**
  (gap between jaws ca. 3 mm)
  for 1/2 Inch cartridges, VHS, TK, DTF-Large, 8mm-cartridges (Exabyte), Travan, OD-Reflection, OD-512, 4mm DDS, CD-ROM (Caddy)

Tools and aids

- Slotted screwdriver, small
- Allan key 4 mm

9.11 Software Backup

a) Do a Software Backup (☞ Software Backup):
  - Robot & Tower Software (old controller software)
  - save files „C:\AMU\AMUCONF.INI“, „C:\AMU\KRNREFPT.R01“, „C:\AMU\KRNREFPT.R02“
  - save via RFM (☞ Rho File Manager) in AMU-menu Service the files „*.BIN“, „*.DAT“ in directory „C:\ROBOT\BACKUP“

9.12 Install new software and edit the parameters

a) Copy the installation disk on your hard disk

b) Unzip the software

c) Copy all files you need in a work directory

from directory	file	needed with	rename in
`bin`	`max2_kin.rho`	System with no or one Quadro tower (equals version 2.2.0)	`mprho3.bin`
	`max3_kin.rho`	System with two Quadro towers (equals version 2.2.0)	`mprho3.bin`
	`mprho3.bin`		
	`read.me`		
`pic`	`iq_aml2.p2x`	always necessary (control program PIC)	`iq_aml2.p2x`
`prs`	alle	copy in directory MOOG for parameterizing of drive amplifiers	
`sourcen`	`init.ird`	always necessary	
	`perman.ird`		
	`amulese.ird`		
	`amuschr.ird`		
	`pteach.ird`		
	`prack.ird`		
	`pbarcode.ird`		
	`pnewgrip.ird`		
	`ptest.ird`		

from directory	file	needed with	rename in
	qturm1.ird	necessary in systems with one Quadro tower	
	qturm2.ird	necessary in systems with two Quadro towers	
	qturm3.ird	necessary in systemen with three Quadro towers	
	plwmulti.ird	necessary for all drives except for 3490	
	plw3490.ird	necessary for 3490 drives	
	plw3480.ird	necessary for 3480 drives with flap	
	exprog.dat	always necessary (Do not change the files!)	
	version.dat		
	kopplung.dat		
	ptest.ger	needed for German Robot Test Program	ptest.dat
	ptest.dat	needed for English Robot Test Program	
	homepos.dat	always necessary (equals version 2.2.0)	
	konfig.bas	always necessary, copy the parameters of version 2.2.0 or determine new	konfig.dat
	plw34907.dat	necessary if a drive is defi-ned in AMU as D7	
	plw34909.dat	necessary if a drive is defi-ned in AMU as D9	

d) Edit file KONFIG.DAT:

e) Take on the parameters as described in the table below (☞ Software BAckup)

NEW		OLD		Name of variable	Actual	Explanation
Pos.	Line	Pos.	Line			
1	12	1	22	T_ADR_RHO		Address of control
2	13	3	24	T_EA1_TYP		Type I/O unit1
3	14	4	25	T_EA2_TYP		Type I/O unit2
4	15	5	26	G_EA1_Nr		Logical no. of I/O unit 1
5	16	6	27	G_EA2_Nr		Logical no. of I/O unit 2
6	17	7	31	G_RobotNr		Logical no. of robot
7	21	8	35	T_Cart_Type1		Media type 1
8	22	9	36	T_Cart_Type2		Media type 2
9	23	10	37	T_Cart_Type3		Media type 3
82	177	59	134	LW1		Logical name for drive type 1
83	178	60	135	LW2		Logical name for drive type 2
84	179	61	136	LW3		Logical name for drive type 3
85	180	62	137	LW4		Logical name for drive type 4
96	194	71	149	FZ_Unload[1]		Y = press Unload button N = don’t press Unload button
104	205	80	161	FZ_Unload[2]		Y = press Unload button N = don’t press Unload button
112	216	89	173	FZ_Unload[3]		Y = press Unload button N = don’t press Unload button
120	227	98	185	FZ_Unload[4]		Y = press Unload button N = don’t press Unload button
145	264	103	196	G_X_MAXLIMIT		Maximal value of x-coordinate
146	265	104	197	G_X_MINLIMIT		Minimal value of x-coordinate.
147	266	105	198	G_Z_MAXLIMIT		Maximal value of z-coordinate.
148	267	106	199	G_Z_MINLIMIT		Minimal value of z-coordinate.
149	268	107	201	G_H_SAVEELBO		Position limit safe elbow
150	272	113	210	D_HANDL		Slow speed at linear interpolation.
151	276	116	216	G_PHGECHO		0: PHG not plugged in, 1: PHG plugged in
160	293	136	243	G_BCErrIgn		Reaction on BC-Read-Error, 0→terminate; 1→ignore
163	300	117	220	D_TIME1		Timeout Quadro tower.

NEW		OLD		Name of variable	Actual	Explanation
Pos.	Line	Pos.	Line			
164	301	118	221	D_TIME2		Timeout I/O unit
165	302	120	223	D_WARTE_KEEP		Timeout at Keep from drive
166	306	99	189	D_Z_TO_V		Proportion of movement Z- to lif-ting axis.
167	307	100	190	D_Y_Elb		Abs. Y-Pos. at movement between racks and drives
170	311	108	202	G_UMSCHLAG		0=any elbow 1=left elbow 2=right elbow
171	312	109	203	G_FIRSTTOWER		Number (Address) of 1st tower

f) Enter the gripper type parameter

NEW		OLD		Name of variable	Actual	Explanation
Pos.	Line	Pos.	Line			
159	292	-	-	G_Parallel		Gripper type: 0 = for small medias (401 004 930) 1 = for large medias (401 004 920)

g) Enter the parameters of the gripper data sheet

NEW		OLD		Name of variable	Actual	Explanation
Pos.	Line	Pos.	Line			
153	282	-	-	G_X_TEACH		X-Teach-Offset
154	283	-	-	G_Y_TEACH		Y-Teach-Offset
155	284	-	-	G_Z_TEACH		Z-Teach-Offset
156	286	156	274	G_X_OFFSET		Gripper -Offset X-coordinate
157	287	157	275	G_Y_OFFSET		Gripper-Offset Y-coordinate
158	288	158	276	G_Z_OFFSET		Gripper-Offset Z-coordinate

h) Send the new software to the rho control via **Rho File Manager** (☞ AMU Reference Guide „Rho File Manager“)

9.13 Adjust the drives

Information

All standard drives have example files (including the parameters) on the installation diskette (e.g. `plwodr.dta`**).**

If you don't find the corresponding file for your drive or if you have handling problems then edit the following parameters:

a) Edit your drive files as described:
   - e.g. an ODR-drive (**D0**) was declared first in „KONFIG.DAT“ then enter
     `copy plwodr.dta plwdat1.dat`
   - define for each other drive the file „FLWDAT?.DAT“ (?=1..7), max. 7 different drive types are possible
   - define for the DTF medium and small as well as for the D2 medium and small for each 2 drive types

b) Send the files to the control via **Rho File Manager** (☞ AMU Reference Guide „Rho File Manager“)

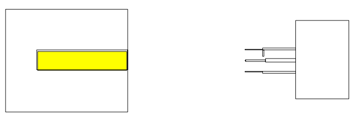
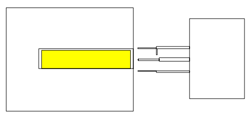
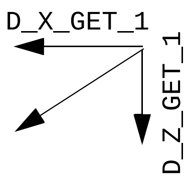
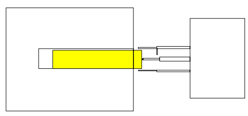
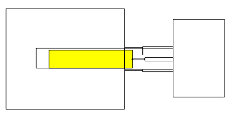
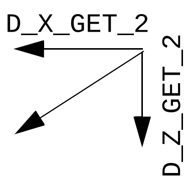
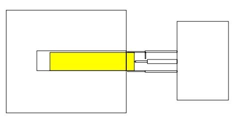
c) Restart your system

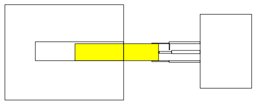
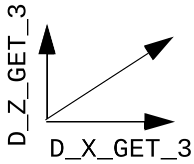
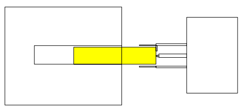
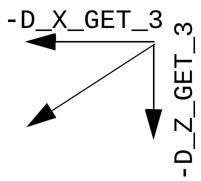
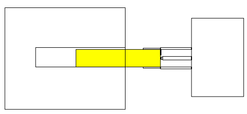
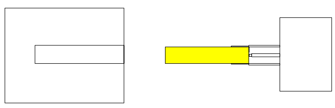
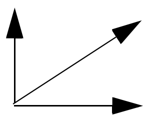
9.13.1 Meaning of the drive parameters

Information

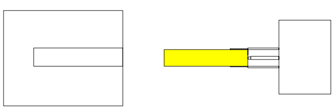
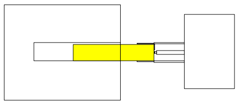
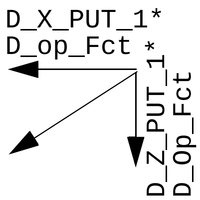
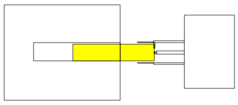
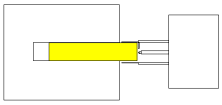
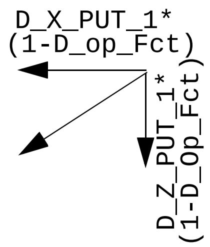
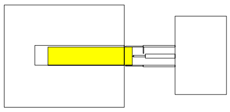
If wait times and movements have value „0“, the corresponding function is switched off.
Speed factors need not to have value „0“.

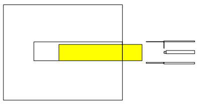
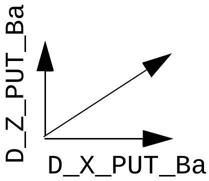
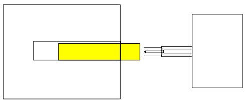
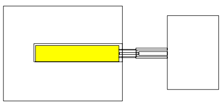
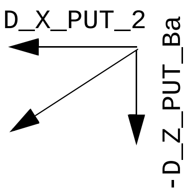
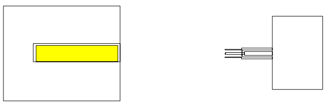
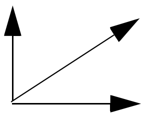
GET command

Situation	Parameter	Explanation
drive 	INIT (X, Y, Z, tilt angle, angle offset cover)	Start position for drive handling. The parameters are added to the teach points.
1st movement drive 	 D_Vel_FctG1 G_Detect	First movement at Get command. Speed can be changed via parameter D_Vel_FctG1 in area 0.1 - 1. Target of that movement is the position where the gripper waits for the medium. Parameter `G_Detect` gives the status of the pusher while waiting: • 0 = Pusher pressure reduced • 1 = Pusher without pressure
drive 	`D_Wait_Get`	After Unload of medium (pusher sensor active) the robot waits as long as entered in parameter `D_Wait_Get` (seconds)
2nd movement drive 		The second movement brings the gripper to the position where it's being closed. On that position the gripper is closed immediately
drive 	`D_X_Put_Ra`	If regip is not possible: reduction of the depth via parameter `D_X_Put_Ra` for the following **`Put`**.

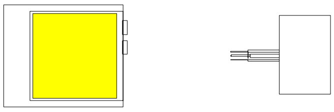
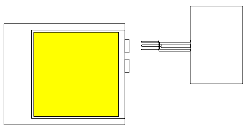
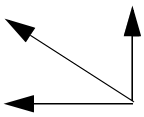
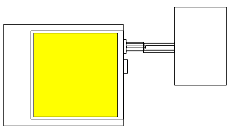
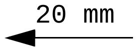
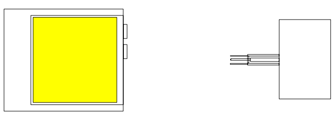
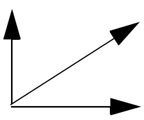
Situation	Parameter	Explanation
3rd movement drive 		Via sensor „Pusher in the back“ the gripper recognizes if the medium was gripped correctly: • medium gripped correctly: robot moves immediately to end position • medium not gripped correctly: gripper opens and Regrip routine is started
4th movement, regrip drive 		robot moves near the drive, until the medium will be gripped correctly.
drive 		Gripper is closed
5th movement drive 		Fifth movement leads to the end position

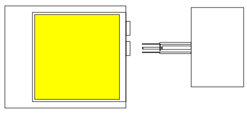
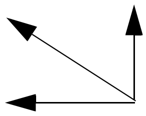
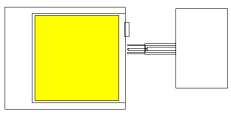
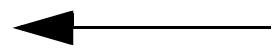
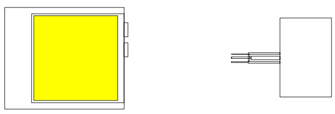
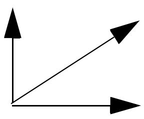
PUT command

Situation	Parameter	Explanation
drive 	INIT (X, Y, Z, tilt angle, angle-offset cover)	Start position for drive handling. The parameters are added to the teach points.
1st movement drive 	 D_Vel_FctP1	First movement at Put command. Speed can be changed via parameter D_Vel_FctG1 in area 0.1 - 1. Target of that movement is the position where movement will be converted (inside the drive, how far to get inside)
drive 		Gripper will be opened after in parameter D_Op_Fct entered stretch
drive 		First movement is continued with opened gripper
drive 	D_Bgl	Pushing of the medium with the pusher: • 1 = medium is pushed with full pressure • 2 = medium is pushed with reduced pressure • 3 = medium is not pushed

Situation	Parameter	Explanation
2nd movement drive 		Gripper drives back to push
drive 	G_Close	Gripper position while pushing: • 1 = pushing with closed gripper jaws • 2 = pushing with open gripper jaws
3rd movement drive 	 D_Vel_Fct_P2	Movement of pushing with speed entered in D_Vel_Fct_P2
4th movement drive 		Fifth movement leads to the end position

UNLOAD command

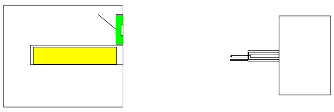
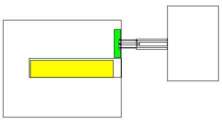
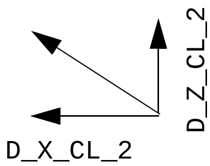
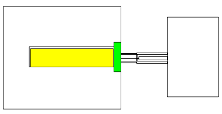
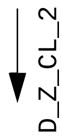
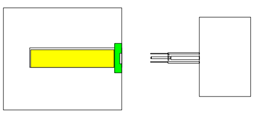
Situation	Parameter	Explanation
drive 	G_GRP_DIS	Start position for handling of buttons at the drive (Unload and Not Ready). Via G_GRP_DIS you enter the gripper position for Unload: • 0 = gripper 0°, pusher reduced pressure • 1 = gripper 0°, pusher full pressure • 2 = gripper 7°, pusher without pressure • 3 = gripper 0°, pusher without pressure
1st movement drive 	 D_Y_EJECT_1 D_X_EJECT_1 D_Z_EJECT_1	First movement at Unload command Closed gripper is positioned 20 mm before the first button
2nd movement drive 	20 mm 	Gripper handles the (first) button
3rd movement drive 		Third movement leads to the start position

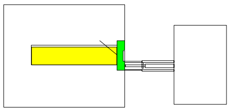
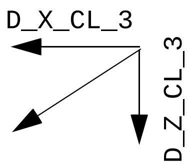
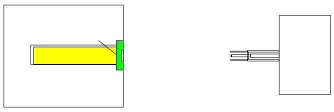
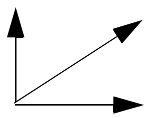
Situation	Parameter	Explanation
	G_Scnd_Btn	Handling of a second button • 1 = handle 2nd button • 0 = handle only 1 button
4th movement drive 	 D_Y_EJECT_2 D_X_EJECT_2 D_Z_EJECT_2	Fourth movement at Unload command Closed gripper is positioned 20 mm before the second button
5th movement drive 	20 mm 	Gripper handles the (second) button
6th movement drive 		Sixth movement leads to the start position

Close Unit command

Information

This configuration is only for linear movements while closing a flap. Use for IBM 3480 drives with flap the routine „PLW3480.IRD“ and the affiliated configuration file.

Situation	Parameter	Explanation
drive 		Start position
1st movement drive 		First movement at command Close Unit Closed gripper drives into the gap of the flap.
2nd movement drive 		Gripper drives down
3rd movement drive 		Gripper quits the flap

Situation	Parameter	Explanation
4th movement drive 		Gripper tests via pusher sensor if the flap was closed.
5th movement drive 		Sixth movement leads to the start position

9.13.2 „PLWDAT?.DAT“ for AML/2

Line	Name	Description
9	D_X_PUT_2	Push media into drive
11	D_X_EJECT_1	X-coordinate of 1st Unload button (20mm in front of button). Configuration, if button has to be pressed via KONFIG.DAT
12	D_Y_EJECT_1	Y-coordinate of 1st Unload button
13	D_Z_EJECT_1	Z-coordinate of 1st Unload button
15	G_Scnd_Btn	1= 2nd Unload button has to be pressed 0= no 2nd Unload button
16	D_X_EJECT_2	X-coordinate of 2nd Unload button (20mm in front of button)
17	D_Y_EJECT_2	Y-coordinate of 2nd Unload button
18	D_Z_EJECT_2	Z-coordinate of 2nd Unload button
20	G_CL_U	1=drive flap has to be closed 0= no closing of flap
21	D_X_CL_1	X-coordinate for gripper in depression of drive flap
22	D_Z_CL_1	Z-coordinate for gripper in depression of drive flap
23	D_Z_CL_2	Z-value closing of flap, movement down (of gripper)

Line	Name	Description
24	D_X_CL_3	X-coordinate for testing if flap is closed
25	D_Z_CL_3	Z-coordinate for testing if flap is closed
27	D_X_Put_Ra	Reduced putting down of cartridge at rack if cartridge was at the drive not completely in the gripper and couldn’t be regripped at the drive
29	D_X_PUT_1	X-coordinate for putting down the cartridge in the drive, 1st movement
30	D_Z_PUT_1	Z-coordinate for putting down the cartridge in the drive
31	D_Vel_FctP1	Speed factor for the 1st movement 1 = full speed (0.1-1.0)
32	D_Op_Fct	Factor for the 1st movement, from now on the 1st movement will be continued with opened gripper (0-1) 1 = whole movement with gripper closed
33	D_X_PUT_Ba	X-coordinate for movement back and re-pushing again the cartridge with closed gripper. 0 = no re-pushing
34	D_Z_PUT_Ba	Z-coordinate for movement back (re-pushing again)
35	G_Close	1=close gripper for re-pushing
36	G_Bgl	Pusher 1 = Pusher at front on PUT, 0 = Pusher without pressure
37	D_Vel_FctP2	Velocity factor for re-pushing the cartridge into the drive (Distance see value 1, line 52) 1.0 = max. velocity
38	D_Wait_Push	Wait time until the gripper moves out of the drive after re-pushing [sec]
40	D_X_GET_1	X-coordinate for getting the cartridge out of the drive, 1st movement
41	D_Z_GET_1	Z-coordinate for getting the cartridge out of the drive
42	D_Vel_FctG1	Velocity factor for the 1st movement. 1 = full velocity (0.1-1.0)
43	D_Wait_Get	Wait time between recognizing the cartridge and closing the gripper
44	D_X_GET_2	X-coordinate gripper movement forward after recognizing the cartridge
45	D_Z_GET_2	Z-coordinate gripper movement forward after recognizing the cartridge
46	D_X_GET_3	X-coordinate movement backward with the cartridge out of the drive. Query if the cartridge was gripped OK or if there should be a regrip. 0 = no regrip
47	D_Z_GET_3	Z-coordinate movement backward
49	G_Detect	Recognition of the cartridge at the drive 0 = Pusher slightly under pressure, 1 = Pusher without pressure

Line	Name	Description
50	G_GRP_DIS	Gripper position while pressing the Unload button 0 = 0°, Pusher slightly under pressure; 1 = 0°, Pusher under pressure; 2 = 7°, Pusher without pressure; 3 = 0°, Pusher without pressure
51	reserve	Reserve
52	D_Winkel	Rolling axis angle for drive handling, here **same value** as in **Line 58: W**
53	INIT	Must not be changed
54	X	X-coordinate global approach of the drive at main program
55	Y	Y-coordinate global approach of the drive at main program
56	Z	Z-coordinate global approach of the drive at main program
57	K	Angle of gripper while global approach of the drive at main program
58	W	Angle between drive and cover coordinate global approach of the drive at main program

9.14 Exchange of the gripper

9.14.1 Disassembly of the old gripper

a) Shut down your system (**Shutdown AML**)

b) Dismount the old gripper:
- unscrew the plug-fixing-screws
- unplug that plug
- loosen the fixing of the air hose and pull off the hose
- unscrew the 4 screw with an Allan key 4 mm

9.14.2 Edit „KONFIG.DAT“

(☞ “Install new software and edit the parameters” from page 9 - 36)

9.14.3 Assembly of the new gripper (parallel gripper)

a) Mount the parallel gripper (= new gripper)
- tighten the 4 screws with an Allan key 4 mm
- mount the air hose
- plug in the plug and screw it down with the fixing screws

9.14.4 Teach your system

a) Restart your system

b) Determine the teach points with the PHG, position the pusher always as exact as possible onto the teach label

c) Enter the values of **Teach Coordinates** on your PHG in **Graphical Configuration**

d) Teach now all components via **MTCG dialog**.
Duration: like systems without parallel gripper

e) Test handling of all components with **Get** and **Put** commands

f) Correct - only if necessary - the offset values in „KONFIG.DAT“ and offset values of the drives in the corresponding parameter files for these drives

9.14.5 Exchange parallel gripper - parallel gripper

Always replace the entire gripper.

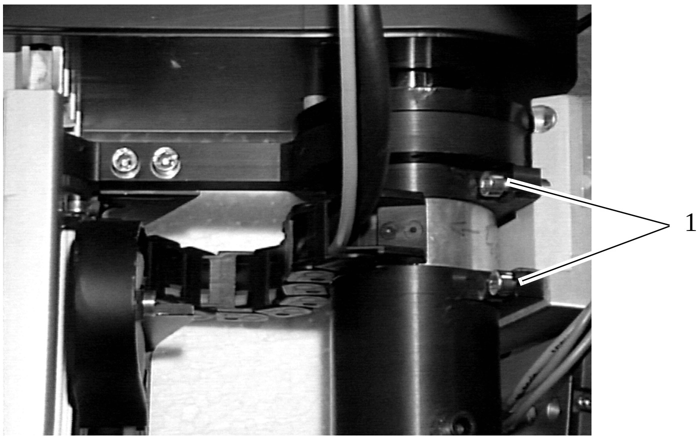


Fig. 9-25: Gripper Retaining Screws

9.14.6 Preparation

Change all parameters on the gripper data sheet in “KONFIG.DAT”:

a) Call up the **Rho File Manager** (☞ AMU Reference Guide)

b) Select **Receive from Rho**

c) Select the partner (robot control system)

d) Select the file “KONFIG.DAT”

e) Select chosen target directory

f) Click on **Start Receive**

g) Open OS/2 window

h) Change to chosen directory (cd ..)

i) Open the file with the “EPM” editor (EPM KONFIG.DAT)

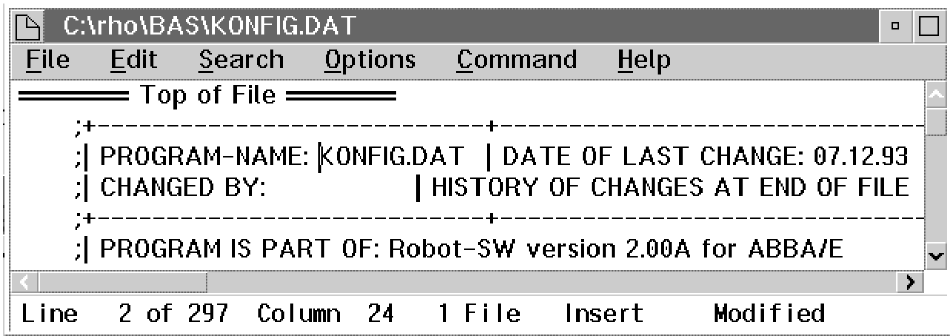


Fig. 9-26: Window OS/2-Editor EPM

j) Enter data on the gripper data sheet into “KONFIG.DAT”

Information

Also enter the values on the parameter list!

k) Save the file
l) Exit the editor
m) Change to the **Rho File Manager**
n) Select **Send to Rho**
o) Select directory
p) Select the file “KONFIG.DAT”
q) Click on **Select**
r) Click on **Start Send**
s) Quit the **Rho File Manager**
t) Press <CONTROL OFF>
u) Switch off the main switch

9.14.7 Dismounting

a) Remove the cover of the connections

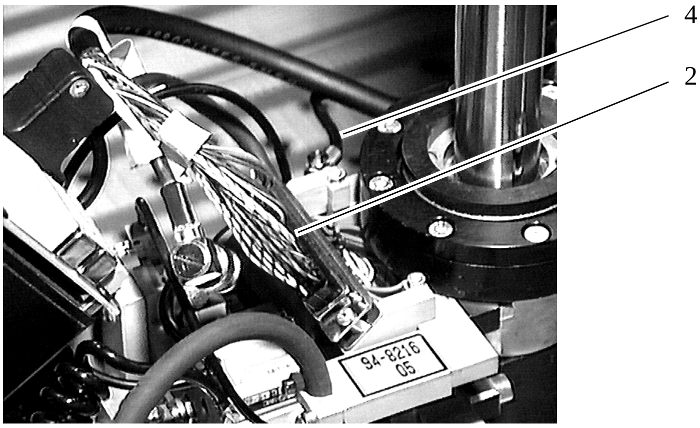


Fig. 9-27: Connection Gripper Cable on the Gripper (Barcode Scanner)

b) Unplug the cable
- gripper cable (2)
- air hose (4)

ATTENTION

The gripper can fall down.
Hold the gripper while dismounting it.

c) Remove the fastening screws (1) on the rear of the gripper

d) Horizontally pull the gripper from the locating bores

9.14.8 Mounting

reverse sequence

ATTENTION

Be sure to care for correct and clean mounting of

- **the cable connection**
- **the air hose connection**

Protect cable and hose from unintentional disconnection.

Information

Tightening torque for the fastening screws 5.5 Nm.

9.14.9 Testing the Gripper Functions

a) Switch on the main switch and let the control unit run up

b) Press <CONTROL ON>

c) Call up the test program: press [ALT] + [SHIFT] + <dead man>

- press [1] + <dead man> (TEST)
- press [1] + <dead man> (installation)
- press [3] + <dead man> (gripper test)
- press [1] + <dead man> (gripper functions)
- check the gripper functions by proceeding from one function to the next by pressing

d) Quit the gripper test program by pressing [0]

e) Quit installation by pressing [0]

f) Quit the robot test program by pressing [9]

9.14.10 Test the Teach Facility

a) Open the **Trace** window in the **View** menu

b) Select **Online**

c) Select **TraceID KRN8**

d) Reteach (☞ page 5 - 6)

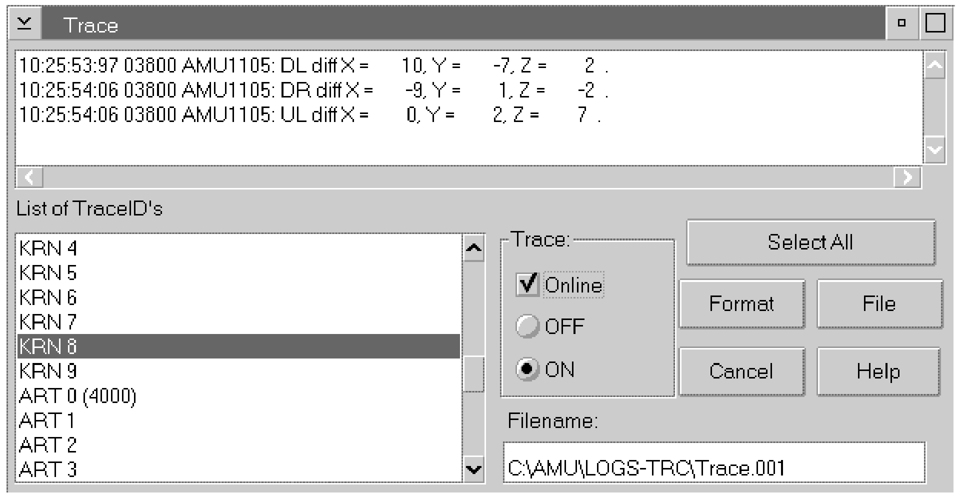


Fig. 9-28: Trace Window with KRN8

e) The **Trace** window displays the differences: if one of the offset values are > 60,
- repeat teach procedure on a other segment
- if now the differnces < 60 reteach the first segment

9.14.11 Test the Handling

a) Reduce the speed to 10 % (PHG Mode 11.4)

- press MODE , 1 , 1 (11), ⟐ (help functions)
- press MODE , 4 , ⟐ (adjust VFACTOR)
- press 0 , . , 1 (0.1), ⟐

b) Test the AMU commands **Put** and **Get** on all units

c) Check whether the gripper moves smoothly into and out of the compartments (does not bump into the edges of the compartment)

d) If necessary correct the handling offset values in the file “KONFIG.DAT”

9.14.12 Test the Barcode Read System

a) Start the **Inventory** command

b) Check whether the barcode is read immediately

c) If necessary activate the special code types (default only Code 39 and STK) (☞ page 6 - 26)

d) If necessary apply barcode optimization to the robot test program (☞ page 6 - 21)

e) Reset the speed to “1”

9.14.13 Software Backup

a) Copy the changed KONFIG.DAT on the floppy robot & tower software.

b) Fill in the changed parameter(s) in list of the „Software Backup“

9.14.14 Gripper Power Connection

Preparations on the gripper

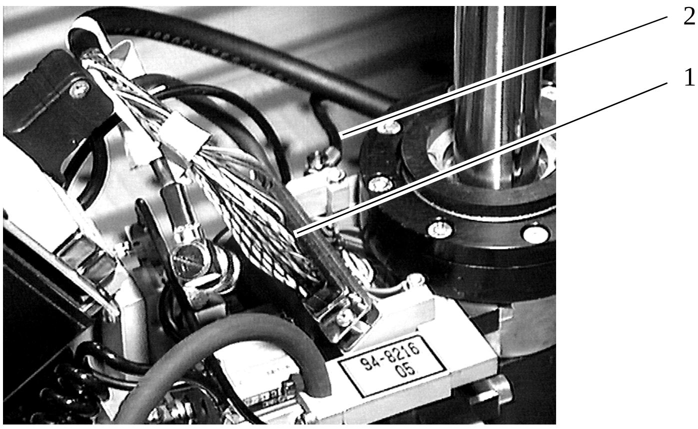


Fig. 9-29: Connections: Gripper Cable on the Gripper (Barcode Scanner)

a) Remove the cover of the connections

b) Unplug the cables
   - gripper cable (1)
   - air hose (2)

Preparations on the robot

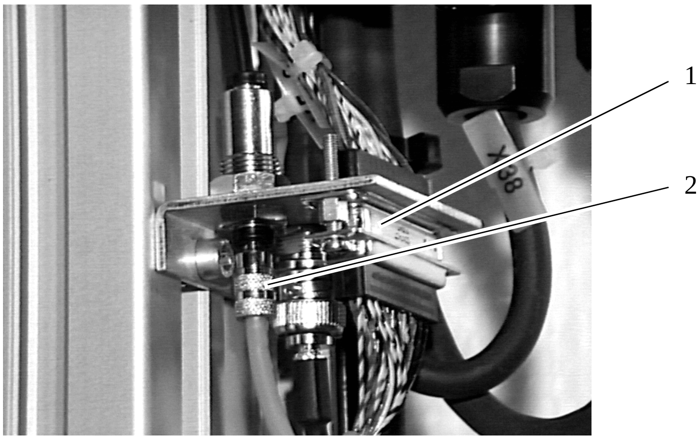


Fig. 9-30: Connections: Gripper Cable on the Robot

a) Remove the cover

b) Unplug the cables
   - gripper cable (1)
   - air hose (2)

on the lifting axis of the robot

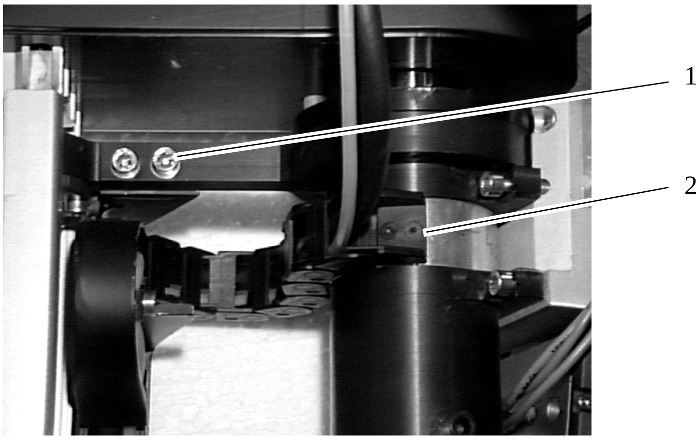


Fig. 9-31: Cable Duct of Gripper

Dismounting

a) Loosen the retaining screws
   - two on the gripper (2)
   - two on the top of the alu profile (1)
   - two on the bottom of the alu profile

b) Remove the cable duct

Mounting

ATTENTION

The number of chain-links of the new cable duct must agree with the number on the old.
Be sure to care for correct and clean mounting of

- **the cable connection**
- **the air hose connection**

Protect cable and hose from unintentional disconnection.

reverse sequence

After mounting

a) Reconnect cables and hose

9.15 I/O Unit/A

9.15.1 Overview

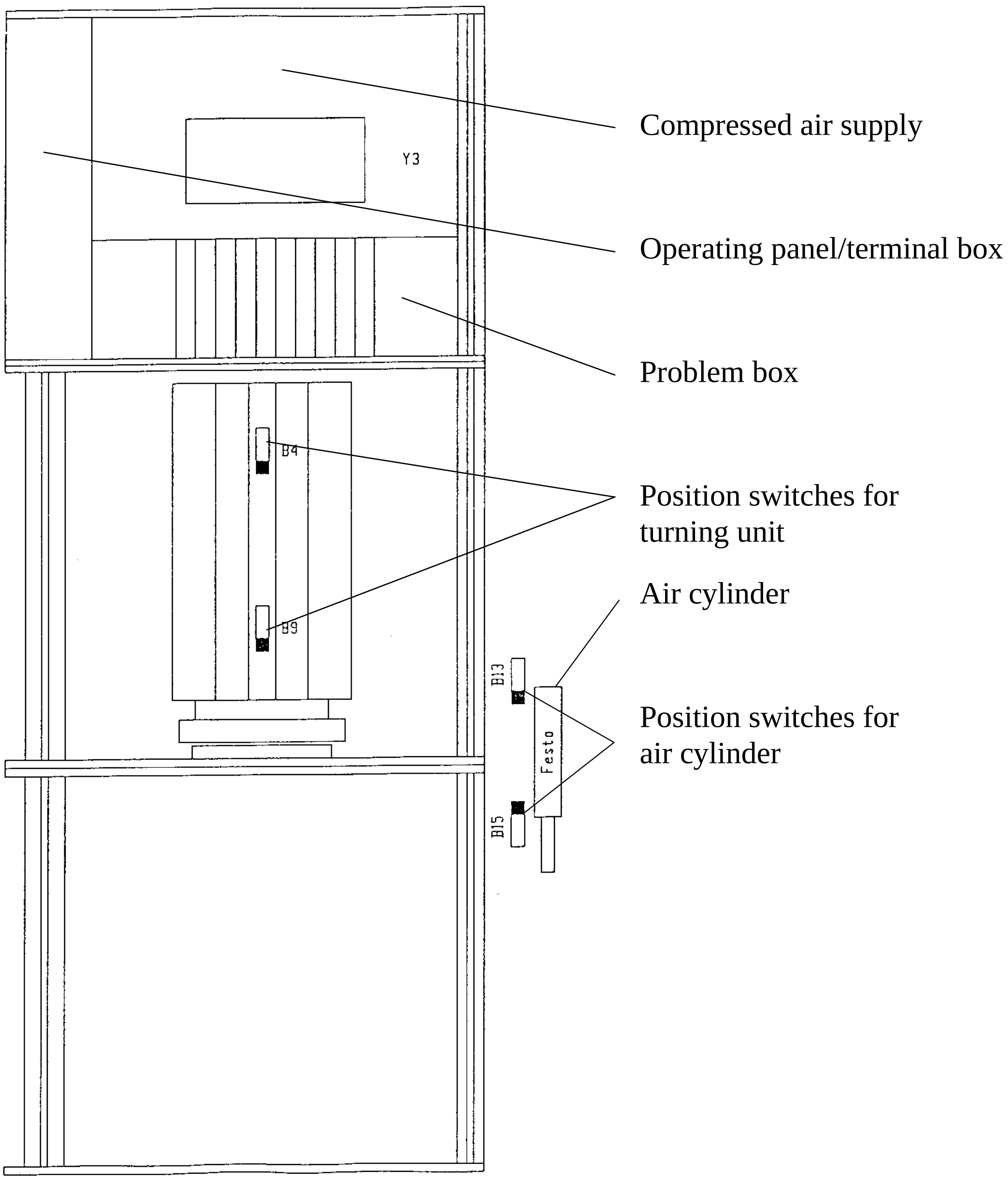


Fig. 9-32: I/O Unit/A Overview

9.15.2 Position Switches for Turning

behind the covers of the turning unit on the side facing the operator
(4 position switches in all)

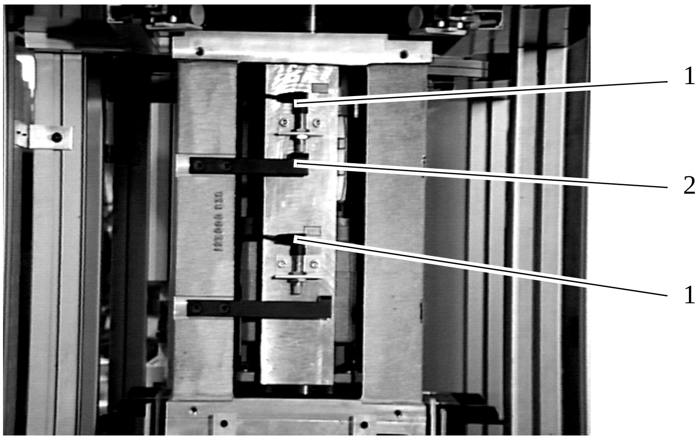


Fig. 9-33: Position Switches for Turning

Dismounting

a) Remove the handling box if present
b) Remove the cover
   - remove two screws each on top and bottom
c) Unplug connector
d) Loosen lock nuts
e) Remove defective position switch (1)

Mounting

a) Mount the position switch
b) Adjust the distance of the cam plate (2) to 2 mm
c) Tighten the lock nuts
d) Unplug the connector
e) Check the function
f) Mount the cover
g) Adjust handling box

9.15.3 Position Switches for Cylinder

robot in the I/O unit

Fig. 9-34: Position Switch for Cylinder

Information

If you want to replace the rear position switch you do not need to dismount the rear panel.

Dismounting

a) Remove the handling box
b) Dismount the rear panel
c) Loosen the clamping (2)
d) Pull out the position switch (1)
e) Pull off the plug

Mounting

Information

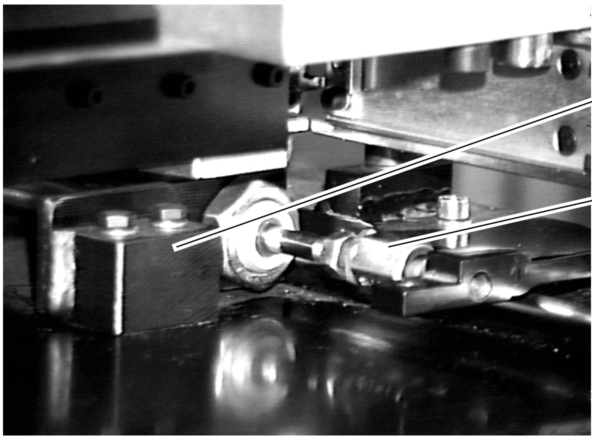
Check the function before remounting the rear wall.

reverse sequence

a) Check the function

9.15.4 Air Cylinder

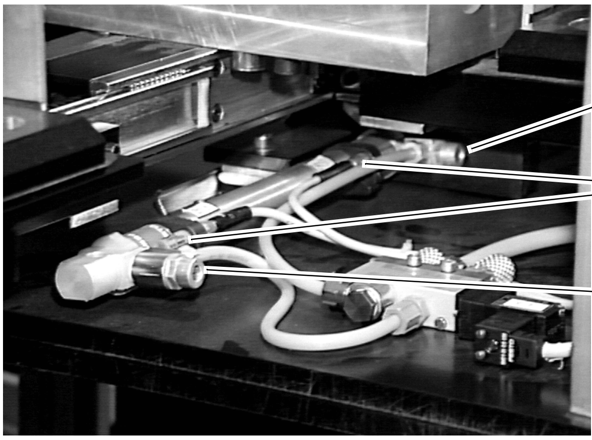
operator or robot side of the I/O unit below the turning unit



1

2

Fig. 9-35: Support Bracket for Air Cylinder



3

4

5

Fig. 9-36: Air Cylinder, Valve and Throttles

Dismounting

a) Remove the handling box

b) Separate the connection (2) of piston rod and shifting unit

c) Loosen the retaining screws on the cylinder support (1)

d) Pull the cylinder with the parts assembled to it out from the robot side

e) Disconnect the air hoses

f) Dismount the following parts
- support (1)
- connector on the piston rod (2)
- position switch (4)
- throttle valves (3, 5)

Mounting

a) Mount the following parts
- throttle valves
- position switches (☞ page 9 - 64)
- connector on the piston rod
- support

b) Connect the air hoses

c) Mount the cylinder with the parts assembled to it from the robot side

d) Connect the piston rod and the shifting unit

e) Insert the handling box

f) Check the function on all four positions of the turning unit

9.15.5 Air Valve

robot side of the I/O unit

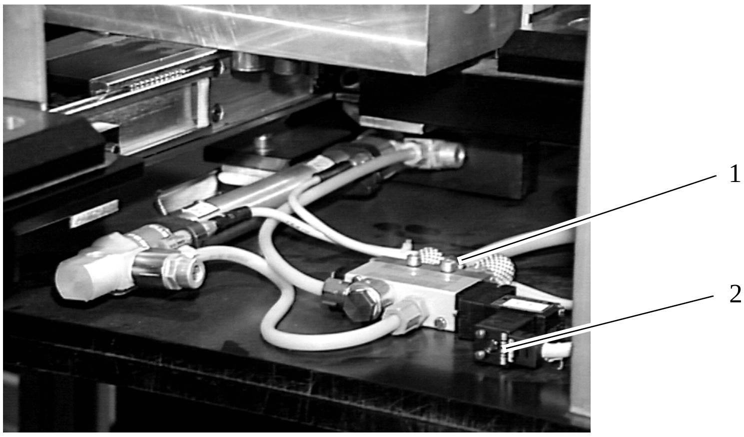


Fig. 9-37: Air Valve and Solenoid

Dismounting

a) Loosen the retaining screws (1)

Information

Note the position of the air hoses.

b) Remove the air hoses and the muffler
c) Remove the solenoid (2) by loosening the knurled nut

Mounting

a) Mount the solenoid to the valve
b) Connect the air hoses and the muffler as recorded for the old valve
c) Mount the valve
d) Check the function

9.15.6 Throttle Valve

integrated into the hose connection of the air hose

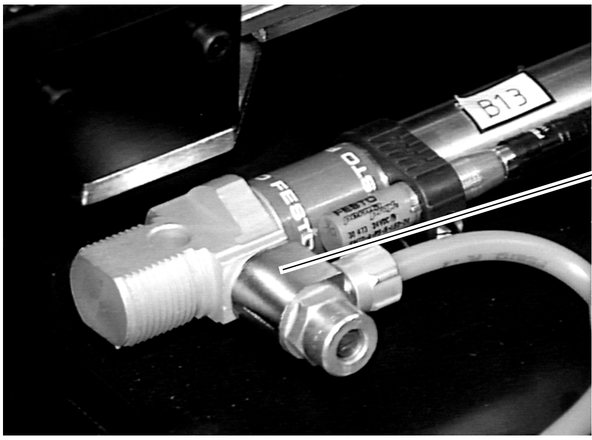


Fig. 9-38: Throttle Valve

Dismounting

a) Disconnect the air hose
b) Remove the throttle valve (1)

Mounting

a) Mount the throttle valve
b) Connect the air hose
c) Adjust the piston speed with the throttle valve

9.15.7 Lightbarriers on the Turning Unit

robot side of the I/O unit

Fig. 9-39: Dismounting the Lightbarriers

a) Unplug the cable

b) Remove the lightbarrier

Mounting

a) Mount the light barrier

b) Connect the cable

9.15.8 Lightbarrier for Problem Box

robot side of the I/O unit

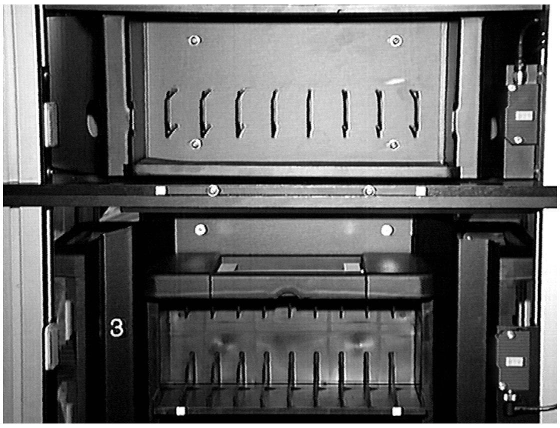


Fig. 9-40: Lightbarrier for Problem Box

Dismounting

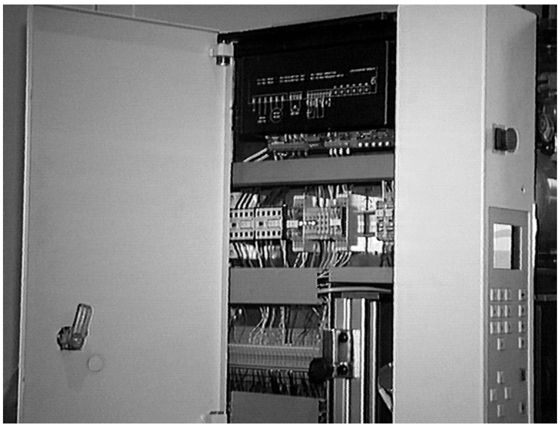
a) Unplug the cable
b) Remove the lightbarrier

Mounting

a) Mount the light barrier
b) Connect the cable

9.15.9 Operaing Panel

left of the operating panel



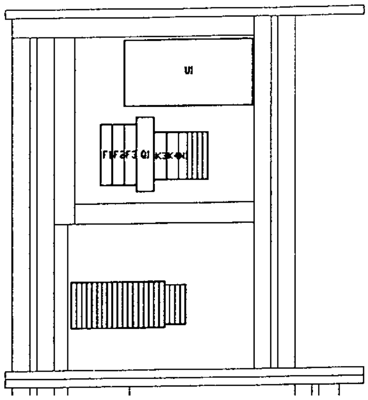


Fig. 9-41: Operating Panel

Dismounting

a) Remove the cover plate (two screws each inside and on top)
b) Unplug three plugs
c) Remove the operating panel

Mounting

reverse sequence

a) Test the operating panel (☞ page 6 - 49)

9.16 I/O Unit/B

9.16.1 Overview

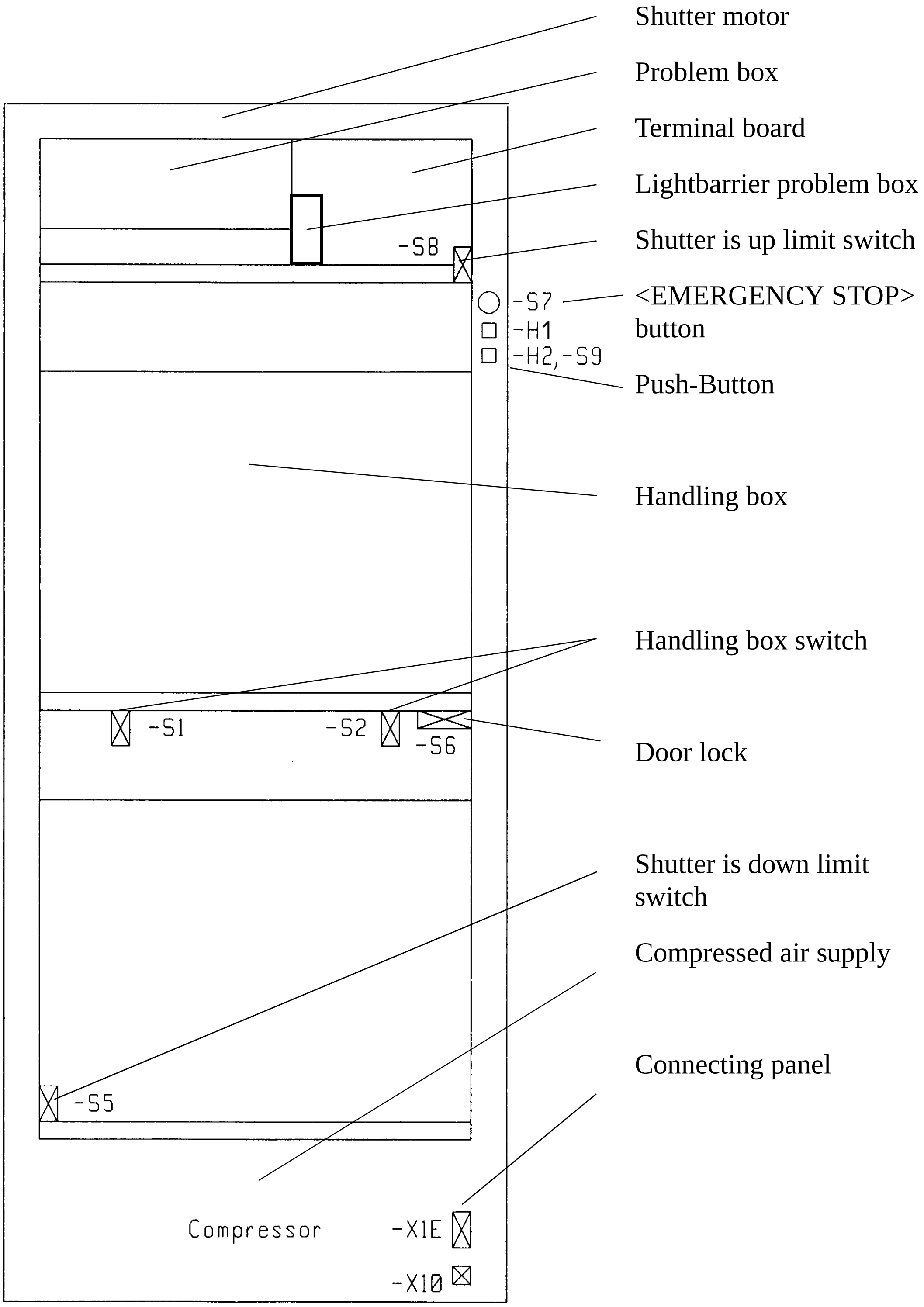


Fig. 9-42: I/O Unit/B Overview

9.16.2 Connecting Panel

on the bottom inside the I/O unit, behind the cover (☞ page 9 - 72)

- X1E: connecting plug
- X10: 230 V supply voltage for compressor

pin configuration (☞ circuit diagram)

9.16.3 Shutter is Up Limit Switch

S8 inside the I/O unit (☞ page 9 - 72)

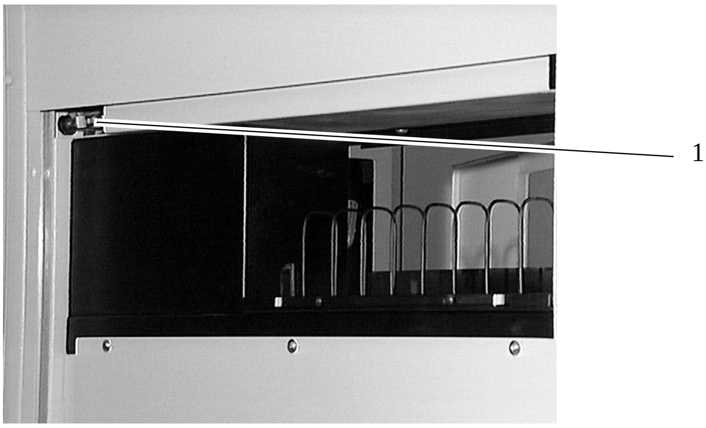


Fig. 9-43: I/O Unit/B Problem Box Seen from Inside

Dismounting

a) Dismount the shutter (☞ page 9 - 74)
b) Dismount the limit switch
c) Disconnect the limit switch

Mounting

ATTENTION

During operation the cam pulley must run above the shutter cam.

reverse sequence

9.16.4 Shutter is Down Limit Switch

S6 inside the I/O unit (☞ page 9 - 72)

Dismounting

a) Dismount the two cover plates
b) Mark the position of the support plate
c) Dismount the switch with the support plate
d) Separate the switch from the support plate
e) Disconnect the cable

Mounting

a) Insert cable and connect it
b) Mount the switch to the support plate
c) Align the support plate with the marks and screw it
d) Mount the two cover plates

9.16.5 Shutter with Motor

on top inside the I/O unit (☞ page 9 - 72)

Dismounting

a) Open the I/O door
b) Open the terminal box
c) Disconnect the shutter drive motor
d) Remove inside cover above the shutter
e) Dismount the shutter cover
f) Loosen the seven fastening screws from the top of the I/O unit
g) Pull the shutter out

Mounting

a) Insert the cable into the terminal box
b) Mount the shutter
c) Tighten the fastening screws
d) Mount the shutter cover
e) Mount the cover
f) Connect the shutter drive motor inside the terminal box

9.16.6 Push-Button

H2 and S9 on the left side of the I/O unit (☞ page 9 - 72)

Dismounting and Mounting

a) Dismount the support plate
b) Continue with
(☞ “Operating Mode Switch and Push-Button” from page 10 - 10)

9.16.7 <EMERGENCY STOP> Button

S7 on the left side of the I/O unit (☞ page 9 - 72)

Dismounting

a) Dismount the support plate
b) Unlock plug catch by turning the plug
c) Dismount the switch insert

Mounting

a) Mount the switch insert
b) Plug in the plug
c) Mount the support plate

9.16.8 Door Lock

S6 on the right side of the I/O unit (☞ page 9 - 72)

Dismounting

a) Dismount the two cover plates
b) Dismount the door lock
c) Disconnect the door lock (note down the terminal connection)

Mounting

a) Connect the door lock (observe correct terminal connection)
b) Mount the door lock
c) Mount the two cover plates
d) Check the function

9.16.9 Lightbarrier for Problem Box

inside the terminal box, next to the problem box (☞ page 9 - 72)

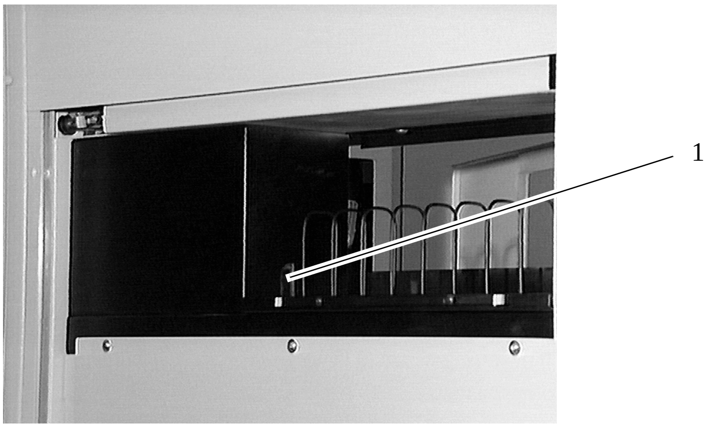


Fig. 9-44: I/O Unit/B Problem Box Seen from Inside

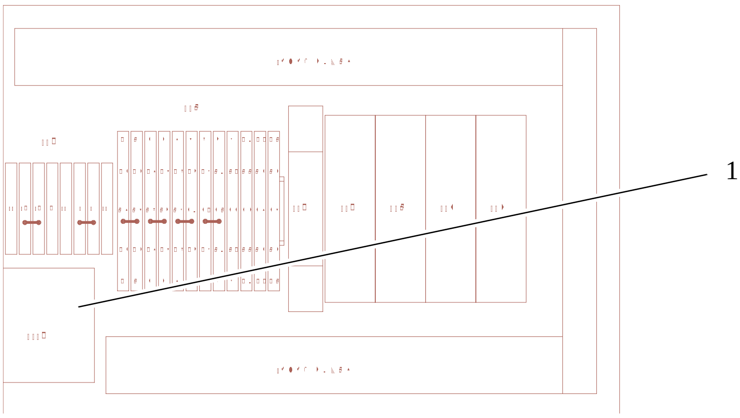


Fig. 9-45: I/O Unit/B Terminal Box

Dismounting

a) Open the I/O door
b) Open the terminal box
c) Unplug the lightbarrier
d) Dismount the support bracket of the lightbarrier
e) Separate the lightbarrier from the support bracket

Mounting

reverse sequence

9.17 Quadro Tower

9.17.1 Connecting Panel

pin configuration (☞ electric diagram)

9.17.2 Main and Auxiliary Tower Drive-Motors

behind the cover doors of the Quadro tower

- left: main tower drive-motor
- right: auxiliary tower drive-motor

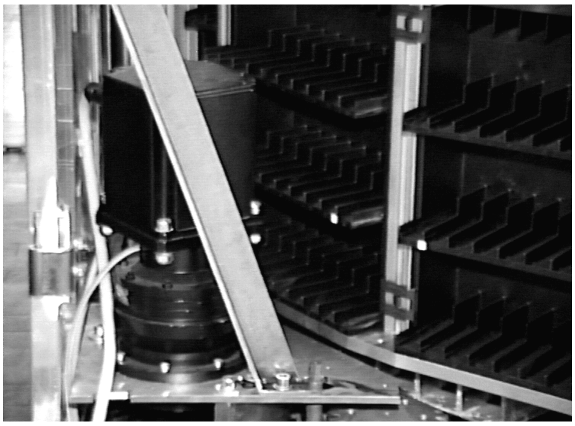


Fig. 9-46: Main Tower Drive-Motor

Fig. 9-47: Auxiliary Tower Drive-Motor

Dismounting

a) Open the cover door
b) Pull the motor plugs (1)
c) Loosen the motor screws (3)
d) Dismount the motor (2)

Mounting

a) Carefully insert the motor

Information

Slowly turn the motor until the spline shaft settles.

b) Insert motor screws and washers
c) Push earthwire (4) under a washer
d) Tighten motor screws crosswise with 45 Nm
e) Connect motor plugs
f) Close the cover door

9.17.3 Main and Auxiliary Tower Gears

behind the cover doors of the Quadro towers

- left: main tower gears
- right: auxiliary tower gears

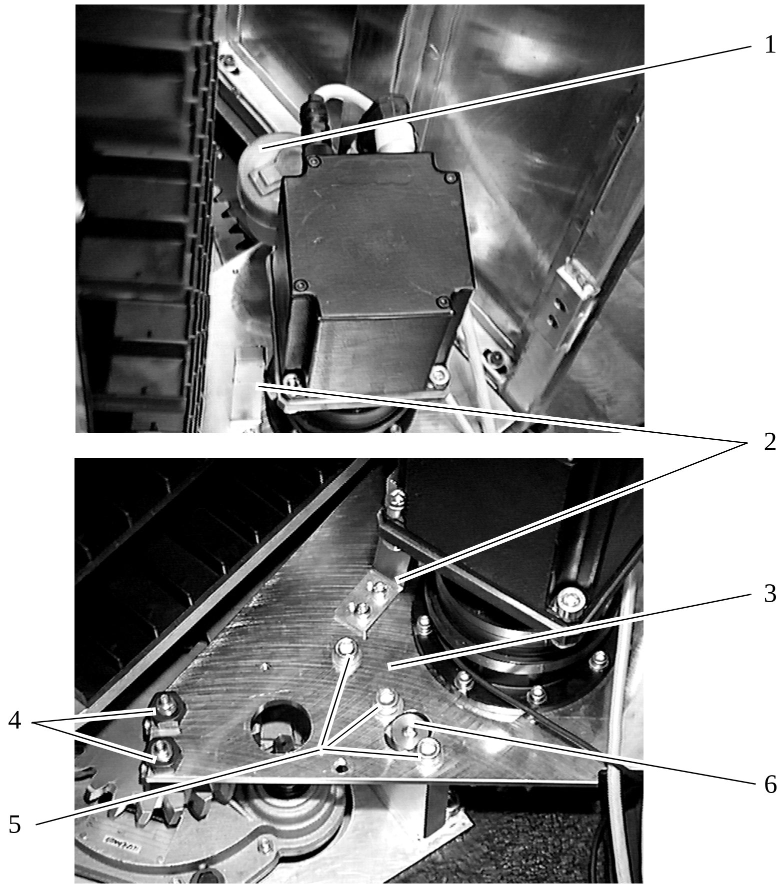


Fig. 9-48: Auxiliary Tower Drive-Unit

Preparation

a) Position Quadro tower to align the cam with the reference switch (☞ page 9 - 85)

Dismounting

a) Dismount the motor (☞ page 9 - 79)
b) Dismount the grease nipple (4)
c) Unscrew the lubricating cartridge (1)
d) Dismount the connection of the lubricating cartridge
e) Measure and note down the distance of reference switch (2) and the cam
f) Only on the auxiliary tower: dismount the reference switch and the bracket (2)
g) Dismount the base plate (3)
   - loosen and remove the fastening screws (5)
h) Dismount the drive gear from the drive shaft
i) Dismount the gears from the base plateMounting

Mounting

a) Mount the gears to the base plate
   - tightening torque 10 Nm
b) Mount the drive gear to the drive shaft
c) Mount the base plate (3)
d) Lightly tighten the screws (5)
e) Adjust the play of the tooth profile with the eccenter (6)

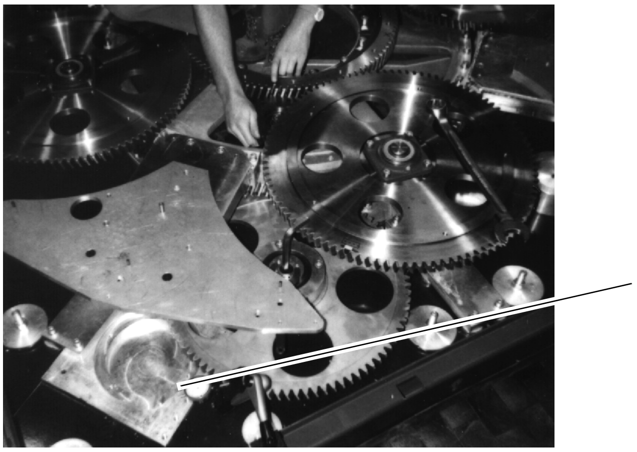


Fig. 9-49: Play of the Tooth Profile on the Main Tower

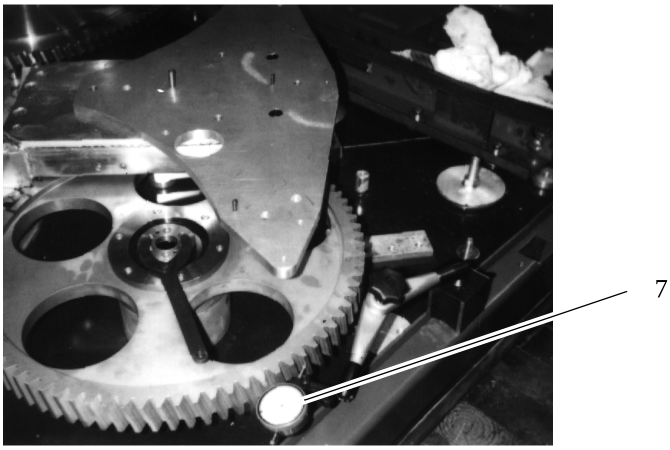


Fig. 9-50: Play of Tooth Profile on Auxiliary Tower

- adjust the base plate until no play can be detected anymore
- apply a dial gauge (resolution 0.01 mm) to the frame of the Quadro tower
- apply the caliper of the dial gauge (7) to one tooth on the drive gear
- adjust the play of the tooth profile to 0.05 mm

f) Tighten the fastening screws (5) with 20 Nm

g) Check the play of the tooth profile, readjust if necessary

h) Only on the auxiliary tower: mount the reference switch and the bracket (2)
- adjust the distance to the cam

i) Mount
- the connection of the lubricating cartridge
- the lubricating catridge
- the grease nipple

j) Mount the motor (☞ page 9 - 79)

k) Teach the Quadro tower with open “Trace“ window (☞ page 9 - 17)

9.17.4 Main Tower Reference Switch

center of the Quadro tower below the lower cover plate

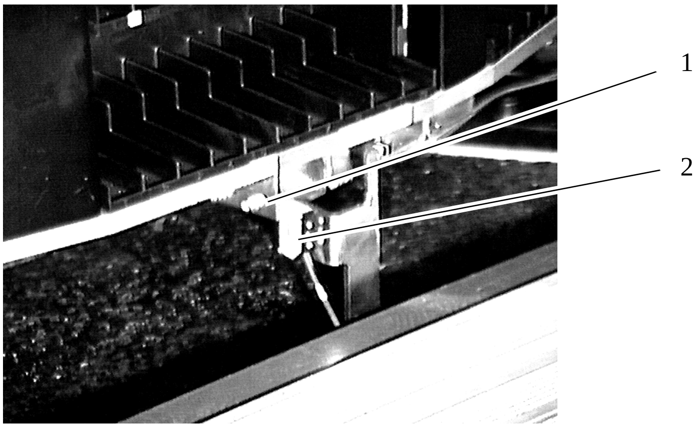


Fig. 9-51: Main Tower Reference Switch

Preparation

a) Position Quadro tower to align the cam (1) with the reference switch (2)

Dismounting

a) Measure and note down the distances
   - distance to the cam (1): 2 mm
   - position relative to the cam

b) Dismount and disconnect the reference switch (2)

Mounting

a) Connect and mount the reference switch

b) Adjust the reference switch
   - distance to the cam: 2 mm
   - position relative to the cam

c) Check the function

d) Teach the Quadro tower with the “Trace“ window open (☞ page 9 - 17)

e) If the position of the reference switch has changed by more than 5 mm, reteach the Quadro tower

9.17.5 Auxiliary Tower Reference Switch

behind the right cover door of the Quadro tower next to the motor

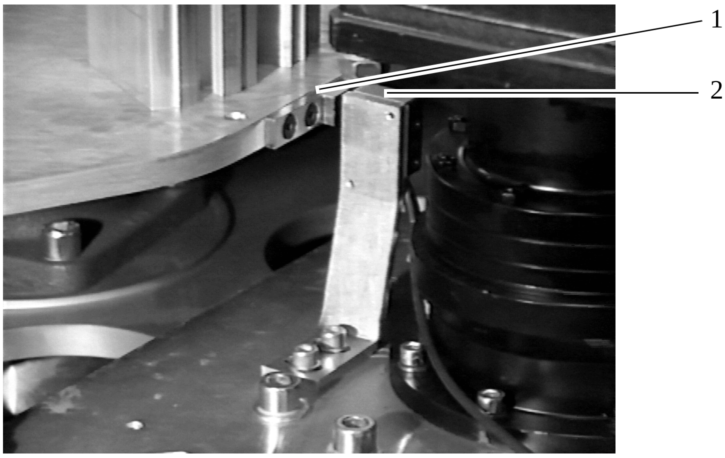


Fig. 9-52: Auxiliary Tower Reference Switch

Preparation

a) Position Quadro tower to align the cam (1) with the reference switch (2)

Dismounting

a) Measure and note down the distances
   - distance to the cam (1): 2 mm
   - position relative to the cam

b) Dismount and disconnect the reference switch (2)

Mounting

a) Connect and mount the reference switch

b) Adjust the reference switch
   - distance to the cam: 2 mm
   - position relative to the cam

c) Check the function

d) Teach the Quadro tower with open “Trace“ window (☞ page 9 - 17)

9.17.6 Storage Box

inside the storage tower

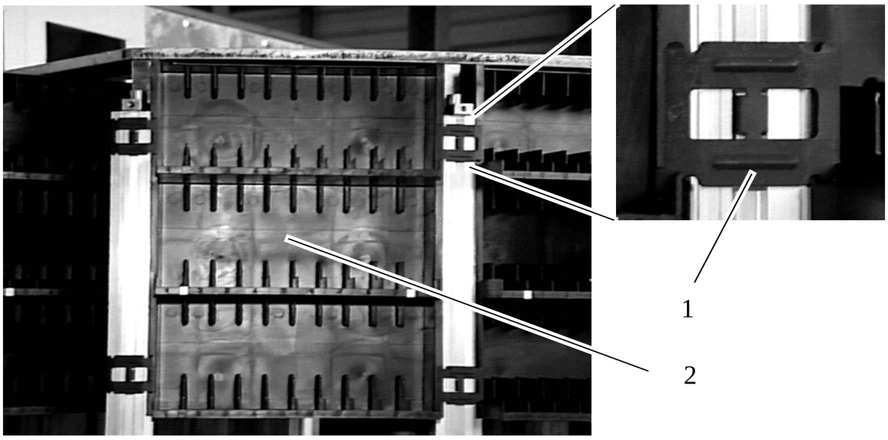


Fig. 9-53: Storage Box

Dismounting

a) Dismount the cover plates

Information

The cover plates are screwed to the base plate from underneath.

b) Remove the clamping plates (1)

ATTENTION!

Remember the sequence of the storage boxes.
All media must be replaced to the same positions!

c) Remove the storage boxes (2) from the top

Mounting

ATTENTION!

Do not mix up

- **the positions of the media**
- **the storage boxes (with or without teach label)**

a) Put the media in the new storage boxes

b) Put in the new storage box

ATTENTION!

Pay attention to the order of the storage boxes.

a) Put in the other storage boxes

b) Mount the clamping plates

c) Mount the cover plates

d) Open a `Trace` window and teach the tower segment (☞ page 9 - 17)

10 Repairs of the Electrical Installation

10.1 For Your Safety

According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 repair work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.

WARNING!

During all work observe the safety rules in chapter 3 “For Your Safety” (☞ page 3 - 1).

10.2 Preparation

WARNING!

All repair work must be carried out only when the system is switched off and voltageless.

The main switch and the push-button <SYSTEM LIGHTING> are live even when the main switch is switched off. Before working on these components pull the plug XB1 on the bottom left inside the operating cabinet (☞ page 10 - 12).

Before working on other components shut off power with the main switch and secure it with a padlock.

Guard the key in a safe place or keep it with you.

Shut the AML/2 system off before (☞ Operator Guide)

Exceptions:

- **functional checks**
- **measuring and transmitting paramaters**

a) Apply the warning sign (☞ page 3 - 14)

10.3 Putting Back into Service

WARNING!

Before starting the AML/2 system be sure the start will not

- **endanger people,**
- **damage property.**

a) Start the AML/2 system (☞ Operator Guide)

10.4 Overview of Control Cabinets

The AML/2 system has three control cabinets. These contain functional units:

operating cabinet

- device panel
- AMU computer
- operating panel
- terminal box (in the double bottom)

robot cabinet

- drive amplifier for the robot
- rho control system for the robot
- power module with fuses
- robot cabinet connecting panel

Quadro tower cabinet

- drive amplifiers for max three Quadro towers
- rho control system for max three Quadro towers
- power module with fuses
- Quadro tower cabinet connecting panel

10.5 Operating Cabinet

10.5.1 Overview

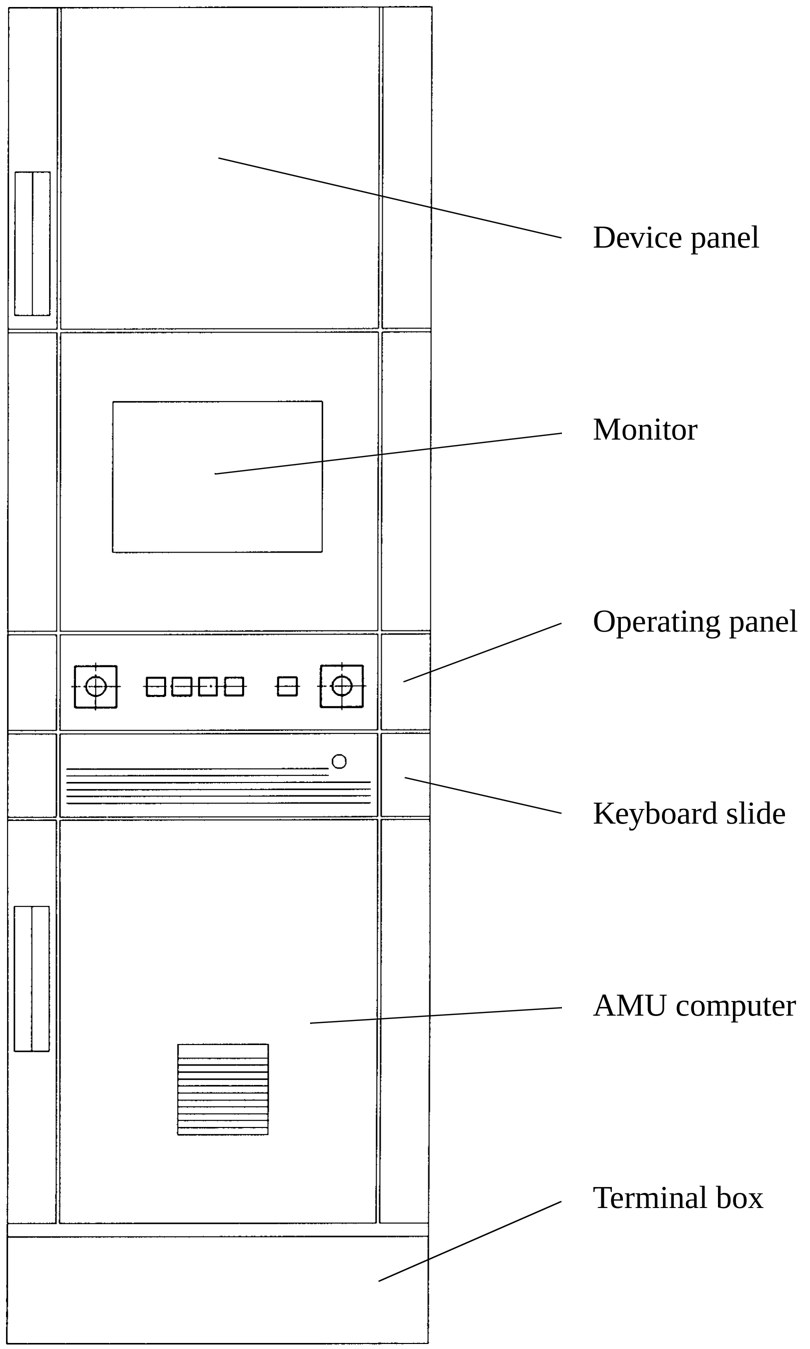


Fig. 10-1: Operating Cabinet Overview

10.5.2 Device Panel for Power Supply

on top inside the operating cabinet

Device panel 1 (front level)

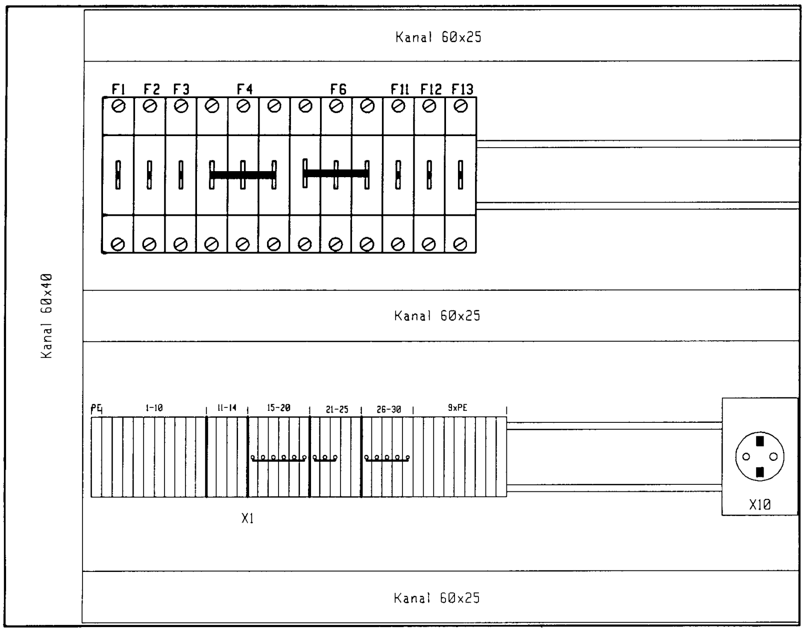


Fig. 10-2: Device Panel 1

- F1: service socket
- F2: system lighting I
- F3: system lighting II
- F4: fuse for main power supply circuit robot I
- F6: fuse for main power supply circuit tower I
- F11: sockets
- F12: fuse for power supply unit
- F13: fuse for 24 V supply
- X1: terminals
- X10: service socket

Device panel 2 (center level)

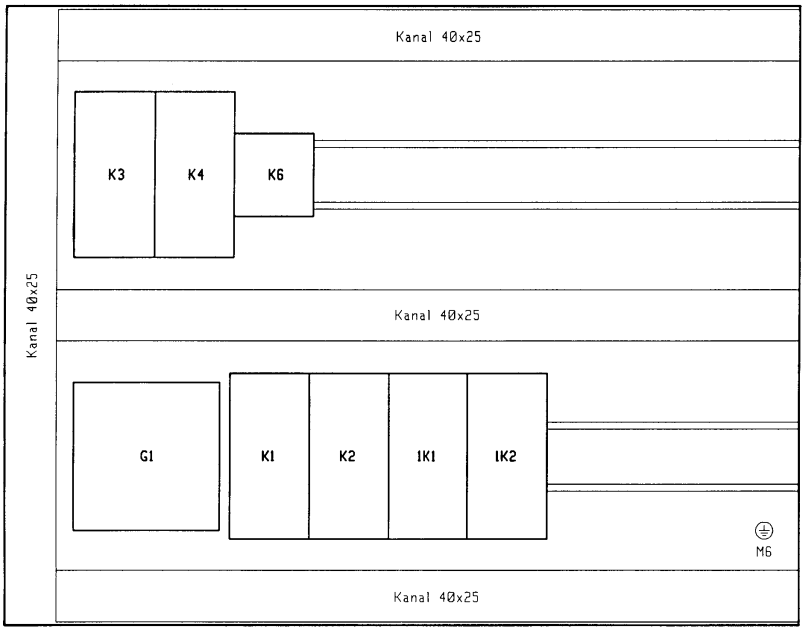


Fig. 10-3: Device Panel 2

- K3: control on
- K4: control off
- K6: system lighting
- G1: power supply for EMERGENCY STOP circuits (contactors); fuse 5 A T
- K1: EMERGENCY STOP entire system
- K2: EMERGENCY STOP entire system
- 1K1: automatic robot 1
- 1K2: automatic robot 1

Connecting panel for power supply (rear level)

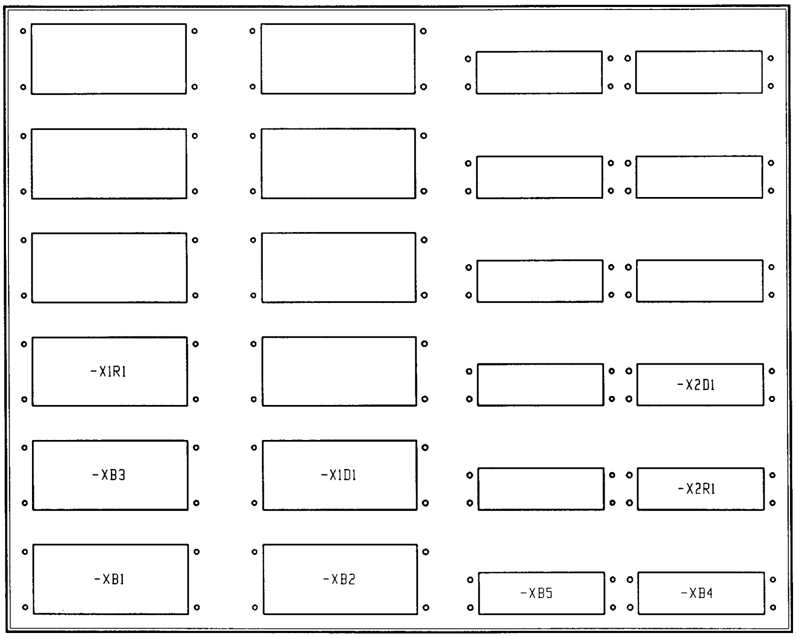


Fig. 10-4: Connecting Panel for Power Supply

10.5.3 Main Switch

on the AML/2 operating panel (1)

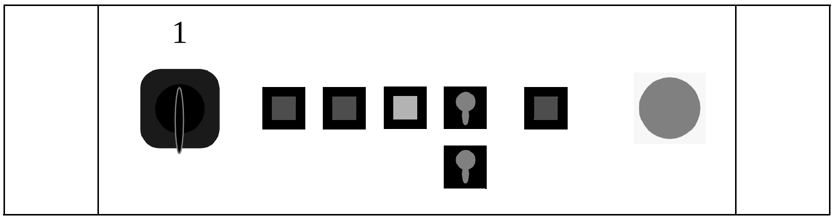


Fig. 10-5: AML/2 Operating Panel

Dismounting

a) Disconnect the main switch from power: connecting panel for power supply XB1 (☞ page 10 - 6)
b) Secure the disconnected connection
c) Open the operating panel: push the lock knob up

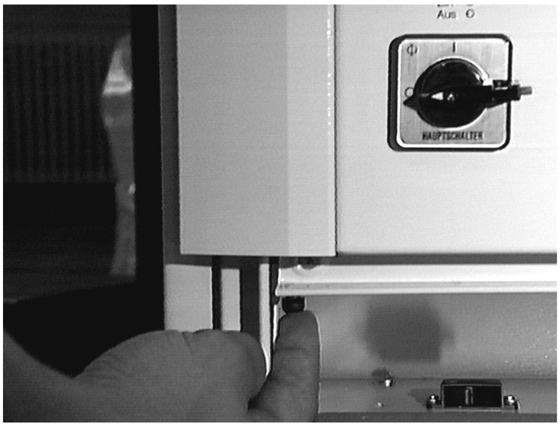


Fig. 10-6: Lock Knob on the Operating Panel

d) Disconnect the contacts by turning (rear)
e) Loosen the screw in the center of the switch (front)
f) Remove the knob and the cover plate
g) Loosen the nut
h) Pull off the switch to the rear

Mounting

reverse sequence

10.5.4 EMERGENCY STOP Button

on the AML/2 operating panel (1)

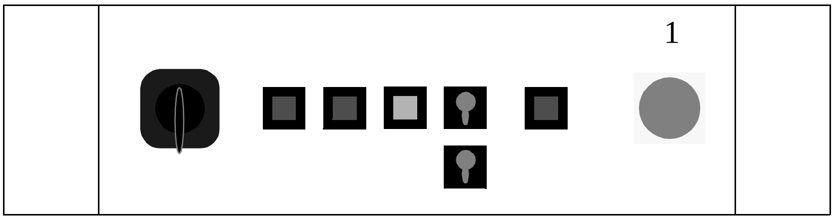


Fig. 10-7: AML/2 Operating Panel

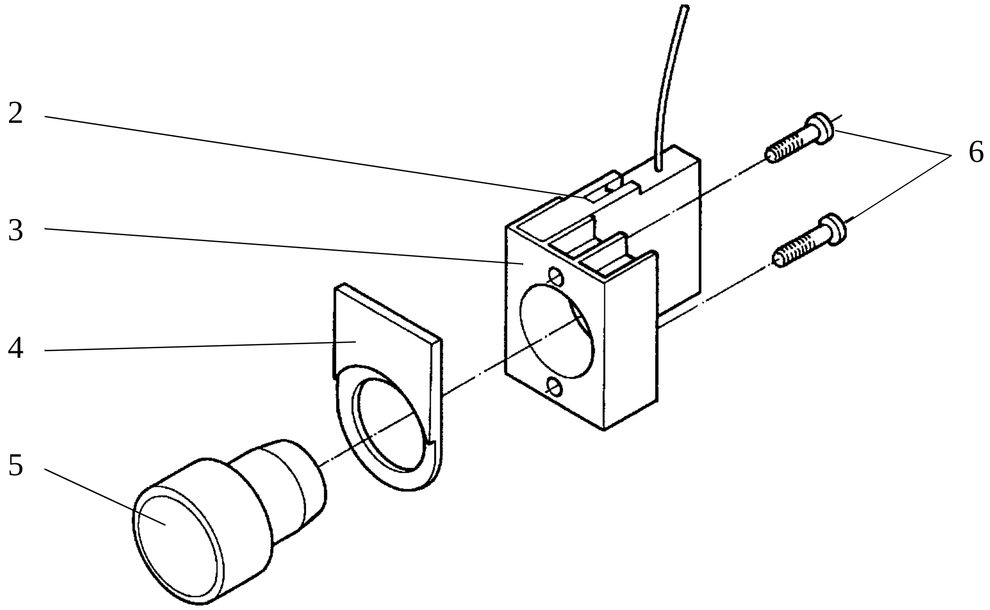


Fig. 10-8: Schematic Structure of <EMERGENCY STOP> Button

Dismounting

a) Open the operating panel: push the lock knob up

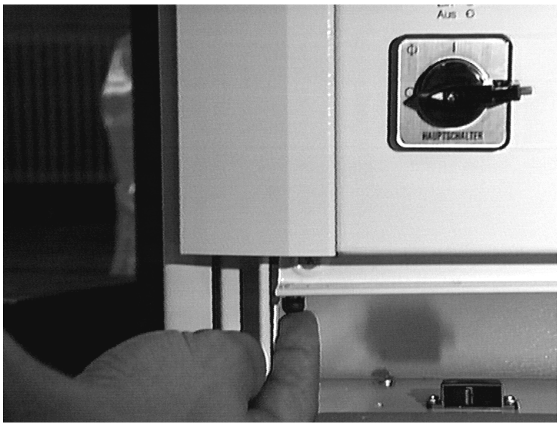


Fig. 10-9: Lock Knob on the Operating Panel

b) Disconnect the wires

c) Actuate the catch (2) with a screwdriver to separate the contact block from the support (3)

d) Loosen the screws (6)

e) Separate the attachment (5) from the support by turning it counterclockwise

f) Remove all parts

Mounting

a) Attach the label carrier (4) to the attachment (5)

b) Insert the attachment through the bore in the operating panel

c) Push the support (3) onto the attachment from the rear

d) Lock the attachment to the support by turning it clockwise

e) Handtighten the screws (6)

f) Align label carrier and support

g) Tighten the screws

h) Mount the contact block

i) Connect the wires

j) Close the operating panel

10.5.5 Operating Mode Switch and Push-Button

on the AML/2 operating panel (1)

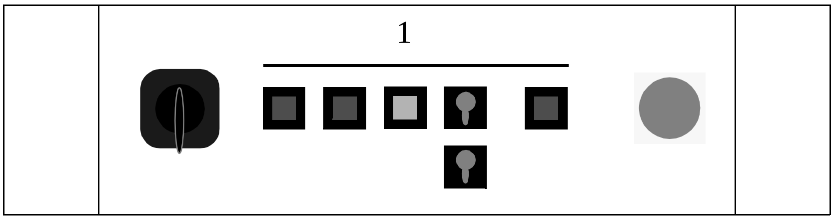


Fig. 10-10: AML/2 Operating Panel (only on twin systems with 2 operating mode selector switches)

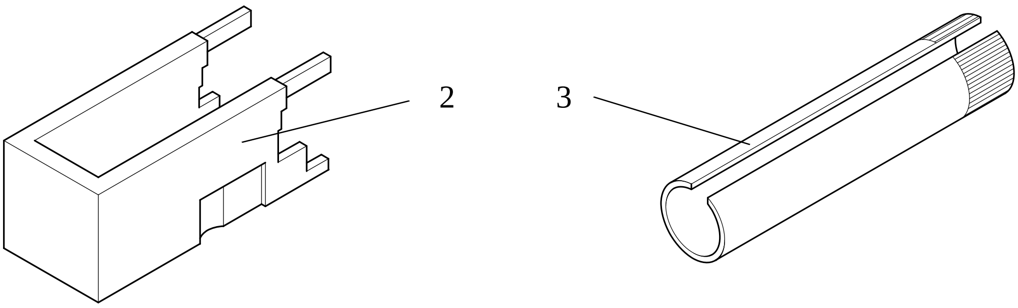


Fig. 10-11: Dismounting Tool (2) and Assembly Key (3)

Dismounting

a) Open the operating panel: push the lock knob up

Fig. 10-12: Lock Knob on the Operating Panel

b) Disconnect the contacts

c) Pull off the contact block with the dismounting tool (2)

d) Loosen the locking ring with the assembly key (3)
e) Remove the switch inserts

Mounting

reverse sequence

10.5.6 Terminal Box

below the operating cabinet in the double bottom

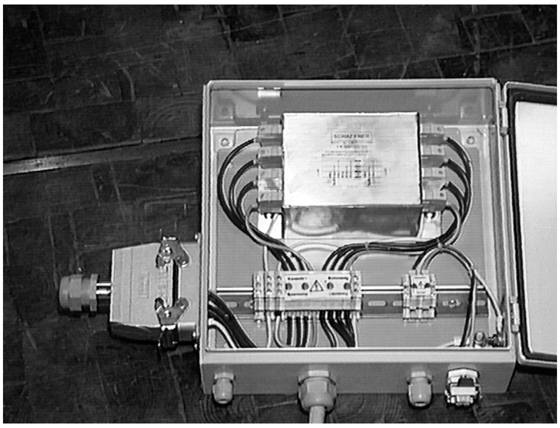


Fig. 10-13: Terminal Box in the Operating Cabinet

Information

The terminal box is “hidden” in the double bottom below the operating cabinet. To access it you must open the double bottom.

10.6 Robot Cabinet

10.6.1 Overview

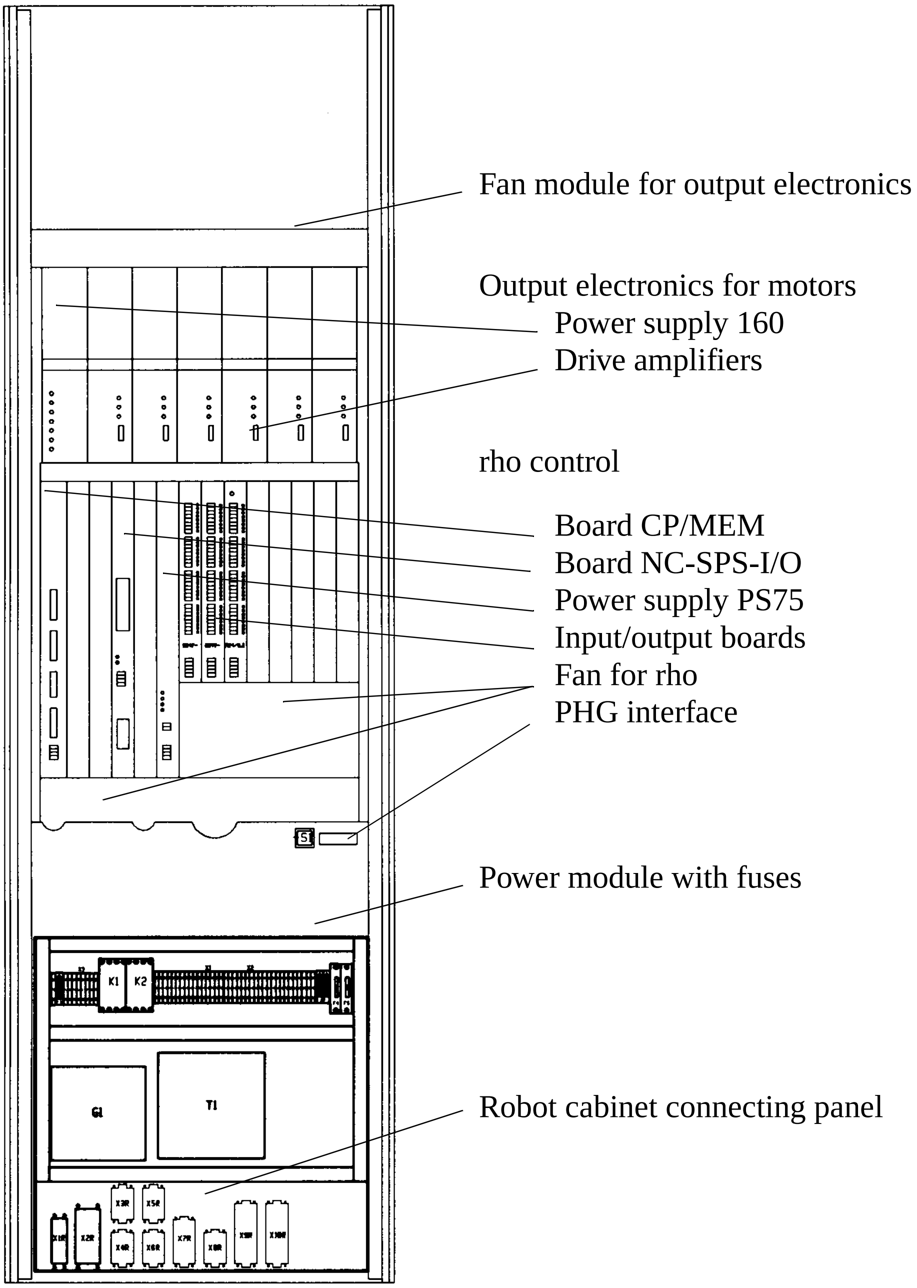


Fig. 10-14: Overview of Robot Cabinet

10.6.2 19’’ Rack for Drive Amplifiers

on top inside the robot cabinet (☞ page 10 - 12)

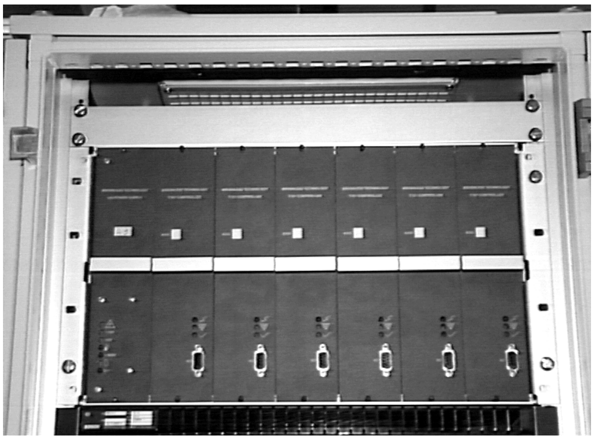


Fig. 10-15: 19’’ Rack Drive Amplifiers

Dismounting

a) Switch off the main switch

b) Remove all boards
   - mark the boards and note down their positions
   - loosen the fastening screws of the boards
   - unplug the boards

c) Loosen the fastening screws of the fan module

d) Pull out the fan module and put it aside

e) Remove the side wall of the control cabinet

f) Unplug all cables on the 19’’ rack

g) Loosen the fastening screws of the 19’’ rack

h) Dismount the 19’’ rack

Mounting

reverse sequence

10.6.3 Power Supply 160 for the Drive Amplifiers

on top inside the robot cabinet (☞ page 10 - 12)

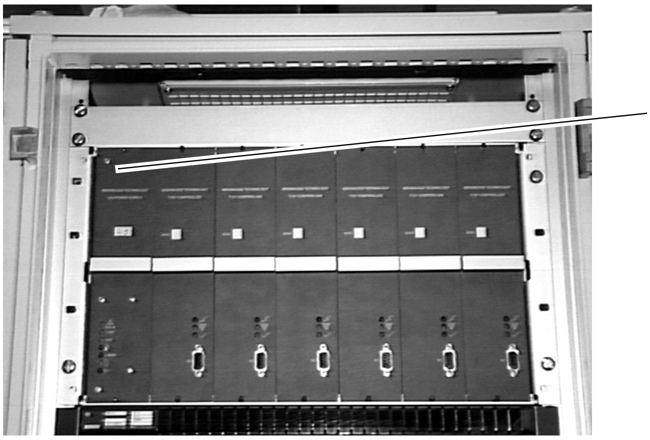


Fig. 10-16: Robot Amplifier Front

Dismounting

a) Switch off the main switch
b) Disconnect the connectors
c) Loosen the fastening screws
d) Unplug the board

Mounting

Information

Note the position of the load resistor plug. The internal load resistance (below the plug) is not sufficient for the motors used.

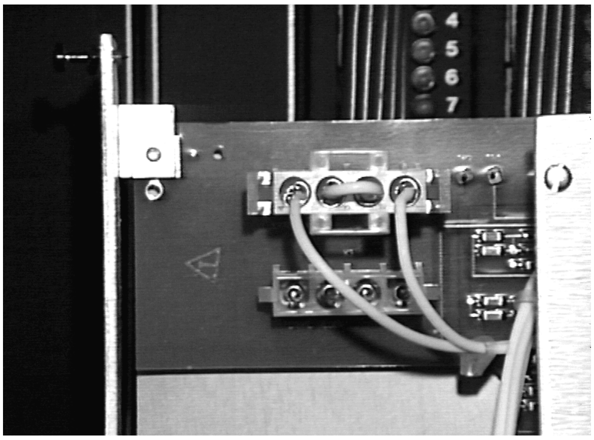


Fig. 10-17: Power Supply 160: Load Resistor Plug

Plug the plug in at the top position (external).

a) Configurate the board
   - plug the load resistor plug into “Extended Regeneration”
   - plug the jumper JW1 into “E” (3-phase failure monitoring activated)

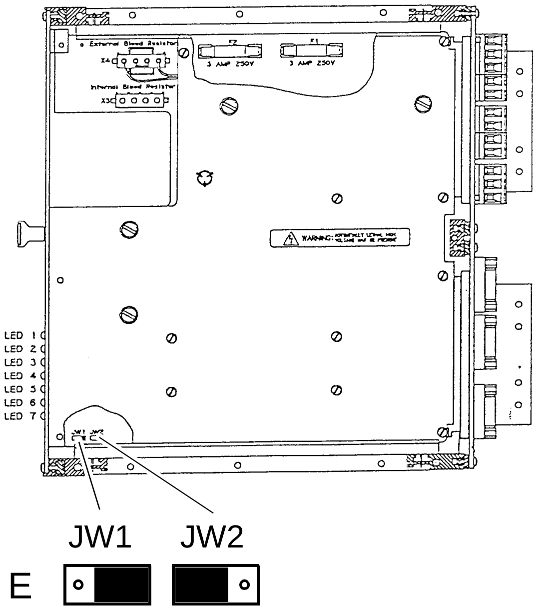


Fig. 10-18: Power Supply for Amplifiers: Jumper

b) Plug in the board

c) Tighten the fastening screws

10.6.4 Position of Drive Amplifiers

on top, inside the robot cabinet (☞ page 10 - 12)

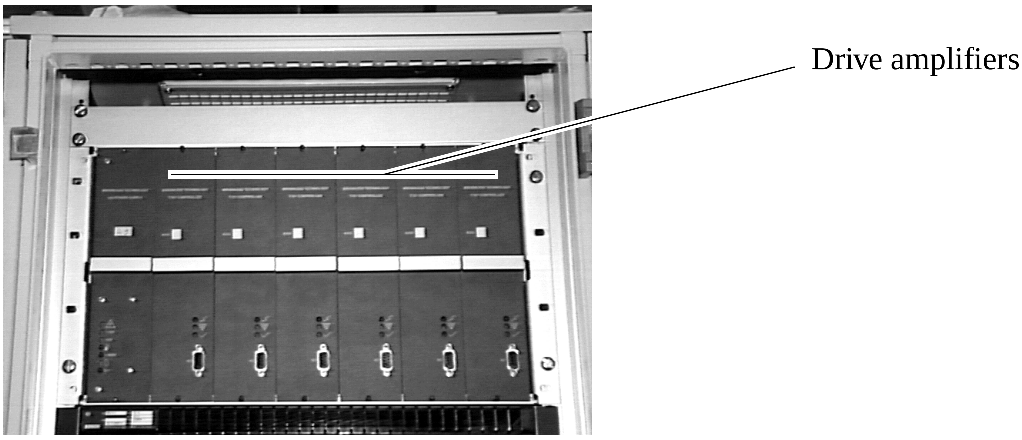


Fig. 10-19: Drive Amplifiers Front

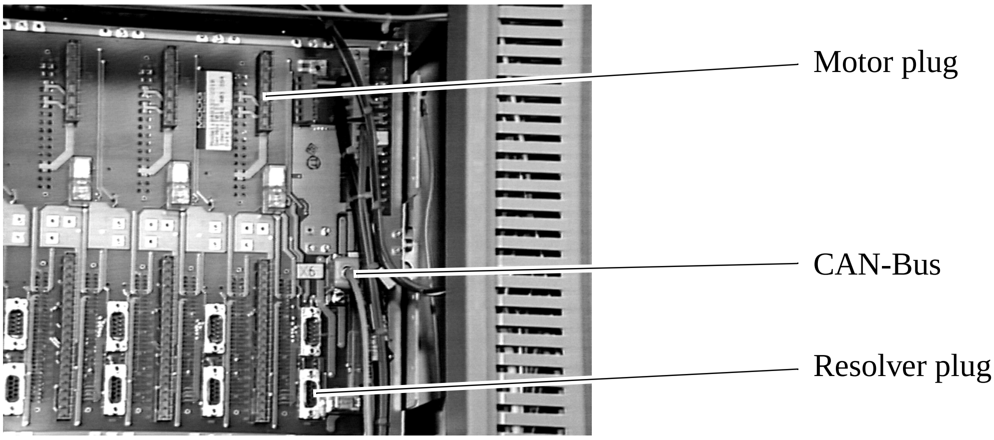


Fig. 10-20: Drive Amplifier Rear

Check the actual HPO parameter

Connect AMU to the board

a) Switch on the main switch

b) Connect the installation cable to the AMU interface COM1 or COM2
(if necessary disconnect another cable)

c) Connect the installation cable to the drive amplifier socket X6

d) Open AMU OS/2 window

e) Change to directory “C:\MOOG” (`cd moog`)

f) Call up the communication program “BOSCHTRM” (`boschtrm`)

g) Enter <C> for „Configurate“

h) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Interface type	IQ 140/RHO3	<2>
- Help file	IQ 140/RHO3	<2>

i) Press <ENTER> until the following message appears:

Enter first letter of a command or H for help >	input: <SHIFT>+<*>
Privileged Mode (Y/N) >>	input: <Y>
Password ? OK!	input: <7>, <8>, <2>, <3>
Enter first letter of a command or H for help >	input: <o>, <o> (letter)
Home Position Offset [Deg] 12 -more-	input: <ENTER>
Offset [Deg] 0 - 360 ?	compare value with the parameter in the software backup (write actual value in the software backup) <ENTER>

Dismounting

a) Switch off the main switch

b) Unplug the connectors

c) Loosen the fastening screws

d) Unplug the board

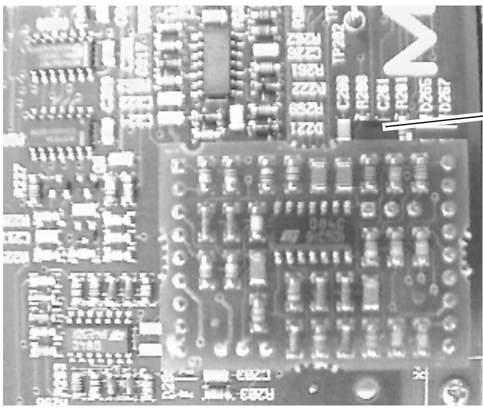
10.6.5 Amplifier Series T 161 - 6xx

Mounting

Axis	Motor	Drive Amplifier			Jumper Position MCO
		Type	Bosch	Grau	
1	D 313 L15	T 161 612	3 842 404 498	15A 200 036	L2-L3
2	D 313 L05	T 161 611	3 842 404 497	15A 200 035	L1-L2
3					
4					
5	D 315 L10	T 161 613	3 842 404 499	15A 200 037	L2-L3
6	D 314 L20				L1-L2
Main Tower	D 315 L10	T 161 613	3 842 404 499	15A 200 037	L2-L3
Aux. Tower	D 315 L10				

Information

Observe the position of the Jumper of the MCO module.



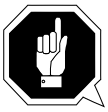
1 Jumper position (☞ table)

Fig. 10-21: Drive Amplifier: MCO-Module

a) Set the jumper (1) of MCO module (☞ table)

b) Check the software version on the board (number on EPROM’s)

EPROM	Version of Robot Software	Version of Robot and Tower Software
A5	B80858-001	B80858-002
A6	B80859-001	B80859-002



ATTENTION!

If the drive amplifier is still unparamaterized, load the parameters before starting operation.

Operation is possible with parameters only.

Parameterizing the drive amplifiers ::

`Enter first letter of a command or H for help >`	input: <CTRL> + <T>
`File Transfer function.` `'D' to down load from a disk file to the RMC.` `'U' to up-load data from the RMC to a disk file.` `'Q' to return to emulator`	
`Please enter option:`	input: <D>
`Please enter the source filename with no extension followed by return.`	
`Source file:`	input: filename, <ENTER> filenames: • BA1G100 or BA1G131 (axis 1) • BA2G100 (axis 2 • BA3G60 (axis 3) • BA4G29 (axis 4) • BA5G8 (axis 5) • BA6G9 (axis 6) • BHT (Main Tower) • BNT (Auxilary Tower)
`Writing parameters to EEPROM.` `Please wait` `Writing new values in EEPROM.` `Ctrl - X to restart with new parameters.` `>`	
`Enter first letter of a command or H for help >`	input: <CTRL> + <X>
`Defaults Set from EEPROM`	

`Moog T161-21X` `6/4/92` `EEPROM ID` `- more -`	input: <ENTER>
`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT>+<*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!` `-more-`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <o>, <o> (letter)
`Home Position` `Offset [Deg]` `12` `-more-`	input: <ENTER>
`Offset [Deg]` `0 - 360` `?`	Input HPO values from software backup, <ENTER>
`Enter first` `letter of a` `command or H` `for help >`	input: <C> (save)
`Sure (Y/N)?`	input: <Y>
`EEPROM ID ?`	input: number of the axis, <ENTER>
`Wait-`	
`Saving Defaults` `Gaints in EEPROM`	

```
Enter first
letter of a
command or H
for help >
```

input: <ESC> ,<Y>

c) Disconnect the installation cable (if necessary reconnect other cable)
   - AMU interface
   - drive amplifier socket X6

d) Quit the OS/2 window

e) Reset the control unit: press the reset button on the power supply PS75

10.6.6 Amplifier Series T161-2xx

Mounting

ATTENTION!

Don’t mix up the types of the drive amplifier and the MCO modules.

<table>
<tr><th rowspan="2">Axis</th><th rowspan="2">Motor</th><th colspan="3">Drive Amplifier</th><th colspan="3">MCO Module</th></tr>
<tr><th>Type</th><th>Bosch</th><th>Grau</th><th>Type</th><th>Bosch</th><th>Grau</th></tr>
<tr><td>1</td><td>D 313
L15</td><td>T 161
212</td><td>3 842
403 198</td><td>15A
200 009</td><td>B 48
518-303</td><td>3 842
403 202</td><td>15 A
200 013</td></tr>
<tr><td>2</td><td>D 313
L05</td><td rowspan="3">T 161
211</td><td rowspan="3">3 842
403 197</td><td rowspan="3">15A
200 008</td><td>B 48
518-301</td><td>3 842
403 201</td><td>15A
200 012</td></tr>
<tr><td>3</td><td rowspan="2">D 312
L05</td><td rowspan="2">B 48
518-201</td><td rowspan="2">3 842
403 200</td><td rowspan="2">15A
200 011</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>D 315
L10</td><td rowspan="2">T 161
213</td><td rowspan="2">3 842
403 199</td><td rowspan="2">15A
200 003</td><td>B 48
518-510</td><td>3 842
403 442</td><td>15 A
200 043</td></tr>
<tr><td>6</td><td>D 314
L20</td><td>B 48
518-412</td><td>3 842
403 205</td><td>15A
200 014</td></tr>
<tr><td>Main
Tower</td><td rowspan="2">D 315
L10</td><td rowspan="2">T 161
213</td><td rowspan="2">3 842
403 199</td><td rowspan="2">15A
200 003</td><td rowspan="2">B 48
518-510</td><td rowspan="2">3 842
403 442</td><td rowspan="2">15 A
200 043</td></tr>
<tr><td>Aux.
Tower</td></tr>
</table>

a) Observe the mounting position of the MCO module

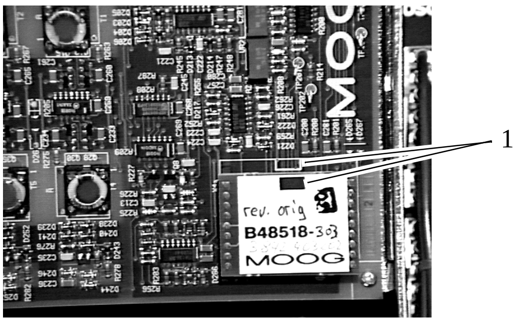


Fig. 10-22: Drive Amplifier: MCO-Module

Information

The marks (1) on the board and on the MCO module must agree.

b) Plug in the MCO module
c) Plug in the board
d) Tighten the fastening screws

ATTENTION!

If the drive amplifier is still unparamaterized, load the parameters before starting operation.

Operation is possible with parameters only.

e) Connect AMU to the board
f) Switch on the main switch
g) Connect the installation cable to the AMU interface COM1 or COM2 (if necessary disconnect another cable)
h) Connect the installation cable to the drive amplifier socket X6
i) Open AMU OS/2 window
j) Change to directory “C:\MOOG” (cd moog)
k) Call up the communication program “Terminal“ or ”BOSCHTRM“
l) Enter <C> for „Configurate“
m) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Controller Type	T 161 Series	<2>

Parameterizing the drive amplifiers (axes 1-4, axis 6)

Information

Axis 5, main tower and auxilary tower (☞ page 10 - 28).

a) Press <ENTER> and wait until the following message appears:

```
Enter first
letter of a
command or H
for help >
```

input: <SHIFT> + <*>

`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <D>
`Sure   (Y/N) ?`	input: <Y>
`Moog T161-21X` `6/4/92` `EEPROM ID    0` `- more -`	input: <ENTER>
`Drive Disabled` `RHO Sample` `Period [ms]` `?`	input: <2>, <0>, <ENTER>
`Controller: -` `e.g. T161-211` `?T161-21_`	input: (☞ software backup), <ENTER>
`Motor:-` `e.g. D314 .. L10` `      304 - 111A` `      ?_`	input: <D>
`      ?D31_`	input: (☞ software backup)
`      ?D31* .. L_`	input: (☞ software backup), <ENTER>
`T161-21*` `D31* .. L**` `OK (Y/N)  ?_`	input: <Y>
`Wait ...`	
`CAN Position Loop`	
`Defaults Set`	

`Enter first` `letter of a` `command or H` `for help >`	input: <CTRL> + <T>
`File Transfer function.` `'D' to down load from a disk file to the RMC.` `'U' to up-load data from the RMC to a disk file.` `'Q' to return to emulator`	
`Please enter option:`	input: <D>
`Please enter the source filename with` `no extension followed by return.`	
`Source file:`	input: filename, <ENTER> filenames: • A1G100 or A1G131 • A2G100 • A3G60 • A4G29 • A6G9
`Writing parameters to EEPROM.` `Please wait` `Writing new values in EEPROM.` `Ctrl - X to restart with new parameters.` `>`	
`Enter first` `letter of a` `command or H` `for help >`	input: <CTRL> + <X>
`Defaults Set` `from EEPROM`	
`Moog T161-21X` `6/4/92` `EEPROM ID` `- more -`	input: <ENTER>

`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT>+<*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!` `-more-`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <o>, <o> (letter)
`Home Position` `Offset [Deg]` `12` `-more-`	input: <ENTER>
`Offset [Deg]` `0 - 360` `?`	Input HPO values from software backup, <ENTER>
`Enter first` `letter of a` `command or H` `for help >`	input: <C> (save)
`Sure (Y/N)?`	input: <Y>
`EEPROM ID ?`	input: number of the axis, <ENTER>
`Wait-`	
`Saving Defaults` `Gaints in EEPROM`	
`Enter first` `letter of a` `command or H` `for help >`	input: <ESC> ,<Y>

b) Disconnect the installation cable (if necessary reconnect other cable)
   - AMU interface
   - drive amplifier socket X6

c) Quit the OS/2 window

d) Reset the control unit: press the reset button on the power supply PS75

Parameterizing the drive amplifiers (axis 5, main tower and auxilary tower)

a) Press <ENTER> and wait until the following message appears:

`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT> + <*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <D>
`Sure   (Y/N) ?`	input: <Y>
`Moog T161-21X` `6/4/92` `EEPROM ID    0` `- more -`	input: <ENTER>
`Drive Disabled` `RHO Sample` `Period [ms]` `?`	input: <2>, <0>, <ENTER>
`Controller: -` `e.g. T161-211` `?T161-21_`	input: <3>, <ENTER>

Motor:- e.g. D314 .. L10 304 - 111A ?_	input: <D>
?D31_	input: <5>
?D315 .. L_	input: <1>, <0>, <ENTER>
T161-213 D315 .. L10 OK (Y/N) ?_	input: <Y>
Non Standard Motor Enter Parameters (Y/N) ?	input: <Y>
Kt [Nm/A] ?	input: <0>, <.>, <5>, <9>, <ENTER>
Number Motor Poles ?	input: <1>, <2>, <ENTER>
Motor Current Limit [A] ?	input: <2>, <5>, <ENTER>
Max Speed [RPM] ?	input: <5>, <8>, <0>, <0>, <ENTER>
Wait ...	
CAN Position Loop	
Defaults Set	
Enter first letter of a command or H for help >	input: <CTRL> + <T>
File Transfer function. 'D' to down load from a disk file to the RMC. 'U' to up-load data from the RMC to a disk file. 'Q' to return to emulator	
Please enter option:	input: <D>

`Please enter the source filename with` `no extension followed by return.`	
`Source file:`	input: filename, <ENTER> filenames Quadro tower: • HTURM • NTURM filename axis 5: • A5G8
`Writing parameters to EEPROM.` `Please wait` `Writing new values in EEPROM.` `Ctrl - X to restart with new parameters.` `>`	
`Enter first` `letter of a` `command or H` `for help >`	input: <CTRL> + <X>
`Defaults Set` `from EEPROM`	
`Moog T161-21X` `6/4/92` `EEPROM ID` `- more -`	input: <ENTER>
`Enter first` `letter of a` `command or H` `for help >`	input: <SHIFT>+<*>
`Privileged` `Mode` `(Y/N) >>`	input: <Y>
`Password ?` `OK!` `-more-`	input: <7>, <8>, <2>, <3>
`Enter first` `letter of a` `command or H` `for help >`	input: <o>, <o> (letter)

`Home Position` `Offset [Deg]` `12` `-more-`	input: <ENTER>
`Offset [Deg]` `0 - 360` `?`	Input HPO values from software backup, <ENTER>
`Enter first` `letter of a` `command or H` `for help >`	input: <C> (save)
`Sure (Y/N)?`	input: <Y>
`EEPROM ID ?`	input: number of the axis, <ENTER>
`Wait-`	
`Saving Defaults` `Gaints in EEPROM`	
`Enter first` `letter of a` `command or H` `for help >`	input: <ESC> ,<Y>

a) Disconnect the installation cable (if necessary reconnect other cable)
   - AMU interface
   - drive amplifier socket X6

b) Quit the OS/2 window

c) Reset the control unit: press the reset button on the power supply PS75

10.6.7 Board CP/MEM

middle, inside the robot cabinet (☞ page 10 - 12)

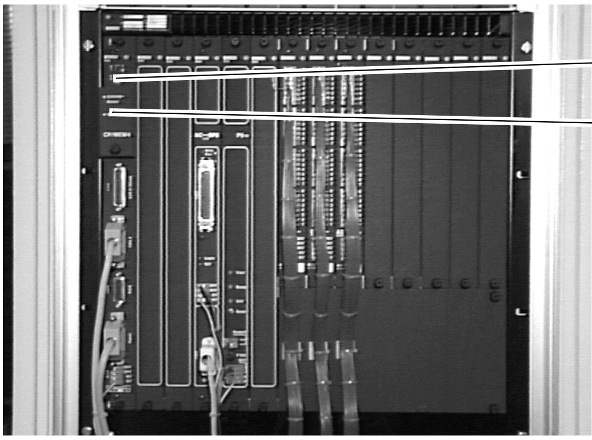


Fig. 10-23: rho Control Unit

Dismounting the board

a) Switch off the main switch
b) Unplug the connectors
c) Loosen the fastening screws
d) Push the retaining levers evenly outward to release the board
e) Pull out the board

Mounting the board

a) Plug in the board
b) Press the board hard
c) Tighten the fastening screws
d) Plug the connectors
e) Connect the PHG
f) Switch on the main switch
g) Let the control system run up

Check the operating system version

PHG-Mode 7.11:

a) Press MODE , 7 , ⇨ one after the other (diagnosis)

b) Press MODE , 1 , 1 , ⇨ one after the other (versions)

- the version number must be “TO02F” or higher

c) Quit menu by pressing ← , ←

Replace the operating system (EPROM-board) if necessary

(in currentless condition)

a) Remove the cover (EPROM module, battery)
b) Pull out the old EPROM board and insert the new EPROM board
c) Mount the cover

Adjust the coupling interface

PHG-Mode 9.1.1

a) Press MODE , 9 , ⇨ one after the other (device/file I/O)

b) Press MODE , 1 , ⇨ one after the other (interfaces)

c) Press MODE , 1 , ⇨ one after the other (coupling)

(☞ “rho error 102 ‘falsche MK-Bestueck‘” from page 11 - 15)

- interface	0
- baudrate	9600
- stop-bit number	1
- parity	2 (even)
- word length	8
- soft-hardware hsk	0
- timeout read	-1
- timeout write	5000

Parameterize the board

a) Call up AMU **Rho File Manager**
b) List the files contained in the rho control unit
c) Delete all files in the rho control unit
d) Insert the backup disk into the AMU drive
e) Change to the directory “A:\ROBOT\SOURCES” (cd robot\sources)
f) Transfer MPRHO3.BIN” files with **Send to Rho** (memory configuration)
g) Start **Restore**
h) Quit the **Rho File Manager**
i) Reset the control unit: press the reset button on the power supply PS75
j) Press <CONTROL ON> when the system has run up

10.6.8 Board NC-SPS-I/O (PIC-Board)

middle, inside the robot cabinet (☞ page 10 - 12)

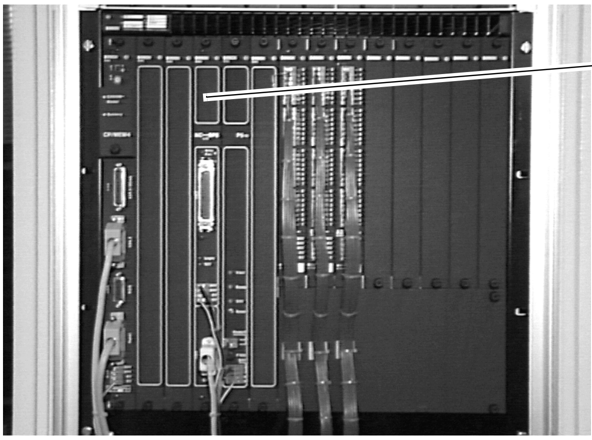


Fig. 10-24: rho Control Unit

Dismounting the board

a) Switch off the main switch
b) Unplug the connectors
c) Loosen the fastening screws
d) Pull out the board

Mounting the board

a) Insert the board
b) Press the board hard
c) Tighten the fastening screws

Parameterize the board

a) Plug the connectors

b) Switch on the main switch

c) Let the control system run up (do not press <CONTROL ON>)

d) Call up the AMU **Rho File Manager**

e) Call up the menu item **Send to rho**

f) Select the partner (robot control system)

g) Insert the backup disk into the AMU drive

h) Change to the directory “A:\ROBOT\SOURCEN” (cd robot\sourcen)

i) Select the file IQ_ROBO.P2X or IQ_TURM.P2X

j) Click on **Select**

k) Click on **Send**

l) Quit the **Rho File Manager**

m) Reset the control unit: press the reset buttton on the power supply PS75

n) Press <CONTROL ON> when the system has run up.
The system is ready to operate

10.6.9 Power Supply PS75 for rho

middle, inside the robot cabinet (☞ page 10 - 12)

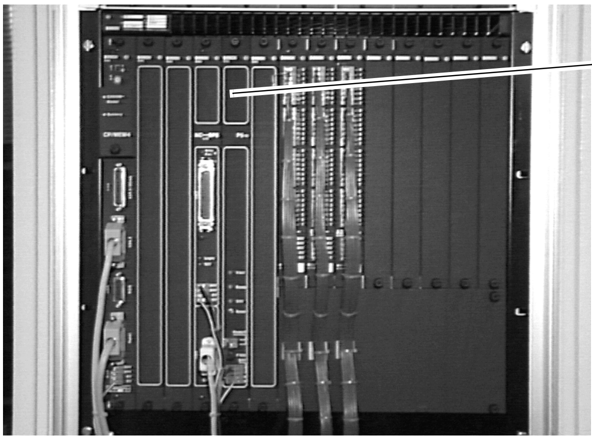


Fig. 10-25: rho Control Unit

Fuse

type: F 10 A

Dismounting the board

a) Switch off the main switch
b) Unplug the connectors
c) Disconnect the 24 V/0 V supply cable
d) Loosen the fastening screws
e) Pull out the board

Mounting the board

a) Insert the board
b) Tighten the fastening screws
c) Plug the connectors
d) Connect the 24 V/0 V supply cable

10.6.10 Input Boards

middle, inside the robot cabinet (☞ page 10 - 12)

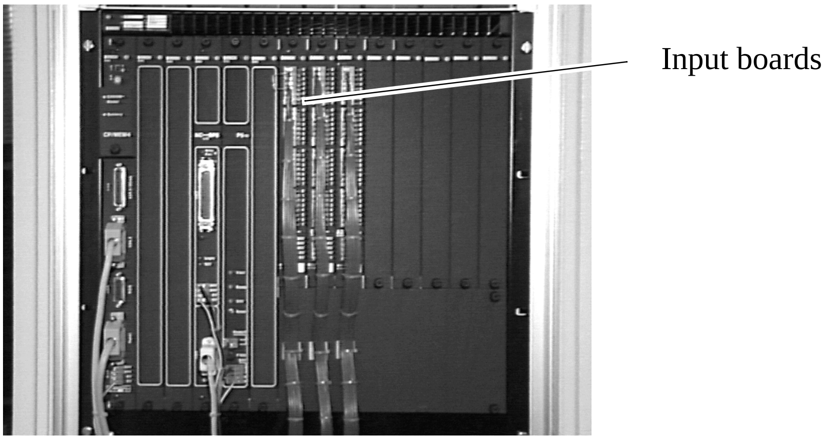


Fig. 10-26: rho Control Unit

Dismounting

a) Switch off the main switch
b) Unplug the connectors
c) Loosen the fastening screws
d) Pull out the board

Mounting

a) Adjust the address (☞ page 4 - 27)
   - board 1: address 0 (all switches “OFF”)
   - board 2: address 4 (only switch 3 “ON”, remaining switches “OFF”)
b) Insert the board
c) Press the board hard
d) Tighten the fastening screws
e) Plug the connectors

10.6.11 Output Board

middle, inside the robot cabinet (☞ page 10 - 12)

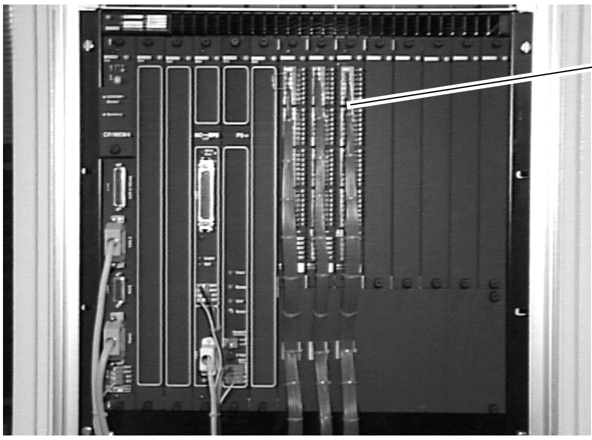


Fig. 10-27: rho Control Unit

Dismounting

a) Switch off the main switch
b) Loosen the fastening screws
c) Pull out the board

Mounting

a) Insert the board
b) Press the board hard
c) Tighten the fastening screws
d) Plug the connectors

10.6.12 Fans of the rho Control Unit

middle, inside the robot cabinet (☞ page 10 - 12)

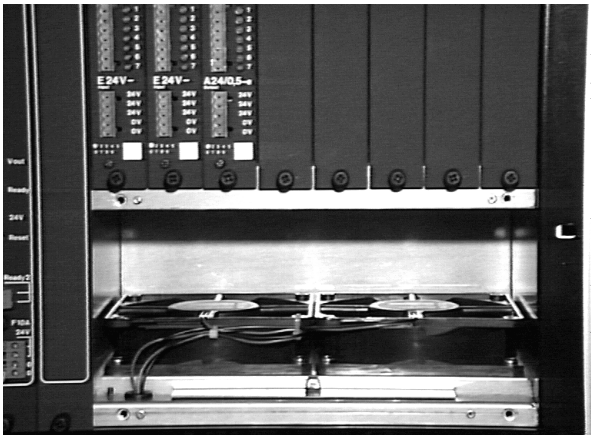


Fig. 10-28: Fans for Input and Output Boards

The fans for the boards from CP/MEM to power supply PS75 are mounted below the boards.

10.6.13 Fuses of the rho Control Unit

middle, inside the robot cabinet (☞ page 10 - 12)

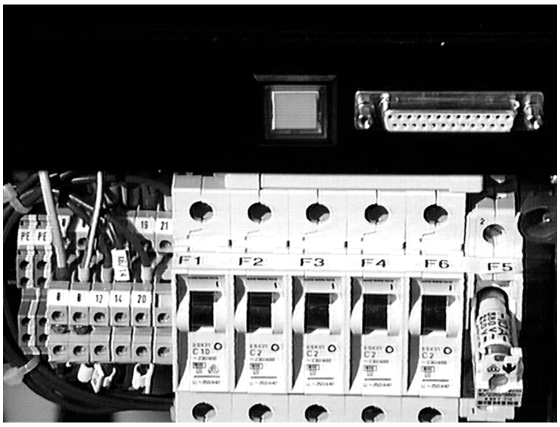


Fig. 10-29: Fuses of the rho Control Unit

Information

The fuse F5 (far right) is a wire fuse (6 A 380 V) and not a circuit breaker, like the other fuses.

10.6.14 Interface Converter

on the bottom, inside the robot cabinet (☞ page 10 - 12)

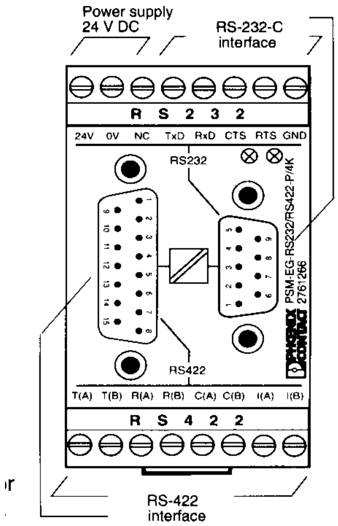


Fig. 10-30: Interface Modem

Dismounting

a) Switch off the main switch

b) Disconnect the shield wire on the housing pin of the Sub-D plug

c) Pull the plug

d) Using a screw driver, press down the red snap-action lever on the underside of the interface converter

e) Unhinge the module upward from the carrying rail

f) Disconnect the PE (earthing) contact

Mounting

a) Check the default settings
  - lever out the housing cover with a screw driver applied at the marked spot, remove the cover
  - check the setting of switch S1 on DTE
  - jumper adjustment X6: pin 2 and pin 4 connected
  - close the cover

b) Connect the PE (earthing) contact

c) Insert the module on the carrying rail from the top and let it snap into place

d) Plug in the connectors on the top and bottom of the module

e) Connect the shield wire to the plug housing

10.6.15 Robot Cabinet Connecting Panel

on the bottom, inside the robot cabinet (☞ page 10 - 12)

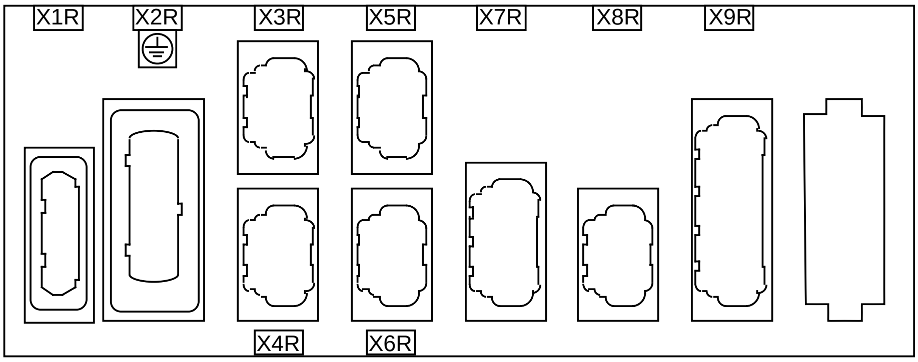


Fig. 10-31: Robot Cabinet Connecting Panel

10.7 Quadro Tower Cabinet

10.7.1 Overview

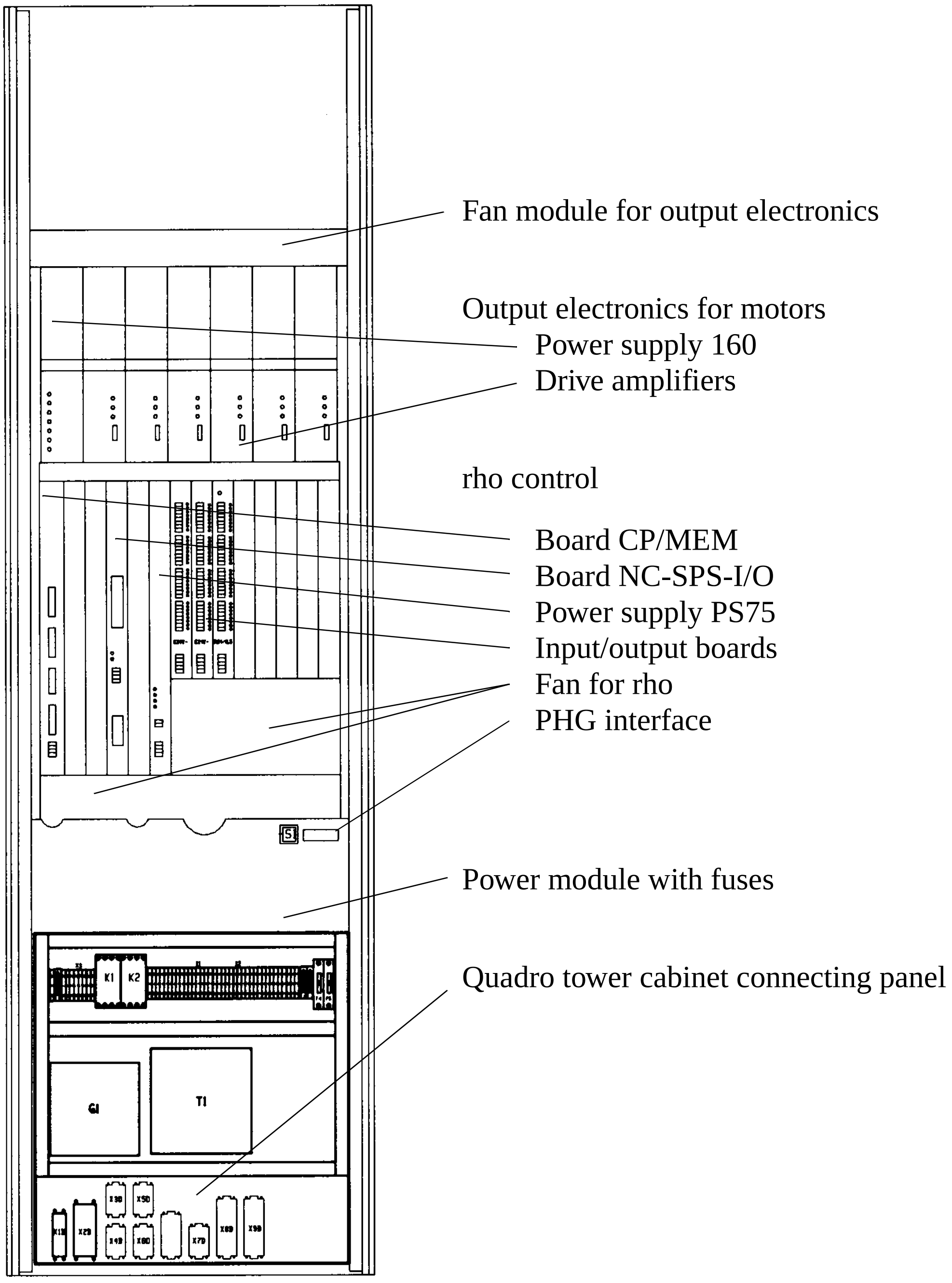


Fig. 10-32: Quadro Tower Cabinet Overview

10.7.2 Power Supply 160 for the Drive Amplifiers

(☞ “Power Supply 160 for the Drive Amplifiers” from page 10 - 14)

10.7.3 Drive Amplifier

(☞ “Position of Drive Amplifiers” from page 10 - 16)

10.7.4 Board CP/MEM

(☞ “Board CP/MEM” from page 10 - 32)

10.7.5 Board NC-SPS-I/O (PIC-Board)

(☞ “Board NC-SPS-I/O (PIC-Board)” from page 10 - 35)

10.7.6 Power Supply PS 75 for rho

(☞ “Power Supply PS75 for rho” from page 10 - 37)

10.7.7 Input Boards

(☞ “Input Boards” from page 10 - 38)

10.7.8 Output Boards

(☞ “Output Board” from page 10 - 39)

10.7.9 Fans of the rho Control Unit

(☞ “Fans of the rho Control Unit” from page 10 - 40)

10.7.10 Fuses of the rho Control Unit

(☞ “Fuses of the rho Control Unit” from page 10 - 40)

10.7.11 Quadro Tower Connecting Panel

- on the bottom, inside the Quadro tower cabinet (☞ page 10 - 43)

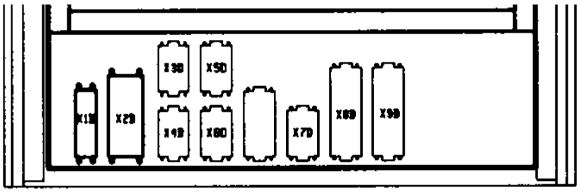


Fig. 10-33: Quadro Tower Connecting Panel

11 Error Messages and Trouble Shooting

11.1 General Information

All messages, including the error messages, are displayed in the log window of the AMU operating console (☞ page 5 - 1). The error number appears in brackets at the end of the message.

Additionally the host processor receives an error information.

You can call up additional information on the operating system level (in an OS/2 window).

a) Enter `help amuxxxx`
`xxxx` means error number

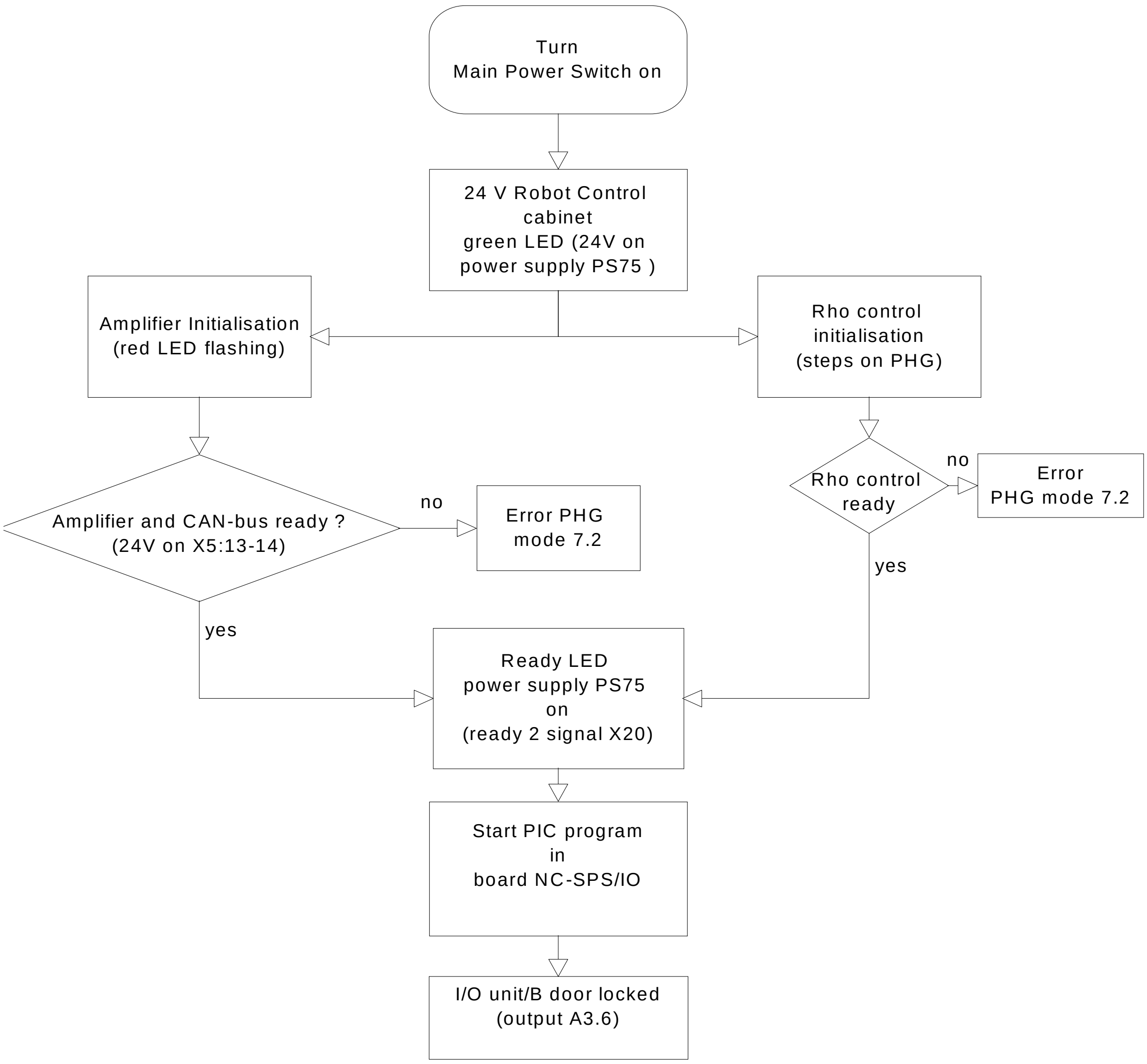
If no solution is given or if you cannot otherwise resolve the error, inform the maintenance technician of your service partner or ADIC/GRAU Storage Systems.

CAUTION!

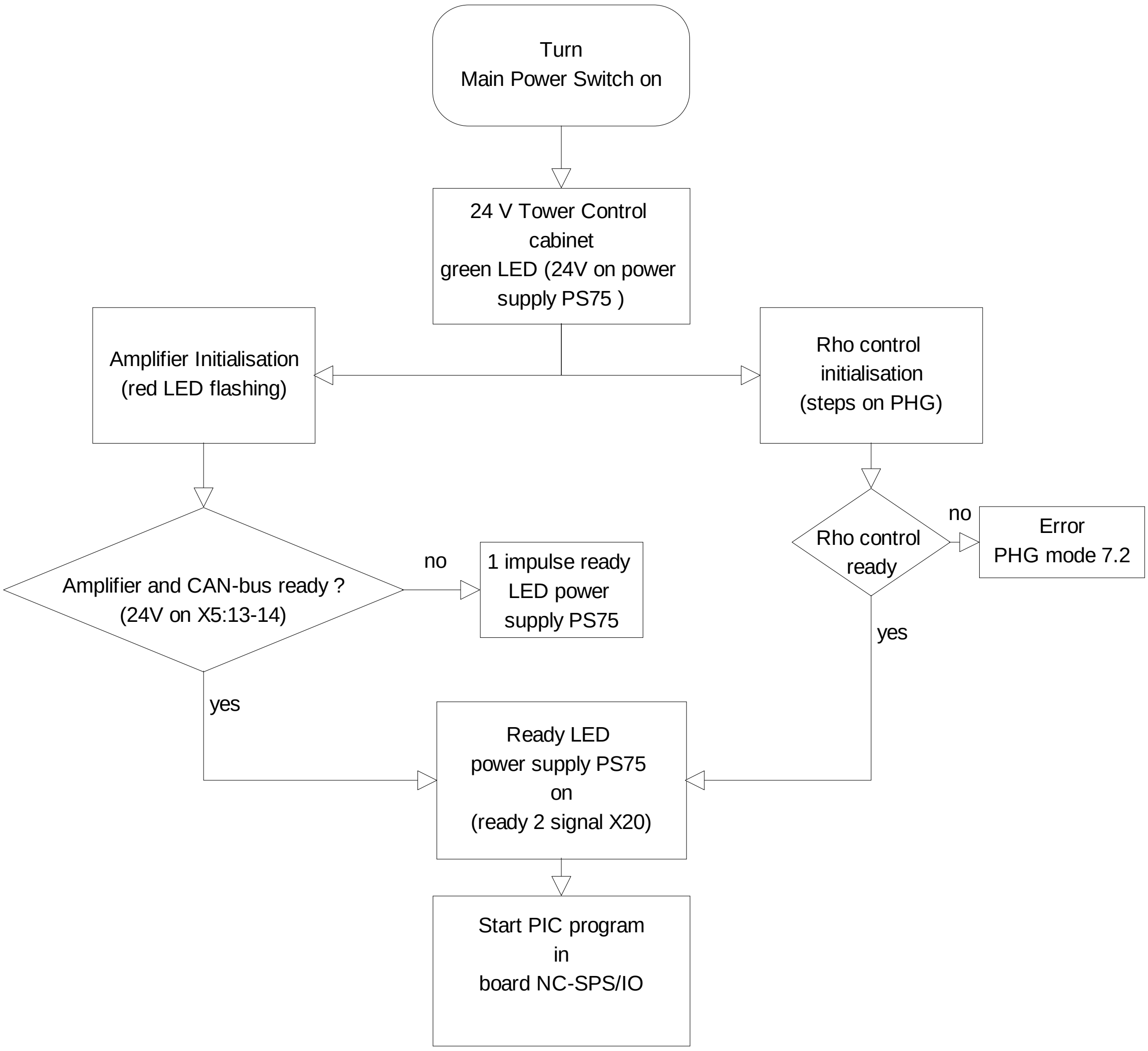
If you need to enter the archive to find or resolve an error, be sure to observe the safety rules (☞ page 3 - 1).

11.2 AML/2 Control Flow during Start Up

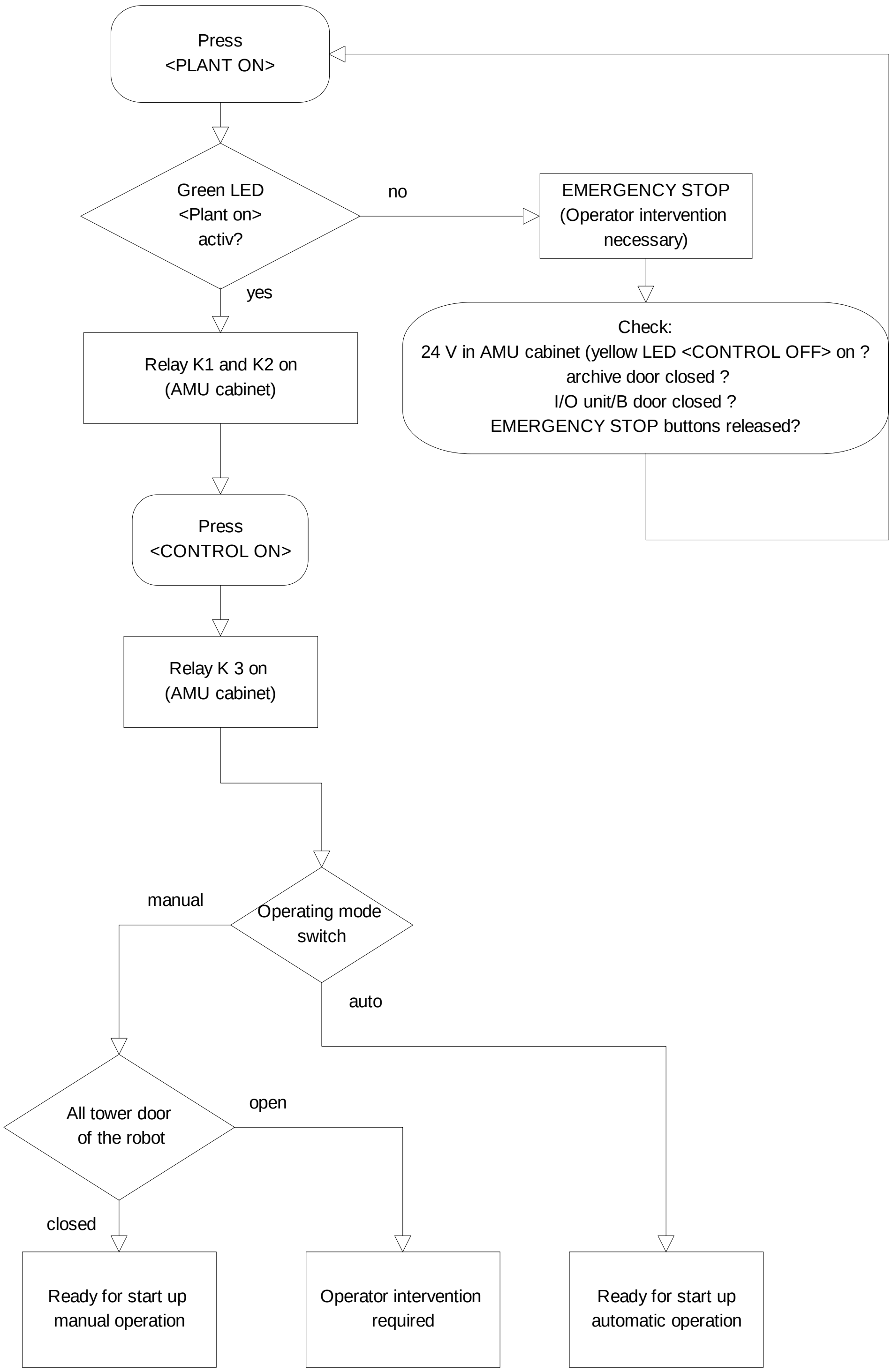
<Main Power On> Robot Control



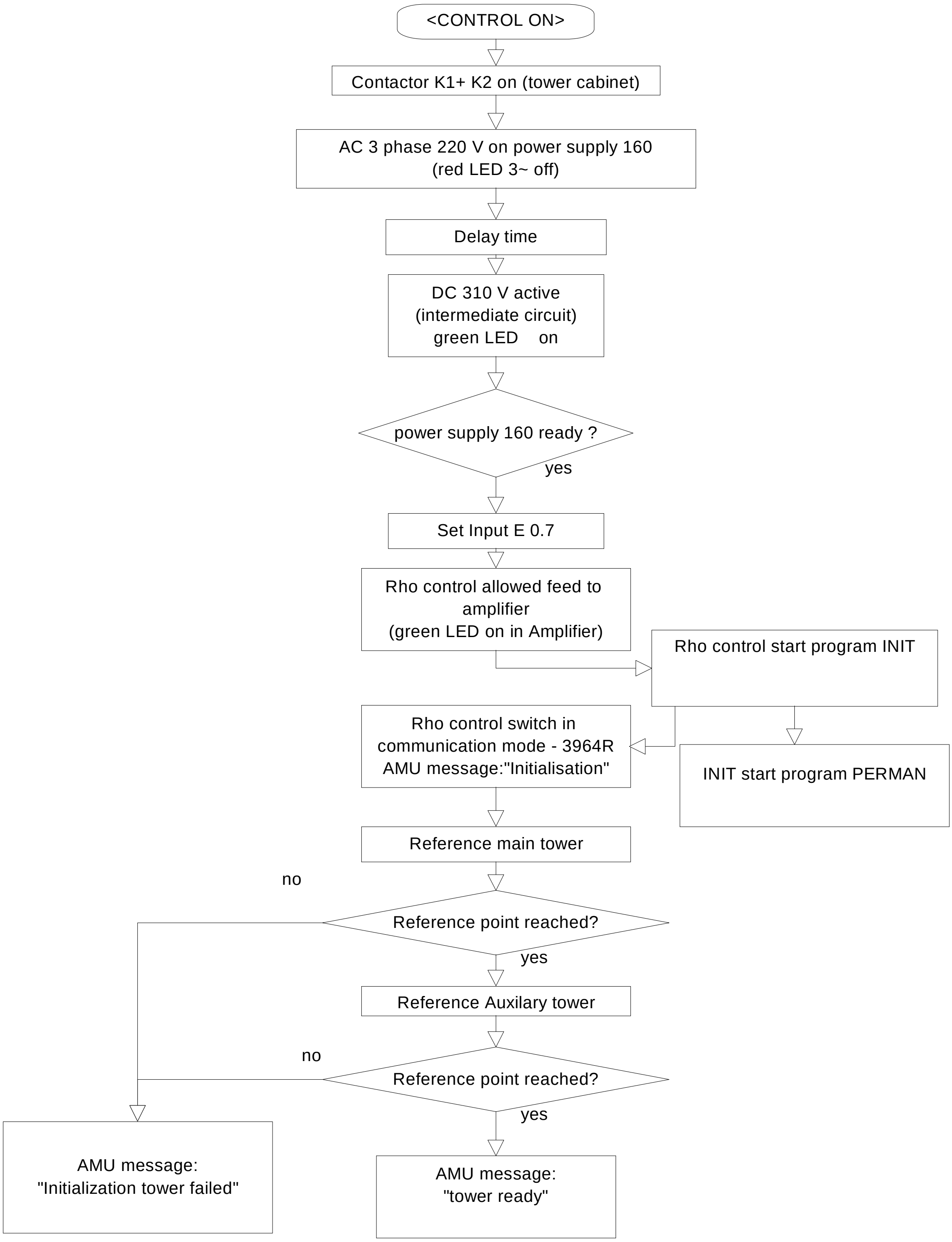
<Main Power on> Tower Control



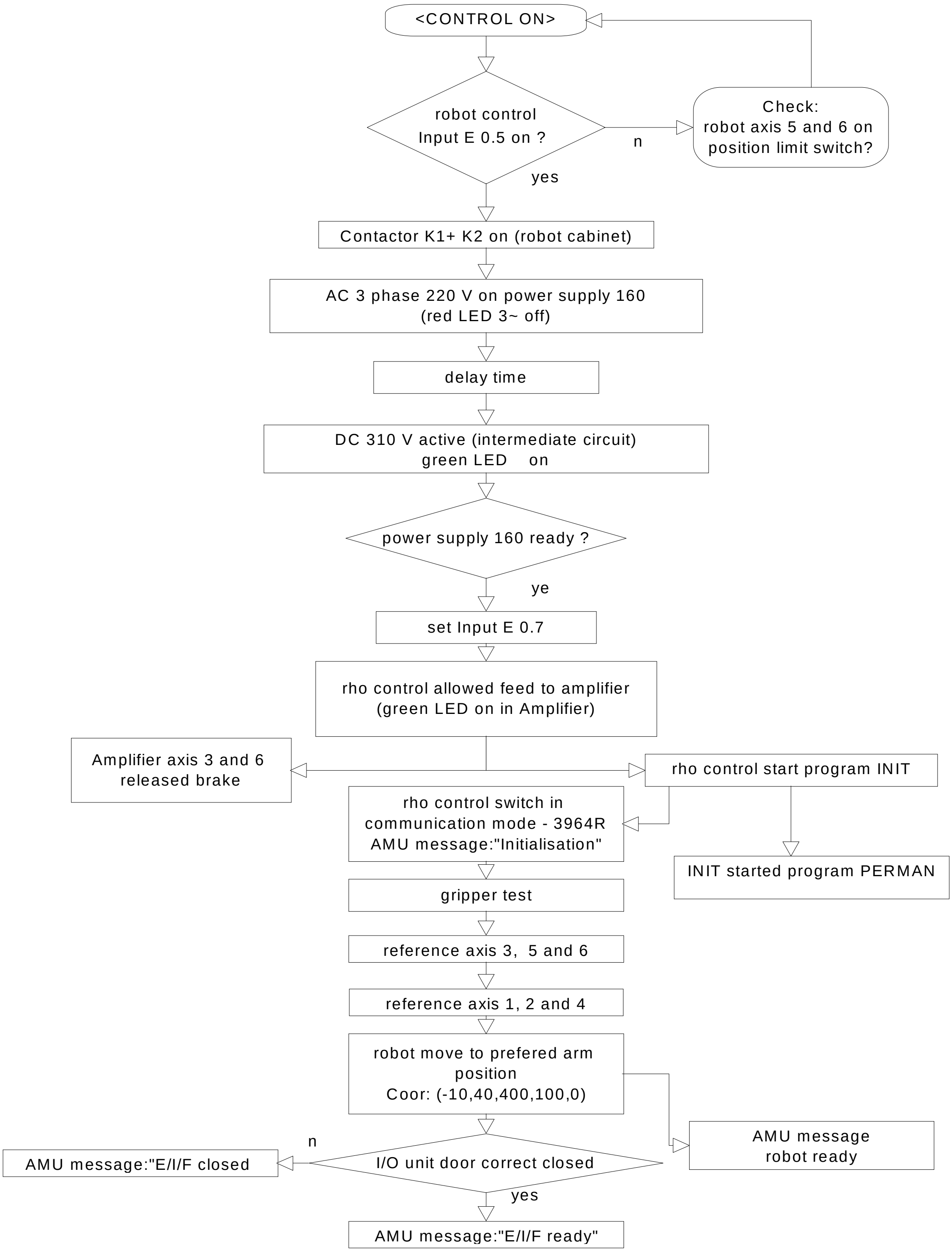
Key Switch Operating Mode



<CONTROL ON> Tower Control



<CONTROL ON> Robot Control



11.3 Trouble Shooting upon EMERGENCY STOP

The AML/2 system is protected by several electric circuits. These are:

- EMERGENCY STOP circuit
- CONTROL ON circuit for robot cabinet
- CONTROL ON circuit for Quadro tower cabinet

Each circuit comprises several guards for protection

- <EMERGENCY STOP> buttons
- safety switches, limit switches, door interlocks
- querry of ready signals (rho control, drive amplifiers)

When a guard is triggered the circuit is interrupted.

11.3.1 EMERGENCY STOP Circuit

The SYSTEM ON circuit activates the EMERGENCY STOP circuit. After an EMERGENCY STOP this circuit is interrupted.

EMERGENCY STOP shuts down the power output electronics (contactor in the operating cabinet) and interrupts the circuits CONTROL ON and SYSTEM ON.

WARNING!
Hazardous voltage!

Pressing the <EMERGENCY STOP> button does not render the entire AML/2 system voltageless. Only the drive amplifiers are shut off.

The following are intergrated into the EMERGENCY STOP circuit:

- <EMERGENCY STOP> buttons
  - on the I/O unit
  - on the operating panel of the operating cabinet
  - on the PHG of the robot cabinet (or dummy plug)
  - on the PHG of the Quadro tower cabinet (or dummy plug)
  - in the archive (on new systems)
- safety switches
  - archive access

11.3.2 CONTROL ON Circuit (only on AML/2)

Preconditions for closing the circuit:

- SYSTEM ON circuit closed
- operating mode “AUTO”

This circuit controls the contactor in the power modules of

- the robot cabinet
- the Quadrotower cabinet

The power module supplies the power supply 160 for the drive amplifiers (220 V, 3 phases). The power module of the Quadro tower cabinet additionally supplies the I/O unit/A (400 V).

The following are integrated into the CONTROL ON circuit of the robot cabinet:

- robot limit switches
  - axis 5 (not behind the mark and not at the front stop)
  - axis 6: You can free the axis if no motor failure has occurred: switch on the main switch, press <SYSTEM ON>, press <CONTROL ON>, press the yellow PHG button on the robot cabinet until axis 6 has completed the reference movement; continue as in a normal start procedure.
- ready signal of the rho control (LED Ready on power supply PS 75)
- ready signal of drive amplifiers

The following are integrated into the CONTROL on circuit of the Quadro tower cabinet:

- door interlocks of Quadro tower
  - open in operating mode “AUTO”
  - closed in operating mode “MANUAL”
- ready signal of the rho control (LED Ready on power supply PS 75)
- ready signal of the drive amplifiers

11.4 Failures during Barcode Reading

Possible Causes	Remedy
hardware failure	Check: • cable connection • DC Voltage on DC-DC converter (☞ table) reset rho and scannner (switch off power of robot control cabinet) In an emergency the system can operate without barcode reading. • 24 V at inputs E3.0 in the robot cabinet • send HOST command “BOFF”
unreadable barcode label	Replace damaged or contaminated barcode label. **ATTENTION!** **Try to find the cause for the damage.** **If the handling is adjusted badly the gripper may damage barcode labels.**
bad adjustment during installation	Parameter error: during the installation, parameters for optimal barcode reading are adjusted. Changes such as • gripper replacement • different or new media • changed lighting call for a correction of these parameters: • measure the parameters with the robot test program (☞ page 6 - 21) • enter the parameters in KONFIG.DAT • check the changed parameters (several compartments on different storage towers) • enter the parameters on the datasheets • save KONFIG.DAT

Clamp connection table of DC-DC converter on scanner

Pin	Color	Voltage
1	brown	+ 24 V
2	blue	0 V
3	black	- 12 V
4	violet	+ 12 V
5	pink	5 V
6	green/yellow	GND

11.5 Error Messages of the Drive Amplifiers

11.5.1 Error Messages on the “Terminal” Program

a) Switch on the main switch

b) Open the AMU OS/2 window

c) Insert the disk “Robot & Tower Software”

d) Change to drive “A:\” (`a:`)

e) Change to directory “A:\ROBOT\MOOG” (`cd robot\moog`)

f) Call up the communication program “BOSCHTRM” (`boschtrm`)

g) Enter <C> for „Configurate“

h) Adjust the configuration

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Interface type	IQ140/RHO3 CAN	<2>
- Helpfile	IQ 140/RHO	<2>

i) Press <ENTER> and wait until the following message appears:

`Enter first letter of a command or H for help >`	call-up of the motor variables input: <?>

j) Enter the motor variable
   - <F> error
   - <V> angle speed of motor shaft [1/min]
   - <L> current limit [A]
   - <B> output amplifier temperature [°C]
   - <M> motor temperature [°C]

… `Occured` … `Present`	occurred protocolled error active error next error: <ENTER> After the last error the following appears:
`Enter first` `letter of a` `command or H` `for help >`	input: <ESC>

k) Disconnect the installation cable (if necessary reconnect the other cable)
   - AMU interface
   - drive amplifier socket X6

l) Remove the disk “Robot & Tower Software” from the drive

m) Quit the OS/2 window

11.5.2 List of Errors

During every second communication cycle the drive is checked for errors by a logic module. When an error is found the operating status changes.

Error	Notes	Solution
Bridge Short Circuit Fault	Each of the three motor-phases is equipped with a current sensor. If a short circuit lasts for more than 15 microseconds the output transistors are shut off by a hardware circuit and a signal for later measures is stored by the logic module.	Check: connecting cable to the motor, replace motor or amplifier if necessary
Analog Power Supply Fault	During every second communication cycle a logic module monitors the comparators; these in turn check the +15 V and -15 V supply.	replace amplifier or power supply unit
300 V Power Supply Fault	During every start time the logic module checks the supply power for • temperature >110 °C • intermediate circuit voltage>420 V • phase loss for 100 milliseconds If one or more of the above conditions are true, the output transistors are shut down during a start time.	replace power supply unit or drive amplifier
Commutation Fault	The logic module checks whether the MCO is installed.	check the MCO module
Resolver Fault	The module of the cosine and sine signals of the resolver is checked during every communication cycle. If it is less than half of the correct value, an error message is transferred twice to the logic module.	check the connecting cable to the motor, if necessary replace motor or drive amplifier
Parameter Fault	A parameter error occurs when the drive has no valid parameters/no valid software due to an initialization error or RAM defect. All parameters are summarized in a checksum which is checked at an interval of 64 communication cycles. If the checksum is wrong, an error message is transferred to the logic module. (Each data element not continuously recalculated is considered a parameter).	reload parameters, if necessary replace amplifier
Bridge Temperature Fault	The temperature of the heat sink of the output transistor is checked at an interval of 64 communication cycles (= 1s). If it rises above 85 °C, a bridge temperature fault is reported to the logic module, and the drive is inactivated.	check fan and ambient temperature, if necessary replace the drive amplifier
motor temperatureFault	If the motor temperature rises above 155 °C for 0.75 seconds, a motor temperature fault is reported, and the drive is inactivated.	check parameters (reload), if necessary replace motor
Thermal Warning	If the motor temperature rises above 130 °C for 0.75 seconds, or if the heat sink temperature of the output transistor is above 70 °C, the drive submits a thermal overload warning to the RHO.	check ambient temperature, fan

Error	Notes	Solution
CAN Bus-Fault	• During a communication cycle no synchronization telegram is received. • The synchronization telegram is received, but this happens neither during the first nor during the last start time of a communication cycle. • Within 2 milliseconds after a synchronization process no COMMAND (setpoint) telegram is received. • The ACTUAL telegram cannot be send.	MPRHO3.BIN in rho: check cycle time reload parameter P005 in drive amplifier, if necessary replace the drive amplifier
CAN Interpolation Fault	The COMMAND_POSITION (setpoint position) contained in the COMMAND_TELEGRAM (setpoint telegram) must be reached during one communication cycle (= time be-tween two synchronization processes). This results in a certain speed. The drive amplifier- speed, however, is always checked for agreement with the ð speed limit of the manual or automatic operating modes. If RHO implicitly requires a higher speed than that specified by the speed limit value for the manual or automatic operating mode, the drive amplifier outputs the CAN_INTERPOLATOR_FAULT_BIT (Bit 9) of the STATUS word contained in the ACTUAL telegram. The drive amplifier outputs this bit as soon as this error occurs and resets it when the error is resolved.	Check mechanics, brake, connecting cables and parameters, if necessary replace the amplifier
CAN Global Fault	This bit is output by the drive amplifier logic-module as soon as it detects a condition preventing the release of the drive system. This bit is never output alone.	

11.6 rho-Controller errror

11.6.1 rho error 102 ‘falsche MK-Bestueck‘

After initialization of the control operating system appears on the PHG:

```
Systemfehler     102
falsche MK- Bestueck

ENTER --> MP aendern
```

Information

The following acts allow for a new parameterizing of the card

a) Press ; (Masch.Param.Programm)

b) One after the other press MODE ; 3 ; ; (Parameter aendern)

c) One after the other press MODE ; 1 ; ; (Para.fuer PC-Kopplung)

d) The following parameters are to be confirmed with or to overwrite:

0	;Schnittstelle
9600	;Baudrate
1.0	;Stop-Bit
gerade	;Parität “ input **2**“
8	;Wortlänge
1	;Soft-Hardw. Hsh(0/1)
-1	;Timeout b.Einlesen:
5000	;Timeout b.Ausgeben:

PHG appears indication:

```
Para. f. PC-Kopplung

ENTER --> MP aendern
```

e) Press [⇨] ; (MP progr.)

f) Press [←] to leave menu “Parameter aendern“

g) Press [←] to leave menu “Masch.Parm.Programm“

PHG appears indication:

```
Systemfehler     102
falsche MK- Bestueck

ENTER --> MP aendern
```

h) Press [⇨] ; (Masch.Param.Programm)

i) One after the other press [MODE] ; [2] ; [⇨] ; (ROB_1 MP SET)

j) One after the other press [-] ; [0] ; [0] ; [0] ; [0] ; [0] ; [⇨]

;(Password for the Systemparameter, there are written only *)

k) As long as press [⇨] ,,until PHG appears indication:

```
Parameter-Nr.:#
```

l) One after the other press [4] ; [0] ; [1] ; [⇨] ;(Maschinenparameter 401)

m) Confirm the following table entries with and only (CAN Stecker-Nummer und CAN Modu-Eingänge) transfer

Tabele Parameter P 401

P 401	Bestückung der Meß-Systemkarten	
	A01 Servo-K.:	1
	A01 CAN Stecker- Nummer	X 5 ; 1 ;
	A01 CAN Modul- Nr.:	1
	A01 CAN Modul- Eingang	1 ;
	A01 Ref.-Mode:	0
	A01 Pulse/Umdrehung	65536
	A01 Meßsystem-Bewertung	1000.0
	A01 Sollw.-Ausg.:	1
	A02 Servo-K.:	1
	A02 CAN Stecker- Nummer	X 5 ; 1 ;
	A02 CAN Modul- Nr.:	2
	A02 CAN Modul- Eingang	2 ;
	A02 Ref.-Mode:	0
	A02 Pulse/Umdrehung	65536
	A02 Meßsystem-Bewertung	1000.0
	A02 Sollw.-Ausg.:	2

n) Press to leave menu „ROB_1 MP SET“

o) Press to leave menu“Masch.-Param.Programm“

PHG appears indication: (from operating system TO03G)**:**

```
Masch.Param.Programm
Aenderungen ueber-
nehmen? (J=1/N=0):#
```

p) Confirm the safety prompt to write the EEPROM with 1 ; ⇨

An automatic reset is called

q) Let the control system run up.
Go to parameterize the CPMEM board

Parameterize the CPMEM board

a) Call up AMU **Rho File Manager** (on AMU)
b) Insert the backup disk into the AMU drive
c) Change to the drive a:, and select the relevant directory eg. A:\robot
d) Initialize the memory of the board: transfer the file “MPRHO3.BIN” (machine parameters) with the command **Send to Rho**
e) Call up **Restore**
f) Start the restore programme
g) Quit the **Rho File Manager**
h) Check the rho delay times (☞ “Adjustment of AMU interface” from page 7 - 6)
i) Activate the write-protection at board CP/MEM (S1 on 1 = write-protected)
j) Reset the control unit: press the reset button on the power supply PS75
k) Press <CONTROL ON> when the system has booted

12 Appendix

12.1 Terms Used

AML/2	**A**utomatic cassette tape operating archive; AML/2 software and physical archive. /2 means second version.
AMU	**AML M**anagement **U**nit Central intelligence of the AML/2 system. Consists of hard and software (AMS).
AMU operating console	OS/2 program for operation of the AML/E system (CON.EXE).
Archive	The archive consists of • physical archive and • logical archive. The physical archive consists of storage towers for cassette tapes/optical discs (= media). The logical archive (archive catalog) is the list of volsers assigned to the compartments in the physical archive.
Archive catalog	An OS/2 database with the logical archive. Contains the assignment of volsers to the compartments in the physical archive, as well as further vital information about the media and the drives.
Archive coordinates	These define the location of a medium in a compartment of the physical drive.
Barcode-Label	Label on the medium, contains the volser in a form readable for the robot (barcode).
Click	Short pressing and releasing of the mouse button.
Command, instruction	A command sent to the AML/E system: • from the host computer • direct operator input at the AMU operator console

Configuration Dertermines the structure of the AML/2 system. The configuration specifies the components and their connections.

- host computer
- AMUs
- rhos
- storage towers
- linear shelfs
- handling unit
- specials
- drives

Foreign medium Media not listed with a Volser in the archive catalog. They are processed by the AML/2 system via the I/O unit.

Handling box Storage box for media in the I/O unit.

Host computer Large computer system. The data of the host computer is stored in the AML/2 system (archive) on media.

I/O unit Input/output area. Media are inserted and ejected via the I/O unit.
Two versions:

- type A: with turning units
- type B: without turning units

Linear shelf Storage archive (only one storage level).

Medium Storage medium in the archive, e. g. a magnetic tape cassette or an optical disk.

Mounting media Inserting a medium into a drive is referred to as mounting (MONT), removing a medium from a drive is referred to as dismounting (KEEP).

Operator Trained operator of the AML/2 system.

Operating panel Panel on the operating cabinet allowing to switch the AML/2 system on and off and monitor it.

Optical disk (OD) Optical storage medium (CD).

Problem box 9 special compartments in the I/O unit:
These house:

- unidentified media
- media, when the robot fails

Quadro tower Storage with 32 segments.

Scratch media	Scratch media are media released for reuse by the archive. They are used to output data without specified volser (unspecific media request).
Segment	A column of rows in a storage tower.
System media	System media have a volser, are stored and registered in the archive.
Teaching	Teaching of the robot system.
Teach label	White reference marks, these are traced in space (accuracy up to 1/100 mm). They are used to compute all points in the system the robot will have to access. The coordinates of all points taught in are stored in the file KRNREFPT.R0X (X represents the respective robot 1-4).
Turning unit	Part of the I/O unit/A. A turning unit houses four handling boxes in its sections.
Unspecific media request	Command to mount a scratch medium or a cleaning cassette.
Volser, VSN	English: **vol**ume **ser**ial number A six-digit alphanumeric designation (with leading zeros). It identifies one medium (cassette, optical disk) in the archive. The volser is attached to the rear of the medium on a barcode label and can be read by the robot.

12.2 Additions to the AMU Operating Console

12.2.1 Component Types

Drives

Type	Drive name and number	Medium	Manufacturer
D1	Colorado T1000	TRAVAN	HP
D2	6380	3480 Kassette	COMPAREX
D2	7480	3480 cartridge	HDS
D3	6390	3490 cartridge	COMPAREX
D3	7490	3490 cartridge	HDS
D7	3480 with ACL	3480 cartridge	IBM
D7	3580 with ACL	3480 cartridge	SNI
D8	3480 with flap	3480 cartridge	IBM
D8	3480 with flap	3480 cartridge	SNI
D9	5480	3480 cartridge	MEMOREX
D9	60/3590E	3490 cartridge	MEMOREX
D9	3580, without flap	3480 cartridge	SNI
D9	3590	3490 cartridge	SNI
D9	3480 without flap	3480 cartridge	IBM
D9	3490	3490 cartridge	IBM
D9	3490-TA91	3490 cartridge	DIGITAL
D9	9309 2	3490 cartridge	IBM
DA	ER90	D2 small	AMPEX
DA	DST 310	D2 small	AMPEX
DB	ER 90, DST 310	D2 medium	AMPEX
DC	8205-8mm	8mm cartridge	EXABYTE
DC	7208 011, Mammouth	8mm cartridge	IBM
DC	DC MK 13	8mm cartridge	SNI
DE	DLT 2000 (modified)	TK cartridge	ADIC
DE	DLT 4000 (modified)	TK cartridge	ADIC
DF	DDS 7206 005	4 mm cartridge	IBM
DF	HP 6400/1300 S (DDS-1)	4 mm cartridge	HP
DF	HP 6400/4000 DC (DDS-2)	4 mm cartridge	HP
DH	HP 1300	OD 512	HP
DJ	3995 Jukebox	OD 512	IBM

Type	Drive name and number	Medium	Manufacturer
DK	4480	3480 cartridge	STK
DL	4490 Silverstone	3480 cartridge	STK
DL	9490 Timberline	3480 cartridge	STK
DN	3591	3591 cartridge	SNI
DN	3590 Magstar	3590 cartridge	IBM
DN	8590	3590 cartridge	ADIC
DO	RF7010E, MF for external unit	OD Reflection	PLASMON
DO	RF7010X, MF	OD Reflection	PLASMON
DP	IFD-1300-A Subsystem	OD 512	FUJITSU
DP	OD 1300T	OD 512	HP
DP	OD 6300 650/A	OD 512	HP
DP	NWP-559	OD 512	SONY
DP	MOD 2,6 GB	OD 512	SNI
DP	OS 13	OD 512	SNI
DP	Gigaburst	OD 512	STORM
DQ	M2485	3490 cartridge	Fujitsu
DQ	M2483K-3480/90	3480 cartridge	Fujitsu
DQ	LMS TD 3610	3480 cartridge	Philips
DQ	7492	3490 cartridge	HDS
DS	3588-GL	3480 cartridge	SNI
DS	4890 TwinPeak	3480 cartridge	STK
DT	5180	3480 cartridge	TANDEM
DU	5190	3480 cartridge	TANDEM
DV	RSP 2150 Mountaingate	VHS cartridge	METRUM
DW	OS 25 (HR 650)	CD-ROM	SNI
DW	XM 3501B	CD-ROM	Toshiba
DW	W2001	CD-ROM	SNI
DX	AKEBONO (GY-10D)	DTF-Small	SONY
DX	AKEBONO (GY-10C)	DTF-Large	SONY
DZ	BetaCAM BTS PBC 2800P	BetaCAM	Beta CAM

I/O unit

Type	Component
P0	Problembox (10 compartments turnable)
P1	Problembox above I/O unit/A (9 compartments turnable)
P2	Problembox above I/O unit/B (9 compartments fix)
P3	Problembox above I/O unit/B Mixed-Media (9 compartments fix)
P4	Problembox (7 compartments fix)
P5	Problembox above I/O unit/C (narrow)
P6	Problembox above I/O unit/A (Mixed Media)
E0	I/O unit/A 120 with 4 Handling boxes
E1	I/O unit/A 240 with 8 Handling boxes
E2	I/O unit/B 60 with 2 Handling boxes
E3	I/O unit/B 120 with 4 Handling boxes
E5	I/O unit/C
E6	I/O unit/D (HiCap)
E7	I/O unit/E

Robot

- R0: Robot system (AML/2)
- R3: Handling unit (AML/E)
- R4: Handling unit (AML/J)

AMU

- A0: AMU without Backup AMU
- A1: AMU with Backup AMU
- A2: Backup AMU (not in use)

Host computer

- H0: MVS-HACC host computer
- H1: VM-HACC host computer
- H2: ROBAR (< V2.5) 66 Byte string length
- H3: ROBAR (80 Byte string length), HACC/VMS
- H4: HACC/Guardian host computer (66 Byte string length)
- H5: HACC/Guardian host computer (80 Byte stringlength)
- H6: HACC/DAS
- H7: HACC/AS400, ADIC-VolServ

Storage units

Type	Component
T0	Grau Quadro tower 18R
T1	Grau Quadro tower 15R
T2	Grau Quadro tower 12R
T3	Grau Hexa tower 18R
T4	Grau Hexa tower 15R
T5	Grau Hexa tower 12R
L0	Grau linear rack 18R
L1	Grau linear rack 15R
L2	Grau linear rack 12R
L3	Grau linear rack above 1 small drive
L4	Grau linear rack above 2 small drives
L5	Grau linear rack full height
L6	Grau linear rack above 4 small drives
L7	Grau linear rack above 5 small drives
L8	Grau linear rack below I/O unit/C
L9	Grau linear rack above 3 drives
LA	Grau linear rack above 1 big drive
LB	Grau linear rack above 2 big drives
LC	Grau linear rack above 3 big drives

12.2.2 Media types

- C0: 1/2 inch Cartdridges
- C1: TK85
- O0: OD Reflexion (9 mm)
- O1: Optical Disk (11mm)
- V0: VHS Cartridges
- V1: Exabyte 8mm
- V2: Exabyte 4mm
- V3: D2 small (25 GByte)
- V4: D2 medium (75 GByte)
- V5: Travan
- V6: DTF small
- V7: DTF medium

12.3 Lubricants

The following table lists the admissible lubricants. „AE“ means delivery unit.

Kind	Type (Manufact.)	Order-No.	Package Unit (AE)	Application	Waste Code
Oil	Structovis BHD (Klüber)	134 000 000	lube cartridge 125 ml	lube cartridges for pinion/rack axis 5+6 (2 AE/Robot), gears on Quadro tower (4 AE/tower)	54 113 ☞ 1 below
	Syntheso HT 220 (Klüber)	178 000 003	500 ml	gearing axis 5+6 (1 AE/robot)	54 401 ☞ 2 below
	Gegol BG 46 SAE 90 (Aral)	144 000 009	complete set (oil, syringe)	robot gearing (1 AE/robot)	54 113 ☞ 1 below
	Centoplex GLP 500 (Klüber)	134 000 005 134 000 002	lube cartridge 125 ml 475 ml	linear guides axis 5 length < 2800 mm (1AE/track) length > 2800 mm (1AE/ track) _	54 113 ☞ 1 below
Grease	Isoflex Topas NCA 52 (Klüber)	178 000 000	tin 1 kg	robot: spindel axis 3 linear guides I/O unit/A (Σ 1 AE/robot)	54 202 ☞ 3 below
	Retinax EP2 (Shell)	178 000 001	cartridge 400 g	four point bearing, cross roller bearing on Quadro tower linear guides axis 6 (Σ 1 AE/robot+ tower)	54 202 ☞ 3 below
	Grafloscon S-SG 0 Ultra (Klüber)	178 000 079	cartridge 400 g	lubrication of too-thed wheels at Qua-dro Tower	54 202 ☞ 3 below

Explanation of the waste code

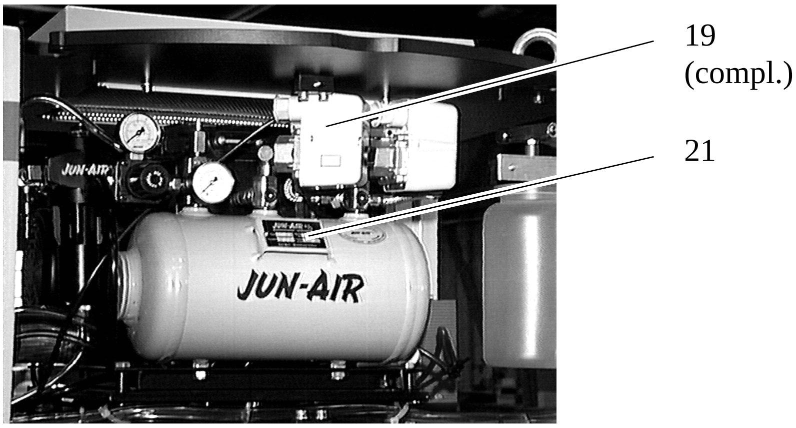
1 Lubrication cartridges are accepted back by ADIC/GRAU Storage Systems.

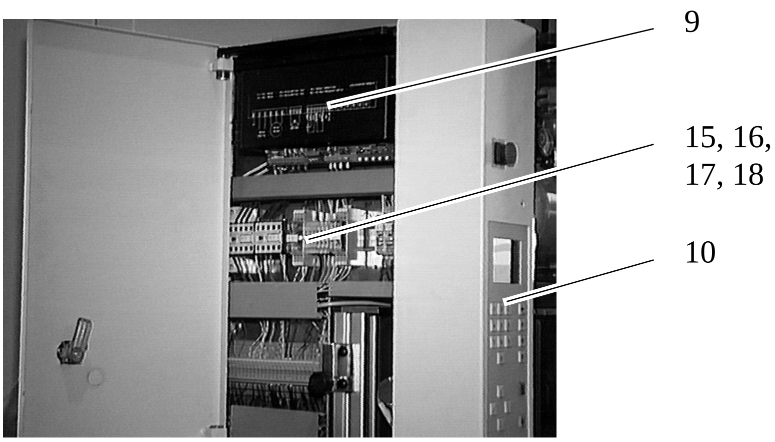
2 Do not mix with mineral oils or other synthetic oils.
Dispose of as category I oil (suitable for recycling) after consulting with local authorities.

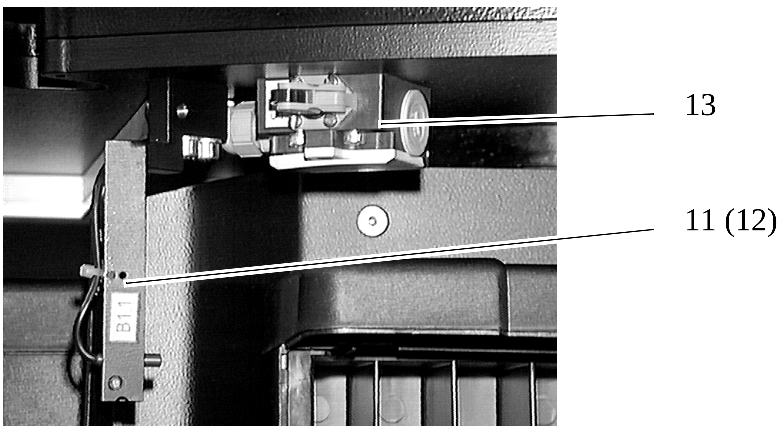
3 Dispose of as problematic waste after consulting with local authorities (burning or problematic waste dump).

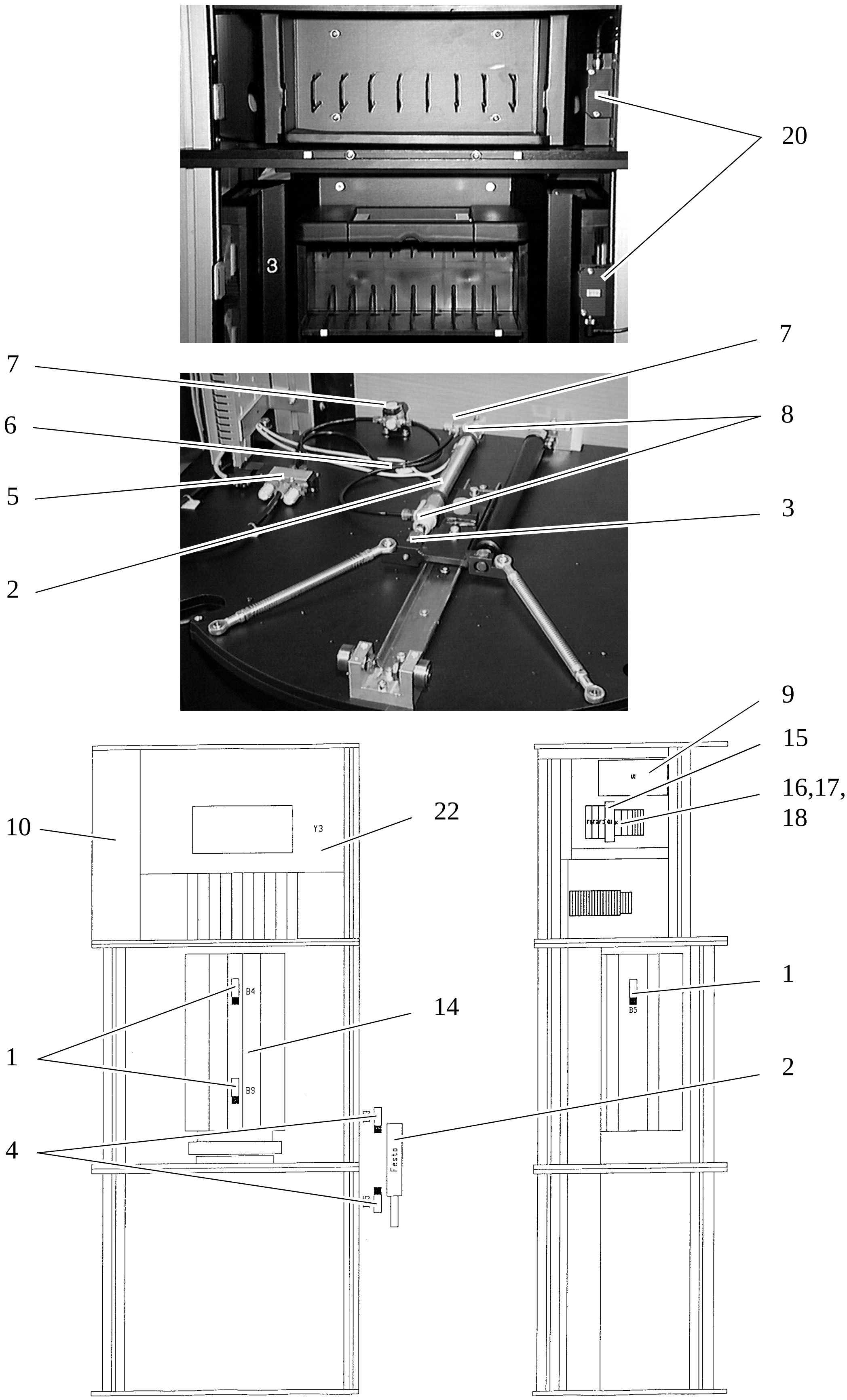
12.4 Spare Parts

12.4.1 I/O Unit/A





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B9
B5
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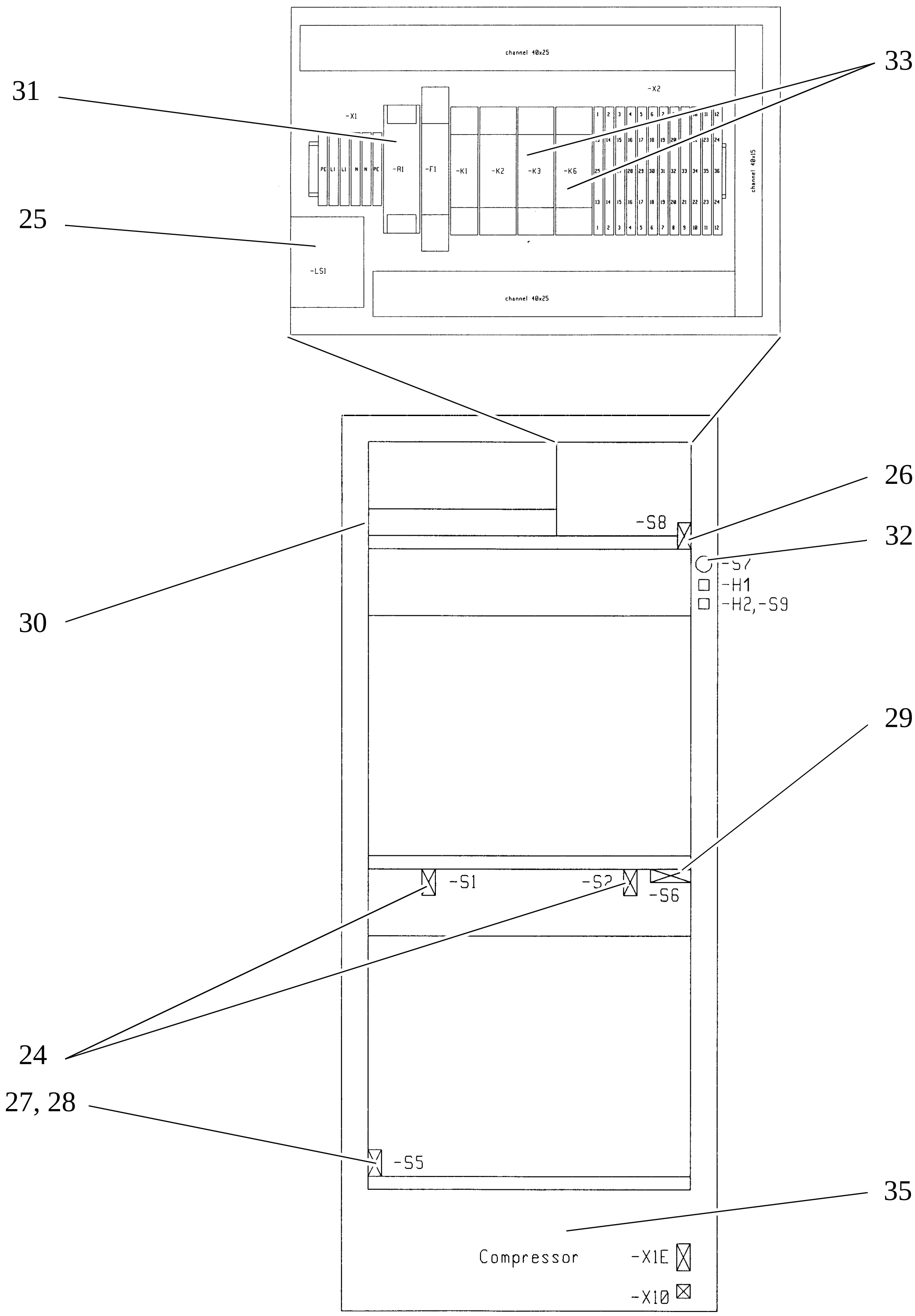
Festo

Pos.	Grau-No.	Manufac.-No.	Description
-	E32700004		E/A Einheit /A Steuerung I/O unit /A Control
1	15b330002	NJ4-F1E2	Näherungsschalter proximity limit switch
2	141000085	DSNU20-200-P-A	DW-Zylinder cylinder
3	140000313		Flexo-Kupplung Fk M8 flexo coupling
4	15b380001	SMTO-4-PS-S-LED-24	Näherungsschalter proximiy limit switch
5	142000086		Ventil MEH-5/2-1/8 24V valve
6	15x380001	SIM-K-GD-2,5	Stecker m. Kabel plug with cable
7	142000087		Drossel GRO 1/8 GRLA 1/8 PK4 throttle
8	142000030		Drosselrückschlagventil GR 1/8 one-way restrictor
9	15u170002		Frequenzumformer FAW 1015X frequency converter
10	15a270002		MET-Master Einheit MET 29213 MET master unit
11	15b430001	40 SE 50010157LS	Lichtschranke-Sender lightbarrier transmitter
12	15b430002	40 SE 50010158LS	Lichtschranke-Empfänger lightbarrier receiver
13	15s010020	3SE3 210-1E	Positionsschalter positioning switch
14	15m170001		Drehstrom-Stirnradgetriebemotor rotary current spur wheel back-geared motor
15	15q010003		Motorschutzschalter 0,4-0,6A motor protection switch

Pos.	Grau-No.	Manufac.-No.	Description
16	15k010054	3TF20 10-OBB4	Schütz (nur bei 8 Handlingkoffern) protecotor
17	15k020001	EMG17-REL/ KSR-24/21 29 53 85 4	Relais Modul 1W Relay module
18	15n430001	VS 27/4 50017263	Verstärker amplifier
19	322001840		Druckluftaufbereitung EA komplett air filter device
20	15b430004	50019926	Reflex.-Lichtschranke IPRK 9544 reflex. lightbarrier
21	141000088		Kompressor 6 Spezial compressor 6 special
22	15y810001	346-980 RS	Schließbolzen make bolt
23	141000108		Filtereinsatz für Kompressor mit Zubehör 40816 filterinsert for compressor with accessories

12.4.2 I/O Unit/B



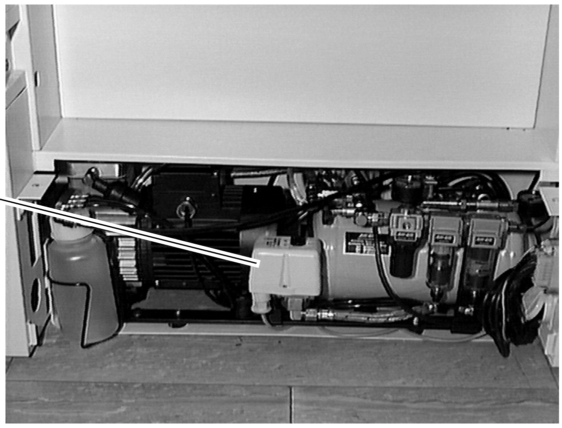
Pos.	Grau-No.	Manufac.-No.	Description
-	E40100001		EA-Einheit/B (Ersatzteilpaket) IO unit/B
24	15s010022	3SE3 200-1E	Positionsschalter (Handlingkoffer vorhanden) position switch
25	15b430004	50019926	Reflex.-Lichtschranke IPRK 9544 (Lichtschranke Problembox) Reflex. light barrier
26	15s010105	3SE3 200-1U	Positionsschalter (Rolladenschalter oben) position switch
27	15s410004		Betätigungsmagnet BPS 33 (Magnet am Rolladenschalter unten) operating magnet
28	323004563	3SE3200OXD	Positionsschalter NA (for S/N > xx-8791) position swich (subsequent work)
	15s410007	BNS 33-11zG	Positionsschalter 3m Kabel (Rolladenschalter unten) position switch 3m cable
29	323002656	160-13YPA	Sicherheitsschalter AZM und Betätigungsriegel NA operating bar and safety switch
30	15b430003	50003189	Kunststoffreflektor TK 30x50mm (für Lichtschranke Problembox) artificial reflector
-	116000106		Rolladen komplett complete shutters

Control

Pos.	Grau-No.	Manufac.-No.	Description
-	E40700003		EA-Einheit/B - Steuerung (Ersatzteilpaket) IO unit/B control
31	15s410005		Auswerteeinheit AES 1126 evaluating unit (for S/N < xx-8792
32	15s250001	1.30074.001	Taster NOT AUS key emergency-off
33	15k020002	29 50 32 3	relay module (for K1 - K3, K6) 2W EMG 22-REL/KSR-24/21-21 relay module
	15k050004	730521	relay module (for K1.1 -1.3) 2W EMG 22-REL/KSR-24/21-21-29 (for new I/O unit since 1995)
34	15k020001		relay module (for K2) (for S/N > xx-8791)

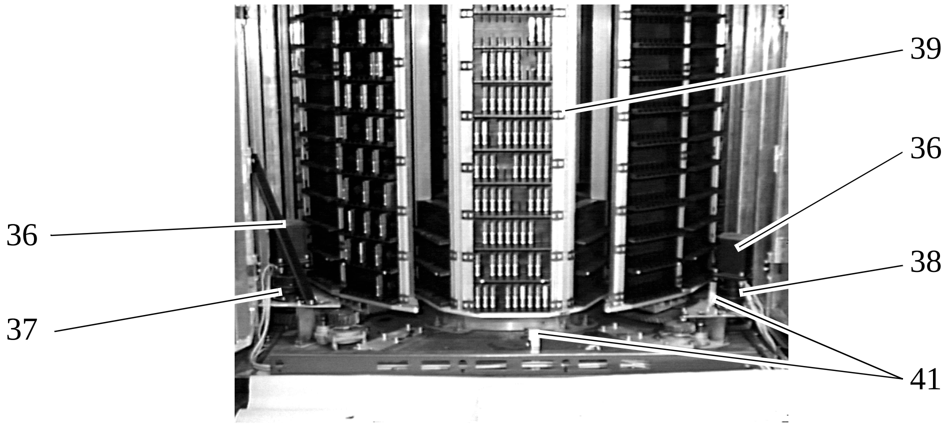
Compressed air supply

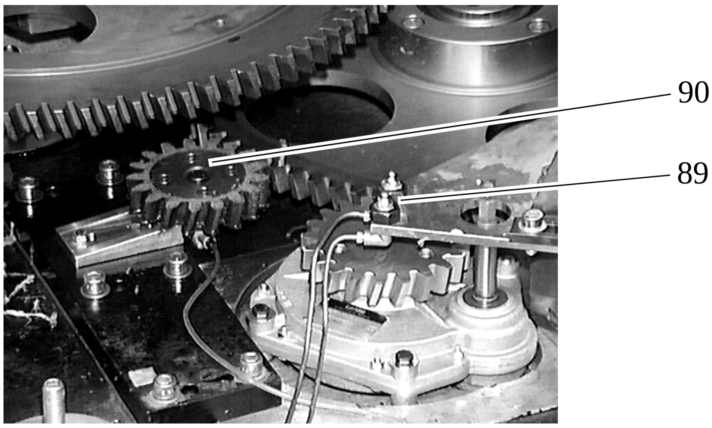
35

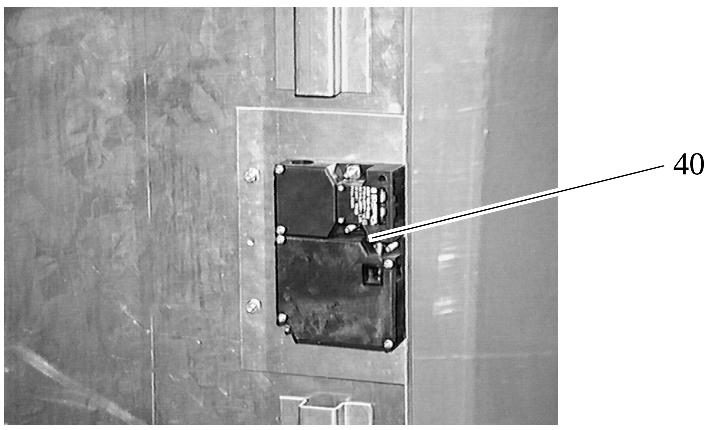


Pos.	Grau-No.	Manufac.-No.	Description
35	141000094		Kompressor Sondermodell 30/4 Compressor special model 30/4

12.4.3 Quadro Tower

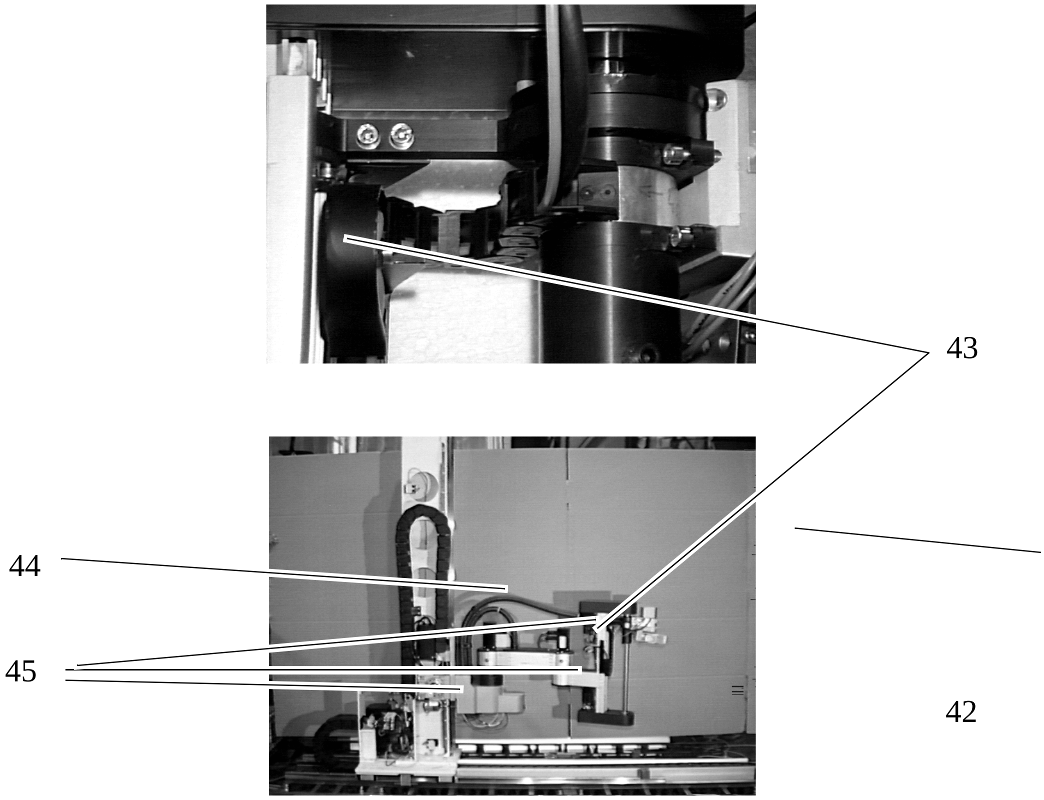






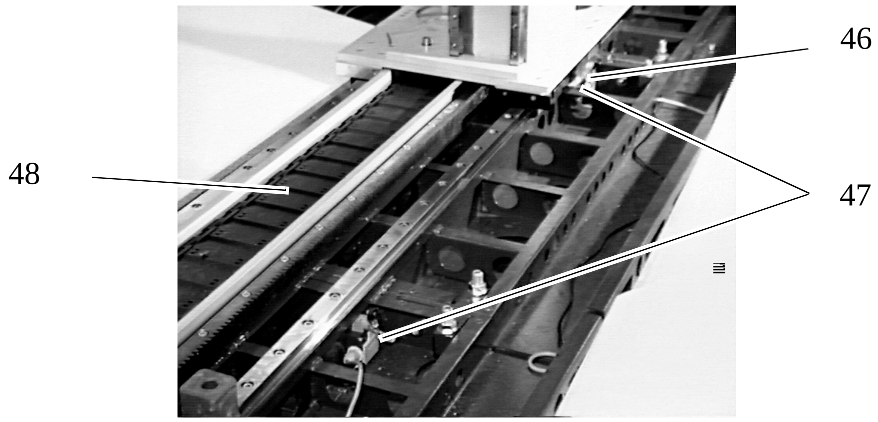
Pos.	Grau-No.	Manufac.-No.	Description
-	E32100001		Quadroturm 12/15/18R (Ersatzteilpaket) Quadro tower
			Getriebe QT Gear of Quadro tower
36	15m200007	3842 508 555	Elektromotor für HT und NT electric motor for main tower and auxi-liary tower
37	118000001		Planetengetriebe FABS 25-89 Serie Robus (Hauptturm) planetary gear
38	118000002		Planetengetriebe FABS 15-89 Serie Robus (Nebenturm) planetary gear
			Verkleidung QT Covering of Quadro tower
39	119000306	717R01-AF	Federclip spring clip
40	15s410002	160-13YRPA	Sicherheitsschalter AZM safety switch
41	15s010022	3SE3 200-1E	Positionsschalter positioning switch
	323000530	0080 002 793	Klammer SX-PN clamp

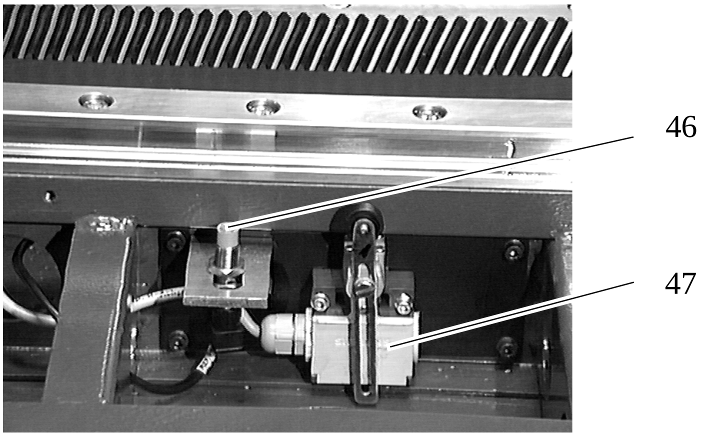
12.4.4 Robot SR 80G



Pos.	Grau-No.	Manufac.-No.	Description
			Schwenkarmroboter SR 80 G Scara robot
42	321000800	3842 513 400	Schwenkarmroboter kompl. complete scara robot
43	322000825		Energieführung Greifer gripper power connection
44	15a200033		Installationssatz für Roboter installation kit for robot
45	15b200001		Nährungsschalter (for A1 - A4) M8 x 1 BDG:PNP proximity switch

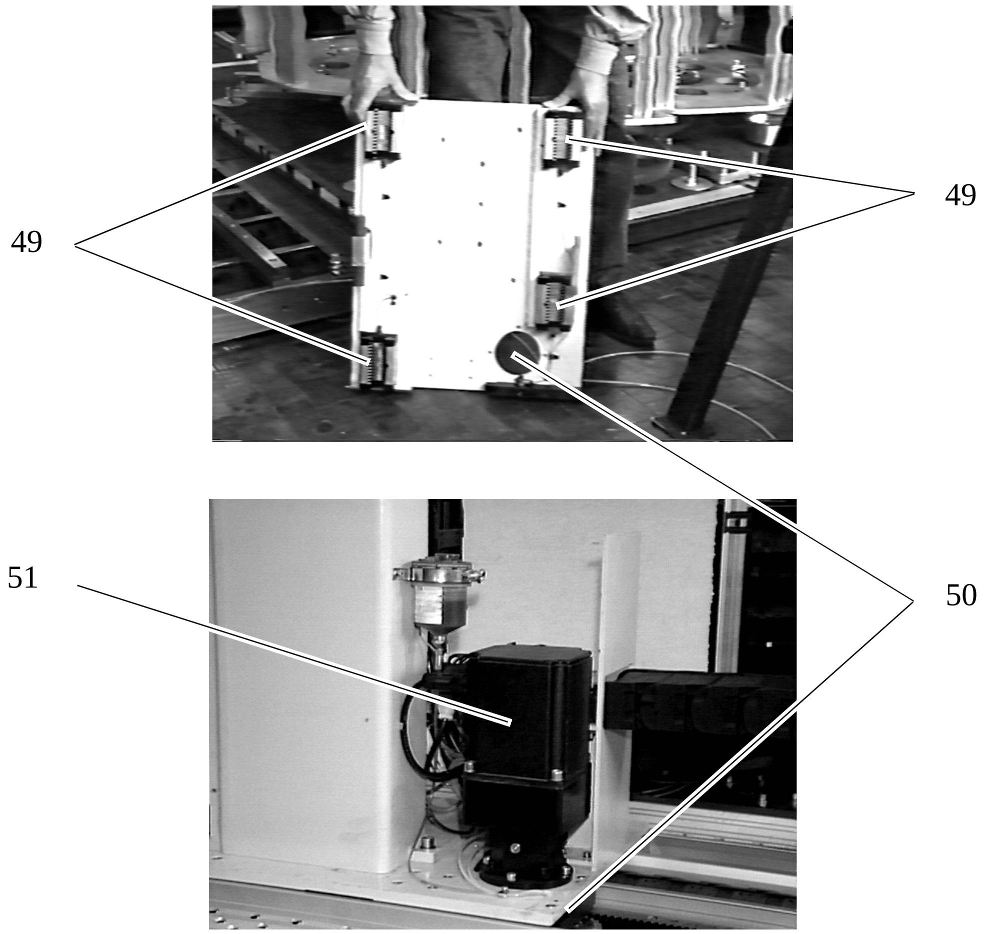
12.4.5 Track





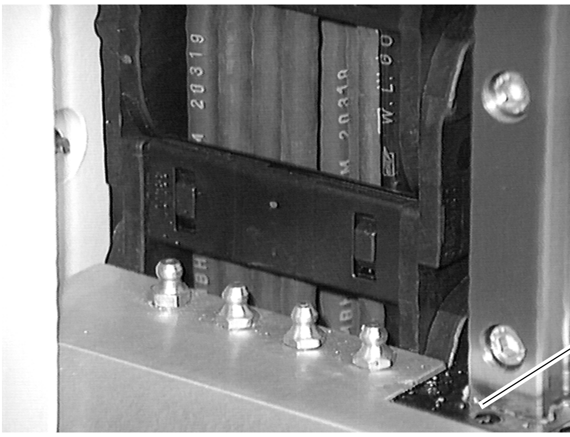
Pos.	Grau-No.	Manufac.-No.	Description
-			Fahrweg Track
46	15b330002	NJ4-F1E2	Näherungsschalter proximity limit switch
47	15s010021	3SE3 210-1U	Positionsschalter positioning switch
48	160 000 036		Kettenglied chain-link

12.4.6 Carriage



Pos.	Grau-No.	Manufac.-No.	Description
-			Fahrwagen Roboter rechts Right carriage of robot
49	127000001		Führungswagen Gr. 35 guide carriage size 35
50	117000001		Ritzel mit Kerbverzahnung DIN 5480 pinion with serration
51	322001001		Antrieb kompl. für Fahrwagen complete drive of carriage

12.4.7 Lifting Column



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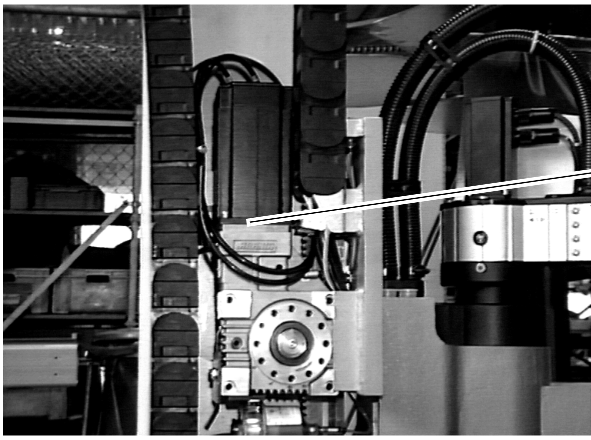

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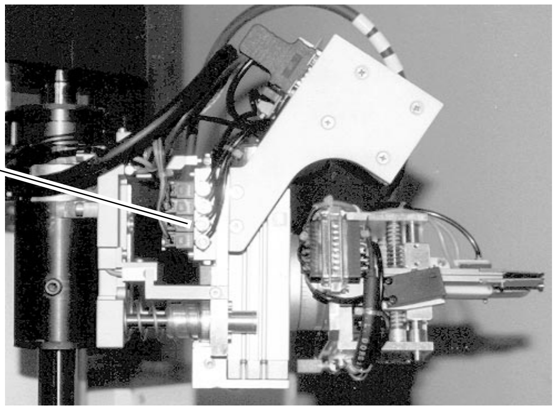
Pos.	Grau-No.	Manufac.-No.	Description
-			Hubsäule Lifting device
52	127000002	1622-293-10	Führungswagen Gr. 25 guide carrage size 25
53	15s010020	3SE3 210-1E	Positionsschalter positioning switch
54	15b330002	NJ4-F1E2	Näherungsschalter proximity limit switch
55	322001002		Antrieb kompl. für Hubsäule complete drive of lifting device
-	323001173		Führungsrolle Hubsäule guide roller for lifting column
-	113000086		Sicherungsring für Führungsrolle Hubsäule retaining ring for guide roller of lifting column

12.4.8 Gripper

61



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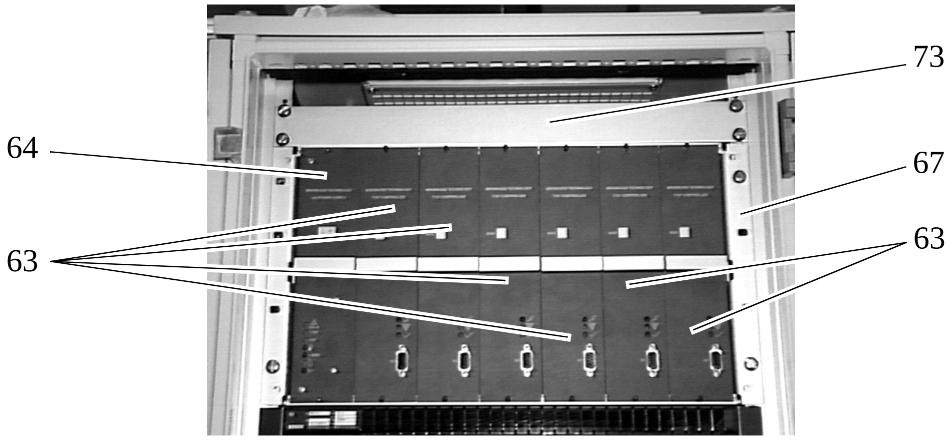
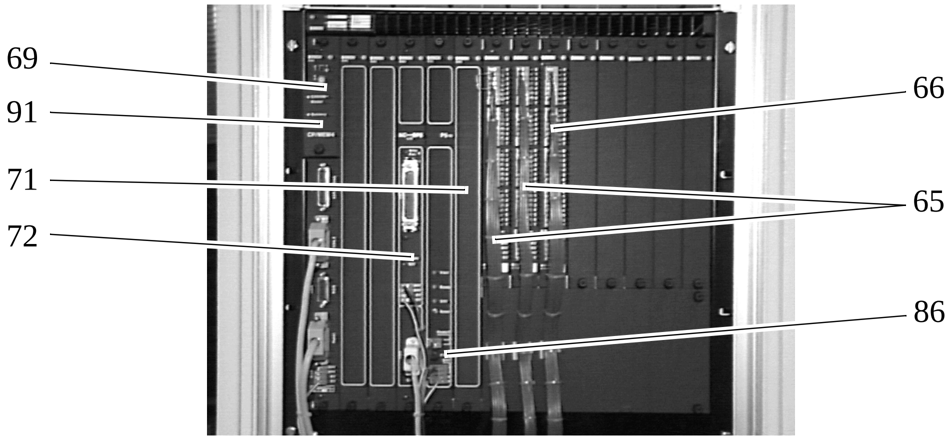
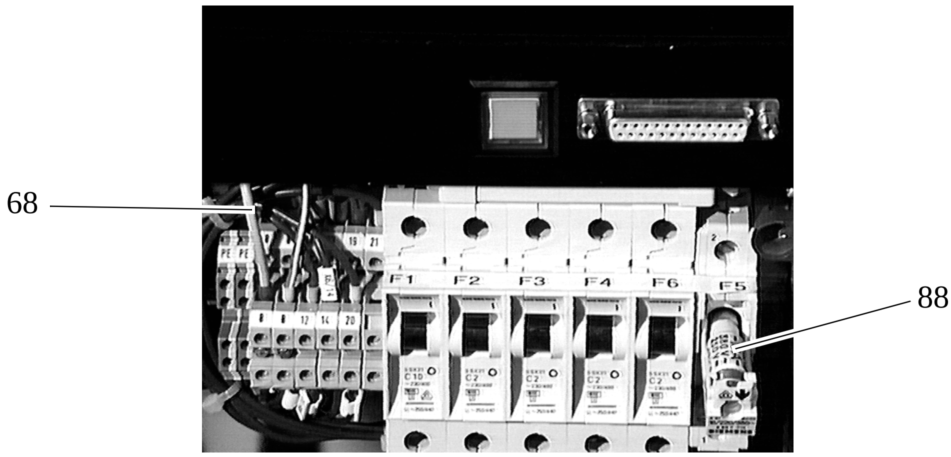
Pos.	Grau-No.	Manufac.-No.	Description
-			Greifer Gripper
56	321000400		Greifer für Barcode 39 Gripper for Barcode 39
	321002480		Greifer für STK-Label Gripper for STK label
57	401002100		Greifer AML/2/E für 3480 Kassette gripper AML/2/E for 3480 cartridge
58	401001220		Greifer AML/2/E OD-Mixedmedia Gripper AML/2/E OD mixedmedia
59	401004050		Greifer AML/2/E D2 Kassetten Gripper AML/2/E D2 tapes
60	401004920		Parallel-Greifer große Medien parallel gripper large media

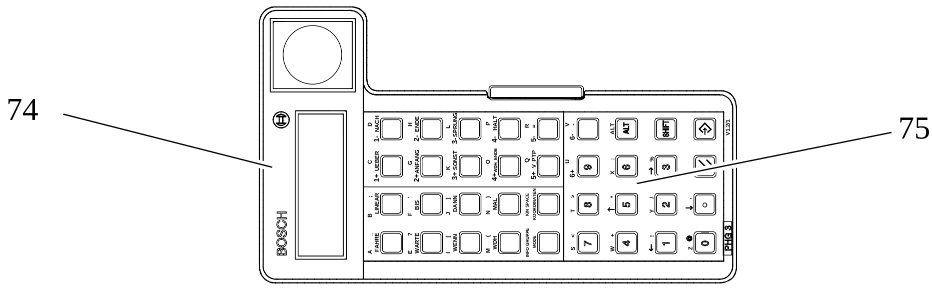
Pos.	Grau-No.	Manufac.-No.	Description
61	401004930		Parallel-Greifer kleine Medien parallel gripper small media
62	123000163		O-ring for gripper D2

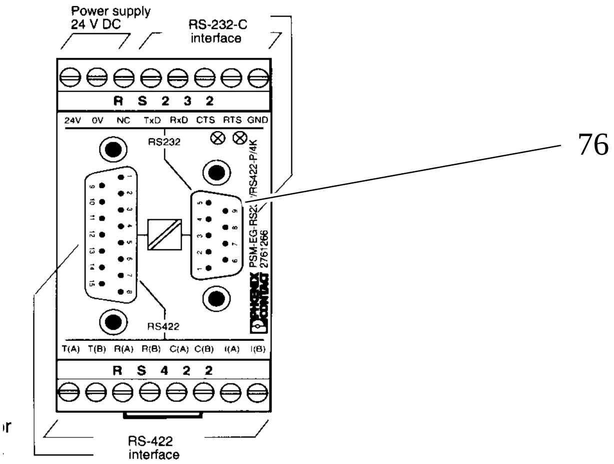
12.4.9 Control Cabinets











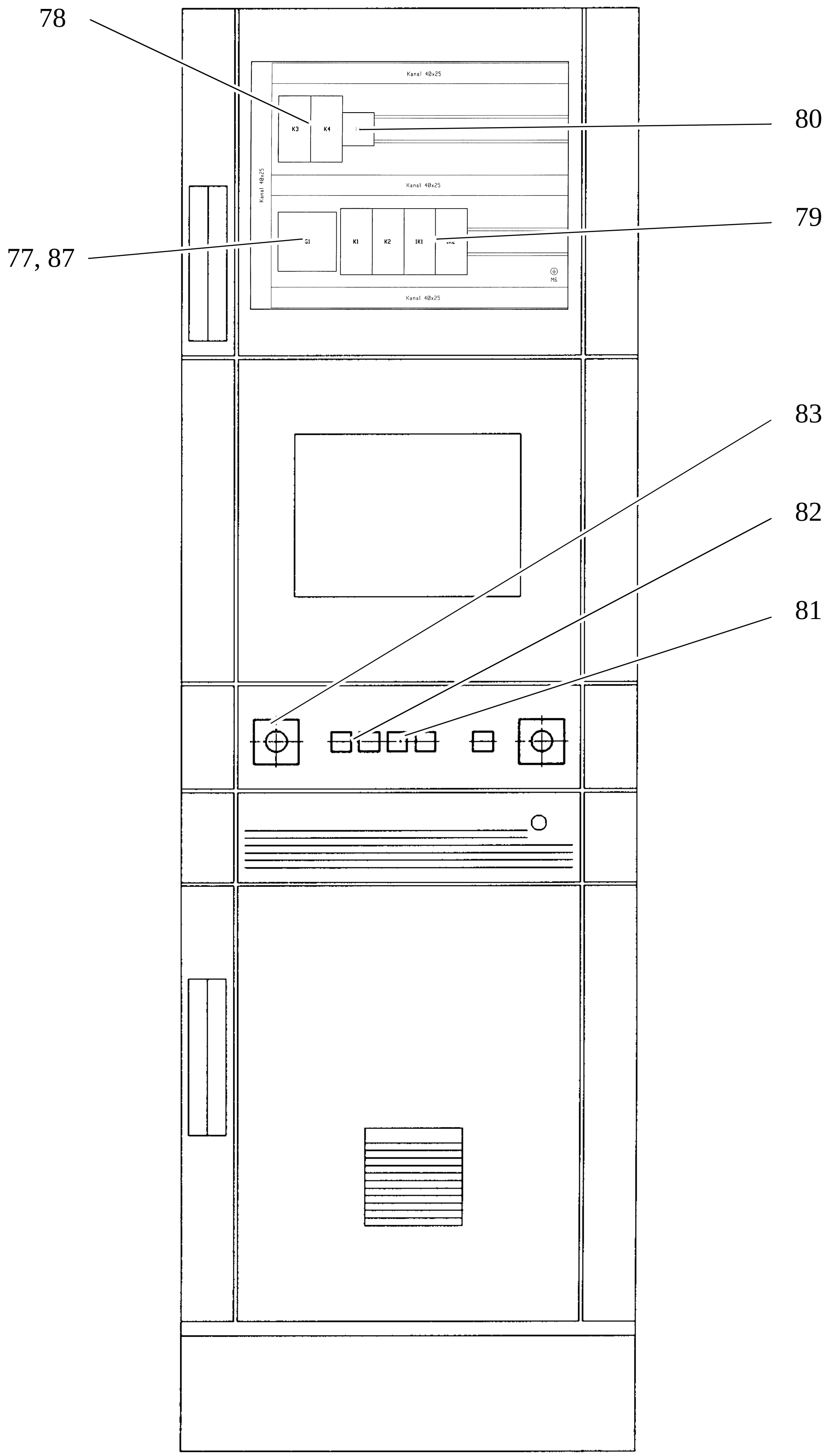
Pos.	Grau-No.	Manufac.-No.	Description
-	E32700001		Steuerschrank Basisausstattung Control cabinet basic equipment
63	15a200035	3842 403 497	Achskarte SM 3,5/8 GC (Achsen 2 - 4) (Antriebsverstärker) axis board
	15a200036	3842 403 498	Achskarte SM 4,7/20 GC (Achse 1) (Antriebsverstärker) axis card
	15a200037	3842 403 499	Achskarte SM 6,5/30 GC EC (Achsen 5, 6 und HT, NT) (Antriebsverstärker) axis board
64	15a200005	3842 403 206	Stromver.-Einschub (Netzteil 160) current supply plug-in package
65	15a200019	1070 047 961	Eingangs-Karte 24V/32F input adapter
66	15a200020	1070 050 560	Ausgangs-Karte 24V/0,5A output adapter
67	15a200010	3842 403 353	Servo-Rack für 6 Achsen (19” Rack für Antriebsverstärker) servo rack for 6 axis

Pos.	Grau-No.	Manufac.-No.	Description
68	15a200002	3842 404 096	Netzteil 5kVA (Netz-Einschub) power pack
69	15a200039	1070075198	CP-MEM5 Prozessorplatte 15 MHz (Karte CP/MEM 5) processor plate
	15a200040		CP-MEM5 Prozessorplatte 30 MHz (Karte CP/MEM 5) processor plate
70	15a200030		Operating system for rho 3 (TO03G)
	15a200042		Operating system for rho 3(TO05L)
71	15a200016	1070 047 181	Netzteil PS75 power pack
72	15a200017	1070 071 304	Steckkarte PC-I/O+CAN (Karte NC-SPS-I/O) plug-in card
73	15a040001		Einschublüfter SK3142 24VDC (Lüfter für Antriebsverstärker) plug-in ventilator
74	15a200006	3842 403 460	PHG German PHG German
75	15a200027		Folie (English) für PHG Foil in English for handheld pro- gramming unit

Option Scanner

Pos.	Grau-No.	Manufac.-No.	Description
-	E32700003		Steuerschrank Option Scanner Control cabinet option Scanner
76	15a020003		Konverter PSM-EG Converter

12.4.10 Operating Cabinet



Pos.	Grau-No.	Manufac.-No.	Description
-	E32700005		Bedienschrank Operating cabinet
77	15g190001		Netzgerät 230V DC-24V-AC power rectifier
78	15k010014	62-OBB4 62E	Schütz 3TH42 (K3, K4) protector
79	15k010010	40-OBB4 40E	Schütz 3TH30 (1K1, 1K2) protector
80	15k010015	10-OAL2 HS	Schütz 3TF20 (K6 Licht) protector 3H 1S
81	15v240003		LED gelb LED yellow
82	15v240001		LED grün LED green
83	15q180001		Hauptschalter Frontbefestigung main switch

12.4.11 AMU

Pos.	Grau-No.	Manufac.-No.	Description
-	E32700007		AMU (AML Management Unit)
-	15a220001	3211	qCOM Packages -ARTICm/2
-	15a230001	92F4520	Token-Ring Adapter
-	15a230003	39F7597	Koaxkarte 3270 Conncection coaxial board
-	15a230004		AMU kmpl. (Tastatur/Bildschirm/Maus) complete AMU (keyboard/screen/ mouse)
-	15a910001		BOCAMODEM Ultra Performance M144GR
-	15a230002	6451013	Dual ASYNC Adapter
-	15a930001		Etherlink Karte Koax 10BASE-T Etherlink Card coaxial
-	15a230116		SDLC Multiport Adapter

12.4.12 Wire and Fine Wire Fuses

Pos.	Grau-No.	Manufac.-No.	Description
-	E32700006		Schmelz- und Feinsicherungen Cut-out fuses and fine-wire fuses
84	15f110001	45G340	Feinsicherung 0,2 A MT (BDE E/A-Einheit/A), fine-wire fuse
85	15f110002	45G622	Feinsicherung 6,3 A T (E/A-Einheit/A), fine-wire fuse
-	15f110003	45G600	Feinsicherung 2 A T (Ausgangs-Karte), fine-wire fuse
86	15f110004	45G264	Feinsicherung 10 A F (Netzteil PS75), fine-wire fuse
-	15f110005	45G55	Feinsicherung 3, 15 AMT (Karte NC-SPS-I/O), fine-wire fuse
87	15f110006	45G455	Feinsicherung 5 A T (Bedienschrank), fine-wire fuse
-	15f106001	45G615	Feinsicherung 2.5/415V (Netzteil 160 F1) fine-wire fuse
-	15f110008	46G333	Feinsicherung 10 A T, (Netzteil 160 F2) fine-wire fuse
-	15f110009	45G323	Feinsicherung 1 A T (Vision-System IRIS), fine-wire fuse
-	15f110010	45G390	Feinsicherung 0,63 A MT (DET), fine-wire fuse
88	15f260001		Sicherung Neozed 10 A fuse
-	15f110011		Behälter Typ: AB 6-12 box

12.4.13 Storage Boxes for Libary Segments

Pos.	Grau-No.	Manufac.-No.	Description
	323000774		cover for all types of handling boxes
	322000360		handling box for 3480/90 cartridges
	323004757		box for 3480/90 cartridges
	323004756		box for 3480/90 cartridges with teach label
	402003490		handling box for D2 medium cartridges
	402004600		box for D2 medium cartridges
	402004610		box for D2 medium cartridges with teach label
	402003110		handling box for D2 small cartridges
	402004620		box for D2 small cartridges
	402004630		box for D2 small cartridges with teach label
	402002890		handling box for TK cartridges
	402004680		box for TK cartridges
	402004690		box for TK cartridges with teach label
	402001120		handling box for VHS cartridges
	402004700		box for VHS cartridges
	402004710		box for VHS cartridges with teach label
	402002470		handling box for Optical Disc 512
	402004640		box for Optical Disc 512
	402004650		box for optical disc 512 with teach label
	402001180		handling box for optical disc reflection
	402004660		box for optical disc reflection

Pos.	Grau-No.	Manufac.-No.	Description
	402004670		box for optical disc reflection with teach label
	402003100		handling box for 8 mm cartridges
	402004580		box for 8 mm cartridges
	402004590		box for 8 mm cartridges with teach label
	402003320		handling box for 4 mm cartridges
	402004560		box for 4 mm cartridges
	402004570		box for 4 mm cartridges with teach label

12.4.14 Accessories and Tools for Maintenance

Lube cartridges

Pos.	Grau-No.	Manufac.-No.	Description
-	134000000		Schmierbüchse klein mit Structovis BHD (carriage, lifting column, Quadro tower) lubricating cartridge small
-	134000002		Schmierbüchse groß Centoplex GLP 500 (carriage) lubricating cartridge big

Lubricants

Pos.	Grau-No.	Manufac.-No.	Description
-	178000000		Fett Isoflex Topas NCA 52 grease
-	178000001		Fett Retinax EP2 grease
-	178000079		Schmierfett Grafloscon C-SG 0 grease
-	178000003		Öl Syntheso HT 220 oil
-	144000009		Getriebeöl-Gebinde Set gear oil set
-	173000004		Loctite 572 Rohrgewindedichtmittel 572 Loctite pipe thread proofing compound
-	173000005		Loctite 243 Schraubensicherung 243 Loctite for screw locking

Hoses

Pos.	Grau-No.	Manufac.-No.	Description
-	140000240		Schlauch PU4 schwarz PU4 hose black
-	140000332		Schlauch PU6 schwarz PU6 hose black

Pos.	Grau-No.	Manufac.-No.	Description
-	140000210		Schlauch PU3 schwarz PU3 hose black
-	144000010		Fettpresse 405mm (Achtung: nur in Verbindung mit Panzerschlauch 140000364) grease gun (Attention: only in connection with armoured tube 140000364)
-	140000364		Panzerschlauch 300mm armoured tube

Miscellaneous

Pos.	Grau-No.	Manufac.-No.	Description
-	130000002	404603	Einsteckhülse insert sleeve
-	130000003	404611	Kegelring securing ball ring
-	130000004	404612	Überwurfschraube male fitting
-	130000008	323541	Verteiler. 3xM8x1 distribution bus bar
89	130000011		Kegelschmiernippel AM8x1 hydraulic-type lubrication nipple
-	130000063		Flachdichtring A10x13 flat conical nipple
-	119000000		Klemmriegelverschluß clamping closer
90	323000191		Filzzahnrad 118x22 felt toothed gear
-	141000108		Filtereinsatz Kompressor micro filter compressor
91	15a200018		CP/MEM Batterie CP/MEM battery
-	15a200021		Filtermatte rho (bei Bedarf) filter matting rho (when required)

Pos.	Grau-No.	Manufac.-No.	Description
-	15a200034		Filtermatte SPS (bei Bedarf) filter matting SPS (when required)
-	170000000		Meßuhr (0,01mm) dial gauge
-	170000001		Halterung für Meßuhr fixing device for dial gauge
-	170000002		Anschlagwinkel 500x280 stop angle
-	170000003		Federwaage 300N spring scale
-	171000006		Lösewerkzeug H-D loosening tool
-	322002721		Klemmklotz für Hubsäule clamping device for lifting device
43	322000825		Energieführung Greifer gripper power connection
-	327000365		Systemkabel system cable
-	171000047		Außen Einspreng-Zange (für Führungsrolle Hubsäule) retaining ring pliers (for guide roller of lifting column)
	171000029		Innensechskant Drehschlüsselsatz Allenkey set

12.4.15 Standard equipment aids

Mechanical

Pos.	Grau-No.	Manufac.-No.	Description
-	401000304		Teach-Lehre 7° (3490/3590) Teach template
-	401000305		Teach-Lehre 0° (6390/7490) Teach template
-	401000306		Teach-Lehre `80 (3480/3580, Philips LMS) Teach template
-	401001089		Teach-Lehre `80 (6380/7480) Teach template
-	401000638		Teach-Lehre (5180 Tandem) Teach template
-	401000402		Teach-Lehre VHS-Medium Teach template
-	401000403		Teach-Lehre OD Refection Teach template
-	401003270		Teach-Lehre D2 Teach template
-	401003280		Teach-Lehre OD 512 Jukebox IBM 3995,EA Teach template
-	401003290		Teach-Lehre OD 512 Sony Teach template
-	401004550		Teach-Lehre 4mm HP Teach template
-	401000531		Teach Lehre 8mm Teach template
-	401000921		Teach-Lehre DLT Teach template
-	401001604		Teach-Lehre STK 9490 Timberline Teach template
-	401001861		Teach-Lehre DTF Large, Small, Betacam Teach template

Pos.	Grau-No.	Manufac.-No.	Description
-	401001691		Teach-Lehre SNI3588, STK4890, Mag-star Teach template
	401001802		Teach-Lehre CD-Caddy Teach template

Electrical

Pos.	Grau-No.	Manufac.-No.	Description
-	327000365		Kabel für Inbetriebnahme cable for operation

12.5 Example Robot Data Sheet

12.5.1 German Orginal (BOSCH)

Maschinenbegleitkarte

Schwenkarmroboter SR80-G 3 842 513 400 (321 000 800)

Seriennummer ______________________________

<u>Steuerungsparameter</u> (Ergänzung zu 3 842 404 548)

207 Referenzpunkt Istwert	A1....................	Grad
	A2....................	Grad
	A3....................	mm
	A4....................	Grad
208 Referenzpunkt Versatz	A1....................	Grad
	A2....................	Grad
	A3....................	mm
	A4....................	Grad
307 Achslängen	L1....................	mm
	L2....................	mm
	L3....................	mm
	L4....................	mm
	L5....................	mm
310 Verschiebung des RK-Systems	X_0....................	mm
	Y_0....................	mm
	Z_0 0	mm
	01_0....................	Grad
	02_0 0	Grad
	03_0 0	Grad

<u>Antriebsparameter</u> (Ergänzung zu 3 842 404 550)

hpo Home Position Offset	A1....................	Grad
	A2....................	Grad
	A3....................	mm
	A4....................	Grad

Ausgestellt am:_____________ von:______________

MASCHBG.DOC

BOSCH
Flexible Automation

IA3/FVA1 9/94

12.5.2 English Translation of Robot Data Sheet

Robot Data sheet

Swivel arm robot SR80-G 3 842 513 400 (321 000 800)

Serial number ______________________________

Control Parameter (Completion to 3 842 404 548)

207 Reference point positiont	A1....................	degree
	A2....................	degree
	A3....................	mm
	A4....................	degree
208 Reference point offset	A1....................	degree
	A2....................	degree
	A3....................	mm
	A4....................	degree
307 Length of axis	L1....................	mm
	L2....................	mm
	L3....................	mm
	L4....................	mm
	L5....................	mm
310 Offset of world coordinate system	X_0....................	mm
	Y_0....................	mm
	Z_0 0	mm
	01_0....................	Grad
	02_0 0	Grad
	03_0 0	Grad

Drive parameter (Completion to 3 842 404 550)

hpo Home Position Offset	A1....................	degree
	A2....................	degree
	A3....................	mm
	A4....................	degree

Exhibit on:______________ from:_______________

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12.6 Example Gripper Data Sheet

Gripper Data Sheet

- Gripper AML/2/E for 3480 Cartridges — Part Number: 401 004 840
- Gripper AML/2/E for D2 Cartridges — Part Number: 401 004 050
- Gripper AML/2/E for OD-multimedia — Part Number: 401 001 220
- Parallel Gripper small AML/2/E PS — Part Number: 401 002 093
- Parallel Gripper large AML/2/E PL — Part Number: 401 002 092

Gripper Serial Number	
Scanner Serial Number	
Scanner Software	

Par. No.	Parameter	Line in KONFIG.DAT			Value	
	Software release	**2.20**	**2.30**		**Standard Gripper**	**Parallel Gripper**
	AML System	**E/2**	**E**	**2**		
152	G_Y_BC		284	280		
154	G_Y_CAMERA	271				
155	G_Z_CAMERA	272				
153	G_X_TEACH		286	282		
154	G_Y_TEACH		287	283		
155	G_Z_TEACH		288	284		
156	G_X_OFFSET	274	290	286		
157	G_Y_OFFSET	275	291	287		
158	G_Z_OFFSET	276	292	288		

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