

## *E1 Semi-automatic screen printer System Manual*



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## CE Declaration of Conformity

in accordance with the EC Machine Directive 89/392/EEC, Appendix IIA

**We hereby confirm that the type of construction of:**

**Screen Printing Machines and Printer Lines of the following models:**

Microtronic II, Microtronic III, Microtronic IV, Microtronic V, Microtronic VI, Microtronic VII, M8  
Mat-S15, Mat-S20, Mat-S30, Mat-S40, Mat-S45, Mat-S50, Mat-S55, E1, E3XL, E4, E5 Series, X5 Series,  
High Speed Printer, Microtronic III Line, Varistor Printing Line, Glass Printing Machine

**Dryers of the following models:**

IR Dryer 2500 x 600, 3500x650, TRO-REMA

**Handling Devices:**

Magazine Loader, Magazine Reloader, Stack Loader, Oven Loader and Reloader,  
Laser Loader and Reloader, Hand-over Unit, Transport Conveyor, Control Conveyor

manufactured by EKRA Eduard Kraft GmbH (year of construction: as of 12/92)

**conform to the following relevant regulations:**

- EC Machine Directive 89/392 EEC, Appendix IIA of June 14, 1989
- EC Machine Directive 91/368 EEC of June 20, 1991
- EC Low-Voltage Directive 73/23 EEC
- Electromagnetic Compatibility 89/336/EEC

**applied harmonized standards:**

- DIN EN 292 Part 1 and Part 2 (safety of machines, devices and systems)
- DIN EN 29001 / ISO 9001 (quality standards)
- DIN EN 60204 Part 1, electrical equipment of machines


**applied national standards and technical specifications:**

- - VBG 4, VBG 5, VBG 7a accident prevention regulations
- - ZH 1 545 (safety regulations for screen printing machines)
- - ZH 1 597 (safety regulations for contact-free safety equipment in power-driven facilities)
- - DIN/VDE 0530 T1 (rotating electrical machines)
- - DIN/VDE 0660 T2 (low-voltage controlgear/switchgear and switching elements)
- - DIN 57113/VDE 0113 (electrical equipment of machines)
- - DIN/VDE 0100
- - DIN 40050 (degree of protection IP)

**corresponding to Appendix V of the EC Machine Directive:**

- CE symbol is attached to the machine so that it is clearly visible
- Technical documentation is available for inspection at the manufacturer's factory.
- Descriptions of the machines can be found in the relevant User Manuals

EKRA Eduard Kraft GmbH  
Bönningheim 1.12.2000



W. Kraft (General Manager)

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## **Declaration of Trained Personnel**

## **1 Introduction**

### **General**

This user's manual is supplied with the E1 semi-automatic screen printer.

It explains the function of the printer, provides information concerning possible hazards during operation, contains detailed information concerning the correct use of the machine and describes the necessary maintenance and troubleshooting measures.

Before commissioning the machine, you should read the user's manual thoroughly even if you have attended a training course explaining how to operate the machine.

Sign the last page to verify that you have fully read and understood the user's manual. The owner of the machine is only permitted to authorise personnel who satisfy this requirement to operate and maintain the machine.

### **Safety and accident prevention**

All E1 printers incorporate the very latest technology and are totally reliable. Nevertheless, a number of rules which will protect the machine and reduce the risk of injury must be observed.



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#### **Note:**

**It is particularly important to observe the >basic safety instructions<: Chapter 2>Safety, Hazards<.**

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**Structure of the user's manual**

This user's manual has 10 chapters.

Chapter 1 **Introduction** provides general information concerning the user's manual and describes the steps to be taken when taking delivery of the machine. It also contains information concerning transport, commissioning and possible repairs. It deals with the basic safety instructions as well as general safety measures and the associated regulations.

Chapter 2 **Safety, Hazards** describes general rules with respect to the machine and possible hazards as well as the appropriate measures to be taken to prevent injuries.

Chapter 3 **Description of the Machine** describes the main components of the machine and provides an overview of the options and their function (application).

Chapter 4 **Switching On and Off** explains how to switch on / switch off and start the printer.

Chapter 5 **Operation** explains the procedures used for operating the E1 semi-automatic printer.

Chapter 6 **Manual Optical Positioning System** explains the way the MOPS works and how to use it.

Chapter 7 **Drawings and Parts Lists** contains the drawings and mechanical parts lists for the printer components.

Chapter 8 **Electrical and Pneumatic Equipment** contains an overview of the electrical and pneumatic assemblies and components and the related parts lists.

Chapter 9 **Maintenance** contains maintenance information.

Chapter 10 **Vendor Documentation** contains lists of the documentation supplied.

## Symbols

Symbols are used to present the information contained in the user's manual in a simple and clearly organised manner.

- indicates a list of points

□ indicates steps to be taken

⇒ indicates the result of an action



This symbol identifies texts which contain operating notes and useful information for optimum handling and usage of the device.



This symbol identifies critical points which may cause damage to the device, faulty operation or incorrect production.



This symbol indicates hazards which are potentially fatal, may be detrimental to health or may cause serious injury.

The potential hazards are explained in Chapter 2 >Safety, Hazards<.

## Terminology

The following terms and abbreviations are used in the user's manual:

**Print material** - Parts that are to be printed.

**Printing medium** - Paste, solder, silicone or other materials which are applied to the part to be printed.

**Coating, flooding** - Application of the printing medium to the stencil before the actual printing process.

**PCB** - The abbreviation PCB used in the manual stands for printed circuit board.

**Substrate** - Substrates can also be used as print materials instead of printed circuit boards. You will see this term used in some chapters.

## Notation

CAPITALS indicate commands, instructions/functions and button/key labelling.

Italics are used for the requirements necessary for an action.

## Taking delivery of the machine



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**Note:**

**Follow the shipping instructions on the crates!**

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If the crates have to be opened for inspection by customs officials, always try to arrange for this inspection to be carried out at storage facilities on your company's premises. The packaging will most likely be destroyed during the customs inspection and the device will then be exposed to air humidity from the surrounding environment.

The entire shipment must be stored in a dry and (where possible and necessary) heated room. The shipment must never be stored outdoors. Protection against rain or intensive sunlight must also be provided.

When taking delivery of the machine, unload the crates and check that no components are missing.

## Transport, commissioning, repairs

### Transport



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**Note:**

**The machine weighs approximately 350 kg.**

**The device may only be lifted using suitable lifting gear (fork-lift truck / low-lift platform truck).**

**Personnel must not stand under suspended loads.**

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The lifting fork of the fork-lift truck or the platform of the low-lift platform truck must be positioned centrally under the bearing frame construction of the printer.

## **Commissioning**

The machine is installed / assembled by trained technicians from EKRA Eduard Kraft GmbH or authorised representatives.

## **Repair / modifications**

If your company has its own service department, repair work can be carried out by your personnel, provided that they have received appropriate, official training from EKRA.

EKRA must be notified of any repair work carried out by the owner during the warranty period.

If problems or faults occur which you cannot rectify yourself and which are not described in this user's manual, please contact the EKRA Service Hotline.

Telephone: ++49 (0) 7143/8844-0 Switchboard  
++49 (0) 7143/8844-72 Service Dept.

Service Dept. Please make a note of the following details before calling Ekra

Type of machine:	
Number of machine:	
Year of manufacture:	
Software Version: (might be on operation surface)	
E-Plan Version:	



### **Note:**

**You can obtain further contact addresses from:**

EKRA Eduard Kraft GmbH  
Zeppelinstrasse 16

D - 74357 Bönningheim

Telephone: ++49 (0) 71 43 88 44-0  
Facsimile: ++49 (0) 71 43 88 44 22 Sales Dept.  
Facsimile: ++49 (0) 71 43 88 44 29 Service Dept.



## **Basic safety instructions**

### **Observing the information in the user's manual**

Familiarity with the basic safety instructions and safety regulations is essential in ensuring that this machine is used according to the relevant safety requirements and that no faults are encountered during operation. This user's manual contains the most important information to ensure that the machine is operated in compliance with the relevant safety requirements.

The user's manual, especially the safety instructions, must be observed by all persons who use the machine.

Furthermore, the accident prevention rules and regulations applicable for the installation location must also be observed.

### **Obligations of the owner**

The owner must ensure that the machine is operated only by personnel

- who are familiar with the basic occupational safety and accident prevention regulations and trained to use the machine,
- who have read and understood the chapter on safety and the warnings in this user's manual and have verified this by signing the last page (see Appendix).

Inspections must be performed at regular intervals to ensure that the personnel are working in compliance with the relevant safety requirements.

### **Obligations of the personnel**

All personnel who are authorised to operate the machine are obliged

- to observe the basic occupational safety and accident prevention regulations,
- to read the chapter on safety and the warnings in this user's manual and to verify that they have understood their content by signing the last page.

**Possible hazards when operating the machine**

The E1 semi-automatic printer incorporates the very latest technology and is built to comply with the recognised safety regulations. Nevertheless, hazards which may cause injury to the user or third parties and result in damage to the machine or other material assets may still exist when the machine is being used.

The machine should only be used:

- for its intended purpose,
- if it is in perfect working order.

Faults, which may have a detrimental effect on safety, must be rectified immediately.

**Proper use**

The E1 semi-automatic printer is intended for printing printable SMT materials (solder paste, SMD adhesive).

The machine can also be used for printing hybrid and solar cell media.

Any other use deviating from the machine's intended purpose is considered to be incorrect.

EKRA Eduard Kraft GmbH shall refuse all liability for any damage resulting from incorrect use.

Proper use also means that:

- all information in the user's manual must be complied with
- and the inspection and maintenance intervals must be observed.

**Warranty and liability**

Our "General Terms and Conditions of Sale and Delivery" shall apply. They shall be available to the owner upon conclusion of the contract at the latest. Only EKRA Eduard Kraft GmbH is permitted to issue promises of warranty. If defects or damage are repaired by the customer or by a third party without the prior agreement of EKRA Eduard Kraft GmbH, the latter shall refuse all liability for consequential damage and cannot acknowledge any further warranty claims.

Warranty and liability claims for injury and damage shall be excluded if they are due to one or more of the following:

- Incorrect use of the machine.
- Incorrect assembly, commissioning, operation and maintenance of the machine.
- Operation of the machine with faulty safety devices, or incorrectly attached or non-functional safety and protective devices.
- Failure to observe the information in the user's manual concerning transport, storage, assembly, commissioning, operation, maintenance and set-up of the machine.
- Arbitrary modifications to the construction of the machine.
- Arbitrary modification of programs which affect machine control.
- Insufficient monitoring of device components which are subject to wear.
- Incorrectly performed repairs.
- Severe damage caused by foreign bodies and force majeure.

**Safety regulations**

It is imperative that all operating personnel and, where applicable, service personnel observe these sections.

**Organisational measures**

All fitted safety devices must be inspected regularly.

**Safety devices**

The E1 semi-automatic printer is equipped with the following safety devices:

**Emergency-stop switches**

Emergency-stop switches interrupt the supply of power to the printer. An emergency-stop switch is fitted. It is located at the front on the left-hand side of the printer frame.

**Safety switches and locks**

The E1 semi-automatic printer uses hardware and software safety switches to prevent injuries caused by printer components during printing.

- When triggered, the hardware safety switches and software safety switches stop all moving parts.
- Mechanical locks are locked and released manually.

## Using safety devices

The following section describes where safety switches and locks are used.

- **Cover**  
A hardware safety switch is fitted at the rear of the cover. The software safety switches are activated when the cover is closed. The printer can only be used when the cover is closed. Opening the cover during a printing process triggers an emergency stop.
- On the front of the machine, below the cover, is a cleaning flap. The flap is monitored by a safety switch. Opening the cleaning flap during a printing process triggers an emergency stop.
- A safety screen is fitted at the inlet to the printing table.
- The safety screen is safeguarded by a hardware safety switch. It protects the operator from reaching into the print area from the outside. If the screen is moved, an emergency stop is triggered.
- **Enclosures**  
The front and rear enclosures are protected from unauthorised opening either by a switch gear cabinet lock or by being screwed in place.



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### Caution:

**The operator must not disable any of the safety devices.  
The printer must never be operated without the enclosures.**

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## Bypassing the locks

In certain situations, power must be supplied and the printer must be operated while the side doors or covers are open (e.g. troubleshooting and maintenance).



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### Note:

**Locks may only be bypassed in compliance with all relevant safety regulations by service personnel who have received special training in maintaining the E1 printer.**

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### Caution:

**All of the safety devices must be fitted properly and function correctly before the machine or system is started.**

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Safety devices may only be removed:

- if the machine is at rest and service work is to be carried out and
- if measures have been taken to ensure that the machine cannot be started inadvertently.

## Checking safety devices

- Cover
  - ☐ Start the machine while the cover is open.  
⇒ The E1 printer should not start.
  - ☐ Open the cover during a printing cycle.  
⇒ An emergency stop must be triggered.
- Cleaning flap
  - ☐ Start the machine while the cleaning flap is open.  
⇒ The E1 printer should not start.
  - ☐ Open the cover during a printing cycle.  
⇒ An emergency stop must be triggered.
- Safety screen
  - ☐ Start the machine with the safety screen set at an angle.  
⇒ The E1 printer should not start.
  - ☐ Move the safety screen during a printing cycle.  
⇒ An emergency stop must be triggered.

### **Informal safety measures**

- The user's manual must always be kept in the immediate vicinity of the machine.
- In addition to the user's manual, the generally applicable and local accident prevention and environmental protection regulations must also be made available and observed.
- All safety instructions and warnings on the machine must be kept in a legible state.

### **Training of personnel**

- Only trained and instructed personnel are permitted to operate the machine.
- Responsibilities for assembly, commissioning, operation, set-up, maintenance and repair must be divided up and assigned accordingly.
- Trainee personnel are only permitted to operate the machine under supervision of an experienced person.

### **Machine control**

- Never make program modifications to the software.

### **Safety measures under normal operating conditions**

- The machine should only be operated if all of the safety devices are fully functional.
- Before switching on the machine, ensure that no personnel can be injured by the machine as it starts.
- The machine must be inspected for visible damage and checked to ensure that its safety devices are functioning correctly at least once per shift.

### **Electrical hazards**

- Work on the electrical power supply should be carried out by trained electricians only.
- The electrical equipment of the machine must be checked regularly. Repair any loose connections and damaged cables immediately.
- The power supply unit must always remain closed. It may only be opened by authorised personnel.
- An explosive atmosphere must be avoided, as the electrical components are not explosion-proof.

### **Maintenance and repair, troubleshooting**

- The intervals specified for the prescribed maintenance and repair work must be observed.
- The operating personnel must be informed before any maintenance and repair work is started.
- Before commencing maintenance, inspection and repair work, care must be taken to ensure that the machine is de-energised and that the main switch cannot be switched on again inadvertently.  
A warning sign must be put in place to prevent the machine from being started by a third party.
- When replacing large assemblies, carefully attach and secure them to the lifting gear.
- Check loosened screw connections to ensure that they are secure.
- Once the maintenance work has been completed, check to ensure that the safety devices are fitted and are functioning correctly.



### **Structural modifications to the machine**

- No modifications should be made and no additional devices attached to the machine without the prior consent of the manufacturer.
- All modifications require written confirmation from EKRA Eduard Kraft GmbH.
- Faulty or damaged device components must be changed immediately.
- Only genuine spare and wearing parts should be used. The design and construction of components from other manufacturers may not be able to satisfy the stress and safety requirements of the machine.

### **Cleaning the machine and disposal**

- Used materials must be handled and disposed of correctly. This particularly applies to lubricants, adhesives and solder pastes. Solder pastes and adhesives which can no longer be used must be returned to the manufacturer. Lubricants and residues of pastes and creams must be disposed of as hazardous waste.
- If pastes or adhesives containing solvents are used, the owner of the E1 printer must ensure that sufficient ventilation is provided. Furthermore, the concentration of vapours containing solvents must be continually monitored in order to avoid situations which are detrimental to the health of personnel.
- Cloths soaked in detergent are flammable! Observe the manufacturer's instructions.
- The national guidelines must be observed when disposing of waste materials.

### **First aid**

- If solder paste, adhesive or cream is swallowed, contact a doctor immediately.
- If materials come into contact with skin, wash the affected area thoroughly with soap and water.
- If materials come into contact with eyes, rinse thoroughly with plenty of water.

## 2 Safety / Hazards

### Safety precautions



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**Note:**

**EKRA recommends that you check all safety devices before using the E1 semi-automatic printer.**

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**Caution:**

**Always switch off the power supply at the main switch of the E1 printer before starting repair or maintenance work on the machine. The printer must not be operated if the safety devices are not functioning correctly.**

**Do not wear any loose-fitting clothing when working with the E1 printer.**

**Before commissioning the E1 printer, check whether there are any tools or damaged or loose parts which could prevent mechanical movement of the machine and thus cause damage.**

**Always wear protective gloves when handling solder paste.**

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**Danger:**

**Never reach into the printer during the printing process.**

**In an emergency, press the emergency-stop switch immediately to stop the E1 printer.**

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### Safety devices

Familiarise yourself with the E1 printer and the safety devices before beginning work.



Fig. 1. Safety devices

### Emergency-stop switch

An emergency-stop switch is fitted on the front left-hand side of the E1 semi-automatic printer. Pressing the emergency-stop switch interrupts the supply of power.

The emergency-stop switch should only be pressed in emergencies. The emergency-stop switch must be released before the machine is restarted.

**Cover**

A hardware safety switch is fitted at the rear of the cover. The software safety switches are activated when the cover is closed. The printer can only be used when the cover is closed. Opening the cover during a printing process triggers an emergency stop.

**Cleaning flap**

On the front of the machine, below the cover, is a cleaning flap. The flap is monitored by a safety switch. Opening the cleaning flap during a printing process triggers an emergency stop.

**Safety screen**

A safety screen is fitted at the inlet to the printing table. The safety screen is safeguarded by a hardware safety switch. It protects the operator from reaching into the print area from the outside. If the safety screen is moved, an emergency stop is triggered.

**Checking safety devices**

- Cover
  - ☐ Start the machine while the cover is open.  
⇒ The E1 printer should not start.
  - ☐ Open the cover during a printing cycle.  
⇒ An emergency stop must be triggered.
- Cleaning flap
  - ☐ Start the machine while the cleaning flap is open.  
⇒ The E1 printer should not start.
  - ☐ Open the cover during a printing cycle.  
⇒ An emergency stop must be triggered.
- Safety screen
  - ☐ Start the machine with the safety screen set at an angle.  
⇒ The E1 printer should not start.
  - ☐ Move the safety screen during a printing cycle.  
⇒ An emergency stop must be triggered.

## Hazards

It is important to observe the >Basic Safety Instructions< in Chapter 1.  
There is no risk of injury for operating personnel provided that the machine is operated correctly.

Operating personnel should be aware of the following hazards:



Fig. 2. Warning labels



### **Danger:**

The operator must take special care when the printing table is moving. Failure to do so could result in hand injuries if the operator reaches into the area containing moving parts.

### **Preventive measures:**

The operator should only reach into the area containing moving parts when the machine is switched off.



**Danger:**

Steel squeegees have particularly sharp edges. There is an increased risk of injury to the hand or lower arm when fitting/removing these components. Always follow the recommended sequence of fitting/removal steps, and wear protective gloves.



**Danger:**

Inhaling flux vapour may cause allergic reactions. Lead on the hands can enter the body when a person is eating, smoking or drinking, or when the hands touch mucous membranes.

**Preventive measures:**

Do not store solder paste in open containers and do not leave solder paste residue in the printer if it is not being used.

Always make sure that sufficient vapour extraction is provided. Do not touch mucous membranes with contaminated hands.

**Other hazards**



**Danger:**

Solder paste is a tin-lead alloy with a rosin-based fluxing agent.

Birth defects are possible if pregnant women who come into contact with solder containing lead fail to observe the personal hygiene recommendations.

**Preventive measures:**

Where possible, ensure that adequate vapour extraction is provided.

Do not allow vapours to be produced. Do not allow the solder paste to overheat in the machine.

Always wash hands before eating, smoking and drinking. Do not allow solder paste to come into contact with skin. Change contaminated clothing.

### **3 Description of the Machine**

#### **General**

The E1 screen printer processes solder pastes (precious metal pastes), resistor pastes, dielectric materials, silicones, conductive adhesives, lacquers and protective coatings to a degree of accuracy and quality that is absolutely essential for the production of sophisticated film circuitry such as hybrids, multilayers, LCDs, components, chip carriers and solar cells, and for SMD technology in general.

Printing can be performed on flexible or rigid base materials such as glass, ceramics, plastic or metal, with a material thickness of up to 10 mm.

The E1 semi-automatic screen printer is operated with the aid of a control panel and other operating elements.

A programmable logic controller (PLC) takes care of control of the machine. The supporting frame is made of rugged Itempofil.

The printing table is finely adjustable in the X, Y and theta directions. In conjunction with the manual optical positioning system (MOPS), it is perfectly possible to achieve printing results in the fine pitch range.

#### **Printing sequence**

The operator sets up the printing stencil in the machine by hand. Two clamping cylinders fix the stencil in position in the guideway.

The snap-off is adjusted by hand using a handwheel on the right-hand side of the machine. The value is indicated by a high-precision indicating instrument.

The operator adjusts the squeegee pressure with the pressure regulator on the control desk.

The solder paste is applied to the stencil by hand. The squeegee parameters, such as squeegee speed, front and rear squeegee position, printing mode and separation speed, are entered in the main menu on the control panel. The plastic cover over the print area must remain closed during printing.

The operator places a PCB in the PCB holder on the printing table by hand. The PCB clamping switch triggers the PCB clamping system, and the PCB is fixed in place in the holder. The printing process is started with the foot switch. The printing table moves in the X-direction from the loading position on the left to the printing position in the machine. The squeegee unit moves in the Y-direction from the rear towards the front. The printing process proceeds according to the printing mode. When printing is completed, the printing table moves out to the loading position. The operator removes the PCB from the printing table.



## Overview of the machine components

### Front of machine



Fig. 3. Front of machine

1 Main switch	7 MOPS cameras
2 Cleaning flap	8 Keypad
3 Snap-off and pneumatic settings on* right-hand side	9 Emergency-stop switch
4 Protective cover	10 Control desk
5 Print area	11 Printing table guideway
6 Screen for manual optical positioning system (MOPS)	12 Foot switch



## Electrical equipment

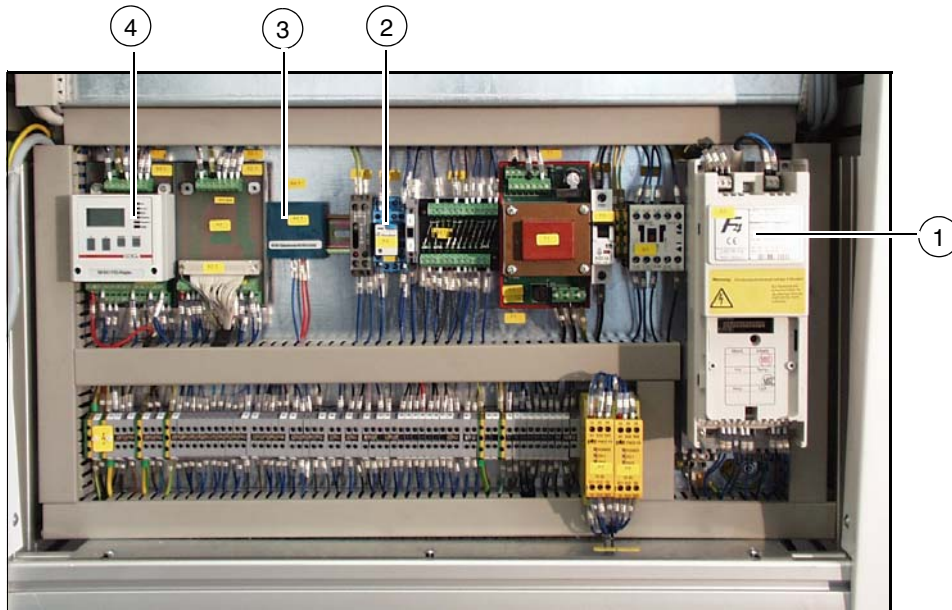


Fig. 4. Machine control

1 Frequency converter, printing table drive	3 Ballast module, delay, printing table
2 Changeover squeegee drive/snap-off	4 Motor control squeegee drive/snap-off

The electrical equipment including the machine control unit is located behind the front panel. This is fixed in place with four screws.

## PC positioning system MOPS

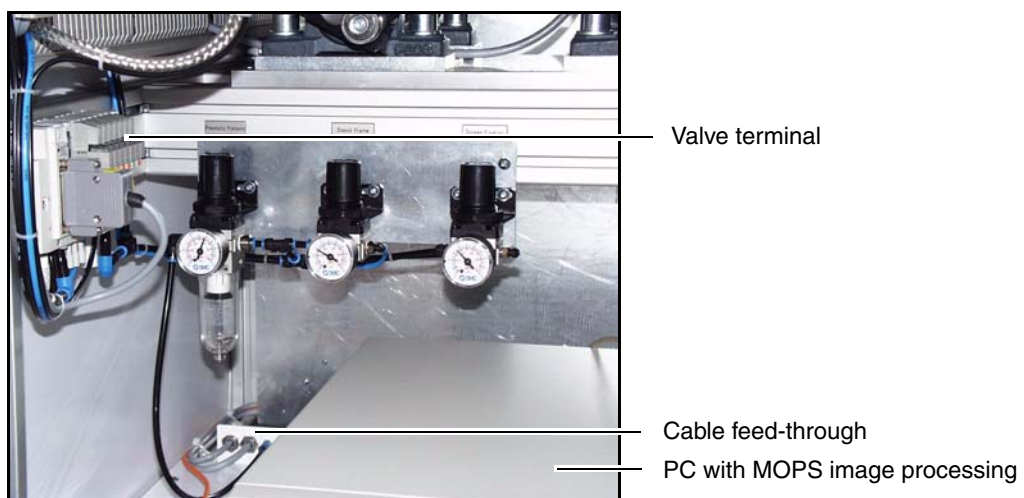
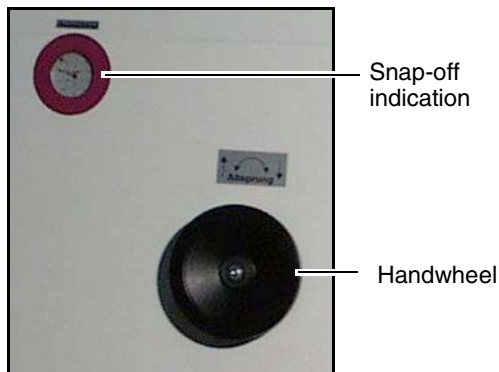


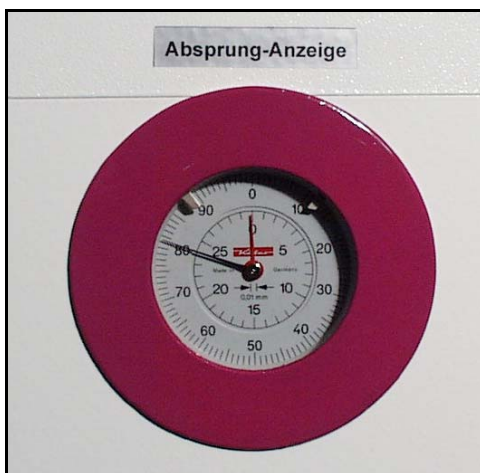
Fig. 5. PC positioning system / rear of machine

## Snap-off setting



To reduce snap-off:  
turn handwheel clockwise.

To increase snap-off:  
turn handwheel anti-clockwise.



One rotation of the  
outer indicator corresponds to  
1 mm snap-off

Fig. 6. Snap-off setting

## Pneumatic setting

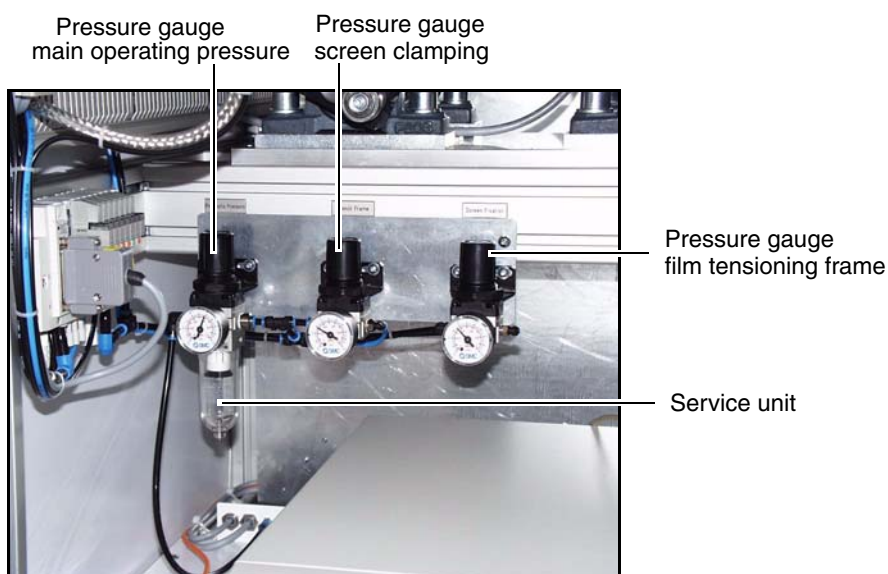


Fig. 7. Pneumatic control unit

## Print area, with cover open

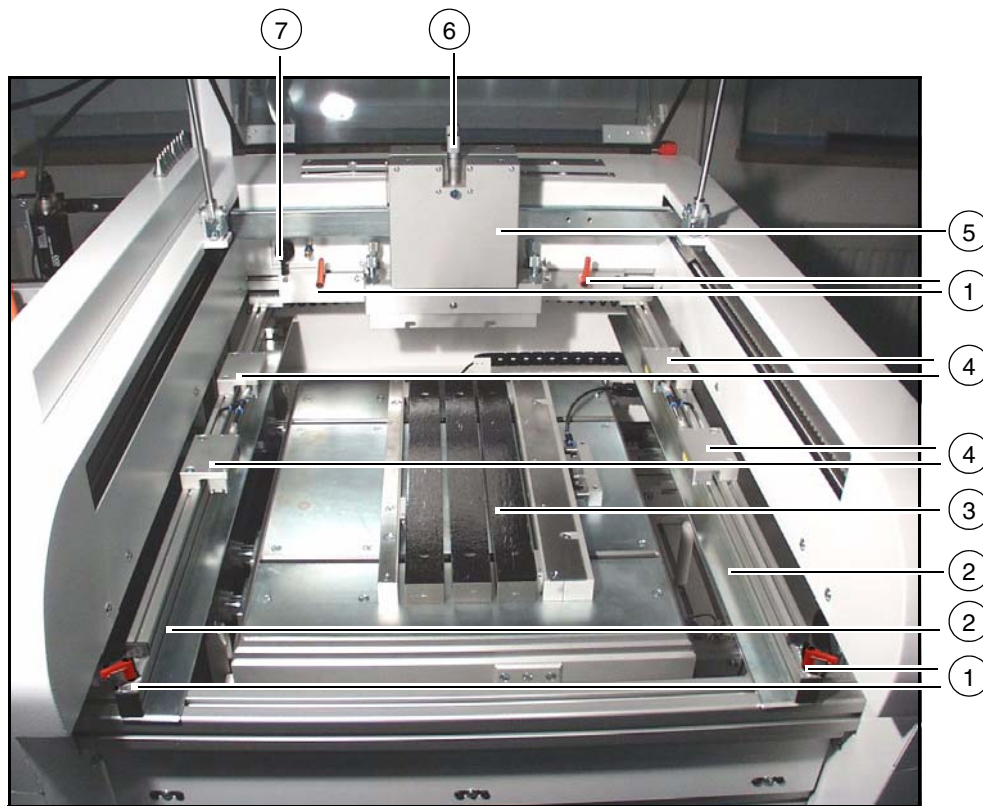


Fig. 8. Print area, with cover open

1 Locking lever, stencil guideway	5 Squeegee head
2 Stencil guideway	6 Down stop micrometers
3 Printing table with PCB holder and PCB supports	7 Screen clamping switch
4 Clamping cylinder for screen frame	

The cover can be opened upwards in order to allow the print material to be placed in the machine and to change the printing squeegee and the flooding squeegee.

The stencil guideways for the screen frame are adjustable. Release the levers at the front and rear, and adjust the position of both guideways. Once the screen fits perfectly in the guideways, lock all levers. To clamp the behind, actuate the screen clamping switch. The clamping cylinders are pressurised and clamp the screen in place.



### Note:

**Always align the screen layout centrally.**

### Printing table



Fig. 9. Printing table

1 Control desk	7 Table adjustment in X-direction
2 Clamping strips, PCB holder	8 Table adjustment in Y-direction
3 PCB support	9 Table adjustment in X-direction
4 MOPS cameras	10 PCB clamping switch
5 Locking handle for locking camera position	11 Register pins, test print film
6 MOPS operating keypad	

On the E1, the printing screen is fixed and the print material (substrate etc.) is aligned with the screen. To do this, place the test print film in the machine and perform a printing cycle. Then align the PCB with the printed image on the film by adjusting the printing table manually. The PCB is fixed in the printing nest (optionally with vacuum suction) with the clamping rails.



## Squeegee unit

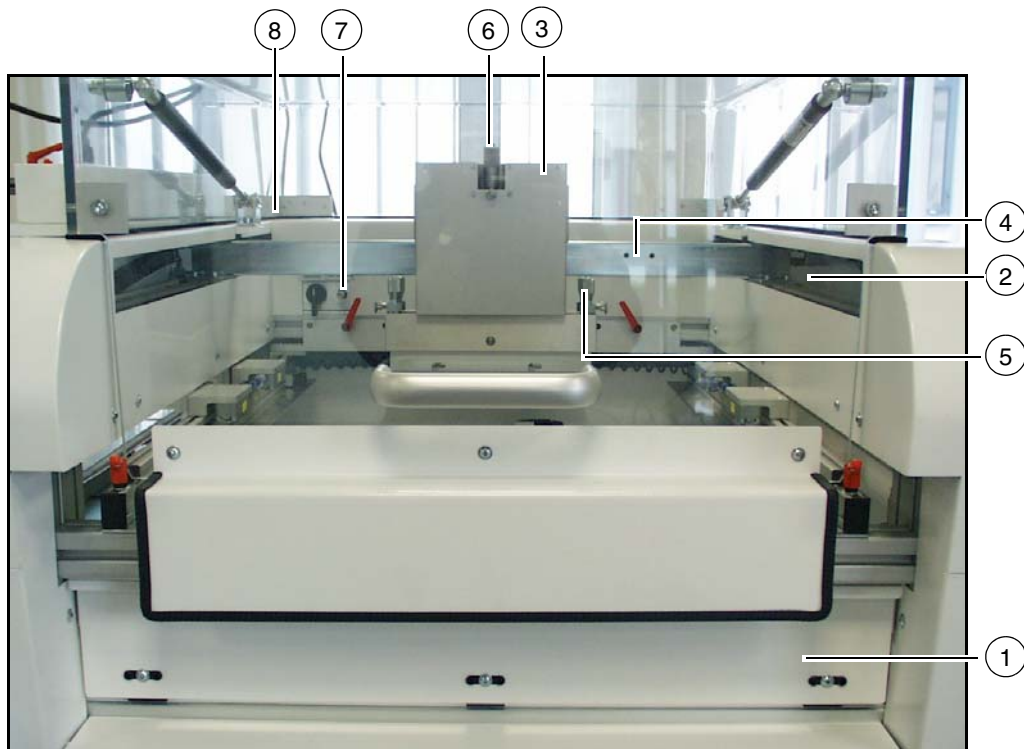


Fig. 10. Squeegee unit

1 Cleaning flap	5 Pivot-stop screws
2 Squeegee guideway with ball-bearing bushes	6 Down stop micrometers
3 Squeegee head	7 Pneumatic connection, film tensioning frame
4 Squeegee beam	8 Screen clamping switch

The squeegee unit is fitted in the upper part of the machine. It consists of the squeegee head with a printing squeegee and a flooding squeegee, the squeegee drive and the squeegee guideway with ball-bearing bushes. The squeegee head consists of two units for the printing squeegee and the flooding squeegee. Three precision-guided pneumatic cylinders for each unit execute the squeegee stroke. The down stop can be adjusted using the down stop micrometers. The pivoting range of the individual squeegees can be limited mechanically by adjusting the pivot-stop screws. To allow cleaning of the screen the cleaning flap can be opened forwards, enabling the underside of the screen to be cleaned.



### Note:

**If the screen is removed for cleaning, a new alignment procedure is required.**

## Control desk



Fig. 11. Machine control

1 Pressure reducer, squeegee pressure	3 Squeegee pressure indicator
2 Control panel	4 Emergency-stop switch

The squeegee pressure is set at the control desk with the aid of a pressure reducer. The pressure range extends from 0 to 5 bar. 1 bar is equivalent to 80 newtons.

On the control panel you can select the main menu and the file menu, enter the program parameters and execute functions.



Fig. 12. PCB clamping

PCB clamping switch  
with three positions:  
ON - AUTO - OFF

The switch for PCB clamping has three positions: "O", AUTO and "I".

**AUTO:** In this position the foot switch is used for clamping the PCB. When the foot switch is released, the printing table moves to the printing position. The printing cycle is executed, and the printing table moves away from the printing position again. The PCB clamping is released automatically.

**"I":** Set the switch to the "I" position to switch on screen clamping manually, and to the "O" position to switch it off again.

## Functional description of the operating elements

### Control panel

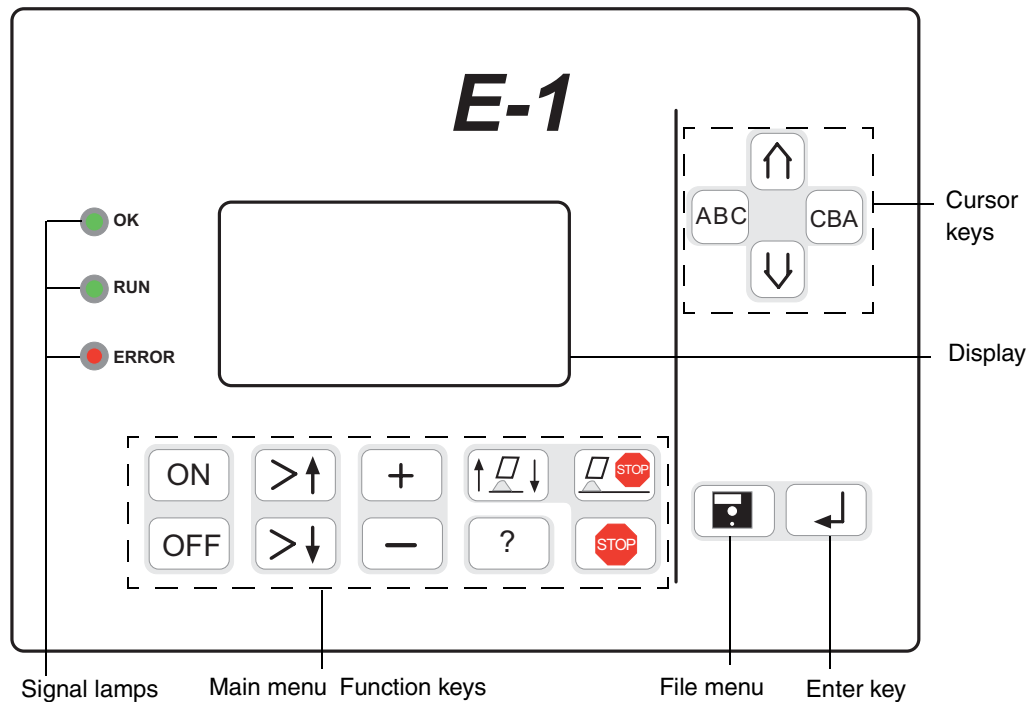


Fig. 13. Control panel

### Signal lamps

OK – This lamp showing a green light indicates that there are no hardware faults present.

RUN – This lamp showing a green light indicates that the printer is in operation.

ERROR – This lamp showing a red light indicates that an error has occurred.

### Function keys



The ON button switches the control voltage on.



The OFF button switches the control voltage off.



Up: press this button to move up through the main menu on the display.



Down: press this button to move down through the main menu on the display.



Plus key: press this button to increase the selected value.



Minus key: press this button to reduce the selected value.



Squeegee up/down: press this button to make the active squeegee move either up or down.



Help key: press this button to call up the help text relating to the selected menu item.



Squeegee stop front: If you press this button, the squeegee stops at the front. The printing cycle starts with "Flooding"- "Printing table moves to printing position"- "Print forwards"- "Printing table moves to loading position"



## Note:

**The SQUEEGEE STOP FRONT function can only be used with printing mode 1.**



Stop: Press this button to stop the squeegee.

## Main menu display

E1 Default	Program name
Squeegee speed: .....80	
Squeegee pos. rear: .....480	
Squeegee pos. front: .....295	
Printing mode: .....1	Printing mode parameter is selected
Separation speed: .....0.5	
ON	

The name of the program is shown in the header of the main menu. This is the program that has been chosen for the printing process.

You can use the function keys in the main menu to change parameters, set the squeegee stop position, raise and lower the squeegee and activate the Help function.

The ON and OFF buttons for switching the control voltage on and off are always active.



### Cursor keys



Up: press this button to move up through the file menu on the display.



Down: press this button to move down through the file menu on the display.



Press this button to select the letters, in ascending order. Confirm the letter that you want to select by pressing the Enter key.

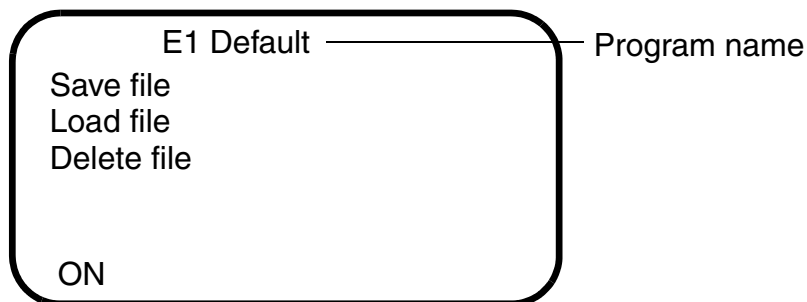


Press this button to select the letters, in descending order. Confirm the letter that you want to select by pressing the Enter key.



Press this button to select the file menu. To return to the main menu, press this button again.

### File menu display



In the file menu you can save the currently active program, load a different program from the files available for selection, or delete an existing program.



Enter key: confirm your selection by pressing this key. After you have entered values, they are accepted by the system when you confirm entry with this key.

**Technical data**

<b>Board handling</b>	
PCB size	430 x 570 mm 350 x 400 mm (with standard clamping)
PCB thickness	10 mm
PCB support	magnetic pins and blocks; optional: customer-specific workpiece holder
PCB clamping	PCB clamping by lateral clamping strips; optional: vacuum nest
Stencil size	min. 300 mm x 300 mm max. 630 mm x 850 mm
Frame thickness	30 mm
<b>Printing parameters</b>	
Print area	max. 430 x 570 mm
Printing speed	10 mm - 110 mm
Printing head	Two independent pneumatic printing heads; closed-loop control circuit; squeegee free-swinging
Squeegee pressure	0 - 4 bar, equivalent to 0 - 320 N adjustable via pneumatic cylinders
Squeegee types	all types
Squeegee speed	min. 5 mm/s max. 100 mm/s
Squeegee depth setting	down stop adjustable on squeegee head
Separation speed	0.4 - 1 mm per second
Separation way	2 mm
Snap-off setting	manually with handwheel; 1 revolution equivalent to 1 mm stroke
PCB adjustment range	X/Y: $\pm 8$ mm / theta: $+ 2^\circ$
Printing modes	1 Print - Flood 2 Print - Flood – Print - Flood 3 Print - Print 3a Print - Print (both squeegees unpressurised in parking position) 4 Print 4a Print (both squeegees unpressurised in parking position)
<b>Manual optical positioning system (MOPS - option)</b>	
Cameras	2 manually adjustable CCD cameras

Fiducials	2 fiducials or any required structures in PCB layout
Fiducial size	0.7 - 3 mm <sup>2</sup>
Fiducial position	Anywhere in area of PCB
<b>Performance</b>	
Generation of a program	>5 min
Product changeover	> 5 min
<b>Machine control</b>	
Hardware	Microprocessor-controlled; LCD display
Memory	100 PCB profiles
<b>General data</b>	
Electrical connection	230 V / 50 Hz / 1 kW
Pneumatic connection	6 - 10 bar
Width x depth x height	1270 mm x 1100 mm x 1420
Working height	850 mm ± 25 mm (adjustable)
Weight	350 kg
Permissible operating temperature	+10°C - +40°C
Relative air humidity	30 - 90%

## 4 Switching On and Off

### Switching on

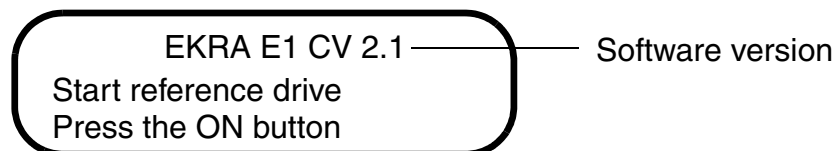
#### Requirements:

- Screen printer connected to power supply system
- Compressed air connected
- Emergency-stop switch released
- Foot switch connected
- Cover closed
- ☐ Turn the main switch of the screen printer on the front of the machine to the "ON" position.


⇒ Electricity is supplied to the machine.

⇒ The display lights up.

⇒ The following message appears:



⇒ The OK and RUN LEDs light up (green).

- ☐ Press the  button on the control panel.

⇒ The control voltage for the screen printer is switched on.

⇒ The following message appears on the display:  
PRESS FOOT SWITCH.

- ☐ Press the foot switch.

⇒ The following message appears on the display:  
REFERENCE DRIVE RUNNING.


⇒ The screen printer performs a reference drive.

⇒ The main menu appears on the display.



⇒ The screen printer is ready for operation.

### Switching off


- ☐ Press the  button on the control panel.
- ☐ Turn the main switch of the screen printer on the front of the machine to the "0" position (OFF).
- ⇒ The display goes out.
- ⇒ All poles of the machine's electrical system are disconnected from the mains power supply.

### Emergency stop

Press the emergency-stop switch in all situations where:

- people could be injured, or
  - parts of the printer could be damaged or destroyed.
- ☐ Strike the red button of the emergency-stop switch with your hand.
  - ⇒ The power supply to the screen printer is interrupted.
  - ⇒ All moving parts are brought to a standstill.

### Switching on after an emergency stop

- ☐ Release the emergency-stop switch by turning the red button clockwise.
- ☐ Press the  button on the control panel.
- ⇒ The control voltage is switched on.
- ☐ Press the foot switch.
- ⇒ The screen printer performs a reference drive.



---

#### Note:

**If the cover is opened during the printing process without the Stop button having been pressed first, an emergency stop is triggered.**

---

## 5 Operation

### General

- Automatic mode can only be started with the foot switch.
- If the foot switch is held down, the vacuum is switched in. When the foot switch is released, the printing table moves into the printer and the printing process begins.

### Setting the pneumatics

#### Presetting

- Pneumatic control unit on the right-hand side of the machine
  - ☐ Set the main pneumatic connection to 5 to 6 bar on the pressure gauge.
  - ☐ Set the screen clamping to 3 to 4 bar.
  - ☐ Set the compressed air for the film tensioning frame to 1 to 2 bar.
- On the control desk
  - ☐ Set the squeegee pressure (0 to 4 bar; 1 bar is equivalent to 80 newtons).



#### Note:

**It may be the case that different settings produce better results for your application.**



#### Note:

**Refer also to Chapter 3 PNEUMATIC SETTING.**



#### Caution:

**Do not set the screen clamping to a higher figure than 4 bar. Otherwise the clamping cylinders may be severely damaged.**



#### Danger:

**Do not reach into the printer in the vicinity of the moving printing table.**

## Aligning the PCB

Requirement:

The machine must be ready for operation and in its basic position.



---

### Note:

**Always mount the PCB centrally on the table.**

---

- ☐ Release the two fixing screws holding the clamping strips at the front and rear.
- ☐ Align the clamping strips with the PCB such that there is still a gap of 2-3 mm between the edge of the PCB and the clamping strip.
- ☐ Tighten the two fixing screws holding the clamping strips at the front and rear.
- ☐ In the printing nest, position the magnetic strips or magnetic pins to support the PCB.
- ☐ Place the PCB in the printing nest. Make sure that the PCB is lying flat and that it can be clamped.
- ☐ Turn the PCB clamping switch at the side of the control desk to the "I" position:
- ☐ The PCB is clamped.



---

### Note:

**If the foot switch is pressed while the printing table is in motion, the table is immediately stopped and the control voltage is switched off. After this, press the ON button and press the foot switch again. The printer performs a reference drive.**

---

### Aligning a stencil


Requirements:

The machine must be ready for operation and in its basic position.

The squeegees must be installed.

The main menu must be displayed.

A PCB must be mounted.

- ☐ Start a printing process by pressing the foot switch.
- ☐ When the printing table has run up, press the Stop button  on the control panel.
- ☐ Open the cover.




---

#### Caution:

**Check the height of the table. The upper edge must not be above the upper edge of the stencil guideway. If it is, lower the table by turning the snap-off handwheel.**

---

- ☐ Turn the screen clamping switch to the "0" position (OFF).
- ☐ Release the levers on the stencil guideway.
- ☐ Push the stencil into the stencil guideway towards the rear to the stop (position the print layout centrally).
- ☐ Adjust the position of the stencil until the PCB layout and the stencil layout are fully aligned.
- ☐ Close the levers on the stencil guideway.
- ☐ Turn the screen clamping switch to the "I" position (ON).
- ☐ On the right-hand side of the machine, set the required snap-off with the handwheel.
- ☐ Close the cover.
- ☐ Press the Stop button  again to end the printing process.
- ☐ The printing cycle is brought to an end and the printing table moves out.



## Setting up the printing program

Requirements:

The machine must be ready for operation and in its basic position.

The squeegees must be installed.

The main menu must be displayed.

A PCB must be mounted.

**Set the following squeegee parameters in the main menu:**

E1 Default

Squeegee speed:.....80

Squeegee pos. rear:.....480

Squeegee pos. front:.....295

Printing mode:.....1



Separation speed:.....0.5


ON


Program name



Activated parameter is stored


Press either of these two keys   until the SQUEEGEE SPEED parameter is active.


Press either of these two keys   until the parameter value is set in mm/sec. (10 - 110 mm/sec.).



Confirm entry of the parameter by pressing ENTER .


Press the  key and select the SQUEEGEE POSITION REAR parameter.


Press either of these two keys   until the rear squeegee position is set in mm (0 - 550 mm).

Confirm entry of the parameter by pressing ENTER .


Press the  key and select the SQUEEGEE POSITION FRONT parameter.


Press either of these two keys   until the front squeegee position is set in mm (0 - 550 mm).

Confirm entry of the parameter by pressing ENTER .


Press the  key and select the PRINTING MODE parameter.

Press either of these two keys   until the printing mode (1 to 4a) is selected.

Confirm your selection of the printing mode by pressing ENTER .

Press the  key and select the SEPARATION SPEED parameter.

Press either of these two keys   until the separation speed is selected in mm/sec. (0.3 - 1 mm/sec.).

Confirm entry of the separation speed by pressing ENTER .



**Note:**

**Pay attention to the following points:**

1. In printing modes 1 and 2 for screen printing, one printing squeegee (rear) and one flooding squeegee (front) are used.
2. In printing modes 3, 3a, 4 and 4a for stencil printing, two printing squeegees are used.

### Setting the down stop




Requirements:

The machine must be ready for operation and in its basic position.

The squeegees (flooding squeegee and printing squeegee) must be installed.

The main menu must be displayed.

A PCB must be mounted.

- ☐ Open the cover.
- ☐ Turn the two down stop micrometers for the squeegees clockwise to zero (squeegees are lifted out).
- ☐ Close the cover.
- ☐ Press the  key and select the PRINTING MODE parameter.
- ☐ Press either of these two keys   until printing mode 3 is selected.

- ☐ Confirm your selection of the printing mode by pressing ENTER



- ☐ Start a printing process by pressing the foot switch.
- ⇒ The printing table moves to the printing position and the printing process starts.

- ☐ Press the Stop button



- ☐ Press the squeegee up/down button



- ☐ The rear squeegee is lowered.
- ☐ Open the cover.
- ☐ Turn the micrometer until the squeegee is touching the stencil.
- ☐ Turn the micrometer another 1 to 2 revolutions (2 revolutions = 1mm adjustment distance), depending on the squeegee type (lowering the squeegee).
- ☐ Close the cover.

- ☐ Press the Stop button



again.

- ⇒ The printing cycle is resumed.

- ☐ When the squeegee unit travels to the rear again, press the Stop button



once more.

- ☐ Press the squeegee up/down button



- ☐ The front squeegee is lowered.
- ☐ Open the cover.
- ☐ Turn the micrometer for the front squeegee until the squeegee is touching the stencil.
- ☐ Turn the micrometer another 1 to 2 revolutions (2 revolutions = 1mm adjustment distance), depending on the squeegee type (lowering the squeegee).
- ☐ Close the cover.
- ☐ Press the Stop button again.

- ⇒ The printing cycle is ended





**Note:**

**Adjust the flooding squeegee for screen printing in such a way that the steel squeegee will never touch the screen (risk of damage).**

**Adjusting the printing table**

Requirements:

The machine must be ready for operation and in its basic position.

The squeegees must be set up.

The main menu must be displayed.

A PCB must be mounted.

The printing table must be in the centre of the adjustment range.

- ☐ Place the frame of the test print film on the printing table locating pins.  
⇒ The test print film is now lying over the PCB.
- ☐ Open the cover and apply solder paste to the screen.
- ☐ Close the cover.
- ☐ Start a printing process by pressing the foot switch.
- ☐ After the printing process, use the scale screws on the printing table to align the PCB with the printed image on the test print film.
- ☐ If you are working with the manual optical positioning system (MOPS), you can now teach the fiducials.



**Note:**

**Refer to the section on using the manual optical positioning system in this manual.**

- ☐ Remove the test print film from the printing table and start the printing process.

## Printing modes

You can choose between the following different modes for printing:

- Screen printing:
  - 1: Move in – Print – Flood – Move out
  - 2: Move in – Print – Flood – Print – Flood – Move out
- Stencil printing:
  - 3/3a: Move in – Print – Print – Move out
  - 4/4a: Move-in – Print – Move-out (forwards/backwards alternately)



---

### Note:

**Pay attention to the fact that depending on which printing mode you choose either one printing squeegee and one flooding squeegee or two printing squeegees must be used.**

---

### Screen printing mode 1

After the foot switch is pressed, the table moves into the print area and is raised. The rear squeegee is lowered and pressure is supplied at the set level. The squeegee unit moves forwards, during which time printing takes place on the PCB. After printing is completed, the table moves down and out. The rear squeegee is raised and the front squeegee is lowered. The squeegee unit moves to the rear, during which time flooding of the stencil takes place.

### Screen printing mode 2

After the foot switch is pressed, the table moves into the print area and is raised. The rear squeegee is lowered and pressure is supplied at the set level. The squeegee unit moves forwards, during which time printing takes place on the PCB. After the first printing process the table remains in position. The rear squeegee is raised and the front squeegee is lowered. The squeegee unit moves to the rear. During this time the stencil is flooded. After flooding is completed the flooding squeegee is raised, and the rear squeegee is lowered and pressure is supplied at the set level. The same printing procedure takes place again. After the second printing process, the table is moved down and out. The rear squeegee is raised and the front squeegee is lowered. The squeegee unit moves to the rear, during which time flooding of the stencil takes place.

### Stencil printing mode 3

Stencil printing is carried out with a steel squeegee. After the foot switch is pressed, the table moves into the print area and is raised. The rear squeegee is lowered and pressure is supplied at the set level. The forward printing process is carried out. After this, the rear squeegee is raised and the front squeegee is lowered. The squeegee unit moves to the rear and a

rearward printing process is carried out. After the printing process, the separation process takes place according to the set parameter. The separation motor slowly lowers the table. The table is then fully lowered by the pneumatic system and is moved out. The front squeegee is raised and the rear squeegee is lowered.

### **Stencil printing mode 3a**

Printing mode 3a is identical to mode 3, except that at the end of the complete printing cycle the rear squeegee is lowered and the front squeegee remains lowered. This prevents gaps forming in the solder paste as it heats up.

### **Printing mode 4**

After the foot switch is pressed, the table moves into the print area and is raised. The rear squeegee is lowered and pressure is supplied at the set level. The forward printing process is carried out. After the printing process, the separation process takes place according to the set parameter. The separation motor slowly lowers the table. The table is then fully lowered by the pneumatic system and is moved out. The rear squeegee is raised and the front squeegee is lowered.

### **Printing mode 4a**

Printing mode 4a is identical to mode 4, except that at the end of the complete printing cycle the front squeegee is lowered and the rear squeegee remains lowered. This prevents gaps forming in the solder paste.

### **Printing mode 99**

After the foot switch is pressed, the table moves into the print area and is raised. The rear squeegee is lowered and pressure is supplied at the set level. The forward printing process is carried out. The rear squeegee is raised, and the front squeegee is lowered and pressurised. A rearward printing process is carried out. A forward printing process then starts again,

etc. This procedure continues until the  button is pressed.

## Saving a file

Requirements:

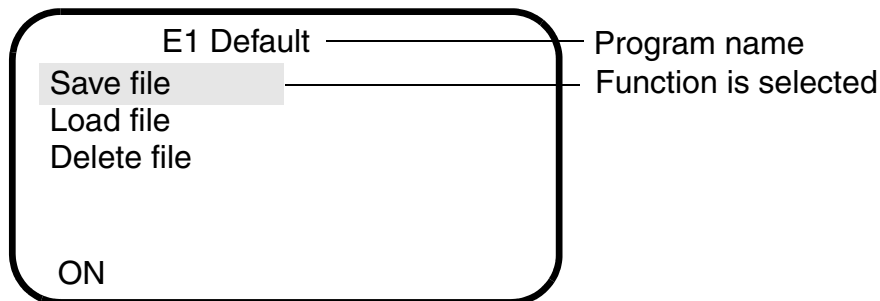
The machine must be ready for operation and in its basic position.

The main menu must be displayed.


After you have entered and checked all the parameters for your printing process, you can save the data under a particular program name. To do this, proceed as follows:

- Press the  key.

⇒ The file menu appears.




- Press either of these two keys   until the SAVE FILE function is selected.

- Confirm selection of the function by pressing ENTER .


⇒ An input field appears in which you can enter the file name (max. 13 characters).

- Use these keys   to enter the first character.

- Press the  key.

⇒ The cursor jumps to the next input position.

- Repeat this entry procedure for each character of the file name.

- When entry of the file name is complete, press the Enter key .

⇒ The file name is saved and the main menu appears.

### Loading a file

Requirements:

The machine must be ready for operation and in its basic position.

The main menu must be displayed.



- ☐ Press the  key.


⇒ The file menu appears.

- ☐ Press either of these two keys   until the LOAD FILE function is selected.

- ☐ Confirm selection of the function by pressing ENTER  .

⇒ The list of file names appears.

- ☐ Press either of these two keys   until the required file is selected.

- ☐ Confirm selection of the file by pressing ENTER  .

⇒ The file is loaded. The main menu appears and the program name is displayed.

### Deleting a file



Requirements:

The machine must be ready for operation and in its basic position.

The main menu must be displayed.

- ☐ Press the  key.




⇒ The file menu appears.

- ☐ Press either of these two keys   until the DELETE FILE function is selected.

- ☐ Confirm selection of the function by pressing ENTER  .

⇒ The list of file names appears.



- ☐ Press either of these two keys   until the required file is selected.
  - ☐ Confirm selection of the file by pressing ENTER  .
- ⇒ The file is deleted.

## **6 Manual Optical Positioning System**

# **MOPS**

Manual Optical Positioning System

## **Operating Instructions**

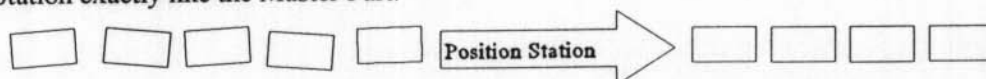
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## 1. General Information

### 1.1. Discription of Functions

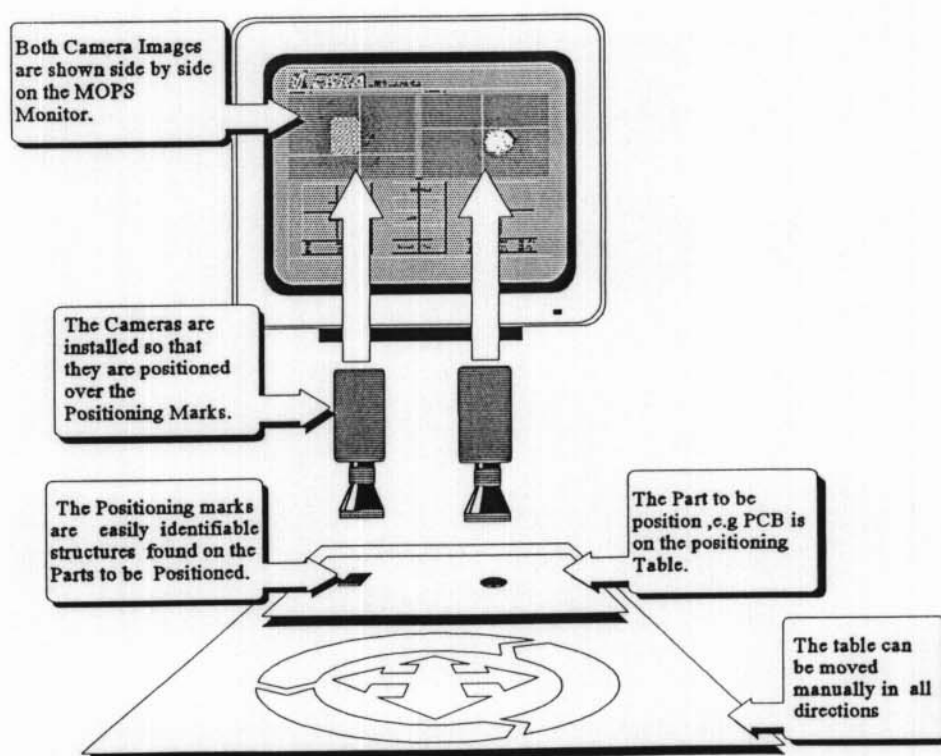
The Manual Optical Positioning System (MOPS) helps by correcting the alignment of PCB's or Subtrats in the Productions process. The aim is to arrange all the pieces in such a way that they leave the Positioning Station in an identical position.. The first part is the Master. It's position is measured and stored. The position of all following pieces can now be corrected so that they leave the Positioning Station exactly like the Master Part.



The correction is carried out by the operator manually in the Positioning Station. The MOPS supports this procedure by outlining the correct position, or by directing the operator to move the part in the right direction on the Monitor.

The MOPS consists of a CPU and a Monitor, a Keyboard, and two CCTV cameras. The cameras are installed on top of the positioning table and are so placed that the pictures of positioning marks are visable on the monitor. Positioning marks are easy identifiable parts on the PCB.

When the position of a substrate or PCB changes on the Positioning Station the image on the monitor also changes in the same way. By means of the MOPS the misalignment is shown. If the right camera objectives are installed, the smallest mistakes in alignment can be detected and compensated.



## **1.2. Variations of MOPS**

The MOPS is available in two different versions.

### **MOPS with Cross Sights**

This version of the MOPS with Cross Sights allows the positioning and correcting of PCB's by using free moving Cross Sights. The Cross Sights are placed on the edge of a significant structure of the substrate in order to recognise each difference in it's position.

### **MOPS with Compared Images**

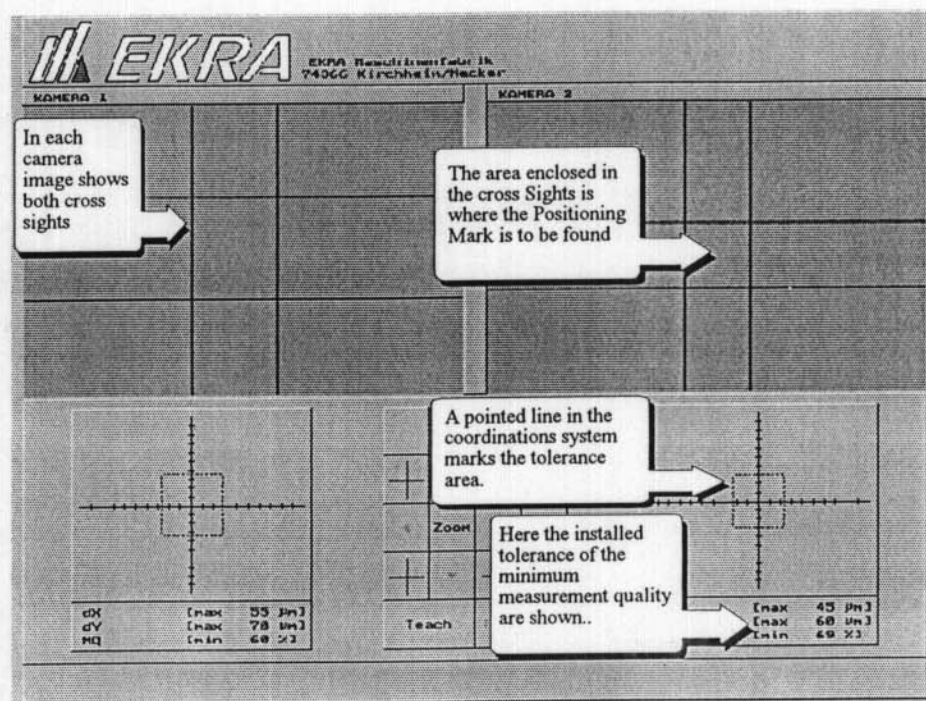
This version compares the position of substrates by using transparent Dia. It can also read out the misalignment, which it has measured.

### **MOPS Comparing Images**

This version compares the position of substrate with a transparent Dia, and can read out the misalignment, which is measured.

## 2. Mode of operations

### 2.1. Cross Sight Mode



#### Function

In the cross sight mode the MOPS shows two “living” camera pictures, each with two cross sights. The MOPS in this version is used as an optical limitation stop. When the fiducials are chosen from significant positions of the substrate, changes in position can be watched in very simple way.

In cross sight mode the sections for the Dia-mode and the automatic mode are selected and fixed too. Further the parameters for the automatic mode (tolerance and fiducial quality) are installed in cross sight mode.

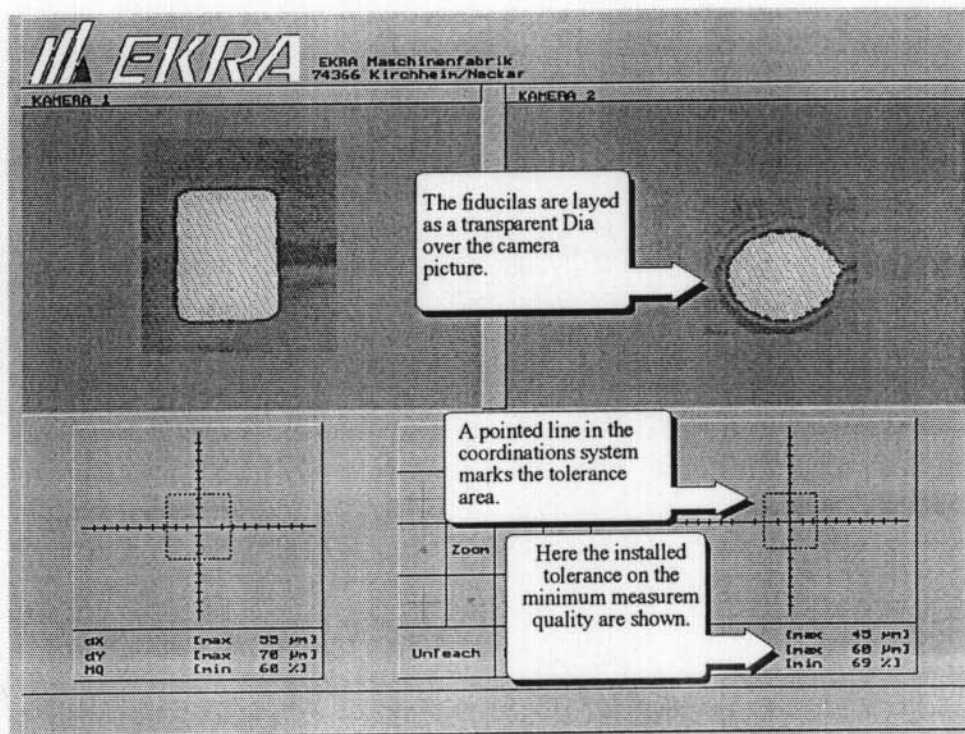
#### Announcement

**Camera pictures:** In each camera pictures two cross sights are shown. They show the differences in correct position of the fiducial.

**System of coordinates:** The frame in the system of coordinates shows the installed field of tolerance.

**Digital read out:** Below the system of coordinates the parameter for the automatic mode are shown. The maximum acceptable tolerance in fiducial position in micrometer ( $dx_{max}$ ,  $dy_{max}$ ) and the minimum measurement quality in per cent ( $MQ_{min}$ ).

## 2.2. Dia Mode



### Function

In Dia Mode the MOPS shows the fiducial as a transparent Dia over the “living” camera pictures. In case of a shift of the substrate the Dias are not corresponding to the camera pictures. In this way the changes in position can be checked very accurate, better than in sight cross mode.

Further in Dia Mode the parameters for the automatic mode (Tolerance limits and Minimum measurement quality) can be installed.

### Announcement

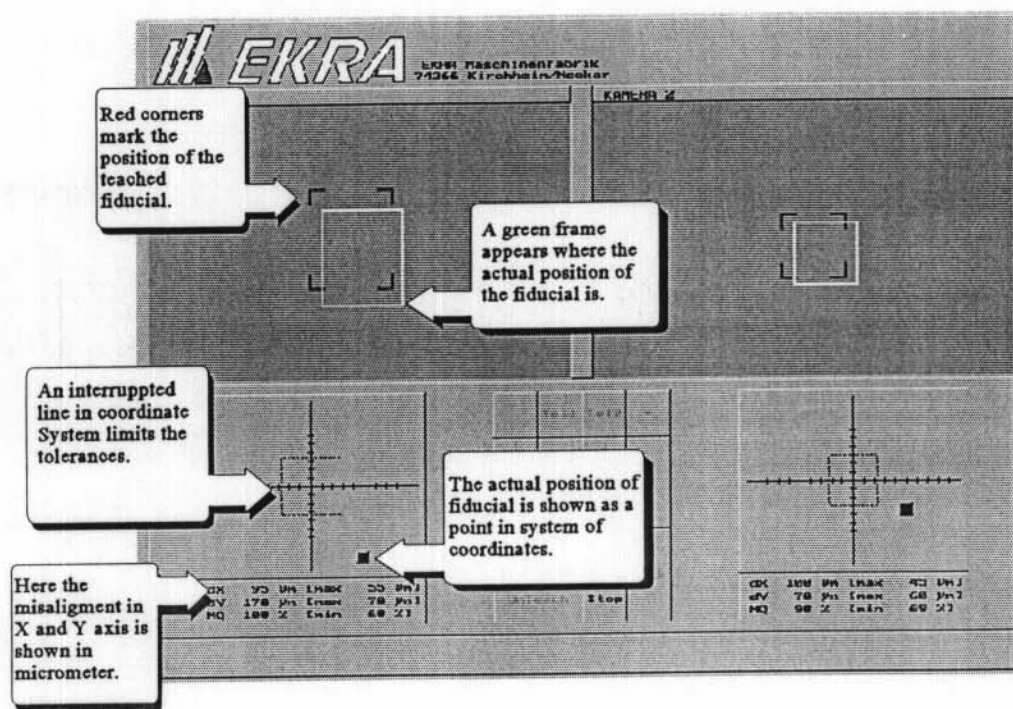
**Camera pictures:** In each camera picture a transparent Dia is shown, which is identical with the fiducial in the original teched position. Now the misalignment can be detected very easily.

**System of coordinates:** The frame in the system of coordinates shows the installed tolerance limits.

**Digital read out:** Below the system of coordinates the parameter for the automatic mode are shown. The maximum acceptable tolerance in fiducial position in micrometer ( $dx_{max}$ ,  $dy_{max}$ ) and the minimum measurement quality in per cent ( $MQ_{min}$ ).



### 2.3. Automatic mode



#### Function

In automatic mode the MOPS constantly detects the misalignment of the fiducials to the original teached position and shows it on the monitor. The system announces, whether the misalignment is placed within the filed of acceptable tolerance. This information is available as an Exit bit too.

#### Announcement

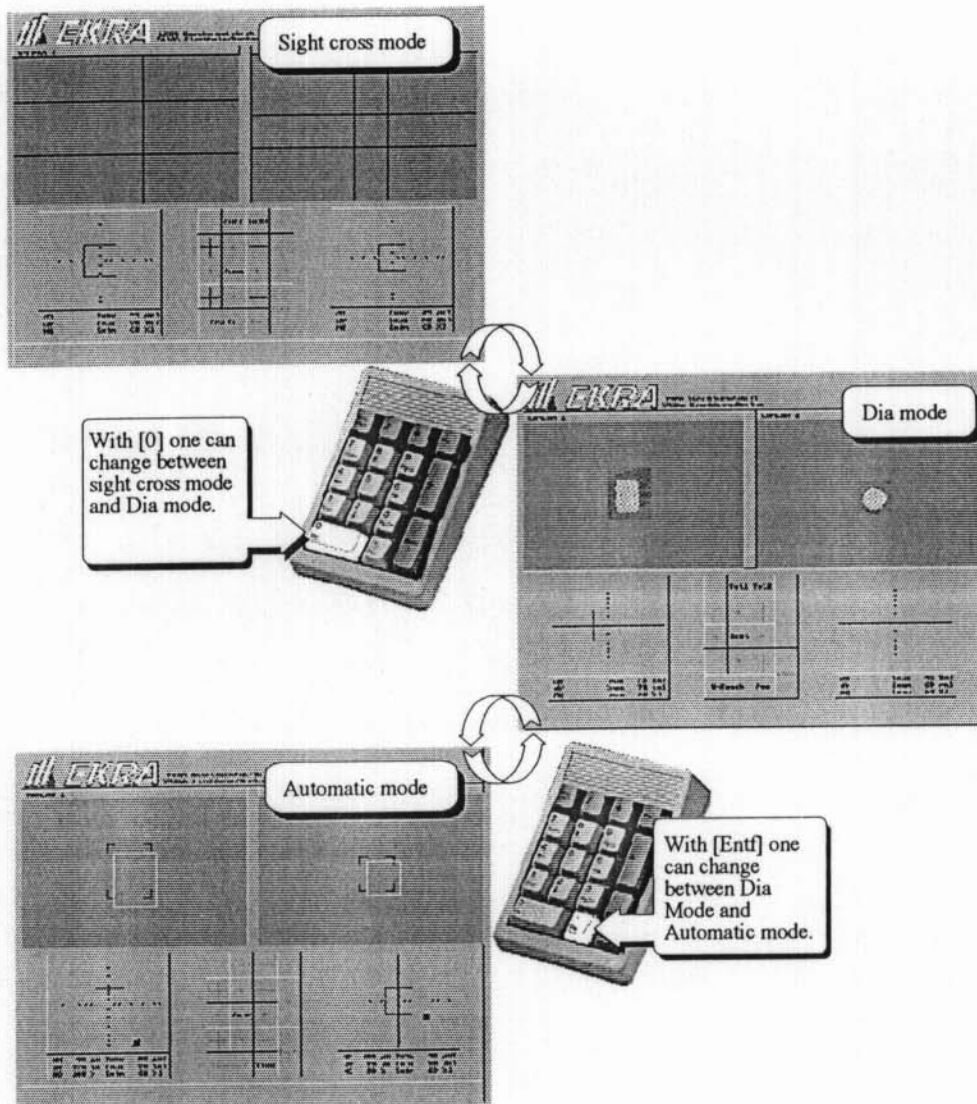
**Camera pictures:** Red corners mark the position of the teached fiducial. A green frame shows the actual fiducial position. In case the fiducial is not found in the field of view, no green frame appears.

**System of coordinates:** System of coordinates is shown under each camera picture. A point moves within this coordinates system, which shows the position of the fiducial in relation to the teached original position. If the fiducial is shown in centric position, the actual position is identical with the teached position. The acceptable tolerance is limited by an interrupted frame in the system of coordinates. As soon as the point is inside that frame, the acceptable tolerance is reached. The colon of the point shows, whether the fiducial is within the acceptable tolerance or not. Green point means ok, red point means, the fiducial is out of tolerance field. If the fiducial is not in the field of view, no point appears.

**Digital read out:** Below the system of coordinates the parameter for the automatic mode are shown. The maximum acceptable tolerance in fiducial position in micrometer ( $dx_{max}$ ,  $dy_{max}$ ) and the minimum measurement quality in per cent ( $Mq_{min}$ ).

### 3. Operating

#### 3.1. Choice of operating mode

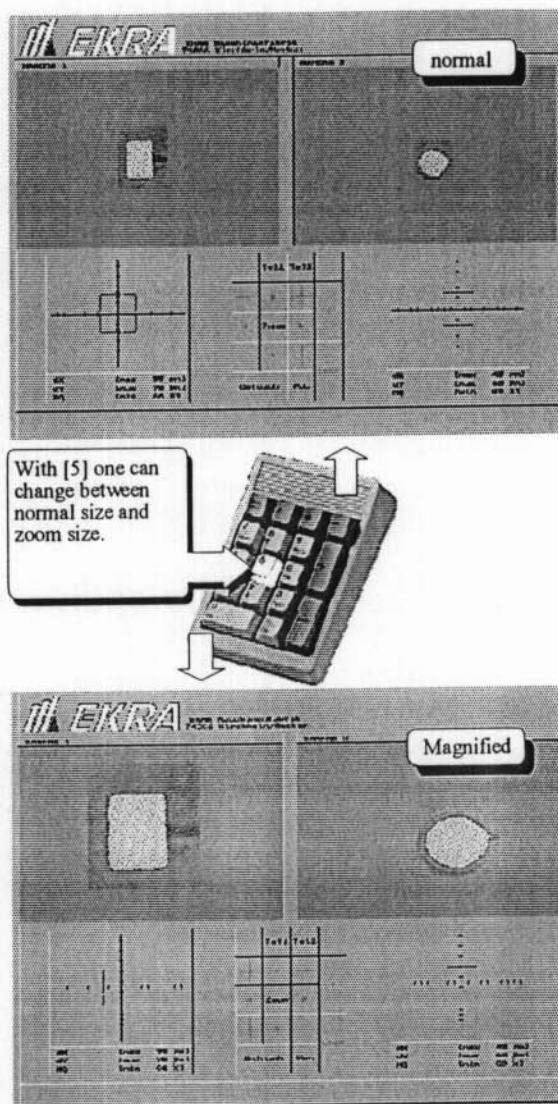


With [0] one can change between sight cross mode and Dia mode  
 With [Entf] one can change between Dia mode and automatic mode.

The most simple mode is the sight cross mode version. In this mode the MOPS no fiducials has saved. When the mode of operation is changed over to Dia mode the fiducials surroundet by the target lines are saved automatically. Reverse stop the saved fiducial are distinguished when ths system changes back from Dia mode to sight cross mode.

In automatic mode the system needs the fiducials. Therefore the change over to automatic mode is only possible from Dia mode.

### 3.2. Zoom



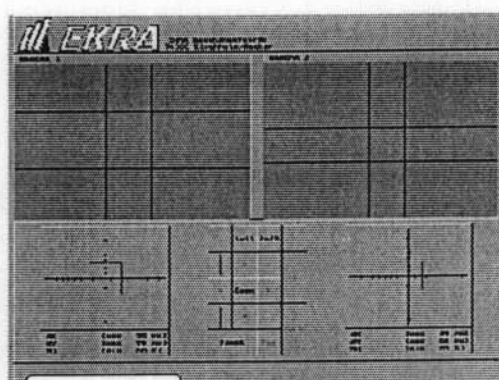
With [5] one can switch over from normal size to Zoom size.

In all operating modes (Sight cross, Dia and automatic mode) at any time you can change between normal view and zoom display.

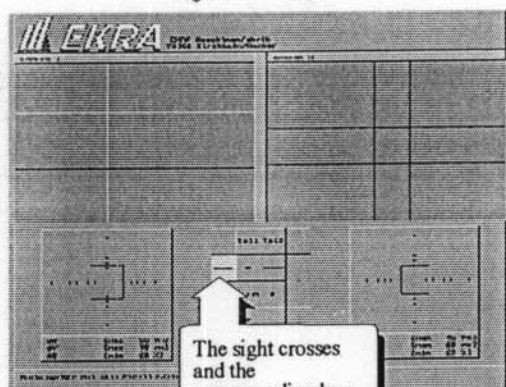
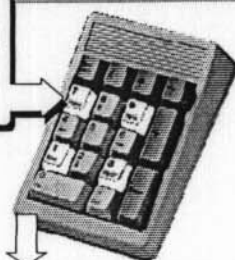
In the **normal** size the complete camera picture is shown in the field of view. The camera picture has a scale, not all details are visible.

In the **Zoom** version only a sector of the camera picture is shown, but magnified. The camera-pixel is identical with one picture-pixel.

### 3.3. Set up of sight crosses



With the keys [1], [3], [7] and [9] one can select the single sight crosses.



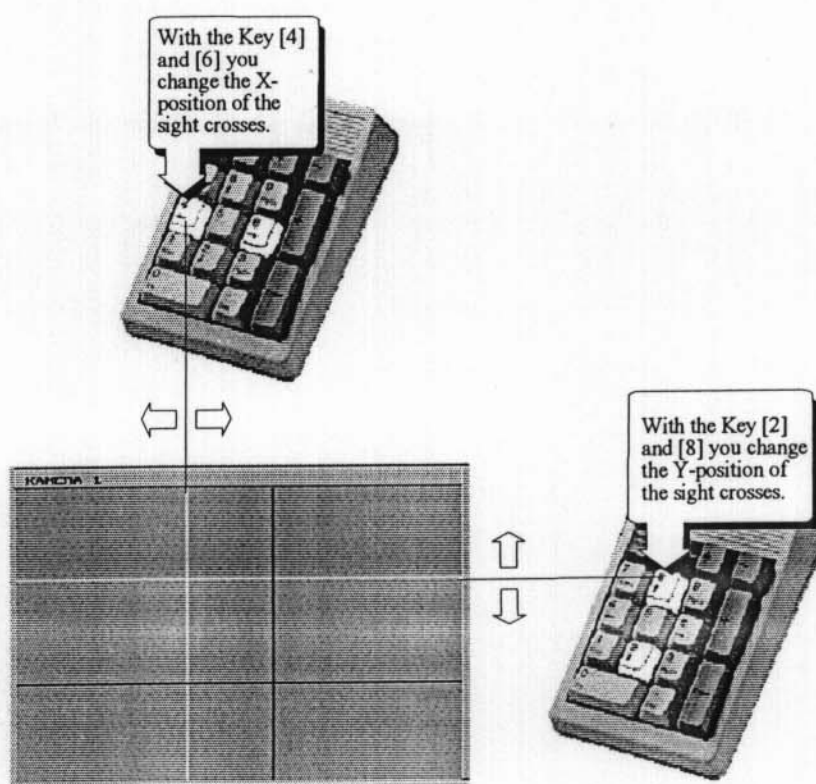
The sight crosses and the corresponding key are shown in yellow colour.

- ① Switch over to sight cross mode!
- ② Select the sight cross, you want to install!

Key	Sight cross	
[1]	left camera	down right
[3]	right camera	down right
[7]	left camera	left up
[9]	right camera	left

The selected sight cross is shown yellow.





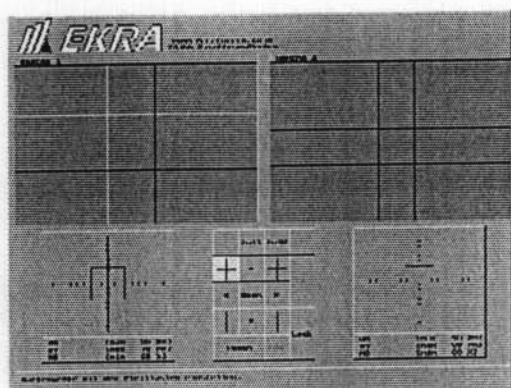
③ Move the sight cross in the wanted position!

Key	Motion
[2]	downward
[4]	to left
[6]	to right
[8]	upward

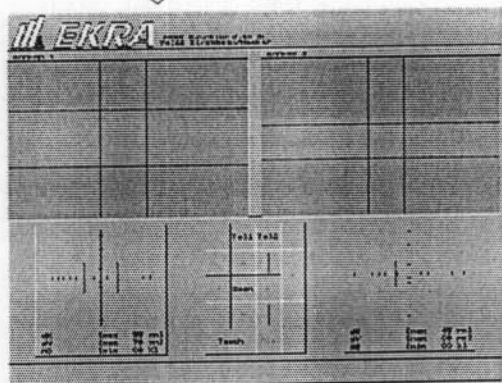
The area which is surrounded by the sight cross lines is used as a fiducial in Dia mode and automatic mode. The possible shift of sight cross lines is limited by maximum and minimum dimensions of fiducials.

To set up the sight crosses in most effective way switch over to zoom function.





With [Enter] Key  
you close the  
fiducial  
adjustment.

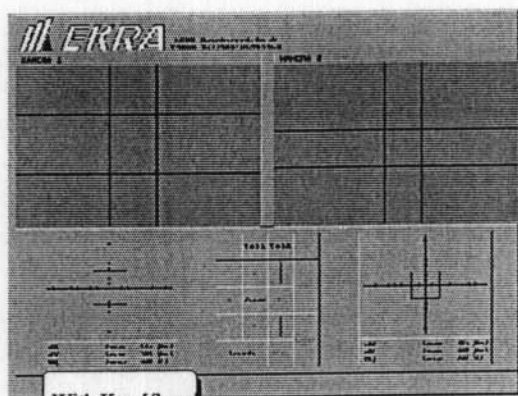


- ④ With the [Enter] Key you close the fiducial adjustment!

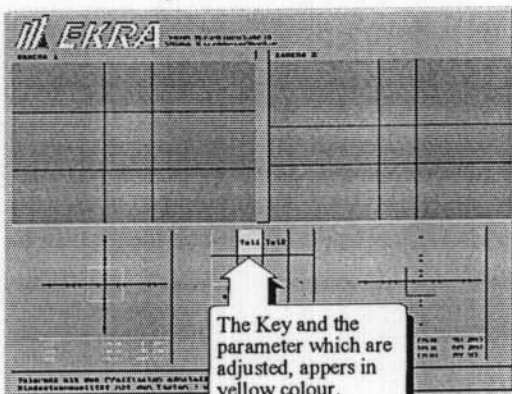
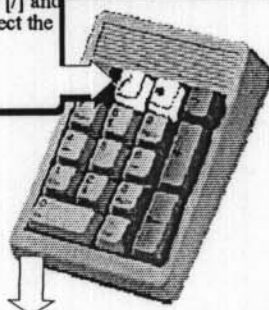
The new position of the sight crosses is automatic saved, when the adjustment is closed. The position is saved, when the machine is switched off, too.



## 3.4. Tolerance field Minimum measurement quality Set up



With Key [/] and  
[\*] you select the  
fiducial.



The Key and the  
parameter which are  
adjusted, appears in  
yellow colour.

①

Switch over to Dia mode or sight cross mode, close automatic mode.!

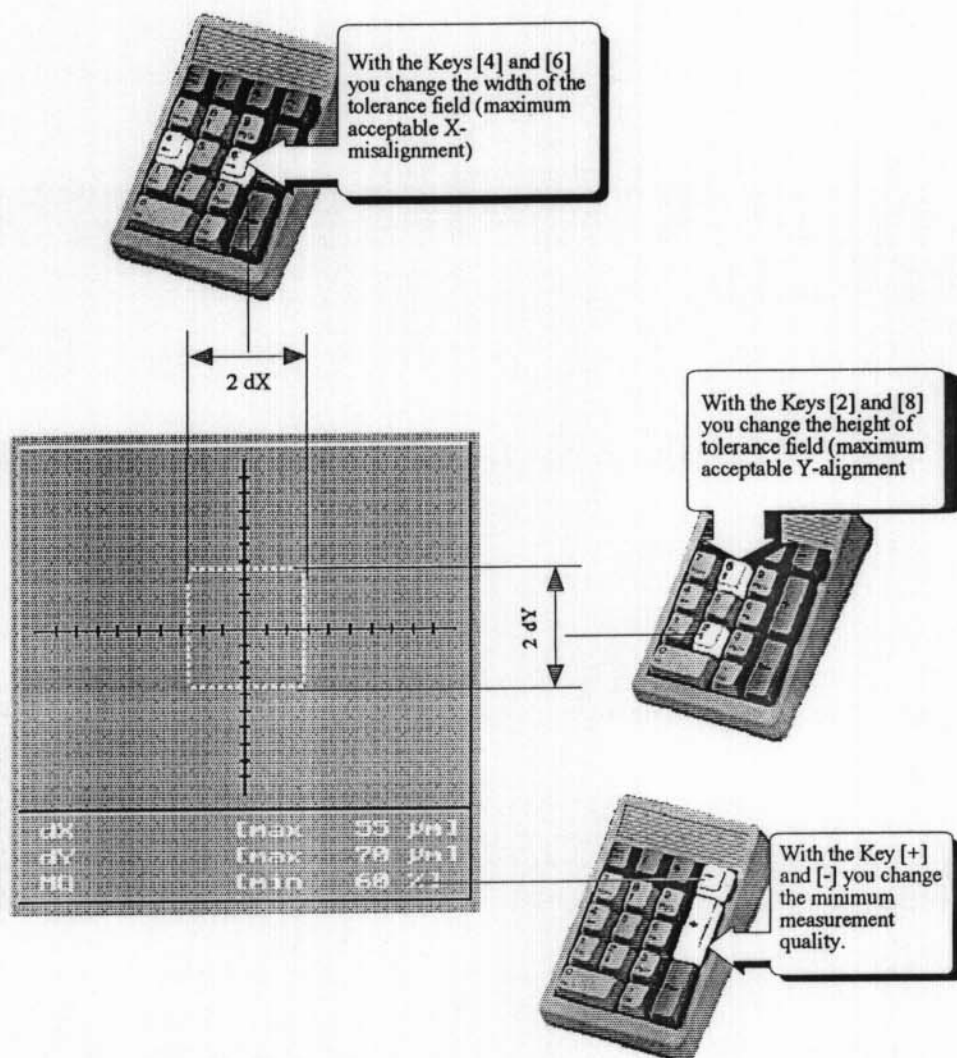
②

Select the fiducial which you want Set up for tolerance limitation and Minimum measurement quality!

Key	Fiducial
[ / ]	Fiducial under left camera
[ * ]	Fiducial under right camera

The adjustable parameters and the corresponding Key appears in yellow colour.



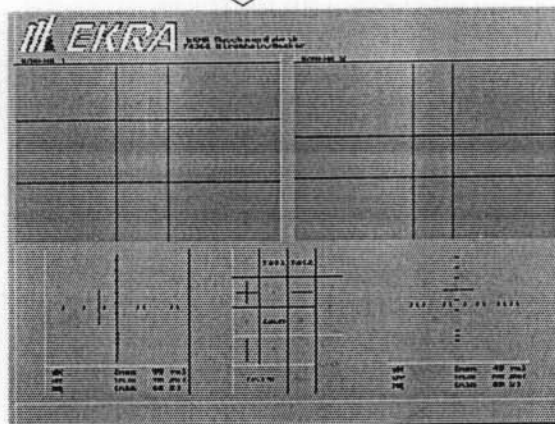
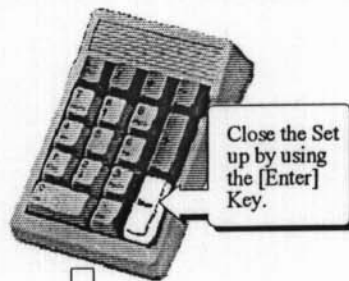
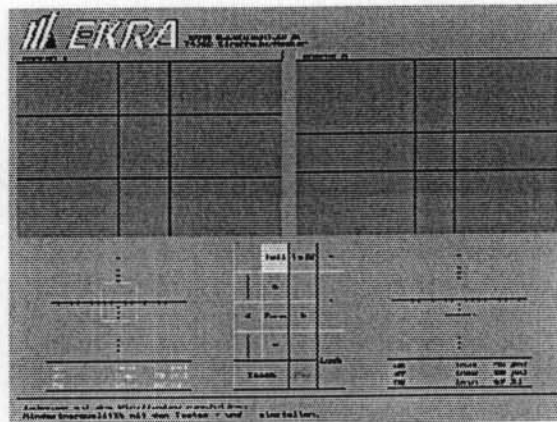


③ Install the filed of tolerance and the minimum measurement quality of the selected fiducial !

Key	Function
[2]	dY <sub>max</sub> lower
[4]	dX <sub>max</sub> lower
[6]	dX <sub>max</sub> higher
[8]	dY <sub>max</sub> higher
[+]	MQ <sub>min</sub> higher
[-]	MQ <sub>min</sub> lower







- ④ Close the Set up and installation of Tolerance field and Minimum measurement quality by the [Enter]- Key!

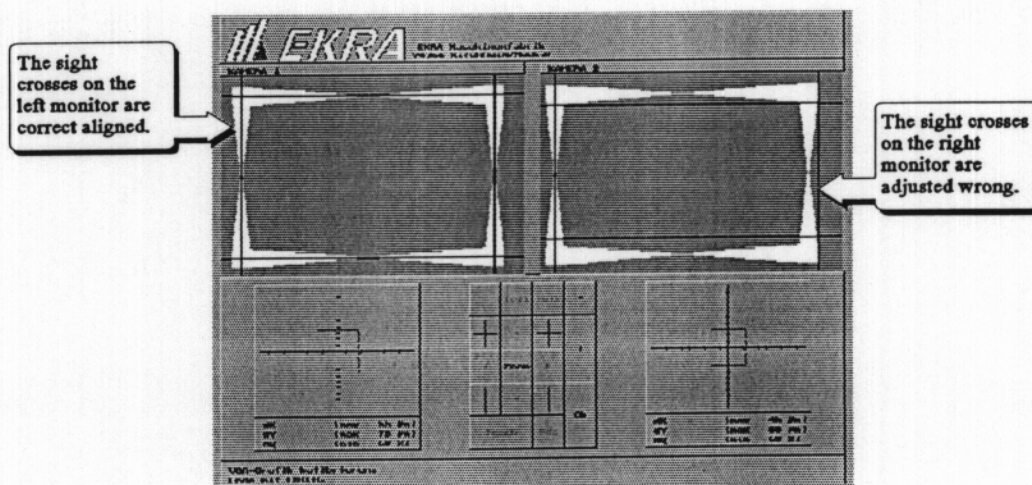
The new parameters are saved automatic. When you switch of they are saved.

### 3.5. Calibration

The calibration is used to bring VGA monitor picture and camera picture in identical position. The correct calibration is the condition for accurate position announcement of Dias and sight crosses. MOPS is not calibrated correctly, when immediately after switch over into Dia mode the dia do not correspondent to the fiducials or when the sight crosses in Zoom function (Key 5) change their position in the camera picture.

MOPS is supplied in calibration version. A new calibration is only required in case of hardware changes in set up mode. The calibration is made in following steps:

- ① Use a PC-Keyboard instead of the numeric Key-block!
- ② Switch over to sight cross mode!
- ③ Press Key [K]. The MOPS now works in calibration mode. Instead of the camera images two white calibration frames appear. On each calibration frame two sight crosses are drawn.
- ④ Now bring the sight crosses together with the white calibration frame. Go back to the description "Set up of sight crosses and adjustment"!
- ⑤ Press Key [5] (Zoom) and adjust with the Zoom function the sight crosses in accordance to the white calibration frame!
- ⑥ Press Key[Enter] to close the calibration procedure. The new installed parameters are saved automatically and remain in this position even when the machine is switched off.

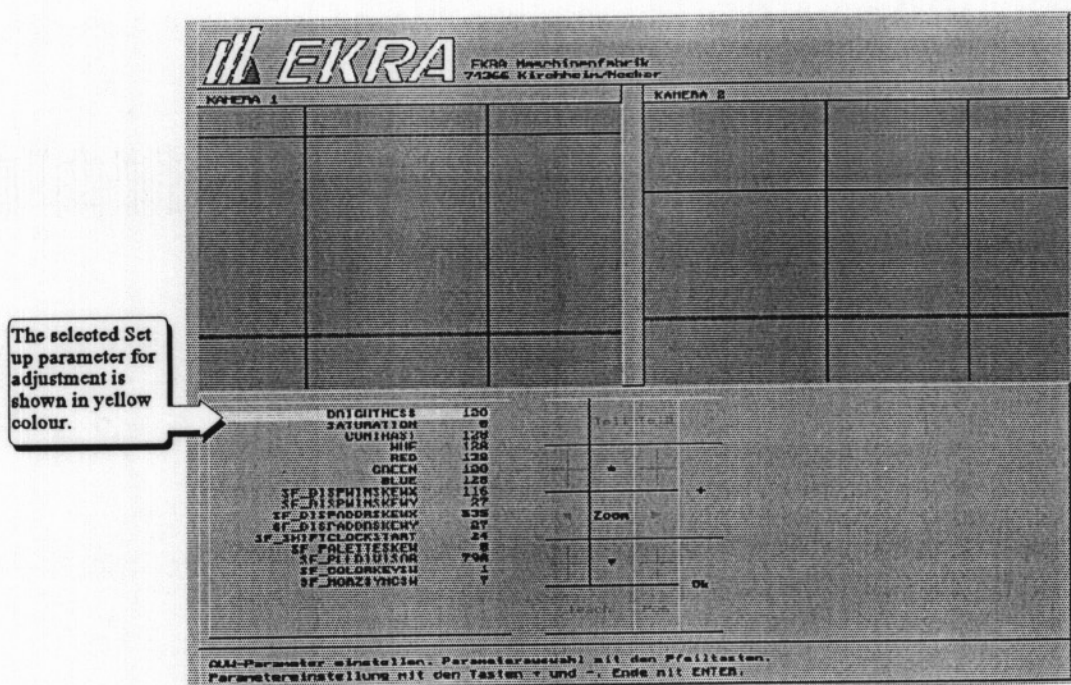


### 3.6. Set Up

In Set up mode the camera image is adjusted. The Set up parameter are preadjusted in correct way when the system is supplied. A correcture of the parameters is only required in case of hardware exchange. **Please take into consideration, that each chngement of these parameters requires a new MOPS calibration.**

To adjust the Set up parameters follow these instructions:

- ① Connect a normal PC-Keybord instead of the numeric keyblock!
- ② Switch over to sight cross mode!
- ③ Press Key [S]. MOPS now shows the SetUp-Menue!
- ④ Select with Key [2] and [8] the parameter you want toadjust!
- ⑤ Change the parameter by the [+] or [-] Key!
- ⑥ Repeat step 4 and 5, until the adjustment is correct.
- ⑦ Finish the Set up with the [Enter] Key! The new Set up parameters are saved automatically, even when the machine is switched off.



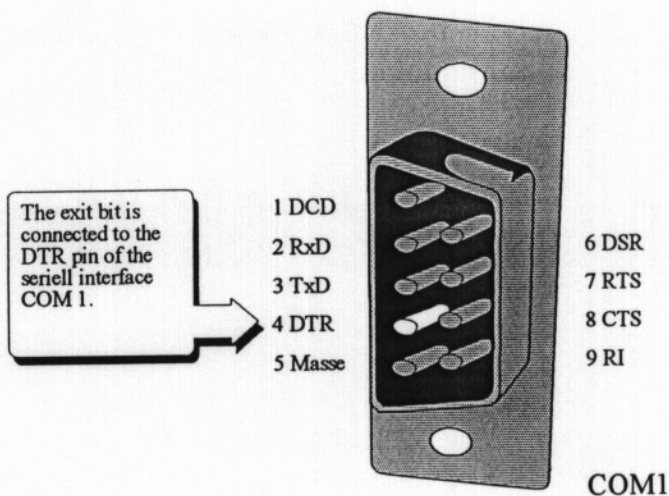
## 4. Exit bit

The MOPS supplies an output bit in order to transfer the good-bad information to other units. The Exit-bit is active, when the automatic mode is running and the fiducials are either not found or lay aside the selected tolerance field. In all other cases the output bit is not available.

The output bit can be used in a production line, to allow the next production stop. The further production of a substrate is allowed, when the output bit is off. The transfer and continuity of production is interrupted, when the output bit is "on".

In this way an operation with or without the MOPS is possible. If the MOPS is switched off, the continuous production is always open and running, for the exit bit cannot be set on. If the MOPS is not running in automatic mode, the production flow is continuously running too. The stop can only be set in automatic mode, when a substrate is not placed in correct position.

The Exit bit is connected to CTR Pin at the serial interface COM 1. The 9-terminal socket is fixed at the backside.





## 7 Drawings and Mechanical Parts Lists

Assembly	Drawing	Parts list
Table lifting drive	77657F	2223000003
Printing table	77735E	2230000003
Screen clamping	77859E	2213000003
Upper part	77843F	2210000003
Squeegee unit 60 stroke	77844E	2216000001
Enclosure		2297000001
<b>Options</b>		
Plexiglass cover (clear)		2208000015
Polycarbonate cover (clear, antistatic)		2208000016
MOPS (Manual Optical Positioning System)		2250000006
Universal printing nest E1 350 mm	76012F	2283000010
Universal printing nest E1 450 mm (standard)	73632F	2283000012
Universal printing nest E1 550 mm	73726F	2283000011
Vacuum suction with PICOLINO VTE 6 pump		2679000004
Vacuum suction with PICO VLT15 pump		2679000003
<b>Accessories</b>		
Test print unit E1	77907D	2283000001
Adapter frame (adjustable)	65250E	2203000005
Adapter bracket for KSB10	78766C	4054000123 (Order No.)
Magnetic strip 350 mm	75545D	4054000124
Magnetic strip 450 mm	73618C	2283000013
Pin		2299000011
Vacuum Pin		2699000003



**Table lifting drive E1**

**Date of design:** 23.03.2001      **Date of change:** 20.04.2001      **Drawing** 77657F  
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	plate	15*220*500	4052000061
20		4,00 piece	plate	50*12*164	4052000062
30		2,00 piece	shaft	30h6*310	4036000006
40		2,00 piece	lever	60*25*120	4053000057
50		1,00 piece	shaft		4036000007
60		4,00 piece	excenter	40*40*74	4053000058
70		4,00 piece	bolt	25*63	4034000005
80		4,00 piece	washer	60*24	4030000012
90		4,00 piece	shaft	25h6*234	5031140008
100		2,00 piece	attachement	120*15*468	4052000063
110		6,00 piece	base	60*2*60	4044000003
120		1,00 piece	plate	420*15*610	4052000064
130		4,00 piece	bearing	80*140	4057000004
140		4,00 piece	bush	40*5*16	4038000004
200		1,00 piece	angle	L80*64*8*200	4056000043
210		1,00 piece	pneumatic-connection	Sk13*18	4039000004
220		1,00 piece	angle	L80*80*8*181	4056000044
230		1,00 piece	holder	36*35*60	4053000059
240		1,00 piece	treaded rod (right)	M16*1*175	4033000008

**Table lifting drive E1**
**Date of design:** 23.03.2001

**Date of change:** 20.04.2001

**Drawing** 77657F

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
250		1,00 piece	bearing	40*40*45	4057000005
260		1,00 piece	ledger	24*20*44	4053000060
270		1,00 piece	angle	L30*20*3*14	4056000045
280		1,00 piece	shaft	6h6*125	4036000008
290		1,00 piece	guidance	26*15*54	4054000029
300		1,00 piece	angle	L100*30*5*30	4056000046
310		1,00 piece	washer		4030000013
320		1,00 piece	bush	M10*M6*10	4034000006
330		1,00 piece	angle	L40*30*3*125	4056000047
340		1,00 piece	treaded rod	TR10*3*330	4033000009
350		3,00 piece	slide DIN 705-A10 zincd		5014000004
360		1,00 piece	motor plate	120*10*106	4052000065
370		1,00 piece	washer	28*5	4030000014
380		1,00 piece	shaft	30h6*145	4036000009
390		1,00 piece	synchronous washer 31T10/24-2		5011150021
400		1,00 piece	washer	40*6	4030000015
410		1,00 piece	synchronous washer 31T10/24-2		5011150022
420		1,00 piece	axis	15h6*64	4037000002
430		1,00 piece	angle	L60*54*10*40	4056000048



**Table lifting drive E1**
**Date of design:** 23.03.2001

**Date of change:** 20.04.2001

**Drawing** 77657F

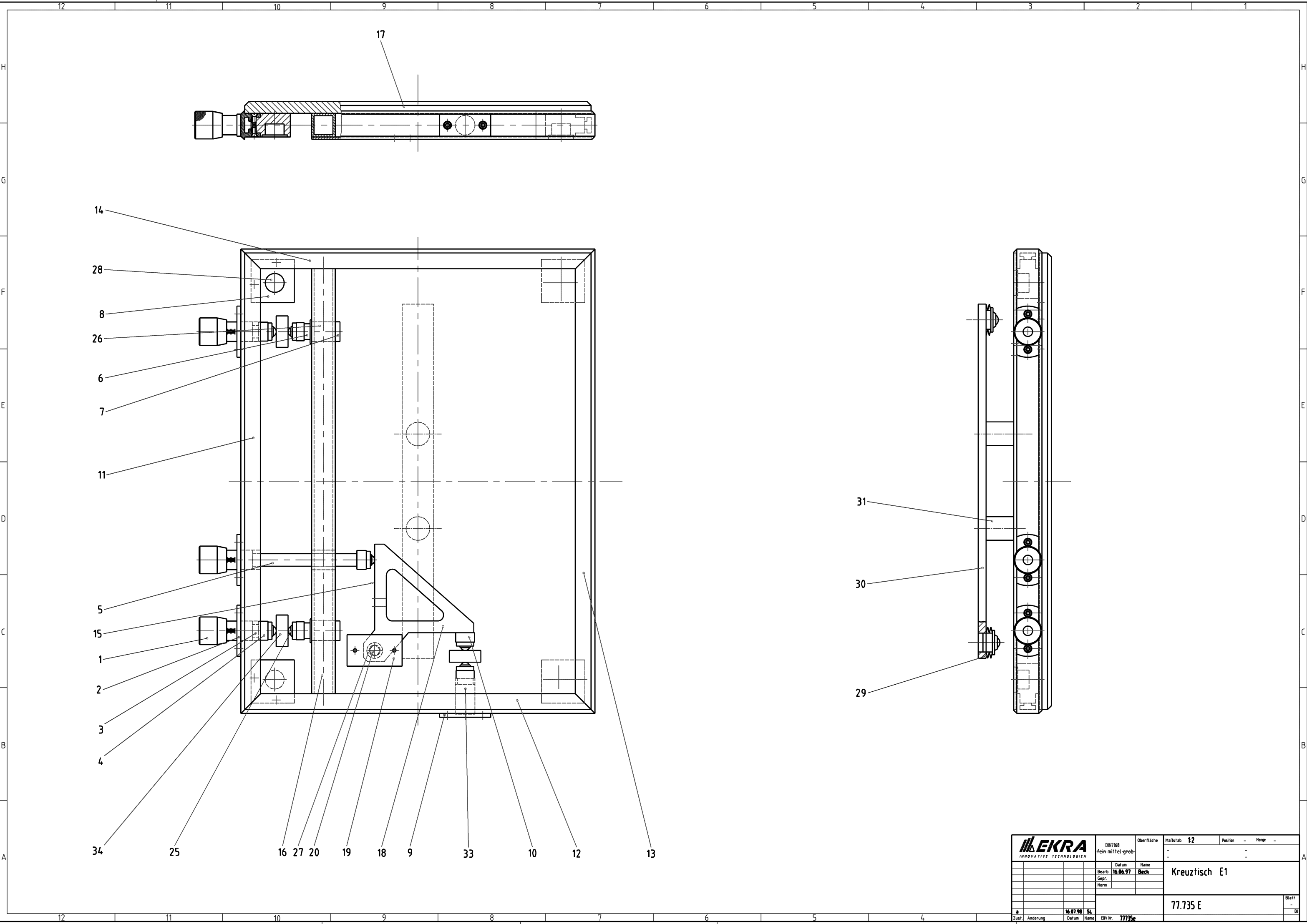
**Variation:**


Item	Var.	Quant.	Designation	Dimension	Article
440		2,00 piece	pressure piece	10*12	4039000005
450		2,00 piece	ledger	80*12*80	4053000061
460		1,00 piece	support	15*8*100	4054000030
470		1,00 piece	plate	20*8*34	4052000066
480		1,00 piece	plate	20*8*34	4052000067
490		1,00 piece	limited	24*15*165	4054000031
500		4,00 piece	angle	L30*30*3*40	4056000049
510		1,00 piece	holder	25*10*30	4053000062
520		1,00 piece	angle	L80*40*6*40	4056000050
530		1,00 piece	push botton	50*12*160	4054000032
540		1,00 piece	bolt NLM 02010-061		5054000002
550		1,00 piece	metering clockwork 30mm M2/30 T		5028000001
560		1,00 piece	synchronus belt 16T10*1450-V		5011100013
570		2,00 piece	groove ball bearing DIN 625-6202 D15*35*11 with 2 cover disk		5013000008
580		1,00 piece	worm gear pair motor NMS40-HU-7.5/1		5310040001
590		1,00 piece	frequency converter 0.9kVA 230V		5382000007
600		2,00 piece	linear guidance Bgr.25 SSR 25XWY2UU+940LY		5031080010
610		8,00 piece	guide bush compact 25*58		5031120006
620		4,00 piece	support roll D=32 d=12 B=15		5013230003

**Table lifting drive E1**

**Date of design:** 23.03.2001      **Date of change:** 20.04.2001      **Drawing** 77657F  
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
630		4,00 piece	housing unit DW=30		5013080002
640		2,00 piece	high-performance-joint head DIN ISO 12240-4 D=10 right-hand thread		5013120001
650		1,00 piece	high-performance-joint head DIN ISO 12240-4 D=10 left-hand thread		5013120002
660		1,00 piece	pneumatical carrier piston 32 stroke 80		5600060005
670		1,00 piece	DC motor 24V with Mini-lifting gear		5310020004
680		2,00 piece	DU-collar bushing (H) 10*12*18*17		5012070003
690		1,00 piece	handwhell 80*10		5024030001
700		4,00 piece	Item-profile bar		4010000034



 INNOVATIVE TECHNOLOGIEN		DIN 7168 fein mittel-grob-		Oberfläche	Haltslab <b>E2</b>	Position	-	Menge	-
				-	-	-	-	-	-
			Datum	Name	Kreuztisch E1				
		Bearb.	<b>16.06.97</b>	Beck					
		Gepr.							
		Norm			77.735 E				
<b>a</b>		<b>16.07.98</b>	<b>SL</b>						
Zust.	Änderung	Datum	Name	EDV Nr. <b>77735e</b>	Blatt -				
					Bl				

## Printing table E1

Date of design: 27.03.2001

Date of change: 11.09.2001

Drawing 77735E

Variation:

Item	Var.	Quant.	Designation	Dimension	Article
10		3,00 piece	handle	35*35	4039000006
20		3,00 piece	flange	65*45	4039000007
30		2,00 piece	adjustable spindle left-hand thread	M16*1*75	4033000010
40		3,00 piece	bush	24*12	4030000008
50		1,00 piece	adjustable spindle left-hand thread	M16*1*200	4033000011
60		3,00 piece	pressure piece	23*45	4039000008
70		2,00 piece	spring support	30*40	4039000009
80		4,00 piece	block	55*55*30	4053000067
90		1,00 piece	print plate	28*5*65	4052000077
100		1,00 piece	bush	24*12	4030000008
110		1,00 piece	frame	Profil*590	4010000036
120		1,00 piece	frame	Profil*450	4010000037
130		1,00 piece	frame	Profil*590	4010000038
140		1,00 piece	frame	Profil*450	4010000039
150		1,00 piece	metal strip	12*0.3*60	4044000004
160		1,00 piece	rectangular tube	30*30*3*540	4010000044
170		1,00 piece	table plate E1	443*15*583	4052000078
180		1,00 piece	lever	140*15*149	4052000079
190		1,00 piece	plate	40*6*70	4052000080

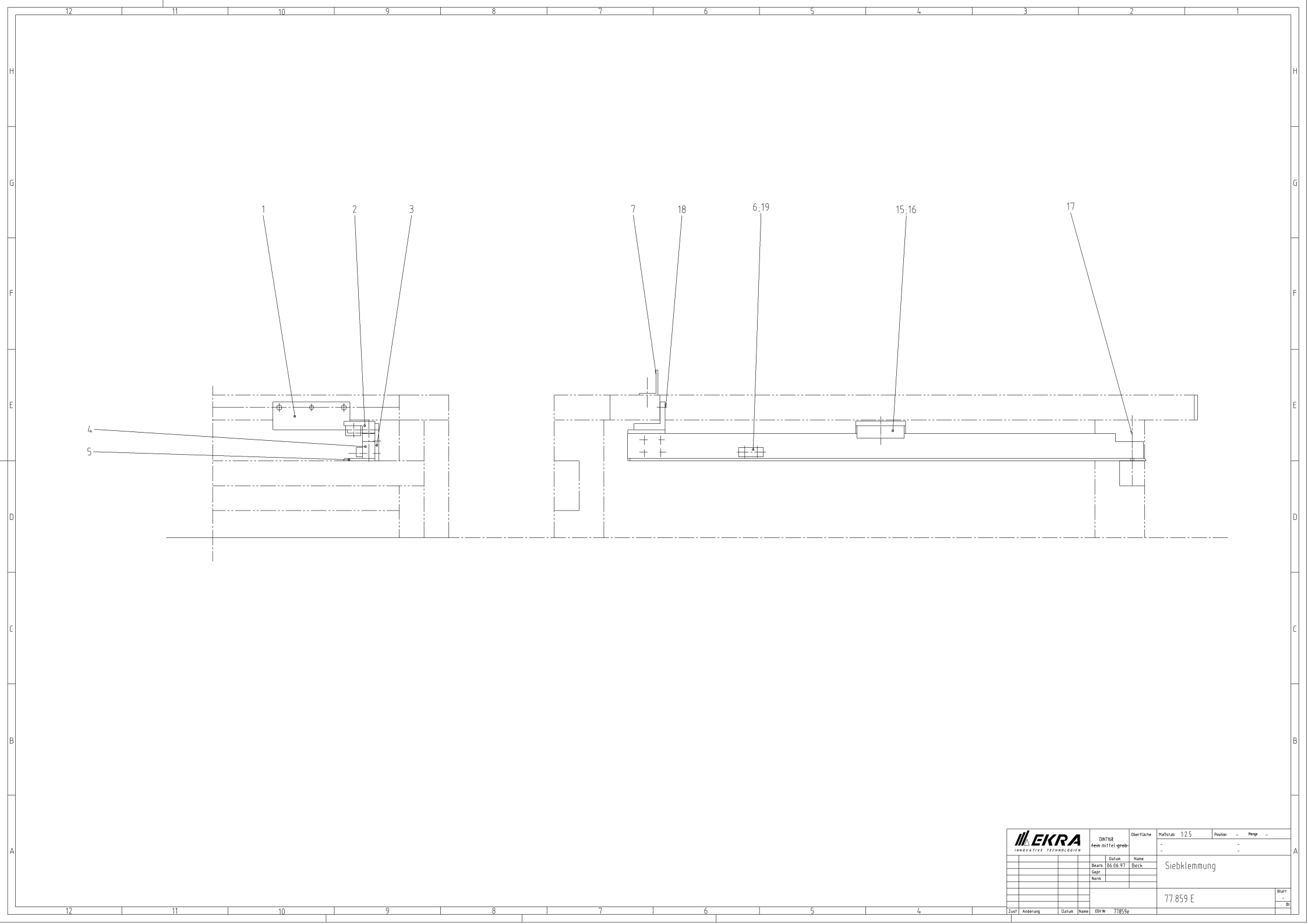
**Printing table E1**
**Date of design:** 27.03.2001


**Date of change:** 11.09.2001

**Drawing** 77735E

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
200		1,00 piece	bolt	12h6*38	4034000008
210		1,00 piece	angle	L20*20*3*44	4056000055
220		600,00 mm	energy chain series 06 E2 B=16.5 R=28 black		5090010005
230		1,00 piece	connection element series 06 E2 B=16.5		5090110004
240		4,00 piece	T-sliding block DIN 508-M6*8		5051000001
250		7,00 piece	ball caster without bond da=22 H=17.5 h=5.5		5013210002
260		2,00 piece	spring DIN 2098-2.50*12.50*67.5		5023000005
270		2,00 piece	DU-collar bushing (H) 12*14*20*7		5012070004
280		6,00 piece	ball roll with bond da=24 H=21.5 h=9.5		5013210003
290		8,00 piece	disc spring DIN 2093 39.6*25.5*0.4		5023300002
300		1,00 piece	holder	40*10*450	4054000039
310		2,00 piece	distance	30*68	4038000011
330		1,00 piece	spring support	24*38	4038000012
340		3,00 piece	pressure piece	30*15*40	4053000071



 INNOVATIVE TECHNOLOGIEN		DWT168 fein mittel grob		Oberfläche		Maßstab 1:25		Position -- Menge --	
						-- --		-- --	
		Datum		Name		Siebklemmung			
		Bearb. 05.06.97		Beck.					
		Gepr. nach							
						77.859 E			
Zust.	Änderung	Datum	Name	EDW-Nr.	77859e		Blatt --		
							- BI		

**Screen clamping E1**
**Date of design:** 28.03.2001

**Date of change:** 12.09.2001

**Drawing** 77859E

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		2,00 piece	angle	L50*45*10*170	4056000056
20		4,00 piece	cylinder holder	50*20*80	4052000085
30		2,00 piece	angle	L50*50*5.5*60	4056000057
40		2,00 piece	Item-profile 5 40*20	40*20*830	4010000045
50		2,00 piece	ledge	50*4*830	4054000040
60		1,00 piece	ledger	15*10*40	4053000074
70		1,00 piece	holder	L40*30*3*70	4056000058
150		4,00 piece	print plate EV-15/63-DP		5027020002
160		4,00 piece	tightening unit EV-15/63 stroke 4mm	80*23*18	5027020001
170		2,00 piece	adjustable clamp lever with screw M5		4090000008
180		2,00 piece	adjustable clamp lever with screw M6		4090000009
190		1,00 piece	knurled head screw M5*16 ,plastic		5024050002
200		4,00 piece	cover 40*20 for profile 5		5070600001





**Upper part E1**
**Date of design:** 18.04.2001

**Date of change:** 18.04.2001

**Drawing** 77843F

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		2,00 piece	angle	L60*60*6*875	4056000063
40		2,00 piece	bearing block		4057000006
60		2,00 piece	instep block	12*10*40	4053000030
70		2,00 piece	bearing bolt	50*36	4057000002
80		2,00 piece	plate	40*6*155	4052000093
90		2,00 piece	clamp ledge 70mm	40*8*70	4054000046
100		1,00 piece	drive shaft	20H6*680	4036000015
110		1,00 piece	square for the motor	L80*80*8*90	4056000064
140		1,00 piece	plate	55*5*50	4052000094
160		1,00 piece	belt stretcher	50*15*70	4052000095
200		1,00 piece	square angle pipe	30*15*2*450	4010000046
210		1,00 piece	sensor holder	20*4*70	4052000096
220		1,00 piece	coupling	15*27	4039000010
230		1,00 piece	holder	U50*50*4*50	4010000047
350		2,00 piece	synchronous belt 16T10*1880		5011100014
360		1,00 piece	synchronous belt 124L/100 neopren		5011100015
370		4,00 piece	groove ball bearing DIN 625-6001 D12*28*8 with 2 cover disk		5013000004
380		2,00 piece	synchronous washer 31T10/16-2		5011150013
390		2,00 piece	synchronous washer 31T10/16-2		5011150010

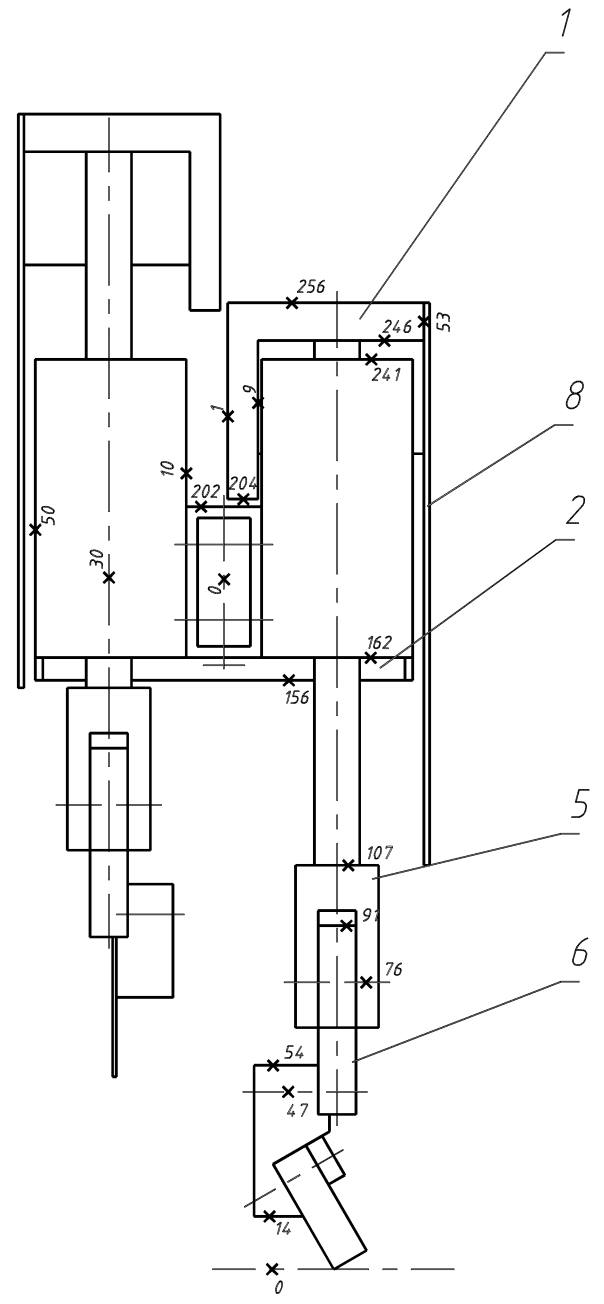
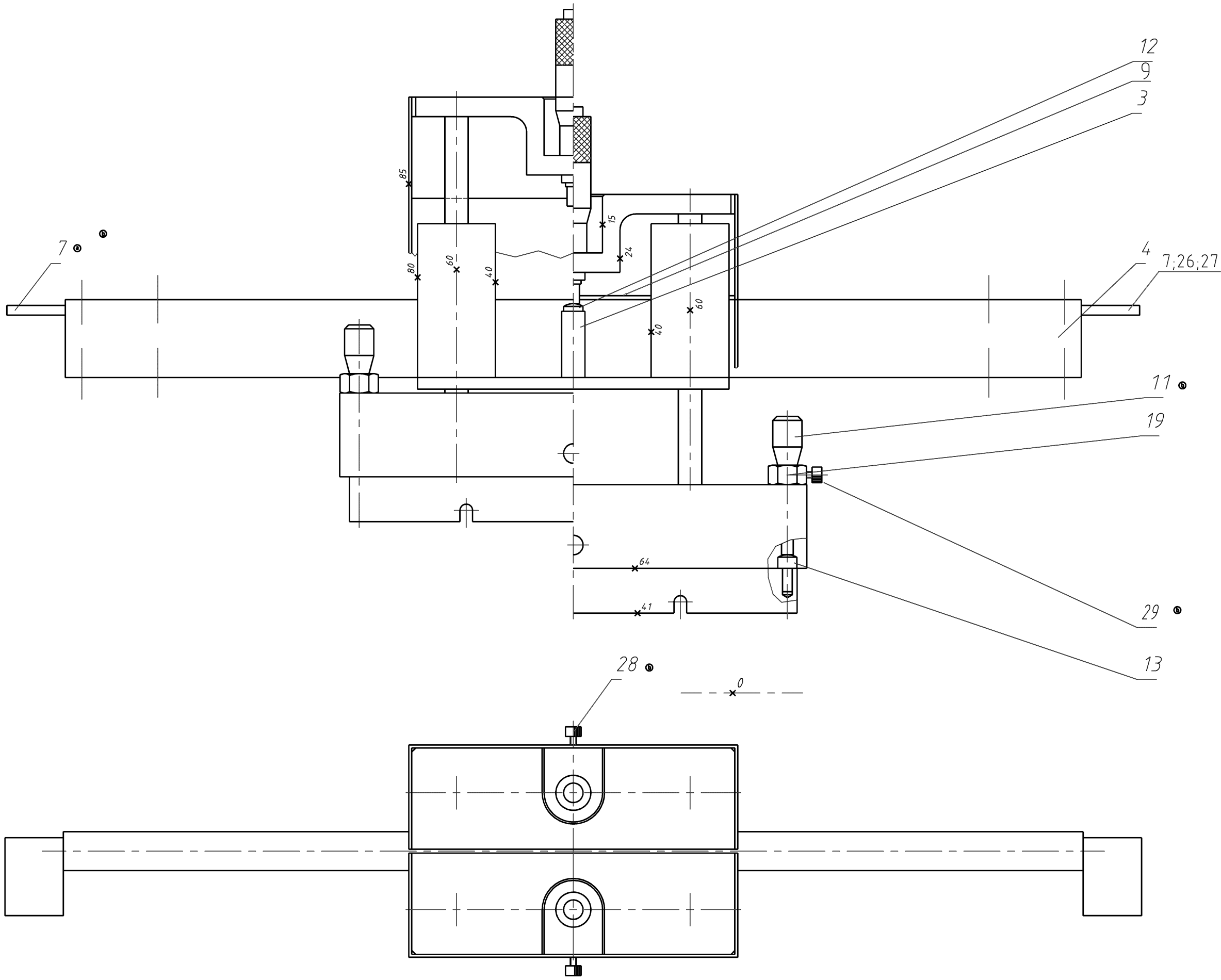
**Upper part E1**
**Date of design:** 18.04.2001


**Date of change:** 18.04.2001

**Drawing** 77843F

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
400		2,00 piece	housing unit DW=20		5013080001
410		4,00 piece	shaft bracket 1055 für shaft d=16		5031180001
420		2,00 piece	shaft	16h7*764	5031140010
430		2,00 piece	shaft support for shaft d=16, L=30		4010000018
460		1,00 piece	synchronous washer 14L100		5011150023
470		1,00 piece	DC gear motor d=63, 24V, i=64:1		5310020006
480		1,00 piece	synchronous washer 14L100		5011150024
490		4,00 piece	guide bush 16*36		5031120005
510		2,00 piece	Polyurethan-spiral hose L=1.5m		5671000003



 INNOVATIVE TECHNOLOGIEN				DIN 7168 fein mittel-grob-		Oberfläche	Haftstab 1:1		Position - Menge -	
				Datum	Name	Rakelwerk				
				Bearb. 07.06.97	Beck					
				Gepr.						
				Norm						
b		21.07.98		SL		77.844 E				Blatt -
a		16.04.98		SL						(B)
Zust.	Änderung	Datum	Name	EDV Nr. 77844e						

**Squeegee device E1 stroke 60**

**Date of design:** 19.04.2001      **Date of change:** 16.05.2001      **Drawing** 77844E  
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		2,00 piece	angle	52*52*166	4053000083
20		1,00 piece	plate	100*6*160	4052000097
30		2,00 piece	stud bolt	12*50	4034000011
40		1,00 piece	traverse	40*220*3*695	4050000010
50		2,00 piece	holder	43*22*240	4054000047
60		2,00 piece	ledge	50*10*230	4054000048
70		2,00 piece	plate	40*5*80	4052000098
80		2,00 piece	casing sheet	1*170*270	4040000135
90		1,00 piece	safety guard	1.5*20*302	4040000136
120		2,00 piece	pressure piece	10*12	4039000005
130		4,00 piece	pressure bolt	9.8*19	4034000012
180		4,00 piece	knurled head screw	15*76	4039000011
190		4,00 piece	threaded bushing	17*32	4039000012
260		1.200,00 mm	energy chain series 06 E2 B=16.5 R=28 black		5090010005
270		2,00 piece	connection element series 06 E2 B=16.5		5090110004
280		2,00 piece	knurled head screw DIN 464-M3*25-St- zincd	3*25	5050000049
290		4,00 piece	knurled head screw DIN 464-M3*10-St- zincd	3*10	5050000050
300		2,00 piece	adjusting screw 25mm/0.01 with tension nut		5028000002
310		4,00 piece	cylinder with guid piston 25mm, stroke 60mm, double acting		5601040006

**Squeegee device E1 stroke 60**

**Date of design:** 19.04.2001      **Date of change:** 16.05.2001      **Drawing** 77844E  
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
320		4,00 piece	knurled head screw DIN 464-M6*18-St-zincd	6*18	5050000051
330		2,00 piece	DU-bush cylindric 10*12*10		5012070005
340		20,00 piece	button hexagon-socket head screw M3*6-10.9 zincd	M3*6	5050000039
350		2,00 piece	pin ISO 2338-10*24-A-St		5055000006
360		4,00 piece	plug-in nipple-thread joint with sealing ring tube. di=3 / M5		5675000005
390		16,00 piece	countersunk screw ISO 10642-M5*20-10.9 zincd	M5*20	5050000021
400		4,00 piece	shim ring DIN 988-12*18*1	12*18*1	5052000016
410		2,00 piece	knurled head screw DIN 464-M3*10-St-zincd	3*10	5050000050
420		1,00 piece	treaded pin DIN 916-M3*6-45H	M3*6	5050000059
430		4,00 piece	spring DIN 2098-0.90*14.10*39.20		5023000008
440		4,00 piece	hexagon socket head screw ISO 4762-M6*16-8.8 zincd	M6*16	5050000010

**Casing E1**
**Date of design:** 30.03.2001

**Date of change:** 05.12.2001

**Drawing** 77325

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	mounting sheet metal, curved	2.5*665*775	4040000134
30		2,00 piece	plate	40*10*46	4052000099
40		1,00 piece	holder	30*5*45	4052000100
50		1,00 piece	switching cam	12*56	4036000016
60		2,00 piece	distance	18*213	4033000014
70		1,00 piece	distance	18*100	4033000015
80		1,00 piece	bearing	20*8*33	4057000007
90		1,00 piece	cover ring E1		4032000005
100		1,00 piece	panel housing		5392000005
110		1,00 piece	mounting sheet emtal	2.5*90*280	4040000137
120		1,00 piece	angle	L100*40*5*40	4056000065
140		1,00 piece	angle	3*70*83 roh	4040000138
150		1,00 piece	security flap		2299000010
200		1,00 piece	valve	1.5*134*667	4040000139
210		1,00 piece	cover	1.5*93*750	4040000140
250		1,00 piece	DU-bush cylindric 5*7*5		5012070006
260		2,00 piece	magnet lock adhesive force 40N		5025000003
270		1,00 piece	safety switch with switching cam 76039B		5353000018
280		3,00 piece	hinge 8 PA (right)		5070300002

**Casing E1**
**Date of design:** 30.03.2001

**Date of change:** 05.12.2001

**Drawing** 77325

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
290		1,00 piece	Rollo-cover		5900000013
310		2,00 piece	sheet metal	1.5*239*989	4040000141
320		2,00 piece	sheet metal	1.5*99*715	4040000142
330		2,00 piece	sheet metal	1.5*131*779	4040000143
340		1,00 piece	sheet metal	2*630*750	4040000144
350		1,00 piece	door (rear)	1.5*678*885	4040000145
360		1,00 piece	cover	1.5*420*1020	4040000146
370		1,00 piece	sheet metal (front ,right)	1.5*885*963	4040000147
380		1,00 piece	sheet metal (front,left)	1.5*885*963	4040000148
390		1,00 piece	cover	1.5*310*750 roh	4040000149
400		1,00 piece	pan	1.5*531*776 roh	4040000150
410		1,00 piece	door (front)	1.5*698*800 roh	4040000151
420		1,00 piece	sheet metal for table	1.5*229*619 roh	4040000152
430		1,00 piece	cover		4080000045
440		1,00 piece	bush	40*25	4039000002
450		2,00 piece	sticker "Handverletzung mit Messer"		8012520010

**Plexiglass cover**
**Date of design:** 27.06.2001

**Date of change:** 14.11.2001

**Drawing** 77326

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	cover E1 XT clear		5075000006
20		1,00 piece	stiffening angle	L80*80*6*30	4056000094
30		1,00 piece	stiffening angle	L80*80*6*30	4056000095
40		2,00 piece	stiffening angle	L40*40*5*40	4056000096
50		2,00 piece	among piece	25*31	4039000027
60		2,00 piece	plate	30*5*80	4052000184
70		2,00 piece	plate	25*5*80	4052000185
120		1,00 piece	safety switch with switching cam 76039B		5353000018
150		4,00 piece	washer	18*3	4030000030
200		2,00 piece	hexagon nut DIN 1587-M8 zincd		5051000013
210		2,00 piece	gas spring 80N d=19 stroke=250		5062000004
220		1,00 piece	grip		5024000001
230		2,00 piece	bearing chair für ISO-cylinder (LBN-20/25)		5601500001
240		1,00 piece	hinge 8 PA (right)		5070300002
250		1,00 piece	hinge 8 PA (left)		2299000027



**Cover PC clear antistatic**
**Date of design:** 27.06.2001

**Date of change:** 05.07.2001

**Drawing** 68027

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	cover E1 PC clear antistatic		5075000007
20		1,00 piece	stiffening angle	L80*80*6*30	4056000094
30		1,00 piece	stiffening angle	L80*80*6*30	4056000095
40		2,00 piece	stiffening angle	L40*40*5*40	4056000096
50		2,00 piece	among piece	25*31	4039000027
60		2,00 piece	plate	30*5*80	4052000184
70		2,00 piece	plate	25*5*80	4052000185
120		1,00 piece	safety switch with switching cam 76039B		5353000018
200		2,00 piece	hexagon nut DIN 1587-M8 zincd		5051000013
210		2,00 piece	gas spring 80N d=19 stroke=250		5062000004
220		1,00 piece	grip		5024000001
230		2,00 piece	bearing chair für ISO-cylinder (LBN-20/25)		5601500001
240		1,00 piece	hinge 8 PA (right)		5070300002
250		1,00 piece	hinge 8 PA (left)		2299000027

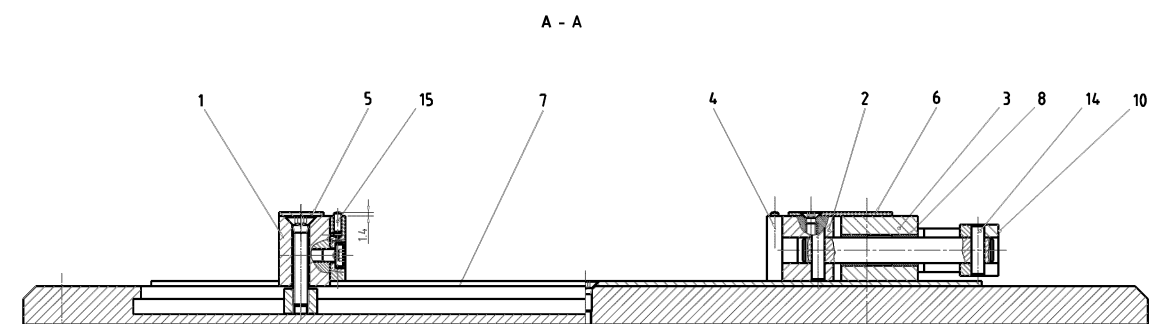
**MOPS-B**
**Date of design:** 06.07.2001

**Date of change:** 06.07.2001

**Drawing** 77324

**Variation:**

Item	Var.	Menge	Designation	Dimension	Article
10		1,00 piece	monitor stand		4080000069
20		4,00 piece	instep block	34*25*60	4053000121
30		2,00 piece	angle	L50*22*3*100	4056000070
40		2,00 piece	block	15*15*80	4053000122
50		2,00 piece	ledger	7.5*30	4035000010
80		1,00 piece	plate for plug E1	3*74*205	4052000188
90		1,00 piece	plate	10*162*686	4052000189
100		1,00 piece	plate	10*60*686	4052000190
200		1,00 piece	linear guidance Bgr.15 SSR 2 carrier L=680		5031080026
210		2,00 piece	linear guidance Bgr.15 SSR 2Wagen L=400		5031080027
220		4,00 piece	adjustable clamp lever with screw M5*35		5024110004
230		2,00 piece	cover 15*15*20		5900000027
330		1,00 piece	MOPS (manual optical positioning system)		2450000003



**Universal print nest 350mm**

**Date of design:** 27.06.2001      **Date of change:** 02.07.2001      **Drawing** 76012F  
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	ledge	20*27.4*350	4054000129
20		1,00 piece	stretching ledge	20*27.4*350	4054000130
30		1,00 piece	guidance ledge	30*27.4*350	4054000131
40		4,00 piece	plate	40*5*25.4	4052000186
50		1,00 piece	sheet metal	1.5*17.5*350	4040000234
60		1,00 piece	sheet metal	1.5*40*350	4040000235
70		1,00 piece	sheet metal	2*285*325	4040000236
80		2,00 piece	guidance bolt	10h6*74.5	4034000037
90		5,00 piece	magnet strip 350 mm	40*24.7*350	4054000124
100		1,00 piece	cylinder fixing	20*15*120	4054000132
110		1,00 piece	sheet metal	1*17.5*350	4040000237
120		1,00 piece	sheet metal	1*40*350	4040000238
140		4,00 piece	pin ISO 28734-5*20-A-St	5*20	5055000010
150		4,00 piece	pin ISO 28734-3*8-A-St	3*8	5055000005
160		2,00 piece	spring DIN 2098-1.10*9.20*26.00 stainless		5023000011
170		4,00 piece	Polymer plain bearing 10*12*14.5		5012050001
180		1,00 piece	tightening unit EV-10/30 stroke 3mm		5027020003
190		1,00 piece	print plate EV-10/30-DP		5027020004

[illegible]

Ansicht ohne Magnetleiste

Tischplatte

451mm

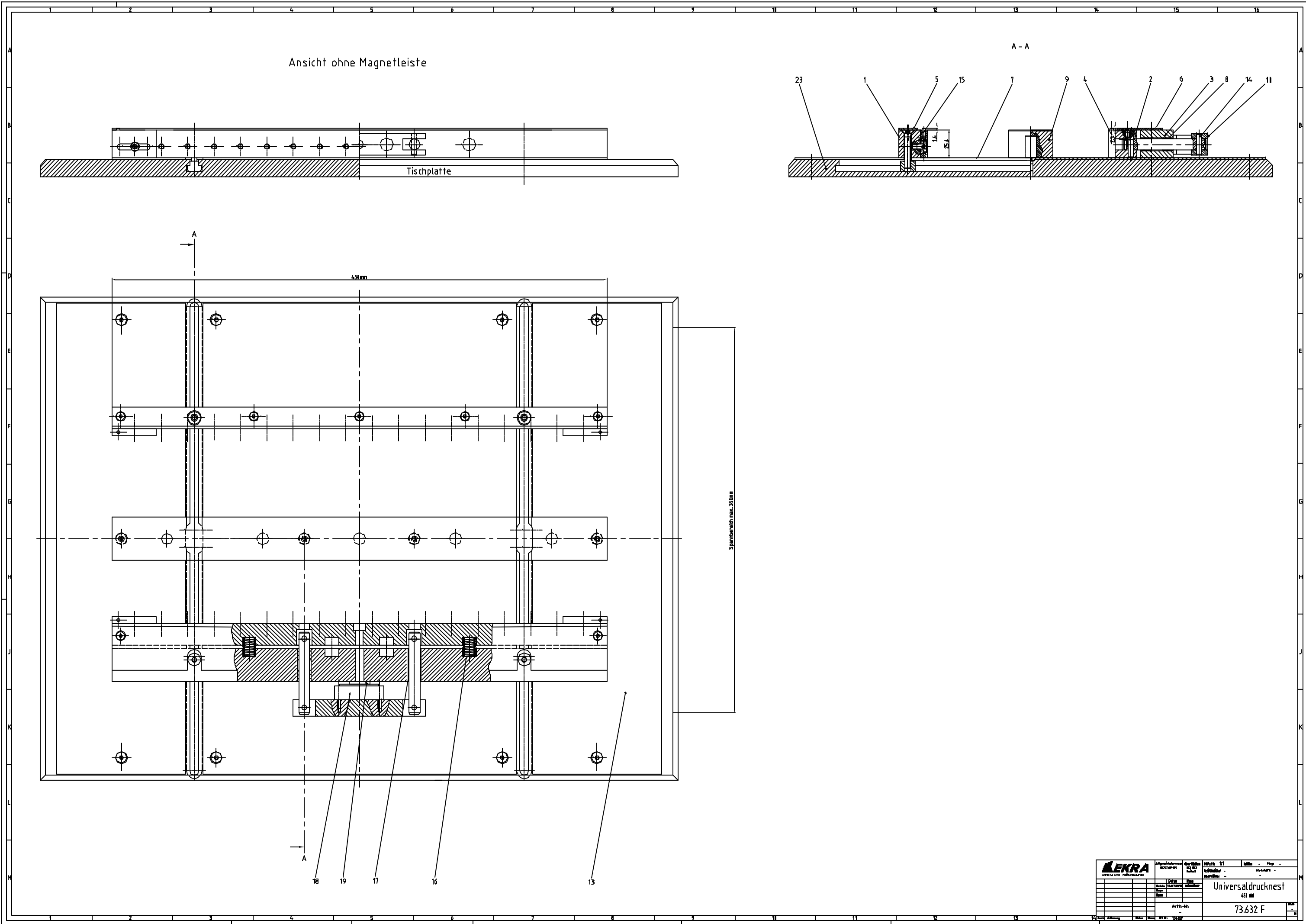
Spannbereich max. 351mm

A - A

23 1 5 15 7 9 4 2 6 3 8 14 11

18 19 17 16 13

<b>EKRA</b> UNIVERSALDRUCKNEST		Art.-Nr. 73.632 F	Stück 1	Zeichn.-Nr. 73.632 F
Hersteller EKRA		Material Alu	Druck 0,1 - 10 bar	Temperatur -20 °C bis +80 °C
Abmessungen 451 x 351 x 100 mm		Gewicht 0,5 kg	Zusätzliche Informationen Universaldrucknest	



Ansicht ohne Magnetleiste

Tischplatte

A - A

431mm

Spannbereich max. 351mm

18 19 17 16 13

<b>LEKRA</b> UNIVERSALDRUCKNEST		Art.-Nr. 73.632 F	Stück 1	Zeichn.-Nr. 73.632 F
Technische Zeichnung		Universaldrucknest		
Skizze		Skizze		
Maßstab		Maßstab		
Datum		Datum		
Gezeichnet		Gezeichnet		
Geprüft		Geprüft		
Freigegeben		Freigegeben		

Ansicht ohne Magnetleiste

Tischplatte

A - A

431mm

Spannbereich max. 351mm

18 19 17 16 13

<b>LEKRA</b> UNIVERSALDRUCKNEST		Art.-Nr. 73.632 F	Stück 1	Zeichn.-Nr. 73.632 F
Technische Zeichnung		Universaldrucknest		
Skizze		Skizze		
Maßstab		Maßstab		
Datum		Datum		
Gezeichnet		Gezeichnet		
Geprüft		Geprüft		
Freigegeben		Freigegeben		

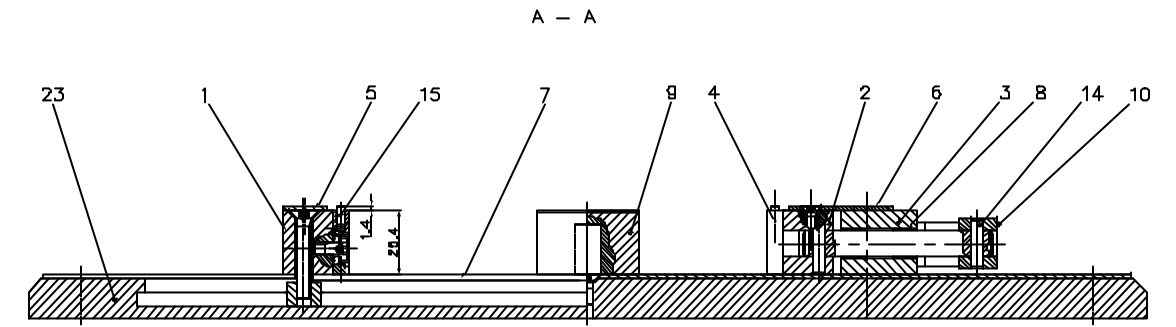
**Universal print nest 450mm**
**Date of design:** 27.06.2001


**Date of change:** 15.11.2001

**Drawing** 73632F

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	ledge	20*25.4*450	4054000137
20		1,00 piece	stretching ledge	20*25.4*450	4054000138
30		1,00 piece	guidance ledge	30*25.4*450	4054000139
40		4,00 piece	plate	40*5*25.4	4052000186
50		1,00 piece	sheet metal	1.5*17.5*450	4040000245
60		1,00 piece	sheet metal	1.5*40*450	4040000246
70		1,00 piece	sheet metal	2*285*428	4040000241
80		2,00 piece	guidance bolt	10h6*74.5	4034000037
90		5,00 piece	magnet strip 450mm		2283000013
100		1,00 piece	cylinder fixing	20*15*120	4054000132
110		2,00 piece	sheet metal	2*117.5*428	4040000242
120		1,00 piece	sheet metal	17.5*1*450	4040000247
130		1,00 piece	sheet metal	1*40*450	4040000248
140		4,00 piece	pin ISO 28734-5*20-A-St	5*20	5055000010
150		4,00 piece	pin ISO 28734-3*8-A-St	3*8	5055000005
160		2,00 piece	spring DIN 2098-1.10*9.20*26.00 stainless		5023000011
170		4,00 piece	Polymer plain bearing 10*12*14.5		5012050001
180		1,00 piece	tightening unit EV-10/30 stroke 3mm		5027020003
190		1,00 piece	print plate EV-10/30-DP		5027020004

[illegible]

 <b>LEKRA</b> UNIVERSALDRUCK NEWMARKT	Allgemeine Druckerei und Verlag 53757 NEWMARKT 0224 7222801		Maßstab: 1:1 Zeichnungs- nummer:	Position: -- Menge: -- Version: --
	DRUCK Datum: -- Name: -- Preis: -- Kurz: --	UNIVERSALDRUCKNEST 650 8778		
Auftrag-Nr.: -- --		73.726 F		Blatt: -- von: --
24x36 Zentimeter	Datum Name: --	02.07.2001		

**Universal print nest 550mm**
**Date of design:** 27.06.2001

**Date of change:** 14.09.2001

**Drawing** 73726F

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	ledge	20*25.4*550	4054000133
20		1,00 piece	stretching ledge	20*25.4*550	4054000134
30		1,00 piece	guidance ledge	30*25.4*550	4054000135
40		4,00 piece	plate	40*5*25.4	4052000186
50		1,00 piece	sheet metal	1.5*17.5*534	4040000239
60		1,00 piece	sheet metal	1.5*40*550	4040000240
70		1,00 piece	sheet metal	2*285*428	4040000241
80		2,00 piece	guidance bolt	10h6*74.5	4034000037
90		5,00 piece	magnet strip 550mm		2283000014
100		1,00 piece	cylinder fixing	20*15*120	4054000132
110		2,00 piece	sheet metal	2*117.5*428	4040000242
120		1,00 piece	sheet metal	1*17.5*550	4040000243
130		1,00 piece	sheet metal	1*40*550	4040000244
140		4,00 piece	pin ISO 28734-5*20-A-St	5*20	5055000010
150		4,00 piece	pin ISO 28734-3*8-A-St	3*8	5055000005
160		2,00 piece	spring DIN 2098-1.10*9.20*26.00 stainless		5023000011
170		4,00 piece	Polymer plain bearing 10*12*14.5		5012050001
180		1,00 piece	tightening unit EV-10/30 stroke 3mm		5027020003
190		1,00 piece	print plate EV-10/30-DP		5027020004



**Universal print nest 550mm****Date of design:** 27.06.2001**Date of change:** 14.09.2001**Drawing** 73726F**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
230		1,00 piece	table plate	15*440*580	4052000187

**Vacuum pump 6I**
**Date of design:** 27.06.2001      **Date of change:** 29.06.2001

**Drawing**      **67494**
**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	vacuum pump PICOLINO VTE 6		5613000001
20		1.400,00 mm	PC-tube da=15; di=9		5671000008
30		1,00 piece	5/2-magnet valve MVH-5-1/4-S-B air pressure control		5630160001
40		2,00 piece	silencer connection G1/4 outside		5690000005
50		1,00 piece	screwed sealing plug DIN 908-G1/4A-St		5677000011
60		3,00 piece	plug-in nipple-thread joint tube.di=9 / G1/4, SW17		5675000009
70		1,00 piece	silencer connection M5 outside		5690000004
80		1,00 piece	push-in fitting angle di=6 thread R1/8		5673000033
90		1,00 piece	locking plug ramification di=6 of di=6		5673000034
100		1,00 piece	threaded elbow joint 90° di=10, R1/4 outside		5677000017
110		1,00 piece	threaded elbow joint 90° di=10, R3/8 outside		5677000018
120		1,00 piece	Schott-plug in connection di=4 auf di=4, thread M10		5673000032
130		1,00 piece	sheet metal	2*60*191	4040000233
140		1,00 piece	3pol. clutch box DIN 43 650 version B		5360000048
150		1,00 piece	illuminated seal for plug-in connector DIN 43 650		5360000049

**Vacuum pump 15l**
**Date of design:** 27.06.2001

**Date of change:** 14.11.2001

**Drawing** 67495

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	vacuum pump PICO VTL 15		5613000002
20		1,00 piece	reducer nipple G3/8 inside / G1/2 outside, SW24		5677000016
30		1,00 piece	hexagon	Sk19*70	4034000036
40		1,00 piece	5/2-magnet valve MVH-5-1/4-S-B with air pressure control		5630160001
50		2,00 piece	silencer connection G1/4 outside		5690000005
60		1,00 piece	screwed sealing plug DIN 908-G1/4A-St		5677000011
70		1,00 piece	plug-in nipple-thread joint tube.di=9 / G1/4, SW17		5675000009
80		1,00 piece	silencer connection M5 outside		5690000004
90		1,00 piece	push-in fitting angle di=6 thread R1/8		5673000033
100		1,00 piece	plug in connection ramification di=6 auf di=6		5673000034
110		900,00 mm	PC-tube da=15; di=9		5671000008
150		1,00 piece	Schott-plug in connection straight di=4 auf di=4, thread M10		5673000032
160		1,00 piece	threaded elbow joint 90° di=10, R1/4 outside		5677000017
170		1,00 piece	threaded elbow joint 90° di=10, R3/8 outside		5677000018
180		1,00 piece	3pol. clutch box DIN 43 650 version B		5360000048
190		1,00 piece	illuminated seal for plug-in connector DIN 43 650		5360000049



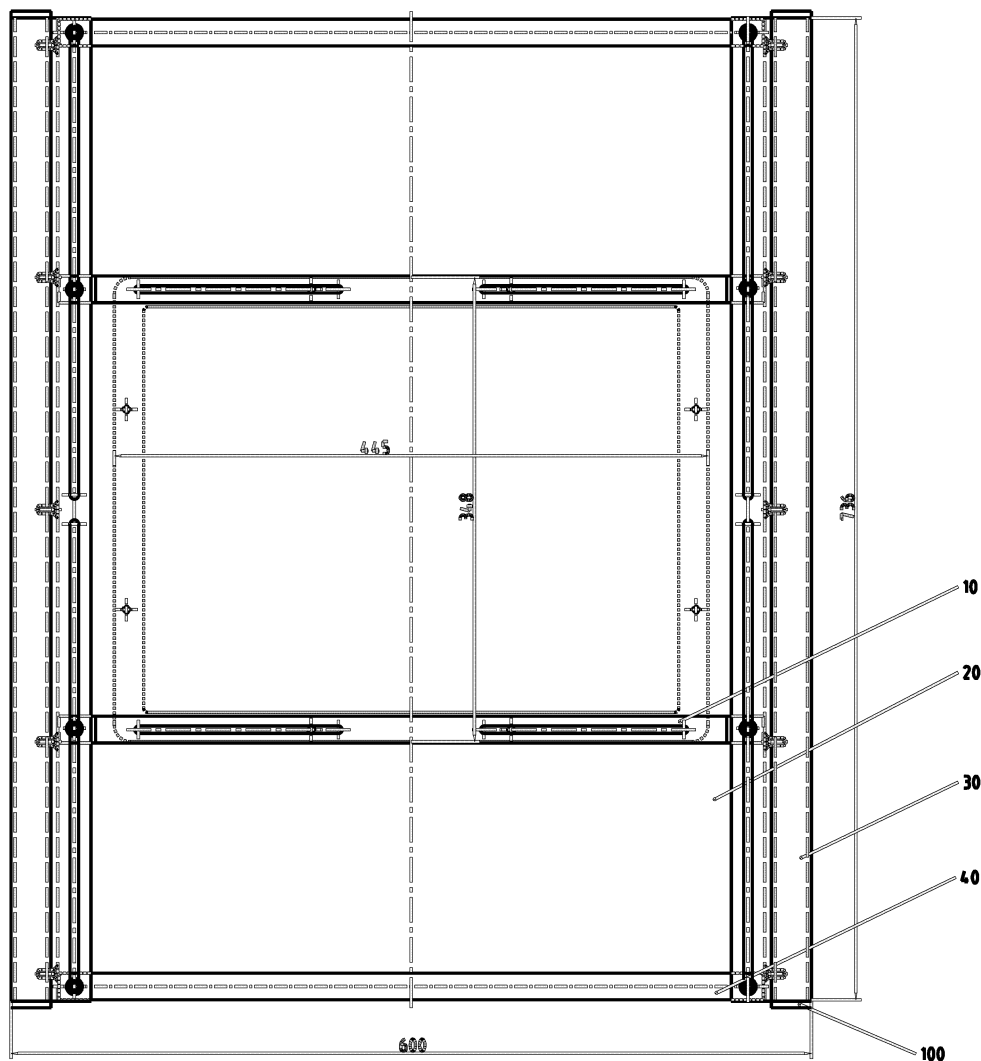
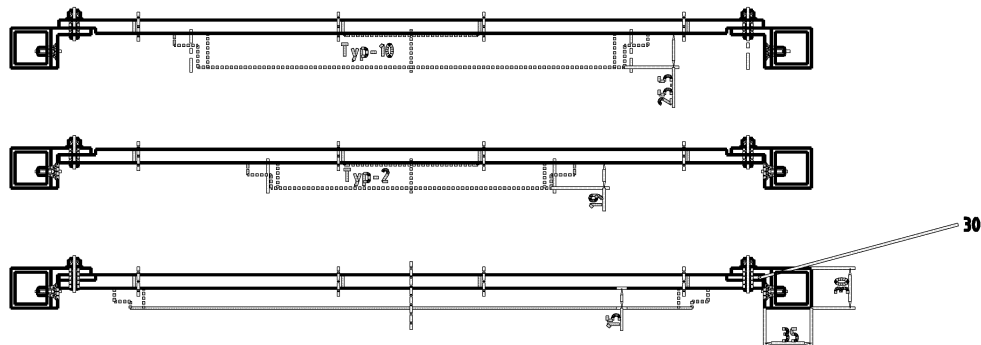
**Trial prints device**
**Date of design:** 28.03.2001

**Date of change:** 28.03.2001

**Drawing** 77907D

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	frame	1*467*580	4040000128
20		1,00 piece	foil	520*0.5*380	4090000006
30		2,00 piece	bracket block	20*20*21	4053000072
40		2,00 piece	bracket block	60*20*78.5	4053000073
80		2,00 piece	drilling sleeve DIN 179-A 5.1*20		5027010002
90		2,00 piece	pin ISO 28734-5*40-A-St	5*40	5055000013



<b>EKRA</b> extruded aluminum		Baugruppe Bauteil-Nr.	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250
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		Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250	Bauteil-Nr. 65.250

Adaptierraum  
 für 20  
 65.250 E

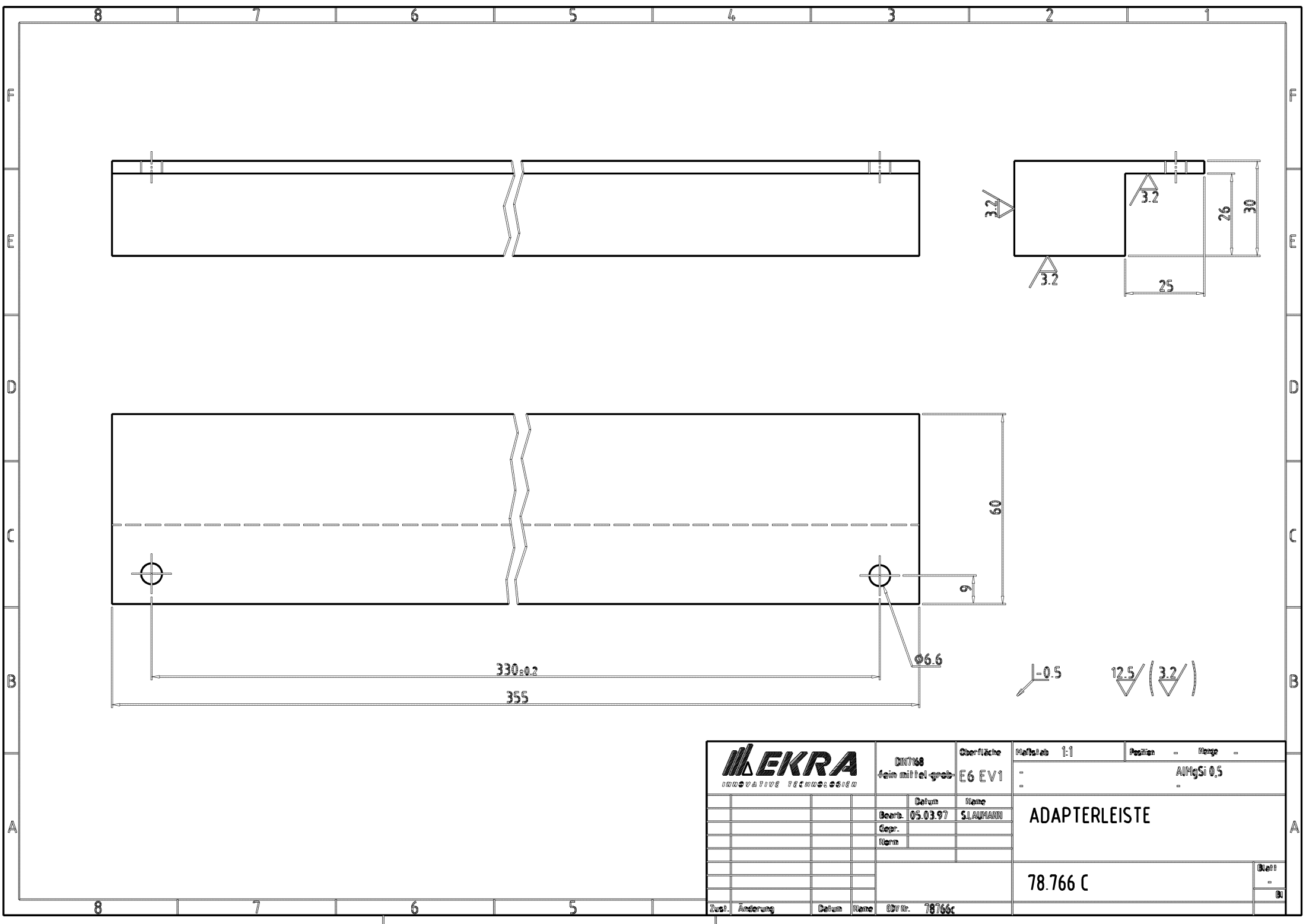
**Adapter frame adjustable**
**Date of design:** 27.06.2001


**Date of change:** 09.07.2001

**Drawing** 65250E

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		2,00 piece	stencile-holder	20*10*528	4054000140
20		2,00 piece	angle	L30*30*3*737	4056000097
30		2,00 piece	rectangular tube	30*30*3*737	4010000066
40		2,00 piece	bracket	20*20*528	4054000141
50		4,00 piece	distance	20*4*27.5	4052000191
100		4,00 piece	cover prop for rectangular tube 30*30, black	30*30	5900000028



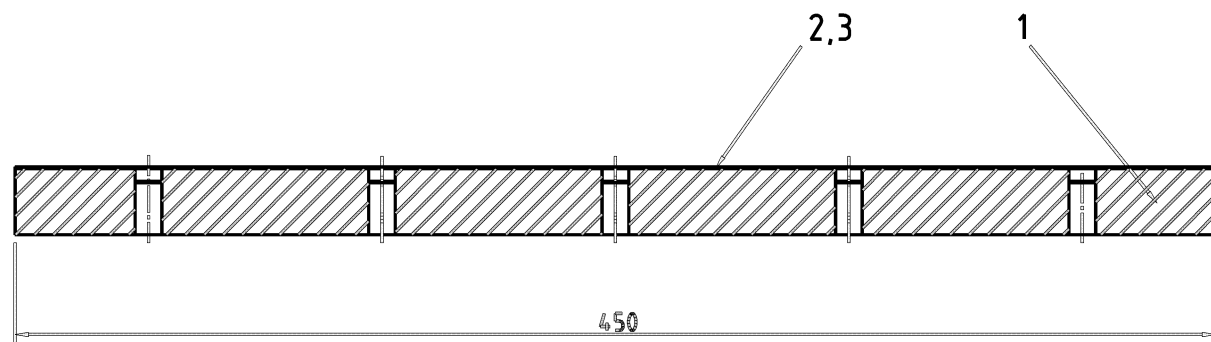
 UNIVERSAL TECHNOLOGIES				DN7168 fein mittel grob		Oberfläche E6 EV1		Maßstab 1:1		Position - Menge -	
								ALMgSi 0,5			
				Datum		Name		ADAPTERLEISTE			
				Gez. 05.03.97		SLAUMANN					
				Gepr.							
				Norm							
								78.766 C			
								Bez. -			
								DN			
Zust.		Änderung		Datum		Name		DN Nr.		78766c	






**Magnet ledge 350 mm****Date of** 06.09.2001**Date of change:** 29.01.2002**Drawing** 75545D**design:****Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	cutting plate AlMgSi1 40*30*353	40*30*353	6361400009



				Allgemeintoleranzen ISO 2768-mK		Oberflächen ISO 1302 Reihe 2		Maßstab 1:2		Position - Menge -	
								Schichtdicke: -		Werkstoff: -	
								Oberfläche: -		-	
					Datum	Name		Magnetleiste			
				Bearb.	22.07.1998	Bahn Müller					
				Gepr.							
				Norm							
						Auftr.-Nr.		73.618 C			
						-					
Zust.	Änderung	Datum	Name	GrV Nr.	73618c						Gepr.

**Magnet ledge 450mm**
**Date of design:** 27.06.2001

**Date of change:** 09.07.2001

**Drawing** 73618C

**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	magnet strip	24.7*40*450	4054000142
20		450,00 mm	foil footsure 0.6*400 black (roll 9000mm)		5900000025
30		500,00 mm	double side scotch tape PVC 370 b=38mm (roll=50m)		8012520004
40		5,00 piece	magnet blank Samarium-Cobalt		5900000020

**Magnet pin****Date of design:** 25.04.2001**Date of change:** 25.04.2001**Drawing** 74554B**Variation:**

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	pin	16*25,4	4039000013
20		1,00 piece	magnet round 10*3		5900000014

**Vacuum pin**
**Date of design:** 27.06.2001

**Date of change:** 10.01.2002

**Drawing** 75011

**Variation:** a = 5 Pin  
b = 10 Pin

Item	Var.	Quant.	Designation	Dimension	Article
10		1,00 piece	angle	L30*100*5*138	4056000098
20		1,00 piece	divider	25*25*138	4054000062
30	a	5,00 piece	pin	13*25.4	4035000011
35	b	10,00 piece	pin	13*25.4	4035000011
50		1,00 piece	sheet metal	2*60*191	4040000233
120	a	5,00 piece	venturi nozzle plugable suction connector.da=4mm, air connector di=4mm		5690000014
125	b	10,00 piece	venturi nozzle plugable suction connector.da=4mm, air connector di=4mm		5690000014
130	a	5.000,00 mm	polyurethan-tube da=4; di=2.6		5671000002
135	b	10.000,00 mm	polyurethan-tube da=4; di=2.6		5671000002
140		500,00 mm	polyurethan-tube da=6; di=4		5671000005
170		1,00 piece	5/2-magnet valve MVH-5-1/4-S-B air pressure control		5630160001
180		1,00 piece	push-in fitting angle di=6 thread R1/4		5673000035
190		2,00 piece	screwed sealing plug DIN 908-G1/4A-St		5677000011
200	a	10,00 piece	push-in fitting straight di=4 thread M5		5673000024
205	b	20,00 piece	push-in fitting straight di=4 thread M5		5673000024
210		1,00 piece	push-in fitting angle di=6 thread R1/8		5673000033
220		2,00 piece	plug in connection ramification di=6 of di=6		5673000034
230		1,00	silencer connection G1/8 outside		5690000012

**Vacuum pin**
**Date of design:** 27.06.2001

**Date of change:** 10.01.2002

**Drawing** 75011

**Variation:** a = 5 Pin  
b = 10 Pin

Item	Var.	Quant.	Designation	Dimension	Article
		piece			
240	a	5,00 piece	suction head, rubber bellow SF10		5614000001
245	b	10,00 piece	suction head, rubber bellow SF10		5614000001
250	a	10,00 piece	screwed sealing plug DIN 908-M5-Al with SW7 outside		5677000014
260		1,00 piece	3pol. clutch box DIN 43 650 version B		5360000048
270		1,00 piece	illuminated seal for plug-in connector DIN 43 650		5360000049

## 8 Electrical and Pneumatic Equipment

### Electrical equipment

#### Control cabinet

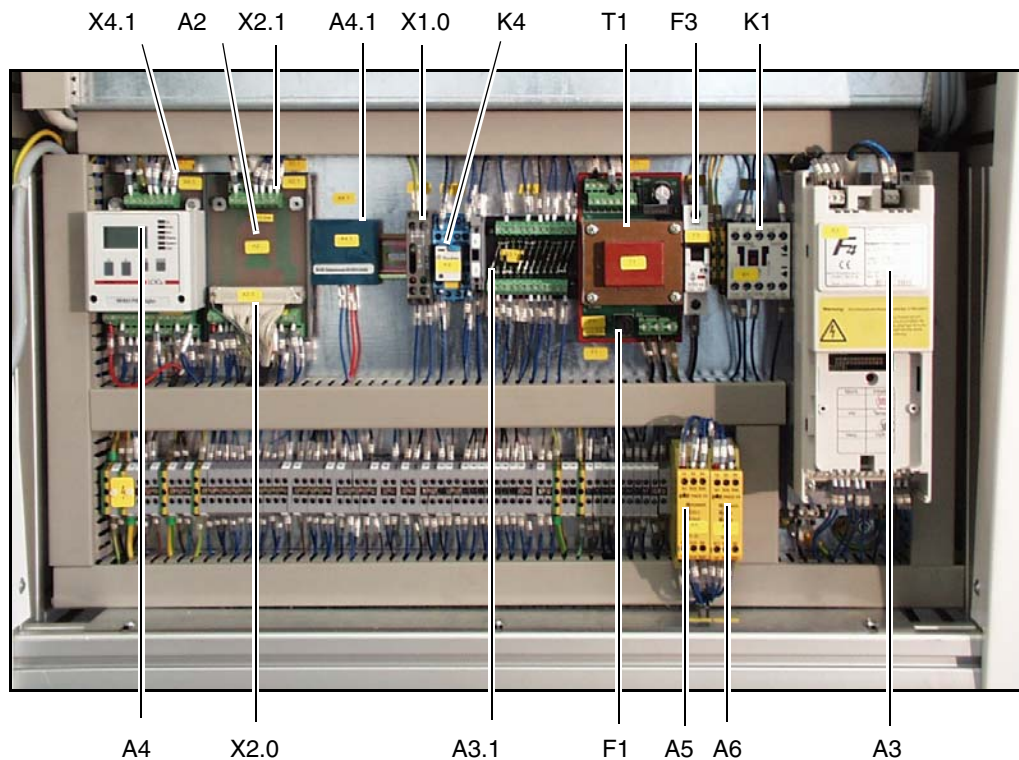


Fig. 14. Control cabinet

#### Control desk



Fig. 15. Control desk



### Snap-off control

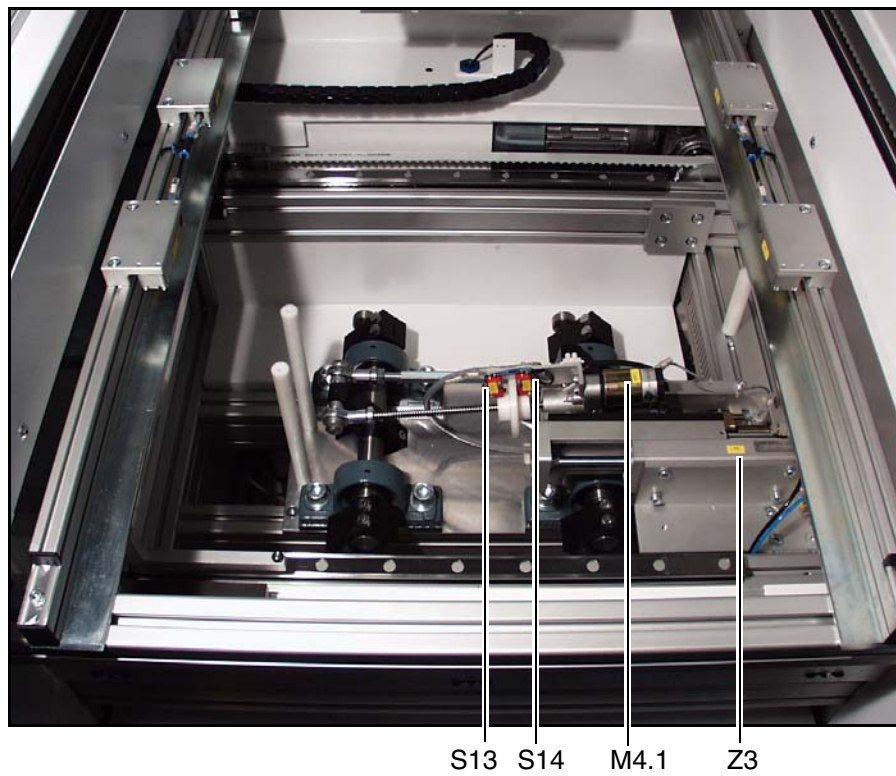


Fig. 16. Snap-off control

### Cleaning flap

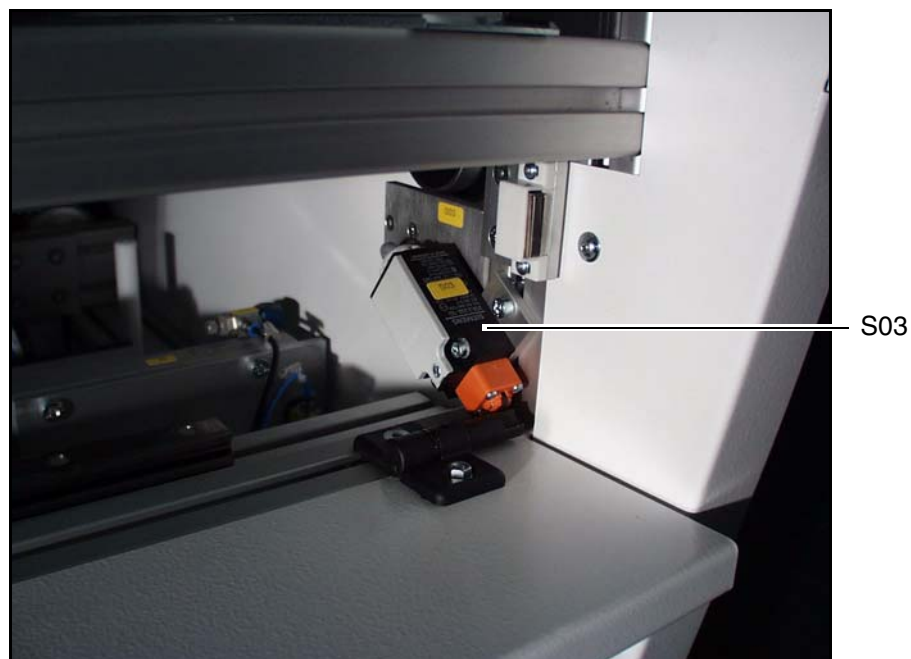


Fig. 17. Cleaning flap

### Snap-off control

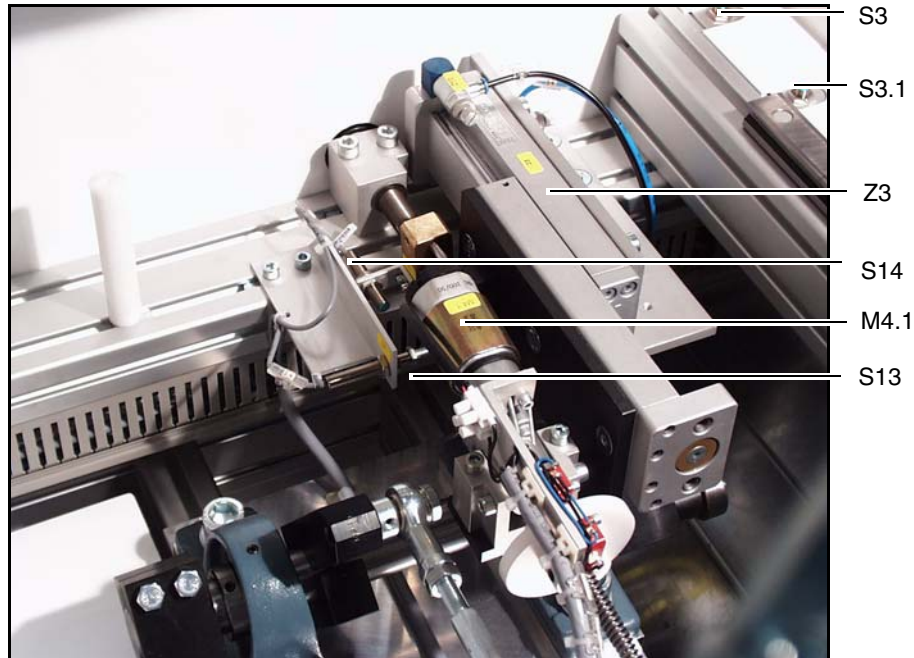


Fig. 18. Snap-off control

### Cover safety switch

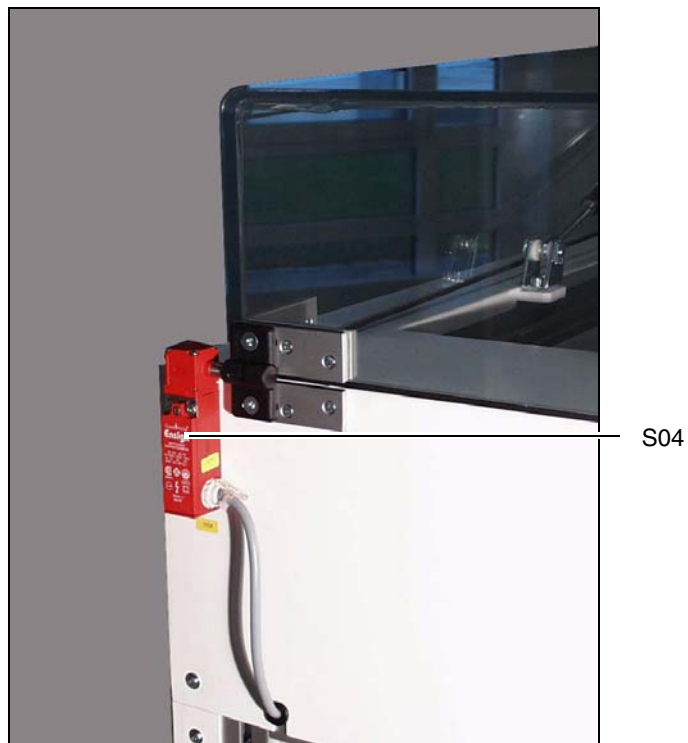


Fig. 19. Cover safety switch

Table drive motor, view from rear



Fig. 20. Table drive motor, view from rear

Table loading position sensors



Fig. 21. Table loading position sensors

### Squeegee position sensor

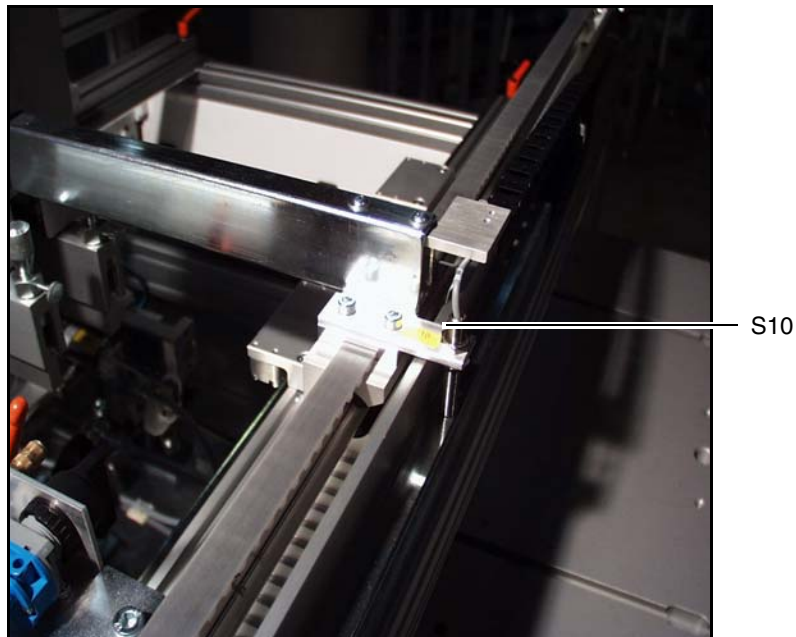


Fig. 22. Squeegee position sensor

### Squeegee motor

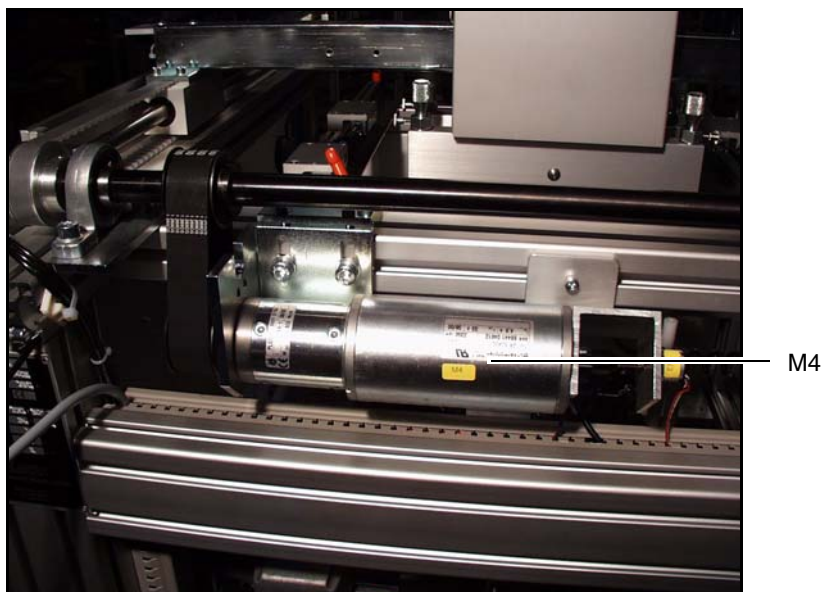


Fig. 23. Squeegee motor



#### Note:

Other electrical components, such as motors and ....., are listed in the mechanical parts lists.



## Pneumatic equipment

### Printing nest

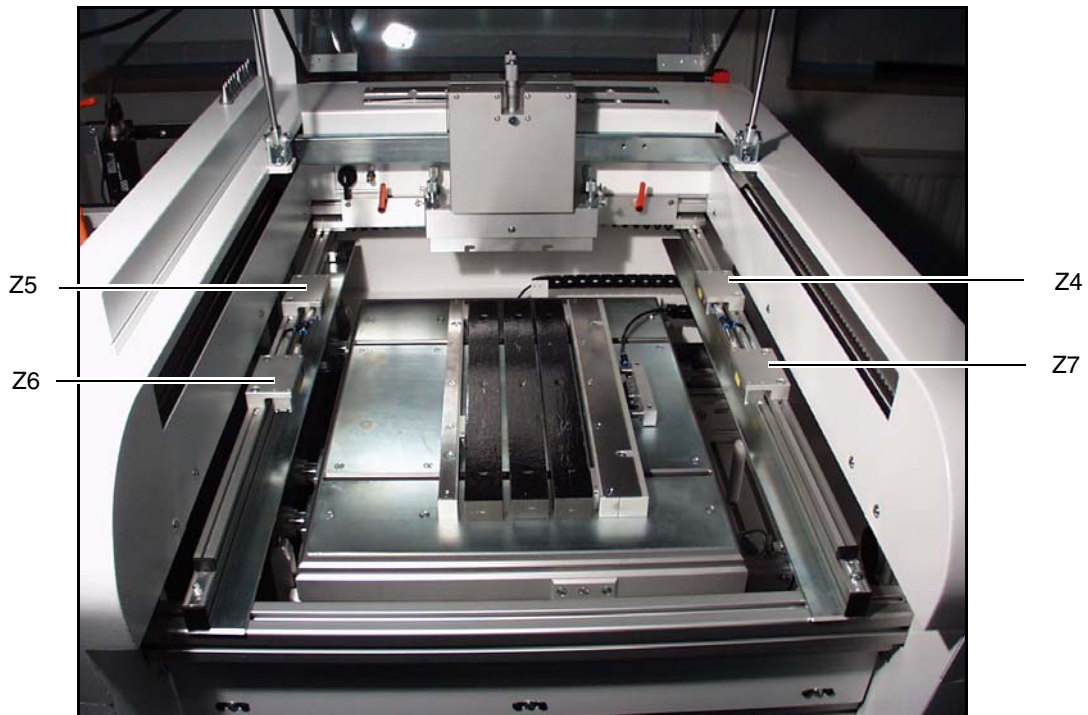


Fig. 24. Printing nest

### Service unit and pressure adjustment

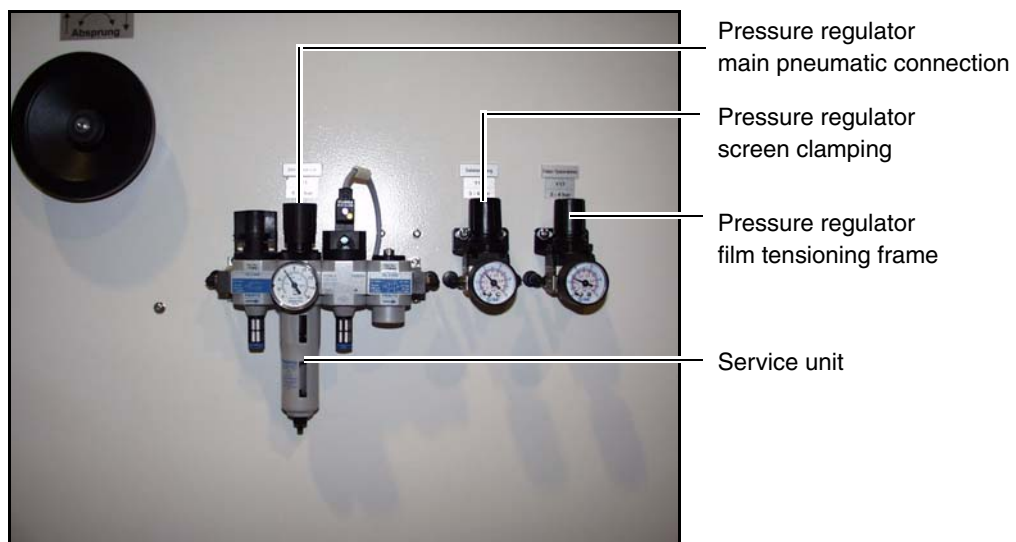


Fig. 25. Service unit and pressure adjustment

### Squeegee pressure



Fig. 26. Squeegee pressure

### Snap-off

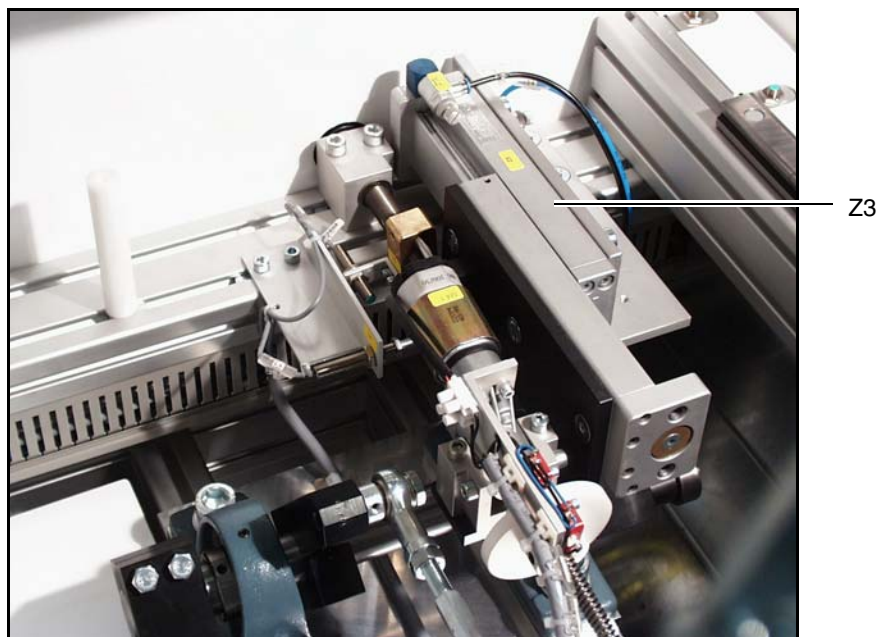


Fig. 27. Snap-off

### Valve terminal



Fig. 28. Valve terminal

**Note:**

Other pneumatic components, such as cylinders and linear units, are included in the mechanical parts lists.

**Note:**

In the case of the Picoline VTE6 and VLT15 options and the venturi suction option, the valves are included in the mechanical parts list.

### Pneumatic parts list

Pos.	Designation	Articel designation	Order-no./ Ident-no.
1	X6	valve terminal-E1 SS5Y3-45NFD-7B-C4 V100770	SS5Y3-45NFD-7B-
2	Y16	pressure regulator G1/8 gauge G1/8 0-10 bar mounting angle pressure regulator G1/8 gauge G1/8 0-10 bar	EAR2000-F01 K8-10-40 B220
3	Y17	mounting angle	EAR2000-F01 K8-10-40 B220
4	Y13/Y18 / Y19 / Y20	main air / service unit (complete) LFR-1/8-D-Mini-KD HE-1/8-D-Mini	185743 162806
5	Screen clamping	valve SV-3-M5 selector switch N-22 S black	006817 009301
6	Display squeegee pressure	gauge 1/8"NW40/0-4bar	304/40
7	Y14 Squeegee pres- sure	pressure regulator 0,07-4,0 11-818-100	11-818-100



## Chapter 8

## Electrical and Pneumatic Equipment

### Electric parts list

Pos.	Designation	Articel designation	Order-no./ Ident-no.
1	A2	power controller	IM-651
2	A3.1	soldering terminal MP 12	00062010
3	A4	basic module	IM-880
4	A4.1	ballast module	IM-051
5	A5	emergency stop switch-safety module	PNOZ X5
6	A6	emergency stop switch-safety module	PNOZ X5
7	at A3.1	1N4..... 1A diode	K-013
8	EN4	encoder	IGV18-0001
9	F1	fuse 5x20T4,0A 802285	802285
10	F3	automatic circiut breaker 1-pole-C6A	FAZNC6
11	Key pad	membrane keyboard	IM-556T
12	K1	contactor	3RH1122-1B1340
13	K4	relay with plug connection 24V * socket with screw terminal for 55.31-32-34	55.34.9.024.004 94.44.1
14	Q1 electrical main switc	main switch K&M	T0-2-1/EA/SVB
15	R1	resistor 470 Ohm 1/4 Watt	K-000WIDERSTAND
16	R2	resistor 1,8K 1/4W	K-042WIDERST.1.
17	S01	emergency stop switch-button K&M 072370 emergency stop switch Kontaktelement K&M 090401 emergency stop switch Schild deutsch/ englisch K&M 058874	Q25PV E01 SQT1
18	S10	proximity sensorM8x1 NJ1,5-8GM40-E2 on call	15176
19	S11 PCB-clamp	selector switch contact 1Sr 1O 22/30mm	D1G3S DA11
20	S13	microswitch 6A (1005.0401)	13.537.12
21	S14	microswitch 6A (1005.0401)	13.537.12
22	S03	position limitation switch 1s 1ö	3SE3200-1D
23	S04	position limitation switch 1s 1ö	3SE3200-1D
24	S2 / S2.1	proximity sensorM8x1 NJ1,5-8GM40-E2	15176
25	S3 / S3.1	proximity sensorM8x1 NJ1,5-8GM40-E2	15176

26	S6 (foot switch)	foot switch F1-U2Z UN	606.1700.004
27	T1	power supply	IM-815
28	X1.0	binder M 4/8 SF	011513106

**Electric partslist**

The electric partlist 2499000127 and 2499000128 are following on the next pages

**Electric drawings**

The following pages contain the electric drawings

**Control E1**

**Date of design:** 01.03.2002    **Date of change:** 12.04.2002    **Circuit diagram:** **E1\_006**

#	Article description	Order no.
A3	Frequency converter 0.9kVA 230V	5382000007
A3.1	Soldering terminal MP12 (12paired transition)	5360000055
A4.1	Overvoltage load module	5382000006
Basic module	Mounting basic module	5399000004
D11	Diode 1N4007	5375000001
D11.1	Diode 1N4007	5375000001
D2	Diode 1N4007	5375000001
D2.1	Diode 1N4007	5375000001
D3	Diode 1N4007	5375000001
D3.1	Diode 1N4007	5375000001
D4	Diode BY251(2A)	5375000006
D5	Diode BY251(2A)	5375000006
F2	Fuse 5*20mm T4.0A 250V	5357000002
	Series terminal M4/8.SF gray with fuse clip	5360000058
F3	Automatic cut-out 1pole C6A	5357000029
for foot switch S6	Cable Ölflex-110 2*1.0mm <sup>2</sup>	5361000021
for MOPS	3pin mini coupling socket M8 with cable 6m	5360000091
for power line	Cable Ölflex-110 3G*1.5mm <sup>2</sup>	5361000020
K1	Mini relay 24V with 4 change-over contacts	5350000004
	Socket for plug-in relay	5350000005
K4	Mini relay 24V with 4 change-over contacts	5350000004
	Socket for plug-in relay	5350000005
Q1	Main switch 3pole, 400V, 4kW, for front mounting	5353000005
	Cable Ölflex-110 5G*1.5mm <sup>2</sup>	5361000027
R1	Resistor 470 Ohm 5% 0.25W Baugr. 0207	5373000001
R2	Resistor 1.8k Ohm 5% 0.25W Baugr. 0207	5373000002
S01	Front element Emergency Stop push-button Q25PV	5353000015
	Auxiliary switch 1 NC E01	5353000016
	Plate EMERGENCY STOP square-type, in 4 languages	5353000017
	Cable Ölflex-110 3G*0.5mm <sup>2</sup>	5361000018
S11	Selector switch front element with actuator, 3 switch positions	5353000012
	Auxiliary switch 1 NO + 1 NC for panel mounting	5353000013
	Cable Ölflex-110 5G*0.5mm <sup>2</sup>	5361000019
T1	Power supply 230V / 24V 2A	5321000003
X1	Series terminal M4/6 gray	5360000056
	Series terminal M4/6.P green/yellow	5360000057
X6	25pin Sub-D socket with 2.3m LIYY 10*0.14 with housing	5360000140

**Machine E1**
**Date of  
design:**

01.03.2002 **Date of change:** 12.04.2002

**Circuit E1\_006  
diagram:**

#	Article description	Order no.
A4	Analogue power controller	5382000005
En4	Encoder	5355000003
for M3	Cable Ölflex-110CY 4G*1.5mm <sup>2</sup> with shield	5361000092
for M4	Cable Ölflex-110 3G*1.5mm <sup>2</sup>	5361000020
for M4.1	Cable Ölflex-FD810 7G*0.5mm <sup>2</sup>	5361000034
for key pad	Cable 37*?mm <sup>2</sup> , L= 2m	5361000010
S02	Safety switch 1 NC + 1 NO with switch cam Cable Ölflex-110 4*1.0mm <sup>2</sup> , 3.5 m	5353000019 5361000009
S03	Position limitation switch 1NO + 1NC with roller tappet, moulded case Cable Ölflex-110 4*1.0mm <sup>2</sup> , 1.60m	5353000009 5361000009
S04	Safety switch 1 NC + 1 NO with trip cam Cable Ölflex-110 4*1.0mm <sup>2</sup> , 2.60m	5353000019 5361000009
S10	Inductive proximity switch	5355000002
S13	Micro switch 6A (1005.0401) Cable Ölflex-FD810 7G*0.5mm <sup>2</sup>	5353000007 5361000034
S14	Micro switch 6A (1005.0401) Cable Ölflex-FD810 7G*0.5mm <sup>2</sup>	5353000007 5361000034
S2	Inductive proximity switch	5355000002
S2.1	Inductive proximity switch	5355000002
S3	Inductive proximity switch	5355000002
S3.1	Inductive proximity switch	5355000002
S4	Inductive proximity switch	5355000002
S5	Inductive proximity switch	5355000002
S6	Pedal switch	5353000006
Tastatur	Key pad with LCD display	5353000014
X0	Safety plug 16A 250VAC, vertical side cable entry	5360000081
X7	Multiple socket-outlet with earthing contact	5360000060



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Fax: +49 (0) 7143 / 88 44 22  
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Kunde / Customer :

Ort / City :

Bönningheim

Anlage / System :

E1-006

Maschinen-Nr. / Serial number :

Auftrags-Nr. / P/O number :

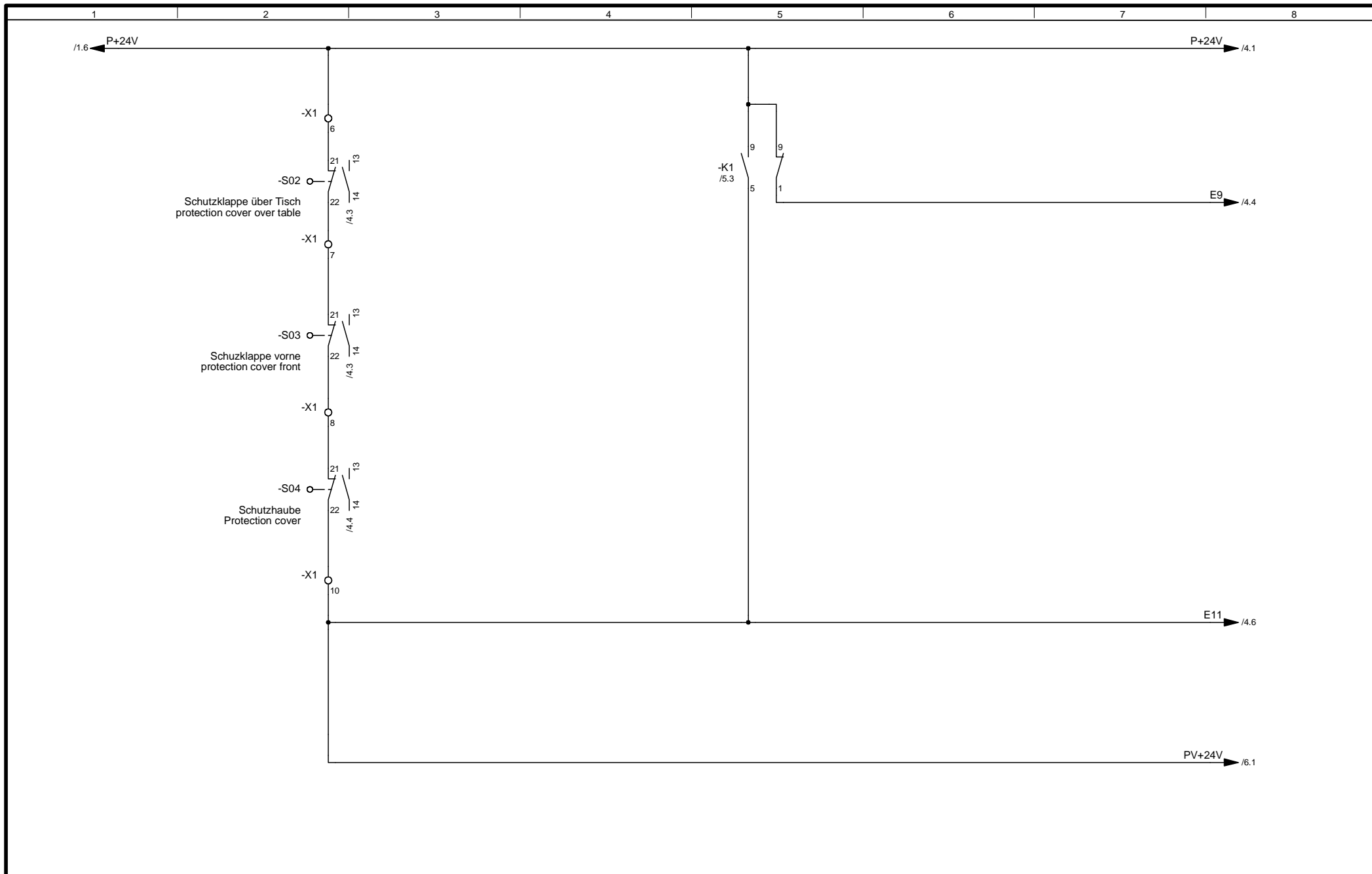


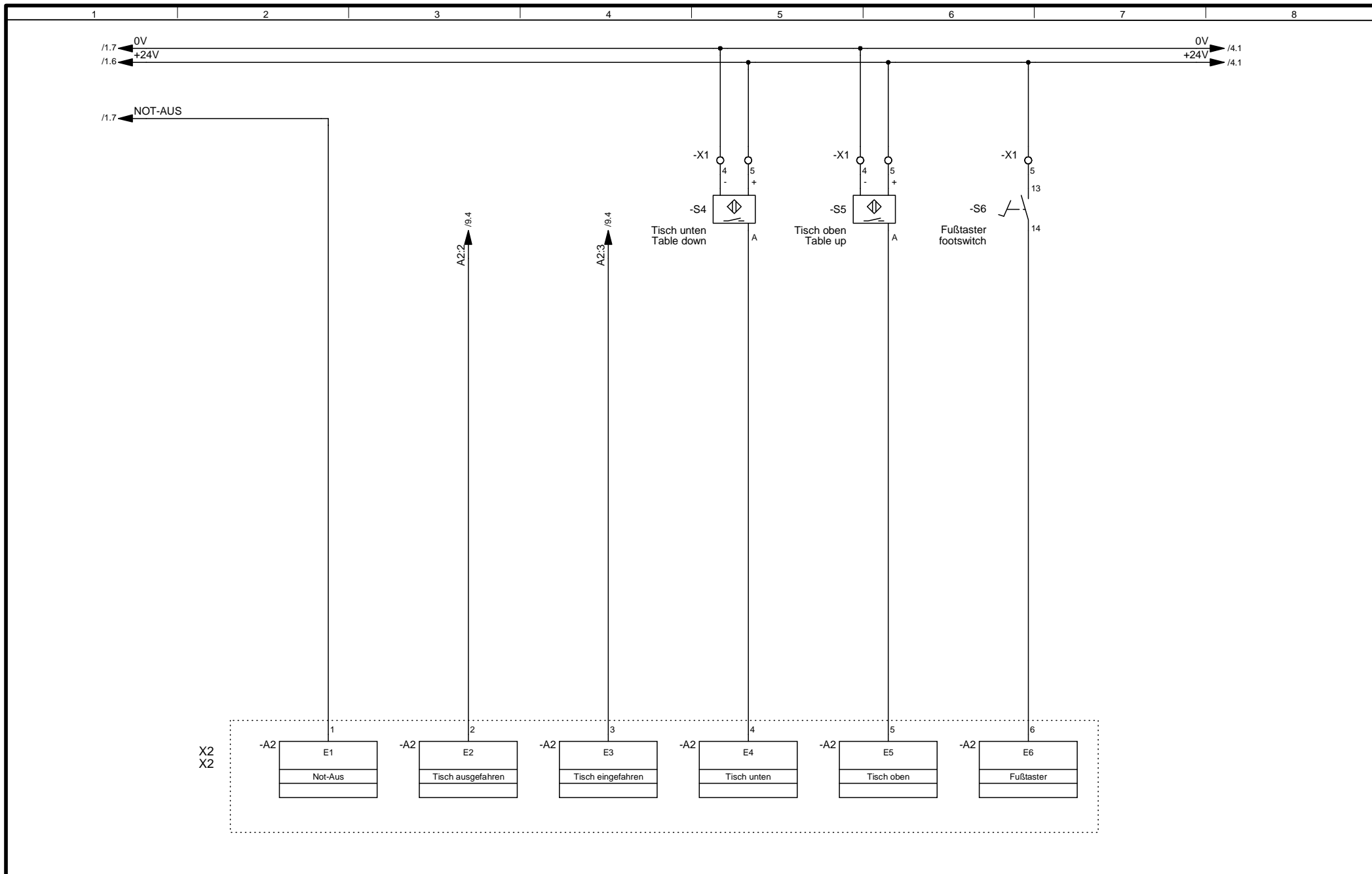
EKRA GmbH  
Zeppelinstr.16  
D-74357 Bönningheim  
Tel.: +49 (0) 7143 / 88 44-0

E1-006

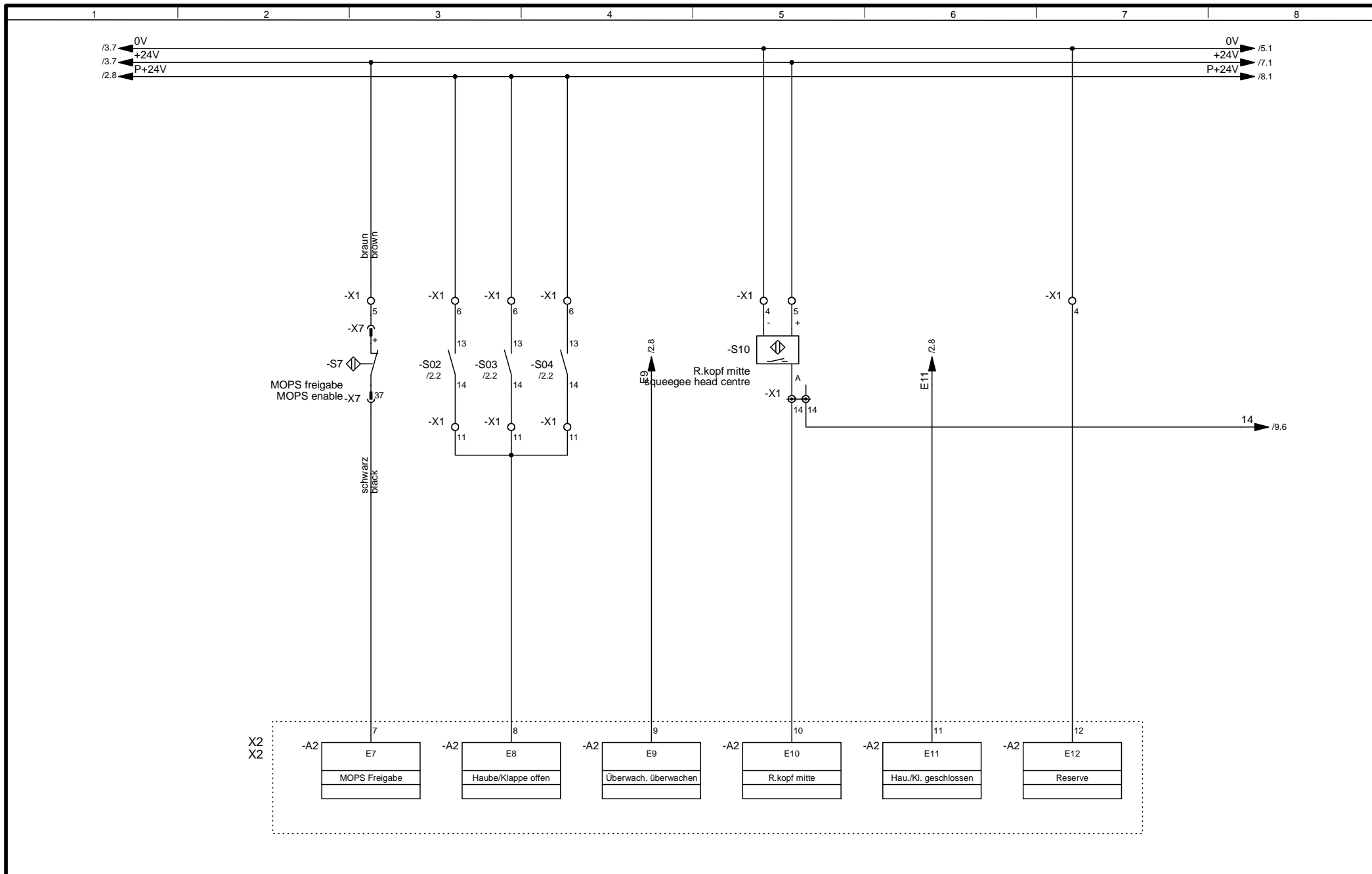
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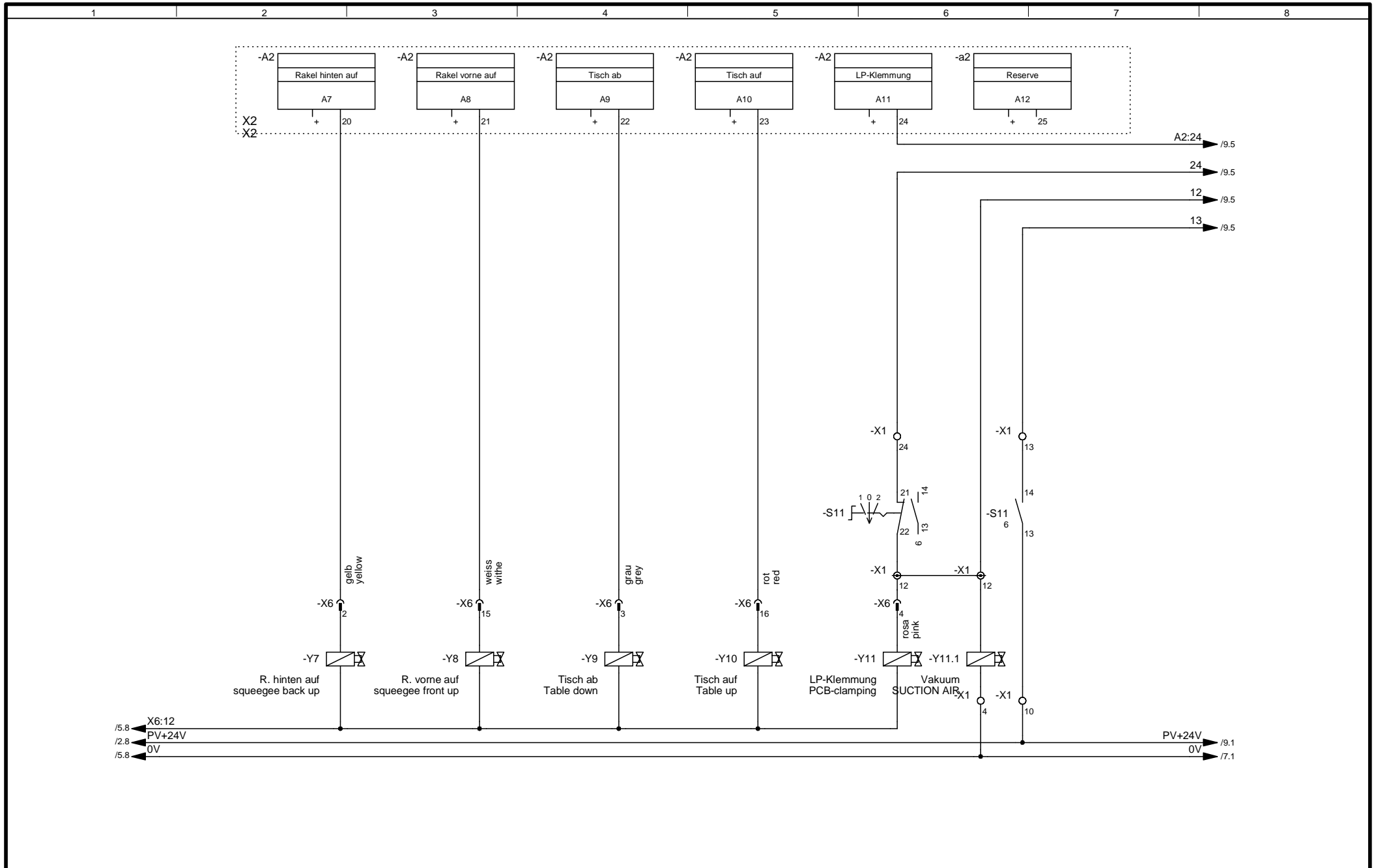


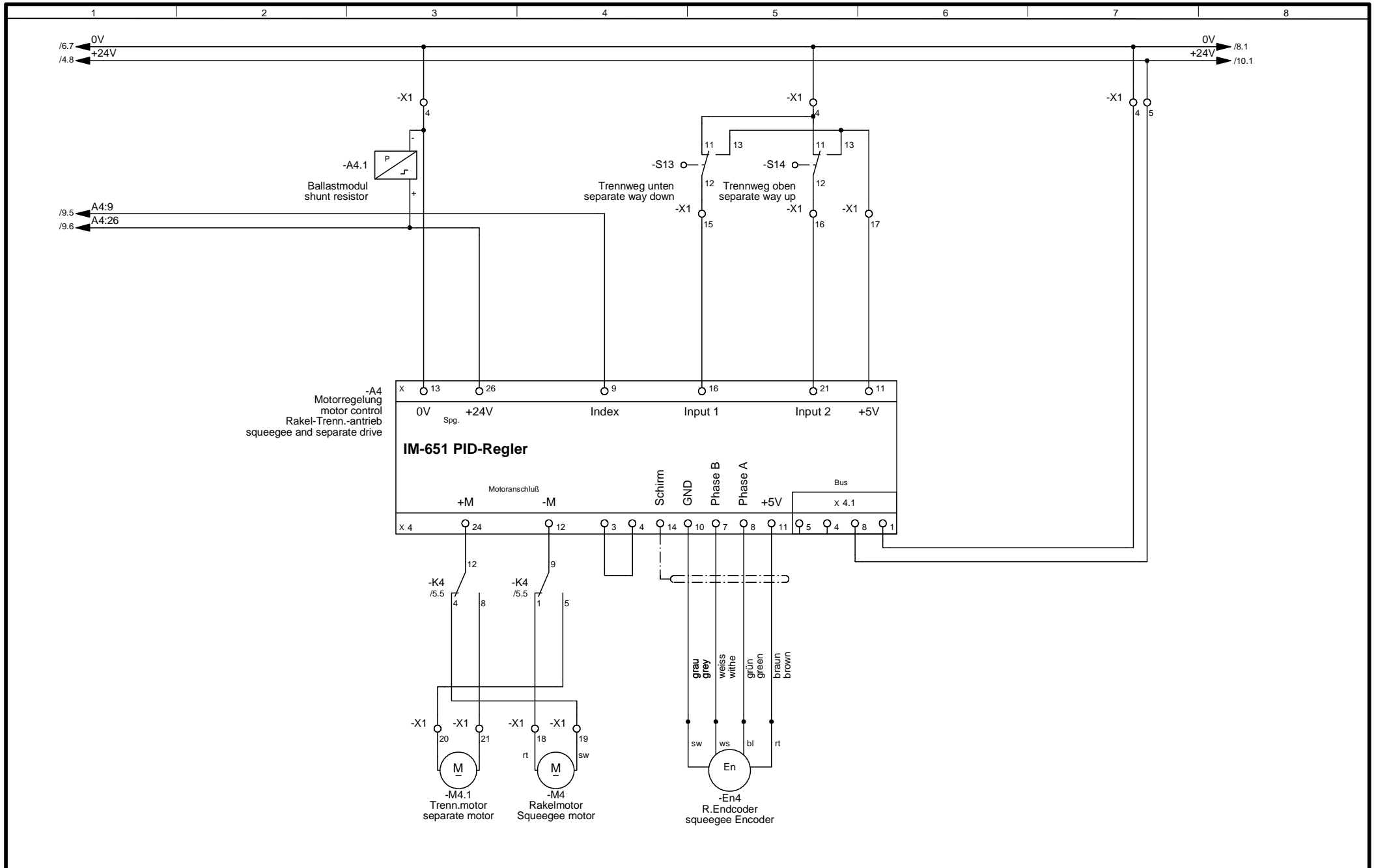


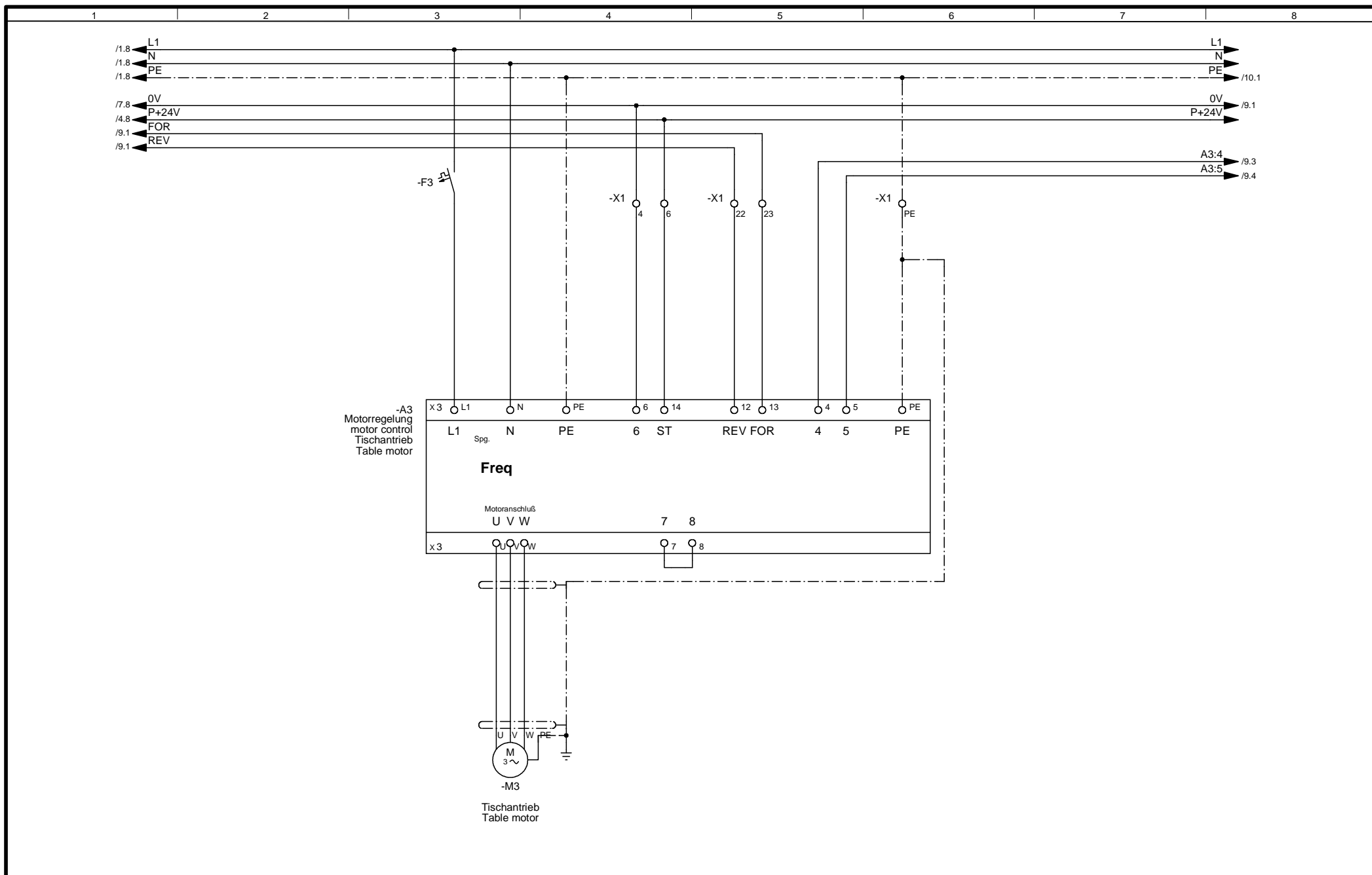


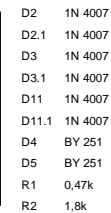


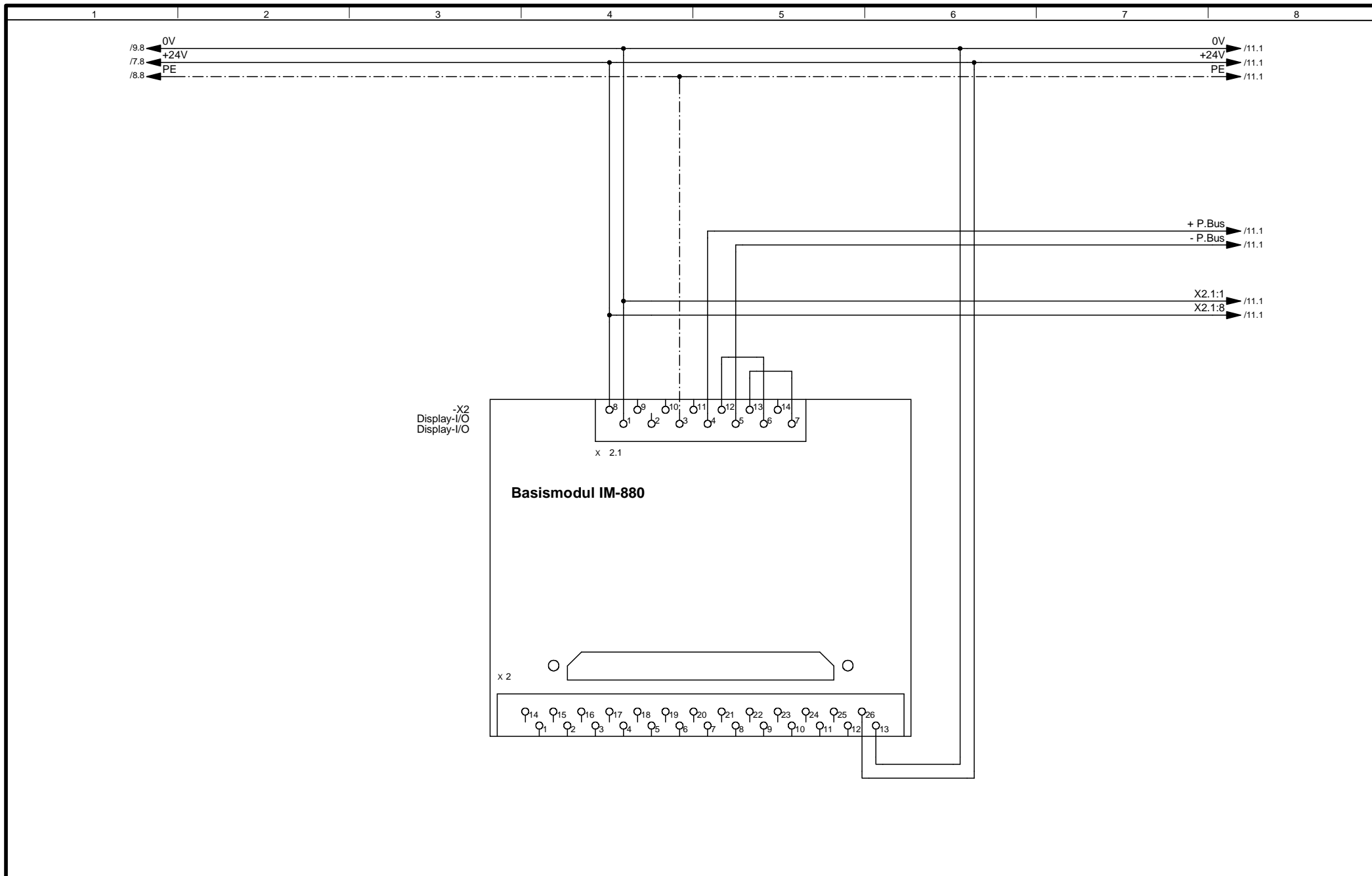


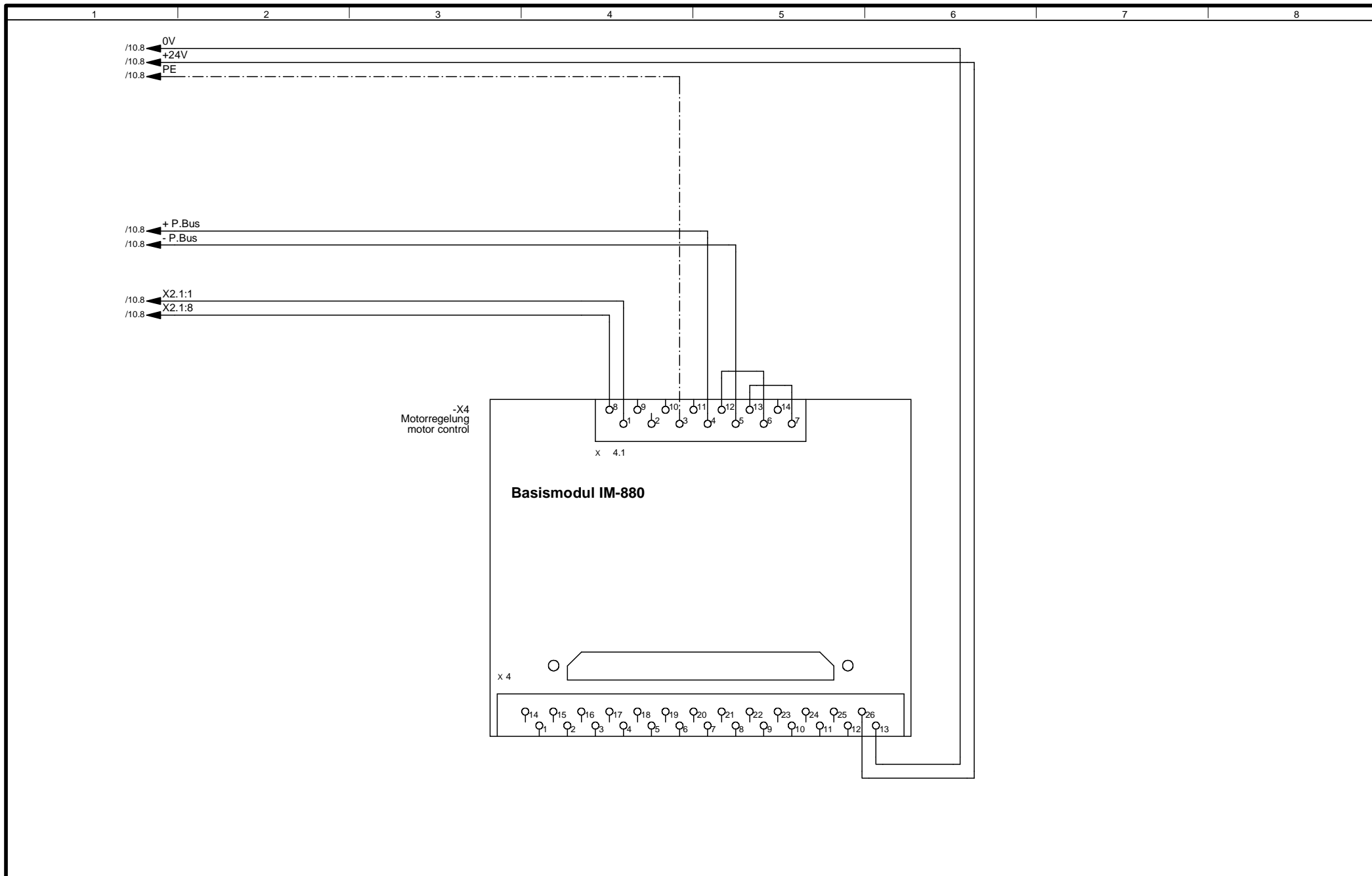










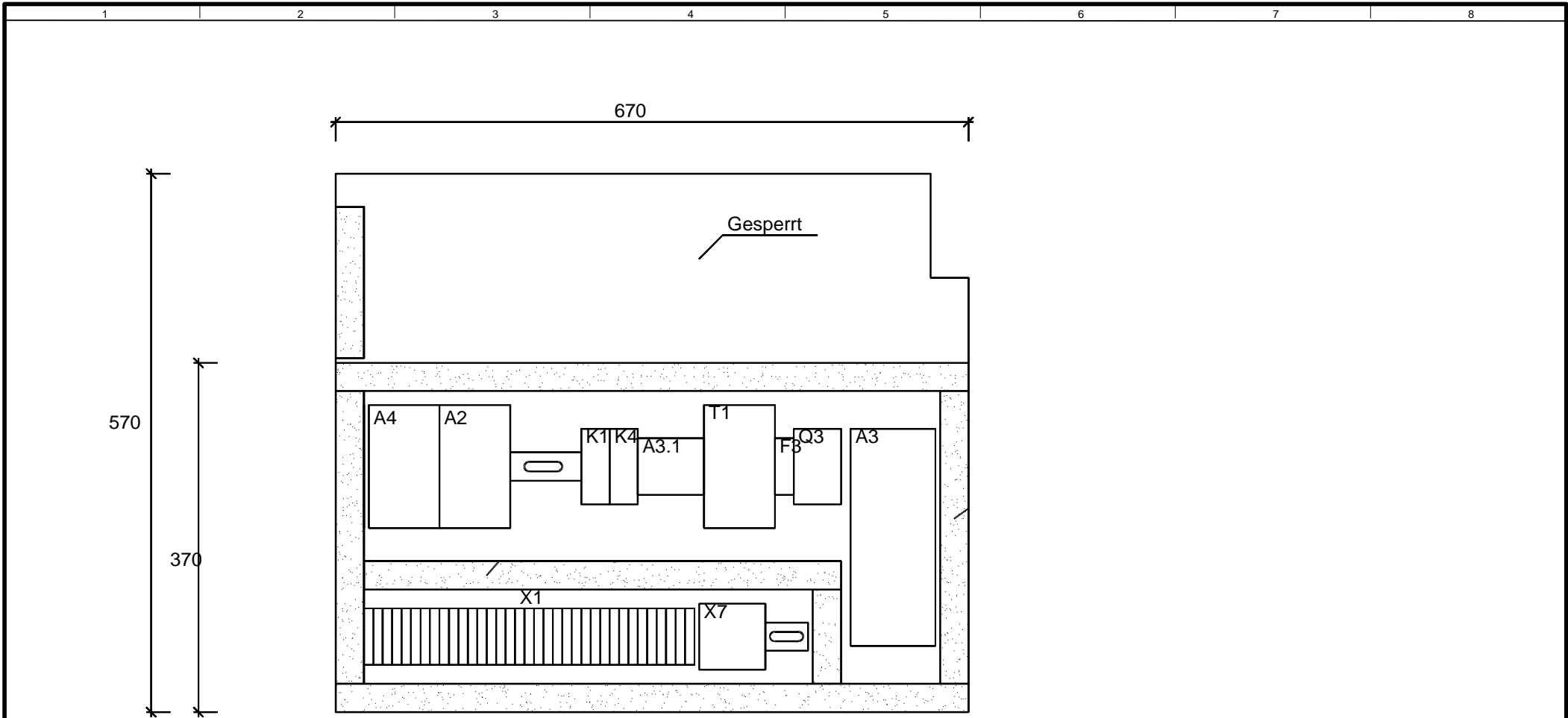












## 9 Maintenance

### General

The proper functioning of the individual components of the machine crucially depends on the quality of cleaning and maintenance. Insufficient maintenance causes unnecessary wear and may result in a decrease in production time because the machine is not in operation.



---

**Caution:**

**If pastes containing solvent are used, customers must check to what extent these solvents do not influence the lubricants.**

---



---

**Caution:**

**Switch off the main switch on the machine before starting maintenance work.**

---

- ☐ Switch the E1 printer off at the main switch.
- ☐ Open the cover.



---

**Note:**

**Only expert personnel who have received relevant training are permitted to carry out maintenance work.**

---

## Cleaning the machine

Carry out the work described below every day.



### Note:

**It is important that the machine is kept clean.  
In particular, residues of solder paste must be removed immediately.**

## Squeegee unit

- ☐ Remove the squeegee blades.
- ☐ Thoroughly clean the squeegee holders and blades with a lint-free cloth and cleansing agent.

## Printing table

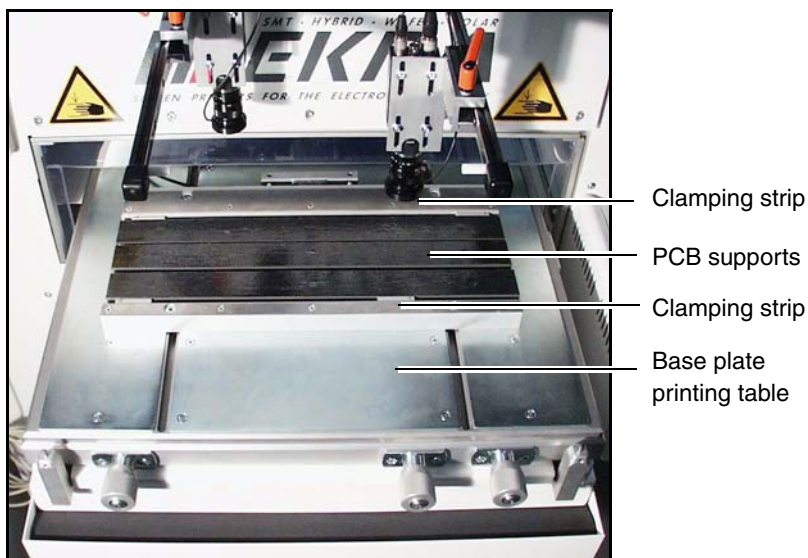


Fig. 29. Printing table

- ☐ Always keep the printing table clean in order to ensure that the PCB is positioned perfectly.
- ☐ Clean the clamping strips, PCB supports and the base plate of the printing table.

### Pneumatic service unit

The condensate in the water separator should be drained from time to time. No condensate must be allowed to enter the control elements or power components, as this may cause malfunctioning.



Fig. 30. Service unit

- ☐ Empty the water separator by pushing up the valve beneath the inspection glass with your finger to allow the condensate to drain away.

### Casing

- ☐ Only use antistatic agents for cleaning the cover.



#### Note:

**Other cleaning agents may cause damage to the covers (cracking).**



#### Note:

**The transport belts and toothed belts do not require maintenance.**

### PC positioning system MOPS

Prevent the computer for the MOPS from overheating by always providing for sufficient circulation of air.

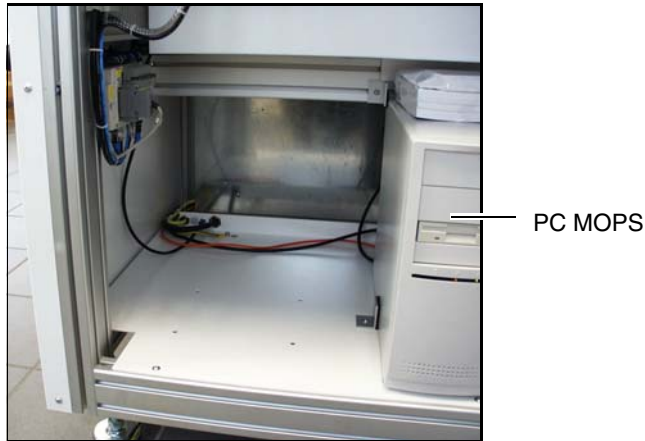


Fig. 31. Machine computer at the rear of the machine

Carry out this work once a month.

- ☐ Open the rear of the machine.
- ☐ Use a vacuum cleaner to clean the fan at the rear of the PC.

### Bearings and guideways



#### Note:

The E1 screen printer contains guideways and bearings which are lubricated for life. Even if you find a lubrication nipple on a guideway or bearing, this does not mean that you are expected to lubricate it. They are included because of the manufacturer's production process.

Carry out this work once every six months.

- ☐ Clean the guideways with a dry, clean cloth.



#### Note:

If you intend not to use the E1 printer for a relatively long time, protect the guideways from rust by applying grease (anti-friction bearing grease conforming to DIN 51825, consistency class NLGI 2 or NLGI 3).



## **10 Vendor Documentation**

### **Ordering spare parts**

This user's manual contains drawings and spare parts lists to enable you to identify the spare parts.

When ordering, always specify the machine type and the associated machine number together with the item number of the spare part. This helps us to speed up the process of sending you the required spare parts.

Our address

EKRA Eduard Kraft GmbH

Zeppelinstrasse 16

D - 74357 Bönningheim

Telephone: ++49 (0) 71 43 88 44-0

Facsimile: ++49 (0) 71 43 88 44 22 Sales Dept.

Facsimile: ++49 (0) 71 43 88 44 29 Service Dept.

**Vendor documentation**

No.	Manufacturer	Designation	Item no./ Order no.
1	KEB Antriebstechnik	Combivert User's Manual	00.00EMV- K002
2	KEB Antriebstechnik	Combivert 2 User's Manual	00.F4.SOB- K111

# COMBIVERT



- (D)** Bevor Sie beginnen
- (GB)** Getting Started
- (F)** Avant que vous ne commenciez
- (I)** Prima di Iniziare
- (E)** Antes de comenzar
- (FIN)** Ennen käyttöönottoa
- (P)** Antes de começar
- (S)** Innan start
- (DK)** Før De begynder
- (GR)** Πριν ξεκινάτε
- (NL)** Voordat u begint
- (RU)** Прежде чем начать



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## 1. Introduction

### 1.1 About this Manual

Before you start with the installation of the frequency inverter/servo, please read this manual carefully and pay special attention to the notes and suggestions.

This manual contains:

- **safety and warning instructions**
- **installation instructions that conform with EMC**
- **explanation of the EG directive/CE mark**
- **sticker to fasten onto the inverter/servo controller**

This manual must be made available to every user. Before working with the unit the user must become familiar with it. This especially applies to the knowledge and observance of the following safety and warning indications.

The pictograms used here have the following meaning:

**Danger  
Warning  
Caution**



Is used when the life or health of the user is in danger or considerable damage to property can occur.

**Attention  
Essential  
Measure**



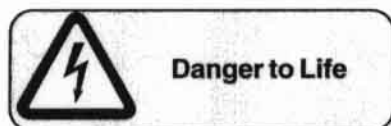
Is used when a measure is necessary for safe and disturbance free operation.

## 2. Safety and Application Instructions

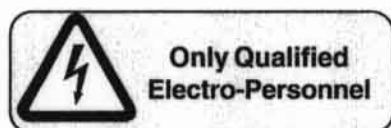
The directions in this chapter must be absolutely observed for the following reasons:

- **Safety for people and machines**
- **Function and susceptibility to faults**
- **Guarantee and warranties**

### 2.1 General



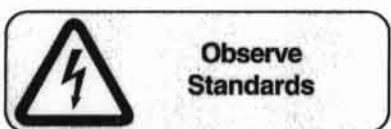
Inverters/servo drives contain dangerous voltages which can cause death or serious injury. Care should be taken to ensure correct and safe operation to minimise risk to personnel and equipment.



All work from the transport, to installation and start-up as well as maintenance may only be done by qualified personnel (IEC 364 and/or CENELEC HD 384 and IEC-Report 664 and note national safety regulations). According to this manual qualified staff means:

- those who are able to recognise and judge the possible dangers based on their technical training and experience
- those with knowledge of the relevant standards and who are familiar with the field of power transmission (VDE 0100, EN 50178, EN 60204 as well as the appropriate regulations for your area).

### 2.2 Use as directed



Inverters/servo drives are designed for speed control of asynchronous and permanent magnet motors, respectively. Use for other purpose is not recommended and may lead to equipment damage.

The inverter/servo drive must not be started until it is determined that the installation complies with 89/392/EEC (machine directive) as well as the EMC-directive (89/336/EEC) (note EN60204).

The frequency inverters/servo drives meet the requirements of the Low-Voltage Directive 73/231/EEC. The harmonized standards of the series EN 50178 in connection with EN 60439-1 and EN 60146 were used.

### 2.3 Transport, Storage and Installation



Inverters/servo drives must be protected against physical damage during transport, installation and use. Components and covers must not be bent or moved as this may affect insulation distances. The equipment must not be switched on if it is damaged as it may no longer comply with mandatory standards.

This equipment contains electrostatic sensitive devices which may be damaged by careless handling.

Make sure that during installation there is enough minimum clearance and enough cooling. Climatic conditions must be observed in accordance with EN 50178.

## 2.4 Electrical Connection



**Note Capacitor  
Discharge Time**

Before any installation and connection work, the system must be switched off and secured. After clearing the frequency inverter the intermediate circuit capacitors are still charged with high voltage for a short period of time. The unit can be worked on again, after it has been switched off for 5 minutes.



**Control  
Lines**

With frequency inverters that are not isolated from the supply circuit all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated). Further information is found in the technical documentation part 3.



**Voltage with  
respect to  
ground**

Connection of the frequency inverter is only permissible on symmetrical networks with a maximum line voltage (L1, L2, L3) with respect to earth (N/PE) of 300V. An isolating transformer must be used for supply networks which exceed this value! The units may be damaged if this is not observed.



**Only Fixed  
Connection**

The inverter is only designed for a fixed connection, because when using filters a leakage current > 3.5mA can occur. Protective conductor cross section must be at least 10mm<sup>2</sup> copper or a 2nd conductor must be electrically parallel to the protective conductor on separate terminals. Ground point-to-point with the shortest connection possible to mains earth (avoid earth loops).



**Voltage Peaks**

When using IGBT inverters, high voltage peaks may arise in the motor due to the switching action of the inverter output devices. These voltage peaks may damage the insulation of the motor winding and must be taken into account when using motor cables longer than 15m with high frequency motors. In this case, the motor can be protected with a motor choke, dv/dt filter or sine filter.



**Insulation  
Measurement**

When doing an insulation measurement in accordance with VDE 0100 / Part 620, the power semiconductor of the unit and existing radio interference filters must be disconnected because of the danger of destruction. This is permissible in compliance with the standard, since all inverters are given a high voltage test in the end control at KEB in accordance with EN 50178.



**Different Earth-  
Potentials**

When using components without isolated inputs/outputs, it is necessary that equipotential bonding exists between the components to be connected (e.g. through the equalizer). Disregard can cause destruction of the components by the equalizing currents.

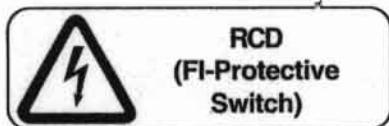


**Prevent  
Disturbances**

A trouble-free and safe operation of the frequency inverter is only guaranteed when the connection instructions below are strictly followed. Incorrect operation or damage may result from incorrect installation.

- Note mains voltage and rated motor voltage.
- Install power cables and control cables separately (> 15cm separation).
- Use shielded/twisted control lines. Connect shield to PE at inverter only.
- Only use suitable circuit elements to control the logic and analog inputs, whose contacts are rated for extra-low voltages.
- Make sure inverter and motor housing are well grounded. The screen of the cable between the inverter and the motor must be directly and securely attached to both the inverter PE terminal and the motor ground terminal. Remove paint finish where necessary.
- Connect the braking module/ braking resistor with shielded/twisted cables (install shield on one side of the inverter).
- Ground the cabinet or the system earth star point with the shortest connection to mains earth (avoid earth loops).





If personnel protection is required during installation of the system the frequency inverters must be protected according to EN 50178 (VDE 0160):

- 1-phase inverters by RCD type A (pulse-current sensitive FI's) or type B (all-current sensitive FI's)
- 3-phase inverters (with B6 bridge-connected rectifier) by RCMA's with separation (used privileged) or RCD's type B (all-current sensitive FI's)

The tripping current should be 300mA or more, in order to avoid a premature triggering of the inverter by discharge currents (about 200mA).

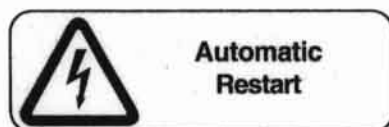
Dependent on the load, the length of the motor cable and the use of a radio interference filter, substantially higher leakage current can occur.

The connection instructions from the manufacturer and the valid local requirements must be observed.

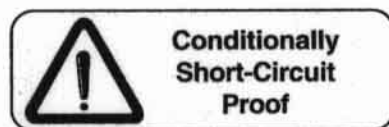
Dependent on the available mains form (TN, IT, TT) further protective measures are necessary in accordance with VDE Part 410 (Part 4; Chapter 41). For example, with TN-mains this protection is made with overcurrent protective devices. With IT-mains it is insulation monitoring with a pulse-code measuring method. A protective separation can be used with all mains forms as long as the required power and cable lengths permit this.

## 2.5 Operating Instructions

Before starting, all respective enclosures must be secured again, as well as the terminals and screws must be checked to see that they are securely fixed.



Inverters/servo drives may be set, dependent on type, to restart automatically following a fault stoppage (e.g. Undervoltage Error), when the fault conditions clear. System design must take this into account, if appropriate, and additional monitoring or protective features added where necessary.



The frequency inverters/servo drives are conditionally short-circuit proof (EN 50178). After resetting the internal protection devices, the function as directed is guaranteed.

Exceptions:

- If an earth-leakage fault or short-circuit often occurs at the output, this can lead to a defect in the unit.
- If a short-circuit occurs during regenerative operation (2nd or 4th quadrant, feedback into the intermediate circuit), this can lead to a defect in the unit.



### 3. EMC Fundamentals

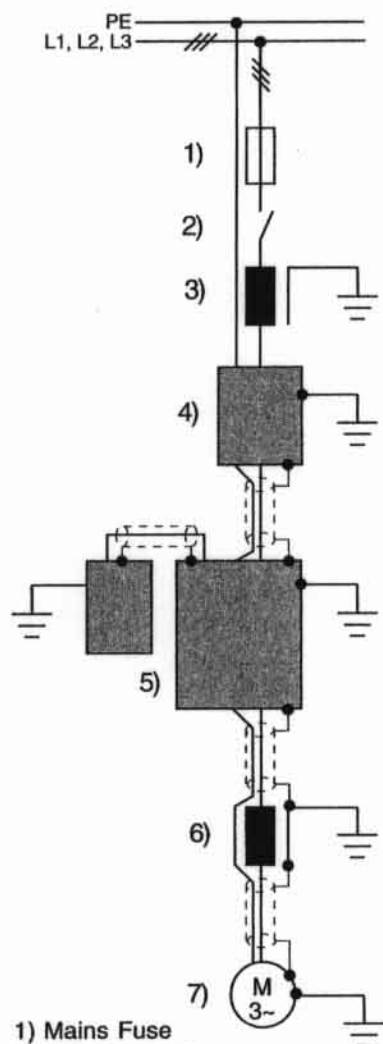
#### 3.1 General

Frequency inverters/servo drives are electrical equipment for use in industrial and commercial systems. They are used for the stepless speed adjustment of three-phase/permanent magnet motors. In accordance with the EMC-directive 89/336/EEC these units do not require a CE-marking. In the sense of the EMC-directive and the EMVG the frequency inverter/servo drive components are not designed for stand alone operation, while they are only a part of the machine/system to be used by competent machine or system manufacturers. The proof of compliance with the required protective measures in the EMC-directives must be furnished by the erector/owner of the machine/system.

By using interference filters specified by KEB and following the advice given the quoted limits are realized.

**According to production norm EN 61800-3, the KEB COMBIVERT with filter is designed to be used in class "A" environments.**

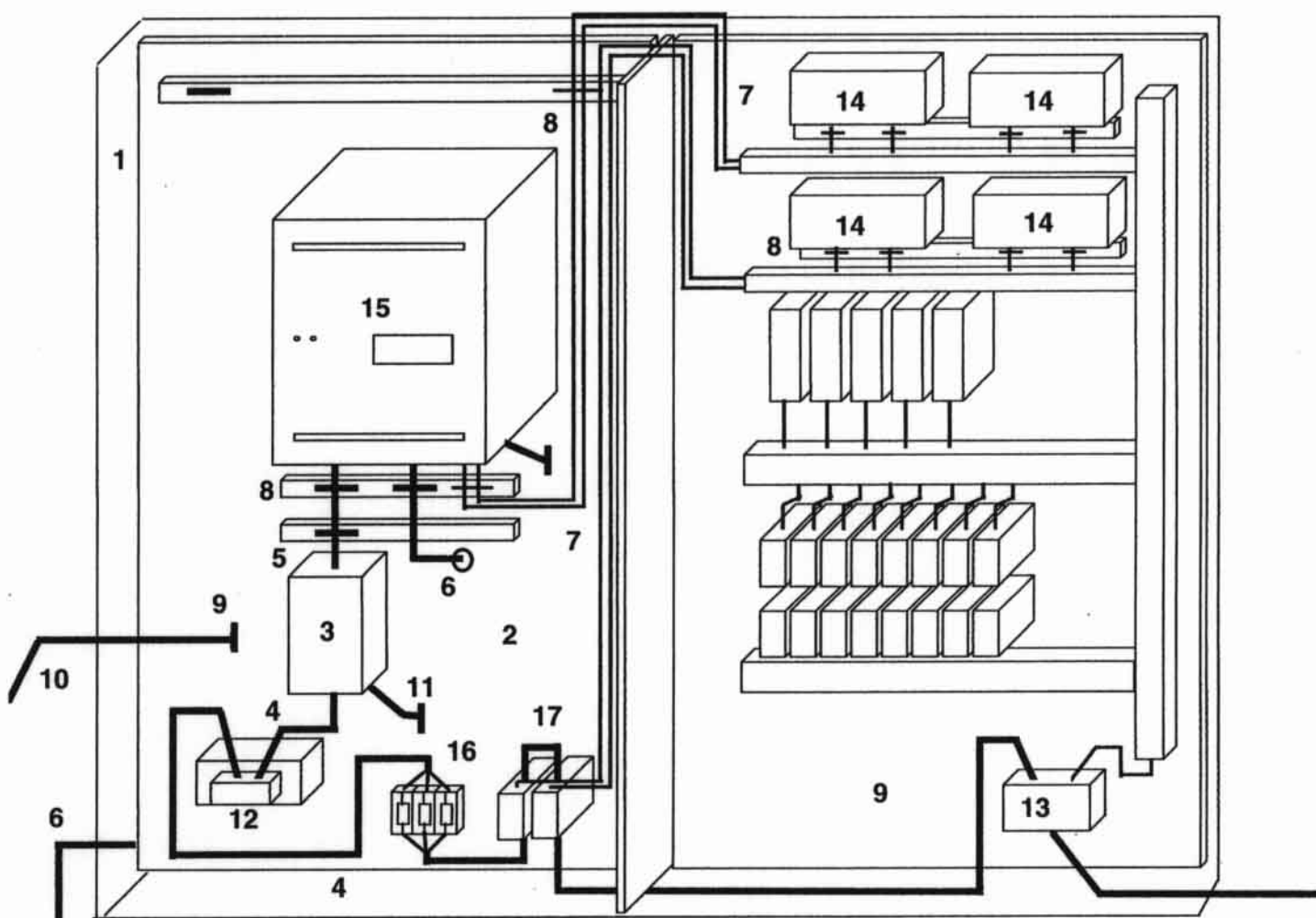
#### 3.2 Installation



- 1) Mains Fuse
- 2) Main Protection
- 3) Line Reactor
- 4) Interference Suppression Filter (if not already installed)
- 5) Inverter with Braking Resistor
- 6) Motor Choke or Output Filter
- 7) Motor

- ☑ Install the cabinet or system correctly.
- ☑ In order to prevent noise crosstalk
  - Mains/supply lines
  - Motor lines from inverters and servo controllers
  - Control and data lines (low voltage levels < 48V)
 must have a clearance of at least 15 cm when installed.
- ☑ In order to maintain low-resistance high frequency connections, earthing and shielding, as well as other metallic connections (e.g. mounting plate, installed units) must be in metal-to-metal contact with the mounting plate, over as large an area as possible. Use earthing and equipotential lines with a section as large as possible (min. 10mm<sup>2</sup>) or use thick earthing strips.
- ☑ Only use shielded cable with copper or tin-plated braid, since steel braid is not suitable for high frequency ranges. Always install the shield with clamps or metal cable glands onto the equalizing bars and/or PE-connections. Do not extend cable screens with single wires, but connect the braid directly to the appropriate point.
- ☑ If external interference suppression filters are used, then these must be installed as close as possible to (<30cm from) the interference source and in metal-to-metal contact with the mounting plate, over as large an area as possible.
- ☑ Always equip inductive control elements (contactors, relays etc.) with suppressors such as varistors, RC-elements or damping diodes.
- ☑ All connections must be kept as short as possible and as close as possible to the earth, as free floating lines work as active and passive aerials.
- ☑ Keep connection cables straight (do not bundle). Install a non-assigned wire on both sides of the protective conductor.
- ☑ The flow and return circuit must be twisted when the lines are not shielded, in order to dampen common-mode noise.
- ☑ Further informations are found in the instruction manual part 2/3.

### 3.3 Installation of an EMC Conform Cabinet



#### Power Range

1. Cabinet
2. Mounting Plate
3. Interference Suppression Filter
4. Mains Supply
5. Line between interference suppression filter and mains supply
6. Motor Supply
7. Control Cable
8. Shield with Clamps

#### Control Range

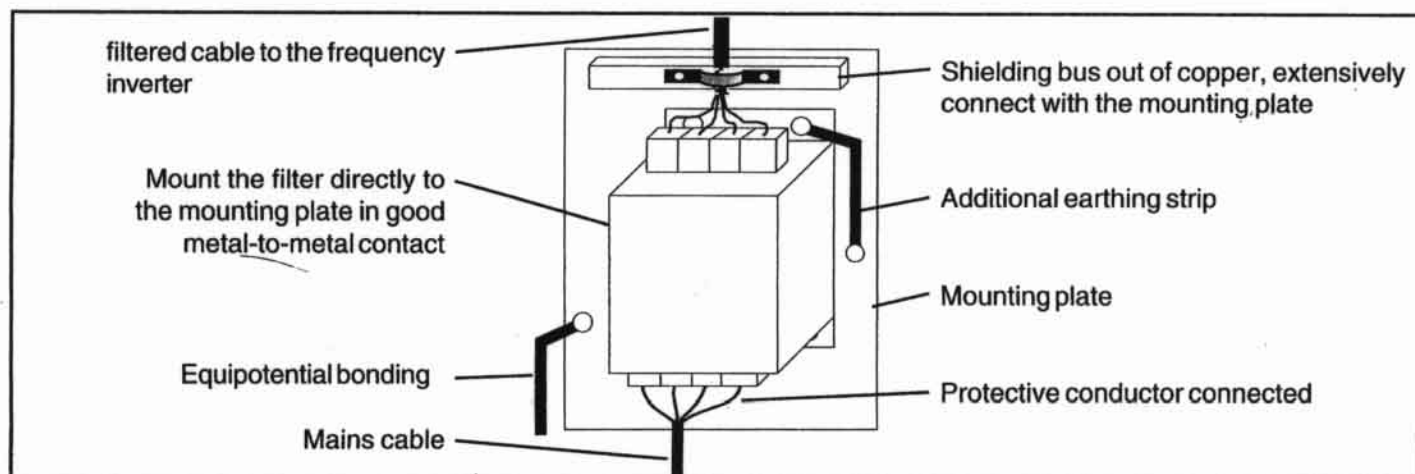
9. Mounting plate as neutral point
10. Potential equalization to building PE
11. Additional Earthing
12. Mains Choke
13. Power Supply
14. Control
15. Inverter
16. Mains Fuse
17. Mains Contactor

### 3.4 Explanations

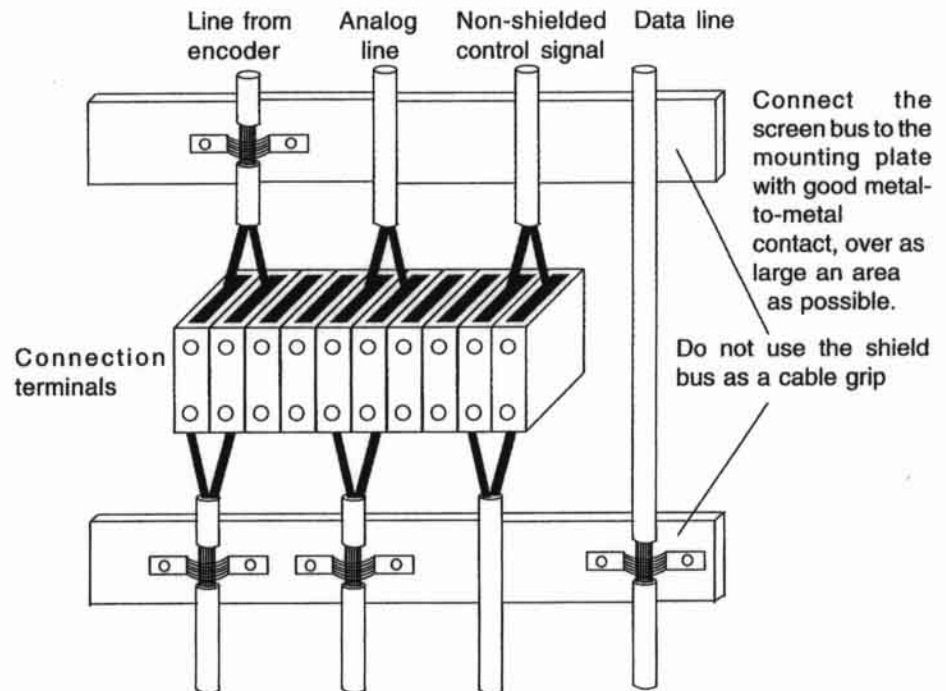
- ☑ A system should be broadly separated into power section and control section, whether comprising a single enclosure or multiple enclosures. It is recommended that a screen wall is installed between the two sections because of the radiated noise from the power section. This screen must be in good metal-to-metal contact with the mounting plate, over as large an area as possible.
- ☑ The inverter together with its filter must be mounted on a common mounting plate. They must make good metal-to-metal contact with the mounting plate, over as large an area as possible.
- ☑ The connection cable between interference suppression filter and the inverter, must be installed on both sides as a shielded cable normally no longer than 50 cm.
- ☑ The mounting plate of the inverter must be seen as the neutral point for the entire earthing and shield connection in the machine or system. If the motor or other system parts lead to disturbances, then the HF-connection of these elements is bad. In this case equipotential bonding must be done.
- ☑ A good connection of the shield onto the motor terminal box is only given, when the terminal box is made out of metal, and a metal cable gland is used to connect the screen. When a plastic box is available, then the shield must be equipped with a cable lug and be directly connected with the earthing point.
- ☑ The leakage currents in the circuit increase when interference suppression filters are used. Since these lie above the 3,5mA threshold, one of the following conditions must be met:
  - Protective conductor section at least 10 mm<sup>2</sup> copper
  - Monitoring of the protective conductor by a device that independently switches off under fault conditions.
  - Install a second conductor electrically parallel to the protective conductor via separate terminals.
- ☑ If an additional line reactor is used because of the load on the mains, then this must be installed on the mains side of the interference suppression filter.

### 3.5 Connection of the Interference Suppression Filter

The drawing below shows the assembly and connection of an external interference suppression filter.



### 3.6 Connection of the Control Lines



#### Notes:

- The shield from the digital signal lines, which is not connected via terminals, must be clamped to the screen bus, both at the cabinet entrance and near the inverter, in order to decrease the screen impedance.
- If digital signal lines are connected via terminals, the screen must be clamped to the screen bus before and after the terminals.
- If a screen bus is used near the inverter ( max 20 cm distance ), then the screen no longer needs to be connected to the inverter.
- If the shield is earthed with a single charger, then the interference derivation deteriorates by 70%.
- Metal copper pipe clips are suitable as a shield connection.
- When using non-shielded signal lines, they should always be installed as a twisted pair with a forward and return circuit.

### 4. CE-Marking

CE marked frequency inverter and servo drives were developed and manufactured to comply with the regulations of the Low-Voltage Directive 73/23/EEC. The applied standards are listed in the technical documentation part 2.

### 5. Manufacturer's Declaration

A manufacturer declaration in accordance with 89/392 EEC can be provided by KEB if needed.

# COMBIVERT



0,37...0,75 kW

BETRIEBSANLEITUNG  
MANUEL D'INSTRUCTIONS  
MANUAL DE INSTRUCCIONES

INSTRUCTION MANUAL  
MANUALE DI ISTRUZIONE



Erst Betriebsanleitung Teil  
Read instruction manual part  
Lisez d'abord le manuel d'instructions partie  
Prima leggere le manuale di istruzione parte  
Leer manual de instrucciones parte

1

lesen  
before  
antes







Seite 3 ..... 24

Diese Betriebsanleitung muß jedem Anwender zugänglich gemacht werden. Vor jeglichen Arbeiten muß sich der Anwender mit dem Gerät vertraut machen. Darunter fällt insbesondere die Kenntnis und Beachtung der Sicherheits- und Warnhinweise. Die in dieser Betriebsanleitung verwendeten Pictogramme entsprechen folgender Bedeutung:



Gefahr  
Warnung  
Vorsicht



Achtung,  
Unbedingt  
beachten



Information  
Hilfe  
Tip



Page 25 ..... 46

This instruction manual must be made available to any user. Before working with this unit the user must be familiarized with it. This is especially true for the attention, safety and warning guides. The meaning of the pictograms used in this manual are:



Danger  
Warning  
Caution



Attention,  
observe at  
all costs



Information  
Help  
Tip



Page 47 ..... 68

Ce manuel d'instructions doit être rendu accessible à tout utilisateur. Avant tous travaux, l'utilisateur doit se familiariser d'abord avec le variateur, notamment tenir compte des mesures de sécurité et des avertissements. Les pictogrammes utilisés dans ce manuel ont les significations suivantes:



Danger  
Avertissement  
Précaution



Attention,  
à respecter  
obligatoirement



Information  
Aide  
Astuces



Página 69 ..... 90

Questo manuale di istruzioni deve essere messo a disposizione di tutti gli utenti. Prima di impregare questa apparecchiatura. L'utente deve prima familiarizzare con essa. In particolar modo prestare attenzione alle sottoindicate direttive di avvertimento e sicurezza personale nell' utilizzo dell' apparecchiatura.



Pericolo  
Avvertimento  
Cautela



Attenzione,  
osservare  
assolutamente



Informazione  
Aiuto  
Suggerimento



Página 91 ..... 112

Este manual de instrucciones debe ser accesible a todos los usuarios. Antes de conectar el convertidor, el usuario debe de familiarizarse con el convertidor, especialmente debe de tener en cuenta las medias de seguridad y advertencias. Los pictogramas utilizados en este manual tienen los significados siguientes:



Peligro  
Advertencia  
Precaución



Atención  
de obligado  
cumplimiento



Información  
Ayuda  
Nota

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## 1. General

### 1.1 Product Description

In selecting the KEB COMBIVERT you have chosen a frequency inverter with the highest demands on quality and dynamic.



It exclusively serves for a stepless speed regulation of the three-phase motor.

The operation of other electrical utilization equipment is forbidden and can lead to the destruction of the unit.

GB

This instruction manual describes the COMBIVERT F4-S

- 0.37kW / 230V-class
- 0.75kW / 230V-class

Through small dimensions and an optimal price the unit is convincing with following features:

- operator-friendly interface
- low switching losses due to IGBT power circuit
- short-time overload up to 200%
- extensive protection devices for current, voltage and temperature
- conditional short-circuit and earth-fault-proof
- immunity to interference according to IEC1000
- potential-separated digital inputs
- programmable relay output
- DC-brake
- 3 fixed frequencies
- slip compensation
- auto-boost
- output voltage stabilization
- speed search
- adjustable current limits for acceleration and constant operation
- fast commissioning by way of keyboard (Drive-Mode)
- optional networking via gateway with Interbus-S, CAN and Profibus



## 1.2 Identification of the unit



### Input Specifications:

Input mains perm. mains voltage range  
 Input current during nominal load mains frequency

### Output Specifications:

Output phases Output voltage range  
 Output current during nominal load Output frequency range  
 Max. output rated power of the inverter in relation to 230VAC  
 Recommended nominal data of the motor to be used  
 COMBIVIS Identification number:  
 Part number: 07.F4.S0C-1220  
 Serial number: /

### Unit Size

## 2. Power Circuit

### 2.1 Performance Data

The following performance data apply to 2/4-pole standard motors. For other pole numbers the frequency inverter must be dimensioned onto the rated motor current. With regard to special-purpose or medium frequency motors please contact KEB.

Size	05	07
Nominal power output <sup>1)</sup> [kVA]	0,9	1,6
Peak current (<30s) [A]	4,6	8,0
Nominal output current [A]	2,3	4,0
Max. rated motor power [kW]	0,37	0,75
Max. switching frequency [kHz]	8	8
Power loss [W]	35	50
Load capacity	30s max. peak current	
Mains voltage [V]	180...264 ± 0 %	
Network phase	1	
Mains frequency [Hz]	50 / 60 ± 2	
Output voltage [V]	3 x 0 ... U <sub>Mains</sub>	
Output frequency [Hz]	0...409,58	
Max. permissible mains fuse [A]	10	20
Supply cross section <sup>2)</sup> [mm <sup>2</sup> ]	1,5	2,5
Permissible temp. limit value	-25...70°C storage -10...45°C in operation max.95% (without precipitation)	
Relative humidity	IP20	
Design-/protective system	EN 50081-1/ 50082-2	
Noise suppression <sup>3)</sup>	IEC 1000 4-2/-3/-4/-5/-6	
Noise immunity	EN55011-B / EN 55022-A	
Emitted interferences		

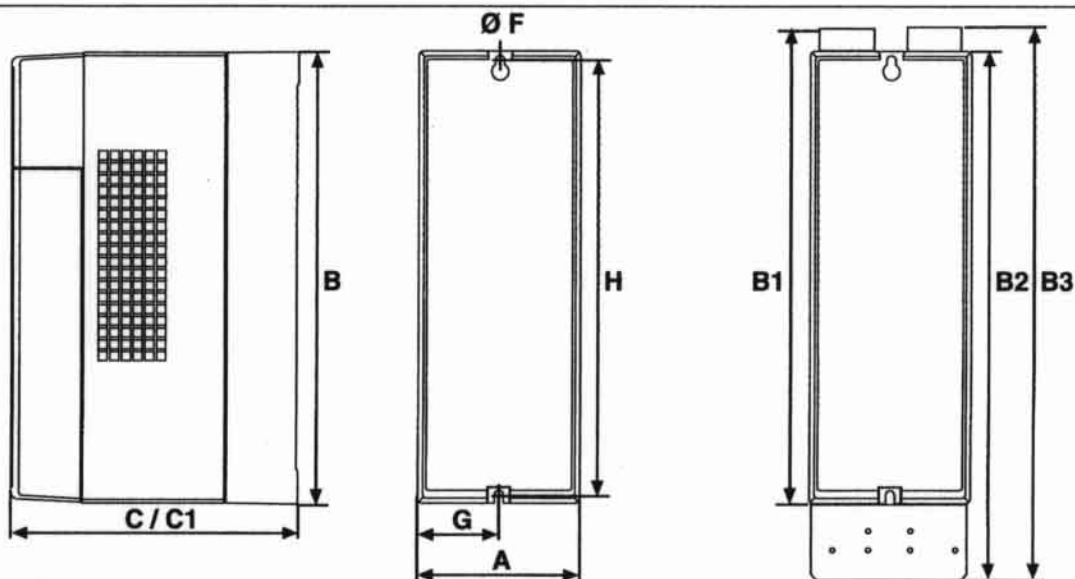
<sup>1)</sup> In relation to 230V rated voltage

<sup>2)</sup> Recommended minimal cross section at rated power and cable length up to 100m (copper).

<sup>3)</sup> Only with optional built-in filter und shielded, grounded motor cable on both sides

## 2.2 Dimensions

GB



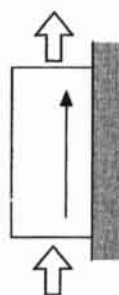
Size	A	B	B1	B2	B3	C	C1	F	G	H	H1	Weight [kg]
C	90	230	264	260	300	115	165	5	45	220	240	1,5

B1/C1/H1 with submounted filter  
 B2 with screening plate  
 B3 with submounted filter and screening plate

## 2.4 Installation Instructions

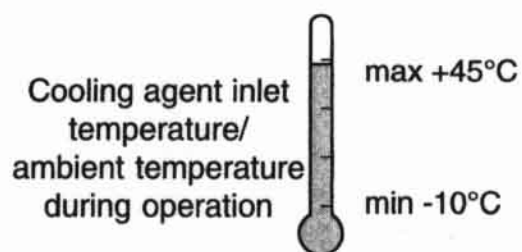
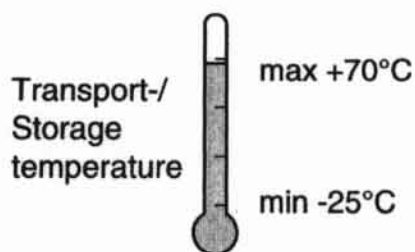
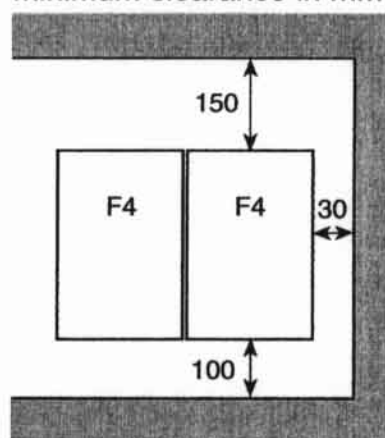
**i** Installation height max. 2000 m. At installation heights over 1000 m a power reduction of 1% per 100m must be taken into consideration.

Direction of the cooling fins

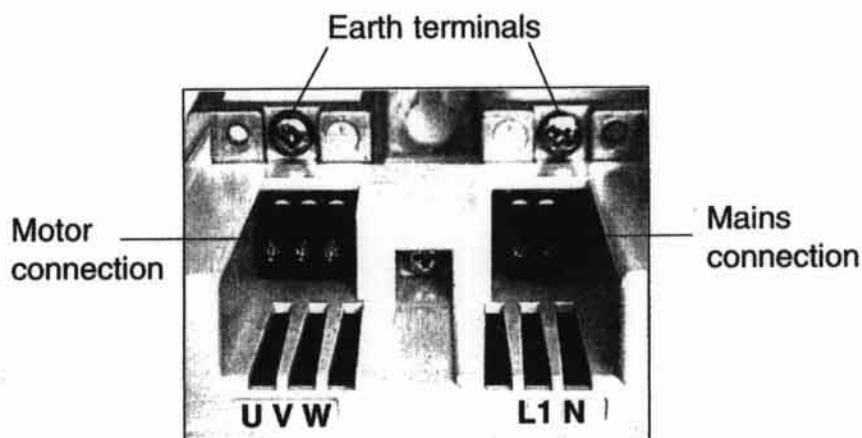


Always install vertically!

minimum clearance in mm

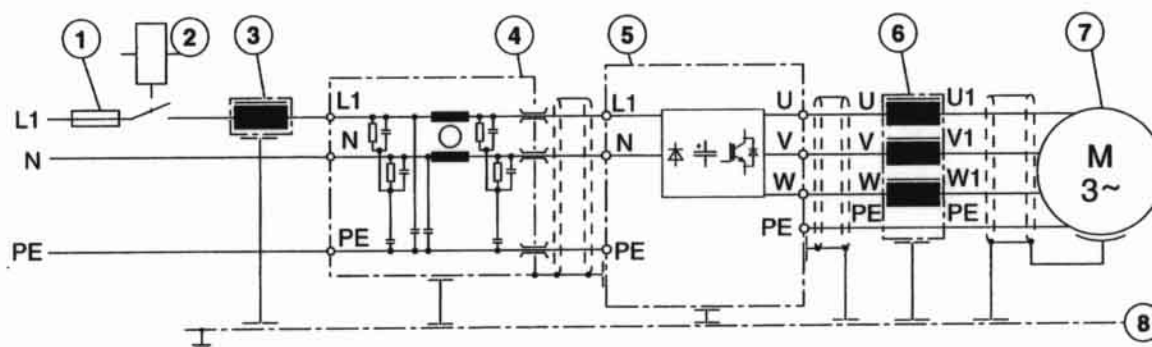


## 2.3 Terminals



GB

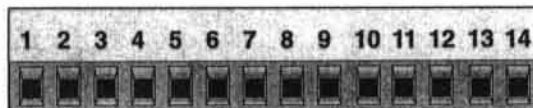
## 2.5 Connection of the Power Circuit



- ① Mains fuse (see „Technical Data“)
- ② Mains contactor !!! Generally switch only the phase !!!
- ③ Input reactor (Part.No. Size 05: 00.90.291-4848 / Size 07: 00.90.291-2948)
- ④ Interference suppression filter (GEN.No. Size 05: 05.U4.00C-B600 / 07: 07.U4.00C-B600)
- ⑤ KEB COMBIVERT F4-S
- ⑥ Motor choke (Part.No. Size 05: 00.90.290-4245 / Size 07: 00.90.291-2845)  
 !!! Only use up to 4 KHz switching and 51 Hz output frequency !!!  
 For other switching or output frequencies ask KEB.
- ⑦ Motor
- ⑧ Mounting plate

## 3. Control circuit

### 3.1 Assignment of Terminal Strip X1



PIN	Function	Name	Description
X1.1	NO contact	RLA	Relay output (30V DC / 1A)
X1.2	NC contact	RLB	Function see parameter CP.22
X1.3	Main contact	RLC	( factory setting: fault indication)
X1.4	Fixed frequency 1	I1	X1.4 + X1.5 = fixed frequency 3 no input = analog set value
X1.5	Fixed frequency 2	I2	
X1.6	Digital Ground	0V	Zero potential for digital in-/outputs
X1.7	+10V	CRF	Supply voltage for set value potentiometer (max. 4mA) 0...10VDC for analog set value Ground for analog in- and outputs
X1.8	Set value input	REF	
X1.9	Common	COM	
X1.10	Analog output	AOUT	Analog output of real frequency 0...10VDC = 0...100Hz
X1.11	15V	+15V	voltage supply for digital in-/outputs (max. 100mA)
X1.12	Reverse	R	Preset rotation; forward has priority
X1.13	Forward	F	
X1.14	Control release	ST/RST	Power modules are enabled; Reset at opening

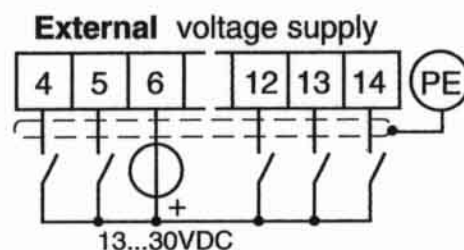
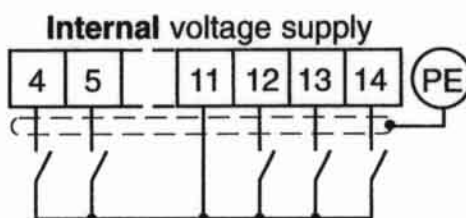
### 3.2 Connection of the control

In order to prevent a malfunction caused by interference voltage supply on the control inputs, the following directions should be observed:



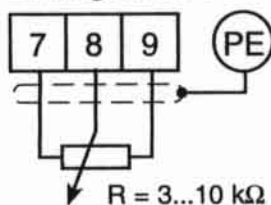
- Use shielded/drilled cables
- Lay shield **on one side** of the inverter onto earth potential
- Lay control and power cable **separately** (about 10...20 cm apart)
- Lay crossings in a right angle (in case it cannot be prevented)

#### 3.2.1 Digital input

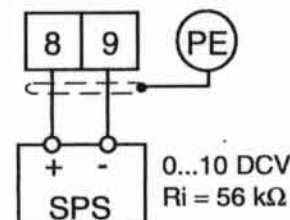


#### 3.2.2 Analog input

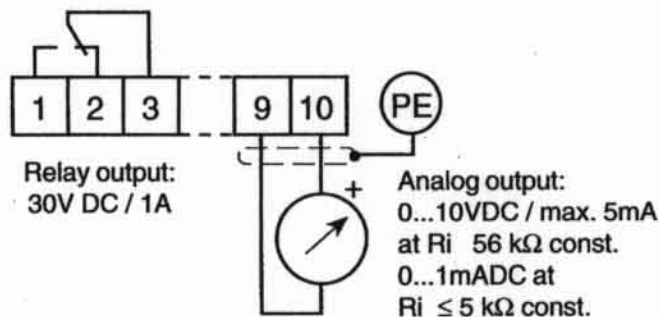
**Internal analog set-point setting 0...10V**



**External analog set-point setting**



## 3.2.3 Outputs

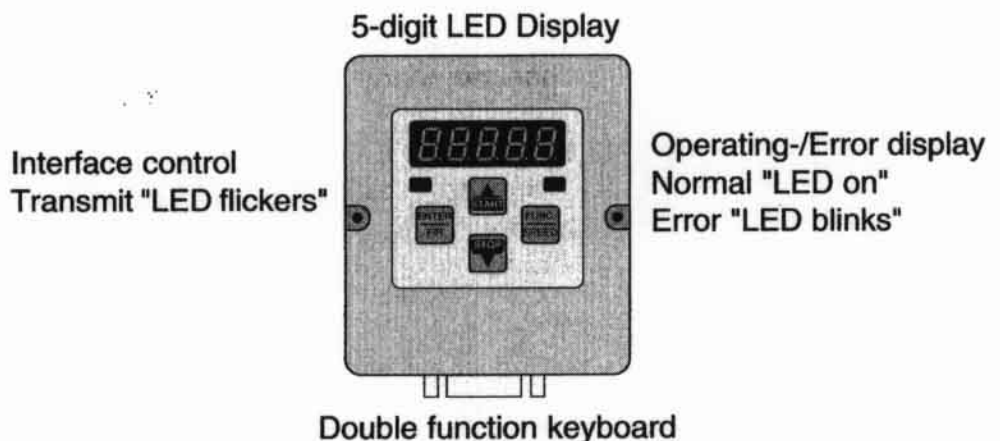


## 4. Operation of the unit

As an accessory to the local operation an operator is necessary. To prevent malfunctions, the inverter must be brought into **nOP** status before connecting/disconnecting the operator (open control release terminal X1.14). When starting the inverter without an operator, it is started with the last stored values or factory setting. The operator is obtainable in different versions:

### 4.1 Digital operator

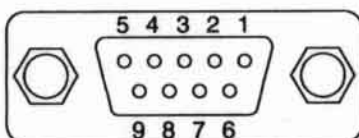
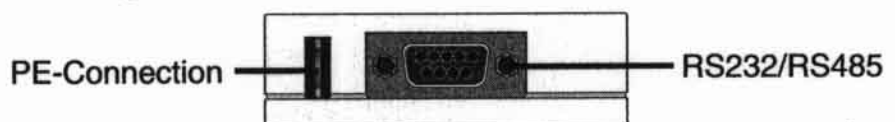
Part-No. 00.F4.010-2009



### 4.1.1 Interface operator

Part-No. 00.F4.010-1009

In the Interface operator there is an additional isolated RS232/RS485-Interface integrated.



PIN	RS485	Signal	Meaning
1	—	—	reserved
2	—	TxD	Transmitter signal/RS232
3	—	RxD	Receiver signal/RS232
4	A'	RxD-A	Receiver signal A/RS485
5	B'	RxD-B	Receiver signal B/RS485
6	—	VP	Voltage supply-Plus +5V ( $I_{max} = 10$ mA))
7	C/C'	DGND	Data reference potential
8	A	TxD-A	Transmitter signal A/RS485
9	B	TxD-B	Transmitter signal B/RS485

Informations about other versions of operators contact KEB!

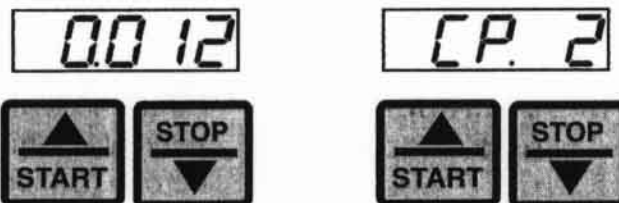
## 4.1.2 Keyboard

When switching on KEB COMBIVERT the value of parameter CP.1 appears. (See Drive mode to switch the keyboard function)

The **function key (FUNC)** changes between the parameter value and parameter number.



With **UP (▲)** and **DOWN (▼)** the value of the parameter number is increased/decreased with **changeable** parameters.

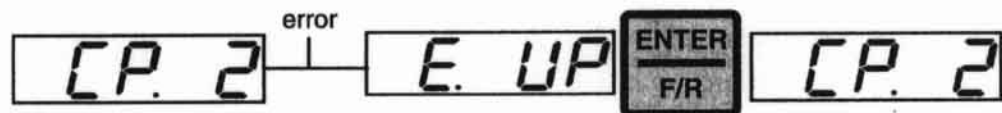


Principally during a change, parameter values are immediately accepted and stored non-volatile. With some parameters it is not useful, that the adjusted value immediately be accepted. When this type of parameter is changed, then a point appears behind the last digit.

By pressing **ENTER** the adjusted value is accepted and non-volatile stored.



If a malfunction occurs during operation, then the actual display is overwritten by the alarm message. The alarm message in the display is reset by ENTER.



With ENTER the error message is only reset in the display. In order to reset an error oneself, the cause must be removed and a reset on terminal X1.14 or a power-on reset must occur. In the Inverter status display (CP. 2) the error is still displayed.



## 4.2 Parameter Summary

Display	Parameter	Adjust. range	Resolution	Factory setting
CP. 0	Password input	0...9999	1	-
CP. 1	Actual frequency display	-	0,1 Hz	-
CP. 2	Inverter status display	-	-	-
CP. 3	Actual load	-	1 %	-
CP. 4	Peak load	-	1 %	-
CP. 5	Rated frequency	0...409.58 Hz	0.0125 Hz	50.0 Hz
CP. 6	Boost	0...25.5 %	0.1 %	2 %
CP. 7	Acceleration time	0.01...300 s	0.01 s	10 s
CP. 8	Deceleration time	0.01...300 s	0.01 s	10 s
CP. 9	Minimal frequency	0...409.58 Hz	0.0125 Hz	0 Hz
CP.10	Maximal frequency	0...409.58 Hz	0.0125 Hz	70 Hz
CP.11	Fixed frequency 1	±0...409.58 Hz	0.0125 Hz	5 Hz
CP.12	Fixed frequency 2	±0...409.58 Hz	0.0125 Hz	50 Hz
CP.13	Fixed frequency 3	±0...409.58 Hz	0.0125 Hz	70 Hz
CP.14	Max. ramp current	10...200 %	1 %	140 %
CP.15	Max. constant current	10...200 %	1 %	200 %
CP.16	Speed search	0...7	1	0
CP.17	Voltage stabilization	150...649 V, oFF	1 V	oFF
CP.18	Slip compensation	-2.50...2.50	0.01	0=oFF
CP.19	Autoboost	-2.50...2.50	0.01	0=oFF
CP.20	DC-braking	0...9	1	0
CP.21	Braking time	0...100 s	0.01 s	10 s
CP.22	Relay output	0...25 (0...24) <sup>1)</sup>	1	2
CP.23	Frequency level	0...409.58 Hz	0.0125 Hz	4 Hz

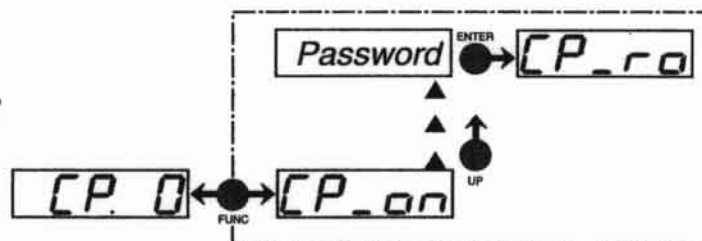
<sup>1)</sup> Value 0...24 is valid as of software version 1.1

## 4.3 Password Input

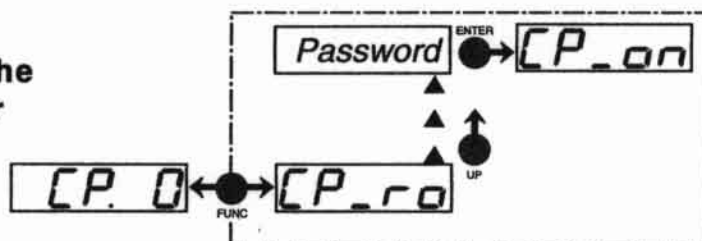
CP. 0

Ex works the frequency inverter is supplied without password protection, this means that all changeable parameters can be adjusted. After parameterizing the unit can be barred against unauthorized access. The adjusted mode is stored.

### Locking the CP-Parameter



### Releasing the CP-Parameter



## 4.4 Operating Display

### Actual frequency display

CP. 1

The 4 parameters below serve to control the frequency inverter during operation.

Display of the actual output frequency with a resolution of 0.0125 Hz. The rotation of the inverter is indicated by the sign.

Examples: 18.3 Output frequency 18.3 Hz, rotation forward  
- 18.3 Output frequency 18.3 Hz, rotation reverse

GB

### Inverter status display

CP. 2

The status display shows the actual working conditions of the inverter. Possible displays and their meanings are:

<span style="border: 1px solid black; padding: 2px;">noP</span>	" no Operation " control release (terminal X1.14) not bridged, modulation switched off, output voltage = 0 V, drive is not controlled.
<span style="border: 1px solid black; padding: 2px;">LS</span>	" Low Speed " no rotation preset ( terminal X1.12 or X1.13), modulation switched off, output voltage = 0 V, drive is not controlled.
<span style="border: 1px solid black; padding: 2px;">FAcc</span>	" Forward Acceleration " drive accelerates with a forward direction of rotation.
<span style="border: 1px solid black; padding: 2px;">FdEc</span>	" Forward Deceleration " drive decelerates with a forward direction of rotation.
<span style="border: 1px solid black; padding: 2px;">rAcc</span>	" Reverse Acceleration " drives accelerates with a reverse direction of rotation.
<span style="border: 1px solid black; padding: 2px;">rdEc</span>	" Reverse Deceleration " drive decelerates with a reverse direction of rotation.
<span style="border: 1px solid black; padding: 2px;">Fcon</span>	" Forward Constant " drive runs with a constant speed and a forward direction of rotation.
<span style="border: 1px solid black; padding: 2px;">rcon</span>	" Reverse Constant " drive runs with constant speed and a reverse direction of rotation.

Other status messages are described at the parameters, which they cause.

### Actual load

CP. 3

Display of the actual inverter rate of utilization in percent. 100% rate of utilization is equal to the inverter rated current. Only positive values are displayed, meaning there is no differentiation between motor and regenerative operation.

### Peak load

CP. 4

This display makes it possible to recognize short-term fluctuations of the rate of utilization by storing the highest value that occurred. The display occurs in percent (100% = inverter rated current).



With the UP or DOWN key the peak value can be reset when the unit is on. Switching off the unit deletes the peak value.



#### 4.5 Basic Adjustment of the Drive

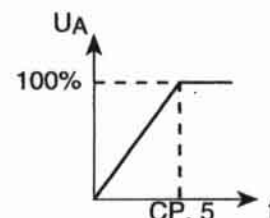
##### Rated frequency

CP. 5

The following parameters determine the fundamental operating data of the drive. They should be checked and/or adapted to the application.

With the adjusted frequency here the inverter reaches a maximal output voltage. The adjustment of the motor rated frequency is typical here. Note: Motors can overheat when the rated frequency is incorrectly adjusted!

Adjustment range: 0...409.58 Hz  
Resolution: 0.0125 Hz  
Factory setting: 50.0 Hz  
Customer adjustment: \_\_\_\_\_ Hz



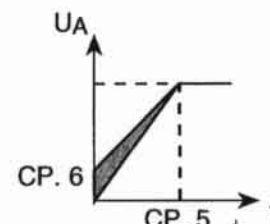
GB

##### Boost

CP. 6

In the lower speed range a large part of the motor voltage decreases on the stator resistance. In order that the breakdown torque of the motor remains almost constant in the entire speed range, the voltage decrease can be compensated by the boost.

Adjustment range: 0...25.5 %  
Resolution: 0.1 %  
Factory setting: 2.0 %  
Customer adjustment: \_\_\_\_\_ %



- Adjustment: - Determine the rate of utilization in no-load operation during rated frequency  
- Preset about 10 Hz and adjust the boost, so that about the same rate of utilization is reached as with the rated frequency.



When the motor, during continuous operation, drives with low speed and too high voltage it can lead to an overheating of the motor.

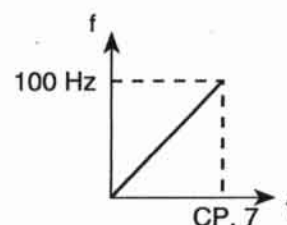
##### Acceleration time

CP. 7

The parameter determines the time needed, in order to accelerate from 0 to 100 Hz. The actual acceleration time is proportional to the frequency change.

$$\text{actual acceleration time} = \frac{\text{CP. 7} \times \Delta f}{100 \text{ Hz}}$$

Adjustment range: 0.01...300 s  
Resolution: 0.01 s  
Factory setting: 10 s  
Customer adjustment: \_\_\_\_\_ s



Example: CP. 7 = 10 s ; the drive should accelerate from 10 Hz to 60 Hz  
 $\Delta f = 60 \text{ Hz} - 10 \text{ Hz} = 50 \text{ Hz}$

$$\text{actual acceleration time} = (50 \text{ Hz} / 100 \text{ Hz}) \times 10 \text{ s} = 5 \text{ s}$$

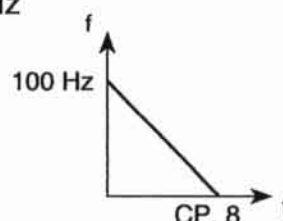
## Deceleration time

CP. 8

The parameter determines the time needed in order to decelerate from 100 to 0 Hz. The actual deceleration time is proportional to the frequency change.

$$\text{actual acceleration time} = \frac{\text{CP. 8} \times \Delta f}{100 \text{ Hz}}$$

Adjustment range: 0.01...300 s  
Resolution: 0.01 s  
Factory setting: 10 s  
Customer adjustment: \_\_\_\_\_ s



Example: CP. 8 = 10 s ; the drive should decelerate from 60 Hz to 10 Hz  
 $\Delta f = 60 \text{ Hz} - 10 \text{ Hz} = 50 \text{ Hz}$

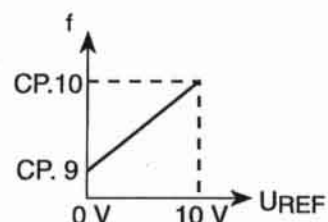
$$\text{actual deceleration time} = (50 \text{ Hz} / 100 \text{ Hz}) \times 10 \text{ s} = 5 \text{ s}$$

## Minimal frequency

CP. 9

Frequency on which the inverter runs without presetting an analog set value. Internal limiting of the fixed frequencies CP.11...CP.13.

Adjustment range: 0.0...409.58 Hz  
Resolution: 0.0125 Hz  
Factory setting: 0.0 Hz  
Customer adjustment: \_\_\_\_\_ Hz



## Maximal frequency

CP. 10

Frequency on which the inverter runs with maximum analog set value. Internal limiting of the fixed frequencies CP.11...CP.13.

Adjustment range: 0.0...409.58 Hz  
Resolution: 0.0125 Hz  
Factory setting: 70 Hz  
Customer adjustment: \_\_\_\_\_ Hz

## Fixed frequency 1...3

terminal X1.4

CP. 11

terminal X1.5

CP. 12

terminals X1.4+X1.5

CP. 13

Three fixed frequencies can be adjusted. The selection of the fixed frequencies occurs with the terminals X1.4 and X1.5.

Adjustment range: 0.0...±409.58 Hz  
Resolution: 0.0125 Hz  
Factory setting: 5/50/70 Hz  
Customer adjustment 1: \_\_\_\_\_ Hz  
Customer adjustment 2: \_\_\_\_\_ Hz  
Customer adjustment 3: \_\_\_\_\_ Hz

If presetting occurs outside of the fixed limits of CP.9 and CP.10, then the frequency is internally limited.

#### 4.6 Special Adjustments

Max. ramp current

**CP. 14**

The following parameters serve to optimize the drive and adaption onto certain applications. These adjustments can be ignored at the initial startup.

This function protects the frequency inverter against switching off by overcurrent during the acceleration ramp. When the ramp reaches the adjusted value here, then it is stopped as long as the current decreases again. CP.2 displays "LAS" at active function.

Adjustment range: 10...200%, 200% = oFF  
Resolution: 1 %  
Factory setting: 140 %  
Customer adjustment: \_\_\_\_\_ %

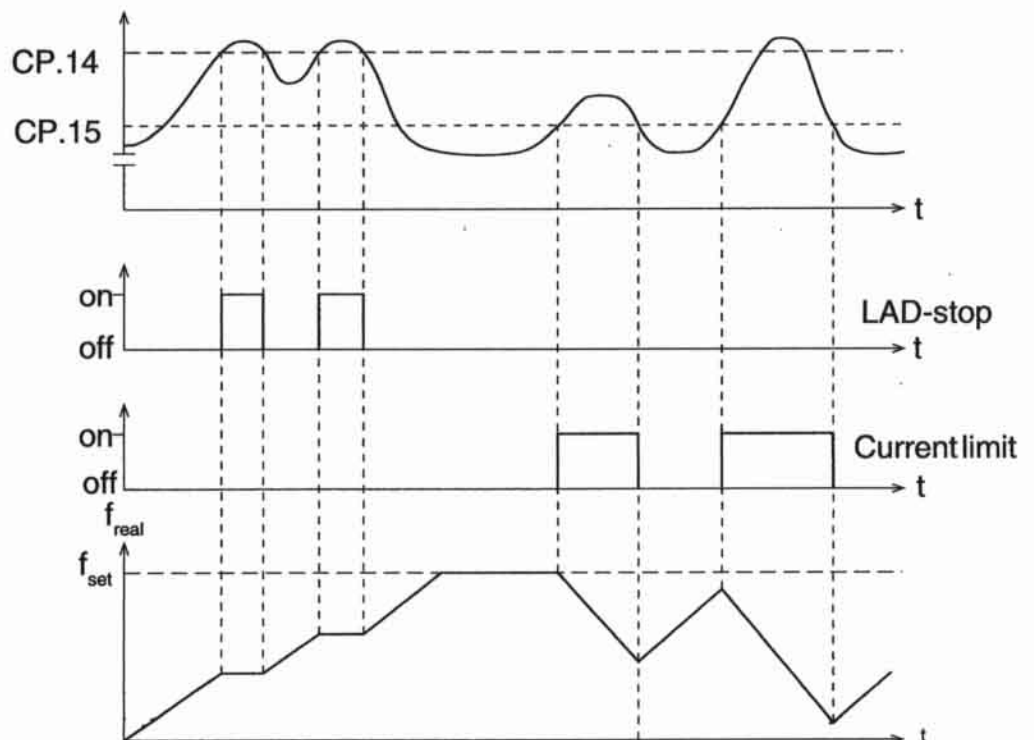
GB

Max. constant current

**CP. 15**

This function protects the frequency inverter against switching off due to overcurrent during constant output frequency. When exceeding the adjusted value here, the output frequency is reduced until the value drops below the adjusted value. CP. 2 displays "SSL" at active function.

Adjustment range: 10...200%, 200% = oFF  
Resolution: 1 %  
Factory Setting: 200 %  
Customer adjustment: \_\_\_\_\_ %



## Speed search

CP.16

When connecting the frequency inverter onto a decelerating motor, an error can be triggered by the differing rotating field frequencies. At activated speed search the inverter searches the actual motor speed, adapts its output frequency and accelerates with the adjusted ramp onto the given set value. During speed search CP.2 displays "SSF". The parameter determines, under what conditions the functions operate. With several conditions the sum of the value must be entered.

Example: CP.16 = 5 means at control release and after reset

Adjustment range: 0...7  
Resolution: 1  
Factory setting: 0  
Customer adjustment: \_\_\_\_\_

Value	Condition
0	function off
1	at control release
2	at switch on
4	after reset

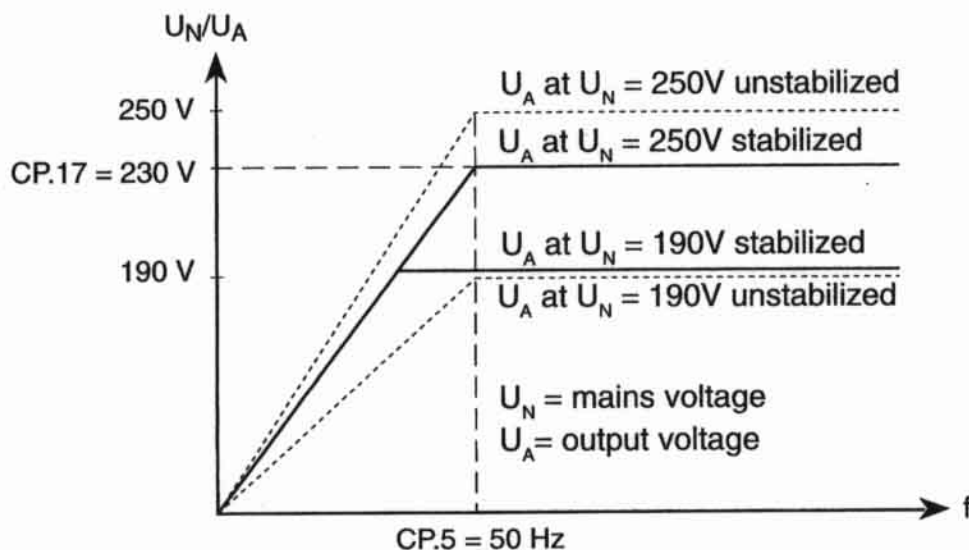
GB

## Voltage stabilization

CP.17

This parameter can adjust a regulated output voltage in relation to the rated frequency. Because of this voltage variations at the input as well as in the intermediate circuit only have a small influence on the output voltage (U/f-characteristic). The function allows, among other things, an adaption of the output voltage onto the special motors. In the example below the output voltage is stabilized onto 230 V (0% boost).

Adjustment range: 150...649 V, oFF  
Resolution: 1 V  
Factory setting: oFF  
Customer adjustment: \_\_\_\_\_ V



## Slip compensation

CP. 18

Slip compensation balances the speed changes caused by the load variation. In order to activate the function, set the value at 1.00 and optimize as directed in the examples below.

Adjustment range: -2.50...2.50  
Resolution: 0.01  
Factory setting: 0.00 (= oFF)  
Customer adjustment: \_\_\_\_\_

## Autoboost

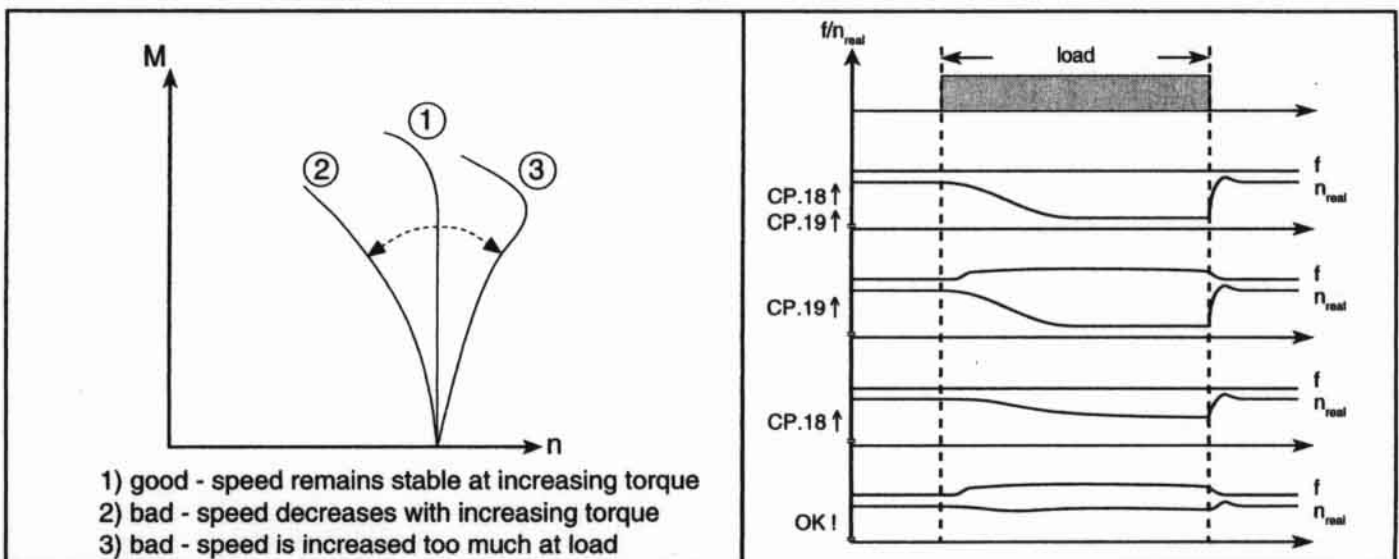
CP. 19

Autoboost causes an automatic I\*R-compensation by raising the output voltage during high load torques. The magnetizing current remains constant. To activate the function set the value to 1.00 and optimize as directed in the examples below. Check the motor voltage to see, whether it returned to the normal value after no load of the drive. Otherwise reduce CP.19.

Adjustment range: -2.50...2.50  
Resolution: 0.01  
Factory setting: 0.00 (= oFF)  
Customer adjustment: \_\_\_\_\_



Slip compensation and autoboost work on the basis of preset motor data. When using a special motor or in case of overdimensioning of more than one size, then both functions should be deactivated.



## DC-braking

CP.20

With DC-braking the motor is not decelerated by the ramp. Quick braking is caused by DC voltage, which is applied onto the motor winding. This parameter determines how the DC-braking is triggered.

Value	Activation
0	DC-braking deactivated
1	DC-braking at switch off of the direction of rotation and in reaching 0Hz. Braking time is dependent on CP.21 or until the next direction of rotation presetting.
2	DC-braking as soon as the direction of rotation presetting is absent. Braking time dependent on the real frequency
3	DC-braking, as soon as the direction of rotation changes. Braking time dependent on the real frequency.
4	DC-braking at switch off of the direction of rotation and the real frequency goes below 4 Hz.
5	DC-braking, when the real frequency goes below 4 Hz.
6	DC-braking, as soon as the set value goes below 4 Hz.
7	DC-braking deactivated
8	DC-braking deactivated
9	DC-braking after switching on the modulation on. Braking time is dependent on CP.21.

Factory setting: 0  
 Note: Enter-Parameter  
 Customer adjustment: \_\_\_\_\_

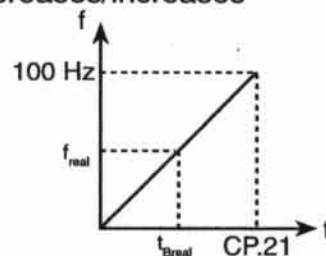
## Braking time

CP.21

The braking time is evaluated depending on CP.20 as follow:

- entered time = braking time
- entered time relates to 100 Hz and decreases/increases proportionally to the real frequency.

Adjustment range: 0.00...100 s  
 Resolution: 0.01 s  
 Factory setting: 10 s  
 Customer adjustment: \_\_\_\_\_



Calculation of the braking time:

$$t_{Breal} = \frac{CP.21 * f_{real}}{100 \text{ Hz}}$$



## Relay output

CP.22

Relay output (terminal X1.1...X1.3) is adjusted in the factory as a fault relay. This parameter can adjust the function of the output onto any function listed in the table below.

Value	Function
0	No function
1	Generally on
2	Fault relay
3	No function
4	Overload alert signal (10s before switch off)
5	* Overtemperature alert signal inverter
6	* Overtemperature alert signal motor (10s before switch off)
7	No function
8	Max. constant current (stall, CP.15) exceeded
9	Max. LA-/LD-Stop (CP.14) exceeded
10	DC-braking active
11	No function
12	Rate of utilization (CP.3) > 100%
13	No function
14	Actual value = set value (CP.2 = Fcon, rcon; not at noP, LS, error, SSF)
15	Accelerate (CP.2 = FAcc, rAcc, LAS)
16	Decelerate (CP.2 = FdEc, rdEc, LdS)
17	Right handed rotation (not at noP, LS error)
18	Left handed rotation (not at noP, LS error)
19	Real direction of rotation = set direction of rotation
20	Real value > frequency level CP.23
21	Set value > frequency level CP.23
22	No function
23	Operating signal (after initialization as long as no error is active)
24	Run signal
25	No function (not available since software version 1.1)

GB

Factory setting: 2  
 Note: Enter-Parameter  
 Customer adjustment: \_\_\_\_\_

\* available as of software version 1.1

## Frequency level

CP.23

This parameter determines the switching point for the relay output X1.1...X1.3 at CP.22 = "20" or "21"

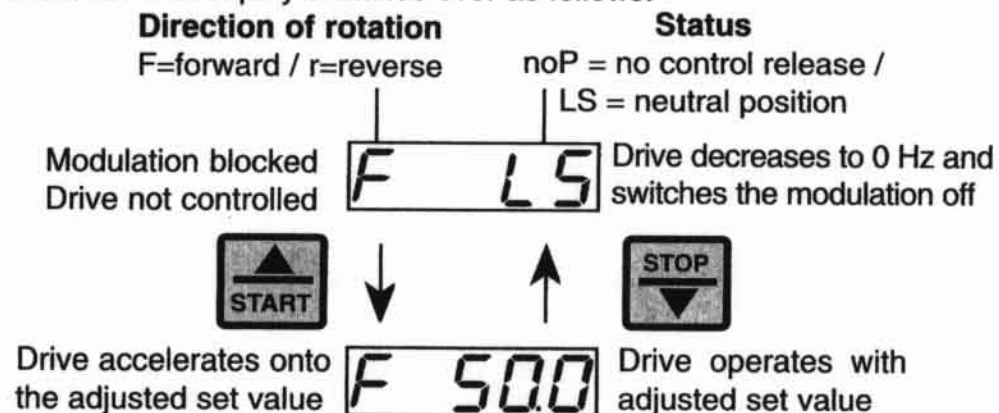
After the switching of the relay, the frequency can move within a 0.5 Hz window, without the relay dropping off.

Adjustment range: 0.0...409.58 Hz  
 Resolution: 0.0125 Hz  
 Factory setting: 4 Hz  
 Customer adjustment: \_\_\_\_\_

## 4.7 The Drive Mode

The drive mode is a operating mode of KEB COMBIVERT to start the drive manually by the operator. After switching the control release the set value and rotation presetting is done exclusively by the keyboard. In order to activate the drive mode the corresponding **password in CP.0** must be entered. The display switches over as follows.

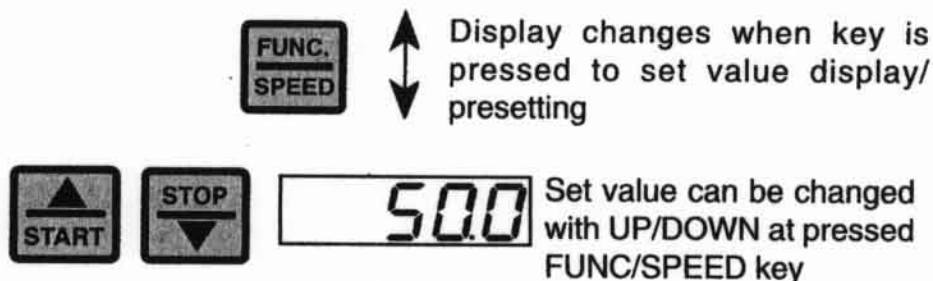
### GB 4.7.1 Start / Stop Drive



### 4.7.2 Change Direction of Rotation



### 4.7.3 Preset Set Value



### 4.7.4 Leave Drive Mode

To exit the drive mode the inverter must be in status "stop" (Display noP or LS). Press the FUNC and ENTER keys simultaneously for about 3 seconds in order to leave the drive mode. The CP-parameters appear in the display.





## 5. Error Diagnosis

### Undervoltage

**E. UP**

Error messages are represented with an "E." and the corresponding error in the display of the KEB COMBIVERT. The displays and their causes are described below.

Occurs, when the intermediate circuit voltage falls below the permissible value.

Possible causes are

- input voltage too low or unstable
- inverter power too small
- voltage loss due to incorrect cabling
- power supply by generator/transformer breaks down, because ramps are too short

### Overvoltage

**E. OP**

Occurs, when the intermediate circuit voltage rises above over the permissible value.

Possible causes are

- input voltage too high
- disturbance voltages at the input
- delay ramps too short

### Overcurrent

**E. OC**

Occurs, when exceeding the peak current or at ground fault.

### Overload

**E. OL**

Occurs when a too high load is applied for more than the allowed time (see "Performance Data"). Possible causes for this are

- error or overload in the application
- inverter incorrectly dimensioned
- motor incorrectly wired

### Cooling down phase completed

**E.nOL**

After error E. OL you must wait for a cooling down time. This message appears after the cooling down phase is completed. The error can be reset.

### Overheat

**E. OH**

Occurs, when the heat sink temperature  $> 85^{\circ}\text{C}$ . Possible causes for this are

- insufficient cooling
- surrounding temperature too high

### no Overheat

**E.nOH**

Internal or external excess-temperature error do not occur anymore. Error "E. OH" can be reset.

### Current limit resistor error

**E.LSF**

Current limit resistor not bridged, occurs for a short time during the turn on phase and is reset immediately. If the error message remains the following may be the cause

- incorrect or input voltage too small
- high loss in the supply line

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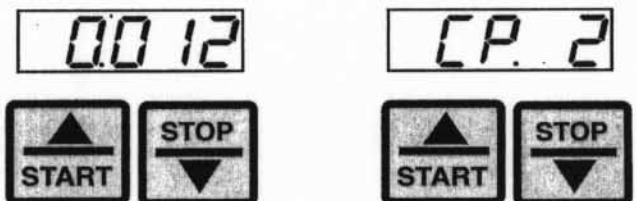
Display	Parameter	Adjust. range	Resolution	Customer setting
CP. 0	Password input	0...9999	1	-
CP. 1	Actual frequency display	-	0,1 Hz	-
CP. 2	Inverter status display	-	-	-
CP. 3	Actual load	-	1 %	-
CP. 4	Peak load	-	1 %	-
CP. 5	Rated frequency	0...409.58 Hz	0.0125 Hz	
CP. 6	Boost	0...25.5 %	0.1 %	
CP. 7	Acceleration time	0.01...300 s	0.01 s	
CP. 8	Deceleration time	0.01...300 s	0.01 s	
CP. 9	Minimal frequency	0...409.58 Hz	0.0125 Hz	
CP.10	Maximal frequency	0...409.58 Hz	0.0125 Hz	
CP.11	Fixed frequency 1	0...±409.58 Hz	0.0125 Hz	
CP.12	Fixed frequency 2	0...±409.58 Hz	0.0125 Hz	
CP.13	Fixed frequency 3	0...±409.58 Hz	0.0125 Hz	
CP.14	Max. ramp current	10...200 %	1 %	
CP.15	Max. constant current	10...200 %	1 %	
CP.16	Speed search	0...7	1	
CP.17	Voltage stabilization	150...649 V, oFF	1 V	
CP.18	Slip compensation	-2.50...2.50	0.01	
CP.19	Autoboost	-2.50...2.50	0.01	
CP.20	DC-braking	0...9	1	
CP.21	Braking time	0...100 s	0.01 s	
CP.22	Relay output	0...25 (0...24) <sup>1)</sup>	1	
CP.23	Frequency level	0...409.58 Hz	0.0125 Hz	

<sup>1)</sup> Value 0...24 is valid as of software version 1.1

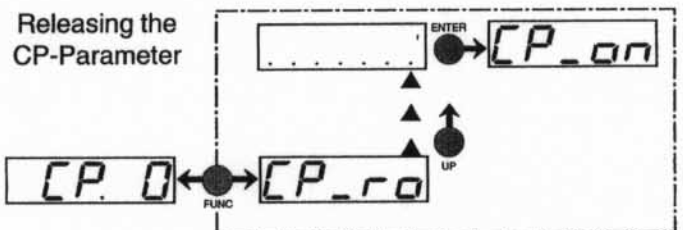
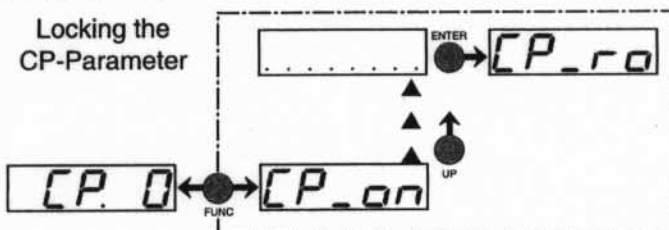
The **function key** (FUNC) changes between the parameter value and parameter number.



With **UP** (▲) and **DOWN** (▼) the value of the parameter number is increased/decreased with **changeable** parameters.



Password input:



## Declaration of Trained Personnel

### Declaration of Trained Personnel

I herewith declare that I have attended an internal training course for the operation of the E1 semi-automatic screen printer and have been informed about all details regarding safety.  
I also declare that I have read and understood this operating manual in full and that I have entirely understood my subject matter.

Subject matter			
Place	Date	Name in block capitals	Signature

Subject matter			
Place	Date	Name in block capitals	Signature

Subject matter			
Place	Date	Name in block capitals	Signature

Subject matter			
Place	Date	Name in block capitals	Signature

Subject matter			
Place	Date	Name in block capitals	Signature