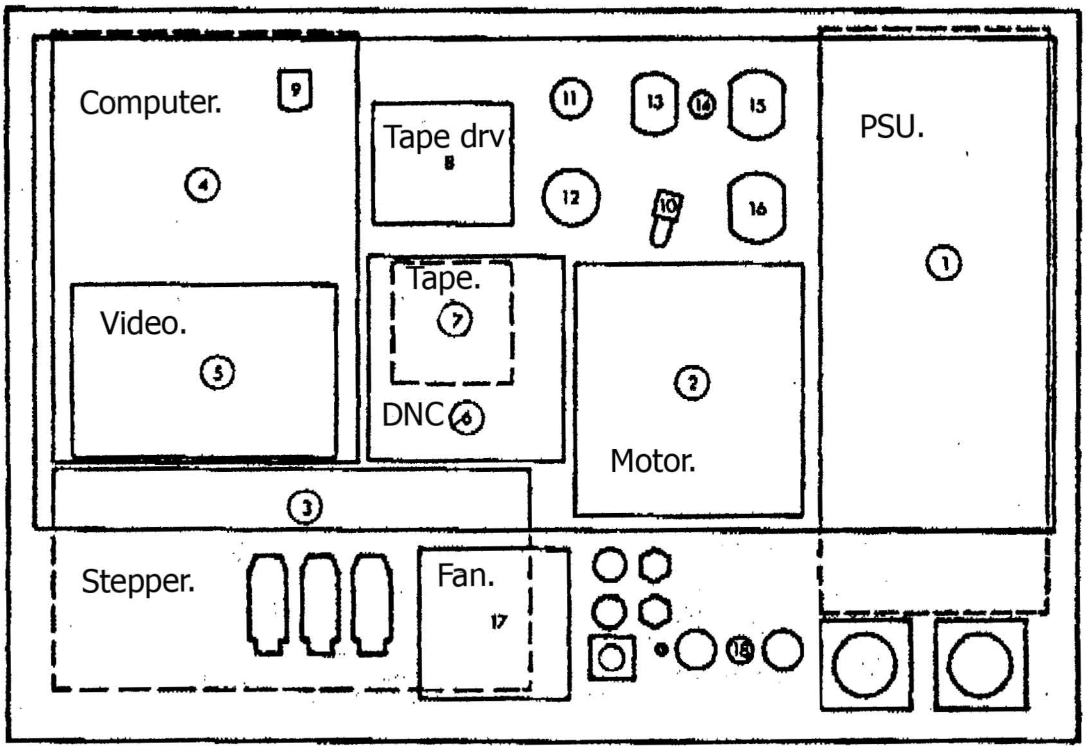


<u>Hauptmotor</u> <u>Main motor</u>	220-240 V: ZMO 78 1445 100-115 V: ZMO 78 1446
<u>Vorschubspindel</u> <u>Spindles feed</u>	X : F1A 031 001 Y : F1A 032 001 Z : F1A 021 001
	X,Y,Z beziehen sich auf vertikales Achssystem X,Y,Z in vertical axis system
<u>Schrittmotor</u> <u>Step motor</u>	X : F1A 103 000 Y : F1A 103 000 Z : F1A 103 000

8 bit 1 or 2 stop.
N parity.

Serial Interface 7.14.

Serial
5533

Information Service

Important Note:

Cleaning the plug contacts

Plug contacts can oxidize, the resistance increases or contact failures occur. The problematic component is the multipoint connector. The multipoint plug is hardly affected by this.

Cleaning:

Proper cleaning

1. Ultrasonic: This possibility is not available for in-situ service.
2. So-called contact sprays:

   Proper application:

   - Spray on
   - The contact spray must be completely removed. The plug must be washed - subsequent ultrasonic treatment would be preferable.
   - The contacts must be greased with pole grease or Vaseline (this is hardly possible with Panduit plugs).

Again, this method is not available for in-situ service.

Where the contact is only sprayed with contact spray, a momentary contact will be present. However, renewed oxidation is accelerated by the "contact spray" and the contacts become dirty very rapidly.

Accordingly, the only correct method:

The Panduit plug (multipoint connector) must be replaced. A special gripping device is required (available from Emco).

Foreword

This Service Manual concerns the Compact 5 CNC and F1 CNC.

The electrical-electronic section applies for the Compact 5 CNC and F1 CNC.
For precise trouble-shooting, experience with simple electrical measuring instruments is required (see Description of Measuring Instruments).

The brochure is designed so that you can obtain servicing proficiency yourself.
The most important special information, that has already been issued, has also been integrated.
Possible future information should be attached to this Service Manual, by you, so that the documentation remains comprehensive and up-to-date.

Copies of this Service Manual for your employees, should be made by you, as required.
The required number of service cards, circuit diagrams and prints of the measuring points (Chapter 15) can be obtained from EMCO Hallein.

EMCO
Technical Documentation

Table of Contents:

Chapter 1

General information on the Service Manual

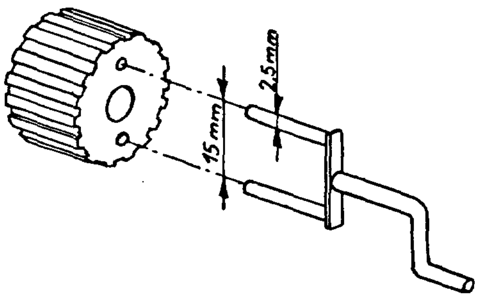
1. The Service Manual is only intended for use by service personnel, and not for the final customer.
   Circulation and reproduction only with the written permission of EMCO MAIER & CO, Hallein, Austria.

2. Safety Note:
   Servicing and repairs must be expertly carried out. The service technician must be aware of the pertinent national safety regulations. He must be authorized to carry out service work.

3. Service tools COMPACT 5 CNC/F1-CNC (mechanical):

   - Fork wrenches sizes 7, 10, 13, 23
   - Screwdriver 3 and 6 mm
   - Screwdrivers for cross-recess DIN 5260, Philips size 2 and 3
   - Hexagonal socket wrenches size 2, 3, 4, 5 (2.5 for changing pc-board)
   - Round files
   - Timer for setting the slide clearance

   Special tool note: To turn the spindles, insert a stud in the bore. A self-produced spanner wrench is more suitable.



4. Measuring instruments for measuring the electrical rated value:

4.1. Multimeter
Characteristic: Minimum accuracy $\pm$ 1.5 %
Voltage range 1 - 250 V ac/dc
Current range 100 mA - 10 A ac/dc
Resistance range 1 - 10 MOhm
Internal resistance about 3 KOhm/V
(e.g. BBC Metravo 2H)

4.2. Measuring instrument for measuring digital conditions
- Logic tester for 5 V level (TTL)
  (e.g. LOGIC Probe LT 2500; Messrs. MONACOR)
- Alternatively, a multimeter with an internal resistance of about 1 MOhm/V would be suitable (e.g. BBC Metravo 3D). This device would also replace the instrument specified under 4.1.

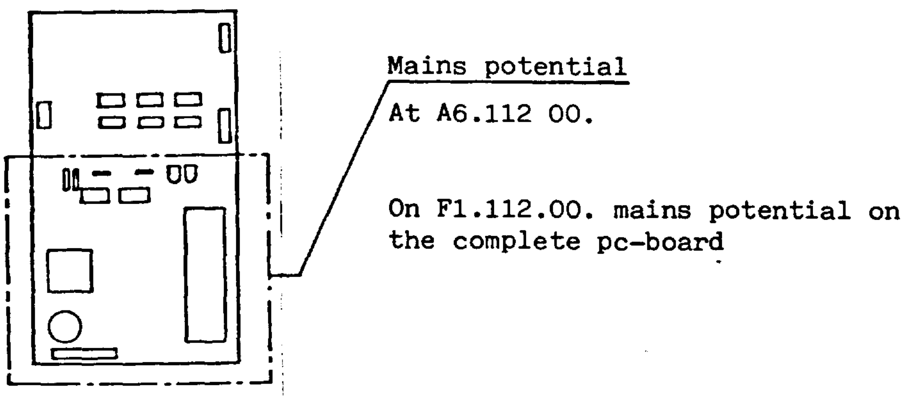
4.3. One oscilloscope
Every modern device, with a mains voltage-proof input is suitable for this purpose.

Note:

- The reference potential for all low voltages in the control is ground (connect with the housing and protective earth).
- Always earth the devices properly (via power socket).
- The Service Manual states the most suitable measuring points with comparative values.

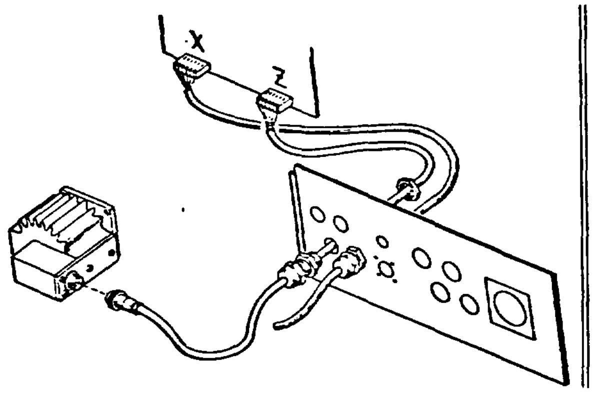
Attention!

Mains potential on the main spindle pc-board.

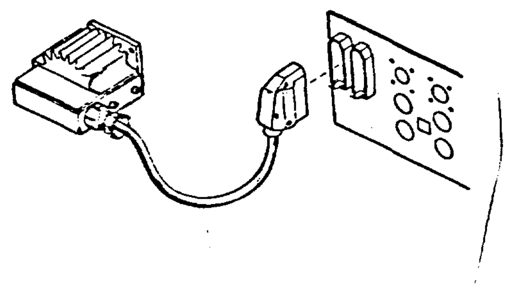


5. The COMPACT 5 CNC machines with serial numbers 1-299 differ constructively in some points from the machines with serial numbers over 300.
The major deviations are shown in chapter 10.

Immediately recognizable difference: Stepping motor cable



Comp 5 CNC
Serial number 0-299


Comp 5 CNC
Serial number from 300 upward

<u>Note:</u>

The $\oplus$ symbol is shown on several pages of chapters 4 and 5. This symbol means that deviating terms or procedures apply for COMPACT 5 CNC machines with serial numbers below 300.
These deviations are listed in chapter 10.

6. The instruction electrical-electronic is the same for COMPACT 5 CNC and F1 CNC. Differences are listed.

7. As a matter of principle, the newer pc-boards are suitable as replacement pc-boards for the older pc-boards.

8. Please note the comments on frequent sources of defects. You will save yourself long weary searches.

Chapter 2

The Reference Number System

1. Ref. No. of basic machine

Compact 5:

The reference number is engraved on the bed (on mounting socket for vertical drilling and milling attachement).

Year of production   Production period

A6A 82 05 42 —— Current production number

Code for COMPACT 5 CNC   Mechanical/electrical outfit

F1 CNC:

The reference number is engraved on the base below the milling tabel.

Year of production   Production period

F1A 85 02 42 —— Current production number

Code for F1-CNC   Mechanical/electrical outfit

2. The Ref. No. for the electrical equipment and the electrical control unit

On the inside of the electrical housing you find these numbers.

A6S 100 000	....Ref.No. for electrical equipment
A6S 105 000	....Ref.No. for electrical control
003 240	....Serial number (by earlier controls on own plate)

A6A 86 09 053

2.1. The E-equipment number

The E-equipment number indicates the voltage variant and the design variant.

2.1.1. COMPACT 5 CNC

A6A 100 000	A = 220 V / metric
A6B 100 000	B = 240 V / metric-inch
A6C 100 000	C = 115 V / metric-inch

Variants A, B and C were built up to Serial No 299.

A6F 100 000	F = 220 V / metric
A6G 100 000	G = 240 V / metric-inch
A6H 100 000	H = 115 V / metric-inch
A6N 100 000	N = 220 V / France version

Variants F, G, H and N were built up to Serial No. 1499.

A6R 100 000	R = 220 V / metric
A6S 100 000	S = 220-240 V / metric-inch
A6T 100 000	T = 110-120 V / metric-inch
A6U 100 000	U = 220-240 V / France version
A6V 100 000	V = 100 V / metric-inch
A6W 100 000	W = 110-120 V / metric-inch CSA

These variants were built from Serial No. 1500.
At present, only variants S, U, V and W are offered.

Serial CC5533

A6S

2.1.2. F1-CNC

F1S 100 000	S = 220-240 V / metric-inch
F1N 100 000	N = 220-240 V / France version
F1V 100 000	V = 100 V / metric-inch
F1W 100 000	W = 110-120 V / metric-inch CSA

Should the last digit not be 0, this indicates a modification in the internal construction (e.g. A6S 100 001).

2.2. The E-serial number indicates the pc-board structure

Comp. 5 CNC — A6A 105 000 to A6W 105 000 — as before

or

F1 CNC — F1S 105 000 to F1W 105 000 — as before

Where the last digit is not 0 (Zero), this indicates a modification in the internal construction.

2.3. The serial number

This number is important, since it indicates the development stage. Please note this number, especially for retrofitment and extensions.
e.g. A6W 105 000 / 3245

3. The pc-board number

The numbers are indicated either by an adhesive label or by embossing.
As a matter of principle, the latest generation pc-boards are supplied as replacement pc-boards. Exchangeability is compatible upwards.

Example:

Fitment of pc-board F1A 111 000 is possible in machines with pc-boards A6A 111 001.
This is not possible vice-versa.

3.1. The mains pc-board

Comp. 5 CNC	A6A 111 000 220-240 V A6C 111 000 115 V	up to Serial No. 299
	A6A 111 001 220-240 V A6C 111 001 110-120 V	up to Serial No. 3540
F1 CNC	F1A 111 000 220-240 V F1C 111 000 110-120 V F1V 111 000 100 V	Latest version for use in COMPACT 5 CNC and F1-CNC.

3.2. The main spindle pc-board

Comp. 5 CNC	A6A 112 000	220-240 V	up to Serial No. 49
	A6C 112 000	115 V	
	A6A 112 001	220-240 V	from 50 (TUV tested version from 3540)
	A6C 112 001	110-120 V	
F1 CNC	F1A 112 000	220-240 V	for F1-CNC
	F1C 112 000	110-120 V	

3.3. The step motor pc-board

Comp 5 CNC	A6A 113 000	up to 299
	A6A 113 001	from 300
F1 CNC	F1A 113 000	for F1-CNC

3.4. The computer pc-board

Comp. 5 CNC	A6A 114 000	metric	up to 49
	A6C 114 000	metric-inch	

These pc-boards are not suitable for the video and tool reverser extensions.

Comp. 5 CNC	A6A 114 001	metric	from 50 - 618
	A6A 114 001	metric-inch	

These pc-boards are not suitable for the video and tool reverser extensions. However, they can be retrofitted by Emco.

Comp. 5 CNC	A6A 114 002	metric	from 619-2499
	A6A 114 002	metric-inch	

These pc-boards are suitable for the video extension. They are not suitable for the tool reverser extension (can be retrofitted by Emco).

Where an A-variant is replaced by a C-variant, the metric/inch selector switch must be fitted.

Comp. 5 CNC —— A6C 114 003 from 2500 up to 3539

This pc-board has the following software extensions: Video and RS 232 interface, tool reverser and DNC interface, absolute value programming

Comp. 5 CNC —— A6C 114 003 from 3540, type according to TÜV, otherwise as above

F1 CNC —— F1C 114 000 for F1-CNC

3.5. The video pc-board

Comp. 5 CNC —— A6A 115 000 (lettering on EPROM CG1) Only COMPACT 5 CNC

Comp. 5 CNC/ F1 CNC —— A6A 115 000 (lettering on EPROM CG2 This pc-board is suitable for COMPACT 5 CNC and F1-CNC

3.6. The tool reversal pc-board, also DNC pc-board

Comp. 5 CNC ——	A6A 116 000	Tool reversal pc-board for COMPACT 5 CNC
Comp. 5 CNC/ F1 CNC	A6A 116 001	Tool reversal pc-board for COMPACT 5 CNC and DNC pc-board for F1-CNC

3.7. Cassette deck assembly

Comp. 5 CNC/ F1 CNC	A6F 090 000	Contains the recorder and interface pc-board A6F 091 000. Suitable for COMPACT 5 CNC and F1-CNC.

Note: The interface pc-board is fitted in the recorder of the COMPACT 5 CNC with serial numbers lower than 50.

Chapter 3

The Service Card for Compact 5 CNC and F1 CNC

When sending in below mentioned service-/spare parts to EMCO Hallein, the service card has to be attached:

- Complete electrical control unit
- Step motors
- Main motor
- Power supply circuit board
- Main spindle circuit board
- CPU circuit board
- Cassette Deck with Interface circuit board
- Video circuit board
- DNC-board
- Step motor board

Reason for service card

1. All electronic and electrical parts are thoroughly checked before they are built in. If there are errors occurring, the EMCO service department needs the defective boards to locate the error.

2. Organisational reasons

Therefore the following regulations:

1. If faults occur on above parts during the guaranty period, we shall write out a credit note on the condition that the defective part is sent to the EMCO service department together with the filled out service card within one month's time.

2. Outside the guaranty period we can re-imburse you after the repair service only if the defective part comes with a filled out service card (within one month's time). For parts not sent in or parts sent in without a service card there will be no re-imbursement to you whatsoever. We follow an usance which is quite common in the electronic repair sector. We ask for your understanding.

Example:

cancel not correct

Servicekarte
Service Card **EMCO COMPACT 5 CNC** **EMCO F1-CNC**

Ausgebautes Element Original Part	Best.-Nr. Order No.	Seriennummer Serial No.
1		
2 Anmerkungen/Remarks		
Eingebautes Element Replaced Part	**Best.-Nr. Order No.**	**Seriennummer Serial No.**
3		
Anmerkungen/Remarks		

Firma
Company 4

Monteur
Technician 5

Datum
Date

Please send dismounted element with service card to the following address:
EMCO MAIER & CO., Electronic Service,
P.O.Box 131, A-5400 Hallein/Austria

1 Here you enter the designation of the part (e.g. main motor circuit board). The second column is for Ref.No./Order No. and the third one for Serial No. - The Ref.No./Order No. and the Serial No. can be read directly from the board (sticker).

2 Should you note anything special has happened to the defective part, please write here.

3 Please also fill in Order No. and Serial No. of the new part which you are going to mount.

4 + 5 is selfunderstood

Servicekarte
Service Card **EMCO COMPACT 5 CNC EMCO F1-CNC**

6 7	E-Kastennummer Electrical Housing No.	
	E-Ausrüstungsnummer Electrical Equipment No.	
8	Maschinennummer Machine No.	
9	Ihre Fehlerbeschreibung: Description of Malfunction:	

Wollen Sie Rückmeldung über Fehlerursache? Would you like to be informed about cause of malfunction?	Ja Yes ○	Nein No ○

Servicekarte am ausgebauten Element befestigen
und an untenstehende Adresse schicken:
EMCO MAIER & CO., Electronic Service,
Postfach 131, A-5400 Hallein/Österreich

6 + 7 Numbers are to be found inside of the electrical housing.

8 The machine number is engraved on the backside of the bed.
(by F1 CNC on base)

9 Describe in a few words the fault, e.g. main motor not running.

Chapter 4

Fault rectification

1. Notes on trouble-shooting

2. Checklist for fault location

3. Fault repair

<u>Removal of the pc-boards</u>

Disconnect the plug connections (disconnect the potentiometer)
Unscrew the screws
Remove the pc-boards

<u>Attention:</u>

Pull out the computer pc-board upwards. Pull out the step motor pc-board downwards, otherwise the pins of the connector plug on the computer pc-board will be bent!

1. Notes on trouble-shooting and fault repair

A basic understanding of the structure of the electrical control and the function of the assemblies is required for fault repair.
The functions of the assemblies are shown in chapter 5.

Structure of chapter 4

The checklist, 4.2., is used for rough fault location. Notes on detailed testing (4.3.) are given and you will be able to repair the causes of the fault.

Fault repair without measuring devices

You may have to replace several pc-boards or assemblies, since you will be unable to precisely locate the cause of the fault.

Fault repair with measuring devices

The fault can be located.
The measuring points are precisely listed in 4.3. and in chapter 5.

Additional notes:

1. Proceed systematically. Please note the relationships of internal/external fault sources.

2. Please note: Incorrect service can destroy intact components!
   A defective component can destroy other parts.
   For this reason, check and exchange the components in the correct sequence.

   Example:

   A defective step motor can destroy the step motor pc-board. For this reason, where the feed drive is defective, check the step motor first, and replace where necessary, prior to exchanging the step motor pc-board.

3. Visual checks:
   Visual checks are essential. Numerous defects and causes of faults, such as
   - fouled air filter
   - chips in the internal space (short-circuits)
   - burnt contacts
   - loose components
   can be rapidly recognized by visual checks, and can be repaired.

4. Make certain that you have not loosened or disconnected any connections whilst carrying out your service.
   Check through all functions, you may thus be able to prevent a possible "next failure".

2. Checklist for fault location

2.1. Check mains supply

The mains voltage range is specified on the type plate (obverse of electric control).
The maximum admissible values have a ± 5 % tolerance.

With - 10 %, e.g. the computer pc-board will start to produce software failures.
With + 10 %, the mains pc-board can become damaged (thermal damage of the voltage controller of the transformer, etc.).

2.2. Visual inspection

See the notes on trouble-shooting

2.3. Check disengagement of the emergency-off pushbutton

2.4. Switch on the main switch

- "ON control lamp lights up	no, see page 4.8
- Main contactor energizes (clicking noise)	no, see page 4.9
- Blower operates	no, see page 4.10
- Display and manual operation lamp alight	no, see page 4.11 and page 4.12

2.5. Switch on main motor

- Main motor running	no, see page 4.13
- Main motor speed can be controlled	no, see page 4.14

- Main spindle display illuminated (only Compact 5 CNC)	no, see page 4.15
- Main spindle display shows rpm. (only Compact 5 CNC)	No or wrong spindle speed indication see page 4.16
<u>2.6 Moving the slides in mode hand operation</u>	
- $\pm X$, $\pm Y$ and $\pm Z$ traverse with feed 10-100 mm/min possible	no, see page 4.17
- $\pm X$, $\pm Y$ and $\pm Z$ rapid traverse possible	no, see page 4.18
<u>2.7 Display shows traverse</u>	
- Display shows X, Y, Z traverse	no, see page 4.19
<u>2.8</u>	
- Programminput with G-functions G00/G01/G02 possible	no, see page 4.19
- Command START is executed	no, see page 4.20

2.9 - Command G64 (cutting-off power of step motors) is executed (sign on screen).	no, see page 4.21
2.10 - Switching over from inch to metric resp. vertical/horizontal is possible. (sign on screen)	no, see page 4.21
2.11 - G33/G78 is executed (only Compact 5CNC)	no, see page 4.22
2.12 - G65 is executed (display shows letter "C")	no, see page 4.23
- SAVE, CHECK and LOAD operations are possible.	no, see pages 4.23 and 4.24
2.13 - Impulses on video outlet existing	No impulses on video outlet see page 4.25
- Impulses on antenna outlet existing	No impulses on antenna outlet see page 4.26
- Impulses on Interface RS 232 existing	No impulses on Interface RS 232 see. page 4.27

- Pulses present from several outputs	No pulses at several outputs see page 4.28

2.14. Functions of the tool reverser and DNC pc-board

- Tool reverser can be energized in CNC and manual operation (only on COMPACT 5 CNC)	No movement of the tool reverser see page 4.29
- Switching the main spindle On and Off with M03/M05 is possible	not possible see page 4.30
- DNC interface: Outputs are set, inputs are executed	No function see page 4.31

3. Fault Clearing

Note: Hints which are marked with ⊕ are only valid for Compact 5 CNC with serial numbers below 800!

Main switch on
Control lamp for main switch not illuminated

↓

Check main fuse e8 ⊕

Control lamp and display dark	Control lamp and display illuminated
↓	↓
Control lamp defect	Main switch defect
↓	↓
Meter the voltage on control lamp MP3	Meter the voltage before and behind the main switch input: Pin 1,2 MP1 output: Pin 3,4 MP2

Note:

If the main fuse becomes defect when you switch on the machine, look for short circuit on:

- socket(s)
- connection for machine lamp
- fan
- Power supply board
- control lamp

Graphic presentation of measuring points (MP)
see chapter 15

Main switch does not energize
(No "clicking" noise when switching on the main switch)

Check whether the emergency off switch is disengaged

On main pc-board check fuse e2 ⊕

Fuse actuated when switching on

Look for short-circuit in the control current circuit

Contacts emergency-off switch defective

Main contactor defective

Check wiring
Exchange power pack pc-board

Trouble-shooting with a voltmeter:

Look for, and check the voltage on the guard coil. Wiring information is given on plans A13.168-22 (for the COMPACT 5 CNC) and A13.168-71 (for F1-CNC) as well as on A13.168-72 ⊕.

Please note that contact 5/6 of the main switch is only closed between limit positions 0 and 1 (wiper contact).

Fan does not run

Without fan the temperature in the electrical housing can raise too high what can cause a lock up of the microprocessor (CPU).
- It operates "crazy".

⊕

Check power supply voltage for fan X11 MP4

Voltage present

Replace fan

No voltage

Look for current interruption
(for example plug X11)

No display

(Lamp manual, N, G, X, Y, Z, F, A, CNC, travel paths fail to light up)

↓

Check + 5 V supply: Pin 5 (+ 5 V) and Pin 6 (GND) at X11

+ 5 Volt present

↓

Check wiring on computer pc-board
X44 Pin 2 + 5 V
Pin 3 GND MP5

↓

Exchange computer pc-board

↓

Look for interruption (printed circuit, plug connection X44 defective)

+ 5 Volt not present

↓

Check fuses e1 and e6

↓

(Replace power pack pc-board)

↓

Look for fault on pc-board (diodes, voltage regulator)

Please note:

Incorporated faults in the 5 V circuit: The 5 volts are also present on the interface, video, tool reverser (DNC), step motor and main spindle pc-board (only COMPACT 5 CNC). Similarly, a fault (short-circuit) can also be incorporated from the "outside" via the DNC interface (X62). Check by disconnecting the connections (see wiring diagrams A13.168-22 and A13.168-71 ⊕).

In addition, the voltage can break down due to excessive load of the 5 V circuit ⊕ . The consequence of this, is that undefined fault conditions occur on all possible pc-boards.

Measuring the voltage: This must be between + 4.9 V and + 5.1 V (at X44).

Where the voltage exceeds this range, unplug the pc-boards until the cause is found. Replace the power pack pc-board.

Main motor fails to operate

On machines with wheel box cover limit switches:
Check through this control circuit. A.13168-22 and A.13168-72 (only COMPACT 5 CNC type France).

Measure the mains voltage on pin 1/3 of the main spindle pc-board X21. MP6

Present

Measure voltage at the output of the main spindle pc-board. MP6
X21 Pin 8/10
Direct current/phase angle at highest speed without motor about
150 V = at 220-240 Volt
80 V = at 100-120 Volt

Not present

Check fuse e21/e22 ⊕

Exchange main spindle pc-board

Not present ⊕

Measure motor switch

Measure pin 7/8 on the power-pack pc board X11. MP7

Present

Check additional power circuit
- Blocking rectifier (only F1-CNC)
- Ammeter
- Choke
- Plug connection pin 2/3 X9 (F1) X5 (C5)

Main motor defective (see Chapter on External Defects)

Exchange motor

Note:

A defective main motor can also destroy the main spindle pc-board. For this reason, always check the motor prior to repairing the main spindle pc-board.

Main motor operates, speed cannot be controlled

Replace the main spindle pc-board

↓

Look for possible defects on the pc-board:
- Potentiometer
- Thyristors on heat sink
- Diodes

Main spindle display dark

Check 5 V-fuse e1 and e6

Check 5V-supply on X22 Pin 2/3
Check 5V-supply on X22 Pin 2/1 MP8

5V present
10V present

Replace main motor board

Look for interruption
on board

no 5V present
no 10V present

Check plugs and wiring

No or wrong spindle speed indication

Check light barrier(look outside sources of defects)

↓

Check wiring
X23/X24 to X6 - look A.13168-22 ⊕

↓

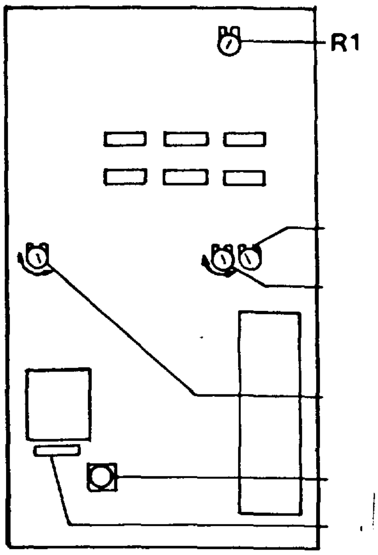
Replace main motor board

Notice:

Adjusting the indication of the main spindle speed.

Note:

R1 has been adjusted by the factory, if it has been turned,adjust it using a speedometer.



$\pm$X, $\pm$Y and $\pm$Z traverse with feed 10-100 mm/min not possible

Check + 10V supply on X33 Pin 2/3 (C5 CNC)
X33 Pin 3/6 (F1-CNC) MP9

+ 10V present

Replace step motor board

Replace Computer board

(Check power transistors on step motor board)

No +10 V present

Meter 10 V on power supply board
COMPACT 5 CNC X11 Pin 3/6 MP10
F1-CNC X12 Pin 3/6 MP11

Check fuse e7 ⊕

Replace power supply board (measure 10V circle ⊕ A. 13168-72)

± X, ±Y and ±Z traverse not possible

Check +40V supply on X33 Pin 3/4 (Compact 5 CNC) MP9
X33 Pin 6/10 (F1 CNC)

+40V present

↓

Replace step motor board

↓

Replace computer board
(Check transistors on step motor board)

No 40V present

↓

Meter +40V power supply board.
Compact 5 CNC X11 Pin 2/6 MP10
F1 CNC X12 Pin 6/10 MP11

↓

Check fuse e3

↓

Replace power supply board

(measure 40V circle (+)
A.13168-72)

Display does not show X, Y, or Z traverse

Meter 5V circle MP12

MP 5

↓

Replace computer board

Programm input of G00/G01/G02/G03/G04

is not possible

Meter 5V circle MP12

MP 5

↓

Replace computer board

Program start is not possible

Disconnect the tool reverser and DNC pc-board

Start possible	Measure 5 V circuit	MP 12 MP 5
Check repair of the defect on the tool reverser or DNC pc-board (chip protection cover inlet)	Exchange the computer pc-board	

Note:

When using the DNC interface, faulty circuits can cause disturbance of some functions of the computer pc-board, e.g.

- HI on Pin 9/X62 (manual/CNC changeover) blocks the Manual/CNC pushbutton

- LO on Pin 10/X62 (protective cover open, with J4 open) produces intermediate HI and start interlock.

- etc.

For this reason, where there are defects on the computer pc-board, unplug the accessories!

Command G64 is not executed

Meter 5V circle MP12
MP 5

↓

Replace computer board

The switching over from metric to inch
or inch/metric/vertical/horizontal is not possible

Meter 5V circle MP 12
MP 5

↓

Check plug connection and wiring to change-over-switch

↓

- Meter change-over-switch

↓

Replace computer board

Change-over-switch b3
metric = connecting Pin A to Pin 2 } COMPACT 5 CNC
inch = connecting Pin A to Pin 1 }

for F1-CNC see page 5.30

G33/G78 is not executed

Check light barrier (look outside sources of defects), adjust resp. replace it.

Check wiring from X6 to X23 and X24 and X23/X24 to X46

Check light barrier pulse on X46 Pin 1/2 (see A13.168-22 and outside sources of defects) ⊕ see page 53

Pulse present

No pulse present

Replace main motor board

Replace computer board

Command G65 is not executed (No "C" on display)

Meter 5V circle   MP12
                  MP 5

↓

Replace computer board

Operation SAVE, CHECK and LOAD is not possible

- Switch off mainmotor

- Try new cassette (erase cassette before beginning with → + ⊕ DEL)
  If the new cassette works, the old one has been defect.

↓

Check correct pluging of plug X7 and X92

↓

Check, if the 16V supply on X7 Pin 4/6 MP15
is present

16V present

Check 5V on X7 Pin 9/12 MP 14

5V

Replace Cassette
recorder

Replace computer board

No 5V

Look for current interruption of
the 5V ⊕
(see A.13168-22 and A.13168-71)

No 16V present

Check 16V on power supply
board X11 Pin 4/6 MP 13

Check fuse e6 ⊕

Replace power supply board

No pulses at the video output

Check monitor function,
check voltage selection
75 Ohm setting / Input Video IN

Check plug connections for loose connections
Check wiring

Connect television to aerial output

Television - Display
(i.e. computer pc-board o.k.)

Exchange video pc-board

Television - No display

Exchange computer
pc-board

Exchange video pc-board

Check setting 50/60 Hz!

No pulses at the aerial output

Check the function of the television (channel or frequency, UHF 500 - 700 MHz)

Check wiring to the video pc-board (loose contact)

Connect monitor to the monitor output.

Monitor - display
(i.e. computer pc-board o.k.)

Exchange video pc-board

Monitor - No display

Exchange computer pc-board

Exchange video pc-board

Check 50/60 Hz setting!

No impulses on Interface outlet RS232

Check function of connected apparatures.
Check transmission code.
Check Pin-Connections of plug.

↓

Note:

Look on this passage the hints above chapter RS232.
In nearly all cases you find the fault by the new connected apparaturs.

↓

Check wiring to videoboard

↓

Replace videoboard

↓

Replace computer board

No impulses on more outlets

Check, if computer board A6C 114 002 or 003 is mounted (only Compact 5 CNC)

A6C 114 002 (003) mounted

Replace computer board

Replace videoboard

A6C 114 000 or 001 mounted

Mount computer board A6C 114 002 or 003

(Only COMPACT 5 CNC)

No movement of the tool reverser (neither in CNC nor in manual operation)

Check whether the tool reverser lock (bow contact J1 on tool reverser pc-board) has bow contact. See also the remarks in the tool reverser chapter regarding "wrong connection".

Check tool reverser motor (see external defects)

Measure voltage + 10 V (during swivelling) at X64 1/2 as well as - 3.5 V (during locking).

MP 16

Voltage present

Check wiring (plug connection, motor connection)

Replace complete tool reverser motor

Voltage not present

Check wiring to the computer pc-board

Exchange tool reverser pc-board

Replace computer pc-board

(only F1 CNC)

M03 and M05 are not executed

Is plug X61 inserted on the DNC pc-board?

Can you hear the power relay clicking on the DNC pc-board?

Yes

(i.e. the defect is in the motor power circuit)

Motor switch at CNC

Check wiring (see A13.168-71)

Power relay defective

No

(i.e. the defect is in the control power circuit)

MP 17
Check + 5 V at X68 1/2 and + 10 V at X63 1/3
MP18

Check wiring to the computer pc-board

Exchange DNC pc-board

Exchange computer pc-board

No function on DNC Interface

Check wiring to computer board

↓

Replace DNC board (F1 CNC)
Replace turret circuit board (Compact 5 CNC)

↓

Replace computer board

Note:
See also chapter DNC-board resp.
turret circuit board.

Chapter 5

Function of the components/ sources of defects

+ External components - sources of defects

1. Light barrier (COMPACT 5 CNC)
2. Step motors
3. Main motor
4. Tool reverser motor (only COMPACT 5 CNC)
5. Chip door limit switch (only F1-CNC)

+ Internal components - sources of defects

1. Computer pc-board
2. Step motor pc-board
3. Interface pc-board and cassette recorder
4. Main spindle pc-board
5. Power pack pc-board
6. Fuses
7. Video pc-board
8. Tool reverser and DNC pc-board
9. Measuring points in the electrical control

A basic understanding of the design of the electrical control and the function of the individual assemblies, is required for fault repairs.

The wiring diagrams and the flow diagram indicate the relationships and are aids to improved understanding.

5.1 External components - sources of defects

5.1.1. Light barrier (only COMPACT 5 CNC)

- Two light barriers are fitted on the main spindle, on a common mount.

- The first light barrier reports the main spindle speed. This light barrier transmits 100 pulses per revolution to the computer and the main spindle pc-board. Where the light barrier is defective, there is no speed display and wrong or no thread cutting G33/G78.

- The second light barrier is for the return report of the synchronous pulse. This light barrier transmits 1 pulse per revolution of the main spindle to the computer.

  Where this light barrier is defective, the G33/G78 command is not executed, since the computer does not receive a synchronous pulse.

- ⊕

Please note:

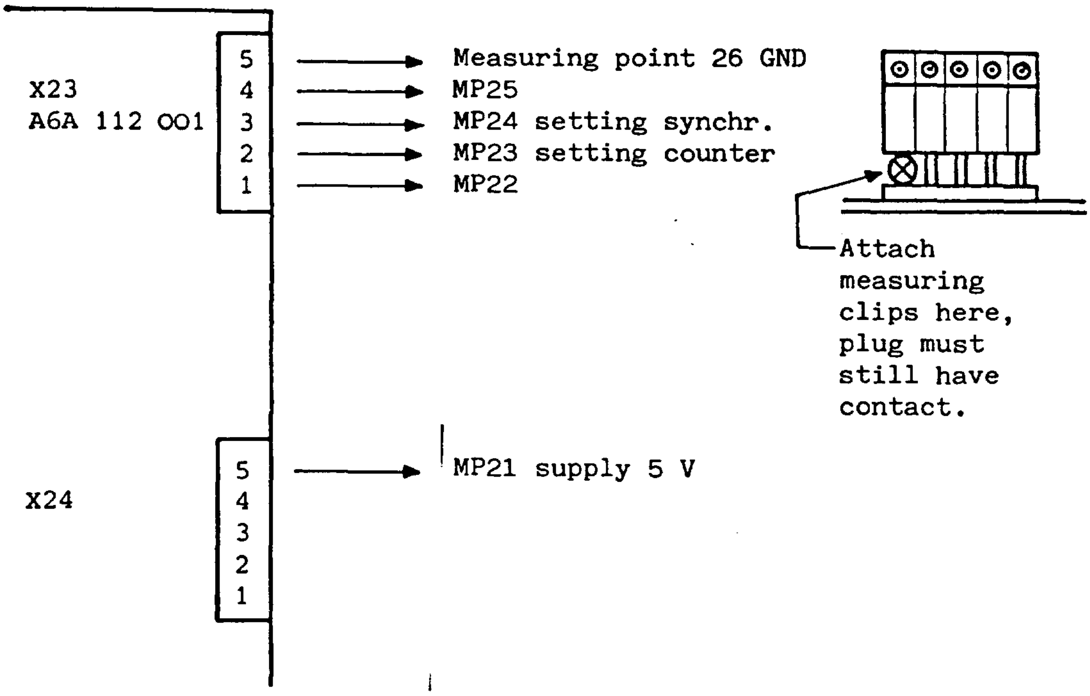
A defective light barrier can destroy the complete 5 V power supply. For this reason, the 5 V supply should always be initially checked.

Measuring the light barrier function

The following types of defect are possible (same diagnosis):

- No supply voltage + 5 V, GND at the light barrier
- Light barrier defective
- Wiring defective
- Main spindle pc-board defective (the signal for the computer pc-board is transformed via this pc-board)
- Computer pc-board defective

Measure on the main spindle pc-board



Measuring device with - pole on X11 / 6 of the power pack pc-board (GND)

Digital tester with GND on X11 / 6 and + 5 V at X11 / 5

Note: The chopper disk and the light barrier can be fouled by dust and oil.
Check the bore of the chopper disk.
Clean the light barrier with a cloth.

Description of the measuring points:

MP21 + 5 V supply
(at X24/5); disconnect plug X23, then + 5 V at pin.

Connect plug X23, then about 1.2 V due to the load of the light barriers.

MP22 Counting pulse (from the main spindle pc-board to the computer pc-board)
(at X23/1);
This measuring point is only useful for testing the function of the main spindle pc-board.
(remove light barrier and cover individually)

Synchronous light barrier -
open: 5 V
covered: 0-1 V pulse, then 5 V again

MP23 Counting pulse (from the light barrier)
(at X23/2)
The function of the light barrier itself is tested with this measuring point.
(open 0-1 V, covered 5 V)
In the fitted condition, the switch processes can be checked by very slow rotation of the main spindle, and appropriately setting the light barrier.

MP24 Synchronous pulse (from the light barrier)
(to X23/3)
Procedure as for MP 3, however 0-1 V pulse should only occur once with one main spindle revolution (start for G33/G78).

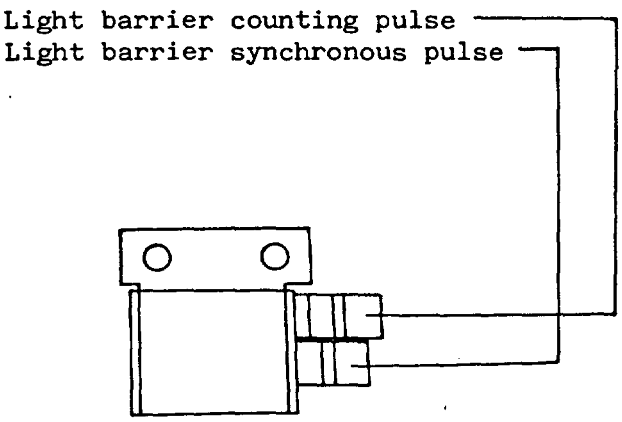
MP25 Synchronous pulse (from main spindle pc-board to computer pc-board)
(to X23/4)
This measuring point is only useful for testing the function of the main spindle pc-board.
(remove light barrier and cover individually)
Open 5 V, covered 0-1 V.

MP26 GND
No voltage may be measurable.

Note:

It is possible, with low impedance measuring devices (less than 10 kOhm), to measure voltages lower than 5 V, due to the internal voltage drop in the light barrier.

With digital tester, accordingly HI for 5 V and LO for 0 V.



Procedure: Light barrier

MP21 and MP26

+ 5 V not present,
GND with voltage

Look for breakage
(wiring, plug connections)

+ 5 V present, GND o.k.

MP23 and MP24

Pulse not present

Check wiring

Replace light barrier

Pulses present

MP22 and MP25

Replace main spindle pc-board

Pulses present

Check wiring to the computer
pc-board

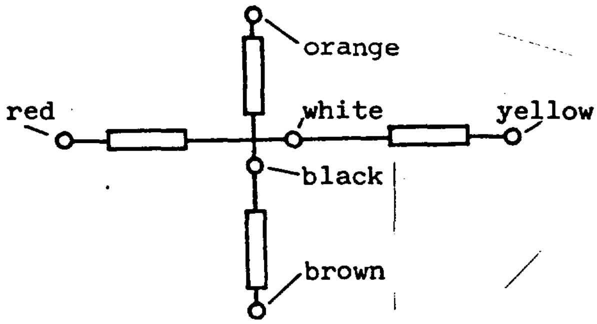
Replace computer pc-board

5.1.2. Step motor

- Step angle per step: 5°
  Supply voltage: 10 V dc

  With every step there is a pulse of about 200 µsec at 40 V. Where these 40 V pulses are lacking, high frequencies are not possible (no rapid traverse).

- The winding

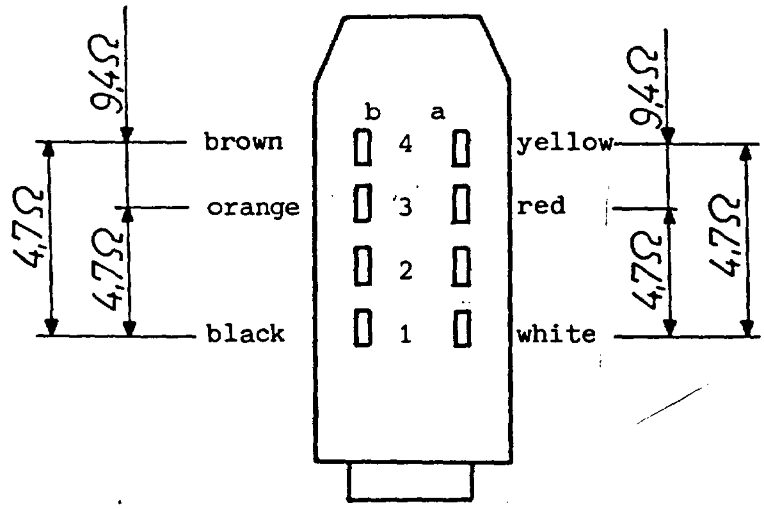


- Sources of defects:

  The motor can have the following electrical defects:

  - Interturn short-circuit (i.e. the resistive value is no longer correct)
  - Winding short-circuit (i.e. there is a measurable passage through the not related windings)
  - Earth short-circuit (i.e. there a measurable passage of one winding against earth, measurement with higher voltage, e.g. 100 V is recommended)
  - Winding breakage (i.e. no passage)

- Connections (resistance value)



A defective step motor can destroy the 10 V and the 40 V circuit (on the step motor pc-board). For this reason, always check the step motor first.

Section sequence table

Step	Brown	Red	Orange	Yellow
1	x	x		
2		x	x	
3			x	x
4	x			x

Procedure: Step motor

Disconnect motor
Check resistances of the motor

Deviating values
↓
Check wiring
↓
Replace motor

Values o.k.
↓
Check motor for winding short-circuit (passage b1 to a1)

Passage b1 - a1
↓
Check wiring
↓
Replace motor

No passage b1 - a1
↓
Check motor for earth short-circuit (passage b1 to earth, and a1 to earth)

Passage b1 - earth
a1 - earth
↓
Check wiring
↓
Replace motor

No passage b1 - earth
a1 - earth
↓
Motor o.k.

5.1.3. Main motor

- 2 different motors were used on the COMPACT 5 CNC.

  Previous make Kemo, present make Baumueller.
  The Baumueller motor is described. The values are similar to those of the Kemo motor. The F1-CNC is only fitted with the Baumueller motor.

- A defective main motor can destroy the main spindle pc-board. For this reason, always check the motor first.

- This motor is a permanent magnet motor. The permanent magnetic field is weakened by high currents (uncontrolled switching on). The consequence of this is excessive speed, (i.e. the capacity is lacking in the lower speed range). This effect occurs with destroyed thyristors or diodes, where no FF-fuse is used and with external supply of the motor, where this is fully switched on, immediately.

- Measuring the main motor

  - Idling measurement (where possible) with the fitted ammeter.
    0.3 - 1 A according to speed for 220 - 240 Volt
    0.6 - 2 A according to speed for 100 - 120 Volt

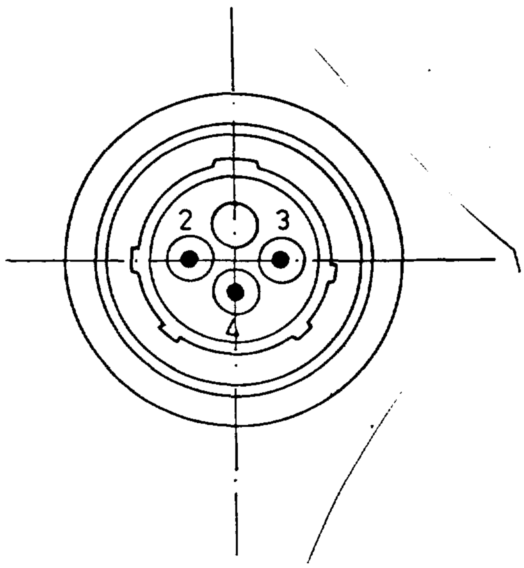
  - Resistance measurement:
    Ohmmeter between PIN 2 and 3 of the motor plug, about 2.5 Ohm (180 V) or 1 Ohm (95 V).
    Possibly about 0.75 Ohm higher due to brush contact resistance.

    Note:

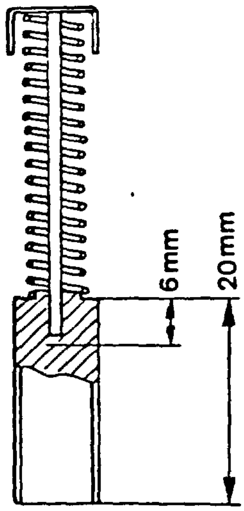
    Where you turn the motor during the measurement (improving brush contact) you should note that a voltage is induced.
    In the event of rapid turning the measuring device will be destroyed.

  - Earth short-circuit
    Ohmmeter between Pin 2 and earth
    Pin 3 and earth

    No passage should be measurable (measurement with a higher voltage, e.g. > 100 V, is recommended).



Control of the Carbon Brushes on Main Motor



Before checking the carbon brushes, draw out plug to cut of power supply.

Worn off carbon brushes damage the anchor lamellas and may destroy the main spindle circuit board by brush firing.

Control of carbon brushes:

After 100 hours of operation.

A new brush is approx 20 mm long.
When a length of only 6 mm is left, then it must be replaced.

An unregular wear of the 2 carbon brushes is a typical characteristic of a direct current permanent motor.

Swap unregular weared brushes if they are long enough.

Procedure: Main motor

Disconnect motor
Check idling (where the fitted main spindle pc-board is still functional)

Idling not o.k.

Check wiring

Replace motor

Idling o.k.
(or cannot be measured)

Resistance measurement

Resistance measurement wrong

Check wiring

Check carbon brushes

Replace motor

Resistance measurement correct

Earth short-circuit measurement

Check wiring

Replace motor

Motor in working order

5.1.4. Tool reverser motor (only COMPACT 5 CNC)

- This motor is a bell-anchor permanent magnet motor, with attached gearing.

- Measuring the tool reverser motor:

  a) Resistance measurement with the ohmmeter between X8/ Pin 1 and 2 of the tool reverser motor plug: about 11 Ohm

     Note: Since the brush passage resistance changes, repeat the measurement several times. Inbetween, turn the motor slightly.

  b) Current and voltage measurement:
     Unsolder X8/Pin 1 on plug and connect the ammeter inbetween. Clamp the voltmeter between X8/ Pin 1 and 2.

     Measured values:

     Forward run 13.5 V, 290 mA
     Return run 3.25 V, 100 mA
     Return run stop 3.25 V, 280 mA

     Please note that the polarity changes between forward and return run.

Procedure: Tool reverser motor

Measure motor

No current and no voltage measurable

Measure voltage on the tool reverser pc-board between X64/1 and 2

Voltage not present, defect in the wiring

Voltage not present
Defect on the tool reverser pc-board

Current and voltage measurable and o.k. Tool reverser does not turn

Remove motor and supply with 6 V external voltage

Motor turn
Tool reverser sticks
Look for mechanical cause

Motor does not turn

Motor defective

5.1.5. Chip door limit switch (only F1-CNC special version)

This limit switch is a safety limit switch, i.e. there is forced opening of the contacts.
It is connected as a closer.

Functional check:

Remove plug X8 and clamp an ohmmeter (or continuity tester) to Pin 3 and 4.
Where the chip door is closed, the ohmmeter must indicate a passage of about 0 Ohm. When the chip door is open, the passage is interrupted.

5.2 Internal components - sources of defects

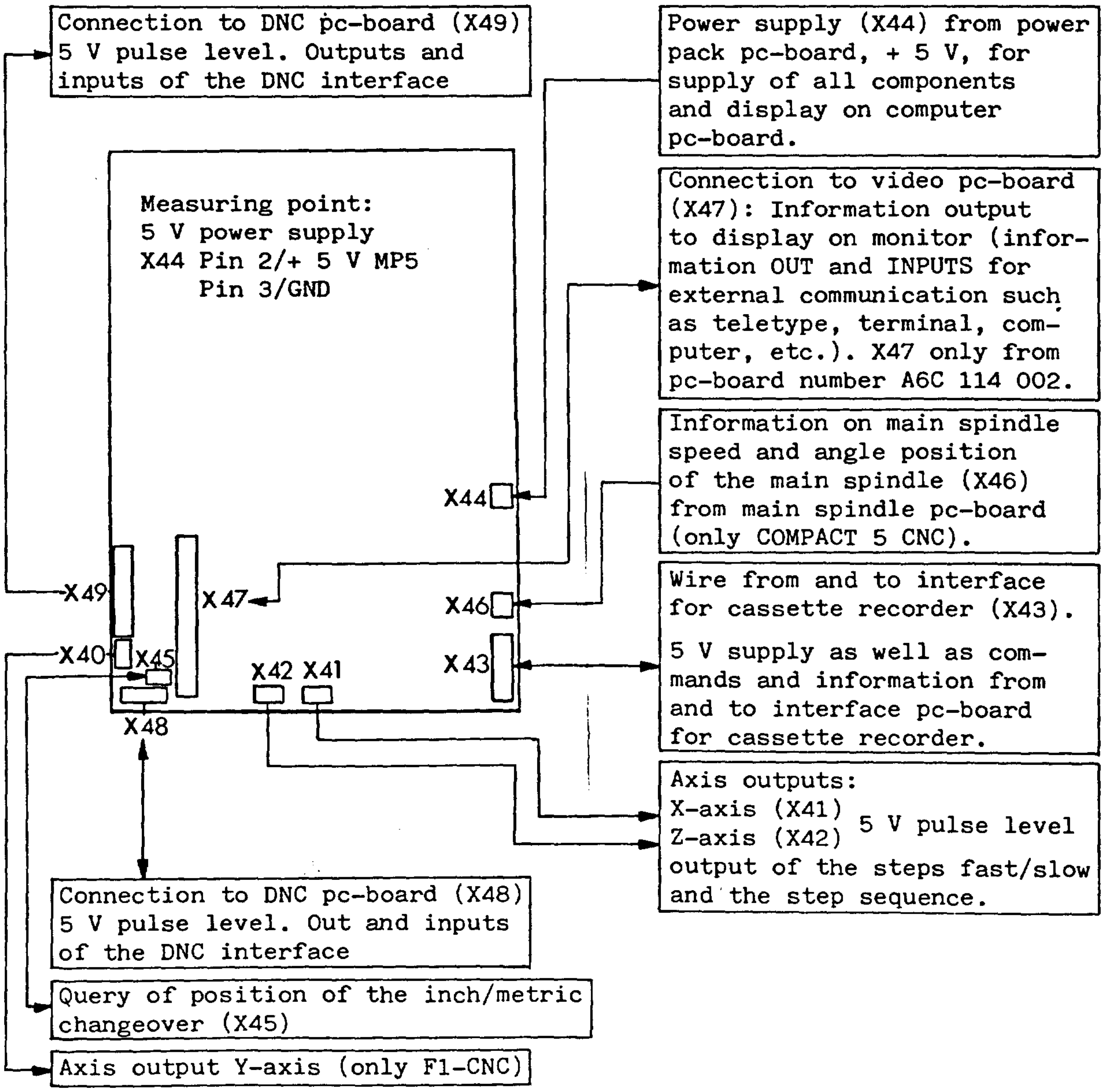
The following pages indicate the flow of data and the power supply paths.

The measuring instructions for the individual pc-boards, specified in the "fault,repair" chapter, are specially listed here as measuring points.

5.2.1. Computer pc-board (CPU)

Functions:

- Command information via keyboard
- Memory of the machine program (EPROM) and the workpiece program (RAM)
- Display via display
- Transformation of input and stored values (from path in steps)
- Computation work
- Synchronisation of angle position of the main spindle with step motor
- etc.

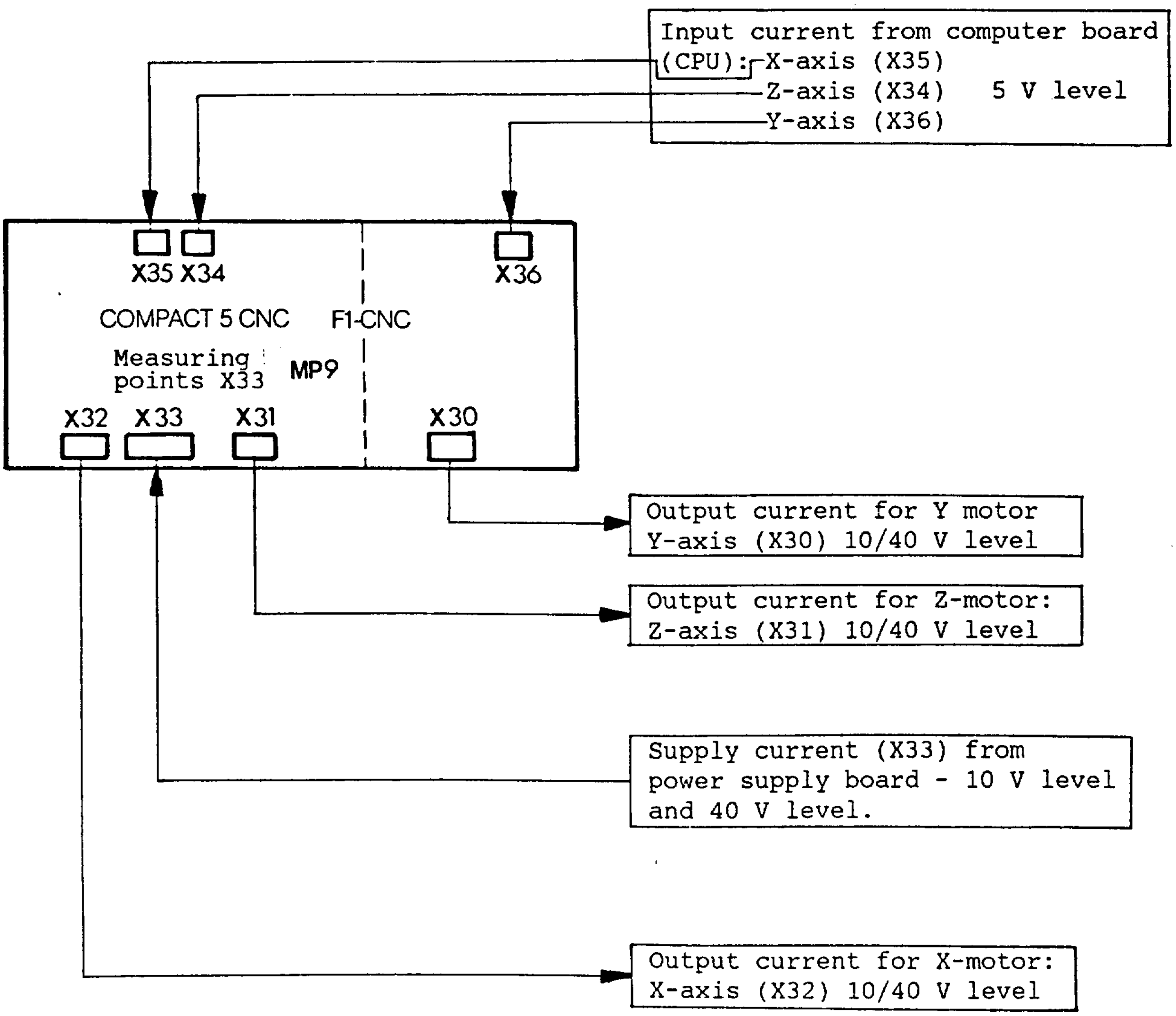


5.2.2. Step motor board

Functions:

- Transforming 5V current step informations from CPU into 10 V.

- Transmission of 10 V impulses and 40 V needle impulses to step motors.
  Explanation:
  10 V is normal voltage for the step motors. The 40 V needle impulses are necessary to overcome the inertia of the step motors when they run with high speed.

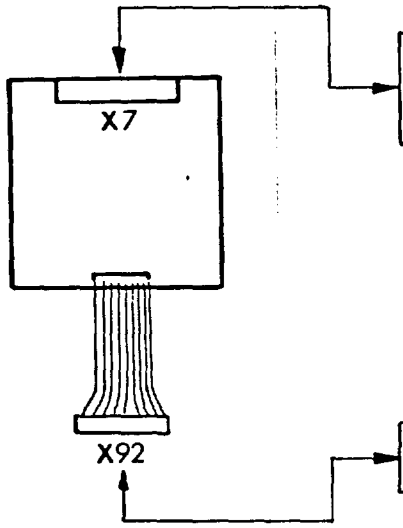


Measuring points:	Compact 5 CNC	X33/Pin 1 and 3 ....10V	
		X33/Pin 4 and 3 ....40V	⊕
	F1 CNC	X33/Pin 1 and 6 ....10V	
		X33/Pin 9 and 6 ....40V	

5.2.3. Interface board for cassette recorder ⊕

Function:

Transforming of digital information of CPU board of EMCO machine code to the code of the Philips cassette recorder.



Connection to computer board (CPU) and 16 V supply from power supply board (X7)

Measuring points: X7/Pin 4 and 6 .....16V MP15
X7/Pin 9 and 12..... 5V MP14

Measuring points: X92/Pin 1 and 3.....12V } MP36
X92/Pin 5 and 3..... 5V }

Connection to cassette recorder (X92)

Cassette recorder:

Function:

Transmit the digital information of CPU board to magnetic tape, resp. reading the information.

5.2.4. Main spindle board

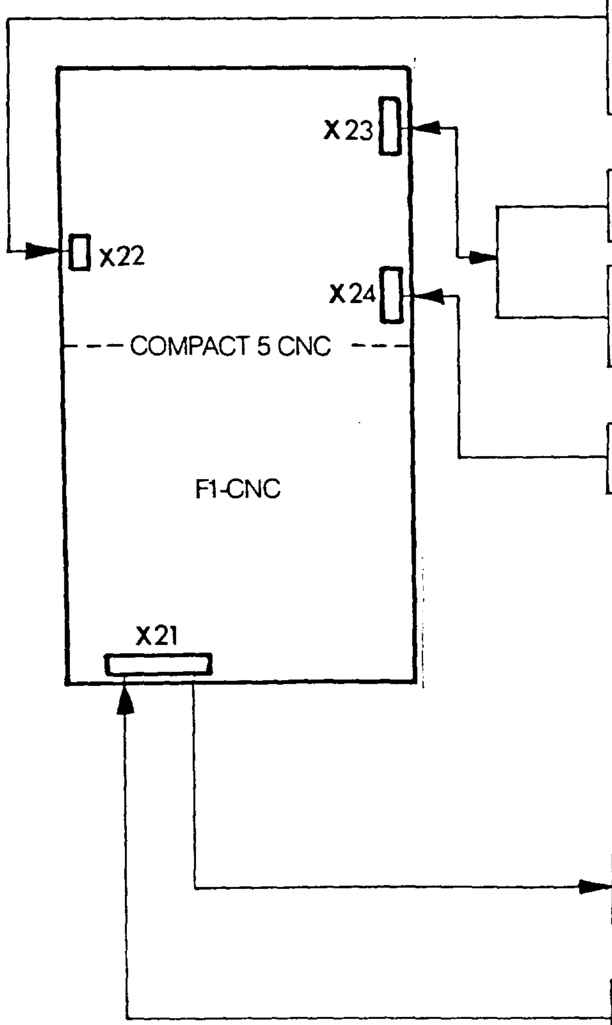
Functions:

A. Control of main motor speed

1. Speed adjustment with control knob
2. Control of adjusted speed under varying load
3. Speed-depending current limit

B. Interpretation of light barrier impulses (only Compact 5 CNC)

1. Transformation of counting impulses of the light barrier into digital numbers of spindle speeds on main spindle display (rev./min)
2. Improving and passing on the counting and synchronisation impulses to the computer board.
3. 5V supply for light barrier.



10V supply via motor switch to switch off the spindle speed display when main motor stands . 5V supply to transform counting impulses into digital read out (X22).

Impulses from light barrier (X23, Pin 2/3/5)

Passing on counting and synchronisation impulses to the computer board (X23, Pin 1/4).

Power supply light barrier (X24, Pin 5)

Measuring points:

X21, Pin 1 and 3	MP6	Power voltage
X21, Pin 8 and 10	MP6	Controlled motor voltage
X22, Pin 2 and 3	MP8	5V
X22, Pin 2 and 1	MP8	10V
X23 and X24		see chapter 5.1.1

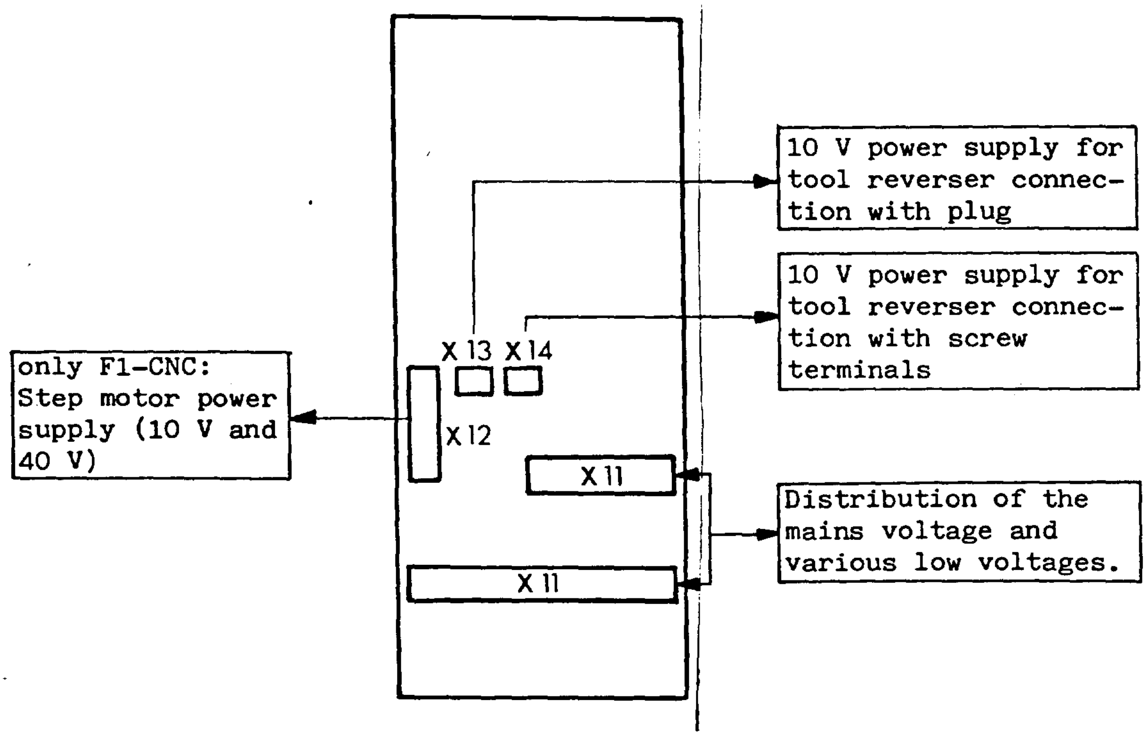
Controlled power current supply for main motor (X21, Pin 8/10)

Power current supply via motor switch (X21, Pin 1 and 3)

5.2.5 Power pack pc-board

Functions:

- Distribution of the mains voltage
- Generating the required low voltages (5/10/16/40 V)



Meauring points: Low voltages

X11, Pin 5 and 6	5 V	MP 12
X11, Pin 3 and 6	10 V	MP 10
X11, Pin 2 and 6	40 V	MP 41
X11, Pin 4 and 6	16 V	MP 13
X12, Pin 1 and 6	10 V	MP 11
X12, Pin 9 and 6	40 V	

Measuring points: Mains voltages

X11, Pin 19 and 18	Mains - Input	MP42
X11, Pin 16 and 17	Mains - Machine lamp	MP43
X11, Pin 16 and 1	Mains - Pilot circuit	MP44
X11, Pin 13 and 15	Mains - Socket	MP45
X11, Pin 9 and 10	Mains - Blower	MP4
X11, Pin 7 and 8	Mains - Main motor	MP7

Measuring points: Transformer alternating current ⊕

a) The secondary voltage is stated at the terminals on pc-boards with the No. F1A 111 000.

b) The following secondary voltages apply for the terminal numbers of pc-boards with the No. A6A 111 001:

Terminal 12 and 13	35 V
Terminal 16 and 18	10 V
Termianl 10 and 11	18 V
Terminal 14 and 15	8.5 V

Measuring points: Power supply tool reverser

X13, Pin 1 and 3	10 V	MP37
X14, Pin 1 and 3	10 V	MP38

5.2.6. Fuses

a) Main fuse /fuse on electrical housing ⊕

El. control unit F-W

Function: Main fuse

Size for 220/240 V: Glass tube fuse
dia. 5 x 20, 8 A slow

Size for 115V: Glass tube fuse
dia.1,4 x 1", 10 A slow

b) Fuses on power supply board
A6A 111 001 and A6C 111 001
-"- 2 -"- 2
F1A/C/V 111 000

Size of all fuses, except e7:
Glass tube fuse dia.5 x 20
Size e7: Neozed cartridge

Designation	Function	Amperes	
e1	5 V supply	4 A slow	
e2	Control current circuit 220 resp. 115 V	4 A slow	
e3	50 V supply	6,3 A slow	
e4	Transformer fuse for primary winding	4 A slow 2,5 A slow	by 100 - 115 V by 220 - 240 V
e6	16 V supply	1 A slow	
e7	10 V supply	16 A slow	

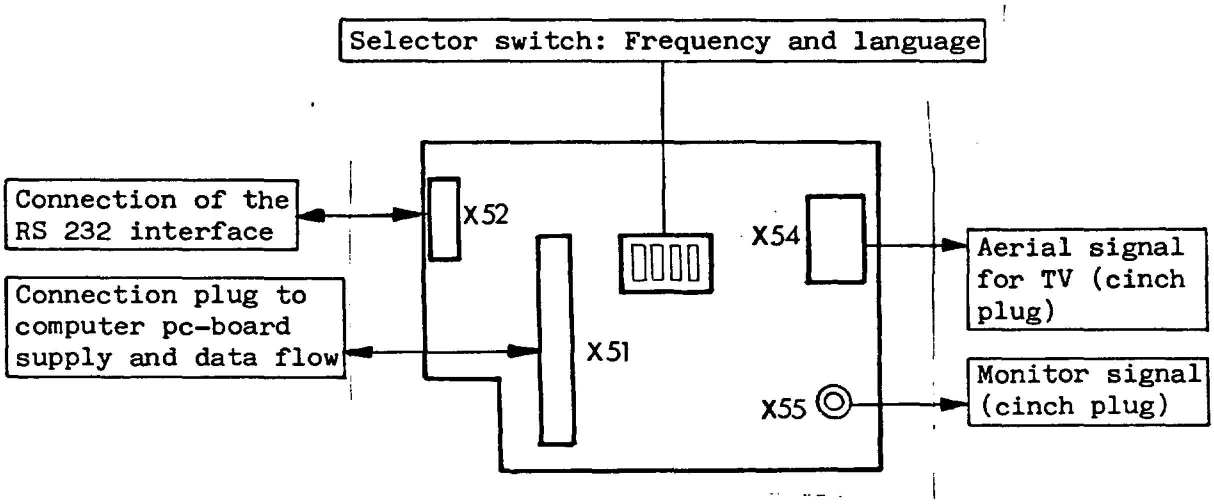
c) Fuses on main spindle board ⊕

e21	Motor current circuit	10 A, FF (super fast)
e22	Automatic control system	0,1 A slow

5.2.7. Video pc-board

Functions:

- Transformation of the memory content (RAM) into a usable form for the screen (monitor or TV).
- Issuance of the memory content (RAM) at the RS 232 interface.



The exact functions and DIN occupancies are comprehensively dealt with in the chapters Video and RS 232.

5.2.8. Tool reverser and DNC pc-board

A) Function with COMPACT 5 CNC:

- Triggering the tool reverser

- DNC interface

- Switching the main motor off and on with the so-called X-output is not wired in the works, although it is functional. The same applies for the input chip protection limit switch.

B) Functions with F1-CNC:

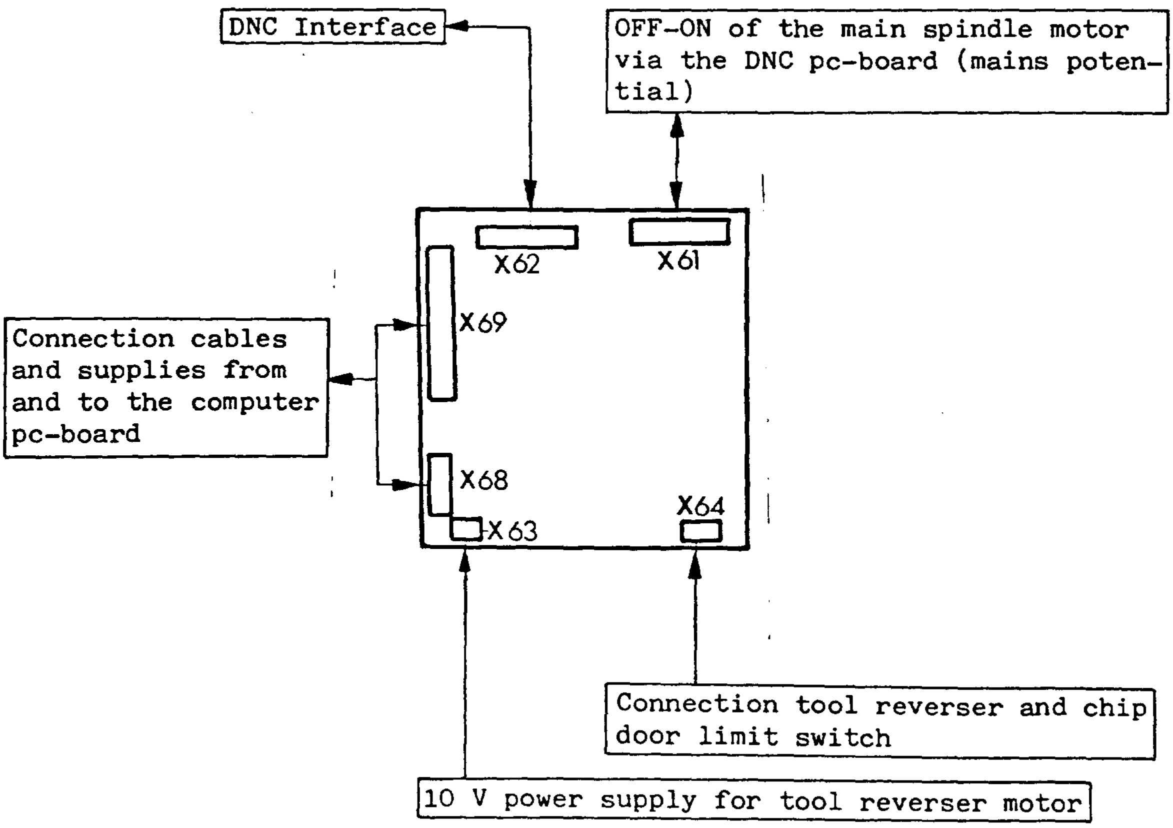
- DNC interface

- SWITCHING the main motor OFF and ON

- Tool reverser triggering is not used for the F1-CNC.

- Input chip door limit switch

More comprehensive information in the chapter DNC interface



Measuring points:

X61, Pin 2 and 9 ...... Switch function mains potential MP39

X62, Pin 25 and 26 .... 5 V } MP40

X62, Pin 22 and 26 .... 10 V } MP40

X63, Pin 1 and 3 ...... 10 V MP18

X64, Pin 1 and 2 ...... Voltage tool reverser motor
See details in chapter 5.1.4. } MP16

X64, Pin 5 and X63, Pin 3 (GND) .... 5 V } MP16

X68, Pin 1 and 2 .... 5 V MP17

5.2.9. Measuring points of the electrical control

Notes:

a) The safest source of supply voltages is obtainable from X11 of the power pack pc-board (start from there when trouble-shooting).

b) Please note, that the 5 V supply voltage runs over several pc-boards. That means, e.g. when you unplug X44, the computer pc-board, video pc-board, interface pc-board and tool reverser pc-board are without 5 V supply.

c) Attention: When measuring mains potentials, carelessness can drag voltage to the low voltage side. This could then destroy all the pc-boards.

d) Most measuring points are precisely described in the previous chapters. To find wiring defects, the following measuring points may be useful:

e) Please note that the measured voltage can be higher where there is a lack of load (motors without current, etc.).
Instead of 10 V - 13 V / 16 V - 24 V / 40 V - 44 V

Measuring points	Potential
a) Main switch a1, Pin 1 and 3 a1, Pin 2 and 4	Mains input MP1 Mains output MP2
b) Main fuse e8	Passage mains
c) Input terminal X1, Pin 1 and 2	Mains to machine MP19
d) Lighting connection h1	Mains MP3
e) Emergency Off pushbutton b1	Passage mains MP20
f) Socket X2 and X3	Mains MP27
g) Input terminal X1, Pin 5 and 6	Mains to machine lamp MP19
h) Blower connection m2 X11 Pin 9 and 10	Mains MP4
i) Main motor switch b2, Pin 5 and 3 b2, Pin 4 and 6 (F1-CNC) b2, Pin 1 and 3 b2, Pin 2 and 4	Mains input direct Mains output direct Mains input CNC MP28 Mains output CNC
Main motor switch b2, left side (COMPACT 5 CNC) b2, right side	Mains passage 10 V passage MP29
Main motor switch b2, Pin 1 and 7 (COMPACT 5 CNC France version) b2, Pin 2 and 8 b2, Pin 5 and 6	Mains input Mains output MP30 10 V passage
j) Ammeter g1	Mains passage MP31
k) Choke m3 (COMPACT 5 CNC) m4 (F1-CNC)	Mains passage Mains passage MP32
l) Choke c1, Pin 1 and 3 c1, Pin 2 and 4	Mains input Mains output MP33

Measuring points	Potential
m) Changeover switch metric/inch (COMPACT 5 CNC): b3, Pin A to Pin 1 b3, Pin A to Pin 2	 Passage with inch Passage with metric MP34
n) Changeover metric/inch/vertical/-horizontal (F1-CNC)	
b3, Pin B to Pin 1 Pin D to Pin 7	Horizontal, inch
Pin B to Pin 2 Pin D to Pin 8	Horizontal, metric MP35
Pin B to Pin 3 Pin D to Pin 9	Vertical, inch
Pin B to Pin 4 Pin D to Pin 10	Vertical, metric

Wiring b3 to X45:

D =	X45/1
B =	X45/5
1, 2 =	X45/4
7, 9 =	X45/3
8, 10 =	X45/2

Chapter 6

Notes on frequent fault sources

6.1. The most frequent source of fault is that of the chip problem. The symptoms extend from software breakdown to short-circuits between the voltages.

The chips are distributed between the IC feet, in the cassette deck (front and back) as well as throughout the control box.

The remedy is: Remove all pc-boards (including the cassette deck) and clean with compressed air (visual inspection). Suction away all chips which remain in the electrical control box.

6.2. Faults in connection with the computer pc-board. Symptom: Software problems, display dark, etc.

- The keys bounce or are oxidized (exchange the computer pc-board).

- The supply plug X44 has a loose contact or a transition resistance (less than 4.9 V at the CPU) due to oxidation (replace plug, clean contacts).

- The plug strips on the computer pc-board are the wrong way round compared with the new board on machines with serial numbers below 300 (COMPACT 5 CNC). Accordingly, insertion must be the other way round, where a new computer pc-board is fitted.

- Where software problems arise at lower temperatures, an additionally soldered ceramic capacitor can be of assistance (see the diagram on page 6.5).

6.3. Faults in connection with the power pack pc-board. Symptoms: Problems with the software supply, software breakdown.

- Lack of the 10 V, fuse e7 (16 A) is loose. Remedy: Tighten.

- On machines below No. 2720 (COMPACT 5 CNC), due to induced peak currents when the main motor is switched off and on, defects can occur on the main motor pc-board (see Service Information, page 6.4).

- On COMPACT 5 CNC machines below No. 300, fuse e2 burns through when a new power pack pc-board is fitted. This is normal. Please remove the fuse.

- Loose contact and oxidation on plug X11.
  Remedy: Bend contact springs and clean contact.

- Where fuse e6 (16 A) is burnt through, the 5 V in the control will also be missing.

6.4. Faults in connection with the step motor pc-board.

- On machines COMPACT 5 CNC under No. 300, plug X33 burns out (also carbonization or deformation). When replacing the plug or exchanging the step motor pc-board, change the plug to 5 pole.

- Frequently, problems with the step motors are due to mechanical faults.
  Symptom: Loss of steps.
  The feed spindles move with difficulty.
  Check: You must be able (with some force), to move the slide (only with motors G64 switched off) by hand.

6.5. Problems with the cassette deck.

- Chips (see item 6.1.)

- On machines COMPACT 5 CNC below No. 300: Weak power supply, trial by G64 input and new attempt.
  Remedy: Exchange the power pack pc-board.

6.6. Problems with the main spindle pc-board.

- Power diodes burnt through.
  Symptom: Short-circuit

- Power thyristors burnt through.
  Symptom: Main spindle motor cannot be controlled, runs at highest speed.

6.7. Problems with extensions.

- Plug connections made offset by one pin.

- Plug connections made the wrong way round.

- 10 V connection of tool reverser pc-board the wrong way round. In this case, the Zener diode burns through at the 10 V input of the tool reverser pc-board.
  Remedy: Correct the connection and remove the Zener diode.

- When installing the tool reverser pc-board, ensure that the heat sink of the interface pc-board does not touch the tool reverser pc-board.

- Where the tool reverser motor fails to operate properly, remove the motor, place grease in the free bore of the tool reverser and reattach the motor.
  Important: Tighten lightly and uniformly.

COMPACT 5 CNC, 22o/24o Volt, F,G,S Ausführung

Eine Untersuchung hat ergeben, daß beim Aus- und Einschalten des Hauptmotors induzierte Spitzenströme auftreten können, die zu einem Defekt auf der Hauptmotorplatine führen können.

Maßnahme:

Einlöten des Kondensators o,1 µF, 63o V, parallel zum Primäranschluß des Trafos auf der Netzteilplatine. Der Kondensator nimmt die gefährlichen Spitzenströme auf.

Maschinen mit Steuerungsseriennummer O - 299 (Netzteilplatine A6A/B 111 ooo)

Kein Einlöten des Kondensators erforderlich.

Maschinen mit Steuerungsseriennummer 300-1499 (Netzteilplatine A6A 111 oo1)

Kondensator zwischen Pin 1 und Pin 5 oder Pin 1 und Pin 8 einlöten.

Maschinen mit Steuerungsseriennummer 1500-2720:

Kondensator zwischen Pin 1 und Pin 4 einlöten

Compact 5 CNC/22o/24o Volt Versions F, G, S

When switching on and off the main motor inductive peak currents could disturb a diode on the main spindle board.

Measures:

Solder the condenser O,1 µF 63o V parallel to the primary winding of the transformer. This condenser takes the peak current.

Machines with control unit serial no. oo-299:

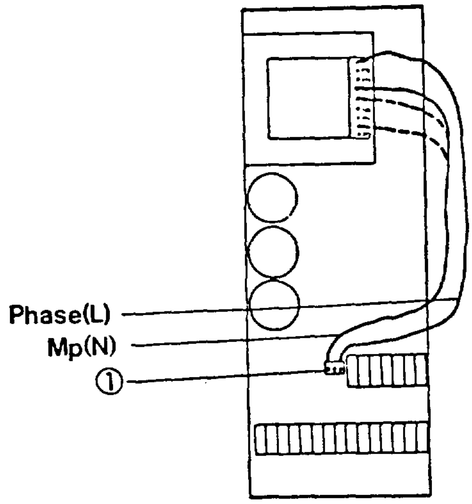
No condenser must be soldered

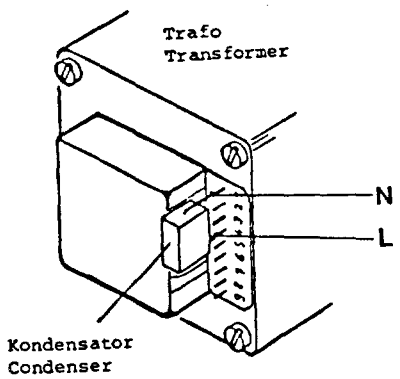
Machines with control unit serial no. 3oo-1499

Solder condenser between pin 1 and 5 or pin 1 and 8.

Machines with control unit serial no.15oo-272o

Solder condenser between pin 1 and 4.





Weiterer Hinweis

Die 2 Kabel (Phase L und Mittelpunktsleiter N) führen von der Klemmbuchse (1) auf die Pins zur Primärseite des Trafos. Zwischen diese Pins muß der Kondensator eingelötet werden.

- Steuerungsseriennummer 3oo-1499 zwischen 1 und 5 oder 1 und 8 (siehe Kabel von Klemmbuchse)
- Steuerungsseriennummer 1500-2720 zwischen 1 und 4.

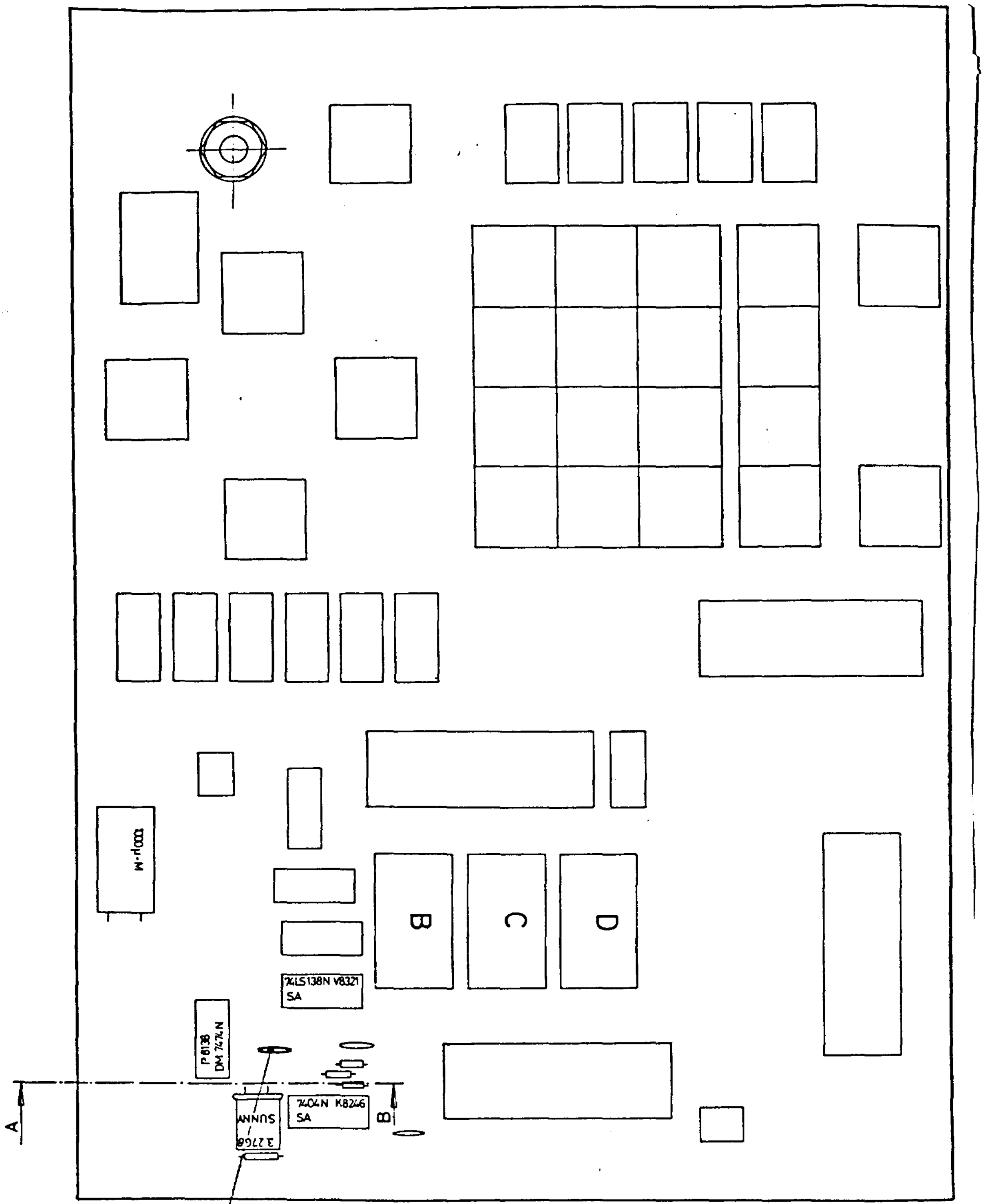
Additional tip

The two wires (Phase L and neutral wire N) go from the clamping socked(1) to the pins of the primary circuit of the transformer.

The condenser has to be soldered between phase L and the neutral wire N.

This is with
- control serial no. 3oo-1444 pin 1 and 5 or 8.
- control serial no. 15oo-272o between pin 1 and pin 4.

Computer board A6. 114 003 and F1. 114 000



Ceramic capacitor 470 pF

Service remarks:

Symptom:

At lower temperatures (below about 5°C), the following occurs: The machine software breaks down. This can cause the most diverse faults (hanging of the computer, changeover manual/CNC no longer possible, etc.).

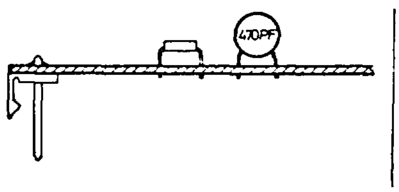
Cause:

One capacitor is fitted in a series of pc-boards A6. 114 003 and F1. 114 000, which have excessive capacity loss at lower temperatures.

Remedy:

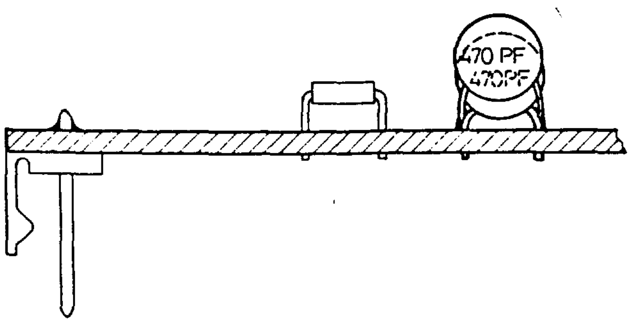
Solder a second capacitor of the same type parallel to the 470 pF ceramic capacitor.

Section AB



Repair note

The ceramic capacitor 470 pF must be connected in parallel to the already existing ceramic capacitor 470 pF.



Chapter 7

Expansion, accesories, extension

For Compact 5 CNC and F1 CNC more expansions and accesories are available. Look chapter 8. There you find notices if the generation of your machine is suitable for expansion resp. how you can get your machine on the latest state of engineering.

In following the instructions for:

7.1 extension video
7.2 extension RS232 and connecting cable
7.3 extension turret toolholder Compact 5 CNC
7.4 extension DNC Interface Compact 5 CNC
7.5 extension DNC Interface F1 CNC
7.6 extension heating device
7.7 extension door-limit-switch F1 CNC

7.1 Extension video

In following the installation instruction. Pay attention on frequency setting.

EMCO machines deliver a fixed signal, therefore you should check the following if you have a bad picture.

1. Set exactly the receive frequency on your TV resp. check the controlers of the picture (contrast, brightness etc.)

   Does your TV work well on local TV station?

2. Check if the right input socket is chosen on Monitor (video-in-signal)
   Check contrast and brightness.
   Adjust horizontal deflect and vertical deflect,by moving picture.

3. In most cases bad connection cables resp. bad contacts with the connection plugs are responsible for a flickering picture.
   (Clean plugs with an anti oxident medium, intensify spring tension of contacts.)

Video Connection
TV-Connection
Interface RF 232

1. Mounting possibilities of Videoprint

1.1. COMPACT 5 CNC with electrical serial numbers A6A/B/C 1o5.ooo / ooo - o49:

No connection possibility!

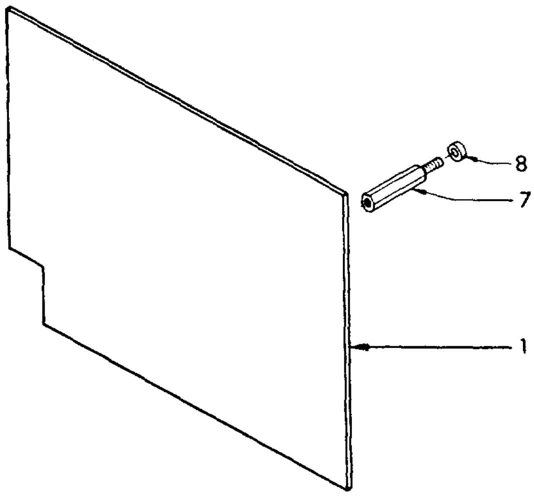
1.2. COMPACT 5 CNC with electrical serial number A6A/B/C/F/G/H/N 1o5.ooo / o5o - 618:

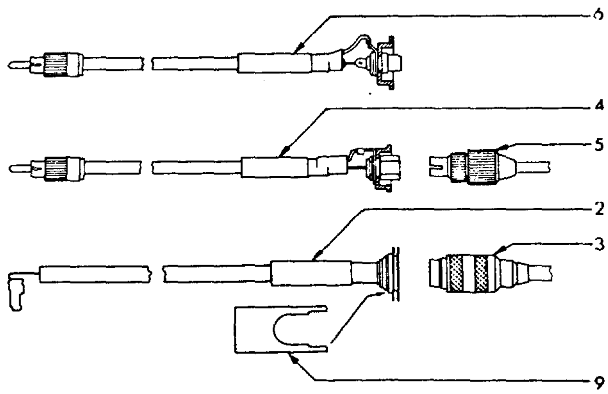
Means: Computer board A6C 114 oo2 + Videoprint (Ref.No. 26o 2oo)

1.3. COMPACT 5 CNC with electrical serial number A6A/F/G/H/N 1o5.ooo / 619 upwards:

Means: Videoprint Ref.Nr. 26o 2oo (The computer board A6C 114 oo2 is mounted)

2. Equipment of Videoprint (Ref.No. 26o 2oo)





1 Videoboard (A6A 115 ooo)

2 Cable RS 232 (A6Z 2o1 ooo)

3 Coupling plug RS 232 (ZEL o3 oo12)

4 TV-cable (A6Z 2o2 ooo)

5 TV-coupling plug (ZES 15 1oo6)

6 Video cable (A6Z 2o3 ooo)

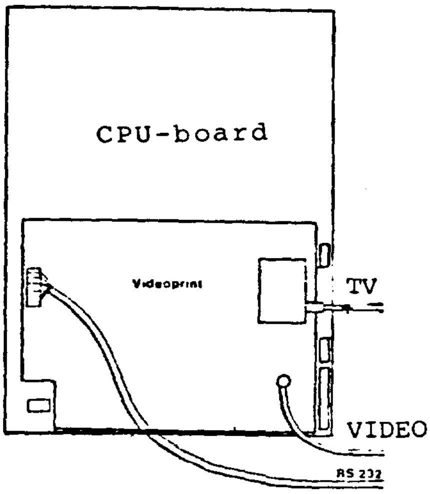
7 Spacing bolt (ZBO oo 6256)

8 Washer (ZSB 51 o315)

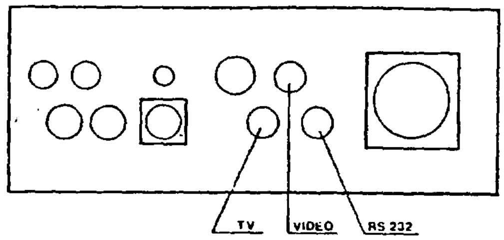
9 Key for tightening cable couplings (A6Z 2oo o1o)

4.3. Mounting the cables:

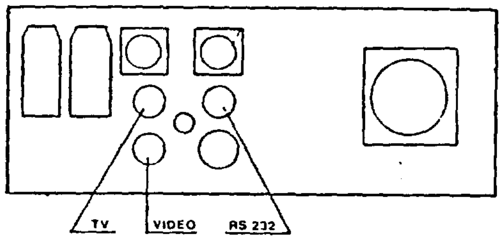
Insert the cables through the bores. Fix the cables with the counter nuts and plug them to the video print.



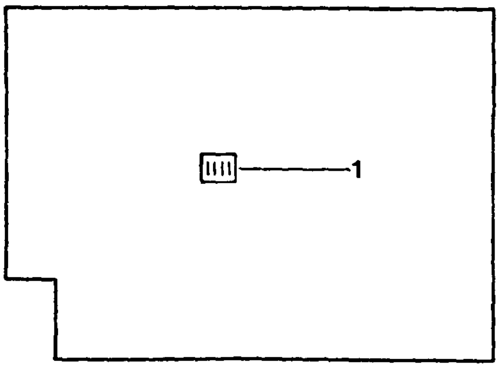
Electrical control unit A6A/B/C



Electrical control unit A6F/G/H/N



5. Setting language and frequency on the video board

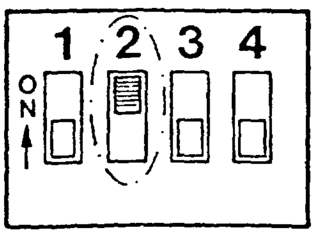


Language and frequency are set with the code switch (1).

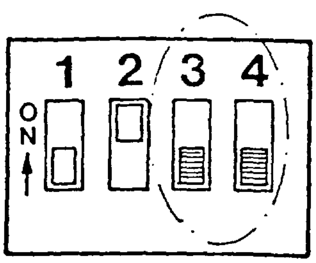
5.1. Frequency setting:
50 Hz: switch 2 "ON"
60 Hz: switch 2 "OFF"
Illustration shows position for 50 Hz

5.2. Languages are set with switch 3 and 4.

5.1



5.2



Combinations

Language	Switch 3	Switch 4
German	OFF	OFF
English	OFF	ON
French	ON	OFF
Spanish	ON	ON

Illustration shows switch positions for German.

Note:

The first switch is without function. The change of language appears when the machine is switched off and on.

Examples RS 232

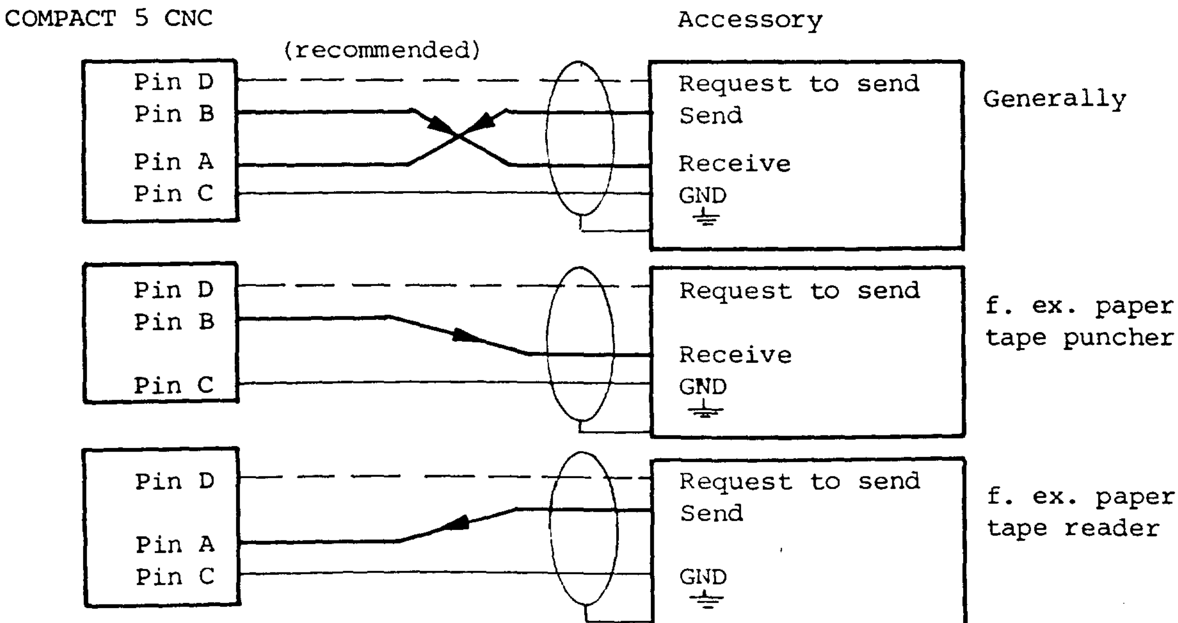
a) 2o mA Interface:

Connection to Teletype ASR 33
(Duplex operation, 11obd.)

COMPACT 5 CNC			TTY
Pin	J	Receive +	TB 7
	H	Receive -	TB 6
	G	Transmit +	TB 4
	F	Transmit -	TB 3
	E, C jumpered	GND	GND Shield connected to ground

b) V24 Interface:

Connection to printer, paper tape recorder/paper tape puncher etc.



Note: Parity bit is not used.

Note: If pins H and J are not used they must be jumpered.

Activating RS 232:

RS 232 is activated via G66. G66 does not enter the memory, it is a switching function.

Examples:

● Transmission from paper tape to memory of COMPACT 5 CNC
(With "Request to send" signal)

- Switch to CNC-mode (memory must be empty),
- Insert paper tape
- Start paper tape reader

1. Program G66

2. Press [INP]
On the display appears

o o o o o o
[A]

(A is the abbreviation for ASCII = American Standard Code for Information Interchange)

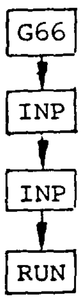
3. Press [INP]
The display shows

o o o o o o
[A L O]

(LO = LOAD)
The program is transferred. At the end of the transfer the display shows [N OO]

● Transmission from paper tape to COMPACT 5 CNC
(without "Request to send" signal)

- Insert paper tape
- Switch to CNC-mode



1. Program G66

2. Press [INP] The display shows

o o o o o o
[A]

3. Press [INP] The display shows

o o o o o o
[A L O]

4. Start paper tape reader (transmission begins)

7.2 Removal RS 232 Interface

The installation instructions are the same as in 7.1. Video Removal, since the RS 232 is located on the same pc-board.

With the RS 232 interface, you can transfer the workpiece program, which is located on the COMPACT 5 CNC or F1-CNC, to a peripheral device (printer, paper tape reader, computer), or vice versa. Information on data transmission is given in the following instructions for the accessory RS 232 connection cable.

Please also note the differing record structure of the COMPACT 5 CNC and F1-CNC.

The % sign is for the start of the data transmission.
The Mod. " sign is for the end of the data transmission.

Several Ø signs should be set before and after the transmission.

RS 232 C Connection Cable for COMPACT 5 CNC and F1-CNC

The V24 Interface is used with this cable. The machine (COMPACT 5 CNC/F1-CNC) is thus set at 300 baud.

Pin occupancy of the cable (standard) for V24 Interface

Pin B	———	Transmit	———► Pin 3	3
A	◄———	Receive	——— 2	2
D	———	Request to send	——— 5	
C	———	GND	——— 7	5
H ┐ J ┘		Bow contact		9 Pin

COMPACT 5 CNC F1-CNC		25-pin RS 232 plug for peripheral device

The only "handshake line" of the COMPACT 5 CNC and F1-CNC is intended for the "request to send" (RTS) signal. The RTS core is connected to pin 5 of the 25-pin plug.
The Interface of the COMPACT 5 CNC/F1-CNC does, however, function without the request to send signal.
(A handshake line is a control line for the data flow. It releases or stops a transmission)

Notes in the event of problems with Interface RS 232 C

Since the COMPACT 5 CNC and the F1-CNC do not depend on a handshake line, you can presume that the transmission and reception mode will be carried out (simple design of the Interface on COMPACT 5 CNC and F1-CNC).

Trouble-shooting in the event of problems

1. Check whether the peripheral device actually has a RS 232 Interface. That is a BIT serial Interface and not a BYTE serial, such as Centronics or IEEE 488.

2. Check whether the V24 or 20 mA Interface on the peripheral device is active.

Pin occupancy COMPACT 5 CNC/F1-CNC

Pin occupancy RS 232 Interface:

V24 Interface		
Plug Pin	B	Transmit
	A	Receive
	C	GND
	D	Request to send

20 mA Interface		
Plug Pin	F	- 20 mA
	G	+ Transmit
	H	- Receive
	J	+ 20 mA

Plug Pin E	Baud rate	open	300 bd.
		to GND	110 bd.

If you use the 20 mA connection, open bow contact H/J and note the baud setting.

3. 110 or 300 baud rate: Check setting on peripheral device and COMPACT 5 CNC or F1-CNC.

   With the EMCO cable, the COMPACT 5 CNC/F1-CNC is set at 300 baud (Pin E not with Pin C - GND - with bow contact).

4. The Interface of data receiver (e.g. printer, PC ...) must be equipped with a buffer memory (due to the lack of handshake signals of the COMPACT 5 CNC/F1-CNC).

5. Check the pin occupancy TRANSMIT and RECEIVE.

   Transmit: From COMPACT 5 CNC/F1-CNC to peripheral device (the peripheral device is the receiver).

   Receive: From the peripheral device to COMPACT 5 CNC/F1-CNC (the peripheral device is the transmitter).

Pin occupancy of the cable:

Pin B ——— Transmit ———→ Pin 3
A ←—— Receive ——— 2
D ——— Request to send ——— 5
C ——— GND ——— 7
H
J] Bow contact

COMPACT 5 CNC F1-CNC	Peripheral device

6. Check whether your peripheral device is operating without the cabling of the handshake line, or if the handshake lines must be functionally disconnected (bow contact, DIL-switch, etc.)

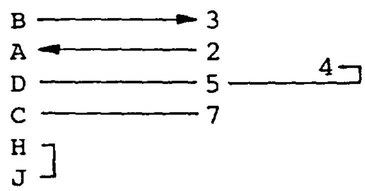
7. Transmission from COMPACT 5 CNC/F1-CNC to the peripheral device: the COMPACT 5 CNC/F1-CNC transmits 7 bit ASCII code. The eighth bit is intended as parity bit, which is not, however, transmitted.
   In the event of reception, a parity bit can be transmitted, although it is not required and is disregarded by the COMPACT 5 CNC/F1-CNC.

   At 110 baud, one start bit and two stop bits are transmitted.
   At 300 baud, one start bit and one stop bit are transmitted.

Peripheral device remarks, control lines

The control line connections differ according to the device. Please note the instructions.

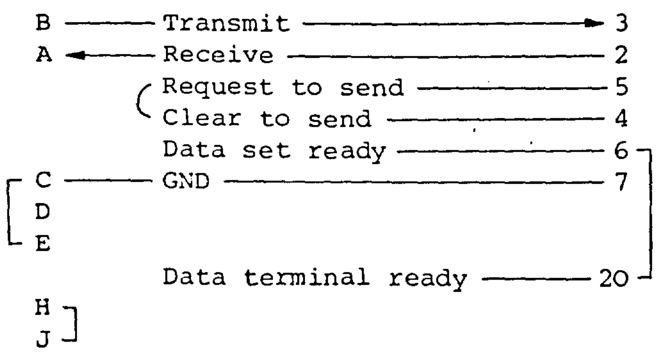
- Where the peripheral device requires control lines for operation, the clear to send (Pin 4) can be connected with the request to send (Pin D) of the COMPACT 5 CNC/F1-CNC.
  The second possibility would be, to bow connect Pin 4 and Pin 5.



- There are also devices which require the additional signal "Data Terminal Ready". This signal can be generated by bow connection of Pin 6 and 20.

<u>Example of a connection:</u>

4/5 bow connected
6/20 bow connected
C/E bow connected (setting at 110 baud).



Data formats COMPACT 5 CNC/F1-CNC

You can also obtain the data format by printout of a punched tape.

Data format COMPACT 5 CNC for RS 232 Interface

```
123456789012345678901234567890 31 32
% CR LF
↑↑↑N00↑G00↑X-↑↑↑2↑Z-↑↑↑12↑F↑↑↑ CR LF
↑↑↑N01↑G01↑X↑5999↑Z↑39999↑F499 CR LF
↑↑↑N02↑G02↑X-↑500↑Z↑↑↑↑↑↑↑F↑↑2 CR LF
↑↑↑N03↑G03↑X↑2000↑Z↑↑↑↑↑↑↑F120 CR LF
↑↑↑N04↑G90↑X↑↑↑↑↑↑Z↑↑↑↑↑↑↑F↑↑↑ CR LF
↑↑↑N05↑G92↑X-↑100↑Z↑↑↑200↑F↑↑↑ CR LF
↑↑↑N06↑G01↑X↑3998↑Z↑39999↑F↑80 CR LF
↑↑↑N07↑G33↑X↑↑↑↑↑↑Z-↑1000↑F150 CR LF
↑↑↑N08↑G78↑X↑↑↑20↑Z↑↑4000↑F200 CR LF
↑↑↑N09↑G84↑X-↑↑↑2↑Z↑↑↑↑↑4↑F↑↑4 CR LF
↑↑↑N10↑G91↑X↑↑↑↑↑↑Z↑↑↑↑↑↑↑F↑↑↑ CR LF
↑↑↑N11↑G20↑X↑↑↑↑↑↑Z↑↑↑↑↑↑↑F↑↑↑ CR LF
↑↑↑N12↑G22↑X↑↑↑↑↑↑Z↑↑↑↑↑↑↑F↑↑↑ CR LF
↑↑↑M
```

CR	... Carriage return	ASCII=13
LF	... Line feed	ASCII=10
↑	... Space	ASCII=32
M	... Metric program	ASCII=77
"	... Inch program	ASCII=34
-	... Minus sign	

When programs are received, the data format must be fully retained, otherwise the programs will not be correctly stored.

Data formats F1-CNC for RS 232 interface

```
1234567890123456789012345678901 31 32
% CR LF
↑↑↑↑N—↑G—↑↑X↑↑—↑↑Y↑—↑↑↑Z↑—↑F↑↑ CR LF
↑↑↑↑00↑21↑'↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑01↑S1↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑02↑00-19999-9999↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑03↑00↑↑↑00-1234-19999↑↑↑↑ CR LF
↑↑↑↑04↑00-↑↑↑01↑↑↑00-↑↑↑01↑↑↑↑ CR LF
↑↑↑↑05↑01-↑↑↑12↑↑↑12↑↑↑↑↑↑↑499 CR LF
↑↑↑↑06↑01-12345↑↑↑00-12345↑↑02 CR LF
↑↑↑↑07↑02↑↑9999↑9999↑↑↑↑↑↑↑100 CR LF
↑↑↑↑08M95J↑↑↑01K↑↑89↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑09↑03↑↑↑↑00-↑100↑↑↑100↑100 CR LF
↑↑↑↑10↑04↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑11↑21↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑12↑25↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑L221 CR LF
↑↑↑↑13↑27↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑L↑06 CR LF
↑↑↑↑14↑40↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑15↑45↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑16↑46↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑17↑47↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑18↑48↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑19↑72-↑1234↑↑↑12↑↑↑456↑↑45 CR LF
↑↑↑↑20↑81↑↑↑↑↑↑↑↑↑↑↑-12345↑120 CR LF
↑↑↑↑21↑62↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑01↑↑09 CR LF
↑↑↑↑22↑83↑↑↑↑↑↑↑↑↑↑↑↑↑↑125↑↑09 CR LF
↑↑↑↑23↑89↑↑↑↑↑↑↑↑↑↑↑↑↑1234↑232 CR LF
↑↑↑↑24M00↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑25M05↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑26M06D↑99999999-19999T499 CR LF
↑↑↑↑27M17↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑28M30↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑29↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑ CR LF
↑↑↑↑30↑S2↑↑1000↑↑100-↑↑100↑↑↑↑ CR LF
↑↑↑MI
```

↑	Space	
—	Apostroph	
CR	Carriage Return	
LF	Line Feed	
-	(Minuszeichen) Waagrechtfräsmaschinenprogrammierung	Minus sign / Horizontal programming
I	Senkrechtfräsmaschinenprogrammierung	Vertical programming
"	Zoll-Programmierung	Inch programming
M	Metrisch-Programmierung	Metric programming

7.3 Removal tool reverser (only COMPACT 5 CNC)

The installation instructions for this accessory are given below.

Please note the following:

- Do not exchange the + and - 10 V connection.

- Do not connect offset the connection plugs (6/12/16 pole).

The DNC interface is also located on the tool reverser pc-board of the COMPACT 5 CNC. See also chapter 7.4.

Automatic Turret Toolholder
COMPACT 5 CNC

Necessary Equipment

1. CPU board A6C 114 003 (for machines with with electrical control serial no. below 25oo)
2. Automatic turret tollholder ref. no. 26o o4o
3. Chip guard A6A 14o oo1 (for electr. contr. unit no. below 25oo)

Mounting work

- Mount CPU board
- Make slot for cable in chip pan
- Mount turret circuit board
- Connect 1o Volt power supply
- Mount plug connection
- Mount automatic turret toolholder

Attention:

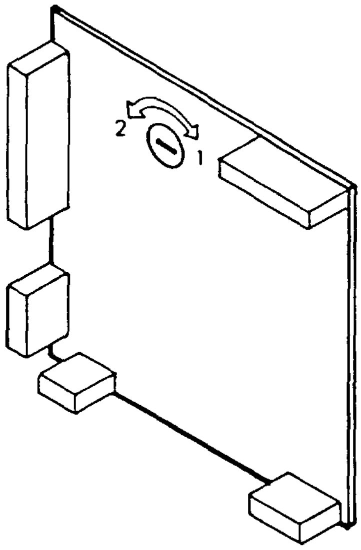
+ Before mounting displug main plug! Not only danger of accidents but also possibility of disturbing electronical parts on the boards.
+ Never plug or switch on machine before all plugs on the board are fitted and the boards are mounted firmly.

Loose cables and boards could cause short circuits if they get a contact with other boards or the electrical housing.

Basic equipment of automatic turret toolholder comprises

1. Automatic turret toolpost
2. Turret circuit board
3. Cable 16 poles for CPU board
4. Cable 6 pole
5. Cable for power supply 1oV
6. Plug cable
7. Distance pins
8. Washers for adjustment of tools
9. Cable clips and cable binders
10. Special key and hexagon keys.

Potentiometer on turret circuit board



Potentiometer on turret circuit board

Check that the actual number of swivels is identical with the programm number (in hand-operation).
Caused by the different frictions of the toolholder it might be possible that too much or too less swivels are executed.

Measures:

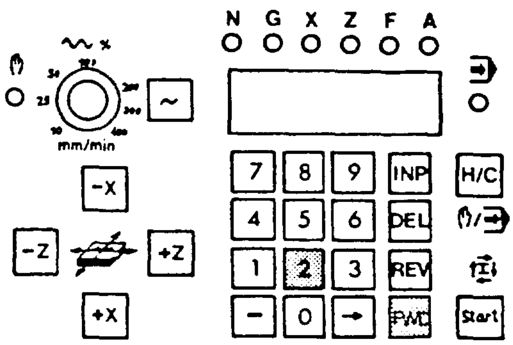
1. Too much swivels:

Turn the potentiometer clockwise.

2. Too less swivels:

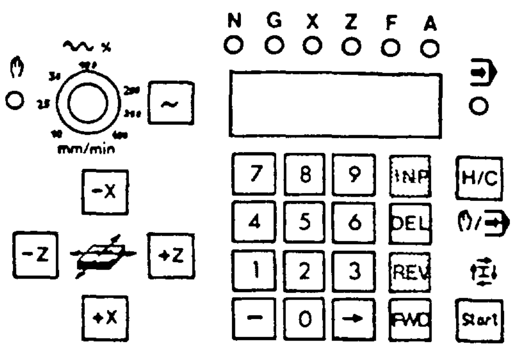
Turn the potentiometer counterclockwise.
Check number of swivels 1 to 6.

Operating the Turret Toolholder



1. By hand:

Press key FWD and a number key, the turret will swivel by the number on the number key pressed.
For example: you press FWD and 2: the turret swivels twice.



2. Swivelling in CNC-operation:

G26/X=O/Z=O/F..
Put in the number of positions to be swivelled under address F.
For example: G26/X=O/Z=O/F=2: the turret swivels by 2 positions.

Interrupting the swivel operation

Press key INP + REV

Cables:

- 16 poles cable (1) on CPU and turret circuit board.
- 6 poles cable (2) on CPU and turret circuit board.
- Mount socket for the connection of the turret into hole for "TV" or "VIDEO". Put cable plug (3) onto turret circuit board.

Note:

Three bores for plugs are privided. If the videoboard is mounted, remove either TV or monitor plug and mount plug for automatic turret toolholder instead of it.

4. 2-pole cable (4) for 1o V supply

+ 1oV and ground (GND) are taken from the condensor cables.

4.1 + 1o V supply

The +10V cable is marked with a red point on the condensor. The red point (+1oV) can be either at the right or left side of the condensor.

The +1oV connection cable is marked with a cable binder (7) and goes to pin 1 of the plug.

4.2 Ground wire:

The not marked cable comming from the condensor is the grounding wire.

It leads to pin 3 of the connection cable.

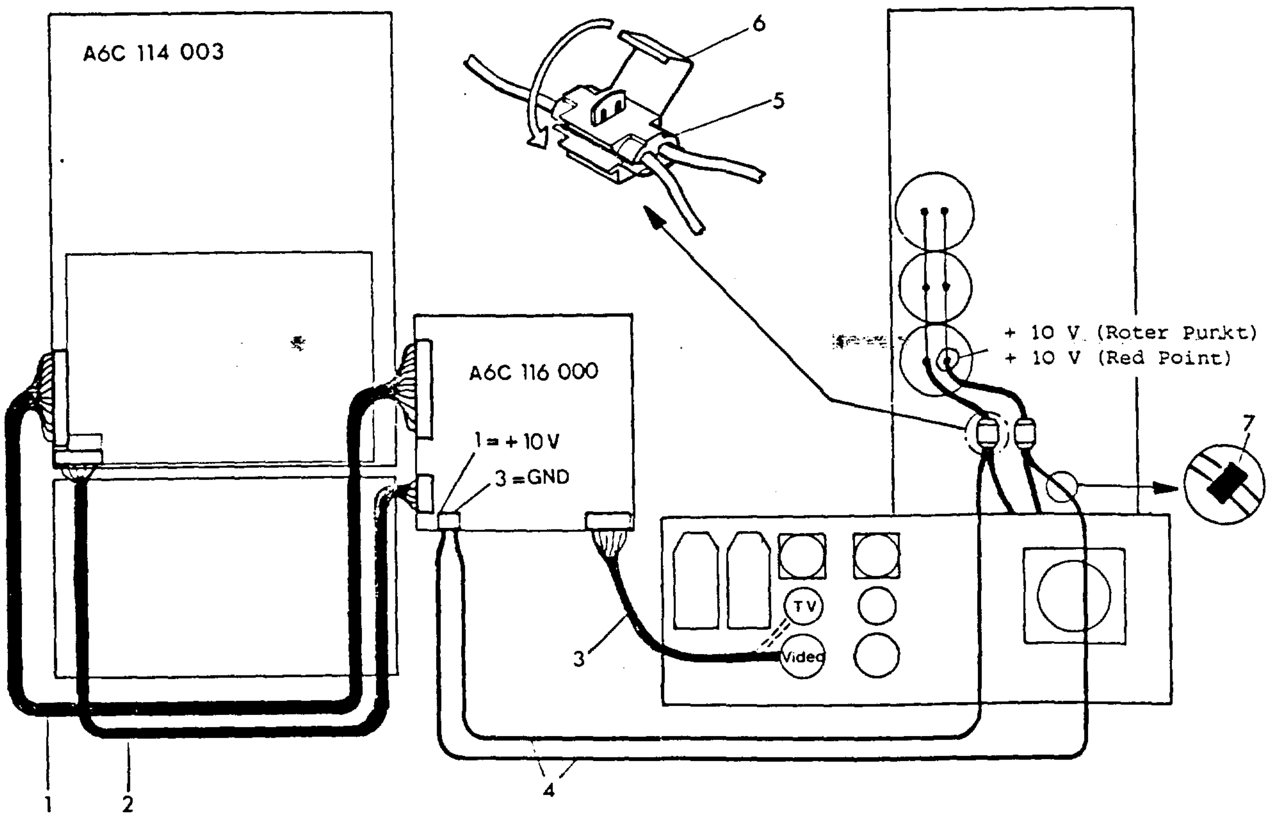
Connection:

Insert the cables in the cable connector (5) close the clip (6) and press it together with a plier.

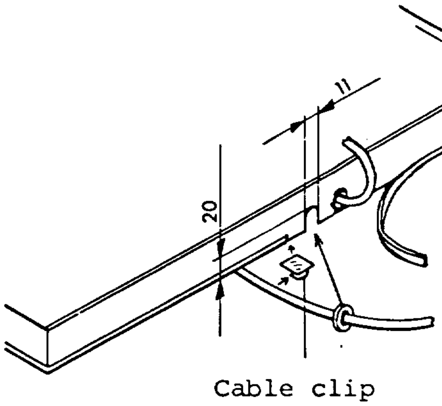
5. Use the cable binders to bind the cables

Place cable clips on the bottom of the E-housing and insert cables.

Attention:
Check that the cables don't lock the fan.



Mounting instructions



Preperations

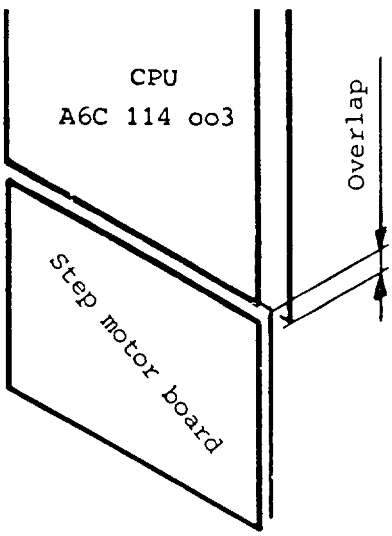
- If there is no slot in chip pan, use file to get slot in order to guide through cable.

- To tighten cable underneath chip pan use cable clip.

Mounting the automatic turret tool post

Dismount intermediate plate from cross slide and mount turret tool post with the 4 socked head screws M5x6o.

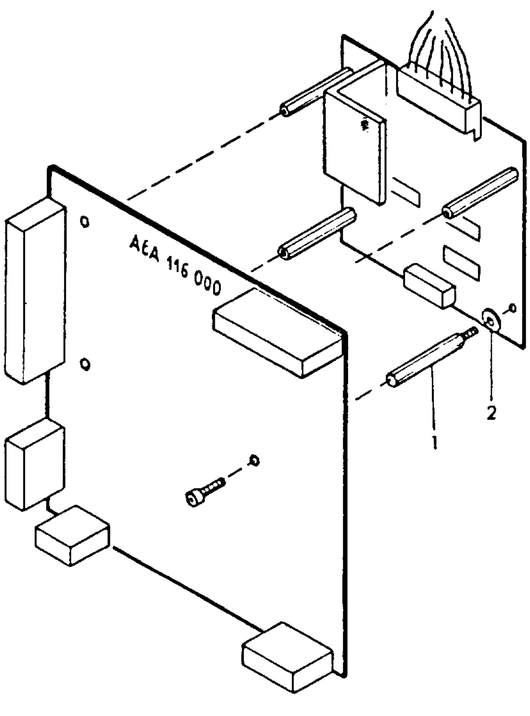
Pay attention that no chips will enter into the threaded holes of the cross slide.



Mounting the circuit boards:

Exchange old CPU against new one. (ref.no. A6C 114 oo3)if necessary.

Attention:
The cover foil of the CPU boards has to overlap with the foil of the step motor board in order to protect against chip creeping in.



- Instead of screws on cassette board use distance pins (1). Pay attention that plastic washers (2) are put on.

- Tighten turret circuit board with the hexagon head screws.

Making mounting easier: Plug in connections before mounting the turret circuit board itself.

7.4 Removal DNC - Interface of the Compact 5 CNC

The DNC interface permits the external input of commands to the machine, enquiry of machine conditions or the transmission of switch functions with the CNC program. For this reason, the DNC interface is divided into outputs, inputs and supply voltages.

ATTENTION:

When using the DNC interface with external voltage sources, the maximum admissible currents and voltages must be noted. In addition, possible potential differences between the devices must be observed. An excessive voltage at a DNC input or output can destroy the complete electronics of the COMPACT 5 CNC (spread of the voltage throughout the 5 V network).

All functions are carried via plug X62 to the tool reverser pc-board.

Input and output possibilities

7.4.1. Outputs

Pin 1:	Manual operation status (the machine reports whether it is in manual or CNC operation). In CNC operation, Pin 1 is LO In manual operation, Pin 1 is HI
Pin 7:	Status program operates (the machine reports whether a program is being processed). Program runs HI Program does not run LO
Pin 8:	Intermediate stop status (the machine reports whether or not it is in an intermediate stop). No intermediate stop LO Intermediate stop HI
Pin 15:	Alarm status (the machine reports whether or not it is in an alarm). No alarm LO Alarm HI

Output switch functions:

The following functions can be switched through the input of

$G23/X^{=0}_{\neq 0}/Z^{=0}_{\neq 0}/F^{=0}_{\neq 0}$

Input of	Causes on switch output/pin	The condition	Initial condition
G23 X=0	X62/19	LO	LO
G23 X≠0	X62/19	HI	
G23 Z=0	X62/18	LO	LO
G23 Z≠0	X62/18	HI	

These 2 switch outputs can also be manually actuated (by manual operation).

The path LED lights up	and pressing the pushbutton	produces at switch output/pin	the condition
X	REV	X62/19	LO
Z	FWD	X62/18	HI
Z	REV	X62/18	LO

Note:

The function X-FWD (X62/19 HI) is suppressed (i.e. is not possible).
Where X62/19 is set at HI by the program (G23/X=0), this output can be set at LO with REV during the intermediate stop. Where the program continues with Start, X62/19 becomes HI. 2 seconds later, the program then starts with the set following the intermediate stop.

Compare the function of the X output X62/19 with the F1-CNC output M03/M05. It would be used for the OFF-ON switching of the main spindle. However, this function is not included in the hardware.

Considerable wiring requirement: The motor switch of the F1-CNC would have to be fitted (ZEL 22 0010; ZEL 22 0020). See the circuit diagrams A13.168-22 and A13.168-71.
In addition, the power relay (ZER 82 6033) must be inserted on the tool reverser pc-board.

Pin 20: Pulse output
With a frequency of 100 Hz, the number of pulses specified with G23/F (HI-LO) are input at Pin 10.

Initial condition: LO
Maximum F-input: 0-499

The program is interrupted during the output time of the pulses, and is then continued.
(For this reason, one can also use G23/F as dwell time = between 0.01 and 4.99 seconds)

Input format for G23:

N.../G23/X..../Z...../F...

i.e. simultaneous input of all 3 functions is possible.

7.4.2. Inputs

Where a voltage of 3-30 V is applied to the following inputs, the following function is executed by the machine:

X62/Pin 3: Bring machine into RS-232 operation (receive as G66 + INP).

X62/Pin 4: Break off program (function as INP/REV).

X62/Pin 5: Intermediate stop (function as INP/FWD).

X62/Pin 6: Bring machine into RS-232 operation (receive as G66 + FWD).

X62/Pin 9: Bring machine from manual to CNC operation, or vice versa.

X62/Pin 10: When voltage is applied to Pin 10, the machine changes to intermediate stop. In addition, there is a start interlock (e.g. function protective cover).

Note: This function is also on plug X64/Pin 6. This is where one can obtain the + 5 V from plug X64/Pin 5, and thus connect a limit switch (as an opener).

ATTENTION:

Pin 10 only functions, where the wire bridge J4 is removed from the tool reverser pc-board.

X62/Pin 11: Manual traverse X/Z

X62/Pin 12: Manual traverse +/-

X62/Pin 13: Manual traverse command

With voltage on Pin 13, the COMPACT 5 CNC traverses with the set feed (potentiometer), with the axis (Pin 11) and direction (Pin 12) which were preselected.

X62/Pin 17: A start command is actuated by voltage at Pin 17.

X62/Pin 2: The tool reverser indexes, as long as there is voltage at Pin 2 (J2 must be removed).

X62/Pin 21: When the wire bridge J1 is open, the tool reverser is blocked. When a voltage is applied to Pin 21, one can again index. This function is also on X64/3.
Function, e.g. tool reverser cover.

7.4.3. Supply:

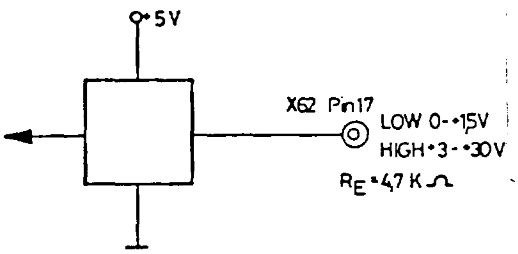
X62/Pin 22: + 10 V uncontrolled

X62/Pin 23, 24, 25 —— GND

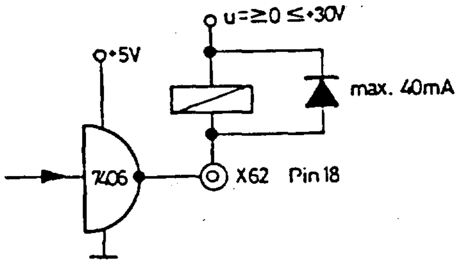
X62/Pin 26: + 5 V controlled

7.4.4. Examples for the wiring

Example Input



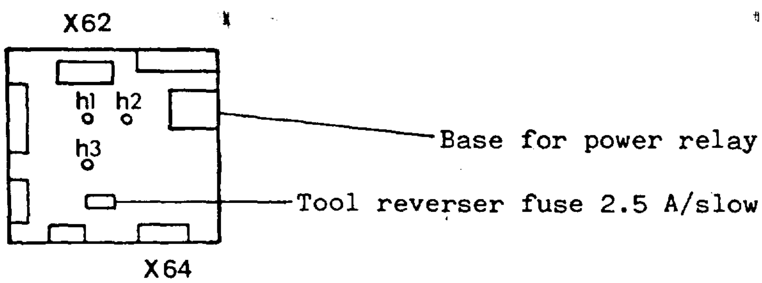
Example Output



7.4.5. Notes on the tool reverser pc-board

- Where wire bridge J3 is removed, indexing can proceed during intermediate stop and manual operation.

- There are 3 LED's on the tool reverser pc-board.
  h1 is alight when the tool reverser lock is open (J1)
  h2 is alight when the tool reverser swivel is blocked (J2)
  h3 is alight when the chip protection cover is open (J4)



7.7 Removal chip door limit switch of the F1 CNC

As an additional safety package, the F1-CNC can be equipped with one limit switch, for the following:

- When the chip door is open, a start interlock of the CNC program is actuated.

- With an already running CNC program, when the chip door is opened the program is interrupted (the step motors stand still and the main motor is stopped when the motor switch is set at CNC). The machine is in intermediate stop. When the chip door is closed, start must be actuated, so that the machine can proceed with the program.

  Installation is already prepared. The precondition for the function is the DNC interface.

7.5 Removal DNC - Interface
(F1 CNC)

In following the fitting instruction for these accessories.

Notice that the connection plugs (6/12/16 polar) are not overplugged displaced.

The DNC-board is corresponding to the turret toolholder board of COMPACT 5 CNC. Here the tur-- ret toolholder functions are not wired.

The programm is interrupted during the time of realising the impulses and is continued afterwards.

(Therefore you can also use G23/F as dwell = between 0,01 and 4,99 seconds)

Input for G23:

N../G23/X..../Z..../F....

I.e.You can input all 3 functions simultaneously.

DNC Interface F1-CNC

Ref. No. 770 070

Scope of supply

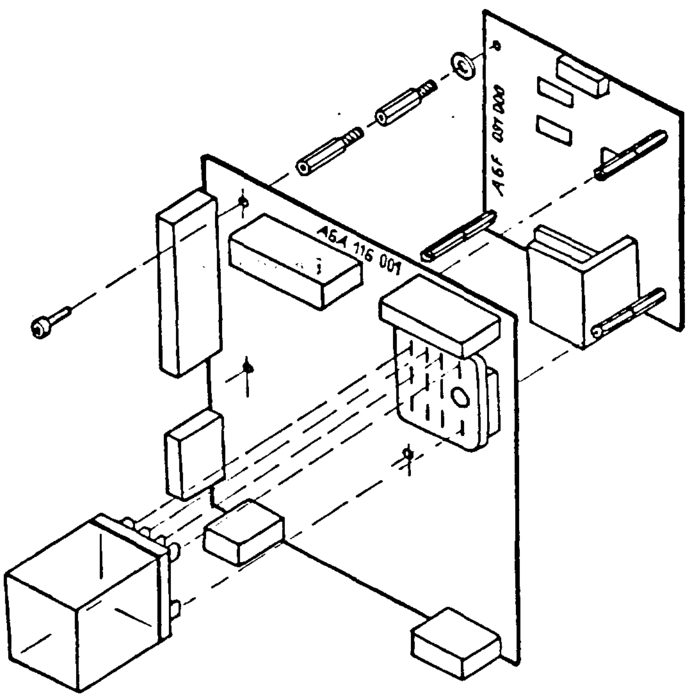
1. PC-board
2. Cable 16 - 12-pole
3. Cable 5-pole
4. Cable 2-pole
5. Spacer bolt with washers
6. Cable clips
7. Relay

Work to be carried out:

- Assemble DNC-board
- Connect all cables

Attention:

- Disconnect the mains plug prior to carrying out all assembly work. Otherwise there is not only the danger of accident, but also the danger of electronic components on the boards being destroyed.
- Never connect and switch on the machine, when all the plug connections are not fitted and the printed circuit boards are not fastened.
  Loose cables and printed circuit boards cause short-circuits, when they come into contact with the housing or other pc-boards.



Assembly of the DNC-board

- Replace the cylinder bolts on the cassette board with spacer bolts (1). Ensure that the plastic washers (2) are fitted.
- Fasten the DNC-board with cylinder bolts.
- Plug-in the relay.

Assembly simplification:

First plug-in all cables, then screw the pc-board tight.

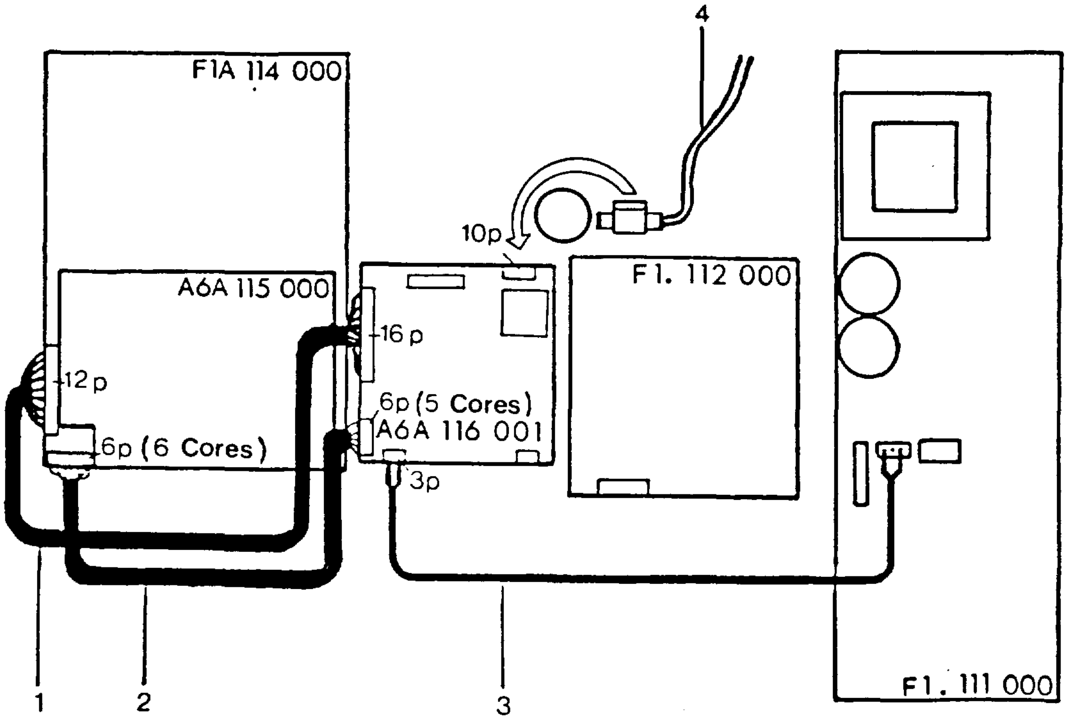
Cable:

1. Attach 16 - 12-pole cable (1) to CPU and DNC-board.

2. Attach 5-pole cable (2) to CPU and DNC-board.

3. Attach 2-pole cable (3) from mains board to DNC-board.

4. Remove the 2-pole cable (4) from the cable clip and attach to the DNC-board.



Note:

On 5-pole cable, the side with the 6 cores on the plug must be attached to the CPU, and the side with the 5 cores on the plug must be attached to the DNC-board.
Pin 3 of this cable may not be wired (Pin 3 is connected with Pin 1, as standard, for this reason, the CPU side has 6 cores). Via Pin 3, the "Start" pulse for the main spindle is transmitted, that comes with the programming of M06/T/0 after the issuance of the intermediate stop (danger of injury during manual tool change).

Function of the DNC-board:

1.

- The main spindle can be switched on with M03 and switched off with M05 (set main spindle switch to CNC). - See page 7.2 of the instructions.

- A main spindle switched on with M03, can be switched off manually during the intermediate stop, by actuating the M-switch (e.g. for measuring processes). Where the intermediate stop is interrupted by a start, the main spindle is automatically switched on again, and after a 2 second start delay, the program continues to operate.

- The program end command M30, automatically produces a switching off of the main spindle (additional programming of M05 is not necessary).

2. In and output possibilities of the DNC-interface via the 26-pole plug X62:

A) Outputs:

Pin 1: Status manual operation (the machine indicates whether it is in a manual or CNC operating mode)
In CNC operation, Pin 1 is LO
In manual operation, HI

Pin 8: Status intermediate stop (the machine indicates whether it is at intermediate stop, or not)
No intermediate stop LO
Intermediate stop HI

Pin 7:
Pin 15:
Pin 18:

Switch functions programmed with M-commands

Input of	produces at switch output / Pin	the condition	initial condition
M08 M09	X 62 / 15 X 62 / 15	HI LO	LO
M20 M21	X 62 / 7 X 62 / 7	HI LO	LO
M22 M23	X 62 / 18 X 62 / 18	HI LO	LO

These 3 switch outputs can also be manually actuated.

Lighting the WEG-LED	and actuating the pushbutton	produces at switch output / Pin	the condition
X X	FWD REV	X 62 / 15 X 62 / 15	HI LO
Y Y	FWD REV	X 62 / 7 X 62 / 7	HI LO
Z Z	FWD REV	X 62 / 18 X 62 / 18	HI LO

Pin 20: Pulse output

Format M 26
N3/M26/H3

At Pin 20, with a frequency of 100 Hz, the number of pulses given with H is issued (HI-LO).
Initial condition: LO
Maximum H-input: 0-221
The program is interrupted during the output time, and is then subsequently continued.

The main motor is switched on and off with Pin 19.
M03 - HI
M05 - LO
Initial condition - LO

The motor is changed over to anti-clockwise rotation with Pin 14. This only functions with the thread cutting pc-board (accessory, in preparation). This anti-clockwise rotation is required for thread cutting cycles G74/G84.

B) Inputs:

Where a voltage of 3-30 V is applied to the following pins, the following function is executed by the machine:

Pin 3: Bring machine to RS-232 operation (received as G66 + INP)

Pin 6: Bring machine to RS-232 operation (transmit as G66 + FWD)

Pin 9: Bring machine from manual operation to CNC operation, or vice versa.

Pin 10: When voltage is applied to Pin 10, the machine goes to intermediate stop. There is also a start interlock (e.g. protective cover function).
Pin 10 only functions, when the wire bridge J4 is removed from the tool reverser pc-board.

Pin 17: The start command is actuated by voltage at Pin 17.
Pin 17 is not wired to the computer pc-board. See Wiring Note.

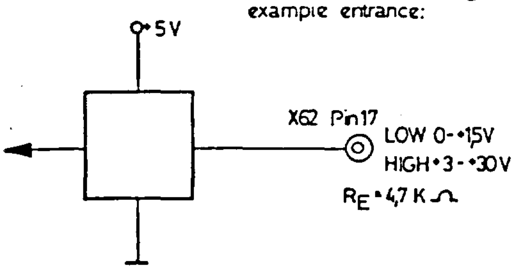
C) Supply:

Pin 22: + 10 V uncontrolled

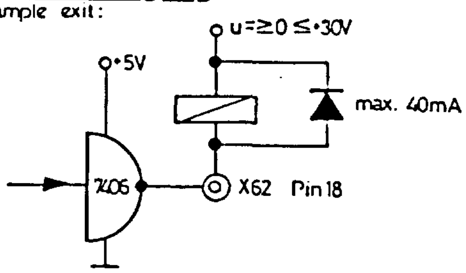
$\left.\begin{array}{l}\text{Pin 23}\\ \text{Pin 24}\\ \text{Pin 25}\end{array}\right\}$ —— GND

Pin 26: + 5 V controlled

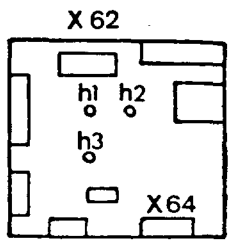
Beispiel Eingang:
example entrance:



Beispiel Ausgang:
example exit:

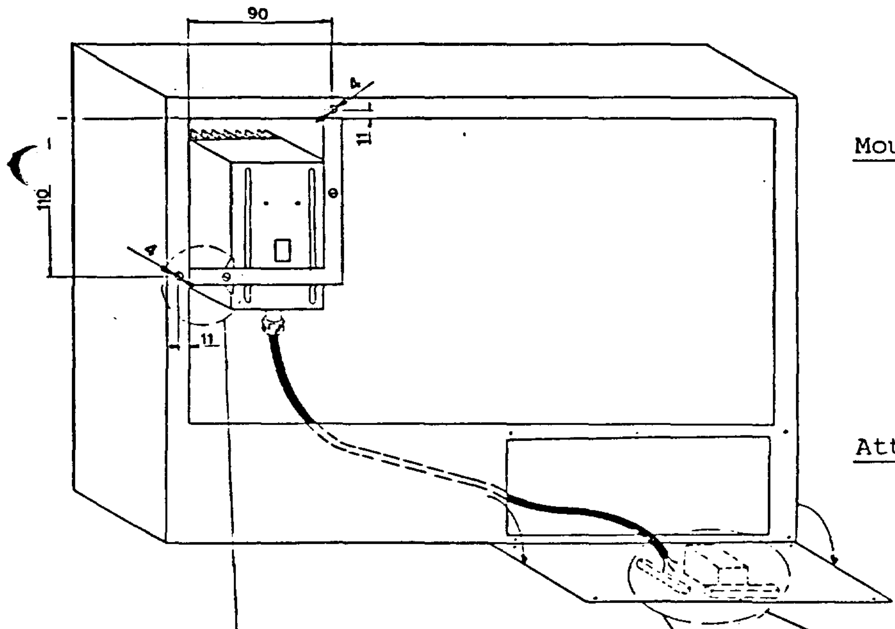


3. One opener contact can be connected to plug X64/-Pin 5,6, with the same function as X62/ Pin 10 (e.g. sliding door limit switch function). h3 lights up when the chip protection cover is open (J4).



Heating device for control unit for Compact 5 CNC and F1 CNC

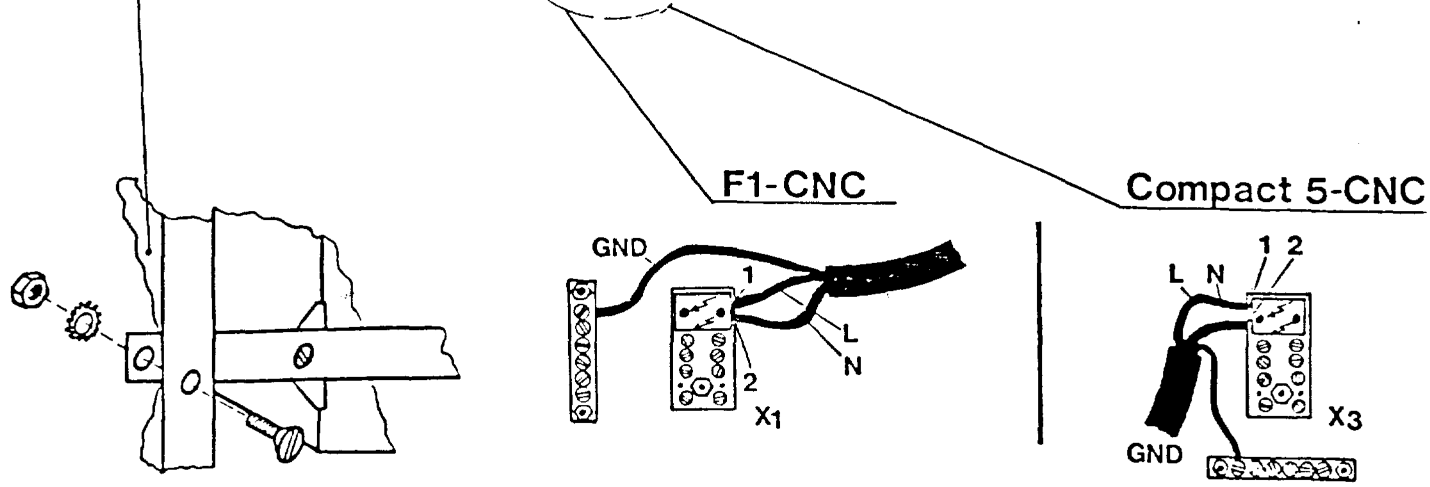
Function: The heating device prevents condensation of water on the boards while the machine is switched off. (Power supply must be plugged)



Mounting: Remove power supply plug. The heating device is mounted on the electrical housing.

If the mounting holes are not machined you have to make two bores diameter 4 mm. (See sketch)

Attention: Be sure that no chips come to boards, into the E-housing when machining the bores. They could cause electrical faults or destructions.



Electrical Connection:

Clamp the brown wire (L) to contact 1, the blue wire to contact 2 (N).
The green-yellow wire (GND) is clamped to grounding contact.

Chapter 8

Generations, retrofitment of old machines

8.1 Generations of the Compact 5 CNC

Serial No.:

1-49	1st Generation: Yellow main motor with old main spindle pc-board, interface pc-board fitted in cassette deck, computer pc-board not suitable for extensions, weak power pack, old step motor pc-board, old step motor wiring.
50-299	2nd Generation: Not suitable for extension video and RS-232. Weak power pack, old step motor pc-board, old step motor wiring.
300-618	3rd Generation: Not suitable for extension video and RS-232. Similar in design to the new machines.
619-1499	4th Generation: Suitable for extension video and RS-232. Similar in design to the new machines.
1500-2499	5th Generation: Suitable for extension video.
2500-3539	6th Generation: Suitable for video and tool reverser extension. Absolute value programming, RS-232 and DNC interface software fitted.
3540-	7th Generation: Software as in 5th Generation, TUV tested, design change internally.

8.2 Notes on retrofitment of old machine in accordance with the latest state of the art (only Compact 5 CNC)

Please note the various generations of the COMPACT 5 CNC.

8.2.1. For machines with serial numbers below 300, see chapter ⊕.

8.2.2. On machines with serial numbers 300-618, the computer pc-board must be exchanged for the video and tool reverser extension.

8.2.3. Machines with serial number 619-2499:

- These machines are suitable for video retrofitment. These machines are only suitable for the tool reverser extension, where the computer pc-board (A6C 114 003) is newly fitted.
- Should a version A6A 100 000, A6F 100 000 or A6R 100 000 (only metric) be retrofitted, retrofitment of the inch/metric switch is also required. In addition, fixed wiring is also possible (see page 70).
- Should various problems arise after conversion (software breakdown, loading problems with the cassette deck, etc.), the power pack pc-board should also be exchanged (F1A 111 000). This will ensure a more stabile power supply.

8.2.4. Machines exceeding serial number 3540, already comply with the latest state of the art.

Chapter 9

Diagnosis Module

To permit the service technician, who is unused to measuring devices, to check through a COMPACT 5 CNC or F1-CNC, the diagnosis module was developed by EMCO.

The following tests are simple to implement, with the diagnosis module:

1. A fuse test (for glass tube fuses - defective or not)

2. The main motor is tested for current consumption.

3. The light barrier pulses are indicated on an LED.

4. The step motors are tested for current consumption.

5. The step motor pc-board is tested for the output pulses.

In principle, you can also test these functions with a multimeter (as described in chapters 4 and 5).

With the diagnosis module, mainly the periphery is rapidly checked through (motors and light barriers).

The diagnosis module can be used for the COMPACT 5 CNC and F1-CNC. However, on the F1-CNC, the step motor test must be carried out in 2 stages (due to the 3rd step motor, initially the XZ motor, then the XY motor).

DIAGNOSIS MODULE - TEST INSTRUCTIONS

Function:

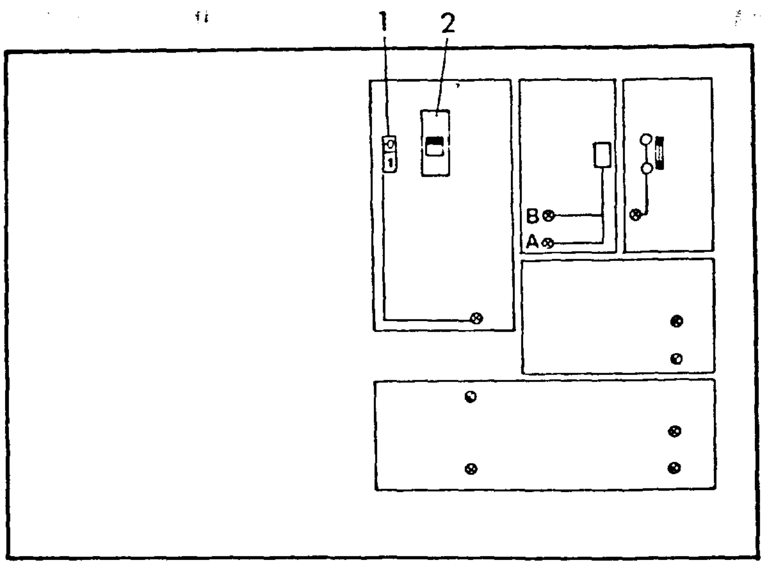
Test possibilities:

1. Fuses
2. Main motor
3. Light barrier
4. X- and Z-motor
5. Feed control (step motor board)

In the diagnosis module you find adaptor cables so that the machine versions A/B/C and F/G/H/N can be tested.

Note:

A defect step motor can disturb the step motor board, a defect main motor can disturb the main spindle board.
Therefore, before changing boards, control step motors and main motor.



Test Instructions

Plug in diagnosis module and switch fuse switch (2). The light of lamp mode A or B appears.

1. Testing the fuses

Hold fuses to the fuse contacts. With intact fuses the lamp "fuse" lightens.

2. Main motor

- Displug main motor plug from electrical control unit.
- Couple 3-pole plug from diagnosis module with plug of main motor cable.
- Switch on main motor switch (1) on the diagnosis module.
- When the main motor is o.k., the motor must run and the lamp "main motor" lightens.

Note:

If main motor runs and lamp "main motor" does not light, replace main motor, otherwise the main spindle board could be damaged.

3. Light barrier main spindle

- Displug coupling of light barrier on control unit.
- Connect twin cable of light barrier of diagnosis module (one coupling for electrical housing, one coupling for light barrier cable.
- Switch diagnosis module to mode A.
- Switch on main motor:
  With correct adjusted and functioning light barrier the lamp "light barrier main motor" must blink when spindle speed is slow and light steady when spindle speed has increased.

4. Testing the feed motors X and Z

Attention:

Do not displug X or Z motor coupling when main switch is switched on. The step motor board can be damaged.

Testing:

- Mount the adaptor cables to the X- and Z twin cables of the diagnosis module if required.
- Switch off main switch of COMPACT 5 CNC.
- Displug couplings for X resp. Z-motor (couplings either direct on step motors or on electrical control unit).
- Connect the coupling of the twin cable of the diagnosis module: one coupling with step motor input plug of the step motor, one coupling with the output plug of the step motor of the COMPACT 5 CNC.
- Switch on main switch of the machine.
- Switch diagnosis module to mode A. With intact step motors the lamp "feed motor X and Z" must light.

Note:
The diagnosis of a winding interruption can be quite tricky. In cold condition they can function. After a certain time of working (expansion of winding caused by raising temperature) the winding is interrupted - the motor stands.
An unpleasant fault is a temporary short circuit in the windings of the step motor which can appear under thermical alterations. As the step motor board is not short circuit protected, a step motor with short circuit generally damages the step motor board. In such cases replace step motor and check cable for short circuit.

An example:

A customer complains non-function of feed drive. The diagnosis module shows intact step motor and intact step motor board. After two hours working feed is defect.

Reason:

A winding interruption or a winding short circuit that cannot be diagnosed in cold condition.

5. Testing the feed control (step motor board)

Procedure is the same as with points 1-5 of testing the step motors. Then:

- Connect light barrier cable from diagnosis module to COMPACT 5 CNC.
- Switch diagnosis module to mode B.
- Switch diagnosis module to mode hand operation and adjust highest feed (4oo mm/min).

Test:

a) Inching

Phase

1. ● ● ○ ○
2. ○ ● ● ○
3. ○ ○ ● ●
4. ● ○ ○ ●

Move the resp. slide in inching mode. With correct step motor control two lamps must light in one of the shown combinations.

When inching the slides in "plus"-directions, the sequence is 1,2,3,4,1,2,3,4 .., in "minus"-direction 4,3,2,1,4,3,2,1 ...

Fault 1: Only one lamp is illuminated:
- Replace step motor board
- Check cables from step motor board to step motors
- Replace computer board

Fault 2: Three lamps are illuminated:
(Motor runs noisy and irregular)
- Replace step motor board
- Check cables

b) Moving the slides with max. feed (4oo mm/min)

Feed control

●

Phase

● ● ● ●

With correct feed control all 4 lamps (phase) and the lamp feed control must be illuminated.
The lamp feed control shows whether the 1o V current and 5o V current supply is existing. If there is no 5o V supply the fault can be a defective step motor board or no 5o V supply to the step motor board.

Checking 1o V / 5o V supply

- No 5o V supply, 1o V existing:
  Slides cannot be traversed in rapid feed (7oo mm/min).
- No 1o V supply, 5o V existing:
  Slides can only be traversed in rapid feed.

Chapter 10

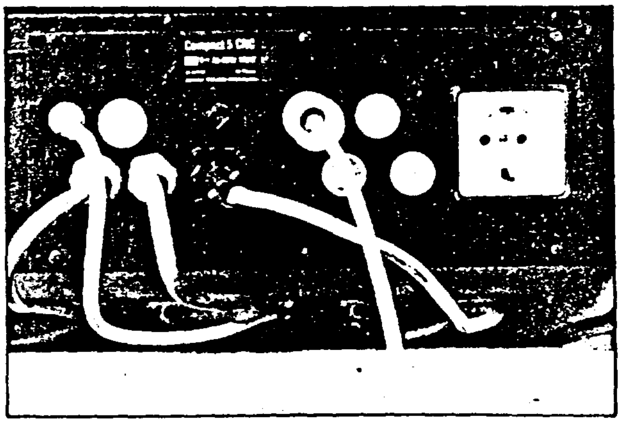
Notes on Machines below Serial No. 300

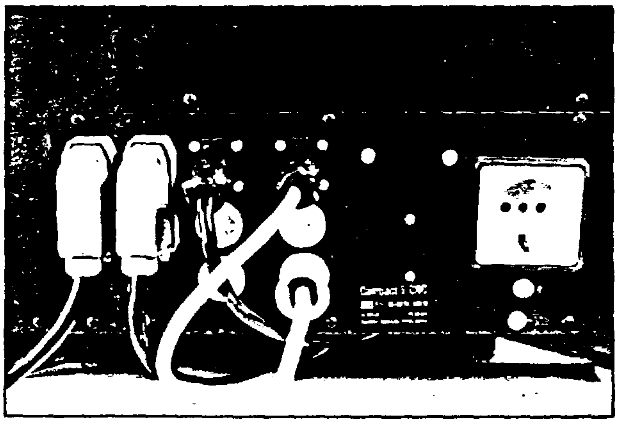
(only Compact 5 CNC)

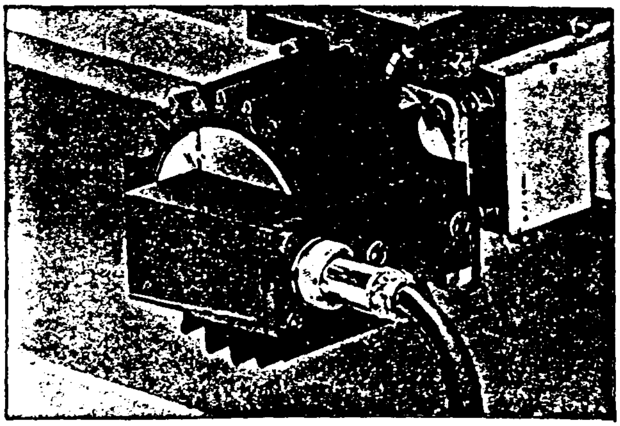
These first generation machines, differ in their electrical design from those of the newer generation. An immediately recognizable external difference is shown below.

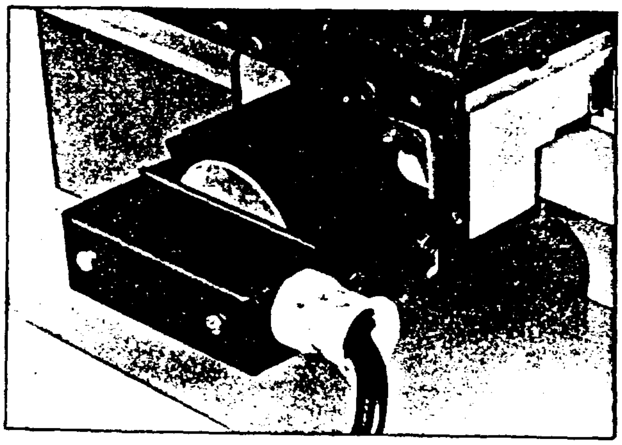
In this Service Manual, those places marked ⊕ indicate a difference.

Serial No. 1-299	from 300
Coupling of the step motor on the step motor	Coupling on electric housing







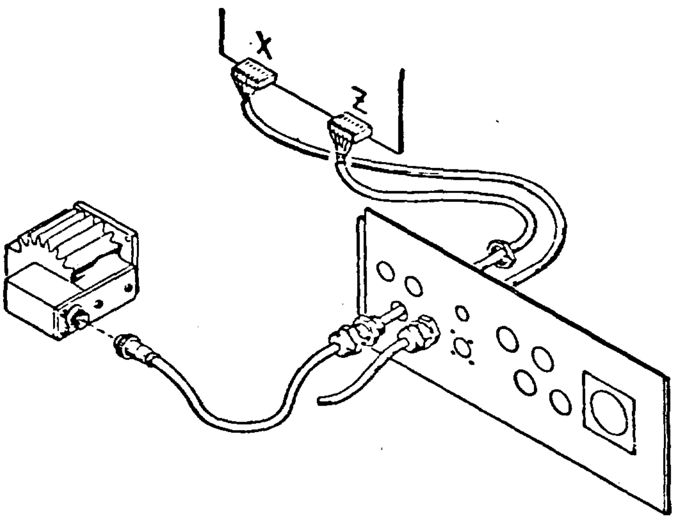


In addition, the light barrier plug and the pc-board design differ on this first generation.

Electrical box number

A6 A/B/C 100.000

(coupling for step motor on step motor; step motor cable leads directly to the step motor pc-board)



Spare part numbers:

1. Step motor X/Z: A6A 103 000
2. Cable X: ZME 200 201
3. Cable Z: ZME 200 202

(step motors X and Z are identical. There is no difference in the voltages)

2. Light barrier for main spindle

The light barrier for the A/B/C version differ in the coupling.

Replacement light barriers

For electrical box A6A 100 000
A6B 100 000
A6C 100 000

Spare parts number for light barrier: A6A 108 000

Replacement electrical control

Replacement electrical control for A = } A6S 105 000
Replacement electrical control for B = }
Replacement electrical control for C = A6W 105 000

Since the couplings for step motors X and Z and the light barrier coupling of version A/B/C are different, adapter cable must be used for their connection.

Adapter cable for X motor   Order No. K1L 702 000
Adapter cable for Z motor   Order No. K1L 702 000

Adapter cable for light barrier   Order No. K1H 303 000

When reinstalling the repaired electrical control A/B/C, the step motors and light barrier are directly reconnected.

Replacement pc-boards

3.1. PC-board numbering

The numbers are either shown on by an adhesive label, or they are embossed.
In addition to the pc-board number, a sequential number is stuck on, it is the sequential serial number (production number).

3.2. Replacement pc-boards

In the machines with the serial numbers A/B/C, pc-boards with the final number Zero (e.g. A6A 111 000) are mainly fitted. As replacement pc-boards, only pc-boards of the latest version with the final number 1,2,3 ... are supplied.

Replacement pc-boards:

- Power pack pc-board: 220/240 V - A/B/F/G/N - A6A 111 001 or F1A 111 000
  115 V - C/H - A6C 111 001 or F1C 111 000
- Main spindle pc-board: 220/240 V - A/B/F/G/N - A6A 112 001
  115 V - C/H - A6C 112 001
- Step motor pc-board: 220/240/115 V - A/B/C/F/G/H/N - A6A 113 001
- Computer pc-board: 220/240/115 V - A6C 114 003 (1)
- Cassette deck with interface: 220/240(115) V - A6F 090 000

Note (1): As a replacement computer pc-board, a pc-board with metric/inch changeover will be supplied. When installing this pc-board, the metric/inch selector switch must also be fitted.

⊕ Differences:

Page 4.8	- Test main fuse e7
Page 4.9	- No fuse present for the control current circuit. Use diagrams A13.168-1 and -2.
Page 4.10	- Test fuse e6
Page 4.11	- A13.168-1
Page 4.12	- This effect occurs with the maximum enlargement stage with accessories, where the power pack pc-board A6. 111 000 is not exchanged.
Page 4.13	- Fuse e4 - power supply of the main motor can be defective. e21 and e22 not present.
Page 4.16	- A13.168-1
Page 4.17	- Test fuse e1 and e2 A13.168-2
Page 4.18	- A13-168-2
Page 4.22	- A13.168-1
Page 4.24	- No fuse for 16 V circuit A13.168-1

Page 5.2	- The main drive differs on machines 1-49. a) Light barrier on motor b) Old main spindle pc-board (A6A,C 112 000) c) Smaller motor (yellow, with ventilation) In this case, it is better to exchange the complete main drive (motor + pc-board). A possible adjustment of the motor light barrier could proceed as specified on page 4.4 - 4.6. For (U6) pin occupancy, see A13.168-1.
Page 5.10	- A smaller motor (250 W) is fitted on machines 1-49. Characteristic: Yellow, with ventilation. See above text.
Page 5.18	- On computer pc-board A6A,C 114 000 plug X47 is missing. This pc-board is not suitable for extensions.
Page 5.19	- The plug X33 was 3 pin. X33, Pin 1 10 V X33, Pin 2 GND X33, Pin 3 40 V
Page 5.20	- On the older machines, the interface pc-board is connected close to the recorder (smaller design size).

Page 5.23 - A ring-core transformer is fitted on the power pack pc-boards A6A,C 112 000, which has the winding output wires directly as the connection.

Measuring points on lead out colour: Secondary

light green / light green — 15 V ac

green/brown / green brown — 35 V ac

red / brown — 12 V ac

Connections of the transformer: Primary:

brown	0 V
black	115 V
blue	220 V
yellow	240 V

Page 8.3 - Machines with serial numbers 1-49 can only be retrofitted by replacement of the computer pc-board and the power pack pc-board.

Machines with serial numbers 50-299 are to be treated as specified in chapter 8.2.2. However, the power pack pc-board must be replaced (too weak for extensions).

Page 5.24

Fuses on the power pack pc-board

A6A 111 000 and A6C 111 000

Design size: Glass tube fuses dia. 5 x 20

Designation	Function	Amperage
e1	10 V power supply	8 A slow
e2	10 V power supply	8 A slow
e3	50 V power supply	4 A slow
e4 (220/240)	Main motor power supply	4 A slow
e4 (115)	Main motor power supply	8 A slow
e5	Transformer fuse for primary winding	2.5 A slow
e6	Blower fuse	1 A slow

Fuses on electrical box / Main fuse c7

Size for 220/240 V: Glass tube fuse dia. 5 x 20, 8 A slow

Size for 115 V: Glass tube fuse dia. 1/4" x 1", 10 A slow

Chapter 11

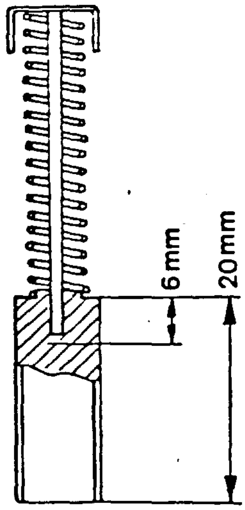
Control, Service and Adjustment

+ Adjustment of carbon brushes on main motor

+ Service and adjustment

  1. Exchanging the main spindle bearings
  2. Exchanging the countershaft belt
  3. Exchanging the countershaft pulley
  4. Nut on carrier plate
  5. Exchanging the main motor
  6. Exchanging the toothed belt, exchange of step motors
  7. Exchanging the lead screw
  8. Exchanging the cross slide spindle
  9. Gibs on longitudinal slide
  10. Tailstock
  11. Adjustment of cross slide guidance

Control of the Carbon Brushes on Main Motor



Before checking the carbon brushes, draw out plug to cut of power supply.

Worn off carbon brushes damage the anchor lamellas and may destroy the main spindle circuit board by brush firing.

Control of carbon brushes:

After 100 hours of operation.

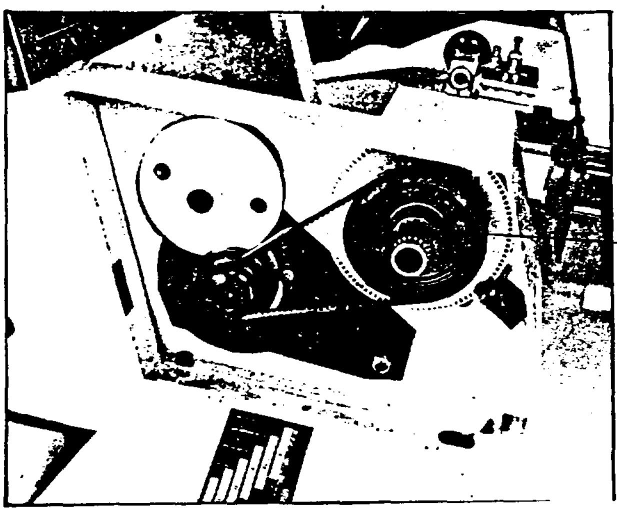
A new brush is approx 20 mm long.
When a length of only 6 mm is left, then it must be replaced.

An unregular wear of the 2 carbon brushes is a typical characteristic of a direct current permanent motor.

Swap unregular weared brushes if they are long enough.

Service and Adjustment

1 Exchanging the main spindle bearings



1. Mark the position of the light barrier for easier re-mounting. Dismount light barrier.

2. Take off retaining ring on main spindle.

3. Use plastic hammer to get main spindle forward, apply only gentle strokes until spindle can be drawn by hand. Pay attention that perforated disc will not be damaged.

4. Exchange bearings

5. Assemble again.

Attention: Note bearings!

Front bearing: Inside and outside medium - force fit, i.e. the bearing has to be pressed onto spindle (inside ring) and into the bore of the headstock (outside ring). If you do not have available a press-on device then you mount the bearings using hammer and bushing (when mounting bearing onto spindle, press only onto inside ring, when mounting bearing in headstock, press only onto outside ring.

Back bearing: Slide fit

---

6. Checking the light barrier mounting

6.1. Digital read out of rpm: switch on machine and check whether rpm. are shown on read out.

6.2. Threading: Check of impulse

- Put in program

N	G	X	Z	F
00	78	-200	-2000	150
01	22			

- Slow down rpm.
- Press start - Threading cycle must run

A wrong adjusted light barrier gives wrong synchronisation impulses so that the start of threading operation is wrong.

Operation not running

Cause: Nc impulse from light barrier. Only the first X-movement is executed, then operation is interrupted because computer waits for start impulse.

Measure: Adjust light barrier

2 Exchange of the countershaft belt

- Loosen motor tightening screws, exchange belt
- Press motor firmly down and tighten screws

3 Exchange of countershaft belt

For this purpose, you have also to take off the motor pulley.

1. Unscrew flat head screw from motor pulley. This screw is secured by "Loctite". For better getting hold of the pulley, press drive belt together.

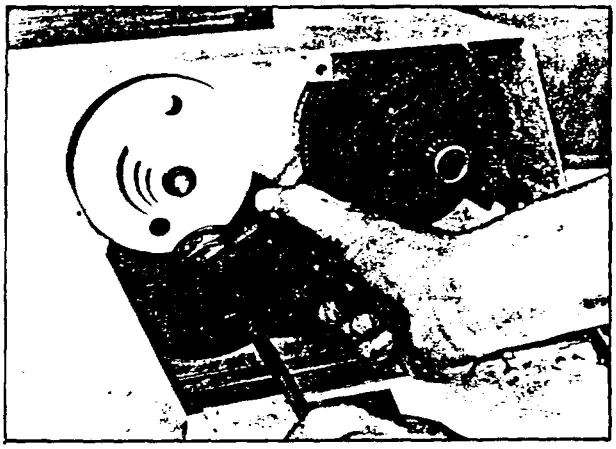
2. Loosen motor tightening screws, and take off countershaft belt.

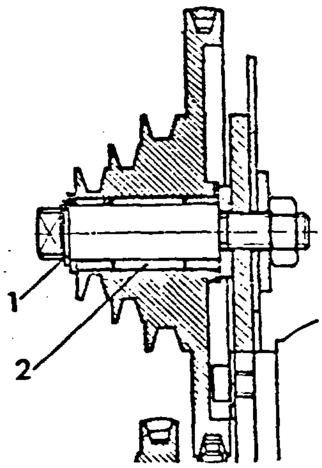
3. Take off motor pulley.

4. Take off retaining ring (1) and then countershaft pulley.

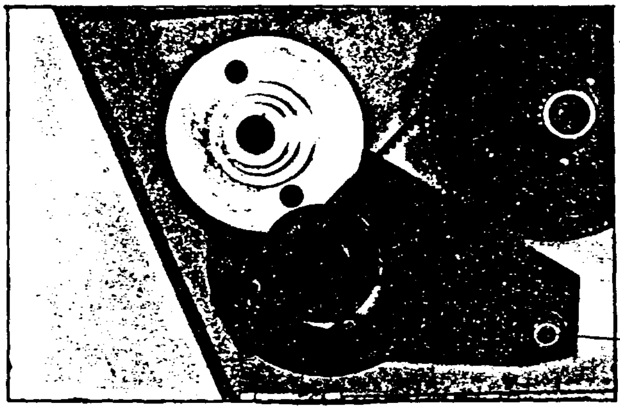
5. Fill out space (2) with ball bearing grease.

6. When remounting do not forget to secure flat head screw again with "Loctite".



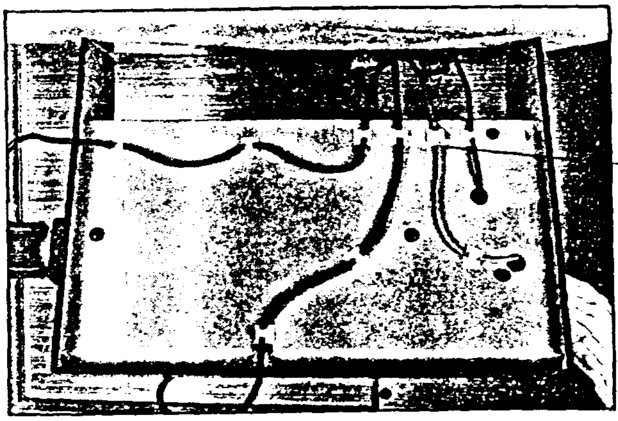


4 Nut on carrier plate



The nut on the carrier plate has to be tightened such that the carrier plate can be swivelled without play. The stud bolt is secured with "Loctite" against torsion. Without this securing, the screw could get loose - thus the carrier plate would not be clamped play-free. This could lead to vibrations and finally to an unsatisfactory surface quality on the workpiece.

5 Exchange of main motor (version without perforated disc)



Draw out plug to cut off power supply.

1. Take off motor pulley (compare before chapter "Exchanging the counter-shaft pulley").
2. Unscrew motor
3. Loosen motor coupling on the back-side of the electrical housing. Press out motor cable from cable clip (1) and draw through cable with coupling.

Motor-version with perforated disc mounted

Same as above, but dismount perforated disc first. The belt pulley is divided into 2 parts, i.e. take off both pulleys.

6 Exchanging the toothed belt, exchange of step motors

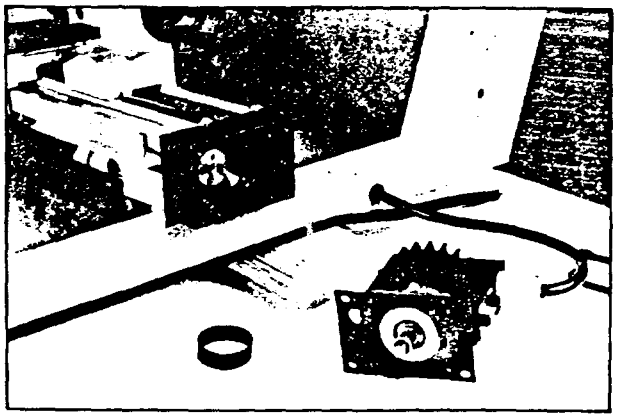
Pay attention!

Step motors X and Z are identical. The COMPACT 5 CNC comes, however, with two different coupling versions. Machines with el. housing ref.no. A6A/B/C 1o5 ooo come with the coupling of the cable directly on the step motor. Machines with el. housing ref.no. A6F/G/H/N 1o5 ooo came with the coupling on the backside of the el. housing.

Exchange

A T T E N T I O N !

Plug out to cut off power, otherwise the power supply circuit board with machines carrying ref.no. A6A/B/C 1o5 ooo may be destroyed.



1. Uncouple motor cable on backside of electrical housing.

2. Press cable through cable clip. Open edge coverage only locally to get cable through.

3. Unscrew step motor together with carrier plate. Mount carrier plate on new step motor.

4. Put pulley into toothed belt and mount motor.
   Tightening of belt:
   Pressing power onto motor for tightening of belt approx. 3o N (3 kp). If the belt is tightened too firm, the wear off will be too high.

The carrier plate for the X-motor

Take care that carrier plate is mounted onto X-motor the right way. If the carrier plate is mounted upside down then the slide would be blocked in direction Minus X.

7 Exchanging the leadscrew

The reason for a necessary exchange of the lead screw can only be a mechanical shortcoming.

e.g. - Spindle bent, because machine was lifted on spindle
- heavy stroke on right hand or left hand side of spindle bearings.

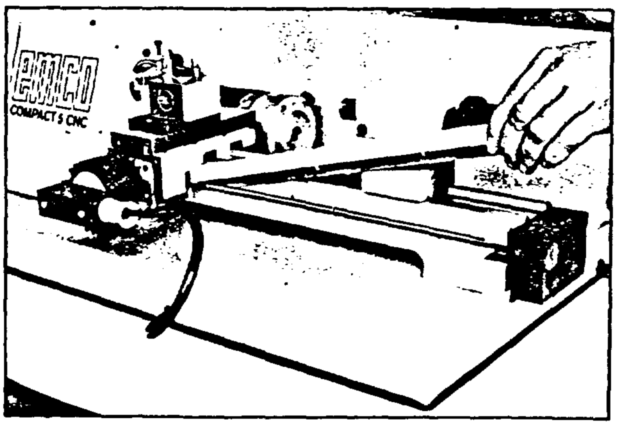
"Leadscrew complete"

The leadscrew as spare part will come to you as "leadscrew complete", ref.no. ZME 2oo o7o (compare spare parts list): leadscrew, left hand bearings, nut carrier with nuts, right hand bearings.

Dismounting of leadscrew

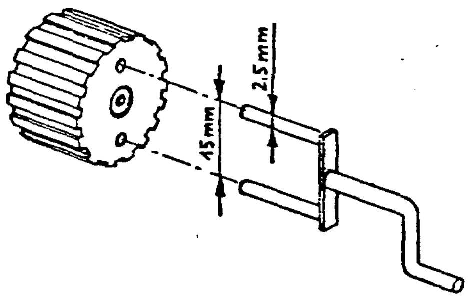
1. Plug out to cut off power. Take off motor together with carrier plate.

2. Unscrew flat head screws of spindle cover. Move longitudinal slide to the left, draw through spindle cover.



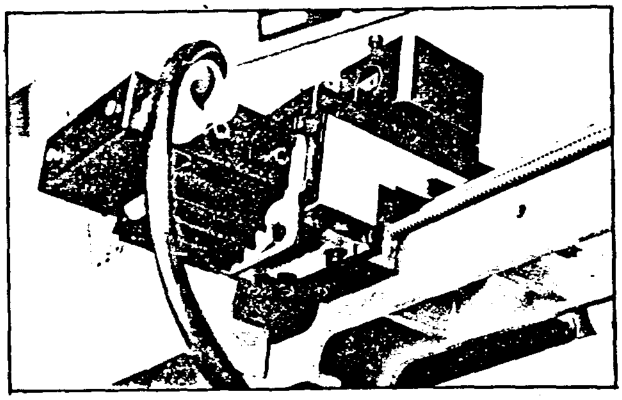
Tool to use:

Place pin into bore of belt pulley so you can turn the slide into the desired position. You manage better with a selft-constructed key.



Stud distance = 15 mm

Stud diameter = 2,5 mm



3. Unscrew tightening screws for nut carrier (flat head screw M5 x 16, DIN 91).

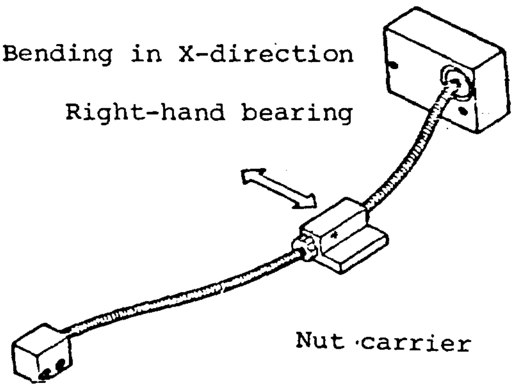
4. Unscrew tightening screws for right hand bearing. Draw through leadscrew in Z-direction. The left hand bearing is a sliding bearing.

Assembly:

The spindle can be overtightened in ± direction as well as vertically, if you are not adjusting it correctly.

Bending in X-direction

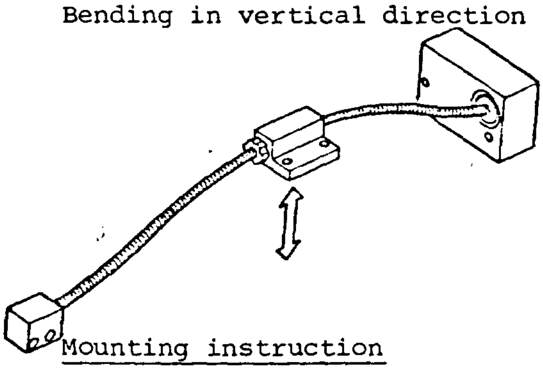
Right-hand bearing



Nut carrier

Left-hand bearing

Bending in vertical direction



Mounting instruction

1. Loosen socket head screw on left hand bearing. The bearing must be easy to move.

2. Draw in leadscrew. Tighten right hand bearing such that you can still move it by hand.

3. - Move slide to the left.
   - Position nut carrier (turn leadscrew)
   - Tighten nut carrier, but not too firmly.

4. Positioning of left hand bearing and of nut carrier:

4.1. Wind slide into left hand position. Press bearing body by hand against bed. Tighten nut body. Position nut carrier and spindle in X-direction.

4.2. Tighten left hand bearing body. Its position in vertical direction is determined by the nut carrier.

5. Positioning of the right hand bearing:

Wind slide to the right. The position of the right hand bearing in X-direction and vertical direction is determined by the position of the spindle carrier. Tighten the screws of the right hand bearing.

6. Mount spindle cover and step motor.

SUMMARY

- Position of nut carrier
  X-direction = determined by left hand bearing. Vertical direction = given

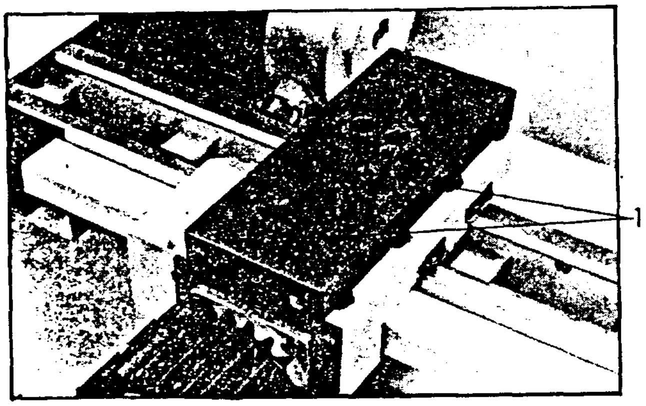
- Position of left hand bearing
  X-direction = given
  Vertical direction = determined by nut carrier.

- Position of right hand bearing
  X-direction + vertical direction = determined by nut carrier.

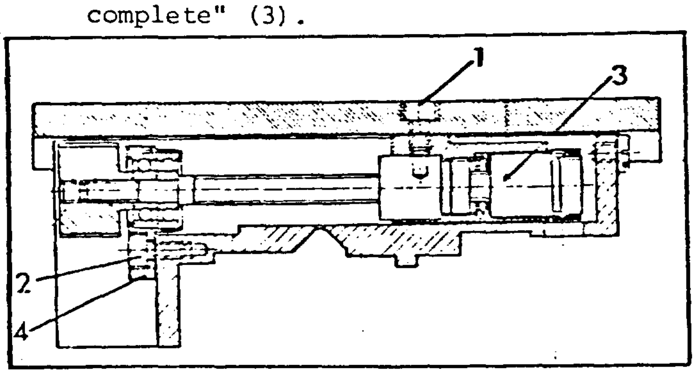
8 Exchanging the cross spindle

Dismounting:

- Unscrew toolpost plate on cross slide.
- Take off X-motor together with carrier plate.
- Unscrew socket head screws for nut carrier (1).



- Unscrew socket head screws on bearing (2), draw out "cross slide spindle complete" (3).



Mounting:

When mounting the spindle must not be bent, i.e. nut carrier and bearing must be aligned.

1. Wind nut carrier in back position, draw in "cross slide spindle complete".
2. Tighten bearing body (4), but do not tighten screws yet. The bearing body must be moveable by hand.
3. Move cross slide such that nut carrier can be tightened. Tighten nut carrier firmly.
4. Move cross slide forward. Tighten screws on bearing.
5. Mount X-motor.

9 Gibs on longitudinal slide

These gibs made of plastic (1) are under tension to keep the longitudinal slide playfree.

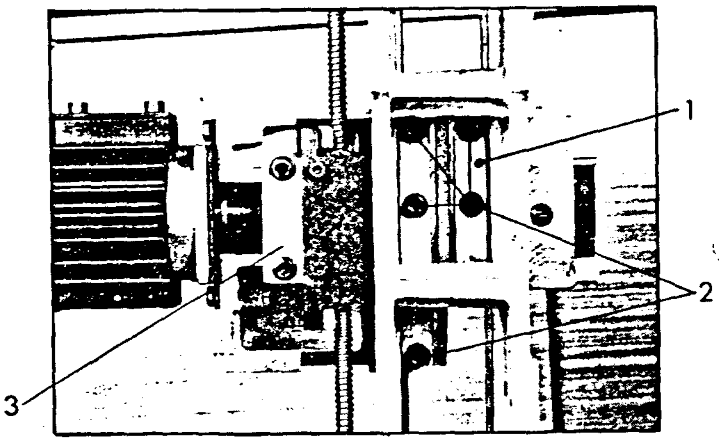
A bad surface quality of the workpiece could well be caused by worn out gibs and/or gibs where the tension is too low.

Measure 1:

Tighten socket head screws (2)
- Loosen nut carrier Z-slide
- Tighten socket head screws symetrically until longitudinal slide runs playfree, but still can be moved efficiently.

Measure 2:

Exchange of gibs
If the gibs cannot be adjusted anymore, they have to be exchanged. Since these gibs as well as the socket head screws are not easy to reach, dismount machine bed.



Dismounting of machine bed

- Uncouple couplings for main motor, X/Z motor and light barrier. Press out cables from cable clips so that cables will not be damaged when bed is lifted.

- The 2 hexagon head screws at the bed and the 2 socket head screws at the gear box have to be taken off.

- The machine bed with headstock, gear box and motor can be lifted.

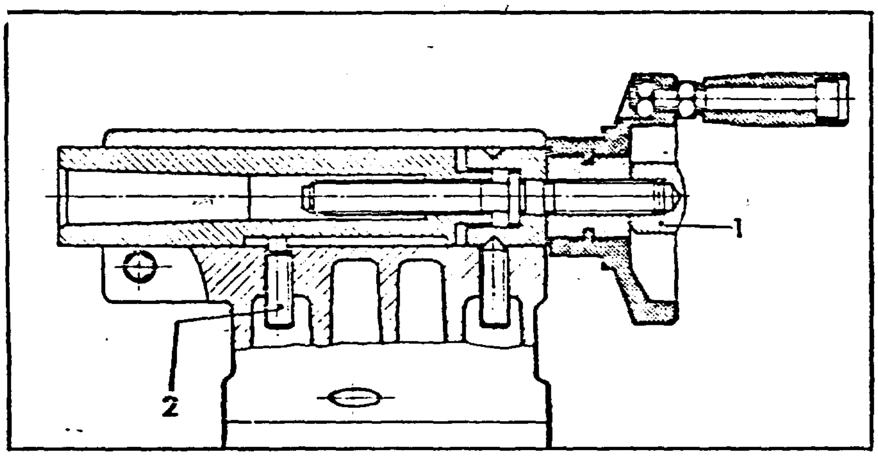
Mounting of gibs

- Loosen nut carrier Z-slide (3)

- Exchange gibs, slides have to run playfree, but it should still be possible to move it by hand efficiently.

- Mounting of nut carrier, bed and cable.

10 Tailstock



1. Adjustment, if play is too big at handwheel

Clamp tailstock barrel, loosen nut (1), adjust handwheel, tighten nut again.

2. Exchange of tailstock barrel

Protection against torsion (2) of the barrel by a glued stud bolt has to be loosened. After exchange of the barrel secure stud bolt again with "Loctite 242" or with similar material.

11 Adjustment of cross slide guidance

- Unscrew socket head screw for the nut carrier (2).

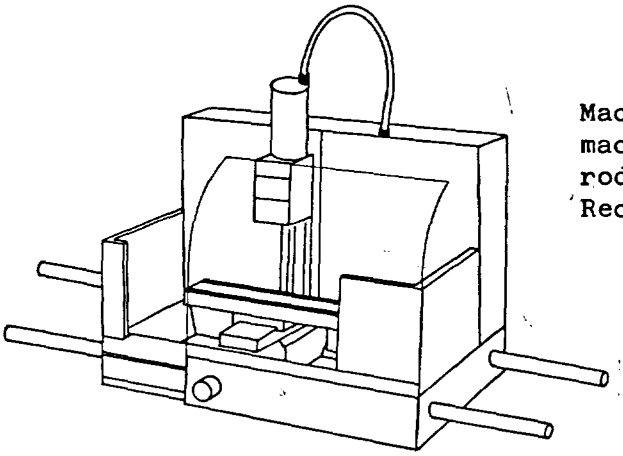
- Adjust stud bolt (5) such that slide moves playfree but does not clamp.

Chapter 12

Inspection, Maintenance, Service, Replacement, Resetting and Adjustmentwork EMCO F1 CNC mechanical, electrical

+ Transporting the machine
+ Tools for mechanical service work
+ Machines, electrical equipment and electrical box number
+ Machining aluminium, materials

Transporting the machine



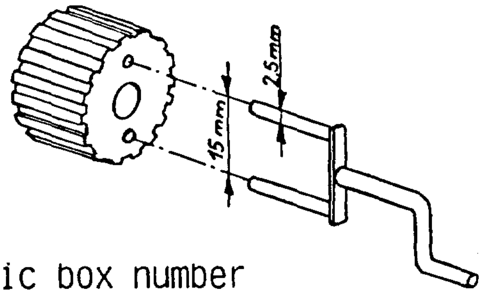
Machine weight about 120 kg. The machine should be transported with rods, maximum dia. 33 mm. Recommended length about 1200 mm.

Tools for service work

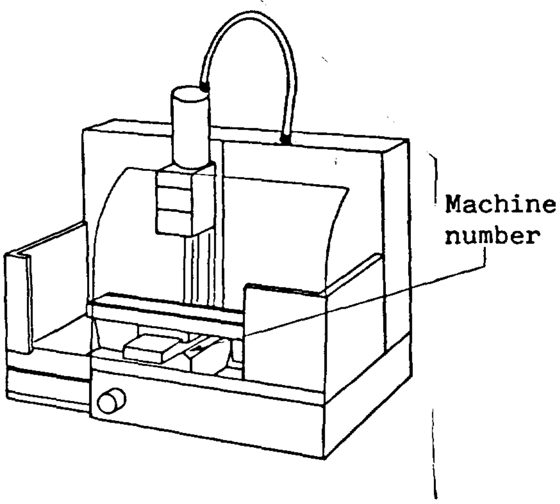
- Fork wrench size 7, 10, 13, 23
- Screwdriver 3 and 6 mm
- Cross-recess screwdriver DIN 5260, Philips size 2 and 3
- Hexagonal socket wrench size 2, 3, 4, 5 (2.5. for pc-board exchange)
- Round files
- Dial gauge for setting the slide clearance

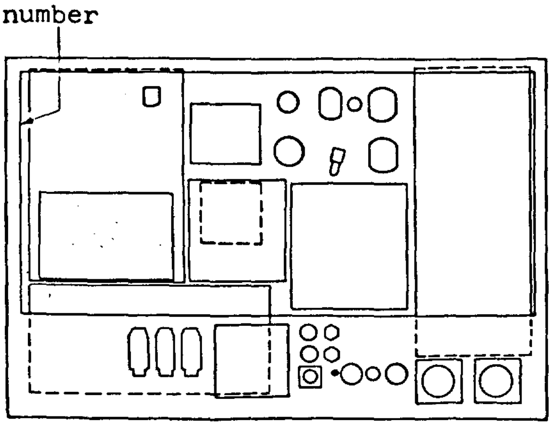
Note: Special tool:

To turn the spindles, insert a stud in the bore. We recommend the use of a self-produced journal key.



Machine, electrical equipment and electric box number





Machining aluminium,materials

When cutting aluminium, only use easy to cut materials.

With material which cannot, or are difficult to cut, jerking, poor surface quality and the formation of built-up cutting edges can occur.

Cuttable types of aluminium:

Frequent trade designation: Torradur B, material number 3.1645.51, material designation Al Cu Mg Pb F 38, or a material which has similar good cutting properties.

Cutting tools:

The geometry and quality of the tool are major factors for the cutting behaviour.

Use the correct cutter for the particular materials.

A) Inspection, Maintenance

1. Lubrication

1.1 Guides

Guideways of longitudinal, transverse and vertical slides should be greased daily with a forced feed lubricator (one lubrication nipple on the vertical slide, two lubrication nipples to the left, below the longitudinal slide).

Oil quality:

Pressure absorbing, corrosion protecting oil with stick-slip reduced characteristics.

73 mm/sec. (cSt) at reference temperature 40°C.

e.g. CASTROL MAGNA BD 68
This oil complies with Cincinnati Milling Specification P 47.

1.2 Spindle bearing and spindles

Feed spindles X, Y, Z:

The spindles fitted in the machine are greased for life.

Where a new spindle is fitted, this must be greased.

Main spindle bearing:

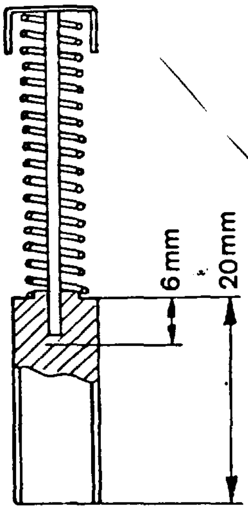
The fitted main spindle bearing is greased for life.

Where the main spindle bearing is replaced, both covers must be covered with depot grease (about 4 cm^3), whilst both tapered roller bearings must be greased.

Grease quality:

Grease spindles and main spindle bearings with Klueber Special Grease ISOFLEX LDS 18 SPECIAL A, or a smilarly good grease quality.

2. Inspection of the main motor carbon brushes



Disconnect the mains plug, prior to inspection of the carbon brushes.

Worn carbon brushes damage the armature laminations, and can destroy the main spindle pc-board due to excessive brush sparks.

<u>Inspecting the carbon brushes</u>

<u>Interval:</u> Every 100 operating hours.

A new carbon brush has a length of about 20 mm. The carbon brush must be replaced, at the latest, when the remaining length is about 6 mm.

Uneven wear is a typical characteristic of a direct current permanent motor that turns in one direction.

Exchange the unevenly worn carbon brushes insofar as they still have sufficient length.

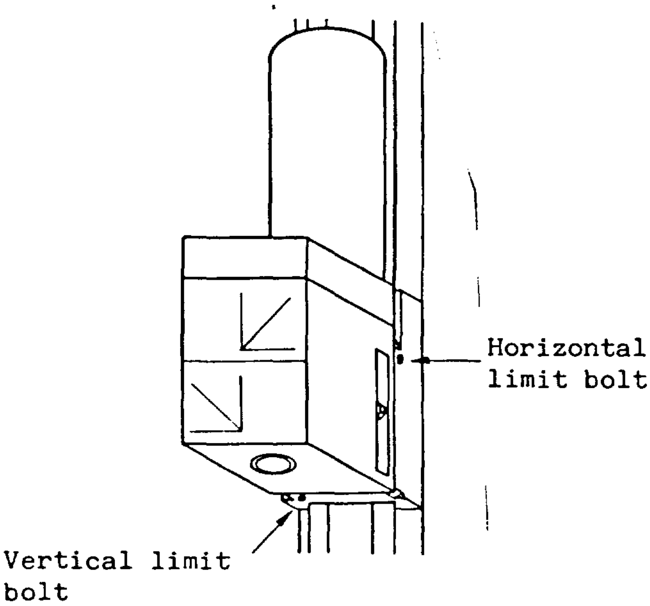
3. Readjustment of the milling head limits

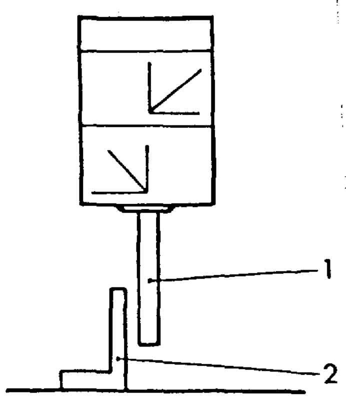
Where the milling head is improperly swivelled at the limits, deformation of the limit bolt can occur. The limit can be readjusted.

<u>Readjustment:</u>

Clamp a mandrel (1) in the collet, and measure angularity with gauge or angle (2).

Reset the limit bolt accordingly.





B) Service, Replacement, Resetting and Adjustment work

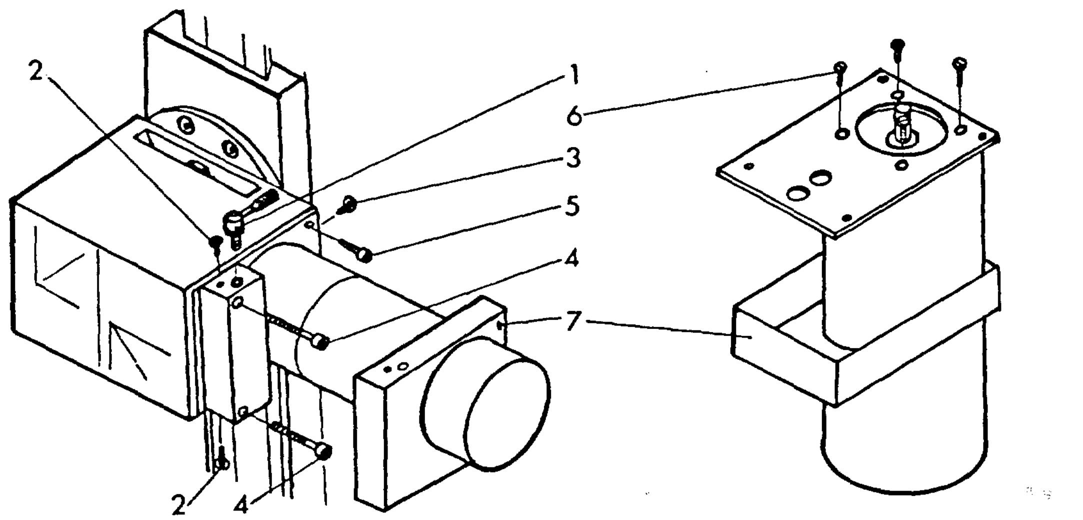
Note:

Disconnect the mains plug, prior to all service, replacement, resetting and adjustment work (possible accident danger and damage to electronic components).

1. Removal and Installation of the Main Motor

1.1 Disassembly

+ Remove back panel.
+ Unscrew the cable screw plate and unscrew the cable screw union.
+ Seal contacts, unthread cable and remove hose.
+ Unscrew lever (1) (anti-clockwise thread).
+ Unscrew both the front oval-head screws (2).
+ Swivel milling head into the horizontal position.
+ Unscrew both the rear oval-head screws and withdraw the cover (7).
+ Unscrew both the front hexagonal socket screws of the eccenter block (4).
+ Unscrew both the rear hexagonal socket screws (5) of the motor plate, remove the motor with motor plate.
+ Unscrew the 4 countersunk screws (6) from the under side of the motor plate.
+ Remove the cover (7) from the motor.



1.2 Assembly

+ Milling head in the horizontal position.
+ Place cover (7) on motor.
+ Assemble motor plate on motor.
+ Place belt on pulley.
+ Place motor with motor plate and belt held on milling head. Tensioning force for tensioning the main motor belt 6.5 kp (65 N).
+ Screw the motor plate tightly with the two rear hexagonal socket screws.
+ Attach eccenter block and screw down.
+ Screw on cover (7).
+ Swivel milling head back to vertical position, screw the lever and milling head tightly.
+ Install cable of the motor, thread on hose, screw on cable screw unions, fit cable screw plate and re-connect the contacts.
+ Install the back panel.

B) Service, Replacement, Resetting and Adjustment work

Note:

Disconnect the mains plug, prior to all service, replacement, resetting and adjustment work (possible accident danger and damage to electronic components).

1. Removal and Installation of the Main Motor

1.1 Disassembly

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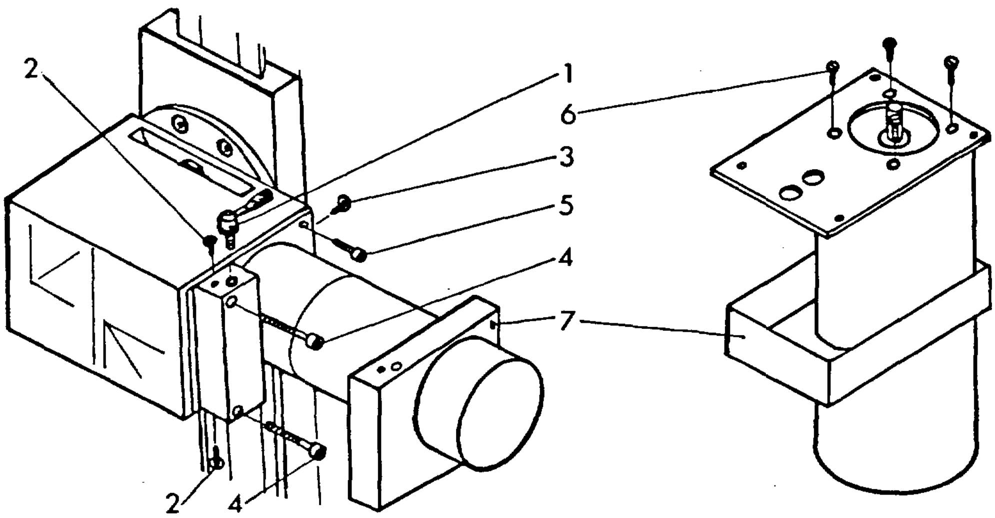

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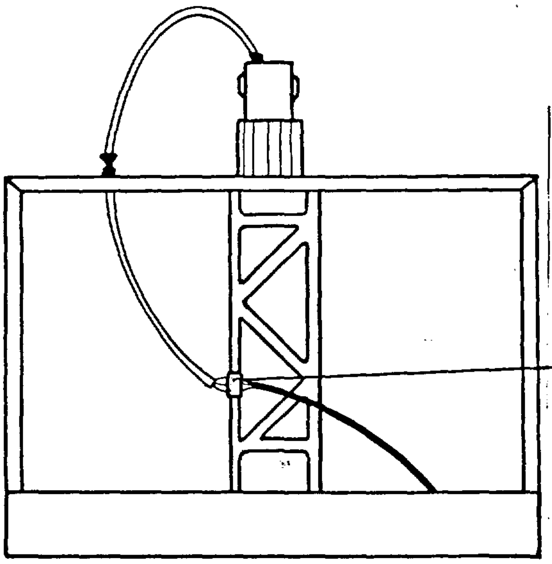
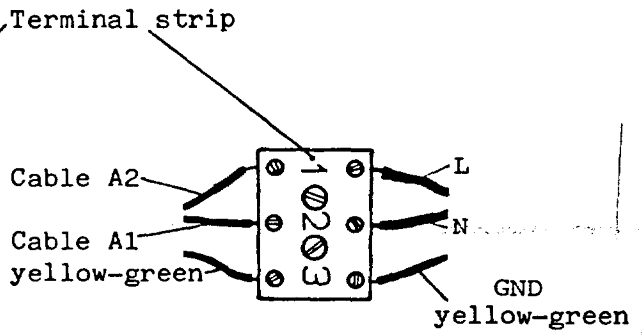
+ Attach eccenter block and screw down.
+ Screw on cover (7).
+ Swivel milling head back to vertical position, screw the lever and milling head tightly.
+ Install cable of the motor, thread on hose, screw on cable screw unions, fit cable screw plate and reconnect the contacts.
+ Install the back panel.

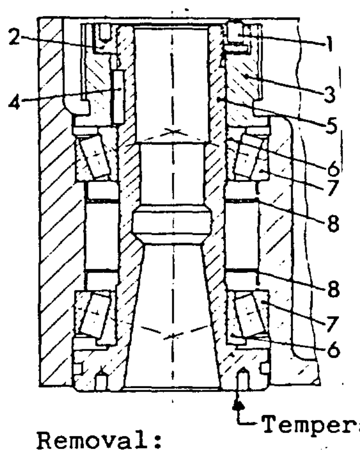
Electrical connection of the motor



+ Back panel removed.
+ Install cable.
+ Screw on cable screw unions.
+ Connect cable of main motor.
+ Install back panel.



2. Changing the main spindle bearing



Removal:

+ Remove main motor.
+ Unscrew threaded stud (1).
+ Unscrew annular nut (2).
+ Remove pulley (3).
+ Remove feather key (4).
+ Punch out the spindle (5) downward (with plastic hammer).
+ Remove inner bearing rings (6) and external bearing rings (7).

Greasing the bearings

Half fill the 2 covers with grease (depot grease, amount about 4 cm^3).
Grease taper roller bearings.

Grease quality:

Use Klueber Special Grease ISOFLEX LDS 18 SPECIAL A or a similar grease quality.

Installation:

+ Top up the depot grease (quantity 4 cm^3) of the bearing cover (8).
+ Press in outer bearing rings (7) in milling head.
+ Press lower inner bearing ring (6) on spindle.
+ Insert spindle and press on upper inner bearing ring (6).
+ Fit feather key (4).
+ Attach pulley (3)
+ Tighten annular nut (2).
+ Adjust the annular nut (2) until the main spindle bearing is tensioned, free of clearance.
  (hit the main spindle with a plastic hammer to prevent tensioning of the spindle and permit clearance-free pretension.)
+ Tighten threaded stud (1).
+ Carry out trial run and check rise in temperature.

Carry out trial run:

Allow motor to run for 15 minutes at 2000 rpm. Temperature should not be higher than 45 - 50°C.
At higher temperatures, the bearing will be excessively pretensioned.

3. Replacing the step motors

The step motor group is identical for the X, Y and Z axis (F1A 103 000).

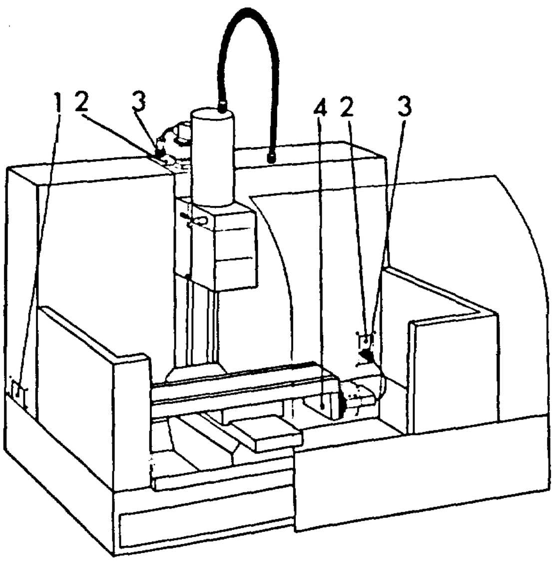
The cable screw union is threaded (for the Y motor, the threaded cable screw union is functionless).
The motor pc-boards are not a part of the step motor group.
A fall brake is additionally fitted on the assembled Z step motor, so that the milling head remains in position, when the step motor is powerless (without it, brake slippage of the milling head is possible).

This brake device must be fitted when a new step motor (see Z motor assembly) is installed.

Note:

Disconnect the mains plug prior to disassembly.

3.1 Removing the step motor



Unscrew the back panel, remove the cable plug, dismantle the leading plate (1), open clip, open cable covering.

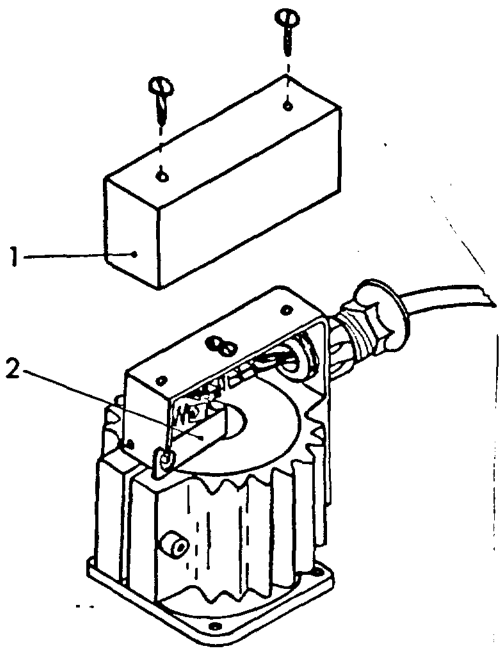
Disassemble the particular plate for cable screw union (2). Unscrew the cable screw union for X, Z motor (3).

Removing the motors

To simplify assembly, remove motor with motor plate. Then unscrew motor from motor plate.

To simplify assembly on the X-motor, previously remove the belt protection (4).

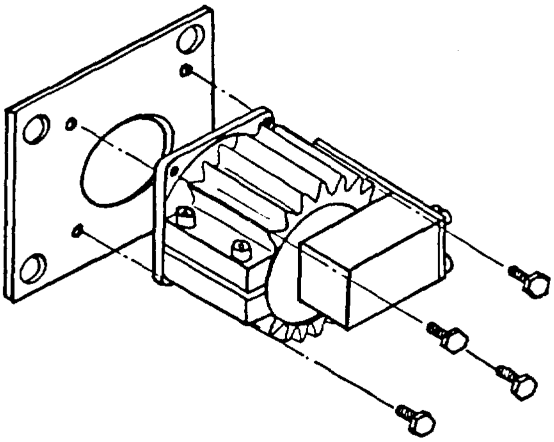
3.2 Assembly of the step motor motors X, Y, Z



On the Z motor:
Initially for the fall brake.

Fitting the fall brake

+ Unscrew the cover (1) from the defective Z motor.
+ Remove the fall brake (2).
+ Unscrew cover from the new motor.
+ Fit fall brake (2) in new Z motor. Screw the cover on again.



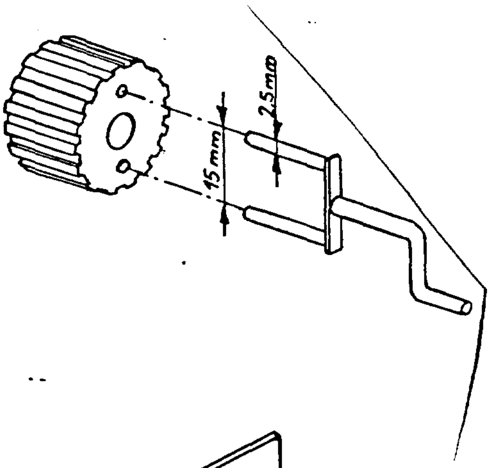
+ Screw motor plate on to the new motor.
+ Attach belt, and screw motor to motor plate. Do not tighten the screws as yet.

Tightening the belt

+ Pressure on motor for belt tensioning: 3 kp (30 N). Where the belt is subjected to excess tension, accelerated wear is produced. With inadequate tension, the belt will jump over the gearing - the gearing will shear off, tearing is the consequence.
+ Tighten the screws.
+ Fit belt cover on X motor.
+ Fit cable screw union and plate for cable screw union on X, Z motor.
+ Lay cable in cable cover and close cable cover.
+ Fit clip.
+ Fit back panel.

4. Replacing the X-, Y-, Z-spindles

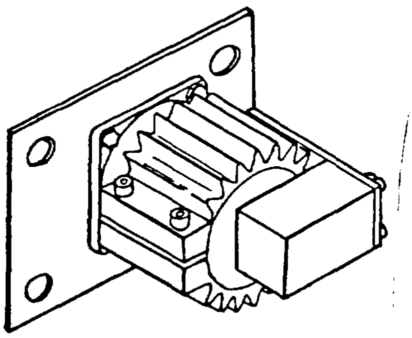
The spindles are only replaced as a group. The group consists of the spindle, nut mount, bearing pedestal and pulley (see Spare Parts List). With the bearing and mounting, ensure that the spindles are not bent. The recirculating ball ways of the nut mount are set in the works.



Note on special tool:

To turn the spindles, insert a stud in the bore. A self-manufactured journal key is more suitable.

Under no circumstances may the spindles be screwed on by the nuts, since this will cause the balls to fall out.

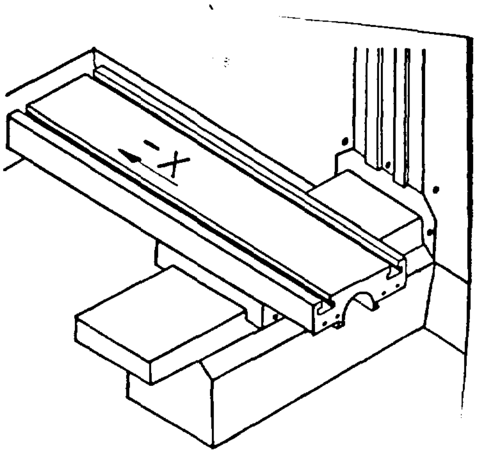


Removal:

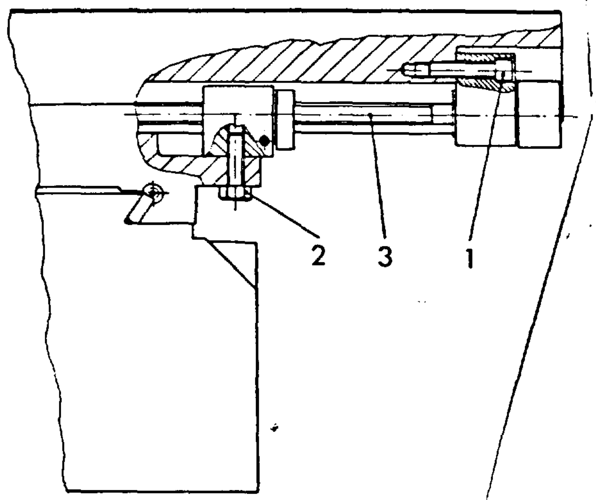
General:

Dismantle the particular step motor with the motor plate. On the X step motor, additionally dismantle the belt protection first.

4.1 Removal of the X spindle



To simplify spindle disassembly, traverse the X slide as far as possible in the X direction.

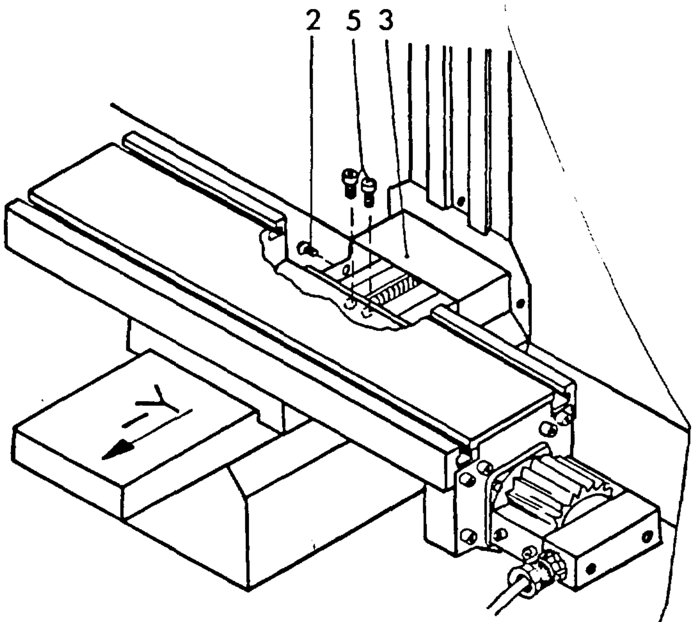


+ Unscrew the cheese-head bolts M5 x 25 (1) on the bearing pedestal.
+ Unscrew the hexagonal bolts M6 x 12 (2) for the nut mount.
+ Withdraw the spindle (3).

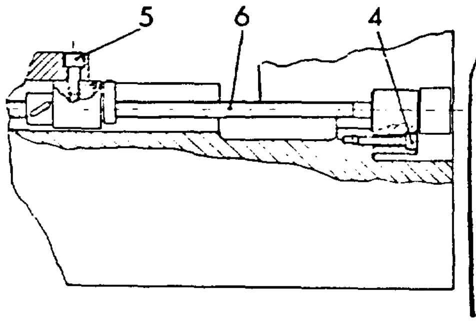
4.2 Removal of the Y spindle

Note:

To simplify spindle disassembly, traverse the Y slide as far as possible in the Y direction.



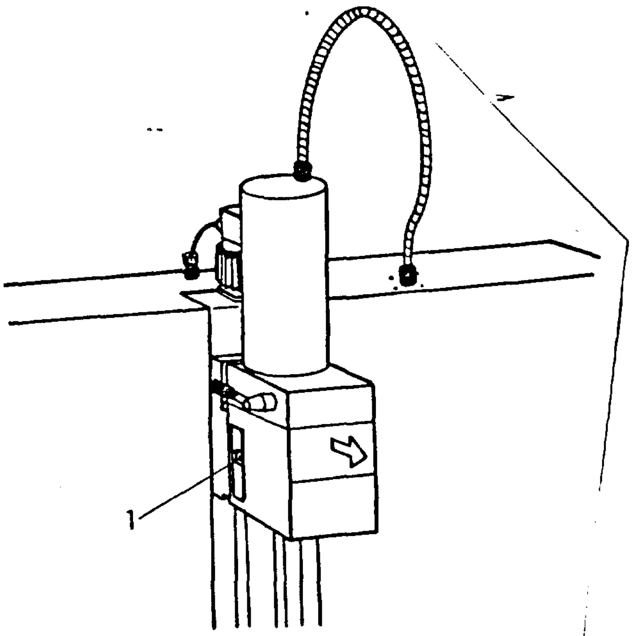
+ Remove back panel.
+ Unscrew the oval-head bolts M6 x 10 (2) for protective sheet 2 (3) and push back the protective sheet.
+ Unscrew the cylinder bolt M5 x 25 (4) on the bearing pedestal.
+ Unscrew the cheese-head screws M6 x 12 (5) for nut mount.
+ Pull out spindle (6).



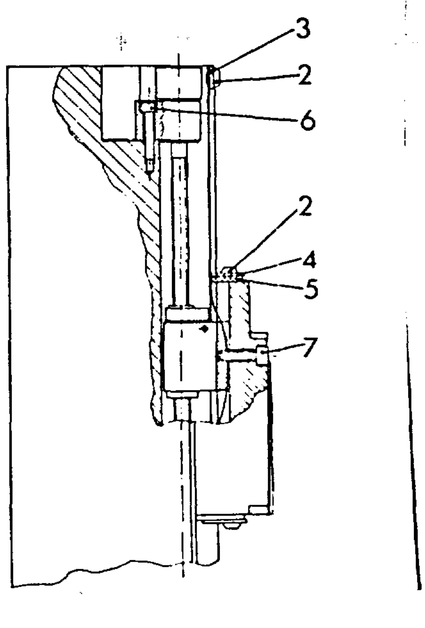
4.3 Removal of the Z spindle

Note: When the step motor of the Z spindle is removed, the vertical slide could slip away (the ball circulating spindles are not self-locking).

For this reason, securely support the vertical slide in the upper position, prior to disassembly of the step motor (also installation aid).



+ Disassemble the milling head with main motor (unscrew the hexagonal nuts M8 (1) and pull off the milling head).
+ Deposit the milling head so that no damage can occur.



+ Unscrew the oval-head bolts M6 x 10 for holding plate 2 and remove the holding plate (3).
+ Unscrew the oval-head bolts M6 x 10 for scraper plate (2) and remove the scraper plate (4) with scraper felt (5).
+ Unscrew the cheese-head bolts M5 x 25 (6) for bearing pedestal.
+ Unscrew the cheese-head bolts M6 x 20 (7) for nut mount and pull out the spindle.

4.4 Installation of the spindles

Prior to installation, grease the spindles with Klueber ISOFLEX LDS 18 SPECIAL A, or a similar quality product.

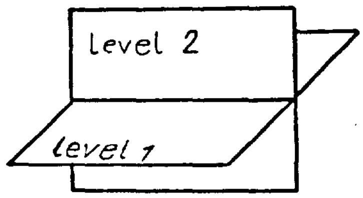
Installation of the spindles

The spindles may not be tensioned during installation.

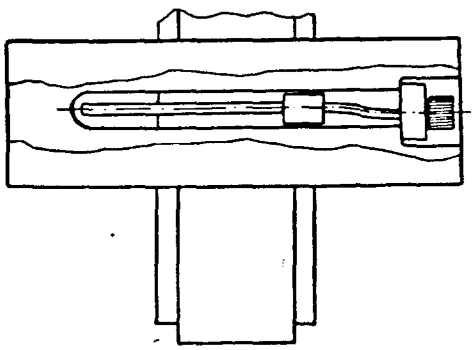
Consequences of tensioned spindle installation

Rapid wear, damage (the balls break out).

Possibilities of tensioning with the X spindle as an example

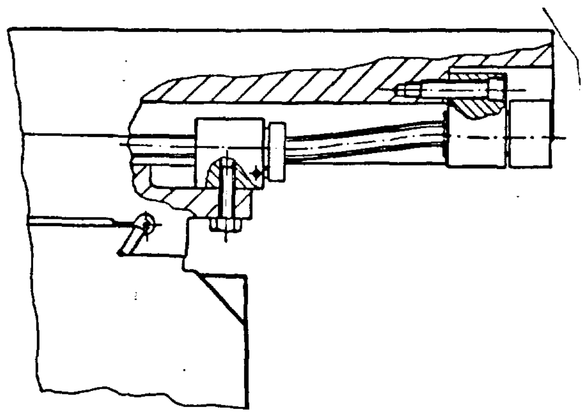


Tensioning in level 1
(plan view)



Spindle side tensioned

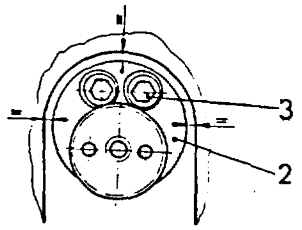
Tensioning in level 2
(front elevation)



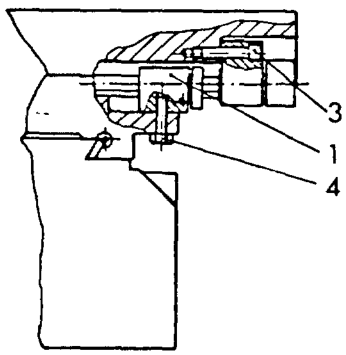
Spindle tensioned at elevation

To prevent tensioning of the spindles during installation, the following procedure generally applies

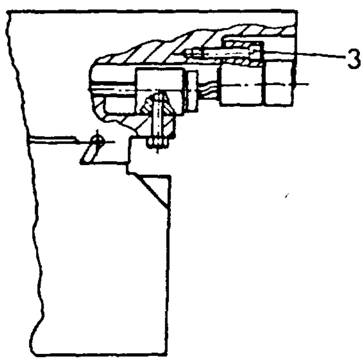
(X spindle example)



+ Thread spindle, screw bearing pedestal (2) with cheese-head bolts M5 x 25 (3) firmly, so that it is centrically placed in the milling out.



+ Screw the nut mount (1) with the hexagonal bolts M6 x 12 (4) firmly.
  Move slide or adjust nut mount so that it can be fastened with the hexagonal bolts.
+ Crank the slide completely to the right.
  Keep the distance between the nut mount - bearing pedestal, as small as possible.



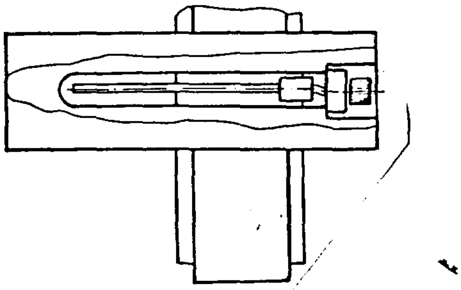
It is now possible that the spindle is tensioned in the elevation (level 2).

Remedy:

+ Loosen the bearing pedestal hexagonal socket head screws (3), which will cause the spindle to align itself in level 2.

  Retighten the cheese-head bolts (3) of the bearing pedestal.

Plan view



Possibility:

Spindle tensioned in Level 1

For this reason:

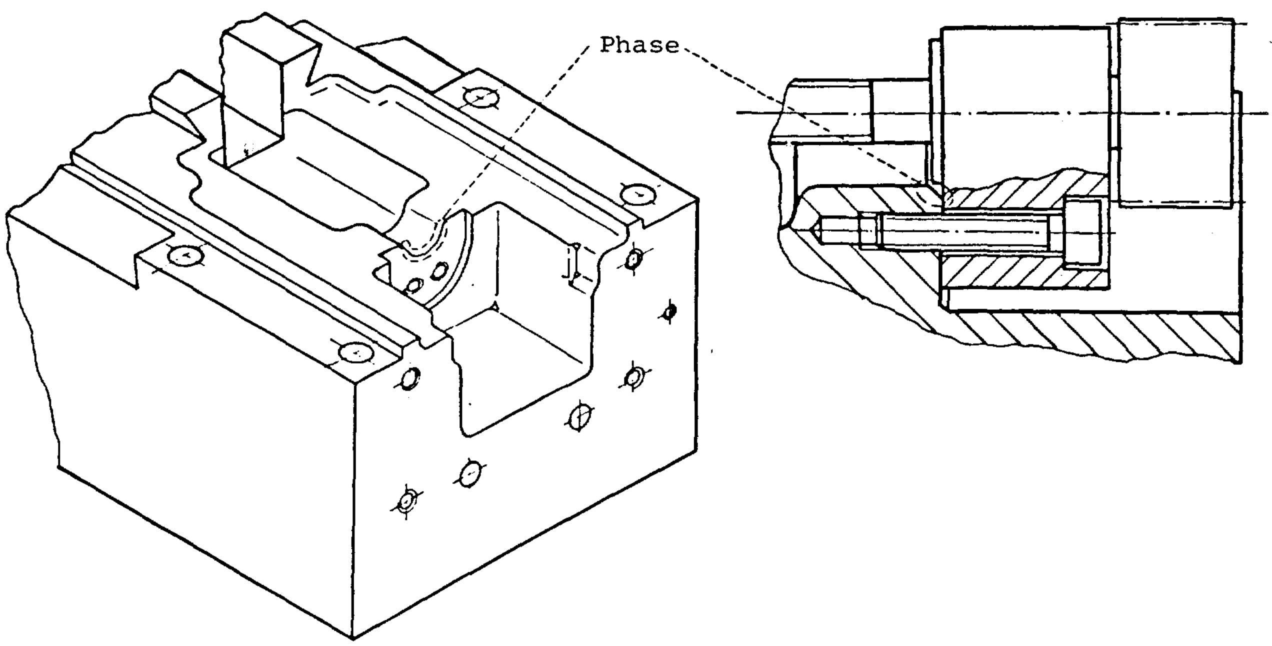
+ For safety, again loosen the bolts of the nut mount and then retighten.
  (possible tensioning of the spindle in Level 1)
+ Refit the other removed parts.

Note:

When fitting the Group Y spindle, the new spindle bearing may project at the semicircular edge. In this case, file the phase.

Reason: The spindle bearing was subsequently improved (more rigid spindle bearing).

Accordingly, the design has become larger. Replacement spindles are only supplied in the more rigid version.



5. Readjustment of the slide clearance

+ Readjust the slide guides after extended use.
+ The wear of the guides on the X, Y, Z slides can differ considerably, since the load normally differs on the slides.
+ Slides with excessive clearance, can cause jerking during machining.
+ The clearance is set with two taper gib strips each per slide.

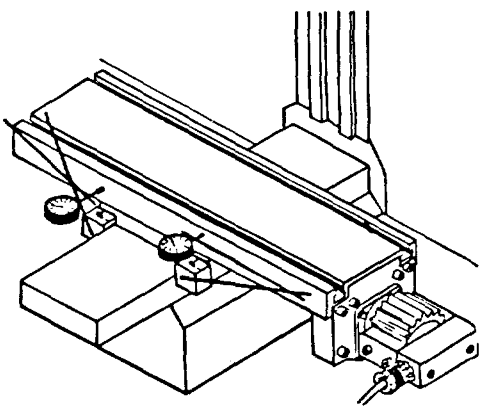
Checking the guide clearance of the X, Y, Z slide

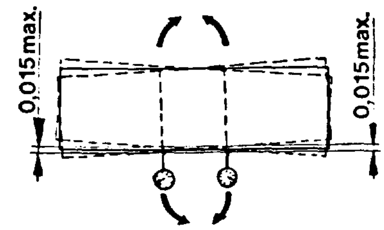
Structure of the gauge:

The slide clearance is measured on both sides of the particular slide, and should not exceed 0.015 mm. During clearance measurement, the slide is swivelled to and fro at the particular measuring point, with a swivel force of 100 N (10 kp).

a) X slide

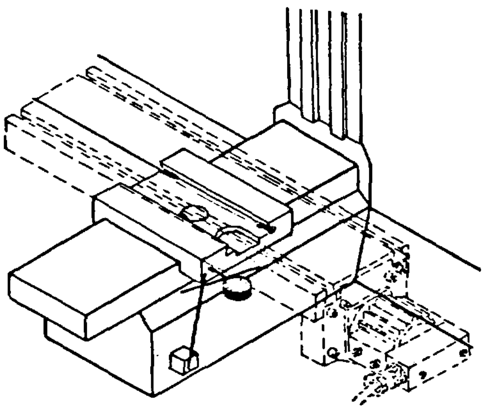
Gauge on Y slide
(If the gauge were fixed to the base, the Y clearance would also be measured)

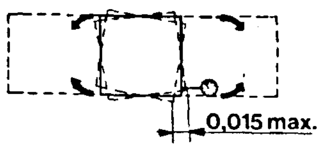




b) Y slide

Gauge on base

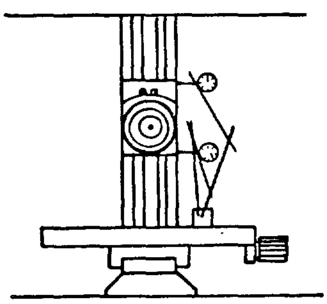


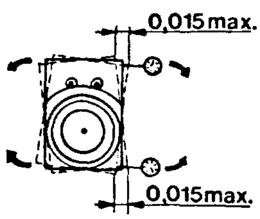


The gauge is only applied at the front, since the slide is guided at the rear by scraper felt.

c) Z slide

Gauge on measuring table (remove milling head)

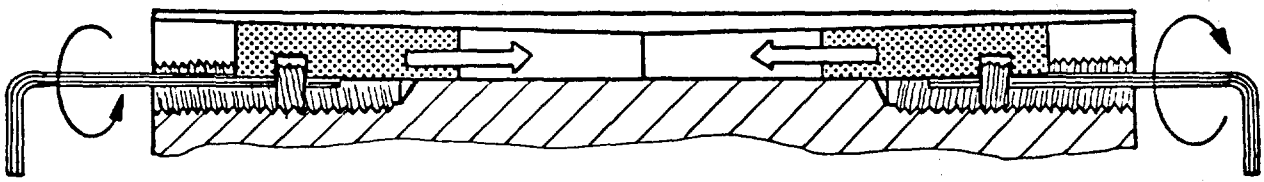




Readjusting the taper gib strips

The slide clearance is readjusted with the appropriate taper gib strips on the slide.

The guide way of the taper gib strip, as well as the taper gib strip, are conical.
By screwing in the tapped stud (size 2.5), the taper gib strips are moved in the direction of the arrow.
The clearance is reduced.



Process:

Readjust the tapped stud slightly.
Measure the slide clearance with a gauge.
Repeat process until the measurement obtained is 0.01 to 0.015 mm.

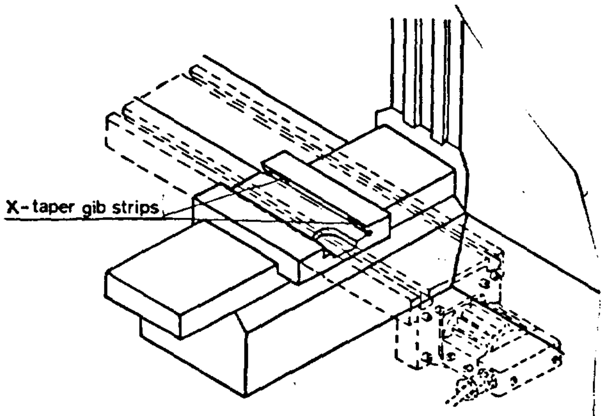
Attention:

Where the taper gib strips are excessively readjusted, the table will be clamped or will be very difficult to move.

The torque of the step motor could then be inadequate for traversing the slide. The step motor could lose the steps (feed force of the step motor is about 1000 N (100 kp).

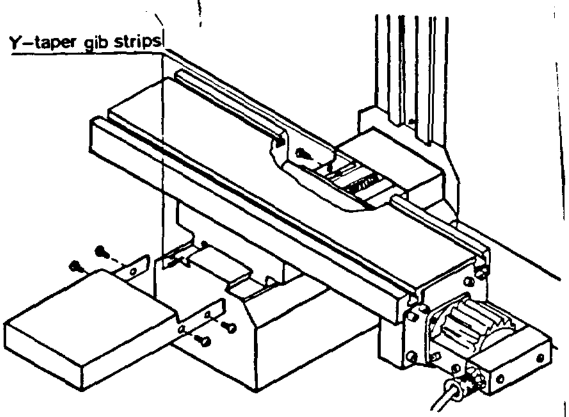
For this reason, unscrew the slide from the appropriate nut mount, and move slide backward and forward by hand (see page 6.18).

Position of the taper gib strips



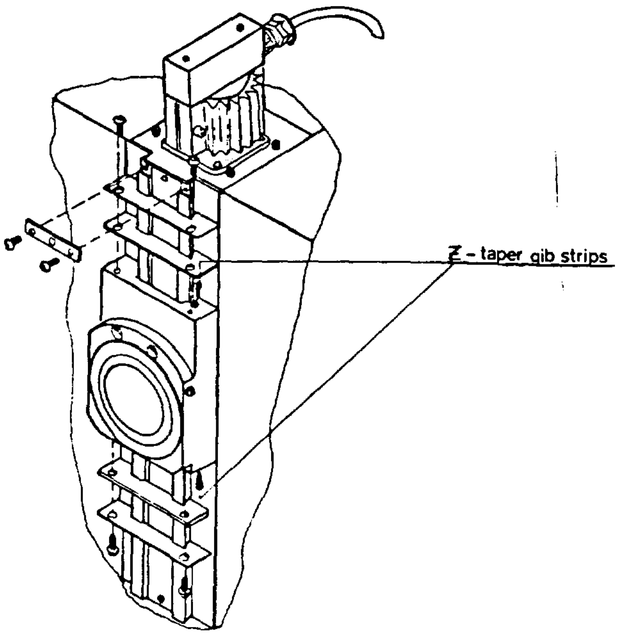
X taper gib strips

The taper gib strips on the X slide are freely accessible.



Y taper gib strips

Remove protective plates 1 and 2.

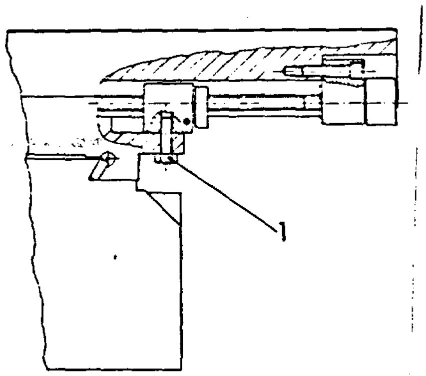


Z taper gib strips

Remove the scraper plates and scraper felts on both sides of the slide.

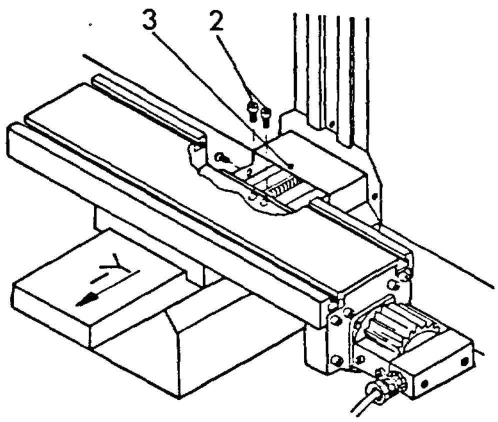
Removing the nut mount for manual movement of the slide:

To measure the slide clearance, unscrew the slides from the nut mount. Move the slides to and fro by hand. The movement force should not exceed 150 N (15 kp).



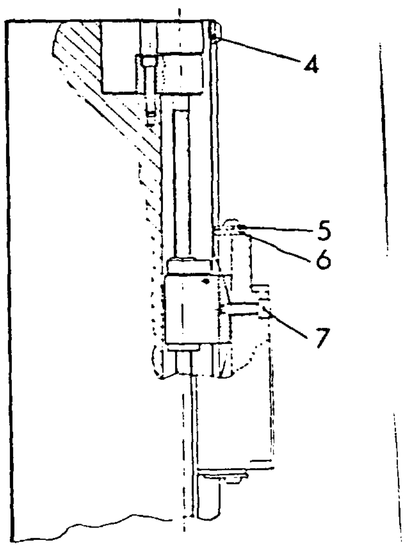
X slide:

Unscrew both hexagonal bolts M6 x 12 (1).



Y slide:

Remove the protective plate 2 (3) and unscrew the hexagonal socket screw of the nut mount (2).



Z slide:

Remove mounting plate (4), scraper plate (5) and scraper felt (6), and then unscrew both hexagonal socket screws of the nut mount (7). (Support Z slide!)

6. measuring the reversal clearance

In addition to the slide clearance, the reversal clearance is important for operating accuracy.
The reversal clearance arises when traversing the slide, e.g. + direction to - direction.
In this case, the control indicates a traverse path, however the slide does not actually traverse (dead path).
The reversal clearance is measured about 5 - 30 mm prior to both the limit positions of the particular slide, and should not exceed 0.08 mm.

Measuring the reversal clearance

+ Fasten gauge with magnetic base.
+ Move slide to gauge.
+ Set gauge at 0.
+ Set display at 0.
+ Move slide about 1 - 2 mm toward the gauge (gauge and display indicate the same traverse path).
+ Move slide with control back to 0.
+ Read off difference (= reversal clearance) on the gauge.
+ Repeat process for the other limit position of the particular slide.

Attention: Relationship slide clearance - reversal clearance

The stronger the setting of the guide strips, the smaller the slide clearance will be, and the larger the reversal clearance.

Accordingly, the slide clearance and reversal clearance must be jointly adjusted. The particular tolerances for slide clearance and reversal clearance, must not be exceeded.

Adjusting the reversal clearance:

By loosening the taper gib strips, the reversal clearance can be reduced (this will enlarge the slide clearance).

Where the reversal clearance remains the same, despite loosening the taper gib strips, check the pretension of both the ball reversal bearings of the nut mounts of the particular spindle.

Setting the ball circulation bearing pretension of the nut mount:

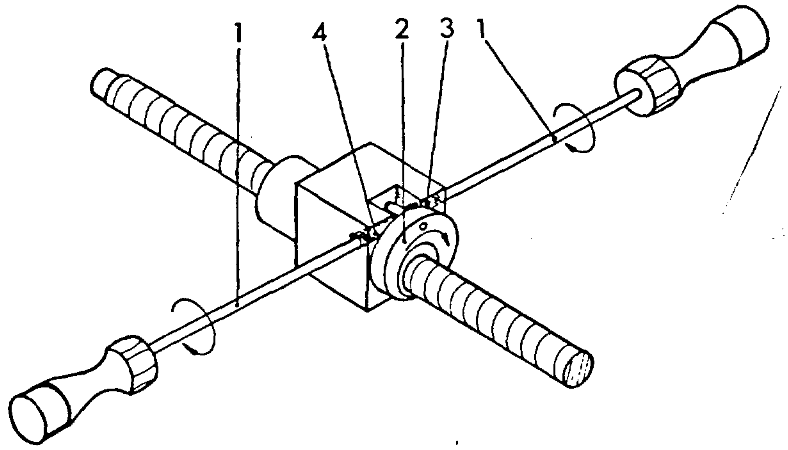
By clockwise rotation of the setting ring (2), the ball circulation bearings are given stronger pretension.

To adjust the ball circulation bearings, complete removal of the spindle unit is required.

However, this setting will hardly be required, since no wear occurs and the pretension is set in the works.

Procedure:

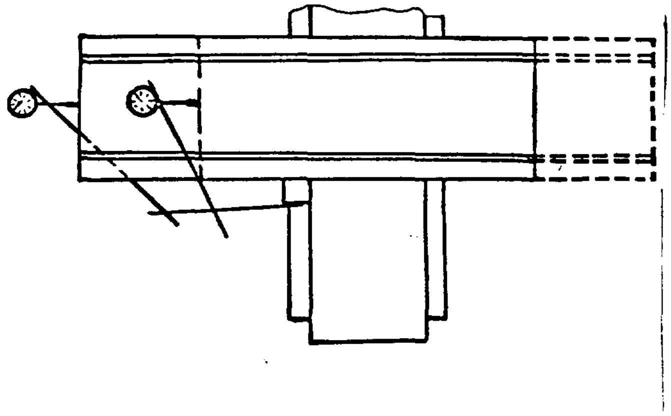
+ Unscrew the tapped stud (3) with screwdriver size 3 (1).
+ Screw in the tapped stud (4) with screwdriver size 3 (1). This will turn the setting ring (2) in the direction of the arrow.
+ Retighten the tapped stud (1) (position locking of the setting ring).



Attention:

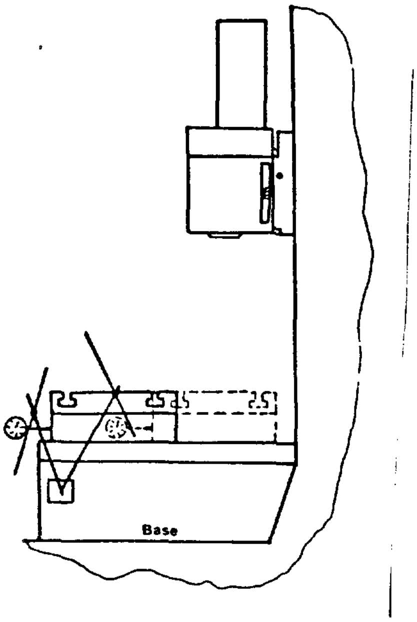
With excessive resetting of the setting ring, breakage of the balls in the ball circulation bearings can occur.

Assembly of the gauge for measuring the reversal clearance of the slide



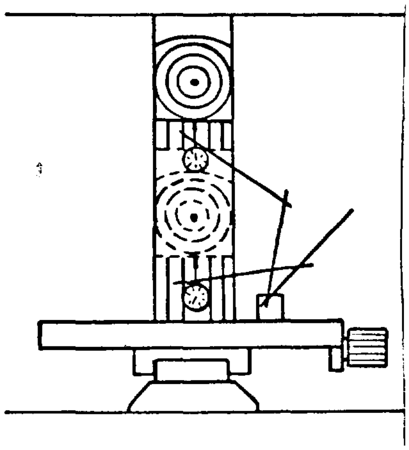
X slide

Gauge on the Y slide



Y slide

Gauge on the base



Z slide

Gauge on the table

7. Seizure of the tool

Seizure of the tool

Cause:

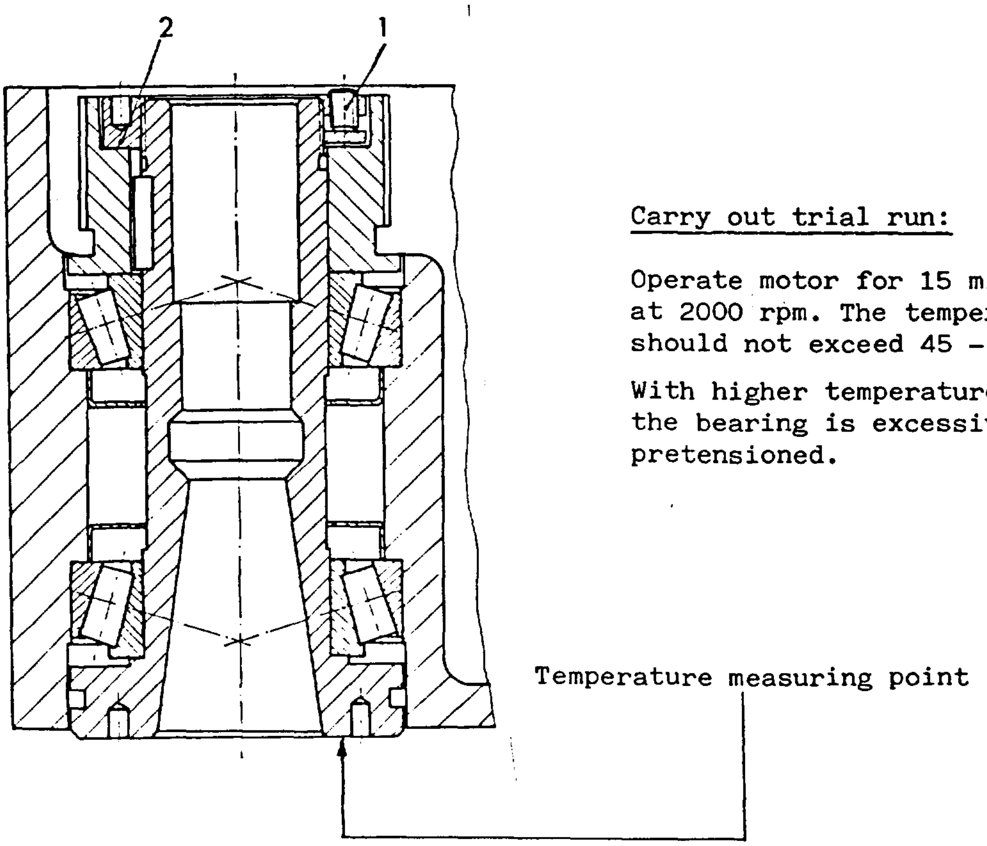
+ Excessive thermal expansion (the spindle bearing may be excessively pretensioned).

Remedy:

+ Allow tool to cool (possibly cool with compressed air).

Reduce the bearing pretension:

+ Remove main motor.
+ Loosen tapped stud (1).
+ Slightly loosen the annular nut (2).
+ With a plastic hammer, gently tap on the spindle (so that the excessively pretensioned bearing relaxes slightly).
+ Retighten the tapped stud (1).
+ Refit the main motor.
+ Carry out trial run.



Carry out trial run:

Operate motor for 15 minutes at 2000 rpm. The temperature should not exceed 45 - 50°C.

With higher temperatures, the bearing is excessively pretensioned.

Chapter 13

Wiring diagrams, flow diagrams Compact 5 CNC / F1 CNC

COMPACT 5 CNC with New Software Package (CPU-A6C 114 003)

Summary

More G-Functions

G90 [illegible]

G91 [illegible]

G92 [illegible]

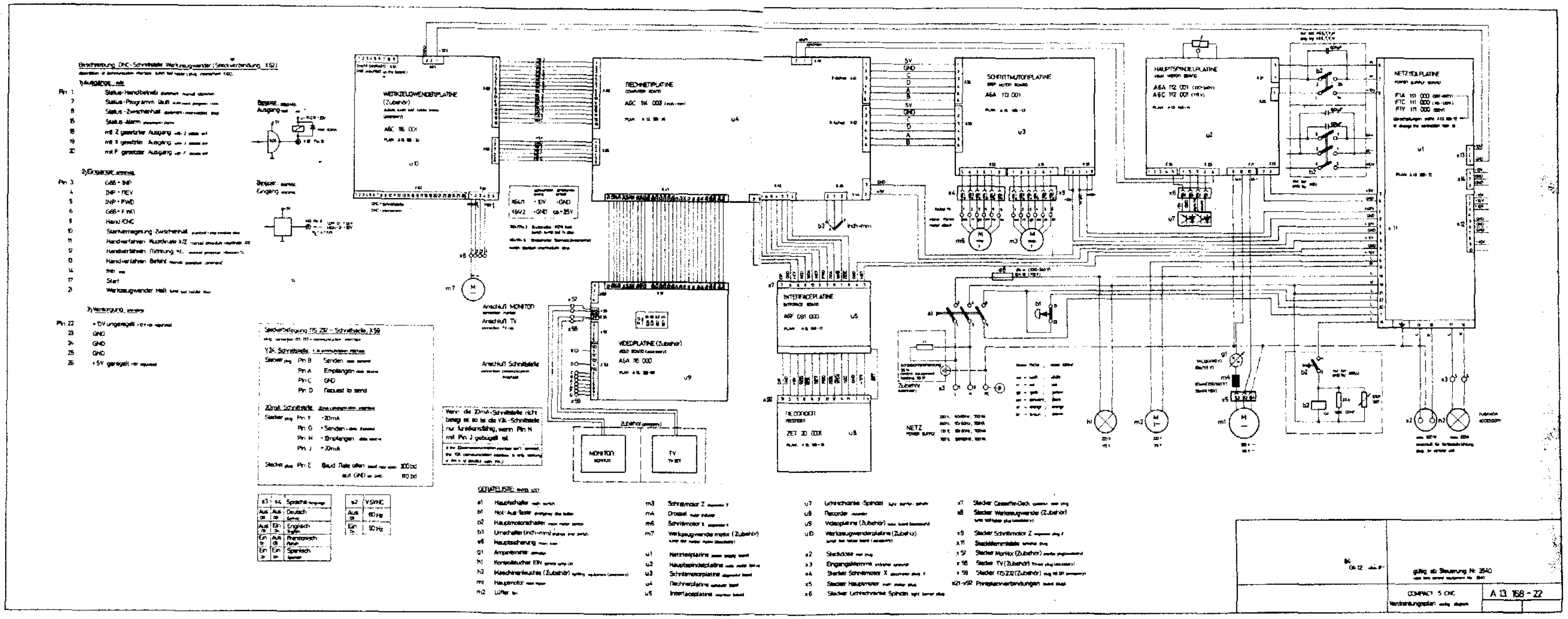
[illegible]

More Memory and Computer Functions

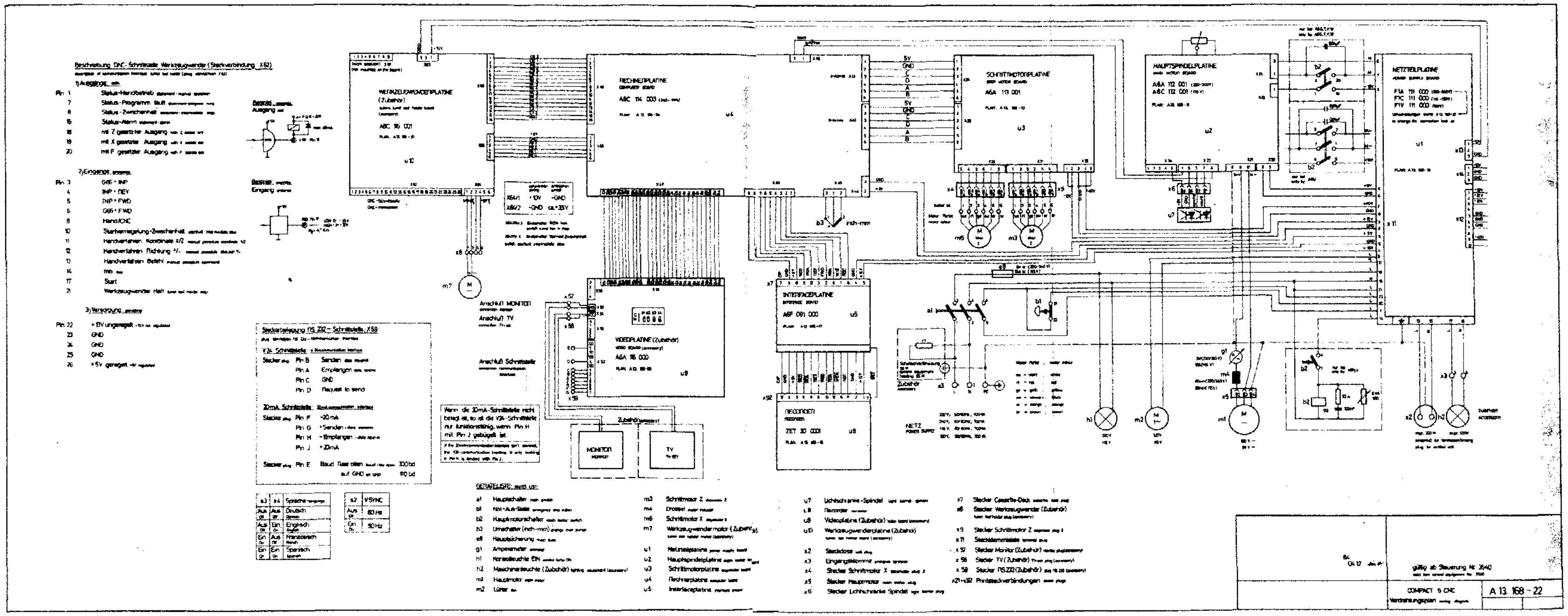
[illegible]

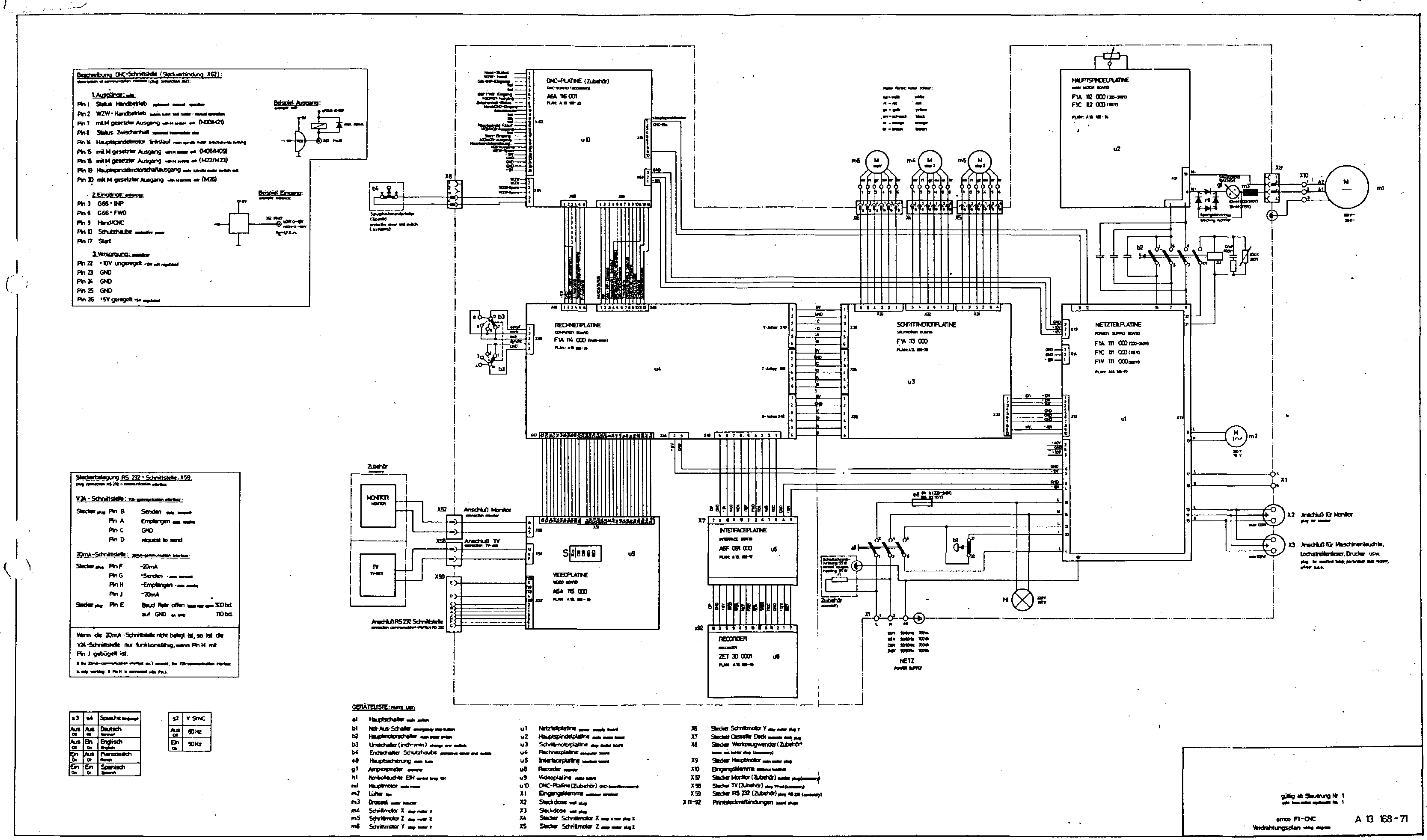
Additional Facilities [illegible]

[illegible]

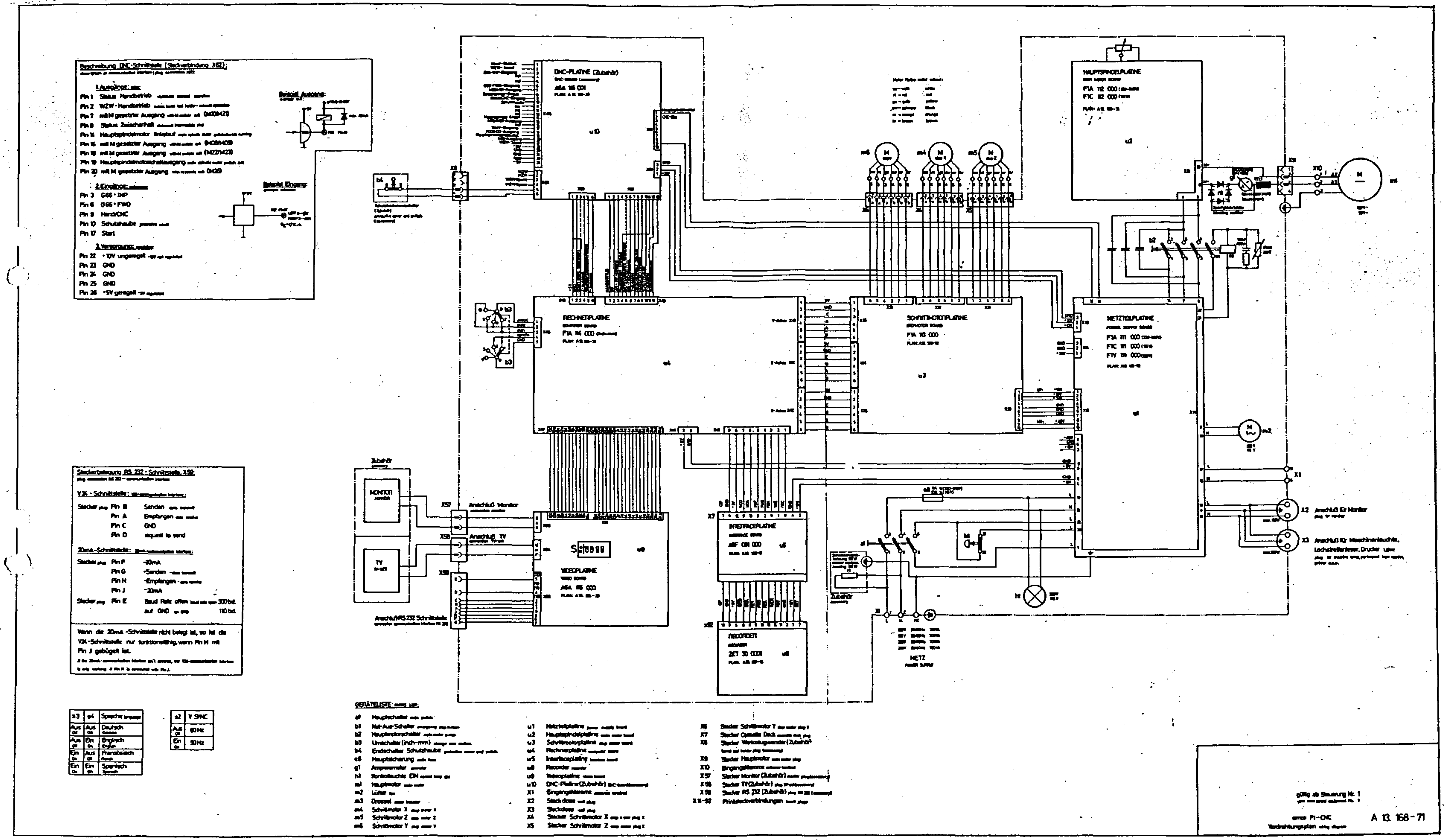


RECHNERPLATINE
SCHRITTMOTORPLATINE
HAUPTSPINDELPLATINE
NETZTEILPLATINE
VIDEOPLATINE (Zubehör)
INTERFACEPLATINE
MONITOR
TV
NETZ
GERÄTELISTE
gültig ab Steuerung Nr. 3540
COMPACT 5 CNC
Verdrahtungsplan
A 13 168 - 22

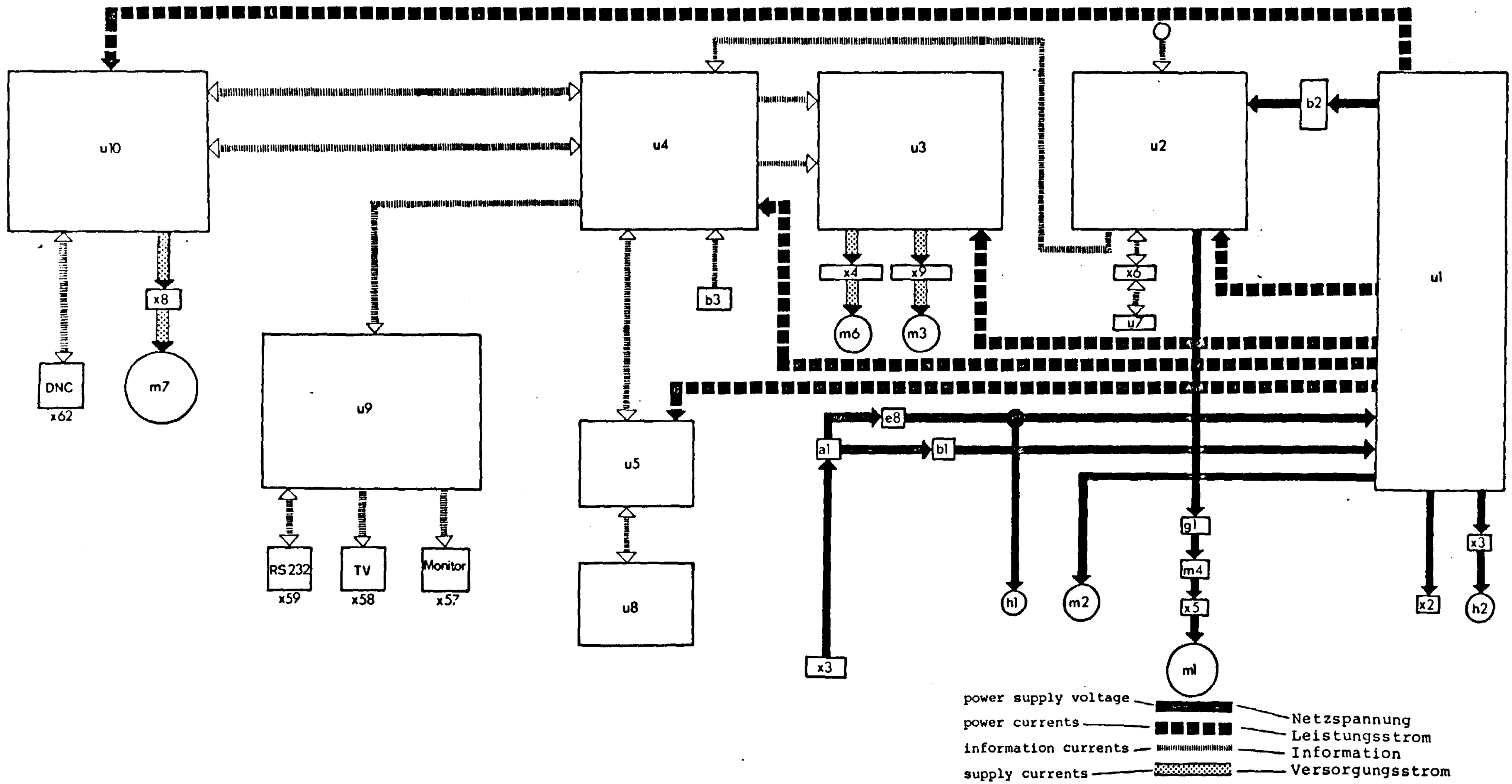

Beschreibung DNC-Schnittstelle Werkzeugwender (Steckverbindung X62)
1) Ausgänge:
Pin 1 Status-Handbetrieb
7 Status-Programm läuft
8 Status-Zwischenhalt
15 Status-Alarm
18 mit Z gesetzter Ausgang
19 mit X gesetzter Ausgang
20 mit F gesetzter Ausgang
2) Eingänge:
Pin 3 G65 + INP
4 INP + REY
5 INP + FWD
6 G65 + FWD
9 Hand/CNC
10 Startverriegelung-Zwischenhalt
11 Handverfahren Koordinate X/Z
12 Handverfahren Richtung +/-
13 Handverfahren Befehl
17 Start
21 Werkzeugwender Halt
3) Versorgung
Pin 22 +15V ungeregelt
23 GND
24 GND
25 GND
26 +5V geregelt
Beispiel: Ausgang
Beispiel: Eingang
WERKZEUGWENDERPLATINE (Zubehör)
ABC 115 001
u10
RECHNERPLATINE
ABC 114 003
u4
SCHRITTMOTORPLATINE
ASA 113 001
u3
HAUPTSPINDELPLATINE
ASA 112 001
ABC 112 001
u2
NETZTEILPLATINE
F1A 111 000
F1C 111 000
F1Y 111 000
u1
VIDEOPLATINE (Zubehör)
ASA 116 000
u9
INTERFACEPLATINE
ABF 081 000
u5
RECORDER
ZET 30 0001
u8
Anschluß MONITOR
Anschluß TV
Anschluß Schnittstelle
Steckerbelegung RS 232 - Schnittstelle X59
V 24 Schnittstelle:
Stecker Pin B Senden
Pin A Empfangen
Pin C GND
Pin D Request to send
20mA Schnittstelle:
Stecker Pin F -20mA
Pin G +Senden
Pin H +Empfangen
Pin J +20mA
Stecker Pin E Baud Rate offen 300 bd
auf GND 110 bd
Wenn die 20mA-Schnittstelle nicht belegt ist, so ist die V24-Schnittstelle nur funktionsfähig, wenn Pin H mit Pin J gebügelt ist.
Zubehör
MONITOR
TV
NETZ
GERÄTELISTE:
a1 Hauptschalter
b1 Not-Aus-Taste
b2 Hauptmotorschalter
b3 Umschalter (inch-mm)
e8 Hauptsicherung
g1 Amperemeter
h1 Kontrolleuchte EIN
h2 Maschinenleuchte (Zubehör)
m1 Hauptmotor
m2 Lüfter
m3 Schrittmotor Z
m4 Drossel
m6 Schrittmotor X
m7 Werkzeugwendermotor (Zubehör)
u1 Netzteilplatine
u2 Hauptspindelplatine
u3 Schrittmotorplatine
u4 Rechnerplatine
u5 Interfaceplatine
u7 Lichtschranke-Spindel
u8 Recorder
u9 Videoplatine (Zubehör)
u10 Werkzeugwenderplatine (Zubehör)
x2 Steckdose
x3 Eingangsklemme
x4 Stecker Schrittmotor X
x5 Stecker Hauptmotor
x6 Stecker Lichtschranke Spindel
x7 Stecker Cassette-Deck
x8 Stecker Werkzeugwender (Zubehör)
x9 Stecker Schrittmotor Z
x11 Steckklemmleiste
x57 Stecker Monitor (Zubehör)
x58 Stecker TV (Zubehör)
x59 Stecker RS 232 (Zubehör)
x21÷x52 Printsteckverbindungen
gültig ab Steuerung Nr. 3540
COMPACT 5 CNC
Verdrahtungsplan
A 13 168 - 22



Beschreibung DNC-Schnittstelle (Steckverbindung X62):
1. Ausgänge:
Pin 1 Status Handbetrieb
Pin 2 WZW - Handbetrieb
Pin 7 mit M gesetzter Ausgang (M20/M21)
Pin 8 Status Zwischenhalt
Pin 14 Hauptspindelmotor linkslauf
Pin 15 mit M gesetzter Ausgang (M08/M09)
Pin 18 mit M gesetzter Ausgang (M22/M23)
Pin 19 Hauptspindelmotorschaltausgang
Pin 20 mit M gesetzter Ausgang (M26)
2. Eingänge:
Pin 3 G66 + INP
Pin 6 G66 + FWD
Pin 9 Hand/CNC
Pin 10 Schutzhaube
Pin 17 Start
3. Versorgung:
Pin 22 +10V ungeregelt
Pin 23 GND
Pin 24 GND
Pin 25 GND
Pin 26 +5V geregelt
Beispiel Ausgang:
Beispiel Eingang:
Steckerbelegung RS 232 - Schnittstelle, X59:
V24 - Schnittstelle:
Stecker Pin B Senden
Pin A Empfangen
Pin C GND
Pin D request to send
20mA-Schnittstelle:
Stecker Pin F -20mA
Pin G +Senden
Pin H -Empfangen
Pin J +20mA
Stecker Pin E Baud Rate offen 300 bd.
auf GND 110 bd.
Wenn die 20mA-Schnittstelle nicht belegt ist, so ist die V24-Schnittstelle nur funktionsfähig, wenn Pin H mit Pin J gebügelt ist.
s3 | s4 | Sprache
Aus | Aus | Deutsch
Aus | Ein | Englisch
Ein | Aus | Französisch
Ein | Ein | Spanisch
s2 | V SYNC
Aus | 60 Hz
Ein | 50 Hz
DNC-PLATINE (Zubehör)
A6A 116 001
u10
RECHNERPLATINE
F1A 114 000
u4
SCHRITTMOTORPLATINE
F1A 113 000
u3
HAUPTSPINDELPLATINE
F1A 112 000
F1C 112 000
u2
NETZTEILPLATINE
F1A 111 000
F1C 111 000
F1V 111 000
u1
VIDEOPLATINE
A6A 115 000
u9
INTERFACEPLATINE
A6F 091 000
u5
RECORDER
ZET 30 0001
u8
Zubehör
MONITOR
TV
Anschluß Monitor
Anschluß TV
Anschluß RS 232 Schnittstelle
X2 Anschluß für Monitor
X3 Anschluß für Maschinenleuchte, Lochstreifenleser, Drucker usw.
NETZ
GERÄTELISTE:
a1 Hauptschalter
b1 Not-Aus-Schalter
b2 Hauptmotorschalter
b3 Umschalter (inch-mm)
b4 Endschalter Schutzhaube
e8 Hauptsicherung
g1 Amperemeter
h1 Kontrolleuchte EIN
m1 Hauptmotor
m2 Lüfter
m3 Drossel
m4 Schrittmotor X
m5 Schrittmotor Z
m6 Schrittmotor Y
u1 Netzteilplatine
u2 Hauptspindelplatine
u3 Schrittmotorplatine
u4 Rechnerplatine
u5 Interfaceplatine
u8 Recorder
u9 Videoplatine
u10 DNC-Platine (Zubehör)
X1 Eingangsklemme
X2 Steckdose
X3 Steckdose
X4 Stecker Schrittmotor X
X5 Stecker Schrittmotor Z
X6 Stecker Schrittmotor Y
X7 Stecker Cassette Deck
X8 Stecker Werkzeugwender (Zubehör)
X9 Stecker Hauptmotor
X10 Eingangsklemme
X57 Stecker Monitor (Zubehör)
X58 Stecker TV (Zubehör)
X59 Stecker RS 232 (Zubehör)
X11-92 Printsteckverbindungen
gültig ab Steuerung Nr. 1
emco F1-CNC
Verdrahtungsplan
A 13 168-71

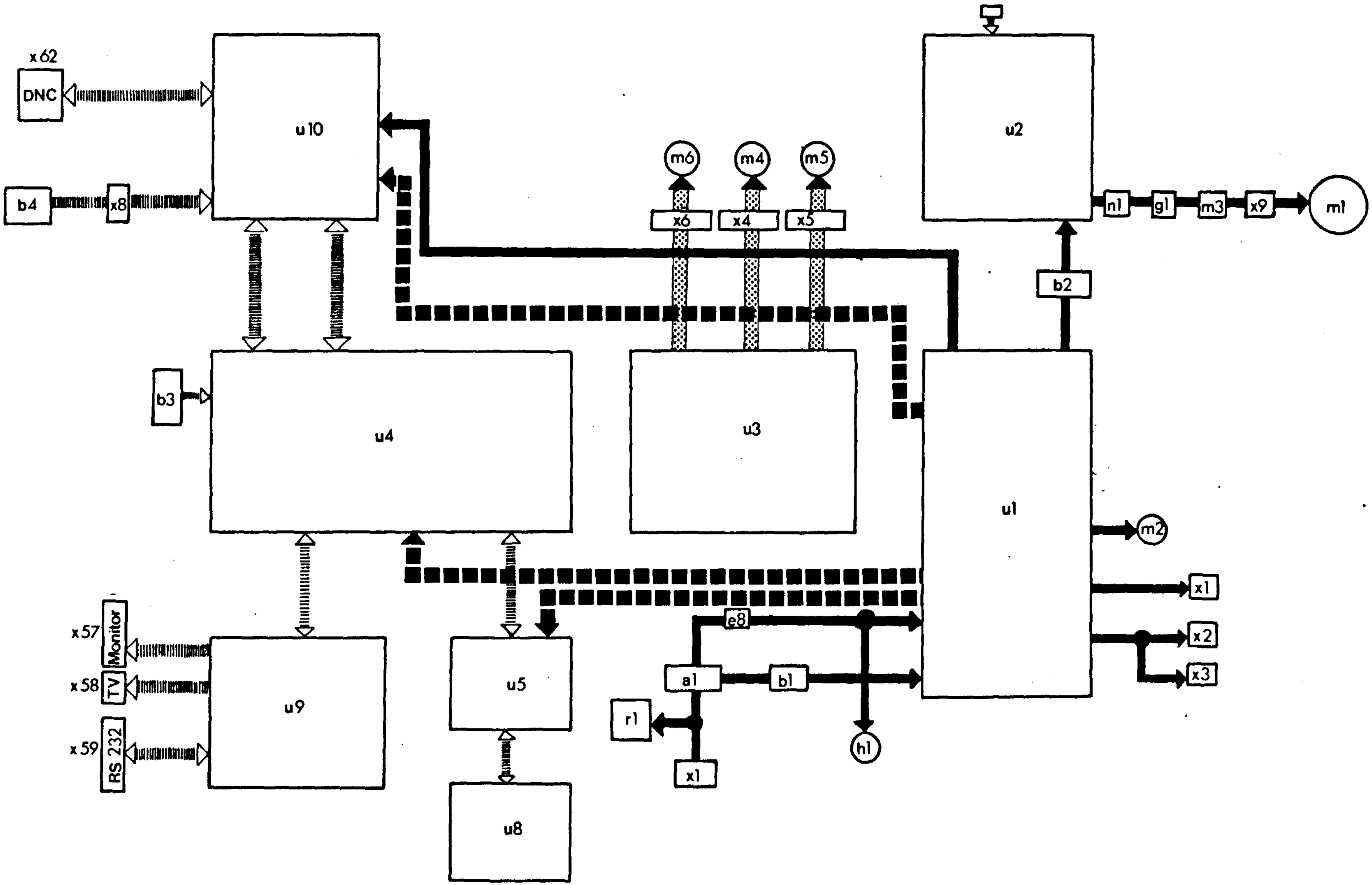

Beschreibung DNC-Schnittstelle (Steckverbindung X62):
1. Ausgänge:
Pin 1 Status Handbetrieb
Pin 2 WZW-Handbetrieb
Pin 7 mit M gesetzter Ausgang (M420/M421)
Pin 8 Status Zwischenhalt
Pin 14 Hauptspindelmotor linkslauf
Pin 15 mit M gesetzter Ausgang (M408/M409)
Pin 18 mit M gesetzter Ausgang (M422/M423)
Pin 19 Hauptspindelmotorschaltausgang
Pin 20 mit M gesetzter Ausgang (M429)
2. Eingänge:
Pin 3 G66 • INP
Pin 6 G66 • FWD
Pin 9 Hand/CNC
Pin 10 Schutzhaube
Pin 17 Start
3. Versorgung:
Pin 22 +10V ungeregelt
Pin 23 GND
Pin 24 GND
Pin 25 GND
Pin 26 +5V geregelt
Beispiel Ausgang:
Beispiel Eingang:
Steckerbelegung RS 232 - Schnittstelle, X59:
V24 - Schnittstelle:
Stecker Pin B Senden
Pin A Empfangen
Pin C GND
Pin D request to send
20mA-Schnittstelle:
Stecker Pin F +20mA
Pin G +Senden
Pin H +Empfangen
Pin J -20mA
Stecker Pin E Baud Rate offen 300 bd.
auf GND 110 bd.
Wenn die 20mA-Schnittstelle nicht belegt ist, so ist die V24-Schnittstelle nur funktionsfähig, wenn Pin H mit Pin J gebügelt ist.
s3 s4 Sprache
Aus Aus Deutsch
Aus Ein Englisch
Ein Aus Französisch
Ein Ein Spanisch
s2 V SYNC
Aus 60Hz
Ein 50Hz
DNC-PLATINE (Zubehör)
ASA 116 001
u10
RECHNERPLATINE
F1A 114 000
u4
SCHRITTMOTORPLATINE
F1A 113 000
u3
NETZTEILPLATINE
F1A 111 000
F1C 111 000
F1Y 111 000
u1
HAUPTSPINDELPLATINE
F1A 112 000
F1C 112 000
u2
VIDEOPLATINE
ASA 115 000
u9
INTERFACEPLATINE
ABF 081 000
u5
RECORDER
ZET 30 0001
u8
MONITOR
TV
Zubehör
Anschluß Monitor
Anschluß TV
Anschluß RS 232 Schnittstelle
Anschluß für Monitor
Anschluß für Maschinenleuchte, Lochstreifenleser, Drucker
NETZ
GERÄTELISTE:
a1 Hauptschalter
b1 Not-Aus-Schalter
b2 Hauptmotorschalter
b3 Umschalter (inch-mm)
b4 Endschalter Schutzhaube
e8 Hauptsicherung
g1 Amperemeter
h1 Kontrolleuchte EIN
m1 Hauptmotor
m2 Lüfter
m3 Drossel
m4 Schrittmotor X
m5 Schrittmotor Z
m6 Schrittmotor Y
u1 Netzteilplatine
u2 Hauptspindelplatine
u3 Schrittmotorplatine
u4 Rechnerplatine
u5 Interfaceplatine
u8 Recorder
u9 Videoplatine
u10 DNC-Platine (Zubehör)
X1 Eingangsklemme
X2 Steckdose
X3 Steckdose
X4 Stecker Schrittmotor X
X5 Stecker Schrittmotor Z
X6 Stecker Schrittmotor Y
X7 Stecker Cassette Deck
X8 Stecker Werkzeugwender (Zubehör)
X9 Stecker Hauptmotor
X10 Eingangsklemme
X57 Stecker Monitor (Zubehör)
X58 Stecker TV (Zubehör)
X59 Stecker RS 232 (Zubehör)
X11-92 Printsteckverbindungen
gültig ab Steuerung Nr. 1
emco F1-CNC
Verdrahtungsplan
A 13 168-71

Flußdiagramm
Flow chart
COMPACT 5 CNC



F· ·ßdiagramm
Flow chart

EMCO F1-CNC

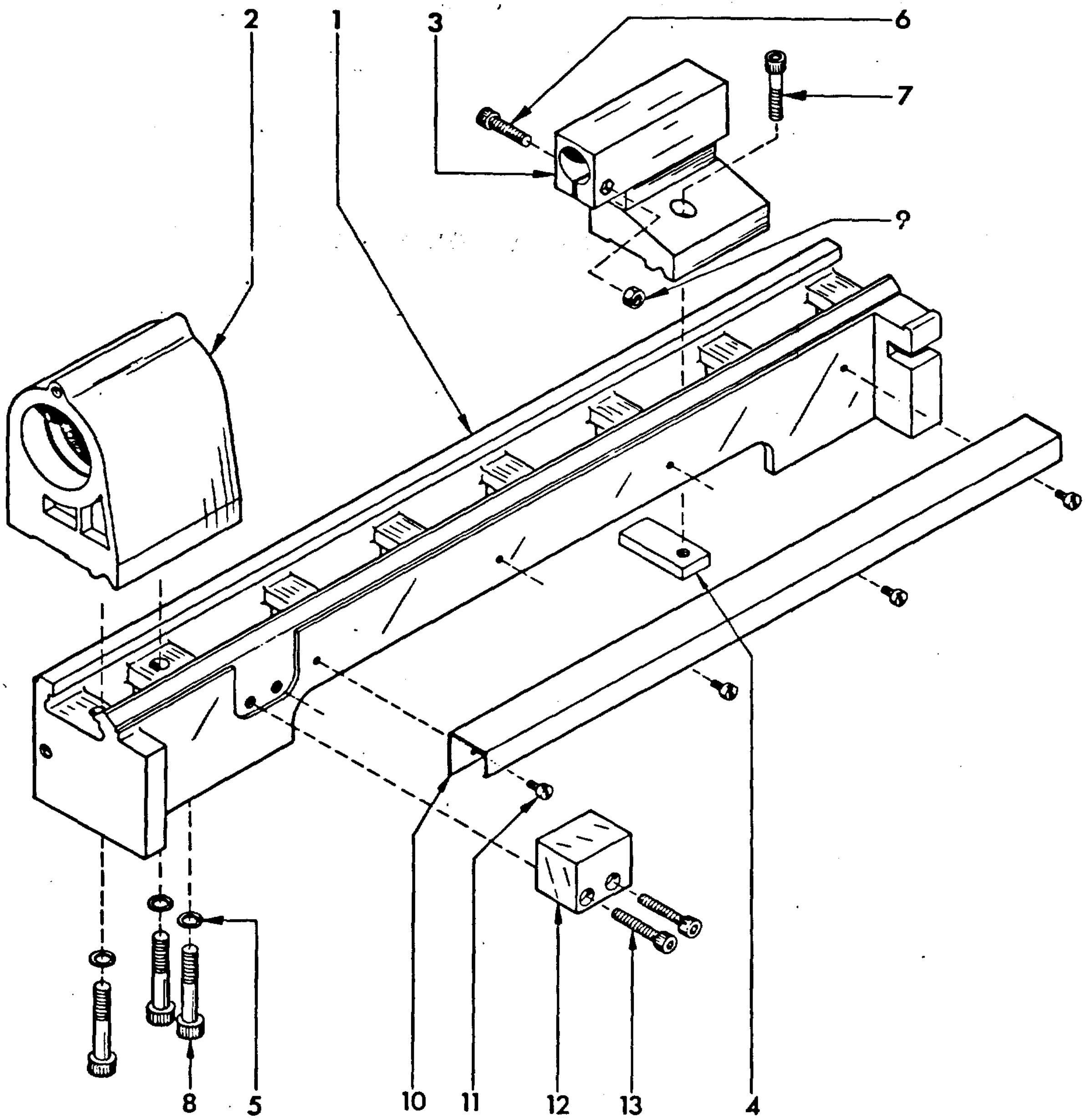


power supply voltage — Netzspannung
power currents — Leistungsstrom
information currents — Information
supply currents — Versorgungsstrom

Chapter 14

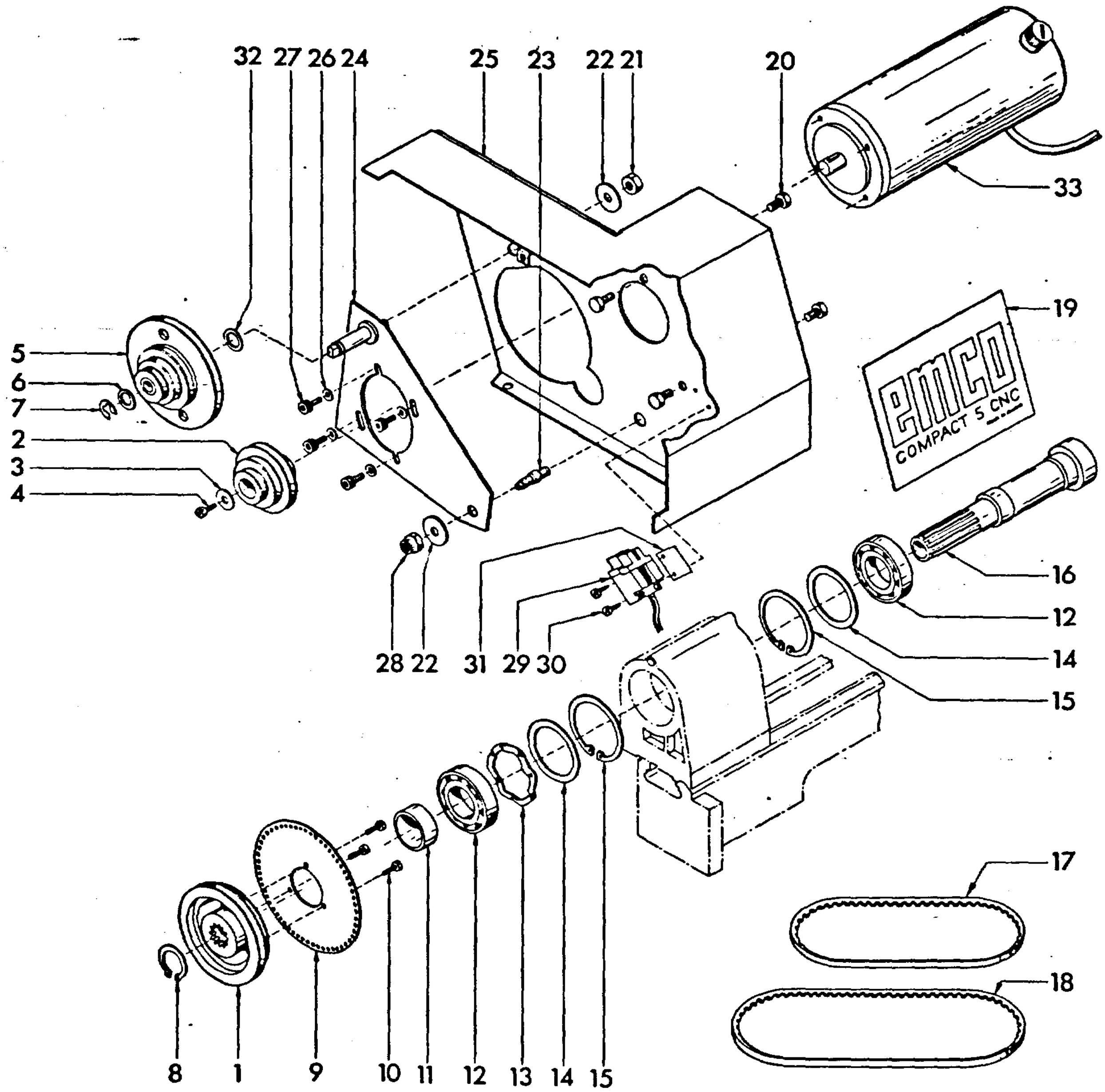
Spare parts list Compact 5 CNC and F1 CNC

Spare parts list Compact 5 CNC

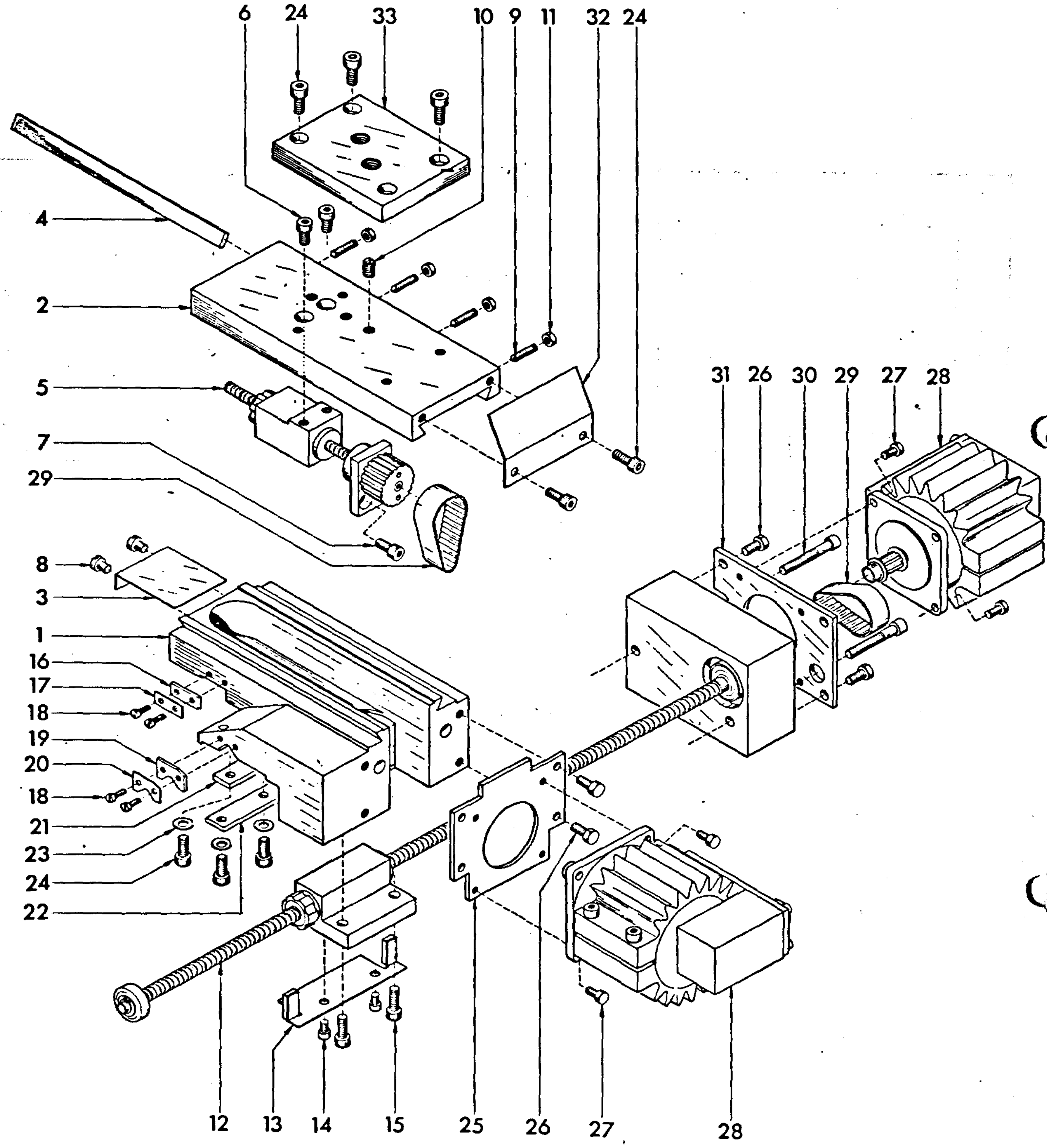

2
1
3
6
7
9
8
5
10
11
12
13
4

Pos.	Ref. No.	DIN		Benennung	Description	Designation
1	A6A olo olo			Bett	Bed	Banc
2	A5A olo o2o			Spindelstock	Headstock	Poupée fixe
3	A5A olo o3o			Reitstockgehäuse	Tailstock housing	Corps de la poupée
4	A3A ooo o4o			Klemmplatte	Clamping plate	Plaque de blocage
5	ZRG 28 oo8o	B8 DIN127		Federring	Spring washer	Rondelle ressort
6	ZSR 12 o625	M6x25 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
7	ZSR 12 o63o	M6x3o DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
8	ZSR 12 o845	M8x45 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
9	ZMU 34 o6oo	M6 DIN934-6		Sechskantmutter	Hexagonal nut	Ecrou 6 pans
1o	A6A ooo o6o			Abdeckung	Cover	Couvercle
11	ZSR 63 o4o8	M4x8 DIN963-4.8		Senkschraube	Countersunk screw	Vis tête fraise
12	A6A ooo o4o			Lagerbock 2	Bearing block	Palier de la roulement
13	ZSR 12 o53o	M5x3o DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux

EMCO Compact 5 CNC



Pos.	Ref. No.	DIN		Benennung	Description	Designation
1	A6A ooo o2o			Riemenscheibe	Pulley	Poulie
2	A5A ooo o3o			Motorriemenscheibe	Motor pulley	Poulie de moteur
3	ZSB 22 o53o	B5,3 DIN9o21		Scheibe	Washer	Rondelle
4	ZSR 84 o512	M5x12 DIN84-4.8		Zylinderschraube	Flat head screw	Vis à tête cylindrique
5	A5A o6o ooo			Vorgelegeriemenscheibe	Countershaft pulley	Poulie
6	ZSB 1o 2181	PS12x18x1,2		Stützscheibe	Supporting ring	Rondelle
7	ZSB 99 o9oo	9 DIN6799		Sicherungsscheibe	Retaining washer	Poulie de retenue
8	ZRG 71 2412	24x1.2 DIN471		Sicherungsring	Retaining ring	Anneau de retenue
9	A6A ooo 11o			Teilscheibe 1oo	Dividing washer 1oo	Disque diviseur 1oo
1o	ZSR 84 o516	M5x16 DIN84-4.8		Zylinderschraube	Flat head screw	Vis à tête cylindrique
11	A6A ooo 24o			Hülse	Spacer	Douille d'écartement
12	ZLG 6o o6o2	6oo6-2Z		Rillenkugellager	Ball bearing	Roulement à billes
13	ZSB o2 6oo6	6oo6/2K		Ausgleichscheibe	Compensating washer	Rondelle de compensation
14	ZSB 1o 5553	SS45x55x3		Stützscheibe	Supporting ring	Rondelle
15	ZRG 72 552o	B55x2 DIN472		Sicherungsring	Retaining ring	Anneau de retenue
16	A5A ooo o1o			Hauptspindel	Main spindle	Broche principale
17	ZRM 4o 6335	6x335		Keilriemen	V-belt	Courroie trapèzoidale
18	ZRM 4o 645o	6x45o		Keilriemen	V-belt	Courroie trapèzoidale
19	A6A ooo 17o			Frontschild	Front plate	Plaque frontale
2o	ZSR 33 o612	M6x12 DIN933-5.6		Sechskantschraube	Hexagon head screw	Vis hexagonale
21	ZMU 34 o8oo	M8 DIN934-6		Sechskantmutter	Hexagonal nut	Ecrou 6 pans
22	ZSB 21 o84o	A8,4 DIN9o21		Scheibe	Washer	Rondelle
23	A5A ooo 1oo			Lagerbolzen	Bearing shaft	Axe palier
24	A6A 13o ooo			Trägerplatte	Carrier plate	Plaque support seule
25	A6A o3o ooo			Spindelstockabdeckung	Headstock cover	Couvercle de la poupée fi
26	ZSB 22 o53o	B5,3 DIN9o21		Scheibe	Washer	Rondelle
27	ZSR 11 o512	M5x12 DIN6912-6.9		Zylinderschraube	Socket head screw	Vis à 6 pans creux
28	ZMU 8o o8oo	NM8 DIN98o-8		Sicherungsmutter	Securing nut	Ecrou de sûreté
29	A6A 1o8 oo1			Lichtschranke	Light barrier	Barrière lumineux
3o	ZSR 75 3513	B3.5x13 DIN7981		Blechschraube	Sheet metal screw	Vis en tôle
31	A6A ooo 28o			Abstimmblech	Compensating sheet	Tôle de compensation
32	ZSB 12 12o3	PS 12x18xo,3		Paßscheibe	Shim ring	Rondelle
33	A6A 1o4 ooo			Motor 22o-24o V (A,B,F,G,N)	Motor 22o-24o V (A,B,F,G,N)	Moteur 22o-24o V (A,B,F,G,N)
	A6C 1o4 ooo			Motor 115 V (C,H)	Motor 115 V (C.H)	Moteur 115 V (C,H)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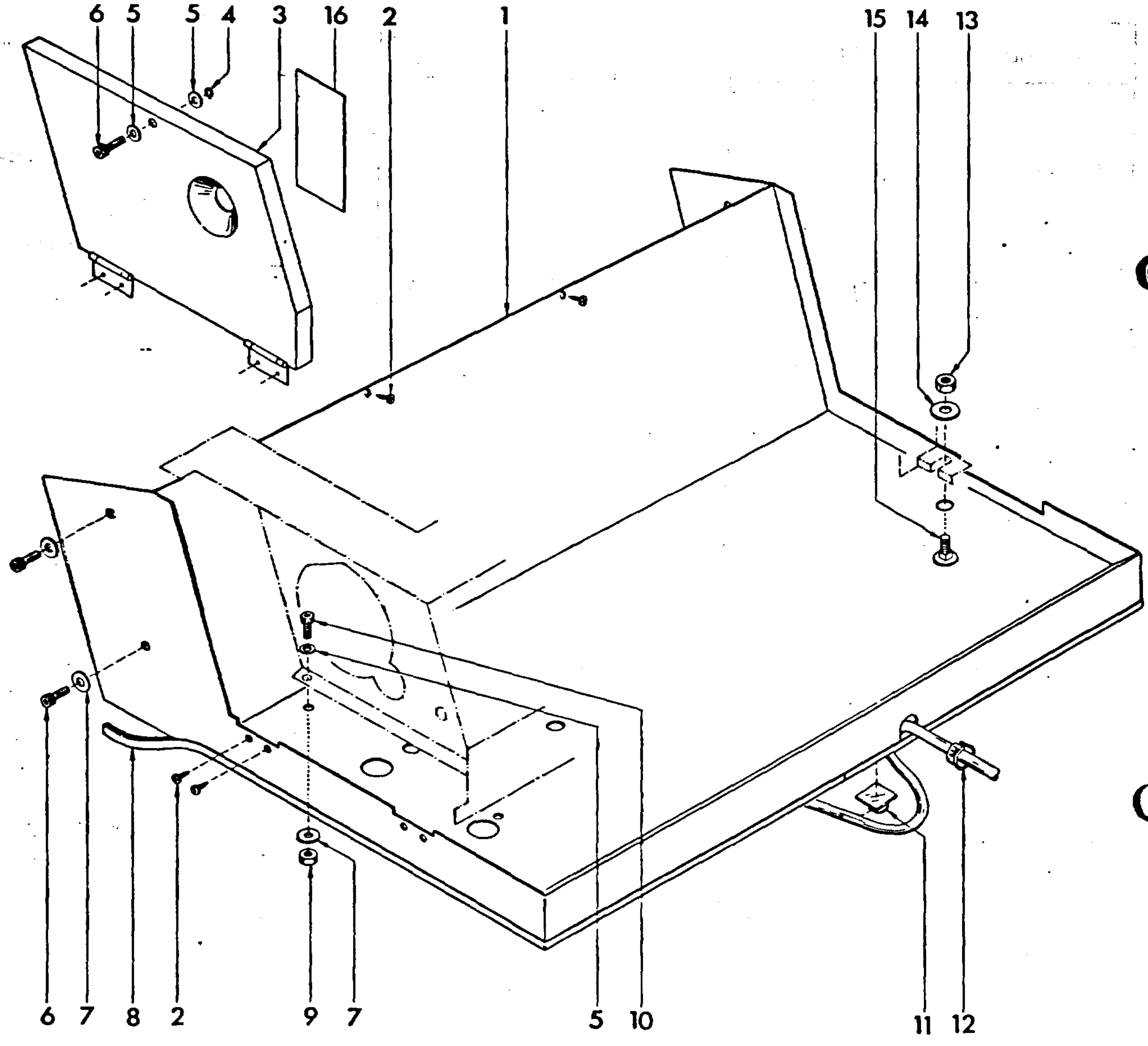
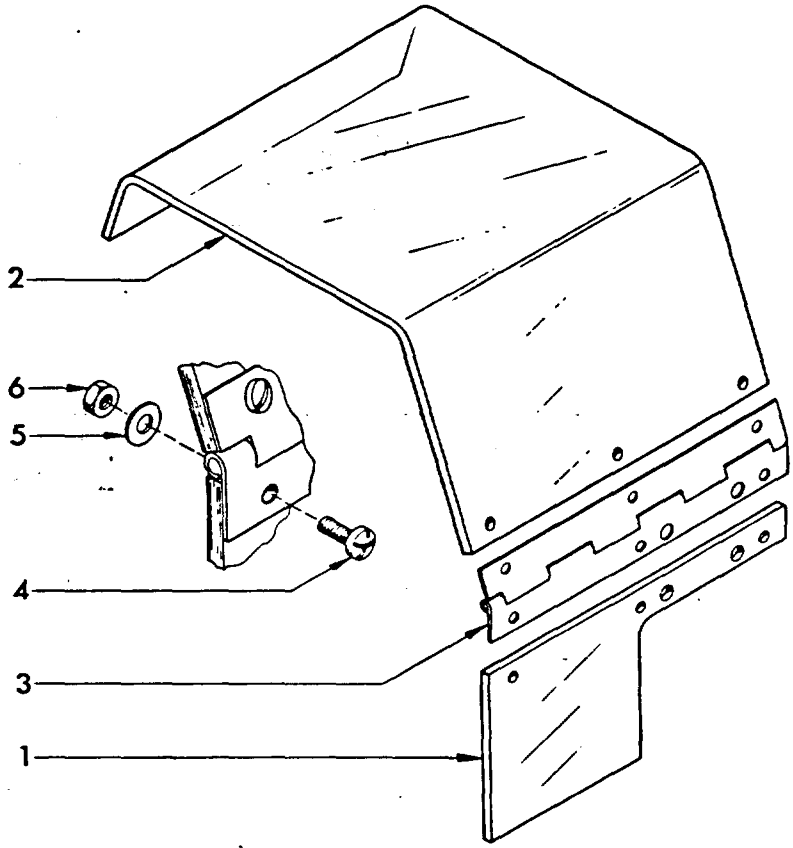
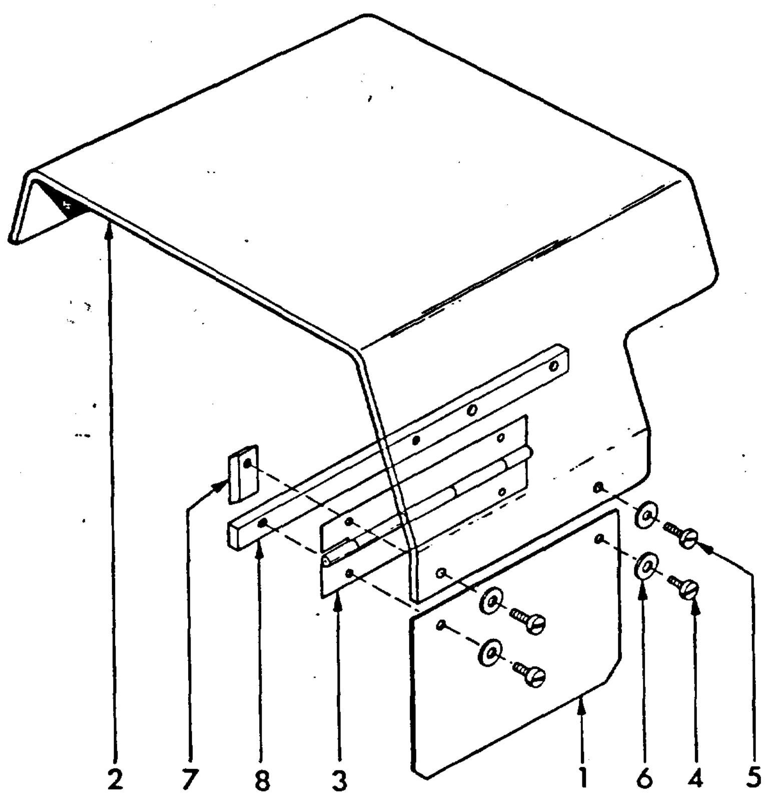
Pos.	Ref. No.	DIN		Benennung	Description	Designation
1	A6A o2o o1o			Schlitten	Slide	Chariot
2	A6A o2o o2o			Querschlitten	Cross slide	Chariot transversal
3	A6A o2o o6o			Abdeckblech	Cover sheet	Couvercle
4	A6A o2o o7o			Einstelleiste	Gib	Lardon
5	ZME 2oo 26o			Gruppe Querspindel	Cross slide spindle c.	Ens. broche transversale
6	ZSR 12 o5o8	M5x8 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
7	ZSR 12 o51o	M5x1o DIN 912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
8	ZSR 84 o5o6	M5x6 DIN 84-4.8		Zylinderschraube	Socket head screw	Vis 6 pans creux
9	A6A o2o o8o			Gewindestift	Set screw	Vis pointeau
1o	ZST 13 o6o6	M6x6 DIN913-45H		Gewindestift	Set screw	Vis pointeau
11	ZMU 34 o4oo	M4 DIN934-5		Sechskantmutter	Hexagonal nut	Ecrou 6 pans
12	ZME 2oo 27o			Gruppe Längsspindel	Lead screw complete	Ens. vis-mère
13	A6A o4o ooo			Abstreifblech	Wiper sheet	Tôle de racleur postérieur
14	ZSR 12 o4o8	M4x8 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
15	ZSR 12 o516	M5x16 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
16	A6A ooo 22o			Abstreiffilz 1	Felt wiper 1	Racleur en feutre post. 1
17	A6A ooo 2oo			Abstreifblech 1	Wiper plate 1	Plaquette de racleur post.1
18	ZSR 84 o3o8	M3x8 DIN84-4.8		Zylinderschraube	Flat head screw	Vis à tête cylindrique
19	A6A ooo 23o			Abstreiffilz 2	Felt wiper 2	Racleur en feutre post. 1
2o	A6A ooo 21o			Abstreifblech 2	Wiper plate 2	Plaquette de racleur post.2
21	A5A ooo 13o			Bettleiste kurz	Keep plate short	Lardon de chariot court
22	A6A ooo o5o			Bettleiste lang	Keep plate long	Lardon de chariot long
23	ZSB 25 o53o	B5,3 DIN125		Scheibe	Washer	Rondelle
24	ZSR 12 o512	M5x12 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
25	A6A ooo o7o			Motorplatte 1	Motor plate 1	Plaque de moteur 1
26	ZSR 33 o51o	M5x1o DIN933-5.6		Sechskantschraube	Hexagon head screw	Vis hexagonale
27	ZSR 33 o4o8	M4x8 DIN933-5.6		Sechskantschraube	Hexagon head screw	Vis hexagonale
28				Schrittmotor	Step motor	Moteur pas à pas
29	ZRM 73 48o5			Zahnflachriemen	Timing belt	Courroie crantée
3o	ZSR 12 o535	M5x35 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
31	A6A ooo o8o			Motorplatte 2	Motor plate 2	Plaque de moteur 2
32	A6A ooo 26o			Anschlag	Stop	Butée
33	A6A ooo 14o			Stahlhalterauflage	Toolpost support	Support de tourelle


6 5 5 4 3 16 2 1 15 14 13
6 7 8 2 9 7 5 10 11 12

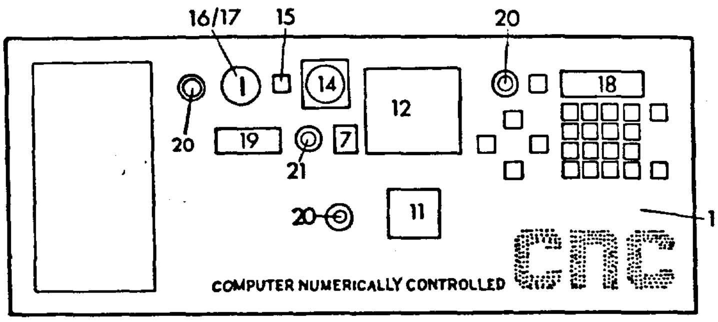
Pos.	Ref. No.	DIN		Benennung	Description	Designation
1	A6A o6o ool			Spänetasse	Chip tray	Bac à copeaux
2	ZSR 75 3595	B3,5x9,5 DIN7981		Blechschraube	Sheet metal screw	Vis en tôle
3	A6A o5o ooo			Deckel	Cover	Couvercle
4	ZRG 71 o6o7	6xo,7 DIN471		Sicherungsring	Retaining ring	Anneau de retenue
5	ZSB 25 o64o	B6,4 DIN125		Scheibe	Washer	Rondelle
6	ZSR 12 o62o	M6x2o DIN912		Zylinderschraube	Socket head screw	Vis 6 pans creux
7	ZSB 21 o64o	A6,4 DIN9o21		Scheibe	Washer	Rondelle
8	ZGU 77 o621	853 mm		Kantenschutzprofil	Protective profile	Perfil protective
9	ZMU 34 o6oo	M6 DIN934-6		Sechskantmutter	Hexagonal nut	Ecrou 6 pans
1o	ZSR 12 o616	M6x16 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
11	ZEE 25 1o1o			Kabelklipp	Clip for cable	Pince pour câble
12	ZEL 15 o75o			Tülle	Ring	Bague
13	ZMU 34 o8oo	M8 DIN934-6		Sechskantmutter	Hexagonal nut	Ecrou 6 pans
14	ZSB 21 o84o	A8,4 DIN9o21		Scheibe	Washer	Rondelle
15	ZSR o3 o82o	M8x2o DIN6o3-4.6		Flachrundschraube	Square neck bolt	Collet carrê
16	A6A ooo 19o			Drehzahlschild	Speed plate	Plaquette de vitesses



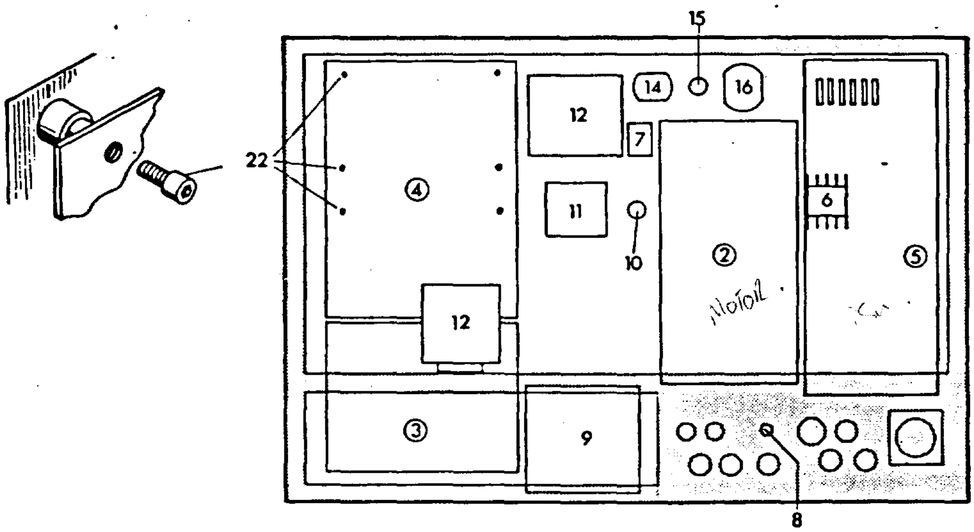
Pos.	Ref. No.	DIN		Benennung	Description	Designation
	A6A 14o ooo			Gruppe Späneschutz	Chip guard complete	Ens. pare-copeaux
1	A6A 14o o1o			Frontschutz	Front guard	Pare-copeaux
2	A6A 14o o2o			Deckel	Cover	Couvercle
3	A6A 14o o3o			Scharnier	Frame joint	Charnière
4	ZSR 89 o41o	M4x1o DIN7985-4.8		Linsenschraube	Filister head screw	Vis à tête lentiforme
5	ZSB 21 o43o	A4,3 DIN9o21		Scheibe	Washer	Rondelle
6	ZMU 34 o4oo	M4 DIN934-5		Sechskantmutter	Hexagonal nut	Ecrou 6 pans



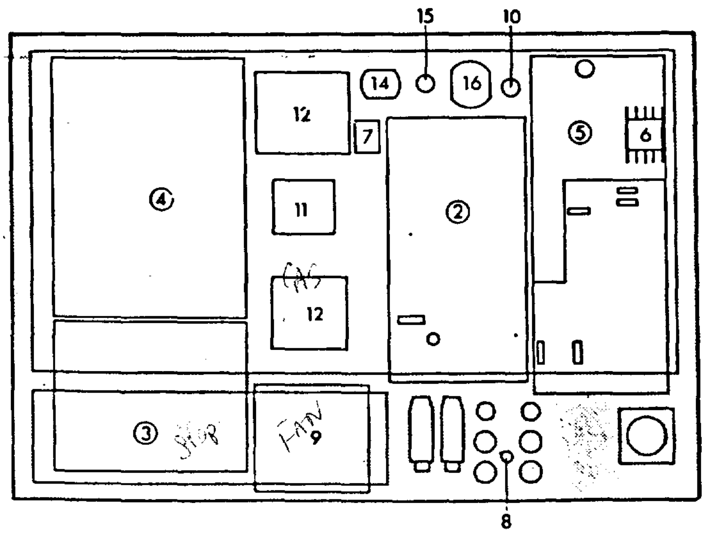
Pos.	Ref. Nr.	DIN		Benennung	Description	Designation
	A6A 14o oo1			Gr. Späneschutz	Chip guard compl.	Ens. pare-copeaux
1	A6A 14o oo1			Frontschutz	Front guard	Pare-copeaux
2	A6A 14o o21			Deckel	Cover	Couvercle
3	A6A 14o o31			Scharnier	Frame joint	Charnière
4	ZSR 89 o41o	M4x1o DIN 7985-4.8		Linsenschraube	Filister head screw	Vis à tête lentiforme
5	ZSR 89 o412	M4x12 DIN 7985-4.8		Linsenschraube	Filister head screw	Vis à tête lentiforme
6	ZSB 21 o43o	A4,3 DIN 9o21		Scheibe	Washer	Rondelle
7	A6A 14o o4o			Anschlag	Stop	Butée
8	A6A 14o o5o			Leiste	Gib	Barre



Version ABC



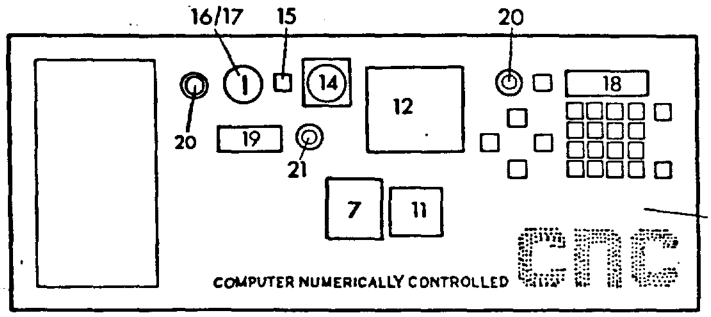
Version FGH

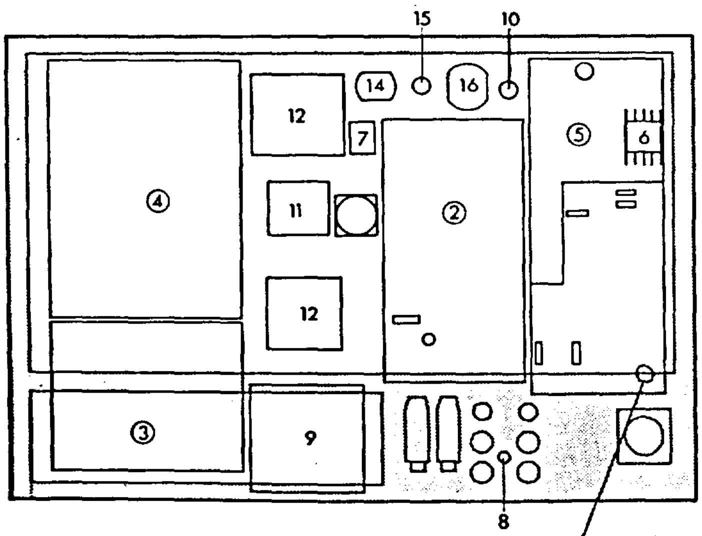


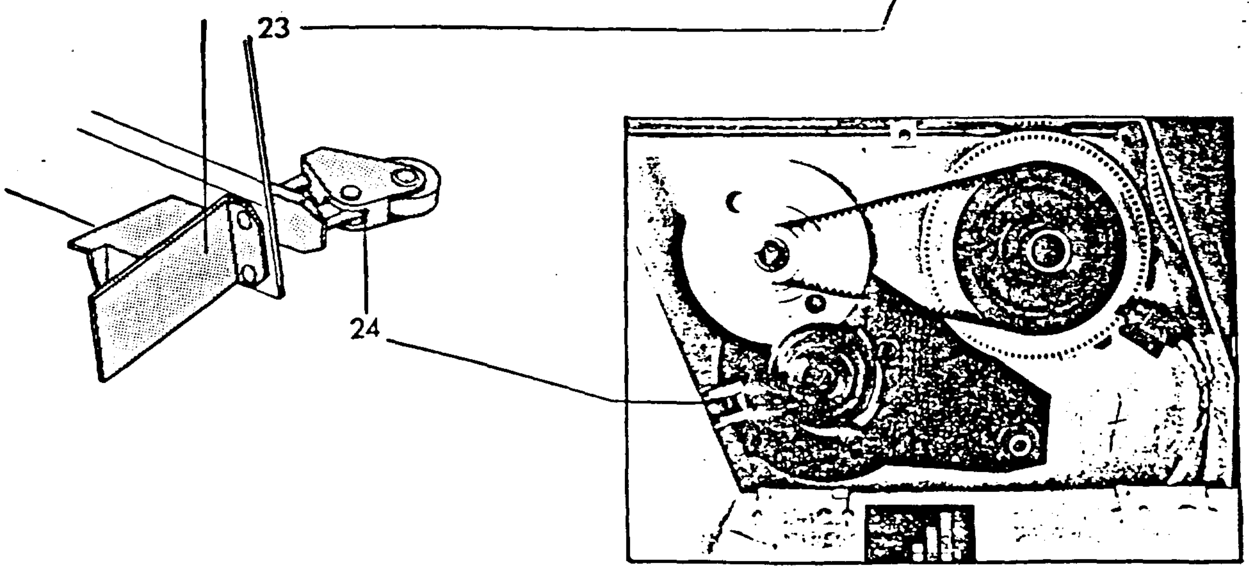
Pos.	Ref. No.	DIN		Benennung	Description	Designation
	A6G 1o5 ooo			E-Kasten komplett	Ass. E-Housing	Ens. Couvercle Elèctrique
	A6H 1o5 ooo			E-Kasten komplett	Ass. E-Housing	Ens. Couvercle Elèctrique
1	A6A 1oo o11			Frontschild	Front plate	Plaque frontale
2	A6A 112 oo1			Hauptspindelplatine (A,B,F,G)	Main spindle circuit board (A,B,F,G)	Platine alimentation broche (A,B,F,G)
	A6C 112 oo1			Hauptspindelplatine (C,H)	Main spindle circuit board (C,H)	Platine alimentation broche (C,H)
3	A6A 113 oo1			Schrittmotorplatine	Step motor circuit board	Platine alimentation moteur pas à pas
4	A6C 114 oo3			Rechnerplatine	CPU board	Platine entrée informations
5+6	A6A 111 oo1			Netzteilplatine (A,B,F,G)	Power supply circuit board (A,B,F,G)	Platine bloc d'alimentation (A,B,F,G)
	A6C 111 oo1			Netzteilplatine (C,H)	Power supply circuit board (C,H)	Platine bloc d'alimentation (C,H)
6	ZEL 53 1o1o			Schütz (A,B,F,G)	Relay (A,B,F,G)	Relais (A,B,F,G)
	ZEL 53 1o14			Schütz (C,H)	Relay (C,H)	Relais (C,H)
7	ZEL 21 31oo			Motorschalter	Motor switch	Commutateur moteur
8	ZEE 75 1o8o			Hauptsicherung 8 A tr. (A,B,F,G)	Main fuse 8 A slow (A,B,F,G)	Fusible principale 8 A lent (A,B,F,G)
	ZEE 75 11oo			Hauptsicherung 1o A tr. (C,H)	Main fuse 1o A slow (C,H)	Fusible principale 1o A lent (C,H)
9	ZMO 78 922o			Ventilator (A,B,F,G)	Fan (A,B,F,G)	Ventilateur (A,B,F,G)
	ZMO 78 9115			Ventilator (C,H)	Fan (C,H)	Ventilateur (C,H)
1o	ZEL 21 9oo3			Umschalter metrisch/zöllig (B,C,G,H)	Throw-over switch metric/inch (B,C,G,H)	Commutateur métrique/en pouces (B,C,G,H)
11	ZEM oo 1oo5			Amperemeter 5 A (A,B,F,G)	Amperemeter 5 A (A,B,F,G)	Ampèremètre 5 A (A,B,F,G)
	ZEM oo 1o1o			Amperemeter 1o A (C,H)	Amperemeter 1o A (C,H)	Ampèremètre 1o A (C,H)
12	A6F o9o.ooo			Cassetten Deck mit Interface Platine	Cassette Deck with Interface circuit board	Elément Cassette Deck avec platine Interface
14	ZEL 4o ooo2			Pilztastenschalter	Mushroom emerg. switch	Arrêt coup de poing
15	ZEE 53 o22o			Leuchte EIN (A,B,F,G)	Power control (A,B,F,G)	Lampe temoin (A,B,F,G)
	ZEE 53 o11o			Leuchte EIN (C,H)	Power control (C,H)	Lampe temoin (C,H)
16	ZEL 21 oo14			Hauptschalter mit 2 Schlüssel	Main switch with 2 keys	Commutateur principal avec 2 clés
17	ZME o62 oo5			Schlüssel zu Hauptschalter	Key for main switch	Clé pour commutateur principal
18	A6A 1o5 o2o			Sichtfenster/Display	Display glass	Ecran visualisation
19	A6A 1o5 o3o			Sichtfenster für Spindeldrehzahl	Display glass for number of spindle speed	Ecran visualisation pour vitesse de broche
2o	ZED 25 1oo6			Potentiometergriff 6 mm	Knob 6 mm	Poignée de potentiomètre 6 mm
21	ZED 25 1oo4			Potentiometergriff 4 mm	Knob 4 mm	Poignée de potentiomètre 4 mm
22	ZSR 12 o3o6	M3x6 DIN 912-6.9		Zylinderschraube	Socket head screw	Vis de fixation

E-Ausrüstung für Version →
El. Equipment for Version →
Equipement el. pour version →

A,F	22o V,	5o/6o Hz,	metr.
B,G ...	22o-24o V,	5o/6o Hz,	metr.-inch
C,H ...	1oo-115 V,	5o/6o Hz,	metr.-inch







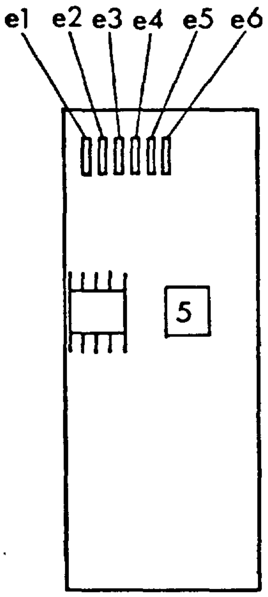
E-Ausrüstung für Sonderversion (Frankreich)
El. Equipment for special version (France)
Equipement el. pour version spéciale (France)

A6N ... 22o-24o V, 5o/6o Hz, metr.-inch

Pos.	Ref. No.	DIN		Benennung	Description	Designation
	A6N 1o5 ooo			E-Kasten komplett	Ass. E-housing	Ens. couvercle elèctrique
1	A6N 1oo o1o			Frontschild	Front plate	Plaque frontale
2	A6A 112 oo1			Hauptspindelplatine	Main spindle circuit board	Platine alimentation broche
3	A6A 113 oo1			Schrittmotorplatine	Step motor circuit board	Platine alimentation moteur pas à pas
4	A6C 114 oo3			Rechnerplatine	CPU board	Platine entrée informations
5+6	A6A 111 oo1			Netzteilplatine	Power supply circuit board	Platine bloc d'alimentation
6	ZEL 53 1o1o			Schütz	Relay	Relais
7	ZEL 22 ooo2			Motorschalter	Motor switch	Commutateur moteur
8	ZEE 75 1o8o			Hauptsicherung 8 A tr.	Main fuse 8 A slow	Fusible principale 8 A
9	ZMO 78 922o			Ventilator	Fan	Ventilateur
1o	ZEL 21 9oo3			Umschalter metrisch/zöllig	Throw-over switch metric/inch	Commutateur mètrique/en pouces
11	ZEM oo 1oo5			Amperemeter 5 A	Amperemeter 5 A	Ampèremètre 5 A
12	A6F o9o ooo			Cassette Deck mit Interface Platine	Cassette Deck with Interface circuit board	Element Cassette Deck avec Platine Interface
14	ZEL 4o ooo2			Pilztastenschalter	Mushroom emerg. switch	Arrêt coup de poing
15	ZEE 53 o22o			Leuchte "EIN"	Power control	Lampe temoin
16	ZEL 21 oo14			Hauptschalter mit 2 Schlüssel	Main switch with two keys	Commutateur principal avec 2 clès
17	ZME o62 oo5			Schlüssel zu Hauptschalter	Key for main switch	Clé pour commutateur principal
18	A6A 1o5 o2o			Sichtfenster/Display	Display glass	Ecran visualisation
19	A6A 1o5 o3o			Sichtfenster für Spindeldrehzahl	Display glass	Ecran visualisation vitesse brocne
2o	ZED 25 1oo6			Potentiometergriff 6 mm	Knob 6 mm	Poignée de potentiomètre 6 mm
21	ZED 25 1oo4			Potentiometergriff 4 mm	Knob 4 mm	Poignée de potentiomètre 4 mm
22	ZSR 12 o3o6	M3x6 DIN 912-6.9		Zylinderschraube	Socket head screw	Vis de fixation
23	ZEL 45 oo1o			Grenztaster	Switch de sécurité sur le couvercle du boîtier	
24	ZEE 47 31o4			Winkelrollenhebel	du harnais d'engrenages	

Sicherungen für Netzteilplatine
Fuses for power supply circuit board
Fusible pour platine bloc d'alimentation

A6A 111 000
A6C 111 000



e1 ..... 8 A ..... ZEE 75 1o8o
e2 ..... 8 A ..... ZEE 75 1o8o
e3 ..... 4 A ..... ZEE 75 1o4o

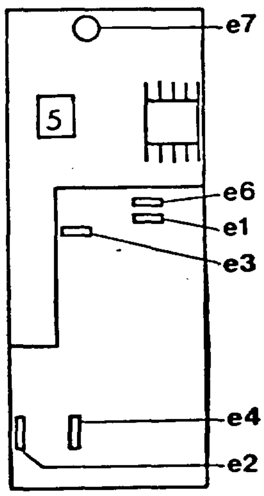
e4 — 22o V - 24o V ..... 4 A ..... ZEE 75 1o4o
e4 — 11o V .... 8 A ..... ZEE 75 1o8o

e5 ....2,5 - 4 A ..... ZEE 75 1o4o

e6 ....1 A ..... ZEE 75 1o1o

Sicherungen für Netzteilplatine
Fuses for power supply circuit board
Fusible pour platine bloc d'alimentation

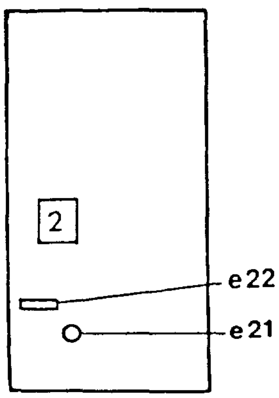
A6A 111 001
A6C 111 001



e1 ..... 4 A ..... ZEE 75 1o4o
e2 ..... 4 A ..... ZEE 75 1o4o
e3 ..... 6,3 A ... EEE 75 1o63
e4 ..... 4 A ..... ZEE 75 1o4o
e6 ..... 1 A ..... ZEE 75 1o1o
e7 ..... 16 A .... ZEE 7o 2o16

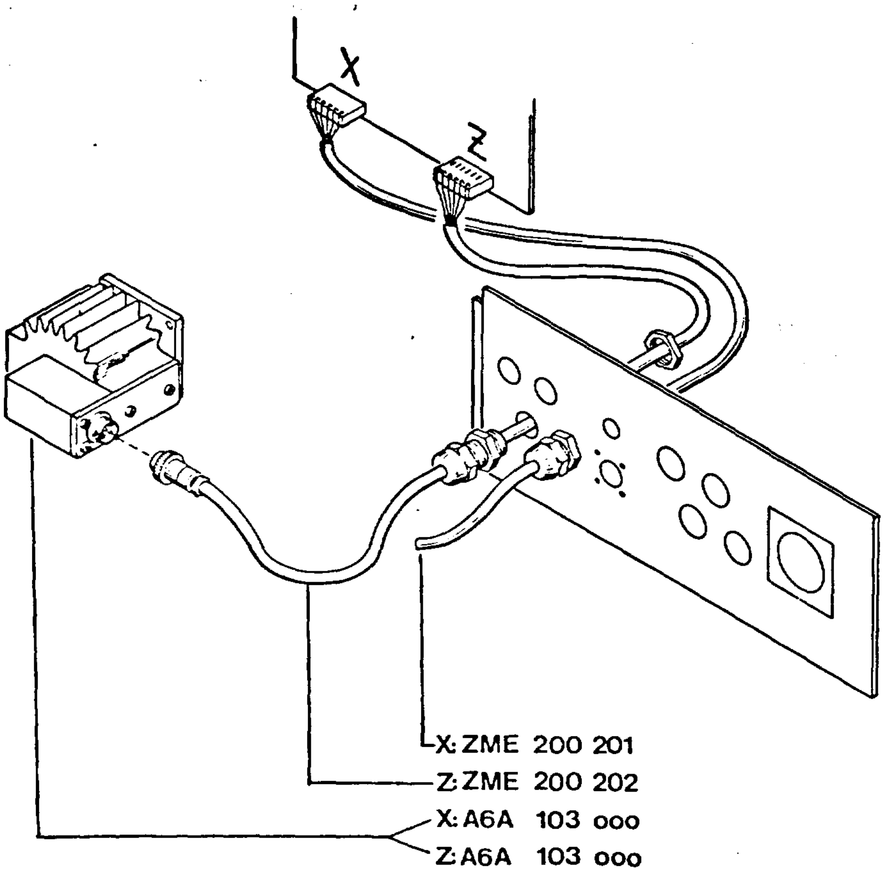
Sicherungen für Hauptspindelplatine
Fuses for main spindle circuit board
Fusibles pour platine d'alimentation broche

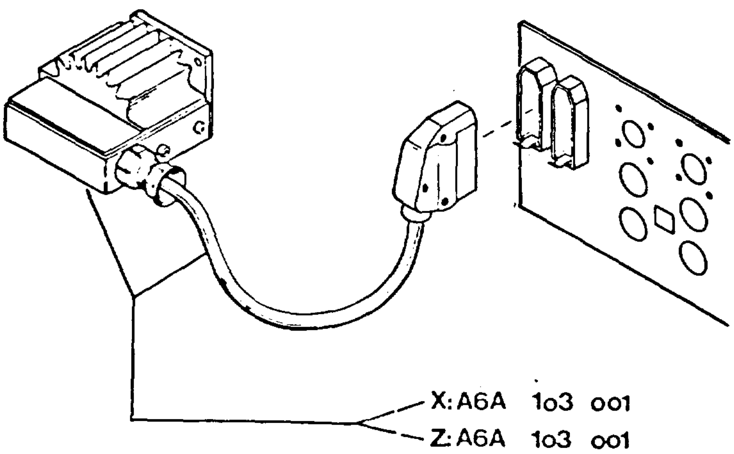
A6A 112 001
A6C 112 001



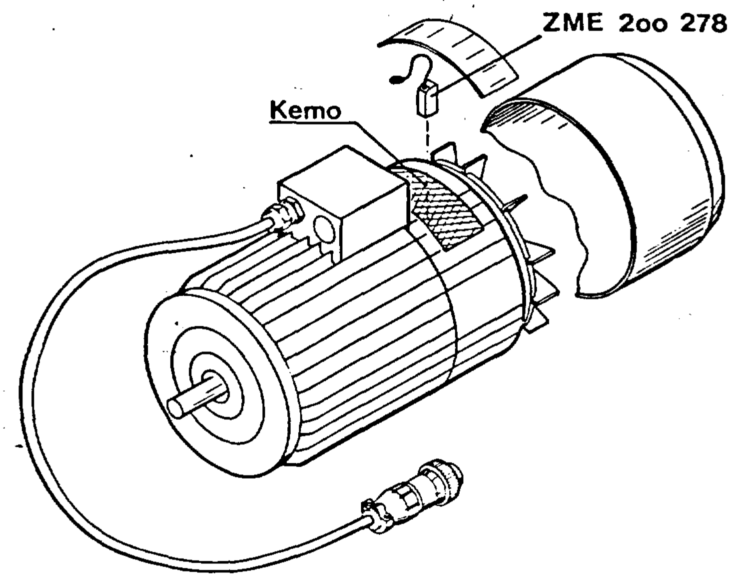
e21 ..... 1o A (ff, super fast, rapide) ..... ZEE 75 11o1
e22 ..... 1oo mA .... ZEE 75 1oo1

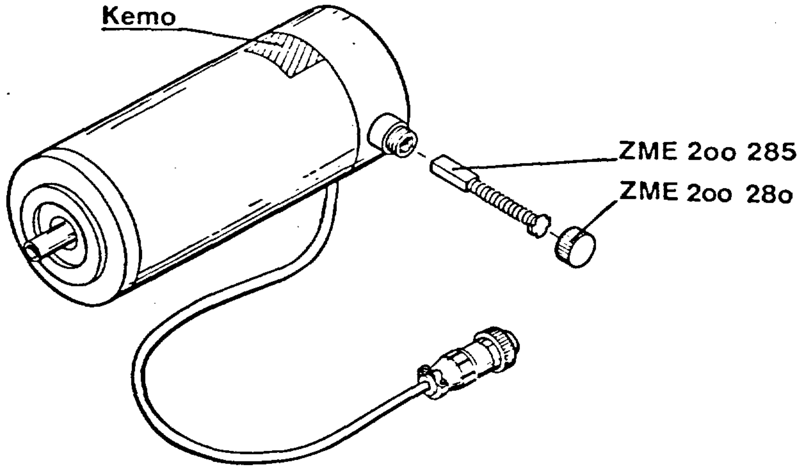
Ref. Nr. für Schrittmotor und Kabel
Ref. No. for step motor and cable
Réf. pour moteur pas à pas et câble

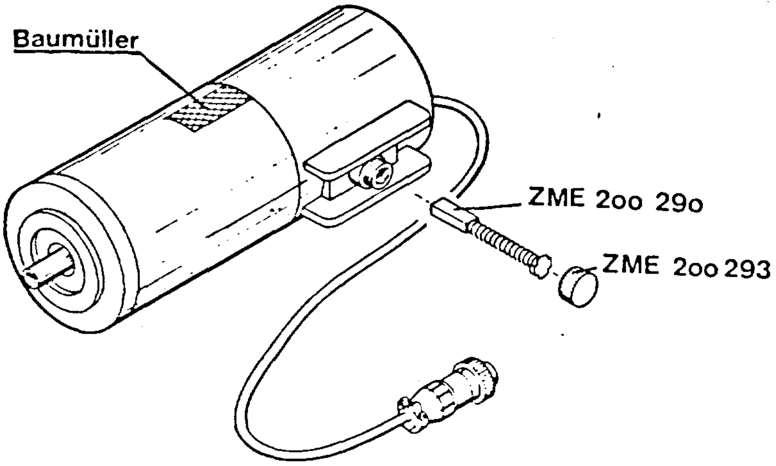


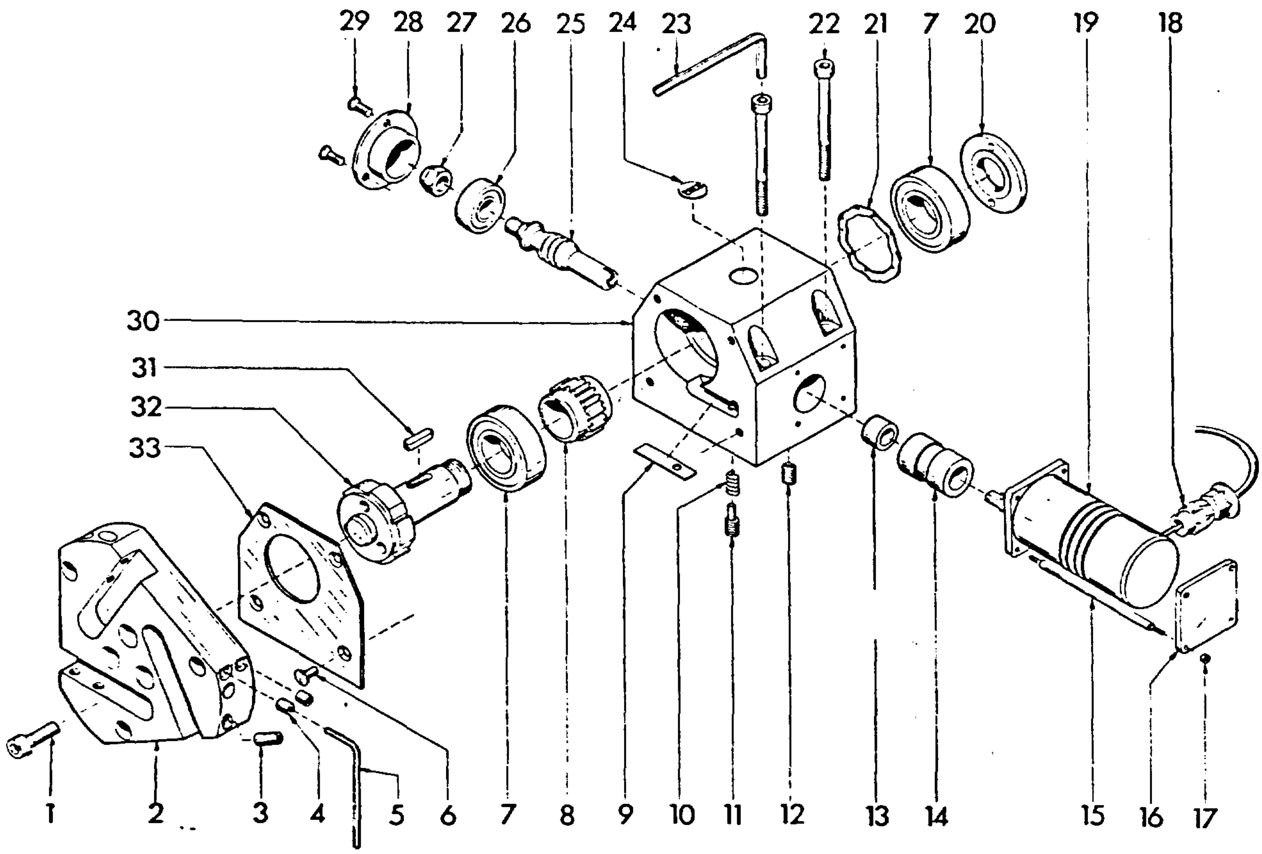


Ref. Nr. für Kohlebürsten
Ref. No. for carbon brushes
Réf. pour balai de charbon

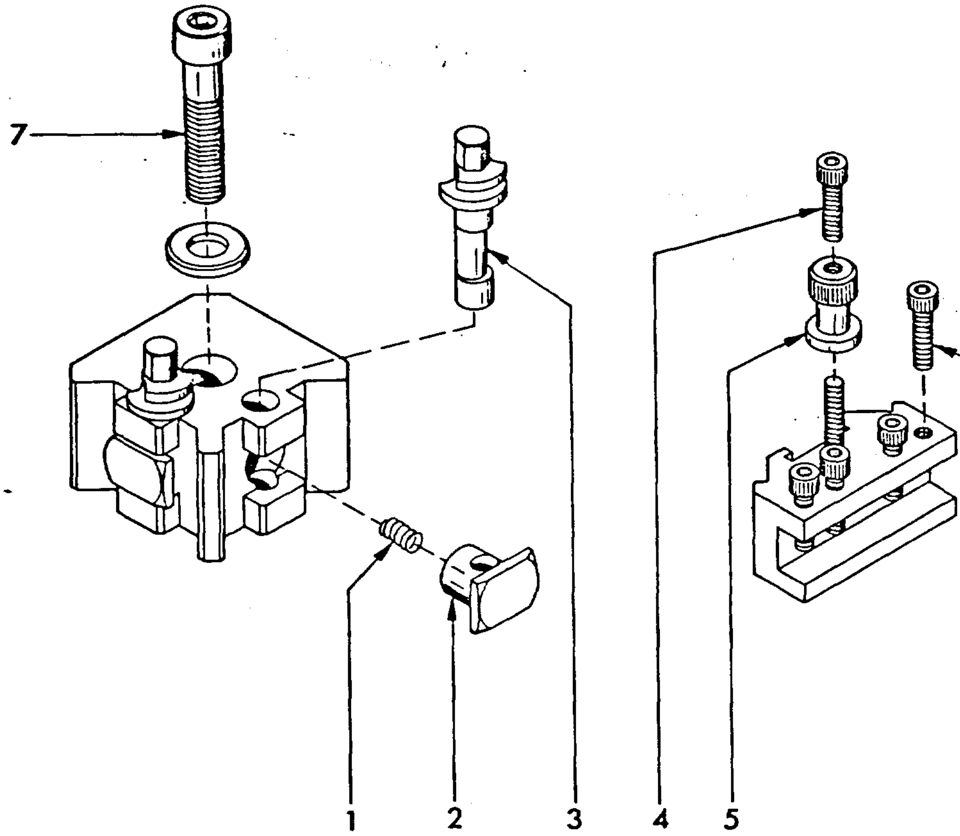




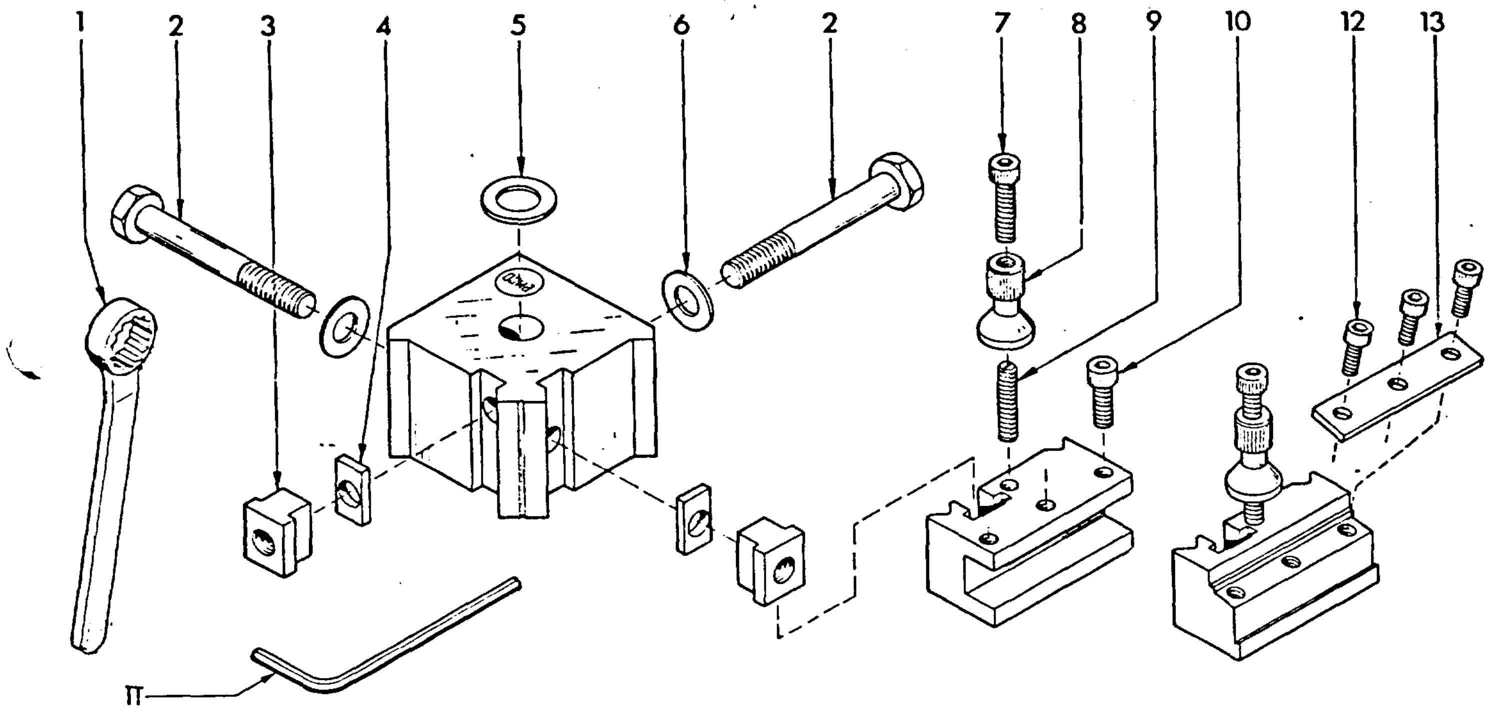




Pos.	Ref. No.	DIN		Benennung	Description	Designation
	26o o4o			Werkzeugrevolver	Turret toolpost	Tourelle-revolver autom.
1	ZSR 12 o62o	M6x2o DIN 912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
2	A6Z o4o o2o			Revolverscheibe	Toolpost disc	Disque de la tourelle
3	ZST 13 o616	M6x16 DIN 913-45H		Gewindestift	Set screw	Vis pointeau
4	ZST 13 o6o6	M6x6 DIN 913-45H		Gewindestift	Set screw	Vis pointeau
5	ZWZ 11 o3oo	SW3 DIN 911		Schraubendreher	Hex.socket screw key	Clé mâle coudée
6	ZSR 63 o4o6	M4x6 DIN 963-4.8		Senkschraube	Countersunk screw	Vis tête fraisée
7	ZLG 6o o4o2	6oo4-2Z		Rillenkugellager	Ball bearing	Roulement à billes
8	A6Z o4o o6o			Schraubenrad	Worm wheel	Roue à vis sans fin
9	A6Z o4o 12o			Federplatte	Leaf spring	Ressort en feuillard plat
10	ZED 21 3o74			Druckfeder	Compression spring	Ressort de compression
11	A6Z o4o 19o			Gewindestift	Set screw	Vis pointeau
12	ZST 16 o6o8	M6x8 DIN 916-45H		Gewindestift	Set screw	Vis pointeau
13	ZBU 5o oo15	J1ox14x1o DIN185o		Sinterlager	Bearing bush	Bague
14	A6Z o4o 11o			Büchse	Bush	Bague
15	A6Z o4o 16o			Spannbolzen	Bolt	Boulon
16	A6Z o4o 17o			Deckel	Cover	Couvercle
17	ZMU 34 o25o	M2,5 DIN 934-5		Mutter	Nut	Ecrou
18	ZPG 1o oo12	MZB7		Kabelverschraubung	Screw-type cond.fittg.	Raccordement à vis
19	A6Z o46 ooo			Motor komplett	Motor compl.	Ens. moteur
20	A6Z o4o 1oo			Mutter	Nut	Ecrou
21	ZSB o2 6oo4	6oo4/K2		Ausgleichscheibe	Compensating washer	Rondelle de compensation
22	ZSR 12 o56o	M5x6o DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
23	ZWZ 11 o4oo	SW4 DIN 911		Schraubendreher	Hex.socket screw key	Clé mâle coudée
24	PoB ooo 16o			Firmenschild	Name plate	Plaque
25	A6Z o4o o5o			Schneckenwelle	Worm	Vis sans fin
26	ZLG 6o ooo2	6ooo-2Z		Rillenkugellager	Ball bearing	Roulement à billes
27	ZMU 8o o8oo	NM8 DIN 98o-8		Sicherungsmutter	Securing nut	Ecrou de sûreté
28	A6Z o4o o7o			Deckel	Cover	Couvercle
29	ZSR 63 o4o8	M4x8 DIN 963-4.8		Senkschraube	Countersunk screw	Vis tête fraisée
30	A6Z o4o o4o			Gehäuse	Housing	Corps
31	ZFD 85 4416	A4x4x16 DIN 6885		Paßfeder	Square key	Clavette parallèle
32	A6Z o4o o3o			Schaltwelle	Shaft	Arbre
33	A6Z o4o o8o			Dichtplatte	Seal plate	Joint d'étanchéité

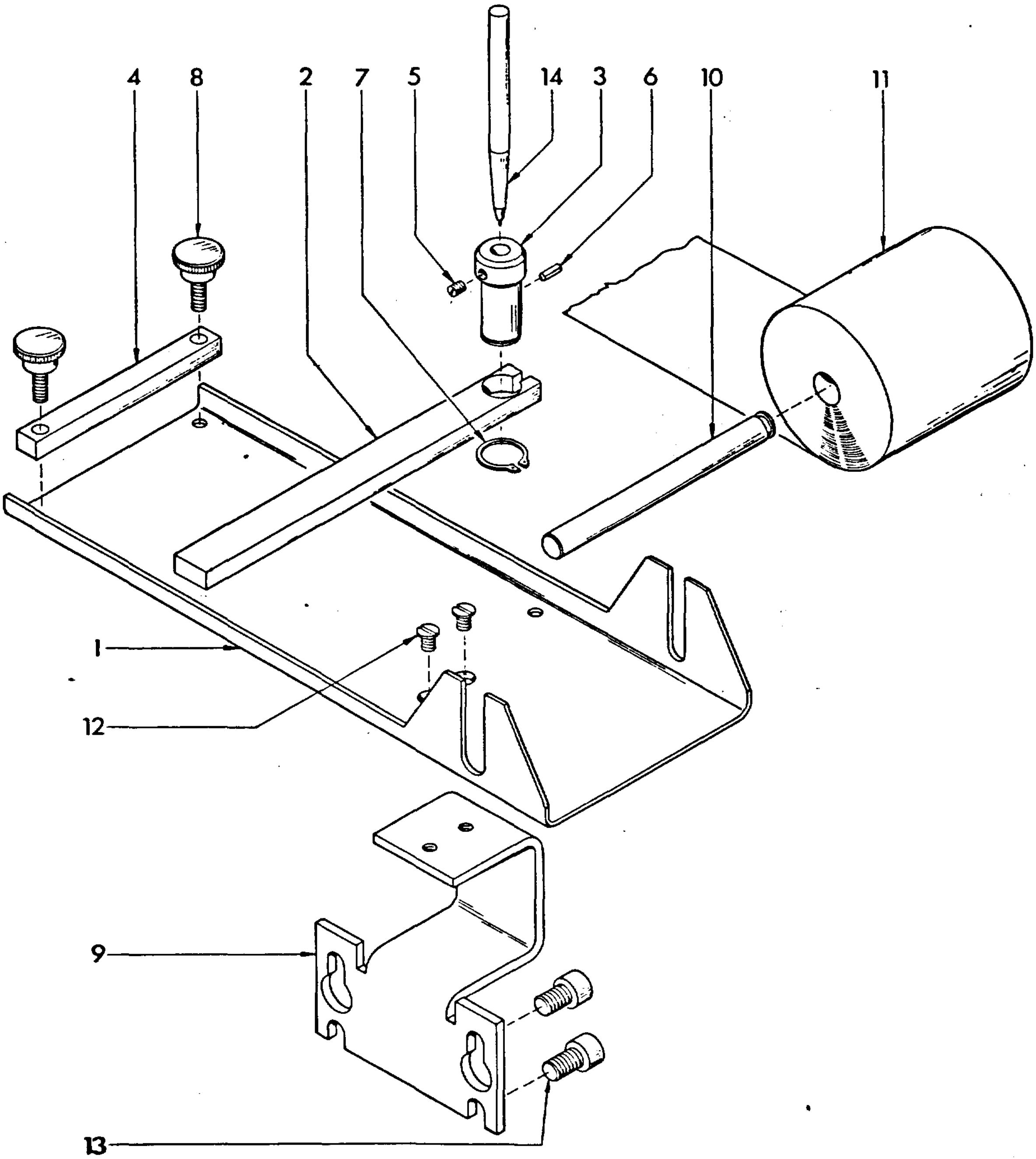


Pos.	Ref. No.	DIN		Benennung	Description	Designation
1-6	544 000			Schnellwechselstahl-halter	Quick-change toolpost	Tourelle porte-outil à changement rapide
1	ZME 11 0002			Feder	Clamp pad spring	Ressort
2	ZME 11 0001			Klemmplatte	Clamp pad	Plaque de serrage
3	ZME 11 0000			Exzenterbolzen	Clamp bolt	Boulon excentré
4	ZSR 12 0520	M4x20 DIN912		Zylinderschraube	Socket head screw	Vis 6 pans creux
5	ZME 11 0005			Mutter	Nut	Ecrou
6	ZSR 12 0516	M4x16 DIN912		Zylinderschraube	Socket head screw	Vis 6 pans creux
7	ZSR 12 1050	M10x50 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux

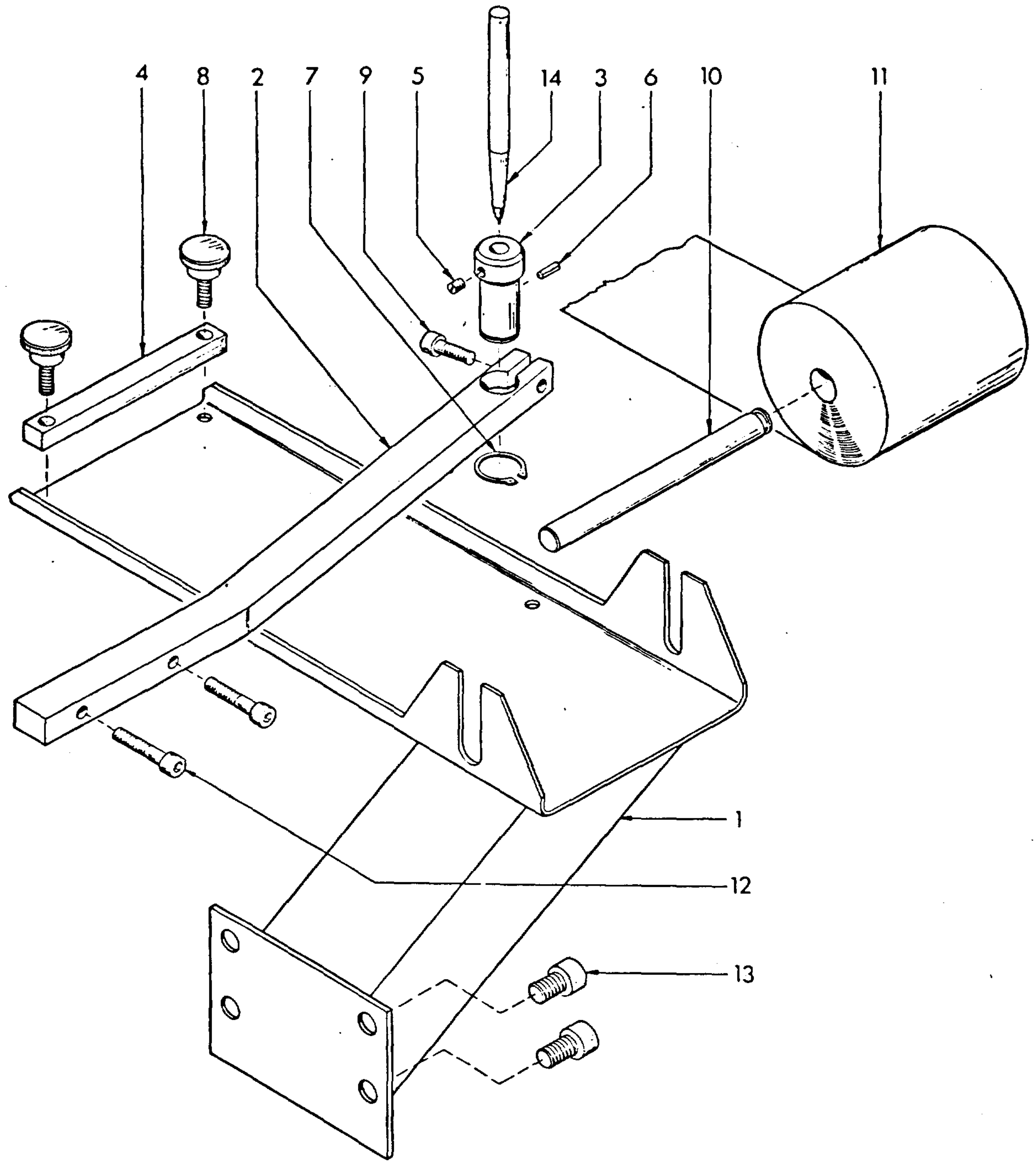


Pos.	Ref. No.	DIN		Benennung	Description	Designation
	584 18o			Schnellwechselstahl-halter	Quick-change tool-post	Tourelle porte-outil â changement rapide
1	C6Z 18o o4o			Ringschlüssel 13	Ring spanner 13	Clê â oeil 13
2	ZSR 31 o86o	M8x6o DIN931-5.6		Sechskantschraube	Hexagon head screw	Vis hexagonale
3	C6Z 18o o2o			T-Nutenstein	T-nut	Boulon en T
4	C6Z 18o o3o			Zwischenstück	Intermediate piece	Piêce d'êcartement
5	ZSB 25 1o5o	B1o,5 DIN125		Scheibe	Washer	Rondelle
6	ZSB 25 o84o	B8,4 DIN125		Scheibe	Washer	Rondelle
7	ZSR 12 o52o	M5x2o DIN912-6.9		Zylinderschraube	Socket head screw	Vis six pans creux
8	C6Z 181 o2o			Stellknopf	Adjusting nut	Ecrou de reglage
9	ZST 13 o525	M5x25 DIN913-45H		Gewindestift	Set screw	Vis pointeau
1o	ZSR 13 o516	M5x16 DIN912-1o.9		Zylinderschraube	Socket head screw	Vis six pans creux
11	ZWZ 11 o4oo	SW4 DIN911		Schraubendreher	Hexagonal key	Clê â six pans
12	ZSR 12 o512	M5x12 DIN 912		Zylinderschraube	Socket head screw	Vis six pans creux
13	C6Z 28o o2o			Spannplatte	Clamping plate	Plaquette de serrage

EMCO Compact 5 CNC

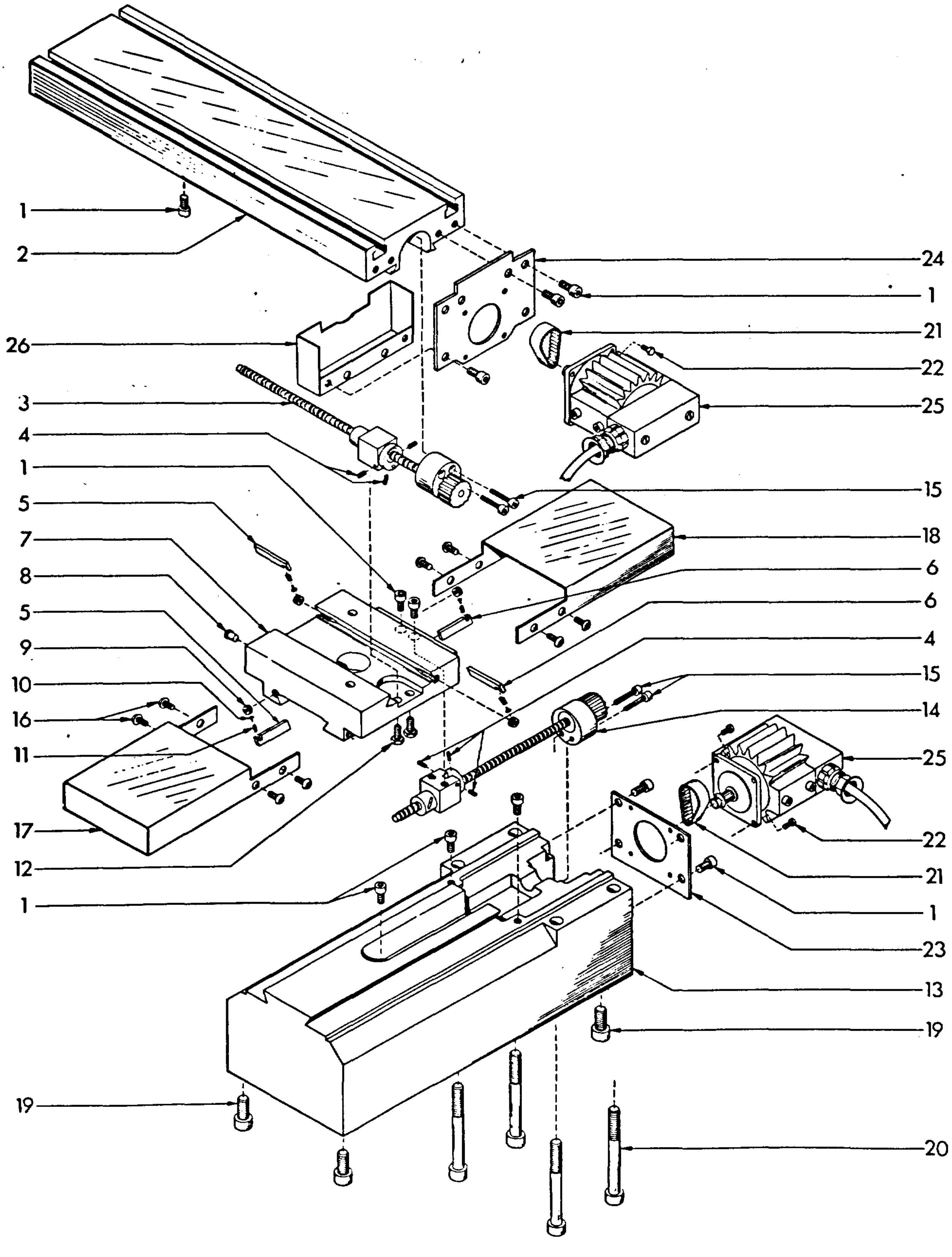


Pos.	Ref. No.	DIN		Benennung	Description	Designation
	26o olo			Gruppe Plotter	Plotter complete	Ens. Plotter
1	A6Z olo olo			Auflage	Table	Tableau
2	A6Z olo o3o			Halter	Bar	Support
3	A6Z olo o5o			Führung	Holder	Guidage
4	A6Z olo o6o			Leiste	Gib	Lardon
5	ZST 51 o4o4	M4x4 DIN551-5.8		Gewindestift	Set screw	Vis pointeau
6	ZHL 81 o3o8	3x8 DIN1481		Spannhülse	Lock pin	Goupille de serrage
7	ZRG 71 141o	W14x1 DIN471		Sicherungsring	Retaining ring	Anneau de retenue
8	ZSR 64 o515	M5x15		Rändelschraube	Knurled screw	Vis moletée
9	A6Z olo o2o			Bettwinkel	Basis element	Equerre
10	A6Z olo o4o			Achse	Axis	Axe
11	ZRO o6 7o7o	7o x 7o		Papierrolle	Paper roll	Rouleau à papier
12	ZSR 63 o5o8	M5x8 DIN963-4.8		Senkschraube	Countersunk screw	Vis tête fraise
13	ZSR 12 o812	M8x12 DIN912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
14	ZST 99 1ooo			Plotterstift	Plotter pen	Crayon Plotter



Pos.	Ref. No.	DIN		Benennung	Description	Designation
	26o 31o			Gruppe Plotter	Plotter complete	Ens. Plotter
1	A6Z o11 ooo			Auflage	Table	Tableau
2	A6Z o1o o31			Halter	Bar	Support
3	A6Z o1o o5o			Führung	Holder	Guidage
4	A6Z o1o o6o			Leiste	Gib	Lardon
5	ZST 51 o4o4	M4x4 DIN 551-5.8		Gewindestift	Set screw	Vis pointeau
6	ZHL 81 o3o8	3x8 DIN 1481		Spannhülse	Lock pin	Goupille de serrage
7	ZRG 71 141o	W14x1 DIN 471		Sicherungsring	Retaining ring	Anneau de retenue
8	ZSR 64 o515	M5x15		Rändelschraube	Knurled screw	Vis moletée
9	ZSR 12 o516			Zylinderschraube	Socket head screw	Vis 6 pans creux
10	A6Z o1o o4o			Achse	Axis	Axe
11	ZRO o6 7o7o	7o x 7o		Papierrolle	Paper roll	Rouleau à papier
12	ZSR 12 o525			Zylinderschraube	Socket head screw	Vis 6 pans creux
13	ZSR 12 o812	M8x12 DIN 912-6.9		Zylinderschraube	Socket head screw	Vis 6 pans creux
14	ZST 99 1ooo			Plotterstift	Plotter pen	Crayon Plotter

Spare parts list F1 CNC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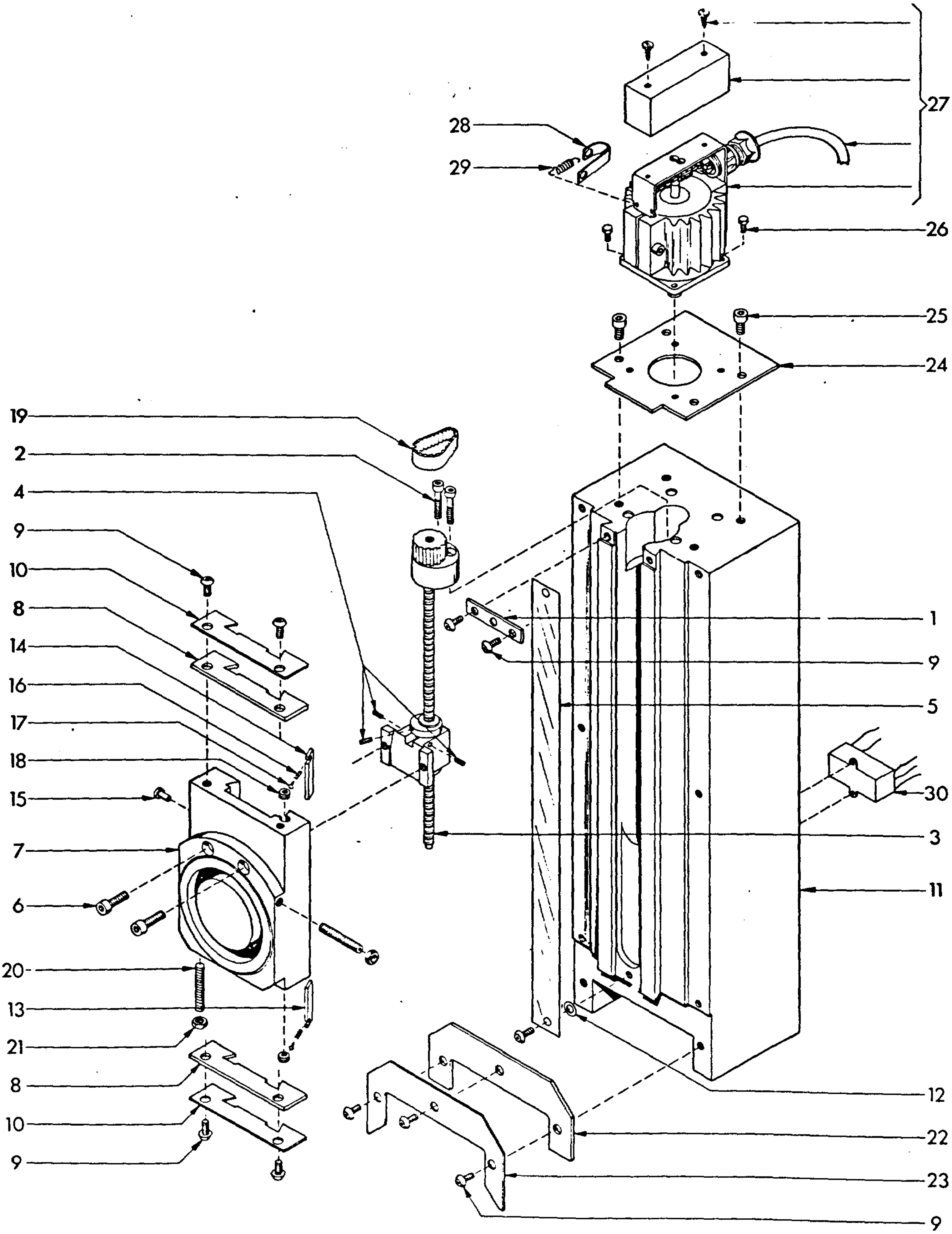
Pos.	Ref. No.	DIN		Benennung	Description
1-15	F1A o3o ooo			Gruppe Kreuzschlitten	Cross slide compl.
1	ZSR 12 o612	M6x12 DIN 912-6.9		Zylinderschraube	Socket head screw
2	F1A o3o o3o			Frästisch	Milling table
3+4	F1A o31 ool			X-Spindel komplett	X-spindle complete
4	ZST 51 o4o8	M4x8 DIN 551-5.8		Gewindestift	Set screw
5	F1A o2o o5o			Keilleiste kurz links	Taper gib short left
	F1A o2o o6o			Keilleiste lang links	Taper gib long left
6	F1A o2o 11o			Keilleiste kurz rechts	Taper gib short right
	F1A o2o 12o			Keilleiste lang rechts	Taper gib long right
7	F1A o3o o2o			Kreuzschlitten	Cross slide
8	ZNP o1 2ooo	A2		Schmiernippel	Grease nipple
9	F1A o2o o7o			Stellschraube	Adjusting screw
10	ZNA 76 o2o4	2x4 DIN 1476-4.6		Kerbnagel	Rivet
11	ZFD o2 4o61			Druckfeder	Compression spring
12	ZSR 33 o616	M6x12 DIN 933-5.6		Sechskantschraube	Hexagon head screw
13	F1A o3o o1o			Sockel	Base
14+4	F1A o32 ool			Y-Spindel komplett	Y-spindle complete
15	ZSR 12 o525	M5x25 DIN 912-6.9		Zylinderschraube	Socket head screw
16	ZSR 88 o61o	M6x1o - 1o.9		Linsenschraube	Filister head screw
17	F1A ooo o1o			Schutzblech 1	Cover sheet 1
18	F1A ooo o2o			Schutzblech 2	Cover sheet 2
19	ZSR 12 1o2o	M1ox2o DIN 912-8.8		Zylinderschraube	Socket head screw
20	ZSR 12 1o9o	M1ox9o DIN 912-1o9		Zylinderschraube	Socket head screw
21	ZRM 73 48o5	MXL 48 o5o		Zahnriemen	Timing belt
22	ZSR 33 o4o8	M4x8 DIN 933-5.6		Sechskantschraube	Hexagon head screw
23	F1A ooo 16o			Motorplatte Y	Motor plate Y
24	F1A ooo 15o			Motorplatte X	Motor plate X
25	F1A 1o3 ooo			Schrittmotor	Step motor
26	F1A ooo 14o			Riemenschutz	Belt cover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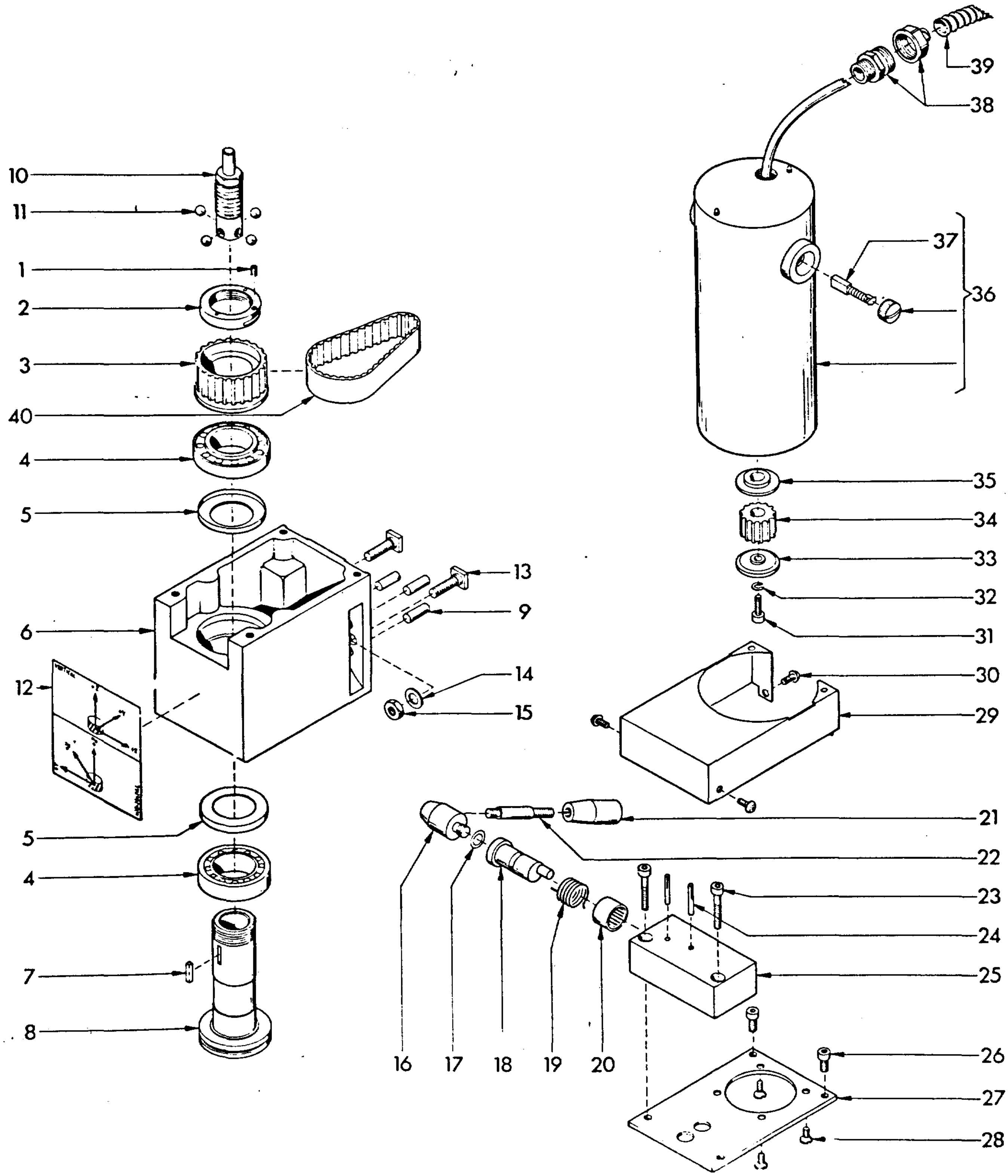
Pos.	Ref. No.	DIN		Benennung	Description
1-18	F1A o2o ooo			Gr. Vertikalschlitten	Vertical slide compl.
1	F1A o2o o4o			Halteblech	Clamping sheet
2	ZSR 12 o525	M5x25 DIN 912-6.9		Zylinderschraube	Socket head screw
3+4	F1A o21 ool			Z-Spindel komplett	Z-spindle complete
4	ZST 51 o4o8	M4x8 DIN 551-5.8		Gewindestift	Set screw
5	F1A o2o o3o			Schutzband	Protection strip
6	ZSR 12 o62o	M6x2o DIN 912-6.9		Zylinderschraube	Socket head screw
7	F1A o2o o2o			Vertikalschlitten	Vertical slide
8	F1A o2o o8o			Abstreiffilz	Felt wiper
9	ZSR 88 o61o	M6x1o - 1o.9		Linsenschraube	Filister head screw
10	F1A o2o o9o			Abstreifblech	Wiper plate
11	F1A o2o o1o			Vertikalsäule	Vertical column
12	ZSB 12 o6o5	PS 6x12x0,5 DIN988		Paßscheibe	Shim ring
13	F1A o2o o5o			Keilleiste kurz links	Taper gib short left
	F1A o2o o6o			Keilleiste lang links	Taper gib long left
14	F1A o2o 11o			Keilleiste kurz rechts	Taper gib short right
	F1A o2o 12o			Keilleiste lang rechts	Taper gib long right
15	ZNP o1 2ooo	A2		Schmiernippel	Grease nipple
16	ZFD o2 4o61	Do61		Druckfeder	Compression spring
17	ZNA 76 o2o4	2x4 DIN 1476-4.6		Kerbnagel	Rivet
18	F1A o2o o7o			Stellschraube	Adjusting screw
19	ZRM 73 48o5	MXL 48 o5o		Zahnriemen	Timing belt
20	ZST 15 o64o	M6x4o DIN 915-45H		Gewindestift	Set screw
21	ZMU 34 o6oo	M6 DIN 934-6		Sechskantmutter	Hexagonal nut
22	F1A ooo 35o			Filzabstreifer	Felt wiper
23	F1A ooo o3o			Dichtblech	Wiper plate
24	F1A ooo 17o			Motorplatte Z	Motor plate Z
25	ZSR 12 o612	M6x12 DIN 912-6.9		Zylinderschraube	Socket head screw
26	ZSR 33 o4o8	M4x8 DIN 933-5.6		Sechskantschraube	Hexagon head screw
27	F1A 1o3 ooo			Schrittmotor	Step motor
28	F1A 15o ooo			Bremsband	Brake strap belt
29	ZFD 5o oo37			Zugfeder	Tension spring
30	ZEF 95 1764			Funkentstörfilter	Interference filter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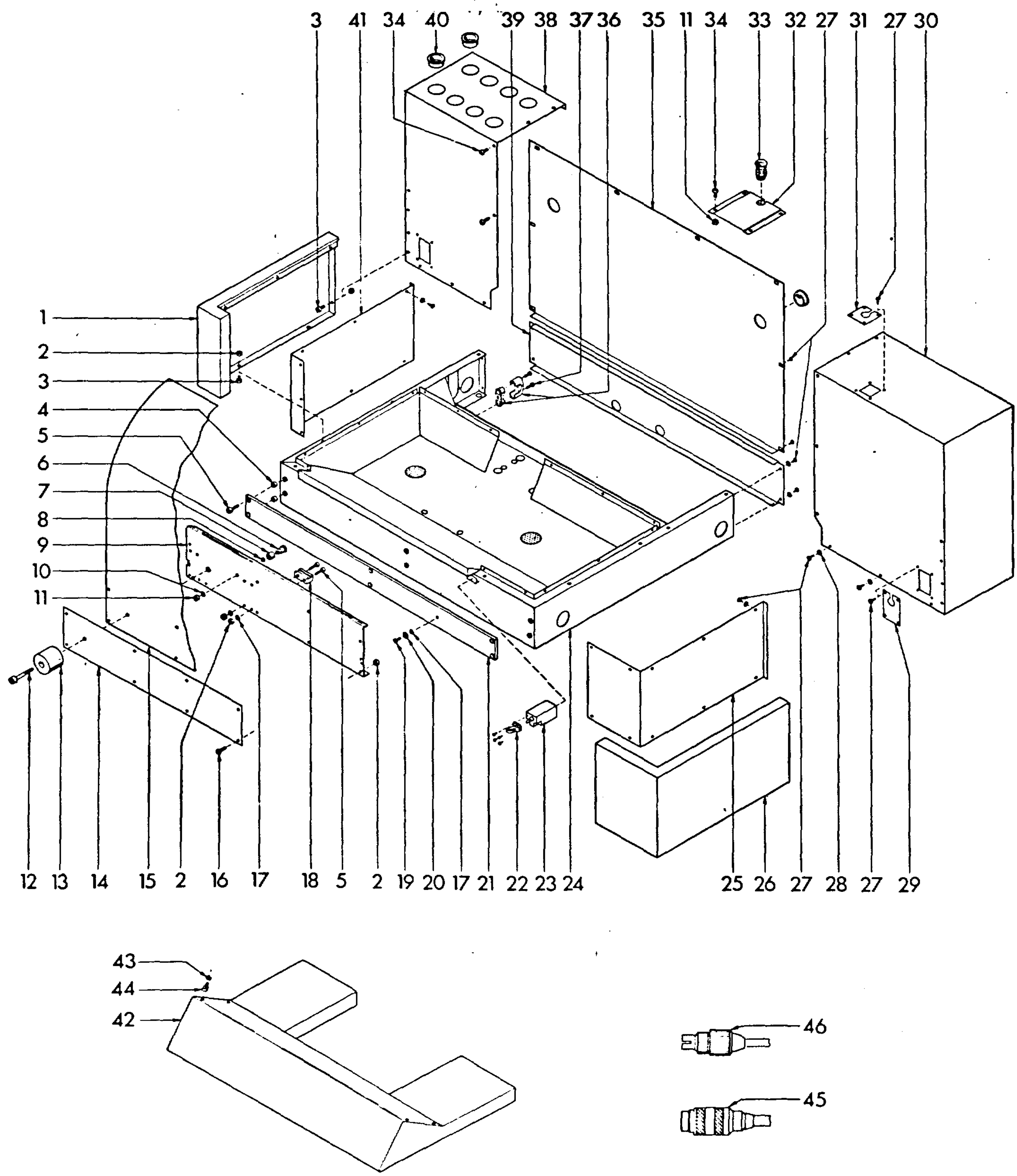
Pos.	Ref. No.	DIN		Benennung	Description
1-9	F1A o1o ooo			Gruppe Fräskopf	Milling head complete
1	ZST 16o 58o	M5x8 DIN 916-45H		Gewindestift	Set screw
2	F1A o1o o4o			Ringmutter	Ring nut
3	F1A o1o o3o			Riemenscheibe	Pulley
4	ZLG 32o o76			Kegelrollenlager	Taper rolled bearing
5	B1A o3o o6o			Deckel	Cover
6	F1A o1o o1o			Fräskopf	Milling head
7	ZFD 854 418	A4x4x18 DIN 6885		Paßfeder	Square key
8	F1A o1o o2o			Frässpindel	Milling spindle
9	ZST o7 o824	8m6x24 DIN 6325		Zylinderstift	Parallel pin
10	F1A o4o ooo			Federeinheit	Belleville spring ass.
11	ZKG oo 1o71	Ø 7		Kugel	Ball
12	F1A ooo 58o			Frontplatte	Front plate
13	C4Z o3o o2o			Nutenschraube	T-nut bolt
14	ZSB 25 o84o	8,4 DIN 125		Scheibe	Washer
15	ZMU 33 o8o1	M8 DIN 934-10B1E		Mutter	Hexagonal nut
16	F1A ooo 41o			Nabe	Hub
17	ZSB 12 1oo1	1ox16xo,1 DIN 988		Paßscheibe o,1	Shim ring o,1
	ZSB 12 1oo3	1ox16xo,3 DIN 988		Paßscheibe o,3	Shim ring o,3
18	F1A ooo o7o			Exzenterbolzen	Eccentric bolt
19	F1A ooo 1oo			Schenkelfeder	Torsion spring
20	ZLG 78 1816			Nadellager	Needle roller bearing
21	ZGF 16 21o8	21xM8 GN 519		Zylinderknopf	Cylindrical knob
22	F1A ooo o8o			Stange	Toggle
23	ZSR 12 o635	M6x35 DIN 912-6.9		Zylinderschraube	Socket head screw
24	ZST 72 o53o			Paßkerbstift	Grooved pin
25	F1A ooo 4oo			Exzenterblock	Eccentric block
26	ZSR 12 o612	M6x12 DIN 912-6.9		Zylinderschraube	Socket head screw
27	F1A ooo o5o			Motorplatte	Motor plate
28	ZSR 79 o512	M5x12 DIN 7991-8.8		Senkschraube	Countersunk screw
29	F1A ooo 42o			Abdeckhaube	Cover
30	ZSR 88 o61o	M6x1o 1o.9		Linsenschraube	Filister head screw
31	ZSR 12 o52o	M5x2o DIN 912-8.8		Zylinderschraube	Socket head screw
32	ZRG 28 oo5o	B5 DIN 127		Federring	Spring ring
33	F1A ooo 12o			Bordscheibe	Washer
34	F1A ooo 11o			Motorriemenscheibe	Motor pulley
35	F1A ooo 13o			Anlaufscheibe	Washer
36	ZMO 78 1445	22o.-24o V		Motor	Motor
	ZMO 78 1446	1oo-12o V		Motor	Motor
37	ZME 2oo 29o			Kohlebürste	Carbon brush
38	ZLT 5o o12o			Schlauchverschraubung	Screw-type conduit fitting
39	ZLT 99 ooo1	FPS 13x17		PVC-Schlauch	Flexible conduit
40	ZRM 51 311o	11o XL o75		Zahnriemen	Timing belt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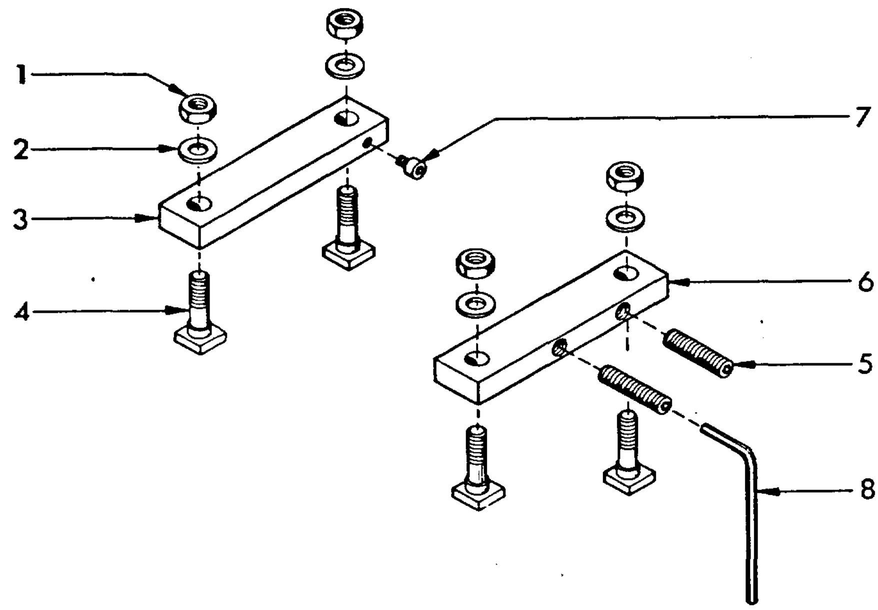
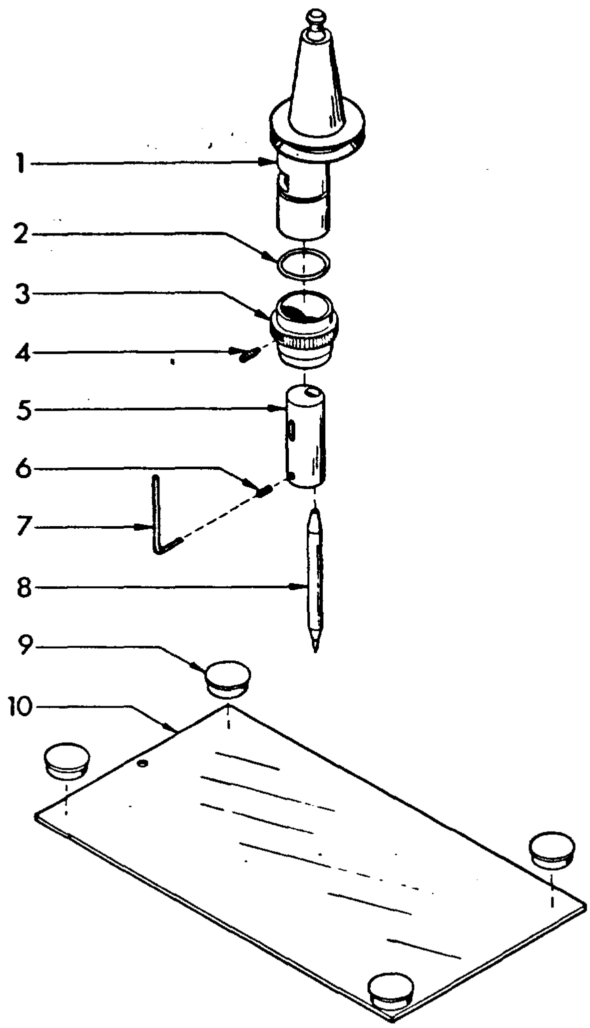
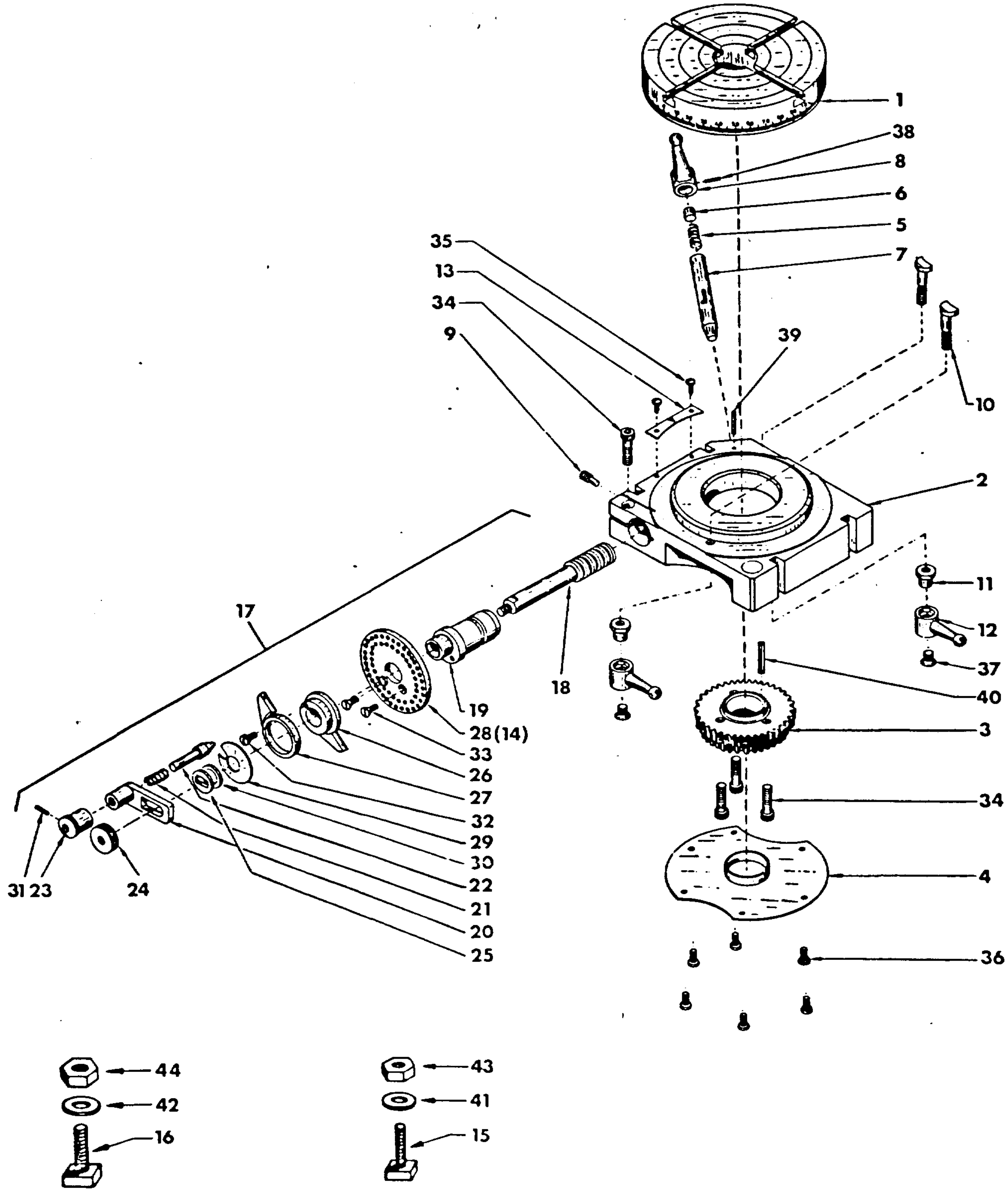
Pos.	Ref. No.	DIN		Benennung	Description
1	F1A 13o ooo			**Verkleidungsblech 1**	Side guard 1
2	ZMU 34 o5oo	M5 DIN 934-5		Sechskantmutter	Hexagonal nut
3	ZSR 12 o5o8	M5x8 DIN 912-6.9		Zylinderschraube	Socket head bolt
4	F1A ooo 5oo			Distanzring	Spacer
5	ZSR 12 o52o	M5x2o DIN 912-8.8		Zylinderschraube	Socket head screw
6	F1A ooo 53o			Lagerbolzen	Bearing bolt
7	ZLG 78 1o1o			Nadelhülse	Needle roller bearing
8	ZRG 71 1o1o	1ox1 DIN 471		Sicherungsring	Retaining ring
9	F1A 18o ooo			Türblech	Door sheet 1
10	ZSB 25 o64o	6,4 DIN 125		Scheibe	Washer
11	ZMU 34 o6oo	M6 DIN 934-6		Sechskantmutter	Hexagonal nut
12	ZSR 12 o855	M8x55 DIN 912-6.9		Zylinderschraube	Socket head screw
13	F1A ooo 51o			Griff	Handle
14	F1A ooo 46o			Frontblech	Door sheet 2
15	F1A ooo 24o			Tür	Door
16	ZSR 88 o52o	M5x2o - 1o.9		Linsenschraube	Filister head bolt
17	ZSB 25 o53o	5,3 DIN		Scheibe	Washer
18	F1A ooo 49o			Führungsleiste	Sliding block
19	ZSR 79 o512	M5x12 DIN 7991		Senkschraube	Countersunk screw
20	ZOR oo 6o3o	Ø 6x3		O-Ring	O-ring
21	F1A ooo 48o			Führungsschiene	Sliding guide
22	ZEE 47 o231			Rollenhebel	Roller arm
23	ZEL 21 2o3o	ZS 231-11y		Endschalter	Limit switch (french version)
24	F1A o6o ooo			Spänetasse	Chip tray
25	F1A ooo 44o			Abdeckung 2	Cover sheet 2
26	F1A 14o ooo			Verkleidungsblech 2	Side guard 2
27	ZSR G1 4295	B4,2x9,5 DIN 7981		Blechschraube	Sheet metal screw
28	ZSB 21 o43o	4,3 DIN 9o21		Scheibe	Washer
29	F1A ooo 31o			Kabelblech 1	Wire sheet 1
30	F1A ooo 22o			Seitenwand 2	Housing 2
31	F1A ooo 36o			Kabelblech 2	Wire sheet 2
32	F1A ooo 47o			Verbindungsblech	Compound sheet
33	ZPG 1o ooo8	MZB 13		Kabelverschraubung	Screw-type conduit fitting
34	ZSR 88 o61o	M6x1o - 1o.9		Linsenschraube	Filister head screw
35	F1A ooo 23o			Rückwand 1	Back cover 1
36	ZEL 99 2o1o			Schelle	Wire clamp
37	ZSR 84 o416	M4x16 DIN 84-4.8		Zylinderschraube	Flat head screw
38	F1A ooo 21o			Seitenwand 1	Housing 1
39	F1A ooo 33o			Rückwand 2	Back cover 2
40	ZXM o1 224o			Schnappdurchführung	Ring
41	F1A ooo 43o			Abdeckung 1	Cover sheet 1
42	F1A o5o ooo			Untersatz	Base for electric box
43	ZSB 21 o64o	6,4 DIN 9o21		Scheibe	Washer
44	ZSR 12 o612	M6x12 DIN 912-6.9		Zylinderschraube	Socket head screw
45	ZEL o3 oo12			Kupplungsstecker RS232	Coupling plug RS232
46	ZES 15 1oo6			TV Kupplungsstecker	TV coupling plug



Pos.	Ref. No.	DIN		Benennung	Description
	F1A 16o ooo			Gruppe Tischspann-leiste	Table clamping gib complete
1	ZMU 34 o8oo	M8 DIN 934-6		Sechskantmutter	Hexagonal nut
2	ZSB 25 o84o	B8,4 DIN 125		Scheibe	Washer
3	F1Z o6o o1o			Anschlagleiste	Stop gib
4	C4Z o3o o2o			Nutenschraube	T-nut bolt
5	ZSR 99 ooo3	M8x35		Stiftschraube	Set screw
6	F1Z o6o o2o			Spannleiste	Clamping gib
7	ZSR 12 o5o6	M5x6 DIN 912-6.9		Zylinderschraube	Socket head screw
8	ZWZ 11 o4oo	SW4 DIN 911		Schraubendreher	Hexagon socket scr. key



Pos.	Ref. No.	DIN		Benennung	Description
	770 300			Plotter F1	Plotter F1
1	F1Z 3oo olo			Aufnahmedorn	Arbor
2	ZOR o2 3324	OR 23,3 - 2,4		O-Ring	O-Ring
3	F1Z 3oo o3o			Einstellring	Adjusting ring
4	ZST 15 o412	M4x12 DIN 915-45H		Gewindestift	Set screw
5	F1Z 3oo o2o			Exzenterhülse	Eccentric sleeve
6	ZST 13 o4o8	M4x8 DIN 913-45H		Gewindestift	Set screw
7	ZWZ 11 o2oo	SW2 DIN 911		6-Kant Schraubendreher	Hexagonal key
8	ZST 99 1ooo			Faserstift	Plotter pen
9	ZXM oo 2oo8	Ø 20x8		Haltemagnet	Magnetic disc
10	F1Z 3o1 ooo			Aufspannplatte	Clamping plate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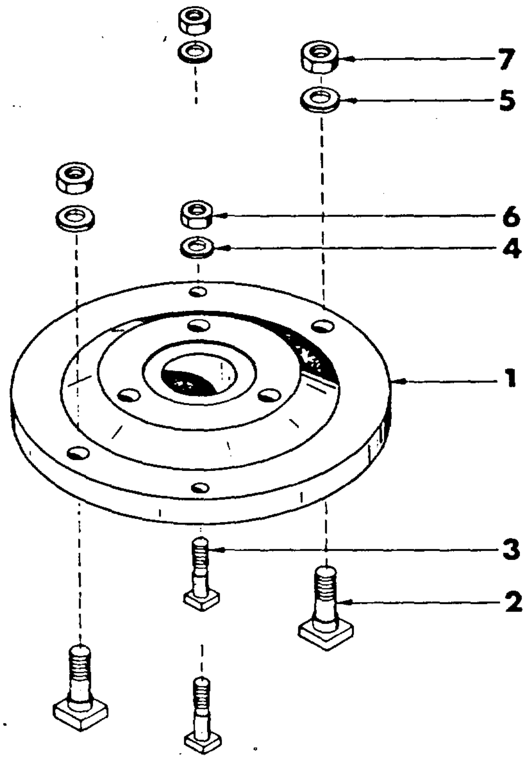
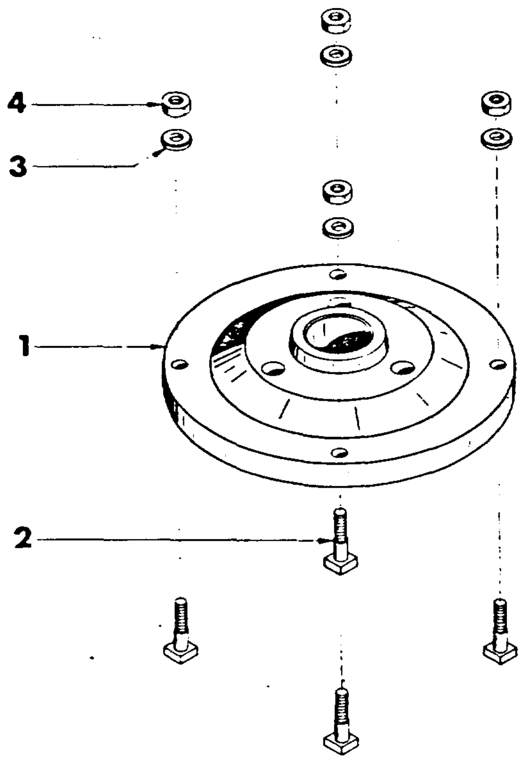
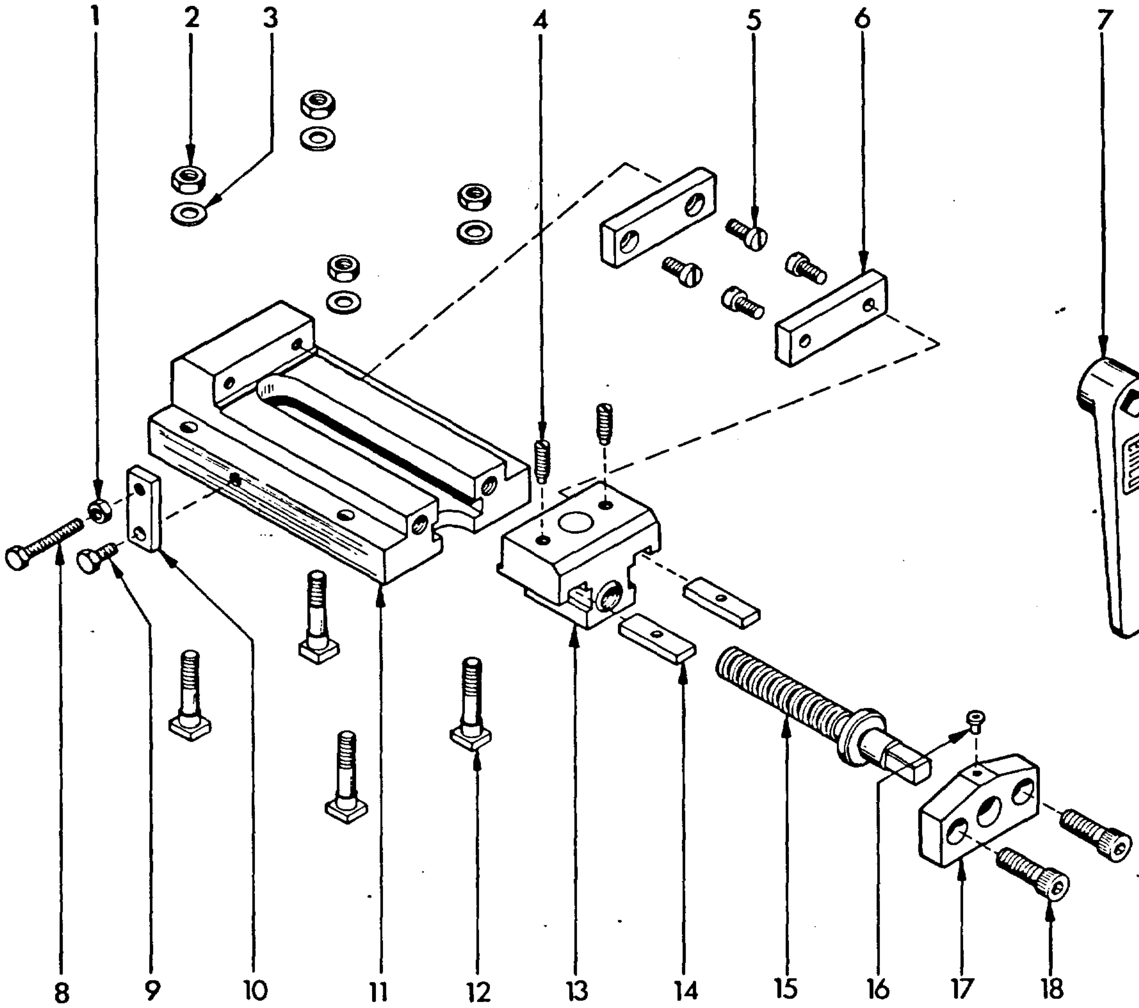
Pos	Ref.No.	DIN		BENENNUNG	DESCRIPTION
	745 000			G. Teilapparat	Dividing head
1	B2Z 320 010			Rundtisch	Table
2	B2Z 320 020			Gehäuse	Housing
3	B2Z 320 030			Teilrad	Table flange
4	B2Z 320 040			Deckblech	Cover mount
5	B2Z 320 050			Druckfeder	Compression spring
6	B2Z 320 060			Druckbolzen	Bolt
7	B2Z 320 070			Index	Locking pin
8	B2Z 320 080			Knebelgriff	Lever
9	B2Z 320 090			Anschlagschraube	Bushing
10	B2Z 320 100			Klemmschraube	Locking bolt
11	B2Z 320 110			Mutter	Nut
12	B2Z 320 120			Knebelgriff	Lever
13	B2Z 320 130			Zeiger	Guide
14	B2Z 320 140			Lochscheibe 33-36-39	Indexing plate
	B2Z 320 150			Lochscheibe 38-40	Indexing plate
15	B2Z 320 160	M 6		Nutenschraube	T-Nut
16	B2Z 320 170	M 8		Nutenschraube	T-Nut
17	B2Z 321 000			Gr. Schnecke	Worm shaft
18	B2Z 321 010			Schnecke	Worm shaft
19	B2Z 321 020			Exzenter	Assembly arbor
20	B2Z 321 030			Kurbel	Crank
21	B2Z 321 040			Druckfeder	Compression spring
22	B2Z 321 050			Absteckbolzen	Bolt
23	B2Z 321 060			Hülse	Sleeve
24	B2Z 321 070			Rändelmutter	Knurled nut
25	B2Z 321 080			Scheibe	Plate
26	B2Z 321 090			Schere rechts	Section arm r. h.
27	B2Z 321 100			Schere links	Section arm l. h.
28	B2Z 321 120			Lochscheibe 27-36-42	Indexing plate
29	B2Z 321 130			Tellerfeder	Spring washer
30	B2Z 321 140			Scheibe 1,8	Plate 1,8
	B2Z 321 150			Scheibe 2,0	Plate 2,0
	B2Z 321 160			Scheibe 2,2	Plate 2,2
31	ZHL 81 0212	2x12 DIN 1481		Spannhülse	Pin
32	ZSR 85 0406	AM4x6 DIN 85		Zylinderschraube	Flat head screw
33	ZSR 63 0410	M4x10 DIN 963		Senkschraube	Flat head screw
34	ZSR 12 0625	M6x25 DIN 912		Innensechskantschraube	Allen head screw
35	ZSR 84 0304	M3x4 DIN 84		Zylinderschraube	Flat head screw
36	ZSR 84 0406	M4x6 DIN 84		Zylinderschraube	Flat head screw
37	ZSR 63 0608	M6x8 DIN 963		Senkschraube	Flat head screw
38	ZHL 81 0214	2x14 DIN 1481		Spannhülse	Pin
39	ZHL 81 0322	3x22 DIN 1481		Spannhülse	Pin
40	ZHL 81 0530	5x30 DIN 1481		Spannhülse	Pin
41	ZSB 25 0640	B6,4 DIN 125		Scheibe	Washer
42	ZSB 25 0840	B8,4 DIN 125		Scheibe	Plate
43	ZMU 34 0600	M6 DIN 934		Mutter	Nut
44	ZMU 34 0800	M8 DIN 934		Mutter	Nut



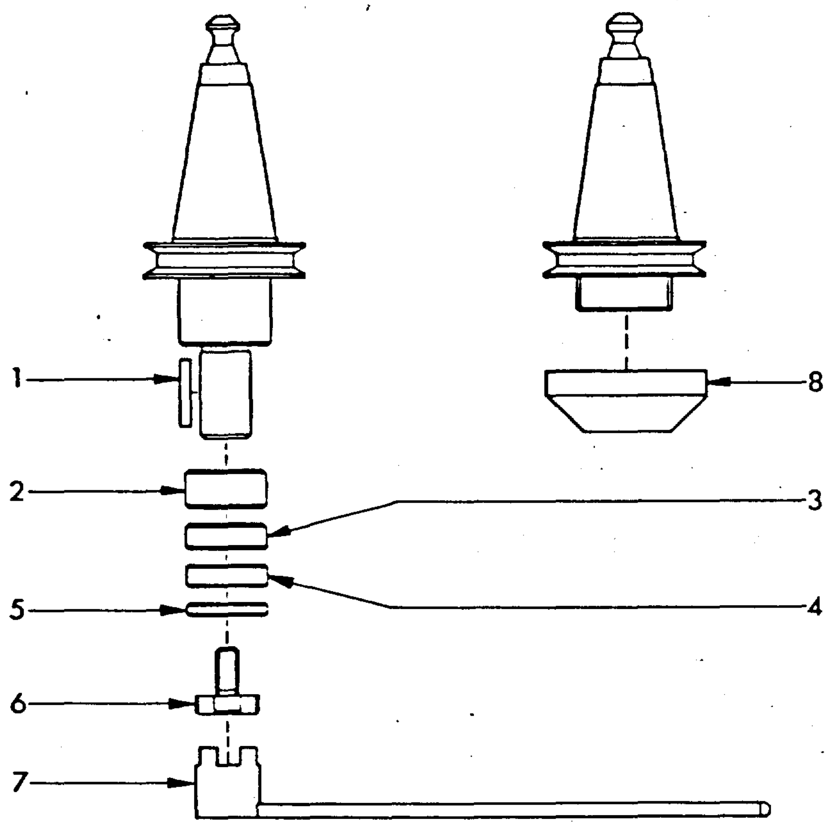
Pos.	Ref. No.	DIN		Benennung	Description
	346 510			**G.Supportflansch**	**Cross slide adaptor compl.**
1	B4Z 250 010			Supportflansch	Cross slide adaptor
2	C3Z 030 040			Nutenschraube M8	T-Bolt M8
3	B4Z 170 020			Nutenschraube M6	T-Bolt M6
4	ZSB 25 0640	B 6,4 DIN 125		Scheibe	Washer
5	ZSB 25 0840	B 8,4 DIN 125		Scheibe	Washer
6	ZMU 34 0600	M6 DIN 934-6		Sechskantmutter	Hexagon nut
7	ZMU 34 0800	M8 DIN 934-6		Sechskantmutter	Hexagon nut



Pos.	Ref. Nr.	DIN		Benennung	Description
	745 510			**G. Zwischenflansch**	**Adaptor plate compl.**
1	B4Z 170 010			Zwischenflansch	Adaptor plate
2	B4Z 170 020			Nutenschraube	T-bolt
3	ZSB 25 0649	B 6,4 DIN 125		Scheibe	Washer
4	ZMU 34 0600	M6 DIN 934-6		Sechskantmutter	Hexagon nut



Pos.	Ref. No.	DIN		Benennung	Description
	77o 31o			Maschinenschraubstock	Machine vice
1	ZMU 34 o6oo	M6 DIN 934-6		Sechskantmutter	Hexagonal nut
2	ZMU 34 o8oo	M8 DIN 934-6		Sechskantmutter	Hexagonal nut
3	ZSB 25 o84o	8,4 DIN 125		Scheibe	Washer
4	ZST 17 o515	M5x15 DIN 417-5.8		Gewindestift	Set screw
5	ZSR 84 o512	M5x12 DIN 84-4.8		Zylinderschraube	Flat head screw
6	B2Z 31o o5o			Aufsatzbacke	Jaw
7	B2Z 31o o8o	SW10		Schlüssel	Key
8	ZSR 33 o64o	M6x4o DIN 933-5.6		Sechskantschraube	Hexagon head bolt
9	ZSR 33 o612	M6x12 DIN 933-5.6		Sechskantschraube	Hexagon head screw
10	F1Z 31o o3o			Anschlagplatte	Stop plate
11	F1Z 31o o1o			Körper	Body
12	F1Z 31o o2o			Nutenschraube	T-bolt
13	B2Z 31o o2o			Backe	Moving jaw
14	B2Z 31o o6o			Einstelleiste	Adjusting gib
15	B2Z 31o o4o			Spindel	Operating screw
16	ZNP o1 1ooo			Schmiernippel	Grease nipple
17	B2Z 31o o3o			Spindelträger	Screw mount
18	ZSR 12 o825	M8x25 DIN 912-8.8		Zylinderschraube	Socket head screw



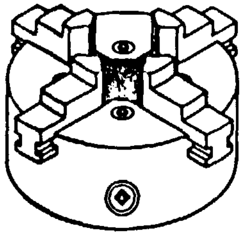
Pos.	Ref. No.	DIN		Benennung	Description
1	ZFD 85 4422	A4x4x22 DIN 6885		Paßfeder	Square key
2	F1Z o2o o5o			Fräsdornring 12 mm	Collar 12 mm
3	F1Z o2o o4o			Fräsdornring 8 mm	Collar 8 mm
4	F1Z o2o o3o			Fräsdornring 6 mm	Collar 6 mm
5	F1Z o2o o2o			Fräsdornring 4 mm	Collar 4 mm
6	ZSR 67 o8oo	M8 DIN 6367		Schraube	Screw
7	ZWZ 58 16oo	16 DIN 6368		Schlüssel	Key
8	A5Z o4o o2o			Spannmutter	Nut

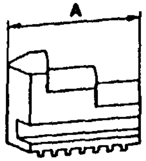
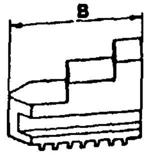
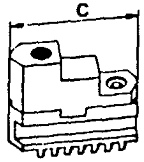
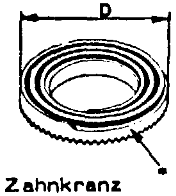
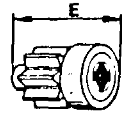
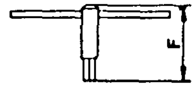
4-BACKEN-FUTTER, SELBSTZENTRIEREND
4-JAW-CHUCK, SELF-CENTERING
MANDRIN À 4 MORS, SERRAGE CONCENTRIQUE

* Am Außenring des Zahnkranzes ist eine Ziffer (o,1,2,3 ...) eingraviert. Bei Bestellung zusätzlich zur Bestellnummer diese Ziffer angeben.

* On the outside ring of the scroll a number (o,1,2 or 3) is engraved. Please state this number also when ordering a scroll.

* Sur l'anneau extérieur de la couronne dentée est gravé un chiffre (o,1,2 ou 3). Prière d'indiquer en plus ce chiffre ensemble avec le numéro de référence.



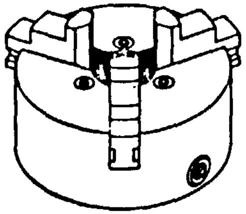
Futter-durchmesser / Dia of chuck / Dia du mandrin	 Satz von 4 nach außen abgestuften Backen / Set of 4 inside jaws / Jeu de 4 mors interieurs		 Satz von 4 nach Innen abgestuften Backen / Set of 4 outside jaws / Jeu de 4 mors exterieurs		 Satz von 4 Umkehr-backen. / Set of 4 reversible jaws. / Jeu de 4 mors reversibles.		 Zahnkranz / Scroll / Couronne		 Triebling / Pinion / Pignon		 Schlüssel / Key(Wrench) / CLE	
	A (mm)	Ref. No.	B (mm)	Ref. No.	C (mm)	Ref. No.	D (mm)	Ref. No.	E (mm)	Ref. No.	F (mm)	Ref. No.
∅ 110 mm	42	ZME 30 1144	42	ZME 30 1154			79	T1C 000 020	37	T0C 000 030	78	T0B 001 000

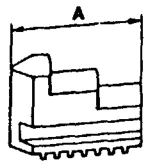
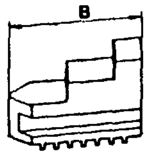
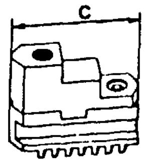
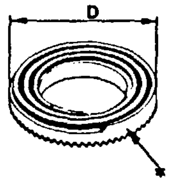
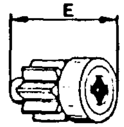
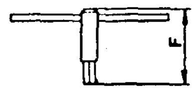
3-BACKEN-FUTTER, SELBSTZENTRIEREND
3-JAW-CHUCK, SELF-CENTERING
MANDRIN À 3 MORS, SERRAGE CONCENTRIQUE

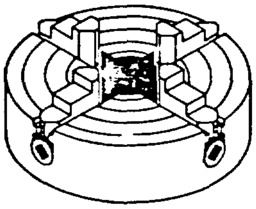
* Am Außenring des Zahnkranzes ist eine Ziffer (o,1,2,3 ...) eingraviert. Bei Bestellung zusätzlich zur Bestellnummer diese Ziffer angeben.

* On the outside ring of the scroll a number (o,1,2 or 3) is engraved. Please state this number also when ordering a scroll.

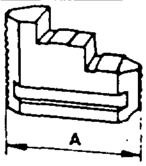
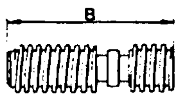
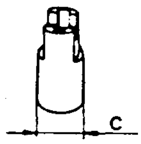
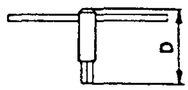
* Sur l'anneau extérieur de la couronne dentée est gravé un chiffre (o,1,2 ou 3). Prière d'indiquer en plus ce chiffre ensemble avec le numéro de référence.

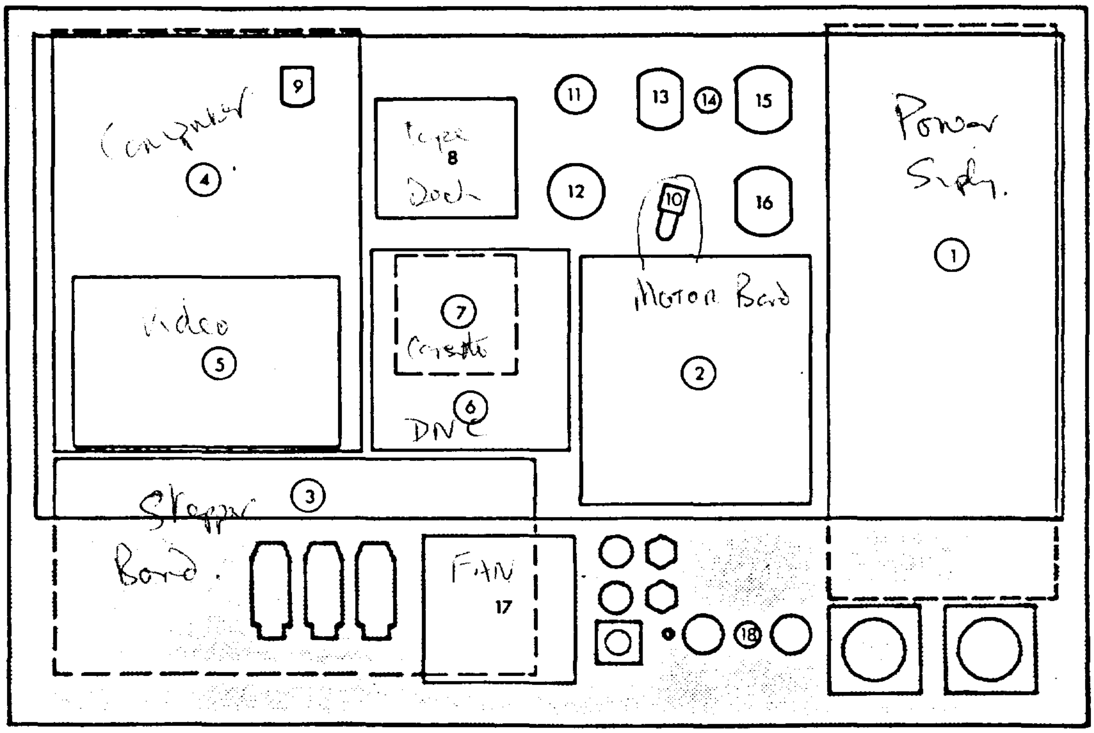


Futterdurch-messer / Dia of chuck / Dia du mandrin	 Satz von 3 nach außen abgestuften Backen / Set of 3 inside jaws / Jeu de 3 mors interieurs		 Satz von 3 nach Innen abgestuften Backen / Set of 3 outside jaws / Jeu de 3 mors exterieurs		 Satz von 3 Umkehr-backen. / Set of 3 reversible jaws. / Jeu de 3 mors reversibles		 Zahnkranz / Scroll / Couronne		 Triebling / Pinion / Pignon		 Schlüssel / Key(Wrench) / CLE	
	A (mm)	Ref. No.	B (mm)	Ref. No.	C (mm)	Ref. No.	D (mm)	Ref. No.	E (mm)	Ref. No.	F (mm)	Ref. No.
∅ 110 mm	42	ZME 30 1143	42	ZME 30 1153			79	T1C 000 020	37	T0C 000 030	78	T0B 001 000



PLANSCHEIBE MIT 4 BACKEN
4-JAW INDEPENDEND CHUCK
PLATEAU DE TOUR À 4 MORS

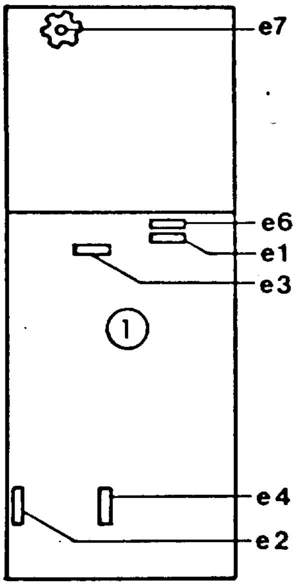
	 Satz von 4 Umkehr-backen Set of 4 reversible jaws Jeu mors revers.		 Spindel Spindle Broche		 Gabelbolzen Bolt Axe a couble fourche		 Schlüssel Key (Wrench) CLE	
D (mm)	A (mm)	Ref. No.	B (mm)	Ref. No.	C (mm)	Ref. No.	D (mm)	Ref. No.
⌀ 152 mm ⌀ 6"	51	P1E oo4	48	P0E ooo o3o	18	P1E ooo 15o	9o	P0E oo1 ooo



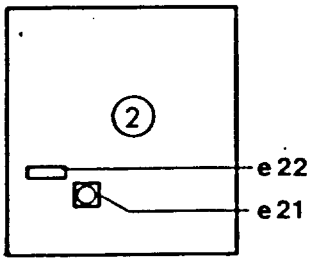
Hauptmotor Main motor	220-240 V: ZMO 78 1445 100-115 V: ZMO 78 1446
Vorschubspindel Spindles feed	X : F1A 031 001 Y : F1A 032 001 Z : F1A 021 001
	X,Y,Z beziehen sich auf vertikales Achssystem X,Y,Z in vertical axis system
Schrittmotor Step motor	X : F1A 103 000 Y : F1A 103 000 Z : F1A 103 000

Position	Position / Description	Ref.Nr.		
		220-240V	110-120V	100V
1	Netzteilplatine Power supply board	F1A 111 000	F1C 111 000	F1V 111 000
2+10	Hauptspindelplatine Main motor board	F1A 112 000	F1C 112 000	
3	Schrittmotorplatine Step motor board	F1A 113 000		
4+9	Rechnerplatine Computer board	F1A 114 000		
5	Videoplatine Videoboard	A6A 115 000		
6	DNC-Platine DNC board	A6A 116 001		
7	Kassettenplatine Cassette board	A6F 091 000		
8	Kassettengerät Cassette deck	ZET 30 0001		
7+8	Kassettengerät mit Platine Cassette deck + cassette board	A6F 090 000		
9	Potentiometer Potentiometer	ZEP 05 4700		
10	Potentiometer Potentiometer	ZEP 03 0500		
11 (b3)	Umschalter (inch - mm) Change-over switch (inch - mm)	ZEP 21 9005		
12 (g1)	Amperemeter Ammeter	ZEM 30 2005	ZEM 30 2010	
13 (b1)	Not-Aus-Schalter Emergency-stop button	ZEL 40 0002		
14 (h1)	Kontrolleuchte EIN Control lamp ON	ZEE 53 7220	ZEE 53 7110	
15 (a1)	Hauptschalter Main switch	ZEL 21 0014		
16 (b2)	Hauptmotorschalter Main motor switch	ZEL 22 0010	ZEL 22 0020	
17 (m2)	Lüfter Fan	ZMO 78 9220	ZMO 78 9220	
18 (e8)	Hauptsicherung Main fuse	ZEE 75 0030 (8A)	ZEE 75 0035 (10A)	

SICHERUNGEN / FUSES

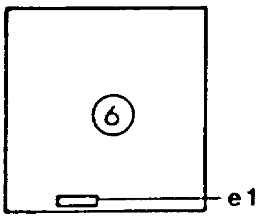


e1	4A	ZEE 75 0011
e2	4A	ZEE 75 0011
e3	6,3A	ZEE 75 0013
e4 (220 V)	2,5A	ZEE 75 0012
(115 V)	4A	ZEE 75 0011
e6	1A	ZEE 75 0014
e7	16A	ZEE 70 2016



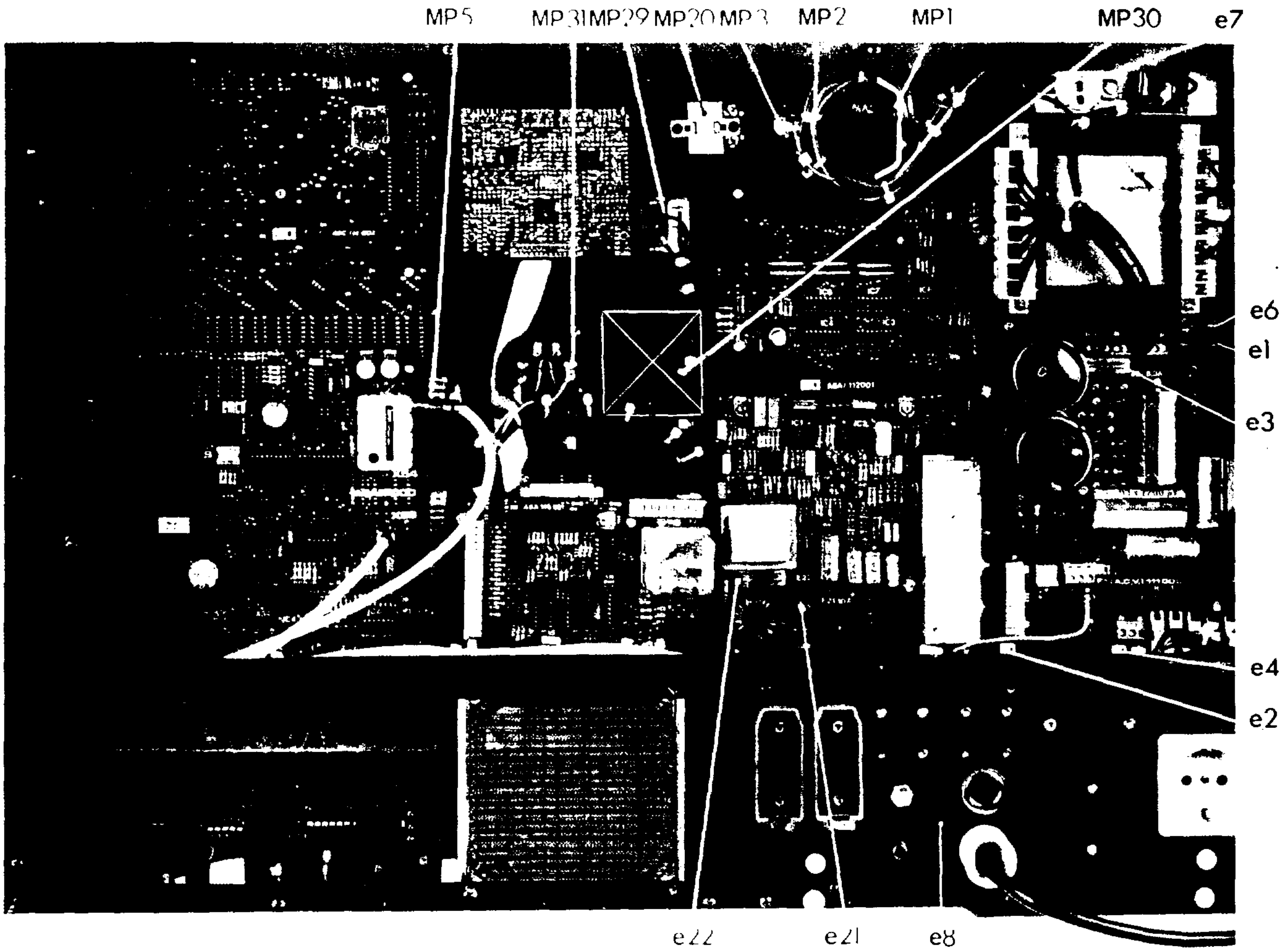
e21 .... 10A ff ... ZEE 75 0021
superfast

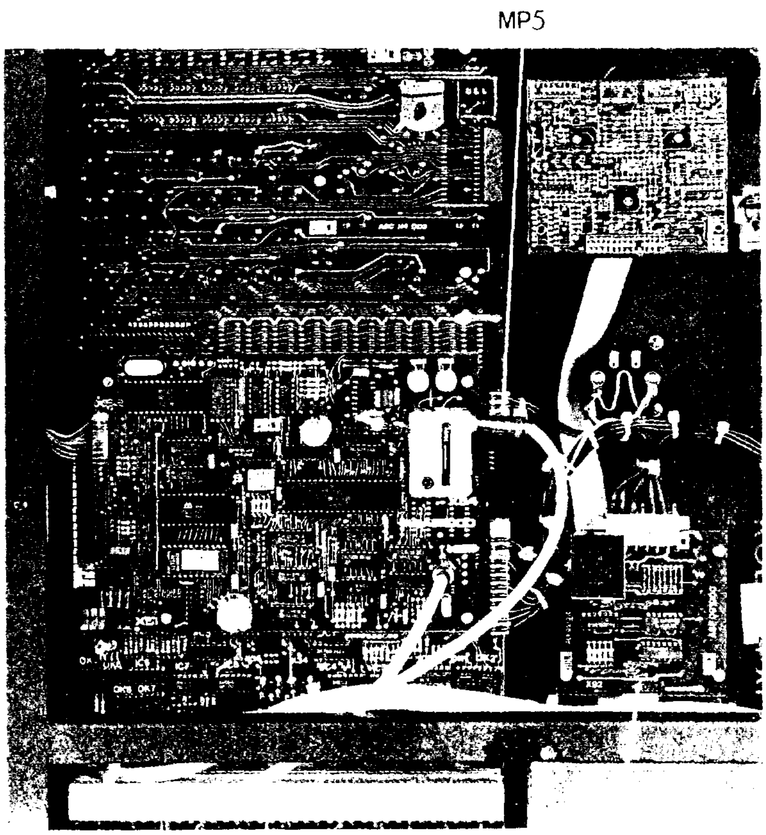
e22 .... 0,1A ...... ZEE 75 0015

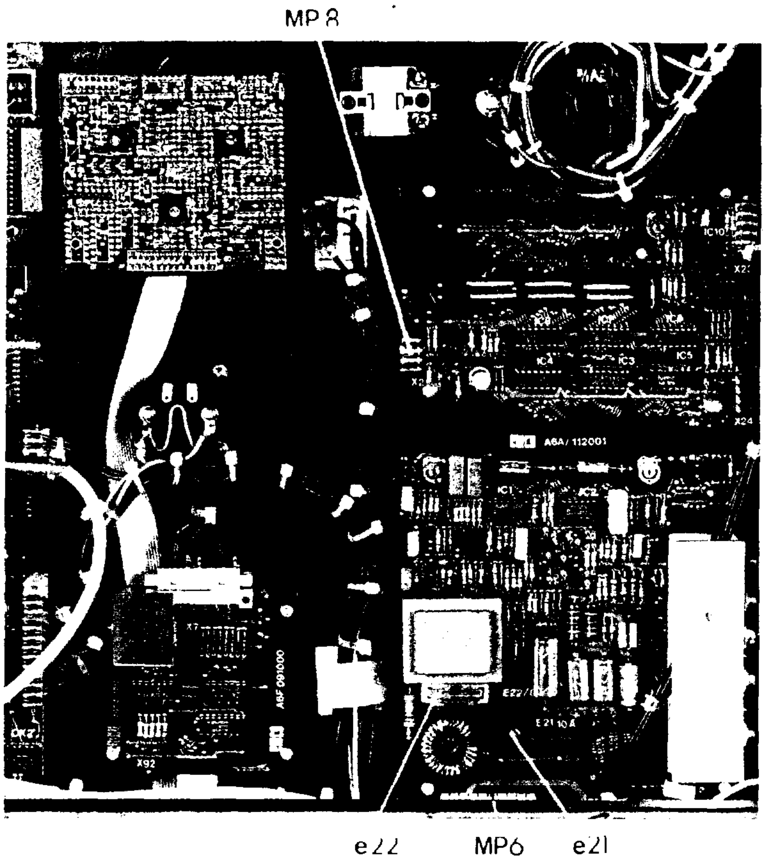


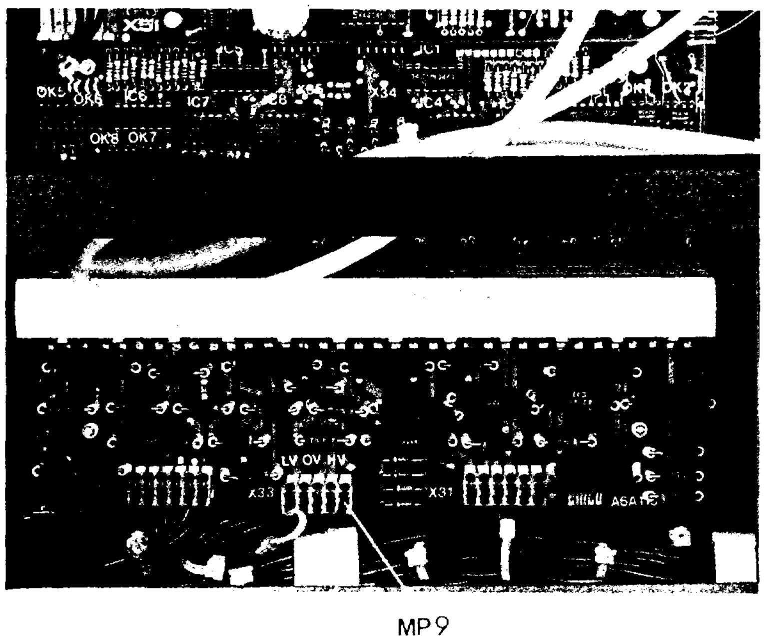
e1 .... 4A .... ZEE 75 0011

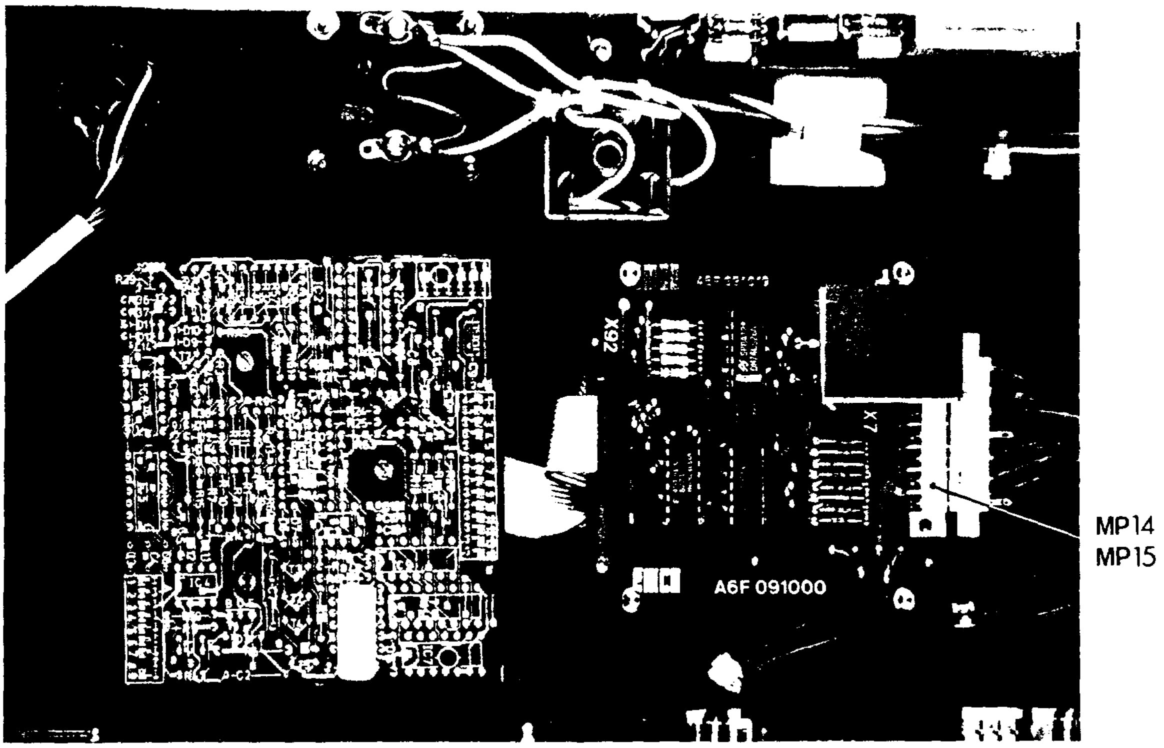
Messpunkte
Compact 5 CNC/ F1 CNC


MP5
MP31
MP29
MP20
MP3
MP2
MP1
MP30
e7
e6
e1
e3
e4
e2
e22
e21
e8


MP5


MP 8
e22
MP6
e21


MP9


X92
X7
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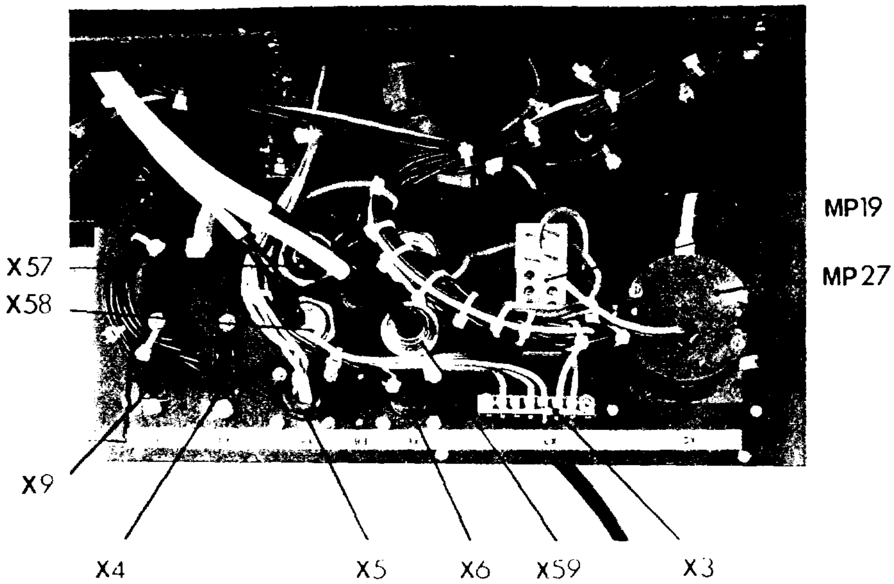
MP14
MP15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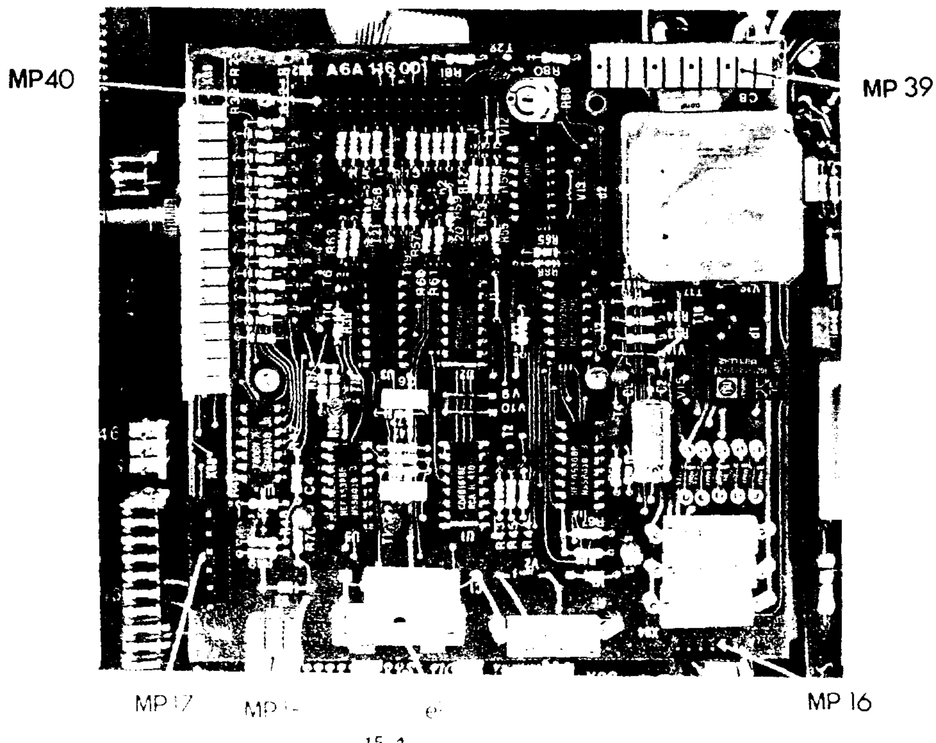
X57
MP 27
X58
X9
X4
X5
X6
X59
X3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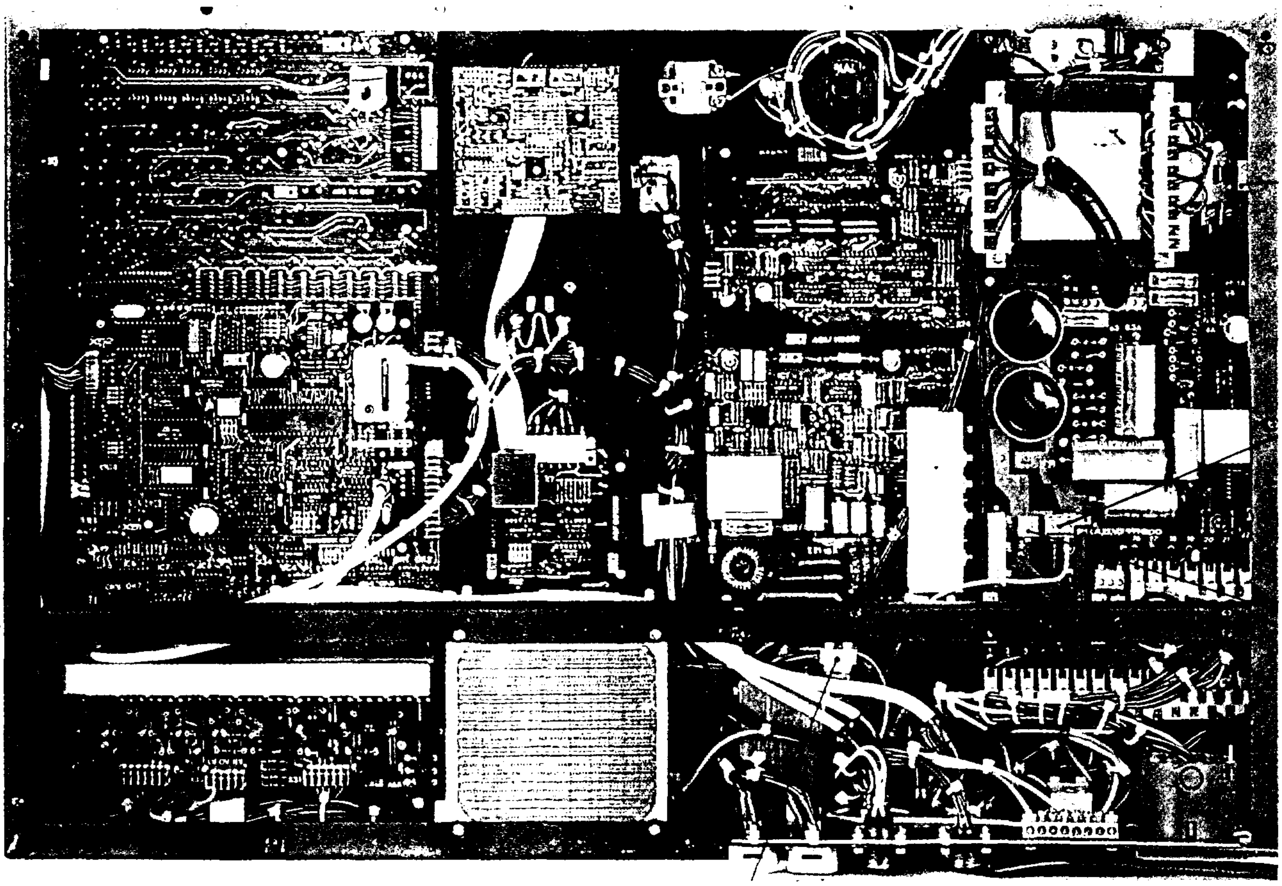
MP 39
MP 17
MP 16

MP34



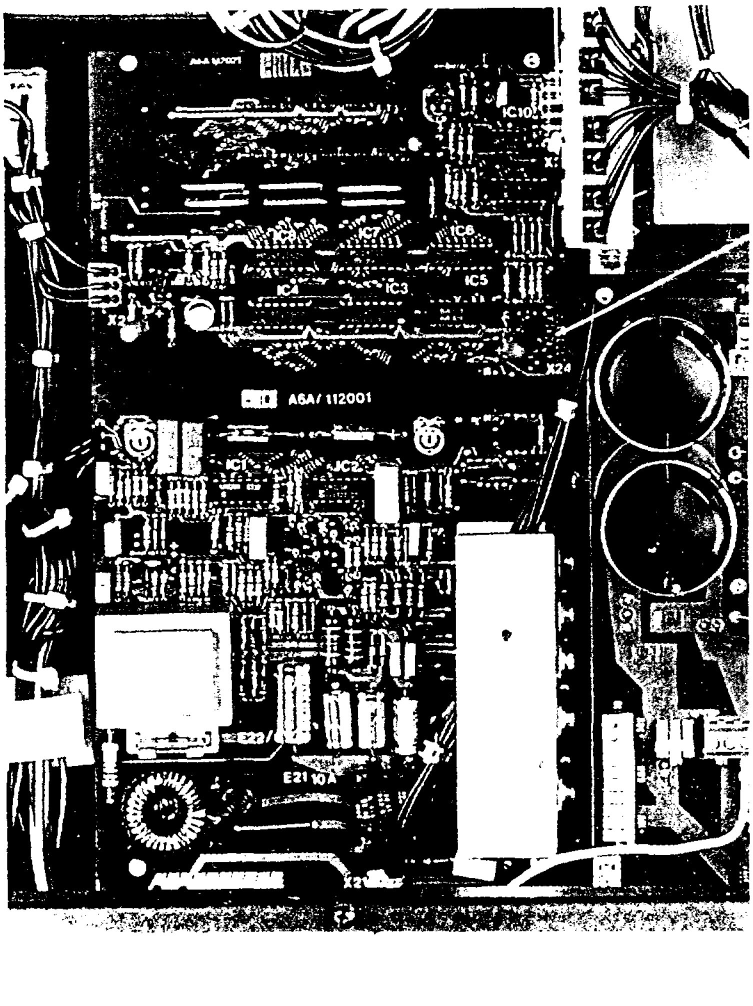
MP33

MP 38

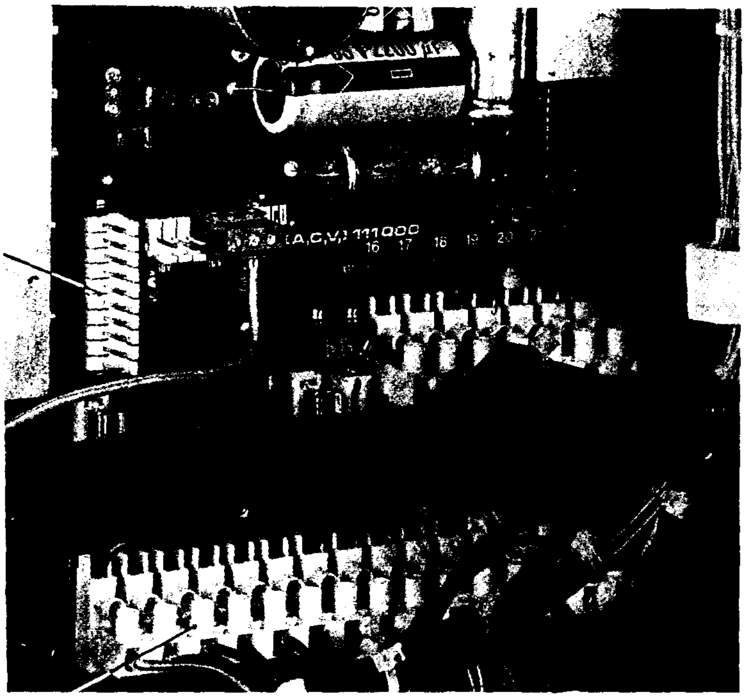
MP37

MP 32

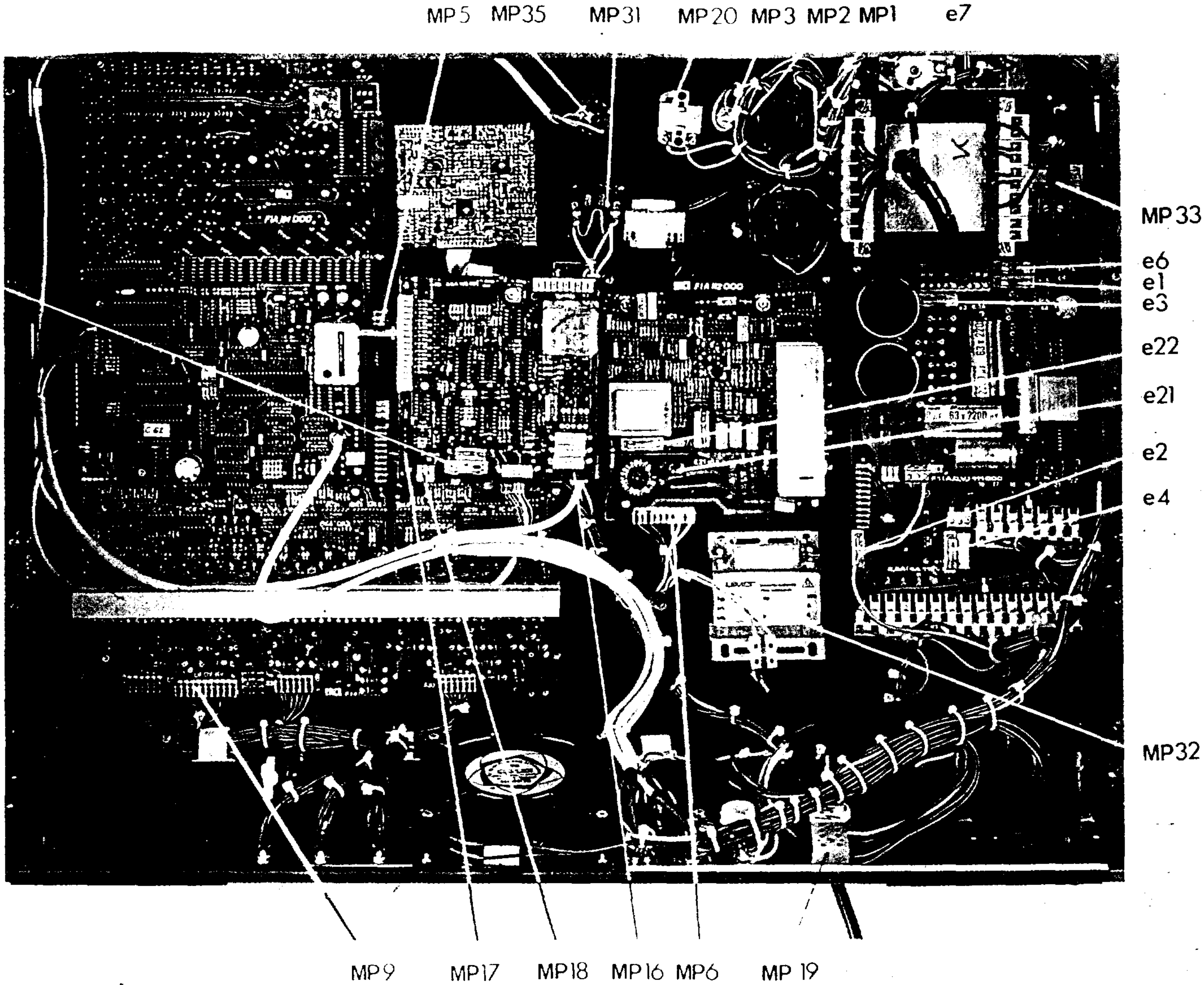
MP22– MP26



MP 21



MP 4 PIN 9/10
MP 7 PIN7/8
MP10 PIN3/6
MP12 PIN5/6
MP13 PIN4/6
MP41 PIN 2/6
MP42 PIN19/18
MP43 PIN16/17
MP44 PIN 16/1
MP45 PIN 13/15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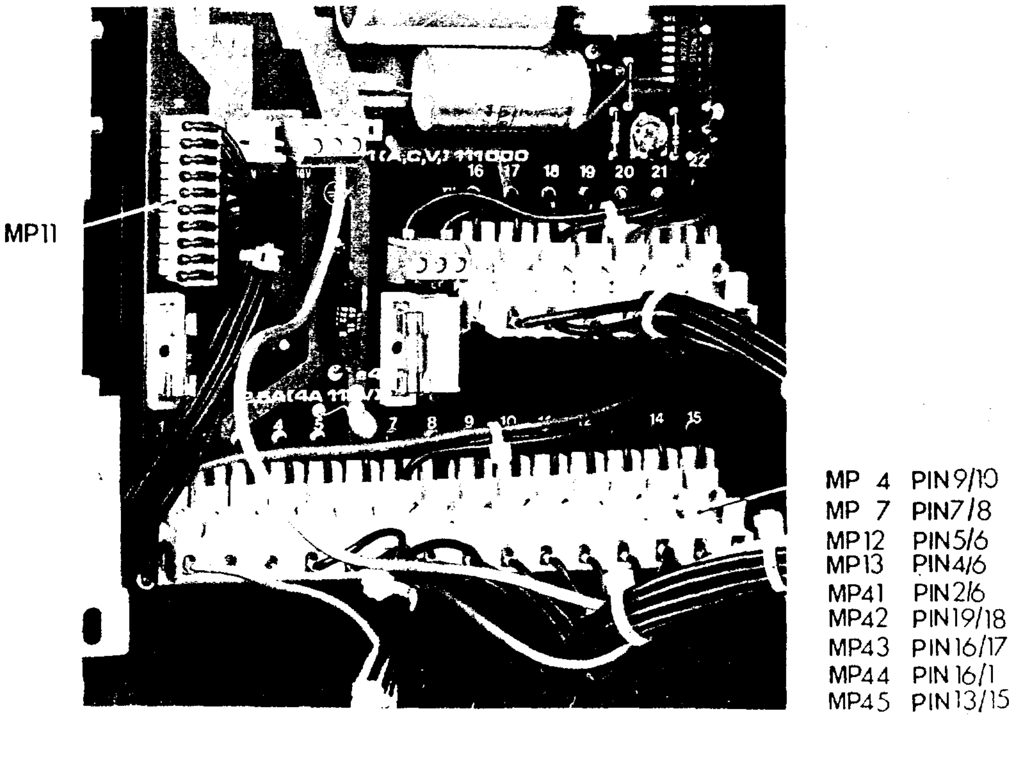
el
MP33
e6
e1
e3
e22
e21
e2
e4
MP32
MP9 MP17 MP18 MP16 MP6 MP 19


MP11
MP 4 PIN9/10
MP 7 PIN7/8
MP12 PIN5/6
MP13 PIN4/6
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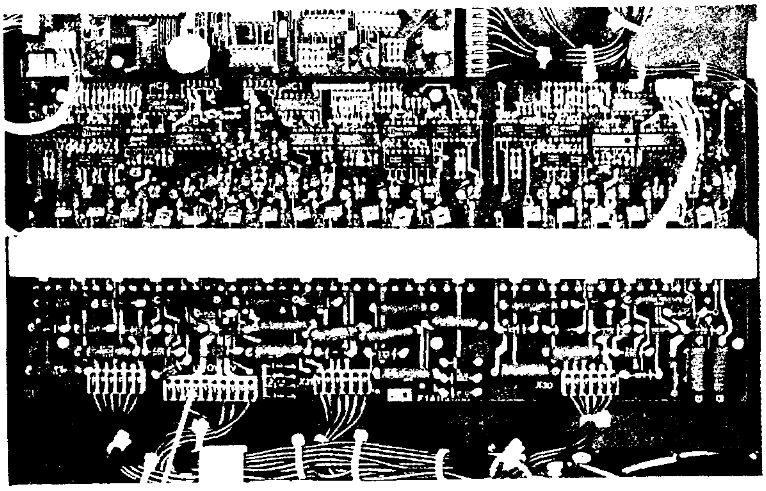
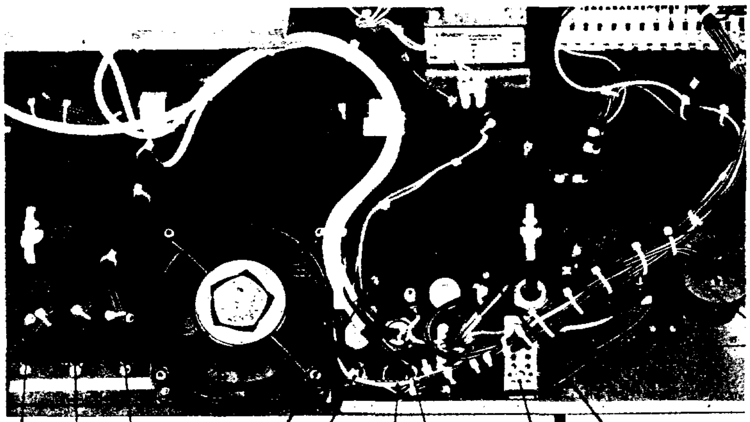
MP42 PIN19/18
MP43 PIN16/17
MP44 PIN16/1
MP45 PIN13/15



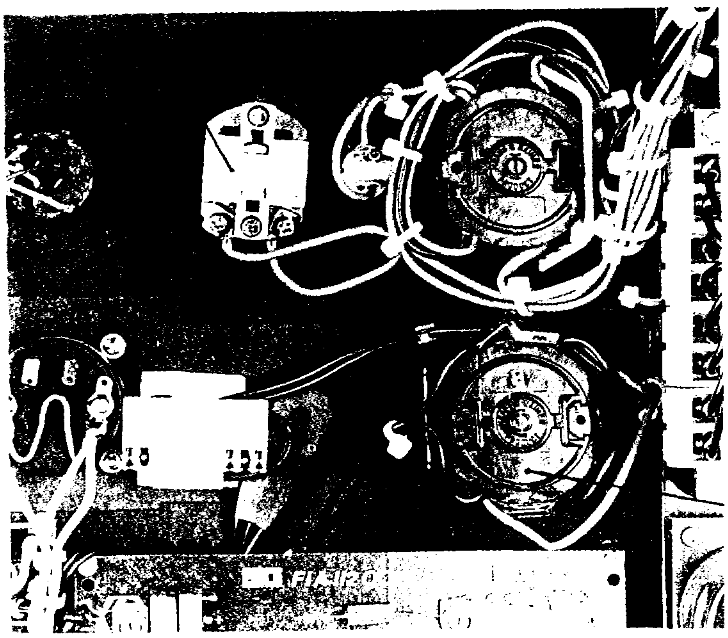
MP9



X2
MP27
X3

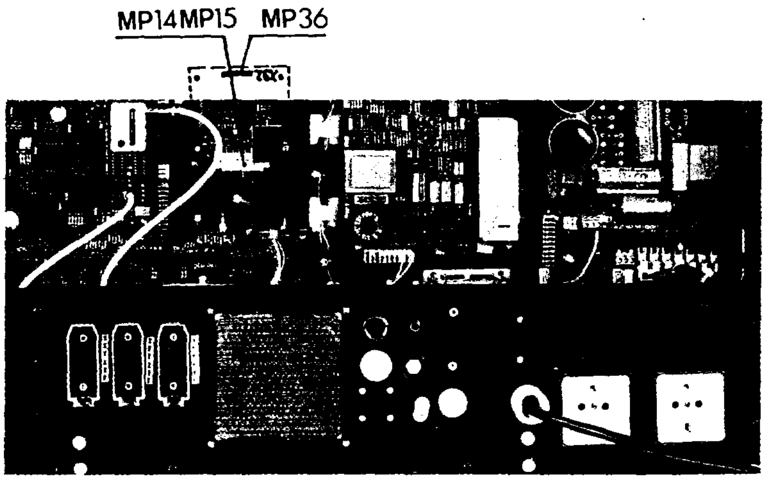
X4 X5 X6 X9 X59 X57 X58 MP19 e8

MP20



MP31

MP28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