

Unimat PC - Software extension

Version 1.8

Minimum configuration of the PC

For version 1.8 the following minimum configuration is necessary:

- * IBM compatible PC-AT
- * Operating system MS-DOS 3.1
- * 640 kB RAM
- * 1 Hercules or EGA graphic adapter
- * Monochrome screen or EGA graphic screen
- * 1 disk drive 1,2 MB or 1,44 MB
- * 1 hard disk 20 MB
- * 1 parallel interface, if a printer shall be connected

An arithmetical coprocessor is not absolute necessary for running the UNIMAT PC software.

Installation floppies

One 3 1/2"HD (1.44 MB) and one 5 1/4"HD (1.2 MB) installation floppy are supplied.

The software can thus be installed without changing the floppy.

Storing and reading of geometries/ programs

As from this software version you may store geometries and programs also on floppy. To do this, indicate the drive name before the file name (e.g. A:DEMO1).

Shifting of geometries

The menu "display" was extended by the function F10-GEO SHIFT. With this function you may shift a drawing on the screen.

F10

Move cursor to desired start point
(ENTER = accept):

Move cursor to one point of the drawing and then press ENTER.

Move cursor to desired end point
(ENTER = accept):

Move cursor to the position to which the point marked before should be shifted and press ENTER. The drawing is shifted.

Altered installation sequence - software version 1.8

- * Setting the language
Select the desired language by using the cursor keys and press ENTER.
- * Setting the printer
Select printer and press ENTER. If no printer will be connected continue with ENTER.
- * Enter program path
The EMCO software will be installed in this path. Offered path: C:\UNIMAT\, accept with ENTER or insert a new path and confirm with ENTER.
- * Enter user path
The programs and geometries created by you will be stored in this path. Offered path: C:\UNIMAT\USER\, accept with ENTER or insert new path and confirm with ENTER.
- * Control screen
Your inputs are displayed. Confirm your selections with "YES" or restart installation at "Setting the printer" by selecting "NO".

Changing of disks while installing is not necessary any more.

Foreword

This CAD/CAM software for the Unimat PC was developed by specialists, who have been working on software development for industrial systems for many years.

New standards were set with this software. Lengthy programming with G and M functions is no longer necessary.

You can learn to operate a computer-controlled machine tool in a very short time by reading the respective manuals yourself, even if you do not have any previous programming knowledge. You should work through this software description step by step and practise all examples listed directly on the PC.

If you have any CAD knowledge, you can start with the specimen examples in chapter 5 by means of the good user guidance on the screen and the operating sheets (the last three pages of this manual).

An index of the important specialist expressions and abbreviations is listed at the end of this manual.

The basic conceptions of turning with safety instructions can be found in the operating instructions of the Unimat PC.



TECHNICAL DOCUMENTATION
wishes you success

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1. RETROFIT PACKAGE

1.1 Safety instructions

- Observe the safety instructions in the operating instructions of the basic device.
- Connect all devices to be connected to the mains to an earthed socket.
- Disconnect the mains plugs for all installation and service work!
- Secure the device against unauthorized putting into operation.
- EMCO does not accept any liability for parts, which are not supplied by EMCO; therefore, always use original spare parts.

1.2 Technical data

STEPPER MOTORS

Step resolution 10 μ m/step
High range speed X/Z axis 200 mm/min

ELECTRICAL CONNECTION 115 V/230 V \pm 10 %, 50/60 Hz

We reserve the right to make technical alterations without previous notification!

1.3 Delivery contents

- 2 disks (software)
- 1 stepper motor card (PC insert card) with cable
- 2 stepper motors with connection cables
- 1 mains unit
- 1 small stepper motor plate (X motor plate)
- 1 large stepper motor plate (Z motor plate)
- 2 drive belts (toothed belts)
- 1 belt guard for cross slide drive
- 1 belt guard for longitudinal slide drive
- 4 rubber feet
- 1 bracket (for fixing the mains cable)
- Various screws, washers and nuts
- Various tools

The mains cable has to be ordered separately according to regional regulations.

1.4 Mounting

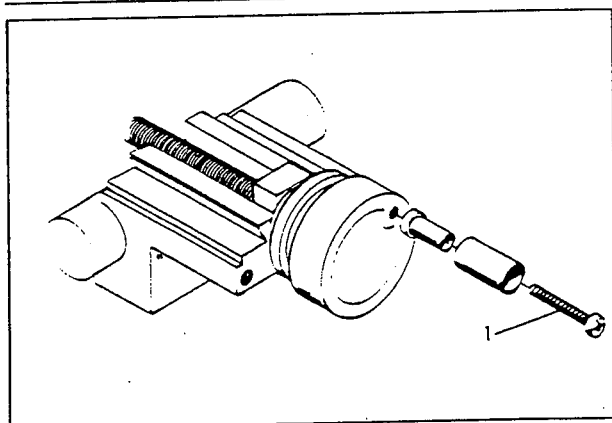
Attention!

Unplug all devices connected to the mains.

Note:

If you wish to operate with the machine via the PC only, remove the hand crank on the longitudinal and cross slides.

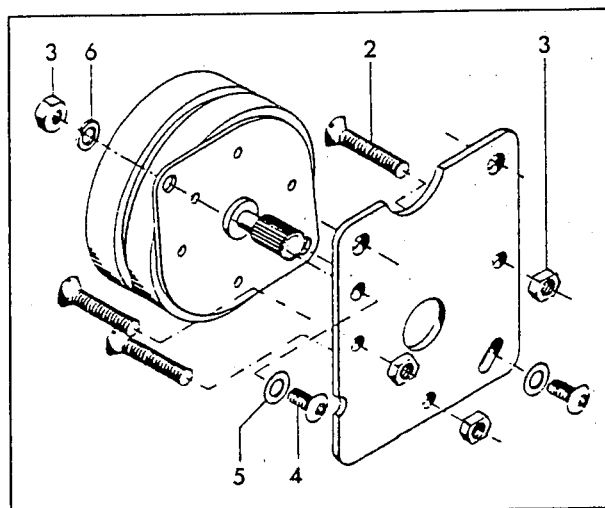
Removing the hand crank - cross slide



Remove the cross recessed screw (1) and pull off the hand crank.

Removing the hand crank - longitudinal slide
Repeat the same procedure.

Securing the stepper motor for the cross slide (X motor)



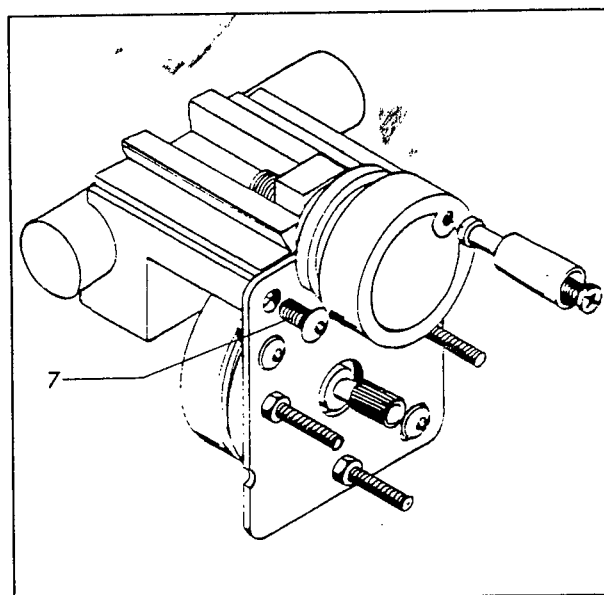
Fix the three counter sunk bolts M4x30 (2) with the hexagon nuts M4 (3) at the stepper motor plate.

Install the stepper motor with socket head bolts M4x10 (4), washers (5), tooth washer (6) and hexagon nuts M4 (3) on the "small stepper motor plate".

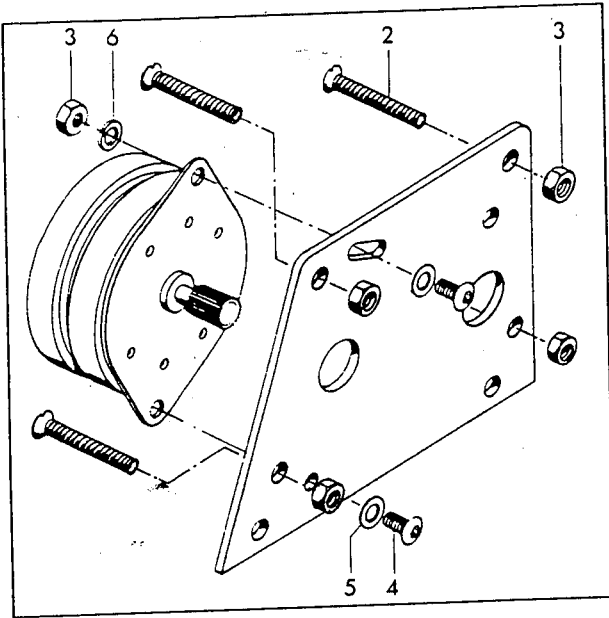
Do not tighten the socket head bolts (4), since you must tension the drive belt after installation on the device.

Installation of the X motor on the slide

Fix the small stepper motor plate on the slide with the two socket head screws M5x10 (7).



Retrofit package

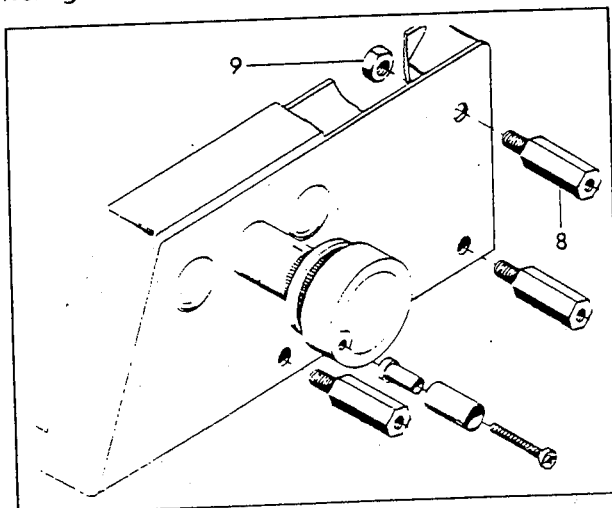
Securing the stepper motor for the longitudinal slide (Z motor)

Fix the four counter sunk bolts M4x30 (2) with the hexagon nuts M4 (3) at the stepper motor plate.

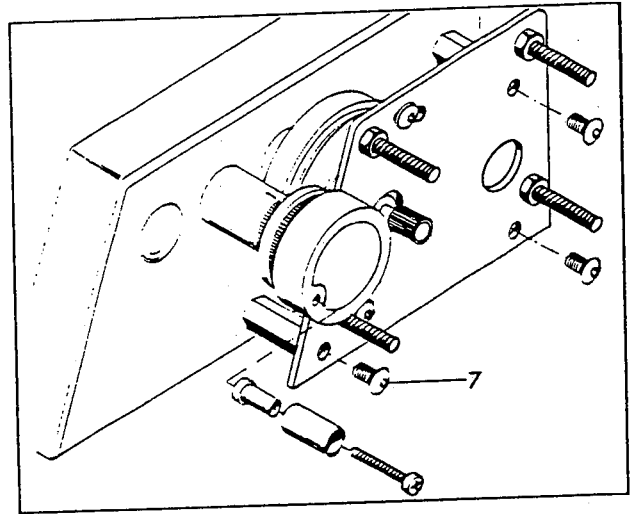
Install the stepper motor with socket head bolts M4x10 (4), washers (5), tooth washer (6) and hexagon nuts M4 (3) on the "larger stepper motor plate".

Do not tighten the socket head bolts (4) since you must tension the drive belt after installation on the device.

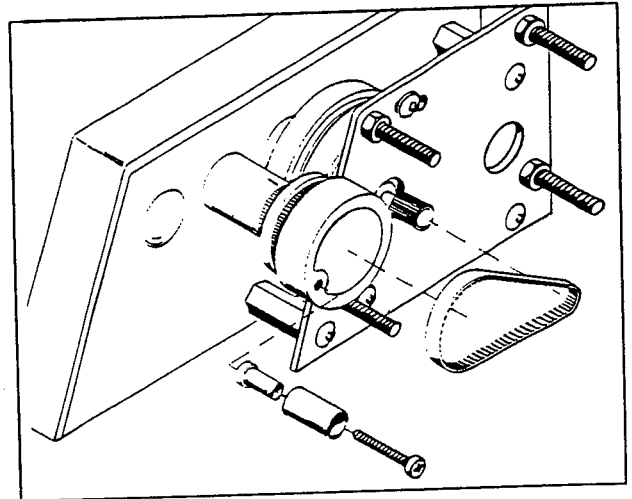
Installation of the distance bolts for the Z motor
Secure the three distance pins (8) with the hexagon nuts M6 (9).

Installation of the Z motor on the slide

Secure the large stepper motor plate on the distance pins with the socket head screws M5x10 (7).

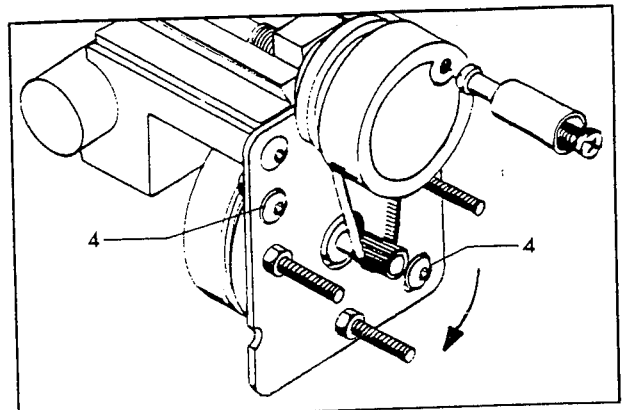
Installation of the drive belts

Install the drive belt according to the diagram (X motor and Z motor).

Tensioning the drive belts

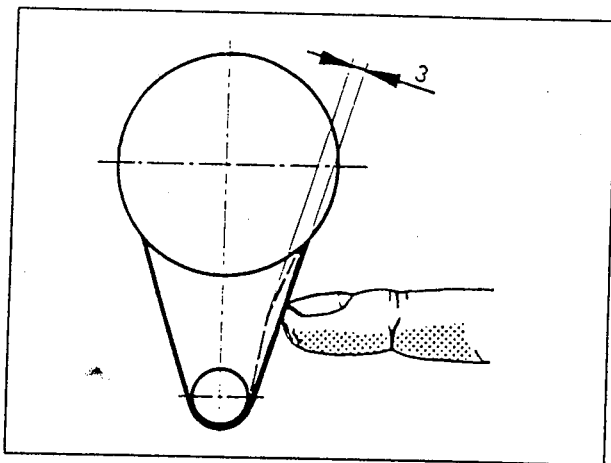
You can move the motor by loosening the socket head bolts M4x10 (4).

Tension the drive belt by swivelling the motor in the direction of the arrow and tighten the bolts (4).



Optimal belt tension

At light pressure with the finger the belt should give way about 3 mm.



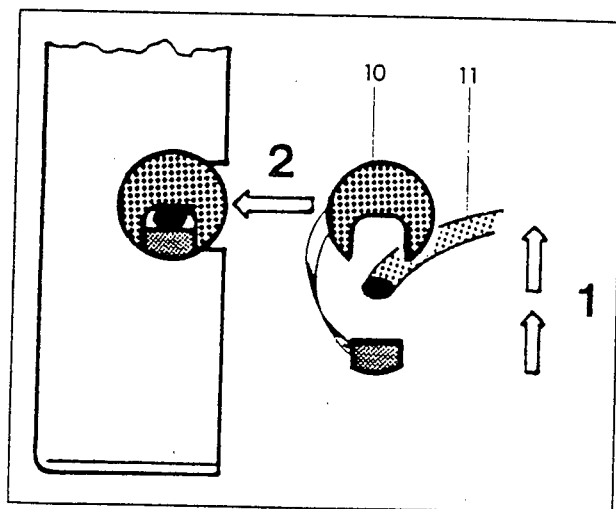
Too strong tensioned belts cause friction losses- the motor might loose steps.

A too light tensioned belt might jump over and a too big reverse clearance could arise.

Installation of the belt guard for the cross slide drive

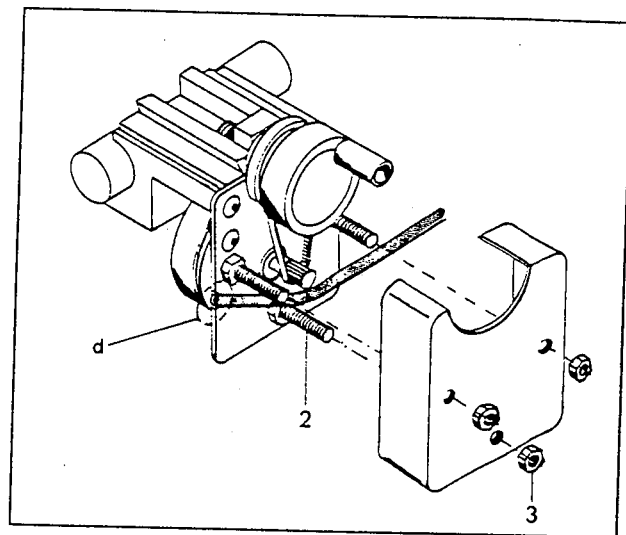
Stick the bushing tube (10) on the stepper motor cable (11) and put it into the recess of the belt guard.

Attention! If the cable is too long, it catches at the motor shaft.



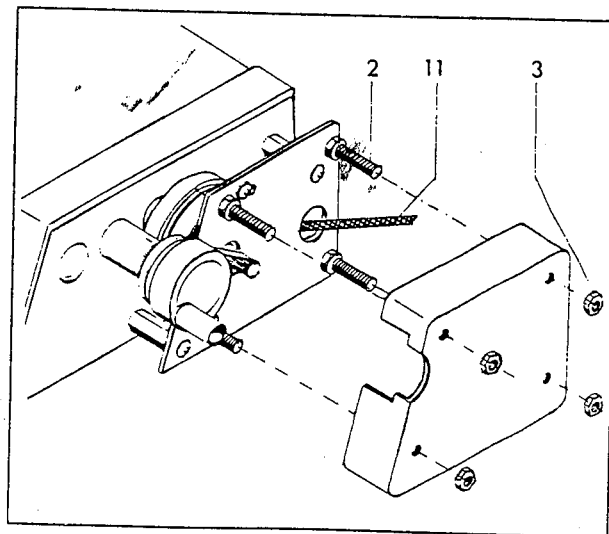
Mount the belt guard on the projecting counter sunk bolts (2) and fix it with the hexagon nuts M4 (3).

The cable must be placed in the recess of the stepper motor plate (d) and shouldn't be squeezed.

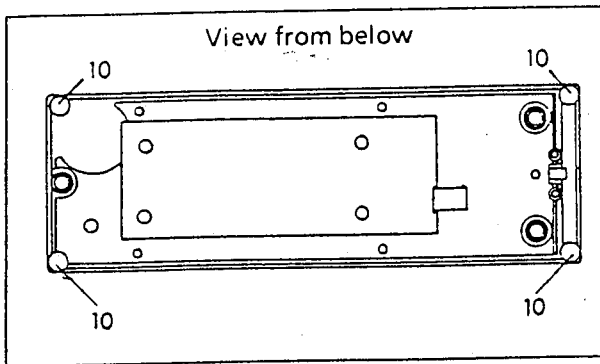
Installation of the belt guard for the longitudinal slide drive

Put the stepper motor cable (11) through the recess of the motor plate according to the drawing and mount the bushing tube (10) as in "Installation of the belt guard for the cross slide drive".

Mount the belt guard on the projecting counter sunk bolts (2) and fix it with the hexagon nuts M4 (3).

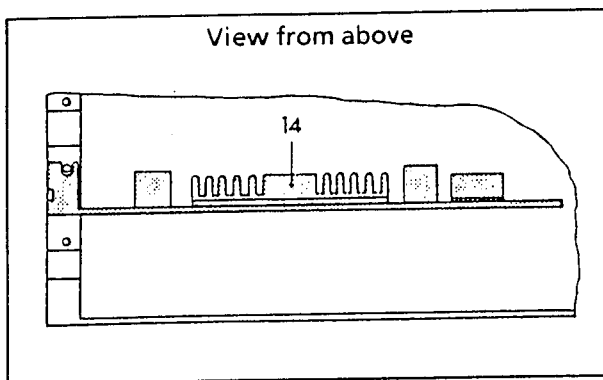


Installation of the rubber feet on the mains unit
Insert the rubber feet (10) according to the diagram.



Installation of the stepper motor card (PC insert)

- Disconnect the PC.
- Remove the housing lid of the PC.
- Insert the stepper motor card (14) into one of the free slots and secure it.
- Replace the housing lid of the PC.

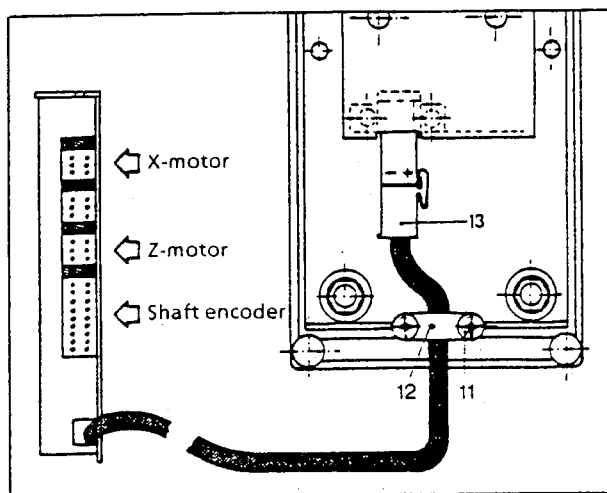


1.5 Wiring

Wiring the mains unit

Insert the connection cable (13) and secure it with the two sheet metal screws BZ 3.5x6.5 (11) and the bracket (12) according to the drawing.

Insert the stepper motor cable (X and Z motor).



Connect the devices to the mains.

The speed of the work piece is to be set on the lathe (completely independently from the feed speed of the stepper motors), see operating instructions for the lathe.

1.6 Important operation instructions

Through the extension with the retrofit package the UNIMAT PC has become a complete CNC lathe.

Adequate to the dimensions of machine and workpiece the power of the driving motors can be small.

Due to this fact the disturbances through friction are stronger than with big, powerful machines.

Considerable friction losses result from:

- too strong tensioned driving belts
- too little clearance adjustment and lubrication of the handwheels
- too little clearance adjustment and lubrication of the slide guidances
- too little clearance adjustment and lubrication of the lead screw nut (longitudinal slide)
- Soiling of the slide guidances
- Soiling of the feed spindles

The troublefree function of the UNIMAT PC is especially due to the correct care and adjustment of these elements.

Check these elements for smooth running. Smooth running is reached through regular cleaning and lubrication with a light, resin- and acid-free machine oil (e.g. sewing machine oil) and following movement of the slides over the whole traverse way of longitudinal and cross slide (for oil distribution).

Attention!!

If the mains unit is connected to the electric mains, the plug 13 (stepper motor card) must not be unplugged or plugged-in.

Otherwise the stepper motor card and even the complete PC could be destroyed.

When reconnecting the stepper motor card, if the stepper motor card has been unplugged (separated) for example during transportation, turn off the PC and disconnect the transfo (at least 3 minutes) from the power supply. (The built-in condenser in the transfo unloads in 3 minutes).

2. SOFTWARE INSTALLATION, ACCESS INTO PROGRAM

2.1 Possible PC configuration

In order to operate with this EMCO software, you require a PC with the following capabilities:

- IBM compatible (PC, PC/XT, PC/AT, PC/AT-386)
- Operating system MS-DOS from version 3.1
- 640 kB RAM (main memory)
- 1 Hercules graphics card with a parallel interface (Centronics) or 1 + EGA colour graphics card
- Monochrome screen or EGA colour screen capable of graphics
- 2 disk drives or 1 disk drive + 1 hard disk with 20 MB
- 1 parallel interface for the use of an EGA colour graphics card (for the connection of a printer = option)

An arithmetic coprocessor is not absolutely necessary for the operation with this EMCO software.

This coprocessor is, above all, recommended for PCs with a slow processing speed (e.g.: PC/XT with a cycle frequency of 4.77 or 8 MHz), however, since it executes the arithmetic operations much faster.

The use of a coprocessor is not required for PCs with a cycle frequency of over 10 MHz (PC/AT).

Example 1: IBM compatible PC with

- 640 kB RAM
- 2 disk drives 360 kB each
- 1 Hercules graphics card
- monochrome screen
- keyboard
- 1 arithmetic coprocessor
- operating system MS-DOS version 3.2

Example 2: IBM compatible PC/AT with

- 640 kB RAM
- 1 disk drive 1.2 MB
- 1 hard disk 44 MB
- 1 EGA graphics card
- EGA screen capable of graphics
- keyboard
- operating system MS-DOS version 3.3
- 1 parallel interface

Compatibility problems

The software runs on all 100 % IBM compatible PCs. Upon request, EMCO informs you of all those processors, on which this EMCO software was tested.

2.2 PC with hard disk and 1 disk drive

Installation

Start DOS (Disk Operating System). If necessary, consult the DOS manual, which was supplied with your computer.

The files **INT10.COM** and **HGC.COM** or **HGC.EXE** must be available on your hard disk (in the main index) and be called up when using a Hercules graphics card in order to initialize this card. These files may not be supplied by us due to copyright laws. If you install this EMCO software on a PC with a Hercules graphics card, the recall of these files is automatically written into the file **AUTOEXEC.BAT** during the installation of the software.




When the DOS prompt "C: \ >" appears, insert the installation disk 1 into the drive A.

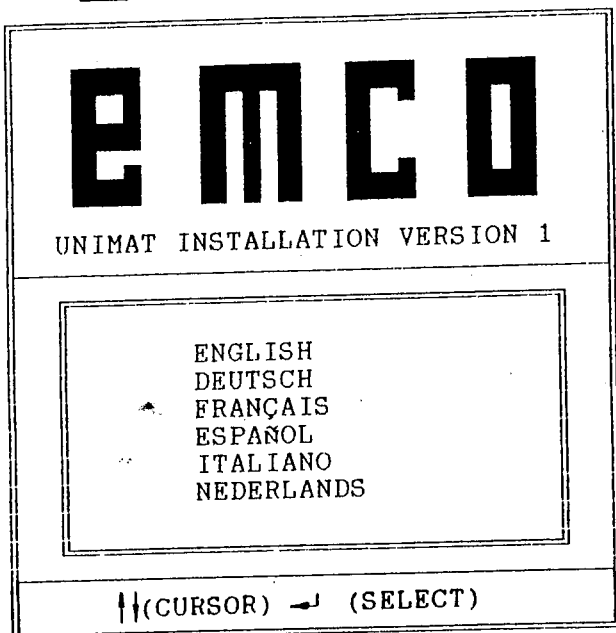
Enter the following command:

Screen display	Entry	Explanation
C: \ >	A : ↵	Change to drive A
A: \ >	I ↵	Call up installation program

After entering the command "I" and pressing the ENTER key, the registration screen for setting the language appears.

Setting the language

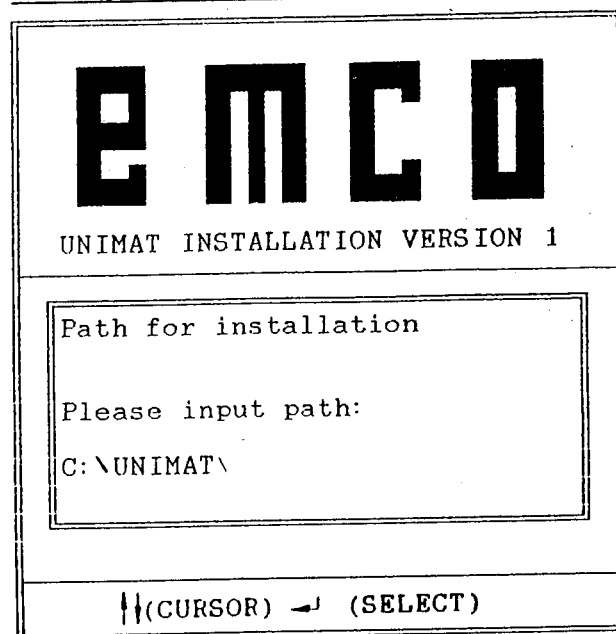
Move the light beam with the arrow  
keys to the desired language and confirm it
with .



emco
UNIMAT INSTALLATION VERSION 1

ENGLISH
DEUTSCH
FRANCAIS
ESPAÑOL
ITALIANO
NEDERLANDS

↑(CURSOR) → (SELECT)

Entering the program path (sub-directory)



emco
UNIMAT INSTALLATION VERSION 1

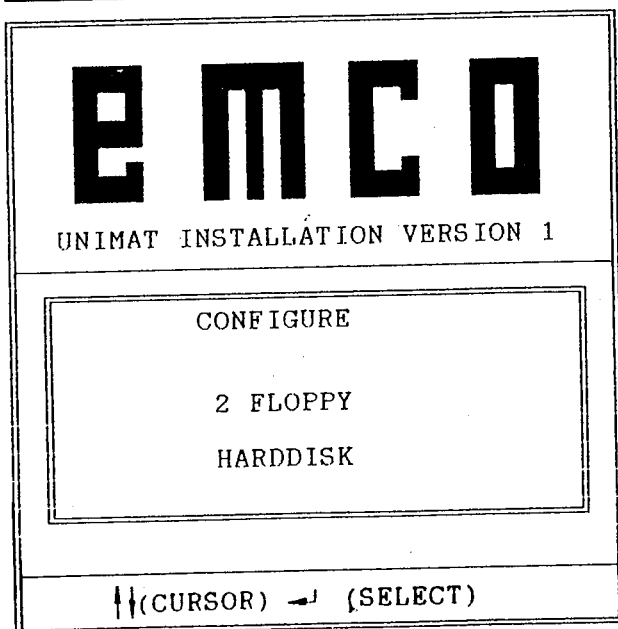
Path for installation

Please input path:

C:\UNIMAT\

↑(CURSOR) → (SELECT)

This EMCO software is installed in the sub-directory UNIMAT by pressing .

Entering the type of PC


emco
UNIMAT INSTALLATION VERSION 1

CONFIGURE

2 FLOPPY
HARDDISK

↑(CURSOR) → (SELECT)


DISKS: PC with 2 disk drives without hard disk
HARD DISK: PC with hard disk

Move the light beam with the arrow keys to the menu point HARD DISK and confirm it.

Altering the program path:

You can also install this EMCO software in a sub-directory determined by you.

Procedure:


- You can delete the suggested sub-directory name letter by letter with the key .
- Enter a new sub-directory name.

Example:

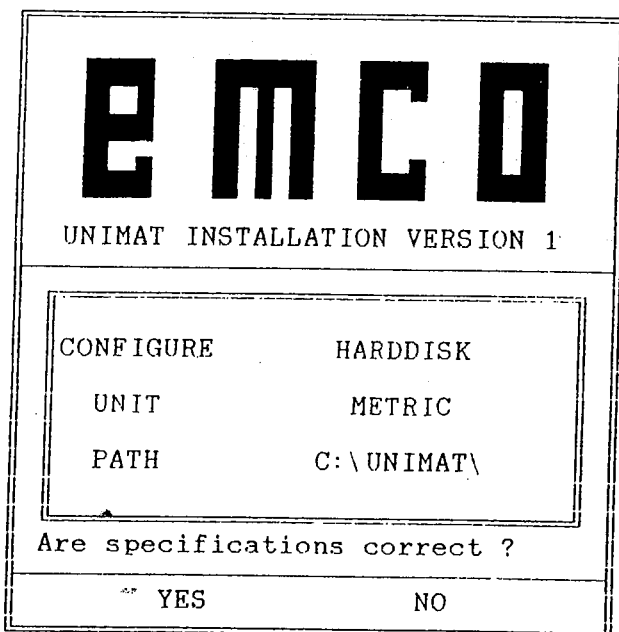
C:\training\ 

This EMCO software is installed in the sub-directory "training"

Attention:

Do not forget  after entering the sub-directory name.

Control menu:



emco

UNIMAT INSTALLATION VERSION 1

CONFIGURE	HARDDISK
UNIT	METRIC
PATH	C:\UNIMAT\

Are specifications correct ?

YES NO

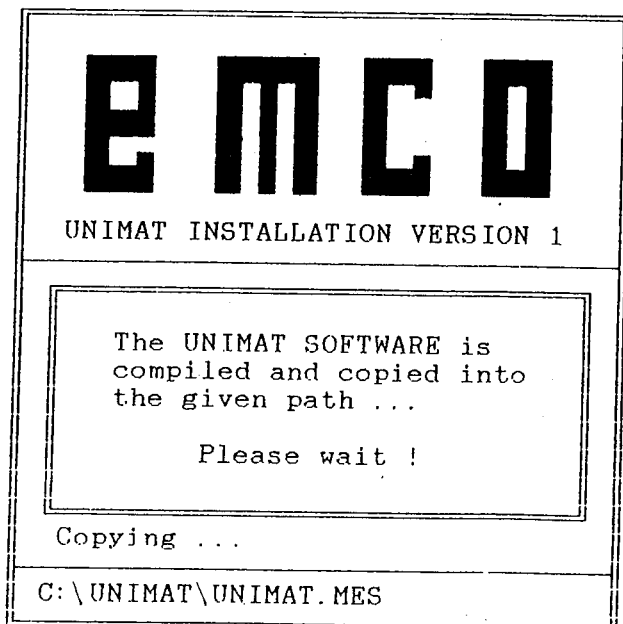
The previous specifications are displayed:

YES ... The previous specifications are correct, the software is installed.

NO The previous specifications are incorrect, the installation begins again with "Entering the type of PC".

Select the desired menu point with the arrow keys and confirm it.

If the menu point YES was selected and confirmed, the following appears on the screen:



emco

UNIMAT INSTALLATION VERSION 1

The UNIMAT SOFTWARE is compiled and copied into the given path ...

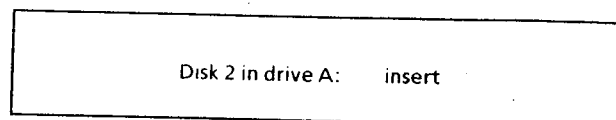
Please wait !

Copying ...

C:\UNIMAT\UNIMAT.MES

The individual files are copied from the drive A into the sub-directory determined by you.

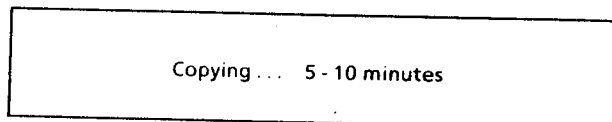
The following message appears after a short time:



Disk 2 in drive A: insert

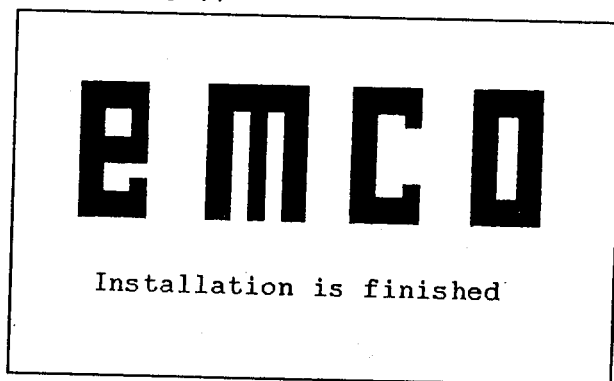
Remove the installation disk 1 from the drive A and insert the installation disk 2 and confirm it.

The following appears:



Copying ... 5 - 10 minutes

If the software was installed correctly in the PC, the following appears:



emco

Installation is finished

The PC registers with drive A.

Changing the drive:

Screen display	Entry
A: \>	<input type="text" value="C"/> <input type="text" value=":"/> <input type="text" value="↵"/>
C: \>	

The software can be called up (see next page).

Access

After the DOS prompt "C: \>" appears, enter the following commands:

Screen display	Entry
C: \>	<div style="text-align: center;">*</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> C D U N I M A T </div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 2px;"> ↓ </div>
C: \UNIMAT >	

* Space bar

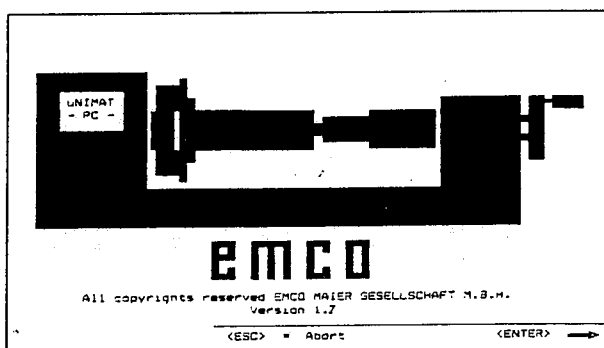
In this way, you change to the sub-directory UNIMAT.

Calling up the program:

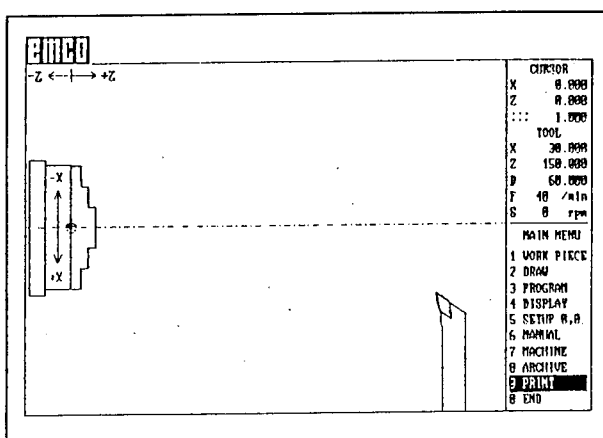
If you have altered the program path (=sub-directory) during the installation of the software, you must enter your selected sub-directory name (here UNIMAT).

Screen display	Entry
C: \UNIMAT >	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> U N I M A T </div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 5px;"> ↓ </div>

The title screen appears:



Pressing ENTER:



Now you are in the program.

2.3 PC with 2 disk drives

Installation

Put the operating system disk (DOS) supplied with your PC into the drive A and switch on the computer. If necessary, consult the DOS (Disk Operating System) manual, which was supplied with your computer.

The files **INT10.COM** and **HGC.COM** or **HGC.EXE** must also be available on your operating system disk, with which you start the PC, for the use of a Hercules graphics card in order to initialize this card.

These files may not be supplied by us due to copyright laws. If you install this EMCO software on a PC with a Hercules graphics card, you must initialize the Hercules graphics card before calling up this program.

After starting up the PC, the prompt "A: \>" appears, and you should enter the following commands

Screen display	Entry
A: \>	I N T 1 0
A: \>	H G C F U L L

* Space bar

Condition

The files **INT10.COM** and **HGC.COM** or **HGC.EXE** are located on your operating system disk.

Prepare two empty (formatted) disks. You will find instructions concerning the formatting of a disk in your DOS manual.

Remove the operating system disk from the drive A and insert the installation disk 1.

Enter the following command

Screen display	Entry	Explanation
A: \>	I	Calling up the installation program

Having input the command "I" and having pressed the ENTER key, the registration screen appears for setting the language.

Setting the language

Move the light beam with the arrow keys to the desired language and confirm with (ENTER).

Entering the type of PC

DISKS: PC with 2 disk drives without a hard disk
HARD DISK: PC with hard disk

Move the light beam with the arrow keys to the menu point DISKS and confirm it.

Control menu:

The previous data are displayed.

emco	
UNIMAT INSTALLATION VERSION 1	
CONFIGURE	2 FLOPPY
UNIT	METRIC
PATH	B:\
Are specifications correct ?	
YES	NO

YES... The previous data are correct, the software is installed.

NO.... The previous data are incorrect, the installation starts again with "Entering the type of PC".

Select the desired menu point with the arrow keys and confirm it.

If the menu point YES was selected and confirmed, the following appears on the screen:

emco
UNIMAT INSTALLATION VERSION 1
<p>The UNIMAT SOFTWARE is compiled and copied into the given path ...</p> <p>Please wait !</p>
New disk in drive B
B:\

Insert a formatted disk in the drive B and confirm it.

Explanation: The software is installed into the main index on drive B on a disk in a standard form.

After a short time, the following appears:

Disk 2 in drive A: insert

Remove the installation disk 1 from drive A and insert the installation disk 2 and confirm it.

The following appears:

Copying... 5 - 10 minutes

If the software was installed correctly in the PC, the following appears:

emco
Installation is finished

The PC registers with drive A.

Remove the installation disk 2 from the drive A. Your program disk for this EMCO software is located in drive B.

Put this program disk in drive A and the second formatted disk in drive B.

This formatted disk is your working disk, on which you can store your drawings and machining programs created.


The software can be called up (see next page).

Access

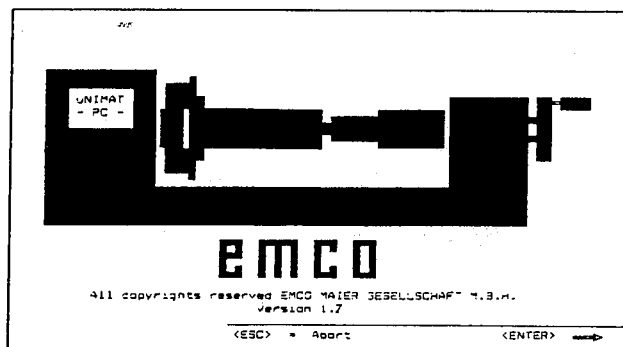
Your program disk is located in drive A, and the DOS prompt "A: \>" is displayed on the screen.

Your working disk is located in drive B.

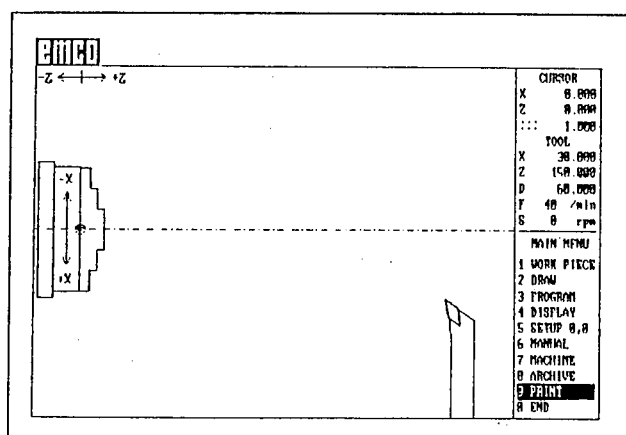
Calling up the program:

Screen display	Entry
A: \>	J V I M A T 

The title screen appears:



Pressing ENTER:

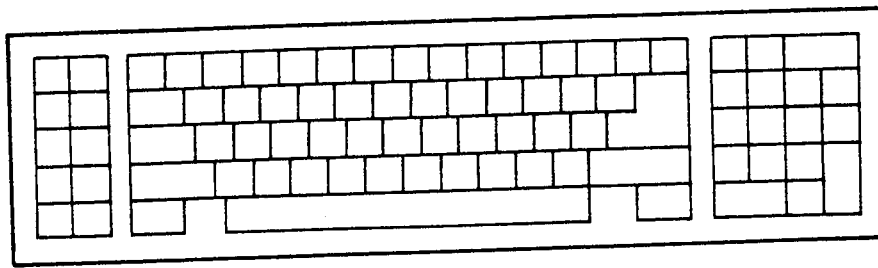


You are in the program.

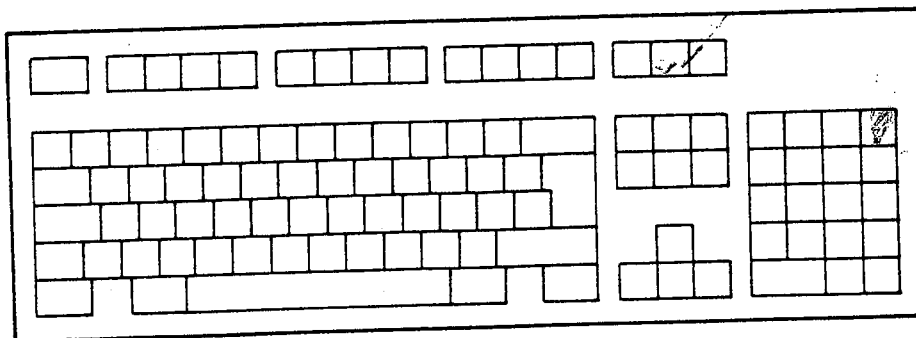
3. EXPLANATIONS FOR THE SOFTWARE

3.1 The differences in the input keyboards

Small PC keyboard



Large PC keyboard



The same key functions are arranged and designated differently on these two types of keyboard.

Differences in the key designation

Small PC keyboard	Large PC keyboard

Note

The keys of the large PC keyboard are used in these instructions.

Preceding zeros

Following zeros

Zeros before a number and after the comma can but do not need to be entered.

Plus/minus sign

Plus signs (+) are not entered. The minus sign (-) must be entered before the number.

Entering large, small letters

Letters can be entered as large or small letters.

Enter key



Inputs are confirmed or stored with the "ENTER" key.

Decimal point



The decimal point is entered with this key.

Separating two entries



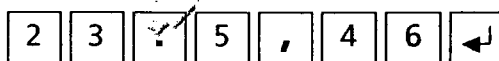
Two subsequent entries are separated with the comma key.

Example

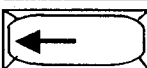
For a work piece compilation, the PC requests:

Diameter, work piece length?

Input: 23.5, 46



Error correction



The entry can be corrected with this key. The previously entered character is deleted.

Interrupting selected commands



The selected command is interrupted with this key.

The previously selected menu level can also be returned to with the Esc. key.

3.2 Important key functions

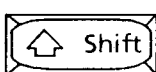
SHIFT key

If the SHIFT key is pressed at the same time as the desired key, the upper case of the respective key is selected.

Example



If the SHIFT key is not active, the lower case (+) is selected.



If the SHIFT key is pressed, the upper case (*) is selected.

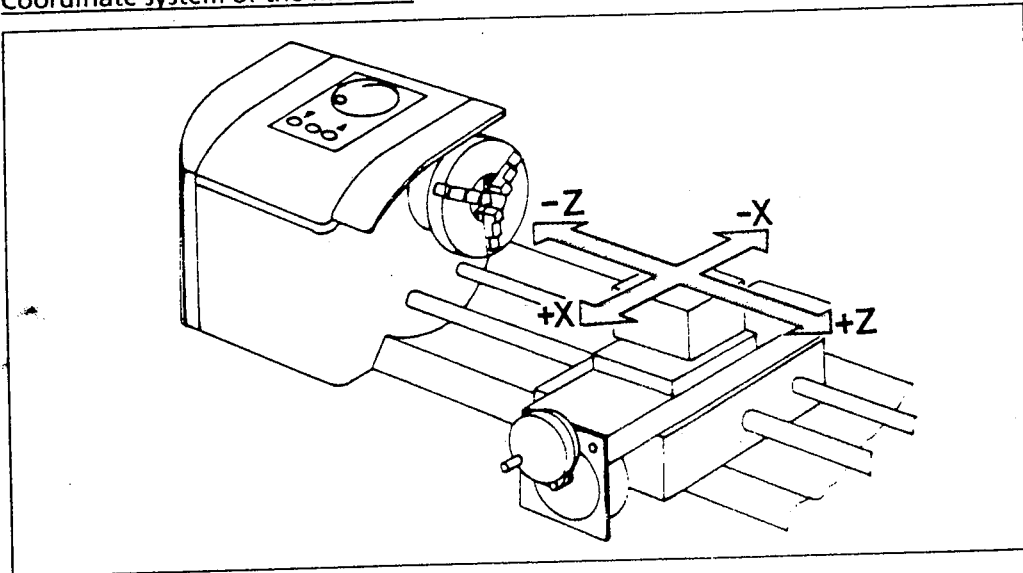
Note

Only the selected key case is shown in these instructions for easier reading.

3.3 Coordinate system

The piece of information "Move the longitudinal slide towards the head stock" is a long piece of information; it would also be different in every language. Thus, the directions of movement for NC machines are described in a coordinate system.

Coordinate system of the machine



Z axis = Axis parallel to the rotary axis

X axis = Axis perpendicular to the rotary axis

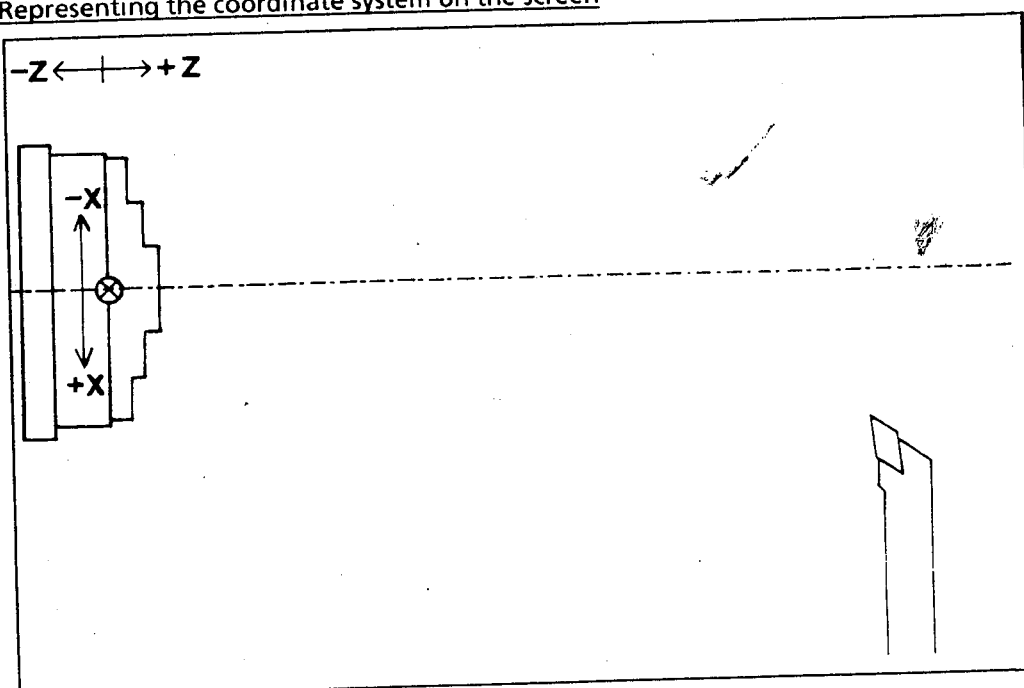
- Z movement = Movement of the longitudinal slide towards the head stock

+ Z movement = Movement of the longitudinal slide away from the head stock

+ X movement = Movement of the cross slide away from the rotary axis

- X movement = Movement of the cross slide towards the rotary axis

Representing the coordinate system on the screen

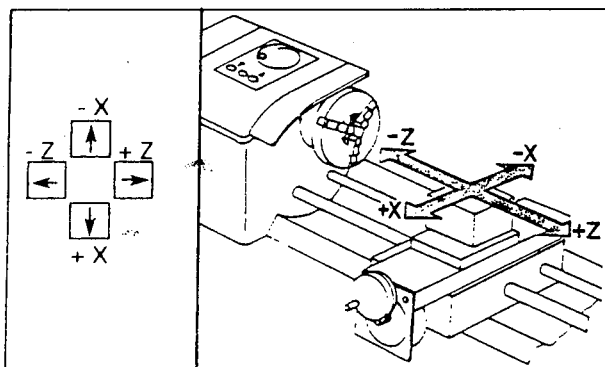


3.4 Screen cursor

A cursor (graticule) is shown on the screen. This cursor can be moved on the screen.

Moving the screen cursor

The cursor is moved on the screen by means of the 4 arrow keys.



Further key functions



Doubling the step size of the cursor



Halving the step size of the cursor



The cursor jumps to the middle of the screen



The cursor jumps to the reference point

Step size distance of movement each time the key is pressed

Showing the screen cursor

There are two ways of showing the cursor on the screen:



1. Cursor as a graticule
Normal representation of the cursor



2. Reduced cursor
A reduced cursor is shown, when the key "<" is pressed.

The cursor is shown as a graticule again, when the key ">" is pressed.

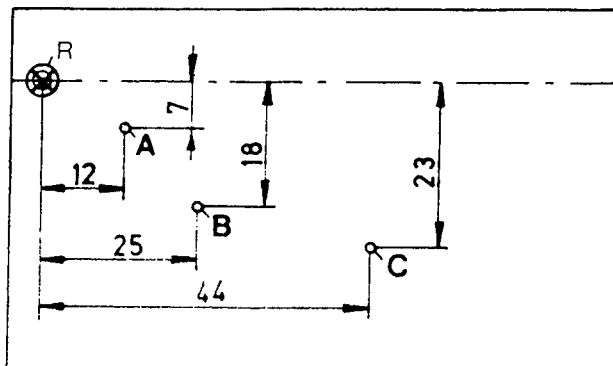
Cursor programming methods

You can describe the path of the screen cursor in the program: there are generally two ways of describing this path.

Absolute value programming (reference value programming)

The points, to which the screen cursor is to proceed, are given starting from a zero point (reference point R).

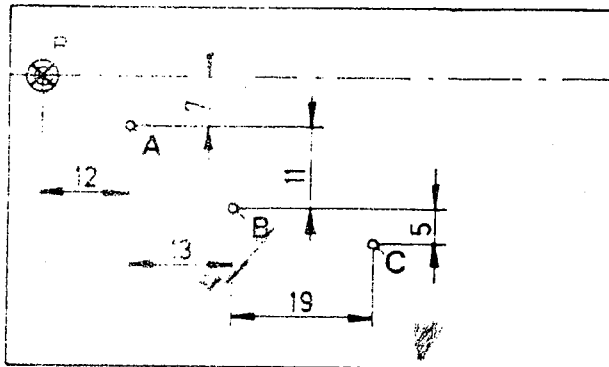
Example



Incremental value programming

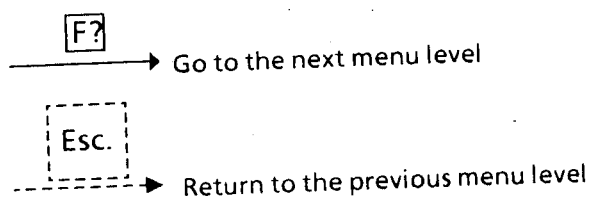
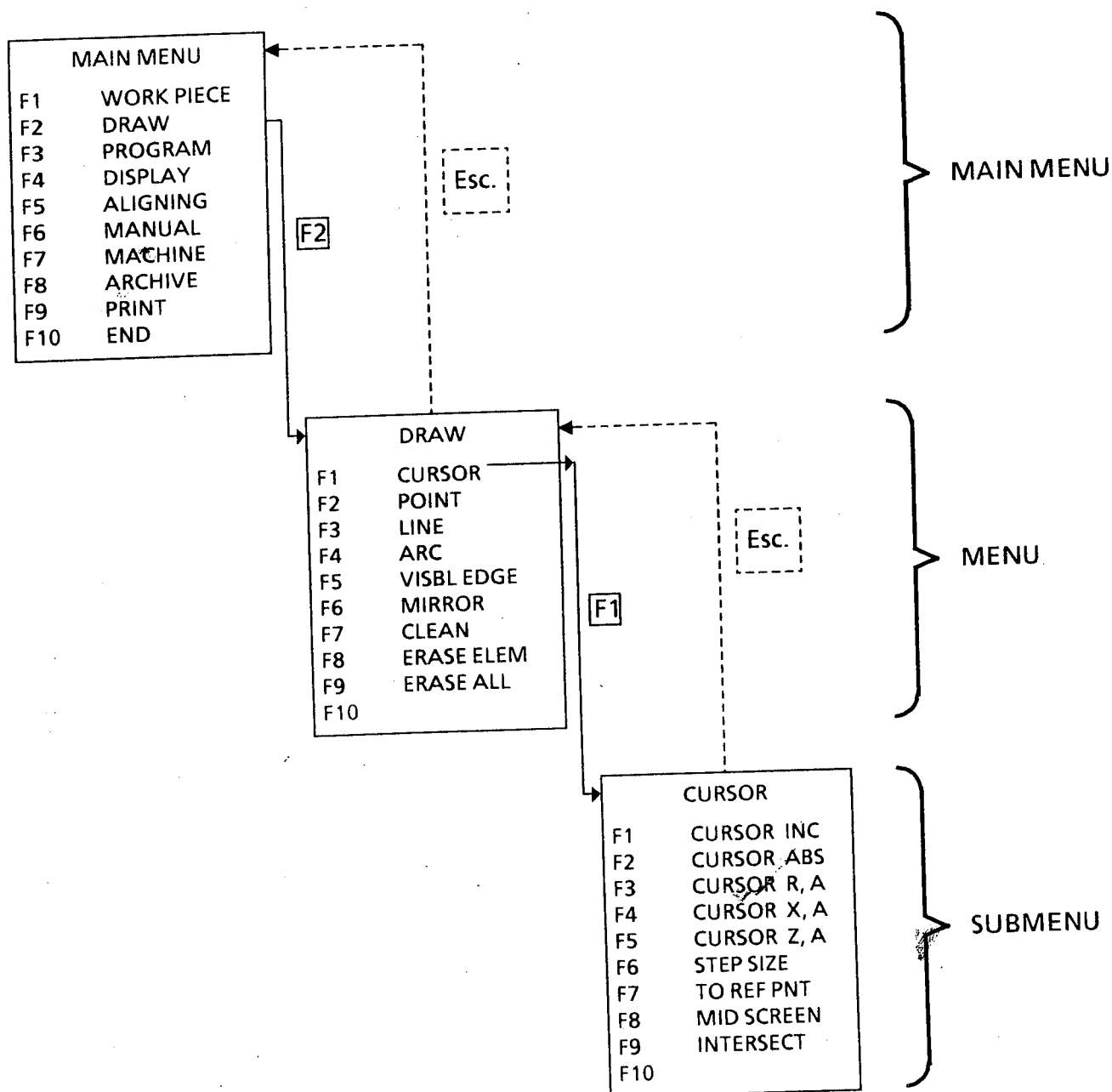
Chain dimensions are entered for the incremental value programming. The current position of the screen cursor is the starting point for every path description.

Example



3.5 Menu structure

This EMCO software is divided into menus (= selection possibilities). Divisions into main menu, menus and submenus are used depending on the hierarchy. Jumps back- and forwards between these individual menus can be made without limitations.

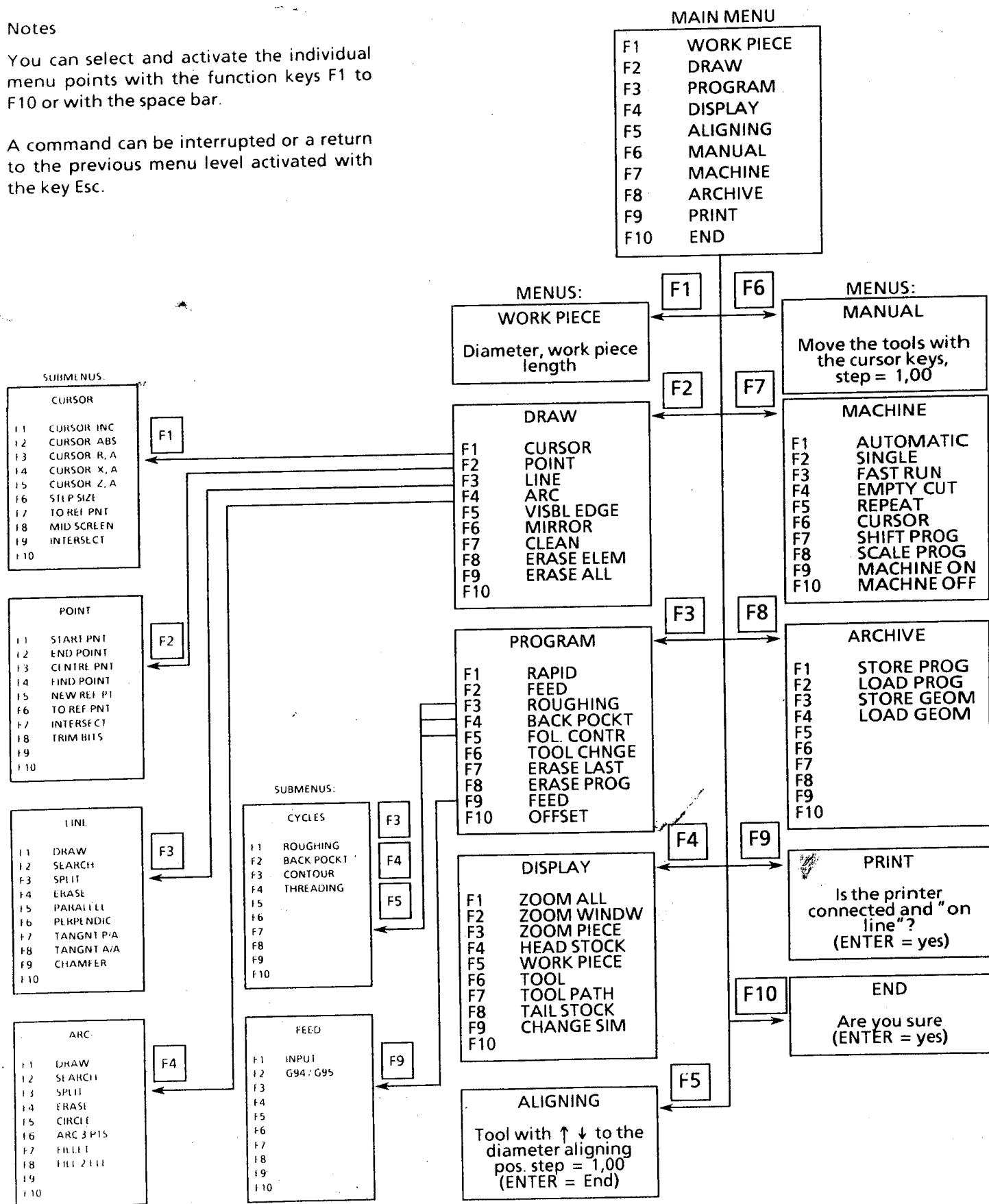


Menu summary

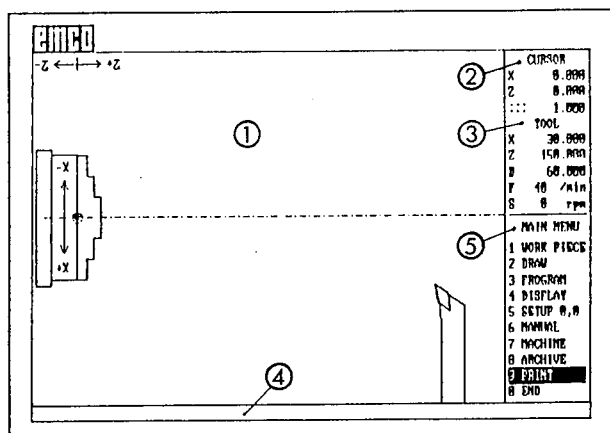
Notes

You can select and activate the individual menu points with the function keys F1 to F10 or with the space bar.

A command can be interrupted or a return to the previous menu level activated with the key Esc.



3.6 Screen display



- 1 Diagrammatic representation of the working area
- 2 Displaying the cursor position [mm]
X, Z ... Position of the cursor
... Step size of the cursor (distance travelled every time a key is pressed)
- 3 Displaying the tool position
X, Z ... Position of the tool [mm]
D ... Diameter position of the tool [mm]
F ... Feed speed [mm/min] or [mic/r]
S ... Main spindle speed [rpm]; works only, when the shaft encoder of the thread cutting attachment is installed.
- 4 Displaying the screen messages
- 5 Menu display

3.7 Selection / deselection of the menu points

There are two possibilities:

Possibility 1

By means of the space bar and

Example

Activating the PROGRAM menu

	Go to the desired menu point with the space bar
	Confirm entry and activate PROGRAM menu
	Return to the main menu

Possibility 2

By means of the function keys F1 to F10

Example

Activating the PROGRAM menu

	Selection and activation of the PROGRAM menu
	Return to the main menu

PROGRAM

F1	RAPID
F2	FEED
F3	ROUGHING
F4	BACK POCKET
F5	FOL. CONTR
F6	TOOL CHNGE
F7	ERASE LAST
F8	ERASE PROG
F9	FEED
F10	OFFSET

Note

The activation of the individual menu points is described with the function keys in these instructions.

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4.8.4	Loading the geometry	60
4.9	Print	60
4.10	End	60

4.1 Work piece (F1)

The work piece is defined in this menu, and it is displayed clamped in the chuck.

Unit: [mm]

Example

F1

Screen message

Diameter, work piece length:

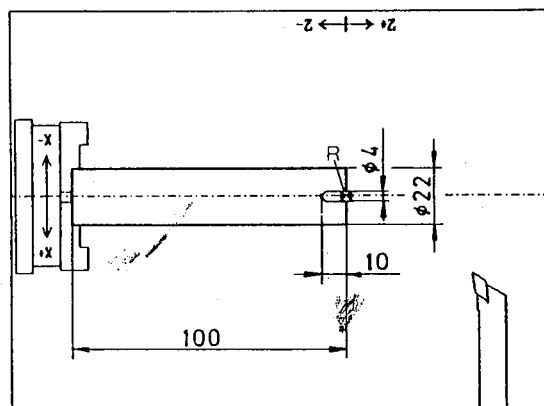
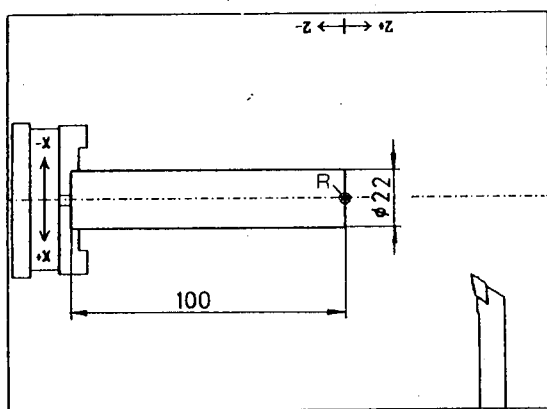
22,100

Diameter, length of the drill hole (ENTER = no)

no

yes

4,10



The work piece clamped in the chuck appears on the screen, and the exit from the WORK PIECE menu takes place at the same time.

Note

The reference point = R (point X = 0, Z = 0 of the coordinate system) is situated on the Z axis at the right-hand end of the work piece, when the work piece is called up.

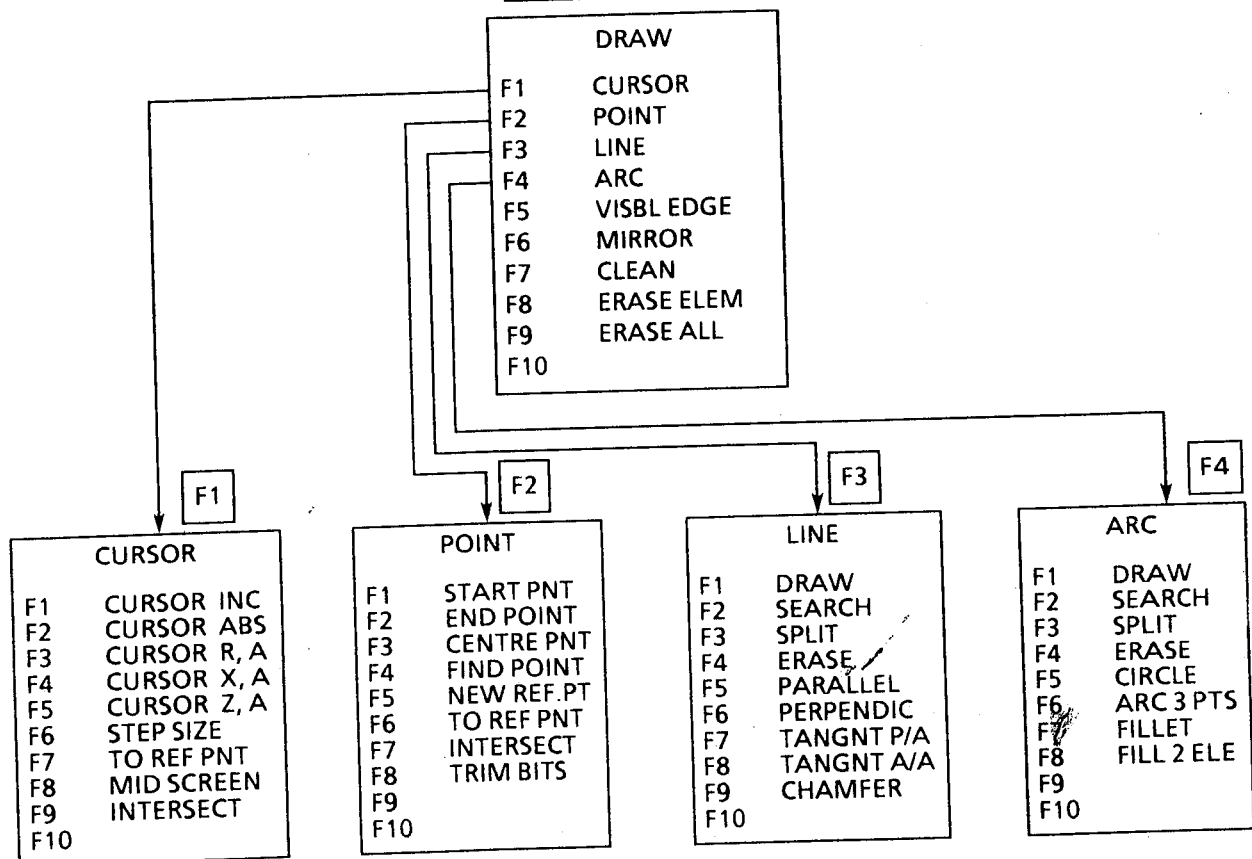
4.2 Draw (F2)

The contour of the work piece is determined in this menu.

Preliminary explanations

You only have to draw the lower half of the work piece edge contour on the screen, without circumferential edges. Circumferential edges are added after drawing the work piece contour, and by mirroring around the Z+ axis, you automatically receive the complete representation of the work piece contour. The compilation of the work piece contour is carried out in the submenus described on the following pages.

Summary of sub menus



Description of the individual sub-menus

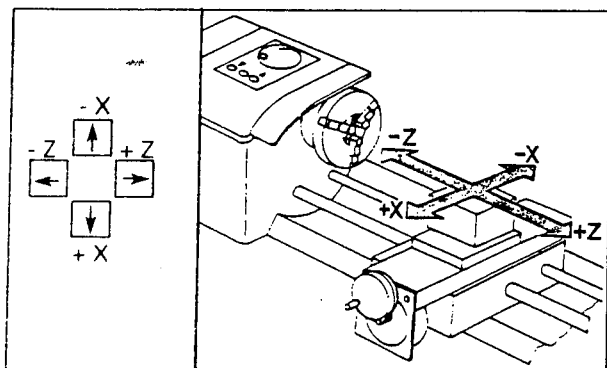
4.2.1 Cursor (F1)

In this submenu, it is determined, how the cursor is to be positioned on the screen.

CURSOR	
F1 CURSOR INC	F6 STEP SIZE
F2 CURSOR ABS	F7 TO REF PNT
F3 CURSOR R, A	F8 MID SCREEN
F4 CURSOR X, A	F9 INTERSECT
F5 CURSOR Z, A	F10

Moving the screen cursor

The cursor is moved on the screen by means of the 4 arrow keys.



Further key functions



Doubling the step size of the cursor



Halving the step size of the cursor



The cursor jumps to the middle of the screen



The cursor jumps to the reference point

Step size distance of movement each time the key is pressed

Showing the screen cursor

There are two ways of showing the cursor on the screen:



1. Cursor as a graticule
Normal representation of the cursor



2. Reduced cursor
A reduced cursor is shown, when the key "<" is pressed.

The cursor is shown as a graticule again, when the key ">" is pressed.

Calculating functions in the CURSOR submenu

For every menu point in the CURSOR submenu, where a number is prompted, there are many calculating functions available to you for the entry of arithmetical functions. In this way, you possess an aid capable of performance, which gives valuable help, especially for coordinate entries and angle calculations.

The following signs or mathematical functions can be used:

Entry	Function
+	Addition
-	Subtraction
*	Multiplication
:	Division
**	To the power of
(	Open bracket
)	Close bracket
SIN	Sin
COS	Cos
TAN	Tan
DSIN	Sin in degrees
DCOS	Cos in degrees
DTAN	Tangent in degrees
ASIN	Arc sin
ACOS	Arc cos
ATAN	Arc tangent
DASIN	Arc sin in degrees
DACOS	Arc cos in degrees
DATAN	Arc tangent in degrees
SQRT	Square root
PI	3.1415927

Any arithmetical function can be entered instead of a simple number for numerical entries (= numbers). The use of brackets is allowed. These can be nested as much as is required.

Note

Entered functions must be written in brackets (see example).

Example

You are in the CURSOR submenu. An incremental coordinate is to be calculated.

$$X = 10 \frac{\sqrt{3}}{2}, Z = 50$$

Therefore, enter the following:

F1

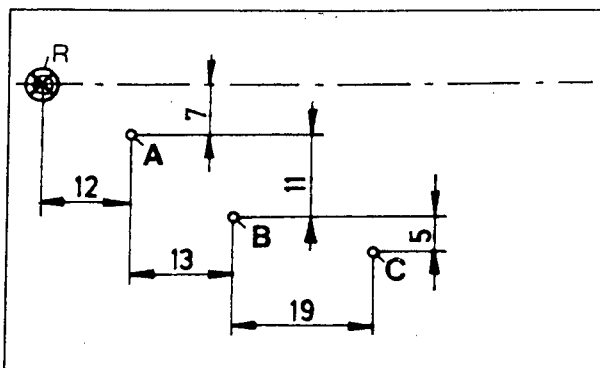
10 * SQRT (3) : 2, 50

A cursor step of 8.66 in X and 50 in Z is the result.

Positioning the cursor incrementally (F1)

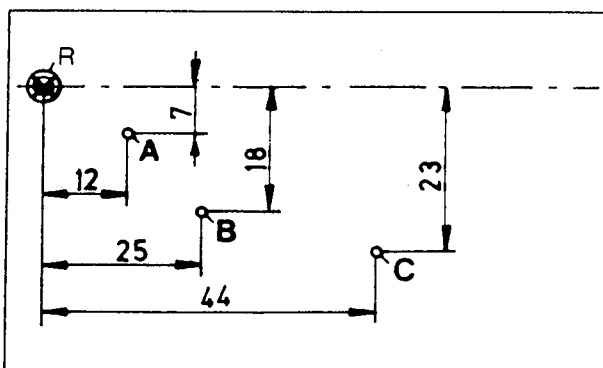
Unit: [mm]

The cursor is shifted from the present position by the entered values.

Positioning the cursor absolutely (F2)

Unit: [mm]

The cursor is shifted by the values entered (always measured from the reference point).

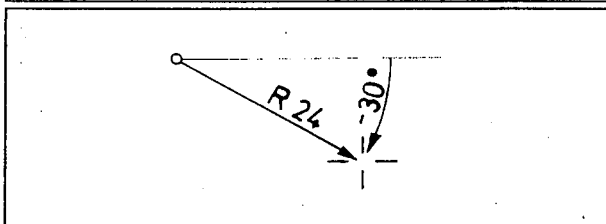
Positioning the cursor with the radius and angle (F3)

Unit: [mm], [°]

The cursor is shifted from the present position by the radius and angle entered.

Example: R = 24 mm, A = -30° (clockwise)

Screen message	Entry
	[F3]
Radius, angle movement from the cursor?	24, -30



Note: Angle entry

Positive (+) sign = angle in the anti-clockwise direction.

Negative (-) sign = angle in the clockwise direction.

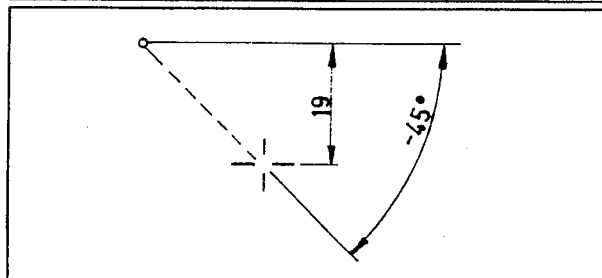
Positioning the cursor with X dimension and angle (F4)

Unit: [mm], [°]

Entering the X dimension incrementally

Example: X = 19 mm, A = -45°

Screen message	Entry
	[F4]
X, angle movement from the cursor?	19, -45

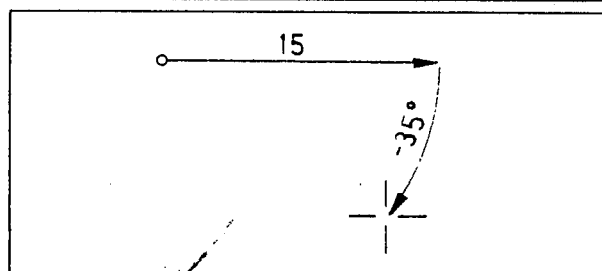
Positioning the cursor with Z dimension and angle (F5)

Unit: [mm], [°]

Entering the Z dimension incrementally

Example: Z = 15 mm, A = -35° (clockwise)

Screen message	Entry
	[F5]
Z, angle movement from the cursor?	15, -35

Determining the step size of the cursor (F6)

Unit: [mm]

The step size is the distance the cursor moves every time a key is pressed.

The step size of the cursor is 1 mm when you call up the software.

Example: Cursor step should amount to 2.5 mm

Screen message	Entry
	[F6]
Cursor step 1.000 New step (ENTER = no change)	2,5

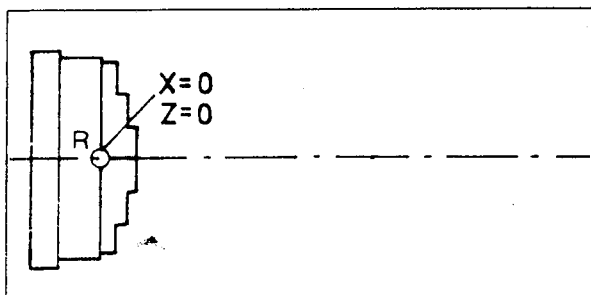
Cursor to the reference point (F7)

The reference point is the origin of the coordinate system shown on the screen (reference point = position $X = 0 / Z = 0$ of the coordinate system).

Position of the reference point

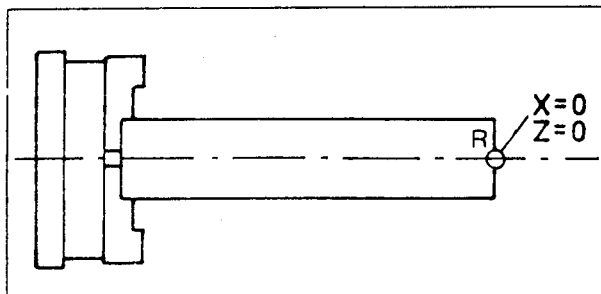
No work piece:

The reference point is situated on the Z axis at the stop of the clamping device.



Workpiece compiled:

The reference point is situated on the Z axis at the right-hand edge of the work piece.



The cursor jumps to the reference point, when the key F7 is pressed.

Cursor to the middle of the screen (F8)

The cursor jumps to the middle of the screen, when the key F8 is pressed.

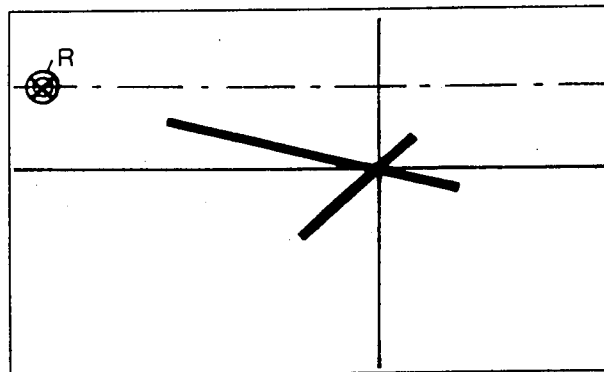
Find the point of intersection (F9)

Position the cursor by means of the arrow keys near to the point of intersection to be found.

The cursor jumps to the neighbouring point of intersection, when the key F9 is pressed.

Possibilities for the point of intersection

- two lines
- two circles
- a line and a circle



4.2.2 Point (F2)

Secondary points for drawing the work piece contour are determined on the screen in this submenu.

The basis of the definition of the geometry (= contour of the work piece) are secondary points.

E.g., a line is defined by a starting point and an end point.

	POINT
F1	START PNT
F2	END POINT
F3	CENTRE PNT
F4	FIND POINT
F5	NEW REF.PT
F6	TO REF PNT
F7	INTERSECT
F8	TRIM BITS
F9	
F10	

Determining the starting point (F1)

The point, on which the cursor is located, is defined as the starting point of an element of geometry (line, circle or arc) by pressing the key F1.

The active starting point is shown on the screen by the symbol ">".

Determining the end point (F2)

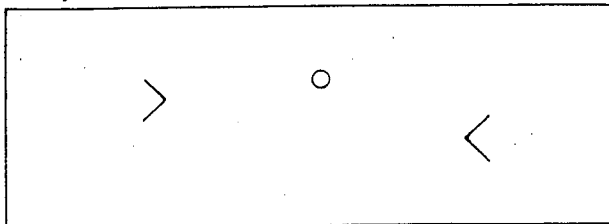
The point, on which the cursor is located, is defined as the end point of an element of geometry (a line, circle or arc) by pressing the key F2.

The active end point is shown on the screen by the symbol "<".

Determining the centre point (F3)

The point, on which the cursor is located, is defined as the centre point of a circle or an arc by pressing the key F3.

The active centre point is shown on the screen by the symbol "o".



Representation of a starting point, centre point and end point.

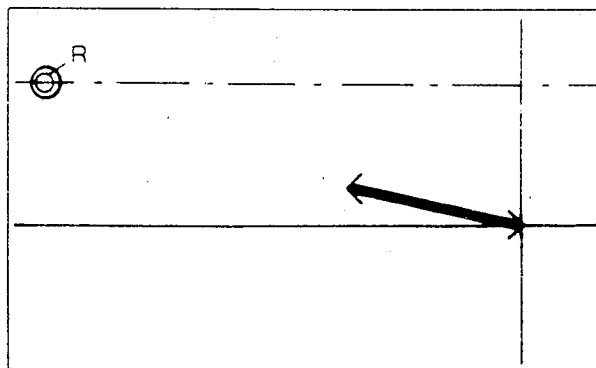
Find point (F4)

Position the cursor by means of the arrow keys near to the point found.

The cursor jumps to the neighbouring point, when the key F4 is pressed.

Purpose:

If machining is to continue from an available point, this must be approached exactly with F4.



Example:

The cursor is located at the starting point of the line.

Re-defining the reference point (F5)

The point, on which the cursor is located, is defined as the new reference point by pressing the key F5.

Reference point (R) = origin of the coordinate system (X = 0 / Z = 0).

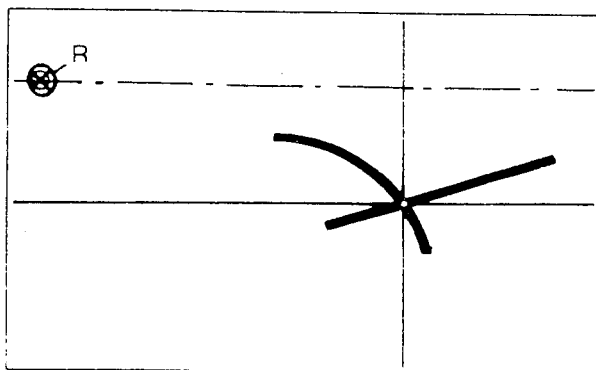
Cursor to the reference point (F6)

The cursor returns to the reference point, when the key F6 is pressed.

Find the point of intersection (F7)

Position the cursor by means of the arrow keys near to the point of intersection to be found.

The cursor jumps to the neighbouring point of intersection, when the key F7 is pressed.



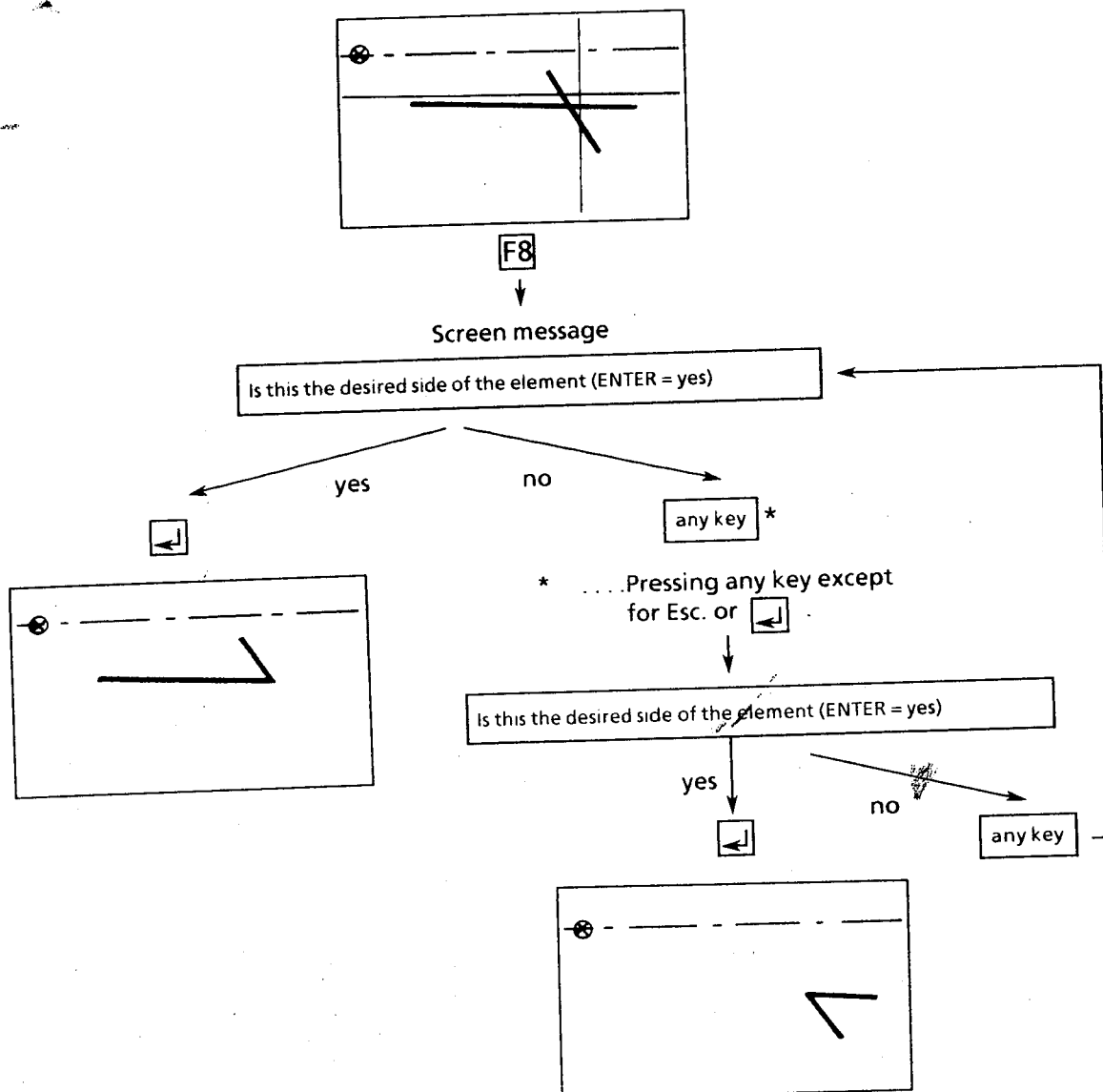
Trim bits (F8)

Trim bits = deleting protruding parts of an element of geometry

Example

Two intersecting lines should result in a bit.

Position the cursor by means of the arrow keys near to the bit to be trimmed.



4.2.3 Line (F3)

Lines are drawn, altered or erased in this submenu.

LINE	
F1	DRAW
F2	SEARCH
F3	SPLIT
F4	ERASE
F5	PARALLEL
F6	PERPENDIC
F7	TANGNT P/A
F8	TANGNT A/A
F9	CHAMFER
F10	

Drawing a line (F1)

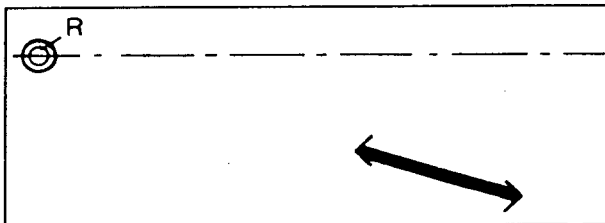
A line is drawn, whose starting and end points are already determined.

Example

Starting point: X = 35 mm, Z = 65 mm

End point: X = 25 mm, Z = 55 mm

A line between the two points is drawn by pressing the key F1.



Searching for a line (F2)

Position the cursor by means of the arrow keys near to the line to be searched for.

The cursor jumps to the neighbouring line, when the key F2 is pressed.

Purpose: If a line is to be machined further, this must first be determined with F2.

Splitting a line (F3)

Position the cursor by means of the arrow keys on the splitting point of the line.

This line is divided into two lines, when the key F3 is pressed. (The point of splitting is invisible.)

Purpose: If only a part of a line is to be machined further, this part must be split from the rest.

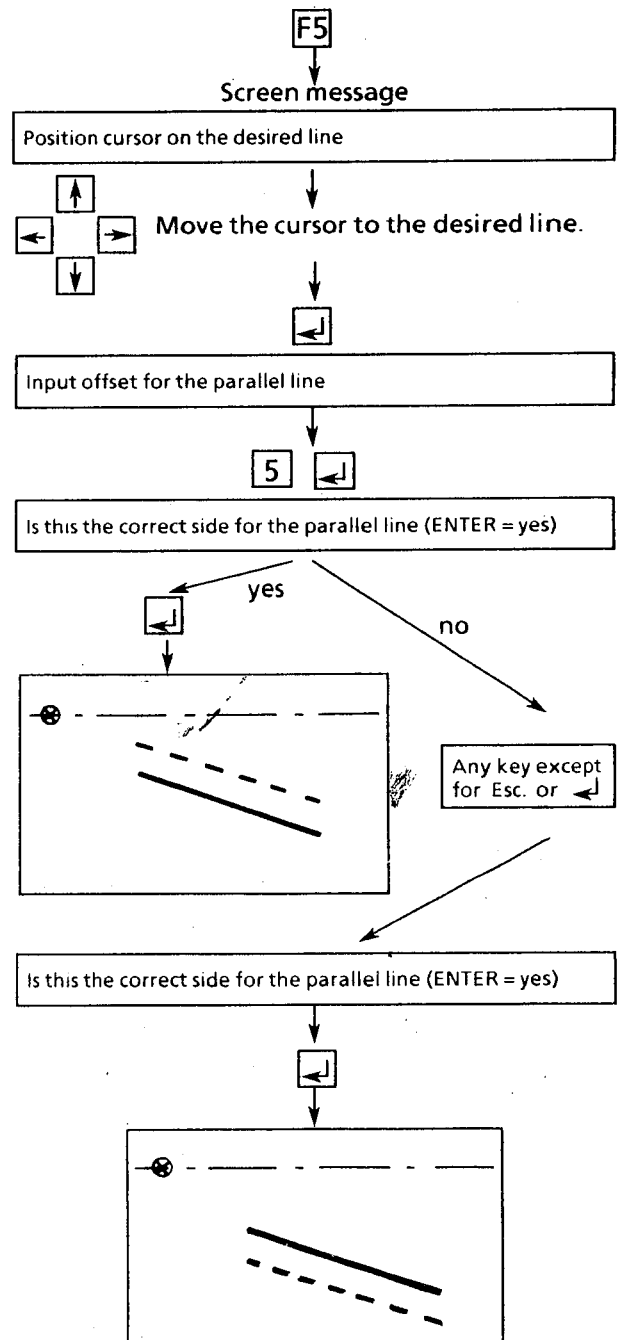
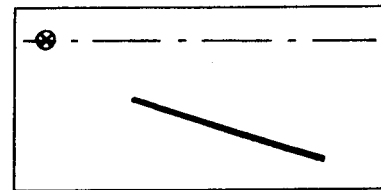
Erasing a line (F4)

Position the cursor by means of the arrow keys near to the line to be erased and press the key F4.

Drawing a parallel line (F5)

Unit: [mm]

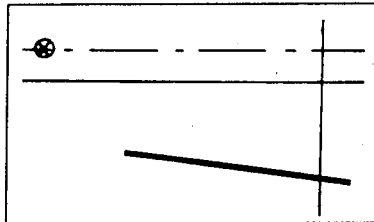
A parallel line is drawn to an existing line (e.g., distance = 5 mm).



Drawing a perpendicular (90°) to a line (F6)

A perpendicular (90°) is drawn to an existing line.

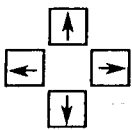
Move the cursor to the point, where the perpendicular should start.



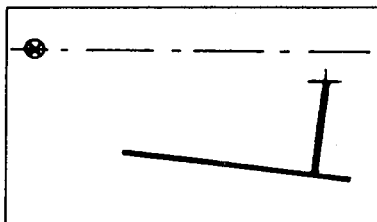
F6

Screen message

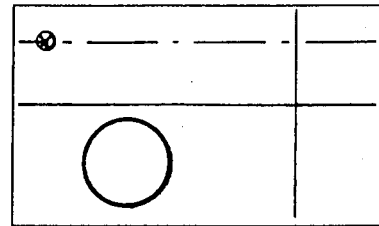
Position cursor on the desired line



Move the cursor near to the line.

Drawing a tangent point/arc (F7)

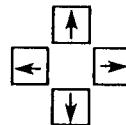
A tangent from the current cursor position to an arc is drawn.



F7

Screen message

Position cursor on the desired arc



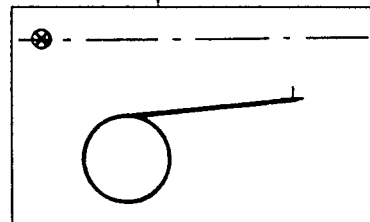
Move the cursor to the desired arc.



Is this the desired tangent (ENTER = yes)

yes

no

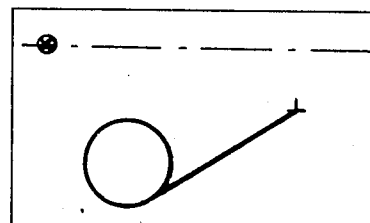


Any key except
for Esc. or ↵

Is this the desired tangent (ENTER = yes)

yes

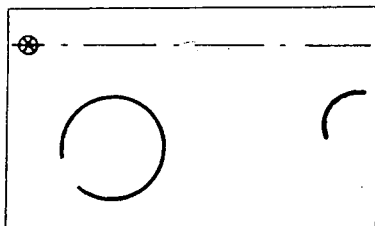
no



Any key except
for Esc. or ↵

Drawing a tangent arc/arc (F8)

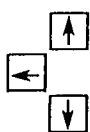
A tangent from an arc to a second arc is drawn.



F8

Screen message

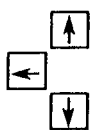
Position cursor on the desired arc



Move the cursor to the 1st arc.



Position cursor on the desired arc



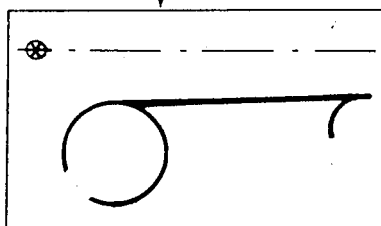
Move the cursor to the 2nd arc.



Is this the desired tangent (ENTER = yes)

yes

no

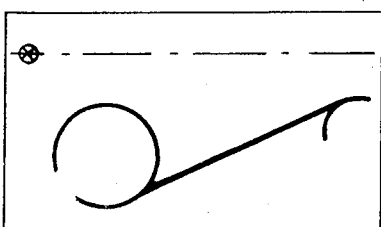


Any key except
for Esc. or

Is this the desired tangent (ENTER = yes)

yes

no



Any key except
for Esc. or

Adding a chamfer (45°) (F9)

Unit: [mm]

Condition:

1. Both lines contact each other at this point (do not intersect).
2. The cursor must be positioned near to this bit.

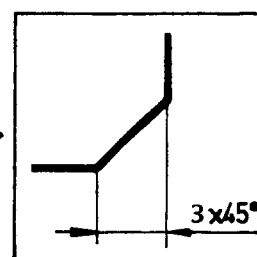
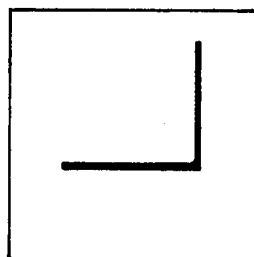
Example: chamfer = 3 x 3 mm

Screen message	Entry
	F9
Size of the chamfer	3
Is the chamfer correct (ENTER = yes)	

Possibilities:

ENTER = Confirming the desired chamfer

Any other key = interruption of this command "Adding a chamfer".



4.2.4 Arc (F4)

Arcs are drawn, altered or erased in this submenu.

ARC	
F1	DRAW
F2	SEARCH
F3	SPLIT
F4	ERASE
F5	CIRCLE
F6	ARC 3 PTS
F7	FILLET
F8	FILL 2 ELE
F9	
F10	

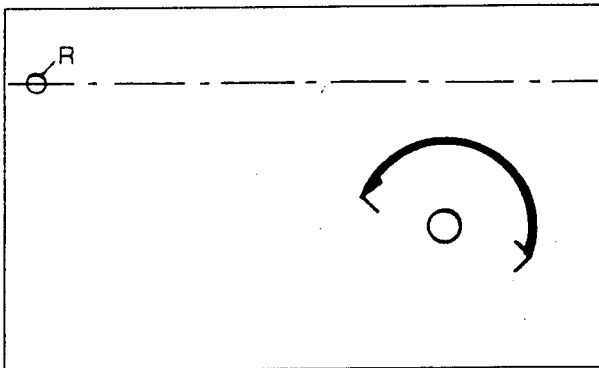
Drawing an arc (F1)

An arc is drawn, whose starting, centre and end points are already determined.

Example:

Starting point: X = 35 mm, Z = 66 mm
 Centre point: X = 30 mm, Z = 58 mm
 End point: X = 25 mm, Z = 55 mm

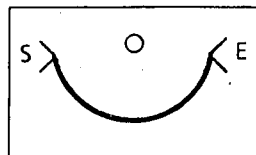
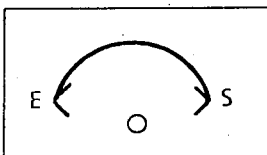
An arc (clockwise) is drawn from the starting point to the end point by pressing F1.



Note:

Arcs are always drawn clockwise.

You can define the position of the arc by the selection of the starting and end points.



Searching for an arc (F2)

Position the cursor by means of the arrow keys near to the arc to be searched for.

The cursor jumps to the neighbouring arc, when the key F2 is pressed.

Purpose

If an arc is machined further, this must be defined with F2 first.

Splitting an arc (F3)

Position the cursor by means of the arrow keys on the splitting point of the arc.

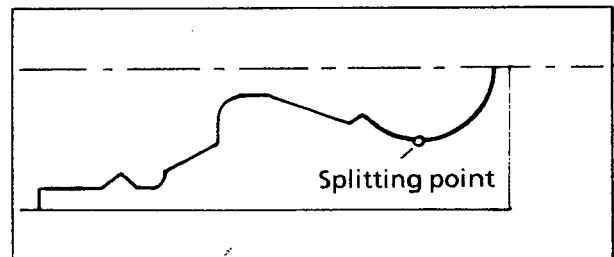
The arc is split, when the key F3 is pressed. (The splitting point is not visible.)

Purpose:

If only a part of an arc is to be machined further, this part must first be split from the rest.

Application example:

You must split arcs over 90°, since a starting point of the back pocket must be determined in the program menu (for back pocket).



Erasing an arc (F4)

Position the cursor by means of the arrow keys near to the arc to be erased and press the key F4.

Attention!

The command "Erase" can no longer be reversed, after it has been carried out!

Drawing a complete circle (360°) (F5)

Unit: [mm]

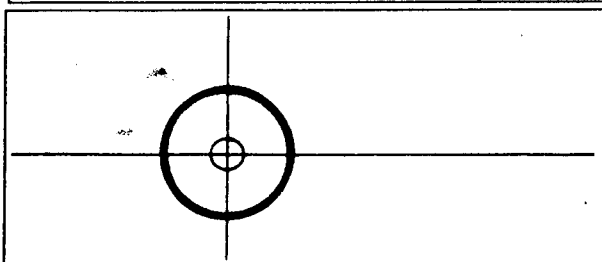
Position the cursor by means of the arrow keys on the centre point of the desired complete circle.

Press F5, enter the radius of the circle and confirm it.

Example:

Constructing a complete circle R = 15 mm

Screen message	Entry
	F5
Circle radius 10.000 (ENTER = no change):	15 <input type="text"/>

Drawing an arc with three points (F6)

Determine the starting point and the end point.

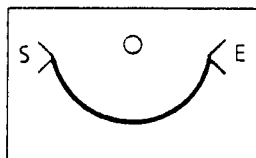
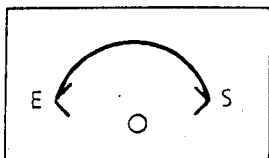
Position the cursor on the circumference of the desired arc (= third point).

An arc is drawn through the starting, end point and cursor position, when the key F6 is pressed.

Note:

Arcs are always drawn anti-clockwise.

You can define the position of the arc by the selection of the starting and end points.



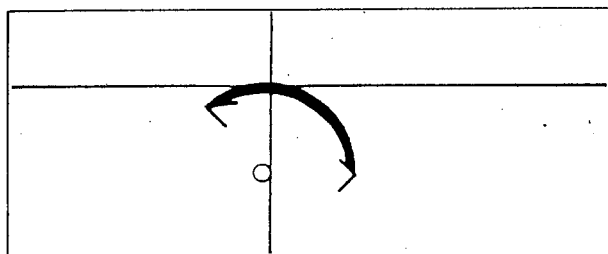
Example:

Starting point: X = 25 mm, Z = 36 mm

End point: X = 16 mm, Z = 25 mm

Cursor position: X = 18 mm, Z = 32 mm

The arc is drawn, when F6 is pressed.

Adding a fillet (F7)

Unit: [mm]

1. Both lines must contact at this point.

2. The cursor must be positioned near to this bit.

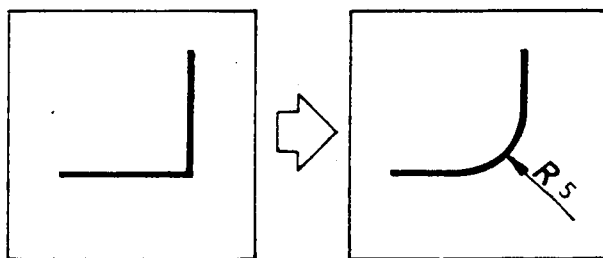
Example: Radius = 5 mm

Screen message	Entry
	F7
Radius for the corner?	5 <input type="text"/>
Is the radius correct (ENTER = yes)	<input type="text"/>

Possibilities:

ENTER = confirming the desired radius

Any other key = interruption of this command "Adding the fillet".

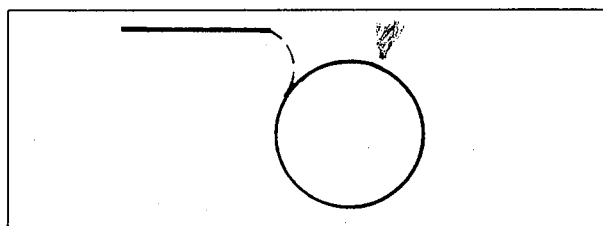
Fill two elements (F8)

Geometric elements (points, lines, circles or arcs) are filled tangentially by an arc.

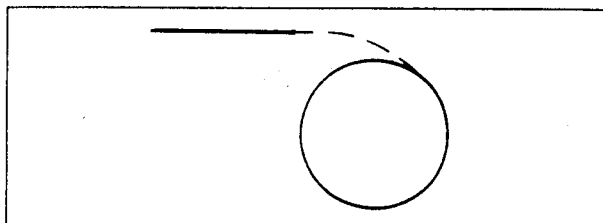
Note:

If you want to fill a circle or an arc, the prompt from the system for the type of filling appears. There are two possibilities.

Filling 1: in front of the circle

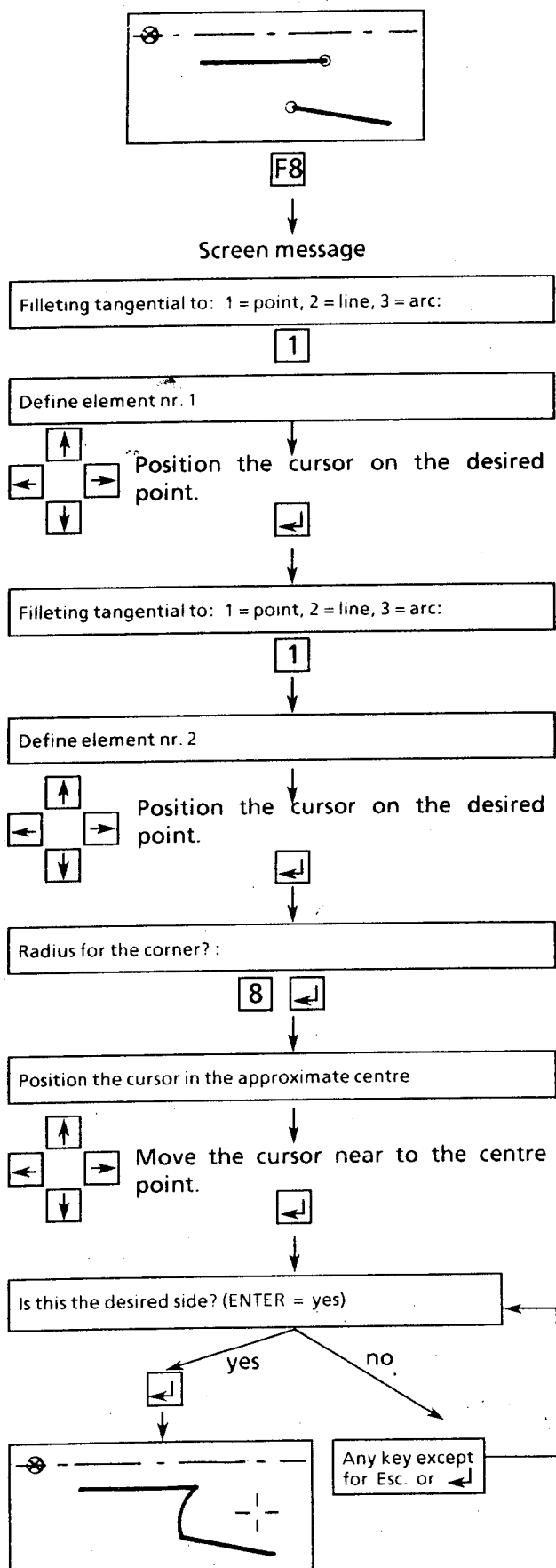


Filling 2: including the circle



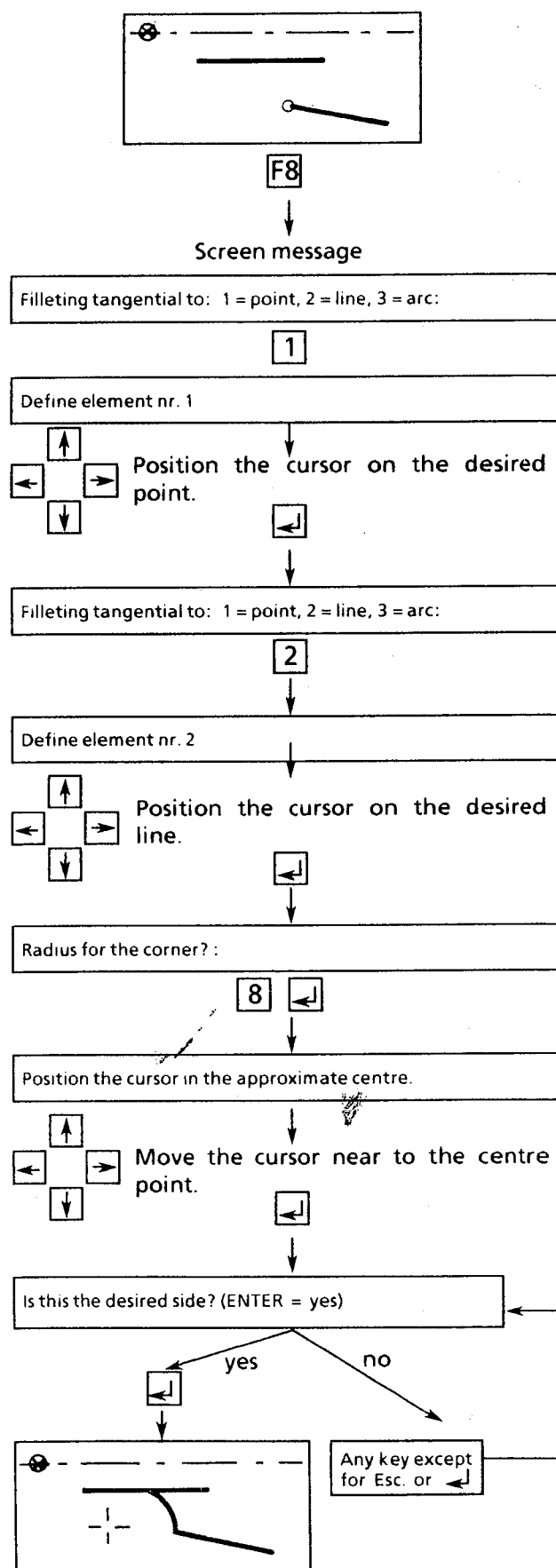
Example 1

Filling the point of one line with a point of another line.



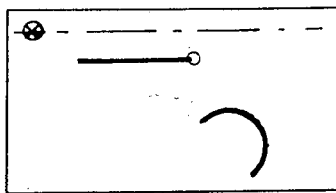
Example 2

Filling the point of a line with a line.



Example 3

Filling the point of a line with an arc.



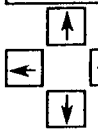
F8

Screen message

Filletting tangential to: 1 = point, 2 = line, 3 = arc:

1

Define element nr. 1



Position the cursor on the desired point.



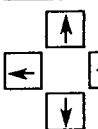
Filletting tangential to: 1 = point, 2 = line, 3 = arc:

3

Filletting type? : 1 = before the arc, 2 = include the arc:

1

Define element nr. 2



Position the cursor on the desired circle.

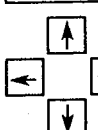


Radius for the corner? :

6



Position the cursor in the approximate centre



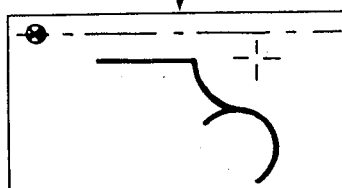
Move the cursor near to the centre point.



Is this the desired side? (ENTER = yes)

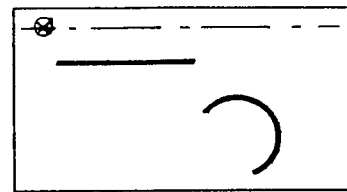
yes

no

Any key except
for Esc. or

Example 4

Filling a straight line with an arc.



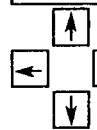
F8

Screen message

Filletting tangential to: 1 = point, 2 = line, 3 = arc:

2

Define element nr. 1



Position the cursor on the desired line.



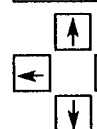
Filletting tangential to: 1 = point, 2 = line, 3 = arc:

3

Filletting type? : 1 = before the arc, 2 = include the arc:

1

Define element nr. 2



Position the cursor on the desired circle.

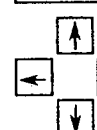


Radius for the corner? :

6



Position the cursor in the approximate centre



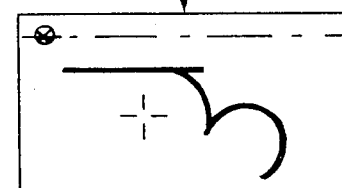
Move the cursor near to the centre point.



Is this the desired side? (ENTER = yes)

yes

no

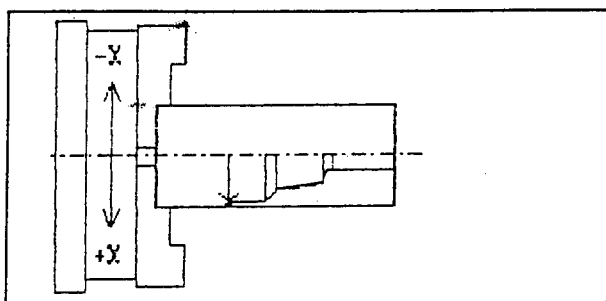
Any key except
for Esc. or

4.2.5 Drawing visible edges (circumferential edges) (F5)

Drawing in the visible edges is not required for the production on a lathe; it only serves to create a complete representation according to the standards.

Procedure:

- The cursor was positioned near to the desired visible edge.
- The visible edge is drawn up to the Z axis, when the key F5 is pressed.
- This procedure is repeated for every visible edge.



4.2.6 Mirroring the work piece contour (F6)

Only the lower half of the work piece must be drawn on the screen for the production on a lathe.

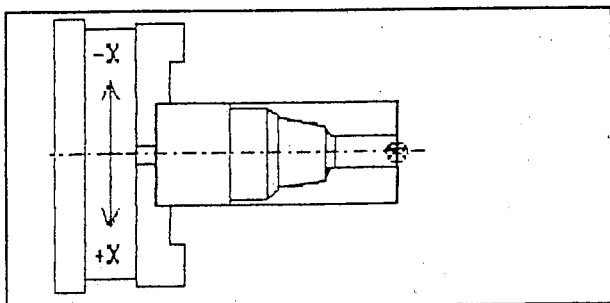
The upper half of the work piece can be created by mirroring around the Z axis.

Procedure

Press F6 key

The command F6 - mirroring remains. This means, that all contour parts programmed after this function are also mirrored.

The command is deselected again, when "F6" is pressed again.



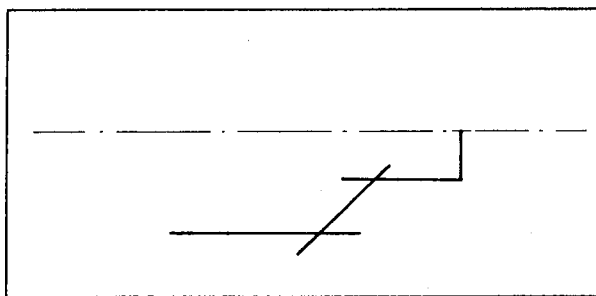
4.2.7 Cleaning the work piece contour (F7)

At the beginning of a geometric definition, it will often be the case that two or more contour elements are cut unclearly. For the machining of the work piece, however, continuous contours are required. The points of intersection must be "cleaned" (for example, see next page).

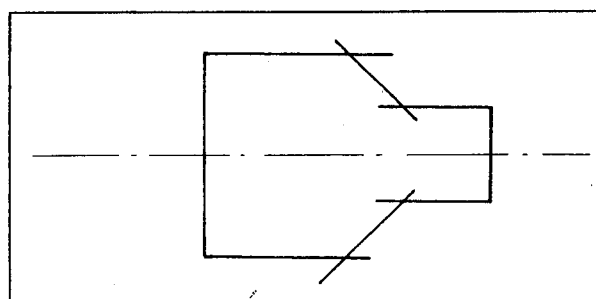
Note:

The prompt from the system for the type of contour appears during the cleaning. There are two possibilities.

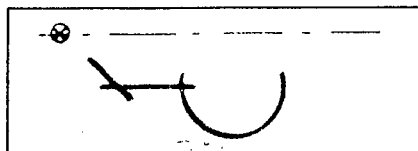
Possibility 1: open contour



Possibility 2: closed contour



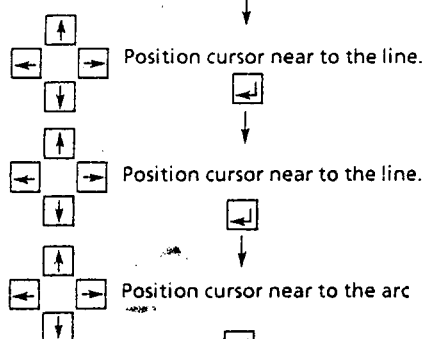
Example: Cleaning



F7

Screen message

Identify elements: 0 = end, 1 = reject last, (ENTER = accept)

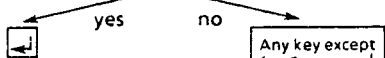


0 End identification

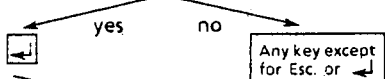
Contour type, 0 = open, 1 = closed:

0

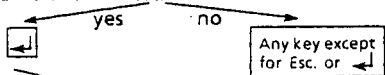
Is the cursor at the correct intersection point (ENTER = yes):



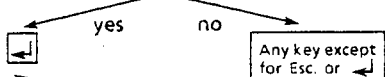
Is this the desired side of the element (ENTER = yes):



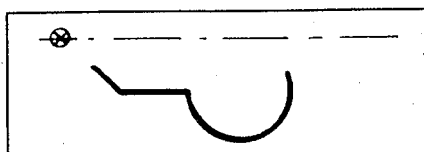
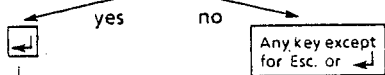
Is the cursor at the correct intersection point (ENTER = yes):



Is this the desired side of the element (ENTER = yes):



Is this correct? (ENTER = yes):



4.2.8 Erasing the geometric element (F8)

The cursor was positioned near to the element to be erased (line, circle or arc).

The neighbouring geometric element is erased, when the key F8 is pressed.

Attention!

The command "Erase" can no longer be reversed, after it has been carried out.

4.2.9 Erasing all (F9)

All the drawing elements shown on the screen are erased.

Attention!

The command "Erase" can not be reversed, after it has been carried out.

Screen message	Entry
	F9
Are you sure? (ENTER = yes)	[left arrow]

Possibilities:

ENTER = drawing is erased

Any other key = erasion command is interrupted

4.2.10 Hotkeys - draw

In order to facilitate a more efficient programming, so-called "hotkeys" were introduced in this software. Hotkey = single-key commands, which are effective in every menu level. You can display a work piece contour on the screen more quickly with the use of these hotkeys.

Example: Constructing a line







Possibility 1 - Menu






1. F2 Recall - menu DRAW
2. F2 Recall - submenu POINT
3. Moving the cursor to the starting point
4. F1 Determining the starting point
5. Moving the cursor to the end point
6. F2 Determining the end point
7. Esc. Exit from the submenu POINT
8. F3 Recall - submenu line
9. F1 Drawing a line





Possibility 2 - hotkeys




1. Moving the cursor to the starting point
2. S Determining the starting point
3. Moving the cursor to the end point
4. + Drawing the line to the cursor position, a new starting point at the same time






Summary - hotkeys

Key	Cursor commands
	Position the cursor incrementally
	Position the cursor by entering the radius and angle
	Cursor to the middle of the screen
	Cursor to the reference point
	Doubling the step size of the cursor
	Halving the step size of the cursor

Key	Screen commands
	Redrawing the screen contents
	Zooming a screen window
	Zooming the work piece
	Cursor as a graticule
	Reduced cursor

Key	Searching commands
	Finding the point
	Searching for the line
	Searching the circle, arc
	Searching any point of intersection

Key	Point commands
	Determining the starting point
	Determining the end point
	Determining the centre point

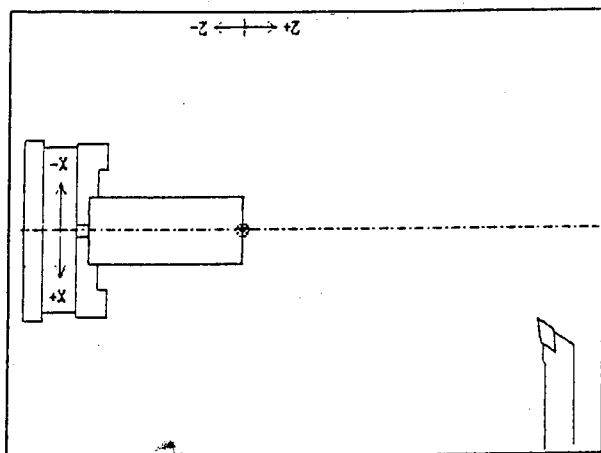
Key	Geometric commands
	Adding a fillet
	Adding a chamfer (45°)
	Cleaning the bit
	Drawing a line to the cursor
	Erasing the element

Note:

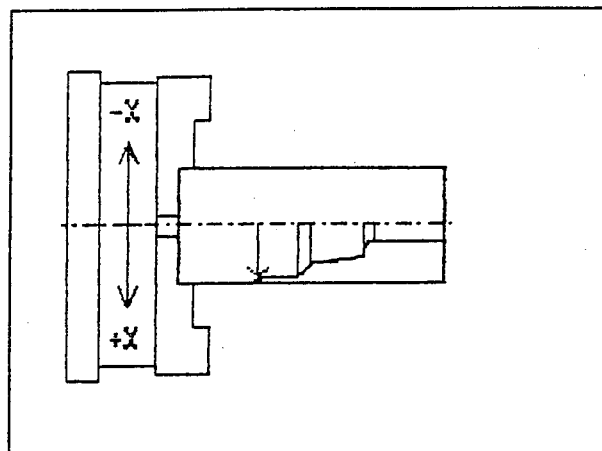
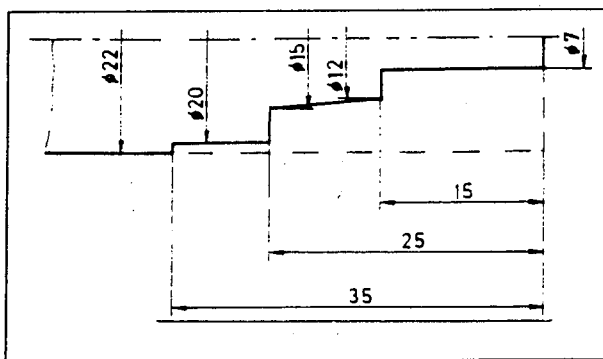
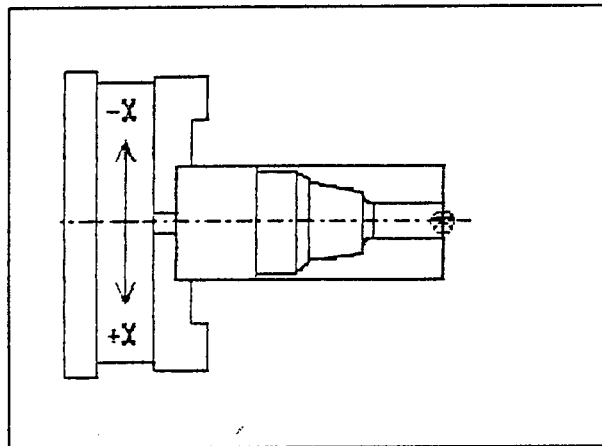
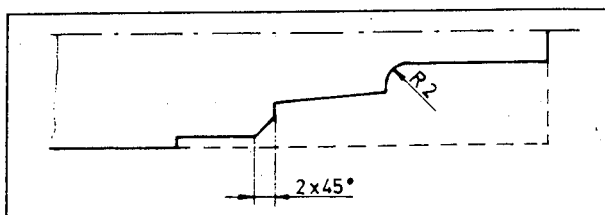
Letters can be entered as capitals or small letters.

Specimen example 1Creating a work piece with F1

$\varnothing = 22$ mm, length = 50 mm, no bore hole

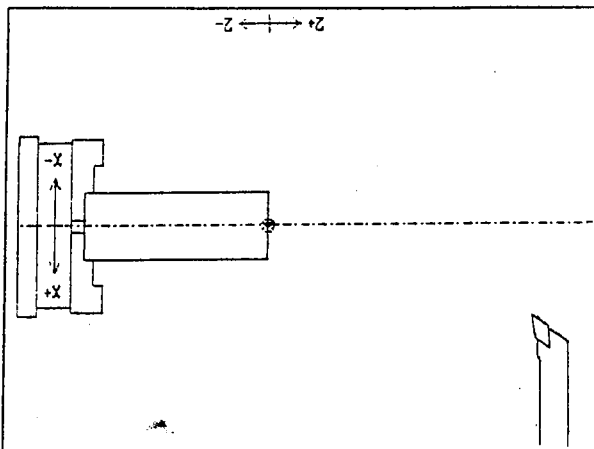


The work piece is enlarged over the whole of the screen surface by means of the hotkey **[Z]**

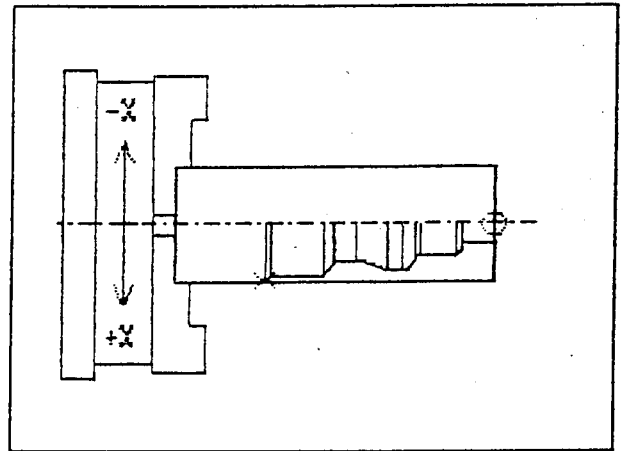
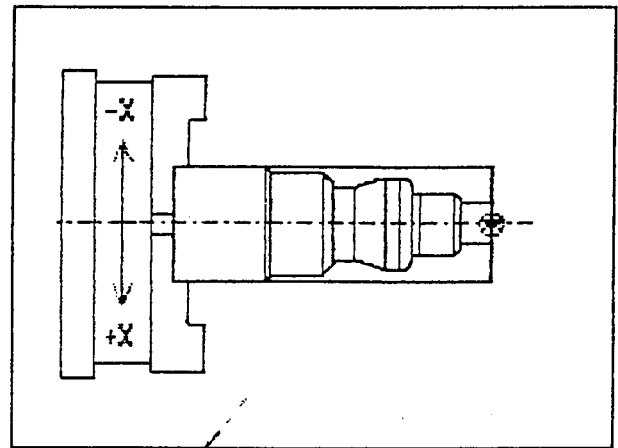
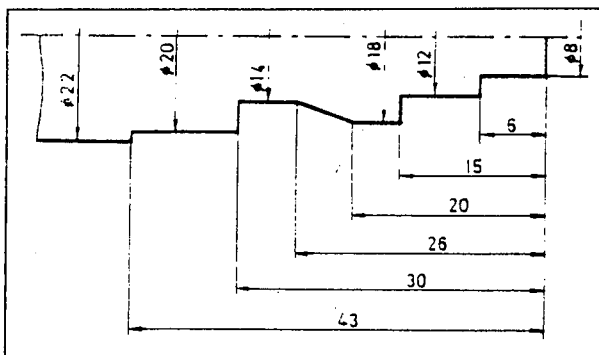
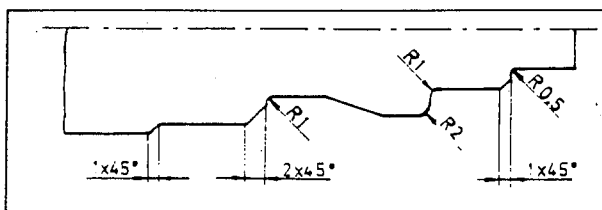
Adding the visible edges with F2, submenu F5Creating the lower half of the work piece contour with F2Reflecting the work piece contour with F2, submenu F6Adding the radii and chamfers with F2Storing the work piece contour with F8

Specimen example 2Creating a work piece with F1

$\varnothing = 22$ mm, length = 60 mm, no bore hole

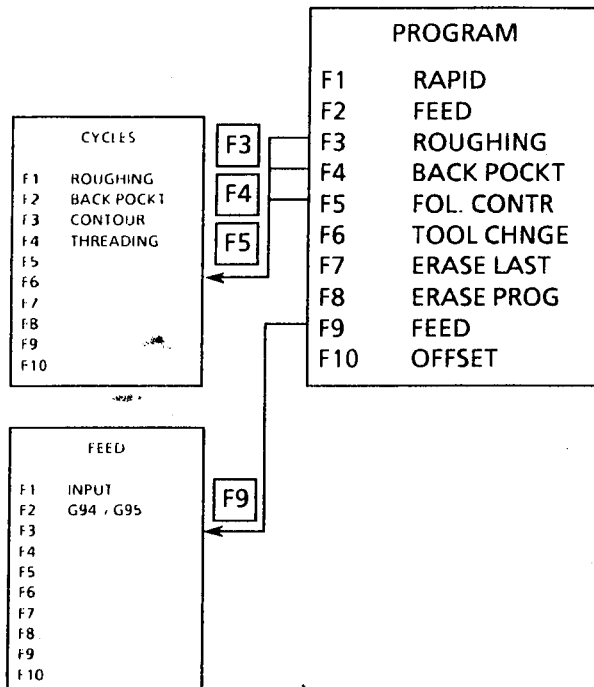


The work piece is enlarged over the whole of the screen surface by means of the hotkey **Z**.

Adding the visible edges with F2, submenu F5Reflecting the work piece contour with F2, submenu F6Creating the lower half of the work piece contour with F2Adding the radii and chamfers with F2Storing the work piece contour with F8

4.3 Program (F3)

The machining cycle is determined for a work piece drawn and simulated on the screen in this menu. The tool path is shown graphically. The machining program is compiled automatically.



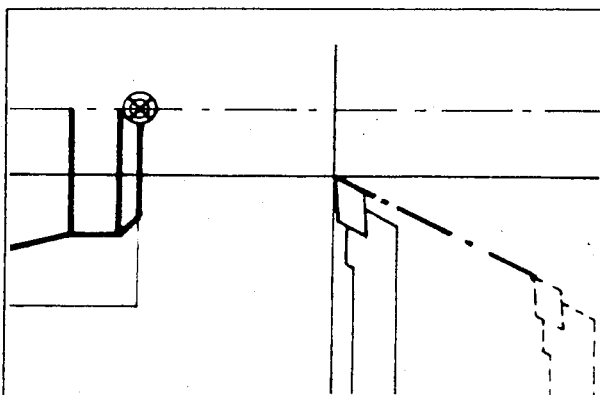
PROGRAM options

4.3.1 Moving at rapid speed (F1)

A rapid move is a move without chip removal and only serves to position the tool. The slides move at the highest possible speed (200 mm/min).

Representation on the screen: - - - - -

The tool moves at rapid speed to the cursor position, when the key F1 is pressed.

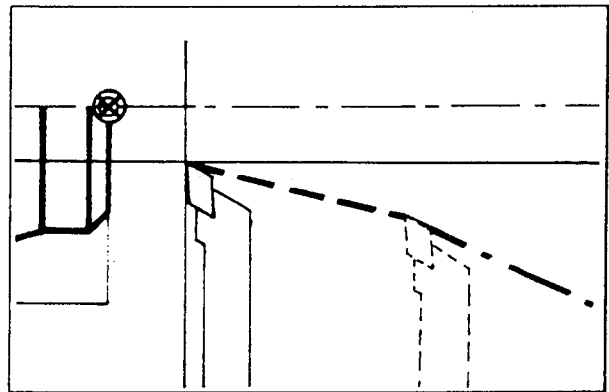


4.3.2 Moving at feed speed (F2)

The slides move at the programmed feed speed (= machining movement, see F9).

Representation on the screen: - - - - -

The tool moves to the cursor position at the feed speed in real time (see F9), when the key F2 is pressed.

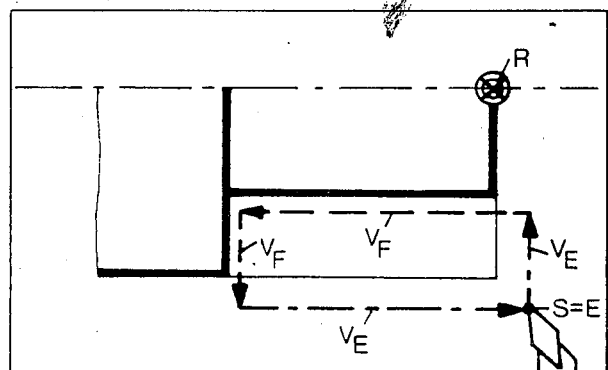


4.3.3 Cycles (F3, F4, F5)

By pressing the keys F3 (roughing), F4 (back pocket) or F5 (follow contour) the submenu CYCLES is activated. Only in this submenu you can choose the desired machining cycle.

A cycle is a pointed tool movement, which is enclosed and composed of many parts.

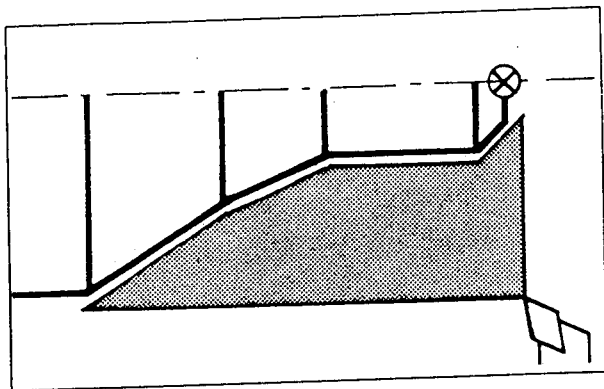
A circle is composed of the rapid and feed movements.



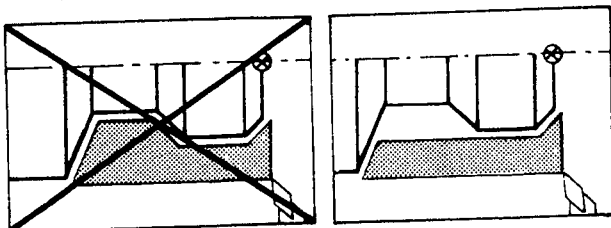
S = Starting point
E = End point
 V_F = Feed speed
 V_E = Rapid speed

Roughing cycle (F1)

The roughing cycle is a movement sequence, where the "coarse contour" of the work piece is machined with the greatest possible chip removal.



If your work piece is designed in such a way that the diameter of the work piece contour decreases to the left, this is not taken into consideration by the roughing cycle. This work piece area must be back pocketed in its own machining procedure.

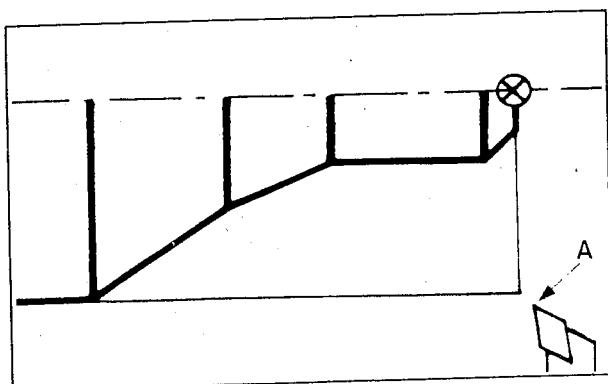


Condition

The work piece contour created in the menu draw may not be interrupted, since otherwise an interruption of the roughing cycle takes place.

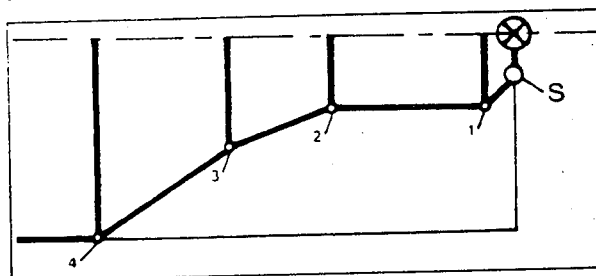
Procedure

1. Position the tool at rapid speed (F1) or at feed speed (F2) on a sensibly selected starting point (A) of the cycle, activate the submenu CYCLES (F3, F4, F5) and press F1 (roughing).

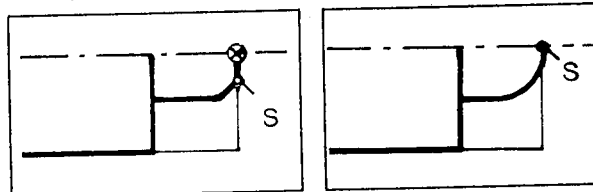


2. Determining the starting point

The starting point (S) of the roughing cycle must always be the outermost point on the work piece contour in the Z direction.



Examples: Starting point for roughing cycles



If F1 - roughing cycle is pressed, the point nearest to the cursor is suggested by the program as the starting point.

Possibilities



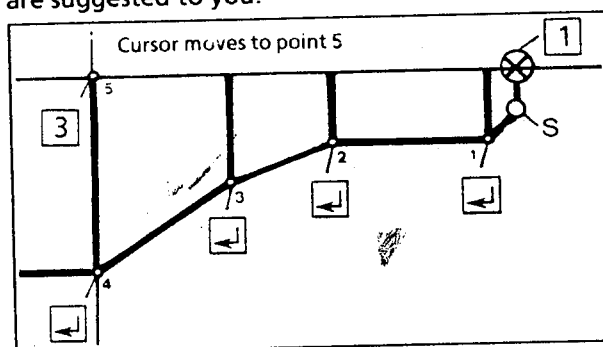
Confirm the starting point



Another point is suggested as the starting point.

3. Determining the contour points

After the starting point has been determined, the contour points (1, 2, ...) of the work piece contour drawn must be determined. These contour points are suggested to you.



Possibilities



Confirm the contour point



Display the next contour point in the opposite direction



Omit the suggested contour point



End of the contour point determination, if all contour points have + been made known to the program.

You can also confirm the points of a back pocket, but these are not taken into account by the roughing cycle and must be machined with back pocket cycles.

4. Entering the technological data

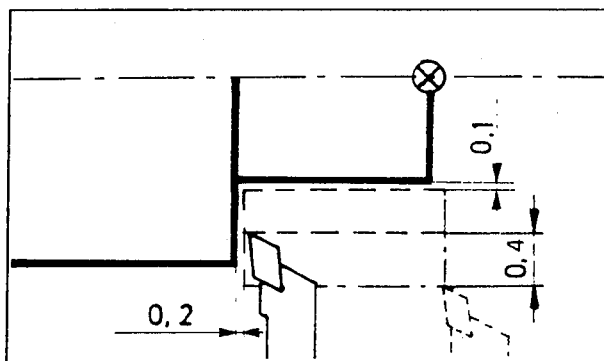
After the contour points have been determined, the following prompts appear on the screen one after the other.

Screen display	Entry example
Finishing offsets [mm] X=0, Z=0	0.1, 0.2
In-feed per cut 0,3 mm	0.4
Feed speed 40 mm/min	

Either confirm the suggested values with ENTER or enter new values.

The values confirmed here are suggested for the following machining variants (back pocket, follow contour).

The data for X values refer to the radius and not to the diameter of the work piece.

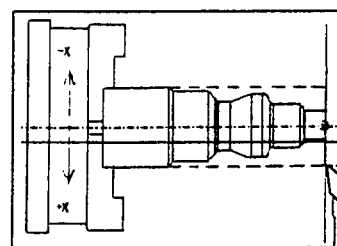


After entering the feed speed, the finishing cycle is processed on the screen. If it is not processed, there are the following causes of errors:

1. No enclosed contour (line draw).
2. Incorrect definition of the contour points.
3. The finishing offset is larger than the contour to be machined.
4. The cutting depth is larger than the contour to be machined.

Example - Roughing cycle

Call up the specimen example 2 (from page 42). Position the tool near to the work piece. Position the cursor near to the starting point.



F1

Screen message

Define start point, (ENTER = accept) any other key = continue

yes

no



Contour points are suggested by the computer and must be confirmed with

Any key except for Esc. or

1 = opposite direction, 2 = omit point, 3 = end (ENTER = accept)



3

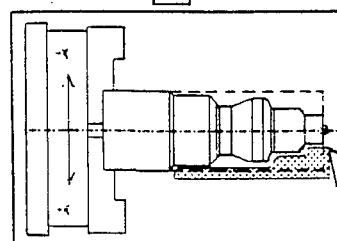
Offset in X, Z 0.000 0.000 (ENTER = no change):

0.1, 0.2

Cutting depth = 0,3 (ENTER = no change):

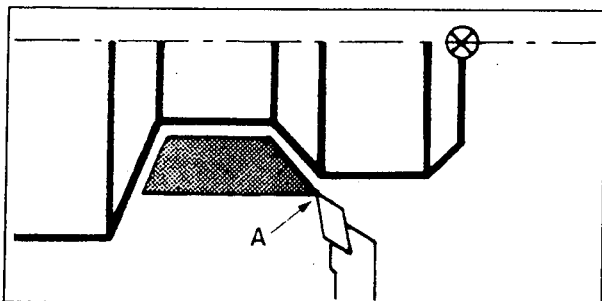
0.4

Feed = 40 (ENTER = no change):



Back pocket cycle (F2)

Machining a work piece area, which was not taken into consideration by the roughing cycle (work piece diameter decreases to the left).



Condition

The work piece contour created in menu draw may not be interrupted, since otherwise an interruption of the back pocket takes place.

Procedure

1. Position the work piece on a sensibly selected starting point (A) at rapid speed (F1) or at feed speed (F2), activate the submenu CYCLES (F3, F4, F5) and press F2 (back pocket).

Note

If a cycle was previously machined, the following message appears on the screen:

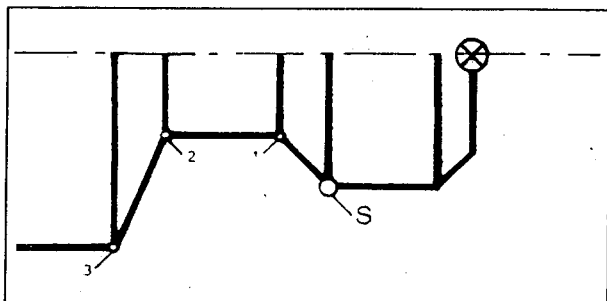
New or last contour (ENTER = last):

Re-machine the last defined contour.

Any key Defining a new contour.

2. Determining the starting point

The starting point (S) of the back pocket must always be the outermost point of the machined contour in the Z direction.



If F2 - back pocket is pressed, the point next to the cursor is suggested by the program as the starting point.

Possibilities:

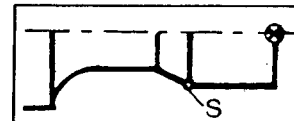
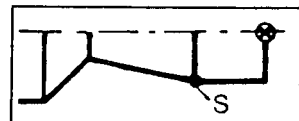


Confirm the starting point



Another point is suggested as the starting point.

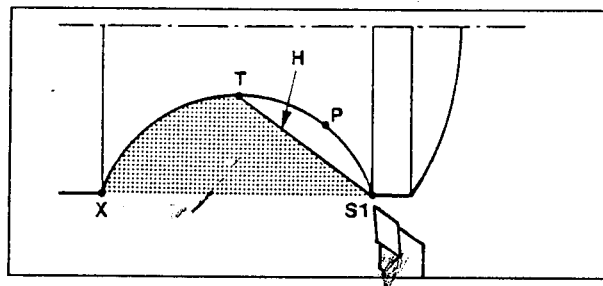
Examples - Starting point for back pockets



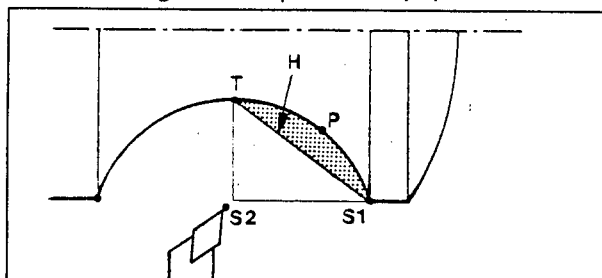
Special case for turning out an arc with two different tools

Procedure

- Split the arc (point T)
- Draw the auxiliary line (H) from the splitting point (T) to the starting point (S1).
Reason: The tool would otherwise cut above the arc and collide.
- Put an additional point (P) on the arc.
Reason: In this way, you can determine whether the tool is to travel the path S1 - T (= line) or the path S1 - P - T (= arc) during the determination of the contour points.
- Carry out the back pocket with the right lateral tool.
Starting point S1
Following contour points T, X



- Change the tool and move to the new starting point (S2).
- Machine the rest from T to S1 with the roughing cycle (there is no more back pocket).
Starting point S2
Following contour points ... T, P, S1

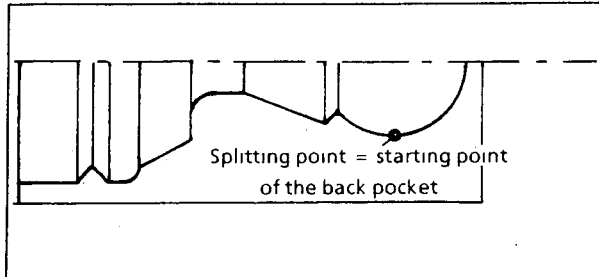


Attention!

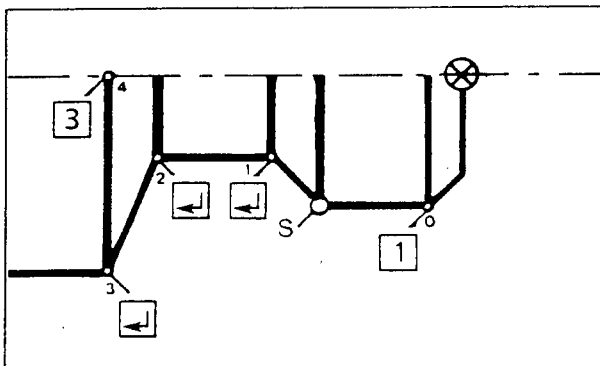
Arcs (larger than 90°), which are back pocketed, must be split before the machining (see page 34).

Reason

The system only recognizes the starting and end points of the arc. A new starting point must be defined for the back pocket. (The starting point of the back pocket is the point, which has come into being, when the arc was split.)

**3. Determining the contour points**

After the starting point was determined, the contour points (1, 2,...) of the back pocket drawn must be determined. These contour points are suggested to you.

**Possibilities**

- ☐ Confirm the contour point
- ☐ Display the next contour point in the opposite direction
- ☐ Omit the suggested contour point
- ☐ Finish the contour point determination

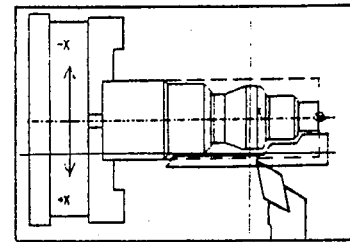
The last contour point of the back pocket must lie on the same level in the X direction or higher than the starting point.

4. Entering the technological data

This is carried out in the same way as described in the chapter "roughing cycle".

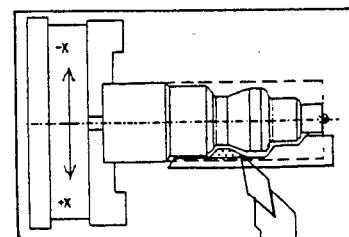
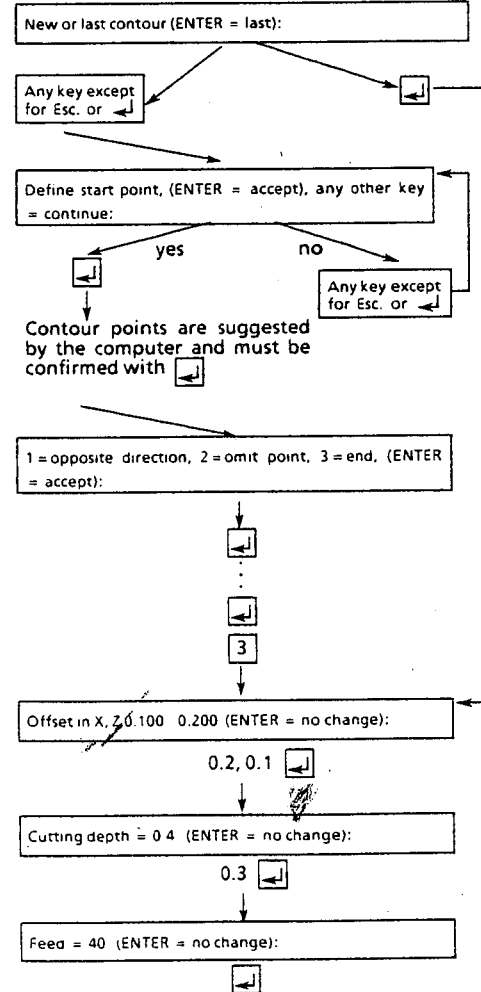
Example - Back pocket

The specimen example 2 (from page 42) is called up. The menu point roughing was carried out. Move the tool near to the starting point of the back pocket. Position the cursor near to the starting point.



F2

Screen message

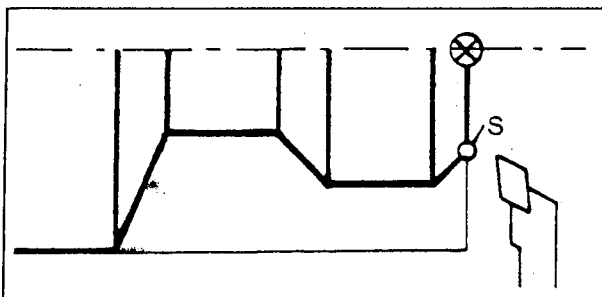


Follow contour cycle (F3)

If a finishing offset was determined in the menu points roughing or back-pocket, this is machined with the follow contour cycle.

Finishing = Dimension-accurate finishing of the work piece contour

This can be also be carried out in several machining cycles.



Procedure

1. Position the tool near to the starting point (S) at rapid speed (F1) or at feed speed (F2), activate the submenu CYCLES (F3, F4, F5) and press F3 (follow contour).

Note

If a cycle was previously machined, the following message appears on the screen:

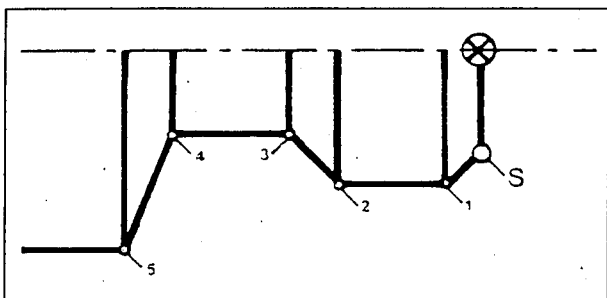
New or last contour (ENTER = last):

Re-machine the last defined contour.

Define the new contour.

2. Determining the starting point

The starting point of the follow contour cycle must always be the outermost point on the machined contour in the Z direction.



S Starting point
1,2,3,4,5 Contour points

If F3 - follow contour is pressed, the point nearest to the cursor is suggested as the starting point.

Possibilities



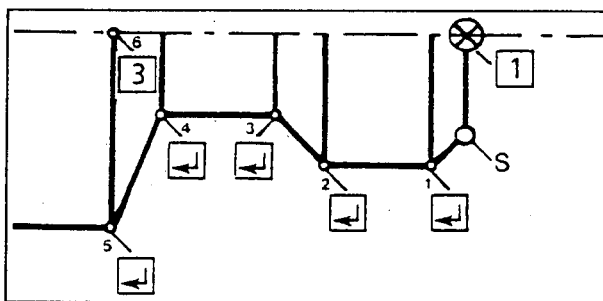
Confirming the starting point



Another point is suggested as the starting point.

3. Determining the contour points (1, 2, 3, 4, 5)

After the starting point has been determined, the contour points of the work piece contour drawn must be determined. These contour points are suggested to you.



Possibilities



..... Confirming the contour point



..... Displaying the next contour point in the opposite direction



..... Omitting the suggested contour point

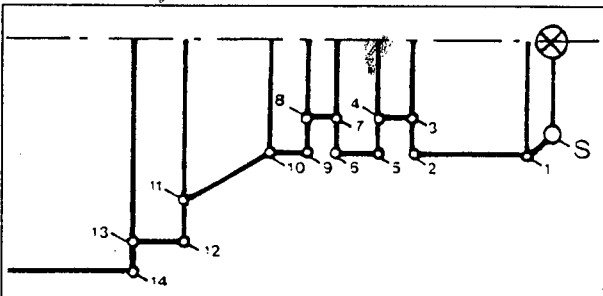


..... Ending the contour point determination

Note

Only the points of the machining, which can be finished with the selected tool, are confirmed as contour points.

E.g., the holes (point 3, 4, 7, 8) may not be confirmed.

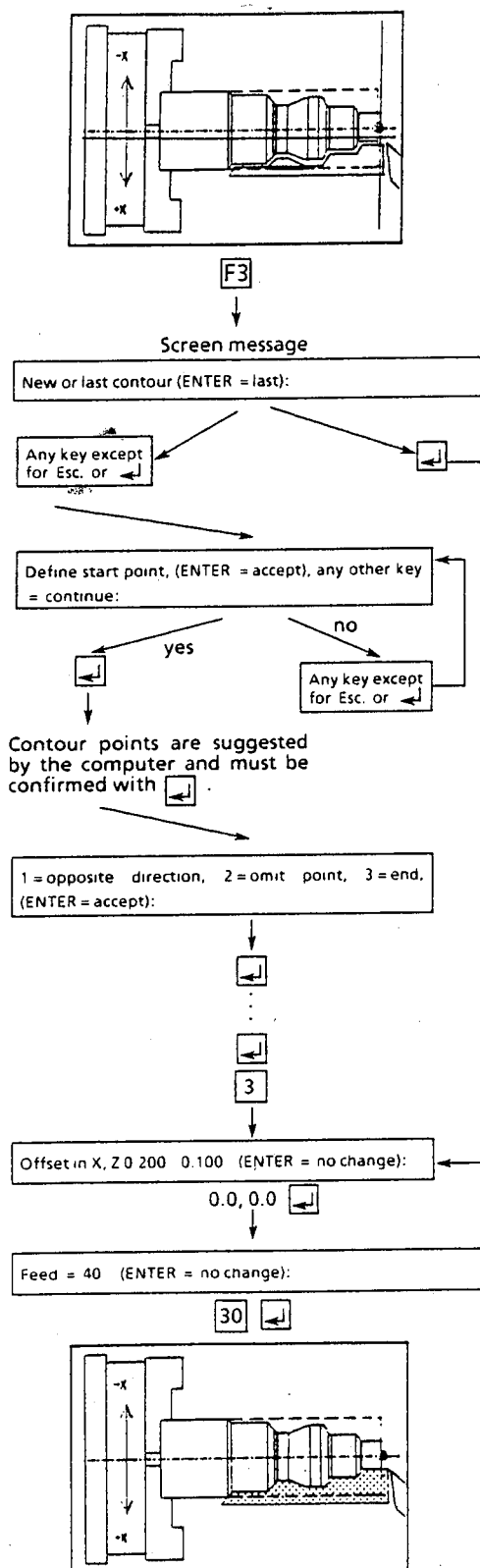


4. Entering the technological data

The input of the finishing offset and feed speed is carried out exactly as described in the chapter "roughing cycle".

Example - Follow contour cycle

The specimen example 2 is called up. The menu points roughing and back pocket were carried out. Move the tool near to the starting point. The cursor is located near to the starting point.



Threading cycle (F4)

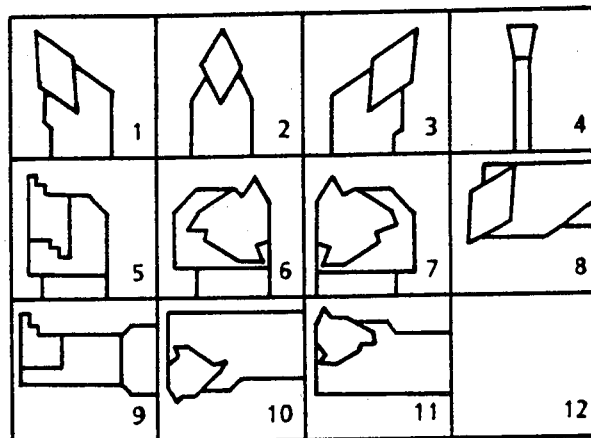
See instruction "Thread-cutting UNIMAT PC" (Ref.No. A4Z 080 050).

4.3.4 Tool change (F6)

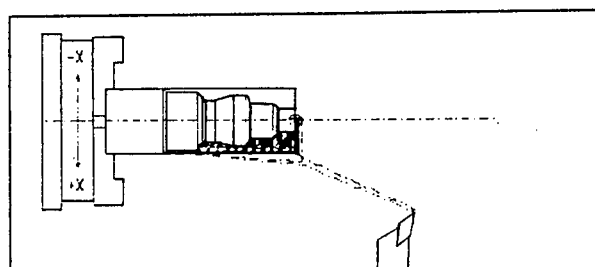
Tool change during the compilation of the machining program

Procedure

- Move the current tool to a tool change position (with F1 = rapid)
- Press F6, a tool range appears on the screen. (Precise tool summary see chapter 7 "tool description").



- Select the tool (e.g., 3 [Enter])



- The machining program to be compiled can be continued with the new tool after the tool change.
- The travelling movements of the new (active) tool are shown in light blue, those of the old tool in dark blue.

Tool change during the processing of a machining program

The machining program remains on the machine during the processing and automatically stops before the tool change on the PC (= intermediate stop).

Carry out the tool change on the PC

1. Select the menu program
2. Press F6
3. Enter the desired tool number and confirm with Enter

Carry out the tool change on the machine

4. Change the tool by hand
5. Select the menu setup and re-synchronize the machine - PC
6. Select the menu machine
7. Select automatic
8. Press enter

4.3.5 Erasing the last movement (F7)

The previously entered movement is erased, when the key F7 is pressed.

4.3.6 Erasing the machining program (F8)

The complete program is erased.

Screen message	Entry
	F8
Erase program (ENTER = yes):	↵

Possibilities

ENTER = program is erased

Any other key = interruption

Attention!

The command "Erase" can not be reversed, after it has been carried out.

4.3.7 Feed data (F9)

The submenu FEED DATA is activated, when the key F9 is pressed.

FEED	
F1	INPUT
F2	G94 / G95
F3	
F4	
F5	
F6	
F7	
F8	
F9	
F10	

Entering the feed values (F1)

The set feed value for F2 (= moving at feed speed) can be altered, when the key F1 is pressed.

Screen message	Entry
	F1
Feed = 30 (ENTER = no change):	40 ↵

Change feed unit (F2)

A feed value can be entered in two different units.

G94 declaration of the feed in mm/min

The feed declaration F is carried out in mm/min. G94 is the initial status of the machine.

G95 declaration of the feed in mic/r

1 mic/r = 1 µm/r = 1/1000 mm/r = 0,001 mm/r

The feed declaration F is carried out in mic/r.

$$F \text{ (mm/min)} = F \text{ (mm/r)} \times S \text{ (r/min)}$$

By pressing the F2 key the feed unit on the screen changes. The adjusted nominal value remains the same.

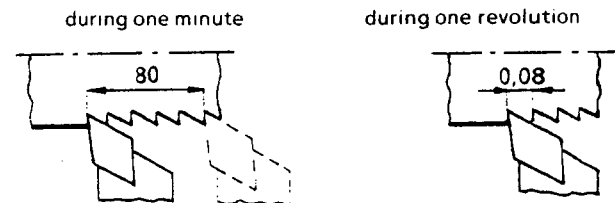
	TOOL
X	2.000
Z	5.252
D	4.300
F	1.00 mm/min
S	0 rpm

Example:

F = 80 mm/min means: The cutting tool travels 80 mm in one minute, no matter how often the workpiece turns.

F = 80 mic/r means: The cutting tool travels 0,08 mm during one workpiece revolution.

At a speed of e.g. 200 rpm there is a feed of 0,08 mm x 200 rpm = 16 mm/min.



4.3.8 Entering the finishing offsets in X and Z (F10)

The set finishing offsets can be altered, when the key F10 is pressed.

Note

The entry of the finishing offset in the X direction refers to the radius of the work piece.

Screen message	Entry
	F10
Offset in X, Z 0.100 0.200 (ENTER = no change):	0.05, 0.1 ↵

4.4 DISPLAY (F4)

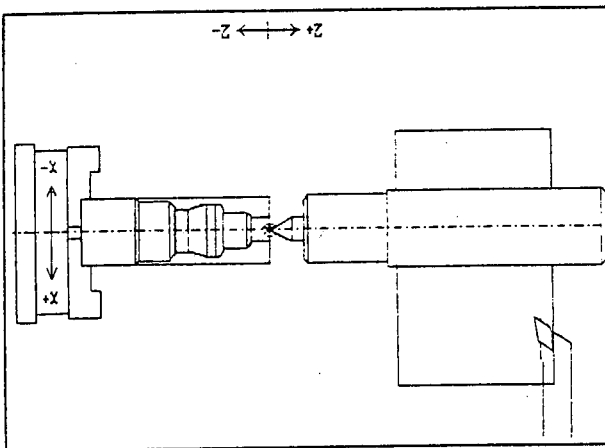
The screen display is determined or altered in this menu.

	DISPLAY
F1	ZOOM ALL
F2	ZOOM WINDW
F3	ZOOM PIECE
F4	HEAD STOCK
F5	WORK PIECE
F6	TOOL
F7	TOOL PATH
F8	TAIL STOCK
F9	CHANGE SIM
F10	

4.4.1 Zoom all (F1)

The complete working area (head stock, work piece, work piece contour, ...) is displayed within the screen.

F1 ... The complete working area is displayed.

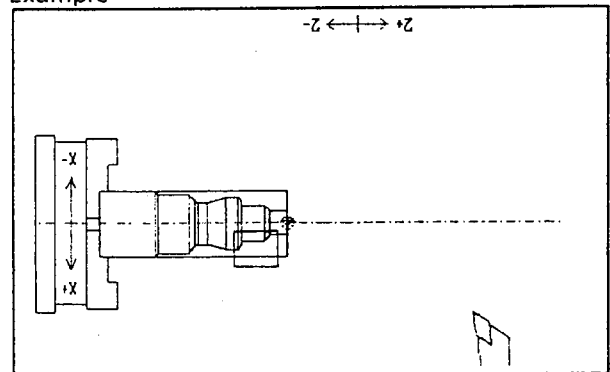


4.4.2 Zoom window (F2)

A "screen window" is defined and enlarged across the whole of the screen area.

Two diagonal bits are determined with the cursor keys and ENTER. The right-hand bit defined in this way is then enlarged across the whole of the screen surface.

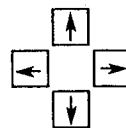
Example



F2

Screen message

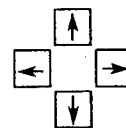
Position cursor ENTER = starting point:



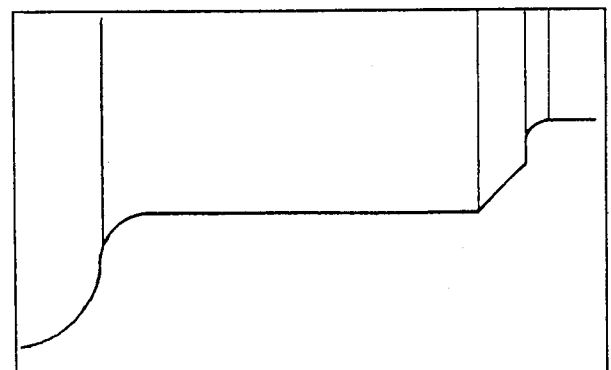
Move the cursor to the 1st bit point
(X = 3 / Z = -4 mm).



Move cursor ENTER = accept position:

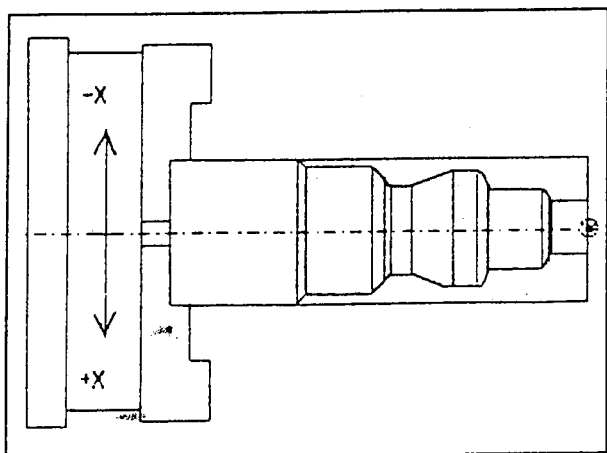


Move the cursor to the 2nd diagonal
bit point (X = 10 / Z = 17mm)



4.4.3 Zoom work piece (F3)

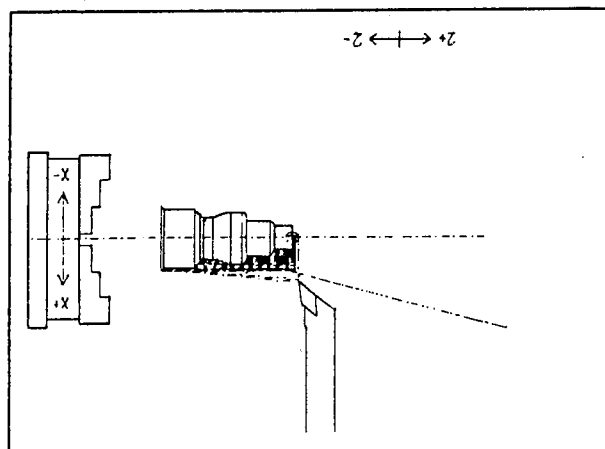
The work piece shown on the screen is enlarged, so that it is still shown within the screen, when the key F3 is pressed.



4.4.5 Removing, inserting the work piece (F5)

The work piece shown on the screen can be removed with the key F5.

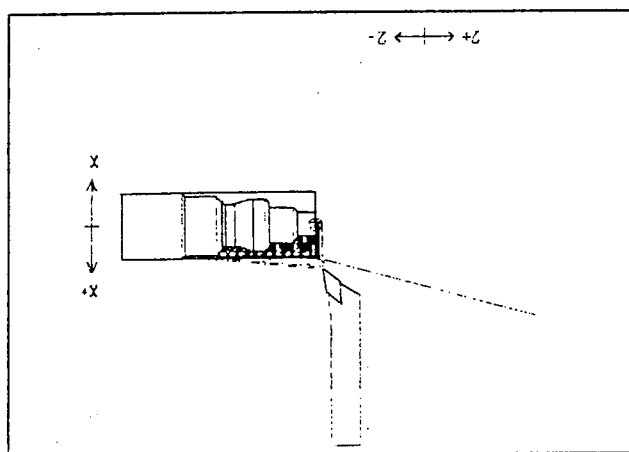
The work piece can be re-inserted, when F5 is pressed again.



4.4.4 Removing, inserting the head stock (F4)

The head stock shown on the screen can be removed with the key F4.

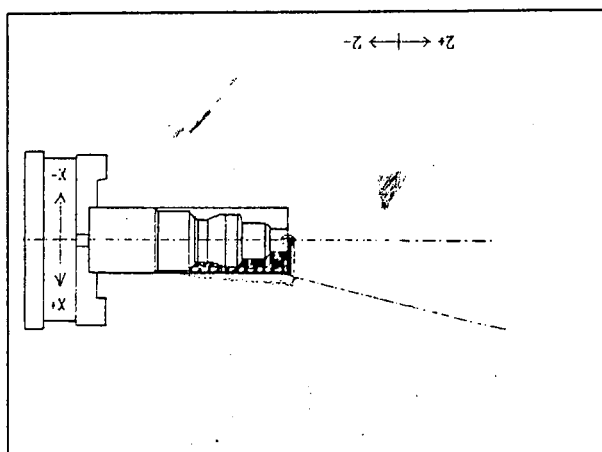
The head stock is re-inserted, when F4 is pressed again.



4.4.6 Removing, inserting the tool (F6)

The tool shown on the screen can be removed with the key F6.

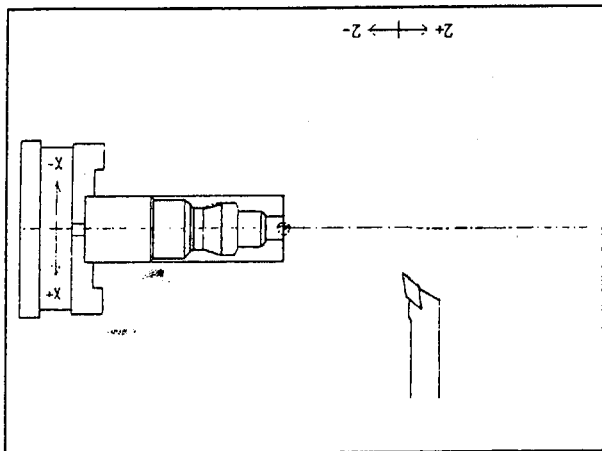
The tool is re-inserted, when F6 is pressed again.



4.4.7 Removing, inserting the tool path (F7)

The tool path shown on the screen can be removed with the key F7.

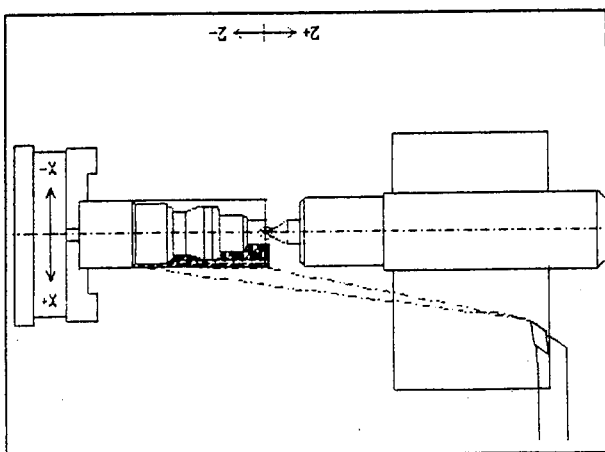
The tool path is re-inserted, when F7 is pressed again.



4.4.8 Inserting, removing the tail stock (F8)

The tail stock can be inserted on the screen with the key F8.

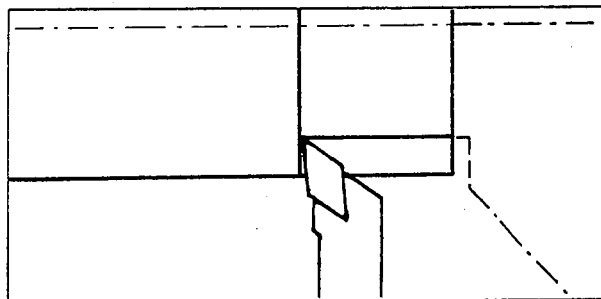
The tail stock is removed again, when F8 is pressed again.



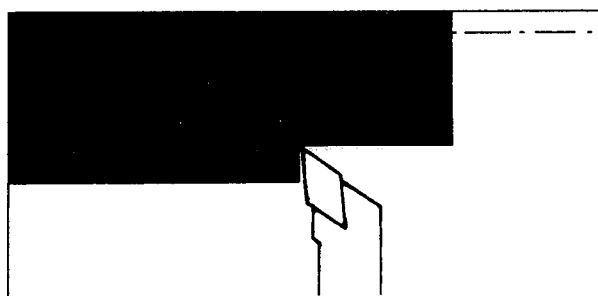
4.4.9 Changing the simulation display (F9)

You can select two simulation displays with the key F9.

1. Displaying the tool path
(= basic setting)









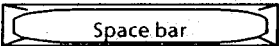



2. Simulating the cutting









4.4.10 Hotkeys - machine













You can move the slides and influence the machining cycles by means of these keys:

	Move the slides in the -X direction
	Move the slides in the + X direction
	Move the slides in the -Z direction
	Move the slides in the + Z direction
	Enlarge the travel path of the stepper motors
	Reduce the travel path of the stepper motors
	Increase the feed
	Reduce the feed
	Stop the slides (= intermediate stop)
	Interrupt the machining

Travel path of the stepper motors

	10 mm (= largest travel path)
	5 mm
	1 mm (= switch-on condition)
	0,5 mm
	0,1 mm
	0,05 mm
	0,01 mm (= smallest travel path)

Altering the programmed feed

	200 %
	150 %
	120 %
	100 % (= switch-on condition)
	80 %
	60 %
	50 %
	40 %
	30 %
	20 %
	10 %
	5 %
	0 %

4.5 Aligning (F5)

The measuring system of the machine and the PC must be synchronized with one another. This is carried out with the "scratching" (on the diameter and the length) of the clamped work piece.


Note

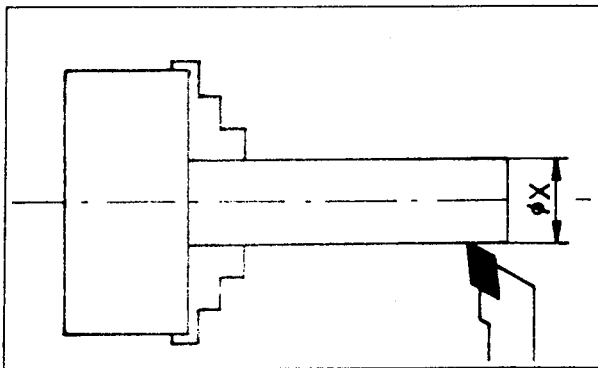
You must synchronize the machine and PC, before you select the menu points MANUAL or MACHINE.

Procedure

- Press F5
- Switch on the main spindle
- Move the tool with the arrow keys (see hotkeys - machine) to the diameter of the clamped work piece (at rapid speed) and "scratch" the work piece.


Note

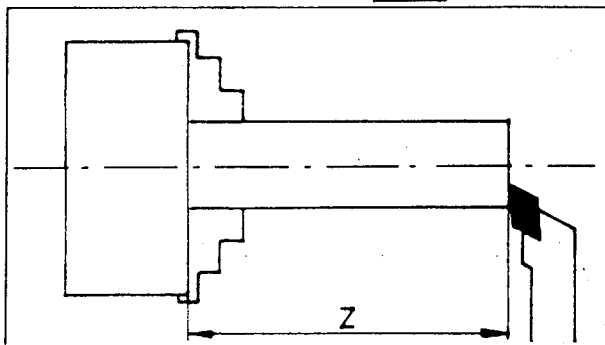
In order to position the work piece exactly, you must reduce the step size with the  key.



- After reaching the desired diameter, press the enter key.
- Enter the X value (diameter values) of the work piece and confirm it.
- Move the tool with the arrow keys to the face of the clamped work piece and "scratch" the face of the work piece.

Note

In order to position the tool exactly, you must reduce the step size with the  key.



- After reaching the desired length, press enter.
- Enter the Z value (length) of the work piece.

- The measuring system of the machine and PC is now synchronized. You can process your compiled machining program on the machine.

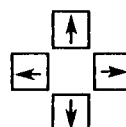

Example

Workpiece \varnothing 20 mm, length = 100 mm

F5

Screen message

Tool with $\uparrow \downarrow$ to the diameter aligning pos.
Step = 1,00 (ENTER = end):

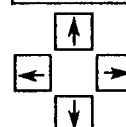

 Move the tool to the diameter and reduce the step size with , until the tool is positioned exactly on the aligning diameter.



Input diameter for this tool position:


20 

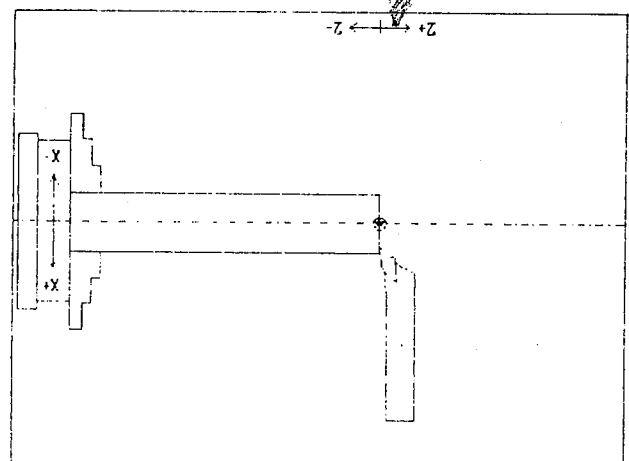
Tool with $\uparrow \downarrow$ to the length aligning pos.
Step = 1,00 (ENTER = end):

 Move the tool to the aligning length and reduce the step size with , until the tool is positioned exactly on the length of the work piece.



Input Z value for this tool position

100 



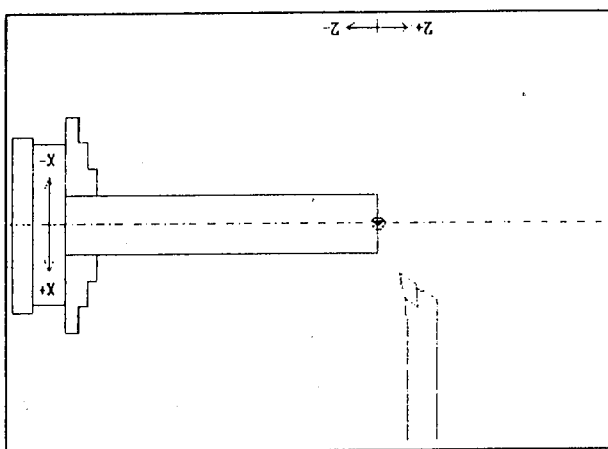
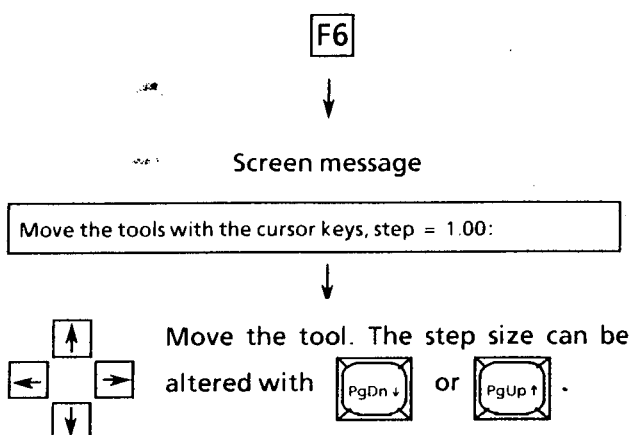
4.6 Manual (F6)

Moving the machine in "manual mode". You can move the tool at rapid speed on the machine and screen at the same time by means of the arrow keys (see page 54, hotkeys - machine).

Condition

The machine was aligning (menu aligning).

Procedure



The respective position of the tool is displayed on the screen.

4.7 Machine (F7)

Processing the compiled machining program on the machine

Condition



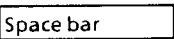

The machine was aligning (menu aligning).

MACHINE	
F1	AUTOMATIC
F2	SINGLE
F3	FAST RUN
F4	EMPTY CUT
F5	REPEAT
F6	CURSOR
F7	SHIFT PROG
F8	SCALE PROG
F9	MACHINE ON
F10	MACHINE OFF

4.7.1 Automatic (F1)

The machining program compiled on the program menu is processed automatically.

Affecting the machining

	.... Increasing the feed
	.... Reducing the feed
	.... Intermediate stop, the slides stop
	.... Interruption of the machining

4.7.2 Single (F2)

The machining program is processed in blocks. Every program block must be confirmed with the enter key before the processing.

You exit from this menu point with the Esc. key.

4.7.3 Fast run (F3)

The complete machining program is automatically processed at rapid speed.

Application

Testing a machining program without a work piece

4.7.4 Empty cut step (F4)

Move to the desired machining step with the arrow key. The machining program can be started from this block.

Procedure










Screen message

Position at desired program steps with ↓ ↑ keys (ENTER = end):

Possibilities

	.... Searching block by block from the start of the program
	.... Searching block by block from the end of the program
	.... Return block by block
	.... Forwards block by block
	.... Confirm the desired block

The machining program can be started from this desired block.

(Automatic, single or fast run)

Application

Re-machining of certain contour parts

E.g., finishing the fit on a tool with overmeasure. Measure the fit on the clamped tool after the machining.

Move to the fit with "F4 empty cut step".

Process the required differential measure in Single in the X direction with "F7 shift program".

4.7.5 Repeating the program (F5)

Unit: [mm]

A machining program can be shifted in the X and Z direction (X = radius dimension) and be repeated. The number of the steps determines how often the machining program is to be shifted and repeated.

Application

Finishing several, similar parts from one work piece

Procedure

F5

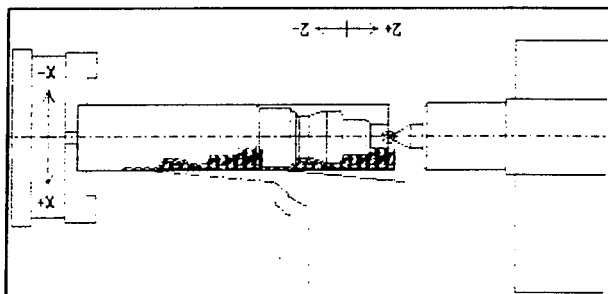
Screen message

Shift program in X, Z:

0, -43

Number of steps:

1



4.7.8 Altering the scale program (F8)

A machining program can be enlarged or reduced. The altered scale is assumed as the new scale M1:1 after the enlargement or reduction.

Examples:

Reduction

Input: 0.5 = M1:2

Enlargement

Input: 2 = M2:1

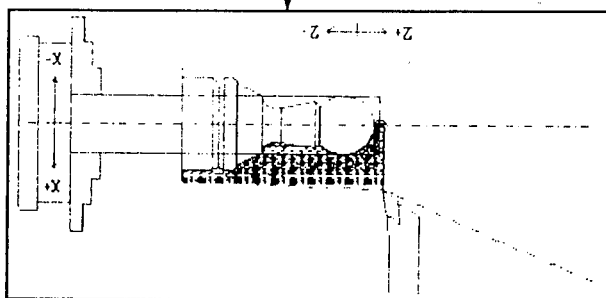
Procedure

F8

Screen message

Input factor for increasing program size:

2



Attention!

Observe the size of your work piece, if you alter the machining program in the scale.

4.7.6 Moving the tool to the cursor (F6)

The tool is moved from its present position to the cursor position with the set feed, whereby the machine moves along the same movement.

This movement is not copied into the machining program.

4.7.7 Shifting the program (F7)

Unit: [mm]

A machining program can be shifted in the X and Z direction (X = radius measurement).

Application

Re-turning the work piece contour

4.7.9 Machine on (F9)

The machine is switched on again.

Condition

The machine was switched off with F10.

4.7.10 Machine off (F10)

The machine was temporarily switched off.

Application

The slides are moved temporarily by hand.

Attention!

If you move the slides by hand, the machine must be set up again.

4.8 Archive (F8)

The programs compiled by you are stored or recalled in this menu.

Note

Drawings created by you or machining programs must be stored as files before leaving the program.

Preliminary explanation

PRG (program) = A complete machining program comprising a work piece, work piece drawing and tool path (= simulation).

GEO (geometry) = Work piece drawing

The programs (PRG) under the name entered by you are stored in your sub-directory (e.g.: UNIMAT) and are automatically provided with the suffix .UNI.


The work piece geometries (GEO) are stored under the name entered by you in your sub-directory (e.g.: UNIMAT) and are automatically provided with the suffix .DXF.

The suffix .DXF means that the work piece geometries are stored in the DXF format. I.e.: you can read AUTOCAD drawings in the DXF format into this software or work piece geometries created with this software can be copied into the AUTOCAD software.

Length of the file name

A program name may have a maximum of eight characters.

4.8.1 Storing the program (PRG) (F1)


Screen message	Entry
	F1
Input file name to be stored:	demo 1 

The machining program is stored under the name "demo 1".

4.8.2 Loading the program (PRG) (F2)


A stored machining program can be recalled.


Example 1: Call-up of a program




Screen message	Entry
	F2
Input file name to be retrieved:	demo 1 

The machining program "demo 1" is loaded.

Example 2: Listing all stored programs

All stored programs are displayed in the area menu display, when the sign  is entered.


Screen message	Entry
	F2
Input file name to be retrieved:	* 

The stored programs are displayed and can be selected by means of the   keys and recalled with .

4.8.3 Storing the geometry (GEO) (F3)

A work piece drawing can be stored.

Example


Screen message	Entry
	F3
Input file name to be stored:	part 1 

The work piece drawing is stored under the name "part 1".

4.8.4 Loading the geometry (GEO) (F4)


A stored work piece drawing can be recalled.


Example 1: Call-up of a work piece drawing

Screen message	Entry
	F4
Input file name to be retrieved:	part 1 




The work piece drawing "part 1" is loaded.

Example 2: Listing all stored work piece drawings

All stored work piece drawings are displayed in the area menu display, when  is entered.

Screen message	Eingabe
	F4
Input file name to be retrieved:	* 

The stored work piece drawings are displayed.

Select the desired program by means of the   keys and recall it with .

Erasing the stored programs and geometries


- Exit the software. (Remain in the sub-directory UNIMAT.)
- All files in the sub-directory UNIMAT are listed by means of the DOS command "DIR".
- Erasing the respective file (see DOS manual).

4.9 Print (F9)

The respective screen display is printed.

Condition

The printer is connected, switched on and set in the IBM graphics mode (see printer manual).

Screen message	Entry
	F9
Is the printer connected and on "line"? (ENTER = yes)	

Possibilities

ENTER = printing


Any other key = interruption

4.10 End (F10)

Exit from the program

Attention!

You must store the programs compiled by you beforehand (archive menu).

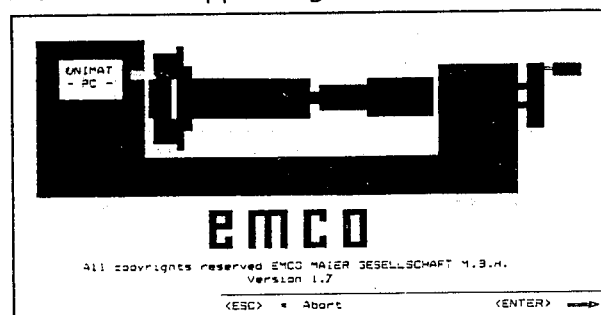
Screen message	Entry
	F10
Are you sure? (ENTER = yes):	

Possibilities

ENTER = exit from the program

Any other key = remaining in the program

The title screen appears again:



... Return to DOS

5. SPECIMEN EXAMPLES

Chess figures

These specimen examples serve to re-inforce the knowledge acquired concerning the programming of this EMCO software.

The creation of the contour of these examples is explained step by step on the following pages.

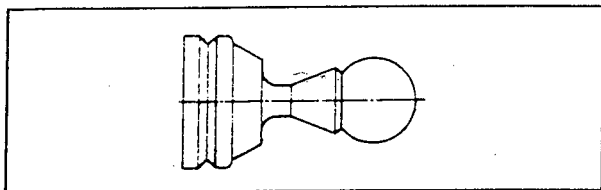
We recommend you to use aluminium and brass with a diameter of 20 and a length of 50-70 mm for the chess figures due to chip removal reasons.

You will find the technological data, like

- max. main spindle speeds
- max. feed
- max. cutting depths

in the operating instructions UNIMAT PC.

Pawn



1. Creating a work piece

(See work piece (F1))

$\varnothing = 20$ mm, length = 50 mm, no bore hole

Drawing aid

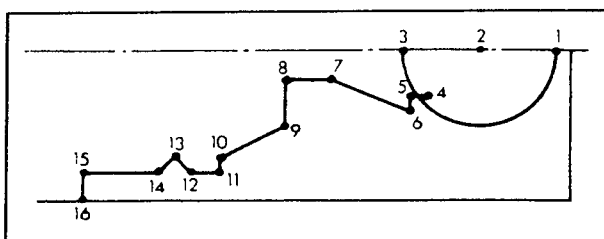
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys)

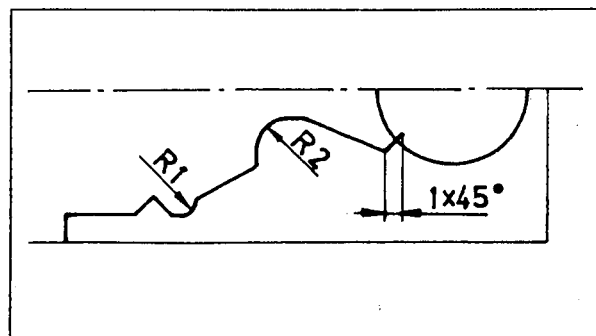
Note

Only the lower half of the work piece contour must be drawn.

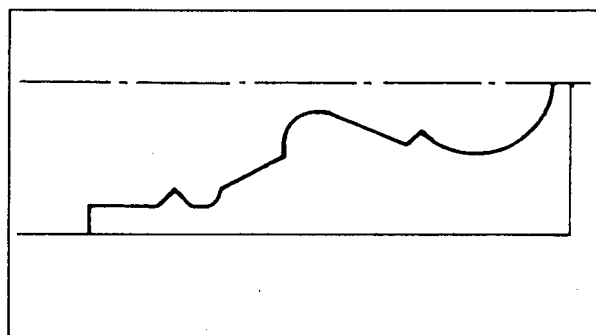


Contour points	X direction	Z direction
1	0	-1
2	0	-6
3	0	-11
4	3	-9,5
5	3	-10,5
6	4	-10,5
7	2	-16
8	2	-19
9	5	-19
10	7	-23
11	8	-23
12	8	-25
13	7	-26
14	8	-27
15	8	-32
16	10	-32

3. Adding the radii and chamfers



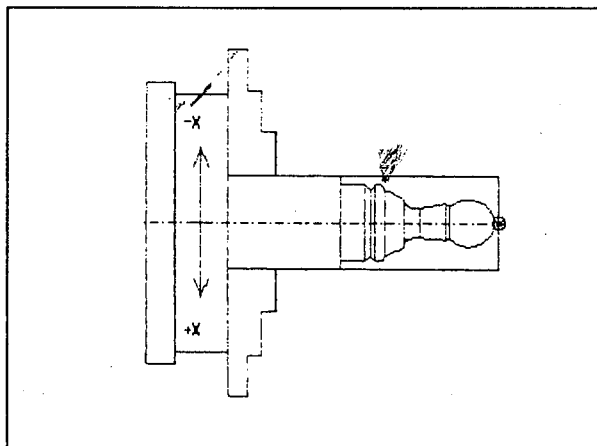
4. Cleaning



5. Splitting the arc (F4)

6. Adding the visible edges (F5)

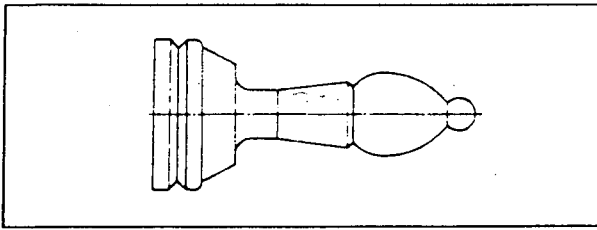
7. Mirroring the work piece contour (F6)



8. Storing the work piece contour

(See ARCHIVE (F8))

Bishop



1. Creating a work piece

(See work piece (F1))

$\varnothing = 20$ mm, length = 60 mm, no bore hole

Drawing aid

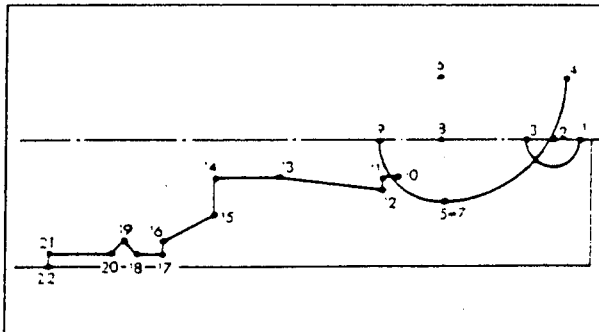
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys)

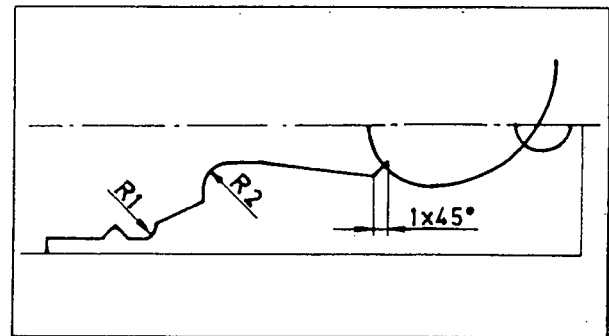
Note

Only the lower half of the work piece contour must be drawn.

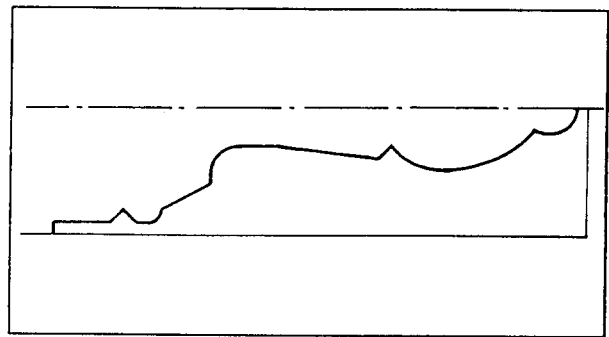


Contour points	X direction	Z direction
1	0	-1
2	0	-3
3	0	-5
4	-5	-2
5	5	-12
6	-5	-12
7	5	-12
8	0	-12
9	0	-17
10	3	-15,5
11	3	-16,5
12	4	-16,5
13	3	-25
14	3	-30
15	6	-30
16	8	-34
17	9	-34
18	9	-36
19	8	-37
20	9	-38
21	9	-43
22	10	-43

3. Adding the radii and chamfers



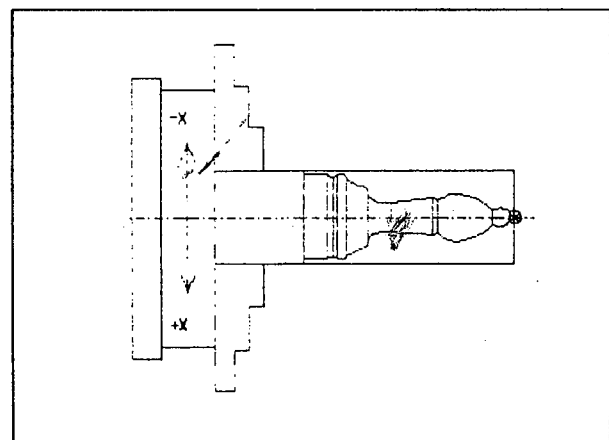
4. Cleaning



5. Splitting the arc (F4)

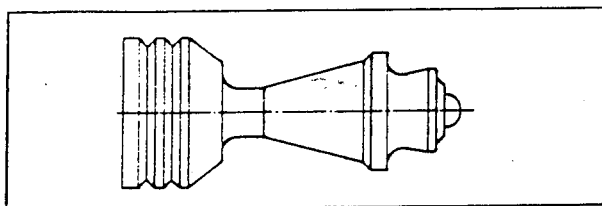
6. Adding the visible edges (F5)

7. Mirroring the work piece contour (F6)



8. Storing the work piece contour (See ARCHIVE (F8))

Queen



1. Creating a work piece

(See work piece (F1))

 $\varnothing = 20$ mm, length = 60 mm, no bore hole

Drawing aid

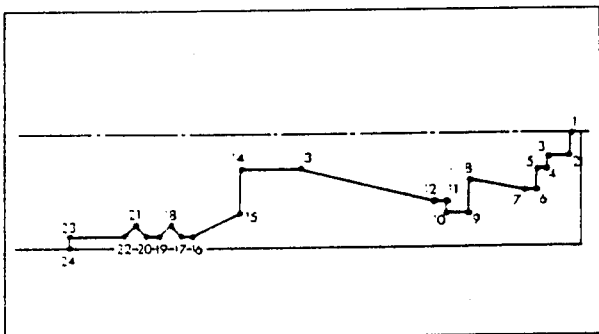
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys)

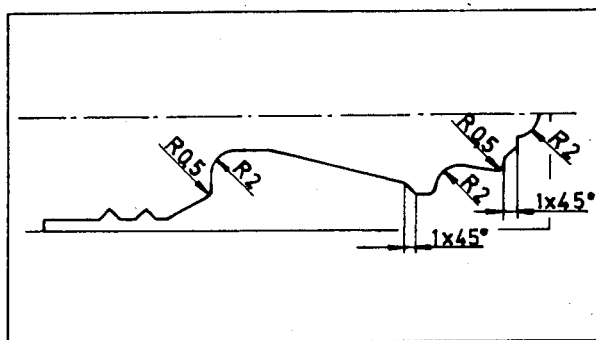
Note

Only the lower half of the work piece contour must be drawn.



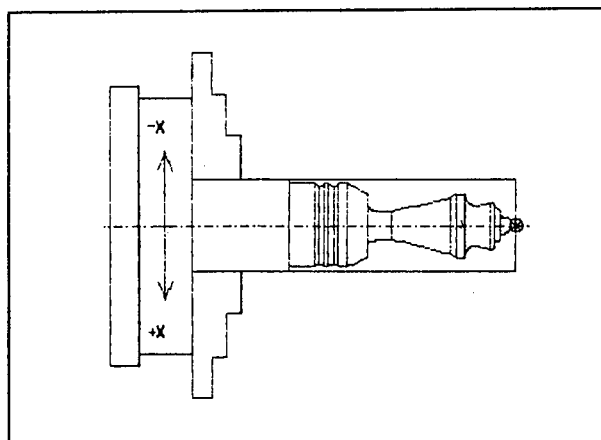
Contour points	X direction	Z direction
1	0	-1
2	2	-1
3	2	-3
4	3	-3
5	3	-4
6	5	-4
7	5	-5
8	4	-10
9	7	-10
10	7	-12
11	6	-12
12	6	-13
13	3	-25
14	3	-30
15	7	-30
16	9	-34
17	9	-35
18	8	-36
19	9	-37
20	9	-38
21	8	-39
22	9	-40
23	9	-45
24	10	-45

3. Adding the radii and chamfers



4. Adding the visible edges (F5)

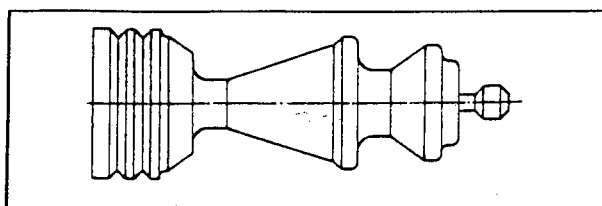
5. Mirroring the work piece contour (F6)



6. Storing the work piece contour

(See ARCHIVE (F8))

King



1. Creating a work piece

(See work piece (F1))

 $\varnothing = 20$ mm, length = 70 mm, no bore hole

Drawing aid

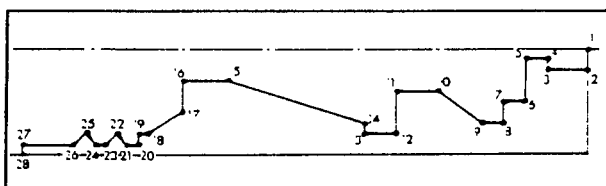
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys,

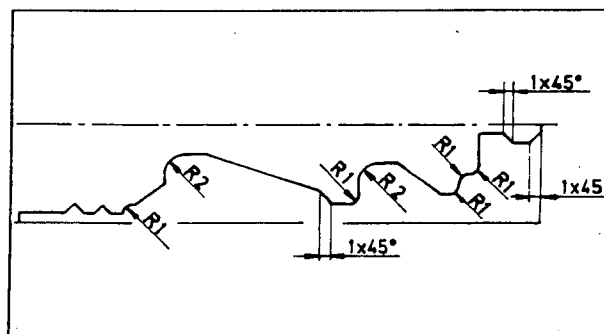
Note

Only the lower half of the work piece contour must be drawn.



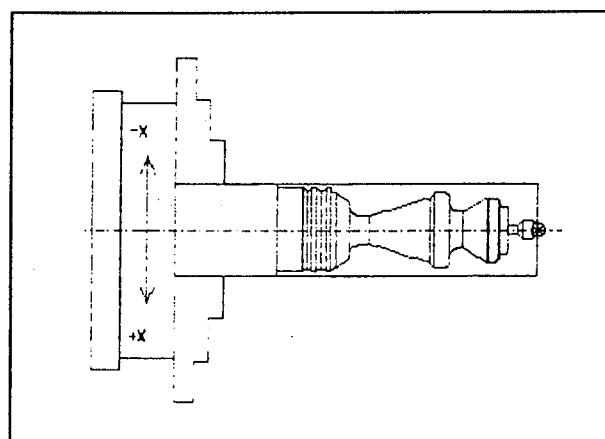
Contour points	X direction	Z direction
1	0	0
2	2	0
3	2	-4
4	1	-4
5	1	-6
6	5	-6
7	5	-8
8	7	-18
9	7	-10
10	4	-14
11	4	-18
12	8	-18
13	8	-21
14	7	-21
15	3	-34
16	3	-38
17	6	-38
18	8	-41
19	8	-42
20	9	-42
21	9	-43
22	8	-44
23	9	-45
24	9	-46
25	8	-47
26	9	-48
27	9	-53
28	10	-53

3. Adding the radii and chamfers

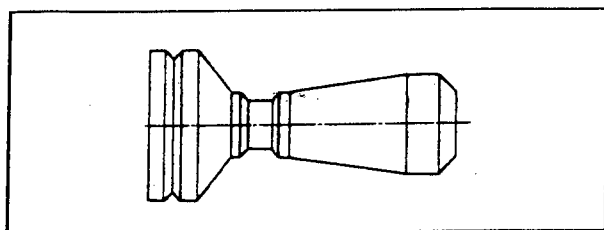


4. Adding the visible edges (F5)

5. Mirroring the work piece contour (F6)

6. Storing the work piece contour
(See ARCHIVE (F8))

Rook



1. Creating a work piece

(See page work piece (F1))

 $\varnothing = 20$ mm, length = 55 mm, no bore hole

Drawing aid

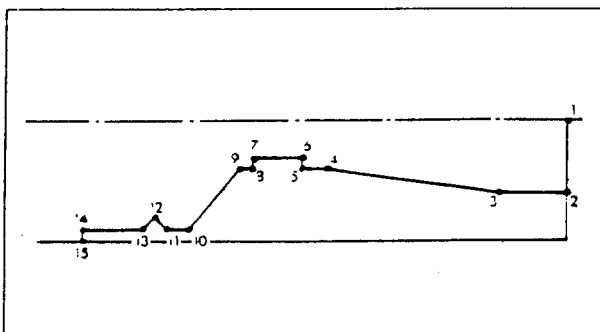
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys)

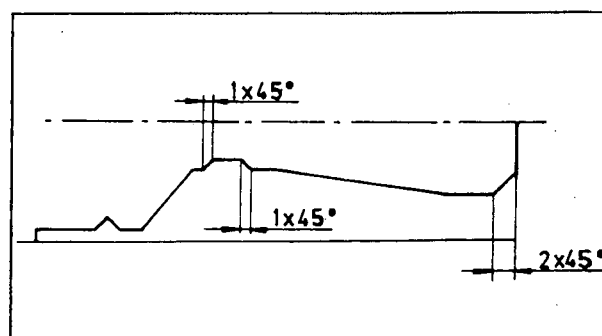
Note

Only the lower half of the work piece contour must be drawn.



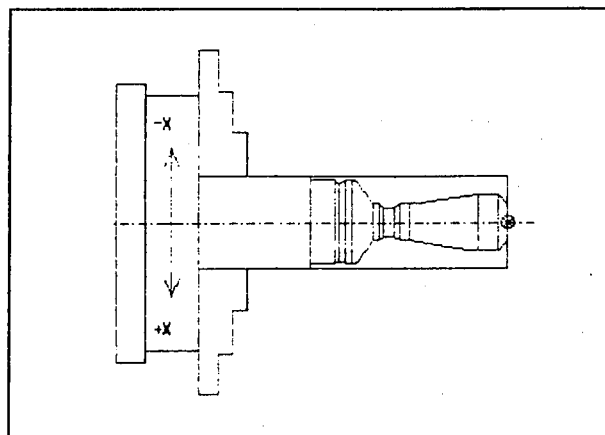
Contour points	X direction	Z direction
1	0	0
2	6	0
3	6	-6
4	4	-20
5	4	-22
6	3	-22
7	3	-26
8	4	-26
9	4	-27
10	9	-31
11	9	-33
12	8	-34
13	9	-35
14	9	-40
15	10	-40

3. Adding the radii and chamfers



4. Adding the visible edges (F5)

5. Mirroring the work piece contour (F6)



6. Storing the work piece contour

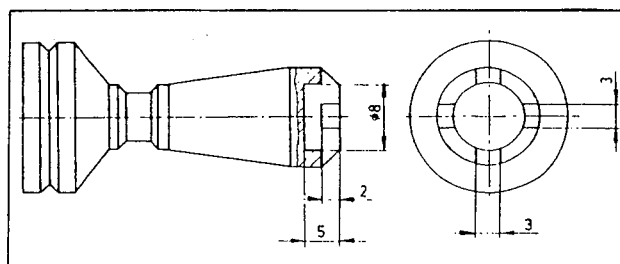
(See ARCHIVE (F8))

Extension for the rook

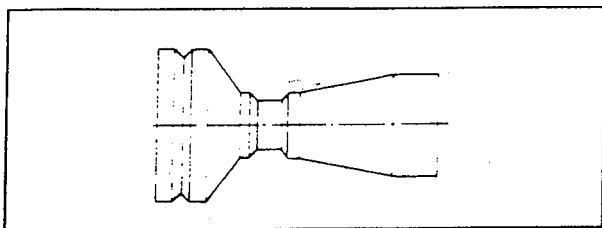
Working with the vertical equipment

Tool: roughing mill $\varnothing 8$ mm
end mill cutter $\varnothing 3$ mm

Re-machining according to the drawing



Knight



1. Creating a work piece

(See work piece (F1))

$\varnothing = 20$ mm, length = 50 mm, no bore hole

Drawing aid

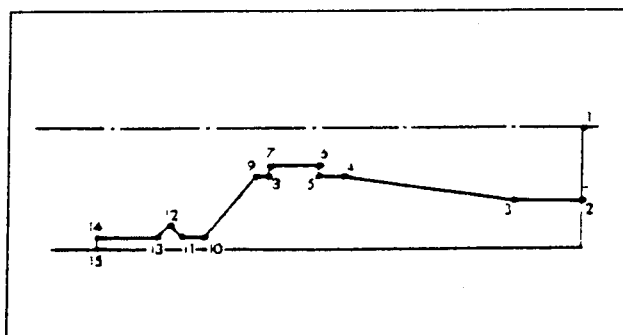
The work piece is enlarged across the whole of the screen surface by means of the hotkey **[Z]**.

2. Drawing the work piece contour

(See submenu point, line/hotkeys)

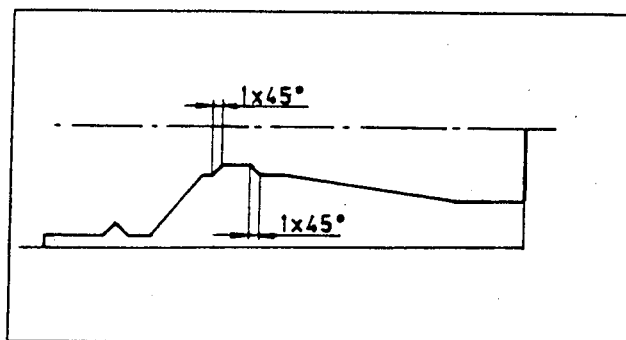
Note

Only the lower half of the work piece contour must be drawn.



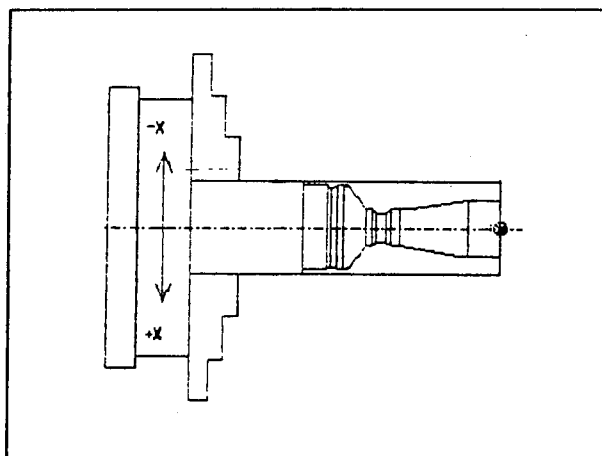
Contour points	X direction	Z direction
1	0	0
2	6	0
3	6	-6
4	4	-16
5	4	-18
6	3	-18
7	3	-22
8	4	-22
9	4	-24
10	9	-27
11	9	-29
12	8	-30
13	9	-31
14	9	-36
15	10	-36

3. Adding the radii and chamfers



4. Adding the visible edges (F5)

5. Mirroring the work piece contour (F6)



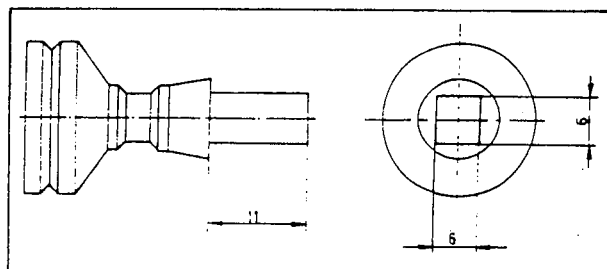
6. Storing the work piece contour

(See ARCHIVE (F8))

Extension for the knight

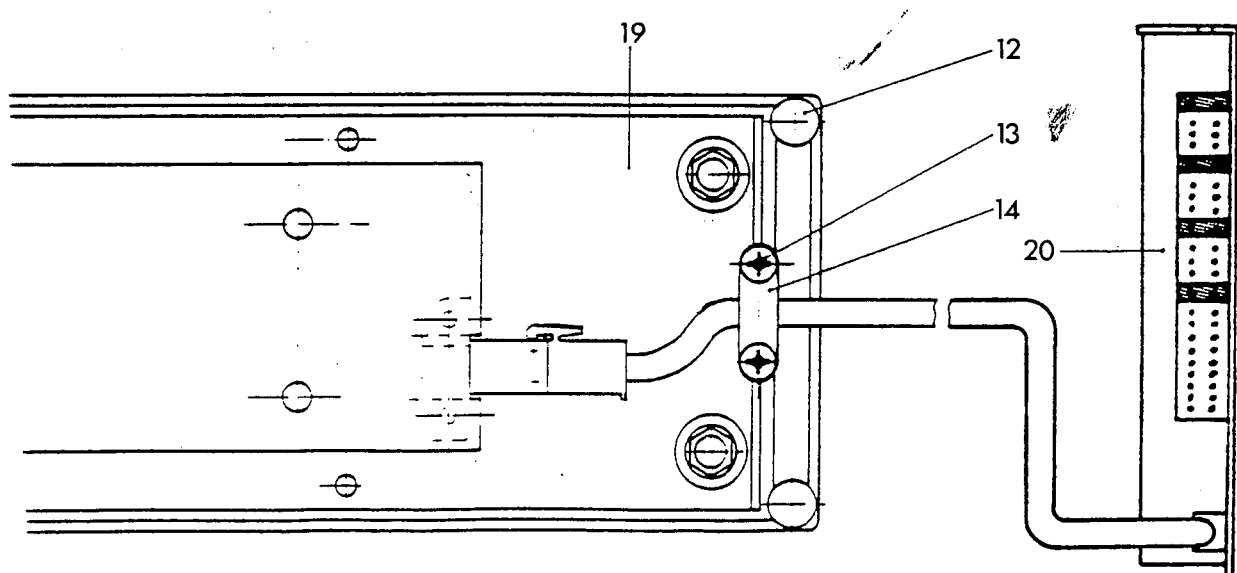
Working with the vertical equipment

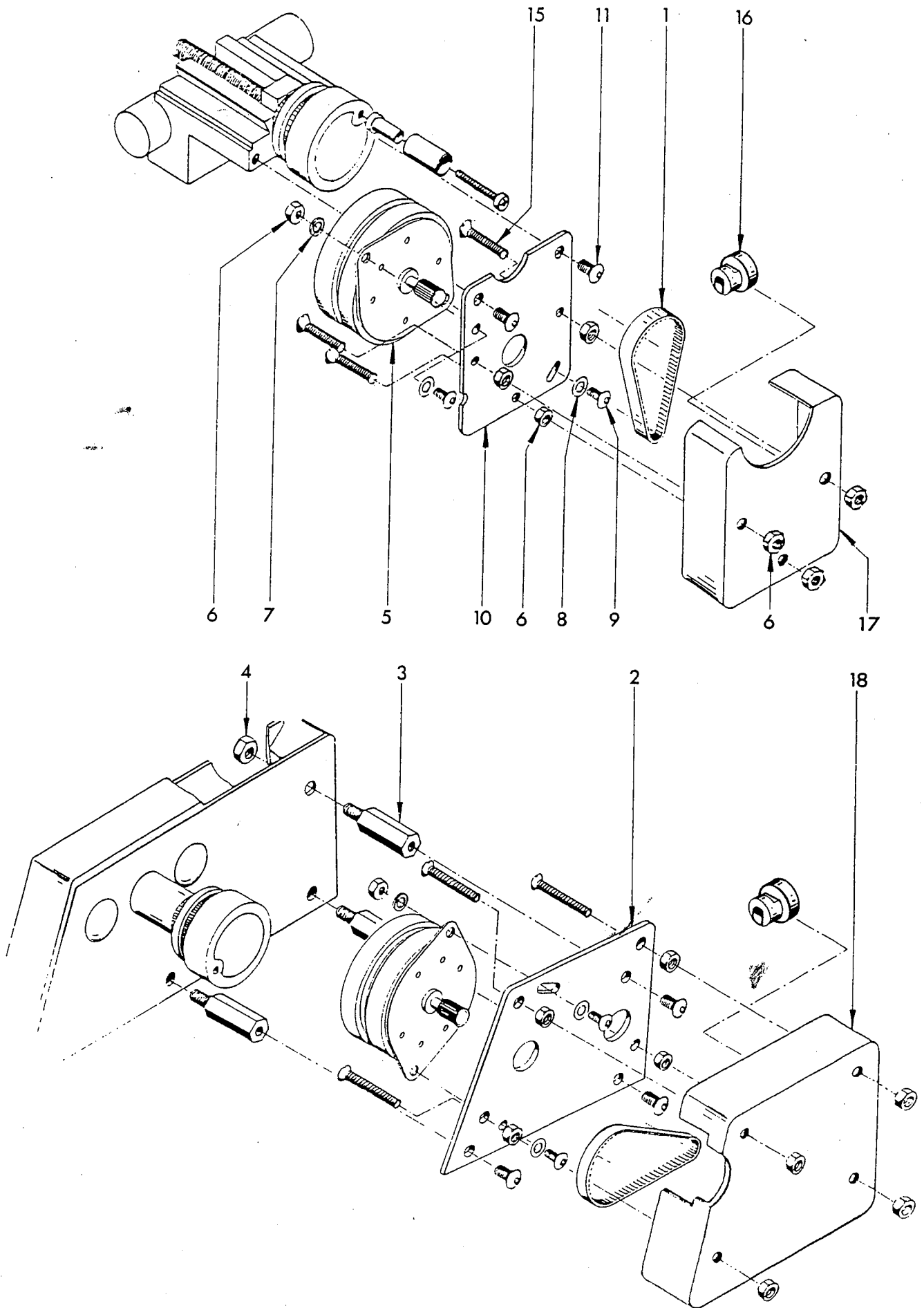
Tool: roughing mill $\varnothing 8$ mm

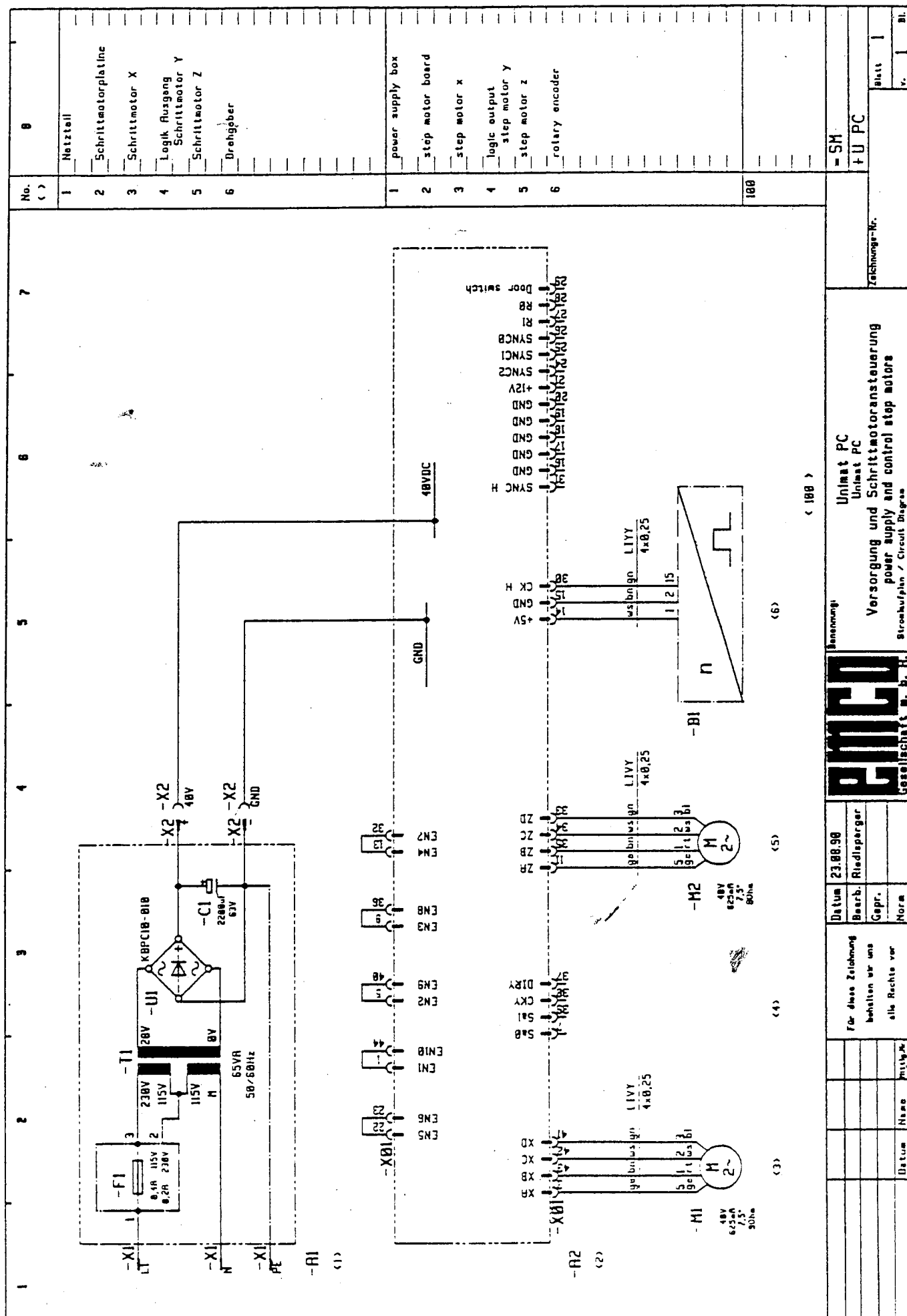


6. SERVICE PARTS AND WIRING DIAGRAM

Pos.	Ref. No.	DIN	Benennung	Description	Designation
	<u>171 070</u>		<u>Gr. PC-Paket</u>	<u>PC-unit compl.</u>	<u>Ens. OP-équipement</u>
1	ZRM 73 3080	MXL 80Z 3/16	Zahnriemen	Timing belt	Courroie crantée
2	A4Z 070 020		Motorblech Z	Motor plate Z	Plaque de moteur Z
3	A4Z 070 040		Distanzbolzen	Spacer	Boulon d'espacement
4	ZMU 34 0600	M6 DIN 934-6	Sechskantmutter	Hexagonal nut	Ecrou hexagonal
5	A4Z 071 000		Gr. Schrittmotor	Step motor compl.	Ens. Moteur pas à pas
6	ZMU 34 0400	M4 DIN 934-5	Sechskantmutter	Hexagonal nut	Ecrou hexagonal
7	ZSB 97 0430	A4,3 DIN 6797	Zahnscheibe	Spring washer	Rondelle à dents
8	ZSB 21 0430	A4,3 DIN 9021	Scheibe	Washer	Rondelle
9	ZSR 88 0410	M4x10-10.9	Linsenschraube	Filister head screw	Vis à tête bombée
10	A4Z 070 030		Motorblech X	Motor plate X	Plaque de moteur X
11	ZSR 88 0510	M5x10-10.9	Linsenschraube	Filister head screw	Vis à tête bombée
12	ZPU 15 0060	Ø6 Nr.3055	Pilzpuffer	Buffer	Butoir
13	ZSR G2 3565	BZ 3,5x6,5 D 7981	Blechschrabe	Sheet metal screw	Vis à tôle
14	A4A 110 040		Zugentlastungsschelle	Traction relief clamp	Pince-câble
15	ZSR 63 0430	M4x30 DIN 963	Senkschraube	Counter sunk screw	Vis tête fraise
16	ZEL 15 0040	DM 4	Durchföhrtülle	Bushing tube	Douille de traversée
17	A4Z 070 060		Riemenschutz X	Belt guard X	Tôle protectrice pour la courroie X
18	A4Z 070 070		Riemenschutz Z	Belt guard Z	Tôle protectrice pour la courroie Z
19	A4A 110 000		Netzgerät	Power pack	Unité de courant
20	A4Z 073 000		Schrittmotorkarte	Stepping motor circuit board	Platine alimentation moteur pas à pas
	ZWZ 94 1000	SW 10	Einmaulschlüssel	Single ended spanner	Clé de service
	ZWZ 94 0700	SW 7	Einmaulschlüssel	Single ended spanner	Clé de service
	ZWZ 11 0250	SW 2,5	Sechskantschraubendr.	Hexagonal key	Clé à 6 pans
	ZEK 14 1025	100/2,5	Kabelbinder	Cable frame	Porte-câble
	A4Z 074 000	5 Disk.	Gr. Software	Software compl.	Ens. Software

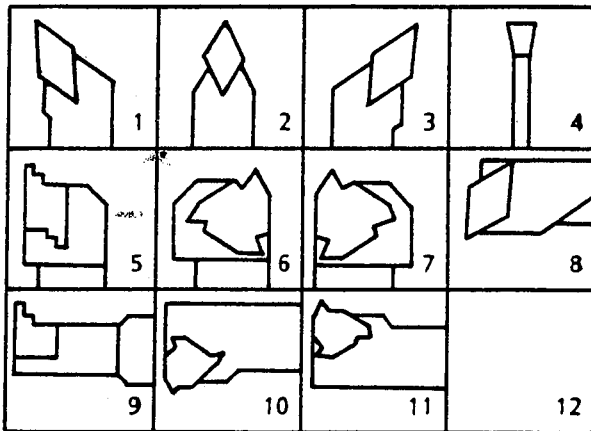






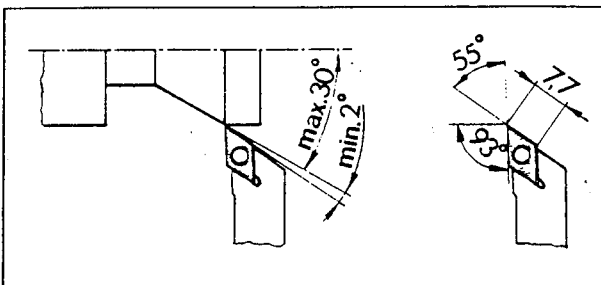
7. TOOL DESCRIPTION

1. Right side tool
2. Neutral side tool
3. Left side tool
4. Parting-off tool
5. Cut-in tool for locking rings
6. Left thread-cutting tool
7. Right thread-cutting tool
8. Inside boring tool
9. Inside cut-in tool for locking rings
10. Right inside thread-cutting tool
11. Left inside thread-cutting tool
12. Not occupied



1. Right side tool

This tool is used for longitudinal and transverse turning and for turning acute corners. When turning a back pocket inwards the angle between the minor cutting edge and the contour of the workpiece has to amount to no less than 2° . If the tool-holder is clamped rectangular to the rotation axis (angle of incidence $\alpha_l = 93^\circ$), the gradient of the workpiece-contour to the rotation axis has to amount to maximal 30° .

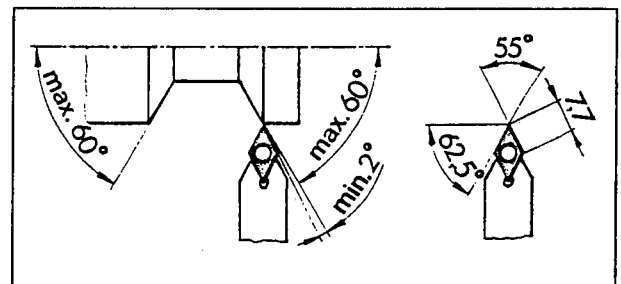


2. Neutral side tool

This tool is used for longitudinal and contour turning.

When turning a back pocket inwards the angle between the minor cutting edge and the contour of the workpiece has to amount to no less than 2° . When turning outwards the angle of incidence α_l of the turning tool has to be greater than the gradient of the workpiece-contour to the rotation axis.

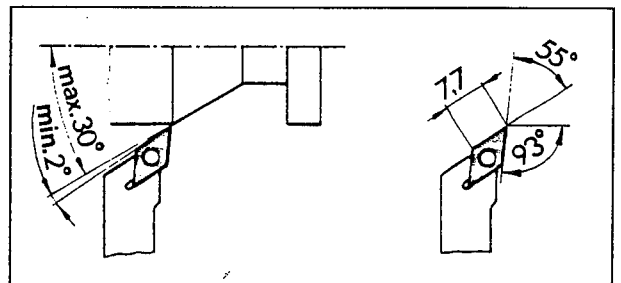
If the tool-holder is clamped rectangular to the rotation axis (angle of incidence $\alpha_l = 62.5^\circ$), the gradient of the workpiece-contour to the rotation axis has to amount to maximal 60° on both sides.



3. Left side tool

Like the right side tool it is used for longitudinal and transverse turning and for turning acute corners.

For angles see "Right side tool"!

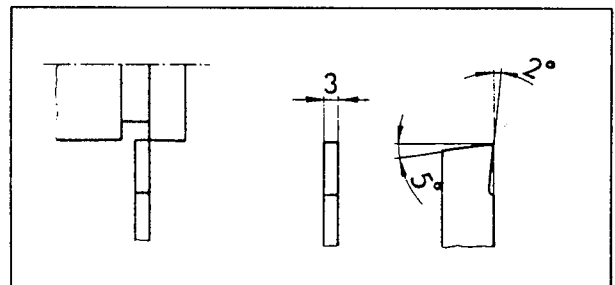


4. Parting-off tool

This tool is used for grooving and parting-off.

Note

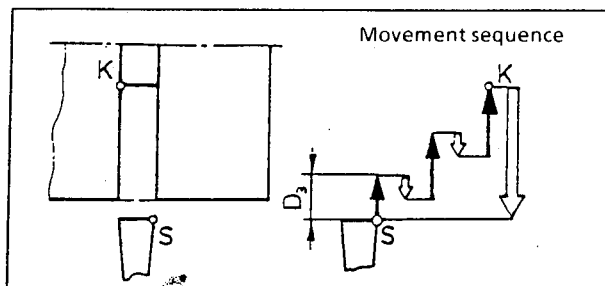
The EMCO software does not allow cut-in cycles. Therefore cutting-in or parting-off has to be done in separate programmed steps.



Working tips for cutting-in and parting off

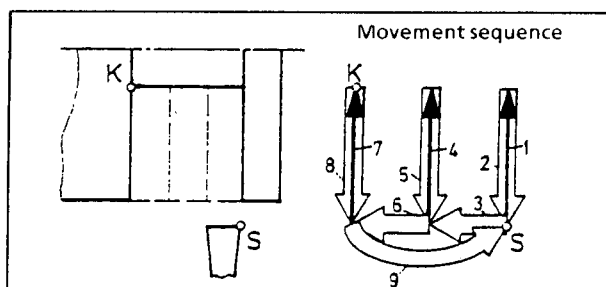
Cut-in width = tool width

The tool movement is carried out in the X-direction. The program should advance the tool from the starting-point S with a low rate of feed by a self chosen measure of D_3 (approx. 1 mm), move a little back (for chip breaking), advance again by a measure of D_3 etc., until point K is reached.



Cut-in width larger than tool width

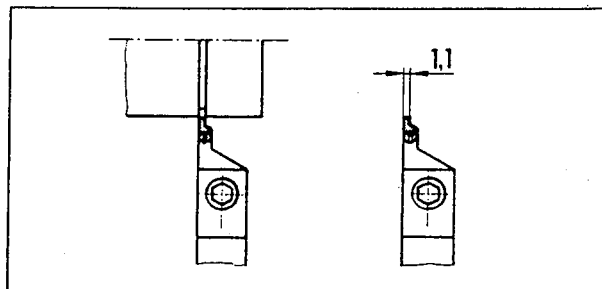
The remaining cut-in width after the first cut-in has to be graded in partial cut-ins with the same chip width. Overlapping of the individual partial cut-ins is at least 1/10 mm.



Each cut-in movement (1,4,7) is graded additionally by D_3 (see previous drawing).

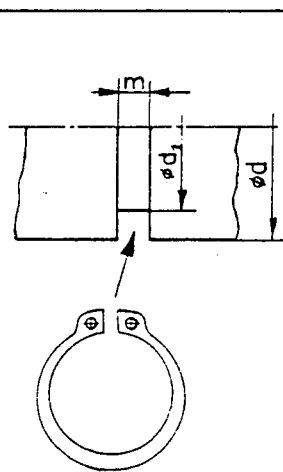
5. Cut-in tool for locking rings

This tool is used for turning grooves for locking rings. If the cut-in width is larger than the tool width, then several partial cut-ins should be used side by side (see parting-off tool).



Cut-in values for sealing rings according to DIN 471.

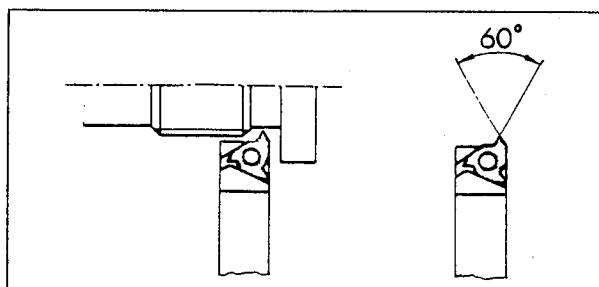
d	d ₁	m
9	8,6	1,2
10	9,6	1,2
12	11,5	1,2
14	13,4	1,2
15	14,3	1,2
17	16,2	1,2
18	17	1,3
20	19	1,3
25	23,9	1,3
30	28,6	1,6
35	33	1,6
40	37,5	1,85
50	47	2,15
60	57	2,15



6. Left thread-cutting tool

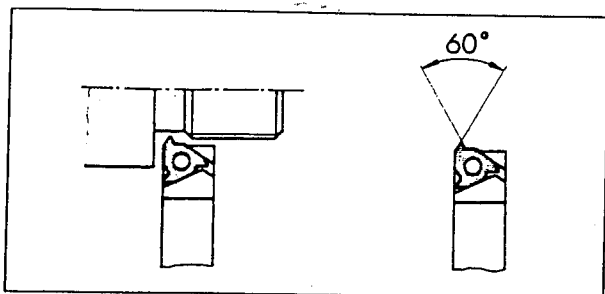
(not available from EMCO!)

This tool is used for turning right- and left-hand threads. The left thread-cutting tool mostly is used, when the workpiece diameter reduces so rapidly before the thread-runin or -runout in -Z-direction (see drawing) that the right thread-cutting tool can't be used because of the space requirement.

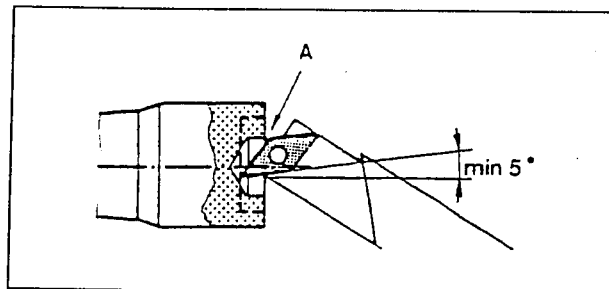


7. Right thread-cutting tool

This tool is used for turning right- and left-hand threads.

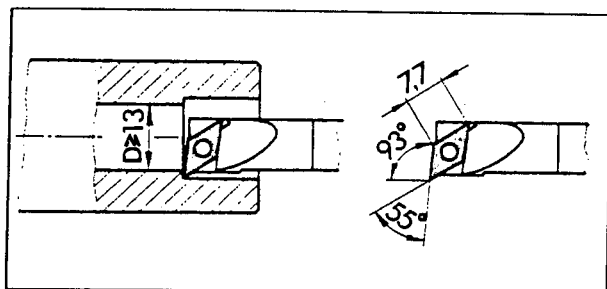


- For inside turning of small diameters the inside cutting tool has to be set obliquely to avoid collisions (A). However, make sure that a clearance angle remains behind the tool tip to guarantee a perfect cut.



8. Inside boring tool

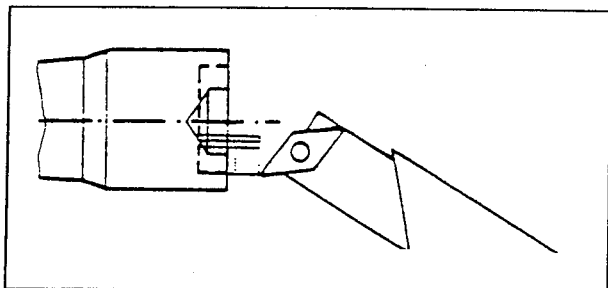
This tool is used for longitudinal, transverse and contour turning inside.



Note

After pre-drilling with a twist drill $\varnothing 13$ mm (approx. $\varnothing 1/2$ ") boring can be started.

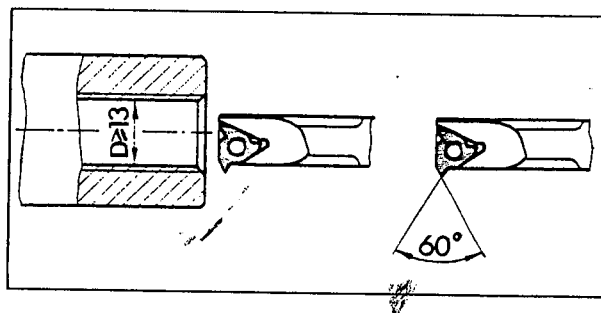
- Since inside turning is carried out in over-mounted form (without center punch support), feed (F) and advance should be as small as possible.
F = approx. 20 mm/min
Advance approx. 0.2 mm



9. Inside cut-in tool for locking rings (not available from EMCO!)

10. Right inside thread-cutting tool

This tool is used for turning right- and left-hand threads inside.



11. Left inside thread-cutting tool (not available from EMCO!)

8. VOCABULARY EXPLANATIONS

bit (b)	Binary sign = smallest memory unit of the computer (e.g., current - not current or magnetic - not magnetic)
Byte (B)	Memory unit to store a letter, a number or a sign (1 byte = 8 bit) <u>Kilobyte (K, kB)</u> : usual unit (measurement) for the memory capacity of a computer (1 kilobyte = 2^{10} bytes = 1024 bytes) <u>Megabyte (MB)</u> : 1 megabyte = 1024 kilobytes
CAD	<u>Computer Aided Design</u> = tool construction (see chapter 4.2)
CAM	<u>Computer Aided Manufacturing</u> = determining the machining cycle (see chapter 4.3)
CNC	<u>Computer Numerical Control</u>
Coprocessor	Additional arithmetic unit as a support for the microprocessor
Disk	Exchangable, magnetic plastic disk, to store software (memory capacity, e.g., $5\frac{1}{4}$ inches disk with 360 + kB or 1.2 MB or $3\frac{1}{2}$ inches disk with 720 kB or 1.44 MB)
Hard disk	Magnetized disks permanently located in the computer, to store software (memory capacity for PC, e.g., up to 80 MB)
Graphics card	Shapes the computer signals for the screen
Hardware	Are all usable objects
Compatibility	Two devices are compatible, if they can operate with each other without any additional equipment or can be exchanged for each other
Menu	List of the possibilities offered
Microprocessor	Central arithmetic unit of the PC
NC program	List of all information, which a machine tool needs to manufacture a work piece
PC	<u>Personal Computer</u> = multi-purpose, small computer for one person
Postprocessor	Converts a program into information, which the CNC machine tool understands and receives
RAM	<u>Random Access Memory</u> = operational memory = component, which loses information, when the device is switched off (memory capacity of the RAM usually amounts to 640 + kB for PC)
Interface	Connection element for connecting external devices to the PC <u>Serial interface</u> : processes 1 bit <u>Parallel interface</u> : processes 1 byte (= 10-fold information flow speed)
Software	The software is a thought-defined product (e.g., a program on a disk), which controls the computer. <u>System software</u> : basic, administrative program; contains the operating system (e.g., DOS = <u>Disk Operating System</u>) and facilitates the running of the application software <u>Application software</u> : special operational program (e.g., Unimat PC software). The hardware can carry out the tasks given by this program.

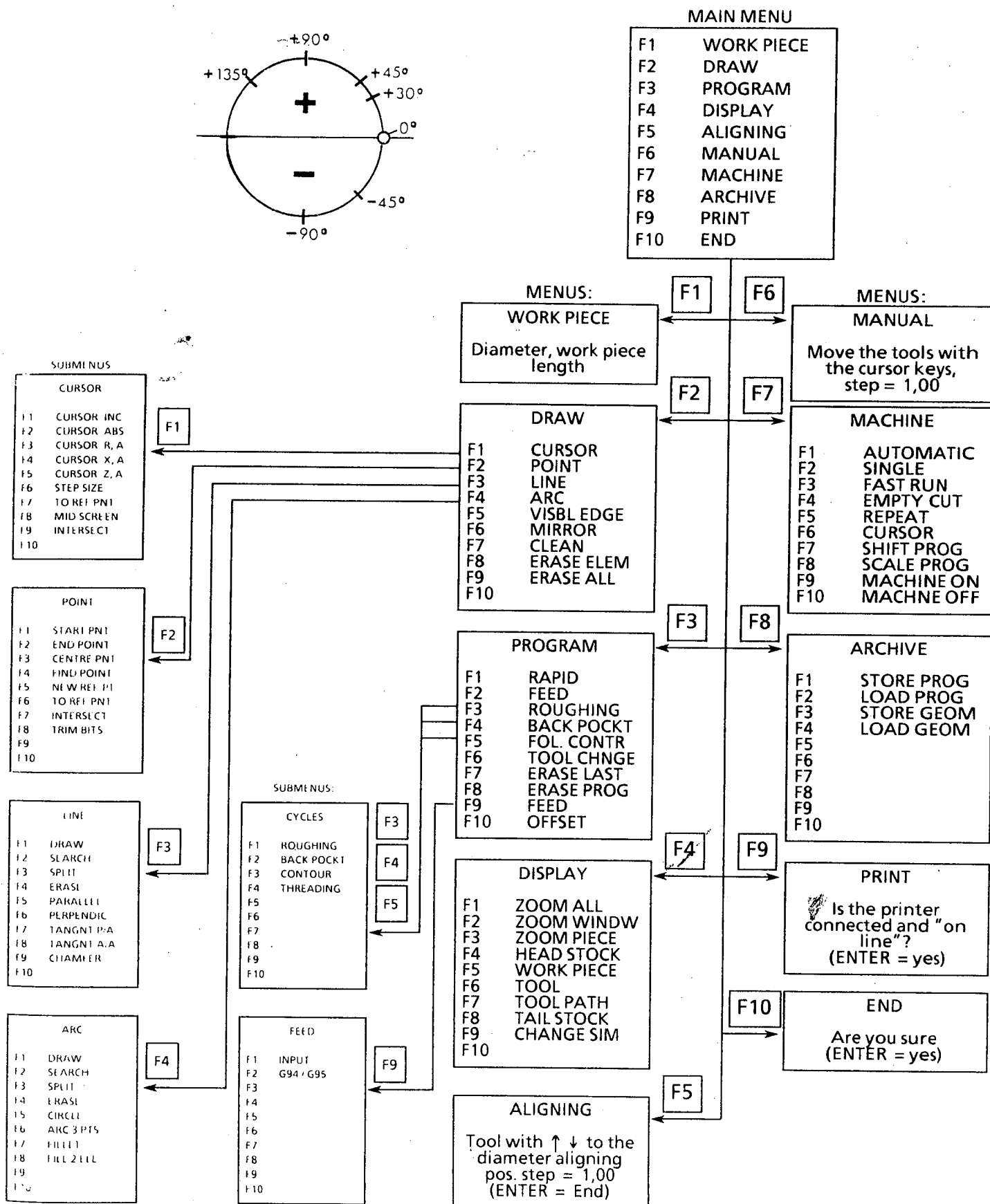
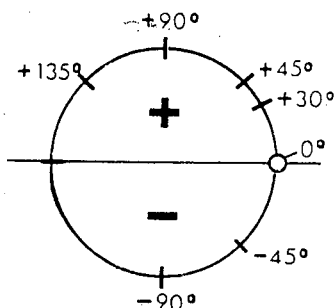
9. TROUBLESHOOTING TABLE UNIMAT PC

(PC retrofit package)

Attention! Disconnect power packs of machine and PC module from the mains before all servicing.

FAILURE EFFECT	CAUSE	REPAIR
No feed movement in X <u>or</u> Z direction.	<p>Bad contact between plug of stepper motor cable and PC.</p> <p>Stepper motor cable broken because of taut tensioning or repeated buckling.</p> <p>Stepper motor got stuck:</p> <ul style="list-style-type: none"> • Slide guidance and feed spindle soiled. • Driving belt too strong tensioned. • Handwheel too tight. • Slide guidances too strong adjusted. 	<p>Check plug of stepper motor cable and plug it in anew.</p> <p>Stepper motor cable must be exchanged or repaired by authorized personnel.</p> <ul style="list-style-type: none"> • Clean slide guidance and feed spindle and lubricate it with light machine oil. • Check belt tension: At light pressure with the finger the belt should give way about 3 mm. • Adjust handwheel clearance (see chapter "Maintenance, care and servicing"). • Adjust slide guidances (see chapter "Maintenance, care and servicing").
No feed movement in X <u>and</u> Z direction.	Bad contact at plug of connection cable between stepper motor card and power pack.	Check plug and plug it in anew.
<p>Stepper motor loses steps.</p> <p><u>Check:</u> To find out if there have been step losses, the slide can be moved to a previously marked position. E.g. position 5 mm before slide stop, graduated ring stands at zero. The slide can always be moved to this position and the position can be compared with the display at the screen.</p>	<p>If the slide is too tight (see above under "•"), maybe the driving motor (stepper motor) carries out only a part of the received motion impulses (it loses steps).</p> <p>Sectional area of chip too big (chip removal too big).</p> <p>Collision.</p>	<p>Repair see above under "•". Afterwards synchronize measuring system of machine and PC (see chapter "Aligning (F5)") and start program anew.</p> <p>Adjust a small cutting depth or a small machining feed, synchronize measuring system of machine and PC (see chapter "Aligning (F5)") and start program anew.</p> <p>Move slide out of collision region, synchronize measuring system of machine and PC (see chapter "Aligning (F5)") and start program anew.</p>

Menu summary



Hotkeys - draw

In order to facilitate a more efficient programming, so-called "hotkeys" were introduced in this software. Hotkey = single-key commands, which are effective in every menu level. You can display a work piece contour on the screen more quickly with the use of these hotkeys.

Example: Constructing a line

Possibility 1 - Menu

1. F2 Recall - menu DRAW
2. F2 Recall - submenu POINT
3. Moving the cursor to the starting point
4. F1 Determining the starting point
5. Moving the cursor to the end point
6. F2 Determining the end point
7. Esc. Exit from the submenu POINT
8. F3 Recall - submenu line
9. F1 Drawing a line

Possibility 2 - hotkeys

1. Moving the cursor to the starting point
2. S Determining the starting point
3. Moving the cursor to the end point
4. + Drawing the line to the cursor position, a new starting point at the same time

Summary - hotkeys

Key	Cursor commands
	Position the cursor incrementally
	Position the cursor by entering the radius and angle
	Cursor to the middle of the screen
	Cursor to the reference point
	Doubling the step size of the cursor
	Halving the step size of the cursor

Key	Screen commands
	Redrawing the screen contents
	Zooming a screen window
	Zooming the work piece
	Cursor as a graticule
	Reduced cursor

Key	Searching commands
	Finding the point
	Searching for the line
	Searching the circle, arc
	Searching any point of intersection

Key	Point commands
	Determining the starting point
	Determining the end point
	Determining the centre point









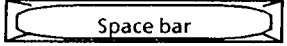

Key	Geometric commands
	Adding a fillet
	Adding a chamfer (45°)
	Cleaning the bit
	Drawing a line to the cursor
	Erasing the element

Note:







Letters can be entered as capitals or small letters.

Hotkeys - machine













You can move the slides and influence the machining cycles by means of these keys.

	Move the slides in the -X direction
	Move the slides in the + X direction
	Move the slides in the -Z direction
	Move the slides in the + Z direction
	Enlarge the travel path of the stepper motors
	Reduce the travel path of the stepper motors
	Increase the feed
	Reduce the feed
	Stop the slides (= intermediate stop)
	Interrupt the machining

Travel path of the stepper motors

	10 mm (= largest travel path)
	5 mm
	1 mm (= switch-on condition)
	0,5 mm
	0,1 mm
	0,05 mm
	0,01 mm (= smallest travel path)

Altering the programmed feed

	200 %
	150 %
	120 %
	100 % (= switch-on condition)
	80 %
	60 %
	50 %
	40 %
	30 %
	20 %
	10 %
	5 %
	0 %