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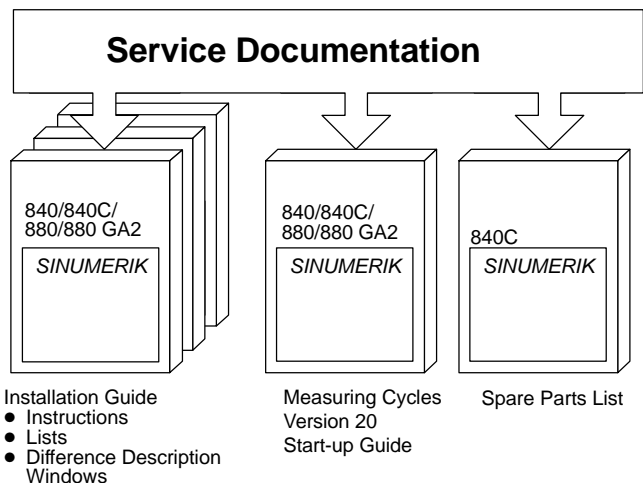
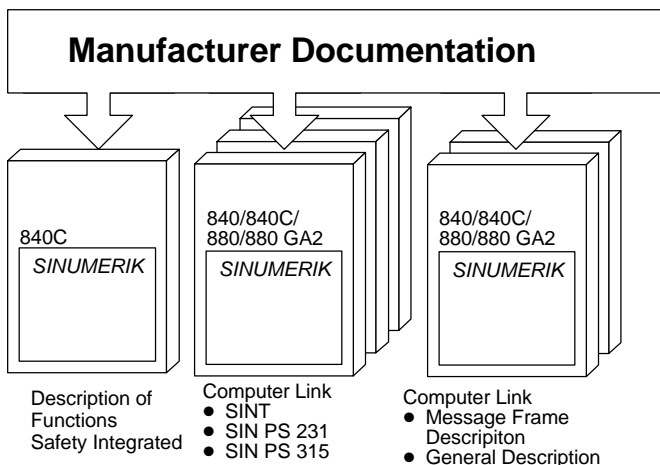
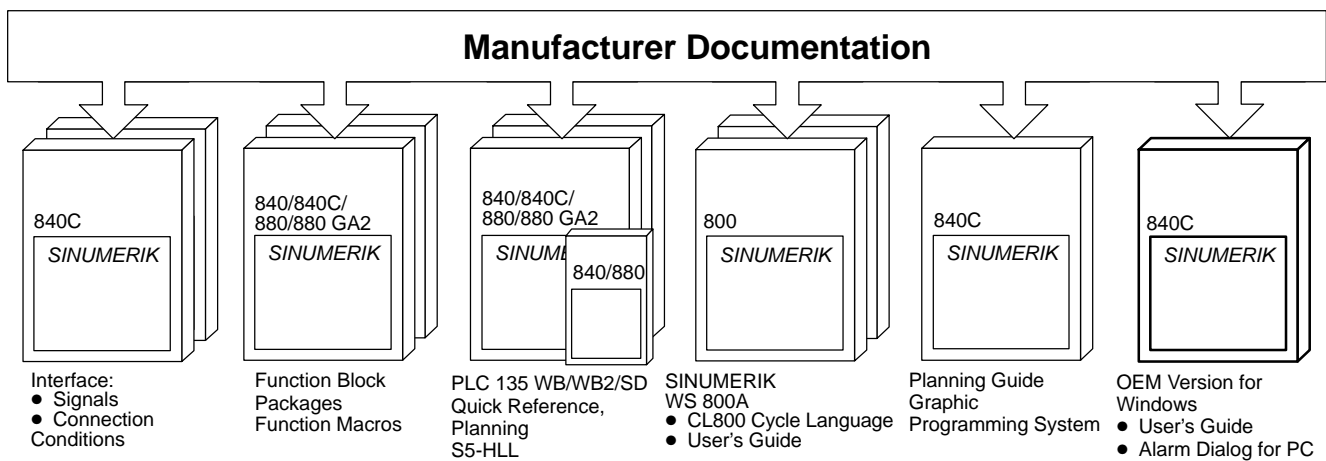
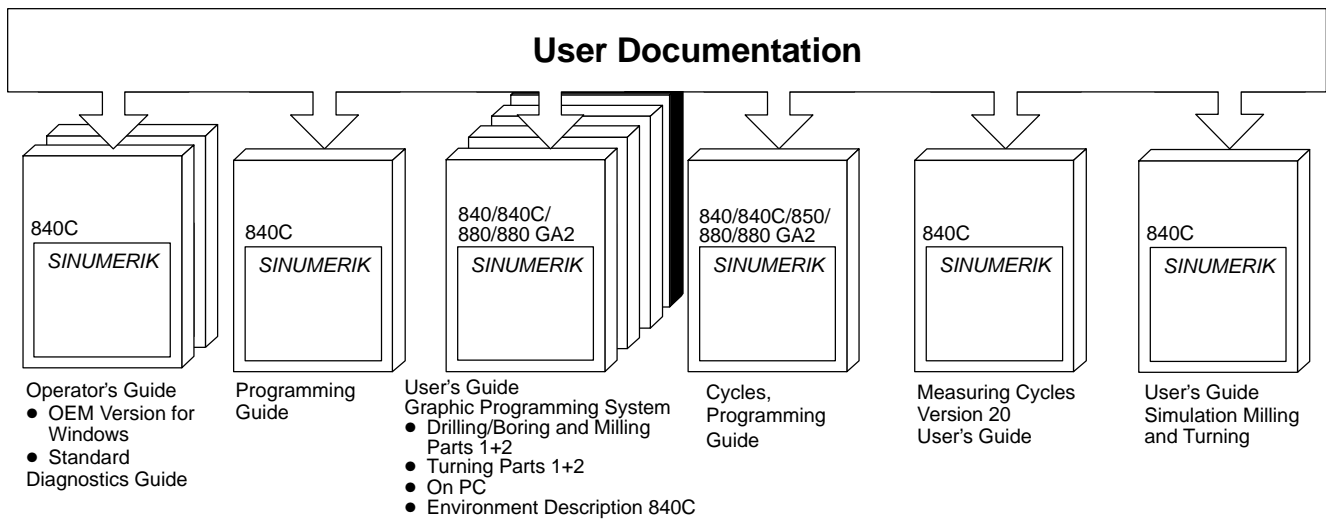
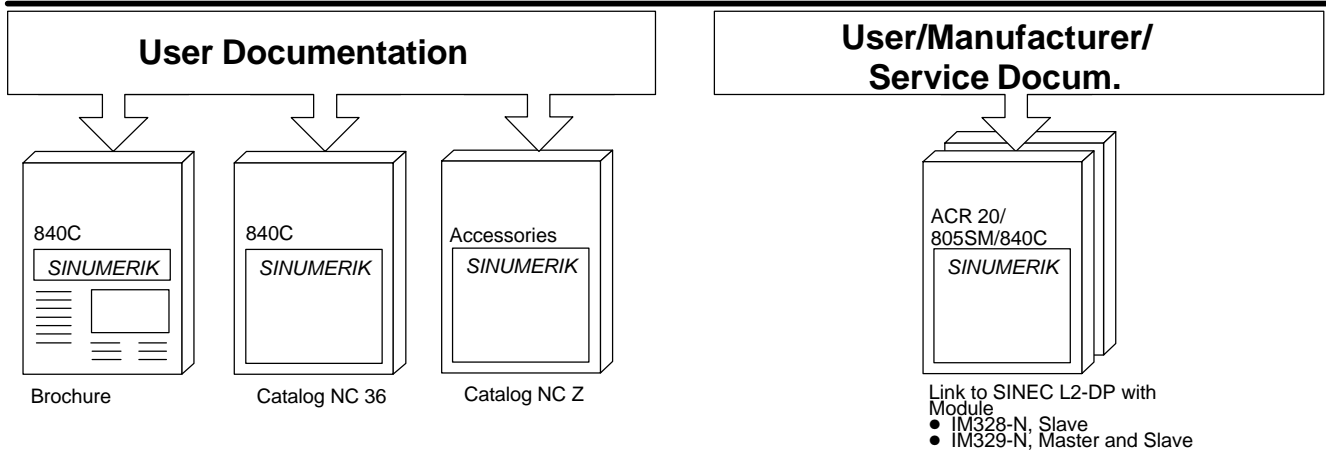
Graphic Programming System
on SINUMERIK 840C
Software Version 6

Environment Description

07.97 Edition

User Documentation

SINUMERIK 840C / OEM Version for Windows



Graphic Programming System on SINUMERIK 840C Software Version 6

Environment Description

User Documentation

Valid for

Control *Software Version*
SINUMERIK 840C/CE as from SW 4
(Standard/Export Version)

07.97 Edition

Introduction

1

Installation and Operation

2

Programming Examples

3

Compatibility Table

4

Index

5

SINUMERIK® documentation

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Brief details of this edition and previous editions are listed below.

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C Revised edition with new status.

If factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

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Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

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Preliminary remarks

This documentation has been written for your graphic programming system and consists of three guides.



- “User’s Guide Graphic Programming System Part 1: Programming Examples”
- “User’s Guide Graphic Programming System Part 2: Operating/Programming Functions”
- “Environment Description Graphic Programming System”

This Environment Description of the graphic programming system on the 840C describes

- **installation,**
- **special operating functions as well as**
- **operating procedures by way of examples.**

Note

Before executing the functions with the graphic programming system you should have worked through the programming examples from Part 1 and carefully read through Part 2 of the User’s Guide.

	<p>The User’s Guide does not contain detailed examples of all the functions provided by the system and all possible operator actions.</p> <p>For this reason, the graphic programming system features a powerful help function that is available in almost all operating situations.</p>	
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Contents

- 1 Introduction 1-1**

- 2 Installation and Operation 2-1**
 - 2.1 How it is supplied 2-1
 - 2.2 Hardware and software requirements 2-1
 - 2.3 Installation 2-1
 - 2.4 840C user interface and keyboard 2-2
 - 2.4.1 Controls on the operator panel 2-2
 - 2.4.2 Operation and display 2-3
 - 2.4.3 Add-on full keyboard 2-5
 - 2.5 Special operating functions 2-6
 - 2.5.1 File environment 2-6
 - 2.5.2 Programming 2-7
 - 2.5.3 Shopfloor sheet 2-9
 - 2.5.4 Create TO file 2-10
 - 2.5.5 Empirical values 2-15

- 3 Programming Examples 3-1**
 - 3.1 Programming in the Programm. area 3-1
 - 3.2 Graphic programming 3-4
 - 3.3 Quitting the Program. WOP function 3-5

- 4 Compatibility Table 4-1**

- 5 Index 5-1**

1 Introduction

This User's Guide describes the operator actions and programming functions for a **SINUMERIK 840C CNC control**.

A **SINUMERIK 840C CNC control** enables you to generate in a simple manner on site, i.e. in the workshop, a part program for creating your workpiece.

Using a workpiece drawing you define by graphical means:

- the tools,
- the blank contour,
- the finished part contour,
- the type of machining

using graphic functions and a part program in DIN code is generated automatically.

You can simulate the programming traversing movements on the screen.

The part program that you have created in this way can then be edited.

With the function **Create part program**, the system calculates the geometry and machining information for the machining plane of the machine.

Rotating tools can machine the end face or peripheral surface of a turned part with drilling and milling operations on condition that the machine has a C axis and the option Transmit.

WOP programming The workshop-oriented graphic programming for turning is incorporated, together with the SINUMERIK 840C CNC control **Programm. softkey**.

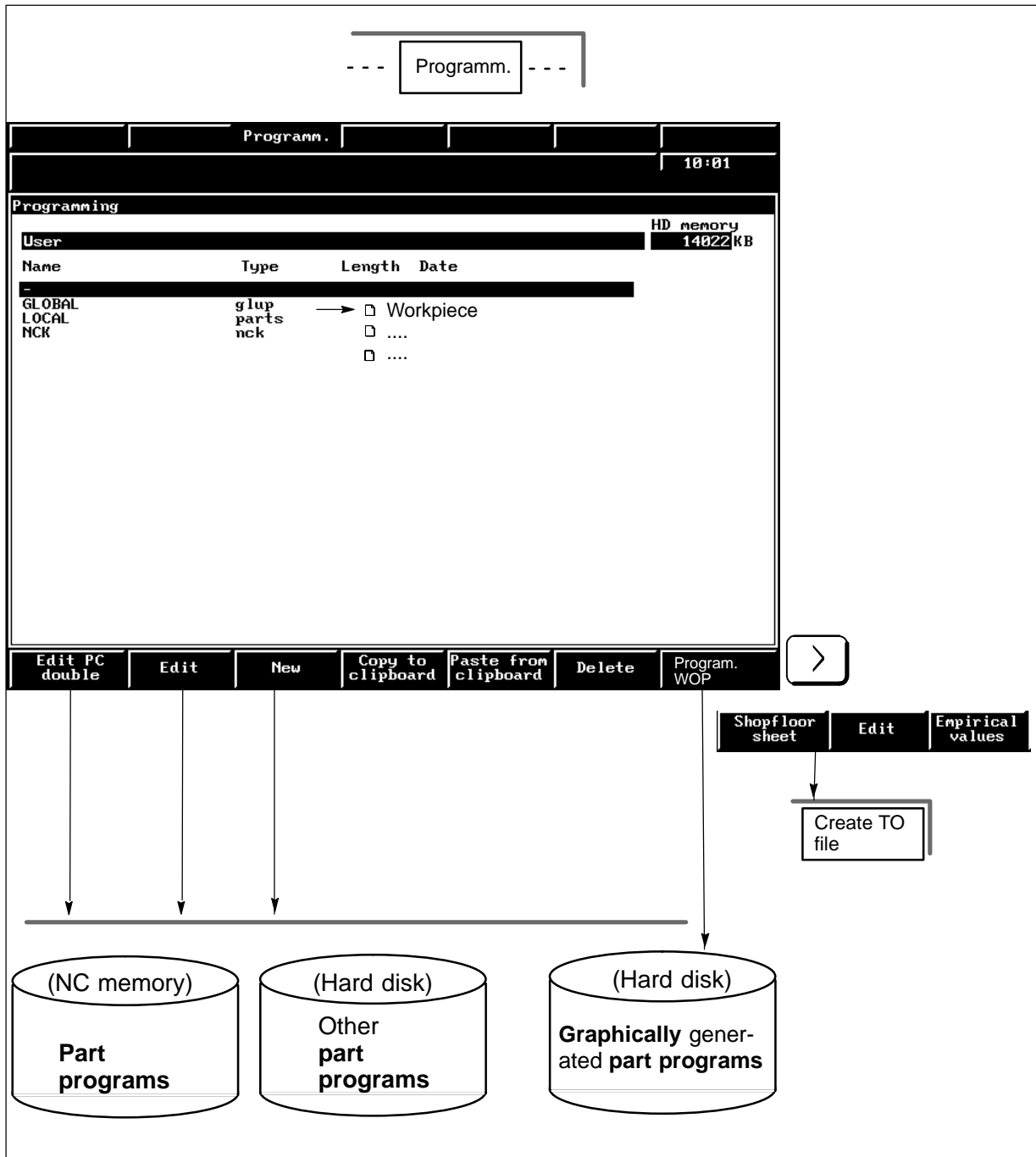


Fig. 1.1 Incorporation of graphic programming into program generation

The graphic programming system is activated using the **Program. WOP** soft-key function.

WOP programming The following items can be programmed graphically on the hard disk:

- the workholders
- the tool and
- the tool geometry
- the type of machining

A part program is also generated.

Shopfloor sheet The graphic programming system generates a shopfloor sheet.

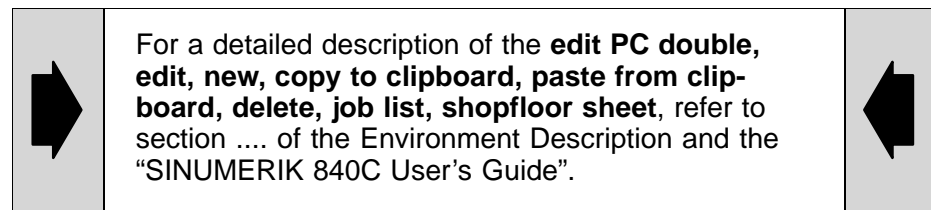
This shopfloor sheet contains technical information about the workpiece.

The graphic programming system stores shopfloor sheet data for each workpiece created.

TOA file The **Create TO file** function creates a tool offset file ("TOA") from the tool data generated in the graphic programming system.

Empirical values There is only **one** empirical value file. This file is modified using a text editor.

The graphic programming system uses the empirical values as the default settings for the input fields in the dialog boxes.



2 Installation and Operation

Section 2 describes the installation and operation of the graphic programming system on the SINUMERIK 840C in detail.

2.1 How it is supplied

SIEMENS supplies the graphic programming system software package on a tape cartridge.

2.2 Hardware and software requirements

See revision notice

2.3 Installation

To install WOP on a SINUMERIK 840C, use a VALITEK streamer to read in the tape cartridge with the WOP graphic programming system software via the "Install MMC system" menu option (see revision notice).

2.4 840C user interface and keyboard

The "SINUMERIK 840C Operator's Guide" provides detailed information on the various versions of the operator panel, the full keyboard and their control and display elements.

In this document we shall concentrate on providing a description of the operating concept and a description of the control and display elements of the graphic programming system package.

As an exercise, we recommend programming a workpiece with reference to an example (see "User's Guide Part 1: Programming Examples").

2.4.1 Controls on the operator panel

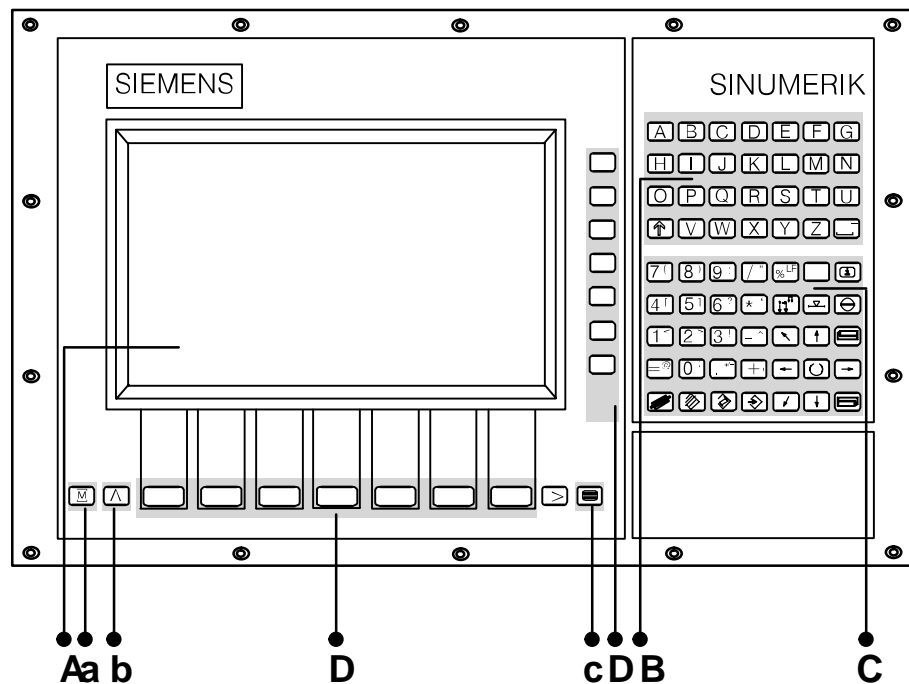


Fig. 2.1 Operator panel

- A 14" graphic monitor, color
- a Machine area key
- b RECALL key
- c Switch area key
- B Alphabetic block
- C Numeric block with offset block and input key, cursor block with cursor keys
- D 14 softkeys

2.4.2 Operation and display

Some aspects of how the **Program. WOP** function is used differ from the way in which the control is used.

The diagram below shows the display fields on screen in the graphic programming system.

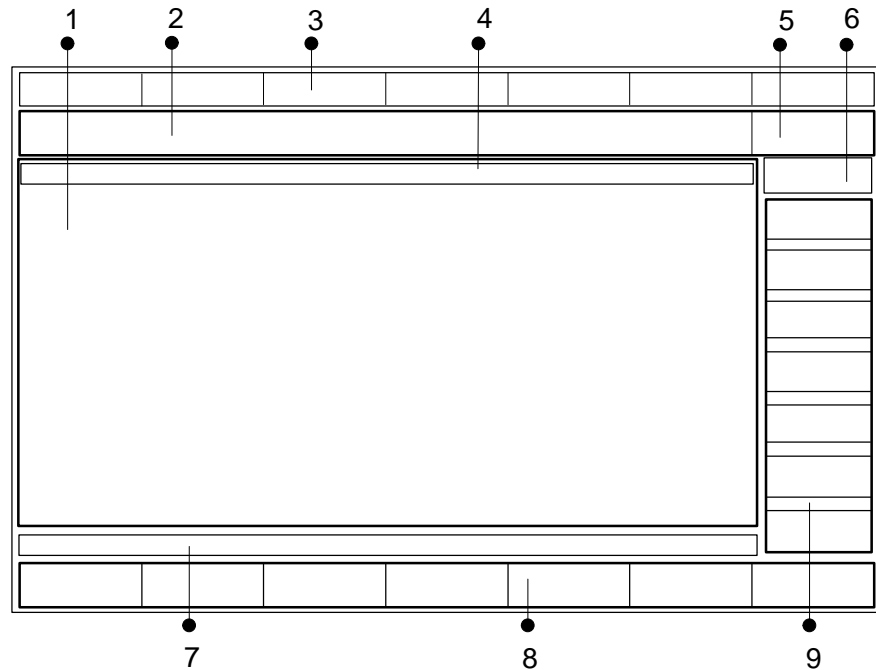


Fig. 2.2 Screen layout

- 1 Graphic area,
- 2 Alarm text, comments
- 3 Display of selected area
- 4 Display lines for the programming levels
- 5 Clock, requirement for cancelling alarms
- 6 Coordinates of the cross-hair position, display of the current work-piece
- 7 Information line for operator guidance
- 8 Horizontal softkey bar** with seven softkey texts
- 9 Vertical softkey bar** with seven softkey texts

During graphic programming, a horizontal and a vertical softkey menu bar are available, each containing seven softkey functions.

Horizontal softkey menu

The horizontal softkey menu contains the functions for the current programming level. During graphic programming, you will see that you move up and down the menu tree.

Vertical softkey menu

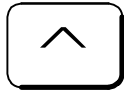
The vertical softkey menu contains the function-independent programming utilities which are always available. When you leave one of the functions, this softkey menu returns to its initial status.

When you press a softkey

- the current softkey menu is replaced by the next menu (you move down the menu),
- or a dialog box is overlaid. This will prompt you to enter or check the parameters required for the function.



A softkey function is activated by pressing one of the horizontal or vertical softkeys.



The **RECALL key** is used to return to the higher-level menu.

If this key is available for use in the horizontal menu, a red triangle will appear in the first softkey.

This enables you to move back through the menu tree to the initial menu.

2.4.3 Add-on full keyboard

The standard full keyboard (which is similar to a PC keyboard) replaces the controls on the operator panel, including the softkeys.

The full keyboard contains all the controls that can be found on the operator panel. However, some of the controls on the full keyboard contain different symbols or are used in a different way compared to the operator panel.

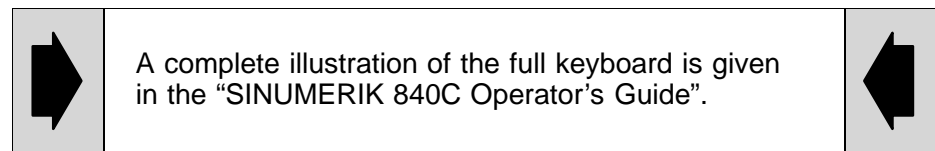
The following sections describe the differences concerning the use of the graphic programming system.



Representation of a key on the operator panel



Representation of a key on the full keyboard



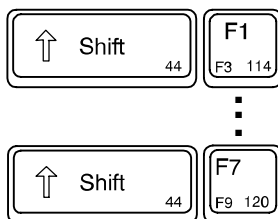
Using the softkeys If you have connected a full keyboard, the softkey functions are activated via the full keyboard using the key combinations illustrated below.

horizontal



Press one of these function keys on the full keyboard to activate the **horizontal softkey** functions.

vertical



Press the <shift> key **plus** the corresponding function key on the full keyboard to activate the **vertical softkey** functions.

2.5 Special operating functions

This section describes

- file functions and
- programming functions

of importance to the graphic programming system on the SINUMERIK 840C.

2.5.1 File environment

During programming, the graphic programming system uses, modifies and creates:

- TO file (uses, creates)
- part programs (creates)
- program steps as a work schedule (creates)
- user magazine (uses, modifies, creates)
- master data directory (uses, modifies)

In each workpiece directory, the graphic programming system creates:

- a **job list** "JOB" (the MMC uses this to interpret instructions for loading system data and programs and the channel)
- a **shopfloor sheet** "WERKSTA" (the shopfloor sheet contains information on blanks, etc.)
- and a **tool list** "WERKZEUG" (contains information on the tools).

The screenshot shows a graphical user interface window titled 'Programm.' with a clock showing 10:02. The main area is titled 'Programmierung' and displays the directory 'User\LOCAL\TEIL1' with 'HD memory 14022KB'. A table lists files with columns for Name, Type, Length, and Date. The files listed are: .JOB (type: jobl, length: 42, date: 01-16-1995 08:34:44), MPF1 (type: part, length: 0, date: 03-15-1995 14:22:10), WERKSTA (type: part, length: 4632, date: 03-15-1995 14:22:10), and WERKZEUG (type: tool, length: 1375, date: 03-15-1995 14:22:10). At the bottom, there is a menu bar with buttons for 'Shopfloor sheet', 'Edit', 'Empirical values', 'View IKA data', 'Job list', and 'Simulation'.

Name	Type	Length	Date
.JOB	jobl	42	01-16-1995 08:34:44
MPF1	part	0	03-15-1995 14:22:10
WERKSTA	part	4632	03-15-1995 14:22:10
WERKZEUG	tool	1375	03-15-1995 14:22:10

Fig. 2.3 Workpiece directory "User/LOCAL/TEIL1"

This information is needed for the external tool default and for the "NC simulation" option at MMC level.

2.5.2 Programming

Programm.

Purpose

Before you activate the **Program. WOP** function, there are various menus available for use via the MMC **Program.ming** function.

The following file handling functions are available:

- **edit PC double**
- **edit**
- **new**
- **copy to clipboard**
- **paste from clipboard**
- **delete**

and the following menus can be used directly, in conjunction with the graphic programming system:

- **WOP programming**
- **shopfloor sheet**
- **create TO file**
- **empirical values.**

Programming tips

The "SINUMERIK 840C Operator's Guide" contains detailed descriptions of the operating sequences for the functions **edit PC double**, **edit**, **new**, **copy to clipboard**, **paste from clipboard**, **delete**, **job list**, **shopfloor sheet**, **create TO file** and **empirical values**.

Procedures

Programm.

From the starting screen on the control, press the **Programm.** softkey to access the next screen.

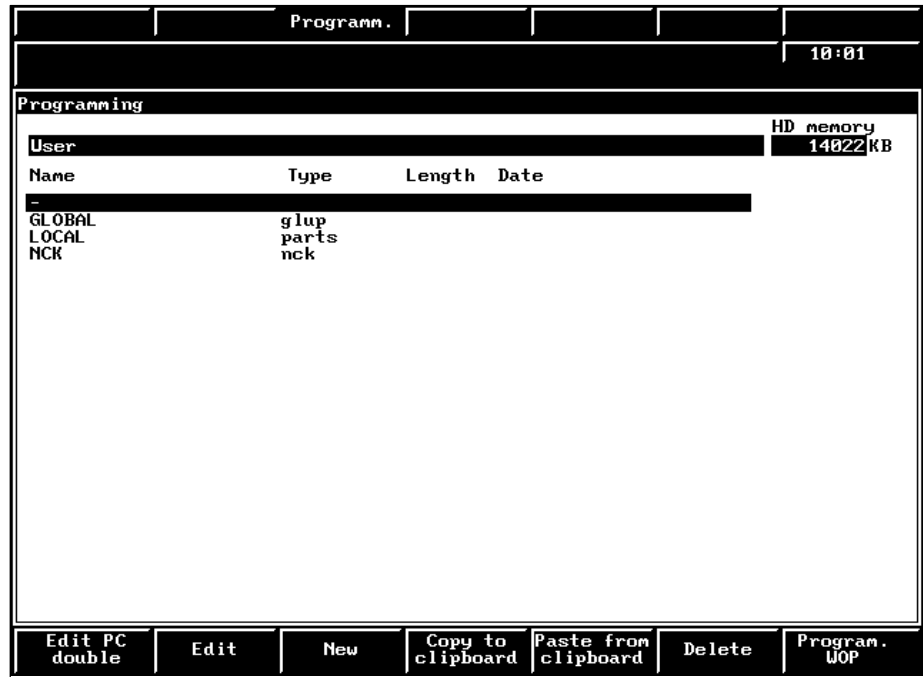


Fig. 2.4 Programming



The functions **job list**, **shopfloor sheet** and **empirical values** are accessed from the additional menu on the horizontal softkey bar by pressing this **More key**.

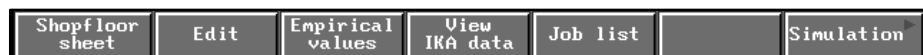


Fig. 2.5 Extended menu bar



Press the **More key** again to return to the previous menus on the horizontal softkey bar.

Program.
WOP

Use the **Program. WOP** softkey to call up the graphic programming system.

2.5.3 Shopfloor sheet

Shopfloor sheet

Purpose

Each graphically programmed workpiece has a shopfloor sheet.

The **Shopfloor sheet** function provides an overview of the type of machining programmed using the graphic programming system.

Programming tips

The shopfloor sheet contains:

- Information concerning the machining of your workpiece and
- Identification, blank and work schedule data and free text.

The data for the shopfloor sheet

- is generated by the system during the graphic programming operation,
- is for your information only, and
- makes it easier for you to set up your CNC machine.

Procedures



To activate the **Shopfloor sheet** function,

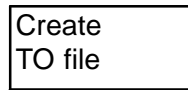
1. Call up the additional functions on the horizontal menu bar by pressing the **More key**.
2. Call up the **Shopfloor sheet** function.

Notes

Additional stored comments can be modified or supplemented using a text editor.

Workpieces identified with "DIN type" have no shopfloor sheet.

2.5.4 Create TO file



Purpose

The **Create TO file** function creates, on the hard disk, a tool offset file (TOA) from the tool data generated in the graphic programming system.

Programming tips

TOA data

The TOA file can be created

- in the conventional manner (see the SINUMERIK 840C Operator's Guide) or
- using the **Create TO file** function.

The following figure shows a workpiece directory with a **TOA1** file.

Programm.						10:03
User/LOCAL/DEM0001						HD memory 14022KB
Name	Type	Length	Date			
MPF111	parp	7951	08-18-1995	09:54:52		
MPF123	parp	7928	08-02-1995	14:29:56		
TOA	toa	999	04-06-1995	16:39:04		
TOA1	toa	851	10-28-1994	11:48:22		
WERKSTA	fainf	12594	08-18-1995	09:54:52		
WERKZEUG	toli	14510	08-18-1995	09:54:52		

Fig. 2.6 TOA file directory

The **Create TO file** function creates, on the hard disk, a TOA file from the tool data generated in the graphic programming system.

The tool data required consists of the data from the user magazine for the corresponding workpiece created in the graphic programming system.

In this file, the offset for wear values are set to the default value "ZERO".

The **active** offset data for the NC is contained in the **Tool Offset Active** memory (user memory) and not on the hard disk.

Let us assume that you have created a WOP TOA file on the hard disk using the **Create TO file** function.

Before loading this TOA file in the TOA memory, you can copy the wear values available for this tool from the offset memory of the NC into this new WOP TOA file (see "SINUMERIK 840C Operator's Guide").

TOA data, recessing The TOA memory of the NC provides two D–offset memory locations for the recessing tools. For these offset values, the graphic programming system requires the width of the tool tip and the cross and longitudinal dimensions of the grooving tool to be entered as parameters.

When the TOA file is created using the **Create TO file** function, the system moves the offset values for both dimensions into a TOA file. The diagram below describes the parameters with reference to the example **Recessing tool, longitudinal**.

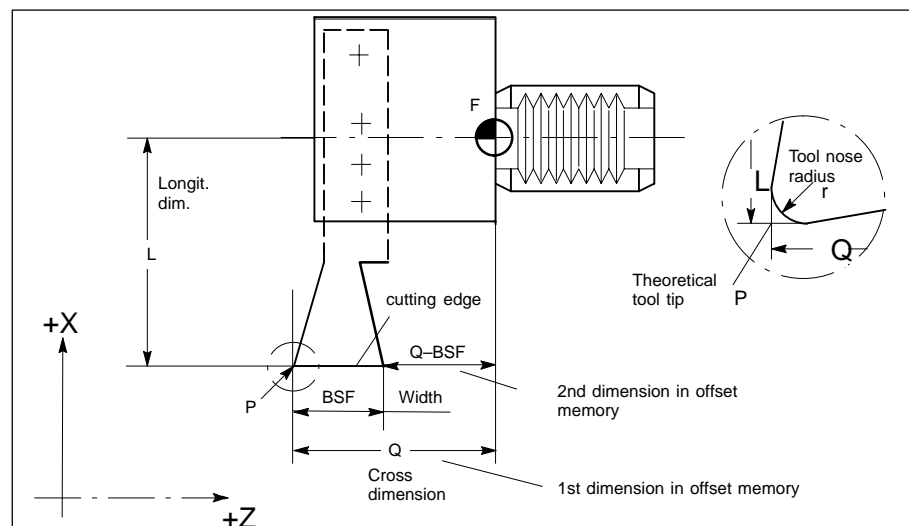


Fig. 2.7 Recessing tool, longitudinal

If, for example, the width of the recessing tool = 5 mm and the cross dimension = 30 mm, then the system will enter

- D1: ... P3=30 mm ;"Q" and
- D2: ... P3=25 mm ;"Q" minus "BSF"

Tool wear offsets using the empirical value file The following variables from the empirical values file determine the percentage "%" by which the **tool nose radius** used in practice can be increased with respect to the desired radius.

- Roughing **V1257**
- Finishing **V1258**
- Recessing **V1298**

Thus, the system calculates a percentage supplement for the maximum admissible wear on the tool nose radius. This is added to the tool nose radius during machining.

This gives the following formula for the definitive tool nose radius “r”:

$$r_{\text{System}} = r + (r \times V12..)/100$$

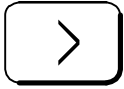
;“Tool nose radius+=
 ;(tool nose radius multiplied by a
 ;variable |1257|or|1258|or|1298|)
 ;divided by 100”

This ensures that optimum machining can take place until the maximum wear on the tool is reached.

Error messages

When machining with the tool radius compensation active, an error message may appear on the machine.

Error message	Explanation	Conclusion or Remedy
"3021 contour violation with TRC"	This error message may occur for the following reason: the wear value for the tool in the TOA file of the NC is larger than that defined under WOP using the variables.	A contour violation can be prevented by increasing the variables accordingly using WOP and recreating the part program.

Procedures

Shopfloor
sheet

The workpiece has already been created graphically.

1. Select a workpiece by positioning the cursor on the workpiece name.
2. Press the **More key** to call up the rest of the menu in the horizontal softkey bar.
3. Call up the **Shopfloor sheet** function.

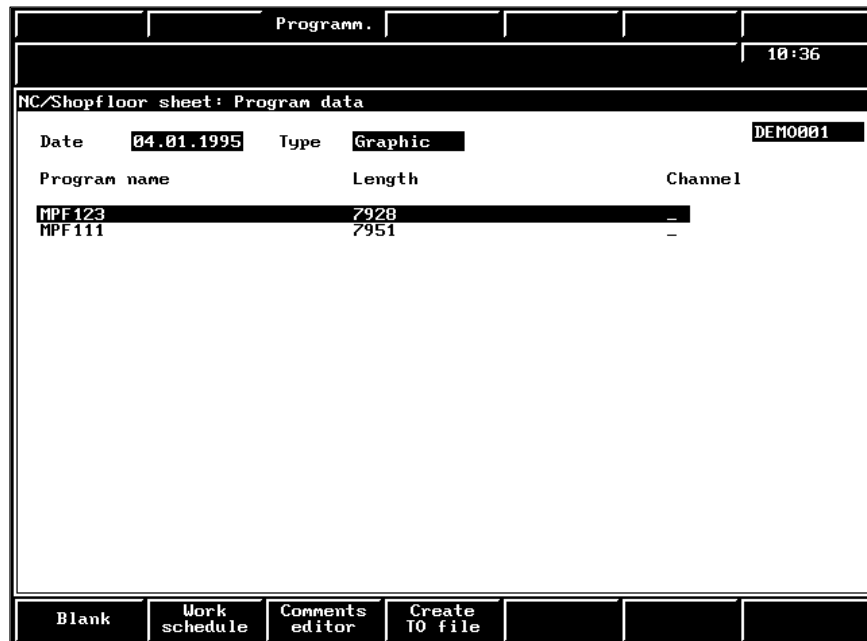


Fig. 2.8 Create shopfloor sheet TO file

Create
TO file

4. Select the **Create TO file** function.
5. Enter a name for this file (e.g. TOA1).

Note

The name **must** contain the channel number (e.g. TOA1). If no channel number (e.g. "1") is specified, an error will occur in the NCK.

6. Press the **INPUT key** and the **OK** softkey.
7. You can use an ASCII editor (see "SINUMERIK 840C Operator's Guide" for a description) to correct or modify the file you have created.

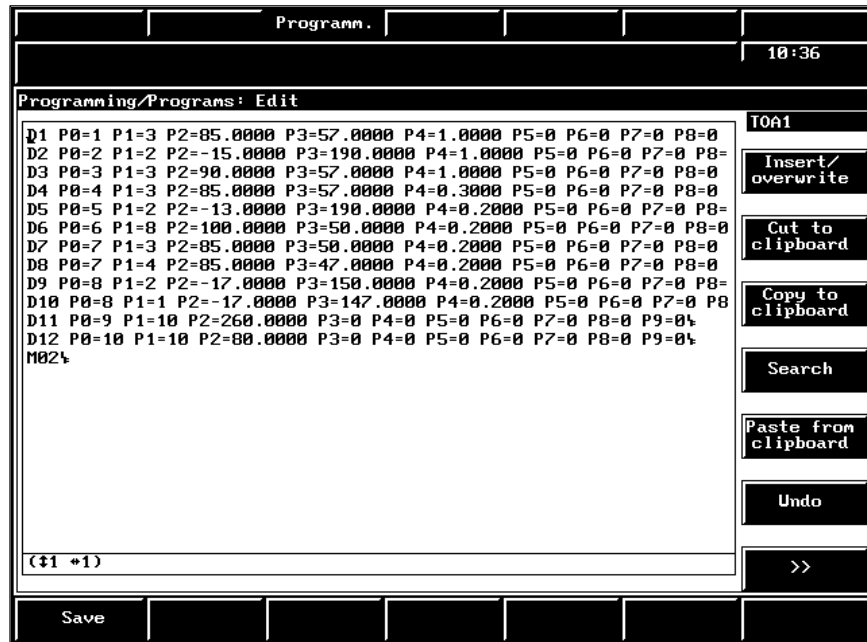


Fig. 2.9 Edit TO file

8. **Save** the file and quit the programming level by pressing the **RE-CALL** key twice.
9. If a job list is available, the file stored on the hard disk can be loaded into the NC user memory.

Note

The SINUMERIK 840C Operator's Guide describes other loading options.

Use the **Program parameters** function (see SINUMERIK 840C Operator's Guide) to enter any outstanding wear values.

	<p>When the TO file is first created, the programming system checks to ensure that the D number (tool offset memory) has not been entered twice.</p>	
--	--	--

2.5.5 Empirical values

Empirical values

The parameters for the empirical value file are given in the “Graphic Programming System, Part 2” User’s Guide.

Purpose

The graphic programming system uses parameters from a table.

The programming system enters these parameters as defaults in the input fields of the overlaid dialog boxes.

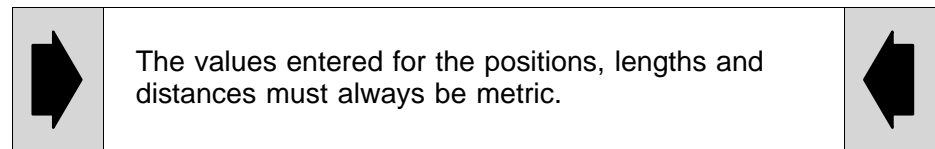
This table is known as the empirical value file.

Programming tips

There is an empirical value file and a configuration file.

The machine data in the configuration file is entered by the machine manufacturer. The data in this file cannot be modified.

The empirical value file can be modified.



The following pages describe the individual empirical values in a file.

Procedures



As already described, the **Empirical values** function, etc., can be accessed on the additional horizontal softkey bar by pressing the **More** key.

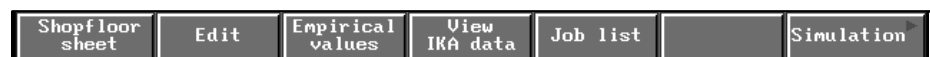


Fig. 2.10 Empirical values

Empirical values

Press the **Empirical values** softkey to view and modify this file.

You can modify the value allocated after the equal sign “=”.

For example: |V831 = 2|

Activate modified empirical values

Once you have

- restarted the system (Power on reset) or
 - initialized the programming system using the **Read new** softkey functions and read in the workpiece geometry with **Read original**,
- the graphic programming system will use the modified values.



3 Programming Examples

As an exercise, this section describes how to

- start graphic programming and create a workpiece in a workpiece directory, and
- terminate graphic programming from the “840C user interface”.

3.1 Programming in the Programm. area

Purpose of the exercise The following section describes how to

- create a new workpiece directory and
- start graphic programming.



Once you have switched on the control and pressed the **Switch area key**, the following screen will appear on your monitor (unless something else has been set by the machine manufacturer):

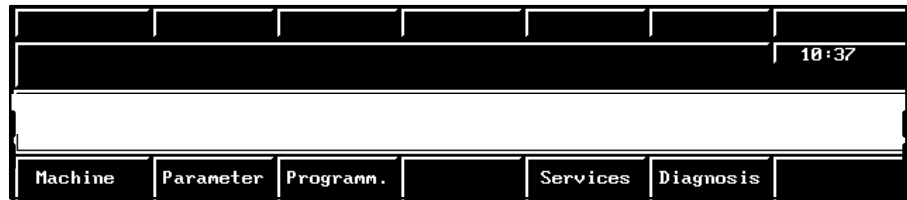


Fig. 3.1 Part of the SINUMERIK 840C initial screen

The user interface of your CNC control provides the **Programm.** softkey on the horizontal softkey menu bar.

Press this softkey.

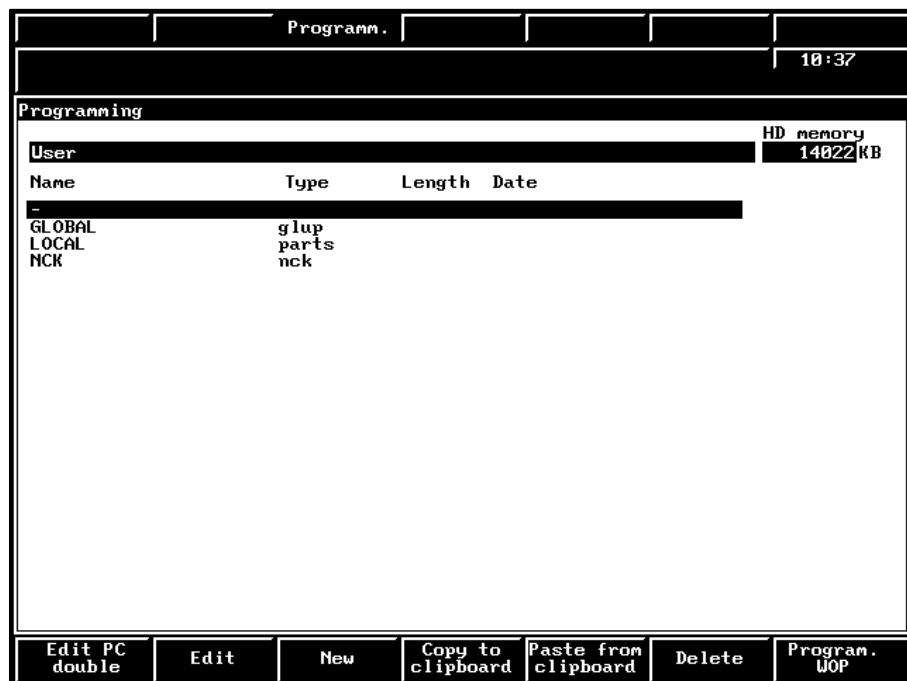
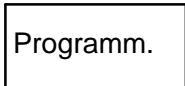


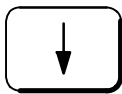
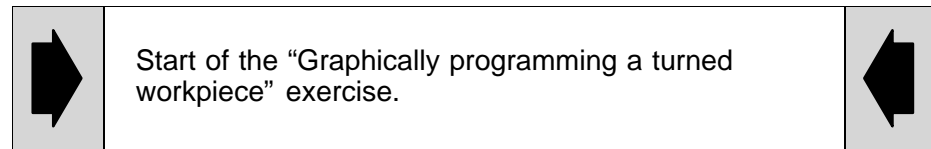
Fig. 3.2 Programming

3.1 Programming in the Programm. area

Once you have selected the **Programm.** area, you will find yourself in the **LOCAL/GLOBAL** directory.

Workpieces are usually stored in the **LOCAL** directory.

Generally applicable data should be stored in the **GLOBAL** directory (e.g. sub-programs with multiple uses, cycles or TOA data (Tool Offset Data)).

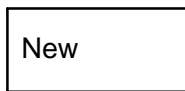


Select the **LOCAL** directory using the cursor key,



and confirm by pressing the **INPUT key**.

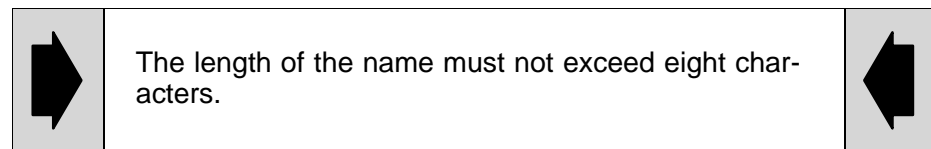
If you want to program a new workpiece in the **LOCAL** directory:



Press the **New** softkey.



To give the workpiece a new name, enter the desired workpiece name using the alphanumeric keys, e.g. "TEIL1".

**Note**

"PART1" is a workpiece name and the generic term for all files created under this workpiece.

According to the exercise, the created part main program "MPF1" is stored in this workpiece directory "LOCAL/TEIL1".

The entry is as follows:

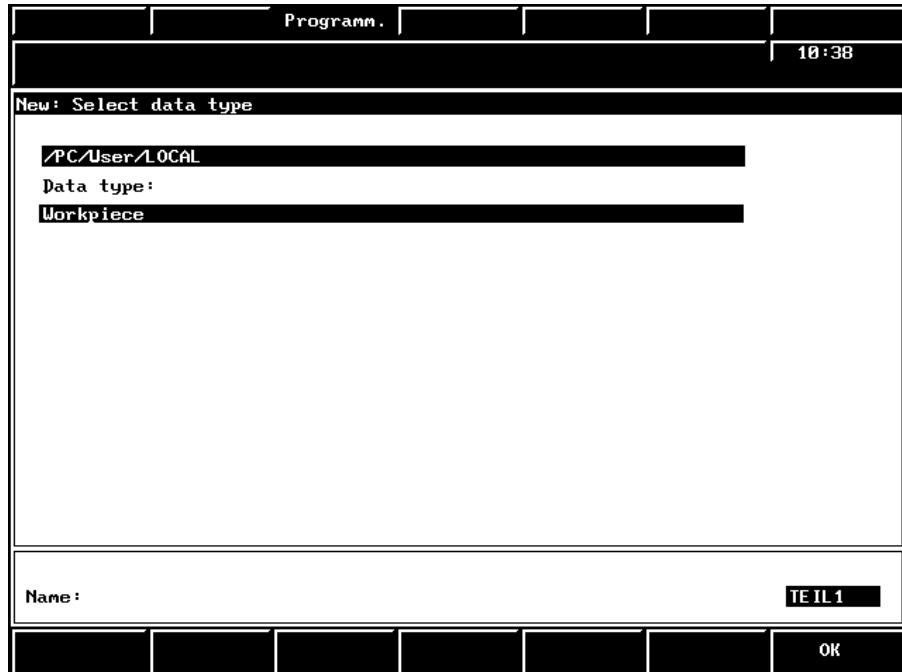
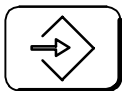


Fig. 3.3 Program new



Press the **INPUT** key to confirm

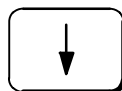


and press the **OK** softkey.

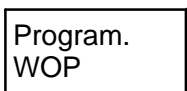
Note: Set the key switch (see SINUMERIK 840C Operator's Guide) to position 1.



Press the **RECALL** key to move to the next level up.



Select your workpiece directory "TEIL1".



Press the **Program. WOP** softkey to start workshop-oriented graphic programming.

3.2 Graphic programming

Once you have loaded the graphic programming system, the following user interface appears:

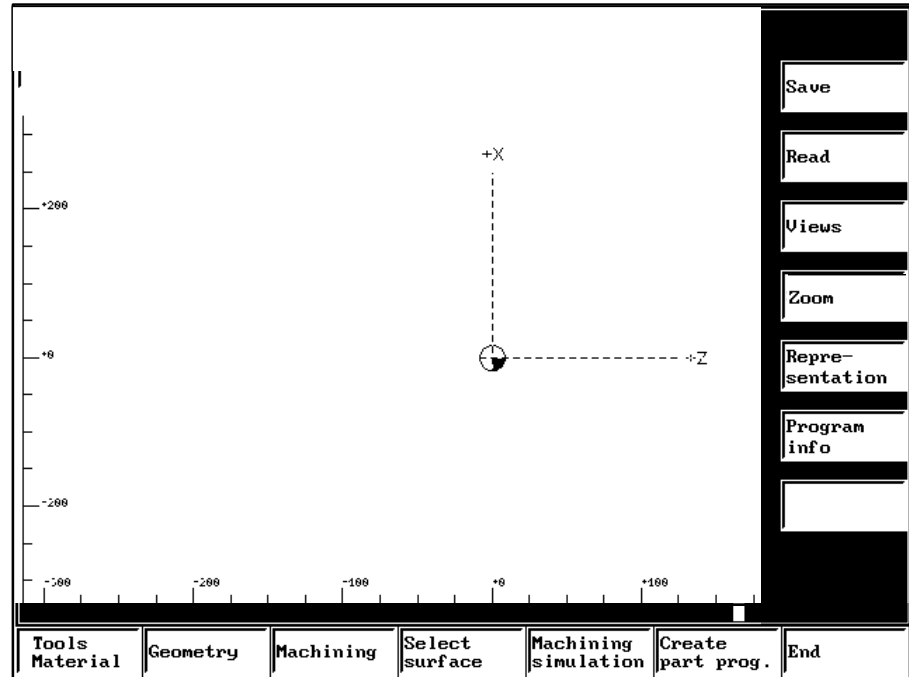


Fig. 3.4 Starting level for WOP programming

Note

You now have access to seven vertical softkeys in addition to the seven horizontal softkeys.

Horizontal softkeys

The horizontal softkeys guide you through the programming of your workpiece "PART1".

Vertical softkeys

The vertical softkeys are used to control the screen and the system and contain general programming utilities that are available at all stages of graphic programming.



The **RECALL** key is used to abort a softkey function and return to the menu.

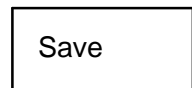
➔	<ul style="list-style-type: none"> • Before you can select the Machining softkey, the geometry must be available. • If you require new tools, then we recommend creating the tools before you create the workpiece geometry. This procedure is practised in the next section ("Create user magazine"). 	➔
---	---	---

3.3 Quitting the Program. WOP function

Before quitting the graphic programming system, carefully read the notes in this section.

Purpose of the exercise To show you how to save the files you have created using the graphic programming system.


Workpiece geometry and machining If you switch to a new workpiece, the programming system will ask whether you wish to save the workpiece geometry and machining you have created.



The vertical softkey **Save** also provides the option of saving your workpiece geometry and machining data during graphic programming.

The programming system stores the workpiece geometry file in the workpiece directory, but it will **not** be visible to you.

Note In the graphic programming system, you always work with workpiece names (e.g. "PART1").

Note  If you quit the graphic programming system using the **Switch area key** and delete the directory "PART1", then the reference to this workpiece name will be lost.

Graphic programming using this name will no longer be possible until you have recreated this directory name.

Part program When you terminate the **Create part pro** function, the graphic programming system stores the part program in your workpiece directory (e.g. "PART1"). It is not necessary to save the program.



4 Compatibility Table

Every software version of the graphic programming system is upwards compatible.

Program info

You can find out which software version you have with the functions **Program info/System status**.

System status

The following tables show the possible versions for

- the graphic programming system for turning and
- the graphic programming system for drilling and milling.

An “×” in the table indicates the compatibility of the created geometry files.

Compatibility table: “Graphic programming system for drilling/boring and milling”:

from/to	V1.1	V2.1	V3.1	V3.3	V6.1	V6.1C ¹⁾	V6.2	V6.2C ¹⁾	V6.4	V6.4C ¹⁾
V1.1	×	×	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾
V2.1		×	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾
V3.1			×	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾
V3.3				×	×	×	×	×	×	×
V6.1					×	×	×	×	×	×
V6.1C ¹⁾						×		× ²⁾		× ²⁾
V6.2							×	×	×	×
V6.2C ¹⁾								×		×
V6.4									×	×
V6.4C ¹⁾										×

1) A C following the version number indicates that multi-side machining has been set with WOP-M and that the C-axis option is active with WOP-T.

2) Problems may be encountered when taking over machining operations.

Compatibility table: "Graphic programming system for turning":

from/to V...	3.1	3.2	4.1	4.1 C ¹⁾	5.2	5.2 C ¹⁾	≥ 5.3	≥ 5.3 C ¹⁾	6.1	6.1 C ¹⁾	6.2	6.2 C ¹⁾	6.4	6.4 C ¹⁾
V3.1	×	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾
V3.2		×	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾	× ²⁾
V4.1			×	×	×	×	×	×	×	×	×	×	×	×
V4.1C ¹⁾				×		×		×		×		×		×
V5.2					×	×	×	×	×	×	×	×	×	×
V5.2C ¹⁾						×		×		×		×		×
≥ V5.3							×	×	×	×	×	×	×	×
≥ V5.3C ¹⁾								×		×		×		×
V6.1									×	×	×	×	×	×
V6.1C ¹⁾										×		×		×
V6.2											×	×	×	×
V6.2C ¹⁾												×		×
V6.4													×	×
V6.4C ¹⁾														×

1) A C following the version number indicates that multi-side machining has been set with WOP-M and that the C-axis option is active with WOP-T.

2) Problems may be encountered when taking over machining operations



5 Index

C

Compatibility table, 4-1
Controls, operator panel, 2-2

D

Display, 2-3
Graphic area, 2-3
lines for operator guidance, 2-3
lines for programming levels, 2-3

E

Empirical values, 1-3, 2-15

F

File, environment, 2-6
Full keyboard (add-on component), 2-5
Functionality, differences in, 2-6

G

Graphic area, 2-3
Graphic programming, 3-4
Graphic programming system, 1-3

H

How it is supplied, 2-1

I

Installation and Operation, 2-1

M

Machining, 3-4
More key, 2-8

O

Operating concept, information lines, 2-3

P

Program. WOP, 3-3
Programming, 2-7
Programming examples, 3-1
Programming functions
empirical values, 2-15
shopfloor sheet, 2-9

S

Screen layout, 2-3
Shopfloor sheet, 2-9
TO file, 2-10
Softkey bar
horizontal, 2-3
vertical, 2-3
Softkeys, 2-2
Switch area key, 3-1

T

TO file, 2-10
TOA data, 2-10
recessing, 2-11
TOA file, 1-3
Tool nose radius, TNR, 2-11
Tool offset file, 2-10
Tool wear offsets, 2-11

V

V1257, 2-11
V1258, 2-11
V1298, 2-11

W

WOP, quit, 3-5
WOP programming, 1-2, 1-3
Workshop sheet, 1-3

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