

# SIEMENS

## SINUMERIK 840D sl

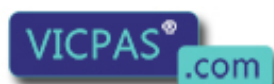
### HMI sl Universal

#### Operating Manual

Foreword	
Introduction	1
Setting up the machine	2
Machine the workpiece	3
Teaching in programs	4
Setting data	5
User data	6
Tool management	7
Program management	8
HT8	9
PCU 321	10
Alarm, error, and system messages	11
Appendix	A

Valid for SINUMERIK 840D sl/840DE sl control system Software Version NCU system software for 840D sl/840DE sl 2.4 with HMI sl 2.1

11/2006  
6FC5398-6AP10-1BA0



Everything for your HMI running  
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## Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.



### Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.



### Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.



### Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

### Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

### Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

## Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

## Prescribed Usage

Note the following:



### Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

## Trademarks

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## Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

# Foreword

## Foreword

### Structure of the documentation

The SINUMERIK documentation is organized in 3 parts:

- General documentation
- User documentation
- Manufacturer/service documentation

An overview of publications, which is updated monthly and also provides information about the language versions available, can be found on the Internet at:

<http://www.siemens.com/motioncontrol>

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The Internet version of DOConCD (DOConWEB) is available at:

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Information about training courses and FAQs (Frequently Asked Questions) can be found at the following website:

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### Target group

This documentation is intended for users of universal machines running the HMI sl software.

### Standard scope

This documentation only describes the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer.

Other functions not described in this documentation might be executable in the control. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.

For the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

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## Questions about the manual

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Fax form: See the reply form at the end of the document.

### Internet address

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### EC declaration of conformity

The EC Declaration of Conformity for the EMC Directive can be found/obtained

- the internet:  
<http://www.ad.siemens.de/csinfo>  
under the Product/Order No. 15257461
- at the relevant branch office of the A&D MC Business Division of Siemens AG



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# Table of contents

	Foreword .....	3
<b>1</b>	<b>Introduction.....</b>	<b>11</b>
1.1	Product overview .....	11
1.2	Operator panel fronts .....	12
1.2.1	Overview .....	12
1.2.2	Keys of the operator panel.....	13
1.3	Machine control panels .....	15
1.3.1	Overview .....	15
1.3.2	Controls on the machine control panel .....	15
1.4	Operator interface .....	18
1.4.1	Status display.....	19
1.4.2	Actual value window .....	22
1.4.3	T,F,S window .....	23
1.4.4	Program block display.....	24
1.4.5	Operation via softkeys and buttons .....	25
1.4.6	Entering parameters .....	27
1.4.7	Context menu.....	28
1.4.8	Touch operation .....	29
1.4.9	Pocket calculator.....	29
1.4.10	Protection levels.....	31
<b>2</b>	<b>Setting up the machine .....</b>	<b>33</b>
2.1	Switching on and switching off.....	33
2.2	Modes of operation .....	34
2.2.1	General information .....	34
2.2.2	Channel switchover.....	36
2.3	Approaching a reference point.....	36
2.3.1	Reference axes .....	36
2.3.2	User agreement .....	38
2.4	Settings for the machine .....	39
2.4.1	Coordinate system (MCS/WCS) .....	39
2.5	Work offsets .....	40
2.5.1	Overview .....	40
2.5.2	Display active zero offset .....	40
2.5.3	Displaying and editing base zero offset .....	42
2.5.4	Displaying and editing settable zero offset .....	43
2.5.5	Displaying and editing details of the zero offsets.....	44
2.5.6	Deleting zero offsets .....	45
2.6	Manual mode .....	46
2.6.1	Traversing the axes .....	46
2.6.2	Traverse axes by a defined increment.....	46
2.6.3	Traversing axes by a variable increment.....	48

2.6.4	Default settings for manual mode .....	48
2.7	Handwheel .....	50
2.7.1	Handwheel assignment.....	50
2.8	MDA .....	52
2.8.1	Loading an MDA program from the Program Manager .....	52
2.8.2	Saving an MDA program.....	53
2.8.3	Executing an MDA program.....	54
2.8.4	Deleting an MDA program.....	55
<b>3</b>	<b>Machine the workpiece .....</b>	<b>57</b>
3.1	Starting program execution .....	57
3.1.1	Starting and stopping machining.....	57
3.1.2	Selecting a program .....	59
3.2	Program running-in .....	60
3.2.1	Executing single blocks.....	60
3.3	Display current program block .....	61
3.3.1	Current block display.....	61
3.3.2	Display program level.....	61
3.4	Correcting programs .....	62
3.5	Repositioning axes.....	63
3.6	Starting execution at a specific point .....	64
3.6.1	Use block search.....	64
3.6.2	Approaching an interruption point again .....	65
3.6.3	Entering a search target.....	65
3.6.4	Parameters for block search .....	66
3.6.5	Block search mode.....	66
3.7	Controlling the program run .....	68
3.7.1	Program control.....	68
3.7.2	Skip blocks .....	70
3.8	Editing programs .....	71
3.8.1	Overview .....	71
3.8.2	Searching in programs .....	72
3.8.3	Replacing program text.....	73
3.8.4	Copying/pasting/deleting program blocks .....	74
3.8.5	Renumbering programs .....	75
3.8.6	Editor settings .....	75
3.9	Display G and auxiliary functions.....	77
3.9.1	Selected G functions .....	77
3.9.2	All G functions .....	79
3.9.3	Auxiliary functions .....	80
3.10	Status of synchronized actions .....	80
3.11	Settings for automatic mode .....	82
3.11.1	Defining the dry run feedrate .....	82
<b>4</b>	<b>Teaching in programs .....</b>	<b>83</b>
4.1	Overview .....	83
4.2	General sequence.....	83
4.3	Inserting blocks .....	84



4.3.1	Teach-in via Windows.....	85
4.3.1.1	General information .....	85
4.3.1.2	Teach in rapid traverse G0 .....	86
4.3.1.3	Teach in straight G1.....	86
4.3.1.4	Teaching in circle intermediate and circle end point CIP.....	87
4.3.1.5	A-spline teach in (option) .....	87
4.3.2	Input parameters for teach-in blocks .....	89
4.4	Changing blocks .....	90
4.5	Block selection .....	92
4.6	Deleting blocks.....	93
4.7	Parameter settings.....	94
4.7.1	Settings for teach-in .....	94
<b>5</b>	<b>Setting data .....</b>	<b>95</b>
5.1	Specify working area limitations.....	95
<b>6</b>	<b>User data .....</b>	<b>97</b>
6.1	Introduction .....	97
6.2	R parameters .....	98
6.3	Displaying global user data (GUD) .....	99
6.4	Displaying channel GUDs .....	101
6.5	Displaying local user data (LUD) .....	102
6.6	Displaying program user data (PUD).....	103
6.7	Searching for user data.....	103
6.8	Defining and activating user data.....	104
<b>7</b>	<b>Tool management.....</b>	<b>107</b>
7.1	Overview .....	107
7.2	Tool list.....	108
7.2.1	Additional data for tools .....	109
7.2.2	Entering new tools in the tool list .....	110
7.2.3	Managing several cutting edges .....	112
7.2.4	Deleting cutting edges .....	113
7.2.5	Deleting tools .....	114
7.2.6	Loading and unloading tools.....	114
7.2.7	Selecting a magazine.....	116
7.3	Tool wear .....	118
7.3.1	Reactivating tools.....	119
7.4	Tool data OEM .....	120
7.5	Magazine.....	121
7.5.1	Position magazine.....	122
7.5.2	Relocating tools .....	122
7.6	Sorting tool management lists.....	124
<b>8</b>	<b>Program management.....</b>	<b>125</b>
8.1	Overview .....	125
8.1.1	NC memory .....	126

8.1.2	Local drive .....	127
8.1.3	USB drives .....	127
8.2	Opening and closing a program .....	127
8.3	Executing a program .....	129
8.4	Creating directories/programs .....	130
8.4.1	Creating a new directory .....	130
8.4.2	Creating a new workpiece .....	131
8.4.3	Creating a new G code program .....	132
8.4.4	Storing any new file .....	133
8.5	Selecting several directories/programs .....	134
8.6	Copying and pasting directories/programs .....	136
8.7	Deleting directories/programs .....	138
8.8	Renaming file and directory properties .....	139
8.9	Templates .....	139
8.9.1	Creating templates .....	139
8.10	Backing up data .....	141
8.10.1	Creating archives .....	141
8.10.2	Importing data .....	142
<b>9</b>	<b>HT8 .....</b>	<b>145</b>
9.1	Traversing keys .....	147
9.2	Machine control panel menu .....	149
9.3	Virtual keyboard .....	150
9.4	Calibrating the touch panel .....	152
<b>10</b>	<b>PCU 321 .....</b>	<b>153</b>
10.1	Overview .....	153
10.2	Basic Functions .....	154
<b>11</b>	<b>Alarm, error, and system messages .....</b>	<b>157</b>
11.1	Displaying alarms .....	157
11.2	Displaying messages .....	159
11.3	Displaying version data .....	160
<b>A</b>	<b>Appendix .....</b>	<b>161</b>
A.1	Correction sheet - fax template .....	161
A.2	Overview .....	162
	<b>Index .....</b>	<b>163</b>

**Tables**

Table 1-1	Keys of the operator panel .....	13
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# Introduction

## 1.1 Product overview

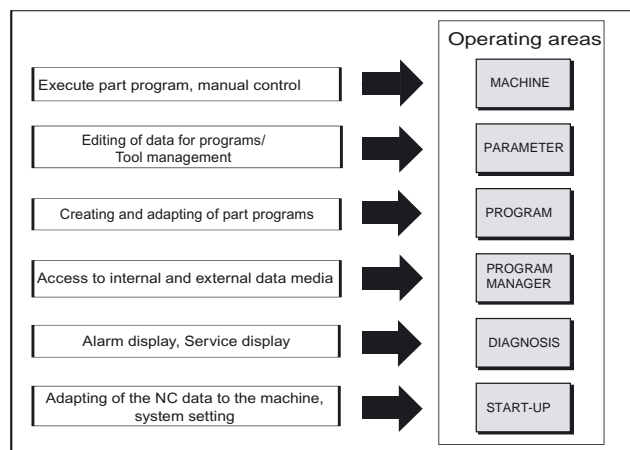
The SINUMERIK controller is a CNC (Computerized Numerical Control) control system for machine tools.

You can use the CNC control system to implement the following basic functions in conjunction with a machine tool:

- Creation and adaptation of part programs
- Execution of part programs
- Manual control
- Access to internal and external data media
- Editing of data for programs
- Displaying and troubleshooting alarms
- Editing of machine data

### Operating areas

The basic functions are grouped in the following operating areas in the control:



## 1.2 Operator panel fronts

### 1.2.1 Overview

#### Introduction

The display (screen) and operation (e.g. hardkeys and softkeys) of the HMI sl operator interface occurs via the panel front.

In this example, the OP 010 operator panel front is used to illustrate the components that are available for operating the control and machine tool.

#### Operator controls and indicators

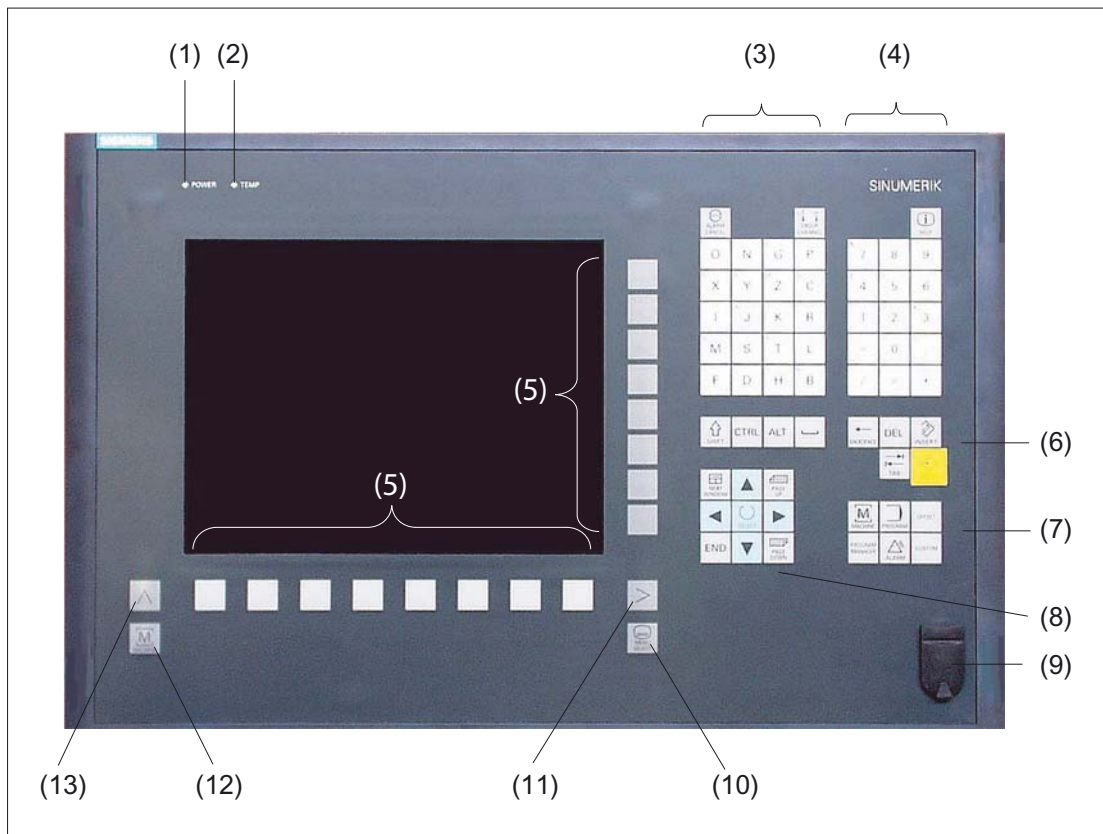


Figure 1-1 View of OP 010 operator panel front

- 1 Status LED: POWER
- 2 Status LED: TEMP  
(illuminated LEDs indicate increased wear)
- 3 Alphabetic key group

- 4 Numerical key group
- 5 Softkeys
- 6 Control key group
- 7 Hotkey group
- 8 Cursor key group
- 9 USB interface
- 10 Menu Select key
- 11 Menu forward button
- 12 Machine area button
- 13 Menu back button

## References







An exact description as well as a view of the other serviceable panel fronts may be found in /BH/, Equipment Manual Panel Components 840D sl/840 Di sl


















## 1.2.2 Keys of the operator panel




The following buttons are available for operation of the control and the machine tool.

### Keys

Table 1-1 Keys of the operator panel

Key	Function
	<b>ALARM CANCEL</b> Cancel alarms and messages that are marked with this symbol.
	<b>CHANNEL</b> Select channel or continue.
	<b>HELP</b> No function.
	<b>NEXT WINDOW</b> Continue to next window.
	<b>PAGE UP or PAGE DOWN</b> Page up or down in a screen.
	

Key	Function
	<b>Cursor</b> Input focus/cursor between different fields. Navigate rows or characters.
	Use the right cursor to open a directory or program in the editor. Use the left cursor to switch to a higher level in the directory tree.
	<b>SELECT</b> Choose one of a number of options presented. Select an element.
	<b>END</b> Moves the cursor to the last input field in a parameterization screen form or table.
	<b>BACKSPACE</b> Delete the value in the input field. In insertion mode, it deletes the character after the cursor.
	<b>TAB</b> Indent the cursor by several characters.
	<b>SHIFT</b> Depress the Shift key to enter the upper character shown on the dual input keys.
	<b>CTRL</b> Use the following key combinations to navigate in the G code editor: <ul style="list-style-type: none"> <li>• &lt;Ctrl + Home&gt; : Jump to the beginning.</li> <li>• &lt;Ctrl + End&gt; : Jump to the end.</li> </ul> Selection
	<b>ALT</b> Irrelevant
	<b>DEL</b> <ul style="list-style-type: none"> <li>• Delete the value in the input field.</li> <li>• In insertion mode, it deletes the character after the cursor.</li> </ul>
	<b>INSERT</b> Activate insertion mode.
	<b>INPUT</b> <ul style="list-style-type: none"> <li>• Finish the entry of a value in the input field.</li> <li>• Open a directory or program.</li> </ul>
	<b>ALARM - only OP 010 and OP 010C</b> Irrelevant
	<b>PROGRAM - only OP 010 and OP 010C</b> Irrelevant
	<b>OFFSET - only OP 010 and OP 010C</b> Irrelevant.
	<b>PROGRAM MANAGER - only OP 010 and OP 010C</b> Irrelevant.
	<b>Menu back key</b> Jump to the next highest menu level.

Key	Function
	<b>MACHINE</b> Open the "Machine" operating area.
	<b>Menu forward key</b> Advance the horizontal softkey bar.
	<b>MENU SELECT</b> Call the main menu for operating area selection.

## 1.3 Machine control panels

### 1.3.1 Overview

The machine tool can be equipped with a machine control panel by Siemens or with a specific machine control panel from the machine manufacturer.

You use the machine control panel to initiate actions on the machine tool such as traversing an axis or starting the machining of a workpiece.

### 1.3.2 Controls on the machine control panel

In this example, the MCP 483C IE machine control panel is used to illustrate the operator controls and displays of a Siemens machine control panel.

#### Overview

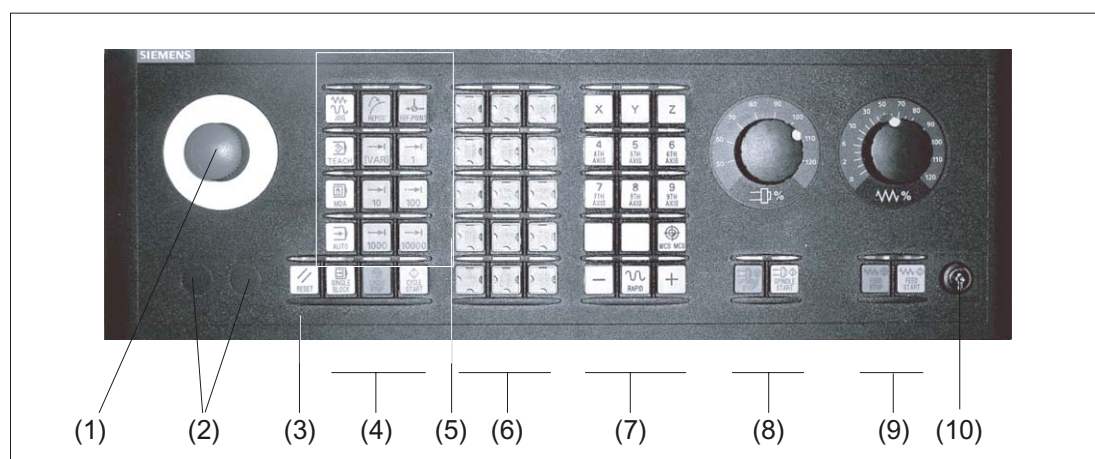
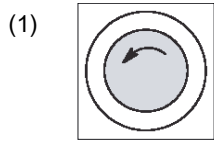


Figure 1-2 Front view of machine control panel (milling version)



**EMERGENCY STOP button**

Activate the button in situations where

- life is at risk.
- there is the danger of a machine or workpiece being damaged.

All drives will be stopped with the greatest possible braking torque.



**Machine manufacturer**

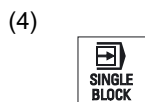
For additional responses to pressing the Emergency Stop button, please refer to the machine manufacturer's instructions.



**Installation locations for control devices (d = 16 mm)**

**RESET**

- Stop processing the current programs.  
The NCK control remains synchronized with the machine. It is in its initial state and ready for a new program run.
- Cancel alarm.



**Program control**

**SINGLE BLOCK**

Single block mode on/off.



**CYCLE START**

Starts execution of a program.



**CYCLE STOP**

Stops execution of a program.



**Operating modes, machine functions**

**JOG**

Select "JOG" mode.



**TEACH IN**

Select "Teach In" submode.



**MDA**

Select "MDA" mode.



**AUTO**

Select "AUTO" mode.



**REPOS**

Repositions, re-approaches the contour.



**REF POINT**

Approach reference point.



**Inc VAR (incremental feed variable)**

Incremental mode with variable increment size.



**Inc (Incremental feed)**

Incremental mode with predefined increment size of 1, ..., 10000 increments.



**Machine manufacturer**

A machine data code defines how the increment value is interpreted.













**Customer keys**

T1 to T15



**Traversal axes with rapid traverse superposition and coordinate exchange**



		<b>Axis keys</b> Selects an axis.
	...	
		
		<b>Direction keys</b> Select the traversing direction.
	...	
		
		<b>RAPID</b> Traverse axis in rapid traverse while pressing the direction key.
		<b>WCS MCS</b> Switches between the workpiece coordinate system (WCS = work) and machine coordinate system (MCS = machine).
(8)		<b>Spindle control with override switch</b> <b>SPINDLE STOP</b> Stop spindle.
		<b>SPINDLE START</b> Spindle is enabled.
(9)		<b>Feed control with override switch</b>
		<b>Feed Stop</b> Stops execution of the running program and shuts down axis drives.
		<b>Feed Start</b> Enable for program execution in the current block and enable for ramp-up to the feedrate value specified by the program.
(10)		<b>Keyswitch (four positions)</b>

## 1.4 Operator interface

### Overview

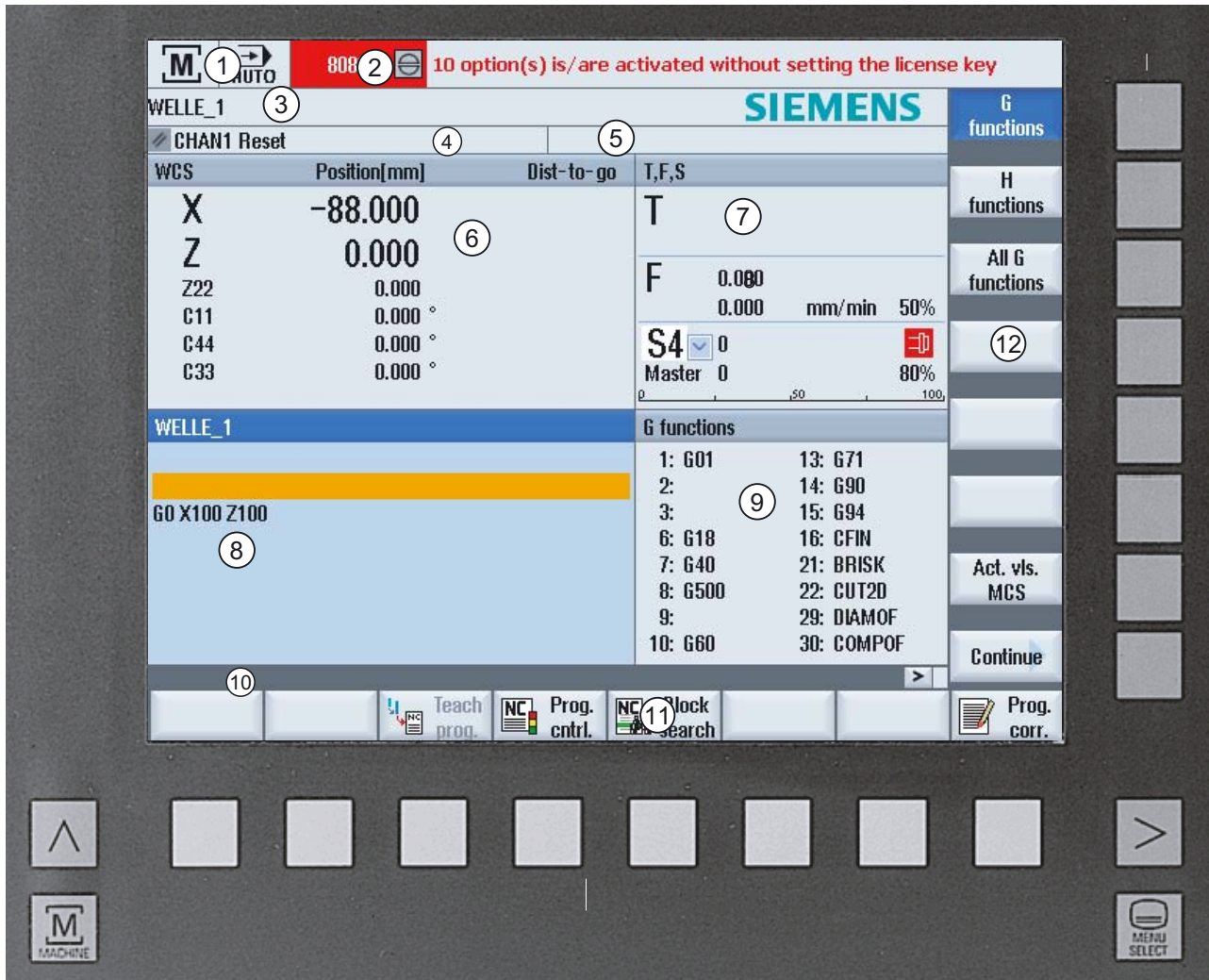


Figure 1-3 Operator interface

- 1 Active operating area and mode
- 2 Alarm/message line
- 3 Program name
- 4 Channel state and program control
- 5 Channel operational messages
- 6 Axis position display in actual value window

- 7 Display for
  - active tool T
  - current feedrate F
  - current spindle condition
- 8 Operating window with program block display
- 9 Display of G functions, H functions, and input windows for different functions (e.g., program control).
- 10 Dialog line to provide additional user notes
- 11 Horizontal softkey bar
- 12 Vertical softkey bar

### 1.4.1 Status display

The status display includes the most important information about the current machine status and the status of the NCK. It also shows alarms as well as NC and PLC messages.

Depending on your operating area, the status display is made up of several lines:

- Large status display




The status display is made up of three lines in the "Machine" operating area.











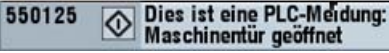
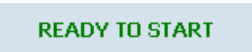
- Small status display

In the "Parameter", "Program", "Program Manager", "Diagnosis" and "Start-up" operating areas, the status display consists of the first line from the large display.

#### Status display of "Machine" operating area

##### First line

Display	Description
Active operating area	
	"Machine" operating area With touch operation, you can change the operating area here.
	"Parameter" operating area
	"Program" operating area

	"Program manager" operating area
	"Diagnosis" operating area
	"Start-up" operating area
Active mode or submode	
	"Jog" mode
	"MDA" mode
	"Auto" mode
	"Teach In" submode
	"Repos" submode
	"Ref Point" submode
Alarms and messages	
	<p>Alarm display</p> <p>The alarm numbers are displayed in white lettering on a red background. The associated alarm text is shown in red lettering.</p> <p>An arrow indicates that several alarms are active.</p> <p>An acknowledgment symbol indicates that the alarm can be acknowledged or canceled.</p>
	<p>NC or PLC message</p> <p>Message numbers and texts are shown in black lettering.</p> <p>An arrow indicates that several messages are active.</p>
	<p>Messages from NC programs do not have numbers and appear in green lettering.</p>

Second line







Display	Description
TEST_TEACHEN	Program path and program name

The displays in the second line can be configured.

**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**Third line**

Display	Description
 <b>CHAN1 RESET</b>	Display of channel status. If several channels are present on the machine, the channel name is also displayed. If only one channel is available, only the "Reset" channel status is displayed. With touch operation, you can change the channel here.
  	Display of channel status: The program was aborted with "Reset". The program is started. The program has been interrupted with "Stop".
<b>DRYPRT</b>	Display of active program controls: PRT: no axis motion DRY: Dry run feedrate M01: programmed stop 1 M101: programmed stop 2 (name varies) SB1: Single block, coarse (program stops only after blocks which perform a machine function) SB2: Data block (program stops after each block) SB3: Single block, fine (program also only stops after blocks which perform a machine function in cycles)
 <b>Faulty NC block / user alarm</b>  <b>Remaining dwell time: 15 Sec.</b>	Channel operational messages: Stop: An operator action is usually required. Wait: No operator action is required.

The machine manufacturer settings determine which program controls are displayed.

**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**See also**

Channel switchover (Page 36)

Touch operation (Page 29)

**1.4.2 Actual value window**

The actual values of the axes and their positions are displayed.

**WCS/MCS**

The displayed coordinates are based on either the machine coordinate system or the workpiece coordinate system. The machine coordinate system (MCS), in contrast to the workpiece coordinate system (WCS), does not take any zero-point offsets into consideration.

You can use the "MCS actual values" softkey to toggle between the machine coordinate system and the workpiece coordinate system.

The actual value display of the positions can also refer to the SZS coordinate system (settable zero system). However the positions are still output in the WCS.



**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**Maximize display**



Press the ">>" and "Zoom act.val." softkeys.

...



**Overview of display**

Display	Description
Header columns	
WCS/MCS	Display of axes in selected coordinate system
Item	Position of displayed axes.
Display of distance-to-go	The distance-to-go for the current NC block is displayed while the program is running.
Feed/override	The feedrate acting on the axes is displayed along with the override.

Display	Description
Repos offset	The distances traversed in manual mode are displayed. This information is only displayed when you are in the "Repos" submode.
Footer	Display of active zero offsets and transformations as well as the T,F,S values.

## See also

Coordinate system (MCS/WCS) (Page 39)


### 1.4.3 T,F,S window

The most important data concerning the current tool, the feedrate (path feed or axis feed in JOG) and the spindle are displayed in the T, F, and S windows.

#### Tool data

Display	Description
T	
Tool name	Name of current tool
Location	Location number of current tool
D	Cutting edge of the current tool
∅	Diameter of current tool

#### Feed data

Display	Description
F	
	Feed disable/rapid traverse reduction
	Actual feed value If several axes are traversing, the largest axis feed will be displayed
Rapid traverse	G0 is active
0,000	No feed is active
Override	Display as a percentage

## Spindle data

Display	Description
<b>S</b>	
S1	Spindle selection, identification with spindle number and main spindle
Speed	Actual value (when spindle turns, display increases) Setpoint (always displayed, also during positioning)
Icon	Spindle condition (spindle disable, spindle stop, clockwise rotation, counter-clockwise rotation, positioned, axis mode)
Override	Display as a percentage
Spindle utilization rate	Display between 0 and 100% The upper limit can also display 200%. See machine manufacturer's specifications.

### 1.4.4 Program block display

The window of the current block display shows you the program blocks currently being executed.

#### Display of current program

The following information is displayed in the running program:

- The workpiece name or program name is entered in the title row.
- Three blocks of the current program are displayed.
- The program block which is just being processed appears colored.

#### See also

Correcting programs (Page 62)



## 1.4.5 Operation via softkeys and buttons

### Operating areas/operating modes

The operator interface consists of different windows featuring 8 horizontal and 8 vertical softkeys.

You operate the softkeys with the keys next to the softkey bars.

You can display a new window or execute functions using the softkeys.

HMI sl is divided into 6 operating areas (machine, parameter, program, program manager, diagnosis, startup) and 5 operating modes or submodes (JOG, MDA, AUTO, TEACH In, REF POINT, REPOS).

### Changing the operating area



Press the "MENU SELECT" key and select the desired operating area using the horizontal softkey bar.

You can call the "Machine" operating area directly using the key on the operator panel.




Select the "Machine" operating area


### Changing the operating mode

You can select a mode or submode directly using the keys on the machine control panel or using the vertical softkeys in the main menu.

### General keys and softkeys



When the  symbol appears to the right of the dialog line on the operator interface, you can change the horizontal softkey bar within an operating area. To do so, press the menu forward key.

The  symbol indicates that you are in the expanded softkey bar. Pressing the key again will take you back to the original horizontal softkey bar.



You use the ">>" softkey to open a new vertical softkey bar.



Press the "<<" softkey to return to the previous vertical softkey bar.



You use this softkey to close the open window.



Use the "Cancel" softkey to exit a window without accepting the entered values and return to the next highest window.



When you have entered all the necessary parameters in the parameter screen form correctly, you can close the window and save the parameters using the "Accept" softkey. The values you entered are applied to a program.



Use the "OK" softkey to initiate an action immediately, e.g., to rename or delete a program.

### See also

Controls on the machine control panel (Page 15)

Channel switchover (Page 36)

## 1.4.6 Entering parameters

On setting up the machine and during programming, you must enter values in the white fields for various parameters. Parameters that have a gray input field are automatically calculated.

### Selecting parameters

Some parameters require you to select from a number of options in the input field. Fields of this type do not allow you to type in a value.

### Selecting the unit

For certain parameters, you can choose from among different units.

### Proceed as follows



1. Keep pressing the "SELECT" key until your preferred setting or unit is selected.

The "SELECT" key only works if there are several selection options available.



2. Enter a numerical value.
3. Press the "INPUT" key to finish the parameter input.

### Changing or calculating parameters

If you only want to change individual characters in an input field rather than overwriting the entire entry, switch to insertion mode. In this mode, the pocket calculator is also active. You can use it during programming to calculate parameter values.



Press the "INSERT" key.  
Insertion mode and the pocket calculator are activated.



...

You can navigate within the input field using the "Left cursor" and "Right cursor" keys.



...

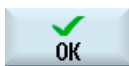
Use the "BACKSPACE" or "DEL" key to delete individual characters.



### Accepting parameters

When you have correctly entered all necessary parameters, you can close the window and save your settings.

You cannot accept the parameters if they are incomplete or obviously erroneous. In this case, you can see from the dialog line which parameters are missing or were entered incorrectly.



Press the "OK" softkey.

- OR -



Press the "Accept" softkey.

- OR -



Press the "Left cursor" key.

### 1.4.7 Context menu

When you right-click, the context menu opens and provides the following functions:

- Copy Ctrl+C
- Paste Ctrl+V

## 1.4.8 Touch operation

If you have an operator panel with a touch screen, you can perform the following functions with touch operation:

### Operating area switchover



...

You can display the operating area menu by touching the display symbol for the active operating area in the status display.



### Channel switchover



You can switch over to the next channel by touching the channel display in the status display.

## 1.4.9 Pocket calculator

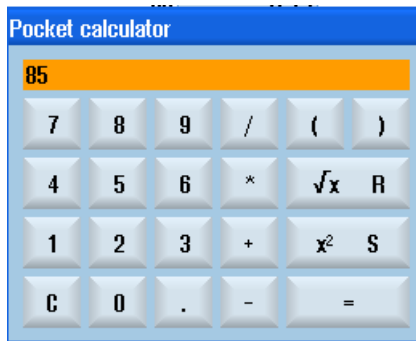
You can use the pocket calculator to quickly calculate parameter values during programming. If, for example, the diameter of a workpiece is only dimensioned indirectly in the workpiece drawing, i.e., the diameter must be derived from the sum of several other dimension specifications, you can calculate the diameter directly in the input field of this parameter.

### Calculation methods

The following arithmetic operations are available:

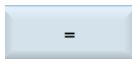
- Addition
- Subtraction
- Multiplication
- Division
- Calculation with parentheses
- Square root of x
- x squared

You can input a maximum of 256 characters in a field.



Proceed as follows

1. Position the cursor on the desired input field.
2. Press the equals sign.  
The pocket calculator is displayed.
3. Input the arithmetic statement.  
You can use arithmetic symbols, numbers, and commas.
4. Press the "=" softkey.



- OR -



Press the "Calculate" softkey.

- OR -



Press the "INPUT" key.

The new value is calculated and displayed in the input field of the pocket calculator.



5. Press the "Accept" softkey.  
The calculated value is accepted and displayed in the input field of the window.

---

**Note**

**Input order for functions**

When using the square root or squaring functions, make sure to press the "R" or "S" function keys, respectively, before entering a number.

---

See also

Entering parameters (Page 27)

### 1.4.10 Protection levels

The input and modification of vital data in the control system is protected by passwords.

#### Access protection via protection levels








The input or modification of data for the following functions depends on the protection level setting:



- Tool offsets
- Work offsets
- Setting data
- Program creation / program editing

For additional information, please refer to the following documentation:

/IHsl/ HMI sl / SINUMERIK 840D sl commissioning manual

#### Softkeys

Softkey	Protection levels
Program Manager operating area	
	3
	4
Startup operating area	
	7
	4
	4
	4
	2

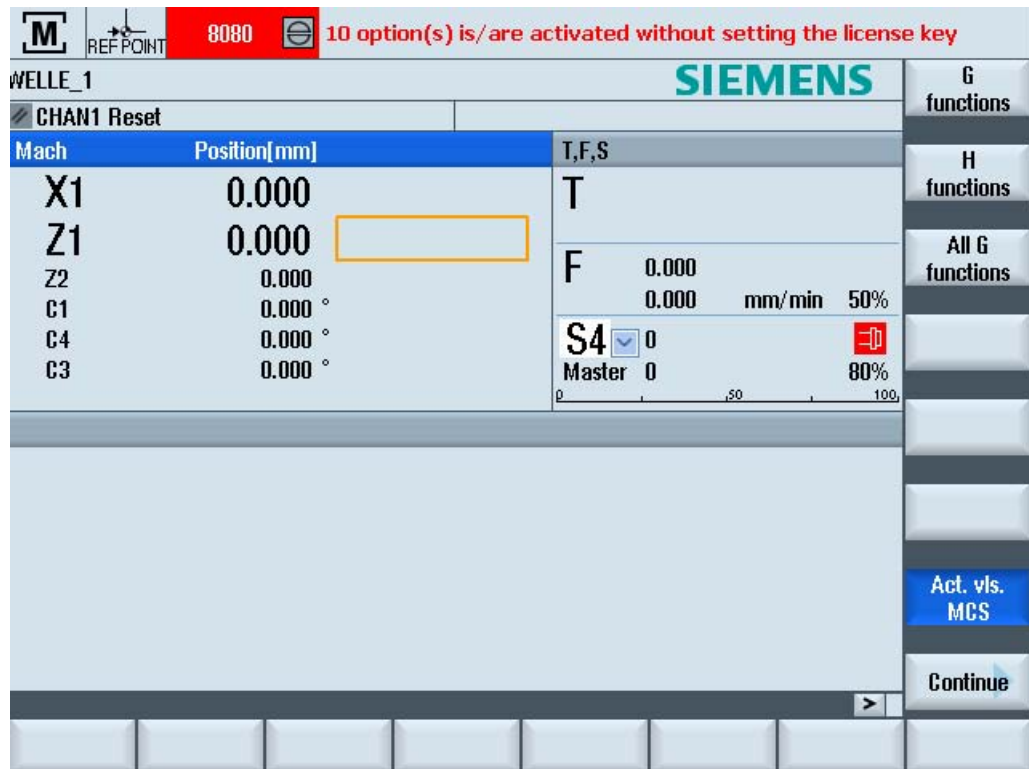
Softkey	Protection levels
	3
	3



## Setting up the machine

### 2.1 Switching on and switching off

#### Start-up



When the control starts up, the main screen opens according to the operating mode specified by the machine manufacturer. In general, this is the main screen for the "REF POINT" submode.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

## 2.2 Modes of operation

### 2.2.1 General information

You can work in three different operating modes.

#### "JOG" mode

"JOG" mode is used for the following preparatory actions:

- Reference point approach, i.e. calibration of the position measuring system
- Preparing a machine for executing a program in automatic mode, i.e. measuring tools, measuring the workpiece and, if necessary, defining the work offsets used in the program
- Traversing axes, e.g. during a program interruption
- Positioning axes

#### Select "JOG"



Press the "JOG" key.

#### "Ref Point" submode

The "REF POINT" submode is used to synchronize the control and the machine. For this purpose, you approach the reference point in "JOG" mode.

#### Selecting "REF POINT"



Press the "REF POINT" key.

#### "REPOS" submode

The "REPOS" submode is used for repositioning to a defined position. After a program interruption (e.g. to correct tool wear values) move the tool away from the contour in "JOG" mode.

The distances traversed in "JOG" mode are displayed in the actual value window as the "Repos" offset.

"REPOS" offsets can be displayed in the machine coordinate system (MCS) or workpiece coordinate system (WCS).

### Selecting "Repos"



Press the "REPOS" key.

### "MDA" mode (Manual Data Automatic)

In "MDA" mode, you can enter and execute G code commands non-modally to set up the machine or to perform a single action.

### Selecting "MDA"



Press the "MDA" key.

### "AUTO" mode

In automatic mode, you can execute a program completely or only partially.

### Select "AUTO"



Press the "AUTO" key.

### "TEACH IN" submode

The "TEACH IN" submode is available in the "AUTO" and "MDA" modes.

There you may create, edit and execute part programs (main programs or subroutines) for motional sequences or simple workpieces by approaching and saving positions.

### Selecting "Teach In"



Press the "TEACH IN" key.

### 2.2.2 Channel switchover

It is possible to switch between channels when several are in use. Since individual channels may be assigned to different mode groups, a channel switchover command is also an implicit mode switchover command.

#### Channel switchover



Press the "CHANNEL" key.

The channel changes over to the next channel.

#### Channel switchover via touch operation

On the HT8 and when using a touch screen operating panel, you can switch to the next channel via touch operation in the status display.

#### See also

HT8 overview (Page 145)

## 2.3 Approaching a reference point

### 2.3.1 Reference axes

Your machine tool can be equipped with an absolute or incremental path measuring system. An incremental path measuring system must be calibrated after being switched on, but an absolute path measuring system does not.

For the incremental path measuring system, all the machine axes must therefore first approach a reference point, the coordinates of which are known to be relative to the machine zero-point.

#### Sequence

Prior to the approach, the axes must be in a position from where they can approach the reference point without a collision.

The sequence or direction is defined by the PLC program.

The axes can also all approach the reference point simultaneously, depending on the manufacturer's settings.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

---

#### Notice

If the axes are not in a collision-free position, you must first traverse them to safe positions in "JOG" or "MDA" mode.

You must follow the axis motions directly on the machine!

Ignore the actual value display until the axes have been referenced!

The software limit switches are not active!

---

#### Proceed as follows

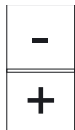


1. Press the "JOG" key.



2. Press the "REF POINT" key.

3. Select the axis to be traversed.



4. Press the "+" or "-" key.

The selected axis moves to the reference point.

If you have pressed the wrong direction key, the action is not accepted and the axes do not move.



A symbol is shown next to the axis if it has been referenced.

The axis is referenced as soon as the reference point is reached. The actual value display is set to the reference point value.

From now on, path limits, such as software limit switches, are active.

End the function via the machine control panel by selecting operating mode "AUTO" or "JOG".

### 2.3.2 User agreement

If you are using Safety Integrated (SI) on your machine, you will need to confirm that the current displayed position of an axis corresponds to its actual position on the machine when you reference an axis. Your confirmation is the precondition for the availability of other Safety Integrated functions.

You can only give your user agreement for an axis after it has approached the reference point.

The displayed axis position always refers to the machine coordinate system (MCS = machine).

#### Option

User agreement with Safety Integrated is only possible with a software option.

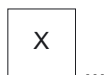
#### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "REF POINT" key.



3. Select the axis to be traversed.



4. Press the "+" or "-" key.  
The selected axis moves to the reference point and stops. The coordinate of the reference point is displayed.



The axis is marked with



5. Press the "User agreement" softkey.

The "User acknowledge" window opens.

It shows a list of all machine axes with their current position and SI position.

5. Position the cursor in the "Agreement" field for the axis in question.



6. Activate the agreement with the "SELECT" key.

The selected axis is marked with an "x" meaning "safely referenced" in the "Agreement" column.



By pressing the "SELECT" key, you deactivate the agreement again.

## 2.4 Settings for the machine

### 2.4.1 Coordinate system (MCS/WCS)

The coordinates in the actual value display are relative to either the machine coordinate system or the workpiece coordinate system.

By default, the workpiece coordinate system is set as a reference for the actual value display.

The machine coordinate system (MCS), in contrast to the workpiece coordinate system (WCS), does not take any zero-point offsets into consideration.

#### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "JOG" or "AUTO" key.



3. Press the "Act.vls. MCS" softkey.



The machine coordinate system is selected.  
The title of the actual value window changes in the MCS.

## 2.5 Work offsets

### 2.5.1 Overview

Following reference point approach, the actual value display for the axis coordinates is based on the machine zero of the machine coordinate system (MCS).

The program for machining the workpiece, however, is based on the workpiece zero of the workpiece coordinate system (WCS). The machine zero and workpiece zero are not necessarily identical. The distance between the machine zero and workpiece vary in accordance with the type of tool and how it is clamped. This zero offset is taken into account during execution of the program and can be a combination of different offsets.

When the machine zero is not identical to the workpiece zero, at least one offset (base offset or work offset) exists in which the position of the workpiece zero is saved.

#### Base offset

The base offset is a work offset that is always active. If you have not defined a base offset, its value will be zero. The base offset is specified in the "Zero offset - Base" window.

#### Coarse and fine offsets

Every zero offset (G54 to G57, G505 to G599) consists of a coarse offset and a fine offset. You can call the zero offsets from any program (coarse and fine offsets are added together).

You can save the workpiece zero, for example, in the coarse offset, and then store the offset that occurs when a new workpiece is clamped between the old and the new workpiece zero in the fine offset.

### 2.5.2 Display active zero offset

The current active offsets and all active system offsets are displayed for all set-up axes in the "Zero offset - Active" window.

This window is generally used only for monitoring.

#### Display of active zero offsets

Work offsets	
Set zero offset	Display of active system offsets. You can alter the data under certain circumstances, i.e. you can correct a zero point. Access to the system offsets is protected via a keyswitch.
Entire Base ZO	Display of all active base offsets, as well as rotation, scaling and mirroring if these are set. You cannot edit these values here.



Work offsets	
G54 ...G599	Display of all zero offsets activated with G54 - G599, as well as rotation, scaling and mirroring if these are set. You cannot edit these values here.
Prog. ZO	Display of all additional zero offsets programmed with \$P_PFRAME=, as well as rotation, scaling and mirroring if these are set.
Frame cycles	Display of all additional zero offsets activated via \$MC_MM_SYSTEM_FRAME_MASK.
Entire ZO	Display of the active zero offset, representing the sum of all zero offsets, as well as rotation, scaling and mirroring if these are set.

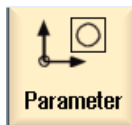
The availability of the offsets depends on the setting.



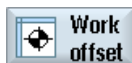
**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**Proceed as follows**



1. Select the "Parameter" operating area.



2. Press the "Work offset" softkey.  
The "Work offset - Active" window is opened.

**Note**

**Further details on zero offsets**

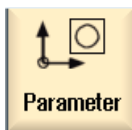
If you would like to see further details about the specified offsets or if you would like to change values for the rotation, scaling or mirroring, press the "Details" softkey.

### 2.5.3 Displaying and editing base zero offset

The defined channel-specific and global base offsets, divided into coarse and fine offsets, are displayed for all set-up axes in the "Work offset - Base" window.

The rotation, scaling and mirroring are displayed if they are set.

Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Work offset" softkey.



3. Press the "Base" softkey.  
The "Zero offset - Base" window is opened.

4. You can edit the values directly in the table.

---

#### Note

##### Activate base offsets

The offsets specified here are immediately active.

---

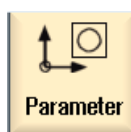
## 2.5.4 Displaying and editing settable zero offset

All settable offsets, divided into coarse and fine offsets, are displayed in the "Zero offset - G54..G599" window.

The current active zero offsets are displayed on a green background.

The rotation, scaling and mirroring are displayed if they are set.

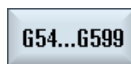
### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Work offset" softkey.



3. Press the "G54...G599" soft key.  
The "Zero offset - G54..G599" window is opened.
4. You can edit the values directly in the table.

---

### Note

#### Activate settable zero offsets

The settable zero offsets must first be selected in the program before they have an impact.

---

### 2.5.5 Displaying and editing details of the zero offsets

For each zero offset, you can display and edit all data for all axes. You can also delete zero offsets.

For every axis, values for the following data will be displayed:

- Coarse and fine offsets
- Rotation
- Scaling
- Mirroring

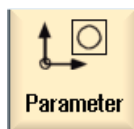
---

#### Note

Settings for rotation, scaling and mirroring are specified here and can only be changed here.

---

#### Proceed as follows



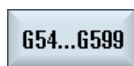
1. Select the "Parameter" operating area.



2. Press the "Work offset" softkey.



3. Press the "Active", "Base" or "G54...G599" softkey.  
The corresponding window appears.



4. Place the cursor on the desired zero offset to view its details.



5. Press the "Details" softkey.

A window opens, depending on the selected zero offset, e.g. "Zero offset - Details: G54 to G599".

6. You can edit the values directly in the table.

- OR -



Press the "Clear Offset" softkey to reset all entered values.



...



Press the "WO +" or "WO -" softkey to select the next or previous offset, respectively, within the selected area ("Active", "Base", "G54 to G599") without first having to switch to the overview window.

If you have reached the end of the range (e.g., G599), you will switch automatically to the beginning of the range (e.g., G54).

These value changes are available in the part program immediately or after "Reset".



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.



Press the "Back" softkey to close the window.

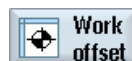
## 2.5.6 Deleting zero offsets

You have the option of deleting zero offsets. This resets the entered values.

### Proceed as follows



1. Select the "Parameter" operating area.

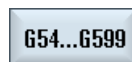


2. Press the "Work offset" softkey.



3. Press the "Active", "Base" or "G54...G599" softkey.

...



4. Press the "Details" softkey.



5. Position the cursor on the zero offset you would like to delete.

6. Press the "Clear Offset" soft key.

## 2.6 Manual mode

### 2.6.1 Traversing the axes

You can traverse the axes in manual mode via the Increment or Axis keys or handwheels.

During a traverse initiated from the keyboard, the selected axis moves at the programmed setup feedrate. During an incremental traverse, the selected axis traverses a specified increment.

#### Set the default feedrate

Specify the feedrate to be used for axis traversal in the set-up, in the "Settings for manual operation" window.

### 2.6.2 Traverse axes by a defined increment

You can traverse the axes in manual mode via the Increment and Axis keys or handwheels.

#### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "JOG" key.



3. Press keys 1, 10, etc. up to 10000 in order to move the axis in a defined increment.

The numbers on the keys indicate the traverse path in micrometers or micro-inches.

Example Press the "100" button for a desired increment of 100  $\mu\text{m}$  (= 0.1 mm).



4. Select the axis to be traversed.



5. Press the "+" or "-" key.

Each time you press the key the selected axis is traversed by the defined increment.

Feedrate and rapid traverse override switches can be operative.

---

### Note

When the control is switched on, the axes can be traversed right up to the limits of the machine as the reference points have not yet been approached and the axes referenced. Emergency limit switches might be triggered as a result.

The software limit switches and the working area limitation are not yet operative!

The feed enable signal must be set.

---



### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

### 2.6.3 Traversing axes by a variable increment

Proceed as follows



1. Select the "Machine" operating area.



Press the "JOG" key.

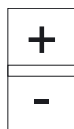


2. Press the "Settings" softkey.  
The "Settings for manual operation" window is opened.

3. Enter the desired value for the "Variable increment" parameter.  
Example Enter 500 for a desired increment of 500 µm (0.5 mm).



4. Press the "Inc VAR" key.



5. Select the axis to be traversed.  
6. Press the "+" or "-" key.  
Each time you press the key the selected axis is traversed by the set increment.

Feedrate and rapid traverse override switches can be operative.

### 2.6.4 Default settings for manual mode

Specify the configurations for manual mode in the "Settings for manual operation" window.

#### Presettings

Settings	Description
Type of feedrate	Here, you select the type of feedrate. <ul style="list-style-type: none"> <li>G94: Axis feedrate/linear feedrate</li> <li>G95: Rev. feedrate</li> </ul>
Default feedrate G94	Enter the desired feedrate in mm/min.
Default feedrate G95	Enter the desired feedrate in mm/r.
Variable increment	Enter the desired increment for axis traversal by variable increments.
Spindle speed	Enter the desired spindle speed in rpm.



Proceed as follows



1. Select the "Machine" operating area.



2. Press the "JOG" key.



3. Press the menu forward key and the "Settings" softkey.  
The "Settings for manual operation" window is opened.



## 2.7 Handwheel

### 2.7.1 Handwheel assignment

You can traverse the axes in the machine coordinate system (MCS) or in the workpiece coordinate system (WCS) via the handwheel.

All axes are provided in the following order for handwheel assignment:

- Geometry axes
- Channel machine axes



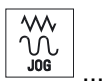
#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

#### Proceed as follows



1. Select the "Machine" operating area.



Press the "JOG", "AUTO", or "MDA" key.



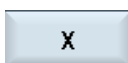
2. Press the menu forward key and the "Handwheel" softkey.

The "Handwheel" window appears.

A field for axis assignment will be offered for every connected handwheel.



3. Place the cursor in the field next to the handwheel with which you wish to assign the axis (e.g. no. 1).



4. Press the corresponding softkey to select the desired axis (e.g. "X").

- OR



To open the "Axis" selection box using the "INSERT" key, navigate to the desired axis, and press the "INPUT" key.



Selecting an axis also activates the handwheel (e.g., "X" is assigned to handwheel no. 1 and is activated immediately).



5. Press the "Handwheel" softkey again.

- OR -



Press the "Back" softkey.

The "Handwheel" window closes.

## Deactivate handwheel



1. Place the cursor on the handwheel whose assignment you wish to cancel (e.g., no. 1).
2. Press the softkey for the assigned axis again (e.g. "X").

- OR -



To open the "Axis" selection box using the "INSERT" key, navigate to the empty field, and press the "INPUT" key.



Clearing an axis selection also clears the handwheel selection (e.g., "X" is cleared for handwheel no. 1 and is no longer active).

## 2.8 MDA

In "MDA" mode (Manual Data Automatic mode), you can enter G-code commands block-by-block and immediately execute them for setting up the machine.

You can load an MDA program straight from the Program Manager into the MDA buffer. You may also store programs which were rendered or changed in the MDA operating window into any directory of the Program Manager.

### 2.8.1 Loading an MDA program from the Program Manager

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "MDA" key.

The MDI editor opens.



3. Press the "Load save" softkey.

A changeover is made into the Program Manager.

4. Select the program that you would like to edit or execute in the MDA window.



5. Press the "Copy into MDA" softkey.

A changeover occurs back to the MDA window, and the program is ready for editing.

## 2.8.2 Saving an MDA program

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "MDA" key.

The MDA editor opens.

3. Create the MDA program by entering the G-code commands using the operator's keyboard.



4. Press the "Load save" softkey.

A changeover is made into the Program Manager.

5. Select the drive on which you want to save the MDA program you created, and select the directory in which the program is to be saved.



6. Press the "Save from MDA" softkey.

When you place the cursor on a folder, a window opens which prompts you to assign a name.

- OR -

When you place the cursor on a program, you are asked whether the file should be overwritten.



7. Enter the name for the rendered program and press the "OK" softkey.  
The program will be saved under the specified name in the selected directory.

### 2.8.3 Executing an MDA program

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "MDA" key.  
The MDA editor opens.



3. Input the desired G-code commands using the operator's keyboard.  
4. Press the "CYCLE START" key.

The control executes the input blocks.

When executing the G-code commands, you can control the sequence as follows:

- Executing the program block-by-block
- Testing the program  
Settings under program control
- Setting the test-run feedrate  
Settings under program control

#### See also

Program control (Page 68)

## 2.8.4 Deleting an MDA program

You can delete the program created in MDA mode.

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "MDA" key.

The MDI editor opens.



3. Input the desired G-code commands using the operator's keyboard.
4. Press the "Delete MDI buffer" soft key.

The program displayed in the program window is deleted.



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## Machine the workpiece

### 3.1 Starting program execution

#### 3.1.1 Starting and stopping machining

During execution of a program, the workpiece is machined in accordance with the programming on the machine. After the program is started in automatic mode, workpiece machining is performed automatically.

#### Prerequisites

The following prerequisites must be met before executing a program:

- The measuring system of the control is referenced with the machine.
- The necessary tool offsets and zero offsets have been entered.
- The necessary safety interlocks implemented by the machine manufacturer are activated.

#### General sequence



1. Use the Program manager to select the desired program.



Select the desired program under "NC". If necessary, it must first be copied to "NC".



3. Press the "Select" softkey.  
The program is selected for execution and automatically switched to the "Machine" operating area.



4. Press the "CYCLE START" key.  
The program is started and executed.

---

**Note**

**Starting the program in any operating area**

If the control is in "AUTO" mode, you can also start the selected program when you are in any operating area.

---

**Stopping machining**



Press the "CYCLE STOP" key.

Machining stops immediately. Individual program blocks are not executed to the end. On the next start, machining is resumed from the point where it left off

**Canceling machining**



Press the "RESET" key.

Execution of the program is interrupted. On the next start, machining will start from the beginning.



**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

### 3.1.2 Selecting a program

Proceed as follows



1. Select the "Program manager" operating area.  
The directory overview is opened.



2. Place the cursor on the directory containing the program that you want to select.
3. Press the "INPUT" key

- OR -



Press the "Cursor right" key.

The directory contents are displayed.



4. Place the cursor on the desired program.
5. Press the "Select" softkey.  
The program is selected.

When the program has been successfully selected, an automatic changeover to the "Machine" operating area occurs.

## 3.2 Program running-in

### 3.2.1 Executing single blocks

When running-in a program, the system can interrupt the machining of the workpiece after each program block, which triggers a movement or auxiliary function on the machine. In this way, you can control the machining result block-by-block during the initial run-through of a program on the machine.

#### Move by single block

In "Program control" you may select from among several types of block processing:

SB mode	Scope
SB1 Single block, coarse	The machining stops after every machine block (except for cycles)
SB2 Data block	The machining stops after every block, i.e. also for data blocks (except for cycles)
SB3 Single block, fine	The machining stops after every machine block (also in cycles)

#### Requirement

A program must be selected for execution in "AUTO" or "MDA" mode.

#### Proceed as follows



1. Press the "Prog. cntrl." softkey and select the desired variant in the "SBL" field.



2. Press the "SINGLE BLOCK" key.



3. Press the "CYCLE START" key.  
 Depending on the execution variant, the first block will be executed. Then the machining stops.  
 In the channel status line, the text "Stop: Block in single block ended" appears.



4. Press the "CYCLE START" key.  
 Depending on the mode, the program will continue executing until the next stop.



5. Press the "SINGLE BLOCK" key again, if the machining is not supposed to run block-by-block.  
The key is deselected again.  
If you now press the "CYCLE START" key again, the program is executed to the end without interruption.

### See also

Selecting a program (Page 59)

## 3.3 Display current program block

### 3.3.1 Current block display

The window of the current block display shows you the program blocks currently being executed.

#### Display of current program

The following information is displayed in the running program:

- The workpiece name or program name is entered in the title row.
- Three blocks of the current program are displayed.
- The program block which is just being processed appears colored.

### 3.3.2 Display program level

You can display the current program level during the execution of a large program with several subroutines.

#### Display of program level

The following information will be displayed:

- Level number
- Program name
- Block number, or line number

### Requirement

A program must be selected for execution in "AUTO" or "MDA" mode.

**Proceed as follows**



1. Press the menu forward key.  
A new vertical softkey bar is displayed.



2. Press the "Program levels" softkey.  
The "Program levels" window appears.

### 3.4 Correcting programs

As soon as a syntax error in the part program is detected by the control, program execution is interrupted and the syntax error is displayed in the alarm line.

#### Correction possibilities

Depending on the state of the control system, you can make the following corrections using the Program editing function.

- Stop state  
Only program lines that have not yet been executed can be edited.
- Reset status  
All program lines can be edited.

#### Requirement

A program must be selected for execution in "AUTO" mode.

**Proceed as follows**



1. The program to be corrected is in the Stop or Reset state.
2. Press the "Prog. corr." softkey  
The program is opened in the editor.



3. Make the necessary corrections.
4. Press the "NC Execute" softkey.  
The system switches back to the "Machine" operating area and selects "AUTO" mode.



5. Press the "CYCLE START" key to resume program execution.

## 3.5 Repositioning axes

After a program interruption in automatic mode (e.g. after a tool breaks) you can move the tool away from the contour in manual mode.

The coordinates of the interrupt position will be saved. The distances traversed in manual mode are displayed in the actual value window. This path difference is called "Repos-offset".

### Resuming program execution

Using the "Repos" function, you can return the tool to the contour in order to continue executing the program.

You cannot traverse the interrupt position, because it is blocked by the control system.

The feedrate/rapid traverse override is in effect



#### Warning

When repositioning, the axes move with the programmed feedrate and linear interpolation, i.e. in a straight line from the current position to the interrupt point. Therefore, you must first move the axes to a safe position in order to avoid collisions.

If you do not use the "Repos" function and subsequently move the axes in manual mode after a program interrupt, the control automatically moves the axes during the switch to automatic mode and the subsequent start of the machining process in a straight line back to the point of interruption.

---

### Requirement

The following prerequisites must be met when repositioning the axes:

- The program execution was interrupted using "Cycle Stop".
- The axes were moved from the interrupt point to another position in manual mode.

### Proceed as follows



1. Press the "REPOS" key.



...

2. Select the axes to be traversed one after the other.



...

3. Press the "+" or "-" key for the relevant direction.

The axes are moved to the interrupt position.



## 3.6 Starting execution at a specific point

### 3.6.1 Use block search

If you would only like to perform a certain section of a program on the machine, then you need not start the program from the beginning. You can also start the program from a specified program block.

#### Applications

- Stopping or interrupting a program
- Specify a target position, e.g. during remachining

#### Prerequisites

1. You have selected the desired program.
2. The control system is in the RESET condition.
3. The desired search mode is selected.

---

#### Notice

##### Collision-free start position

Pay attention to a collision-free start position and appropriate active tools and other technological values.

If necessary, manually approach a collision-free start position. Select the target block considering the selected block search type.

---



### 3.6.2 Approaching an interruption point again

#### Requirement

A program was selected in "AUTO" mode and interrupted during execution with "Reset".

#### Proceed as follows



1. Press the "Interrupt point" softkey.  
The interruption point is loaded.



2. Press the "Start search" softkey.

The search is started. Your specified search mode will be taken into account.

The search screen closes. The current block will be displayed in the program window as soon as the target is found.



3. Press the "CYCLE START" key twice.

The program will continue executing continue from the interruption point.

### 3.6.3 Entering a search target

Enter the program point which you would like to proceed to in the "Search indicator" window.

#### Requirement

The program is selected and the control is in Reset mode.

#### Screen form

Each line represents one program level. The actual number of levels in the program depends on the nesting depth of the program.

Level 1 always corresponds to the main program and all other levels correspond to subroutines.

You must enter the target in the line of the window corresponding to the program level in which the target is located.

For example, if the target is located in the subroutine called directly from the main program, you must enter the target in program level 2.

The specified target must always be unambiguous. This means, for example, that if the subroutine is called in the main program in two different places, you must also specify a target in program level 1 (main program).

**Proceed as follows**



1. Enter the complete target path in the input fields
2. Press the "Start search" softkey.

The search is started. Your specified search mode will be taken into account.

The search window closes. The current block will be displayed in the program window as soon as the target is found.



3. Press the "CYCLE START" key twice in order to continue execution from the required position.

**3.6.4 Parameters for block search**

**Parameters in "Search indicator" window**

Parameters	Description
Number of program level	
Program:	The name of the main program is automatically entered.
Ext:	File extension
P:	Pass counter. If a program part is performed several times, you can enter the number of the pass here at which processing is to be continued.
Line:	Is automatically filled for an interruption point
Type	" " search target is ignored on this level N no. block number Label jump label Text string Sub-r. Subroutine call Row row number
Search target	Point in the program at which machining is to start

**3.6.5 Block search mode**

Set the desired search variant in the "Search mode" window.

The set mode is retained when the the control is shut down. When you activate the "Search" function after restarting the control, the current search mode is displayed in the title row.

## Search variants

Block search mode	Description
With calculation - with approach	It is used to be able to approach the contour in any circumstance. On "Cycle Start", the start position of the target block or the end position of the block before the target block is approached. The program runs in the same way as in normal program processing.
With calculation - without approach	It is used in order to be able to approach a target position in any circumstance (e.g. tool change position). The end position of the target block or the next programmed position is approached using the type of interpolation valid in the target block. Only the axes programmed in the target block are moved.
Without calculation	For a quick search in the main program. Calculations will not be performed during the block search, i.e. the calculation is skipped up to the target block. All settings required for execution have to be programmed from the target block (e.g. feedrate, spindle speed, etc.).

## Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" key.



3. Press the "Block search" and "Blk sear. mode" softkeys.  
The "Search mode" window will open.

...



## 3.7 Controlling the program run

### 3.7.1 Program control

You can change the program sequence in the "AUTO" and "MDA" modes.

Abbreviation/program control	Scope
PRT no axis motion	The program is started and executed with auxiliary function outputs and dwell times. In this mode, the axes are not traversed. The programmed axis positions and the auxiliary function outputs are controlled this way. Note: Program processing without axis motion can also be activated with the function "Dry run feedrate".
DRY Dry run feedrate	The traversing velocities programmed in conjunction with G1, G2, G3, CIP and CT are replaced by a defined dry run feedrate. The dry run feedrate also applies instead of the programmed revolutional feedrate. Caution: Workpieces must not be machined when "Dry run feedrate" is active because the altered feedrates might cause the permissible tool cutting rates to be exceeded and the workpiece or machine tool could be damaged.
M01 Programmed stop 1	The processing of the program stops at every block in which supplementary function M01 is programmed. In this way you can check the already obtained result during the processing of a workpiece. Note: In order to continue executing the program, press the "CYCLE START" key again.
Programmed stop 2 (e.g. M101)	The processing of the program stops at every block in which the "Cycle end" is programmed (e.g. with M101). Note: In order to continue executing the program, press the "CYCLE START" key again. The display can be changed. Please also refer to the machine manufacturer's instructions.
DRF Handwheel offset	Enables an additional incremental zero offset while processing in automatic operation mode with an electronic handwheel. This function can be used to compensate for tool wear within a programmed block.
SB	Individual blocks are configured as follows. Single block, coarse: The program stops only after blocks which perform a machine function. Data block: The program stops after each block. Single block, fine: The program also only stops after blocks which perform a machine function in cycles. Select the desired setting using the "Select" key.
SKP	Skip blocks are skipped during machining.

### Activating program control

You can control the program sequence however you wish by selecting and clearing the relevant check boxes.

### Display / response of active program controls:

If a program control is activated, the abbreviation of the corresponding function appears in the status display as response.

### Proceed as follows



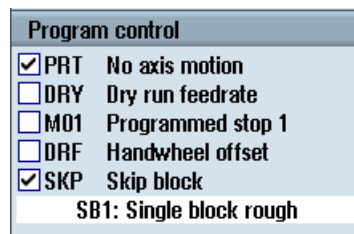
1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "Prog. cntrl." softkey.  
The "Program control" window appears.



### 3.7.2 Skip blocks

It is possible to skip program blocks, which are not to be executed every time the program runs.

The skip blocks are identified by placing a "/" (forward slash) or "/x (x = number of skip level) character in front of the block number. Several consecutive blocks can also be skipped.

The statements in the skipped blocks are not executed, i.e. the program continues with the next block, which is not skipped.

The number of skip levels that can be used depends on a machine datum.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

#### Skip levels, activate

Check the corresponding checkbox in order to skip the required block level.

---

#### Note

The "Program control - skip blocks" window is only available when more than one skip level is set up.

---

#### Proceed as follows



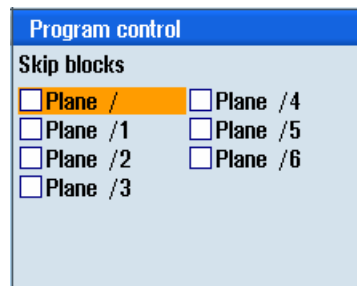
1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "Prog. cntrl." and "Skip blocks" softkeys.  
The "Program control" window appears and shows a list of block levels.



## 3.8 Editing programs

### 3.8.1 Overview

With the editor, you are able to render, supplement, or change part programs.

---

#### Note

The maximum block length is 512 characters.

---

#### Calling the editor

- The editor is started via the "Program correction" function in the "Machine" operating area.
- The editor is started via the "Open" softkey or the "INPUT" key in the "Program manager" operating area.
- The editor opens with the most recently edited part program in the "Program" operating area.

**Note**

Please note that the changes to programs stored in the NC memory take immediate effect. You can exit the editor only after you have saved the changes. This applies for all local drives that allow editing.

---

### 3.8.2 Searching in programs

You can use the search function to quickly arrive at points where you would like to make changes, e.g. in very large programs.

**Requirement**

The desired program is opened in the editor.

**Proceed as follows**



1. Press the "Search" softkey.  
A new vertical softkey bar appears.  
The "Search" window opens at the same time.
2. Enter the desired search term in the "Text" field.
3. Select "Whole words" if you want to search for whole words only.
4. Place the cursor in the "Direction" field and choose the search direction (forward, backward) with the "SELECT" button.



5. Press the "OK" softkey to start the search.

If the text you are searching for is found, the corresponding line is highlighted.



6. Press the "Continue search" softkey if the text located during the search does not correspond to the point you are looking for.



- OR -



Press the "Cancel" softkey when you want to cancel the search.



### Further search options

Softkey	Function
	The cursor is set to the first character in the program.
	The cursor is set to the last character in the program.

### 3.8.3 Replacing program text

You can find and replace text in one step.

#### Requirement

The desired program is opened in the editor.

#### Proceed as follows



1. Press the "Search" soft key  
A new vertical softkey bar appears.
2. Press the "Find + replace" softkey.  
The "Find and replace" window appears.
3. In the "Text" field, enter the term you are looking for and in the "Replace with" field, enter the text you would like to insert automatically during the search.
4. Place the cursor in the "Direction" field and choose the search direction (forward, backward) with the "SELECT" button.
5. Press the "OK" softkey to start the search.  
If the text you are searching for is found, the corresponding line is highlighted.
6. Press the "Replace" softkey to replace the text.  
  
- OR -  
Press the "Replace all" softkey to replace all text in the file that corresponds to the search term.  
  
- OR -



Press the "Continue search" softkey if the text located during the search should not be replaced.

- OR -



Press the "Cancel" softkey when you want to cancel the search.

### 3.8.4 Copying/pasting/deleting program blocks

#### Requirement

The program is opened in the editor.

#### Proceed as follows



1. Press the "Mark" softkey.



2. Select the desired program blocks with the cursor or mouse.



3. Press the "Copy" softkey in order to copy the selection to the buffer memory.

4. Place the cursor on the desired insertion point in the program and press the "Paste" softkey.

The content of the buffer memory is pasted.

#### Deleting program blocks



Use the "Cut" softkey to delete selected program blocks.

---

#### Note

The buffer memory contents are retained even after the editor is closed, enabling you to paste the contents in another program, as well.

---

### 3.8.5 Renumbering programs

You can modify the block numbering of programs opened in the editor at a later point in time.

#### Requirement

The program is opened in the editor.

#### Proceed as follows



1. Press the ">>" softkey.  
A new vertical softkey bar appears.



2. Press the "Renumbering" softkey.  
The "Renumbering" window appears.



3. Enter the values for the first block number and the increment to be used for numbering.
4. Press the "OK" softkey.  
The program is renumbered.

---

#### Note

If you only want to renumber a section, select the program blocks whose block numbering you want to edit.

---

### 3.8.6 Editor settings

In the "Settings" window enter the default settings for newly rendered programs in the editor.

#### Presettings

Settings	Description
Number automatically	Yes: A new block number will automatically be assigned after every line change. In this case, the specifications provided under "First block number" and "Increment" are applicable. No: No automatic numbering
First block number	Specifies the starting block number of a newly created program. The field is only editable when "Yes" is available under "Number automatically".

Settings	Description
Increment	Defines the increment used for the block numbers. The field is only editable when "Yes" is available under "Number automatically".
Display hidden lines	Hidden lines marked with "**HD" (hidden) will be displayed.
Display block end as an icon	The "LF" (line feed) symbol will be displayed at the block end.
Scroll horizontally	A horizontal scrollbar is displayed. In this way, you can scroll horizontally to the end of long lines that would otherwise wrap.

All entries that you make here are effective immediately.

**Proceed as follows**



1. Select the "Program" operating area



You have activated the editor.



2. Press the ">>" and "Settings" softkeys.  
The "Settings" window appears.



3. Make the desired changes here and press the "OK" softkey to confirm your settings.

## 3.9 Display G and auxiliary functions

### 3.9.1 Selected G functions

16 selected G groups are displayed in the "G function" window.

Within a G group, the G function currently active in the control is displayed.

Some G codes (e.g. G17, G18, G19) are immediately active after switching the machine control on.

Which G codes are always active depends on the settings.



#### **Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

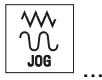
### G Groups Displayed by Default

Group	Description
G group 1	Modally active motion commands (e.g. G0, G1, G2, G3)
G group 2	Non-modally active motion commands, dwell time (e.g. G4, G74, G75)
G group 3	Programmable offsets, working area limitations and pole programming (e.g. TRANS, ROT, G25, G110)
G group 6	Level selection (e.g. G17, G18)
G group 7	Tool radius compensation (e.g. G40, G42)
G group 8	Settable zero offsets (e.g. G54, G57, G500)
G group 9	Offset suppression (e.g. SUPA, G53)
G group 10	Exact stop - continuous-path mode (e.g. G60, G641)
G group 13	Workpiece dimensioning inches/metric (e.g. G70, G700)
G group 14	Workpiece dimensioning absolute/incremental (G90)
G group 15	Feedrate type (e.g. G93, G961, G972)
G group 16	Feedrate override on inside and outside curvature (e.g. CFC)
G group 21	Acceleration profile (e.g. SOFT, DRIVE)
G group 22	Tool offset types (e.g. CUT2D, CUT2DF)
G group 29	Radius/diameter programming (e.g. DIAMOF, DIAMCYCOF)
G group 30	Compressor ON/OFF (e.g. COMPOF)

**Proceed as follows**



1. Select the "Machine" operating area.



2. Press the "JOG", "AUTO", or "MDA" key.



3. Press the "G functions" softkey.  
The "G functions" window is opened.



4. Press the "G functions" softkey again to hide the window again.

The G groups selection displayed in the "G functions" window may differ.



**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**References**

For more information about configuring the displayed G groups, refer to the HM sl commissioning manual

---

**Note**

**Displaying all G functions**

You can display all G codes.

---

### 3.9.2 All G functions

All G groups and their group numbers are listed in the "G functions" window.  
Within a G group, only the G function currently active in the control is displayed.

#### Additional information in the footer

The following additional information is displayed in the footer:

- Current transformations

Display	Description
TRANSMIT	Polar transformation active
TRACYL	Cylinder transformation active
TRAORI	Orientation transformation active
TRAANG	Inclined axis transformation active
TRACON	Cascaded transformation active For TRACON, two transformations (TRAANG and TRACYL or TRAANG and TRANSMIT) are activated in succession.

- Current zero offsets
- Spindle speed
- Path feedrate
- Active tool

#### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "JOG", "AUTO", or "MDA" key.



3. Press the ">>" and "All G functions" softkeys.  
The "G functions" window is opened.



### 3.9.3 Auxiliary functions

Auxiliary functions include M and H functions preprogrammed by the machine manufacturer, which pass parameters to the PLC to trigger reactions defined by the manufacturer.

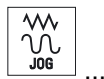
#### Displayed auxiliary functions

Up to 5 current M functions and 3 H functions are displayed in the "Auxiliary functions" window.

#### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "JOG", "AUTO", or "MDA" key.



3. Press the "H functions" softkey.  
The "Auxiliary functions" window opens.



4. Press the "H functions" softkey again to hide the window again.

### 3.10 Status of synchronized actions

You can display status information for diagnosing synchronized actions in the "Synchronized actions" window.

You get a list with all currently active synchronized actions.

In this list, the synchronized action programming is displayed in the same form as in the part program.

You can see the status of the synchronized actions in the "Status" column.

- Waiting
- Active
- Blocked

Non-modal synchronized actions can only be identified by their status display. They are only displayed during execution.



## Synchronization types

Synchronization types	Description
ID=n	Modal synchronized actions in automatic mode, local to program; n = 1 to 254
IDS=n	Static synchronized actions in all modes, n = 1 to 254
Without ID/IDS	Non-modal synchronized actions in automatic mode

### Note

Numbers ranging from 1 to 254 can only be assigned one time, irrespective of the identification number.

## Proceed as follows



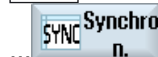
1. Select the "Machine" operating area.



2. Press the "AUTO" key.



3. Press the menu forward key and the "Synchron." softkey. The "Synchronized actions" window appears.



## 3.11 Settings for automatic mode

### 3.11.1 Defining the dry run feedrate

Before machining a workpiece, test the program without moving the machine axes. This allows for early detection of programming errors. For this test, you can use a dry run feedrate that you have defined.

This defined feedrate replaces the programmed feedrate during execution if you have selected "Dry run feedrate" under Program control.

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" key.



3. Press the menu forward key and the "Settings" softkey.  
The "Settings for automatic operation" window is opened.



4. In "DRY run feedrate," enter the desired dry run speed.

---

#### Note

The feedrate can be changed while the operation is running.

---

## Teaching in programs

### 4.1 Overview

The "Teach in" function can be used to edit programs in the "AUTO" and "MDA" modes. You can create and modify simple traversing blocks.

You traverse the axes manually to specific positions in order to implement simple machining sequences and make them reproducible. The positions you approach are applied.

In "AUTO" teach-in mode, the selected program is "taught".

In "MDA" teach-in mode, you teach to the MDA buffer.

External programs, which may have been rendered offline, can therefore be adjusted and modified according to need.

### 4.2 General sequence

#### General sequence

Select the desired program block, press the relevant softkey "Teach position", "Rap. tra. G01", "Straight line G1" or "Circ. interm. pos. CIP", and "Circ. end pos. CIP" and traverse the axes to change the program block.

You can only overwrite a block with a block of the same type.

- OR -

Position the cursor at the desired point in the program, press the relevant softkey "Teach position", "Rap. tra. G01", "Straight line G1" or "Circ. interp. pos. CIP", and "Circ. end pos. CIP" and traverse the axes to insert a new program block.

In order for the block to be inserted, the cursor must be positioned in an empty line via the "Cursor" and "Input" keys.

Press the "Accept" softkey to teach-in the modified or new program block.

---

**Note**

All defined axes are "taught in" in the first teach-in block. In all additional teach-in blocks, only axes modified by axis traversing or manual input are "taught in".

If you exit teach-in mode, this sequence begins again.

---

**Operating mode or operating area switchover**

If you switch to another operating mode or operating area in teach-in mode, the position changes will be canceled and teach-in mode will be cleared.

**4.3 Inserting blocks**

You have the option of traversing the axes and writing the current actual values directly to a new position block.

**Requirement**

"AUTO" mode: The program to be edited is selected.

**Proceed as follows**



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.



4. Press the "Teach prog." softkey.

5. Traverse the axes to the relevant position.



6. Press the "Teach position" softkey.  
A new program block with the current actual position values will be created.

## 4.3.1 Teach-in via Windows

### 4.3.1.1 General information

The cursor must be positioned on an empty line.

The windows for pasting program blocks contain input and output fields for the actual values in the WCS. Depending on the default setting, selection fields with parameters for motion behavior and motion transition are available.

When first selected, the input fields are empty unless axes were already traversed before the window was selected.

All data from the input/output fields are transferred to the program via the "Accept" softkey.

### Requirement

"AUTO" mode: The program to be edited is selected.

### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.

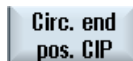


4. Press the "Teach prog." softkey.

5. Use the cursor and input keys to position the cursor at the desired point in the program.  
If an empty row is not available, insert one.



...



6. Press the softkeys "Rap. tra. G0", "Straight line G1", or "Circ. interm. pos. CIP" and "Circ. end pos. CIP".

The relevant windows with the input fields are displayed.

7. Traverse the axes to the relevant position.

8. Press the "Accept" soft key.

A new program block will be inserted at the cursor position.

- OR -

Press the "Cancel" softkey to cancel your input.

#### 4.3.1.2 Teach in rapid traverse G0

You traverse the axes and teach-in a rapid traverse block with the approached positions.

---

##### Note

##### Selection of axes and parameters for teach-in

You can select the axes to be included in the teach-in block in the "Settings" window.

You also specify here whether motion and transition parameters are offered for teach-in.

---

#### 4.3.1.3 Teach in straight G1

You traverse the axes and teach-in a machining block (G1) with the approached positions.

---

##### Note

##### Selection of axes and parameters for teach-in

You can select the axes to be included in the teach-in block in the "Settings" window.

You also specify here whether motion and transition parameters are offered for teach-in.

---

#### 4.3.1.4 Teaching in circle intermediate and circle end point CIP

Enter the intermediate and end positions for the circle interpolation CIP. You teach-in each of these separately in a separate block. The order in which you program these two points is not specified.

---

**Note**

Make sure that the cursor position does not change during teach-in of the two positions.

---

You teach-in the intermediate position in the "Circle intermediate position CIP" window.

You teach-in the end position in the "Circle end position CIP" window.

The intermediate or interpolation point is only taught-in with geometry axes. For this reason, at least 2 geometry axes must be set up for the transfer.

---

**Note****Selection of axes for teach in**

You can select the axes to be included in the teach-in block in the "Settings" window.

---

#### 4.3.1.5 A-spline teach in (option)

For Akima-spline interpolation, you enter interpolation points that are connected by a smooth curve.

Enter a starting point and specify a transition at the beginning and end.

You teach-in each interpolation point via "Teach in of position".

---

**Note**

The relevant option bit must be set to enable you to program a spline interpolation.

---

**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

**Proceed as follows**



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.



4. Press the "Teach prog." softkey.



5. Press the ">>" and "ASPLINE" softkeys.  
The "Akima-spline" window opens with the input fields.

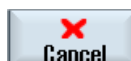


6. Traverse the axes to the required position and if necessary, set the transition type for the starting point and end point.



7. Press the "Accept" soft key.  
A new program block will be inserted at the cursor position.

- OR -



Press the "Cancel" softkey to cancel your input.

---

**Note**

**Selection of axes and parameters for teach-in**

You can select the axes to be included in the teach-in block in the "Settings" window.

You also specify here whether motion and transition parameters are offered for teach-in.

---



### 4.3.2 Input parameters for teach-in blocks

#### Parameters for teach-in of position and teach-in of G0, G1, and circle end position CIP

parameters	Description
X	Approach position in X direction
Y	Approach position in Y direction
Z	Approach position in Z direction
F	Feedrate (mm/r; mm/min) - only for teach-in of G1 and circle end position CIP

#### Parameters for teach-in of circle intermediate position CIP

parameters	Description
I	Coordinate of the circle center point in the X direction
J	Coordinate of the circle center point in the Y direction
K	Coordinate of the circle center point in the Z direction

#### Transition types for teach-in of position and teach-in of G0 and G1, and ASPLINE

The following parameters are offered for the transition:

parameters	Description
G60	Exact stop
G64	Corner rounding
G641	Programmable corner rounding
G642	Axis-specific corner rounding
G643	Block-internal corner rounding
G644	Axis dynamics corner rounding

#### Motion types for teach-in of position and teach-in of G0 and G1

The following motion parameters are offered:

parameters	Description
CP	Path-synchronous
PTP	Point-to-point
PTPG0	Only G0 point-to-point

### Transition behavior at the beginning and end of the spline curve

The following motion parameters are offered:

Parameters	Description
Start	
BAUTO	Automatic calculation
BNAT	Curvature is zero or natural
BTAN	Tangential
End	
EAUTO	Automatic calculation
ENAT	Curvature is zero or natural
ETAN	Tangential

## 4.4 Changing blocks

You can only overwrite a program block with a teach-in block of the same type.

The axis values displayed in the relevant window are actual values, not the values to be overwritten in the block.

---

### Note

If you wish to change any variable in a block in the program block window other than the position and its parameters, then we recommend alphanumerical input.

---

### Requirement

The program to be edited is selected.

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.



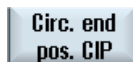
4. Press the "Teach prog." softkey.



5. Click the program block to be edited.

6. Press the relevant softkey "Teach position", "Rap. tra. G0", "Straight line G1", or "Circ. interm. pos. CIP", and "Circ. end pos. CIP".

...



The relevant windows with the input fields are displayed.



7. Traverse the axes to the desired position and press the "Accept" softkey.

The program block is taught with the modified values.

- OR -



Press the "Cancel" softkey to cancel the changes.

## 4.5 Block selection

You have the option of setting the interrupt pointer to the current cursor position. The next time the program is started, processing will resume from this point.

With teach-in, you can also change program areas that have already been executed. This automatically disables program processing.

You must press reset or select a block to resume the program.

### Requirement

The program to be processed is selected.

### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" key.



3. Press the "TEACH IN" key.



4. Press the "Teach prog." softkey.



5. Place the cursor on the desired program block.
6. Press the "Block selection" softkey.

## 4.6 Deleting blocks

You have the option of deleting a program block entirely.

### Requirement

"AUTO" mode: The program to be processed is selected.

### Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.



4. Press the "Teach prog." softkey.



5. Click the program block to be deleted.

6. Press the ">>" and "Delete block" softkeys.



The program block on which the cursor is positioned is deleted.

## 4.7 Parameter settings

### 4.7.1 Settings for teach-in

In the "Settings" window, you define which axes are to be included in the teach-in block and whether motion-type and continuous-path mode parameters are to be provided.

Proceed as follows



1. Select the "Machine" operating area.



2. Press the "AUTO" or "MDA" key.



3. Press the "TEACH IN" key.



4. Press the "Teach prog." softkey.



5. Press the ">>" and "Settings" softkeys.  
The "Settings" window appears.



6. Under "Axes to be taught" and "Parameters to be taught", select the check boxes for the relevant settings and press the "Accept" softkey to confirm the settings.

## Setting data

### 5.1 Specify working area limitations

The "Working area limitation" function can be used to limit the range within which a tool can traverse in all channel axes. These commands allow you to set up protection zones in the working area which are out of bounds for tool movements.

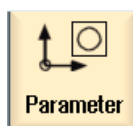
In this way, you are able to restrict the traversing range of the axes in addition to the limit switches.

#### Prerequisites

You can only make changes in "AUTO" mode when in the RESET condition. These changes are then immediate.

You can make changes in "JOG" mode at any time. These changes, however, only become active at the start of a new motion.

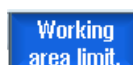
#### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Setting data" softkey.



The "Working area limit." window appears.

3. Place the cursor in the required field and enter the new values via the numeric keyboard.

The upper or lower limit of the protection zone changes according to your inputs.

4. Click the checkbox to "active" to activate the protection zone.

---

**Note**

A list of all setting data is available in the "Start-up" operating area.

---



## User data

### 6.1 Introduction

The defined user data may be displayed in lists.

The following variables can be defined:

- Data parameters (R parameters)
- Global user data (GUD) is valid in all programs
- Local user data (LUD) is valid in one program
- Program-global user data (PUD) is valid in one program and the called subroutines.

Channel-specific user data can be defined with a different value for each channel.

#### Entering and displaying parameter values

Up to 15 positions (including decimal places) are evaluated. If you enter a number with more than 15 places, it will be written in exponential notation (15 places + EXXX).

#### LUD or PUD

Only local or program-global user data can be displayed at one time.

Whether the user data are available as LUD or PUD depends on the current control configuration.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

---

#### Note

#### Reading and writing variables protected

Reading and writing of user data are protected via a keyswitch and protection levels.

---

### Searching for user data

You may search for user data within the lists using any character string.

Refer to the "Defining and activating user data" section to learn how to edit displayed user data.

## 6.2 R parameters

R parameters (arithmetic parameters) are channel-specific variables that you can use within a G code program. G code programs can read and write R parameters.

These values are retained after the control is switched off.

### Number of channel-specific R parameters

The number of channel-specific R parameters is defined in a machine data element.

Range: R0-R999 (dependent on machine data).

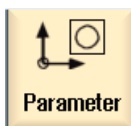
There are no gaps in the numbering within the range.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

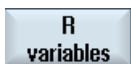
### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "User variable" softkey.



3. Press the "R variables" softkey.  
The "R parameters" window appears.

## Delete R variables



1. Press the ">>" and "Delete area" softkeys.  
The "Delete R parameters" window appears.

...



2. Enter the R parameter(s) whose channel-specific values you would like to delete and press the "OK" softkey.

- OR -



Press the "Delete all" softkey and confirm the prompt with "OK" if you really want to delete all R parameters.

...



A value of 0 is assigned to the selected R parameters or to all R parameters.

## 6.3 Displaying global user data (GUD)

### Global user data

Global GUDs are NC global user data (**Global User Data**) that remains available after switching the machine off.

GUDs apply in all programs.

### Definition

A GUD variable is defined with the following:

- Keyword DEF
- Range of validity NCK
- Data type (INT, REAL, ....)
- Variable names
- Value assignment (optional)

### Example

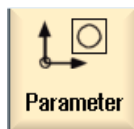
```
DEF NCK INT ZAEHLER1 = 10
```

GUDs are defined in files with the ending DEF. The following file names are reserved for this purpose:

6.3 Displaying global user data (GUD)

File name	Description
MGUD.DEF	Definitions for global machine manufacturer data
UGUD.DEF	Definitions for global user data
GUD4.DEF	User-definable data
GUD8.DEF, GUD9.DEF	User-definable data

Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "User variable" softkey.



3. Press the "Global GUD" softkeys.  
The "Global user data" window is displayed. A list of the defined UGUD variables will be displayed.

- OR -



Press the "GUD selection" softkey and the "SGUD" to "GUD6" softkeys if you want to display GUD 1 to GUD 6 of the global user data.

...



- OR -



Press the "GUD selection" and ">>" softkeys as well as the "GUD7" to "GUD9" softkeys if you want to display GUD 7 to GUD 9 of the global user data.

...



**Note**

After each start-up, a list with the defined UGUD variables is displayed in the "Global user data" window.

## 6.4 Displaying channel GUDs

### Channel-specific user data

Like the GUDs, channel-specific user data are applicable in all programs for each channel. However, unlike GUDs, they have specific values.

### Definition

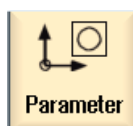
A channel-specific GUD variable is defined with the following:

- Keyword DEF
- Range of validity CHAN
- Data type
- Variable names
- Value assignment (optional)

### Example

```
DEF CHAN REAL X_POS = 100.5
```

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "User variable" softkey.



3. Press the "Channel GUD" and "GUD selection" softkeys.

...



A new vertical softkey bar appears.



4. Press the "SGUD" to "GUD6" softkeys if you want to display GUD 1 to GUD 6 of the channel-specific user data.

...



- OR -



...



Press the "Continue" softkey and the "GUD7" to "GUD9" softkeys if you want to display GUD 7 to GUD 9 of the channel-specific user data.

## 6.5 Displaying local user data (LUD)

### Local user data

LUDs are only valid in the program or subroutine in which they were defined.

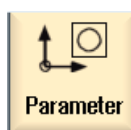
The control displays the LUDs after the start of program processing. The display is available until the end of program processing.

### Definition

A local user variable is defined with the following:

- Keyword DEF
- Data type
- Variable names
- Value assignment (optional)

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "User variable" softkey.



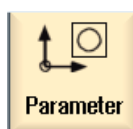
3. Press the "Local LUD" softkey.

## 6.6 Displaying program user data (PUD)

### Program-global user data

PUDs are global part program variables (**Program User Data**). PUDs are valid in all main programs and subroutines, where they can also be written and read.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "User variable" softkey.



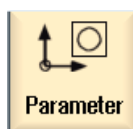
3. Press the "Program PUD" softkey.

## 6.7 Searching for user data

You can search for R parameters and user data.

Enter the R parameter number you wish to find via the numeric keypad.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "R variables", "Global GUD", "Channel GUD", "Local GUD" or "Program PUD" softkeys to select the list in which you would like to search for user data.

...





3. Press the "Search" softkey.  
The "Search for R parameters" or "Search for user data" window opens.



4. Enter the desired search term and press "OK".

The cursor is automatically positioned on the the R parameter or user data you are searching for, if they exist.

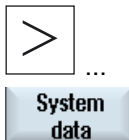
## 6.8 Defining and activating user data

By editing a DEF/MAC file, you can alter or delete existing definition/macro files or add new ones.

Proceed as follows



1. Select the "Program manager" operating area.



2. Press the menu forward key and the "System data" softkey.

3. In the data tree, select the "NC data" folder and then open the "Definitions" folder.

4. Select the file you want to edit.

5. Double-click the file.

- OR -



Press the "Open" softkey.

- OR -



Press the "INPUT" key.

- OR -

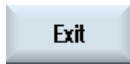


Press the "Right cursor" key.

The selected file is opened in the editor and can be edited there.

6. Define the desired user data.





7. Press the "Exit" softkey to close the editor.

### Activating user data



1. Press the "Activate" softkey.

A prompt is displayed.

2. Select whether the current values in the definition files should be retained

- OR -

Select whether the current values in the definition files should be deleted.

This will overwrite the definition files with the initial values.



3. Press the "OK" softkey to continue the process.



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# Tool management

## 7.1 Overview

Various tools are used for machining workpieces.

### Lists for tool management

HMI sl provides the "Tool list", "Tool wear list", "OEM tools" and "Magazine" windows for managing your tools.

Tool management supports several magazines. The active magazine is displayed in the title line of each list.

The various lists may have been changed by the machine manufacturer, in comparison to the following description.



#### **Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

### References

For additional information, please refer to the following document:



HM sl commissioning manual

## 7.2 Tool list

The Tool list shows all tools in the magazines and the NC memory.

Each tool is uniquely identified by a name and a duplo number.

### Tool parameters

Column heading	Description
Location  *  * * If activated in magazine selection	Magazine/location number <ul style="list-style-type: none"> <li>• Spindle location as an icon</li> <li>• The locations for gripper 1 and gripper 2 (applies only when a spindle with dual gripper is used) as icons.</li> <li>• Magazine location number The magazine number is specified first, followed by the location number in the magazine.  If there is only one magazine, only the location number is displayed.</li> </ul>
Type	Tool type Specific tool offset data are displayed based on the tool type (represented by a symbol).
Tool name	A tool is identified by its name and duplo number of the tool. You may enter the names as text or numbers.
DP	Duplo number of twin tool (replacement tool)
D	Cutting edge number
Length 1	Tool length Geometry data length 1
Radius	Tool radius
Tip angle or Lead	Tip angle for Type 200 - twist drill and Type 220 - center drill Lead for Type 240 - tap
N	Number of teeth for Type 110 - ball end mill for cylindrical die-sinking cutter, Type 111 - ball end mill for tapered die-sinking cutter, Type 120 - end mill, Type 121 - end mill with corner rounding, Type 130 - angle head cutter, Type 140 - facing tool, Type 150 - side mill, Type 155 - bevel cutter, Type 156 - bevel cutter with corner rounding, and Type 157 - tapered die-sinking cutter.

## Icons in the tool list

Icon / Identification	Description
Type	
Red "X"	The tool is disabled.
Yellow triangle	The prewarning limit has been reached.

### 7.2.1 Additional data for tools

Certain tool types require geometry data than are not included in the list form of the tool list.

You can use the configuration file to specify the data to be displayed for specific tool types in the "Additional data" window.



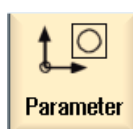
#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

## References

For a description of configuration options, refer to the  
HMI sl / SINUMERIK 840D sl commissioning manual

## Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool list" softkey.



3. Press the "Further data" softkey.  
The "Additional data" window opens.  
The "Further data" softkey is only active if a tool for which the "Additional data" window is configured is selected.

### 7.2.2 Entering new tools in the tool list

A number of tool types are available when you create a new tool. The tool type determines which geometry data are required and how they will be computed.

#### Possible tool types

New tool - favorites		
Typ	Identifier	Tool position
120	- End mill	
140	- Facing tool	
200	- Twist drill	
220	- Center drill	
240	- Tap	
710	- 3D milling probe	
711	- Edge tracer	

Figure 7-1 Example of Favorites list
















New tool - milling cutter		
Typ	Identifier	Tool position
100	- Milling tool	
110	- Cylindr. ball end	
111	- Conical ball end	
120	- End mill	
121	- End mill corner round.	
130	- Angle head cutter	
131	- Corn.round.ang.hd.cut	
140	- Facing tool	
145	- Thread cutter	
150	- Side mill	
151	- Saw	
155	- Bevelled cutter	
156	- Beveled cutter corner	
157	- Tap, die- sink. cutter	
160	- Drill&thread cut.	

Figure 7-2 Available tools in the "New tool - milling cutter" window






New tool - drill		
Typ	Identifier	Tool position
200	- Twist drill	
205	- Solid drill	
210	- Boring bar	
220	- Center drill	
230	- Countersink	
231	- Counterbore	
240	- Tap	
241	- Fine tap	
242	- Tap, Whitworth	
250	- Reamer	

Figure 7-3 Available tools in the "New tool - drill" window

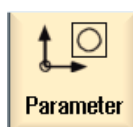
New tool - special tools		
Typ	Identifier	Tool position
700	Groove saw	
710	3D milling probe	
711	Edge tracer	
730	Stop	
900	Auxiliary tools	

Figure 7-4 Available tools in the "New tool - special tools" window

When creating a new tool, the "New tool - favorites" window offers you a number of select tool types, known as "favorites".

If you do not find the desired tool type in the favorites list, then select the milling, drilling or special tool via the corresponding softkeys.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool list" softkey.

3. Place the cursor in the tool list at the position where the new tool should be stored.

For this, you can select an empty magazine location or the NC tool memory outside of the magazine.

You may also place the cursor on an existing tool in the NC tool memory region. Data from the displayed tool will not be overwritten.



4. Press the "New tool" softkey.



The "New tool - favorites" window appears on the screen.

- OR -



If you want to create a tool that is not in the Favorites list, press the "Cutters 100-199", "Drills 200-299" or "Spec.tool 700-900" softkey.



The "New tool - milling cutter", "New tool - drill", or "New tool - special tools" window opens.

5. Select the tool by placing the cursor on the corresponding icon.



6. Press the "OK" softkey.

The tool is added to the tool list with a predefined name. If the cursor is located on an empty magazine location in the tool list, then the tool is loaded to this magazine location.

The tool creation sequence can be defined differently.

### Multiple load points

If you have configured several loading points for a magazine, then the "Load point selection" window appears when a tool is created directly in an empty magazine location or when the "Load" softkey is pressed.

Select the required load point and confirm with the "OK" softkey.

### Additional data

If configured accordingly, the "New tool" window opens after the required tool has been selected and confirmed with "OK".

You can define the following data in this window:

- Names
- Tool location type
- Size of tool

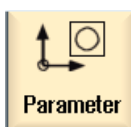
### References:

For a description of configuration options, refer to the HMI sl / SINUMERIK 840D sl commissioning manual

### 7.2.3 Managing several cutting edges

In the case of tools with more than one cutting edge, a separate set of offset data is assigned to each cutting edge. The number of possible cutting edges depends on the control configuration.

#### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool list" softkey.
3. Position the cursor on the tool for which you would like to store more cutting edges.





4. Press the "Edges" softkey in the "Tool list".



5. Press the "New cuttgEdge" softkey.

A new data set is stored in the list.

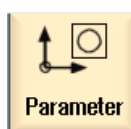
The edge number is incremented by 1 and the offset data are assigned the values of the edge on which the cursor is positioned.

6. Enter the offset data for the second cutting edge.
7. Repeat this process if you wish to create more tool edge offset data.

## 7.2.4 Deleting cutting edges

You can delete unnecessary edges of a tool from the tool list.

Proceed as follows



1. Select the "Parameter" operating area.

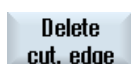


2. Press the "Tool list" softkey.

3. Place the cursor on the edge of a tool that you would like to delete.



4. Press the "Edges" softkey in the "Tool list".

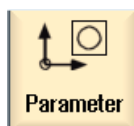


5. Press the "Delete cut. edge" softkey.  
The data set is deleted from the list.

### 7.2.5 Deleting tools

Tools that are no longer in use can be deleted from the tool list for a clearer overview.

Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool list" softkey.



3. Place the cursor on the tool that you would like to delete.

4. Press the "Delete tool" softkey.  
A safety prompt is displayed.



5. Press the "OK" softkey if you really want to delete the tool.

Use this softkey to delete the tool.

If the tool is in a magazine location, it is unloaded and then deleted.

### Multiple load points - tool in magazine location

If you have configured several loading points for a magazine, then the "Loading point selection" window displays after pressing the "Delete tool" softkey.

Select the required load point and press the "OK" softkey to unload and delete the tool.

### 7.2.6 Loading and unloading tools

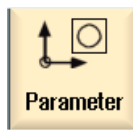
You can load and unload tools to and from a magazine via the tool list. When a tool is loaded, it is taken to a magazine location. When it is unloaded, it is removed from the magazine and stored in the tool list.

When you are loading a tool, the application automatically suggests an empty location. You may also directly specify an empty magazine location.

You can unload tools from the magazine that you are not using at present. HMI sl then automatically saves the tool data in the tool list in the NC memory outside the magazine.

Should you want to use the tool again later, simply load the tool with the tool data into the corresponding magazine location again. Then the same tool data does not have to be entered more than once.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool list" softkey.



3. Place the cursor on the tool that you want to load into the magazine (if the tools are sorted according to magazine location number you will find it at the end of the tool list).
4. Press the "Load" softkey.

The "Load to... " window opens.

The "... empty location" field is initialized with the number of the first empty magazine location.



5. Press the "OK" softkey to load the tool into the suggested location.

- OR -



Enter the location number you require and press the "OK" softkey.

- OR -



Press the "Spindle" softkey.

- . The tool is loaded into the specified magazine location or spindle.

### Several magazines

If you have configured several magazines, the "Load to ..." window appears after pressing the "Load" softkey.

If you do not want to use the suggested empty location, then enter your desired magazine and magazine location. Confirm your selection with "OK".

### Multiple load points

If you have configured several loading points for a magazine, then the "Load point selection" window appears after pressing the "Load" softkey.

Select the required loading point and confirm with "OK".

### Unloading tools



1. Place the cursor on the tool that you would like to unload from the magazine and press the "Unload" softkey.
2. Select the required load point in the "Load point selection" window.
3. Confirm your selection with "OK".

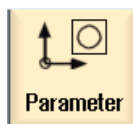
- OR -

Undo your selection with "Cancel".

### 7.2.7 Selecting a magazine

You can directly select the buffer memory, the magazine, or the NC memory.

#### Proceed as follows



1. Select the "Parameter" operating area.
2. Press the "Tool list" softkey.
3. Press the "Magazine selection" softkey.

If there is only one magazine, you will move from one area to the next (i.e., from the buffer memory to the magazine, from the magazine to the NC memory, and from the NC memory back to the buffer memory) each time you press the softkey. The cursor is positioned at the beginning of the magazine each time.

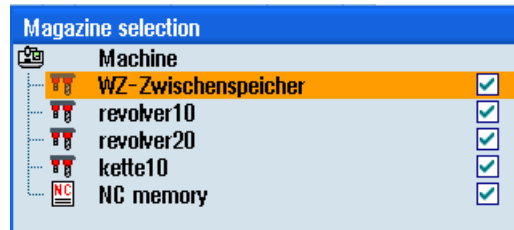
- OR -



If there is more than one magazine, the "Magazine selection" window opens. Position the cursor on the desired magazine in this window and press the "Go to ..." softkey.

The cursor jumps directly to the beginning of the specified magazine.

## Hiding magazines



Clear the check box next to the magazines that you do not want to appear in the magazine list.

The magazine selection behavior with multiple magazines can be configured in different ways.



### Machine manufacturer

Please also refer to the machine manufacturer's instructions.



## References

For a description of configuration options, refer to the HMI sl / SINUMERIK 840D sl commissioning manual

### 7.3 Tool wear

Tools that are in use for long periods are subject to wear. You can measure this wear and enter it in the tool wear list. The control then takes this information into account when calculating the tool length or radius compensation. This ensures a consistent accuracy in workpiece machining.

#### Tool parameters

Column heading	Description
Location  *  * * If activated in magazine selection	Magazine/location number <ul style="list-style-type: none"> <li>• Spindle location as an icon</li> <li>• The locations for gripper 1 and gripper 2 (applies only when a spindle with dual gripper is used) as icons.</li> <li>• The magazine location number. The magazine number is specified first, followed by the location number. Tools that are not assigned to a magazine in the tool list are stored behind the magazine without a location number.</li> </ul>
Type	Tool type Depending on the tool type (represented by a symbol), certain tool offset data are enabled.
Tool name	A tool is identified by its name and duplo number of the tool. You may enter the names as text or numbers.
DP	Duplo number of twin tool (replacement tool).
D	Cutting edge number
$\Delta$ Length 1	Wear for length 1
$\Delta$ Radius	Radius wear
T C	Selection of tool monitoring - by tool life (T) - by count (C) - by wear (W) The wear indicator is configured via a machine data element. Please refer to the machine manufacturer's instructions.
Setpoint	Setpoint for tool life, workpiece count, or wear
Pre-warning limit	Specification of the tool life, workpiece count or wear at which a warning is displayed.
Tool life Workpiece count Wear * *Parameter depends on selection in TC	Tool life. Number of workpieces. Tool wear.
G	The tool is disabled when the check box is selected.

## Symbols in the wear list

Icon / Identification	Description
Type	
Red "X"	The tool is disabled.
Yellow triangle	The prewarning limit has been reached.

## Activating tool monitoring

You can automatically monitor the tools' working times via the workpiece count, tool life or wear.

In addition, you can disable tools when you no longer wish to use them.

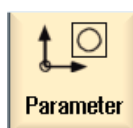
### 7.3.1 Reactivating tools

You can replace disabled tools or make them ready for use again.

#### Requirements

In order to reactivate a tool, the monitoring function (supervision) must be activated and a setpoint must be stored.

#### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Tool wear" softkey.



3. Position the cursor on the disabled tool which you would like to reuse.
4. Press the "Reactivate" softkey.  
The value entered as the setpoint is entered as the new tool life or workpiece count.  
The disabling of the tool is cancelled.

### Reactivating and positioning

When the "Reactivate with positioning" function is configured, the selected tool's magazine location will also be positioned at a loading point. You can exchange the tool.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

### References

HMI sl / SINUMERIK 840D sl commissioning manual

### Multiple load points

If you have configured several loading points for a magazine, then the "Load point selection" window appears after pressing the "Load" softkey.

Select the required load point and confirm with the "OK" softkey.

## 7.4 Tool data OEM

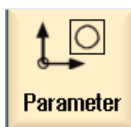
In the OEM tool list, you can customize a list according to your specific needs.

### References:

For more information, see the following references:

HMI sl / SINUMERIK 840D sl commissioning manual

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "OEM Tool" soft key.





## 7.5 Magazine

Tools are displayed with their magazine-related data in the magazine list. Here, you can take specific actions relating to the magazines.

Individual magazine locations can be location-coded or disabled for existing tools.

### Tool parameters

Column heading	Description
Location  *  * * If activated in magazine selection	Magazine location number <ul style="list-style-type: none"> <li>Spindle location as an icon</li> <li>The locations for gripper 1 and gripper 2 (applies only when a spindle with dual gripper is used) as icons.</li> <li>The magazine location numbers The magazine number is specified first, followed by the location number.</li> </ul> If there is only one magazine, only the location number is displayed.
Type	Tool type Depending on the tool type (represented by a symbol), certain tool offset data are enabled.
Tool name	A tool is identified by its name and duplo number of the tool. You may enter the names as text or numbers.
DP	Duplo number of twin tool (replacement tool).
D	Cutting edge number
G	Disabling of the magazine location.
Mag.loctype	Display of magazine location type
Tool.loctype	Display of tool location type of tool.
L R	Assignment of neighboring magazine locations. Defines the permissible tool size. Up to 7 neighboring half locations can be reserved for a tool.
P	Fixed location coding. The tool is permanently assigned to this magazine location.

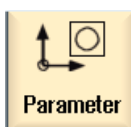
### Magazine list icons

Icon / Identification	Description
Type	
Red "X"	The tool is disabled.
Yellow triangle	The prewarning limit has been reached.

### 7.5.1 Position magazine

You can position magazine locations directly on the loading point.

Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Magazine" softkey.



3. Place the cursor on the magazine location that you want to position onto the load point.

4. Press the "Position magazine" softkey.

The magazine location is positioned on the loading point.

### Multiple load points

If you have configured several loading points for a magazine, then the "Load point selection" window appears after pressing the "Position magazine" softkey.

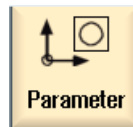
Select the desired loading point in this window and confirm your selection with "OK" to position the magazine location at the loading station.

### 7.5.2 Relocating tools

Tools can be directly relocated within magazines to another magazine location, which means that you do not have to unload tools from the magazine in order to load them into a different location.

When you are relocating a tool, the application automatically suggests an empty location. You may also directly specify an empty magazine location.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Press the "Magazine" softkey.



3. Position the cursor on the tool that you wish to relocate to a different magazine location.
4. Press the "Relocate" softkey.



5. The "... relocate from location ... to ..." window appears on the screen. The "... empty location" field is initialized with the number of the first empty magazine location.
6. Press the "OK" softkey to relocate the tool to the suggested location.

- OR -



Enter the location number you require and press the "OK" softkey.

- OR -



Press the "Spindle" softkey to load a tool into the spindle and press the "OK" softkey.

...

The tool is loaded into the specified magazine location or spindle.



### Several magazines

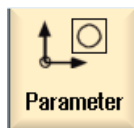
If you have set up several magazines, then the "...relocate from magazine... location... to..." window displays after pressing the "Relocate" softkey.

Select the desired magazine and location, and confirm your selection with "OK" to load the tool.

## 7.6 Sorting tool management lists

When you are working with many tools, with large magazines or several magazines, it is useful to display the tools sorted according to different criteria. Then you will be able to find a specific tool more easily in the lists.

### Proceed as follows



1. Select the "Parameter" operating area.



2. Select the "Tool list", "Tool wear" or "Magazine" softkey in the "Parameter" operating area.



3. Press the ">>" and "Sort" softkeys.



The lists are displayed sorted numerically according to magazine location.

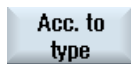
Tool types are used to sort tools with the same magazine location. Identical types (e.g. milling cutters), in turn, are sorted according to their radius value.



4. Press the "Surname" softkey to display the tool names in alphabetical order.

Duplo numbers are used to sort tools with the same names.

- OR -



Press the "Acc. to type" softkey to display the tools arranged by tool type. Identical types (e.g. milling cutters) are sorted according to their radius value.

- OR -



Press the "Acc. to T number" softkey to display the tools numerically sorted by tool number.

The list is sorted according to the specified criteria.

# Program management

## 8.1 Overview

Place all programs that you would like to execute in the NC.

You can access these programs at any time via the Program Manager for execution, editing, copying, or renaming. Programs that you no longer require can be deleted to release their storage space.

### Storage for programs

Possible storage locations are:

- NC
- Local drive
- Network drives
- USB drives

---

#### Note

#### Options

You need the "256 MB user memory" option in order to display the "Local drive" softkey.

To set up network drives, you need the "Network drives" option.

---

### Communication with other workstations

You have the following options for exchanging programs and data with other workstations:

- USB drives (e.g. USB FlashDrive)
- Network drives



### Choosing storage locations

In the horizontal softkey bar, you can select the storage location that contains the directories and programs that you want to display. In addition to the "NC" softkey, via which the passive file system data can be displayed, additional softkeys can be displayed.

The "USB" softkey is only operational when an external storage medium is connected (e.g., USB FlashDrive on the USB port of the operator panel).

### Structure of the directories

In the overview, the symbols in the left-hand column have the following meaning:

-  Folder
-  Program

The directories and programs are always listed complete with the following information:

- Name  
The name can contain up to 24 characters + dot + 3-character extension (e.g., MPF).  
Permissible characters include all upper-case letters (no umlauts), numbers, and underscores.
- Type  
Directory: WPD  
Program: MPF  
Subroutine: SPF  
Zero point/tool data: INI
- Size (in bytes)
- Date/time (of creation or last change)

#### 8.1.1 NC memory

The complete NC working memory is displayed along with all tools and the main programs and subroutines.

You can create further subdirectories here.

#### Proceed as follows



1. Select the "Program manager" operating area.



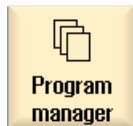
2. Press the "NC" softkey.

### 8.1.2 Local drive

The workpieces, main programs and subroutines stored in HMI sl are displayed.

You can create any number of subdirectories here, in which to store any files (e.g., text files with notes).

#### Proceed as follows



1. Select the "Program manager" operating area.

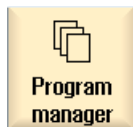


2. Press the "Local drive" software key.

### 8.1.3 USB drives

USB drives enable you to exchange data. For example, you can copy to the NC and execute programs that were created externally.

#### Proceed as follows



1. Select the "Program manager" operating area.



2. Press the "USB" softkey.

---

#### Note

The "USB" softkey can only be operated when a USB FlashDrive is inserted in the front interface of the operator panel.

---

## 8.2 Opening and closing a program

To view a program in more detail or modify it, open the program in the editor.

**Proceed as follows**



1. Select the "Program manager" operating area.



2. Select the desired storage location and position the cursor on the program that you would like to edit.

3. Press the "Open" softkey.

- OR -



Press the "INPUT" key.

- OR -



Press the "Right cursor" key.

- OR -

Double-click the required program.

The selected program is opened in the "Editor" operating area.

4. Now make the necessary program changes.



5. Press the "NC Select" softkey to switch to the "Machine" operating area and begin execution.



When the program is running, the softkey is deactivated.

**Closing the program**



Press the ">>" and "Exit" softkeys to close the program and editor again.



---

**Note**

A program does not have to be closed in order for it to be executed.

---



## 8.3 Executing a program

When you select a program for execution, the control automatically switches to the "Machine" operating area.

### Program selection

Select the workpieces (WPD), main programs (MPF) or subroutines (SPF) by placing the cursor on the desired program or workpiece.

For workpieces, the workpiece directory must contain a program with the same name. This program is automatically selected for execution (e.g., when you select the workpiece SHAFT.WPD, the main program SHAFT.MPF is automatically selected).

If an INI file of the same name exists (e.g., SHAFT.INI), it will be executed once at the first part program start after selection of the part program. Any additional INI files are executed in accordance with machine data 11280 \$MN\_WPD\_INI\_MODE.

\$MN\_WPD\_INI\_MODE=0:

The INI file with the same name as the selected workpiece is executed. For example, when you select SHAFT1.MPF, the SHAFT1.INI file is executed upon "Cycle Start".

\$MN\_WPD\_INI\_MODE=1:

All files of type INI, SEA, GUD, RPA, UFR, PRO, TOA, TMA and CEC which have the same name as the selected main program are executed in the specified sequence. The main programs stored in a workpiece directory can be selected and processed by several channels.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

### Proceed as follows



1. Select the "Program manager" operating area.



2. Select the desired storage location and position the cursor on the workpiece/program that you would like to execute.
3. Press the "Select" soft key.

The control switches automatically into the "Machine" operating area.

- OR -



If the selected program is already opened in the "Program" operating area,  
press the " NC Execute" softkey.



Press the "CYCLE START" key.  
Execution of the workpiece is started.

---

**Note**

Only workpieces/programs located in the NCK memory can be selected for execution.

---

## 8.4 Creating directories/programs

### 8.4.1 Creating a new directory

Directory structures help you to manage your program and data transparently. You can create subdirectories in a directory on the local drive and on USB network drives.

In a subdirectory, in turn, you can create programs and then create program blocks for them.

---

**Note**

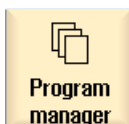
Directories names must end in .DIR or .WPD. The maximum name length is 28 characters including the extension.

All letters (except umlauts), numbers, and underscores are permitted for name assignment. These names are automatically converted to upper-case letters.

This limitation does not apply for work on USB/network drives.

---

**Proceed as follows**



1. Select the "Program manager" operating area.
2. Select the desired storage medium, i.e., the local or USB drive, and position the cursor on the folder in which you would like to create a directory.



3. Press the "New" and "Directory" softkeys.

...



The "New directory" window appears.



4. Enter the desired directory name and press the "OK" softkey.  
The new directory is displayed.

## 8.4.2 Creating a new workpiece

You can set up various types of files such as main programs, initialization files, tool offsets, etc. in a workpiece.

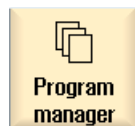
---

### Note

Additional workpiece directories cannot be created within a workpiece directory (WPD).

---

### Proceed as follows



1. Select the "Program manager" operating area.



2. Select the desired storage location and position the cursor on the folder, in which you would like to create a workpiece.

...



3. Press the "New" and "Workpiece" softkeys.

The "New workpiece" window appears.

4. If necessary, select a template if any are available.



5. Enter the desired workpiece name, select a template, if necessary, and press the "OK" softkey.

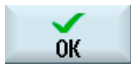
The name can contain up to 28 characters (name + dot. + 3-character extension).

You can use any letters (except umlauts), digits or the underscore symbol (\_).

The directory type (WPD) is set by default.

A new folder with the workpiece name will be created.

The "New G code program" window will open.



6. Press the "OK" softkey again if you want to create the program.

The program will open in the editor.

**See also**

Creating templates (Page 139)

### 8.4.3 Creating a new G code program

You can create G code programs and then render G code blocks for them in a directory/workpiece.

**Proceed as follows**



1. Select the "Program manager" operating area.



2. Select the desired storage location and position the cursor on the folder, in which you would like to store the program.



3. Press the "New" and "G code" softkeys.  
The "New G code program" window appears.

4. If necessary, select a template if any are available.
5. Select the file type (MPF or SPF).



6. Enter the desired program name and press the "OK" softkey.

The program name can contain up to 28 characters (name + dot. + 3-character extension).

You can use any letters (except umlauts), digits or the underscore symbol (\_).

## See also

Creating templates (Page 139)

### 8.4.4 Storing any new file

You can store any type of file in any directory or subdirectory.

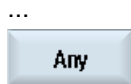
#### Proceed as follows



1. Select the "Program manager" operating area.



2. Select the desired storage location and position the cursor on the folder, in which you would like to create the file.



3. Press the "New" and "Any" softkeys.  
The "Any new program" window appears



4. In the "Type" selection box, select the desired file type (e.g., "GUD").  
The file created automatically has the selected file format.

- OR -

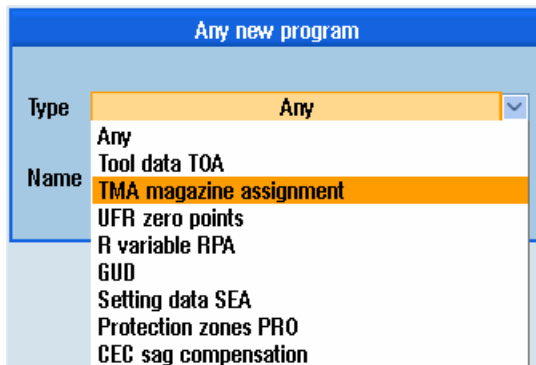
Select "Any" under type.

You can now specify any file format (e.g., My\_Text.txt).

5. Enter the desired file name and press the "OK" softkey.

The name can contain up to 28 characters (name + dot. + 3-character extension).

You can use any letters (except umlauts), digits or the underscore symbol (\_).



## 8.5 Selecting several directories/programs

You can select several files and directories for further processing. When you select a directory, all directories and files located beneath it are also selected.

---

### Note

If you have selected several directories and one of them closes, then selection of the directory and all of the files contained therein is cancelled.

---

### Proceed as follows



1. Select the "Program manager" operating area.



2. Choose the desired storage location and position the cursor on the file or directory from which you would like your selection to start.
3. Press the "Mark" softkey.



The softkey is active.








4. Select the required directories/programs with the cursor or mouse.
5. Press the "Mark" softkey again to deactivate the cursor key and cancel the selection.



### Canceling a selection

By reselecting an element, the existing selection is cancelled.

### Selecting via keys

Key combination	Description
	Renders or expands a selection. You can only select individual elements.
 +  ... 	Renders a consecutive selection.
	A previously existing selection is cancelled.

### Selecting with the mouse

Key combination	Description
Left mouse	Click on element: the element is selected. A previously existing selection is cancelled.
Left mouse +  pressed	Expand selection consecutively up to the next click.
Left mouse +  pressed	Expand selection to individual elements by clicking. An existing selection will expand to include the element you clicked.

### See also

Creating archives (Page 141)

## 8.6 Copying and pasting directories/programs

To create a new directory or program that is similar to an existing program, you can save time by copying the old directory or program and only changing selected programs or program blocks.

The capability of copying and pasting directories and programs can also be used to exchange data with other systems via USB/network drives (e.g., USB FlashDrive).

Copied files or directories can be pasted in a different location.

---

### Note

You can only paste directories on local drives and on USB or network drives.

---

---

### Note

#### Write protection

If the current directory is write-protected for the user, then the function is not offered.

---

---

### Note

When you copy directories, any missing endings are added automatically.

All letters (except umlauts), numbers, and underscores are permitted for name assignment. The names are automatically converted to upper-case letters, and extra dots are converted to underscores.

---

### Example

If the name is not changed during the copy procedure, a copy is created automatically:

MYPROGRAM.MPF is copied to MYPROGRAM\_\_1.MPF. The next time it is copied, it is changed to MYPROGRAM\_\_2.MPF, etc.

If the files MYPROGRAM.MPF, MYPROGRAM\_\_1.MPF, and MYPROGRAM\_\_3.MPF already exist in a directory, MYPROGRAM\_\_2.MPF is created as the next copy of MYPROGRAM.MPF.



Proceed as follows



1. Select the "Program manager" operating area.



2. Choose the desired storage location and position the cursor on the file or directory which you would like to copy.



3. Press the "Copy" soft key.

4. Select the directory in which you want to paste your copied directory/program.

5. Press the "Paste" softkey.

If a directory/program of the same name already exists in this directory, a prompt asks whether you want to overwrite the existing directory or paste it under a different name.

If the name contains illegal characters or is too long, a prompt will appear for you to enter a permissible name.



6. Press the "OK" or "Overwrite all" softkey if you want to overwrite existing directories/programs.

...



- OR -



Press the "No overwriting" softkey if you do not want to overwrite already existing directories/programs.

- OR -



Press the "Skip" softkey if the copy operation is to be continued with the next file.

- OR -



Enter another name if you want to paste the directory/program under another name and press the "OK" softkey.

---

**Note**

**Copying files in the same directory**

You cannot copy files to the same directory. You must copy the file under a new name.

---

## 8.7 Deleting directories/programs

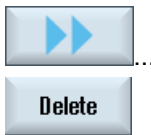
Delete programs or directories from time to time that you are no longer using to maintain a clearer overview of your data management. Back up the data beforehand, if necessary, on an external data medium (e.g., USB FlashDrive) or on a network drive.

Please note that when you delete a directory, all programs, tool data and zero point data and subdirectories that this directory contains are deleted.

### Proceed as follows



1. Select the "Program manager" operating area.



2. Choose the desired storage location and position the cursor on the file or directory that you would like to delete.
3. Press the ">>" and "Delete" softkeys.  
A prompt appears asking whether you really want to delete the file or directory.



4. Press the "OK" softkey to delete the program/directory.

- OR -.



Press the "Cancel" softkey to cancel the process.

## 8.8 Renaming file and directory properties

Information on directories and files can be displayed in the "Properties for ..." window.  
Information on the creation date is displayed near the file's path and name.  
You can change names.

### Proceed as follows



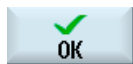
1. Select the Program manager.



2. Choose the desired storage location and position the cursor on the file or directory whose properties you want to display or change.



3. Press the ">>" and "Properties" softkeys.  
The "Properties from ..." window appears.



4. Enter any necessary changes.  
5. Press the "OK" softkey to save the changes.

## 8.9 Templates

### 8.9.1 Creating templates

#### Introduction

You can store your own templates to be used for creating part programs and workpieces.  
These templates provide the basic framework for further editing.

You can use them for any part programs or workpieces you have created.

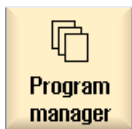
### Storage location for templates

The templates used to create part programs or workpieces can be stored in the following directories:

HMI Data/Templates/Manufacturer/Part programs or Workpieces

HMI Data/Templates/User/Part programs or Workpieces

### Proceed as follows



1. Select the "Program manager" operating area.



2. Press the menu forward key and the "System data" softkey.  
The data tree opens.



3. Position the cursor on the file that you want to store as a template and press the "Copy" softkey.



4. Select the folder in which you want to store the file - "Part programs" or "Workpieces" - and press the "Paste" softkey. See "Storage locations for templates"

Stored templates can be selected when a part program or a workpiece is being created.

### See also

Creating a new workpiece (Page 131)

Creating a new G code program (Page 132)

## 8.10 Backing up data

### 8.10.1 Creating archives

You can back up files so that they can be reloaded at any time.

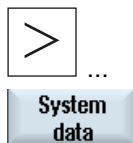
You can select data from the user/manufacture archives, the CF card (but not from the Siemens folder), the NCU, the local drive, and the configured network or USB drives.

Possible storage locations are the "User" and "Manufacturer" subfolders in the "Archives" folder or the external USB FlashDrive memory medium, if connected.

Proceed as follows:



1. Select the "Program manager" operating area.  
The document tree opens.



2. Press the menu forward key and the "System data" softkey.

3. In the data tree, select the required file or directory from which you want to create an archive.

- OR -



If you want to back up several files or directories, press the "Select" softkey and, using the cursor or the mouse, select the required directories or files.

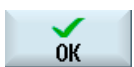


- 4. Press the ">>" and "Generate archive" softkeys. The "Generate archive: Select archiving" window opens.

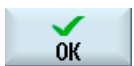
...



- 5. Select the required location for archiving and press the "New directory" softkey to create a suitable subdirectory. The "New directory" window appears.



- 6. Enter the required name and press the "OK" softkey. The directory is created subordinate to the selected folder.



- 7. Press the "OK" softkey. The "Create archive: Name" window opens.



- 8. Enter the required name and press the "OK" softkey. An archive file in .arc format is created in the selected directory.

### 8.10.2 Importing data

Proceed as follows



- 1. Select the "Program manager" operating area.



- 2. Press the menu forward key and the "System data" softkey.



- 3. Below the "Archive" directory in the data tree, select the file you want to re-import.



4. Press the "Read in" softkey.



5. Press the "OK" or "Overwrite all" softkey to overwrite existing files.

...



- OR -



Press the "No overwriting" softkey if you do not want to overwrite existing files.

- OR -



Press the "Skip" softkey if the copy operation is to be continued with the next file.

The "Read in archive" window opens and a progress message box appears tracking the import progress.



6. Press the "Cancel" softkey to cancel the copy process.



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# HT8

# 9

The mobile SINUMERIK HT8 handheld terminal combines the functions of an operator panel and a machine control panel. It is therefore suitable for visualization, operation, teach in, and programming at the machine.



- 1 Customer keys (user-defined)
- 2 Traversing keys
- 3 User menu key
- 4 Handwheel (optional)

## Operation

The 7.5 TFT color display provides touch operation.

It also has membrane keys for traversing the axes, for numeric input, for cursor control, and for machine control panel functions like start and stop.

It is equipped with an emergency stop button and two 3-position enabling buttons. You can also connect an external keyboard.

## References

For more information about connection and start-up of the HT8, see the following references:  
CNC Commissioning: SINUMERIK 840D sl Operator Components and Networking

## Customer keys

The four customer keys are freely assignable and can be set up customer-specifically by the machine manufacturer.



### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

## Integrated machine control panel

The HT8 has an integrated machine control panel consisting of keys (e.g., start, stop, traversing keys, etc.), and keys reproduced as softkeys (see machine control panel menu).

See chapter "Controls on the machine control panel" for a description of the individual keys.

## Enabling button

The HT8 has two enabling buttons. Thus, you can initiate enabling functions for operations that require enabling (e.g., displaying and operating of traversing keys) with either your right hand or your left hand.

Enabling buttons are available for the following key positions:

- Released (no activation)
- Enabling (center position) - enabling for channel 1 and 2 is on the same switch.
- Panic (completely pushed through)

## Traversing keys

In order to traverse the axes of your machine using the traversing keys of the HT8, you must select "JOG" mode or either the "Teach In" or "Ref.Point" submode. Depending on the setting, the enabling button must be activated.



### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

## Virtual keyboard

A virtual keyboard is available for the easy entry of values.

## Changing the channel

You are able to switch the channel by touch in the status display:

- In the Machine operating area (large status display), by touch operation of the channel display in the status display.
- In the other operating areas (no status display), by touch operation of the channel display in the screen headers (yellow field).

## Operating-area switchover

You can display the operating area menu by touching the display symbol for the active operating area.

## Handwheel

The HT8 is available with a hand wheel.

## References

For information about connecting the hand wheel, refer to:

CNC Commissioning: SINUMERIK 840D sl Operator Components and Networking

## See also

Channel switchover (Page 36)

## 9.1 Traversing keys

The traversing keys are not labeled. However, you can display a label for the keys in place of the vertical softkey bar.

Labeling of the traversing keys is displayed for up to 6 axes on the touch panel by default.



### Machine manufacturer

Please also refer to the machine manufacturer's instructions.

### Showing and hiding

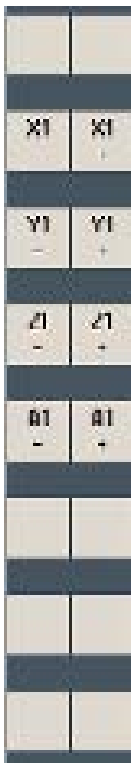
You can link the showing and hiding of the label to activation of the enabling button, for example. In this case, the traversing keys are displayed when you press the enabling button.

If you release the enabling button, the traversing keys are hidden again.



#### Machine manufacturer

Please also refer to the machine manufacturer's instructions.



All existing vertical and horizontal softkeys will be covered up or hidden, i.e., other softkeys cannot be used.

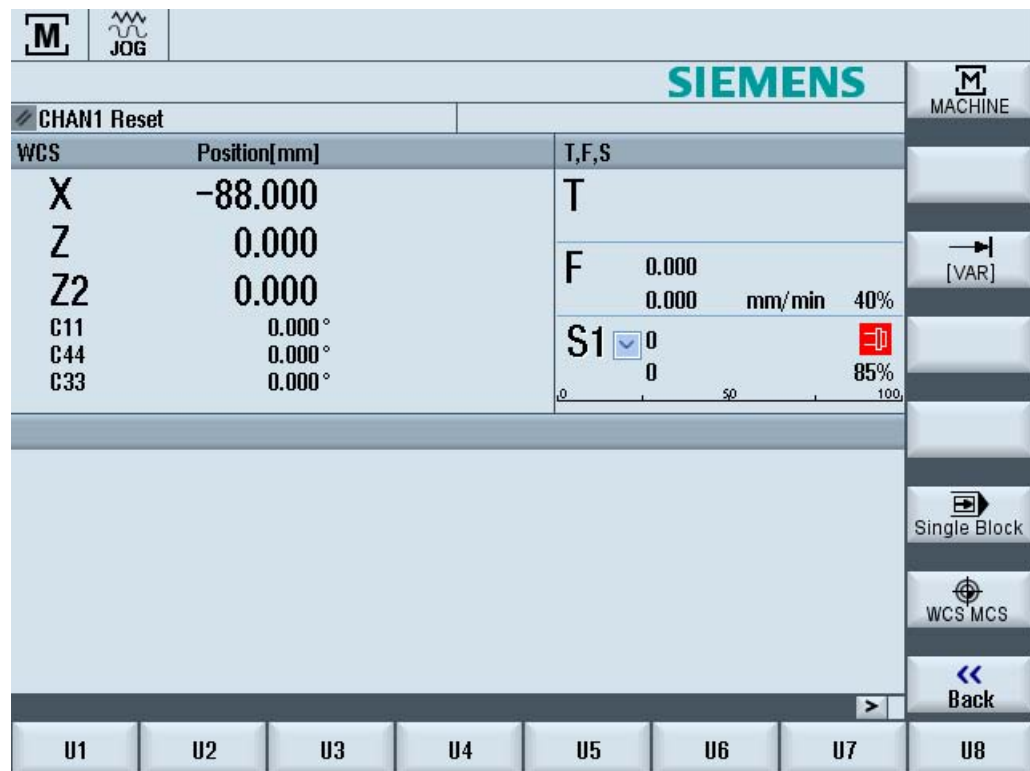
## 9.2 Machine control panel menu

Here you select keys from the machine control panel which are reproduced by the software by touch operation of the relevant softkeys.

See chapter "Controls on the machine control panel" for a description of the individual keys.

### Showing and hiding

The user menu key "U" displays the CPF softkey bar (vertical softkey bar) and the user softkey bar (horizontal softkey bar).



You can expand the user softkey bar to display 8 additional softkeys via the menu forward key.



You use the "Back" softkey to hide the menu bar again.

**Softkeys on the machine control panel menu**

Available softkeys:

"Machine" softkey	Select the "Machine" operating area
"[VAR]" softkey	Select the axis feedrate in the variable increment
"Single Block" softkey	Switch single block execution on/off
"WCS MCS" softkey	Switch between WCS and MCS
"Back" softkey	Close the window.

---

**Note**

The window will automatically disappear when changing regions areas with the "Menu Select" key.

---

## 9.3 Virtual keyboard

The virtual keyboard is used as the input device for touch operator panels.

It opens when you double-click an operator element with input capability (editor, edit field). The virtual keyboard can be positioned anywhere on the operator interface. In addition, you can toggle between a full keyboard and a reduced keyboard that only includes the number block. Moreover, with the full keyboard, you can toggle between English key assignments and the keyboard assignment for the current language setting.

**Proceed as follows**

1. Click in the required input field in order to place the cursor there.
2. Click the input field.  
The virtual keyboard is displayed.
3. Enter your values via the virtual keyboard.
4. Press the "INPUT" key.



- OR -

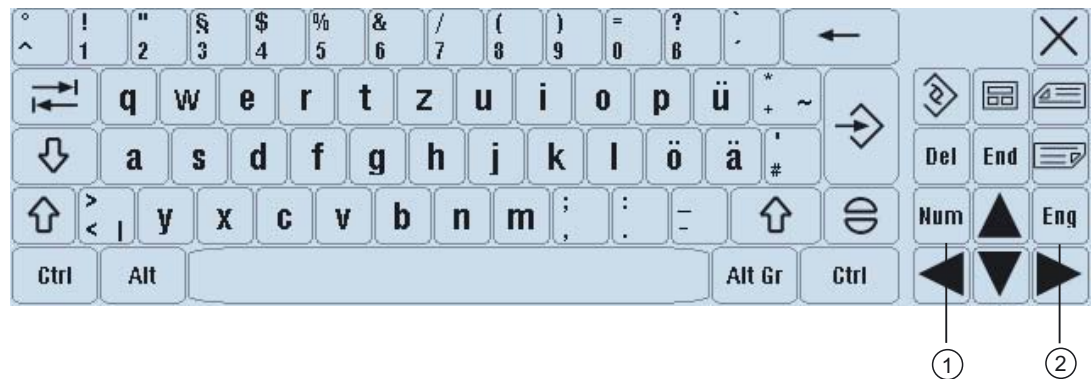
Position the cursor on an another operator element.

The value is accepted and the virtual keyboard is closed.

## Positioning of the virtual keyboard

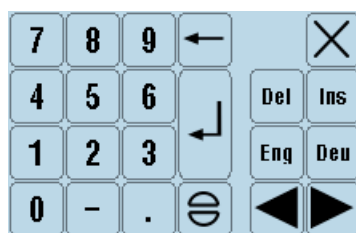
You can position the virtual keyboard anywhere in the window by depressing the empty bar next to the "Close window" symbol with your finger or a stylus and moving it back and forth.

## Special keys on the virtual keyboard



- 1 Num:  
Reduces the virtual keyboard to the number block.
- 2 Eng:  
Toggles the keyboard assignment between the English keyboard assignment and the keyboard assignment for the current language setting.

## Number block of the virtual keyboard



Use the "Deu" or "Eng" keys to return to the full keyboard with the English keyboard assignment or the keyboard assignment of the current language setting.

## 9.4 Calibrating the touch panel

It is necessary to calibrate the touch panel upon first connection to the control.

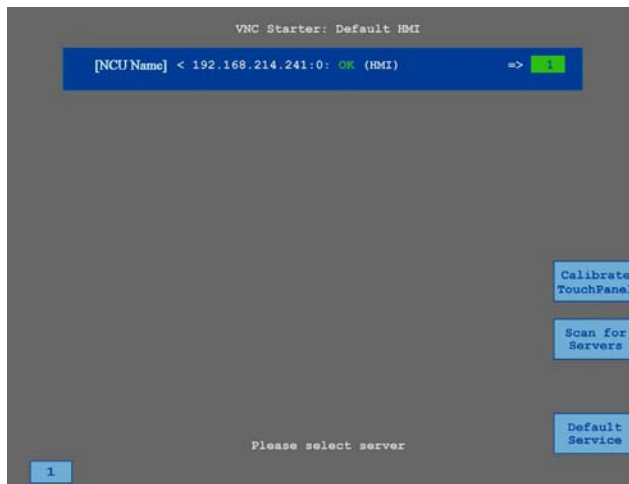
---

### Note

#### Recalibration

If the operation is not exact, then redo the calibration.

---



### Proceed as follows



...



1. Press the "Back" key and the "MENU SELECT" key at the same time to start the TCU service screen.
2. Touch the "Calibrate TouchPanel" button.  
The calibration process will be started.
3. Follow the instructions on the screen and touch the three calibration points one after the other.  
The calibration process has terminated.
4. Touch the horizontal softkey "1" or the key with the number "1" to close the TCU service screen.



## PCU 321

## 10.1 Overview

The SINUMERIK PCU 321 is a powerful computer unit of the same type of construction as the SIMATIC S7-300 allowing simple installation on an S7 mounting rail.

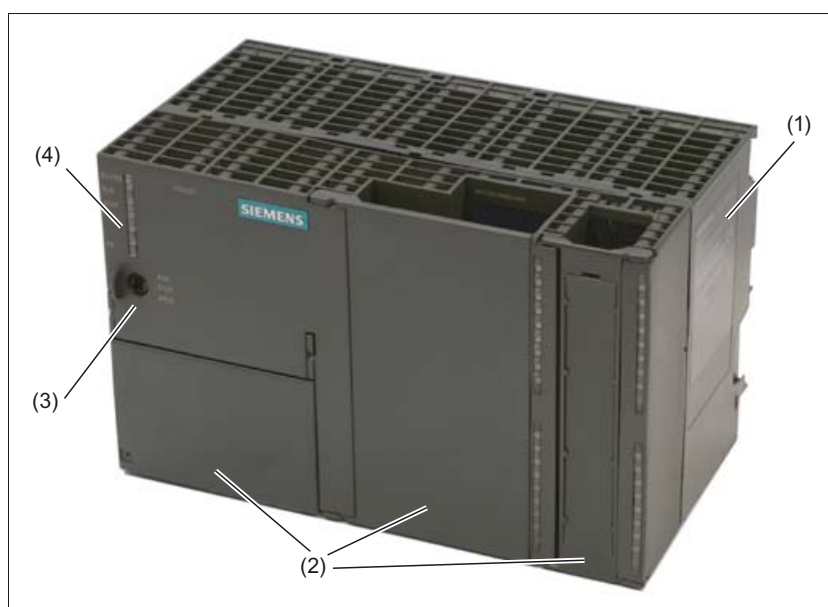


Figure 10-1 View of a PCU 321 (closed)

- (1) Rating plate
- (2) Front door (to fold open)
- (3) Mode switch
- (4) LEDs

Five Ethernet ports are available on-board as a communication interface. Two of these ports are configured as standard Ethernet interfaces and three as PROFINET interfaces. An additional two USB interfaces are available for connecting I/O devices (such as a USB boot stick). The PCU 321 can be operated with the user interface HMI sl (specially configured for the PCU 321) and HMI-Pro sl (Transline).

The SINUMERIK PCU 321 can be used in conjunction with SIMATIC CPUs for:

Operating software	Component
HMI Pro sl	OP 08T, OP 012, OP 12T, OP 015A, OP 015AT, TP 015A, TP 015AT
HMI sl	OP 08T, OP 010, OP 010C, OP 010S, OP 012, OP 012T, OP 015, OP 015A, OP 015AT, TP 015A, TP 015AT

## 10.2 Basic Functions

---

### Note

After ramping up the control, the image "Operating area diagnostics" opens up, determined by an ini file. As opposed to the HMI sl standard software, the areas Machine and Parameter are **NOT** displayed.

---

The basic functions are grouped in the following operating areas in the control - as opposed to the HMI sl standard software:

- Program Manager  
System data HMI, series start-up of the PLC/HMI data
- Diagnostics  
Alarm list, variable view and version
- Commissioning  
See Commissioning Manual.

### Program Manager operating area

In the area Program manager, those functions are displayed which are required for handling the control. When pressing the menu step switch (expansion of the softkey bar in the same menu), the system data for the HMI and the PLC as well as the series start-up are displayed.

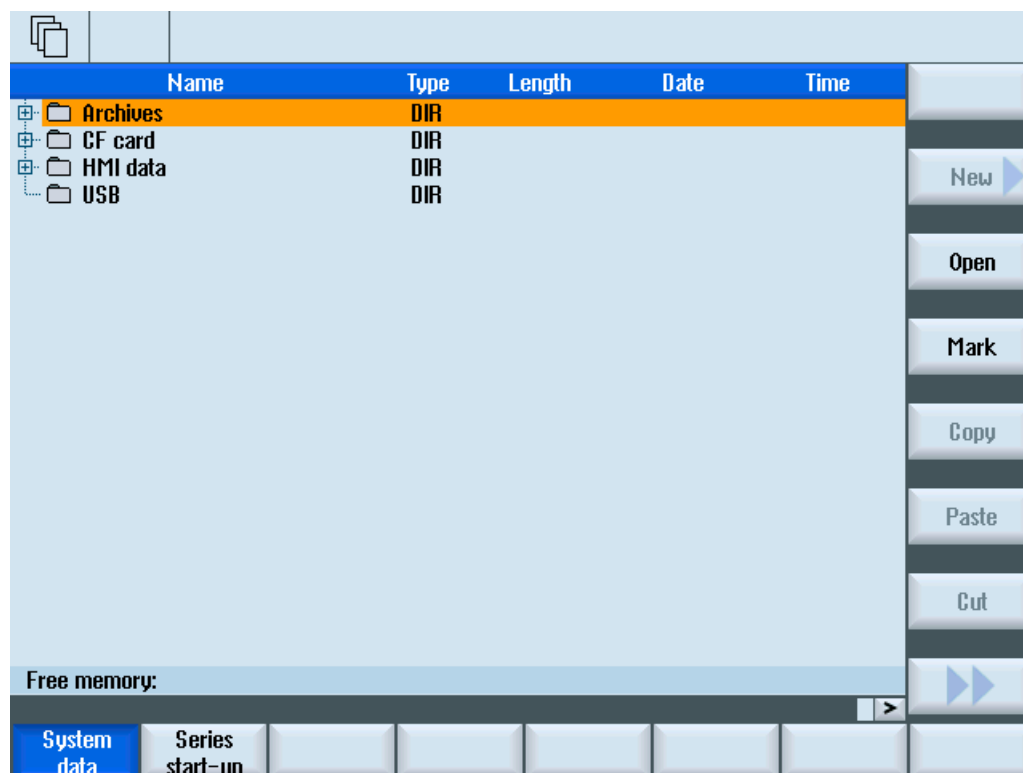


Figure 10-2 Program manager with expansion of softkey bar

Using the arrow keys or the mouse, you can select the data source. Via the vertical softkeys, you are offered functions for processing the data. For a more detailed description of the functions, please refer to Chapter 9 in the Operating Manual.

#### *USB drive*

Data can be transferred using the USB drive. The softkey can be operated only if a USB FlashDrive is used on the operator panel and the option is set accordingly.

### Diagnostics operating area

The alarm list, the variable overview (PLC) and the version are displayed in the operating area Diagnostics.

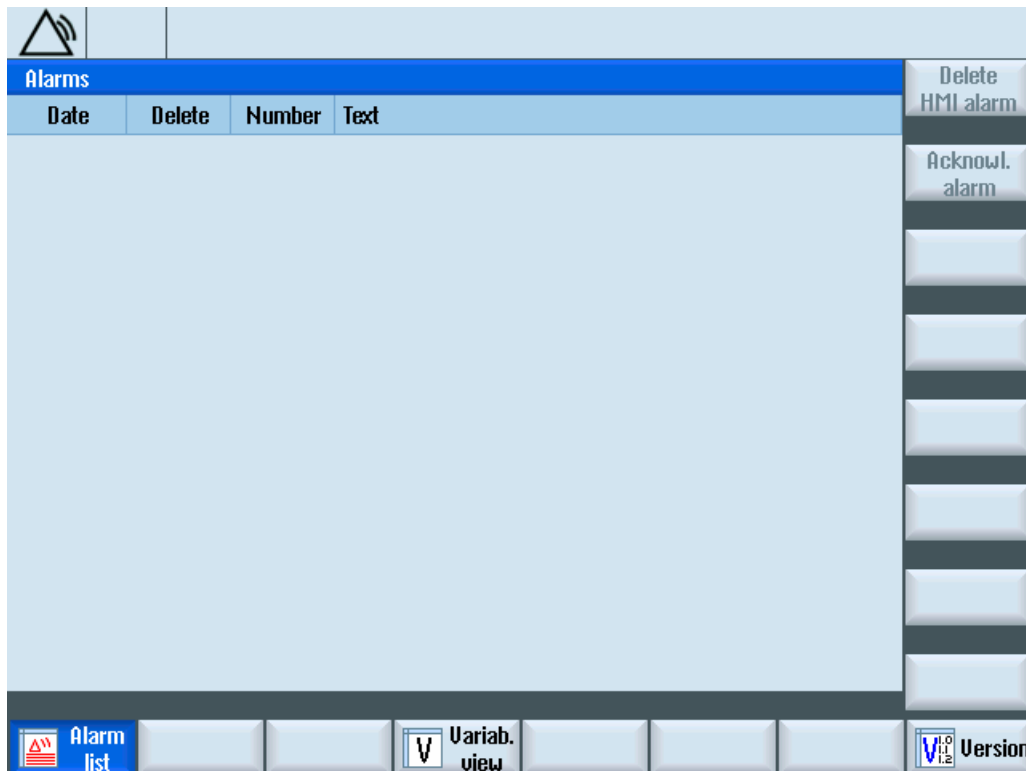


Figure 10-3 Diagnostics operating area

If erroneous states are detected when operating the PCU 321, an alarm is generated. It consists of an alarm number and an error text describing the cause of the error. These alarms can be either deleted or acknowledged. For a more detailed description, please refer to Chapter 11.1 ("Display alarms") in the Operating Manual.

In the variable view (PLC), status control values can be viewed and changed. See Chapter 11.3 "Display and change PLC variables" in the Operating Manual.

When pressing the softkey "Version", the window for version data opens up. Here, all system software components are shown with their corresponding version data.

---

#### Note

As opposed to the HMI sl standard software, no messages are output. On top of that, no information is given regarding axis diagnosis and system utilization.

---

## Alarm, error, and system messages

### 11.1 Displaying alarms

If faulty conditions are recognized in the operation of the machine, then an alarm will be generated and, if necessary, the machining will be interrupted.

The error text that is displayed together with the alarm number gives you more detailed information on the error cause.



---

#### Warning

Please check the situation in the plant on the basis of the description of the active alarm(s). Eliminate the cause/s of the alarm/s and acknowledge it/them as instructed.

Failure to observe this warning will place your machine, workpiece, stored settings and possibly even your own safety at risk.

---

#### Alarm overview

You can display all upcoming alarms and acknowledge them.

The alarm overview contains the following information:

- Date and time
- Clearing criterion  
specifies the key or softkey used to acknowledge the alarm
- Alarm number
- Alarm text

#### Proceed as follows

11.1 Displaying alarms



Diagnosis

1. Select the "Diagnosis" operating area.



2. Press the "Alarm list" softkey.  
The "Alarms" window appears.



3. Position the cursor on an alarm.







4. Press the "Delete HMI alarm" softkey to cancel the alarm.

- OR -



Press the "Acknowl. alarm" softkey for alarms that require acknowledgement.

Acknowledgement symbols

Icon	Description
	Turn the unit off and back on (main switch), or press NCK POWER ON.
	Press the "RESET" key.
	Press the "ALARM CANCEL" key - OR - Press the "Acknowl. HMI alarm" key.
	Press the key provided by the manufacturer.



**Machine manufacturer**

Please also refer to the machine manufacturer's instructions.

## 11.2 Displaying messages

PLC and part program messages may be issued during machining.

These messages will not interrupt the program execution. Messages provide information with regard to a certain behavior of the cycles and with regard to the progress of machining and are usually kept beyond a machining step or until the end of the cycle.

### Overview of messages

You can display all issued messages.

The message overview contains the following information:

- Date
- Message number  
is only displayed for PLC messages
- Message text

### Proceed as follows



1. Select the "Diagnosis" operating area.



2. Press the "Messages" softkey.  
The "Messages" window appears.

## 11.3 Displaying version data

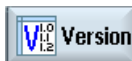
All system software components are provided with their corresponding version data in the "Version data" window.

You may save the version data. Version displays saved as text files can be further processed as required or sent to the hotline in the event of an error.

### Proceed as follows



1. Select the "Diagnosis" operating area.



2. Press the "Version" softkey.  
The "Version data" window appears.  
Data from the available components are displayed.



3. Press the "Details" softkey, in order to receive more exact information on the components displayed.



## Appendix

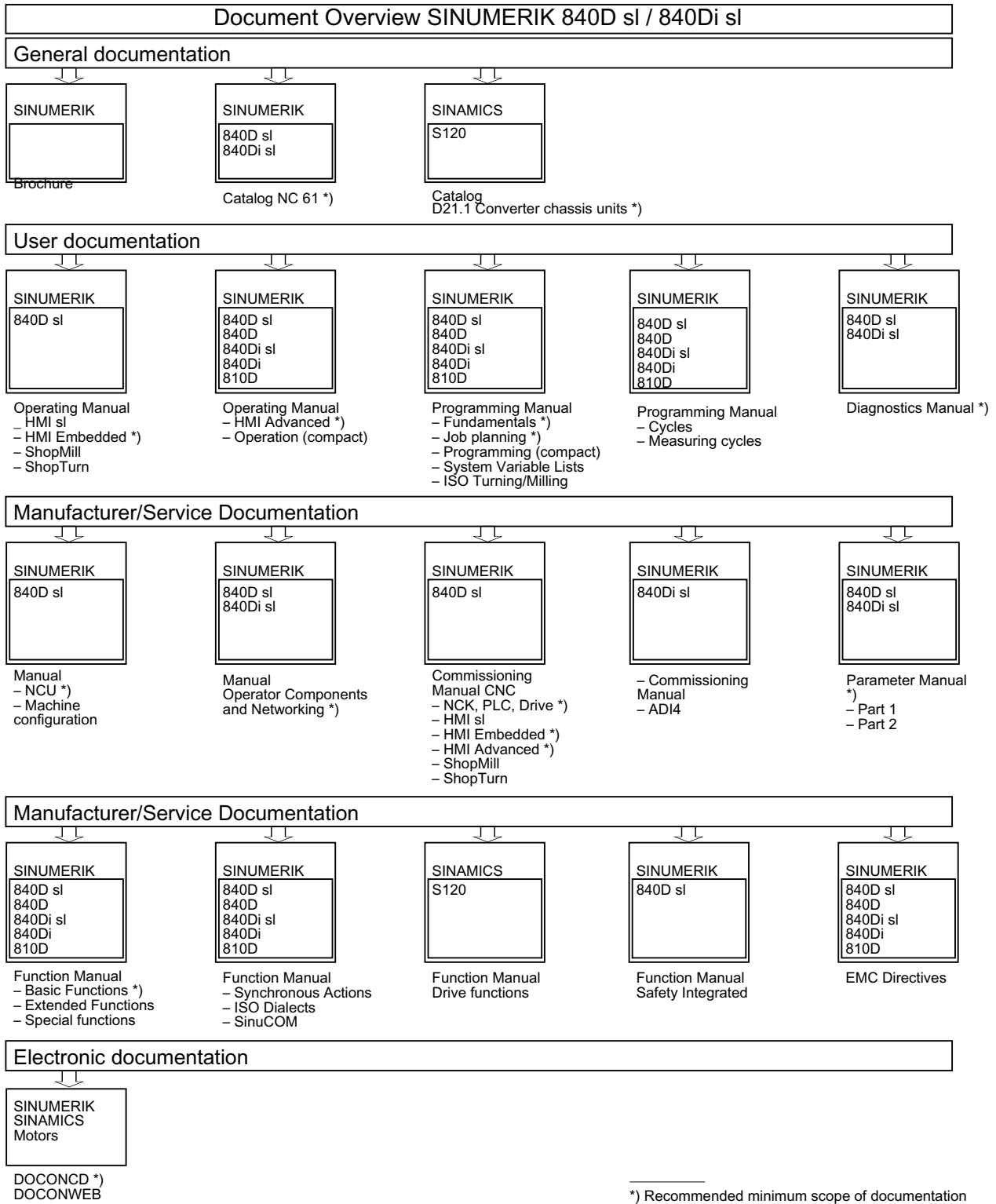
### A.1 Correction sheet - fax template

Should you come across any printing errors when reading this publication, please notify us on this sheet. Suggestions for improvement are also welcome.

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Fax:	/	

Suggestions and / or corrections

## A.2 Overview



\*) Recommended minimum scope of documentation

# Index

## A

- Actual value display, 22
- Any file
  - Create, 133
- Archives
  - Creating, 141
- Automatic mode
  - Specifying settings, 82
- Auxiliary functions
  - H functions, 80
  - M functions, 80
- Axes
  - Referencing, 36
  - Defined increment, 46
  - Repositioning, 63
  - Traversing, 46
  - Variable increment, 48

## B

- Base offset, 40
- Block
  - Finding, 65
- Block display
  - Current, 24, 61
- Block search, 64
  - Mode, 66
  - Parameters, 66

## C

- Channel switchover, 36
- Coarse and fine offsets, 40
- Continuous-path mode, 89, 90
- Coordinate systems, 39
- Copying
  - Directories, 136
  - Programs, 136
- Creating
  - Any file, 133
  - Directories, 130
  - G Code program, 132

- Workpiece, 131
- Current block display, 24, 61

## D

- Data
  - Backing up, 141
  - Importing, 142
- Data block (SB2), 60
- Deleting
  - Programs, 138
- Directories
  - Copying, 136
  - Creating, 130
  - Pasting, 136
  - Selecting, 134
- Display alarm overview, 157
- Display message overview, 159
- Displaying
  - Program level, 61
- Dry run feedrate, 82

## E

- Edges, 112
- Editor
  - Calling, 71
  - Settings, 75
- Enabling button, 146
- Executing
  - Programs, 129

## F

- Feed data
  - Actual value window, 23

## G

- G Code program
  - Creating, 132
- G Functions
  - Displaying selected G groups, 77

## G Functions

- Display all G groups, 79
- Global user data, 99

## H

- H functions, 80
- Handheld terminal 8, 145
- Handwheel
  - Assigning, 50
- Highlight
  - Programs, 134
- HT8, 145
  - Enabling button, 146
  - Touch Panel, 152
  - Traversing keys, 147
  - User menu, 149
  - Virtual keyboard, 150

## I

- Interruption point
  - Approaching, 65

## K

- Keys
  - Operator panel, 13

## M

- Machine control panel
  - Operator controls, 15
- Machining
  - Canceling, 58
  - Starting, 57
  - Stopping, 57
- Magazine
  - Positioning, 122
  - Selecting, 117
- Magazine list, 121
- Manual mode
  - Settings, 48
- MDA, 52
  - Deleting a program, 55
  - Executing a program, 54
  - Loading a program, 52
  - Saving a program, 53
- Motion type, 89

## O

- Opening
  - Programs, 127
- Operating area
  - Changing, 25
- Operating mode
  - AUTO, 35
  - change, 25
  - JOG, 34
  - MDA, 35
- Operator panel
  - Keys, 13
- Operator panel fronts, 12
- Overview
  - Screen layout, 18

## P

- Parameters
  - Changing, 27
  - Entering, 27
- Pasting
  - Directories, 136
  - Programs, 136
- Pocket calculator, 29
- Program control, 68
- Program editing, 62
- Program level
  - Displaying, 61
- Program Manager, 125
- Programs
  - Copying, 136
  - Copying and pasting blocks, 74
  - Correcting, 62
  - Deleting, 138
  - Deleting blocks, 74
  - Executing, 129
  - Managing, 125
  - Opening, 127
  - Pasting, 136
  - Processing, 71
  - Renumbering blocks, 75
  - Replacing text, 73
  - Running in, 60
  - Searching for a program position, 72
  - Selecting, 59, 134
  - Specifying properties, 139
  - Teach-in, 83
- Properties
  - Programs, 139

**R**

R parameters, 98  
 Reference point approach, 36  
 Repositioning, 63

**S**

SB1, 60  
 SB2, 60  
 SB3, 60  
 Screen layout, 18  
 Search mode, 66  
 Security classes, 31  
 Selecting  
   Directories, 134  
 Settings  
   For automatic mode, 82  
   For editor, 75  
   For manual operation, 48  
   Teach-in, 94  
 Single block  
   Coarse (SB1), 60  
   Fine (SB3), 60  
 Skip blocks, 70  
 Spindle data  
   Actual value window, 24  
 Status display, 19  
 Submode  
   REF POINT, 34  
   REPOS, 34  
   TEACH IN, 35  
 Switching off, 33  
 Switching on, 33  
 Synchronized actions  
   Displaying status, 80

**T**

Teach-in, 83  
   Changing blocks, 90  
   Circle intermediate position CIP, 87  
   Deleting blocks, 93  
   General sequence, 83  
   Inserting a position, 84  
   Inserting blocks, 85  
   Parameters, 89  
   Rapid traverse G0, 86  
   Selecting a block, 92  
   Settings, 94  
   Traversing block G1, 86  
 Templates

Creating, 139  
 Storage locations, 140

**Tool**

Relocating, 122

**Tool data**

Actual value window, 23

**Tool list, 108****Tool management, 107**

Sorting lists, 124

**Tool types, 110****Tools**

Delete, 114

Deleting cutting edges, 113

Loading, 114

Multiple edges, 112

Reactivating, 119

Unloading, 114

**Touch Panel**

Calibrating, 152

**U**

User agreement, 38

User data, 97

Channel GUD, 101

Defining and activating, 104

Global GUD, 99

Local LUD, 102

Program PUD, 103

R parameters, 98

Searching for, 103

**V**

Version display, 160

Virtual keyboard, 150

**W**

Wear list, 118

Work offsets, 40

Active zero offset, 40

Basic offsets, 42

Delete, 45

Displaying details, 44

Settable zero offset, 43

Working area limitation, 95

Workpiece

Create, 131



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